Mr. Mark S. Jennette, President
NEWest Construction Co., Inc.
7847 Dunbrook Road, Suite C
San Diego, CA 92126
P. (858) 537-0774 F. (858) 537-9653

CONTRACTOR'S NAME:_____
ADDRESS:_____
TELEPHONE NO.:_____
CITY CONTACT: **CLAUDIA ABARCA, CONTRACT SPECIALIST; Email: CAbarca@sandiego.gov**
Phone No. 619-533-3439; Fax No. 619-533-3633
C.Dadachanji/N.Batta/egz

COPY

CONTRACT DOCUMENTS

FOR

PUMP STATION 65 CAPACITY UPGRADE PROJECT

VOLUME 1 OF 2

BID NO.:	K-13-5522-DBB-3-A
SAP NO. (WBS/IO/CC):	B-00306
CLIENT DEPARTMENT:	2011
COUNCIL DISTRICT:	1
PROJECT TYPE:	BP

THIS CONTRACT IS SUBJECT TO THE FOLLOWING:

- THE CITY'S SUBCONTRACTING PARTICIPATION REQUIREMENTS FOR SLBE PROGRAM.
- PREVAILING WAGE RATES: **STATE**
- PHASED-FUNDING
- THIS IS A PARTICIPATION AGENCY FUNDED CONTRACT.

BID DUE DATE:

2:00 PM
MAY 22, 2013
CITY OF SAN DIEGO
PUBLIC WORKS DEPARTMENT
1010 SECOND AVENUE SUITE 1400, MS 614C
SAN DIEGO, CA 92101

CONSTRUCTION CONTRACT

This contract is made and entered into between THE CITY OF SAN DIEGO, a municipal corporation, herein called "City", and NEWEST CONSTRUCTION CO., INC., herein called "Contractor" for construction of **Pump Station 65 Capacity Upgrade Project;** Bid No. **K-13-5522-DBB-3-A,** in the amount of THREE MILLION SEVEN HUNDRED SIXTY THOUSAND FIVE HUNDRED FORTY DOLLARS AND 00/100 ($3,760,540.00), which is comprised of the Base Bid alone.

IN CONSIDERATION of the payments to be made hereunder and the mutual undertakings of the parties hereto, City and Contractor agree as follows:

1. The following are incorporated into this contract as though fully set forth herein:

   (a) The attached Faithful Performance and Payment Bonds.
   (b) The attached Proposal included in the Bid documents by the Contractor.
   (c) That certain documents entitled **Pump Station 65 Capacity Upgrade Project**, on file in the Public Works Department as Document No. **B-00306**, as well as all matters referenced therein.

2. Contractor shall perform and be bound by all the terms and conditions of this contract and in strict conformity therewith shall perform and complete in a good and workmanlike manner **Pump Station 65 Capacity Upgrade Project**; Bid Number **K-13-5522-DBB-3-A,** San Diego, California.

3. For such performances, the City shall pay to Contractor the amounts set forth at the times and in the manner and with such additions or deductions as are provided for in this contract, and Contractor shall accept such payment in full satisfaction of all claims incident to such performances.

4. No claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

5. This contract is effective as of the date that the Mayor or designee signs the agreement.

CONTRACT FORMS (continued)
AGREEMENT

IN WITNESS WHEREOF, this agreement is signed by the City of San Diego, acting by and through its Mayor or designee, pursuant to Municipal Code §22.3102 (a)(1) authorizing such execution.

THE CITY OF SAN DIEGO

By Tony Heinrichs

Print Name: Tony Heinrichs
Director, Department of Public Works

Date: 8/2/13

APPROVED AS TO FORM AND LEGALITY

Jan I. Goldsmith, City Attorney

By

Jeremy Jung

Print Name:
Deputy City Attorney

Date: 8-2-13

CONTRACTOR

By

Print Name: Mark S Jennette

Title: President

Date: 6/4/2013

City of San Diego License No.: B20040016715

State Contractor's License No.: 847555

CONTRACT FORMS (continued)
PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND

FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

NEWEST CONSTRUCTION CO., INC., a corporation, as principal, and Arch Insurance Company, a corporation authorized to do business in the State of California, as Surety, hereby obligate themselves, their successors and assigns, jointly and severally, to The City of San Diego a municipal corporation in the sum of THREE MILLION SEVEN HUNDRED SIXTY THOUSAND FIVE HUNDRED FORTY DOLLARS AND 00/100 ($3,760,540.00) for the faithful performance of the annexed contract, and in the sum of THREE MILLION SEVEN HUNDRED SIXTY THOUSAND FIVE HUNDRED FORTY DOLLARS AND 00/100 ($3,760,540.00) for the benefit of laborers and materialmen designated below.

Conditions:

If the Principal shall faithfully perform the annexed contract **Pump Station 65 Capacity Upgrade Project**; Bid Number **K-13-5522-DBB-3-A**, San Diego, California then the obligation herein with respect to a faithful performance shall be void; otherwise it shall remain in full force.

If the Principal shall promptly pay all persons, firms and corporations furnishing materials for or performing labor in the execution of this contract, and shall pay all amounts due under the California Unemployment Insurance Act then the obligation herein with respect to laborers and materialmen shall be void; otherwise it shall remain in full force.

The obligation herein with respect to laborers and materialmen shall inure to the benefit of all persons, firms and corporations entitled to file claims under the provisions of Chapter 3 of Division 5 of Title I of the Government Code of the State of California or under the provisions of Section 3082 et seq. of the Civil Code of the State of California.

Changes in the terms of the annexed contract or specifications accompanying same or referred to therein shall not affect the Surety's obligation on this bond, and the Surety hereby waives notice of same.

CONTRACT FORMS (continued)
PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND

The Surety shall pay reasonable attorney's fees should suit be brought to enforce the provisions of this bond.

Dated June 4, 2013

Approved as to Form and Legality

Jan I. Goldsmith, City Attorney

By _____
Deputy City Attorney

Approved:

_____
Tony Heinrichs
Director, Department of Public Works

NEWest Construction Co., Inc.
Principal

By _____ President
Mark S Jennelle
Printed Name of Person Signing for Principal

Arch Insurance Company
Surety

By _____
Attorney-in-fact
Donna M. Robie

10 Waterside Drive, Suite 203
Local Address of Surety

Farmington, CT 06032
Local Address (City, State) of Surety

1-860-255-5357
Local Telephone No. of Surety

Premium $31,709.00

Bond No. SU1122419

AIC 0000069945

THIS POWER OF ATTORNEY IS NOT VALID UNLESS IT IS PRINTED ON BLUE BACKGROUND.

This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated. Not valid for Mortgage, Note, Loan, Letter of Credit, Bank Deposit, Currency Rate, Interest Rate or Residential Value Guarantees.

POWER OF ATTORNEY

Know All Persons By These Presents:

That the Arch Insurance Company, a corporation organized and existing under the laws of the State of Missouri, having its principal administrative office in Jersey City, New Jersey (hereinafter referred to as the "Company") does hereby appoint:

Donna M. Robie, Ellen J. Young and Frank J. Smith of Natick, MA (EACH)

its true and lawful Attorney(s)in-Fact, to make, execute, seal, and deliver from the date of issuance of this power for and on its behalf as surety, and as its act and deed:

Any and all bonds, undertakings, recognizances and other surety obligations, in the penal sum not exceeding Ninety Million Dollars ($90,000,000.00).

This authority does not permit the same obligation to be split into two or more bonds In order to bring each such bond within the dollar limit of authority as set forth herein.

The execution of such bonds, undertakings, recognizances and other surety obligations in pursuance of these presents shall be as binding upon the said Company as fully and amply to all intents and purposes, as if the same had been duly executed and acknowledged by its regularly elected officers at its principal administrative office in Jersey City, New Jersey.

This Power of Attorney is executed by authority of resolutions adopted by unanimous consent of the Board of Directors of the Company on September 15, 2011, true and accurate copies of which are hereinafter set forth and are hereby certified to by the undersigned Secretary as being in full force and effect:

"VOTED, That the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, or the Secretary shall have the power and authority to appoint agents and attorneys-in-fact, and to authorize them subject to the limitations set forth in their respective powers of attorney, to execute on behalf of the Company, and attach the seal of the Company thereto, bonds, undertakings, recognizances and other surety obligations obligatory in the nature thereof, and any such officers of the Company may appoint agents for acceptance of process."

This Power of Attorney is signed, sealed and certified by facsimile under and by authority of the following resolution adopted by the unanimous consent of the Board of Directors of the Company on September 15, 2011:

VOTED, That the signature of the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, and the signature of the Secretary, the seal of the Company, and certifications by the Secretary, may be affixed by facsimile on any power of attorney or bond executed pursuant to the resolution adopted by the Board of Directors on September 15, 2011, and any such power so executed, sealed and certified with respect to any bond or undertaking to which it is attached, shall continue to be valid and binding upon the Company.

In Testimony Whereof, the Company has caused this instrument to be signed and its corporate seal to be affixed by their authorized officers, this 25th day of January, 2013.

Attested and Certified

Arch Insurance Company

Patrick K. Nails, Secretary

David M. Finkelstein, Executive Vice President

STATE OF PENNSYLVANIA SS

COUNTY OF PHILADELPHIA SS

I, Kathleen Marcinkus, a Notary Public, do hereby certify that Patrick K. Nails and David M. Finkelstein personally known to me to be the same persons whose names are respectively as Secretary and Executive Vice President of the Arch Insurance Company, a Corporation organized and existing under the laws of the State of Missouri, subscribed to the foregoing instrument, appeared before me this day in person and severally acknowledged that they being thereunto duly authorized signed, sealed with the corporate seal and delivered the said instrument as the free and voluntary act of said corporation and as their own free and voluntary acts for the uses and purposes therein set forth.

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
KATHLEEN MARCINKUS, Notary Public
City of Philadelphia, Phila. County
My Commission Expires March 14, 2014

Kathleen Marcinkus, Notary Public
My commission expires 03/14/2014

CERTIFICATION

I, Patrick K. Nails, Secretary of the Arch Insurance Company, do hereby certify that the attached Power of Attorney dated January 25, 2013 on behalf of the person(s) as listed above is a true and correct copy and that the same has been in full force and effect since the date thereof and is in full force and effect on the date of this certificate; and I do further certify that the said David M. Finkelstein, who executed the Power of Attorney as Executive Vice President, was on the date of execution of the attached Power of Attorney the duly elected Executive Vice President of the Arch Insurance Company.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seal of the Arch Insurance Company on this 4th day of June 2013.

Patrick K. Nails, Secretary

This Power of Attorney limits the acts of those named therein to the bonds and undertakings specifically named therein and they have no authority to bind the Company except in the manner and to the extent herein stated.

PLEASE SEND ALL CLAIM INQUIRIES RELATING TO THIS BOND TO THE FOLLOWING ADDRESS:

Arch Insurance – Surety Division
3 Parkway, Suite 1500
Philadelphia, PA 19102

SURETY ACKNOWLEDGMENT

State of: Massachusetts
County of: Middlesex

On this 4th day of June , 2013 before me personally came Donna M. Robie to me known, who, being by me duly sworn, did depose and say that he/she resides at Natick,MA that he/she is the Attorney-in-fact for Arch Insurance Company described in and which executed the foregoing instrument; that he/she knows the seal of said corporation; that one of the seals affixed to said instrument is such seal; that it was so affixed by order of the directors or said corporation, and that he/she signed his/ her name thereto by like order.

Notary Public

EILEEN M. RYAN
Notary Public
Commonwealth of Massachusetts
My Commission Expires
September 5, 2019

CONTRACTOR CERTIFICATION

DRUG-FREE WORKPLACE

PROJECT TITLE: **Pump Station 65 Capacity Upgrade Project**

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-17 regarding Drug-Free Workplace as outlined in INSTRUCTION TO BIDDERS, "Drug-Free Workplace", of the project specifications, and that;

NEWest Construction Company
(Name under which business is conducted)

has in place a drug-free workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of subdivisions a) through c) of the policy as outlined.

Signed _____

Printed Name Mark S Jemette

Title President

CONTRACTOR CERTIFICATION

AMERICAN WITH DISABILITIES ACT (ADA) COMPLIANCE CERTIFICATION

PROJECT TITLE: **Pump Station 65 Capacity Upgrade Project**

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-4 regarding the American With Disabilities Act (ADA) outlined in the INSTRUCTION TO BIDDERS, "American With Disabilities Act", of the project specifications, and that;

NEWest Construction Company
(Name under which business is conducted)

has in place a workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of the policy as outlined.

Signed _____

Printed Name Mark S Jennette

Title President

CONTRACTOR CERTIFICATION

CONTRACTOR STANDARDS – PLEDE OF COMPLIANCE

PROJECT TITLE: **Pump Station 65 Capacity Upgrade Project**

I declare under penalty of perjury that I am authorized to make this certification on behalf of Newest Construction Co., as Contractor, that I am familiar with the requirements of City of San Diego Municipal Code § 22.3224 regarding Contractor Standards as outlined in INSTRUCTION TO BIDDERS ("Contractor Standards"), of the project specifications, and that Contractor has complied with those requirements.

I further certify that each of the Contractor's subcontractors whose subcontracts are greater than $50,000 in value has completed a Pledge of Compliance attesting under penalty of perjury of having complied with City of San Diego Municipal Code § 22.3224.

Dated this 4 Day of June, 2013.

Signed _____

Printed Name Mark S Jennette

Title President

PHASED FUNDING SCHEDULE AGREEMENT

Check one:

☑ First Phased Funding Schedule Agreement
☐ Final Phased Funding Schedule Agreement

NOTE: THIS IS A SAMPLE PHASED FUNDING SCHEDULE AGREEMENT FORM. Particulars left blank in this sample, the total number of phases, and the amounts assigned to each phase will be filled with funding specific information as the result of the Pre-Award Schedule, and subsequent Schedules, required by these Bid Documents and approved by the City.

BID NUMBER: K-13-5522-DBB-3-A

CONTRACT: Pump Station 65 Capacity Upgrade Project

CONTRACTOR: NEWest Construction Company

Funding Phase	Phase Description	Phase Start	Phase Finish	Not-to-Exceed Amount
1	Purchase Pumps, VFDs Submittal Review Pump Approval	NTP	June, 2014	2,000,000 $
	Additional phases to be added			
	to this form as necessary.			
2	Wetwell Upgrade, Pump Install, VFD Install, Complete Contract Work	June 2014	NOC	1,760,540
Total				3,760,540 $

Notes:

(1) City Supplement 9-3.6, "PHASED FUNDING COMPENSATION" applies.
(2) The total of all funding phases shall be equal to the TOTAL BID PRICE as shown on BID SCHEDULE 1 - PRICES.
(3) This PHASED FUNDING SCHEDULE AGREEMENT will be incorporated into the CONTRACT and shall only be revised by a written modification to the CONTRACT.

OWNER: CITY OF SAN DIEGO

By: _____
Project Manager &
Public Works Department

Date: 6/10/2013

CONTRACTOR: NEWest Construction

By: _____
Mark S Jennette

Date: 6/4/2013

- END OF PHASED FUNDING SCHEDULE AGREEMENT -

City of San Diego

CONTRACTOR'S NAME:_____
ADDRESS:_____
TELEPHONE NO.:_____ **FAX NO.:**_____
CITY CONTACT: **CLAUDIA ABARCA, CONTRACT SPECIALIST; Email: CAbarca@sandiego.gov**
Phone No. 619-533-3439; Fax No. 619-533-3633
C.Dadachanji/N.Batta/egz

CONTRACT DOCUMENTS

FOR

PUMP STATION 65 CAPACITY UPGRADE PROJECT

VOLUME 1 OF 2

BID NO.: K-13-5522-DBB-3-A
SAP NO. (WBS/IO/CC): B-00306
CLIENT DEPARTMENT: 2011
COUNCIL DISTRICT: 1
PROJECT TYPE: BP

THIS CONTRACT IS SUBJECT TO THE FOLLOWING:

- THE CITY'S SUBCONTRACTING PARTICIPATION REQUIREMENTS FOR SLBE PROGRAM.
- PREVAILING WAGE RATES: **STATE**
- PHASED-FUNDING
- THIS IS A PARTICIPATION AGENCY FUNDED CONTRACT.

BID DUE DATE:

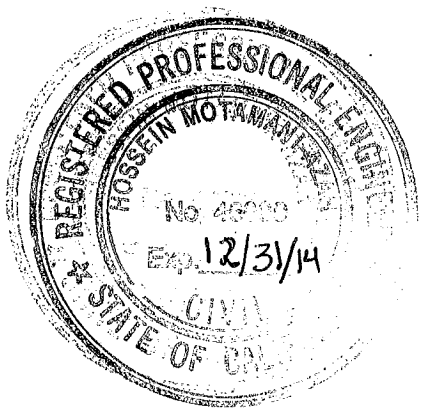
2:00 PM
MAY 22, 2013
CITY OF SAN DIEGO
PUBLIC WORKS DEPARTMENT
1010 SECOND AVENUE SUITE 1400, MS 614C
SAN DIEGO, CA 92101

ENGINEER OF WORK

The engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Engineer:

Vanessa M. Wilbat 03/28/13

1) Registered Engineer — Date — Seal



Hossein Agar 4/2/13

2) For City Engineer — Date — Seal

((((((((((((((((ATTENTION)))))))))))))))

The 2010 edition of the City of San Diego Standard Specifications for Public Works Construction ("The WHITEBOOK") now contains the following distinct Contract Documents:

1) ***City Supplement*** – The City Supplement shall be used in conjunction with the Standard Specifications for Public Works Construction ("The GREENBOOK"), 2009 Edition. The specifications contained in City Supplement take precedence over the specifications contained in The GREENBOOK, 2009 Edition.

   Certain parts of the City Supplement have been highlighted in yellow for the convenience of the users only and shall not affect the interpretation of the Contract.

To obtain The GREENBOOK contact the publisher at: http://www.bnibooks.com

The WHITEBOOK is available only in electronic format under Engineering Documents and References at: http://www.sandiego.gov/publicworks/edocref/greenbook.shtml

TABLE OF CONTENTS

DESCRIPTION **PAGE NUMBER**

REQUIRED DOCUMENTS SCHEDULE

This table is intended to serve as a convenient tool for listing forms and documents required at different times. It is neither exhaustive nor must be considered a Contract Document by itself. Therefore, the users must review the entire Contract Documents and become familiar with the required documentation and the submittal schedule associated with each document.

Bidder's attention is directed to the City's Municipal Code §22.0807(e),(3)-(5) for important information regarding required documentation.

The specified EOC forms are all available for download from the EOC Program's web site at:

http://www.sandiego.gov/eoc/forms/index.shtml

ITEM	WHEN	BY	WHAT
1.	BID DUE DATE/TIME	ALL BIDDERS	Bid
2.	BID DUE DATE/TIME	ALL BIDDERS	Bid Bond
3.	BID DUE DATE/TIME	ALL BIDDERS	Non-collusion Affidavit to be Executed By Bidder and Submitted with Bid under 23 USC 112 and PCC 7106
4.	BID DUE DATE/TIME	ALL BIDDERS	Contractors Certification of Pending Actions
5.	BID DUE DATE/TIME	ALL BIDDERS	Equal Benefits Ordinance Certification of Compliance
6.	BID DUE DATE/TIME	ALL BIDDERS	Form AA35 - List of Subcontractors
7.	BID DUE DATE/TIME	ALL BIDDERS	Form AA40 - Named Equipment/Material Supplier List
8.	WITHIN 3 WORKING DAYS WITH GOOD FAITH EFFORT DOCUMENTATION	ALL BIDDERS	Proof of Valid DBE-MBE-WBE-DVBE Certification Status e.g., Certs.
9.	WITHIN 3 WORKING DAYS WITH GOOD FAITH EFFORT DOCUMENTATION	ALL BIDDERS	SLBE-ELBE Good Faith Documentations
10.	WITHIN 3 WORKING DAYS WITH GOOD FAITH EFFORT DOCUMENTATION	ALL BIDDERS	Form AA60 – List of Work Made Available
11.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Pre-Award Schedule
12.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Phased Funding Schedule Agreement
13.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Names of the principle individual owners of the Apparent Low Bidder - In the event the firm is employee owned or publicly held, then the fact should be stated and the names of the firm's principals and officers shall be provided.

REQUIRED DOCUMENTS SCHEDULE

ITEM	WHEN	BY	WHAT
14.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	If the Contractor is a Joint Venture, the following information must be submitted: • Joint Venture Agreement • Joint Venture License
15.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Form BB05 - Work Force Report
16.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Contract Forms - Agreement
17.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Contract Forms - Payment and Performance Bond
18.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Certificates of Insurance and Endorsements
19.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Contractor Certification - Drug-Free Workplace
20.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Contractor Certification - American with Disabilities Act
21.	WITHIN 10 WORKING DAYS AFTER RECEIPT BY BIDDER OF CONTRACT FORMS	APPARENT LOW BIDDER	Contractors Standards - Pledge of Compliance
22.	BY 5th OF EACH MONTH	CONTRACTOR	Form CC20 - Monthly Employment Report
23.	BY 5th OF EACH MONTH	CONTRACTOR	Form CC25 - Monthly Invoicing Report
24.	PRIOR TO ACCEPTANCE	CONTRACTOR	Form CC10 - Contract Change Order (CCO)
25.	PRIOR TO ACCEPTANCE	CONTRACTOR	Form CC15 - Final Summary Report
26.	PRIOR TO ACCEPTANCE	CONTRACTOR	Affidavit of Disposal

SPECIAL NOTICE
SMALL LOCAL BUSINESS ENTERPRISES (SLBE)
AND
EMERGING LOCAL BUSINESS ENTERPRISES (ELBE)

1. INTRODUCTION. This contract is subject to the requirements of the SLBE Program as specified in the SLBE-ELBE section of the City's EOCP Requirements included in The WHITEBOOK.

1.1. The Bidders are required to review The WHITEBOOK and become familiar with the detailed specifications including the required documentation and the submittal schedule as related to SLBE-ELBE program.

2. AMENDMENTS TO THE CITY'S GENERAL EOCP REQUIREMENTS. To the EOCP General Requirements, Pages 2-10, DELETE in its entirety and SUBSTITUTE with the following:

A. INTRODUCTION.

1. This document sets forth the following specifications:
   a) City's general EOCP requirements for all construction contracts.
   b) Special Provisions for contracts subjects to SLBE and ELBE requirements only.
2. Additional requirements may apply for state or federally funded projects in lieu of (1a) and (1b) above.
3. These requirements shall be included as contract provisions for all Subcontracts.
4. The City specified forms, instructions, and guides are available for download from the EOCP's web site at: http://www.sandiego.gov/eoc/forms/index.shtml.

B. GENERAL.

1. The City of San Diego promotes equal employment and subcontracting opportunities. The City is committed to ensuring that taxpayer dollars spent on public contracts are not paid to businesses that practice discrimination in employment or subcontracting. The City encourages all companies seeking to do business with the City to share this commitment.

C. DEFINITIONS. For the purpose of these requirements:

1. Terms "Bid" and "Proposal," "Bidder" and "Proposer," "Subcontractor" and "Subconsultant," "Contractor" and "Consultant," "Contractor" and "Prime Contractor," "Consultant" and "Professional Service Provider," "Suppliers" and "Vendors," "Suppliers" and "Dealers," and "Suppliers" and "Manufacturers" may have been used interchangeably.
2. The following definitions apply:

   Emerging Business Enterprise (EBE) means a business whose gross annual receipts do not exceed the amount set by the City Mayor, and that meets all other criteria set forth in regulations implementing Municipal Code Chapter 2, Article 2, Division 36. The City Mayor shall review the threshold amount for EBEs on an annual basis, and adjust as necessary to reflect changes in the marketplace.

   Emerging Local Business Enterprise (ELBE) means a Local Business Enterprise that is also an Emerging Business Enterprise.

   Minority Business Enterprise (MBE) means a certified business which is at least 51% owned by African Americans, American Indians, Asians, Filipinos, Latinos, or combination and whose management and daily operation is controlled by one or more members of the identified ethnic groups. In the case of a publicly-owned

business, at least 51% of the stock shall be owned by, and the business operated by, one or more members of the identified ethnic groups.

Women Business Enterprise (WBE) means a certified business which is at least 51% owned by one or more women and whose management and daily operation is controlled by the qualifying party(ies). In the case of a publicly-owned business, at least 51% of the stock shall be owned by, and the business operated by, one or more women.

Disadvantaged Business Enterprise (DBE) means a certified business which is at least 51% owned and operated by one or more socially and economically disadvantaged individuals and whose management and daily operation is controlled by the qualifying party(ies). In the case of a publicly-owned business, at least 51% of the stock shall be owned by, and the business operated by, socially and economically disadvantaged individuals.

Disabled Veteran Business Enterprise (DVBE) means a certified business which is at least 51% owned and operated by one or more veterans with a service related disability and whose management and daily operation is controlled by the qualifying party(ies). The firm shall be certified by the State of California's Department of General Services, Office of Small and Minority Business.

Other Business Enterprise (OBE) means any business which does not otherwise qualify as Minority, Woman, Disadvantaged or Disabled Veteran Business Enterprise.

Small Business Enterprise (SBE) means a business whose gross annual receipts do not exceed the amount set by the City Mayor, and that meets all other criteria set forth in regulations implementing Municipal Code Chapter 2, Article 2, Division 36. The City Mayor shall review the threshold amount for SBEs on an annual basis, and adjust as necessary to reflect changes in the marketplace. A business certified as a Disabled Veteran Business Enterprise by the State of California, and that has provided proof of such certification to the City Mayor, shall be deemed to be an SBE.

Small Local Business Enterprise (SLBE) means a Local Business Enterprise that is also a Small Business Enterprise.

D. CITY'S EQUAL OPPORTUNITY COMMITMENT.

1. Nondiscrimination in Contracting Ordinance.

1. The Contractor, Subcontractors and Suppliers shall comply with requirements of the City's Nondiscrimination in Contracting Ordinance, San Diego Municipal Code §§22.3501 through 22.3517.

   The Contractor shall not discriminate on the basis of race, gender, religion, national origin, ethnicity, sexual orientation, age, or disability in the solicitation, selection, hiring, or treatment of subcontractors, vendors, or suppliers. The Contractor shall provide equal opportunity for subcontractors to participate in subcontracting opportunities. The Contractor understands and agrees that violation of this clause shall be considered a material breach of the contract and may result in contract termination, debarment, or other sanctions.

   The Contractor shall include the foregoing clause in all contracts between the Contractor and Subcontractors and Suppliers.

2. Disclosure of Discrimination Complaints. As part of its Bid or Proposal, the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its

employees, subcontractors, vendors, or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

3. Upon the City's request, the Contractor agrees to provide to the City, within 60 days, a truthful and complete list of the names of all Subcontractors and Suppliers that the Contractor has used in the past 5 years on any of its contracts that were undertaken within San Diego County, including the total dollar amount paid by the Contractor for each subcontract or supply contract.

4. The Contractor further agrees to fully cooperate in any investigation conducted by the City pursuant to the City's Nondiscrimination in Contracting Ordinance, Municipal Code §§22.3501 through 22.3517. The Contractor understands and agrees that violation of this clause shall be considered a material breach of the Contract and may result in remedies being ordered against the Contractor up to and including contract termination, debarment and other sanctions for violation of the provisions of the Nondiscrimination in Contracting Ordinance. The Contractor further understands and agrees that the procedures, remedies and sanctions provided for in the Nondiscrimination in Contracting Ordinance apply only to violations of the Ordinance.

E. EQUAL EMPLOYMENT OPPORTUNITY OUTREACH PROGRAM.

1. The Contractor, Subcontractors and Suppliers shall comply with the City's Equal Employment Opportunity Outreach Program, San Diego Municipal Code §§22.2701 through 22.2707.

   The Contractor shall not discriminate against any employee or applicant for employment on any basis prohibited by law. Contractor shall provide equal opportunity in all employment practices. Prime Contractor shall ensure their subcontractors comply with this program. Nothing in this section shall be interpreted to hold a prime contractor liable for any discriminatory practice of its subcontractors.

   The Contractor shall include the foregoing clause in all contracts between the Contractor and Subcontractors and Suppliers.

2. If the Contract is competitively solicited, the selected Bidder shall submit a Work Force Report (Form BB05), within 10 Working Days after receipt by the Bidder of Contract forms to the City for approval as specified in the Notice of Intent to Award letter from the City.

3. If a Work Force Report is submitted, and the City determines there are under-representations when compared to County Labor Force Availability data, the selected Bidder shall submit an Equal Employment Opportunity Plan.

4. If the selected Bidder submits an Equal Employment Opportunity Plan, it shall include the following assurances:

   1. The Contractor shall maintain a working environment free of discrimination, harassment, intimidation and coercion at all sites and in all facilities at which the Contractor's employees are assigned to work.

   2. The Contractor reviews its EEO Policy, at least annually, with all on-site supervisors involved in employment decisions.

   3. The Contractor disseminates and reviews its EEO Policy with all employees at least once a year, posts the policy statement and EEO posters on all company bulletin boards and job sites, and documents every dissemination, review and posting with a written record to identify the time, place, employees present, subject matter, and disposition of meetings.

4. The Contractor reviews, at least annually, all supervisors' adherence to and performance under the EEO Policy and maintains written documentation of these reviews.
5. The Contractor discusses its EEO Policy Statement with subcontractors with whom it anticipates doing business, includes the EEO Policy Statement in its subcontracts, and provides such documentation to the City upon request.
6. The Contractor documents and maintains a record of all bid solicitations and outreach efforts to and from subcontractors, contractor associations and other business associations.
7. The Contractor disseminates its EEO Policy externally through various media, including the media of people of color and women, in advertisements to recruit, maintains files documenting these efforts, and provides copies of these advertisements to the City upon request.
8. The Contractor disseminates its EEO Policy to union and community organizations.
9. The Contractor provides immediate written notification to the City when any union referral process has impeded the Contractor's efforts to maintain its EEO Policy.
10. The Contractor maintains a current list of recruitment sources, including those outreaching to people of color and women, and provides written notification of employment opportunities to these recruitment sources with a record of the organizations' responses.
11. The Contractor maintains a current file of names, addresses and phone numbers of each walk-in applicant, including people of color and women, and referrals from unions, recruitment sources, or community organizations with a description of the employment action taken.
12. The Contractor encourages all present employees, including people of color and women employees, to recruit others.
13. The Contractor maintains all employment selection process information with records of all tests and other selection criteria.
14. The Contractor develops and maintains documentation for on-the-job training opportunities, participates in training programs, or both for all of its employees, including people of color and women, and establishes apprenticeship, trainee, and upgrade programs relevant to the Contractor's employment needs.
15. The Contractor conducts, at least annually, an inventory and evaluation of all employees for promotional opportunities and encourages all employees to seek and prepare appropriately for such opportunities.
16. The Contractor ensures the company's working environment and activities are non-segregated except for providing separate or single-user toilets and necessary changing facilities to assure privacy between the sexes.

F. SUBCONTRACTING.

1. The City encourages all eligible business enterprises to participate in City contracts as Contractor, Subcontractor, and joint venture partner with the Contractor, Subcontractors, or Suppliers. The Contractor is encouraged to take positive steps to diversify and expand their subcontractor solicitation base and to offer subcontracting opportunities to all eligible business firms including SLBEs, ELBEs, MBEs, WBEs, DBEs, DVBEs, and OBEs.

2. For subcontractor participation level requirements, see the Invitation To Bids, RFP, or Special Notice included in the Contract Documents where applicable.
3. For the purpose of achieving the mandatory subcontractor participation percentage, the City will not account for the Field Orders, Additive or Deductive, and Allowance – Type II Bid Items in the calculation. Allowance – Type I Bid Items are part of the Base Bid integral to the SOW.
4. Each joint venture partner shall be responsible for a clearly defined scope of work. In addition, an agreement shall be submitted, signed by all parties, identifying the extent to which each joint venture partner shares in ownership, control, management, risk and profits of the joint venture.

G. LISTS OF SUBCONTRACTORS AND SUPPLIERS.

1. The Bidders shall comply with the Subletting and Subcontracting Fair Practices Act, Public Contract Code §§4100 through 4113, inclusive.
2. The Bidders shall list all Subcontractors who will receive more than 0.5% of the total Bid amount or $10,000, whichever is greater on the form provided in the Contract Documents i.e., a subcontractors list.
3. The subcontractor list shall include the Subcontractor's name, tax identification number, telephone number including area code, physical and Email addresses, scope of work, the dollar amount of the proposed subcontract, Subcontractor's certification status, and name of the certifying agency.
4. The listed Subcontractor shall be appropriately licensed pursuant to the Contractor License Law.
5. For Design-Build Contracts, refer to the RFQ and RFP for each Project or Task Order.

H. SUBCONTRACTOR AND SUPPLIER SUBSTITUTIONS.

1. Listed Subcontractors and Suppliers shall not be substituted without the Express authorization of the City or its duly authorized agent.
2. Request for Subcontractor or Supplier substitution shall be made in writing to the Public Works Contracting Group, Attention Contracts Specialist, 1010 Second Avenue, Suite 1400, San Diego, CA 92101 with a copy to the Engineer.
3. The request shall include a thorough explanation of the reason(s) for the substitution, including dollar amounts and a letter from each substituted Subcontractor or Supplier stating that they (the Subcontractors or Suppliers) release all interest in working on the Project, written confirmation from the new Subcontractor or Supplier stating that they agree to work on the Project along with the dollar value of the work to be performed.
4. Written approval of the substitution request shall be received by the Contractor, from the City or its authorized officer, prior to any unlisted Subcontractor or Supplier performing work on the Project.
5. Substitution of Subcontractors and Suppliers without authorization shall subject the Contractor to those penalties set forth in Public Contract Code §4110.
6. Requests for Supplier substitution shall be made in writing at least 10 days prior to the provision of materials, supplies or services by the proposed Supplier, and shall include proof of written notice to the originally listed Supplier of the proposed substitution.
7. A Contractor whose Bid is accepted may not:
    1. Substitute a person as Subcontractor or Supplier in place of the Subcontractor, Supplier listed in the original bid, except that the City, or it's duly authorized officer, may consent to the substitution of another person as a Subcontractor or Supplier in any of the following situations:

a) When the Subcontractor or Supplier listed in the Bid after having a reasonable opportunity to do so fails or refuses to execute a written contract with the Contractor, when that written contract, based upon the Contract Documents or the terms of that Subcontractor's or Supplier's written bid is presented to the Subcontractor or Supplier by the Contractor.

b) When the listed Subcontractor or Supplier becomes bankrupt or insolvent.

c) When the listed Subcontractor or Supplier fails to perform its contract.

d) When the listed subcontractor fails or refuses to meet bond requirements as set forth in Public Contract Code §4108.

e) When the Contractor demonstrates to the City or it's duly authorized officer, subject to the provisions set forth in Public Contract Code §4107.5, that the name of the Subcontractor was listed as the result of an inadvertent clerical error.

f) When the listed Subcontractor is not licensed pursuant to the contractors license laws.

g) When the listed Subcontractor is ineligible to work on a public works project pursuant to work on a public works project pursuant to §§1777.1 or 1777.7 of the Labor Code.

h) When the City or its duly authorized agent determines that the listed Subcontractor is not a responsible contractor.

i) When the City, or it's duly authorized officer, determines that the work performed by the listed Subcontractor or that the materials or supplies provided by the listed Supplier are substantially unsatisfactory and not in substantial accordance with the plans and specifications, or that the Subcontractor or Supplier is substantially delaying or disrupting the progress of the work.

2. Permit a contract to be voluntarily assigned or transferred or allow it to be performed by anyone other than the original Subcontractor, Supplier listed in the original bid without the consent of the City, or it's duly authorized officer.

3. Other than in the performance of "Change Orders" causing changes or deviations from the Contract, sublet or subcontract any portion of the work, or contract for materials or supplies in excess of 0.5% of the Contractor's total bid or $10,000, whichever is greater as to which his or her original bid did not designate a Subcontractor or Supplier.

8. Following receipt of notice from the Contractor of the proposed substitution of a Subcontractor or Supplier, the listed Subcontractor or Supplier who has been so notified shall have 5 Working Days within which to submit written objections to the substitution to the Contract Specialist with a copy to the Engineer. Failure to file these written objections shall constitute the listed Subcontractor or Supplier's consent to the substitution. If written objections are filed, the City shall give notice in writing of at least 5 Working Days to the listed Subcontractor or Supplier of a hearing by the City on the Contractor's request for substitution.

I. PROMPT PAYMENT.

1. The Contractor or Subcontractor shall pay to any subcontractor, not later than 7 days of receipt of each progress payment, unless otherwise agreed to in writing; the respective amounts allowed the contractor on account of the work performed by the subcontractors, to the extent of each subcontractor's interest therein. In cases of subcontractor performance deficiencies, the Contractor shall make written notice of

any withholding to the Subcontractor with a copy to the Contracts Specialist. Upon correction of the deficiency, the Contractor shall pay the Subcontractor the amount previously withheld within 14 days after payment by the City.

2. Any violation of California Business and Professions Code, §7108.5 concerning prompt payment to Subcontractors shall subject the violating Contractor or Subcontractor to the penalties, sanction and other remedies of that section. This requirement shall not be construed to limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or Subcontractor in the event of a dispute involving late payment or nonpayment by the Prime Contractor, deficient subcontract performance, or noncompliance by a subcontractor.

J. PROMPT PAYMENT OF FUNDS WITHHELD TO SUBCONTRACTORS.

1. The City will hold retention from the Contractor and will make prompt and regular incremental acceptances of portions, as determined by the Engineer, of the Work, and pay retention to the Contractor based on these acceptances.
2. The Contractor or Subcontractor shall return all monies withheld in retention from a Subcontractor within 30 days after receiving payment for Work satisfactorily completed and accepted including incremental acceptances of portions of the Work by the City.
3. Federal law (49CFR26.29) requires that any delay or postponement of payment over 30 days may take place only for good cause and with the City's prior written approval. Any violation of this provision shall subject the violating the Contractor or Subcontractor to the penalties, sanctions and other remedies specified in §7108.5 of the Business and Professions Code.
4. These requirements shall not be construed to limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or Subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor, deficient subcontract performance, or noncompliance by a subcontractor.

K. CERTIFICATION. The City accepts certifications of MBE, WBE, DBE, or DVBE by any of the following methods:

1. Current certification by the State of California Department of Transportation (CALTRANS) as MBE, WBE or DBE;
2. Current MBE or WBE certification from the California Public Utilities Commission. Additional information may be obtained from:

   http://www.cpuc.ca.gov/PUC/SupplierDiversity/CertInfo.htm;
3. Current MBE certification from the San Diego Regional Minority Supplier Diversity Council. Additional information may be obtained from:

   www.supplierdiversitysd.org;
4. DVBE certification is received from the State of California's Department of General Services, Office of Small and Minority Business (916) 322-5060 or go to their link at:

   http://www.pd.dgs.ca.gov/smbus/default.htm.
5. Current certification by the City of Los Angles as DBE, WBE or MBE. For more information go to:

   http://bca.lacity.org/index.cfm?nxt_body=tutorials_c.cfm

Subcontractors' valid proof of certification status e.g., copy of MBE, WBE, DBE, or DVBE certification shall be submitted as required.

L. CONTRACT RECORDS AND REPORTS.

1. The Contractor shall maintain records of all subcontracts entered into with all firms, all project invoices received from Subcontractors and Suppliers, all purchases of

materials and services from Suppliers, and all joint venture participation. Records shall show name, telephone number including area code, and business address of each Subcontractor and Supplier, and joint venture partner, and the total amount actually paid to each firm. Project relevant records, regardless of tier, may be periodically reviewed by the City.

2. The Contractor shall retain all records, books, papers, and documents directly pertinent to the Contract for a period of not less than 5 years after Notice of Completion; and allow access to said records by the City's authorized representatives.
3. The Contractor shall submit the following reporting using the City's web-based contract compliance i.e., Prism® portal:
    1. *Monthly Employment Utilization*. You and your Subcontractors and Suppliers must submit *Monthly Employment Utilization Reporting* by the 5th day of the subsequent month.
    2. *Monthly Payment*. You and your Subcontractors and Suppliers must submit *Monthly Payment Reporting* by the 5th day of the subsequent month.

Incomplete and/or delinquent reporting may cause payment delays, non-payment of invoice, or both

3. AMENDMENTS TO THE CITY'S EOCP SLBE-ELBE REQUIREMENTS.

To the SLBE-ELBE Program Requirements, Pages 12-20, DELETE in its entirety and SUBSTITUTE with the following:

THESE SPECIAL PROVISIONS SUPPLEMENT THE POLICIES AND REQUIREMENTS ESTABLISHED BY THE CITY OF SAN DIEGO EQUAL OPPORTUNITY CONTRACTING PROGRAM SPECIFIED IN THE CITY'S GENERAL EOC REQUIREMENTS FOR CONTRACTS SUBJECT TO SLBE-ELBE REQUIREMENTS.

A. GENERAL:

1. It is the City's policy to encourage greater availability, capacity development, and contract participation by SLBE firms in City contracts. This policy is, in part, intended to further the City's compelling interest to stimulate economic development through the support and empowerment of the local community, ensure that it is neither an active nor passive participant in marketplace discrimination, and promote equal opportunity for all segments of the contracting community.
2. The City is committed to maximizing subcontracting opportunities for all qualified and available firms.
3. This policy applies to City-funded construction contracts. Bidders shall be fully informed of this policy as set forth in these specifications. Mandatory or voluntary subcontracting percentages, Bid Discounts, and restricted competition are specified in the Invitation To Bids.
4. The Bidders shall make subcontracting opportunities available to a broad base of qualified Subcontractors and shall achieve the minimum SLBE-ELBE subcontractor participation identified for this project.
5. Failure to subcontract the specified minimum (i.e., mandatory) percentages of Bid to qualified available SLBE-ELBE Subcontractors will cause a Bid to be rejected as non-responsive unless the Bidder has demonstrated compliance with the affirmative steps as specified in the City's document titled "Small Local Business (SLBE) Program, INSTRUCTIONS FOR BIDDERS COMPLETING THE GOOD FAITH EFFORT SUBMITTAL" and has submitted documentation showing that all required positive efforts were made prior to Bid submittal due date. The required Good Faith Effort (GFE) documentation shall be submitted to the Contract Specialist.

6. The current list of certified SLBE-ELBE firms and information for completing the GFE submittal can be found on the City's EOC Department website: http://www.sandiego.gov/eoc/boc/slbe.shtml.
7. At the City's sole discretion, these requirements may be waived in advance on projects deemed inappropriate for subcontracting participation.

B. DEFINITIONS. The following definitions shall be used in conjunction with these specifications:

Bid Discount – Additional inducements or enhancements in the bidding process that are designed to increase the chances for the selection of SLBE firms in competition with other firms.

Commercially Useful Function – An SLBE-ELBE performs a commercially useful function when it is responsible for execution of the Work and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To perform a commercially useful function, the SLBE-ELBE shall also be responsible, with respect to materials and supplies used on the Contract, for negotiating price, determining quantity and quality, ordering the material, and installing (where applicable) and paying for the material itself.

To determine whether an SLBE-ELBE is performing a commercially useful function, an evaluation will be performed of the amount of work subcontracted, normal industry practices, whether the amount the SLBE-ELBE firm is to be paid under the contract is commensurate with the Work it is actually performing and the SLBE-ELBE credit claimed for its performance of the Work, and other relevant factors. Specifically, an SLBE-ELBE does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of meaningful and useful SLBE-ELBE participation, when in similar transactions in which SLBE-ELBE firms do not participate, there is no such role performed.

Good Faith Efforts. **(GFE)** – Documentation of the Bidder's intent to comply with SLBE Program goals and procedures included in the City's SLBE Program, Instructions for Completing Good Faith Effort Submittal available from the City's EOCP website or the Contract Specialist.

Independently Owned, Managed, and Operated – Ownership of a SLBE-ELBE firm shall be direct, independent, and by individuals only. Business firms that are owned by other businesses or by the principals or owners of other businesses that cannot themselves qualify under the SLBE-ELBE eligibility requirements shall not be eligible to participate in the Program. Moreover, the day-to-day management of the SLBE-ELBE firm shall be direct and independent of the influence of any other businesses that cannot themselves qualify under the SLBE-ELBE eligibility requirements.

Joint Venture - An association of two or more persons or business entities that is formed for the single purpose of carrying out a single defined business enterprise for which purpose they combine their capital, efforts, skills, knowledge, or property. Joint ventures shall be established by written agreement to qualify for this program.

Local Business Enterprise ("LBE") - A firm having a Principal Place of Business and a Significant Employment Presence in San Diego County, California that has been in operation for 12 consecutive months and a valid business tax certificate. This definition is subsumed within the definition of Small Local Business Enterprise.

Minor Construction Program – A program developed for bidding exclusively among SLBE-ELBE Construction firms.

Principal Place of Business – A location wherein a firm maintains a physical office and through which it obtains no less than 50% of its overall customers or sales dollars.

Protégé – A firm that has been approved, is an active participant in the City's Mentor-Protégé Program, has signed the required program participation agreement and has been assigned a mentor.

Significant Employee Presence – No less than 25% of a firm's total number of employees are domiciled in San Diego County.

C. SUBCONTRACTOR PARTICIPATION. SLBE–ELBE firms will be recognized as participants in the Contract according to the following criteria:

1. For credit to be allowed toward respective participation level, all listed SLBE-ELBE firms shall have been certified by the Bid due date.
2. The Subcontractor shall perform a commercially useful function for credit to be allowed toward subcontractor participation levels. The Subcontractor shall be required by the Contractor to be responsible for execution of a distinct element of the Work and shall carry out its responsibility by actually performing and supervising its own workforce.
3. If the Bidder is seeking the recognition of materials, supplies, or both towards achieving any mandatory subcontracting participation level, the Bidder shall indicate on Form AA40 with the Bid.
    1. If the materials or supplies are obtained from a SLBE-ELBE manufacturer, the Bidder will receive 100% of the cost of the materials or supplies toward SLBE participation. For the purposes of counting SLBE-ELBE participation a manufacturer is a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract and of the general character described by the specifications.
    2. If the materials or supplies are obtained from a SLBE-ELBE supplier, the Bidder will receive 60% of the cost of the materials or supplies toward SLBE participation. For the purposes of counting SLBE-ELBE participation a Supplier is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. To be a supplier, the firm must be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question. A person may be a supplier in such bulk items as petroleum products, steel, cement, gravel, stone, or asphalt without owning, operating, or maintaining a place of business if the person both owns and operates distribution equipment for the products. Any supplementing of suppliers' own distribution equipment shall be by a long-term lease agreement and not on an ad hoc or contract-by-contract basis.
    3. If the materials or supplies are obtained from a SLBE-ELBE, which is neither a manufacturer nor a supplier, the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, fees or transportation charges for the delivery of materials or supplies required on a job site will be counted toward SLBE-ELBE participation, provided the fees are reasonable and not excessive as compared with fees customarily allowed for similar services. No portion of the cost of the materials and supplies themselves will be counted toward SLBE-ELBE participation.
4. If the Bidder is seeking the recognition of SLBE-ELBE Trucking towards achieving any mandatory subcontracting participation level, the Bidder shall indicate on Form AA35 with the Bid. The following factors will be evaluated in determining the credit to be allowed toward the respective participation level:

1. The SLBE-ELBE shall be responsible for the management and supervision of the entire trucking operation for which it is getting credit on a particular contract, and there cannot be a contrived arrangement for the purpose of counting SLBE-ELBE participation.
2. The SLBE-ELBEE shall itself own and operate at least one fully licensed, insured, and operational truck used on the contract.
3. The SLBE-ELBE receives credit for the total value of the transportation services it provides on the contract using trucks it owns, insures, and operates using drivers it employs.
4. The SLBE-ELBE may lease trucks from another SLBE-ELBE firm including an owner-operator, who is certified as a SLBE-ELBE. The SLBE-ELBE who leases trucks from another SLBE-ELBE receives credit for the total value of the transportation services the lessee SLBE-ELBE provides on the contract.
5. The SLBE-ELBE may also lease trucks from a non-SLBE-ELBE firm, including an owner operator. The SLBE-ELBE who leases trucks from a non-SLBE-ELBE is entitled to credit for the total value of transportation services provided by non-SLBE-ELBE lessees not to exceed the value of transportation services provided by SLBE-ELBE owned trucks on the contract. Additional participation by non-SLBE-ELBE lessees receives credit only for the fee or commission it receives as a result of the lease arrangement.
6. A lease shall indicate that the SLBE-ELBE has exclusive use of and control over the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the SLBE-ELBE, so long as the lease gives the SLBE-ELBE absolute priority for use of the leased truck.

D. SLBE-ELBE SUBCONTRACTOR PARTICIPATION PERCENTAGES.

1. Contracts valued at $1,000,000 and above include a mandatory subcontractor participation requirement for SLBE–ELBE firms.
   a) The Bidder shall achieve the mandatory subcontractor participation requirement or demonstrate GFE.
   b) The Bidders shall indicate the participation on Forms AA35 and AA40 as applicable regardless of the dollar value.
   c) An SLBE-ELBE Bidder may count its own participation toward achieving the mandatory goal as long as the SLBE-ELBE Bidder performs 51% of the Contract Price.
2. Contracts Valued over $500,000 and under $1,000,000 shall include the mandatory subcontractor participation requirements described above and the following:
   a) 5% bid discount for SLBE-ELBE firms.
   b) Non-certified Contractor will receive 5% bid discount if they achieve the specified mandatory subcontracting participations.
   c) Bid discounts shall not apply if the award will result in a total contract cost of $50,000 in excess of the apparent lowest Bid.
   d) In the event of a tie bid between a SLBE-ELBE Bidder and a non-SLBE-ELBE Bidder, the SLBE-ELBE Bidder will be awarded the Contract.
   e) In the event of a tie bid between a discounted Bid and a non-discounted Bid, the discounted Bid will be awarded the Contract.
3. Minor Public Works Projects - Contracts valued over $250,000 up to $500,000 will

be considered Minor Construction Projects and will be awarded through a competitive bid process open only to City certified SLBE-ELBE firms. If there are no bidders or no responsible bidders, the Contract will be made available to all Bidders and subject to requirements listed in "Major Public Works Projects" sections above.

4. Contracts valued at $250,000 and below will also be considered Minor Construction Projects and will be awarded through a competitive bid process open only to City certified ELBEs unless there are less than 2 firms available at which it will be awarded through a competitive process open only to the City certified SLBE-ELBE firms. If there are no bidders or no responsible bidders, the Contract will be made available to all Bidders and subject to requirements listed in Major Public Works Projects above.

E. JOINT VENTURES.

1. The City may allow for Joint Venture bid discounts on some contracts. Contracts that allow for Joint Venture bid discounts will be designated in Bid documents. A firm that is bidding or competing for City contracts may partner with a certified SLBE or ELBE to compete for contracts as a Joint Venture.
2. A Joint Venture shall be between two entities with the same discipline or license as required by the City. Joint ventures will receive bid discounts depending on the SLBE or ELBE percentage of participation. To be eligible for a discount, a Joint Venture Agreement shall be approved by the City at the time of Bid submittal. The maximum allowable discount shall be 5%. The parties shall agree to enter in the relationship for the life of the projects.
3. Joint Venture shall submit a Joint Venture Management Plan, a Joint Venture Agreement, or both at least 2 weeks prior to the Bid due date. Copies of the Joint Venture applications are available upon request to the Contract Specialist. Each agreement or management plan shall include the following:
    1. Detailed explanation of the financial contribution for each partner;
    2. List of personnel and equipment used by each partner;
    3. Detailed breakdown of the responsibilities of each partner;
    4. Explanation of how the profits and losses will be distributed;
    5. Description of the bonding capacity of each partner; and
    6. Management or incentive fees available for any one of the partners (if any).
4. Commercially Useful Functions Performed by Joint Venture Partners – Each Joint Venture partner shall perform a "commercially useful function" as the term is defined herein. An SLBE or ELBE that relies on the resources and personnel of a non-SLBE or ELBE firm will not be deemed to perform a "commercially useful function".
5. License Requirements – Each Joint Venture partner shall possess licenses appropriate for the discipline for which a proposal is being submitted. If a Joint Venture is bidding on a single trade project, at the time of bid submittal, each Joint Venture partner shall possess the requisite specialty license for that trade bid.
6. Delineation of Work – The SLBE or ELBE partner shall clearly define the portion of the Work to be performed. This work shall be of the similar type of work the SLBE or ELBE partner performs in the normal course of its business. The Joint Venture Participation Form shall specify the Bid items to be performed by each individual Joint Venture partner. Lump sum Joint Venture participation shall not be acceptable.
7. Responsibilities of the SLBE or ELBE Joint Venture Partner:
    1. The SLBE or ELBE partner shall share in the control, management responsibilities, risks and profits of the Joint Venture in proportion with the level of participation in the project.

2. The SLBE or ELBE partner shall perform work that is commensurate with its experience.
3. The SLBE or ELBE partner shall use its own employees and equipment to perform its portion of the Work.
4. The Joint Venture as a whole shall perform Bid items that equal or exceed 50% of the Contract Price, excluding the cost of manufactured items, in order to be eligible for a Joint Venture discount.

F. MAINTAINING PARTICIPATION LEVELS.

1. Credit and preference points are earned based on the level of participation proposed prior to the award of the Contract. Once the Project begins the Contractor shall achieve and maintain the SLBE-ELBE participation levels for which credit and preference points were earned. The Contractor shall maintain the SLBE-ELBE percentages indicated at the Award of Contract and throughout the Contract Time.
2. If the City modifies the original scope of Work, the Contractor shall make reasonable efforts to maintain the SLBE-ELBE participation for which creditor preference points were earned. If participation levels shall be reduced, approval shall be received from the City prior to making changes.
3. The Contractor shall notify and obtain written approval from the City in advance of any reduction in subcontract scope, termination, or substitution for a designated SLBE-ELBE subcontractor. Failure to do so shall constitute a material breach of the Contract.
4. If the Contractor fails to maintain the SLBE-ELBE participation listed at the time the contract is awarded, and has not received prior approval from the City, the City may declare the Contractor in default of its contract with the City.
5. The Contractor shall submit its Final Payment Report including all subcontracting activities to the City within 15 days after the Work has been accepted. Failure to comply may result in assessment of liquidated damages or withholding of retention. The City will review and verify 100% of subcontract participation reported in the Final Payment Reporting prior to approval and release of final retention to the Contractor. In the event such withheld retention includes sums that are due to Subcontractors for successfully completed work, the City may authorize payment by the City of that portion of the withheld retention via a joint check.

G. SUBCONTRACTING EFFORTS REVIEW AND EVALUATION.

1. Documentation of Bidder's subcontracting efforts will be reviewed by EOCP to verify that the Bidder made subcontracting opportunities available to a broad base of qualified subcontractors, negotiated in good faith with interested subcontractors, and did not reject any bid for unlawful discriminatory reasons. The EOCP review is based on the federal "Six Good Faith Efforts" model.
2. The GFE are required methods to ensure that all ELBE and SLBE firms have the opportunity to compete for the City's Public Works procurements. The Six Good Faith Efforts also known as affirmative steps represent GFE to attract and utilize ELBE and SLBE firms:
    1. Ensure ELBE firms are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities.
    2. Make information of forthcoming opportunities available to SLBE-ELBE firms and arrange time for contracts and establish delivery schedules, where requirements permit, in a way that encourages and facilitates participation by SLBE-ELBE firms in the competitive process. This includes posting solicitations for bids or proposals for a minimum of 10 Working Days before the Bid or Proposal due date.

3. Consider in the contracting process whether firms competing for large contracts could subcontract with SLBE-ELBE firms.

4. Encourage contracting with a consortium of ELBE-SLBE firms when a contract is too large for one of these firms to handle individually.

5. Use the services and assistance of the City's EOC Office and the SLBE-ELBE Directory.

6. If the Contractor awards subcontracts, it shall require the Subcontractors to take the steps in subparagraphs (a)-(e) of this subsection.

H. GOOD FAITH EFFORT DOCUMENTATION.

If the specified SLBE-ELBE subcontractor participation percentages are not met, the Bidder shall submit information necessary to establish adequate GFE were taken to meet the contract subcontractor participation percentages. See the City's document titled "Small Local Business (SLBE) Program, INSTRUCTIONS FOR BIDDERS COMPLETING THE GOOD FAITH EFFORT SUBMITTAL" for the documentation requirements posted on the City's website at the time of Bid.

I. SUBCONTRACTOR SUBSTITUTION. Evidence of fraud or discrimination in substitution of subcontractors will result in sanctions including assessment of penalty fines, termination of contract or debarment. This section does not replace applicable California Public Contract Code.

J. FALSIFICATION OF SUB-AGREEMENT AND FRAUD. Falsification or misrepresentation of a sub-agreement as to company name, contract amount or actual work performed by Subcontractor, or any falsification or fraud on the part of Bidders in the submission of documentation and forms pursuant to this program, will result in sanctions against the Bidder including assessment of penalty fines, termination of the Contract, or debarment. Instances of falsification or fraud which are indicative of an attempt by Bidders to avoid subcontracting with certain categories of subcontractors on the basis of race, gender, religion, national origin, ethnicity, sexual orientation, age, or disability, shall be referred to the Equal Opportunity Contracting Program's Investigative Unit for possible violations of Article 2, Division 35 of the City Administrative Code, §§22.3501 et seq. (Nondiscrimination in Contracting).

K. RESOURCES. The current list of certified SLBE-ELBE firms and information for completing the GFE submittal can be found on the City's EOC Department website: http://www.sandiego.gov/eoc/boc/slbe.shtml

4. SUBCONTRACTING PARTICIPATION PERCENTAGES.

4.1. The City has incorporated **mandatory** SLBE-ELBE subcontractor participation percentages to enhance competition and maximize subcontracting opportunities. For the purpose of achieving the mandatory subcontractor participation percentages, a recommended breakdown of the SLBE and ELBE subcontractor participation percentages based upon certified SLBE and ELBE firms has also been provided to achieve the mandatory subcontractor participation percentages:

1.	SLBE participation	**2.7%**
2.	ELBE participation	**4.5%**
3.	Total mandatory participation	**7.2%**

4.2. The Bidders are strongly encouraged to attend the Pre-Bid Meeting to better understand the Good Faith Effort requirements of this contract. See the City's document titled "SLBE Program, Instructions For Bidders Completing The Good Faith Effort Submittal" available at: http://www.sandiego.gov/eoc/

4.3. The Bid will be declared non-responsive if the Bidder fails the following mandatory conditions:

4.3.1. Bidder's inclusion of SLBE-ELBE certified subcontractors at the overall mandatory participation percentage identified in this document; OR.

4.3.2. Bidder's submission of Good Faith Effort documentation demonstrating the Bidder made a good faith effort to outreach to and include SLBE-ELBE Subcontractors required in this document within 3 Working Day of the Bid opening if the overall mandatory participation percentage is not met.

5. **PRE-BID CONFERENCE.** A Pre-Bid Conference is scheduled for this contract as specified in the Invitation to Bids. The purpose of this meeting is to inform Bidders of the submittal requirements and provisions relative to the SLBE Program. Bidders are strongly encouraged to attend the Pre-Bid Conference to better understand the Good Faith Effort requirements of this contract.

6. **MANDATORY CONDITIONS.** Bid will be declared **non-responsive** if the Bidder fails the following mandatory conditions.

6.1. Bidder's inclusion of SLBE-ELBE certified subcontractors at the overall mandatory participation percentage identified in this document; **OR**

6.2. Bidder's submission of Good Faith Effort documentation demonstrating the Bidder made a good faith effort to outreach to and include SLBE-ELBE Subcontractors required in this document within 3 Working Days of the Bid opening if the overall mandatory participation percentage is not met.

7. **BID DISCOUNT.** This contract **is not** subject to the Bid Discount program as described in The WHITEBOOK, SLBE-ELBE Program Requirements, Section IV(2).

8. **RESOURCES.** The current list of certified SLBE-ELBE firms can be found on the EOC Department website at **http://www.sandiego.gov/eoc/**

CITY OF SAN DIEGO, CALIFORNIA

INVITATION TO BIDS

1. **RECEIPT AND OPENING OF BIDS:** Bids will be received at the Public Works Contracting Group at the location, time, and date shown on the cover of these specifications for performing work on **Pump Station 65 Capacity Upgrade Project** (Project).

2. **DESCRIPTION OF WORK:** The Work involves furnishing all labor, materials, equipment, services, and other incidental works and appurtenances for the construction of the Project as described below:

   Upgrade for Pump Station 65 includes replacing the existing 400 hp motors with 500 hp motors and installing a new 500 hp pump and motor, together with the wet well modification and all other work as defined by the contract documents.

   The Work shall be performed in accordance with:

   - Bid No. **K-13-5522-DBB-3-A** and Plans numbered **36349-01-D through 36349-40-D**, inclusive.

3. **ENGINEER'S ESTIMATE:** The Engineer's estimate of the construction price for this contract is **$4,533,000.**

4. **LOCATION OF WORK:** The location of Work is as follows:

   Pump Station 65 12112 Sorrento Valley Road, San Diego, CA 92121

5. **CONTRACT TIME:** The Contract Time for completion of the Work shall be **530 Working Days.**

6. **CONTRACTOR'S LICENSE CLASSIFICATION:** In accordance with the provisions of California Law, the Contractor shall possess valid appropriate license(s) at the time that the Bid is submitted. Failure to possess the specified license(s) shall render the Bid as non-responsive and shall act as a bar to award of the Contract to any Bidder not possessing required license(s) at the time of Bid.

   The City has determined the following licensing classification(s) for this contract:

   - CLASS A

7. **PRE-BID CONFERENCE:** There will be a Pre-Bid Conference to discuss the scope of the project, bidding requirements, pre-qualification process, and Equal Opportunity Contracting Program requirements and reporting procedures in the Public Works Contracting Group, Conference Room at 1010 Second Avenue, Suite 1400, San Diego, CA 92101 **at 10:00 AM, on MAY 2, 2013.**

   All potential bidders are encouraged to attend.

   To request a copy of the agenda on an alternative format, or to request a sign language or oral interpreter for this meeting, call the Public Works Contracting Group at (619) 533-3450 at least 5 Working Days prior to the Pre-Bid Conference to ensure availability.

8. **REFERENCE STANDARDS:** Except as otherwise noted or specified, the Work shall be completed in accordance with the following standards:

1. **STANDARD SPECIF**ICATIONS

Document No.	**Filed**	**Description**
PITS0504091	05-04-09	Standard Specifications for Public Works Construction (The GREENBOOK), 2009 Edition
PITS090110-1	09-01-10	City of San Diego Standard Specifications for Public Works Construction (The WHITEBOOK), 2010 Update
AEC1231064	12-31-06	California Department of Transportation, Manual of Uniform Traffic Control Devices (MUTCD 2006)
769023	09-11-84	Standard Federal Equal Employment Opportunity Construction Contract Specifications and the Equal Opportunity Clause

NOTE: The City of San Diego Supplement, 2010 Update now consolidates various City Public Works Construction Standard Specifications which in the past were included in the Supplementary Special Provisions. The Bidders' attention is directed to this edition of the City Supplement for a close review to ensure no important information is missed for the preparation of the Bids.

2. STANDARD DRAWINGS

Document No.	**Filed**	**Description**
AEC1230163	12-31-06	City of San Diego Standard Drawings*
N/A	Varies	City Standard Drawings – Standard Drawings Updates Approved For Use*
AEC0925061	09-25-06	Caltrans 2006 U.S. Customary Unit Standard Plans

NOTE: * Available online under Engineering Documents and References:
http://www.sandiego.gov/publicworks/edocref/index.shtml

9. **WAGE RATES:** Prevailing wages are applicable to this project.

10. **PRE-BID SITE VISIT:** The prospective Bidders are encouraged to visit the Work Site with the Engineer. The purpose of the Site visit is to acquaint Bidders with the Site conditions. To request a sign language or oral interpreter for this visit, call the Public Works Contracting Group at (619) 533-3450 at least 5 Working Days prior to the meeting to ensure availability. A Pre-Bid Site Visit is offered when the details are provided as follows:

Time: **1:00 PM**
Date: **MAY 2, 2013**
Location: **12112 Sorrento Valley Road, San Diego, CA 92121**

11. **INSURANCE REQUIREMENTS:** Upon receipt of the City's Notice of Intent to Award letter, the Contractor will be asked to submit all certificates of insurance and endorsements to the City.

    Refer to sections 7-3, "LIABILITY INSURANCE", and 7-4, "WORKERS' COMPENSATION INSURANCE" of the Supplementary Special Provisions (SSP) for the insurance requirements which must be met.

    You must ensure all required insurance certificates and endorsements are submitted accurately and on time. Failure to provide the requisite insurance documents by the date stated in the City's Notice of Intent to Award will result in delay of contract award and may result in annulment of the contract award or other more severe sanctions as provided in the City's Municipal Code §22.0807(e),(3)-(5).

12. **PHASED FUNDING:** The Apparent Low Bidder will be required to provide a Pre-award Schedule in accordance with sections 9-3 and 6-1 of the WHITEBOOK and Supplementary Special Provisions (SSP) prior to award of Contract.

Tony Heinrichs, Director
Public Works Department

INSTRUCTIONS TO BIDDERS

1. **PREQUALIFICATION OF CONTRACTORS:** The contractor(s) who intend to submit Bid or Proposal in response to this invitation to bid, or RFP's for JOC or As-Needed Design-Build Task Orders valued over $50,000, must be pre-qualified for the total amount proposed, inclusive of all alternate bid items or the specified Task Order limits prior to the date of Bid submittal.

   a) Bids from contractors who have not been pre-qualified as applicable, and Bids that exceed the maximum dollar amount at which contractors are pre-qualified, will be deemed **non-responsive** and ineligible for award or a Task Order authorization. Complete information and prequalification questionnaires are available at:

      http://www.sandiego.gov/cip/bidopps/prequalification.shtml

   b) The completed questionnaire, financial statement, and bond letter or a copy of the contractor's SLBE-ELBE certification and bond letter, must be submitted no later than 2 weeks prior to the bid opening to the Public Works Department - Engineering & Capital Project, Prequalification Program, 1010 Second Avenue, Suite 1200, San Diego, CA 92101. For additional information or the answer to questions about the prequalification program, please contact David Stucky at 619-533-3474 or dstucky@sandiego.gov.

2. **CONTRACTOR REGISTRATION:** Prospective bidder(s) as well as existing contractors and suppliers are required to register with the City's EOCP. Refer to 2-17, "CONTRACTOR REGISTRATION" for details.

3. **CITY'S RESPONSES AND ADDENDA:** The City at its option, may respond to any or all questions submitted in writing, via letter, or FAX in the form of an addendum. No oral comment shall be of any force or effect with respect to this solicitation. The changes to the Contract Documents through addendum are made effective as though originally issued with the Bid. The Bidders shall acknowledge the receipt of Addenda on the form provided for this purpose in the Bid.

4. **CITY'S RIGHTS RESERVED:** The City reserves the right to cancel the Invitation to Bids at any time, and further reserves the right to reject submitted Bids, without giving any reason for such action, at its sole discretion and without liability. Costs incurred by the Bidder(s) as a result of preparing Bids under the Invitation to Bid shall be the sole responsibility of each bidder. The Invitation to Bid creates or imposes no obligation upon the City to enter a contract.

5. **CONTRACT PRICING FORMAT:** This solicitation is for a Lump Sum contract with Unit Price provisions as set forth in the Bid Proposal Form(s), Volume 2 unless specified otherwise such as as-needed contracts e.g., JOC in the Contract Documents.

6. **SUBMITTAL OF "OR EQUAL" ITEMS:** See 4-1.6, "Trade Names or Equals."

7. **AWARD PROCESS:**

   a) The Award of this contract is contingent upon the Contractor's compliance with all conditions precedent to Award, including the submittal of acceptable insurance and surety bonds pursuant to San Diego Municipal Code § 22.3007.

   b) If the responsible Bid does not exceed the City's engineering estimate, the City will, in most cases, prepare contract documents for execution within 3 weeks of the date of the Bid opening and award the Contract within 5 Working Days of receipt of properly executed Contract, bond, and insurance documents.

c) This contract is deemed to be awarded, and effective, only upon the signing of the Contract by the Mayor or designee of the City.

8. **SUBCONTRACT LIMITATIONS:** The Bidder's attention is directed to Standard Specifications for Public Works Construction, Section 2-3, "SUBCONTRACTS" which requires the Contractor to perform not less than the amount therein stipulated with its own forces. Failure to comply with these requirements may render the Bid **non-responsive** and ineligible for award.

9. **AVAILABILITY OF PLANS AND SPECIFICATIONS:** Contract Documents may be obtained by visiting the City's website: http://www.sandiego.gov/cip/. Plans and Specifications for this contract are also available for review in the office of the City Clerk or Public Works Contracting Group.

10. **QUESTIONS:** The Director (or designee), of the Public Works Department is the officer responsible for opening, examining, and evaluating the competitive Bids submitted to the City for the acquisition, construction and completion of any public improvement except when otherwise set forth in these documents. All questions related to this procurement action shall be addressed to the Public Works Contracting Group, Attention Contract Specialist, 1010 Second Avenue, Suite 1400, MS 614C, San Diego, California, 92101, Telephone No. (619) 533-3450.

    Questions received less than 14 days prior to the date for opening of Bids may not be answered.

    Interpretations or clarifications considered necessary by the City in response to such questions will be issued by Addenda which will be uploaded to the City's online bidding service.

    Only questions answered by formal written addenda will be binding. Oral and other interpretations or clarifications will be without legal effect. It is the Bidder's responsibility to become informed of any Addenda that have been issued and to include all such information in its Bid.

11. **ELIGIBLE BIDDERS:** No person, firm, or corporation shall be allowed to make, file, or be interested in more than 1 Bid for the same work unless alternate Bids are called for. A person, firm or corporation who has submitted a sub-proposal to a Bidder, or who has quoted prices on materials to a Bidder, is not hereby disqualified from submitting a sub-proposal or quoting prices to other Bidders or from submitting a Bid in its own behalf.

12. **SAN DIEGO BUSINESS TAX CERTIFICATE:** All Contractors, including Subcontractors, not already having a City of San Diego Business Tax Certificate for the work contemplated shall secure the appropriate certificate from the City Treasurer, Civic Center Plaza, first floor, before the Contract can be executed.

13. **PROPOSAL FORMS:** Bid shall be made only upon the Bidding Documents i.e., Proposal form attached to and forming a part of the specifications. The signature of each person signing shall be in longhand.

    a) The entire specifications for the bid package do not need to be submitted with the bid. Bidder shall complete and submit, only, all pages in the "Bidding Documents" section (see Volume 2) as their Bid per the schedule given under "Required Documents Schedule," (see Volume 1). Bidder is requested to retain for their reference other portions of the Contract Documents that are not required to be submitted with the Bid.

    b) The City may require any Bidder to furnish a statement of experience, financial responsibility, technical ability, equipment, and references.

    c) Bids and certain other specified forms and documents shall be enclosed in a sealed envelope and shall bear the title of the work and name of the Bidder and the appropriate State Contractors License designation which the Bidder holds.

d) Bids may be withdrawn by the Bidder prior to, but not after, the time fixed for opening of Bids.

14. BIDDERS' GUARANTEE OF GOOD FAITH (BID SECURITY):

a) With the exception of the contracts valued $5,000 or less, JOC and Design-Build contracts, and contracts subject to the Small and Local Business Program of $250,000 or less e.g., ELBE contracts, each Bidder shall accompany its Bid with either a cashier's check upon some responsible bank, or a check upon such bank properly certified or an approved corporate surety bond payable to the City of San Diego, for an amount of not less than 10% of the aggregate sum of the Bid, which check or bond, and the monies represented thereby shall be held by the City as a guarantee that the Bidder, if awarded the contract, will in good faith enter into such contract and furnish the required final bonds.

b) The Bidder agrees that in case of Bidder's refusal or failure to execute this contract and give required final bonds, the money represented by a cashier's or certified check shall remain the property of the City, and if the Bidder shall fail to execute this contract, the Surety agrees that it will pay to the City damages which the City may suffer by reason of such failure, not exceeding the sum of 10% of the amount of the Bid.

c) A Bid received without the specified bid security will be rejected as being **non-responsive**.

15. AWARD OF CONTRACT OR REJECTION OF BIDS:

a) This contract may be awarded to the lowest responsible and reliable Bidder (for Design-Build contracts refer to the RFP for the selection and award information). Bidders shall complete the entire Bid schedule (e.g., schedule of prices). Incomplete price schedules will be rejected as being **non-responsive**.

b) The City reserves the right to reject any or all Bids, and to waive any informality or technicality in Bids received and any requirements of these specifications as to bidding procedure.

c) Bidders will not be released on account of their errors of judgment. Bidders may be released only upon receipt by the City from the Bidder within 3 Working Days, excluding Saturdays, Sundays, and state holidays, after the opening of Bids, of written notice which includes proof of honest, credible, clerical error of material nature, free from fraud or fraudulent intent, and of evidence that reasonable care was observed in the preparation of the Bid.

d) A non-selected Bidder may protest award of the Contract to the selected Bidder by submitting a written "Notice of Intent to Protest" including supporting documentation which shall be received by Public Works Contracting Group no later than 10 days after the City's announcement of the selected Bidder or no later than 10 days from the date that the City issues notice of designation of a Bidder as non-responsible in accordance with San Diego Municipal Code Chapter 2, § 22.3029, "Protests of Contract Award."

e) The City of San Diego will not discriminate with regard to race, religious creed, color, national origin, ancestry, physical handicap, marital status, sex or age, in the award of contracts.

f) Each Bid package properly executed as required by these specifications shall constitute a firm offer, which may be accepted by the City within the time specified in the Invitation to Bids.

g) The City reserves the right to evaluate all Bids and determine the lowest Bidder (or winner for Design-Build contracts) on the basis of any proposed alternates, additive items or options, at its discretion.

16. **BID RESULTS:** The Bid opening by the City shall constitute the public announcement of the Apparent Low Bidder (or Apparent Winner in case of Design-Build contracts). In the event that the Apparent Low Bidder (or Apparent Winner in case of Design-Build contracts) is subsequently deemed non-responsive or non-responsible, a public announcement will be posted in the City's web page: http://www.sandiego.gov/cip/index.shtml, with the name of the newly designated Apparent Low Bidder.

    a) To obtain Bid results, either attend Bid opening, review the results on the City's web site, or provide a self-addressed, stamped envelope, referencing Bid number, and Bid tabulation will be mailed to you upon verification of extensions. Due to time constraints, Bid results cannot be given out over the telephone.

17. **THE CONTRACT:** The Bidder to whom award is made shall execute a written contract with the City of San Diego and furnish good and approved bonds and insurance certificates specified by the City within 10 Working Days after receipt by Bidder of a form of contract for execution unless an extension of time is granted to the Bidder in writing.

    a) If the Bidder takes longer than 10 Working Days to fulfill these requirements, then the additional time taken shall be added to the Bid guarantee. The Contract shall be made in the form adopted by the City, which includes the provision that no claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

    b) If the Bidder to whom the award is made fails to enter into the contract as herein provided, the award may be annulled and the Bidder's Guarantee of Good Faith will be subject to forfeiture. An award may be made to the next lowest responsible and reliable Bidder who shall fulfill every stipulation embraced herein as if it were the party to whom the first award was made.

    c) For contracts that are not Design-Build, pursuant to the San Diego City Charter section 94, the City may only award a public works contract to the lowest responsible and reliable Bidder. The City will require the Apparent Low Bidder to (i) submit information to determine the Bidder's responsibility and reliability, (ii) execute the Contract in form provided by the City, and (iii) furnish good and approved bonds and insurance certificates specified by the City within 10 Working Days, unless otherwise approved by the City, in writing after the Bidder receives notification from the City, designating the Bidder as the Apparent Low Bidder and formally requesting the above mentioned items.

    d) The award of the Contract is contingent upon the satisfactory completion of the above mentioned items and becomes effective upon the signing of the Contract by the Mayor or designee. If the Apparent Low Bidder does not execute the Contract or submit required documents and information, the City may award the Contract to the next lowest responsible and reliable Bidder who shall fulfill every condition precedent to award. A corporation designated as the Apparent Low Bidder shall furnish evidence of its corporate existence and evidence that the officer signing the Contract and bond for the corporation is duly authorized to do so.

18. **EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE OF WORK:** The Bidder shall examine carefully the Project Site, the Plans and Specifications, other materials as described in the Special Provisions, Section 2-7, and the proposal forms (e.g., Bidding Documents) therefore. The submission of a Bid shall be conclusive evidence that the Bidder has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and scope of Work, the quantities of materials to be furnished, and as to the requirements of the Bidding Documents Proposal, Plans, and Specifications.

19. DRUG-FREE WORKPLACE:

a) General:

City projects are subject to City of San Diego Resolution No. R-277952 adopted on May 20, 1991. Bidders shall become aware of the provisions of Council Policy 100-17 which was established by Resolution No. R-277952. The policy applies equally to the Contractor and Subcontractors. The elements of the policy are outlined below.

b) Definitions:

i. "Drug-free workplace" means a site for the performance of work done in connection with a contract let by City of San Diego for the construction, maintenance, or repair of any facility or public work by an entity at which employees of the entity are prohibited from engaging in the unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance in accordance with the requirements of this section.

ii. "Employee" means the employee of a contractor directly engaged in the performance of work pursuant to a contract as described in Section 3, "City Contractor Requirements."

iii. "Controlled substance" means a controlled substance in schedules I through V of Section 202 of the Controlled Substances Act (21 U.S.C. Sec. 812).

iv. "Contractor" means the department, division, or other unit of a person or organization responsible to the contractor for the performance of a portion of the work under the contract.

c) City Contractor Requirements:

i. Every person or organization awarded a contract or grant by the City of San Diego for the provision of services shall certify to the City that it will provide a drug-free workplace by doing all following:

a. Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited in the person's organization's workplace and specifying the actions that will be taken against employees for violations of the prohibition.

b. Establishing a drug-free awareness program to inform employees about all of the following:

ii. The dangers of drug abuse in the workplace.

iii. The person's or organization's policy of maintaining a drug-free workplace.

iv. Any available drug counseling, rehabilitation, and employee assistance programs.

v. The penalties that may be imposed upon employees for drug abuse violations.

c. Posting the statement required by subdivision (1) in a prominent place at contractor's main office. For projects large enough to necessitate a construction trailer at the job site, the required signage would also be posted at the Site.

i. The Contractor shall include in each subcontract agreement language which indicates the Subcontractor's agreement to abide by the provisions of subdivisions a) through c) above. The Contractors and Subcontractors shall be individually responsible for their own drug-free workplace programs.

ii. Note: The requirements of a drug-free awareness program can be satisfied by periodic tailgate sessions covering the various aspects of drug-abuse education. Although an in-house employee assistance program is not required, contractors should be able to provide a listing of drug rehabilitation and counseling programs available in the community at large.

iii. Questions about the City's Drug-free Workplace Policy shall be referred to the Contract Specialist, Public Works Contracting Group.

20. AMERICANS WITH DISABILITIES ACT:

a) General: City projects are subject to City of San Diego Resolution No. R-282153 adopted on June 14, 1993. The Bidders shall become aware of the provisions of Council Policy 100-04 which was established by Resolution No. R-282153. The policy applies equally to the Contractor and all Subcontractors. The elements of the policy are outlined below.

b) Definitions:

"Qualified individual with a disability" means an individual with a disability who satisfies the requisite skill, experience, education and other job-related requirements of the employment position such individual holds or desires, and who, with or without reasonable accommodation, can perform the essential functions of such position.

"Employee" means the employee of the Contractor directly engaged in the performance of Work.

c) The City Requirements: Every person or organization entering into a contractual agreement with or receiving a grant from the City of San Diego shall certify to the City of San Diego that it will comply with the ADA by adhering to all of the provisions of the ADA listed below:

1. The Contractor shall not discriminate against qualified persons with disabilities in any aspects of employment, including recruitment, hiring, promotions, conditions and privileges of employment, training, compensation, benefits, discipline, layoffs, and termination of employment.

2. No qualified individual with a disability may be excluded on the basis of disability, from participation in, or be denied the benefits of services, programs, or activities by the Contractor or Subcontractors providing services for the City.

3. The Contractor shall post a statement addressing the requirements of the ADA in a prominent place at the worksite. The Contractor shall include in each subcontract agreement, language which indicates the Subcontractor's agreement to abide by the provisions of subdivisions (a) through (c) inclusive of Section 3. The Contractor and Subcontractors shall be individually responsible for their own ADA employment programs. Questions about the City's ADA Policy should be referred to the Contract Administrator.

21. CONTRACTOR STANDARDS – PLEDGE OF COMPLIANCE: This contract is subject to City of San Diego Municipal Code §22.3224 as amended 11/24/08 by ordinance O-19808. Bidders shall become aware that the requirements apply to Contractors and Subcontractors for contracts greater than $50,000 in value.

a) Upon award, amendment, renewal, or extension of this contract, the Contractors shall complete a Pledge of Compliance attesting under penalty of perjury that they complied with the requirements of this section.

b) The Contractors shall ensure that their Subcontractors whose subcontracts are greater than $50,000 in value complete a Pledge of Compliance attesting under penalty of perjury that they complied with the requirements of this section. Subcontractors may access the Pledge of Compliance at:

http://www.sandiego.gov/purchasing/pdf/contractor_standards_questionnaire.pdf.

c) The Contractors shall include in each subcontract agreement, language which requires Subcontractors to abide by the provisions of City of San Diego Municipal Code §22.3224. A sample provision is as follows:

"**Compliance with San Diego Municipal Code §22.3224**: Subcontractor acknowledges that it is familiar with the requirements of San Diego Municipal Code §22.3224 ("Contractor Standards"), and agrees to comply with requirements of that section. The Subcontractor further agrees to complete the Pledge of Compliance, incorporated herein by reference."

22. NOTICE OF LABOR COMPLIANCE PROGRAM APPROVAL: The City of San Diego received initial approval as a Labor Compliance Program on August 11, 2003. The Labor Compliance Program Manual is available at:

http://www.sandiego.gov/eoc/laborcompliance/#manual.

a) The limited exemption from prevailing wages pursuant to Labor Code §1771.5(a) does not apply to contracts under jurisdiction of the Labor Compliance Program. Inquiries, questions, or assistance about the Labor Compliance Program should be directed to: Equal Opportunity Contracting Program, 1010 Second Avenue Suite 1400, MS 614C, San Diego, CA 92101, Tel. 619-533-3450.

23. PAYROLL RECORDS: The Contractor's attention is directed to the City of San Diego Labor Compliance Program, Section IV, pages 4-7, and the State of California Labor Code §§ 1771.5(b) and 1776 (Stats. 1978, Ch. 1249). These require, in part, that the Contractor and Subcontractors maintain and furnish to the City, at a designated time, a certified copy of each weekly payroll containing a statement of compliance signed under penalty of perjury.

a) The Contractor and Subcontractors shall submit weekly certified payrolls online via Prism® i.e., the City's web-based labor compliance program. Instructions on how to use the system will be provided to the Contractor after the award.

b) The Contractor shall be responsible for the compliance with these provisions by Subcontractors. The City shall withhold contract payments when payroll records are delinquent or inadequate, or when it is established after investigation that underpayment has occurred.

24. APPRENTICES ON PUBLIC WORKS: The Contractor shall abide by the requirements of §§1777.5, 1777.6, and 1777.7 of the State of California Labor Code concerning the employment of apprentices by contractors and subcontractors performing public works contracts.

25. EQUAL BENEFITS: This Contract Is Subject To The City's Equal Benefits Ordinance (EBO), Chapter 2, Article 2, Division 43 Of The San Diego Municipal Code (SDMC).

a) In accordance with the EBO, Bidders shall certify they will provide and maintain equal benefits as defined in SDMC §22.4302 for the duration of the Contract (SDMC §22.4304(f)). Failure to maintain equal benefits is a material breach of the Contract (SDMC §22.4304(e)). The Contractor shall notify employees of their equal benefits policy at the time of hire and during open enrollment periods and shall post a copy of the following statement in an area frequented by employees:

"During the performance of a contract with the City of San Diego, this employer will provide equal benefits to its employees with spouses and its employees with domestic partners."

b) The Contractor shall give the City access to documents and records sufficient for the City to verify the contractors are providing equal benefits and otherwise complying with EBO requirements.

c) Full text of the EBO and the Rules Implementing the Equal Benefits Ordinance are posted on the City's website at www.sandiego.gov/purchasing/ or can be requested from the Equal Benefits Program at (619) 533-3948.

26. CITY STANDARD PROVISIONS. This contract is subject to the following standard provisions. See The WHITEBOOK for details.

a) The City of San Diego Resolution No. R-277952 adopted on May 20, 1991 for a Drug-Free Workplace.

b) The City of San Diego Resolution No. R-282153 adopted on June 14, 1993 related to the Americans with Disabilities Act.

c) The City of San Diego Municipal Code §22.3004 for Pledge of Compliance.

d) The City of San Diego's Labor Compliance Program and the State of California Labor Code §§1771.5(b) and 1776.

e) Sections 1777.5, 1777.6, and 1777.7 of the State of California Labor Code concerning the employment of apprentices by contractors and subcontractors performing public works contracts.

f) The City's Equal Benefits Ordinance (EBO), Chapter 2, Article 2, Division 43 of The San Diego Municipal Code (SDMC).

g) The City's Information Security Policy (ISP) as defined in the City's Administrative Regulation 90.63.

27. PRE-AWARD ACTIVITIES:

a) Pre-award Submittals - The Apparent Low Bidder (or winner in case of Design-Build contracts) shall provide the information required within the time specified in "Required Documents," of this bid package. Failure to provide the information within the time specified may result in the Bid being rejected as **non-responsive**.

b) If the Bid is rejected as non-responsive, the Apparent Low Bidder (or winner in case of Design-Build contracts) shall forfeit the Bid Security required under Invitation to Bids, of this bid package. The decision that the Apparent Low Bidder (or winner in case of Design-Build contracts) is non-responsive for failure to provide the information required within the time specified shall be at the sole discretion of the City.

c) Pre-award Schedule and Phased Funding - For phased funded contracts, One of the Pre-award Submittals is the Pre-award Schedule which is a cost loaded CPM schedule prepared in accordance with section 6-1.1, "Construction Schedule." The Apparent Low Bidder (or the apparent winner in case of Design-Build contracts) shall review subsection 6-1.4, "Phased Funding" and submit the required information as specified.

CITY OF SAN DIEGO
FUNDING AGENCY PROVISIONS
FOR
CONSTRUCTION CONTRACT REQUIREMENTS

1. STATE REQUIREMENTS FOR CONTRACTS SUBJECT TO STATE PREVAILING WAGE REQUIREMENTS:

1.1. In accordance with the provisions of California Labor Code Sections 1770, et seq. as amended, the Director of the Department of Industrial Relations has determined the general prevailing rate of per diem wages in accordance with the standards set forth in such Sections for the locality in which the Work is to be performed. Copies of the prevailing rate of per diem wages may be found at http://www.dir.ca.gov/dlsr/statistics_research.html. The Contractor shall post a copy of the above determination of the prevailing rate of per diem wages at each job site and shall make them available to any interested party on request.

1.2. Pursuant to Sections 1720 et seq., and 1770 et seq., of the California Labor Code the Contractor any Subcontractor shall pay not less than said specified rates determined by the Director of the California Department of Industrial Relations to all workmen employed by them in the execution of the Work.

The wage rates determined by the Director of Industrial Relations and published in the Department of Transportation publication entitled, "General Prevailing Wage Rates", refer to expiration dates. If the published wage rate does not refer to a predetermined wage rate to be paid after the expiration date, said published rate of wage shall be in effect for the life of this contract. If the published wage rate refers to a predetermined wage rate to become effective upon expiration of the published wage rate and the predetermined wage rate is on file with the Department of Industrial Relations, such predetermined wage rate shall become effective on the date following the expiration date and shall apply to this contract in the same manner as if it had been published in said publication. If the predetermined wage rate refers to one or more additional expiration dates with additional predetermined wage rates, which expiration dates occur during the life of this contract, each successive predetermined wage rate shall apply to this contract on the date following the expiration date of the previous wage rate. If the last of such predetermined wage rates expires during the life of this contract, such wage rate shall apply to the balance of the contract.

The successful bidder intending to use a craft or classification not shown on the prevailing rate determinations may be required to pay the rate of the craft or classification most closely related to it.

CONTRACT FORMS
AGREEMENT

CONSTRUCTION CONTRACT

This contract is made and entered into between THE CITY OF SAN DIEGO, a municipal corporation, herein called "City", and _____, herein called "Contractor" for construction of **Pump Station 65 Capacity Upgrade Project;** Bid No. **K-13-5522-DBB-3-A,** in the amount of _____ ($ _____), which is comprised of the Base Bid plus/minus Additive/Deductive Alternates _____.

IN CONSIDERATION of the payments to be made hereunder and the mutual undertakings of the parties hereto, City and Contractor agree as follows:

1. The following are incorporated into this contract as though fully set forth herein:

   (a) The attached Faithful Performance and Payment Bonds.
   (b) The attached Proposal included in the Bid documents by the Contractor.
   (c) That certain documents entitled **Pump Station 65 Capacity Upgrade Project**, on file in the Public Works Department as Document No. **B-00306**, as well as all matters referenced therein.

2. Contractor shall perform and be bound by all the terms and conditions of this contract and in strict conformity therewith shall perform and complete in a good and workmanlike manner **Pump Station 65 Capacity Upgrade Project**; Bid Number **K-13-5522-DBB-3-A,** San Diego, California.

3. For such performances, the City shall pay to Contractor the amounts set forth at the times and in the manner and with such additions or deductions as are provided for in this contract, and Contractor shall accept such payment in full satisfaction of all claims incident to such performances.

4. No claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

5. This contract is effective as of the date that the Mayor or designee signs the agreement.

CONTRACT FORMS (continued)
AGREEMENT

IN WITNESS WHEREOF, this agreement is signed by the City of San Diego, acting by and through its Mayor or designee, pursuant to Resolution No. R - _____ or Municipal Code _____authorizing such execution.

THE CITY OF SAN DIEGO

By_____

Print Name:_____
Mayor or designee

Date:_____

APPROVED AS TO FORM AND LEGALITY

Jan I. Goldsmith, City Attorney

By_____

Print Name:_____
Deputy City Attorney

Date:_____

CONTRACTOR

By_____

Print Name:_____

Title:_____

Date:_____

City of San Diego License No.:_____

State Contractor's License No.:_____

CONTRACT FORMS (continued)
PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND

FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

_____, a corporation, as principal, and _____, a corporation authorized to do business in the State of California, as Surety, hereby obligate themselves, their successors and assigns, jointly and severally, to The City of San Diego a municipal corporation in the sum of _____ for the faithful performance of the annexed contract, and in the sum of _____ for the benefit of laborers and materialmen designated below.

Conditions:

If the Principal shall faithfully perform the annexed contract **Pump Station 65 Capacity Upgrade Project;** Bid Number **K-13-5522-DBB-3-A,** San Diego, California then the obligation herein with respect to a faithful performance shall be void; otherwise it shall remain in full force.

If the Principal shall promptly pay all persons, firms and corporations furnishing materials for or performing labor in the execution of this contract, and shall pay all amounts due under the California Unemployment Insurance Act then the obligation herein with respect to laborers and materialmen shall be void; otherwise it shall remain in full force.

The obligation herein with respect to laborers and materialmen shall inure to the benefit of all persons, firms and corporations entitled to file claims under the provisions of Chapter 3 of Division 5 of Title I of the Government Code of the State of California or under the provisions of Section 3082 et seq. of the Civil Code of the State of California.

Changes in the terms of the annexed contract or specifications accompanying same or referred to therein shall not affect the Surety's obligation on this bond, and the Surety hereby waives notice of same.

The Surety shall pay reasonable attorney's fees should suit be brought to enforce the provisions of this bond.

Dated_____, 2_____

Approved as to Form and Legality

Jan I. Goldsmith, City Attorney

By_____
Deputy City Attorney

Approved:

_____
Mayor or designee,

_____
Principal

By_____

_____
Printed Name of Person Signing for Principal

_____
Surety

By_____
Attorney-in-fact

_____
Local Address of Surety

_____
Local Address (City, State) of Surety

_____
Local Telephone No. of Surety

Premium $_____

Bond No._____

CONTRACTOR CERTIFICATION

DRUG-FREE WORKPLACE

PROJECT TITLE: Pump Station 65 Capacity Upgrade Project

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-17 regarding Drug-Free Workplace as outlined in INSTRUCTION TO BIDDERS, "Drug-Free Workplace", of the project specifications, and that;

_____

(Name under which business is conducted)

has in place a drug-free workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of subdivisions a) through c) of the policy as outlined.

Signed_____

Printed Name_____

Title_____

CONTRACTOR CERTIFICATION

AMERICAN WITH DISABILITIES ACT (ADA) COMPLIANCE CERTIFICATION

PROJECT TITLE: Pump Station 65 Capacity Upgrade Project

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-4 regarding the American With Disabilities Act (ADA) outlined in the INSTRUCTION TO BIDDERS, "American With Disabilities Act", of the project specifications, and that;

_____

(Name under which business is conducted)

has in place a workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of the policy as outlined.

Signed_____

Printed Name_____

Title_____

CONTRACTOR CERTIFICATION

CONTRACTOR STANDARDS – PLEDE OF COMPLIANCE

PROJECT TITLE: Pump Station 65 Capacity Upgrade Project

I declare under penalty of perjury that I am authorized to make this certification on behalf of _____, as Contractor, that I am familiar with the requirements of City of San Diego Municipal Code § 22.3224 regarding Contractor Standards as outlined in INSTRUCTION TO BIDDERS ("Contractor Standards"), of the project specifications, and that Contractor has complied with those requirements.

I further certify that each of the Contractor's subcontractors whose subcontracts are greater than $50,000 in value has completed a Pledge of Compliance attesting under penalty of perjury of having complied with City of San Diego Municipal Code § 22.3224.

Dated this _____ Day of _____, 2_____.

Signed_____

Printed Name_____

Title_____

PHASED FUNDING SCHEDULE AGREEMENT

Check one:

☐ First Phased Funding Schedule Agreement
☐ Final Phased Funding Schedule Agreement

NOTE: THIS IS A SAMPLE PHASED FUNDING SCHEDULE AGREEMENT FORM. Particulars left blank in this sample, the total number of phases, and the amounts assigned to each phase will be filled with funding specific information as the result of the Pre-Award Schedule, and subsequent Schedules, required by these Bid Documents and approved by the City.

BID NUMBER: K-13-5522-DBB-3-A

CONTRACT: Pump Station 65 Capacity Upgrade Project

CONTRACTOR: _____

Funding Phase	**Phase Description**	**Phase Start**	**Phase Finish**	**Not-to-Exceed Amount**
1				$
	Additional phases to be added			
	to this form as necessary.			
Total				$

Notes:

(1) City Supplement 9-3.6, "PHASED FUNDING COMPENSATION" applies.
(2) The total of all funding phases shall be equal to the TOTAL BID PRICE as shown on BID SCHEDULE 1 - PRICES.
(3) This PHASED FUNDING SCHEDULE AGREEMENT will be incorporated into the CONTRACT and shall only be revised by a written modification to the CONTRACT.

OWNER: CITY OF SAN DIEGO

By: _____
Project Manager &
Public Works Department

Date: _____

CONTRACTOR: _____

By: _____

_____

Date: _____

- END OF PHASED FUNDING SCHEDULE AGREEMENT -

AFFIDAVIT OF DISPOSAL

WHEREAS, on the _____ DAY OF _____, 2____, the undersigned entered into and executed a contract with the City of San Diego, a municipal corporation, for:

Pump Station 65 Capacity Upgrade Project
(Name of Project)

as particularly described in said contract and identified as Bid No. **K-13-5522-DBB-3-A;** SAP No. **B-00306** and **WHEREAS**, the specifications of *said contract* requires the Contractor to affirm that "all brush, trash, debris, and surplus materials resulting from this project have been disposed of in a legal manner"; and **WHEREAS**, said contract has been completed and all surplus materials disposed of:

_____

_____

_____

NOW, THEREFORE, in consideration of the final payment by the City of San Diego to said Contractor under the terms of said contract, the undersigned Contractor, does hereby affirm that all surplus materials as described in said contract have been disposed of at the following location(s)

_____

_____

_____

and that they have been disposed of according to all applicable laws and regulations.

Dated this _____ DAY OF _____, 2_____.

_____Contractor
by

ATTEST:

State of _____
County of _____

On this _____ DAY OF _____, 2_____, before the undersigned, a Notary Public in and for said County and State, duly commissioned and sworn, personally appeared _____ known to me to be the _____ Contractor named in the foregoing Release, and whose name is subscribed thereto, and acknowledged to me that said Contractor executed the said Release.

Notary Public in and for said County and State

THESE SUPPLEMENTARY SPECIAL PROVISIONS CONFORM TO THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (THE GREENBOOK) CURRENTLY ADOPTED BY THE CITY, INCLUDING ITS CURRENT SUPPLEMENT AMENDMENTS (CITY SUPPLEMENTS INCLUDED IN THE WHITEBOOK), EXCEPT FOR THE FOLLOWING:

STYLE OF SPECIFICATIONS

The City is gradually standardizing the style and language of the standard specifications for the public works construction. The new style and language follows the Federal guidelines for "Plain Language" to the extent possible.

The use of this new style does not change the meaning of a specification not yet using this style. Where used in the Contract Documents, statement or command type phrases (i.e., active voice and imperative mood) refer to and are directed at the Bidder or Contractor as applicable. The specifications are written to the Bidder before award and the Contractor after. Before award, interpret sentences written in the imperative mood as starting with "The Bidder must" and interpret "you" as "the Bidder" and "your" as "the Bidder's." After award, interpret sentences written in the imperative mood as starting with "The Contractor must" and interpret "you" as "the Contractor" and "your" as "the Contractor's." Similarly, interpret "we" and "us" as "the City" and "our" as "the City's."

PART 1 – GENERAL PROVISIONS

SECTION 1 – TERMS, DEFINITIONS, ABBREVIATIONS, UNITS OF MEASURE, AND SYMBOLS

1-2 TERMS AND DEFINITIONS.

Agency – ADD the following:

Regulatory activities handled by the City of San Diego Developmental Services, Fire and Planning Departments, or any other City Department are not subject to the responsibilities of the City under this contract.

Certificate of Compliance – To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Certificate of Compliance – A written document signed and submitted by a supplier or manufacturer that certifies that the material or assembled material supplied to the Work site complies with the requirements of the Contract Documents.

Contract Documents – To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

The Agreement, Addendum, Invitation to Bids, Instructions to Bidders, special notice page, funding agency provisions, Bid and documentation accompanying the Bid and any post-bid documentation submitted prior to the Notice of Award when attached as an exhibit to the Contract, Bonds, permits from jurisdictional regulatory agencies, Supplementary Special Provisions (SSP), City's EOCP Requirements, City Supplement, Plans, Standard Plans, Construction Documents, Reference Specifications listed in the Invitation to Bids or the RFP for Design-Build contracts, Request for Qualifications (RFQ), Statement of Qualifications (SOQ), Request for Proposals (RFP), modifications issued after the execution of the Contract e.g., Change Orders, Construction Manager At Risk's Guaranteed Maximum Price including written qualifications, assumptions and conditions thereto and Pre-construction Services Agreement.

Limited Notice To Proceed – A written notice given from the City to the Contractor that authorizes the Contractor to start a limited amount of work that is not Construction Work, such as finalizing subcontract agreements, ordering materials, mobilization, furnishing a field office, and any other preliminary work done prior to performing Construction Work.

Normal Working Hours - To the City Supplement, ADD the following:

The Normal Working Hours shall be 7:00 AM to 4:00 PM.

Notice of Completion (NOC) – ADD the following:

See California Civil Code section 9204.

Samples - Physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be evaluated.

SECTION 2 - SCOPE AND CONTROL OF WORK

2-1.2.2 Joint Venture Contractors. To the City Supplement, last paragraph, DELETE in its entirety and SUBSTITUTE with the following:

The Joint Venture shall designate an on-site representative and an alternate in writing. The on-site representative and the alternate shall have the full authority to bind all Joint Venture partners.

The Joint Venture shall provide a copy of the Joint Venture agreement and the Joint Venture license to the City within 10 Working Days after receipt by the Bidder of Contract forms.

2-3.1.2 Subcontractor List. ADD the following:

For Extra Work, the Contractor shall submit Form CC10, "CONTRACT CHANGE ORDER (CCO)" with each CCO proposal. Form CC10 is available for download from the EOCP site at: http://www.sandiego.gov/eoc/pdf/cc10.pdf

2-3.2 Self Performance. DELETE in its entirety and SUBSTITUTE with the following:

2-3.2 Self Performance: The Contractor shall perform, with its own organization, Contract work amounting to at least **30 percent** of the base bid alone or base bid and any additive or deductive alternate(s) that together when added or deducted form the basis of determining the Apparent Low Bidder as specified.

2-3.3 Status of Subcontractors. ADD the following:

With every request for payment, the Contractor shall submit to the Engineer a breakdown showing monthly and cumulative amounts of the Work performed under Change Order by the Contractor and the Subcontractors. The reporting format shall be approved by the Engineer.

2-3.4 Subcontract Requirements. To the City Supplement, ADD the following paragraph:

The Contractor shall ensure that all of its Subcontractors are licensed at the time of the execution of their subcontract agreements. In the event a Subcontractor is not properly licensed, the Contractor shall cease payment to Subcontractor for all work performed when the Subcontractor was improperly licensed. Any payment made by the Contractor to a Subcontractor for work performed when the Subcontractor was unlicensed shall be returned to the City.

Where the Contract Documents require that a particular product be installed or applied by an applicator approved by the manufacturer, it is the Contractor's responsibility to ensure the Subcontractor or Supplier employed for such work is approved by the manufacturer.

2-5.2 Precedence of Contract Documents. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

2-5.2 Precedence of Contract Documents. If there is a conflict between any of the Contract Documents, the document highest in the order of precedence shall control. The order of precedence, from highest to lowest, shall be as follows:

1) Permits (i.e., issued by jurisdictional regulatory agencies)
2) Change Orders and Supplemental Agreements; whichever occurs last
3) Contract and Agreement
4) Addenda
5) Bid (e.g., price Proposal for Design-Build contracts)
6) Request for Proposal (RFP)
7) Invitation to Bid
8) Instruction to Bidders
9) Request for Qualifications (RFQ)
10) Special Provisions (i.e., City's EOCP Requirements, City Supplement, and Supplementary Special Provisions (SSP))
11) Plans
12) Construction Documents (for Design-Build contracts)
13) Standard Drawings
14) Reference Specifications (e.g., GREENBOOK)
15) Technical Proposal (for Design-Build contracts)
16) Statement of Qualifications (SOQ)

When additional requirements by the funding sources are physically or by reference incorporated in the Contract Documents, the funding source's requirements shall govern **unless specified otherwise**.

Figured dimensions shall take precedence over scaled dimensions. Detailed drawings shall take precedence over general drawings.

2-5.3.1 General. ADD the following:

When required by the Contract Documents or when requested by the Engineer, the Contractor shall provide the submittals as specified in 2-5.3.2, 2-5.3.3, and 2-5.3.4 to the Engineer. Materials shall neither be furnished nor fabricated, nor shall any work for which submittals are required be performed before the required submittals have been reviewed and accepted by the Engineer. The payment for the submittals shall be included in the various Bid items. Neither review nor acceptance of submittals by the Engineer shall relieve the Contractor from responsibility for errors, omissions, or deviations from the Contract Documents, unless such deviations were specifically called to the attention of the Engineer in the letter of transmittal. The Contractor shall be responsible for the correctness of the submittals.

The Contractor shall allow a minimum of 20 working days for review of submittals unless otherwise specified in the Special Provisions. Each submittal shall be accompanied by a letter of transmittal.

Unless otherwise noted, within 14 days after the date of commencement as stated in the Notice to Proceed, the CONTRACTOR shall submit the following items to the ENGINEER for review:

a. The final version of the draft submittals given to the CONTRACTOR by the ENGINEER at the Preconstruction Conference. The CONTRACTOR shall have reviewed and added items that the CONTRACTOR believes require approval or review prior to proceeding with specific work activities. This list shall include specification section numbers and description of the submittal. Scheduled submission dates and anticipated approval dates for all CONTRACTOR submittals shall be included in the CONTRACTOR's Construction Schedule.

b. A list of all permits and licenses the CONTRACTOR is required to obtain, indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit. The CONTRACTOR is responsible for identifying and delivering all submittals and/or permits required by the contract documents.

c. The CONTRACTOR is to recognize the time and sequence related to the submittals required by the contract documents. Therefore, the CONTRACTOR shall demonstrate competency in preparing and delivering submittals. The CONTRACTOR will not be allowed additional contract time or compensation due to delays associated with submittals. In addition, the costs associated with expedited review of a submittal or a submittal conference may be withheld from monies due the CONTRACTOR by the OWNER to cover additional costs of the ENGINEERS and DESIGN CONSULTANT's review.

2-5.3.2 Working Drawings. ADD the following:

The CONTRACTOR shall maintain and submit Record Documents with Field Engineering. Failure of the CONTRACTOR to maintain updated Record Documents shall result in delaying the CONTRACTOR'S monthly progress payments until the Record Documents are updated.

2-5.3.3 Shop Drawings. ADD the following:

a. Wherever called for in the Contract Documents, the CONTRACTOR shall furnish to the Engineer for review, six (6) copies, plus one reproducible copy, of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items. The CONTRACTOR shall submit, as applicable, the following for all prefabricated or manufactured structural, mechanical, electrical, plumbing, and process systems and equipment:

    1. Wiring and control diagrams of systems and equipment.

    2. Complete manufacturer's specifications, including materials description and paint system.

    3. Samples of finish colors for selection.

    4. Requirements for storage and protection prior to installation.

    5. Installation procedures.

    6. List of all requested exceptions to the Contract Documents and/or variations from the specified equipment.

       A bill of material shall be provided for each component.

A catalog cut sheet shall be provided for each component and the full model number shall be provided and clearly identified for each item.

Termination numbers and terminal block numbers for each electrical component.

b. All shop drawing submittals shall be accompanied by the Engineers standard submittal transmittal form. The form may be obtained in quantity from the Engineer. Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal.

   1. Sequentially number the transmittal forms. Resubmittals shall have original number with an alphabetic suffix.

   2. Identify Contract, CONTRACTOR, Subcontractor and/or Supplier; pertinent drawing sheet and detail number(s), and specification section number, as appropriate. On standard drawings or data sheets, clearly indicate model and option being proposed and strike out all non-relevant data.

   3. All submittals must be capable of being scanned electronically for filing on a computer file.

   4. All submittals must be formatted by indexing with the use of tabs and a table of contents.

c. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the Engineer.

d. If three (3) copies of a submittal are returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will not be required.

e. If four (4) copies of a submittal are returned to the CONTRACTOR marked "MAKE CORRECTIONS NOTED," formal revision and resubmission of said submittal will not be required, unless specifically required.

f. If a submittal is returned to the CONTRACTOR marked "REJECTED-RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the ENGINEER.

g. Fabrication of an item shall be commenced only after the DESIGN CONSULTANT has reviewed the pertinent submittals and the ENGINEER has returned copies to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the contract requirements.

   All CONTRACTOR shop drawing submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR, prior to submission to the ENGINEER. Each submittal shall be dated, signed, and certified by the CONTRACTOR, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated, signed, and certified. No consideration for review by the ENGINEER of any CONTRACTOR submittals will be made for any items which

have not been so certified by the CONTRACTOR. All non-certified submittals will be returned to the CONTRACTOR without action taken by the ENGINEER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

h. The ENGINEERS and DESIGN CONSULTANT's review of CONTRACTOR shop drawing submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

i. The ENGINEER may schedule a submittal conference to provide for a rapid review of a submittal, should the project schedule warrant such a review. The ENGINEER, DESIGN CONSULTANT, CONTRACTOR, and a qualified manufacturer's representative shall attend the submittal conference.

ADD: 2-5.3.5 Owners' Manual. The CONTRACTOR shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the OWNER'S MANUAL. The OWNER'S MANUAL shall be written so that it can be used and understood by the OWNER'S operation and maintenance staff.

The OWNER'S MANUAL shall be subdivided first by specification section number; second, by equipment item; and last, by "part." "Parts" shall conform to the following (as applicable):

1. Part 1 - Equipment Summary

   a. Summary: A summary table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.

   b. Form: The ENGINEER will supply an Equipment Summary Form for each item of mechanical, electrical and instrumentation equipment in the WORK. The CONTRACTOR shall fill in the relevant information on the form and include it in Part 1.

2. Part 2 - Operational Procedures

   a. Procedures: Manufacturer-recommended procedures for the following shall be included in Part 2:

      Installation

      Adjustment

      Start-up

      Location of controls, special tools or other equipment required

      Related instrumentation needed for operation

      Operating Procedures

      Load Changes

      Calibration

      Shutdown

      Troubleshooting

      Disassembly

      Reassembly

Realignment

Testing to determine performance efficiency

Tabulation of proper settings for all pressure relief valves, low and high pressure switches and other protection devices

List of all electrical relay settings including alarm and contact settings

3. Part 3 - Preventive Maintenance Procedures

   a. Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component and by leaving the equipment in place.

   b. Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade and type, and temperature ranges shall be covered.

4. Part 4 - Parts List

   a. Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.

   b. Drawings: Cross-sectional or exploded view drawings shall accompany the parts list.

5. Part 5 - Wiring Diagrams

   a. Diagrams: Part 5 shall include complete internal and connection wiring diagrams for electrical equipment items in both half and full size.

6. Part 6 - Shop Drawings

   a. Drawings: This part shall include approved shop or fabrication drawings, complete with dimensions in both half and full size.

7. Part 7- Safety

   a. Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

8. Part 8 - Documentation

   a. All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

      The CONTRACTOR shall furnish to the ENGINEER 7 identical OWNER'S MANUALS. Each set shall consist of one or more volumes, each of which shall be labeled and bound in a standard size, 3-ring, loose leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A table of contents indicating all equipment in the manuals shall be prepared.

      OWNER'S MANUALS shall be submitted in final form to the ENGINEER not later than the 75 percent of construction completion date. All discrepancies found by the ENGINEER in the OWNER'S MANUALS shall be corrected by the CONTRACTOR within 30 days from the date of written notification by the ENGINEER.

The CONTRACTOR'S attention is directed to the condition that one percent of the contract price will be deducted from any monies due the CONTRACTOR as progress payments, if at the 75 percent construction completion point, the approved OWNER'S MANUAL complying with Section 2-5.3.5 has not been submitted. The aforementioned amount will be retained by the OWNER as the agreed, estimated value of the approved OWNER'S MANUALS. Any such retention of money for failure to submit the approved OWNER'S MANUALS on or before the 75 percent construction completion point shall be in addition to the retention of any payments due to the CONTRACTOR.

When available from the equipment vendor, the CONTRACTOR shall submit one (1) copy of available sections of the final OWNER'S MANUALS in an electronic media format. The information shall be provided on a compact disk (CD or DVD) in either Microsoft Word or PDF files.

SPARE PARTS LIST

The CONTRACTOR shall furnish to the ENGINEER five (5) copies of spare parts information for all mechanical, electrical and instrumentation equipment. The spare parts list shall include the current list price of each spare part. The spare parts list shall be limited to those spare parts which each manufacturer recommends be maintained by the OWNER in inventory at the site. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the OWNER in ordering. The CONTRACTOR shall cross-reference all spare parts lists to the equipment numbers designated in the contract documents. The spare parts list shall be bound in standard size, 3-ring, loose leaf, vinyl plastic hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches.

2-5.4.1 General. ADD the following:

Source Identification e.g., RFI numbers and Change Order numbers as required to identify the source of the change to the Contract Documents shall be noted.

2-5.4.2 Asset Specific Red-lines. To the City Supplement, item d), ADD the following:

- Dimensional changes to the drawings.
- Revisions to details shown on drawings.
- Depths of foundations below first floor.
- Locations and depths of underground utilities.
- Revisions to routing of piping and conduits.
- Revisions to electrical circuitry.
- Actual equipment locations.
- Duct size and routing.
- Locations of concealed internal utilities.
- Changes made by Change Order.
- Details not on original Plans.

ADD the following:

h) Slurry Seal and Asphalt Overlay Red-Lines: The Contractor shall clearly record on the City provided forms in MS Excel format the actual dates and quantity of each Bid item applied to each street segment and comments regarding each segment. The Contractor shall record reasons if no work is performed.

2-6 WORK TO BE DONE. ADD the following:

In accordance with the provisions of California Law, the Contractor shall possess or require the Subcontractor(s) to possess valid appropriate license(s) for the Work being performed.

2-9.1 Permanent Survey Markers. DELETE in its entirety and SUBSTITUTE with the following:

The Contractor shall notify the Engineer or the owner on a Private Contract, at least 7 days before starting the Work to allow for the preservation of survey markers, survey monuments, lot stakes (tagged), and benchmarks. The Engineer or the owner on a Private Contract, will, at its cost, file a Corner Record Form referencing survey monuments subject to disturbance in the Office of the County Surveyor prior to the start of construction and also prior to the completion of construction for the replacement of survey monuments. The Contractor shall not disturb or permanently cover survey markers, survey monuments, lot stakes (tagged), or benchmarks without the consent of the Engineer or the owner on a Private Contract. The Contractor shall bear the expense of uncovering and replacing any that may be disturbed without permission. Replacement shall be done only under the direction of the Engineer by a Registered Land Surveyor or a Registered Civil Engineer authorized to practice land surveying within the State of California. When a change is made in the finished elevation of the pavement of any roadway in which a permanent survey monument is located, the Contractor shall adjust the monument cover to the new grade within 7 days of finished paving unless otherwise specified in the Special Provisions.

2-9.2 Survey Services. DELETE in its entirety and SUBSTITUTE with the following:

The Contractor shall be responsible for all surveying services or as may be specified in these special provisions.

The payment for survey services shall be included in the various Bid items unless a Bid item for Survey Service has been provided

2-10 AUTHORITY OF BOARD AND ENGINEER. ADD the following:

Regulating agencies of the City, such as Developmental Services, Fire and Planning Departments, enforce Legal Requirements and standards. These enforcement activities are not subject to the responsibilities of the Engineer under this Agreement.

2-11 INSPECTION. ADD the following:

The City may utilize field inspectors to assist the Engineer during construction in observing performance of the Contractor. The inspector is for the purpose of assisting the Engineer and shall not be confused with an inspector with a City regulatory agency or with a Special Inspector.

Code compliance testing (including all Geotechnical requirements) and inspections required by codes or ordinances, or by a plan approval authority, shall be the responsibility of and shall be paid by the Contractor, unless otherwise provided in the Contract Documents.

The Contractor's quality control testing and inspections shall be the sole responsibility of the Contractor and paid by the Contractor included in the Bid price.

ADD: 2-17 CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM.

1. Prior to the Award of the Contract or each Task Order, you and your Subcontractors and Suppliers **must** register with the City's web-based contract compliance i.e., Prism® portal at:

   https://pro.prismcompliance.com/default.aspx

   The City may not award the contract until registration of all subcontractors and suppliers is complete. In the event this requirement is not met within the time frame specified in the Notice of Intent to Award letter, the City reserves the right to rescind the Notice of Award / Intent to Award and to make the award to the next responsive and responsible bidder / proposer.

2. Following NTP, you must use Prism® for EOCP reporting purposes e.g., The Weekly Certified Payroll, Monthly Employment Utilization, and Monthly Payments. Online tutorials are available at:

   http://stage.prismcompliance.com/etc/vendortutorials.htm

ADD: 2-18 CHECKOUT PLAN. Submit a Checkout Plan with Physical Checkout; Shop Testing, Field Testing, Functional Testing and System Loop Checks. The Checkout Plan shall define the sequence and schedule and procedures for physical checkout, shop testing, field testing, and functional testing of equipment and systems.

a. Shop Testing is defined as testing that is done by the Supplier either at the place of manufacture, the place of assembly, or at another location where the required testing apparatus is located, for the purpose of proving that the products meet the requirements of the pertinent technical specification(s).

b. Physical Checkout is defined as the process of physically inspecting products after they have been installed to determine if the products have been properly and completely installed, comply with the approved shop drawings and are ready for Field and/or Functional Testing.

c. Field Testing is defined as testing that is performed by the CONTRACTOR, and/or Subcontractors, with Supplier assistance, on products after they have been installed, and after the performance of physical checkout, for the purpose of proving that the tested products meet the requirements of the pertinent technical specifications. Field testing is required regardless of whether or not shop testing was performed on the same piece of equipment or material

d. System Loop Checks - (Applies to equipment or systems controlled by the Programmable Logic Controller or Distributed Control System) are defined as tests performed jointly by the CONTRACTOR, their Control Systems Provider SUBCONTRACTOR providing control systems (COMNET), and equipment manufacturers to verify the control wiring (both hardwired and data linked) between the Programmable Logic Control or Distributed Control System and instruments or equipment which it monitors or controls throughout the plant. Loop checks are to be performed to insure the Programmable Logic Controller and Distributed Control System can properly control or monitor each instrument or piece of equipment and that the systems are ready for functional testing. The requirements and procedures for Loop Checks are contained in the pertinent specifications and subsection 2-24 of this section.

   Loop Checks are defined as tests performed to verify the control wiring (both hardwired and datalink) between local control panels (LCPs) and/or the Programmable Logic Controllers (PLC) and the distributed control system (DCS) and instruments or equipment which they control. The CONTRACTOR performs loop checks from local control panels to all instruments or equipment which they control. Additionally the CONTRACTOR shall perform loop checks jointly with their Control Systems Provider (CSP) SUBCONTRACTOR, for instruments or equipment controlled by the programmable logic controller and distributed control system. The test verifies proper operational control or monitoring of the instrument or equipment. Loop checks are to be performed to insure the

LCP and/or PLC and the DCS can properly control or monitor each instrument or piece of equipment and that the systems are ready for functional testing. The requirements and procedures for System Loop Checks are contained in the pertinent specifications and subsection 2-24 of this section.

e. Functional Testing is defined as testing performed by the CONTRACTOR on a "system" normally comprised of two or more pieces of equipment, after the equipment has been installed, and after Physical Checkout, Field Testing and System Loop Checks have been completed, for the purpose of proving that the system meets requirements as specified and as indicated. The administrative requirements for Functional Testing are specified in subsection 2-25 of this Section, while the technical requirements are specified in the technical specifications.

f. The Supplier's Representative or Manufacturer's Representative is defined as a person, or persons provided by the Supplier or Manufacturer, who is qualified by having the training and experience, to provide technical and/or process related advice, and/or assistance, relating to the installation or utilization of the products provided by that same Supplier. The Supplier's Representative or Manufacturer's Representative shall be a Professional Engineer registered in the State of California in the discipline most appropriate for the product provided or approved by the OWNER.

g. The Testing, Checkout, and Start-Up Coordinator is defined as the person provided by the CONTRACTOR to coordinate and oversee the total spectrum of testing and inspection activities required by the Contract Documents. The Testing, Checkout and Start-Up Coordinator shall be a Professional Engineer registered in the State of California in the discipline most appropriate for the equipment to be tested and checked out or approved by the OWNER.

ADD: 2-19 ROLES AND RESPONSIBILITIES.

a. The CONTRACTOR shall provide all outside services, materials, labor, supplies, test equipment and other items necessary to perform the testing specified herein and interim connections. In addition the CONTRACTOR shall arrange for and provide the participation or assistance of survey crews, engineers, quality control technicians, Suppliers' and/or Manufacturer's representative(s), and required utility, regulator, or governmental agency representatives. The CONTRACTOR shall provide the services of the Supplier's and/or Manufacturer's representative(s) as follows:

   1. Shop Testing as specified in the specifications in Divisions 2 through 16, and as specified herein.
   2. Assistance during installation as specified in the specifications in Divisions 2 through 16.
   3. Field Testing as specified in the specifications in Divisions 2 through 16, and as specified herein.
   4. Functional Testing as specified in the specifications in Divisions 2 through 16, and as specified herein.
   5. Manufacturers to provide services for loop checks between LCP's and equipment as specified in Specifications 2 through 16.
   6. Based on past experience on similar projects at this facility, the CONTRACTOR shall provide the on-site services of manufacturers and subcontractors over a number of months to complete system loop checks, functional tests and other start-up activities.

b. The Supplier's and/or Manufacturer's representative's activities required by this Section are in addition to the requirements for vendor training and other services specified elsewhere in the Contract Documents. Timing for the performance of these services shall be defined in the Checkout Plan, specified herein.

c. The ENGINEER and/or OWNER may review and comment on the CONTRACTOR's deliverables, participate in the physical inspection activities, witness the shop and field testing, witness loop checks, witness functional testing, and provide verification of conformance to the specifications.

ADD: 2- 20 SHOP TESTING.

When required by the Technical Specifications, perform shop testing prior to delivery of the equipment or material. Unless otherwise noted, provide 45 days written notice indicating the time and place of testing. The CONTRACTOR shall submit the following for approval thirty days prior to this notice:

1. Description of the equipment and the applicable specification sections
2. **Description of the test:** Specifically outlining how tests will conform to the requirements in the Technical Specifications.
3. **Testing Devices That Will Be Used in the Tests:** Description must state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts.
4. **Personnel Used to Perform the Tests:** Resumes, qualifications, and experience shall be submitted. Personnel performing tests shall be Professional Engineers registered in the discipline most appropriate for the testing that will be performed.
5. **Schedule for testing:** Schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or test failure.
6. **Test forms:** Submit all forms used to record and report on Shop Test data, for approval, prior to the test. No testing shall be conducted until these forms are approved. Forms shall provide the following information: description of test, equipment used, personnel present, equipment specification numbers, and measurements made. Forms shall have a place for signature by the person responsible for conducting the test, and an officer of the company verifying that the tests performed are true, accurate, have met the required criteria, and that the equipment will operate as indicated and as specified.

   Submit six (6) copies of the following within seven days after completion of the tests for approval:

   i. Completed test forms, for each device tested, on forms as approved prior to the test.

   ii. Completed certification, the content of which was approved prior to the tests.

   iii. A written summary of test; a report of the results and a summary of the entire procedure.

   iv. A schedule for retesting, if necessary. The CONTRACTOR shall perform any retesting required to fulfill the intent of the Technical Specification test requirements at no additional cost to the OWNER

ADD: 2-21 WITNESSING TESTS.

a. Unless otherwise noted, provide a minimum of 45 days written notice to the ENGINEER so that the ENGINEER, the OWNER, or its representatives may have the opportunity to witness the Shop tests, Field tests, Loop checks, and Functional tests. The ENGINEER's or OWNER's witnessing of tests does not relieve the CONTRACTOR of its obligation to comply with the requirements of the Contract Documents.

ADD: 2-22 CHECKOUT PLAN REQUIREMENTS.

a. The CONTRACTOR shall submit a Checkout Plan based upon the requirements defined herein, and the Technical Specifications to the ENGINEER. Six (6) copies and one (1) copy on

electronic media (MS Word or PDF) of the preliminary Checkout Plan shall be submitted for review. The plan shall define:

1. The equipment and applicable specification section(s) for the equipment
2. The logical and systematic performance of physical inspections, shop tests, field tests, loop checks, and functional tests including:

   ii. A chronological schedule of all testing, checking, and inspection activities.

   iii. A checklist of all inspection, checking, and testing activities broken down by location, discipline, system, and device or item.

   iv. All blank forms proposed by the CONTRACTOR for verification or recording for all testing.

   v. An index which cross references the forms to their intended application(s).

   vi. A list of all shop tests, and supplier certifications, including those required by the applicable technical specifications. Provisions shall also be included for re-testing, in the event it is required.

1. Participants in the testing.
2. Special test equipment.
3. Sources of the test media (water, power, air.)
4. The proposed method of delivery of the media to the equipment to be tested.
5. Temporary or interim connections for the sequencing of multiple units.
6. Ultimate proper disposal of the test media.

b. The plan will be reviewed by the ENGINEER, modified or revised as necessary by the CONTRACTOR, then approved by the ENGINEER. The CONTRACTOR shall continue to update the Checkout Plan, working in conjunction with the ENGINEER prior to the start of the scheduled equipment checkout and functional testing activities. Each specific element of the plan must receive written approval by the ENGINEER prior to the actual commencement of testing.

c. The CONTRACTOR shall designate, in the Checkout Plan, a coordinator for Testing, Checkout, and Start-Up to coordinate and manage the activities defined in the checkout plan, as approved by the ENGINEER.

ADD: 2-23 FIELD TESTING OF EQUIPMENT.

a. The CONTRACTOR shall provide the services of an experienced and authorized Supplier's or Manufacturer's representative for each item of equipment indicated in the specifications. In each case, the CONTRACTOR shall arrange to have the Supplier's or Manufacturer's representative revisit the job site as often as necessary until any and all trouble is corrected and the equipment installation and operation are satisfactory to the ENGINEER. The CONTRACTOR shall notify the ENGINEER of the visit of the Supplier's or Manufacturer's representative at least 48 hours in advance of arrival at the work site.

b. The CONTRACTOR shall deliver to the ENGINEER a written report prepared by the Supplier's or Manufacturer's representative, addressed to the OWNER, certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, and has been operated satisfactorily under full-load conditions. The Supplier's or Manufacturer's representative shall also provide written authorization that the equipment can be operated. This report shall be submitted within 7 days of the Supplier's or Manufacturer's representative visit to the site.

c. **Scheduling Tests:** The CONTRACTOR shall be responsible for scheduling all field testing. The CONTRACTOR is advised that the ENGINEER and the OWNER's operating personnel will witness field testing and that the Supplier's or Manufacturer's representative shall be required to instruct the OWNER's operating personnel in the correct operation and maintenance procedures. Such instruction shall be scheduled at a time arranged with the OWNER at least 2 weeks in advance, and shall be provided while the equipment is fully operational. On-site instruction shall be given by qualified persons who have been made familiar in advance with the equipment and systems in the plant. One hundred and twenty (120) days prior to scheduling any field testing, the CONTRACTOR shall have previously received approval of the Owner's Manuals. No field testing will be permitted if this requirement is not met. Any associated delays to the completion of the contract resulting from delayed testing due to incomplete or unapproved OWNER's manuals will be the responsibility of the CONTRACTOR.

d. **Test Support:** The CONTRACTOR shall furnish all personnel, power, water, chemicals, fuel, oil, grease, and all other necessary equipment, facilities, temporary and interim connections, and services required for conducting the tests and shall properly dispose of all material, media, and lubricants upon completion of the test.

e. **Notice Requirement:** Field testing shall be in addition to, and not in lieu of, shop testing. Field testing will be performed as a part of the overall physical and functional testing process defined herein and in accordance with the approved Checkout Plan. However, as a minimum the following specific instructions shall also apply. The CONTRACTOR shall provide sixty (60) calendar days written notice indicating the date and time for testing each piece of equipment, or a series of equipment pieces.

    1. All equipment installed by the CONTRACTOR shall undergo an operational check by the CONTRACTOR to verify that the equipment is functioning (electrically, mechanically and structurally) as it has been designed.

    2. Each device shall be operated through its full range of motion and each instrument shall be checked against its full span.

    3. At a minimum, this check shall include turning the equipment on and running it through one full cycle. This cycle shall include all operating possibilities. Signals or interlocks from other pieces of equipment may be simulated upon prior approval of the ENGINEER.

f. **Review of Procedures:** Field test procedures will be reviewed and returned by the ENGINEER within 30 (thirty) days of receipt. Incorporate minor comments to the procedures, equipment, or personnel prior to testing. Major comments by the ENGINEER will require a resubmission of the field test procedure and proposed test date. The CONTRACTOR will be notified, in writing, by the ENGINEER if a formal resubmission is required with the transmittal of the review comments.

g. **Additional Notice Requirements:** Provide 14 (fourteen) days written notice to the ENGINEER prior to the actual start of any testing. This will include a statement by the CONTRACTOR that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

h. **Test Report Requirements:** At conclusion of the test the CONTRACTOR will deliver draft test report data, and then submit, within seven (7) days after completion of the tests, six (6) copies of the following to the ENGINEER for approval:

    1. Completed test forms, for each device tested, on forms provided by the CONTRACTOR prior to the tests.

    2. Completed certification documentation, the content of which was approved prior to the tests.

3. A written summary of the test; a report of the results and a summary of the entire procedure.

4. A schedule for retesting, if necessary. Perform any retesting required to fulfill the intent of the technical specification test requirements at no additional cost to the OWNER.

ADD: 2-24 SYSTEM LOOP CHECKS.

a. Loop checks are performed jointly by the CONTRACTOR, SUBCONTRACTOR, and VENDOR after field-testing. The CONTRACTOR will have primary responsibility and will provide personnel to insure that the installed equipment and/or instruments are properly installed and operating during loop checks. The CONTRACTOR, SUBCONTRACTOR and/or VENDOR will provide personnel to operate the Distributed Control System and/or Programmable Logic Controller. The CONTRACTOR will provide communication equipment as required for the SUBCONTRACTOR, VENDOR and ENGINEER personnel to insure coordinated communication between the field and the Control Room.

b. The CONTRACTOR will provide 30 (thirty) days written notice indicating the date and time when loop checks will start. Submit with this notice a loop check package which includes the following to the ENGINEER for approval:

   1. Testing devices that will be used in the tests: Description must state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts. Include certifications of the calibration of instruments/testing devices.

   2. Schedule for Testing: Schedule shall include frequency of measurement, personnel present, and contingency plans for equipment and/or system failure.

   3. Test forms: Provide test forms for recording and reporting on the test data.

   4. Provide material and equipment required for the test.

   5. Utility requirements: Utilities will be supplied by the CONTRACTOR for loop checks, as required.

   6. Operational requirements: Include precautions which will be taken to protect equipment and personnel during testing.

   7. Loop diagrams must be approved and available during System Loop Check.

c. The ENGINEER and the OWNER may witness the performance of these tests, at their option.

d. Approval of the loop check package will be made within two weeks of the test date. Incorporate minor comments on the procedures and equipment prior to testing. Major comments by the ENGINEER will require a resubmission of the loop check package and test date.

e. The CONTRACTOR shall provide seven days written notice to the ENGINEER prior to the actual start of any testing.

f. The CONTRACTOR shall Submit within one week after completion of the tests, the following to the ENGINEER for approval:

   1. Completed test forms, for each loop tested on forms provided by the CONTRACTOR and approved prior to the test.

   2. Written summary of testing, reporting on the results and summarizing the entire procedure.

   3. A schedule for retesting, if necessary, including changes to procedures, testing devices, or personnel. Any retesting required to fulfill the intent of these requirements, due to negligence, poor workmanship, or products that fail to meet the Contract requirements, shall be at no additional cost to the OWNER.

ADD: 2-25 FUNCTIONAL TESTING.

a. Functional tests shall be performed by the CONTRACTOR who supplied the equipment being tested in addition to the requirement for shop, field, and other tests called for in the Technical Specifications. If more than one CONTRACTOR supplied the equipment being tested, each CONTRACTOR will provide a representative for the functional test team, and the team leader will be the representative from the CONTRACTOR with the major piece of equipment being tested. If no clear distinction exists under these criteria, then the CONTRACTOR with the largest dollar value of equipment incorporated into the system being tested shall be the team leader. Functional tests will be performed with fluid or gaseous substances that are generally non-septic, non-corrosive, non-toxic, and non-inflammable.

b. The CONTRACTOR shall provide 45 days written notice indicating the date and time during which the specified functional test is proposed. Submit with this notice a detailed contract specific functional test plan which includes the following to the ENGINEER for approval:

   1. Description of the system's equipment, piping, valves, instruments and other components, and the applicable specification sections.

   2. Testing devices that will be used in the tests: Description must state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results, catalog cuts and Calibration Certificates.

   3. **Personnel Used to Perform the Tests:** The CONTRACTOR shall submit resumes and qualifications of persons to be assigned to perform the tests. As a minimum, personnel must have 1 year experience with the operation of the equipment and/or system to be tested and have participated in at least one similar test during this period of experience.

   4. Schedule for Testing: Schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or system test failure.

   5. Test forms: Provide test forms for recording and reporting on the test data.

   6. Material and equipment required for the test.

c. The CONTRACTOR shall be obligated for installation and cost associated with all temporary materials and systems required to facilitate functional testing.

d. The ENGINEER, and the OWNER will direct specific actions when conflicts surface and will witness the performance of these tests.

e. Approval of the functional test package by the ENGINEER will be made within two weeks of the test date. Incorporate minor comments on the procedures, equipment, and personnel prior to testing. Major comments by the ENGINEER will require a resubmission of the functional test package and test date.

f. Provide fourteen days written notice to the ENGINEER prior to the actual start of any testing. This will include a statement by the CONTRACTOR that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

g. Submit within seven (7) days after completion of the tests, six (6) copies of the following to the ENGINEER for approval:

   1. Completed test forms, for each device, or system tested, on forms approved prior to the test.

   2. Completed certification, the content of which was approved prior to the tests.

   3. A written summary of the test; a report of the results and a summary of the entire procedure.

4. A schedule for retesting, if necessary, including changes to procedures, testing devices, or personnel. Any retesting required to fulfill the intent of the test requirements due to negligence, poor workmanship, or products that fail to meet the Contract requirements, shall be at no additional cost to the OWNER.

ADD: 2-26 SEVEN (7) DAY TESTING AND FACILITY STARTUP.

a. The startup of a pump station is a highly complex operation requiring the combined technical expertise of the CONTRACTOR, manufacturers, subcontractors, the CONSTRUCTION MANAGER, and the OWNER. The CONTRACTOR shall provide the effective coordination of all parties necessary for the successful plant startup.

b. It is not the intent of the CONSTRUCTION MANAGER to instruct the CONTRACTOR in the startup of the pump station; however, the CONSTRUCTION MANAGER will be available prior to and during startup to provide technical support to the CONTRACTOR.

c. The CONTRACTOR shall be required to start up the plant, under direction of the OWNER, operate it, and pass a 7-day test prior to acceptance. All equipment must properly run continuously 24 hours per day for the test period at rates indicated by the CONSTRUCTION MANAGER. If any item malfunctions during the test, the item shall be repaired and the test restarted at day zero with no credit given for the operating time before the aforementioned malfunction. This startup will be required for all equipment installed under this contract.

d. At about 50 to 70 percent completion of the project, but not less than 3 months prior to startup, the CONTRACTOR shall submit to the CONSTRUCTION MANAGER for review and approval, a detailed schedule of operations which will be necessary to effect a successful initial operation and sustained period of operation for the duration of the required startup period.

e. The CONTRACTOR shall provide operating personnel for the duration of the startup. Additionally, the CONTRACTOR shall provide its own alternative plan for providing, at its own expense, all water, power, chemicals, and other consumables required for successful completion of the test, in the event that public utilities, facilities, and/or resources become not readily available for hookup or tapping.

f. The startup shall not be commenced until all required leakage tests and equipment tests have been completed to the satisfaction of the CONSTRUCTION MANAGER.

g. The CONTRACTOR shall review outstanding punch list items with the CONSTRUCTION MANAGER 15 days prior to the scheduled start up; and complete, correct, or resolve at the option of the OWNER and CONSTRUCTION MANAGER, any items which impact or interfere with the facility start up.

h. The CONTRACTOR shall provide to the CONSTRUCTION MANAGER a list of 24 hour, “on call” representative supervisory persons who will monitor the facility start up and serve as a liaison for the CONSTRUCTION MANAGER and OWNER.

i. All defects in materials or workmanship which appear during this test period shall be immediately corrected by the CONTRACTOR. Time lost for equipment repairs, wiring corrections, control point settings, or other reasons which actually interrupt the startup may, at the discretion of the CONSTRUCTION MANAGER, be justifiable cause for extending the startup test duration.

j. During the startup, the CONTRACTOR shall provide the services of authorized representatives of the manufacturers, in addition to those services required under operations testing, as necessary, to correct faulty equipment operation.

k. During the startup, the CONTRACTOR shall keep records of the operations, in accordance with the instructions of the CONSTRUCTION MANAGER.

SECTION 3 – CHANGES IN WORK

3-3.2.2 Basis for Establishing Costs. To the City Supplement, item (a) Labor, 1st and 2nd paragraphs, DELETE in their entirety and SUBSTITUTE with the following:

The City reserves the right to request financial records of salaries for an employee, wages, bonuses and deductions to substantiate the actual cost of labor certified by a California licensed Certified Public Accountant. The Contractor shall use the City provided form i.e., "PUBLIC WORKS PAYROLL REPORTING FORM" which is available at http://www.sandiego.gov/eoc/pdf/payrollreport.pdf to list the labor rates of its personnel and Subcontractors who work on this Project. An initial submittal shall be made prior to NTP.

The payment for payroll records shall be included in the various Bid item unless a separate Bid item has been provided.

SECTION 4 - CONTROL OF MATERIALS

4-1.3.2 Inspection of Materials Not Locally Produced. ADD the following:

The Engineer will perform inspection of out-of-town manufacturer for the items of Work specified here:

a) New Pumps and Motors

4-1.3.4 Inspection Paid For By the Contractor. To the City Supplement, ADD the following:

The Contractor shall employ and pay for the services of qualified inspection entity to perform specialty inspection services as shown on the Plans and specified in the Specifications.

Examples of the special inspection required include Concrete Construction, Soils, and Steel Construction. See drawing numbers **36349-09-D (S-1)** through **36349-10-D (S-2)** for notes and requirements.

"If no bid item is provided, payment shall be included in General construction line item of Proposal (Bid) in Bidding Documents."

4-1.3.5 Special Inspections. To the City Supplement, ADD the following:

Special Inspection and testing by the Special Inspectors shall meet the minimum requirements of the prevailing Codes and by the City's Development Services Department (DSD) and reference in http://www.sandiego.gov/development-services/industry/special.shtml

4-1.5 Certificates of Compliance. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

4-1.5 Certificates of Compliance. DELETE in its entirety and SUBSTITUTE with the following:

Certificates of Compliance shall be furnished to the Engineer prior to the use of any material or assembled material for which these Specifications so require or if so required by the Engineer.

The Engineer may waive the materials testing requirements of the Specifications and accept a Certificate of Compliance. Manufacturing test data may be required by the Engineer to be included with the submittal.

Materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The submission of a Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating material in the Work which conforms to the requirements of the Contract Documents, and any material not conforming to the requirements will be subject to rejection whether in place or not.

When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the City shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

4-1.6 Trade Names or Equals. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Whenever materials or equipment are indicated in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the naming of the item is intended to establish the type, function, and quality required. Unless stated otherwise, materials or equipment of other Suppliers may be accepted if sufficient information is submitted to the Engineer for review to determine whether the material or equipment proposed is equivalent or equal to that named.

a) The Contractor shall submit its list of proposed substitutions for "an equal" ("or equal") item(s) **no later than 5 Working Days after the determination of the Apparent Low Bidder** and on a City form when provided by the City.

b) The request for substitution shall include the following information:

   i. Whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents to adopt the design to the proposed substitute.

   ii. Whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.

   iii. All variations of the proposed substitute from the items originally specified will be identified.

   iv. Available maintenance, repair, and replacement service requirements. The manufacturer shall have a local service agency within 50 miles of the site which maintains properly trained personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.

   v. Certification that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, and be similar and of equal substance to that indicated, and be suited to the same use as that specified.

c) There is no guaranteed time frame for the City's review of the substitution requests.

d) The burden of proof as to the type, function, and quality of any such substitute product, material or equipment shall be upon the Contractor. The Engineer may require at the Contractor's expense additional data about the proposed substitute.

e) If the Engineer takes no exceptions to the proposed substitution, it shall not relieve the Contractor from responsibility for the efficiency, sufficiency, quality, and performance of the substitute material or equipment, in the same manner and degree as the material and equipment specified by name.

f) The lack of action(s) on the Engineer's side within the Contractor's requested time shall not constitute acceptance of the substitution.

g) Acceptance by the Engineer of a substitute item shall not relieve the Contractor of the responsibility for full compliance with the Contract Documents.

h) For the substitution review process or to have materials listed on the AML, refer to the AML standard review process.

i) The Bid submittal shall be based on the material and equipment specified by name in the Contract. If the proposal is rejected by the Engineer, the Contractor shall not be entitled to either an extension in Contract Time, increase in the Contract Price, or both.

j) As applicable, no Shop Drawing or Working Drawing submittals shall be made for a substitute item nor shall any substitute item be ordered, installed, or utilized without the Engineer's prior written.

The Contractor shall reimburse the City for the charges of the Engineer for evaluating each proposed substitute.

SECTION 6 - PROSECUTION, PROGRESS AND ACCEPTANCE OF WORK

6-1.2 Commencement of Work. To the GREENBOOK and City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Unless specified otherwise, construction shall start within 5 Working Days after NTP and be diligently prosecuted to completion within the Contract Time. The Contractor shall not start any construction activity at the Site until the Pre-construction Meeting is held and the NTP has been issued by the Engineer.

Upon the Contractor's written request, the City may delay the NTP as follows:

a) Up to 5 Working Days from the Pre-construction Meeting, or

b) Up to 40 Working Days from the Limited NTP for the preparation, submittal, obtaining approval for and filing of the PRDs in accordance with 801, "STORM WATER POLLUTION CONTROL," or

c) Up to 60 Working Days from the Limited NTP for the preparation, submittal, and approval of the TCP on "D-sheets" when specified in 7-10.2, "Traffic Control."

For areas that do not require engineered TCP on D-sheets, the Contractor may at any time after the Pre-construction Meeting obtain a TCP Permit via Working Drawings or the City's over the counter process and start the Work. If the Contractor decides to commence the construction work before the completion of the D-sheet TCPs, the Contractor shall forfeit the 60 Working Days specified here. The D-sheet TCP shall be done concurrently and no additional time will be granted.

For paving Work, the Contractor shall coordinate the Work to facilitate the installation and protection of the new curb ramps and associated concrete work prior to commencing the asphalt overlay operations. The Work at a specific location shall not commence until all layouts and measurements are agreed upon by both the Contractor and the Engineer.

The Contractor shall notify SDG&E at least 10 Working Days prior to excavating within 10' of SDG&E Underground High Voltage Transmission Power Lines **(i.e., 69 KV and higher).**

6-1.4 Phased Funding. To the City Supplement, ADD the following:

This contract is subject to Phased Funding.

ADD: 6-1.8 Pre-construction Meeting. Within 20 Working Days from the Limited NTP the Engineer will schedule a mandatory pre-construction meeting (Pre-construction Meeting) with the Contractor. The agenda will include items such as NTP, design services and submittal and review process for Design-Build contracts, critical elements of the work schedule, submittal schedule, cost breakdown of major lump sum items, payment requests and processing, environmental and community concerns, coordination with the involved utility firms, the level of record project documents required and emergency telephone numbers for all representatives involved in the course of construction.

ADD: 6-8.1 Completion. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

6-8.1 Completion. The Contractor shall submit a written assertion that the Work has been completed. If, in the Engineer's judgment, the Work has been completed in accordance with the Contract Documents, the Engineer will set forth in writing the date the Work was completed. This will be the date when the Contractor is relieved from responsibility to protect and maintain the Work.

ADD: 6-8.1.3 Contract Closeout Sequence of Events.

a.. The sequence of events and their description listed below represent the suggested order of activities as the Contract proceeds from construction, through checkout, testing,

Substantial Completion, and the Notice of Completion. Not all work will proceed in this exact order. Adjustments may be made, after approval by the ENGINEER, for the mutual benefit of the CONTRACTOR and the OWNER, if the situation so warrants. Any adjustment made in the sequence of events, to accommodate the CONTRACTOR, shall be at no additional cost to the OWNER.

b. Closeout Sequence of Events and Description:

1. Checkout Plan - The CONTRACTOR will prepare a Checkout Plan in accordance with Section 2-18. This plan becomes the basis for all checkout, shop, field, and functional testing. It includes schedules, personnel, test media, and equipment requirements, and shall fully define the CONTRACTOR's intended checkout process.
2. WORK Nears Completion - Signifies the start of checkout and testing. The CONTRACTOR shall indicate when work is ready for checkout and testing on a facility and/or system basis.
3. Contract Closeout Deliverables - The CONTRACTOR shall provide the following, in accordance with the Checkout Plan and as specified:
   i. Shop Testing
   ii. Field Testing
   iii. Physical Checkout
   iv. Functional Testing
   v. OWNER's Manuals: provide seven (7) hard copies of the Owner's Manuals and one (1) electronic copy (DVD) of vendor information when available.
   vi. Vendor Training
   viiFinal Record Drawings: provide seven (7) hard copies in half size format and seven (7) hard copies in full size format
   viii. Maintenance stock items; spare parts; special tools.
   ix. Certificates of inspection and acceptance by local governing agencies having jurisdiction.
   x. Loop Drawings: Provide three (3) copies of loop diagrams within a three (3) ring 11 x 17 binder and one (1) electronic copy (DVD) with both Bentley Microstation (.DGN) files and Adobe Acrobat PDF files.

6-8.2 Acceptance. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

6-8.2 Acceptance. Acceptance will occur after all of the requirements contained in the Contract Documents have been fulfilled. If, in the Engineer's judgment, the Contractor has fully performed the Contract, the Engineer will accept the Contractor's performance of the Contract.

6-8.3 Warranty. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

6-8.3 Warranty. Unless specified otherwise, the Work shall be warranted by the Contractor against defective workmanship and materials for a period of 1 year.

a) The warranty period shall start on the date of completion of the Work as determined by the Engineer.

b) The Contractor shall provide an unconditional warranty on all installed fiber optic cable for a minimum period of 2 years.

c) The warranty period for the following items of the Work shall be 3 years:

1. Work under Section 500 (requires Long Term Warranty Contract (LTWC))
2. DWT Construction (requires manufacturer's warranty)
3. LED signal modules (requires manufacturer's warranty)
4. Private sewer pumps including the alarm panel and all other accessories. The Contractor shall provide the City and property owner a copy of the warranty. (requires manufacturer's warranty)

The Contractor shall involve the manufacturer in the installation and startup as needed to secure any extended warranty required.

d) The warranty period for specific items covered under manufacturers' or suppliers' warranties shall commence on the date they are placed into service at the direction of or as approved by the Engineer in writing.

e) All warranties, express or implied, from Subcontractors or Suppliers, of any tier, for the work performed and materials furnished shall be assigned, in writing, to the City, and such warranties shall be delivered to the Engineer prior to acceptance of the Contractor's performance of the Contract.

f) The Contractor shall replace or repair defective Work in a manner satisfactory to the Engineer, after notice to do so from the Engineer, and within the time specified in the notice. If the Contractor fails to make such replacement or repairs within the time specified in the notice, the City may perform the replacement or repairs at the Contractor's expense. If the Contractor fails to reimburse the City for the actual costs, the Contractor's Surety shall be liable for the cost thereof.

g) Nothing in this warranty is intended to limit any manufacturer's warranty which provides the City with greater warranty rights than set forth in this section or the Contract Documents.

h) These specifications are not intended to constitute a period of limitations or waiver of any other rights or remedies City may have regarding the Contractor's other obligations under the Contract Documents or federal or state law.

i) The Contractor shall respond and initiate corrective action within 24 hours of notice of nonconforming Work that poses an imminent threat to person or property.

6-9 LIQUIDATED DAMAGES. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

MODIFY to increase the daily value from $250 to $1,000.

SECTION 7 - RESPONSIBILITIES OF THE CONTRACTOR

7-3 LIABILITY INSURANCE. DELETE in its entirety and SUBSTITUTE with the following:

The insurance provisions herein must not be construed to limit your indemnity obligations contained in this contract.

ADD: 7-3.1 Policies and Procedures.

a) You must procure the insurance described below, at your sole cost and expense, to provide coverage against claims for loss including injuries to persons or damage to property, which may arise out of or in connection with the performance of the Work by you, your agents, representatives, officers, employees or subcontractors.

b) Insurance coverage for property damage resulting from your operations is on a replacement cost valuation. The market value will not be accepted.

c) You must maintain this insurance for the duration of this contract and at all times thereafter when you are correcting, removing, or replacing Work in accordance with this contract. Your liabilities under this contract, e.g., your indemnity obligations, will is not deemed limited to the insurance coverage required by this contract.

d) Payment for insurance is included in the various items of Work as bid by you, and except as specifically agreed to by the City in writing, you are not entitled to any additional payment. Do not begin any work under this contract until you have provided and the City has approved all required insurance.

e) Policies of insurance must provide that the City is entitled to 30 days (10 days for cancellation due to non-payment of premium) prior written notice of cancellation or non-renewal of the policy. Maintenance of specified insurance coverage is a material element of this contract. Your failure to maintain or renew coverage or to provide evidence of renewal during the term of this contract may be treated by the City as a material breach of contract.

ADD: 7-3.2 Types of Insurance.

7-3.2.1 Commercial General Liability Insurance.

a) Commercial General Liability Insurance must be written on the current version of the ISO Occurrence form CG 00 01 07 98 or an equivalent form providing coverage at least as broad.

b) The policy must cover liability arising from premises and operations, XCU (explosions, underground, and collapse), independent contractors, products/completed operations, personal injury and advertising injury, bodily injury, property damage, and liability assumed under an insured's contract (including the tort liability of another assumed in a business contract).

c) There must be no endorsement or modification limiting the scope of coverage for either "insured vs. insured" claims or contractual liability. You must maintain the same or equivalent insurance for at least 10 years following completion of the Work.

d) All costs of defense must be outside the policy limits. Policy coverage must be in liability limits of not less than the following:

General Annual Aggregate Limit	Limits of Liability
Other than Products/Completed Operations	$2,000,000
Products/Completed Operations Aggregate Limit	$2,000,000
Personal Injury Limit	$1,000,000
Each Occurrence	$1,000,000

7-3.2.2 Commercial Automobile Liability Insurance.

a) You must provide a policy or policies of Commercial Automobile Liability Insurance written on the current version of the ISO form CA 00 01 12 90 or later version or equivalent form providing coverage at least as broad in the amount of $1,000,000 combined single limit per accident, covering bodily injury and property damage for owned, non-owned, and hired automobiles ("Any Auto").

b) All costs of defense must be outside the limits of the policy.

7-3.2.3 Contractors Pollution Liability Insurance.

a) You must procure and maintain at your expense or require Subcontractor, as described below to procure and maintain, the Contractors Pollution Liability Insurance including contractual liability coverage to cover liability arising out of cleanup, removal, storage, or handling of hazardous or toxic chemicals, materials, substances, or any other pollutants by you or any Subcontractor in an amount not less than $2,000,000 limit for bodily injury and property damage.

b) All costs of defense must be outside the limits of the policy. Any such insurance provided by Subcontractor instead of you must be approved separately in writing by the City.

c) For approval of a substitution of Subcontractor's insurance, you must certify that all activities for which the Contractors Pollution Liability Insurance will provide coverage will be performed exclusively by the Subcontractor providing the insurance. The deductible must not exceed $25,000 per claim.

d) Contractual liability must include coverage of tort liability of another party to pay for bodily injury or property damage to a third person or organization. There must be no endorsement or modification of the coverage limiting the scope of coverage for either "insured vs. insured" claims or contractual liability.

e) Occurrence based policies must be procured before the Work commences and must be maintained for the Contract Time. Claims Made policies must be procured before the Work commences, must be maintained for the Contract Time, and must include a 12 month extended Claims Discovery Period applicable to this contract or the existing policy or policies must continue to be maintained for 12 months after the completion of the Work without advancing the retroactive date.

f) Except as provided for under California law, the policy or policies must provide that the City is entitled to 30 days prior written notice (10 days for cancellation due to non-payment of premium) of cancellation or non-renewal of the policy or policies.

7-3.2.4 Contractors Hazardous Transporters Pollution Liability Insurance.

a) You must provide at your expense or require Subcontractor to provide, as described below Contractors Hazardous Transporters Pollution Liability Insurance including contractual liability coverage to cover liability arising out of transportation of hazardous or toxic, materials, substances, or any other pollutants by you or any subcontractor in an amount not less than $2,000,000 limit per occurrence/aggregate for bodily injury and property damage.

b) All costs of defense must be outside the limits of the policy. The deductible must not exceed $25,000 per claim. Any such insurance provided by a subcontractor instead of you must be approved separately in writing by the City.

c) For approval of the substitution of Subcontractor's insurance you must certify that all activities for which Contractors Hazardous Transporters Pollution Liability Insurance will provide coverage will be performed exclusively by the Subcontractor providing the insurance.

d) Contractual liability must include coverage of tort liability of another party to pay for bodily injury or property damage to a third person or organization. There must be no endorsement or modification of the coverage limiting the scope of coverage for either "insured vs. insured" claims or contractual liability. Occurrence based policies must be procured before the Work commences and must be maintained for the duration of this contract. Claims Made policies must be procured before the Work commences, must be maintained for the duration of this contract, and must include a 12 month extended Claims Discovery Period applicable to this contract or the existing policy or policies must continue to be maintained for 12 months after the completion of the Work under this contract without advancing the retroactive date.

e) Except as provided for under California law, the policy or policies must provide that the City is entitled to 30 days prior written notice (10 days for cancellation due to non-payment of premium) of cancellation or non-renewal of the policy or policies.

7-3.2.5 Contractors Builders Risk Property Insurance.

a) You must provide at your expense, and maintain until Final Acceptance of the Work, a Special Form Builders Risk Policy or Policies. This insurance must be in an amount equal to the replacement cost of the completed Work (without deduction for depreciation) including the cost of excavations, grading, and filling. The policy or policies limits must be 100% of this contract value of the Work plus15% to cover administrative costs, design costs, and the costs of inspections and construction management.

b) Insured property must include material or portions of the Work located away from the Site but intended for use at the Site, and must cover material or portions of the Work in transit. The policy or policies must include as insured property scaffolding, falsework, and temporary buildings located at the Site. The policy or policies must cover the cost of removing debris, including demolition.

c) The policy or policies must provide that all proceeds thereunder must be payable to the City as Trustee for the insured, and must name the City, you, Subcontractors, and Suppliers of all tiers as named insured. We as Trustee will collect, adjust, and receive all monies which may become due and payable under the policy or policies, may compromise any and all claims thereunder, and will apply the proceeds of such insurance to the repair, reconstruction, or replacement of the Work.

d) Any deductible applicable to the insurance must be identified in the policy or policies documents and responsibility for paying the part of any loss not covered because of the application of such deductibles must be apportioned among the parties except for the City as follows: if there is more than one claimant for a single occurrence, then each claimant must pay a pro-rata share of the per occurrence deductible based upon the percentage of their paid claim to the total paid for insured. The City must be entitled to 100% of its loss. You must pay the City any portion of that loss not covered because of a deductible, at the same time the proceeds of the insurance are paid to the City as trustee.

e) Any insured, other than the City, making claim to which a deductible applies must be responsible for 100% of the loss not insured because of the deductible. Except as provided for under California law, the policy or policies must provide that the City is entitled to 30 days prior written notice (10 days for cancellation due to non-payment of premium) of cancellation or non-renewal of the policy or policies.

ADD: 7-3.3 Rating Requirements. Except for the State Compensation Insurance Fund, all insurance required by this contract as described herein must be carried only by responsible insurance companies with a rating of, or equivalent to, at least "A-, VI" by A.M. Best Company, that are authorized by the California Insurance Commissioner to do business in the State, and that have been approved by the City.

7-3.3.1 Non-Admitted Carriers. The City will accept insurance provided by non-admitted, "surplus lines" carriers only if the carrier is authorized to do business in the State and is included on the List of Eligible Surplus Lines Insurers (LESLI list).

All policies of insurance carried by non-admitted carriers must be subject to all of the requirements for policies of insurance provided by admitted carriers described herein.

ADD: 7-3.4 Evidence of Insurance. Furnish to the City documents e.g., certificates of insurance and endorsements evidencing the insurance required herein, and furnish renewal documentation prior to expiration of this insurance. Each required document must be signed by the insurer or a person

authorized by the insurer to bind coverage on its behalf. We reserve the right to require complete, certified copies of all insurance policies required herein.

ADD: 7-3.5 Policy Endorsements.

7-3.5.1 Commercial General Liability Insurance.

7-3.5.1.1 Additional Insured.

a) You must provide at your expense policy endorsement written on the current version of the ISO Occurrence form CG 20 10 11 85 or an equivalent form providing coverage at least as broad.

b) To the fullest extent allowed by law e.g., California Insurance Code §11580.04, the policy must be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured.

1. The additional insured coverage for projects for which the Engineer's Estimate is $1,000,000 or more must include liability arising out of: (a) Ongoing operations performed by you or on your behalf, (b) Your products, (c) Your work, e.g., your completed operations performed by you or on your behalf, or (d) premises owned, leased, controlled, or used by you.

2. The additional insured coverage for projects for which the Engineer's Estimate is less than $1,000,000 must include liability arising out of: (a) Ongoing operations performed by you or on your behalf, (b) Your products, or (c) premises owned, leased, controlled, or used by you.

7-3.5.1.2 Primary and Non-Contributory Coverage. The policy must be endorsed to provide that the coverage with respect to operations, including the completed operations, if appropriate, of the Named Insured is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives. Further, it must provide that any insurance maintained by the City and its elected officials, officers, employees, agents and representatives must be in excess of the Contractor's insurance and must not contribute to it.

7-3.5.1.3 Project General Aggregate Limit. The policy or policies must be endorsed to provide a Designated Construction Project General Aggregate Limit that will apply only to the Work. Only claims payments which arise from the Work must reduce the Designated Construction Project General Aggregate Limit. The Designated Construction Project General Aggregate Limit must be in addition to the aggregate limit provided for the products-completed operations hazard.

7-3.5.2 Commercial Automobile Liability Insurance.

7-3.5.2.1 Additional Insured. Unless the policy or policies of Commercial Auto Liability Insurance are written on an ISO form CA 00 01 12 90 or a later version of this form or equivalent form providing coverage at least as broad, the policy must be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured, with respect to liability arising out of automobiles owned, leased, hired or borrowed by you or on your behalf. This endorsement is limited to the obligations permitted by California Insurance Code §11580.04.

7-3.5.3 Contractors Pollution Liability Insurance Endorsements.

7-3.5.3.1 Additional Insured.

a) The policy or policies must be endorsed to include as an Insured the City and its respective elected officials, officers, employees, agents, and representatives, with respect to liability arising out of: (a) Ongoing operations performed by you or on your behalf, (b) your products, (c) your work, e.g., your completed operations performed by you or on your behalf, or (d) premises owned, leased, controlled, or used by you; except that in connection with, collateral to, or affecting any construction contract to which the provisions of subdivision (b) of § 2782 of the California Civil Code apply, this endorsement must not provide any duty of indemnity coverage for the active negligence of the City and its respective elected officials, officers, employees, agents, and representatives in any case where an agreement to indemnify the City and its respective elected officials, officers, employees, agents, and representatives would be invalid under subdivision (b) of §2782 of the California Civil Code.

b) In any case where a claim or loss encompasses the negligence of the Insured and the active negligence of the City and its respective elected officials, officers, employees, agents, and representatives that is not covered because of California Insurance Code §11580.04, the insurer's obligation to the City and its respective elected officials, officers, employees, agents, and representatives must be limited to obligations permitted by California Insurance Code §11580.04.

7-3.5.3.2 Primary and Non-Contributory Coverage. The policy or policies must be endorsed to provide that the insurance afforded by the Contractors Pollution Liability Insurance policy or policies is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives with respect to operations including the completed operations of the Named Insured. Any insurance maintained by the City and its elected officials, officers, employees, agents and representatives must be in excess of your insurance and must not contribute to it.

7-3.5.3.3 Severability of Interest. For Contractors Pollution Liability Insurance, the policy or policies must provide that your insurance must apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability and must provide cross-liability coverage.

7-3.5.4 Contractors Hazardous Transporters Pollution Liability Insurance Endorsements.

7-3.5.4.1 Additional Insured.

a) The policy or policies must be endorsed to include as an Insured the City and its respective elected officials, officers, employees, agents, and representatives, with respect to liability arising out of: (a) Ongoing operations performed by you or on your behalf, (b) your products, (c) your work, e.g., your completed operations performed by you or on your behalf, or (d) premises owned, leased, controlled, or used by you; except that in connection with, collateral to, or affecting any construction contract to which the provisions of subdivision (b) of §2782 of the California Civil Code apply, this endorsement must not provide any duty of indemnity coverage for the active negligence of the City and its respective elected officials, officers, employees, agents, and representatives in any case where an agreement to indemnify the City and its respective elected officials, officers, employees, agents, and representatives would be invalid under subdivision (b) of §2782 of the California Civil Code.

b) In any case where a claim or loss encompasses the negligence of the Insured and the active negligence of the City and its respective elected officials, officers, employees, agents, and representatives that is not covered because of California Insurance Code §11580.04, the insurer's obligation to the City and its respective elected officials, officers, employees, agents, and representatives must be limited to obligations permitted by California Insurance Code §11580.04.

7-3.5.4.2 Primary and Non-Contributory Coverage. The policy or policies must be endorsed to provide that the insurance afforded by the Contractors Pollution Liability Insurance policy or policies is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives with respect to operations including the completed operations of the Named Insured. Any insurance maintained by the City and its elected officials, officers, employees, agents and representatives must be in excess of your insurance and must not contribute to it.

7-3.5.4.3 Severability of Interest. For Contractors Hazardous Transporters Pollution Liability Insurance, the policy or policies must provide that your insurance must apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability and must provide cross-liability coverage.

7-3.5.5 Builders Risk Endorsements.

7-3.5.5.1 Waiver of Subrogation. The policy or policies must be endorsed to provide that the insurer will waive all rights of subrogation against the City, and its respective elected officials, officers, employees, agents, and representatives for losses paid under the terms of the policy or policies and which arise from work performed by the Named Insured for the City.

7-3.5.5.2 Builders Risk – Partial Utilization. If we desire to occupy or use a portion or portions of the Work prior to Acceptance in accordance with this contract, we will notify you and you must immediately notify your Builder's Risk insurer and obtain an endorsement that the policy or policies must not be cancelled or lapse on account of any such partial use or occupancy. You must obtain the endorsement prior to our occupation and use.

ADD: 7-3.6 Deductibles and Self-Insured Retentions. You are responsible for the payment of all deductibles and self-insured retentions. Disclose deductibles and self-insured retentions to the City at the time the evidence of insurance is provided.

ADD: 7-3.7 Reservation of Rights. We reserve the right, from time to time, to review your insurance coverage, limits, deductibles and self-insured retentions to determine if they are acceptable to the City. We will reimburse you, without overhead, profit, or any other markup, for the cost of additional premium for any coverage requested by the Engineer but not required by this contract.

ADD: 7-3.8 Notice of Changes to Insurance. You must notify the City 30 days prior to any material change to the policies of insurance provided under this contract.

ADD: 7-3.9 Excess Insurance. Policies providing excess coverage must follow the form of the primary policy or policies e.g., all endorsements.

7-3.10 Architects and Engineers Professional Insurance (Errors and Omissions Insurance).

1. For contracts with required engineering services (e.g., Design-Build, preparation of engineered Traffic Control Plans (TCP), etc. by the Contractor) for all of your employees or Subcontractors who provide professional engineering services under this contract, you must keep or must require its Subcontractor keep in full force and effect, Professional Liability coverage with a limit of $**1,000,000** per claim and $**2,000,000** annual aggregate.

2. You must ensure both that: (a) the policy retroactive date is on or before the date of commencement of the Project; and (b) the policy will be maintained in force for a period of 3 years after completion of the Project or termination of this contract whichever occurs last. You agree that for the time period specified above, there will be no changes or endorsements to the policy that affect the specified coverage.

3. If professional engineering services are to be provided solely by the Subcontractor, you must (a) certify this to the City in writing and (b) agree in writing to require the Subcontractor to procure Professional Liability coverage in accordance with the requirements set forth above.

7-4 WORKERS' COMPENSATION INSURANCE. DELETE in its entirety and SUBSTITUTE with the following:

7-4.1 Workers' Compensation Insurance and Employers Liability Insurance.

a) In accordance with the provisions of §3700 of the California Labor Code, you must provide at its expense Workers' Compensation Insurance and Employers Liability Insurance to protect you against all claims under applicable state workers compensation laws. The City, its elected officials, and employees will not be responsible for any claims in law or equity occasioned by your failure to comply with the requirements of this section.

b) Limits for this insurance must be not less than the following:

Workers' Compensation	Statutory Employers Liability
Bodily Injury by Accident	$1,000,000 each accident
Bodily Injury by Disease	$1,000,000 each employee
Bodily Injury by Disease	$1,000,000 policy limit

c) By signing and returning this contract you certify that you are aware of the provisions of §3700 of the Labor Code which require every employer to be insured against liability for worker's compensation or to undertake self-insurance in accordance with the provisions of that code and you will comply with such provisions before commencing the Work as required by § 1861 of the California Labor Code.

7-4.1.1 Waiver of Subrogation. The policy or policies must be endorsed to provide that the insurer will waive all rights of subrogation against the City, and its respective elected officials, officers, employees, agents, and representatives for losses paid under the terms of the policy or policies and which arise from work performed by the Named Insured for the City.

7-5 PERMITS, FEES, AND NOTICES. To the City Supplement, item e), DELETE in its entirety.

7-5.3 Payment. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

The payment for applying for and obtaining the required permits shall be included in the various Bid items unless a Bid item has been provided.

7-8.6 Water Pollution Control. ADD the following:

a) The Project is subject to the Storm Water Pollution control requirements listed on the Plans or as specified in these specifications.

b) For contracts subject to Construction General Permit (CGP), the Contractor's QSD shall verify the City's assessment prior to submittal through SMARTS.

c) The Contractor's attention is directed to Section 801, "WATER POLLUTION CONTROL" of these specifications for more information.

Based on a preliminary assessment by the City, this contract is subject to WPCP.

7-9 PROTECTION AND RESTORATION OF EXISTING IMPROVEMENTS. ADD the following:

In any emergency affecting the safety of persons or property, the Contractor shall act, at its discretion, to prevent threatened damage, injury or loss. Any change in Contract Price or Contract Time resulting from emergency work shall be determined as provided in SECTION 3, "CHANGES IN WORK."

7-15 INDEMNIFICATION AND HOLD HARMLESS AGREEMENT. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

ADD: 7-15 INDEMNIFICATION AND HOLD HARMLESS AGREEMENT. You must defend, indemnify, protect, and hold harmless the City, the City's agents, officers, and employees, from and against all claims asserted, or liability established for damages or injuries to any person or property resulting from your action or failure to take the necessary measures to prevent such damages and injuries.

You are responsible for payment of any fines resulting from citations issued to the City by either the federal, state, or local environmental and safety enforcement agencies due to your failure to abide by applicable safety, health, and environmental standards.

You agree to defend, indemnify, protect and hold the City, the City's agents, officers and employees, harmless from and against any dispute between you and the Subcontractor if the City are made a party to any judicial or administrative proceeding and all claims asserted, or liability established for damages or injuries to any person or property including to your employees, agents or officers, or judgments arising directly or indirectly out of obligations, work or services herein undertaken, which arise from, are connected with, are caused or claimed to be caused by your acts or omissions, your agents', officers' and employees'.

The obligation to indemnify must be effective even if the City, the City's agents, officers or employees established passive negligence contributes to the loss or claim. You agree that the City may elect to conduct its own defense or participate in its own defense of any claim related to this project. Your duty to indemnify and hold harmless does not include any claims or liability arising from the established active or sole negligence, or willful misconduct of the City, its officers, or employees.

ADD: 7-21 ELECTRONIC COMMUNICATION. The Contractor shall post all communications addressed to the Engineer concerning construction including RFIs, submittals, and transmittals to the Virtual Project Manager (VPM) website established for the Project. The Contractor shall maintain a list of scheduled activities including planned and actual execution dates for all major construction activities and milestones defined in the approved Schedule. The Contractor shall review and act on all communications addressed to the Contractor in the VPM project website. A user's guide to the VPM system is available on the City's website and will be provided to the Contractor at the preconstruction meeting. The payment for electronic communications shall be included in the various Bid items.

SECTION 8 - FACILITIES FOR AGENCY PERSONNEL

8-2 FIELD OFFICE FACILITIES. To the City Supplement, DELETE in its entirety**.**

PART 2 - CONSTRUCTION MATERIALS

SECTION 207 – PIPE

207-17.1 General. ADD the following:

All House Connection Sewer Laterals shall use acceptable stainless steel shielded couplings manufactured by Mission, Fernco or approved equal.

ADD: 207-17.2.3 Pipe Manufacturer. Pipe, fittings, couplings, and joints as manufactured or distributed by J-M Manufacturing Company shall not be used on this contract.

ADD: PART 8 – ENVIRONMENTAL WORKS

SECTION 801 – WATER POLLUTION CONTROL

801-2.9 Post-Construction Requirements. To the City Supplement second paragraph, ADD the following:

The decal-disc inlet markers shall be "das Duracast Curb Marker®" or approved equal.

801-9.3 BMP Requirements. To the City Supplement, ADD the following:

c) WTAP shall be required when the Project exceeds the Maximum Disturbed Area Requirements unless the grading Work is performed in phases that do not exceed the limit shown on the Plans per phase.

SECTION 803 – ENCOUNTERING OR RELEASING HAZARDOUS SUBSTANCES

803-16 PAYMENT. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Payment for waste management shall be included in the applicable Bid items as follows:

a) Preparation of Hazardous Waste Management Plan and Reporting (LS)

b) Monitoring, Testing, Sampling, Site Storage, and Handling of Soils Containing RCRA Hazardous Waste (TONS)

c) Loading, Transportation, and Disposal of soils containing RCRA Hazardous Waste (TONS)

d) Monitoring, Testing, Sampling, Site Storage and Handling of Petroleum Contaminated Soil (TONS)

e) Loading, Transportation, and Disposal of Petroleum Contaminated Soil (TONS)

f) Monitoring, Testing, Sampling Site Storage and Handling of Soils Containing Non-RCRA Hazardous Waste (TONS)

g) Loading, Transportation, and Disposal of Soils Containing Non-RCRA Hazardous Waste (TONS)

h) Testing, Sampling, Site Storage, Handling, Transportation, and Disposal of Containerized RCRA Hazardous Waste (55 Gal DRUMS)

i) Testing, Sampling, Site Storage, Handling, Transportation, and Disposal of Containerized Non-RCRA Hazardous Waste (55 Gal DRUMS)

j) Testing, Sampling, Site Storage, Handling, Transportation and Recycling/Disposal of Universal Waste (EACH)

k) Testing, Sampling, Site Storage, Handling, Transportation and Recycling/Disposal of Regulated Waste (TONS)

l) Testing, Sampling, Site Storage, Handling, Transportation, and Disposal of RCRA Hazardous Waste Contaminated Ground Water (GAL)

m) Testing, Sampling, Site Storage, Handling, Transportation, and Disposal of Non-RCRA Hazardous Waste Contaminated Ground Water (GAL)

Shorter testing time and availability of preliminary results may be required by the Engineer and paid as Extra Work.

SECTION 804 – SEWAGE SPILL PREVENTION

To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

804-1 GENERAL. The Contractor shall observe and comply with the City's policy of zero spills. **The Contractor shall be liable for all damages and fines associated with sewage spills caused by improper support or damage to the existing sewer facilities.**

The Contractor shall designate a person responsible for the development and enforcement of the Sewage Spill Response Plan, and for ensuring sewer spills are minimized to the maximum extent possible. The Contractor shall provide a status of all bypass related work at biweekly progress meetings as requested by the City.

804-2 SEWAGE SPILL PREVENTION AND RESPONSE PLAN. Prior to the start of construction, the Contractor shall develop and submit to the Engineer, for review and approval, a written Sewage Spill Prevention and Response Plan. The plan shall include sewage spill response plan, spill containment and cleanup plan, staging area, and sewage bypass and pumping plan.

The Sewage Spill Prevention and Response Plan shall be developed to respond to any construction related sewage spill(s). The plan shall include:

a) Identifying all nearby environmentally-sensitive areas such as waterways, channels, catch basins and entrances to existing underground storm drains.

b) Making arrangements for an emergency response unit, stationed at or near the Site, comprised of emergency response equipment and trained personnel to be immediately dispatched in the event of a sewage spill(s). This includes field biologists, archaeologists, or both if in an environmentally-sensitive area such as a canyon.

c) Developing an emergency notification procedure that includes an emergency response team with telephone numbers and arrangements for backup personnel and equipment. The emergency response unit shall be able to dispatch to the Site 24 hours a day 7 days a week including weekends and holidays. The Contractor shall designate primary and secondary representatives, their respective phone numbers, pager numbers, and mobile phone numbers. These Contractor's representatives shall be accessible and available at all times to respond immediately to any sewer spill event.

d) Identifying any property owners who may be affected e.g., the City Park and Recreation Department.

At the pre-construction meeting the Contractor will be provided with a list of the City representatives to contact in case of sewage spill(s). In case of a sewage spill(s), the Contractor shall immediately call the Sewage Spill Hotline number at (619) 527-5481 and shall act immediately without instructions from the City, to control the spill and take all appropriate steps to contain it in accordance with the

Sewage Spill Prevention and Response Plan and 804-2.1, "Sewage Bypass and Pumping Plan." The Contractor shall immediately notify the City representatives of the spill and shall report Project name, location, Contractor name, Project Engineer, and Engineer names.

The Contractor shall, within 3 Working Days from the occurrence of the spill, submit to the Engineer a written report describing the following information related to the spill: the location; the nature and estimated volume; the date and time; the duration; the cause; the type of remedial and/or clean up measures taken (including erosion control measures) and the date and time of implementation; the corrective and/or preventive actions taken to avoid further spills; equipment used in spill response; and the environmentally-sensitive habitat such as a water body, if any, impacted and results of any necessary monitoring. The Contractor shall provide a list of who from the City was notified, date and time of notification, date and time the Contractor was notified of the spill, date and time the Contractor arrived on Site.

The Engineer may institute further corrective actions, as deemed necessary, to fully comply with existing laws, ordinances, codes, order or other pertinent regulations. In addition to any penalties provided by federal, state, and local laws, the Contractor shall be responsible for all costs incurred for the corrective actions including mitigation measures (habitat restoration, etc.) and obtaining after-the-fact permits if necessary, in environmentally sensitive areas. These permits include but are not limited to those from the City Planning Department Development Services, California Coastal Commission, U.S. Army Corps of Engineers and the California Department of Fish and Game.

It shall be the Contractor's responsibility to assure that all field forces, including Subcontractors, know and obey all safety and emergency procedures, including the Sewage Spill Prevention and Response Plan applicable to the work, to be maintained and followed at the Site. If in an environmentally sensitive area, such as canyon, stream, or lagoon, impacts shall be minimized. Crews shall be aware at the start of the job of any sensitive environmental habitats, breeding season restrictions, etc.

The Contractor shall prevent spills when working on sewer lines, such as when making temporary connection, when connecting new lines into the sewer system, ensuring no laterals are connected to mains being abandoned, ensuring diversions are appropriately installed, and diversions are completely removed when finished so there are no blockages. The Contractor shall not trap debris and discharge rock or debris downstream. Avoidance of streams is paramount unless authorized via permits.

The Contractor shall defend, indemnify, protect, and hold harmless the City, its agents, officers, and employees, from and against all claims asserted, or liability established for damages or injuries to any person or property resulting from any sewage spill caused or claimed to be caused by the Contractor's action or failure to take measures to prevent a spill. **The Contractor shall be responsible for payment of any fines assessed against the City for such sewage spills.** The Contractor's duty to indemnify and hold harmless shall not include any claims or liability arising from the established active or sole negligence or willful misconduct of the City, its agents, officers or employees.

The Contractor shall obtain and maintain an additional insurance coverage for Pollution Liability with its limits and requirements as set forth in 7-3.5.3, "Contractors Pollution Liability Insurance Endorsements." The limits and requirements for Pollution Liability shall be in an amount sufficient to cover potential losses from sudden and accidental pollution. Unless otherwise provided for in the Bid Proposal, all costs associated with the requirements for Sewage Spill Prevention and Response Plan, including additional insurance, shall be included in the prices for other related Bid items.

804-2.1 Sewage Bypass and Pumping Plan. The Contractor shall submit to the Engineer for approval, a Sewage Bypass and Pumping Plan at least 15 Working Days prior to implementation of flow diversion in compliance with the City's policy of "ZERO SPILLS." The Sewage Bypass and Pumping Plan shall indicate the sequence of diversion operations, all other operations the Contractor

will establish to maintain wastewater service during the construction period, and a quality assurance and quality control plan for the diversion Work. The Sewage Bypass and Pumping Plan shall include an emergency response plan indicating the procedures, equipment, and activities that will be implemented in the event of an emergency shutdown or failure of the flow diversion equipment used for construction. The Contractor shall be responsible for implementation of the emergency plan in accordance with 804-2 "Sewage Spill Prevention and Response Plan".

The Contractor's Sewage Bypass and Pumping Plan shall be reviewed and approved by the Wastewater Collection Division of the City before flow can be diverted. No deviation from the approved Sewage Bypass and Pumping Plan will be allowed without prior approval from the Engineer.

The Contractor shall observe and comply with all Federal, State, and local laws, ordinances, codes, orders, and regulations which in any manner affect the conduct of the work, specifically as it relates to sewage spills. The Contractor shall be fully responsible for preventing sewage spill(s), containing any sewage spill(s), recovery and legal disposal of any spilled sewage, any fines, penalties, claims and liability arising from negligently causing a sewage spill(s), and any violation of any law, ordinance, code, order, or regulation as a result of the spill(s).

The Contractor shall exercise care not to damage existing public and private improvements, interrupt existing services or facility operations which may cause a sewage spill(s). Any reasonably anticipated utility or improvement which is damaged by the Contractor shall be immediately repaired at the expense of the Contractor. In the event that the Contractor damages an existing utility or interrupts an existing service, which causes a sewage spill(s), the Contractor shall immediately call the emergency number at (619) 515-3525.

The Contractor shall exercise care not to damage any sensitive habitats or historic resources unless authorized via the discretionary permit and Mitigation, Monitoring and Reporting Program approved by the City.

The Contractor shall provide all facilities, labor, power, and appurtenances necessary to divert wastewater flows as necessary to allow proper installation of the pipeline and/or manhole linings.

The Contractor shall submit as part of their Sewage Bypass and Pumping Plan their monitoring procedure and frequency and shall continuously monitor the flow levels downstream and upstream of the flow diversion to detect any possible failure that may cause a sewage backup and spill(s). The Contractor shall maintain a log of the monitoring and provide daily copies to the Engineer in a manner acceptable to the Engineer.

The Contractor shall inspect and maintain the diversion system daily, including the back-up system. The Contractor shall submit with their Sewage Bypass and Pumping Plan their maintenance procedures and frequency. The Contractor shall maintain a log of all inspection, maintenance and repair records, and provide copies to the Engineer upon request in a manner acceptable to the Engineer.

The Contractor shall size the flow diversion system to handle the peak flow and shall include a 100% backup in the flow diversion system. The Contractor shall provide temporary means to maintain and handle the sewage flow in the existing system as required to complete the necessary construction. The Contractor shall utilize the flow diversion system to mitigate any additional wet weather flows, perform the necessary maintenance and repairs on the flow diversion system, and exercise and ensure the operation of the backup system. Each pump, including the backup pumps, shall be a complete unit with its own suction and discharge piping. The Contractor shall operate the backup flow diversion system for a minimum of 25% of the total diversion time on a weekly basis. The backup

flow diversion system shall be fully installed, operational, and ready for immediate use. The diversion system shall be hydraulically tested with clean water prior to wastewater flow diversion. The Contractor shall demonstrate to the satisfaction of the Engineer that both the primary and backup flow diversion systems are fully functional and adequate, and shall certify the same, in writing, to the Engineer in a manner acceptable to the Engineer.

The Contractor shall provide one dedicated fuel tank for every single pump or generator, if fuel or generator driven pumps are used. The Contractor shall provide an emergency standby power generator, if electric power driven pumps are used. The Contractor shall provide a fuel level indicator outside each fuel tank. The Contractor shall continuously (while in use) monitor the fuel level in the tanks and ensure that the fuel level does not drop below a level equivalent of two hours of continuous flow diversion system operation. The Contractor shall take the necessary measures to ensure the fuel supply is protected against contamination. This includes but is not limited to fuel line water traps, fuel line filters, and protecting fuel stores from precipitation. The Contractor shall monitor all hoses and repair leaks immediately.

804-2.2 Payment Unless a Bid item has been provided, full compensation for the Sewage Bypass and Pumping Plan, its implementation e.g., labor, facilities, equipments, power, appurtenances and incidental, shall be included in the payment for sewer main.

SECTION 805 – WATER DISCHARGES

805-2.7 Payment. To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Payment for dewatering will be made as follows:

a) The Allowance Bid item for Permit and Discharge Fees shall cover the payment for monthly discharge fees as invoiced by Public Utilities Department and associated expenses e.g. water samples and lab testing to obtain the required permit from the City's Public Utilities Department for such discharges.

b) The Lump Sum payment for "Treatment System for Hazardous Contaminated Water" shall include Equipment and Set up for contaminated water containing hazardous substances. It Payment shall include Dewatering Plan, installing and operating proper equipment to treat the hazardous contaminated water not treatable by the dewatering system to bring the discharged water to the level that is in compliance with the permitting agencies' requirements and water quality standards. Payment shall include but not limited to piping, wells, pumps, electrical system, maintenance, water holding tank, water meters, chemicals, filters and other operating expenses.

c) The Lump Sum payment for "Dewatering System" shall include Equipment and Set up for dewatering and cleaning groundwater containing non-hazardous substances e.g. sand and silt. This includes Dewatering Plan, installing and operating proper equipment to treat and bring the discharged water to the level that is in compliance with the permitting agencies' requirements and water quality standards. This payment shall include but not limited to piping, wells, pumps, electrical system, maintenance, water holding tank, water meters, operating expenses, 24 hour monitoring of the system to prevent the impacts of pump failure, vandalism, etc.

d) For the payment for "Handling and Disposal of the Hazardous Contamination", see 803-16, "Payment."

e) The payment for preparing "Community Health and Safety Plan" shall be included in the various Bid items unless a Bid Item has been provided.

END OF SUPPLEMENTARY SPECIAL PROVISIONS (SSP)

APPENDIX A1

Notice Of Exemption

NOTICE OF EXEMPTION

(Check one or both)

TO: X RECORDER/COUNTY CLERK
P.O. BOX 1750, MS A-33
1600 PACIFIC HWY, ROOM 260
SAN DIEGO, CA 92101-2422

_____ OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET, ROOM 121
SACRAMENTO, CA 95814

FROM: CITY OF SAN DIEGO
DEVELOPMENT SERVICES DEPARTMENT
1222 FIRST AVENUE, MS 501
SAN DIEGO, CA 92101

PROJECT NO.: WBS #B-00306.02.06 PROJECT TITLE: PUMP STATION NO. 65 CAPACITY UPGRADE

PROJECT LOCATION-SPECIFIC: The project is located at 12112 Sorrento Valley Road in the University Community Planning Area.

PROJECT LOCATION-CITY/COUNTY: San Diego/San Diego

DESCRIPTION OF NATURE AND PURPOSE OF THE PROJECT: –PUMP STATION NO. 65 CAPACITY UPGRADE THE PROJECT INCLUDES THE UPGRADE OF TWO OF THE EXISTING PUMPS FROM 400 HP TO 500 HP AND ADDING A THIRD 500 HP PUMP. THE SCOPE ALSO INVOLVES THE MODIFICATION OF THE WET WELL INVOLVING THE DEMOLITION OF A DIVIDING WALL AND A 4-FOOT SQUARE SLUICE GATE. ALL CONSTRUCTION WILL BE LOCATED WITH THE EXISTING BUILDING. NO IMPACTS TO ARCHAEOLOGICAL, PALEONTOLOGICAL OR BIOLOGICAL RESOURCES WOULD RESULT FROM THIS ACTIVITY.

NAME OF PUBLIC AGENCY APPROVING PROJECT: City of San Diego

NAME OF PERSON OR AGENCY CARRYING OUT PROJECT: Chisti Dadachanji
Engineering and Capital Projects Department
600 B Street, San Diego, CA 92101
Phone: 619-533-4648.

EXEMPT STATUS: (CHECK ONE)

( ) MINISTERIAL (SEC. 21080(b)(1); 15268);
( ) DECLARED EMERGENCY (SEC. 21080(b)(3); 15269(a));
( ) EMERGENCY PROJECT (SEC. 21080(b)(4); 15269 (b)(c))
(X) CATEGORICAL EXEMPTION: 15301(b) Existing Facilities.
( ) STATUTORY EXEMPTIONS:

REASONS WHY PROJECT IS EXEMPT: The City of San Diego conducted an Initial Study which determined that since the project is located within the boundaries of the existing pump station structure, the action would not result in impacts to any resources. Furthermore the project meets the criteria set forth in CEQA Section 15301 which allows for the minor alteration of a public structures, facilities or mechanical equipment, and where the exceptions listed in CEQA Section 15300.2 would not apply.

LEAD AGENCY CONTACT PERSON: Cameron TELEPHONE: (619) 446-5379

IF FILED BY APPLICANT:

1. ATTACH CERTIFIED DOCUMENT OF EXEMPTION FINDING.
2. HAS A NOTICE OF EXEMPTION BEEN FILED BY THE PUBLIC AGENCY APPROVING THE PROJECT?
   ( ) YES ( ) NO

IT IS HEREBY CERTIFIED THAT THE CITY OF SAN DIEGO HAS DETERMINED THE ABOVE ACTIVITY TO BE EXEMPT FROM CEQA

_____ JANUARY 24, 2012
JEAN CAMERON/SENIOR PLANNER DATE

CHECK ONE:
(X) SIGNED BY LEAD AGENCY
( ) SIGNED BY APPLICANT

DATE RECEIVED FOR FILING WITH COUNTY CLERK OR OPR:

APPENDIX B1(1)

Materials Typically Accepted By Certificate Of Compliance

Materials Typically Accepted by Certificate of Compliance

1. Soil amendment
2. Fiber mulch
3. PVC or PE pipe up to 16 inch diameter
4. Stabilizing emulsion
5. Lime
6. Preformed elastomeric joint seal
7. Plain and fabric reinforced elastomeric bearing pads
8. Steel reinforced elastomeric bearing pads
9. Waterstops (Special Condition)
10. Epoxy coated bar reinforcement
11. Plain and reinforcing steel
12. Structural steel
13. Structural timber and lumber
14. Treated timber and lumber
15. Lumber and timber
16. Aluminum pipe and aluminum pipe arch
17. Corrugated steel pipe and corrugated steel pipe arch
18. Structural metal plate pipe arches and pipe arches
19. Perforated steel pipe
20. Aluminum underdrain pipe
21. Aluminum or steel entrance tapers, pipe downdrains, reducers, coupling bands and slip joints
22. Metal target plates
23. Paint (traffic striping)
24. Conductors
25. Painting of electrical equipment
26. Electrical components
27. Engineering fabric
28. Portland Cement
29. PCC admixtures
30. Minor concrete, asphalt
31. Asphalt (oil)
32. Liquid asphalt emulsion
33. Epoxy

APPENDIX C1

Sample City Invoice

City of San Diego, Field Engineering Div., 9485 Aero Drive, SD CA 92123
Project Name:
Work Order No/J. O. No.
Purchase Order No.
Resident Engineer (RE):
RE Phone#: **Fax#:**

Contractor's Name:
Contractor's Address:
Contractor's Phone #:
Contractor's fax #:
Contact Name:

Invoice No.
Invoice Date:
Billing Period: (To)

Item #	Item Description	Contract Authorization				Previous Estimate		This Estimate		Totals to Date	
		Unit	Price	Qty	Extension	%/QTY	Amount	% / QTY	Amount	% / QTY	Amount
1.00					$		$		$		$
2.00					$		$		$		$
3.00					$		$		$		$
4.00					$		$		$		$
5.00					$		$		$		$
6.00					$		$		$		$
7.00					$		$		$		$
8.00					$		$		$		$
9.00					$		$		$		$
10.00					$		$		$		$
11.00					$		$		$		$
12.00					$		$		$		$
13.00					$		$		$		$
14.00	**Field Orders**				$		$		$		$
15.00					$		$		$		$
	CHANGE ORDER No.				$		$		$		$
			$		$		$		$		$
	Total				$		$		$		$

A. Original Contract Amount	$ -
B. Approved Change Order #00 Thru #00	$ -
C. Total Authorized Amount (A+B)	$ -
D. Total Billed to Date	
E. Less Total Retention (5% of C or 10% of D)	
F. Less Total Previous Payments	
G. Payment Due Less Retention	$
H. Remaining Authorized Amount	

Retention and Escrow Payment				
Total Retention Required as of this				$
Less Previous Retention Withheld				
Add'l Amt to Withhold in				***$***

Signature: _____

Contractor/Date

APPENDIX D1

Technical Specifications

TABLE OF CONTENTS

Pages

VOLUME I - Division 1 through 12

** END OF TABLE OF CONTENTS **

SECTION 01014 - WORK SEQUENCE

PART 1 -- GENERAL

1.1. THE REQUIREMENT

A. The CONTRACTOR shall coordinate the scheduling of construction activities so that the operation of the existing pump station and the flow of sewage will not be disrupted.

B. CONTRACTOR shall be responsible for the draining and removal of any liquids in the pipelines prior to any connections. CONTRACTOR to coordinate such removal of liquids with the CITY.

C. The CONTRACTOR shall provide the necessary personal and equipment in order to prevent sewage spills.

1.2. RELATED WORK SPECIFIED ELSEWHERE

A. Section 02050 Demolition

B. Section 02200 Earthwork

C. Section 02999 Temporary Handling of Sewage Flows

1.3. CONTRACTOR SUBMITTALS

In addition to the Construction Schedule required by the General Requirements, the CONTRACTOR shall submit a detailed sequence of operation plan and schedule. The plan will address the detailed implementation steps necessary to accomplish the scope of work, Work specified herein, and work per the Contract Documents. The detailed implementation steps shall address and include, but not be limited to, the following conditions and restrictions:

A. Specific restrictions and conditions specified in Part 3 – EXECUTION of this section of the Specifications.

B. A detailed outage plan and time schedule for operations.

C. The detailed plan shall describe the CONTRACTOR's method of operation and the length of time required to complete said operation.

D. Systems or individual equipment items that will be isolated, dewatered, decommissioned, de-energized, or depressurized in accordance with the detailed outage plan and schedule. Notify the ENGINEER in writing at least one week in advance of the planned operation.

E. Detailed implementation or modifications to the traffic control plan.

F. The CONTRACTOR’s sewage bypassing plan to accomplish the switch over from the existing sewage system to the new sewage pumping scheme per the CONTRACT DOCUMENTS.

G. The CONTRACTOR shall provide detailed plans and details showing temporary shoring and protection of existing pipelines and utilities. Detailed plan shall be designed and signed by Registered Engineer in the State of California and approved by the ENGINEER per Section 02200, Earthwork.

1.4. CONTINUITY OF SYSTEM OPERATIONS

A. The Existing Pump Station No. 65 is currently and continuously receiving and conveying sewage, and those functions shall not be interrupted except as specified herein. The CONTRACTOR shall coordinate the Work to avoid any interference with normal operation of the system.

B. CONTRACTOR must provide emergency bypass pumping for the Existing Pump Station No. 65 during construction and demolition of all the sewer lines. All emergency tie-in points and lay down area for the emergency pumps must be designed and installed by the CONTRACTOR and approved by the CITY. CONTRACTOR must be able to switch over to the emergency bypass pumping system within 15 minutes of an emergency. CONTRACTOR to design and provide detailed plan and receive approval from CITY for each phase of construction. CONTRACTOR shall also comply with requirements of Section 02999, Temporary Handling of Sewage Flow.

1.5. SEWAGE SPILLS

A. Spills of untreated or partially treated sewage to surface waters or drainage courses is prohibited. In the event of a spill caused by the CONTRACTOR's operations, the CITY shall immediately be entitled to employ others to stop the spill without giving written notice to the CONTRACTOR.

B. Cost of penalties imposed on the CITY as a result of a spill caused by the actions of the CONTRACTOR, its employees, or subcontractors, shall be borne in full by the CONTRACTOR, including legal fees and other expenses to the CITY resulting directly or indirectly from the spill.

1.6. WET WEATHER

A. Wet weather flows occur from October 1st thru May 31st. See Contract Documents for restrictions during wet weather season.

PART 2 -- PRODUCTS

CONTRACTOR shall provide all required equipment and personal necessary to perform Work specified herein. Any approved deviations from Work herein shall be borne in full by the CONTRACTOR at no additional cost to the CITY.

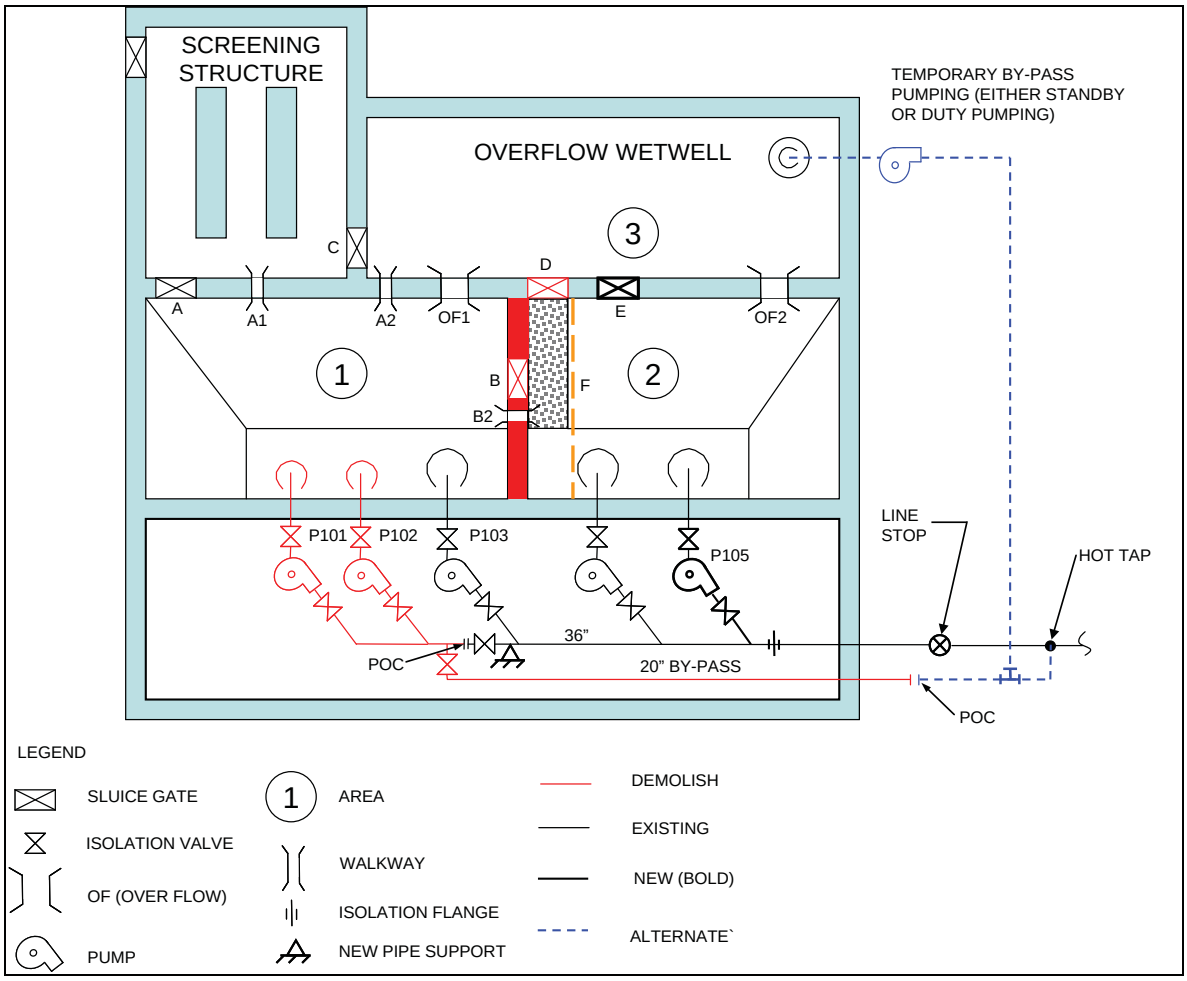
PART 3 -- EXECUTION

3.1 CONSTRUCTION OF NEW PUMP STATION

A. CONTRACTOR shall not proceed from one step to the next as outlined below without satisfying the requirements of the Contract Documents and upon CITY approval.

Work not specifically listed herein shall be sequenced in a logical order and shown in CONTRACTOR's detailed sequence of operation plan and schedule and approved by the CITY.

B. **Sequencing Plan:** The presented plan provided is only a suggestion and does not contain all action items to make it complete. It is the CONTRACTOR's full responsibility to adopt, modify and/or to propose and submit a complete plan. The following sketch shall be utilized while referring to the sequencing plan below.



1. **Isolate Wet Well Area (2)**

   a. Close gate valves (B), (C), and (D)
   b. Install P-105 suction plug valve
   c. Return wet well area (2) to normal service

2. **Pipeline Modifications**

   a. Install 20 inch hot-tap to 36 inch pipeline

b. Install 36 inch line stop
c. Install 20 inch bypass piping

3. **Isolate 36 inch Header**

Wet weather flows will require temporary bypass pumping on standby.

a. Provide 20 inch bypass valving within the station to utilize pumps P-101 & P-102 to bypass the 36 inch header. (In-lieu of this, temporary bypass pumps can be utilized for duty pumping)
b. Close 36 inch line stop
c. Remove blind flange from P-105 wye
d. Remove P-105 wye and install galvanic isolation flange kit in header
e. Install P-105 tee
f. Install P-105 discharge valve
g. Place header back in service

4. **Commission P-105**

a. Complete the following tasks anytime prior to this point:

i. Install Remote I/O Panel
ii. Install new pump, motor, line-shaft, VFD, and ancillary devices
iii. Provide new control logic as well as any temporary logic

b. Commission and test P-105

5. **Install P-103 & P-104 Motors and VFDs**

Wet weather will require temporary bypass pumping on standby.

a. Install P-103 and P-104 one at a time and commission one at a time

6. **Wet Well Area (2) Modifications**

Wet weather will require temporary bypass pumping on standby.
(In-lieu of stop logs, temporary bypass pumps can be utilized for duty pumping)

a. Close Gates: (B) & (C)
b. Open Gate: (A)
c. Empty wet wells (2) & (3)
d. Modify wet well (2) as required
e.

i. Demo Gate Valve (D) and fill wall penetration with concrete
ii. Install new gate valve (E) at elevation -20 feet

f. Install Stop Logs (F); (Stop log track and wall shall be designed by the CONTRACTOR's California Registered Engineer to suit the site conditions.)
g. Place Wet Well Area (2) back in service

7. **Wet Well Area (1) Modifications**
(In-lieu of stop logs, temporary bypass pumps can be utilized for duty pumping)

a. Close Gate: (A)
b. Open Gates: (C) & (E)
c. Empty wet well (1)
d. Modify wet well (1) as required
    i. Demolish concrete dividing wall
    ii. Fill in fillet approach for gate (D) and install liner
    iii. Demo suction bells for P-101 & P-102
e. Place Wet Well Area (1) back in service

8. **Place Wet Well Back in Service**
9.

a. Remove Stop Logs (F) in the wet condition

10. **150-hp Pumps Demolition**
11.

a. Bypass the 36 inch header utilizing temporary by-pass pumping
b. Demolish 20 inch Valve
c. Blind the main header
d. Install New 36 inch Pipe Support
e. Remove pumps P-101 and P-102 and all ancillary equipment
f. Demo 20 inch pipeline inside and outside of the station

12. **Remove Temporary Bypass Pumping and Restore Site**

13. **Clean Overflow Wetwell**

*** *END OF SECTION * ***

SECTION 02050 - DEMOLITION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes furnishing materials, equipment and labor necessary to perform and complete demolition of equipment and items shown on the CONTRACT DRAWINGS.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02200 Earthwork

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Building Code

1.5 SUBMITTALS

A. **Demolition Schedule**: The CONTRACTOR shall submit a complete coordination schedule for demolition work including shut-off and continuation of utility services prior to start of the WORK. The schedule shall indicate proposed methods and operations of facility demolition, and provide a detailed sequence of demolition and removal work to ensure uninterrupted operation of occupied areas.

1.6 ASBESTOS REMOVAL

A. The OWNER is responsible for the removal and disposal of any asbestos found in structures scheduled for demolition, prior to commencement of demolition work by the CONTRACTOR.

B. If, during demolition work, any additional asbestos materials are being discovered, the CONTRACTOR shall stop the work immediately and notify the CONSTRUCTION MANAGER for further instructions.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.1 GENERAL

A. Structures shall be demolished and removed in compliance with SSPWC subsection 306-5 and the requirements indicated herein.

3.2 POLLUTION CONTROL

A. Water sprinkling, temporary enclosures, chutes, and other suitable methods shall be used for dust suppression.

B. Water shall not be used when it creates hazardous or objectionable conditions such as flooding, erosion, sedimentation, or pollution.

3.3 PROTECTION

A. Safe passage of persons around the area of demolition shall be provided. Operations shall be conducted to prevent injury to people and damage to adjacent buildings, structures, and other facilities.

B. Interior and exterior shoring, bracing, or supports shall be provided to prevent movement, settlement or collapse of structures to be demolished.

C. Existing landscaping materials, structures, and appurtenances which are not to be demolished shall be protected and maintained as necessary.

D. Unless otherwise indicated, the CONTRACTOR shall protect and maintain all utilities in the proximity of the facilities to be demolished.

E. The CONTRACTOR shall protect the nearby existing equipment such as control panels and others from dust caused by demolition activities by covering, drop-curtains and other similar methods.

3.4 STRUCTURE DEMOLITION

A. Building structures and appurtenances shall be demolished, as shown and required to complete work, in compliance with governing regulations.

B. Small structures may be removed intact when approved by authorities having jurisdiction.

C. Demolition shall proceed in a systematic manner, from top of structure to ground.

D. Concrete and masonry shall be demolished in small sections. Use bracing and shoring to prevent collapse.

E. Demolition equipment shall be dispersed throughout structure and demolished materials removed to prevent excessive loads on supporting walls, floors or framing.

3.5 BELOW-GRADE DEMOLITION

A. Footings, foundation walls, below-grade construction and concrete slabs on grade shall be demolished and removed to a depth which will not interfere with new construction, but not less than 12 inches below existing ground surface or future ground surface, whichever is lower. All floors of basements, vaults, and other underground structures shall be broken up.

B. Below-grade areas and voids resulting from demolition of structures shall be completely filled to a minimum compaction of 95%.

C. All fill and compaction shall be in accordance with Section 02200.

D. After fill and compaction, surfaces shall be graded to meet adjacent contours and to provide flow to surface drainage structures, or as indicated.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Demolition and removal of debris shall be conducted to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities which shall not be closed or obstructed without permission from the OWNER. Alternate routes shall be provided around closed or obstructed traffic ways.

B. Site debris, rubbish, and other materials resulting from demolition operations shall be removed and disposed of in compliance all laws and regulations. Burning of removed materials from demolished structures shall not be permitted.

3.7 PATCHING AND REPAIRING

A. The CONTRACTOR shall provide patching, replacing, repairing, and refinishing of damaged areas involved in demolition as necessary to match the existing adjacent.

B. The CONTRACTOR shall repair all damages caused to adjacent facilities by demolition at no additional cost to the OWNER.

C. After patching and repairing has been completed, the CONTRACTOR shall carefully remove splatterings of mortar from adjoining work (plumbing fixtures, trim, tile, and finished metal surfaces) and repair any damage caused by such cleaning operations.

3.8 CLEANING

A. During and upon completion of work, the CONTRACTOR shall promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave areas affected by work in a clean condition.

B. Clean adjacent structures and facilities of dust, dirt, and debris caused by demolition and return adjacent areas to condition existing prior to start of work.

C. The CONTRACTOR shall clean and sweep the affected portions of roads, streets, sidewalks and passageways daily.

** END OF SECTION **

SECTION 02140 - DEWATERING

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes site dewatering necessary to lower and control groundwater levels and hydrostatic pressures to permit excavation and construction to be performed properly under dry conditions.

B. Dewatering operations shall be adequate to assure the integrity of the finished project. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the CONTRACTOR. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the CONTRACTOR.

C. The CONTRACTOR shall bear the sole responsibility for the design, installation, and operation of the dewatering system to comply with the requirements of this section. The CONTRACTOR shall be required to install additional dewatering equipment as may be required throughout the duration of the project to maintain specified groundwater levels.

1.2 RELATED SECTIONS

A. The WORK of the following Section applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02200 Earthwork

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.4 SCHEDULE AND PLAN

A. The following shall be submitted:

1. The CONTRACTOR shall make an independent investigation of the soil and groundwater conditions at each site. The results of the CONTRACTOR's independent investigation shall include the results of any and all exploratory borings, laboratory tests, and analyses. The CONTRACTOR's independent investigation shall be in report form.

2. Prior to commencement of excavation, a detailed plan and schedule, with description, for dewatering of excavations, piezometers, estimated dewatering rates, volume and equipment requirements shall be submitted with the dewatering plan. The plan shall be signed and sealed by a California registered Civil Engineer, Geotechnical Engineer, Engineering

Geologist or Hydrogeologist with experience of at least one dewatering operation of similar magnitude and complexity in a recently completed construction project. The qualification of the dewatering system designer shall be submitted to CONSTRUCTION MANAGER for approval. The CONTRACTOR shall make an independent investigation of the soil conditions to be dewatered. The dewatering plan shall be prepared specifically to accommodate soil materials and groundwater conditions of the site.

3. Demonstration of proposed system and verification that adequate personnel, materials and equipment are readily available, including standby equipment.

4. A copy of the executed industrial waste permit approved by MWWD.

1.5 CONTROL AND OBSERVATION

A. Adequate control shall be maintained to ensure that the stability of excavated and constructed slopes are not adversely affected by water, that erosion is controlled and that flooding of excavation or damage to structures does not occur.

B. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed daily to detect any settlement which may develop.

C. A daily report shall be maintained recording the following:

1. Groundwater elevations of ground water and piezometric water levels in observation wells (if any).

2. Change in elevation of reference points as stated in subsection 1.5 to detect settlement in adjacent structures. CONSTRUCTION MANAGER may suspend work if any settlement exceeds 0.05 feet.

D. After dewatering is discontinued, a weekly report shall be maintained for two months recording:

1. Change in elevation of reference points as stated in subsection 1.5 to detect settlement in adjacent structures.

1.6 INSPECTION

A. During or after trench excavation, when CONTRACTOR observes sufficient groundwater to be present that may prevent proper installation of pipe bedding, pipelines, backfill and compaction, then CONTRACTOR shall call for inspection of conditions by the CONSTRUCTION MANAGER. The CONSTRUCTION MANAGER shall inspect the conditions and determine if unacceptable conditions are present for pipe installation.

B. If unacceptable trench conditions are found by the CONSTRUCTION MANAGER, then the CONTRACTOR will be authorized to mobilize and start dewatering operations of the pipeline trench.

C. Damp soils or low volumes of groundwater in the bottom of trenches are not sufficient cause for trench dewatering.

1.7 MEASUREMENT AND PAYMENT

A. Separate payments shall be made as specified in the contract for providing all dewatering equipment and apparatus, for mobilization/demobilization of dewatering equipment, and for all dewatering operations.

B. The CONTRACTOR shall also be responsible for all costs associated with the discharge of dewatering effluent into the sanitary sewer system of the City.

C. Storm water run-off flowing into the excavation site shall be minimized to the maximum extent possible. All water entering the excavation site shall be subject to all dewatering requirements specified in this documents.

D. Protection of adjacent structures from adverse effects of dewatering shall be the responsibility of the CONTRACTOR.

1.8 PERMITS

A. The CONTRACTOR shall obtain an Industrial Waste Discharge Permit from MWWD for discharging effluent from dewatering operations into the City sanitary sewer system.

B. The CONTRACTOR shall be responsible for all costs associated with obtaining all proper permits and for maintaining permit compliance, including all costs associated with permit violations.

PART 2 -- PRODUCTS

2.1 EQUIPMENT

A. Dewatering, where indicated, includes deep wells, well points, piezometers, sump pumps, temporary pipelines for water disposal, and rock or gravel placement, and other means including standby pumping equipment maintained on the jobsite continuously.

2.2 FOUNDATION ROCK

A. Foundation rock shall be included in the dewatering system to replace weakened soil within the excavation. Rock shall be 1-1/2 inch maximum crushed stone placed in minimum 12-inch layers and completely wrapped in filter fabric. Foundation rock shall be used in addition to bedding material shown on the plans and shall be used at the CONTRACTOR'S discretion, or as directed by the CONSTRUCTION MANAGER. Foundation rock shall be considered to be part of the dewatering system.

PART 3 -- EXECUTION

3.1 GENERAL REQUIREMENTS

A. All water encountered in the trench shall be disposed by the CONTRACTOR in such a manner as will not damage public or private property or create a nuisance or health nuisance. The CONTRACTOR shall furnish, install, and operate pumps, pipes, appliances, and equipment of sufficient capability to keep trench excavation free from water until the trench is backfilled, unless otherwise authorized by the CONSTRUCTION MANAGER. No dewatering from inside the trench will be permitted while the pipeline is being installed, unless it is approved by the CONSTRUCTION MANAGER.

B. Dewatering shall be performed in compliance with Subsection 306-3.3 of SSPWC and as specified herein.

C. An independent assessment of the subsurface conditions shall be performed prior to submitting a dewatering plan. The assessment shall be signed and sealed by a California registered Geotechnical Engineer, Engineering Geologist or Hydrogeologist. The plan shall include, but not be limited to:

1. Additional exploratory borings.
2. Laboratory testing.
3. Pump testing.

All boreholes and wells advanced by the CONTRACTOR shall be logged and submitted for review.

D. An adequate system shall be designed, installed and maintained to lower and control the ground water to permit excavation, construction of structures, and placement of fill materials to be performed under dry conditions. The system shall include two piezometers at each structure and one piezometer at the midpoint of each pipeline reach. The piezometers shall be properly installed to accurately reflect the groundwater depth adjacent to the excavation.

E. Sufficient dewatering equipment shall be installed to pre-drain the water-bearing strata below the bottom of foundations, sewers and other excavations.

F. The hydrostatic head in water-bearing strata below foundations, drains, sewers and other excavations shall be reduced to ensure that the water level and piezometric water levels are below the excavation surface at all times. The piezometric water level shall be maintained a minimum of 3 feet below the excavation surface. No excavation shall be made without proof of required lowered groundwater levels.

G. The system shall be placed into operation prior to excavation below ground water level to lower the ground water level and shall be operated continuously 24 hours a day, 7 days a week until drains, sewers and structures have been constructed and fill materials have been placed and dewatering is no longer required. Groundwater will need to remain depressed until adequate loading from proposed structures and uplift resistance to buoyant forces can be provided. All dewatering wells, well points and piezometers shall be installed under the supervision of a California registered Geotechnical Engineer, Engineer Geologist, or Hydrogeologist. The

registered professional shall submit a written certificate that the system has been installed according to the dewatering plan.

H. The site shall be graded to facilitate drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and then be pumped or drained by gravity away from the excavation and disposed of in compliance with the CWP Guidelines, and local, State and Federal regulations.

I. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

J. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with foundation rock completely wrapped in filter fabric at no additional cost to the OWNER.

K. Flotation of structures and facilities shall be prevented by maintaining a positive and continuous removal of water. The dewatering system shall be in continuous operation until all structure and pipelines are properly backfilled.

L. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.

M. An Industrial Waste Discharge Permit shall be obtained from MWWD to discharge dewatering effluent into the sanitary sewer system.

If the laboratory results of the independent assessment of subsurface conditions show contamination levels above what is acceptable, a treatment system shall be provided under the bid allowances in the Bid Schedule.

N. The release of groundwater to its original level shall be performed in such a manner as not to disturb natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, pipelines, and sewers.

** END OF SECTION **

SECTION 02200 - EARTHWORK

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes all earthwork required for construction of the WORK. Such earthwork shall include the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the WORK.

B. Fill material is defined as material used to raise the level of a portion of the site to the line and grade indicated. Backfill material is defined as material used to refill an excavation.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02140 Dewatering
2. Section 02510 AC Pavement and Base
3. Section 02575 Pavement Rehabilitation
4. Section 02600 Pipeline Construction

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 REGULATORY REQUIREMENTS

A. The WORK of this Section shall comply with current versions, with revisions, of the following:

1. Construction Safety Orders, Division of Industrial Safety, State of California.
2. California Department of Transportation Traffic Manual.

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. The CONTRACTOR shall comply with the provisions for "Shoring and Bracing Drawings" in Section 6705 of the California Labor Code. The CONTRACTOR, prior to beginning any trench or structure excavation 5 feet deep or over shall submit to the OWNER and shall be in possession of the OWNER's written acceptance of the CONTRACTOR's detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. If such plan varies from the shoring system

established in the Construction Safety Orders of the State of California, such alternative system plans shall be prepared by a civil or structural engineer licensed in the State of California.

2. Copy of the excavation permit issued by the California Department of Industrial Safety.

3. Samples of imported material. Samples shall be submitted in accordance with SSPWC, Subsection 306-1.3.5.

4. Such other samples of materials as the CONSTRUCTION MANAGER may require.

1.6 SOIL TESTING

A. **General:** All soils testing shall be done in accordance with SSPWC, Section 211, and by a testing laboratory of the OWNER's choice at the OWNER's expense.

B. **Compaction Tests:** Where soil material is required to be compacted to a percentage of maximum density, the maximum density shall be determined in accordance with the requirements of SSPWC, Subsection 211-2. In case the tests of the fill or backfill show non-compliance with the required density, the CONTRACTOR shall accomplish such remedy as may be required to insure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the OWNER and shall be at the CONTRACTOR's expense.

PART 2 -- PRODUCTS

2.1 FILL AND BACKFILL MATERIALS

A. **General:** Fill and backfill material shall consist of select material obtained from the excavation, imported material, granular bedding material, or unclassified material. The CONTRACTOR shall import at his expense materials in excess of the approved material obtained from excavation as required to complete the fill, backfill, and grading WORK as indicated.

B. **Select Material:** Select material shall consist of primarily granular material encountered in the excavation which is free of vegetation, organic matter, debris, rocks larger than 4 inches in diameter and other unsuitable material, and shall have an expansion index less than 30 (less than 20 for footings and floor slabs) as determined by UBC Standard No. 29-2, plasticity index of 10 or less, a liquid limit of 30 or less and shall be approved as select material by the CONSTRUCTION MANAGER.

C. **Imported Material:** Imported material shall conform to the same specifications as select material defined above. In addition, the imported materials shall have a minimum sand equivalent of 15 as determined by California Test Method No. 217. Imported material placed in areas to be planted shall be able to support normal plant growth. Obtain approval by the CONSTRUCTION MANAGER prior to transporting imported material.

D. **Bedding Material:** Bedding material, defined as that material supporting, surrounding and extending to 1 foot above the top of a pipe, shall be in accordance with SSPWC, Subsection 306-1.2.1.

E. **Unclassified Material:** Unclassified material shall conform to SSPWC, Subsection 300-4.

2.2 ROCK PRODUCTS

A. Rock products, consisting of crushed rock, rock dust, gravel, sand, and stone for riprap shall be clean, hard, sound, durable, uniform in quality and free of disintegrated material, organic matter, oil alkali, or other deleterious substance, and shall, unless otherwise specified, conform with the requirements of SSPWC, Subsection 200-1.

2.3 UNTREATED BASE MATERIALS

A. Untreated base materials shall conform with the requirements of SSPWC, Subsection 200-2.

B. Materials for use as untreated base or subbase shall be:

1. Crushed Aggregate Base
2. Crushed Miscellaneous Base
3. Processed Miscellaneous Base
4. Select Subbase

2.4 TOPSOIL (NOT USED)

PART 3 -- EXECUTION

3.1 GENERAL

A. The CONTRACTOR shall perform earthwork as necessary to complete the WORK as shown on the Contract Drawings and specified herein. The CONTRACTOR shall take the necessary precautionary measures to prevent dust or other nuisances which might be created by reason of his activities. The necessary precautionary measures shall conform to the requirements of SSPWC, Subsection 7-8. The requirements specified in Subsection 7-8 shall be extended to include paved surfaces.

B. All types of earthwork, including trench, structural and general excavation, fill, backfill and compaction, shall conform to applicable requirements of the SSPWC. Section 300, and to the requirements specified herein.

3.2 SITE PREPARATION

A. Areas to be excavated, filled, graded, and to be occupied by permanent construction or embankments shall be prepared by clearing and grubbing. Clearing and grubbing shall conform to the applicable requirements of SSPWC, Subsection 300-1.

3.3 EXCAVATION

A. **General:** Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. Unless otherwise directed,

the removal of said materials shall conform to the lines and grades shown. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. The CONTRACTOR shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measures for the removal or exclusion of water as required by Section 02140. Excavations shall be sloped or otherwise supported in a safe manner in accordance with the rules, orders, and regulations of the Division of Industrial Safety of the State of California.

B. **Unclassified Excavation:** Unclassified excavation shall consist of all excavation, including roadways, unless separately designated.

1. Unsuitable material shall be excavated and disposed of in accordance with the requirements of SSPWC, Subsection 300-2.2.

2. Wet material, if unsatisfactory for the specified use on the project solely because of high moisture content, may be processed to reduce the moisture content, or may be required to be removed and replaced with suitable material in accordance with the requirements of SSPWC, Subsection 300-2.2.2.

3. The removal and disposal of slide and slipout material shall be in accordance with SSPWC, Subsection 300-2.4.

4. Excavation slopes shall be finished in conformance with the lines and grades shown, and in accordance with SSPWC, Subsection 300-2.5.

5. Surplus material shall be disposed of off-site, and in accordance with SSPWC, Subsection 300-2.6.

C. **Structure Excavation:** Structure excavation shall consist of the removal of material for the construction of foundations for bridges, retaining walls, headwalls, culverts, buildings, or other structures, and shall be in accordance with SSPWC, Subsection 300-3.

1. Cofferdams for foundation construction shall be constructed in accordance with SSPWC, Subsection 300-3.2.

2. The treatment of foundation material shall be in accordance with SSPWC, Subsection 300-3.3**.**

D. **Underground Conduit Excavation:**

1. **General:** Excavation for underground conduits shall be in accordance with SSPWC, Subsection 306-1.1 and the requirements contained herein. Unless otherwise shown or ordered, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of pipe zone densification selected by the CONTRACTOR, but shall have a minimum width at the bottom of the trench equal to the outside diameter of the pipe plus 24 inches for mechanical compaction methods and 18 inches for water consolidation methods. The maximum width at the top of the pipe shall be equal to the outside diameter of the pipe plus 36 inches for pipe diameters 18 inches and

larger and to the outside diameter of the pipe plus 24 inches for pipe diameters less than 18 inches.

2. **Bracing Excavations:** The manner of bracing excavations shall be as set forth in the rules, orders and regulations of the Division of Industrial Safety of the State of California, and in accordance with the requirements of SSPWC, Subsection 306-1.1.6.

3. **Trench Bottom**: Except when pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe. The trench bottom shall be given a final trim, using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Rounding out the trench to form a cradle for the pipe will not be required.

4. **Open Trench**: The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights conforming to requirements set forth in the California Department of Transportation Traffic Manual shall be provided and maintained.

5. **Trench Over-Excavation**: Where the Drawings indicate that trenches shall be over-excavated, they shall be excavated to the depth required, and then backfilled to the grade of the bottom of the pipe.

6. Where pipelines are to be installed in embankment fills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

E. **Over-Excavation Ordered by CONSTRUCTION MANAGER:**

1. Trenches shall be over-excavated beyond the depth shown when required by the CONSTRUCTION MANAGER. Such over-excavation shall be to the depth ordered. The trench shall then be backfilled to the grade of the bottom of the pipe. All work specified in this Section shall be performed by the CONTRACTOR at no additional cost to the OWNER when the over-excavation ordered by the CONSTRUCTION MANAGER is less than 6 inches below the limits shown. When the over-excavation ordered by the CONSTRUCTION MANAGER is 6 inches or greater below the limits shown, additional payment will be made to the CONTRACTOR for that portion of the work which is located below said 6-inch distance.

F. **Over-Excavation not Ordered or Indicated:**

1. Any over-excavation carried below the grade ordered or indicated shall be backfilled to the required grade with the specified material and compacted. Such work shall be performed by the CONTRACTOR at no additional cost to OWNER.

G. **Rock Excavation:**

1. Rock excavation shall include removal and disposal of the following: (1) all boulders measuring 1/3 of a cubic yard or more in volume; (2) all rock material in ledges, bedding deposits, and unstratified masses which cannot be removed without systematic drilling and blasting; (3) concrete or masonry structures which have been abandoned; and (4) conglomerate deposits which are so firmly cemented that they possess the characteristics of solid rock and which cannot be removed without systematic drilling and blasting.

2. Said rock excavation shall be performed by the CONTRACTOR; provided, that should the quantity of rock excavation be affected by any change in the scope of the WORK, an appropriate adjustment of the contract price will be made.

3.4 FILL AND BACKFILL

A. **General:**

1. Fill and Backfill shall be placed in accordance with the applicable provisions of SSPWC, Section 300, and the requirements stated herein.

2. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has been properly cured in accordance with the requirements of Section 03300 and has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

3. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall not be placed until all water is removed from the excavation.

B. **Placing and Spreading of Materials:**

1. Materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment the layers shall be evenly spread so that when compacted each layer shall not exceed 8 inches in thickness. When compaction is achieved using flooding and jetting methods, each layer shall not exceed 3 feet in thickness after compaction.

2. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Bedding materials shall be brought up evenly around the pipe so that when compacted the material will provide uniform bearing and side support.

3. Where the material moisture content is below the optimum moisture content water shall be added before or during spreading until the proper moisture content is achieved.

4. Where the material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory.

C. **Compaction Requirements**

1. Compaction tests shall be performed in accordance with SSPWC, Subsection 211-2.

2. The relative compaction of fill, backfill, and base material shall be in accordance with SSPWC, Section 300, with the following exceptions:

a.	Subgrade where trench has been overexcavated	95%
b.	One foot layer of crushed aggregate backfill in overexcavated trench. Where trench is overexcavated more than 2 feet, minimum of 2 layers shall be compacted.	95%
c.	Pipe zone for flexible and rigid pipe :	95%
d.	Fill beneath structures, including water containing structures:	95%
e	Backfill on underground structure roof:	90%

D. **Unclassified Fill:**

1. All fill shall be of unclassified material unless separately designated. Construction of unclassified fill, including preparing the area on which fill is to be placed, and the depositing, conditioning, and compacting of fill material shall be in accordance with SSPWC, Subsection 300-4.

E. **Underground Conduit Backfill:**

1. Bedding around pipe shall be bedding material placed in accordance with the requirements of SSPWC, Subsection 306-1.2.

2. Backfill above shall be considered as starting 1 foot above the pipe or conduit, or at the subgrade for cast-in-place structures such as manholes, transition structures, junction structures, vaults, and valve boxes.

3. Backfill at underground conduits shall be select material placed and densified according to SSPWC, Subsection 306-1.3.

3.5 PREPARATION OF SUBGRADE UNDER IMPROVEMENT

A. The preparation of subgrade for pavement, curbs and gutters, driveways, sidewalks and other roadway structures shall be in accordance with SSPWC, Subsection 301-1.

** END OF SECTION **

SECTION 02510 - A.C. PAVEMENT AND BASE

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing asphalt concrete pavement, cement-treated base, and associated materials.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02100 Site Preparation
2. Section 02200 Earthwork

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

PART 2 -- PRODUCTS

2.1 MATERIALS REQUIREMENTS

A. **Base:** Materials for aggregate base shall be crushed rock and rock dust complying with SSPWC Subsection 301-2.1.

B. **Tack Coat:** Tack coat material shall comply with SSPWC Subsection 302-5.4.

C. **Asphalt Concrete:** Asphalt concrete shall comply with SSPWC Subsection 400-4. Where construction of the pavement is to be accomplished in a single course, Class C2 grading shall be used. Where construction consists of 2 or more courses, the surface course shall be Class C2 grading and the lower courses shall be Class B3 grading. Paving asphalt of viscosity grade AR 4000 shall be used.

D. **Pavement Marking Paint:** Pavement marking paint shall comply with SSPWC Subsection 210-1.6.

E. **Emulsified Asphalt Slurry Coat:** The slurry coat shall meet the requirements of SSPWC Subsection 203-5, and shall have the composition and grading indicated for Type II material.

PART 3 -- EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. **Subgrade Preparation:** The subgrade shall be prepared as specified in Section 02200 as applicable to roadways and embankment. Two-inch by 4-inch redwood headers shall be firmly staked in the proper positions along all edges other than those where the pavement is to be placed against existing concrete or paved surfaces.

B. **Cement-Treated Base:** Cement-treated base shall be installed where indicated and to the thickness indicated. Construction of the cement-treated base shall comply with SSPWC Subsection 301-3.3.

C. **Tack Coat:** A tack coat shall be applied in accordance with the requirements of SSPWC Subsection 302-5.4.

D. **Asphalt Concrete:** Asphalt concrete paving shall be constructed in accordance with SSPWC Subsection 302-5.

E. **Traffic Marking:** Application of paint shall comply with SSPWC Subsection 310-5.6.

F. **Emulsified Asphalt Slurry Coat:** An emulsified asphalt slurry coat shall be applied to surfaces of existing asphaltic-concrete pavement as indicated. Mixing and spreading of the slurry coat shall conform to applicable portions of SSPWC Subsection 302-4. Slurry shall be applied at the rate of 1350 square feet per extra long ton.

** END OF SECTION **

SECTION 02575 - PAVEMENT REHABILITATION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes removal and rehabilitation of pavement affected by CONTRACTOR'S operations such as trenching, modification to facilities or as otherwise indicated.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02200 Earthwork
2. Section 02510 AC Pavement and Base

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

1.4 PROJECT RECORD DRAWINGS

A. The following shall be included in the PROJECT RECORD:

1. Drawings indicating the exact extent of pavement removed and rehabilitated.

PART 2 -- PRODUCTS

2.1 ASPHALT CONCRETE

A. Asphalt concrete shall conform to the requirements of SSPWC subsection 203-6. Composition and grading of the asphalt concrete mixture shall conform to SSPWC subsection 203-6.3.2, class F.

B. Tack coat shall comply with subsection 302-5.4 of SSPWC.

2.2 PORTLAND CEMENT CONCRETE

A. Portland cement concrete shall comply with the requirements of subsection 201-1 of SSPWC; class 560-C-3250 per subsection 201-1.1.2 of SSPWC.

B. Curing compound for concrete that is to be topped by an asphaltic wearing course shall comply with SSPWC subsection 201-4 and shall be asphaltic type. Pigmentation is not required.

PART 3 -- EXECUTION

3.1 REMOVAL OF PAVEMENT

A. Existing AC pavement shall be sawcut to a minimum depth of 1-1/2 inches or 25 percent of its thickness, whichever is greater.

B. Removal of the existing cement concrete pavement for trench excavation shall be done in accordance with subsection 300-1.3 of SSPWC.

3.2 PLACEMENT OF PORTLAND CEMENT CONCRETE PAVEMENT

A. Subgrade preparation shall be done in accordance with subsection 301-1 of the SSPWC.

B. Prior to placing concrete, pavement edges shall be trimmed to neat horizontal and vertical lines. In case of AC pavement, a tack coat shall be applied to the existing pavement prior to placing cement concrete; while in the case of concrete pavement, the surface of edges shall be thoroughly wetted with water.

C. Portland cement concrete pavement shall be reconstructed in accordance with the applicable provisions of SSPWC subsection 302-6.

3.3 PLACEMENT OF WEARING SURFACE COURSE FOR AC PAVEMENT

A. In the case of rehabilitation of AC pavement, use only asphaltic type concrete curing compound.

B. Apply tack coat, to cement concrete pavement surface after it has cured, in accordance with SSPWC subsection 302-5.4.

C. Install asphaltic concrete, Class F, wearing course in accordance with the applicable provisions of SSPWC subsection 302-5.

** END OF SECTION **

SECTION 02600 - PIPELINE CONSTRUCTION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing general requirements for pipelines, including pipe, joints, specials, and appurtenances, complete and in place.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1.	Section 02200	Earthwork
2.	Section 02630	Ductile Iron Pipe
3.	Section 02646	PVC Pressure Pipe
4.	Section 02651	Steel Pipe, Lined and Coated
5.	Section 02653	Fabricated Steel Pipe Specials

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 SHOP DRAWINGS AND SAMPLES

A. In addition to the requirements of Section 02200 and the pipe material specifications, the following shall be submitted:

1. Post-installation videotape and inspection reports.

2. Line layout and marking diagrams which indicate the specific number of each pipe and fitting and the location of each pipe and the direction of each fitting in the completed line. In addition, the line layouts shall include: the pipe station and invert elevation at all changes in grade or horizontal alignment; the station and invert elevation to which the bell end of each pipe will be laid; all elements of curves and bends, both in horizontal and vertical alignment; and the limits of each reach of retrained and/or welded joints, or of concrete encasement.

3. Shop drawings and design calculations for joint restraint systems using reinforced concrete encasement of pressure pipe and fittings.

4. Drawings and calculations for thrust blocks.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials:** Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer. Materials delivered onsite without an approved submittal for verification shall be rejected and payment withheld.

B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

C. **Protection of Equipment**: Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment with anti-friction or sleeve bearings shall be stored in weather tight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers shall not be used to prevent accumulation of condensate in gears and bearings. Gears and bearings to be stored for extended periods shall be containerized suitable for export shipment.

1.6 FACTORY INSPECTION AND TESTING

A. The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture. This shall include costs for travel, meals, lodging, and car rental for two OWNER-designated inspectors for the number of days indicated to complete such inspections or observations, if the place of manufacture, fabrication and factory testing is more than fifty (50) miles outside the geographical limit of the City. The CONTRACTOR shall not be responsible for salary or salary-related costs of the inspectors.

PART 2 -- PRODUCTS

2.1 PIPE AND APPURTENANCES

A. Provide pipe materials, coatings and linings, and appurtenances of the sizes and types indicated on the Drawings and comply with Section 02630 - Ductile Iron Pipe, Section 02646 - PVC Pressure Pipe, Section 02651 - Steel Pipe, Lined and Coated, Section 02653 - Fabricated Steel Pipe and Specials.

2.2 FILL AND BACKFILL MATERIAL

A. Fill and backfill materials shall be in accordance with Section 02200.

PART 3 -- EXECUTION

3.1 PREPARATION

A. **Utility Relocation:** Notify the CONSTRUCTION MANAGER of property which must be relocated of existing public utilities and franchise holders which must be relocated and the reasonable time for doing so. The OWNER will contact the utility or franchise holder and request relocation. Relocation and protection of existing utilities which are the CONTRACTOR's responsibility shall be in accordance with Section 01530.

B. Before submitting joint shop drawings, where the proposed piping will connect to existing piping, the CONTRACTOR shall excavate the point of connection to verify size, layout, and depth. Prepare a sketch of the proposed point of connection for submittal with the joint shop drawings. The CONTRACTOR shall give the CONSTRUCTION MANAGER a minimum of two hours to inspect the existing piping before backfilling.

3.2 DEWATERING

A. Install and operate according to Section 02140 a continuous dewatering system capable of maintaining the ground water level 2 feet below the excavated trench bottom. Only well points located on both sides of the trench shall be used for dewatering, unless otherwise approved by the CONSTRUCTION MANAGER.

B. Operate the dewatering system 7 days per week, 24 hours per day with water level as indicated above until backfilling is completed.

C. Dewatering shall prevent softening of the bottom of excavations or formation of "quick" conditions. Dewatering shall not remove native soils. All loose soil shall be removed and recompacted in accordance with Section 02200.

3.3 EXCAVATION

A. Unless indicated otherwise, excavation and overexcavation shall be in accordance with Section 02200.

B. Trench width shall be as indicated.

C. Stabilize the trench subgrade by compaction to 95 percent relative density. Where trench bottom has been over-excavated, compact the bedding to 95 percent in 1-foot thick layers.

3.4 LAYOUT AND HANDLING

A. **Handling of Pipe and Accessories:** Pipe shall be lifted in such a manner as to minimize bending and prevent damage to the pipe. During transport, pipe shall be supported to prevent distortion or damage to the pipe. When not being handled, pipe shall be stockpiled on timber cradles or properly prepared ground with all rocks larger than 3 inches eliminated. All pipe, fittings valves and accessories shall be carefully lowered into the trench in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. The CONTRACTOR shall smooth out any burrs, gouges, or weld splatter and repair other defects prior to laying the pipe. Any pipe section, including coatings and linings, that becomes damaged as a result of handling or stockpiling shall be replaced with a new unit or repaired at the discretion of the CONSTRUCTION MANAGER at no additional cost to the OWNER.

3.5 DIVERSION PUMPING

A. Where the proposed piping will connect to existing piping which is in sewage service, install and operate bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow.

B. Design diversion piping, joints, and accessories to withstand 150 psi.

C. No sewage shall be diverted into any open area outside of a sanitary sewer.

D. In the event of spill or overflow, immediately stop the overflow and take action to clean up and disinfect the spillage area to original condition. Promptly notify the CONSTRUCTION MANAGER.

3.6 INSTALLATION

A. **General:** Pipe shall be installed in accordance with the pipe manufacturer's recommendations and the applicable provisions of SSPWC Subsection 306-1.2, and the requirements herein.

B. **Interferences:**

1. CONTRACTOR shall protect and maintain all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the WORK. Where indicated that the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, or pipes, the obstruction shall be supported until it is relocated, removed, or reconstructed by the CONTRACTOR in cooperation with owners of such utility structures. Unless otherwise indicated, this WORK shall be performed at no additional cost to the OWNER.

2. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the CONSTRUCTION MANAGER may direct a change in the alignment or the grades. Such change shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection recommended by the pipe manufacturer. No joint shall be misfit any amount which will be detrimental to the strength and integrity of the finished joint.

C. Cutting and machining of the pipe shall only be in accordance with the pipe manufacturer's standard procedures for this operation. Pipe shall not be cut with a cold chisel, standard iron pipe cutter, nor any other method that may fracture the pipe, produce ragged, uneven edges, or otherwise impair the condition of the pipe.

D. The CONTRACTOR shall install all pipe, fittings, closure pieces, bends, reducers, wyes, tees, crosses, outlets, manifolds, and other steel plate specials, bolts, nuts, gaskets, jointing materials, and all other appurtenances as indicated and as required to provide a complete and workable installation. No pipe or appurtenance shall be installed when the interior or exterior surfaces show cracks or other defects that may be harmful as determined by the CONSTRUCTION MANAGER. Damaged interior and exterior surfaces shall be repaired to the satisfaction of the CONSTRUCTION MANAGER or a new undamaged pipe or appurtenance shall be provided.

E. Pipe laying operations shall be stopped and dewatering operations shall be adjusted to prevent the pipe from floating due to water entering the trench from any source. The CONTRACTOR shall reinstall all affected pipe to its specified condition and grade.

H. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after laying. All openings in the pipe line shall be closed with water tight expandable type sewer plugs or PVC test plugs at the end of

each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar temporary plugs will not be permitted.

I. Immediately before placing each section of pipe in final position for jointing, the bedding shall be checked for firmness and uniformity of surface.

J. Pipe shall be laid directly on the bedding material. No blocking will be permitted and the bedding shall form a continuous, solid bearing for the full length of the pipe. Excavate to facilitate removal of handling devices after the pipe is laid. Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings and to facilitate placement of grout bands. Excavation shall be adequate to permit access to the joints for bonding operations and for application of coating on field joints.

L. Sheet piling used for shoring shall extend at least 2 feet below the bottom of the trench. After completion of the pipe, it may be removed by cutting at least 12 inches above the top of the pipe. No vibratory methods for pile removal will be accepted, and piling lower than 12 inches above the top of the pipe shall be left in place.

M. Lay section of pipe with the bell end upgrade.

N. Except for short runs which may be permitted by the CONSTRUCTION MANAGER, sections of pipe shall be laid in a sequence moving in an upgrade direction on grades exceeding 10 percent. Pipe which is laid in a downgrade direction shall be blocked and held in place until sufficient support is furnished by the following pipes to prevent movement.

O. Where indicated, concrete thrust blocks shall be provided.

3.7 FIELD TESTING

A. Field testing shall be in accordance with Section 02666.

3.8 CORROSION CONTROL

A. **Joint Bonding/Test Stations:** Except where otherwise indicated, all joints shall be bonded in accordance with the details indicated. The CONTRACTOR shall furnish all materials required for joint bonding and test station installations. The pipe shall be cleaned to bare bright metal at the point where the bond is installed. The pipe manufacturer shall be responsible for determining and implementing a suitable procedure and schedule for installation of bonding-field versus factory versus combination-in such a manner that the corrosion resistance of the lining and coating is not degraded by the bonding process. It may involve welding joint bonding pads, or welding the bonding wires in the factory before applying the lining and coating specified and/or may involve patching impaired areas in the factory or the field.

To accommodate attachment of the joint bonding pad, which is used to eliminate damage to the interior pipe lining- polyurethane and fusion-bonded epoxy-during the alumino-thermal welding, 2 1/2" x 2" x d" thick pads of the same metal as the pipe shall be welded on both ends of the pipe prior to lining and coating. Following field welding of the bond wires to the pipe, the exterior coating shall be repaired per Section 15025. The CONTRACTOR shall use the proper size of alumino-thermal welding charge for installing the joint bonding wires.

3.9 POST-INSTALLATION TELEVISION INSPECTION (NOT USED)

3.10 SITE RESTORATION

A. Backfill and compact soil in accordance with Section 02200.

B. Place subgrade and base materials in accordance with Section 02200.

C. Replace damaged pavement, curbs, gutters, and sidewalks, shrubs, and trees as indicated in SSPWC Subsection 306-1.5.2.

** END OF SECTION **

02630 - DUCTILE IRON PIPE

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing ductile iron pipe and all appurtenant work. Polyurethane and fusion bond epoxy coating and lining material shall be furnished only by an OWNER-approved manufacturer.

B. The WORK requires that one pipe manufacturer accept responsibility for furnishing the coated and lined pipe without altering or modifying the CONTRACTOR's responsibilities under the Contract Documents.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02140 Dewatering
2. Section 02200 Earthwork
3. Section 02600 Pipeline Construction
4. Section 09800 Protective Coating
6. Section 15000 Piping Components

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

AWWA C110/ANSI A21.10	Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. for Water and Other Liquids
AWWA C150/ANSI A21.50	Thickness Design of Ductile-Iron Pipe
AWWA C151/ANSI A21.51	Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C153/ANSI A21.53	Ductile-Iron Compact Fittings, 3 in. through 24 inches and 54 through 64 inches for Water Service
ANSI/AWWA C203	Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied

ANSI/AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
ASTM D 16	Definition of Terms Relating to Paint, Varnish, Lacquer, and Related Products
ASTM, D 471	Test Method for Rubber Property - Effect of Liquids
ASTM D 1248	Polyethylene Plastics Molding and Extrusion Materials
ASTM D 2240	Test Method for Rubber Property - Durometer Hardness
ASTM D 4060	Test Method for Abrasion Resistance of Organic Coatings by Taber Abraser
ASTM D 4541	Method for Pull-Off Strength of Coatings using Portable Adhesion Testers
ASTM E 96	Test Methods for Water Vapor Transmission of Materials
ASTM G 14	Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Certified dimensional drawings of all valves, fittings, and appurtenances.

2. For pipe 24 inches in diameter and larger, line layout and marking diagrams which indicate the specific number of each fitting and the location and the direction of each fitting in the completed line.

3. Certification from the polyurethane manufacturer that the proposed material meets all the indicated requirements.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. A certified affidavit of compliance for pipe and other products or materials with the requirements of this Section.

1.7 FACTORY INSPECTION AND TESTS

A. The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture. This shall include costs for travel, meals, lodging, and car rental for two OWNER-designated inspectors for 3 days required to complete such inspections or observations exclusive of travel days, if the place of manufacture, fabrication and factory testing is more than fifty (50) miles outside the geographical limit of the City. The CONTRACTOR shall not be responsible for salary or salary-related costs of the inspectors.

B. **Inspection:** All pipe shall be subject to inspection at the place of manufacture and place of coating and lining application in accordance with the provisions of the referenced standards, as supplemented by the requirements herein. The CONTRACTOR shall notify the CONSTRUCTION MANAGER in writing of the manufacturing starting date not less than 14 calendar days prior to the start of the pipe manufacture and coating application.

C. During the manufacture of the pipe, the CONSTRUCTION MANAGER shall be given access to all areas where manufacturing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

D. **Tests:** Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.

E. The CONTRACTOR shall perform said material tests at no additional cost to the OWNER. The CONSTRUCTION MANAGER will witness all testing conducted by the CONTRACTOR; provided, that the CONTRACTOR'S schedule is not delayed for the convenience of the CONSTRUCTION MANAGER.

F. In addition to those tests specifically required, the CONSTRUCTION MANAGER may request additional samples of any material including lining and coating samples for testing by the OWNER. The additional samples shall be furnished at no additional cost to the OWNER.

1.8 MARKING, HANDLING, AND STORAGE

A. **Markings:** All pipes shall be factory marked indicating size and class. Legibly mark specials 24 inches in diameter and larger in accordance with the laying schedule and marking diagram. Mark the surface of each fitting and special that is intended to be at the top when the fitting or special is placed in the trench.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Pipe and Fittings:** Ductile iron pipe and fittings shall be in accordance with SSPWC, Subsection 207-9 and the requirements contained herein. The pipe shall be of the diameter and class indicated.

B. **Bonding and Electrical Conductivity:** All pipe joints shall be prepared for bonding for electrical conductivity in accordance with the details indicated. The CONTRACTOR shall furnish all materials required for joint bonding and electrolysis test station installations. To accommodate attachment of the joint bonding pad, which is used to eliminate damage to the interior pipe lining - polyethylene, polyurethane, or fusion-bonded epoxy - during alumino-thermal welding, 2 1/2" X 2" X 3/8" thick ductile iron pads on both ends of the pipe shall be welded to the pipe prior to lining and coating. Following welding of the bond wires to the pipe, the exterior coating shall be repaired per Section 15025.

C. **Closures and Correction Pieces:** Closures and correction pieces shall be provided as required to adjust the pipe laying to conform to pipe stationing shown. The locations of correction pieces and closure assemblies are indicated. Any change in location or number of said items shall be subject to acceptance by the CONSTRUCTION MANAGER.

2.2 PIPE JOINTS

A. Ductile iron pipe joints shall comply with the requirements of SSPWC, Subsection 207-9.2.2 and shall be of the type indicated.

B. Restrained joints shall be an approved type provided and recommended by the pipe manufacturer.

2.3 MATERIALS

A. **Ductile Iron Pipe:** Pipe materials shall conform to the requirements of SSPWC, Subsection 207-9.2, and AWWA C151.

B. **Polyethylene Sleeves:** Polyethylene sleeves shall not be used.

2.4 SPECIAL FITTINGS

A. Fittings of the compact type for ductile iron pipe shall conform to the requirements of AWWA C153/ANSI A21.53, and shall have a minimum pressure rating of 250 psi. Ductile iron fittings larger than 48-inch shall conform to the above referenced standard with the necessary modifications for the larger size.

B. Fittings shall be of the diameter and class shown in the Specifications or the Plans. Compact type fittings shall only be used where expressly specified.

2.5 CEMENT MORTAR LINING (NOT USED)

2.6 FUSION-BONDED POLYETHYLENE LINING (NOT USED)

2.7 POLYURETHANE COATING AND LINING (NOT USED)

2.8 EXTERIOR COATING OF EXPOSED PIPING (NOT USED)

2.9 FUSION-BONDED EPOXY COATING AND LINING FOR DUCTILE IRON PIPE

A. **General:** Ductile iron pipe, fittings, and specials shall be lined and coated with fusion bond epoxy where indicated. Except as described below, the material system for the exterior and interior of ductile iron pipe and fittings installed underground or underwater shall be in accordance with ANSI/AWWA C213.

B. **Minimum Pipe Diameter:** The minimum pipe diameter for application of an internal lining shall be 4 inches.

C. **Maximum Temperature:** This material system shall be able to withstand a maximum service temperature of 190^0 F.

D. **Thickness:** The powder shall be applied to the preheated pipe at a uniform cured thickness. The minimum uniform cured thickness of the applied material shall be as follows:

1. Interior 16 mils

2. Exterior 14 mils

3. Maximum thickness shall be determined by the applicator based on the roughness of the pipe so as to obtain a holiday free product. Lining and coating thickness for pipe joints shall be compatible with the pipe dimensional tolerances.

E. **Degassifying:**

The pipe and fittings shall be heated to between 425^0 F and 475^0F and held at that temperature for 60 minutes or until total outgassing is achieved.

F. **Blast Cleaning:**

The pipe surfaces to be covered in the plant shall be blast-cleaned with steel grit to achieve a near white surface conforming to SSPC SP10 or NACE TM-01-70 grade NACE No.1, as applicable to ductile iron pipe.

G. **Continuity Tests:**

1. Interior of pipe shall be electrically inspected at the factory for continuity at 2100 volts. At the option of the CONSTRUCTION MANAGER, if the number of holidays exceeds one per 3 linear feet of pipe 20 inches O.D. or smaller, or one per 2 linear feet of pipe over 20 inches O.D., the pipe shall be reprocessed. Unless reprocessed, all defects disclosed by the holiday detector shall be repaired in the shop according to Subsection 3.4 - Coating Repair of ANSI/AWWA C213.

2. Exterior of pipe shall be electrically inspected at the factory for continuity at 1965 volts. If the number of holidays exceeds one per 3 linear feet of pipe 20 inches in O.D. or smaller or one per 2 linear feet of pipe over 20 inches O.D., the CONSTRUCTION MANAGER will determine if the pipe coating shall be removed and reapplied or if holidays shall be repaired in the shop. Shop repairs shall be performed similar to the procedures in ANSI/AWWA C213.

H. **Coating Repair and Field Touch-Up:**

Exothermic weld connections required for the installation of bond cables across joints of the pipeline for cathodic protection shall be repaired and touched-up with 3M-312 coating material or equal.

I. **Fusion Bond Epoxy Manufacturers**

1. Scotchkote
2. Lilly Powder Coatings
3. HB Fuller
4. or equal

J. **Qualifications, Approval, and Documentation of Fusion Bond Epoxy Manufacturers**

1. **Qualifications:** The fusion bond epoxy manufacturer shall have a record of at least one application of the proposed coating/lining material on a successfully performing ductile iron piping installation of comparable size and complexity constructed in the recent past.

2. Approval

   a. Bidders shall submit the name and documented qualifications of the manufacturer proposed for the fusion bond epoxy material. The OWNER will review and approve the proposed selection.

   b. Documentation to be submitted by CONTRACTOR

      (1) Documentation of at least one ductile iron pipe project constructed in the recent past and successfully performing under similar service conditions.

      (2) The name, telephone number, and address of the owner and completion date and location for the project listed above.

      (3) The name, telephone number, and address of the firm which applied the fusion bond epoxy in the project listed above.

      (4) Descriptive literature, including Material Safety Data Sheet, for the proposed material.

PART 3 -- EXECUTION

3.1 INSTALLATION OF PIPE

A. Ductile iron pipe shall be installed in accordance with the applicable provisions of SSPWC, Subsection 306-1.2, Section 02600, and the recommendations of the manufacturer.

3.2 FIELD TESTING FOR COATING CONTINUITY

A. All exterior surface coatings, except for cement mortar, shall be inspected electrically immediately before the pipe is lowered into the trench, following the same requirements for factory inspection procedure and voltage indicated above for the protective material. All holidays shall be repaired before the pipe is placed in the trench.

3.3 CORROSION CONTROL

A. **Joint Bonding/Electrolysis Test Stations:** Except where otherwise indicated, all joints shall be bonded in accordance with the details indicated. The pipe shall be cleaned to bare bright metal at the point where the bond is installed. The pipe manufacturer shall be responsible for determining and implementing a suitable procedure and schedule for installation of bonding —field versus factory versus combination— in such a manner that the corrosion resistance of the lining and coating is not degraded by the bonding process. It may involve welding joint bonding pads, or welding the bonding wires in the factory before applying the lining and coating specified and/or may involve patching impaired areas in the factory or the field.

B. **Bonding and Electrical Continuity:** All unwelded pipe joints shall be bonded for electrical conductivity in accordance with the details indicated. The CONTRACTOR shall furnish all materials required for joint bonding and test station installations. Ductile iron pads 2 1/2 "x 2"x 3/8" thick shall be welded on both ends of the pipe prior to lining and coating. Following welding of the bonding wires to the pipe, the exterior coating shall be repaired per Section 15025.

C. **Cathodic Protection:** Corrosion mitigation and testing materials, such as an impressed current cathodic protection system, magnesium anodes, reference electrodes, and test lead wires shall be provided where indicated.

** END OF SECTION **

SECTION 02651-STEEL PIPE, LINED AND COATED

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing lined and coated steel pipe, including fittings and specials, complete in place. Fusion bond epoxy lining and Polyurethane coating material shall be furnished only by an OWNER-approved manufacturer.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02200 Earthwork
2. Section 02600 Pipeline Construction
3. Section 05120 Structural Steel
4. Section 05500 Miscellaneous Metalwork
5. Section 09800 Protective Coating
6. Section 09810 Polyethylene Tape Coating
7. Section 15000 Piping Components
8. Section 15025 Cathodic Protection System

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ASTM A 36	Structural Steel
ASTM A 139	Electric Fusion (Arc)-Welded Steel Pipe
ASTM A 234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A 283	Low and Intermediate Tensile Strength Carbon Steel Plate
ASTM A 370	Mechanical Testing of Steel Products
ASTM A 570	Hot Rolled Carbon Steel Sheet and Strip, Structural Quality
ASTM A 572	High-Strength Low-Alloy Columbium, Vanadium Steels of Structural Quality
ASTM C 150	Portland Cement
ASTM D 16	Definition of Terms Relating to Paint, Varnish, Lacquer, and Related Products
ASTM D 471	Test Method for Rubber Property - Effect of Liquids

ASTM D 2240	Test Method for Rubber Property - Durometer Hardness
ASTM D 4060	Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D 4541	Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM E 96	Test Methods for Water Vapor Transmission of Materials
ASTM E 165	Methods for Liquid Penetrant Inspection
ANSI/AWWA C200	Steel Water Pipe 6 In. and Larger
ANSI/AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied
ANSI/AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied
ANSI/AWWA C206	Field Welding of Steel Water Pipe
ANSI/AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings
ANSI/AWWA C209	Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
ANSI/AWWA C602	Cement-Mortar Lining of Water Pipelines 4-In and Larger - in Place
ANSI/AWS D1-1	Structural Welding Code: Steel
AWWA M-11	Steel Water Pipe - A Guide for Design and Installation.

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Shop drawings and catalog information on pipe and fittings.

2. Pipe and fitting wall construction details which indicate the type and thickness of the cylinder; the position, type, size, and area of reinforcement; manufacturing tolerances; and all other pertinent information required for the manufacture of the product. Joint details shall be submitted in all cases including those where deep bell or butt strap joints are required for control of temperature stresses.

3. Fittings and specials details such as elbows, reducers, wyes, tees, crosses, outlets, connections, test bulkheads, and nozzles or other specials where shown which indicate amount and position of all reinforcement. All fittings and specials shall be properly reinforced to withstand the internal pressure, both circumferential and longitudinal, and the external loading conditions as indicated in the Contract Documents.

4. Design calculations including a complete stress analysis of each critical section of pipe wall, girth joints, and specials - all sufficient to ascertain conformance of pipe and fittings with the Specifications.

5. Material lists and steel reinforcement schedules which include and describe all materials to be utilized.

6. Full and complete information regarding location, type, size, and extent of all welds shall be shown on the shop drawings. The shop drawings shall distinguish between shop and field welds. Shop drawings shall indicate by welding symbols or sketches the details of the welded joints, and the preparation of parent metal required to make them. Joints or groups of joints in which welding sequence or technique are especially important shall be carefully controlled to minimize shrinkage stresses and distortion.

7. Shop and field welding procedures and Welders' Qualification Certification.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. **Certifications:** The CONTRACTOR shall furnish a certification stating that all pipe, special fittings, and other products or materials furnished under this Section of the Specifications comply with ANSI/AWWA C200, C203 and C205. Additionally, the CONTRACTOR shall furnish certified reports of the following tests:

a. Physical and chemical properties of all steel.
b. Hydrostatic test reports.
c. Results of production weld tests.

B. All expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR.

1.7 FACTORY INSPECTION, TESTS AND WELDING REQUIREMENTS

A. The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture. This shall include costs for travel, meals, lodging, and car rental for two OWNER-designated inspectors for 3 days required to complete such inspections or observations exclusive of travel days, if the place of manufacture, fabrication and factory testing is more than fifty (50) miles outside the geographical limit of the City. The CONTRACTOR shall not be responsible for salary or salary-related costs of the inspectors.

B. **Inspection:** All pipe shall be subject to inspection at the place of manufacture and place of coating application in accordance with the provisions of ANSI/AWWA C200, C203 and C205 as supplemented by the requirements herein. The CONTRACTOR shall notify the CONSTRUCTION MANAGER in writing of the manufacturing starting date not less than 14 calendar days prior to the start of any phase of the pipe manufacture.

C. **Tests:** Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of ANSI/AWWA C200, C203 and C205 as applicable.

1. **Shop testing of steel pipe:**

a. After the joint configuration is completed and prior to lining with cement-mortar, each length of pipe of each diameter and pressure class shall be shop-tested and certified to a pressure of at least 80 percent of the yield strength of the pipe steel.

b. Production weld tests shall be conducted in compliance with ANSI/AWWA C200. In addition to the frequency of tests required in ANSI/AWWA C200, weld tests shall be conducted on each 5,000 feet of production welds and at any other times there is a change in the welder, the welding procedure, or the welding equipment.

2. **Shop testing of steel plate specials:**

a. Upon completion of the welding, but prior to lining and coating, each steel plate special shall be bulkheaded and tested under a hydrostatic pressure of 1-1/2 times the design pressure; provided, that if straight pipe used in fabricating the specials has been previously tested and meets the requirements of the applicable piping Section, no further hydrostatic testing will be required; or provided, that all other welded seams are tested by the liquid penetrant inspection procedure conforming to ASTM E 165, under Method "B" and "Leak Testing" or where applicable by the soap and compressed air method at an air pressure of 25 psi. Any pin holes or porous welds which may be revealed by the test shall be chipped out and rewelded and the pipe or fitting retested.

b. No outside coating shall be applied over a seam prior to testing; however, mortar lining may be applied over a seam prior to hydrostatic testing, but under such conditions said pressure test shall be held on the pipe or fitting for a period of not less than 30 minutes.

D. The CONTRACTOR shall perform said material tests at no additional cost to the OWNER. The CONSTRUCTION MANAGER will witness all testing conducted by the CONTRACTOR; provided, that the CONTRACTOR'S schedule is not delayed for the convenience of the CONSTRUCTION MANAGER.

E. In addition to those tests specifically required, the CONSTRUCTION MANAGER may request additional samples of any material including mixed concrete and lining and coating samples for testing by the OWNER. The additional samples shall be furnished at no additional cost to the OWNER.

F. **Welding Requirements:** All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D1.1. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

G. **Welder Qualifications:** All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local, approved testing agency not more than 6 months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the WORK shall be used in qualification tests. The CONTRACTOR shall furnish all material and bear the expense of qualifying welders.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING.

A. All pipe, fittings, etc., shall be carefully handled and protected against damage to lining and coating/interior and exterior surfaces, impact shocks, and free fall. The pipe and specials shall be handled by use of wide slings, padded cradles, or other devices designed and constructed to prevent damage to the pipe coating/exterior. The use of chains, hooks, or other equipment which might injure the pipe coating/exterior will not be permitted. Pipe shall not be placed directly on rough ground but shall be supported in a manner which will protect the pipe against injury whenever stored at the trench site or elsewhere.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Specials are defined as fittings, closure pieces, bends, reducers, wyes, tees, crosses, outlets, manifolds, and other steel plate specials wherever located, and all piping above ground or in structures.

B. The pipe shall be of the diameter shown, shall be furnished complete with rubber gaskets or welded joints as indicated in the Contract Documents, and all specials and bends shall be provided as required under the Contract Documents. For pipe 14 inches in diameter and larger, the inside diameter after lining shall not be less than the nominal diameter indicated. Pipe smaller than 14 inches in diameter may be furnished in standard outside diameters.

C. **Markings:** The CONTRACTOR shall legibly mark all pipes and specials in accordance with the laying schedule and marking diagram. Each pipe shall be numbered in sequence and said number shall appear on the laying schedule and marking diagram in its proper location for installation. All special pipe sections and fittings shall be marked at each end indicating the top. The word "top" shall be painted or marked on the outside top spigot end of each pipe section.

D. Stockpiled pipe and specials shall be suitably supported on sand or earth berms free of rock exceeding 3 inches in diameter. The pipe shall not be rolled and shall be secured to prevent accidental rolling.

E. The CONTRACTOR shall be fully liable for the cost of replacement or repair of pipe and specials which are damaged.

F. **Strutting:** Adequate strutting shall be provided on all specials, fittings, and straight pipe so as to avoid damage to the pipe and fittings during handling, storage, hauling, and installation. In addition, the following requirements shall apply:

1. The strutting shall be placed as soon as practicable after the mortar lining has been applied and shall remain in place while the pipe is loaded, transported, unloaded, installed, and backfilled at the jobsite.

2. Any pipe damaged during handling, hauling, storage, or installation due to improper strutting shall be repaired or replaced.

3. The details of the strutting assembly shall be submitted for review by the CONSTRUCTION MANAGER prior to the start of pipe manufacture.

G. **Laying Lengths:** Maximum pipe laying lengths shall be 40 ft with shorter lengths provided as required.

H. **Offset Tolerances:** For pipe wall thicknesses of 3/8-inch or less, the maximum radial offset (misalignment) for submerged arc and gas metal arc welded pipe shall be 0.1875 times the pipe wall thickness or 1/16-inch, whichever is larger. For pipe wall thicknesses of greater than 3/8-inch, the maximum radial offset shall be 0.1875 times the wall thickness or 5/32-inch, whichever is smaller.

I. **Lining:** The pipe lining shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing and roughness.

J. **Closures and Correction Pieces:** Closures and correction pieces shall be provided as required so that closures may be made due to different headings in the pipe laying operation and so that correction may be made to adjust the pipe laying to conform to pipe stationing shown on the Drawings. The locations of correction pieces and closure assemblies are shown on the Drawings. Any change in location or number of said items shall be submitted for review by the CONSTRUCTION MANAGER

2.2 PIPE DESIGN CRITERIA

A. **General:**

1. The pipe shall be steel pipe with rubber gasketed or field welded joints as indicated.

2. The pipe shall be designed, manufactured, tested, inspected, and marked according to applicable requirements of ANSI/AWWA C 200 except as hereinafter modified.

3. The pipe shall be of the diameter indicated and be suitable for the indicated pressure. The minimum steel cylinder thickness for each pipe size shall be as indicated.

4. Steel cylinder thickness for internal pressure shall be determined in accordance with the more stringent of the criteria specified in subparagraphs B. and C. below.

B. **Cylinder Thickness for Internal Pressure:** For resistance to internal pressure, the thickness of the steel cylinder shall not be less than the greater of that determined by the following 2 formulas:

(1) $T = \frac{P_w D/2}{Y/S_w}$ (2) $T = \frac{P_t D/2}{Y/S_t}$

Where: T = Steel Cylinder thickness in inches
D = Outside diameter of steel cylinder in inches
P_w = Design working pressure in psi
P_t = Design transient pressure in psi
Y = Specified minimum yield point of steel in psi
S_w = Safety factor of 2.0 at design working pressure

S_t = Safety factor of 1.5 at design transient pressure

C. P_w shall be 150 psi. P_t shall be 200 psi. In no case shall the design stress (Y/S_w, using a safety factor of 2.0 to yield strength) exceed 21,000 psi at design working pressure, P_w, nor shall the design stress (Y/S_t, using a safety factor of 1.5 to yield strength) exceed 28,000 psi at design transient pressure, P_t, nor shall the steel shell thickness be less than No. 10 gauge (0.135 in.) or the nominal pipe diameter divided by 240, whichever is greater, as shown in the following table:

Nominal Pipe Diameter (in)	Minimum Cylinder Thickness (in)
6	0.135
12	0.135
18	0.135
24	0.135
30	0.135
36	0.15
42	0.175
48	0.20
54	0.225
60	0.25
66	0.275
72	0.30
78	0.325
84	0.35
90	0.375
96	0.40
102	0.425
108	0.45
114	0.475
120	0.50

2.3 DESIGN OF SPECIALS

A. Except as otherwise provided herein, materials, fabrication and shop testing of straight pipe shall conform to the requirements of ANSI/AWWA C200. Dimensions for fittings shall conform to ANSI/AWWA C208. The minimum thickness of plate for pipe from which specials are to be fabricated shall be the greater of that determined by the following 2 formulas:

(1) $$T = \frac{P_w D/2}{Y/S_w}$$ (2) $$T = \frac{P_t D/2}{Y/S_t}$$

Where:
- T = Steel cylinder thickness in inches
- D = Outside diameter of steel cylinder in inches
- P_w = Design working pressure in psi
- P_t = Design transient pressure in psi
- Y = Specified minimum yield point of steel in psi
- S_w = Safety factor of 2.5 at design working pressure
- S_t = Safety factor of 1.875 at design transient pressure

B. In no case shall the design stress at design working pressure (Y/S_w) for enamel or tape coated steel pipe exceed 21,000 psi or 28,000 psi at design transient pressure (Y/S_t), nor shall plate thickness be less than the thickness of adjacent mainline pipe or the following:

Nominal Pipe Diameter (in)	Pipe Manifolds Piping Above Ground Piping in Structures	Elbows Bends Reducers
24 and under	3/16-in	10-ga
25 to 48	1/4-in	1/4-in
over 48	5/16-in	5/16-in

C. Pipe installed on saddle supports shall be designed to limit the longitudinal bending stress to a maximum of 10,000 psi. Design shall be in accordance with the provisions of Chapter 7 of AWWA M-11.

2.4 MATERIALS

A. **Steel for Cylinders and Fittings:** Pipe manufactured under ANSI/AWWA C200 shall be fabricated from sheets conforming to the requirements of ASTM A 570, Grades 30, 33, 36 or 40, or from plates conforming to the requirements of ASTM A 36, A 283, Grades C or D, or A 572, Grade 42, or coil conforming to the requirements of ASTM A 139, Grades B or C. All longitudinal and girth seams, whether straight or spiral, shall be butt welded using an approved electric-fusion-weld process.

B. All steel used for the fabrication of pipe shall have a maximum carbon content of 0.25 percent, a maximum sulfur content of 0.015 percent, and shall have a minimum elongation of 22 percent in a 2-inch gauge length.

D. Steel exceeding 1/2-inch in thickness used in fabricating pipe shall be tested for notch toughness for each heat using the Charpy V-Notch test in accordance with ASTM A 370. The steel shall withstand a minimum impact of 25 ft lb at a temperature of 30 degrees F.

E. Steel shall be fine-grained, fully killed and manufactured by the continuous casting process.

2.5 JOINT DESIGN

A. Joints and fittings shall be per Section 15000 Piping Components.

2.6 CEMENT-MORTAR LINING OF PIPE (NOT USED)

2.7 EXTERIOR COATING OF PIPE

A. **Exterior Coating of Exposed Piping:** The exterior surfaces of pipe which will be exposed to the atmosphere inside structures or above ground shall be thoroughly cleaned and then given a shop coat of rust-inhibitive primer and then finish coated in conformance to the requirements of 2.12 below.

2.8 FABRICATION OF SPECIALS

A. **General:** Specials and fittings shall conform to dimensions stipulated in ANSI/AWWA C208. Reinforcement for wyes, tees, outlets, and nozzles shall be designed in accordance with AWWA Manual M-11. Reinforcement shall be designed for the pressure indicated and shall be in accordance with the Standard Details. Specials and fittings shall be equal in pressure design strength and shall have the same lining and coating as the adjoining pipe. Unless otherwise shown, the minimum radius of elbows shall be 2.5 times the pipe diameter and the maximum miter angle on each section of the elbow shall not exceed 11-1/4 degrees.

B. Specials and fittings that cannot be mechanically lined shall be lined by hand-application, using the same materials as are used for the pipe and in accordance with the applicable ANSI/AWWA C 602 Standards. Lining applied in this manner shall provide protection equal to that indicated for the pipe. Fittings may be fabricated from pipe that has been mechanically lined. Areas of lining that have been damaged by such fabrication shall be repaired by hand-applications in accordance with applicable ANSI/AWWA C 602 Standards.

C. **Outlets, Tees, Wyes, and Crosses:** Outlets 12-inch and smaller may be fabricated from Schedule 30 or heavier steel pipe in the standard outside diameters, i.e., 12 3/4-inch, 10 3/4 -inch, 8-inch, 6-inch, and 4 1/2-inch. Access manholes shall be located as indicated.

D. The design of outlet reinforcement shall be in accordance with the procedures given in Chapter 13 of AWWA Manual M-11, except that the design pressure, P, used in the M-11 procedure shall equal the greater of 1.25 P_w or 0.9375 P_t. Unless otherwise indicated, outlets 2 inches in diameter and smaller need not be reinforced.

   1. In lieu of saddle or wrapper reinforcement as required by the design procedure in Manual M-11, pipe or specials with outlets may be fabricated in their entirety of steel plate having a thickness equal to the sum of the pipe wall plus the required reinforcement.

   2. All threaded outlets shall be forged steel suitable for 3000 psi service.

E. Where required by the M-11 design procedure, crotch plate reinforcement shall be furnished.

F. **Steel Welding Fittings:** Steel welding fittings shall conform to ASTM A 234.

G. **Ends for Mechanical-Type Couplings:** Except as otherwise required, where mechanical-type couplings are indicated, the ends of pipe shall be banded with Type C collared ends using double fillet welds. Where pipe 12-inch and smaller is furnished in standard schedule thicknesses, and where the wall thickness equals or exceeds the coupling manufacturer's minimum wall thickness, the pipe ends may be grooved.

H. **Lining:** All requirements pertaining to thickness, application and curing of lining indicated for straight pipe shall apply to specials, with the following proviso. If the special cannot be lined centrifugally, it shall be lined by hand. In such case, the lining shall be reinforced with 2-in by 4-in No. 12 welded wire fabric positioned approximately in the center of the lining. The wires spaced 2-in on centers shall extend circumferentially around the pipe with the fabric securely fastened to the pipe. Splices shall be lapped 4 inches and the free ends tied or looped to assure continuity.

I. **Coating of Fittings and Specials:** Fittings and specials shall be coated in accordance with Section 09810.

1. Unless otherwise indicated, the coating on the buried portion of a pipe passing through the wall of a structure shall extend to the center of the wall or the wall flange, if one is indicated.

2. Pipe above ground or in structures shall be field painted as required in Section 09800.

J. **Marking:** A mark indicating the true vertical axis of the special shall be placed on the top and bottom of the special.

2.9 PIPE APPURTENANCES

A. Pipe appurtenances shall be in accordance with the requirements of Section 15000.

2.10 BURIED PIPE APPURTENANCES (NOT USED)

2.11 FUSION-BONDED EPOXY LINING

A. **General:** Except as described below, the material system for the interior of steel pipe and fittings installed shall be in accordance with ANSI/AWWA C213.

B. **Minimum Pipe Diameter:** The minimum pipe diameter for application of an internal lining shall be 8 inches for welded joint pipe, and 4 inches for gasketed joint pipe.

C. **Maximum Temperature:** This material system shall be able to withstand a maximum service temperature of 190^0 F.

D. **Thickness:** The powder shall be applied to the preheated pipe at a uniform cured thickness. The minimum nominal uniform cured thickness of the applied material shall be as follows:

1. Interior, 16 mils minimum

2. Exterior (Not Used)

3. Maximum thickness shall be determined by the applicator based on the roughness of the pipe so as to obtain a holiday free product. Lining and coating thickness for pipe joints shall be compatible with dimensional tolerances.

E. **Field-Welded Joints:** The repair of field-welds shall be per Section 3.5 of ANSI/AWWA C213, EXCEPT that Subsection 3.5.3 shall not be used for the internal repair. After joint repair the joint shall be tested for continuity per Subsection G.2 below.

F. **Blast Cleaning:** The pipe surfaces to be covered in the plant shall be blast-cleaned with steel grit to achieve a near white surface conforming to SSPC-SP10 or NACE TM-01-70 grade NACE No. 1.

G. **Continuity Tests:**

1. Interior of pipe shall be electrically inspected for continuity at 2100 volts. At the option of the CONSTRUCTION MANAGER, if the number of holidays exceeds one per 3 linear feet of pipe 20 inches O.D. or smaller, or one per 2 linear feet of pipe over 20 inches O.D., the pipe shall be reprocessed. If not reprocessed, all defects disclosed by the holiday detector shall be repaired in the shop according to Subsection 3.4 - Coating Repair of the ANSI/AWWA C213 specifications.

2. Exterior of pipe shall be electrically inspected for continuity at 1965 volts. At the option of the CONSTRUCTION MANAGER, if the number of holidays exceeds one per 3 linear feet of pipe length for pipe smaller than 14 inches O.D., or one per 25 square feet of surface area for pipe 14 inches in O.D. and larger, the pipe shall be reprocessed. If not reprocessed, all defects disclosed by the holiday detector shall be repaired in the shop according to Subsection 3.4 - Coating Repair of the ANSI/AWWA C213 specifications.

H. **Coating Repair and Field Touch-Up:** If gasketed joint pipe is used, exothermic weld connections for the installation of bond cables across joints of the pipeline for cathodic protection shall be repaired and touched-up with 3M-312 material or equal.

I. **Fusion Bond Epoxy Manufacturers:**

1. Scotchkote
2. Lilly Powder Coatings
3. HB Fuller
4. or equal

J. **Qualifications, Approval, and Documentation of Fusion Bond Epoxy Manufacturers**

1. **Qualifications:** The fusion bond epoxy manufacturer shall have a record of at least one application of the proposed coating/lining material on a successfully performing steel pipe installation of comparable size and complexity constructed in the recent past.

2. **Approval**

a. Bidders shall submit the name and documented qualifications of the manufacturer proposed for the fusion bond epoxy material. The OWNER will review and approve the proposed selection.

b. Documentation to be submitted CONTRACTOR

(1) Documentation of at least one steel pipe project constructed in the recent past and successfully performing under similar service conditions.

(2) The name, telephone number, and address of the owner and completion date and location for the project listed above.

(3) The name, telephone number, and address of the firm which applied the fusion bond epoxy in the project listed above.

(4) Descriptive literature, including Material Safety Data Sheet, for the proposed material.

2.12 POLYURETHANE COATING

A. **Material:** Polyurethane material shall be a 1 to 1 polyol resin to isocyanate resin 2-component mixture, of Type V according to ASTM D 16.

B. **Performance:** Coating and lining shall have the following properties:

1.	Impact Resistance	no less than 80 inch pounds when tested according to ASTM G14 for 40-mil thickness
2.	Adhesion	no less than 2,000 psi when tested according to ASTM D4541
3.	Hardness	65 (plus or minus 5), Shore D, at 70 degrees F, when tested according to ASTM D 2240.
4.	Abrasion Resistance	less than 100 mg weight loss per 1,000 revolutions of a CS-17 wheel when tested according to ASTM D 4060
5.	Chemical Resistance	less than 5 percent weight change after 90 days tested according to ASTM D 543 (1O% H_2SO_4, 10% HCL, 30%NaOH, H_2S, raw sewage)
6.	Permeability	less than 0.0005 perm inches when tested according to ASTM E 96
7.	Dielectric Strength	no less than 200 volts per mil of coating
8.	Coal Tar Content	zero percent
9.	Fillers	less than 30 percent

C. **Application Conditions**

1. Pipe surfaces shall be prepared by solvent washing (SSPC-SP1) followed by near white blast (SSPC-SP10) with an angular profile of at least 2.5 microns.

2. Pipe temperatures shall be at least 5 degrees F warmer than the dewpoint in the area of the application equipment. Pipe shall be warmed if necessary.

3. Material components shall be stored at temperatures warmer than 50 degrees F and shall not be stored longer than 6 months. Older components shall not be used.

D. **Thicknesses:** Material shall have the following minimum nominal thicknesses:

1.	Pipe Interior	(NOT USED)
2.	Pipe Exterior	25 mils
3.	Sealing Areas on Bells and Spigots	8 mils. Thicker material which does not compromise joint tightness may be accepted.

1. **Factory Testing:**

   a. The entire surface coated and lined with polyurethane shall be tested at 200 volts per mil for holidays after curing. Every holiday shall be repaired as indicated below.

   b. Entire pipe surface shall be inspected visually. Pipe with sharp protuberances or significant sags, dimples, or curtains will not be accepted.

   c. The CONSTRUCTION MANAGER will select one section of pipe from each lot of 20 sections for thickness testing by the CONTRACTOR. Tests shall be made by a Type 1 magnetic thickness gage. The CONSTRUCTION MANAGER will designate locations for spot measurements taken at the points of an equilateral triangle 3 inches on a side: the triangles shall be located at both ends, in the middle, and at the midpoints of each half of the pipe, plus 5 randomly-selected individual points.

      (1) No single spot measurement shall be less than 75 percent of the indicated minimum nominal thickness.

      (2) The average of three spot measurements from any triangle shall not be less than 80 percent of the indicated minimum nominal thickness.

      (3) The average of all spot measurements on a pipe shall not be less than the indicated minimum nominal thickness.

   d. Sections of pipe selected by the CONSTRUCTION MANAGER for thickness testing will also be tested by the CONSTRUCTION MANAGER for delamination by scoring and prying with a pocket knife.

   e. If the tested pipe complies with the thickness criteria above and shows no sign of delamination by knife test, all pipe in the lot of 20 will be considered as complying with requirements and the tested pipe may be repaired for installation. If the tested pipe fails either test, five additional sections from the same lot will be tested in similar fashion, and if all five pass all tests, then the lot, except for the pipe which failed, will be considered in compliance. If any of the additional sections fail, the entire lot will be considered non-compliant and shall not be used.

2. **Coating Repair of Holidays and Cut Ends:**

   a. Holidays and cut ends shall be repaired by solvent cleaning, roughening with coarse sand paper, and application of brushable 2-component material recommended by the manufacturer for such purposes. Overlap the acceptable coating and lining at least one inch in all directions. Mix repair material and apply in accordance with the manufacturer's recommendation.

E. **Polyurethane Manufacturers**

1. LifeLast DuraShield
2. or equal

F. **Qualifications, Approval, and Documentation of Polyurethane Manufacturers**

1. **Qualifications:** The polyurethane manufacturer shall have a record of at least one application of the proposed coating/lining material on a successfully performing steel pipe installation of comparable size and complexity constructed in the recent past.

2. **Approval:**

a. Bidders shall submit the name and documented qualifications of the manufacturer proposed for the polyurethane material. The OWNER will review and approve the proposed selection.

b. Documentation to be submitted CONTRACTOR

(1) Documentation of at least one steel pipe project constructed in the recent past and successfully performing under similar service conditions.

(2) The name, telephone number, and address of the owner and completion date and location for the project listed above.

(3) The name, telephone number, and address of the firm which applied the polyurethane in the project listed above.

(4) Descriptive literature, including Material Safety Data Sheet, for the proposed material.

PART 3 -- EXECUTION

3.1 INSTALLATION OF PIPE

A. When the pipe is being laid, it shall be turned and placed where possible, so that any slightly damaged portion will be on top. The damaged area shall be repaired for the protection of any exposed steel. All damaged areas shall be repaired using materials and methods acceptable to the CONSTRUCTION MANAGER.

B. Moderate deflections may be made by means of beveled joint rings, by pulling standard joints, by using short lengths of pipe, or a combination of these methods; provided that pulled joints shall not be used in combination with bevels. The maximum total allowable angle for beveled joints shall be 5 degrees per pipe joint. Bevels shall be provided on the bell ends. Mitering of the spigot ends will not be permitted. The maximum allowable angle for pulled joints shall be in accordance with the manufacturer's recommendations or the angle which results from a 3/4-inch pull out from normal joint closure, whichever is less. All horizontal deflections or fabricated angles shall fall on the alignment.

C. The openings of all pipe and specials that have been lined in the shop shall be protected with suitable bulkheads to maintain a moist atmosphere and to prevent unauthorized access by persons, animals, water, or any undesirable substance. The bulkheads shall be so designed to prevent drying out of the interior of the pipe. The CONTRACTOR shall introduce water into the pipe to keep the mortar lining moist where moisture has been lost due to damaged bulkheads.

3.2 FIELD TESTING

A. Field testing shall conform to the requirements of Section 02666.

B. All exterior surface coatings shall be inspected electrically immediately before the pipe is installed, following the same requirements for factory inspection procedure and voltage indicated above for the protective material. All holidays shall be repaired before the pipe is laid.

3.3 RUBBER GASKETED JOINTS

A. **Rubber Gasketed Joints:** Immediately before jointing pipe, the spigot end of the pipe shall be thoroughly cleaned, and a clean rubber gasket lubricated with an approved vegetable-based lubricant shall be placed in the spigot groove. The volume of the gasket shall be "equalized" by moving a metal rod between the gasket and the spigot ring around the full circumference of the spigot ring. The bell of the pipe already in place shall be carefully cleaned and lubricated with a vegetable-based lubricant. The spigot of the pipe section shall then be inserted into the bell of the previously laid pipe section and be telescoped into its proper position. Tilting of the pipe to insert the spigot into the bell will not be permitted. After the pipe units have been joined, a feeler gauge shall be inserted into the recess and moved around the periphery of the joint to detect any irregularity in the position of the rubber gasket. If the gasket cannot be "felt" all around, the joint shall be disassembled. If the gasket is undamaged, as determined by the CONSTRUCTION MANAGER, it may be reused, but only after the bell ring and gasket have been cleaned and relubricated.

3.4 WELDED JOINTS

A. **General:** Field welded joints shall be in accordance with ANSI/AWWA C206.

B. Where exterior welds are performed, adequate space shall be provided for welding and inspection of the joints.

C. During installation of welded steel pipe in either straight alignment or on curves, the pipe shall be laid so that the lap joint clearance, at any point around the circumference of the joint, shall comply with the requirements of AWWA C 206. Unless double fillet welds are indicated, field welded lap joints may, at the CONTRACTOR'S option, be made on either the inside or the outside of the pipe.

D. Butt straps, where used or required, shall be a minimum of 6 inches wide, the same thickness as the pipe wall and shall provide for a minimum of 3/4-inch lap at each pipe joint. The pipe ends shall be cut straight on joints where butt straps are used for realignment, adjustment, or deflection, and fillet welds shall be made as indicated.

E. To control temperature stresses, the joint areas of the pipe shall be shaded from the direct rays of the sun by the use of properly supported awnings, umbrellas, tarpaulins, or other suitable materials for a minimum period of 2 hours prior to the beginning of the welding operation and until the weld has been completed. Shading materials at the joint area shall not rest directly on the pipe but shall be supported to allow air circulation around the pipe. Shading of the pipe joints need not be performed when the ambient air temperature is below 45 degrees F.

F. Prior to the beginning of the welding procedure, any tack welds used to position the pipe during laying shall be removed. Any annular space between the facing surfaces of the bell and spigot shall be equally distributed around the circumference of the joint by shimming, jacking, or other suitable means. The weld shall then be made in accordance with ANSI/AWWA C206. Where more than one pass is required, each pass except the first and final one shall be peened to relieve shrinkage stresses; and all dirt, slag, and flux shall be removed before the succeeding bead is applied.

G. As soon as practicable after welding of each joint, all field-welded joints shall be tested by the liquid penetrant inspection procedure conforming to the requirements of ANSI/ASTM E 165 under Method "B" and "Leak Testing." All defects shall be chipped out, rewelded and retested. Upon retest, the repaired area shall show no leaks or other defects.

H. Following testing of the joint, the exterior joint spaces shall be coated in accordance with these specifications after which backfilling may be completed.

3.5 JOINT COATING AND LINING

A. **General:** The interior and exterior joint recesses shall be thoroughly wiped clean and all water, loose scale, dirt and other foreign material shall be removed from the inside surface of the pipe.

B. **Coating Repair:** Coating repair shall be made using tape and primer conforming to ANSI/AWWA C209. When visual inspection shows a portion of the tape-wrap system has sustained physical damage, the damaged area shall be subjected to an electrical holiday test of 6,000 to 7,000 volts.

C. Following repair of the damaged area if the holiday test indicates a holiday still exists, the inner wrap shall be exposed and the exposed area shall be wiped clean with xylol solvent, or equal, and the area coated with tape primer. A patch of 35-mil thick cold-applied tape of sufficient size to cover the damaged area, plus a minimum lap of 2 inches in all directions, shall then be applied. The patched area shall again be tested for holidays. If none are detected, a second layer of 35-mil thick tape shall then be applied over the first patch. The second layer of tape shall overlap the first layer a minimum of 2 inches in all directions.

D. When the area tests show no holiday, a notation shall be applied to the area indicating the test is satisfactory.

E. The lining machine shall be of a type that has been used successfully for a similar size of pipe. The CONTRACTOR shall perform all work in a thorough and workmanlike manner by trained personnel, under the supervision of personnel experienced in machine application of cement-mortar lining to pipelines of size comparable to this work.

F. Defective areas encompassing the full diameter of the pipe shall be replaced by machine wherever the length measured along the pipe centerline is greater than 5 feet; otherwise defective areas may be replaced by hand.

3.6 INSTALLATION OF PIPE APPURTENANCES

A. **Protection of Appurtenances**: Where the joining pipe is coal tar enamel-coated, buried appurtenances shall be coated with cold-applied tape in accordance with ANSI/AWWA C209, Type II.

B. **Installation of Valves:** All valves shall be handled in a manner to prevent any injury or damage to any part of the valve. All joints shall be thoroughly cleaned and prepared prior to installation. The CONTRACTOR shall adjust all stem packing and operate each valve prior to installation to insure proper operation.

C. All buried valves shall be coated and protected in accordance with Section 09800.

D. All valves shall be installed so that the valve stems are plumb and in the location shown.

E. **Installation of Flanged Joints:** Before the joint is assembled, the flange faces shall be thoroughly cleaned of all foreign material with a power wire brush. The gasket shall be centered and the connecting flanges drawn up watertight without unnecessarily stressing the flanges. All bolts shall be tightened in a progressive diametrically opposite sequence and torqued with a suitable, approved and calibrated torque wrench. All clamping torque shall be applied to the nuts only.

F. All buried flanges shall be coated and protected in accordance with Section 09800.

G. **Insulated Joints:** Insulated joints and appurtenant features shall be made by the CONTRACTOR as shown on the Drawings. The CONTRACTOR shall exercise special care when installing these joints to prevent electrical conductivity across the joint. After the insulated joint is completed, an electrical resistance test will be performed by the CONSTRUCTION MANAGER. Should the resistance test indicate a short circuit, the CONTRACTOR shall remove the insulating units to inspect for damage, replace all damaged portions, and reassemble the insulating joint. The insulated joint shall then be retested to assure proper insulation.

H. **Flexible Coupled Joints:** When installing flexible couplings, care shall be taken that the connecting pipe ends, couplings and gaskets are clean and free of all dirt and foreign matter with special attention being given to the contact surfaces of the pipe, gaskets and couplings. The couplings shall be assembled and installed in conformity with the recommendation and instruction of the coupling manufacturer.

I. Wrenches used in bolting couplings shall be of a type and size recommended by the coupling manufacturer. Coupling bolts shall be tightened so as to secure a uniform annular space between the follower rings and the body of the pipe with all bolts tightened approximately the same amount. Diametrically opposite bolts shall be tightened progressively and evenly. Final tightening shall be done with a suitable, approved and calibrated torque wrench set for the torque recommended by the coupling manufacturer. All clamping torque shall be applied to the nut only.

J. Upon completion of the coupled joint, the coupling and bare metal of the pipe shall be cleaned, primed, and protected in accordance with the requirements of Section 09800.

3.7 CORROSION CONTROL

A. **Joint Bonding/Test Stations:** Joints shall be bonded in accordance with the details indicated. The pipe shall be cleaned to bare bright metal at the point where the bond is installed. The pipe manufacturer shall be responsible for determining and implementing a suitable procedure and schedule for installation of bondingCfield versus factory versus combinationCin manner that the corrosion resistance of the lining and coating is not degraded by the bonding process. It may involve welding joint bonding pads, or welding the bonding wires in the factory before applying the lining and coating specified and/or may involve patching impaired areas in the factory or the field. In addition, test stations shall be installed where shown.

B. **Bonding and Electrical Continuity:** All unwelded pipe joints shall be bonded for electrical conductivity in accordance with the details indicated. The CONTRACTOR shall furnish all materials required for joint bonding and test station installations. 2 1/2"x 2"x 3/8" thick steel pads similar to the pipe material shall be welded on both ends of the pipe prior to lining and coating. Following welding of the bond wires to the pipe, the exterior coating shall be repaired per Section 15025.

E. **Cathodic Protection:** Cathodic protection shall be provided in accordance with Section 15025. Corrosion mitigation and testing materials, such as an impressed current cathodic protection system, magnesium anodes, reference electrodes, and test lead wires shall be provided as indicated.

** END OF SECTION **

SECTION 02715 - PVC LINER SPOT REPAIR

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing repairs to existing PVC liner in pumping stations at locations indicated on the Drawings. Repairs shall employ a mastic material and fully-adhered PVC sheet applied to prepared surfaces.

B. The WORK of this Section requires that materials and installation procedures be from Linabond, Inc. No substitutions will be considered.

1.2 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.3 REGULATORY REQUIREMENTS

A. The WORK of this Section shall comply with the current versions of the following:

1. Construction Safety Orders, Division of Industrial Safety, State of California.
2. California Department of Transportation Traffic Manual

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ASTM D 746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM C 805	Test Method for Rebound Number of Hardened Concrete
ASTM D 882	Standard Test Methods for Tensile Properties of Thin Plastic Sheeting
ASTM D 1004	Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 2240	Standard Test Method for Rubber Property - Durometer Hardness
ASTM D 4258	Practice for Surface Cleaning Concrete for Coating
ASTM D 4259	Practice for Abrading Concrete
ASTM D 4262	Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. In addition to the shop drawings required by SSPWC Subsection 500-1.1.2, the following shall be submitted.

a. A written verification at least 2 days before commencing patching that the pump station wet well is free of obstructions and debris and is in suitable condition for repairs.

b. Manufacturer's technical literature on the proposed repair system, including an affidavit attesting to the previous successful use of the material for lining sanitary and pumping stations.

2. Written certification from the manufacturer that the CONTRACTOR is licensed by Linabond, Inc. to install the indicated System.

3. Copy of Linabond, Inc. certification for each individual who will apply the System.

4. Manufacturer's application instructions, including details of seams and terminations, Material Safety Data Sheets, maximum storage life and storage condition requirements, mixing and proportioning requirements, environmental requirements for worker safety such as ventilation, humidity, and temperature, thickness of activator and mastic and seam material applied to the existing PVC liner and at joints, and curing time requirements.

1.6 INSTALLER QUALIFICATIONS

A. The CONTRACTOR or subcontractor performing the WORK of this section shall be licensed by the repair system manufacturer. Each individual installing the repair material shall be certified by the manufacturer.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Repair shall be made with a fully adhered mastic and polyvinyl chloride (PVC) sheet applied to prepared surfaces of existing concrete and PVC liner. Repairs shall be leakproof under a minimum external hydrostatic pressure equal to the lateral pressure of saturated soils outside the wall.

B. Applications of the repair material shall be performed under the supervision of a technical representative of the manufacturer who shall be present at the site during repair operations.

2.2 MATERIALS

A. **Primer:** Primer shall be a 2-component high solids material recommended by the repair system manufacturer for concrete surface preparation.

B. **Mastic:** Mastic shall be a two-component, polyurethane type, resistant to weathering, aging, 10 percent solutions of sulfuric acid, and intermittent wetting by raw sewage.

C. **PVC Sheet Liner:** Polyvinyl chloride lining material shall be a 30 mil thick homogenous thermoplastic sheet recommended by the repair system manufacturer. Liner shall conform to SSPWC Subsection 210-2 except that paragraphs 210-2.4.2 and 210-2.4.4 shall not apply.

1. Instead of the properties in Table 210-2.2(A), the PVC sheet shall have the following properties:

Property	Standard	Initial Requirement	After Exposure
Specific gravity	ASTM D 792	1.33	1.20
Hardness, Shore A	ASTM D 2240	84	--
Tensile Strength	ASTM D 882	2300 psi	2070 psi
Elongation	ASTM D 882	300 percent	270 percent
Brittle Point, ModE	ASTM D 746	-30 degrees C	--
Tear Strength	ASTM D 1004	250 ppi	225 ppi
Color		White	--

D. **Surface Activator:** Surface activator shall provide cross linking with the PVC sheet liner and the mastic and seam material. Surface activator shall be as required by the manufacturer.

E. **Seam Material:** Seam material shall retain chemical and adhesive properties while permitting relatively flat, smooth laps between adjacent PVC sheets. Seam material shall be as required by the manufacturer.

F. **Chemical Resistance:** The PVC sheet liner, sealant material, and surface activator shall act as a cured seam through molecular bonding and shall conform to the chemical resistance test requirements of SSPWC subsection 210-2.3.3 for chemical solutions at listed concentrations. SSPWC subsection 210-2.3.4 shall not apply: the criteria above shall apply.

G. **Hydraulic Plug:** Quick-setting material recommended by the manufacturer for sealing active leaks into sewers. Material shall be compatible with the mastic and the seam material.

PART 3 -- EXECUTION

3.1 PRODUCT, DELIVERY, STORAGE, AND HANDLING

A. Materials shall be shipped in original manufacturer's containers and such additional packaging as needed to protect the material from damage during transport. Containers shall be plainly labeled to show manufacturer's name, product name, batch number, date of manufacture, quantity of contents, and storage requirements.

B. Stored materials shall be protected from excessive heat, cold, and weathering. PVC sheeting pretreated with activator prior to delivery to the job site shall be protected from debris contamination and be maintained at 70 degrees F minimum.

3.2 WORKING CONDITIONS

A. The CONTRACTOR is hereby notified that the wet well is a permit required confined space.

B. Wastewater will continue to flow through the pumping station during wet well repair, and the CONTRACTOR shall be prepared to perform liner repair during prevailing flow conditions or to divert the sewage as indicated below. Liner repair operations shall not be performed if weather conditions are such that anticipated wastewater flows can exceed diversion pumping capacity or depths that prevent proper and safe work within the sewer. Liner repair operations shall be conducted only when the sewage level in the pumping station is at minimal depth.

C. The CONTRACTOR shall employ means and methods which prevent blockage and minimize surcharge of wastewater in upstream manholes and tributary pipelines.

3.3 DIVERSION PUMPING

A. Install and operate diversion pumping equipment to maintain sewage flow and to prevent backup or overflow upstream.

B. Design all piping, joints, and accessories to withstand twice the maximum system pressure or 50 psi, whichever is greater. A spare pump and piping shall be at the site, ready for use in case of a breakdown.

C. In the event of accidental spill or overflow, immediately stop the overflow and take action to clean up spillage and disinfect the spill area to the satisfaction of the CONSTRUCTION MANAGER.

3.4 CLEANING AND SURFACE PREPARATION

A. **Cleaning and Debris Removal:**

1. Prior to blasting the concrete surfaces and installing the new liner systems, the CONTRACTOR shall remove all accumulated debris and dispose of it in compliance with all Federal, State and local regulations. Debris includes sludge, dirt, sand, rocks, grease, roots, and other solid or semi solid materials.

2. Remove defective PVC liner from the entire damaged area plus 2 inches in all directions.

3. The CONTRACTOR shall employ suitable equipment to collect all debris dislodged during cleaning operations. At a minimum, debris shall be removed prior to the end of each day and shall be disposed of daily at an approved off-site location. Hauling containers shall be watertight.

4. Active leaks, if present, shall be sealed by application of hydraulic plug material.

B. **Surface Preparation:** The CONTRACTOR may choose any of the surface preparation methods below that will produce a clean, contamination-free, sound, roughened surface acceptable to the manufacturer's representative.

1. **Wet Abrasive Blast:** Water and blast material at 80 psi or greater at the nozzle. Abrasive shall be free of arsenic and free silica. Residue shall be removed by washing with water and brushing if necessary.

2. **Hydroblast:** Water pressurized to at least 6000 psi.

3. **Dry Sandblasting:** Air and blast material at 80 psi or greater at the nozzle. Abrasive shall be free of arsenic and free silica. Residue shall be removed by brushing, vacuuming, or oil-free compressed air.

3.5 SURFACE TESTING

A. The surface of the abraded concrete shall be tested for soundness by the use of an impact rebound testing device (Schmidt hammer) with a measurement accuracy of plus or minus 500 psi, in accordance with ASTM C 805. Testing shall be performed by the CONTRACTOR in the presence of the manufacturer's representative and the CONSTRUCTION MANAGER. Abraded concrete shall have a compressive strength of 3000 psi or further surface preparation shall be undertaken.

B. The pH of the abraded surface shall be tested according to ASTM D 4262. The acceptable pH range for the prepared surface shall be greater than 7 and less than 11 unless the manufacturer's representative accepts otherwise. Surfaces with pH less than 7.0 shall be reblasted and retested until the pH is in the acceptable range. All testing shall be performed by the CONTRACTOR in the presence of the manufacturer's representative and the CONSTRUCTION MANAGER.

C. The manufacturer's representative shall inspect the prepared surfaces and observe the surface testing above and approve surface conditions before repairs begin.

3.6 REPAIR

A. Repair and surface preparation operations shall be separated sufficiently that contamination with abrasive does not occur.

B. Prior to application of the primer, the abraded concrete shall contain no more than 30 percent moisture when tested by a Delmhorst Moisture Meter Model "DP". Surfaces contaminated by sewage or debris shall be cleaned and dried before application of the lining system. The CONTRACTOR shall be responsible for methods and equipment to achieve a dry condition. If compressed air equipment is utilized, it shall be equipped with an oil filter.

C. Existing PVC liner shall be solvent-cleaned to remove grease and oil for a minimum of 6 inches in all directions from an area which will be repaired.

D. Areas deteriorated to the degree that an uneven, unsightly lined surface will result shall be repaired with a polymer cement patching compound acceptable to the repair system manufacturer.

E. **Patch:**

1. **Proportioning and Mixing:** Materials shall be mixed and proportioned in accordance with the manufacturer's written instructions using the equipment recommended by the manufacturer.

2. **Primer:** Apply primer to clean, prepared and dry, sound concrete at the rate recommended by the manufacturer and allow to cure adequately.

3. **Mastic:**

   a. Mastic shall cover all exposed aggregate and surfaces of exposed reinforcing steel, providing a smooth surface for application of the PVC liner. Mastic shall provide a minimum 60 mils thick cover over the surface of the exposed concrete aggregate material prior to application of the PVC sheets.

   b. Application of PVC liner over mastic shall be in accordance with manufacturer's installation instructions. In no event shall the PVC liner be applied later than 45 minutes after application of the mastic or mastic shall be reapplied and allowed to tack again.

4. **Seam Material on Primer:** Apply seam material over primer to provide a smooth surface for application of liner. Thickness of seam material shall be as recommended by the system manufacturer.

5. **Activator:** The CONTRACTOR may use preactivated sheets or apply activator at the site. Apply activator to clean, dry PVC sheets in accordance with manufacturer's instructions. Allow to dry "tack-free" prior to applying sheet. Activator shall be applied to sheets in a warm (70 degree F minimum), protected environment. Protect prepared sheet from debris contamination. Do not exceed the manufacturer's recommended elapsed time between application of activator to sheet and application of sheet to mastic and seam material.

6. **Sheet Liner:**

   a. Seams between new sheets of liner shall overlap a minimum of 4 inches in the downstream direction of wastewater flow. Apply seam material as recommended by the manufacturer.

   b. The activator-prepared surface of the new PVC sheet shall be pressed onto the tacky mastic and seam material and be rolled carefully to remove trapped air.

7. **Sheet Liner Terminations:** Where the new lining meets the existing lining, the new liner shall overlap the existing liner by a minimum of four inches. Termination of new liner on concrete at upstream, downstream, top, and bottom edges shall be in accordance with the shop drawings and the manufacturer's recommendations.

3.7 FIELD TESTING

A. The liner will be inspected by the CONSTRUCTION MANAGER for proper adhesion, air pockets, edges or seam defects, rips, tears, and punctures. Defective repairs shall be removed, replaced, and retested.

B. The newly applied PVC liner shall be spark tested and any lining failing to meet the spark test shall be properly repaired and retested. The spark testing shall be done with a Tinker and Rasor Holiday Detector set at 20,000 volts.

C. Areas failing the spark test shall be repaired by trimming, application of new mastic or seam material, as determined by the manufacturer's representative, and activated PVC sheet, overlapping the acceptable repairs at least 4 inches all around.

** END OF SECTION **

SECTION 02999-TEMPORARY HANDLING OF SEWAGE FLOW

PART 1 -- GENERAL

1.1 WORK DESCRIPTION

The CONTRACTOR is responsible for the temporary handling of sewage throughout the construction of the Project. This includes the construction, modifications, and the relocations of CITY sewers and facilities.

The CONTRACTOR shall comply with the Regional Water Quality Control Board, Health Department, and CITY standards, Air Quality Management District permits, and regulations. The CONTRACTOR shall cooperate with CITY staff and other regulators and environmental agencies.

1.2 CONTRACTOR LIABILITY

The CONTRACTOR shall be responsible for continuity of sanitary sewer service during the execution of the Work to be performed under this Contract. In the event that sewage backup occurs and enters dwellings or other structures due to in any part to a failure of the bypass piping system or to non-compliance with the Contract Documents, the CONTRACTOR shall be responsible for cleanup, repair, property damage costs, fines imposed by jurisdictional authorities, and all claims arising there from. All spills shall be contained and returned to the sewer system.

In the event the Regional Water Quality Control Board levies a fine on CITY because of a sewage spill caused by the CONTRACTOR (directly or indirectly) due to its lack of attention to procedures or other negligence, the CONTRACTOR shall be held responsible and liable for reimbursing CITY for the entire amount of any fine imposed. CITY may access the amount of the fine against payments due the CONTRACTOR. The California Water Code gives the Regional Water Quality Control Board authority to fine up to $10 per gallon and $10,000 per day for an illicit discharge.

1.3 CONTRACTOR SUBMITTALS

Unless otherwise indicated, the following shall be submitted, for each bypass installation, to the ENGINEER 15 days after receiving the Notice to Proceed, in compliance with the General Requirements, and as specified herein.

A. Plans showing any proposed changes from the Contract Documents for the temporary handling of sewage flow, routing and protection of bypass lines, containment areas, equipment location, schematic of pump set-up and discharge, and proposed sequencing.

B. Shop drawings for the sewage bypass pipe material and fittings, pipe repair kits and procedures, spill recovery mats, and video camera.

C. Bypass pump characteristic curves, electrical, controls, and instrumentation.

D. Proposed alternatives to the spill prevention, control, and countermeasure plan as described in Part 3 of this specification.

E. Odor monitoring reports.

1.4 PAYMENT

Unless otherwise provided in these specifications, full compensation for temporary handling of sewage, implementation of the spill prevention, control and countermeasure plan, and the odor assessment and odor control plan shall be included in the contract unit price for which such work is appurtenant thereto, and no additional allowance shall be made therefor. Said various contract unit prices shall include all labor, materials, tools, and equipment necessary or incidental to the temporary sewer service operations.

The CONTRACTOR shall be reimbursed at a fixed rate for any bypass pumping of sewage flows that utilizes temporary pumps brought to the site required to meet the project demands. The CONTRACTOR shall only be reimbursed at a fixed rate of $50.00 per million gallons of sewage pump beyond the CONTRACTORS fixed bid price. Flow will be metered by the existing stations flow meter. The CONTRACTOR shall keep all bypass pumping to a minimum and shall not utilize bypass pumping unless absolutely necessary. A system will be set up by the CITY during construction to properly meter and document the amount of bypass pumping. The CONTRACTOR may at their option and expense utilize their own flow meter for metering, but must have the installation calibrated and approved by the CITY.

PART 2 -- PRODUCTS

2.1 PUMPING EQUIPMENT

Pumps shall be non-clog sewage pumps.

In the event the CONTRACTOR elects to use engines or Engine/Generators to drive pumps, these shall be muffled in such a manner that the maximum noise level will not exceed 80 dBA at a distance of five feet from the engine. Lower noise levels may be specified in the permit by governing agencies. Regardless of the noise level, soundproofing shields not less than eight feet high shall be provided around each engine by the CONTRACTOR to absorb noise.

Standby pumping equipment shall be at the site continuously during pumping to provide 100 percent standby pumping capacity. The CONTRACTOR shall provide manpower to continuously monitor the pumping equipment on a 24-hour basis while in operation and to activate standby equipment, if necessary.

2.2 TEMPORARY PLUGGING OF SEWER

Plugs shall be appropriate for the application. Unless otherwise indicated, plugs shall be a heavy-duty inflatable type with a steel rod through plug centerline, a retaining plate and an eye-lift on both ends. Plugs shall be new, made of natural rubber and shall show no cracks or signs of damage. The plugs shall have a flexible sealing design to compensate for any irregular interior surface of the pipe. The plug length shall be suitable for the specific application. Plugs shall be equipped with continuous pressure monitoring and an audible alarm when the pressure drops below the minimum pressure recommended by the

manufacturer. The installed pressure shall be as recommended by the manufacturer for the application. The eye-lifts shall be secured to a 5/8-inch diameter stainless steel pulling cable accessible for removal without entry. Inflatable plugs should be installed immediately upstream from the dry manhole to aid emergency removal of the plug. A double block and bleed may be required to protect workers per O.S.H.A.

2.3 STOP LOG SYSTEM

A. Embedded or bolt on channels, or any permanent structure required for the stop log system shall be made of 316 stainless steel or structural fiberglass. Stop logs or any removable structures shall be made of either 316 stainless steel, marine grade aluminum, or structural fiberglass. Channels supporting the stop logs shall not stick beyond the existing wet well lining by more than 3". The supporting channels must not compromise the watertightness of the existing lining. If a stop log system is utilized during construction for the wet well modifications, than after completion of the work, the stop log system shall become the property of the CITY for future use.

The design, implementation, and construction of the stop log system is the sole responsibility of the CONTRACTOR. The design must be stamped by a California Registered Professional Engineer. The CONTRACTOR shall provide submittals for approval per the General Requirements.

All stop logs and frames shall be designed to meet the design criteria of AWWA Standard C513, most current edition, defining head and loading calculations, structural strength, and deflection requirements. Structural components shall have a minimum design safety factor of 4 with regard to ultimate tensile strength, compression, and shear strength and a minimum safety of factor of 2 with regard to tensile, compressive, and shear yield strength.

All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 15 years experience designing and manufacturing stop logs. The manufacturer shall have manufactured stop logs for a minimum of 50 projects.

Stops logs must be installed to an elevation of -9.00 for a total height of 26.55 ft and withstand hydraulic pressures to the high water level of elevation -10.5.

2.4 LINE STOPS

A. Line stop system, including the tapping saddle shall be provided by a single vendor with a minimum of 10 years of experience and provide 5 similar projects for reference. All calculations for the system must be stamped by a licensed Engineer. CONTRACTOR shall maintain and monitor system while in use to prevent accidental sewage spill. Vendor shall be Team Industrial Services, Inc. or approved equal.

B. Stop/Plug

1. System shall be resilient pivot head design or inflatable bag type.

Inflatable Bag Type: Provide lead/standby compressors, control manifold with regulator, valves, hoses, and pressure gages for a complete and functional system.

C. Tapping Saddle

1. **General:** The tapping saddle shall be left in place once bypass operations are complete and shall include a completion plug seal and blind flange. System shall be rated for 175lbs of service pressure or greater. Shall be heavy duty split case type design.

2. **Body and Outlet Nozzle:** Carbon steel, A-36 or equal.

3. **Bolts and Nuts:** Trackhead bolts, heavy hex nuts, 3/4" UNC rolled thread, high strength stainless steel, type 304.

4. **Outlet Gaskets:** SBR per ASTM D 2000, compounded for water and sewer service use. For 3"-12" flanges, the gaskets shall be reinforced with a metal ring. Larger than 12" size-on-size sleeves use a square profile o-ring NBR per ASTM D2000 set in a full body thickness cavity.

5. **Test Plug:** 3/4" NPT type 304 stainless steel test plug.

6. **Flange Gaskets:** 3” - 12” full face gasket shall be made from Styrene Butadiene Rubber (SBR) compounded for water and sewer service in accordance with ASTM D2000.

7. **Coating:** Fusion epoxy 8-12 mil. lined and coated.

8. **Flange:** AWWA Class “D” plate flange, ANSI Class 150 drilling, proper recessing for tapping valves.

9. **Completion Plug/Flange:** Provide metal to metal seal with back-up o-ring and inject sealant into the secondary sealing area.

10. Meets requirements of MSS SP-124, and AWWA C223.

PART 3 -- EXECUTION

3.1 TEMPORARY HANDLING OF SEWAGE

The CONTRACTOR shall construct, operate, maintain, and remove, without damage to existing structures, all temporary sewage handling facilities. CITY forces will not assist the CONTRACTOR with flow handling during the Work. The CONTRACTOR shall submit details of proposed equipment for temporary handling of sewage flow as specified in Section 1.2. Requirements for operating the bypass system shall be as indicated herein and as shown on the Plans. The system shall operate as specified to insure that neither the upstream nor downstream systems are threatened with sewage overload or spill.

Under no circumstances shall sewage or solids be deposited onto the ground surface, streets, or into ditches, catch basins or storm drains or natural drainage ways. Sewage shall be handled in a manner so as not to create a public nuisance or health hazard.

As soon as the bypass system is proved to be operating as specified, the CONTRACTOR shall stop the pump(s) and install and operate all backup pumps to prove their capability and establish a switchover time.

3.2 SPILL PREVENTION, CONTROL AND COUNTERMEASURE PLAN

The CONTRACTOR shall implement the Spill Prevention, Control and Countermeasure Plan as specified in this section and shown on the Plans. The CONTRACTOR may submit equivalent materials and methods for consideration.

A The CONTRACTOR shall submit for approval, all duty and emergency equipment for bypassing flow, containment, cleanup, and repair of any damage. Specifics for each bypass installation shall include as applicable, but are not limited to:

1. Pipe repair kits
2. Sand bags
3. Rubber matting
4. Bypass pipes, spare pipe sections, pumps, and other relevant equipment
5. Standby pumps
6. Secondary containment in trench or other surrounding land relief

B. The CONTRACTOR shall maintain standby and emergency equipment on site.

C. The CONTRACTOR shall provide the names, phone numbers, and hourly working schedules of at least three (3) people who can be contacted 24 hours per day by phone and that may be brought on-site at any time to address on-site emergencies. The CONTRACTOR shall provide notification of any substitution in writing at least two days in advance. When bypassing flows, CONTRACTOR shall have at least two people on site 24 hours per day to monitor and maintain the bypass and implement the emergency procedures in case of an emergency.

D. The CONTRACTOR shall protect storm drains during construction as shown on the Plans. The Plans indicate where the storm drains are located with relief features that could assist in containing the spill. The plans indicate how storm drains will be blocked in the event of a spill: what material and how long will it take. The CONTRACTOR shall verify the time specified for each activity.

1. The CONTRACTOR shall identify those responsible for each activity, present a training plan for approval, and perform the approved training.

2. The CONTRACTOR shall coordinate the plan with the construction storm water management requirements (see Section 02270) to protect water quality and respond to spills of sewage, groundwater, or fuels, ensuring there are no conflicts with implementing each of the respective programs. The CONTRACTOR shall

implement all indicated spill prevention measures (e.g. monitoring of upstream manholes, monitoring in the trench).

E. The following spill procedures shall be followed by the CONTRACTOR.

1. If a spill is detected or a catastrophic pipe failure occurs, the immediate priority of the CONTRACTOR shall be to prevent any sewage from reaching storm drains and ultimately surface waters. A storm drain may be used for containment of a large spill if adequate preparations are made as indicated in the Plans. The CONTRACTOR shall protect vulnerable drains using rubber mats or sand bags continuously during bypass or immediately (have all materials at hand) upon spillage.

2. The CONTRACTOR shall anticipate the following bypass system failure modes in the plan and be prepared to act accordingly.

   a. If the bypass pump fails, begin using standby equipment as soon as possible.

   b. In the event the bypass pipe is ruptured in a traffic accident or otherwise, the CONTRACTOR shall immediately stop the bypass pump, install containment as indicated in the plan, and notify the Control Center. Inform the Control Center what emergency diversion, if any, is indicated in the plan. Make repairs to the bypass pipe and restart the system. Begin cleanup. Notify the Control Center when the system is back in service.

3. The CONTRACTOR shall anticipate the following in-trench failure mode in its plan and be prepared to act accordingly.

   a. As the CONTRACTOR is excavating for a new trench and comes across moderate leaks in the existing pipe, the CONTRACTOR shall make coupling/clamp repairs as soon as possible to minimize sewage flow into the trench.

   b. If the leak is too large to make fast coupling repair, the CONTRACTOR shall start bypassing (see bypassing sequence below), then make repair.

4. In case of catastrophic in-trench leak, the CONTRACTOR shall immediately start the bypassing sequence:

   a. Plug downstream side of the manhole upstream from the leak.

   b. Insert bypass pump. The pump shall be sized to handle peak flow of existing sewer. Full capacity standby pumps shall be available for immediate installation at all times a bypass system is operating.

   c. Connect hose or pipe from pump to discharge point. NOTE: Hose or pipe shall already be in place and connected to a downstream discharge point at all times when working near or with live sewers. Hose shall only be allowed for emergency bypass systems.

5. In event of any spill, the CONTRACTOR shall immediately and in parallel with above activities, notify CITY's Control Center and request CITY's collections

staff to be dispatched. The CONTRACTOR should attempt to give the best indication to the Control Center staff of the approximate size of the spill (<1,000 gallons is small; 1,000 gallons to 10,000 gallons is medium; and >10,000 gallons is large) along with the approximate amount, if any, of sewage discharged to a storm drain or channel so the appropriate response can be dispatched.

6. CITY staff will respond to monitor the CONTRACTOR's clean-up-related activities to ensure the spill is cleaned in accordance with this Plan. It is the CONTRACTOR's responsibility to provide the primary means for pipe repair and spill recovery and clean-up including mobilizing any necessary equipment to be onsite within an hour of a spill. Clean up may require a sweeper truck, Vactor truck, water truck, and/or other equipment. All CITY time and material and special equipment for spill cleaning will be deducted from the CONTRACTOR's progress payment

7. The CONTRACTOR shall attempt to pond the water in an area away from storm drains that can be easily and fully recovered for discharge to CITY's collection system. This ponding activity should not impact any environmentally sensitive areas.

8. The CONTRACTOR and ENGINEER with the assistance of CITY's collections staff shall coordinate the most efficient and appropriate response, repair, and cleanup of a spill as soon as possible. The CONTRACTOR will cooperate with CITY staff to the fullest extent possible in order to minimize the impacts and volume of the spill in the most efficient manner possible.

9. Disinfection of a spill is not allowed (especially if the water is reaching State waters). All wash water and sewage-contaminated wash water must be contained and recovered in the same manner as the sewage.

10. The CONTACTOR shall have cameras on hand and shall document the spill, its cause, and the response activities as these occur with a video camera and photographs. The CONTRACTOR is required to attend a debriefing at the jobsite immediately after the spill is contained and cleaned up.

3.3 ODOR MITIGATION

The CONTRACTOR shall comply with the Odor Monitoring requirements as specified below:

A. The CONTRACTOR shall prepare a listing of all potential construction activities that might produce odors. For each of these construction activities, the CONTRACTOR shall include the scheduled construction date(s), expected construction duration(s), a listing of the potential receptors, and the distance to these receptors. Potential nuisance odor areas shall include open manholes, and open sewers where sewage gases can be present or can be released. Potential nuisance odor areas do not include covered manholes that are sealed or plugged (closed) sewer pipes.

All potential construction activities that might produce odors shall be identified on the construction schedule as required in the General Requirements. If multiple construction activities of this type are required simultaneously due to schedule constraints, multiple sets of gas analyzers shall be obtained and provided for monitoring by the CONTRACTOR.

B. For each site where potential odors may be produced, the CONTRACTOR shall prepare a plan for monitoring with the use of four gas analyzers. The high range gas (0-200 ppmv) analyzers shall be located in the manhole and the three low range gas (0-2 ppmv) analyzers shall be located at the nearest receptors and at a height between 3 and 6 feet above the ground as approved by the ENGINEER. The CONTRACTOR shall utilize the Air Quality Monitoring Logistic Report form or approved similar form to report and document construction and monitoring activities. The CONTRACTOR shall submit each monitoring plan in the form of a Shop Drawing Submittal for review and acceptance prior to conducting monitoring.

C. The CONTRACTOR shall obtain fully functioning and calibrated hydrogen sulfide gas analyzers to measure hydrogen sulfide emission concentrations from potential odor areas during construction. The CONTRACTOR shall obtain three low range hydrogen sulfide gas analyzers, and one high range hydrogen sulfide gas analyzer. The hydrogen sulfide gas analyzers shall be Odalog as manufactured by App-Tek International Pty Ltd or approved equal. The low range hydrogen sulfide gas analyzers shall be capable of measuring and logging hydrogen sulfide gas concentrations between 0.01 and 2 ppmv. The high range hydrogen sulfide gas analyzer shall be capable of measuring and logging hydrogen sulfide gas concentrations between 0 to 200 ppmv. The CONTRACTOR shall also obtain one software kit for downloading data from the gas analyzer, and one calibration kit for calibrating the gas analyzer per the manufacturer requirements. All gas analyzers and accessories that are purchased by the CONTRACTOR shall become the property of CITY at the end of the Project. The analyzers shall be in good working order when turned over to CITY. The software and calibration kits shall also be provided at the same time.

   Prior to purchase, the CONTRACTOR shall submit a shop submittal for review and acceptance. The CONTRACTOR shall ensure that the gas analyzers are calibrated by the manufacturer.

D. After acceptance of the monitoring plan for the specific construction site where odors are anticipated, the CONTRACTOR shall notify the ENGINEER at least forty-eight (48) hours in advance of the proposed work.

E. The CONTRACTOR shall, prior to the commencement of any work, install all gas analyzers as described on the reviewed shop submittal.

F. The CONTRACTOR shall determine the means of achieving less than 10 ppbv at the receptors, as required in the General Requirements, prior to the commencement of all work. Where odor mitigation measures are planned, they shall be in place during the construction period.

G. The CONTRACTOR shall download and record the readings of the hydrogen sulfide gas concentrations daily and present these results in a tabular format to the ENGINEER. Readings shall be logged at an interval to be determined by the ENGINEER. Readings shall be organized in a way that specifies which gas analyzer was used and the location of the analyzer. The CONTRACTOR shall utilize the Air Quality Monitoring Logistic Report form or approved similar form to report and document construction and monitoring activities. The CONTRACTOR shall provide these organized readings to the Inspector at a frequency to be determined by the ENGINEER (which may be daily or less frequently).

H. CITY may choose to download the data directly from the hydrogen sulfide gas analyzers that the CONTRACTOR has set up on-site. CITY may also set up independent hydrogen sulfide gas analyzers at the construction site for additional monitoring. If the CONTRACTOR's hydrogen sulfide gas analyzer readings do not reasonably correlate with CITY's hydrogen sulfide gas analyzer readings, the ENGINEER may require calibration of all gas analyzers, and reevaluation of the monitoring set up.

I. The CONTRACTOR shall record the wind speed and prevailing wind direction where the high range gas monitor has been installed. Depending on wind speed and direction, the CONTRACTOR may be required by the ENGINEER during the course of construction to adjust the locations of the three low range gas analyzers so that at least one of the three low range gas analyzers remains directly downwind of the high range gas monitor and the remaining two monitors also relocated as appropriate.

J. If hydrogen sulfide concentrations exceed 10 ppbv at any of the low range gas monitors (CITY or CONTRACTOR) during the course of construction work activities, the CONTRACTOR shall invoke the Odor Assessment and Odor Control Plan (OAOCP) for mitigation, and notify the ENGINEER immediately. If the CONTRACTOR fails to mitigate ambient hydrogen sulfide concentrations below 10 ppbv at the receptors using OAOCP, the CONTRACTOR shall stop work immediately and coordinate with the ENGINEER on further odor mitigation and control prior to commencement of work at the site where odors are released.

K. The CONTRACTOR shall abide by the following Odor Assessment and Odor Control Plan (OAOCP), at a minimum, to prevent emissions of nuisance odors when hydrogen sulfide concentrations exceed 10 ppbv during the course of construction work:
   1. Cover manholes and openings where bypass pumps are used with plywood or other approved material, including sealing cracks and edges with sealing putty or caulking. Ensure that all covers are secure, safe from vandalism and safe from potential life and safety hazards (i.e. falling or tripping hazards).
   2. Seal open sewer pipes during tie-ins
   3. Keep the duration of open manholes to a minimum
   4. Plug sewers as necessary to reduce odor emissions
   5. Provide in-line bypasses in closed conduits when working in manholes
   6. Reasonably prevent sewer gases from escaping the construction work area

L. If CITY staff determines that odor control is required during construction, the CONTRACTOR shall coordinate with CITY staff for odor control and mitigation requirements. All chemical, liquid or vapor treatment measures will be provided by CITY. Other forms of treatment by the contractor will be considered on a case by case basis.

* * END OF SECTION * *

SECTION 03100 - CONCRETE FORMWORK

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing concrete formwork, bracing, shoring, and supports.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of the WORK.

1. Section 03200 Reinforcement Steel
2. Section 03290 Joints in Concrete Structures
3. Section 03300 Cast-in-Place Structural Concrete
4. Section 03315 Grout

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

PS 1	U.S. Product Standard for Concrete Forms, Class I.
ACI 117	Standard Tolerances for Concrete Construction and Materials
ACI 347	Recommended Practice for Concrete Formwork

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

B. **Falsework Calculations and Drawings:** The CONTRACTOR's attention is directed to the provisions of Section 1717 of the Division of Industrial Safety, Construction Safety Orders, as revised November 1973, which requires that all falsework or vertical shoring installations where the height of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure, exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or provision for vehicular or railroad traffic through falsework or vertical shoring is made, shall be approved and signed by a civil engineer, registered in the State of California; provided further, that a copy of the falsework plan or shoring layout shall be available on the job site at all times.

C. Detailed plans of the falsework proposed to be used. Such plans shall be in sufficient detail to indicate the general layout, sizes of members, anticipated stresses, grade of materials to be used in the falsework, means of protecting existing construction which supports falsework, and typical soil conditions.

D. **Catalog information on:**

1. Form ties and all related accessories, including taper tie plugs, if taper ties are used.
2. Form gaskets.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Materials for concrete forms and falsework shall conform to SSPWC Subsection 303-1.3 and the requirements herein.

B. Except as otherwise expressly accepted, all lumber brought on the job site for use as forms, shoring, or bracing shall be new material. All forms shall be smooth surface forms and shall be of the following materials:

Walls	-	Steel or plywood panel
Columns	-	Steel, plywood, or fiber glass
Roof and floor	-	Plywood
All other work	-	Steel panels, plywood or tongue and groove lumber

C. Form materials which may remain or leave residues on or in the concrete shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application or use.

2.2 FORM AND FALSEWORK MATERIALS

A. Materials for concrete forms, formwork, and falsework shall conform to the following requirements:

1. Lumber shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS20.

2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine plywood manufactured especially for concrete formwork and shall conform to the requirements of PS 1 for Concrete Forms, Class I, and shall be edge sealed.

3. Form materials shall be metal, wood, plywood, or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.

B. Unless otherwise indicated, exterior corners in concrete members shall be provided with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise indicated.

C. Forms and falsework to support the roof and floor slabs shall be designed for the total dead load, plus a live load of 30 psf (minimum).

2.3 FORM TIES

A. Form ties with integral waterstops shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming.

B. Form ties for water-retaining structures shall have integral waterstops. Removable taper ties may be used when approved. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

2.4 MANUFACTURERS

A. Products of the type indicated shall be manufactured by one of the following (or equal):

1. **Form Ties:**

Burke Penta - Tie System by the Burke Company
Richmond Snap Tys by the Richmond Screw Anchor Company

2. **Form ties with Integral Waterstops:**

Burke Taper - Tie System by the Burke Company
Taper Ty by the Richmond Screw Anchor Company

PART 3 -- EXECUTION

3.1 GENERAL

A. Forms and falsework shall be designed and constructed in accordance with ACI 347 and SSPWC Subsections 303-1.3, 303-1.6, and 303-5.2, and the requirements herein, except that the submittal of detailed falsework will not be required.

B. **Tolerances:** The variation from established grade or lines shall not exceed 1/4-inch in 10 feet and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the tolerances of ACI 117.

C. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The CONTRACTOR shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the WORK and replaced at the CONTRACTOR's expense. A sufficient number of forms of each kind shall

be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state and Federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by CONTRACTOR's personnel and by the ENGINEER and shall be in sufficient number and properly installed. During concrete placement, the CONTRACTOR shall continually monitor plumb and string line form positions and immediately correct deficiencies.

D. Concrete forms shall conform to the shape, lines, and dimensions of members as called for on the Drawings, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

3.2 FORM DESIGN

A. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The forms shall be tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1- to 1-1/2-inch diameter polyethylene rod held in position to the underside of the wall form. Adequate clean-out holes shall be provided at the bottom of each lift of forms. The size, number, and location of such clean-outs shall be as acceptable to the CONSTRUCTION MANAGER. Whenever concrete cannot be placed from the top of a wall form in a manner that meets the requirements of the Contract Documents, form windows shall be provided in the size and spacing needed to allow placement of concrete to the requirements of Section 03300. The size, number, and location of such form windows shall be acceptable to the CONSTRUCTION MANAGER.

3.3 CONSTRUCTION

A. **Vertical Surfaces:** All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is shown. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

B. **Construction Joints:** Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the CONSTRUCTION MANAGER. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to

prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.

C. **Form Ties:**

1. **Embedded Ties:** Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as indicated in Section 03300. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.

2. **Removable Ties:** Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls which are dry on both sides. Exposed faces of walls shall have the outer 2 inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

3.4 REUSE OF FORMS

A. Forms may be reused only if in good condition and only if acceptable to the CONSTRUCTION MANAGER. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the CONSTRUCTION MANAGER.

3.5 REMOVAL OF FORMS

A. Careful procedures for the removal of forms shall be strictly followed, and this work shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted. In the case of roof slabs and above-ground floor slabs, forms shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28-day strength specified in Section 03300; provided, that no forms shall be disturbed or removed under an individual panel or unit before the concrete in the adjacent panel or unit has attained 75 percent of the specified 28-day strength and has been in place for a minimum of 7 days. The time required to establish said strength shall be as determined by the CONSTRUCTION MANAGER who will make several test cylinders for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 7-day minimum, then that time shall be used as the minimum length of time. Forms for all vertical walls and columns shall remain in place at least 2 days after the concrete has been placed. Forms for all parts of the WORK not

specifically mentioned herein shall remain in place for periods of time as determined by the CONSTRUCTION MANAGER.

3.6 MAINTENANCE OF FORMS

A. Forms shall be cleaned, treated with a releasing agent, and maintained in accordance with SSPWC Subsection 303-1.3 and the following. The form surfaces shall be treated with a nonstaining mineral oil or other lubricant compatible with the waterproofing membrane material and acceptable to the CONSTRUCTION MANAGER. Any excess lubricant shall be satisfactorily removed before placing the concrete. Where field oiling of forms is required, the CONTRACTOR shall perform the oiling at least two weeks in advance of their use. Care shall be exercised to keep oil off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

3.7 FALSEWORK

A. Falsework, including staging, walkways, forms, ladders, and similar appurtenances, shall be designed, engineered, constructed, and maintained according to the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, and the requirements of the Construction Safety Orders of the California Division of Industrial Safety.

** END OF SECTION **

SECTION 03200 - REINFORCEMENT STEEL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing all concrete reinforcement steel, welded wire fabric, couplers, and concrete inserts for use in reinforced concrete and masonry construction, including all the wires, clips, supports, chairs, spacers, and other accessories.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03100 Concrete Formwork
2. Section 03300 Cast-in-Place Structural Concrete

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. California Building Code, the latest edition

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.

ACI 315	Details and Detailing of Concrete Reinforcement.
ACI 318	Building Code Requirements for Structural Concrete.
ACI 350	Code Requirements for Environmental Engineering Concrete Structures.
CRSI MSP-1	Concrete Reinforcing Steel Institute Manual of Standard Practice.
WRI	Manual of Standard Practice for Welded Wire Fabric.
AWS D1.4	Structural Welding Code - Reinforcing Steel.
ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement.
ASTM A 185	Specification for Welded Steel Wire Fabric For Concrete Reinforcement.
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
ASTM A 775	Specification for Epoxy-Coated Reinforcing Steel Bars.

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Shop bending diagrams, placing lists, and drawings of all reinforcement steel prior to fabrication.

B. Details of the concrete reinforcement steel and concrete inserts shall be submitted by the CONTRACTOR at the earliest possible date after receipt by the CONTRACTOR of the Notice to Proceed. Details of reinforcement steel for fabrication and erection shall conform to ACI 315 and the requirements indicated. The shop bending diagrams shall show the actual lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. The shop drawings shall include bar placement diagrams which clearly indicate the dimensions of each bar splice.

C. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, manufacturer's literature shall be submitted which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and shop drawings which show the location of each coupler with details of how they are to be installed in the formwork.

D. If reinforcement steel is spliced by welding at any location, the CONTRACTOR shall submit mill test reports which shall contain the information necessary for the determination of the carbon equivalent as specified in AWS D1.4. The CONTRACTOR shall submit a written welding procedure for each type of weld for each size of bar which is to be spliced by welding; merely a statement that AWS procedures will be followed is not acceptable.

E. Mill certificates shall be delivered with each shipment of reinforcing bars.

1.6 FACTORY TESTING

A. If requested by the CONSTRUCTION MANAGER, the CONTRACTOR shall provide samples from each heat of reinforcement steel delivered in a quantity adequate for testing. Costs of initial tests and sample materials will be paid by the OWNER. Costs of additional tests due to material failing initial tests shall be paid by the CONTRACTOR.

B. If reinforcement steel is spliced by welding at any location, the CONTRACTOR shall submit certifications of procedure qualifications for each welding procedure used and certification of welder qualifications, for each welding procedure, and for each welder performing the work. Such qualifications shall be as specified in AWS D1.4.

1.7 FIELD TESTING

A. Products shall be field tested for compliance with the indicated requirements. If requested by the CONSTRUCTION MANAGER, the CONTRACTOR shall provide samples of each type of welded splice used in the work in a quantity and of dimensions adequate for testing. At the discretion of the CONSTRUCTION MANAGER, radiographic testing of direct butt welded splices will be performed. The CONTRACTOR shall provide assistance necessary to facilitate testing. The CONTRACTOR shall repair any weld which fails to meet the requirements of AWS D1.4. The costs of testing will be paid by the OWNER; except, the costs of all tests which

fail to meet specified requirements shall be paid by the CONTRACTOR at no additional cost to the OWNER.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Materials specified in this Section which may remain or leave residues on or within the concrete shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application or use.

2.2 REINFORCEMENT STEEL

A. Reinforcement Steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel Reinforcement with supplementary requirement S-1, or as otherwise indicated.

2. Welded wire fabric reinforcement shall conform to the requirements of ASTM A 185 and as indicated; provided, that welded wire fabric with longitudinal wire of W4 size wire and smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches; and provided further, that welded wire fabric with longitudinal wires larger than W4 size shall be furnished in flat sheets only.

3. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A 82.

B. **Accessories:**

1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. All bar supports shall meet the requirements of the CRSI Manual of Standard Practice including special requirements for supporting epoxy coated reinforcing bars. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/8-inch minimum thickness of plastic coating which extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.

2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.

3. Tie wire shall be a minimum 14 gauge annealed steel wire.

C. Epoxy coating for reinforcing and accessories, where specified or shown, shall conform to ASTM A 775, but its usage shall be subject to City approval.

2.3 MECHANICAL COUPLERS

A. Mechanical couplers shall be provided where shown and where approved by the CONSTRUCTION MANAGER. The couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.

C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection. Straight threaded type couplers shall require the use of the next larger size reinforcing bar or shall be used with reinforcing bars with specially forged ends which provide upset threads which do not decrease the basic cross section of the bar.

2.4 WELDED SPLICES

A. Welded splices shall be provided where shown and where approved by the CONSTRUCTION MANAGER. All welded splices of reinforcement steel shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars which are connected.

B. All materials required to conform the welded splices to the requirements of AWS D1.4 shall be provided.

2.5 EPOXY GROUT

A. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet the requirements found in Section 03315.

2.6 MANUFACTURERS

A. Products of the type indicated, shall be manufactured by one of the following (or equal):

1. **Couplers:**

Lenton Form Saver by Erico Products
Dowel Bar Splicer System by Richmond Screw Anchor Company

PART 3 -- EXECUTION

3.1 GENERAL

A. All reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated, and placed in accordance with the requirements of the Building Code and the supplementary requirements specified herein.

3.2 FABRICATION

A. **General:**

1. Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as indicated. Stirrups and tie bars shall be bent around a pin having a diameter not less than 1-1/2-inch for No. 3 bars, 2-inch for No. 4 bars, and 2-1/2-inch for No. 5 bars. Bends for other bars shall be made around a pin having a diameter not less than 6 times the bar diameter, except for bars larger than 1 inch, in which case the bends shall be made around a pin of 8 bar diameters. Bars shall be bent cold.

2. The CONTRACTOR shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings.

B. **Fabricating Tolerances:** Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:

1. Sheared length: $\pm$ 1 inch
2. Depth of truss bars: + 0, - 1/2 inch
3. Stirrups, ties, and spirals: $\pm$ 1/2 inch
4. All other bends: $\pm$ 1 inch

3.3 PLACING

A. Reinforcement steel shall be accurately positioned and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks. For concrete over formwork, the CONTRACTOR shall furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.

B. Limitations on the use of bar support materials shall be as follows.

1. **Concrete Dobies:** Permitted at all locations except where architectural finish is required.

2. **Wire Bar Supports:** Permitted only at slabs over dry areas, interior dry wall surfaces, and exterior wall surfaces.

3. **Plastic Bar Supports:** Permitted at all locations except on grade.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Bars additional to those shown which may be found necessary or desirable by the CONTRACTOR for the purpose of securing reinforcement in position shall be provided by the CONTRACTOR at no additional cost to the OWNER.

E. Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the CBC.

F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to the approval of the CONSTRUCTION MANAGER.

G. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters. Slab bolsters shall be spaced not more than 30 inches on centers, shall extend continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane indicated.

H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3 feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.

I. Epoxy coated reinforcing bars shall be stored, transported, and placed in such a manner as to avoid chipping of the epoxy coating. Non-abrasive slings made of nylon and similar materials shall be used. Specially coated bar supports shall be used. All chips or cracks in the epoxy coating shall be repaired with a compatible epoxy repair material prior to placing concrete.

J. Accessories supporting reinforcing bars shall be spaced such that there is no deflection of the accessory from the weight of the supported bars. When used to space the reinforcing bars from wall forms, the forms and bars shall be located so that there is no deflection of the accessory when the forms are tightened into position.

3.4 SPACING OF BARS

A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than one inch.

B. Where reinforcement in beams or girders is placed in 2 or more layers, the clear distance between layers shall be not less than one inch.

C. In columns, the clear distance between longitudinal bars shall be not less than 1-1/2 times the bar diameter, nor less than 1-1/2 times the maximum size of the coarse aggregate, nor less than 1-1/2 inches.

D. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

3.5 SPLICING

A. **General:**

1. Reinforcement bar splices shall only be used at locations indicated. When it is necessary to splice reinforcement at points other than where shown, the character of the splice shall be as acceptable to the CONSTRUCTION MANAGER.

B. **Splices of Reinforcement:**

1. The length of lap for reinforcement bars, unless otherwise indicated, shall be in accordance with ACI 318.

2. Laps of welded wire fabric shall be in accordance with the ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

3. Splices in column spiral reinforcement, when necessary, shall be made by welding or by a lap of 1-1/2 turns.

C. **Bending or Straightening:** Reinforcement shall not be straightened or rebent in a manner which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the CONSTRUCTION MANAGER. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by the CONSTRUCTION MANAGER.

D. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. Couplers intended for future connections shall be recessed a minimum of 1/2 inch from the concrete surface. After the concrete is placed, the coupler shall be plugged with plastic plugs which have an O-ring seal and the recess filled with sealant to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged.

E. Unless indicated otherwise, mechanical coupler spacing and capacity shall match the spacing and capacity of the reinforcing shown for the adjacent section.

F. Tack welding of reinforcing bars is prohibited.

3.6 CLEANING AND PROTECTION

A. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be reinspected and, if necessary recleaned.

3.7 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS

A. **Hole Preparation:**

1. The hole diameter shall be as recommended by the epoxy manufacturer but shall be no larger than 0.25 inch greater than the diameter of the outer surface of the reinforcing bar deformations.

2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless noted otherwise.
3. The hole shall be drilled by methods which do not interfere with the proper bonding of epoxy.

4. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.

5. The hole shall be blown clean with clean, dry compressed air to remove all dust and loose particles.

6. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that insures that excess material will be expelled from the hole during dowel placement.

7. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with epoxy. The bar shall be inserted slowly enough to avoid developing air pockets.

** END OF SECTION **

SECTION 03290 - JOINTS IN CONCRETE STRUCTURES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing the construction joints, contraction joints, expansion joints, and control joints in structural concrete, including waterstops, joint fillers, and joint sealants.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03100 Concrete Formwork
2. Section 03200 Reinforcement Steel
3. Section 03300 Cast-in-Place Structural Concrete
4. Section 07920 Sealants and Caulking

1.3 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.

ASTM C 920	Specification for Elastomeric Joint Sealants.
ASTM D 412	Test Methods for Rubber Properties in Tension.
ASTM D 624	Test Method for Rubber Property -- Tear Resistance.
ASTM D 638	Test Method for Tensile Properties of Plastics.
ASTM D 746	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
ASTM D 747	Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
ASTM D 1056	Specification for Flexible Cellular Materials -- Sponge or Expanded Rubber.
ASTM D 1752	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
ASTM D 2240	Test Method for Rubber Property -- Durometer Hardness.
CRD-C572	PVC Waterstop.
TT-S-0227E(3)	Sealing Compound, elastomeric type, Multi-component for Caulking, Sealing, and Glazing Buildings and Other Structures).

1.4 TYPES OF JOINTS

A. **Construction Joints:** When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint. Unless otherwise specified, all joints in water bearing members shall be provided with a waterstop and/or sealant groove of the shape specified and shown. The surface of the first pour may also be required to receive a coating of bond breaker as shown.

B. **Contraction Joints:** Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the first pour, which shall be coated with a bond breaker. The slab reinforcement shall be stopped 4-1/2 inches from the joint; which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the second pour. Waterstop and/or sealant groove shall also be provided when specified or shown.

C. **Expansion Joints:** To allow the concrete to expand freely, a space is provided between the two pours, the joint shall be formed as shown. This space is obtained by placing a filler joint material against the first pour, which acts as a form for the second pour. Unless otherwise specified, all expansion joints in water bearing members shall be provided with a center-bulb type waterstop as shown.

D. Premolded expansion joint material shall be installed with the edge at the indicated distance below or back from finished concrete surface, and shall have a slightly tapered, dressed, and oiled wood strip secured to or placed at the edge thereof during concrete placement, which shall later be removed to form space for sealing material.

E. The space so formed shall be filled with a joint sealant material as indicated below. In order to keep the two walls or slab elements in line the joint shall also be provided with a sleeve-type dowel as shown.

F. **Control Joints:** The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions shown, is formed or saw-cut in the concrete. This groove is afterward filled with a joint sealant material.

1.5 SHOP DRAWINGS AND SAMPLES

The following shall be submitted:

A. **Waterstops:** Prior to production of the material required under this contract, qualification samples shall be submitted. Such samples shall consist of extruded or molded sections of each size or shape to be used, and shall be accomplished so that the material and workmanship represents in all respects the material to be furnished under this contract. The balance of the material to be used under this contract shall not be produced until after the CONSTRUCTION MANAGER has reviewed the qualification samples.

B. **Waterstop Samples:** Prior to use of the waterstop material in the field, a sample of a fabricated mitered cross and a tee constructed of each size or shape of material to be used shall be submitted. These samples shall be fabricated so that the material and workmanship represent in all respects the fittings to be furnished under this contract.

C. Field samples of fabricated fittings (crosses, tees, etc.) will be selected at random by the CONSTRUCTION MANAGER for testing by a laboratory at the OWNER's expense. When tested, they shall have a tensile strength across the joints equal to at least 600 psi.

D. **Joint Sealant:** Prior to ordering the sealant material, the CONTRACTOR shall submit sufficient data to show general compliance with the requirements of the Contract Documents.

E. **Joint Location:** The CONTRACTOR shall submit placement shop drawings showing the location and type of all joints for each structure.

F. Certified test reports from the sealant manufacturer on the actual batch of material being supplied indicating compliance with the above requirements shall be furnished before the sealant is used on the job.

1.6 OWNER'S MANUAL

A. **Shipping Certification:** The CONTRACTOR shall provide written certification from the manufacturer as an integral part of the shipping form, to show that all of the material shipped to this project meets or exceeds the physical property requirements of the Contract Documents. Supplier certificates are not acceptable.

1.7 SERVICES OF MANUFACTURER

A. Before work is commenced, the CONTRACTOR shall arrange for a representative of the sealant manufacturer to instruct the crew doing the WORK on the proper methods of mixing and applying the sealant.

B. When requested by the CONSTRUCTION MANAGER, the CONTRACTOR shall arrange for field technical assistance from the bentonite manufacturer.

1.8 INSPECTION AND TESTING

A. **Waterstop Inspection:** It is required that all waterstop field joints shall be subject to rigid inspection, and no such work shall be scheduled or started without having made prior arrangements with the CONSTRUCTION MANAGER to provide for the required inspections. Not less than 24 hours' notice shall be provided to the CONSTRUCTION MANAGER for scheduling such inspections.

B. All field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which shall pass said inspection, and all faulty material shall be removed from the site and disposed of by the CONTRACTOR at its own expense.

C. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:

1. Offsets at joints greater than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.

2. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.

3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16-inch or 15 percent of material thickness at any point, whichever is less.

4. Misalignment of joint which result in misalignment of the waterstop in excess of 1/2-inch in 10 feet.

5. Porosity in the welded joint as evidenced by visual inspection.

6. Bubbles or inadequate bonding which can be detected with a penknife test. (If, while prodding the entire joint with the point of a pen knife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.)

D. **Construction Joint Sealant:** The CONTRACTOR shall prepare adhesion and cohesion test specimens as specified herein, at intervals of 5 working days while sealants are being installed.

E. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:

1. Sealant specimen shall be prepared between 2 concrete blocks (1-inch by 2-inch by 3-inch). Spacing between the blocks shall be 1-inch. Coated spacers (2-inch by 1-1/2-inch by 1/2-inch) shall be used to insure sealant cross-sections of 1/2-inch by 2 inches with a width of 1-inch.

2. Sealant shall be cast and cured according to manufacturer's recommendations except that curing period shall not exceed 24 hours.

3. Following curing period, the gap between blocks shall be widened to 1-1/2-inch. Spacers shall be used to maintain this gap for 24 hours prior to inspection for failure.

1.9 GUARANTEE

A. The CONTRACTOR shall provide a 5-year written guarantee of the entire sealant installation against faulty and/or incompatible materials and workmanship, together with a statement that it agrees to repair or replace, to the satisfaction of the OWNER, at no additional cost to the OWNER, any such defective areas which become evident within said 5-year guarantee period.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All joint materials specified herein shall be classified as acceptable for potable water use, by the Environmental Protection Agency, within 30 days of application.

2.2 PVC WATERSTOPS

A. **General:** Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of these Specifications. No reclaimed or scrap material shall be used. The CONTRACTOR shall obtain from the waterstop manufacturer and shall furnish to the CONSTRUCTION MANAGER for review, current test reports and a written certification of the manufacturer that the material to be shipped to the job meets the physical requirements as outlined in the U.S. Army Corps of Engineers Specification CRD-C572 and those listed herein.

B. **Flatstrip and Center-Bulb Waterstops:** Flatstrip and center-bulb waterstops shall be as indicated; provided, that at no place shall the thickness of flat strip waterstops, including the center bulb type, be less than 3/8-inch.

C. **Multi-Rib Waterstops:** Multi-rib waterstops, where required, shall be as indicated. Prefabricated joint fittings shall be used at all intersections of the ribbed-type waterstops.

D. **Other Types of Waterstops:** When other types of waterstops, not listed above, are required, they shall be subjected to the same requirements as those listed herein.

E. **Waterstop Testing Requirements:** When tested in accordance with the specified test standards, the waterstop material shall meet or exceed the following requirements:

Physical Property, Sheet Material	Value	ASTM Std.
Tensile Strength-min (psi)	1750	D 638, Type IV
Ultimate Elongation-min (percent)	350	D 638, Type IV
Low Temp Brittleness-max (degrees F)	-35	D 746
Stiffness in Flexure-min (psi)	400	D 747
Accelerated Extraction (CRD-C572)		
Tensile Strength-min (psi)	1500	D 638, Type IV
Ultimate Elongation-min (percent)	300	D 638, Type IV
Effect of Alkalies (CRD-C572)		
Change in Weight (percent)	+0.25/-0.10	------
Change in Durometer, Shore A	+5	D 2240
Finish Waterstop		
Tensile Strength-min (psi)	1400	D 638, Type IV
Ultimate Elongation-min (percent)	280	D 638, Type IV

2.3 JOINT SEALANT

A. Joint sealant shall be polyurethane polymer designed for bonding to concrete which is continuously submerged in water. No material will be acceptable which has an unsatisfactory history as to bond or durability when used in the joints of water retaining structures.

B. Joint sealant material shall meet the following requirements (73 degrees F and 50 percent R.H.):

Work Life	45 - 180 minutes
Time to Reach 20 Shore "A" Hardness (at 77 degrees F, 200 gr quantity)	24 hours, maximum
Ultimate Hardness (ASTM D 2240)	20 - 45 Shore "A"
Tensile Strength (ASTM D 412)	200 psi, minimum
Ultimate Elongation (ASTM D 412)	400 percent, minimum
Tear Resistance (Die C ASTM D 624)	75 pounds per inch of thickness, minimum
Color	Light Gray

C. All polyurethane sealants for waterstop joints in concrete shall conform to the following requirements:

1. Sealant shall be 2-part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ANSI/ASTM C 920 Type M or Federal Specification TT-S-00227 E(3) for 2-part material, as applicable.

2. For vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used; all such compounds shall conform to the requirements of ANSI/ASTM C 920 Class 25, Grade NS, or Federal Specification TT-S-0027 E(3), Type II, Class A.

3. For plane horizontal joints, the self-leveling compounds which meet the requirements of ANSI/ASTM C 920 Class 25, Grade P, or Federal Specification TT-S-0027 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics, and having a Shore "A" hardness range of 35 to 45, shall be used.

4. Primer materials, if recommended by the sealant manufacturer, shall conform to the printed recommendations of the sealant manufacturer.

D. Sealants for non-waterstop joints in concrete shall conform to the requirements of Section 07920.

2.4 JOINT MATERIALS

A. **Bearing Pad:** Bearing pad to be neoprene conforming to ASTM D 1752 Type I, 40 durometer hardness unless otherwise noted.

B. **Neoprene Sponge:** Sponge to be neoprene, closed-cell, expanded, conforming to ASTM D 1056, type RE-45-E1, with a compression deflection, 25 percent deflection (limits), 119 to 168 kPa (17 to 24 psi) minimum.

C. **Preformed Joint Filler:** Preformed joint filler material for water retaining applications shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752 for Type I, except as otherwise specified herein.

2.5 BACKING ROD

A. Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8-inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint.

2.6 BOND BREAKER

A. Bond breaker shall contain a fugitive dye so that areas of application will be readily distinguishable.

2.7 BENTONITE WATERSTOP

A. Where called for, bentonite type waterstop, which shall expand in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast, shall be provided.

B. The bentonite waterstop shall be composed of 75 percent bentonite. The balance of the material shall be butyl rubber-hydrocarbon with less than 1.0 percent volatile matter. The waterstop shall contain no asbestos fibers or asphaltics.

C. The manufacturer's rated application temperature range shall be from 5 to 125 degrees F. The service temperature range shall be from -40 to 212 degrees F.

D. The cross sectional dimensions of the unexpanded waterstop shall be one inch by 3/4-inch.

E. The waterstop shall be provided with an adhesive backing which will provide excellent adhesion to concrete surfaces.

2.8 SLIP DOWELS

A. Slip dowels in joints shall be A36 smooth epoxy-coated bars, conforming to ASTM A 775.

2.9 PVC TUBING

A. PVC tubing in joints shall be Sch. SDR 13.5, conforming to ASTM D 2241.

2.10 MANUFACTURERS

A. Products shall be manufactured by one of the following (or equal):

1. **Flatstrip and Center-Bulb Waterstops:**

   Kirkhill Rubber Company
   Water Seals, Incorporated
   Progress Unlimited, Incorporated
   Greenstreak Plastic Products Company

2. **Multi-Rib Waterstops:**

   Water Seals, Incorporated
   Progress Unlimited, Incorporated
   Greenstreak Plastic Products Company

3. **Sealants:**

   Permapol RC-270 by Products Research
   Elastothane 227R by Pacific Polymers
   Sikaflex 2C by Sika Corporation

4. **Bond Breaker:**

   Super Bond Breaker by Burke Company
   Select Cure CRB by Select Products Company

PART 3 -- EXECUTION

3.1 WATERSTOPS - GENERAL

A. Waterstops of the type specified herein shall be embedded in the concrete across joints as shown. All waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed instructions of manufacturer of the waterstops. The CONTRACTOR shall take suitable precautions and means to support and protect the waterstops during the progress of the work and shall repair or replace at its own expense any waterstops damaged during the progress of the work. All waterstops shall be stored so as to permit free circulation of air around the waterstop material.

B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.2 SPLICES IN WATERSTOPS

A. Splices in waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is essential that:

   1. The material not be damaged by heat sealing.
   2. The splices have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.

3. The continuity of the waterstop ribs and of its tubular center axis be maintained.

B. Butt joints of the ends of 2 identical waterstop sections may be made while the material is in the forms.

C. All joints with waterstops involving more than 2 ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections shall be prefabricated by the CONTRACTOR prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.

D. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

3.3 JOINT CONSTRUCTION

A. **Setting Waterstops:** In order to eliminate faulty installation that may result in joint leakage, particular care shall be taken of the correct positioning of the waterstops during installation. Adequate provisions must be made to support and anchor the waterstops during the progress of the WORK and to insure the proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be insured by thoroughly working it in the vicinity of all joints.

B. In placing flat-strip waterstops in the forms, means shall be provided to prevent them from being folded over by the concrete as it is placed. Unless otherwise shown, all waterstops shall be held in place with light wire ties on 12-inch centers which shall be passed through the edge of the waterstop and tied to the curtain of reinforcing steel. Horizontal waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, concrete shall be worked under the waterstops by hand so as to avoid the formation of air and rock pockets.

C. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to for a future concrete placement.

D. **Joint Location:** Construction joints, and other types of joints, shall be provided where shown. When not shown, construction joints shall be provided at 25-foot maximum spacing for all concrete construction, unless noted otherwise. The location of all joints, of any type, shall be submitted to the CONSTRUCTION MANAGER for acceptance.

E. **Joint Preparation:** Special care shall be used in preparing concrete surfaces at joints where bonding between 2 sections of concrete is required. Unless otherwise shown, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with the requirements of Section 03300. Except on horizontal wall construction joints, wall to slab joints

or where otherwise shown or specified, at all joints where waterstops are required, the joint face of the first pour shall be coated with a bond breaker as specified herein.

F. **Construction Joint Sealant:** Construction joints in water-bearing floor slabs, and elsewhere as shown, shall be provided with tapered grooves which shall be filled with a construction joint sealant. The material used for forming the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sand-blasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, they shall be primed, bond breaker tape placed in the bottom of the groove, and filled with the construction joint sealant. The primer used shall be supplied by the same manufacturer supplying the sealant. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant fillet shall be thoroughly cleaned, as outlined for the tapered grooves, prior to application of the sealant.

G. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the manufacturer, taking special care to properly mix the sealant prior to application. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant. All sealant shall achieve final cure at least 7 days before the structure is filled with water.

H. All sealant shall be installed by a competent waterproofing specialty contractor who has a successful record of performance in similar installations.

I. Thorough, uniform mixing of 2-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application.

J. Any joint sealant which, after the manufacturer's recommended curing time for the job conditions of the WORK hereunder, fails to fully and properly cure shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be re-sealed with the specified joint sealant. All costs of such removal, joint treatment, re-sealing, and appurtenant work shall be at the expense of the CONTRACTOR.

K. **Bentonite Waterstop:**

1. Where a bentonite waterstop is called for, it shall be installed with the manufacturer's instructions and recommendations; except, as modified herein.

2. Bentonite waterstop shall only be used where complete confinement by concrete is provided. Bentonite waterstop shall not be used in expansion or contraction joints nor in the first 6 inches of any intersecting joint.

3. The bentonite waterstop shall be located as near as possible to the center of the joint and it shall be continuous around the entire joint. The minimum distance from the edge of the waterstop to the face of the member shall be 5 inches.

4. Where the thickness of the concrete member to be placed on the bentonite waterstop is less than 12 inches, the waterstop shall be placed in grooves formed or ground into the concrete. The groove shall be at least 3/4 inch deep and 1-1/4 inches wide. When placed in the groove, the minimum distance from the edge of the waterstop to the face of the member shall be 2.5 inches.

5. Where a bentonite waterstop is used in combination with PVC waterstop, the bentonite waterstop shall overlap the PVC waterstop for a minimum of 6 inches and shall be placed in contact with the PVC waterstop.

6. The bentonite waterstop shall not be placed when the temperature of the waterstop material is below 40 degrees F. The waterstop material may be warmed so that it shall remain above 40 degrees F during placement; however, means used to warm the material shall in no way harm the material or its properties. The waterstop shall not be installed where the air temperature falls outside the manufacturer's recommended range.

7. The concrete surface under the bentonite waterstop shall be smooth and uniform. The concrete shall be ground smooth if needed. Alternately, the bentonite waterstop shall be bonded to the surface using an epoxy grout which completely fills all voids and irregularities beneath the waterstop material. Prior to installation, the concrete surface shall be wire brushed to remove any laitance or other materials that may interfere with the bonding of epoxy.

8. The bentonite waterstop shall be secured in place with concrete nails and washers at 12-inch maximum spacing. This shall be in addition to the adhesive backing provided with the waterstop.

** END OF SECTION **

SECTION 03300 - CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing finished cast-in-place structural concrete including forming, mixing, placing, curing, repairing, and finishing.

B. The following types of concrete shall be covered in this Section:

1. **Structural Concrete:** Concrete to be used in all cases except where indicated otherwise.

2. **Lean Concrete:** Concrete to be used for thrust blocks, pipe trench cut-off blocks and cradles, where the preceding items are indicated as unreinforced. Lean concrete shall be used as protective cover for dowels intended for future connection.

C. The term "hydraulic structure" used in these specifications shall refer to environmental engineering concrete structures for the containment, treatment, or transmission of water, wastewater, or other fluids.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03100 Concrete Formwork
2. Section 03200 Reinforcement Steel
3. Section 03290 Joints in Concrete Structures
4. Section 03315 Grout
5. Section 07920 Sealants and Caulking

1.3 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.

B. **Federal Specifications:**

UU-B-790A (Int.Amd. 1)	Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant).

C. **Commercial Standards:**

ACI 117	Standard Tolerances for Concrete Construction and Materials
ACI 214	Recommended Practice for Evaluation of Strength Test Results of Concrete

ACI 301	Specifications for Structural Concrete for Buildings
ACI 309	Consolidation of Concrete
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ASTM C 31	Practices for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Specification for Concrete Aggregates
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C40	Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C 88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 94	Specification for Ready-Mixed Concrete
ASTM C 131	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 143	Test Method for Slump of Portland Cement Concrete
ASTM C 150	Specification for Portland Cement
ASTM C 157	Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
ASTM C 172	Standard Method of Sampling Freshly Mixed Concrete
ASTM C 192	Method of Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete
ASTM C 289	Test Method for Potential Reactivity of Aggregates (Chemical Method)
ASTM C 309	Specifications for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	Specification for Chemical Admixtures for Concrete
ASTM C 535	Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction & Criteria for Laboratory Evaluation
ASTM D 175	Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
ASTM D 2419	Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM E 119	Method for Fire Tests of Building Construction and Materials

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. **Mix Designs:** Prior to beginning the WORK and within 14 days of the notice to proceed, preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete. The mix designs shall be checked by an independent testing laboratory acceptable to the CONSTRUCTION MANAGER. All costs related to such checking shall be borne by the CONTRACTOR.

2. Provide the following submittals in accordance with ACI-301:

   a. Mill tests for cement.
   b. Admixture certification. Chloride ion content must be included.
   c. Aggregate gradation and certification.
   d. Materials and methods for curing.

3. **Certified Delivery Tickets:** Where ready-mix concrete is used, the CONTRACTOR shall provide certified weighmaster delivery tickets at the time of delivery of each load of concrete. CONTRACTOR'S certificate with each delivery ticket shall show the public weighmaster's signature, and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

1.5 CONCRETE CONFERENCE

A. A meeting to review the detailed requirements of the CONTRACTOR's proposed concrete design mixes and to determine the procedures for producing proper concrete construction shall be held no later than 14 days after the notice to proceed.

B. All parties involved in the concrete work shall attend the conference, including the following:

   CONTRACTOR's representative
   Testing laboratory representative
   Concrete subcontractor
   Reinforcing steel subcontractor and detailer
   Concrete supplier
   Admixture manufacturer's representative

C. The conference shall be held at a mutually agreed upon time and place. The CONSTRUCTION MANAGER shall be notified no less than 5 days prior to the date of the conference.

1.6 TESTING

A. **General**

1. Tests on component materials and for compressive strength and shrinkage of concrete will be performed as specified herein. Test for determining slump will be in accordance with the requirements of ASTM C 143.

2. The cost of all laboratory tests on cement, aggregates, and concrete, will be borne by the OWNER. However, the CONTRACTOR shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The laboratory must meet or exceed the requirements of ASTM C 1077.

3. Concrete for testing shall be supplied by the CONTRACTOR at no cost to the OWNER, and the CONTRACTOR shall provide assistance to the CONSTRUCTION MANAGER in obtaining samples, and disposal and cleanup of excess material.

B. **Field Compression Tests:**

1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the CONSTRUCTION MANAGER to insure continued compliance with these specifications. Each set of test specimens will be a minimum of 4 cylinders.

2. Compression test specimens for concrete will be made and cured in accordance with ASTM C 31. Specimens will be 6-inch diameter by 12-inch high cylinders.

3. Compression tests will be performed in accordance with ASTM C 39. One test cylinder will be tested at 7 days and 2 at 28 days. The remaining cylinder will be held to verify test results, if needed.

C. **Evaluation and Acceptance of Concrete:**

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, Chapter 5 "Concrete Quality," and as specified herein.

2. A statistical analysis of compression test results will be performed according to the requirements of ACI 214. The standard deviation of the test results shall not exceed 640 psi.

3. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.

4. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the statistical requirement that the probability of any test being more than 500 psi below or the average of any 3 consecutive tests being below the specified compressive strength is 1 in 100. The

required average strength shall be calculated by Criterion No. 3 of ACI 214 using the actual standard of deviation.

5. All concrete which fails to meet the ACI requirements and these specifications, is subject to removal and replacement at no additional cost to the OWNER.

D. **Shrinkage Tests:**

1. Drying shrinkage tests will be made for the trial batch indicated below, the first placement of each class of concrete, and during construction to insure continued compliance with these Specifications.

2. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gauge length of 10 inches, fabricated, cured, dried and measured in accordance with ASTM C 157 modified as follows: specimens shall be removed from molds at an age of 23 ±1 hours after trial batching, shall be placed immediately in water at 70 degrees F ±3 degrees F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F ±3 degrees F. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F ±3 degrees F and 50 percent ±4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

3. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project. Allowable shrinkage limitations shall be as indicated below.

E. **Construction Tolerances:** The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 117.

1. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation from the level or from the grades shown.	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation from the plumb	In 10 feet: 1/4-inch; In 20 feet or more: 1/2-inch
Variation in the thickness of slabs and walls.	Minus 1/4-inch; Plus 1/2-inch
Variation in the locations and sizes of slabs and wall openings	Plus or minus 1/4-inch

PART 2 -- PRODUCTS

2.1 CONCRETE MATERIALS

A. **General:**

1. All materials specified herein shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application.

2. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

B. All materials furnished for the work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.

C. Storage of materials shall conform to the requirements of Section 205 of ACI 301.

D. Materials for concrete shall conform to the following requirements:

1. Cement shall be standard brand Portland cement conforming to ASTM C 150 for Type II or Type V, including Table 1A optional requirements. A minimum of 85 percent of cement by weight shall pass a 325 screen. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the CONSTRUCTION MANAGER. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports, including fineness, for each shipment of cement to be used shall be submitted to the CONSTRUCTION MANAGER if requested regarding compliance with these Specifications.

2. Water for mixing and curing shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local

governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.

3. Aggregates shall be obtained from pits acceptable to the CONSTRUCTION MANAGER, shall be non-reactive, and shall conform to ASTM C 33. Maximum size of coarse aggregate shall be as specified herein. Lightweight sand for fine aggregate will not be permitted.

    a. Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock or a combination thereof. The coarse aggregates shall be prepared and handled in two or more size groups for combined aggregates with a maximum size greater than 3/4-inch. When the aggregates are proportioned for each batch of concrete the two size groups shall be combined. See the requirements below for the use of the size groups.

    b. Fine aggregates shall be natural sand or a combination of natural and manufactured sand that are hard and durable. When tested in accordance with ASTM D2419, the sand equivalency shall not be less than 75 percent for an average of three samples, nor less than 70 percent for an individual test. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.

    c. Combined aggregates shall be well graded from coarse to fine sizes, and shall be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.

    d. When tested in accordance with ASTM C 289, the ratio of silica released to reduction in alkalinity shall not exceed 1.0.

    e. When tested in accordance with ASTM C 40, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.

    f. When tested in accordance with ASTM C 131 or ASTM C 535, the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions, or 10.5 percent after 100 revolutions.

    g. When tested in accordance with ASTM C 88, the loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using sodium sulfate.

4. Ready-mix concrete shall conform to the requirements of ASTM C 94.

5. **Admixtures:** All admixtures shall be compatible and by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations. If the use of an admixture is producing an inferior end result, the CONTRACTOR shall discontinue use of the admixture. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion, and shall be non-toxic after 30 days.

a. Air-entraining agent meeting the requirements of ASTM C 260 shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 5 percent. The OWNER reserves the right, at any time, to sample and test the air-entraining agent received on the job by the CONTRACTOR. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. Air content shall be tested at the point of placement.

b. Set controlling and water reducing admixtures: Admixtures may be added at the CONTRACTOR's option to control the set, effect water reduction, and increase workability. The addition of an admixture shall be at the CONTRACTOR's expense. The use of an admixture shall be subject to acceptance by the CONSTRUCTION MANAGER. Concrete containing an admixture shall be first placed at a location determined by the CONSTRUCTION MANAGER. Admixtures specified herein shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.

(1) Concrete shall not contain more than one water reducing admixture. Concrete containing an admixture shall be first placed at a location determined by the CONSTRUCTION MANAGER.

(2) Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture shall be used.

(3) Normal range water reducer shall conform to ASTM C 494, Type A. The quantity of admixture used and the method of mixing shall be in accordance with the Manufacturer's instructions and recommendations.

(4) High range water reducer shall conform to ASTM C 494, Type F or G. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than 14 ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating water cement ratio.

(5) If the high range water reducer is added to the concrete at the job site, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of 3 inches ∀ 1/2-inch prior to adding the high range water reducing admixture at the job site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.

(6) Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.

(7) Flyash shall not be used.

2.2 CURING MATERIALS

A. Materials for curing concrete as specified herein shall conform to the following requirements and ASTM C 309:

1. All curing compounds shall be white pigmented, resin based; Sodium silicate compounds shall not be allowed. Only water based resin curing compounds shall be used.

2. Polyethylene sheet for use as concrete curing blanket shall be white, and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.

3. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (Int. Amd. 1). The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 gram per square centimeter of surface.

4. Polyethylene-coated burlap for use as concrete curing blanket shall be 4-mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.

5. Curing mats for use in Curing Method 6 as specified herein, shall be heavy shag rugs or carpets or cotton mats quilted at 4 inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

2.3 NON-WATERSTOP JOINT MATERIALS

A. Materials for non-waterstop joints in concrete shall conform to the following requirements:

1. Preformed joint filler for non-water retaining applications shall be a non-extruding, resilient, bituminous type conforming to the requirements of ASTM D 1751.

2. Elastomeric joint sealer shall conform to the requirements of Section 07920.

3. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants.

2.4 MISCELLANEOUS MATERIALS

A. Dampproofing agent shall be an asphalt emulsion.

B. Bonding agents shall be epoxy adhesives.

2.5 CONCRETE DESIGN REQUIREMENTS

A. **General:** Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the qualities specified. The exact proportions in which these materials are to be used for different parts of the work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. In mix designs, the percentage of sand of the total weight of fine and coarse aggregate shall not exceed 41 for hydraulic structures or 50 for all other structures, unless noted otherwise. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the OWNER. All changes shall be subject to review by the CONSTRUCTION MANAGER.

Water-Cement Ratio and Compressive Strength: The minimum compressive strength and cement content of concrete shall be not less than that specified in the following tabulation.

Type of Work	Min 28-Day Compr. Strength (psi)	Max Size Aggregate (in)	Minimum Cement per cu yd (lbs)	Max W/C Ratio (by weight)
Structural Concrete:				
Roof, floor slabs, columns, walls and all other concrete items not specified elsewhere	4,000	1	611	0.45
12" and thicker walls, slabs on grade and footings. (optional)	4,000	1-1/2	611	0.45
Pea Gravel Mix. Thin sections and areas with congested reinforcing, at the CONTRACTOR'S option and with the written approval of the CONSTRUCTION MANAGER for the specific location. Maximum fine aggregate 50% by weight of aggregate.	4,000	3/8	752	0.40
Lean concrete	2,000	1	376	0.60
Note: The CONTRACTOR is cautioned that the limiting parameters specified above are not				

Type of Work	Min 28-Day Compr. Strength (psi)	Max Size Aggregate (in)	Minimum Cement per cu yd (lbs)	Max W/C Ratio (by weight)
a mix design. Additional cement or water reducing agent may be required to achieve workability demanded by the CONTRACTOR'S construction methods and aggregates. The CONTRACTOR is responsible for any costs associated with furnishing concrete with the required workability.				

B. **Adjustments to Mix Design:** The mixes used shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish and the CONTRACTOR shall be entitled to no additional compensation because of such changes.

D. **Quick Set Concrete Mix:** Due to the limitation of pumping the ready mix concrete, quick set concrete mix package can be replaced with ready mix concrete. The products shall be the following, or approved equal: Quikrete 5000 Concrete Mix by Quikrete, Rapidset Concrete Mix by RapidSet. The mixing, curing, and finishing shall be in accordance with manufacturer's installation instructions.

2.6 CONSISTENCY

A. The quantity of water entering into a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation, and which can be compacted by the vibratory methods herein specified to give the desired density, impermeability and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

Part of Work	Slump (in)
All concrete, unless noted otherwise	3 inches +- 1 inch
With high range water reducer added	7 inches +- 2 inches
Pea gravel mix	7 inches +- 2 inches
Ductbanks	5 inches +- 1 inch

2.7 TRIAL BATCH AND LABORATORY TESTS

A. Before placing any concrete, a testing laboratory designated by the CONSTRUCTION MANAGER shall prepare a trial batch of each class of structural concrete, based on the preliminary concrete mixes submitted by the CONTRACTOR. During the trial batch the aggregate proportions may be adjusted by the testing laboratory using the two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments shall be considered refinements to the mix design and shall not be the basis for extra compensation to the CONTRACTOR. All concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the CONTRACTOR's preliminary mix design, or whether the proportions have been adjusted during the trial batch process. The trial batch shall be prepared using the aggregates, cement and admixture proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain 3 drying shrinkage, and 6 compression test specimens from each

batch. The cost of not more than 3 laboratory trial batch tests for each specified concrete strength will be borne by the OWNER but the CONTRACTOR shall furnish and deliver the materials in steel drums at no cost. Any additional trial batch testing required shall be performed at the expense of the CONTRACTOR at no increase in cost to the OWNER.

B. The determination of compressive strength will be made by testing 6-inch diameter by 12-inch high cylinders; made, cured and tested in accordance with ASTM C 192 and ASTM C 39. Three compression test cylinders will be tested at 7 days and 3 at 28 days. The average compressive strength for the 3 cylinders tested at 28 days for any given trial batch shall not be less than 125 percent of the specified compressive strength.

C. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C 136. Values shall be given for percent passing each sieve.

2.8 SHRINKAGE LIMITATION

A. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age shall be 0.036 percent or 0.042 percent, respectively. The CONTRACTOR shall only use a mix design for construction that has first met the trial batch shrinkage requirements. Shrinkage limitations apply only to structural concrete.

B. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent.

C. If the required shrinkage limitation is not met during construction, the CONTRACTOR shall take any or all of the following actions, at no additional cost to the OWNER, for securing the specified shrinkage requirements. These actions may include changing the source or aggregates, cement and/or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

2.9 MEASUREMENT OF CEMENT AND AGGREGATE

A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the CONTRACTOR and acceptable to the CONSTRUCTION MANAGER.

B. **Weighing tolerances:**

Material	Percent of Total Weight
Cement	1
Aggregates	3
Admixtures	3

2.10 MEASUREMENT OF WATER

A. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the CONSTRUCTION MANAGER and capable of measuring the water in variable amounts within a tolerance of one percent. The water feed control mechanism shall be capable of being locked in position so as to deliver constantly any specified amount of water to each batch of concrete. A positive quick-acting valve shall be used for a cut-off in the water line to the mixer. The operating mechanism must be such that leakage will not occur when the valves are closed.

2.11 READY-MIXED CONCRETE

A. At the CONTRACTOR'S option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94, including the following supplementary requirements.

B. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first.

C. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.

E. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

F. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a delivery ticket furnished to the CONSTRUCTION MANAGER.

G. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch

aggregates shall be subject to continuous inspection at the batching plant by the CONSTRUCTION MANAGER.

2.12 MANUFACTURERS

A. Products shall be manufactured by one of the following (or equal):

1. **Air Entraining Agent:**

Micro-Air by Master Builders
Daravair by W.R. Grace
Sika AEA-15 by Sika Corporation

2. **Set Retarding Admixture:**

Plastocrete by Sika Corporation
Pozzolith 300R by Master Builders
Daratard by W.R. Grace

3. **Set Accelerating Admixture:**

Plastocrete 161FL by Sika Corporation
Pozzutec 20 by Master Builders
Daraset by W.R. Grace

4. **Normal Range Water Reducer:**

WRDA 79 by W.R. Grace
Pozzolith 322-N by Master Builders
Plastocrete 161 by Sika Corporation

5. **High Range Water Reducer:**

Daracem 100 or WRDA 19 by W.R. Grace
Sikament FF or Sikament 86 by Sika Corporation
Rheobuild 1000 or Rheobuild 716 by Master Builders

6. **Curing Compound:**

Aqua Resincure by Burke
Aqua-cure by Euclid Chemical Company
Masterkure-W by Master Builders

7. **Evaporation Retardant:**

Confilm by Master Builders
Eucobar by Euclid Chemical Company

8. **Dampproofing Agent:**

Hydrocide 600 by Sonneform
Sealmastic by W.R. Meadows
Damp proofing Asphalt Coating by Euclid Chemical Company

9. **Agents for Bonding Freshly-Mixed Plastic Concrete to Hardened Concrete:**

Sikadur 32 Hi-Mod Epoxy Adhesive by Sika Corporation
Concresive liquid (LPL) by Master Builders
BurkEpoxy MV by Burke

10. **Agents for Bonding Hardened Concrete to Steel:**

Sikadur 31 Hi-Mod Gel by Sika Corporation
BurkEpoxy NS by Burke
Concresive Paste (LPL) by Master Builders

11. **White Portland Cement:**

Atlas White

PART 3 -- EXECUTION

3.1 PROPORTIONING AND MIXING

A. **Proportioning:** Proportioning of the concrete mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301.

B. **Mixing:** Mixing of concrete shall conform to the requirements of Chapter 7 of ACI 301.

C. **Slump:** Maximum slumps shall be as indicated.

D. **Retempering:** Retempering of concrete or mortar which has partially hardened shall not be permitted.

3.2 PREPARATION OF SURFACES FOR CONCRETING

A. **General:** Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

B. **Joints in Concrete up to 60 Days Old:** Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as determined by the CONSTRUCTION MANAGER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the

Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, foreign material, and roughened to a minimum 1/4-inch amplitude. Such cleaning and roughening shall be accomplished by hydroblasting or sandblasting (exposing aggregate) followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

C. After the surfaces have been prepared all approximately horizontal construction joints shall be covered with a 6-inch lift of the pea gravel mix indicated above. The mix shall be placed and spread uniformly. Wall concrete shall follow immediately and shall be placed upon the fresh pea gravel mix.

D. **Placing Interruptions:** When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent work; provided that construction joints shall be made only where acceptable to the CONSTRUCTION MANAGER.

E. **Embedded Items:** No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the CONSTRUCTION MANAGER at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.

F. All inserts or other embedded items shall conform to the requirements herein.

G. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the CONSTRUCTION MANAGER before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

H. **Casting New Concrete Against Concrete over 60 Days Old:** Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting or sandblasting (exposing aggregate). The joint surface shall be coated with an epoxy bonding agent unless indicated otherwise by the CONSTRUCTION MANAGER.

I. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the CONSTRUCTION MANAGER.

J. **Corrosion Protection:** Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2 inches clearance between said items and any part of the concrete

reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

K. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.

L. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

M. **Cleaning:** The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.3 HANDLING, TRANSPORTING, AND PLACING

A. **General:** Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.

B. **Non-Conforming Work or Materials:** Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by the CONTRACTOR at no additional cost to the OWNER.

C. **Unauthorized Placement:** No concrete shall be placed except in the presence of duly authorized representative of the CONSTRUCTION MANAGER. The CONTRACTOR shall notify the CONSTRUCTION MANAGER in writing at least 24 hours in advance of placement of any concrete.

D. **Placement in Wall Forms:** Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in forms shall not exceed 5 feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.

E. **Conveyor Belts and Chutes:** All ends of chutes, hopper gates, and all other points of concrete discharge throughout the CONTRACTOR'S conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of an acceptable type. Chutes

longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered.

F. **Placement in Slabs:** Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

G. **Temperature of Concrete:** The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick nor less than 50 degrees for all other sections. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. When the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall be entitled to no additional compensation on account of the foregoing requirements.

H. **Cold Weather Placement**: Remove all snow, ice and frost from the surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches. All reinforcement and embedded items shall be warmed to above 32 degrees F prior to concrete placement.

3.4 PUMPING OF CONCRETE

A. **General:** If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. **Pumping Equipment:** The pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the site during pumping.

C. The minimum diameter of the hose (conduits) shall be in accordance with ACI 304.2R.

D. Pumping equipment and hoses (conduits) that are not functioning properly, shall be replaced.

E. Aluminum conduits for conveying the concrete shall not be permitted.

F. **Field Control:** Concrete samples for slump, air content, and test cylinders will be taken at the placement (discharge) end of the line.

3.5 ORDER OF PLACING CONCRETE

A. The order of placing concrete in all parts of the work shall be acceptable to the CONSTRUCTION MANAGER. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 7 days for hydraulic structures and 3 days for all other structures before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the 2 adjacent wall panels have cured at least 14 days for hydraulic structures and 7 days for all other structures.

B. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and all laitance shall be removed.

3.6 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be Group 3 (per ACI 309) high speed power vibrators (8000 to 12,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required. Group 2 vibrators may be used only at specific locations when accepted by the CONSTRUCTION MANAGER.

B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.7 FINISHING CONCRETE SURFACES

A. **General:** Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and were indicated above. Tolerances are to be distinguished from irregularities in finish as described below. Aluminum finishing tools shall not be used.

B. **Formed Surfaces:** No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as indicated.

1. Surface holes larger than ½ inch in diameter or deeper than ¼ inch are defined as surface defects in basins and exposed walls.

C. **Unformed Surfaces**: After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation as necessary to prevent drying shrinkage cracks. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:

1. **Finish U1** - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.

2. **Finish U2** - After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where shown or as determined by the CONSTRUCTION MANAGER.

3. **Finish U3** - After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.

4. **Finish U4** - Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid finish.

D. **Unformed surfaces shall be finished according to the following schedule:**

UNFORMED SURFACE FINISH SCHEDULE

Area	Finish
Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with grouted tile or topping grout	U2
Slabs which are water bearing with slopes 10 percent and less	U3
Sloping slabs which are water bearing with slopes greater than percent	U4
Slabs not water bearing	U4
Slabs to be covered with built-up roofing	U2
Interior slabs and floors to receive architectural finish	U3
Top surface of walls	U3

E. **Floor Sealer/Hardener (Surface Applied): (Not Used)**

F. **Sandblasted Concrete Finish**

1. Sandblasting shall be done in a safe manner acceptable to local authorities and per OSHA requirements. The sandblasting shall be a light sandblast to remove laitance and to produce a uniform fine aggregate surface texture with approximately 1/32- to 1/16-inch of surface sandblasted off. Corners, patches, form panel joints, and soft spots shall be sandblasted with care.

2. Protection against sandblasting shall be provided on all surfaces and materials not requiring sandblasting but within or adjacent to areas being sandblasted. After sandblasting, the concrete surfaces shall be washed with clean water and excess sand removed

3.8 ARCHITECTURAL FINISH (Not Used)

3.9 CURING AND DAMPPROOFING

A. **General:** All concrete shall be cured for not less than 14 days after placing, in accordance with the methods specified herein for the different parts of the work, and described in detail in the following paragraphs:

Surface to be Cured or Dampproofed	Method
Unstripped forms	1
Wall sections with forms removed	4 or 6
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically provided for elsewhere in this Paragraph	4
Floor slabs on grade in hydraulic structures	5
Slabs not on grade	6

B. **Method 1:** Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removed. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 14 days of placing the concrete, curing shall be continued in accordance with Method 6, herein.

C. **Method 2:** The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.

D. **Method 3**: The surface shall be covered with moist earth not less than 4 hours, nor more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.

E. **Method 4:** The surface shall be sprayed with a liquid curing compound.

1. Curing compound shall not be used on concrete surfaces to be coated, waterproofed, moistureproofed, or where any coverings are to be bonded.

2. It shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film which will seal thoroughly.

3. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.

4. Wherever curing compound may have been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, said compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.

5. Where curing compound is specified, it shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after removal of forms from contact with formed surfaces. Repairs required to be made to formed surfaces shall be made within the said 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound, following which repairs shall be made as specified herein.

6. At all locations where concrete is placed adjacent to a panel which has been coated with curing compound, the previously coated panel shall have curing compound reapplied to an area within 6 feet of the joint and to any other location where the curing membrane has been disturbed.

7. Prior to final acceptance of the WORK, all visible traces of curing compound shall be removed from all surfaces in such a manner that does not damage surface finish.

F. **Method 5:**

1. Until the concrete surface is covered with curing compound, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed. The concrete shall be given a coat of curing compound in accordance with Method 4, herein. Not less than one hour nor more than 4 hours after the coat of curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting or polyethylene-coated burlap. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 3 inches and fastened together with a waterproof cement to form a continuous watertight joint.

2. The curing blankets shall be left in place during the 14-day curing period and shall not be removed until after concrete for adjacent work has been placed. Should the curing blankets become torn or otherwise ineffective, the CONTRACTOR shall replace damaged sections. During the first 3 days of the curing period, no traffic of any nature and no depositing, temporary or otherwise, of any materials shall be permitted on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8-inch minimum thickness, laid over the curing blanket. The CONTRACTOR shall add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.

G. **Method 6:**

1. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 14 consecutive days beginning immediately after the concrete has reached final set or forms have been removed.

2. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed.

3. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held in place to prevent being dislodged by wind or any other causes and to be substantially in contact with the concrete surface. All edges shall be continuously held in place.

4. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours.

5. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed, any dry spots shall be rewetted, and curing compound shall be immediately applied in accordance with Method 4, herein.

6. The CONTRACTOR shall dispose of excess water from the curing operation to avoid damage to the work.

H. **Dampproofing**

The exterior surface of all buried roof slabs shall be dampproofed as follows:

1. Immediately after completion of curing the surface shall be sprayed with a dampproofing agent consisting of an asphalt emulsion. Application shall be in 2 coats. The first coat shall be diluted to 1/2 strength by the addition of water and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon of dilute solution. The second coat shall consist of an application of the specified material, undiluted, and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon. Dampproofing material shall be as specified herein.

2. As soon as the asphalt emulsion, applied as specified herein, has taken an initial set, the entire area thus coated shall be coated with whitewash. Any formula for mixing the whitewash may be used which produces a uniformly coated white surface and which so remains until placing of the backfill. Should the whitewash fail to remain on the surface until the backfill is placed, the CONTRACTOR shall apply additional whitewash

3.9 PROTECTION

A. The CONTRACTOR shall protect all concrete against injury until final acceptance by the OWNER.

B. Fresh concrete shall be protected from damage due to rain. The CONTRACTOR shall provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring.

3.10 CURING AND THERMAL PROTECTION IN COLD WEATHER

A. The CONTRACTOR shall be prepared to protect all concrete against freezing. After the first frost or when the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the concrete shall be maintained at a temperature not lower than 50 degrees F for at least 72 hours after it is placed.

B. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the worksite is less than 40 degrees F. The concrete shall be maintained at not less than 50 degrees F for the entire curing period.

C. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than 3 successive days, the specified 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.

D. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these Specifications.

3.11 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the CONSTRUCTION MANAGER. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. All repairs and replacements herein specified shall be promptly executed by the CONTRACTOR at its own expense.

B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair proposed shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white Portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.

D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

E. Prior to filling any structure with water, all cracks that may have developed shall be "vee'd" as shown and filled with sealant conforming to the requirements of Section 03290. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane, shall also have cracks repaired.

3.12 PATCHING HOLES IN CONCRETE

A. **Patching Small Holes:**

1. Holes which are less than 12 inches in their least dimension and extend completely through concrete members, shall be filled as specified herein.

2. Small holes in members which are water-bearing or in contact with soil or other fill material, shall be filled with non-shrink grout. Where a face of the member is exposed to view, the non-shrink grout shall be held back 2 inches from the finished surface. The remaining 2 inches shall then be patched according to the Paragraph above.

3. Small holes through all other concrete members shall be filled with non-shrink grout, with exposed faces treated as above.

B. Patching Large Holes:

1. Holes which are larger than 12 inches in their least dimension, shall have a keyway chipped into the edge of the opening all around, unless a formed keyway exists. The holes shall then be filled with concrete as specified herein.

2. Holes which are larger than 24 inches in their least dimension and which do not have reinforcing steel extending from the existing concrete, shall have reinforcing steel set in grout in drilled holes. The reinforcing added shall match the reinforcing in the existing wall unless indicated otherwise.

3. Large holes in members which are water bearing or in contact with soil or other fill, shall have a bentonite type waterstop material placed around the perimeter of the hole as specified in the Section 03290 unless there is an existing waterstop in place.

3.13 CARE AND REPAIR OF CONCRETE

A. The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the OWNER. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR'S expense.

** END OF SECTION **

SECTION 03315 – GROUT

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing grout other than that required for masonry work, complete.

B. The following types of grout are included in the WORK of this Section:

1. Non-Shrink Grout: This type of grout shall be used wherever grout is required, unless another type is specifically indicated.
2. Cement Grout
3. Epoxy Grout
4. Topping Grout and Concrete Fill

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03300 Cast-in-Place Structural Concrete

1.3 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current versions of the following apply to the WORK of this Section:

CRD-C 621	Corps of Engineers Specification for Non-shrink Grout
ASTM C 109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)
ASTM C 531	Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical- Resistant Mortars, Grouts, and Monolithic Surfacings
ASTM C 579	Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings
ASTM C 827	Test Method for Early Volume Change of Cementitious Mixtures
ASTM D 696	Test Method for Coefficient of Linear Thermal Expansion of Plastics

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, and appropriate uses for each type of non-shrink and epoxy grouts proposed for use in the WORK.

2. Certified test results verifying the compressive strength, shrinkage, and expansion properties for proposed non-shrink and epoxy grouts.

1.5 TESTING DURING CONSTRUCTION

A. **Field Tests:**

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the CONSTRUCTION MANAGER to insure continued compliance with these specifications. The specimens will be made by the CONSTRUCTION MANAGER or its representative.

2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the CONSTRUCTION MANAGER. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.
3. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the CONSTRUCTION MANAGER. A set of three specimens will be made for testing at 7 days, and each earlier time period as appropriate.

4. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the CONTRACTOR.

5. The cost of all laboratory tests on grout will be borne by the OWNER, but the CONTRACTOR shall assist the CONSTRUCTION MANAGER in obtaining specimens for testing. However, the CONTRACTOR shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The CONTRACTOR shall supply all materials necessary for fabricating the test specimens.

PART 2 -- PRODUCTS

2.1 CEMENT GROUT

A. **Cement Grout:** Cement grout shall be composed of one part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4000 psi.

B. Cement grout materials shall be as indicated in Section 03300.

2.2 PREPACKAGED GROUTS

A. **Non-Shrink Grout:**

1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific

formulation for each class of non-shrink grout indicated herein shall be that recommended by the manufacturer for the particular application.

2. Class A non-shrink grouts shall have a minimum 28 day compressive strength of 5000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C 827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD C 621.

3. Class B non-shrink grouts shall have a minimum 28 day compressive strength of 5000 psi and shall meet the requirements of CRD C 621.

4. **Application:**

   a. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout and epoxy grout indicated herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

   b. Class B non-shrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

B. **Epoxy Grout:**

1. Epoxy grout shall be a pourable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.

2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.

3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 F.

4. The epoxy grout shall develop a compressive strength of 5000 psi in 24 hours and 10,000 psi in seven days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.

5. The epoxy grout shall exhibit a minimum effective bearing area of 95 percent. This shall be determined by a test consisting of filling a 2-inch diameter by 4-inch high metal cylinder mold covered with a glass plate coated with a release agent. A weight shall be placed on the glass plate. At 24 hours after casting, the weight and plate shall be removed and the area in

plan of all voids measured. The surface of the grout shall be probed with a sharp instrument to locate all voids.

6. The peak exotherm of a 2-inch diameter by 4-inch high cylinder shall not exceed 95 degrees F when tested with 75 degree F material at laboratory temperature. The epoxy grout shall exhibit a maximum thermal coefficient of 30 x 10^{-6} inches/inch/degree F when tested according to ASTM C 531 or ASTM D 696.

7. **Application:** Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other applications required in the Contract Documents.

2.3 TOPPING GROUT AND CONCRETE FILL

A. Grout for topping of slabs and concrete fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as indicated herein. All materials and procedures specified for concrete in Section 03300 shall apply except as indicated otherwise herein.

B. Topping grout and concrete fill shall contain a minimum of 611 pound of cement per cubic yard with a maximum water cement ratio of 0.45. Where concrete fill is thicker than 3 inches, structural concrete as indicated in Section 03300 may be used when accepted by the CONSTRUCTION MANAGER.

C. Coarse aggregate shall be graded as follows:

U.S. STANDARD SIEVE SIZE	PERCENT BY WEIGHT PASSING
1/2"	100
3/8"	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

D. Final mix design shall be as determined by trial mix design under supervision of the approved testing laboratory.

E. **Strength:** Minimum compressive strength of topping grout and concrete fill at the end of 28 days shall be 3000 psi.

2.4 CURING MATERIALS

A. Curing materials shall be as indicated in Section 03300 for cement grout and as recommended by the manufacturer of prepackaged grouts.

2.5 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as required for the particular application.

B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

2.6 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

2.7 MANUFACTURERS

A. Products shall be of the following manufacture (or equal):

1. **Epoxy Grout:** BurkEpoxy Anchoring Grout by the Burke Company

PART 3 -- EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified in Section 03300. The finish of the grout surface shall match that of the adjacent concrete.

B. The manufacturer of Class A non-shrink grout and epoxy grout shall provide on-site technical assistance upon request.

C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the CONSTRUCTION MANAGER.

3.2 GROUTING PROCEDURES

A. **Prepackage Grouts:** All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

B. **Base Plate Grouting:**

1. For base plates, the original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for an one-inch thickness of grout or a thickness as indicated.

2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a trowelable consistency and tamped or rodded solidly into the space between the plate and the base concrete. A backing board or stop shall be provided at the back side of the space to be filled with grout. Where this method of placement is not practical or where required by the CONSTRUCTION MANAGER, alternate grouting methods shall be submitted for acceptance.

C. **Topping Grout:**

1. All mechanical, electrical, and finish work shall be completed prior to placement of topping or concrete fill. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting exposing the aggregates to ensure bonding to the base slab.

2. The minimum thickness of grout topping and concrete fill shall be one inch. Where the finished surface of concrete fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2-inches wide by 1-1/2-inches deep.

3. The base slab shall be thoroughly cleaned and wetted prior to placing topping and fill. No topping concrete shall be placed until the slab is complete free from standing pools or ponds of water. A thin coat of neat Type II cement grout shall be broomed into the surface of the slab just before topping of fill placement. The topping and fill shall be compacted by rolling or tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade.

4 Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.

5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping and fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

3.3 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

** END OF SECTION **

SECTION 05120 - STRUCTURAL STEEL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing structural steel and related appurtenances.

1.2 RELATED SECTIONS

A. The WORK of the following Section applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 09800 Protective Coating

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. California Building Code

1.5 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the applicable sections of the current editions of the documents indicated apply to the WORK of this Section.

AISC M011	Manual of Steel Construction for Shop and Field Welding
AISC S326	Design, Fabrication and Erection of Structural Steel for Buildings
ASTM A36 / A992	Structural Steel for 36 KSI / Structural Steel for 50 KSI
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless, Grade B
ASTM A283	Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
ASTM A307	Carbon Steel Externally Threaded Standard Fasteners, Grade A
ASTM A320	Alloy-Steel Bolting Materials for Low Temperature Service, Type 304
ASTM A325	High-Strength Bolts for Structural Steel Joints
ASTM A490	Heat-Treated Structural Steel Bolts
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes, Grade B

ASTM A501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A666	Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar for Structural Applications, Grade A, Type 304
AWS-B3.0	Welding Procedures and Performance Qualifications
AWS-D1.1	Structural Welding Code—Steel
AWS-W1	Welding Metallurgy

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Shop drawings, including details, dimensions, details of match markings and all information necessary for fabrication.

2. Welding procedures and welder qualifications.

1.7 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. Certificates that steels comply with the indicated standards.

2. Certificates that welding operators and procedures comply with the indicated requirements.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Materials for structural steel members and connection, unless otherwise indicated, shall comply with the following:

1.	Standard rolled steel sections	ASTM A36, A992
2.	Pipe columns	ASTM A53, Grade B
3.	Structural steel tubing	ASTM A500, Grade B, or ASTM A501
4.	Structural bars, plates and similar items	ASTM A36 or A283
5.	Stainless steel	ASTM A666, Grade A, Type 316L
6.	Stainless steel bolts, nuts and washers	ASTM A320, Type 316
7.	High strength steel bolts	ASTM A325 or ASTM A490

2.2 FABRICATION

A. Fabrication shall be in accordance with AISC S326 and indicated requirements. All structural steel welding in off-site fabrication shops shall be continuously inspected by a City of San Diego Certified Special Inspector. The continuous inspection will be waived if the work is done in a shop certified by the International Code Council (ICC), or listed by the International Code Council Evaluation Services (ICC-ESR), Inc. This shall be at no extra cost to the OWNER.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. **General:**

1. Structural assemblies and shop and field welding shall meet the requirements of AISC M011 and AISC S326.

2. Measurements and dimensions shall be verified at the site.

3. Bolt holes shall be 1/16 inch larger than the nominal size of bolts. Where thick metals are indicated, holes shall be sub-punched and drilled or reamed.

4. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators.

5. Bolts shall not be permitted to drift and holes shall not be enlarged to correct misalignment. In the event of mismatching of holes, new materials shall be provided.

6. Structural steel completely encased in concrete shall not be galvanized or painted and shall have a clean surface for bonding to concrete.

7. Damaged structural steel shall be replaced. Use of salvaged, reprocessed, or scrap materials shall not be permitted.

B. **Welding:**

1. Welding shall be performed by operators who have been qualified by tests as prescribed by AWS-W1 Sect. 7, to perform the type of welding indicated. Welding shall comply with AWS Code for Arc Welding in Building Construction, Section 4, Workmanship. Electrodes shall be matching per AWS.

2. Continuous seal welds shall be applied on structural steel designed to be exposed to weather or submerged in water or wastewater. Continuous seal welds shall be applied on both sides of structural steel designed to be submerged in water or wastewater.

C. **Bolted Connections:**

1. Where bolted connections are indicated, they shall comply with AISC Specifications for Framed Beam Connections for bearing type connections. The threaded portion of bolts shall not occur at shear planes.

3.2 CORROSION PROTECTION

A. Unless otherwise indicated, all structural steel, including that used in the fabrication of process equipment, shall be surface prepared and coated in accordance with Section 09800 and shall include the following operations:

1. Exterior and interior edges of flame-cut pieces shall be ground smooth.

2. Sharp edges and punched holes shall be ground smooth.
3. Uneven or rough welds shall be ground smooth.

3.3 TOUCH-UP AND REPAIR

A. After installation, damaged surfaces of shop-primed structural steel shall be cleaned and touched-up with same material used for shop coat.

** END OF SECTION **

SECTION 05500 - MISCELLANEOUS METALWORK

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing miscellaneous metalwork and appurtenances including the following:

1. Anchor Bolts
2. Power Driven Pins
3. Bolts
4. Seat Angles, Supports and Brackets
5. Iron Castings
6. Gratings
7. Pipe Columns

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03300 Cast-in-Place Structural Concrete
2. Section 03315 Grout
3. Section 05120 Structural Steel
4. Section 09800 Protective Coating

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. California Building Code

1.4 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.5 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. **Federal Specifications:**

QQ-F-461 C (1)	Floor Plate, Steel, Rolled
MIL-6-18015	(Ships) Aluminum Planks, (6063-T6)

2. **Commercial Standards:**

AISC MO11	Manual of Steel Constructions
AASHTO HS-20	Truck Loading
ASTM A36 / A992	Specification for Structural Steel
ASTM A 48	Specification for Gray Iron Castings
ASTM A 53	Specification for Pipe, Steel, Black and Hot- Dipped, Zinc-Coated Welded and Seamless
ASTM A 123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 125	Specification for Steel Springs, Helical, Heat Treated
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A283	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
ASTM A320	Specification for Alloy-Steel Bolting Materials for Low-Temperature Service
ASTM A489	Carbon Steel Eyebolts
ASTM A 569	Specification for Steel, Carbon, (0.15 Maximum Percent) Hot Rolled, Sheet and Strip, Commercial Quality
ASTM A 575	Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM B 98	Specification for Copper-Silicon Alloy Rod, Bar, and Shapes
ASTM B 210	Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B 221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
ASTM B 438	Specification for Sintered Bronze Bearings (Oil-Impregnated)
ANSI/AWS D1.1	Structural Welding Code - Steel
NFPA 101	Life Safety Code
NAAMM	Metal Stairs Manual

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Shop drawings showing connection details and locations proposed for power driven pins.
2. Shop drawings of miscellaneous metalwork including seat angles, supports and guides.
3. Shop drawings showing proposed use of adhesive anchors.
4. Data indicating load capacities, chemical resistance and temperature limitations of power driven pins.
5. Manufacturer's catalog data for manhole frame, covers, and each type of anchor.
6. Welding procedures and welder qualifications.

1.7 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. Manufacturer's installation instructions.

PART 2 -- PRODUCTS

2.1 MISCELLANEOUS METALWORK

A. **Materials:** Except as otherwise indicated, products fabricated of structural steel shapes, plates and bars shall comply with the requirements of ASTM A 36 Grade 36 & A992 Grade 50.

B. **Corrosion Protection:** Miscellaneous metalwork of fabricated steel, which will be used in a corrosive environment or will be submerged shall be stainless steel. Other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication except as otherwise indicated.

C. **Stainless Steel:** Stainless steel metalwork shall be of Type 316 L stainless steel. Stainless steel shall not be torch heated for welding. The CONTRACTOR shall submit welding methods and procedures. All welded stainless steel shall be passivated after welding by immersing in a pickling solution of 6 percent nitric acid and 3 percent hydrofluoric acid. Temperature and detention time for passivation shall be sufficient for removal of oxidation and ferrous contamination without etching of surface. The passivated steel shall undergo a complete neutralization by immersion in a detergent rinse followed by clean water wash, or shall be buffed with Scotch Brite EXL (or equal) for removal of weld discoloration and heat tint.

D. **Welding:** Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" and supplemented by other standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards.

In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall comply with the AWS Code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. Sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

E. **Galvanizing:** Where galvanizing is indicated, structural steel plates shapes, bars and fabricated assemblies shall be thoroughly cleaned of rust and scale and shall be galvanized in accordance with the requirements of ASTM A 123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts (except ASTM A325), anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153.

2.2 ANCHOR BOLTS

A **General:** Anchor bolts shall comply with the following:

1. Anchor bolts shall be fabricated of materials complying with SSPWC Subsections 206-1.4.1 and 209-2.2 and as follows:

Steel bolts	ASTM A325
Fabricated steel bolts	ASTM A36
Stainless steel bolts, nuts, washers	ASTM A320, Type 316

2. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 25 percent, up to a maximum oversizing of 1/4 inch. Unless otherwise indicated, minimum anchor bolt diameter shall be 1/2 inch. Anchor bolts for equipment shall be 316 stainless steel and shall be provided with leveling nuts which shall be tightened against flat surfaces to not less than 10 percent of the bolt's safe tensile stress.

3. Tapered washers shall be provided where mating surface is not square with the nut.

4. Expansion, wedge, or adhesive anchors set in holes drilled in the concrete after the concrete is placed is not permitted as substitution for anchor bolts except where otherwise indicated. Upset threads shall not be acceptable.

5. ASTM A307 anchor bolts are prohibited.

B. **Adhesive Anchors:** Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors. Substitutions will not be considered unless accompanied with ICC report verifying strength and material equivalency. Except as otherwise indicated, adhesive anchors shall comply with the following:

1. Epoxy adhesive anchors may be provided for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails and reinforcing bars. Threaded rod shall be stainless steel Type 316.

2. Glass capsule, polyester resin adhesive anchors may be permitted in other locations.

C. **Expanding-Type Anchors:** Expanding-type anchors, where indicated, shall be Type 316 stainless steel. Size shall be as shown. Expanding-type anchors are prohibited from use in corrosive areas and in deteriorating concrete

2.3 POWER DRIVEN PINS

A. **Materials:** Power-driven pins for installation in concrete or steel in interior locations of nonprocess areas shall be heat-treated steel alloy complying with AISI 1062 or 4063 and shall be zinc-plated. Pins shall have capped or threaded heads capable of transmitting the shank loads. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank.

2.4 BOLTS

A. **Bolt Requirements:** Bolts shall comply with the following:

1. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. Bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

2. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2-inch beyond the nut.

B. **Standard Service Bolts (Not Buried or Inside Tanks or Channels)**: Except where otherwise indicated, bolts and nuts shall be steel and shall be galvanized after fabrication. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated herein, steel for bolts, anchor bolts and cap screws shall be in accordance with the requirements of ASTM A 325, or threaded parts of ASTM A 36. ASTM A 325 bolts and nuts shall not be galvanized.

C. **Bolts Buried or Inside Tanks or Channels:** Unless otherwise indicated, bolts, anchor bolts, nuts and washers which are buried, submerged, or below the top of the wall inside any hydraulic structure shall be of Type 316 stainless steel.

D. Unless otherwise indicated, eyebolts shall conform to ASTM A 489.

2.5 SEAT ANGLES, SUPPORTS AND BRACKETS

A. Seat angles over slide gate guides shall be welded to the guides. Seat angles for supports for floor plates, clips for precast panels and brackets for piping shall be steel, hot-dip galvanized after fabrication unless otherwise indicated. Over tanks and channels seat angles and brackets shall be Type 316 L stainless steel.

B. Seat angles for grating shall be aluminum or steel as indicated, except that Type 316 L stainless steel shall be used over tanks and channels. Guides for slide gates shall be Type 316 L stainless steel.

2.6 IRON CASTINGS

A. Castings shall conform to the requirements of ASTM A 48 unless otherwise indicated. Castings weighing less than 100 pounds shall be hot-dip galvanized after machining. Castings weighing greater than 100 pounds shall be galvanized where indicated.

2.7 GRATINGS

A. **General:** Both bearing bars and cross bars shall be continuous. Openings shall be banded with bars having the same dimensions as the bearing bars. Perimeter edges shall be banded with bars flush at the top surface of the grating and 1/4 inch clear of the bottom surface. Bars terminating against edge bars shall be welded to the edge bars when welded construction is used. When crimped or swaged construction is used, bars at edges shall protrude a maximum of 1/16 inch and

shall be peened or ground to a smooth surface. No single piece of grating shall weigh more than 80 pounds unless otherwise indicated.

Rough weld beads and sharp metal edges on gratings and plates shall be ground smooth. Welds exposed to view shall be uniform and neat. Welds to be galvanized shall be sandblasted prior to galvanizing.

Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise indicated. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or shall be drilled. Cutting, drilling, punching, threading and tapping shall be performed prior to hot-dip galvanizing.

1. **Aluminum:** Aluminum grating bearing bars and aluminum floor plates and cover plates shall be of alloy 6061-T6 conforming to ASTM B221. Aluminum grating cross bars shall be of an alloy conforming to either ASTM B221 (extrusions) or B210 (drawn). Unless otherwise indicated, grating shall be fabricated of aluminum. Bearing bars shall be punched to receive the cross bars. After insertion in the bearing bars, cross bars shall be deformed by a hydraulic press or similar means to permanently lock the bars into the bearing bar openings. Fabrication methods employing bending or notching of bearing or cross bars will not be permitted.

2. **Steel:** Steel grating bearing bars and cross bars shall be of welding quality mild carbon steel conforming to ASTM A569. Steel floor plates and cover plates shall be of structural quality steel conforming to ASTM A36. Steel grating shall be used only where indicated. Steel grating shall be hot-dip galvanized. Notching, slotting, or cutting the top or bottom edges of bearing bars to receive cross bars will not be permitted unless each intersection of bars is fully welded to restore each bearing bar to its full cross-sectional strength.

2.8 FLOOR AND COVER PLATES:

A. Plates shall be set flush with surrounding floor. No single piece of floor and cover plate shall weigh more than 80 pounds unless specifically detailed otherwise. Floor and cover plates over tanks and channels shall be Type 316 stainless steel.

2.9 STAIRS (NOT USED)

2.10 SAFETY STAIR TREADS (NOT USED)

2.11 FLOOR HATCHES (NOT USED)

2.12 PIPE COLUMNS

A. Pipe column steel shall conform to the requirements of ASTM A 53, Grade B.

2.13 FALL PREVENTION SYSTEM (NOT USED)

2.14 MANHOLE FRAMES AND COVERS (NOT USED)

2.15 MANUFACTURERS

A. Products of the type or model (if any) indicated shall be manufactured by one of the following (or equal):

1. **Epoxy Adhesive Anchors:**

Hilti RE-500 Epoxy Anchor System
Red Head Epcon G5 Epoxy Adhesive

2. **Glass Capsule Polyester Resin Adhesive Anchors:**

Hilti HY-150 Injection Adhesive
Red Head Epcon A7 Acrylic Adhesive

3. **Expanding-Type Anchors:**

Red Head Trubolt
Hilti Kwik-Bolt 3

4. **Steel Gratings:**

Grating Pacific Type 19-4
McNichols Type GW

5. **Floor and Cover Plates:**

Alcoa C-102 Aluminum Tread Plate
Reynolds Diamond Tread Plate

6. **Field Repairs to Galvanizing:**

"Galvinox"
"Galvo-Weld"

7. **Aluminum Grating:**

Grating Pacifice
Seidelhuber

PART 3 -- EXECUTION

3.1 GENERAL

A. **Fabrication and Erection:** Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."

B. **General:** Fieldwork, including cutting and threading, shall not be permitted on galvanized items. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators. Grouting of anchor bolts with nonshrink or epoxy grouts, where indicated, shall be in accordance with Section 03315.

1. Drilling of bolts or enlargement of holes to correct misalignment will not be allowed.

2. Metalwork to be embedded in concrete shall be placed accurately and held in correct position while the concrete is placed or, if indicated, recesses or blockouts shall be formed in the concrete. The surfaces of metalwork in contact with or embedded in concrete shall be thoroughly cleaned. Recesses may be neatly cored in the concrete after it has attained its design strength and the metalwork grouted in place. Embedments shall comply with Section 03300.

3. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise indicated. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or shall be drilled.

4. Fabrication including cutting, drilling, punching, threading and tapping required for miscellaneous metal or adjacent work shall be performed prior to hot-dip galvanizing.

3.2 INSTALLATION OF ANCHOR BOLTS

A. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.

B. Installation of adhesive, capsule and expansion anchors shall comply with the following:

1. All installation recommendations by the anchor system manufacturer shall be followed carefully, including maximum hole diameter.

2. Use shall be limited to applications where exposure to fire or exposure to concrete or rod temperature above 120 degrees F is not indicated. Overhead applications (such as pipe supports) shall not be allowed.

3. Use shall be limited to locations where exposure to acid concentrations higher than 10 percent, to chlorine gas, or to machine or diesel oils, is not indicated.

4. Concrete temperature (not air temperature) shall be compatible with curing requirements recommended by adhesive manufacturer. Anchors shall not be placed in concrete below 25 degrees F.

5. Anchor diameter and grade of steel shall comply with equipment supplier specifications. Anchor shall be threaded or deformed full length of embedment and shall be free of rust, scale, grease, and oils.

6. Adhesive capsules of different diameters may be used to obtain proper volume for the embedment, but no more than two capsules per anchor may be used. When installing different diameter capsules in the same hole, the larger diameter capsule shall be installed first. Any extension or protrusion of the capsule from the hole is prohibited.

7. Holes shall have rough surfaces, such as can be achieved using a rotary percussion drill.

8. Holes shall be blown clean with compressed air and be free of dust or standing water prior to installation.

9. Anchor shall be left undisturbed and unloaded for full adhesive curing period.

3.3 INSTALLATION OF SEAT ANGLES, SUPPORTS AND GUIDES

A. Seat angles shall be set flush with the floor.

3.4 INSTALLATION OF POWER DRIVEN PINS:

A. Power-driven pins shall be installed by a craftsman who is certified by the manufacturer as being qualified to install the manufacturer's pins. Pins shall be driven in one initial movement by an instantaneous force that has been carefully selected to attain the required penetration. Driven pins shall conform to the following requirements where "D" = Pin's shank diameter:

Material Penetrated by Pin	Material's Minimum Thickness	Pin's Shank Penetration in Supporting Material	Minimum Space From Pin's CL to Edge of Penetrated Material	Minimum Pin Spacing
Concrete	16D	6D minimum	14D	20D
Steel	1/4-inch	Steel thickness	4D	7D

3.5 INSTALLATION OF GRATING, FLOOR AND COVER PLATES

A. Grating, floor and cover plates shall be field measured for proper cutouts and proper sizes.

3.6 INSTALLATION OF STAIRS AND LADDERS (NOT USED)

3.7 INSTALLATION OF SAFETY STAIR TREADS (NOT USED)

3.8 INSTALLATION OF FLOOR HATCHES (NOT USED)

3.9 INSTALLATION OF DRILLED ANCHORS

A. Drilled anchors shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dry. Drilled anchors shall not be installed until the concrete has reached the indicated 28-day compressive strength. Adhesive anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

3.10 INSTALLATION OF MANHOLE FRAMES AND COVERS (NOT USED)

** END OF SECTION **

SECTION 06650 - PLASTIC LINER FOR CONCRETE SURFACES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing plastic lining to surfaces of pipes, manholes and other concrete structures.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03300 Reinforced Concrete

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Catalogue of the manufacturer of plastic liner, including complete data indicating the physical properties and chemical resistance properties as described in Subsection 210-2 of SSPWC, and all details and dimensions per Subsection 210-2.4 of SSPWC.

2. Shop drawings indicating the installation procedures and dimensions and location of all joints or weld strips.

3. Results of all tests made on plastic liner material as indicated herein.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Materials for plastic liner and its installation shall comply with SSPWC, Subsection 210-2.

2.2 TESTS

A. Tests shall be made on samples taken from plastic sheets, joints or weld strips in compliance with SSPWC, Subsection 210-2.3. However, before testing in conformance with SSPWC, Subsection 210-2.3, the CONSTRUCTION MANAGER, will visually and manually inspect the lining with a putty knife or a similar instrument. Any imperfections found as a result of all of the above tests

shall be repaired per manufacturer's instruction and CONSTRUCTION MANAGER's approval, and surfaces restored before placing the lining in service.

PART 3 -- EXECUTION

3.1 INSTALLATION OF PLASTIC LINER

A. Plastic liner shall be installed in compliance with SSPWC, Subsection 311-1.

3.2 LINER ACCEPTANCE

A. The manufacturer, applicator, and the CONTRACTOR shall, upon completion of the work, make a field inspection of the lining and installation and shall provide the OWNER a written certificate of work compliance in their respective areas of responsibility.

** END OF SECTION **

SECTION 07905 - JOINT SEALERS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing joint sealers and appurtenant WORK, complete.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 07920 Sealants and Caulking

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. California Building Code

1.4 SPECIFICATIONS AND STANDARDS

Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ASTM C 719	Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement
ASTM C 790	Recommended Practices for Use of Latex Sealing Compounds
ASTM C 804	Recommended Practices for Use of Solvent-Release Type Sealants
ASTM C 834	Specification for Latex Sealant Compounds
ASTM C 919	Practice for Use of Sealants in Acoustical Applications
ASTM C 920	Specification for Elastomeric Joint Sealants
ASTM C 962	Guide for Use of Elastomeric Joint Sealants
ASTM D 412	Test Methods for Rubber Properties in Tension
ASTM D 1056	Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 2628	Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete
ASTM D 3405	Specification for Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements
ASTM D 3406	Specification for Joint Sealant, Hot-Poured, Elastomeric-Type, for Portland Cement Concrete Pavement

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Product Data: Manufacturer's recommended applications and technical data for each joint sealer product required, including instructions for joint preparation and joint sealer application.

2. Samples for Initial Selection Purposes: Submit manufacturer's standard bead samples consisting of strips of actual products showing the full range of colors available, for each product exposed to view.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. **Delivery of Materials**: Manufactured materials shall be delivered in original, unbroken packages or containers bearing the manufacturer's label. Packages or containers shall be delivered to the site with seals unbroken.

B. Manufacturer's labels shall bear name of manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.

1. **Storage**: All materials shall be carefully stored in an area that is protected from deleterious elements and in a manner recommended by the product manufacturer. Storage and handling of materials shall be in such a manner as to prevent deterioration or damage due to moisture, temperature changes, contaminants or other causes.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Manufacturer's Recommendations**: Only products recommended for the specific application indicated shall be used.

B. **Single Source Responsibility**: All joint sealer materials for a specific application shall be obtained from a single manufacturer.

C. **Compatibility**: Joint sealers, joint fillers, and other related materials shall be provided which are compatible with one another and with joint substrates under the indicated conditions of service and application, as demonstrated by manufacturer's testing and field experience.

D. **Colors**: Colors of exposed joint sealers shall be provided as indicated or, if not otherwise indicated, as selected by the CONSTRUCTION MANAGER from manufacturer's standard colors.

2.2 ELASTOMERIC JOINT SEALANTS

A. **Elastomeric Sealant Standards**: Manufacturer's standard chemically curing elastomeric sealant shall be of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class and Uses.

1. **Two-Part Nonsag Polysulfide Sealant:** Type M; Grade NS; Class 12 1/2; Uses NT, M, G, A, and as applicable to the joint substrate indicated, Use O.

2. **Two-Part Pourable Polysulfide Sealant:** Type M; Grade P; Class 12 1/2; Uses T, M, G, A, and, as applicable to the joint substrates indicated, Use O.

3. **Two-Part Water Immersion Polysulfide Sealant:** Type M; Grade NS; Class 12 1/2; Uses T, M. G, A, and, as applicable to the joint substrates indicated, Use O; with a history of successful field experience in sealing joints immersed intermittently or continuously in water.

4. **One-Part Polysulfide Sealant:** Type S; Grade NS; Class 12 1/2; Uses T, M, G, A, and, as applicable to joint substrates indicated, Use O.

5. **One-Part Non-Acid-Curing Silicone Sealant:** Type S; Grade NS; Class 25; and complying with the following requirements for Uses NT, M, G, A, and, as applicable to joint substrates indicated, Use O. Modulus and additional joint movement capabilities as follows:

    a. Low Modulus: Tensile strength of 45 psi or less at 100 percent elongation when tested after 14 days at 77 degrees F and 50 percent relative humidity per ASTM D 412.

    b. Medium Modulus: Tensile strength of not less than 45 nor more than 75 psi or less at 100 percent elongation when tested after 14 days at 77 degrees F and 50 percent relative humidity per ASTM D 412.

    c. Additional capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, withstand 50 percent increase and decrease of joint width as measured at time of application and remain in compliance with other requirements of ASTM C 920.

6. **One-Part Acid-Curing Silicone Sealant:** Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to joint substrates indicated, Use O.

7. **One-Part Mildew-Resistant Silicone Sealant:** Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, Use O; formulated with fungicide for sealing interior joints with nonporous substrates around ceramic tile, showers, sinks and plumbing fixtures.

8. **Two-Part Non-Acid Curing Silicone Sealant for Use T:** Type M; Grade NS; Class 25; Uses T, M, and, as applicable to joint substrates indicated, Use O; and complying with the following requirement for additional joint movement capability:

    a. Additional capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand an increase and decrease of 50 percent of joint width as measured at time of application and remain in compliance with other requirements of ASTM C 920.

9. **Multi-Part Nonsag Urethane Sealant:** Type M; Grade NS; Class 25; Uses NT, M, G, A, and, as applicable to joint substrates indicated, Use O.

10. **Two-Part Nonsag Low-Modulus Urethane Sealant:** Type M; Grade NS; Class 25; Uses NT, M, A, and as applicable to joint substrates indicated, Use O; with additional capability to withstand an increase and decrease of 50 percent of joint width as measured at time of application and remain in compliance with other requirements of ASTM C 920, based on manufacturer's recommendations and testing.

11. **Two-Part Pourable Urethane Sealant:** Type M; Grade NS; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, Use O.

12. **Two-Part Nonsag Urethane Sealant for Use T:** Type M, Grade NS: Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, Use O.

13. **One-Part Nonsag Urethane Sealant:** Type S; Grade NS; Class 25; Uses NT, M, A, and, as applicable to joint substrates indicated, Use O.

14. **One-Part Nonsag Low-Modulus Urethane Sealant:** Type S; Grade NS; Class 25; Uses NT, M, A, and, as applicable to joint substrates indicated, Use; with additional capability to withstand an increase and decrease of 50 percent of joint width as measured at time of application and remain in compliance with other requirements of ASTM C 920, based on manufacturer's recommendations and testing.

15. **One-Part Pourable Urethane Sealant:** Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, Use O.

2.3 SOLVENT RELEASE CURING JOINT SEALANTS

A. **Acrylic Sealant**: Manufacturer's standard one-part, nonsag, solvent release curing, acrylic terpolymer sealant complying with ASTM C 920 for Type S; Grade NS: Uses NT, M, G, A, and, as applicable to joint substrates indicated, Use O; except for selected test properties which are revised as follows:

1.	Heat aged hardness	-	40 to 50
2.	Weight loss	-	15 percent
3.	Maximum cyclic movement capability (Class)	-	plus or minus 7-1/2 percent

B. **Butyl Sealant**: Manufacturer's standard one-part, nonsag, solvent release curing, polymerized butyl sealant complying with FS TT-S-001657 for Type I and formulated with minimum of 75 percent solids to be nonstaining, paintable, and have a tack-free time of 24 hours or less.

C. **Pigmented Small Joints Sealant**: Manufacturer's standard, solvent release curing, pigmented, synthetic rubber sealant formulated for sealing joints 3/16-inch or smaller in width.

2.4 LATEX JOINT SEALANTS

A. **Acrylic-Emulsion Sealant**: Manufacturer's standard, one- part, nonsag, acrylic, mildew resistant, acrylic-emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior and on protected exterior exposures involving joint movement of not more than plus or minus 7.5 percent.

2.5 MISCELLANEOUS JOINT SEALANTS

A. **Acoustical Sealant for Concealed Joints**: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmissions of airborne sound.

B. **Butyl-Polyisobutylene Sealant**: Manufacturer's standard solvent release curing, butyl-polyisobutylene sealant recommended for concealed joints.

C. **Butyl-Polyisobutylene Tape Sealant**: Manufacturer's standard, solvent-free, butyl-polyisobutylene tape sealants with a solids content of 100 percent; formulated to be nonstaining, paintable, and non-migrating in contact with nonporous surfaces; packaged on rolls with release paper on one side; with or without reinforcement thread to prevent stretching.

2.6 COMPRESSION SEALS

A. **Preformed Foam Sealant**: Manufacturer's standard preformed, precompressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water repellant agent; factory-produced in precompressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by the manufacturer. Provide products which are permanently elastic, mildew-resistant, non-migratory, nonstaining, compatible with joint substrates and other joint sealers, and comply with the following requirements:

1. **Impregnating agent:** Manufacturer's standard

2. **Density:** Manufacturer's standard

3. **Backing:** Pressure sensitive adhesive, factory applied to one side, with protective wrapping or coated on one face with release agent serving as bond breaker for primary joint sealant.

B. **Preformed Hollow Neoprene Gasket**: Manufacturer's standard preformed polychloroprene elastomeric joint seal of the open-cell compression type complying with ASTM D 2628 and with requirements indicated for size, profile and cross-section design.

2.7 JOINT SEALANT BACKING

A. **General**: Provide sealant backings of material and type which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers.

B. **Plastic Foam Joint-Fillers**: Preformed, compressible, resilient, non-waxing, non-extruding strips of either flexible, open cell polyurethane foam or non-gassing, closed-cell polyethylene foam, subject to sealant manufacturer's approval; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. **Bond-Breaker Tape**: Polyethylene tape or other plastic tape as recommended by the sealant manufacturer for preventing bond between sealant and joint filler or other materials at the back or third surface of the joint. Provide self-adhesive tape where applicable.

D. **Elastomeric Tubing Joint Fillers**: Neoprene, butyl or EPDM tubing complying with ASTM D 1056, non-absorbent to water and gas, capable of remaining resilient at temperatures down to minus 26 degrees F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.

2.8 MISCELLANEOUS MATERIALS

A. **Primer**: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated.

B. **Cleaners for Nonporous Surfaces**: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.

C. **Masking Tape**: Provide non-staining, non-absorbent type compatible with joint sealants and with surfaces adjacent to joints.

2.9 MANUFACTURERS

A. Products of the type indicated shall be manufactured by one of the following (or equal):

1. **Two-Part Nonsag Polysulfide Sealant:**

   Bostik Construction Products Division, [Chem-Calk 200]
   W.R. Meadows, Inc., [CM-60]

2. **Two-Part Pourable Polysulfide Sealant:**

   Bostik Construction Products Division, [Chem-Calk 250]

3. **Two-Part Water Immersion Polysulfide Sealant:**

   Bostik Construction Products Division, [Chem-Calk 400]

4. **One-Part Polysulfide Sealant:**

   Bostik Construction Products Division, [Chem-Calk 100]
   Pecora Corp., [Synthacalk GC-9]

5. **One-Part Non-Acid Curing Low-Modulus Silicone Sealant:**

   Bostik Construction Products Division, [Chem-Calk 1000]
   Dow Corning Corp., [Dow Corning 790]

6. **One-Part Non-Acid Curing Medium-Modulus Silicone Sealant:**

   Dow Corning Corp., [Dow Corning 795]
   General Electric Co., [Silpruf]

7. **One-Part Acid-Curing Silicone Sealant:**

   Bostik Construction Products Division, [Chem-Calk 1200]
   Dow Corning Corp., [Dow Corning 999]

8. **One-Part Mildew-Resistant Silicone Sealant:**

   Dow Corning Corp., [Dow Corning 786]
   General Electric Co., [SCS 1702]

9. **Two-Part Non-Acid Curing Silicone Sealant for Use T:**

   Dow Corning Corp., [Dow Corning 888]

10. **Multi-Part Nonsag Urethane Sealant for Uses NT, M, G, A, and O:**

    Bostik Construction Products Division, [Chem-Calk 500]
    Pecora Corp., [Dynatrol II]

11. **Two-Part, Nonsag Low-Modulus Urethane Sealant:**

    Mameco International, Inc., [Vulkem 922]

12. **Two-Part, Pourable, Urethane Sealant:**

    Bostik Construction Products Division, [Chem-Calk 550]
    Mameco International, Inc., [Vulkem 245]

13. **Two-Part Nonsag Urethane Sealant for Use T:**

    Pecora Corp., [Dynatred]

14. **One-Part Nonsag Urethane Sealant:**

    Pecora Corp., [Dynatrol II]

15. **One-Part Nonsag Low-Modulus Urethane Sealant:**

    Mameco International, Inc., [Vulkem 921]
    Sika Corp., [Sikaflex-15LM]

16. **One-Part, Pourable, Urethane Sealant:**

    Mameco International, Inc., [Vulkem 45]
    Pecora Corp., [NR-201 Urexpan]

17. **Acrylic Sealant:**

    Bostik Construction Products Division, [Chem-Calk 800]
    Pecora Corp., [60+Unicrylic]

18. **Butyl Sealant:**

Bostik Construction Products Division, [Chem-Calk 600]
Pecora Corp., [BC-158]

19. **Pigmented Small Joint Sealant:**

Protective Treatments, Inc., [PTI 200]
Tremco, Inc., [Tremco Seam Sealer]

20. **Latex Joint Sealers:**

Bostik Construction Products Division, [Chem-Calk 600]
Pecora Corp., [AC-20]

21. **Acoustical Sealants for Concealed Joints:**

Pecora Corp., [BA-98]
Tremco, Inc., [Tremco Acoustical Sealant]

22 **Butyl-Polyisobutylene Sealant:**

Protective Treatments, Inc., [PTI 404]

23. **Butyl-Polyisobutylene Tape Sealant:**

Pecora Corp., [Extru-Seal Tape]
Protective Treatments, Inc., [PTI 606]

24. **Compression Seals:**

Emseal Corp., [Emseal Greyflex]
Illbruck, [Will-Seal Tape Type 250]
Sandell Manufacturing Co., Inc., [Polytite Standard]

25. **Preformed Hollow-Neoprene Gasket:**

Acme Highway Products Corp.
Watson Bowman Associates, Inc.

PART 3 -- EXECUTION

3.1 PROJECT CONDITIONS

A. **Environmental Conditions**: CONTRACTOR shall not proceed with installation of joint sealers under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by the joint sealer manufacturers.

2. When joint substrates are wet due to rain, frost, condensation, or other causes.

B. **Joint Width Conditions**: Installation of joint sealers shall not proceed when joint widths are less than, or more than, allowed by the joint sealer manufacturer for the application indicated.

3.2 PREPARATION

A. **Surface Cleaning of Joints**: All joints shall be cleaned out immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:

1. All foreign material shall be removed from joint substrates which could interfere with adhesion of joint sealer, including dust; paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer) oil; grease; waterproofing; water repellents; water, and surface dirt.

2. Concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces shall be cleaned by brushing, grinding, blast cleaning, mechanical abrading, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Loose particles remaining from the above cleaning operations shall be removed by vacuuming or blowing out joints with oil-free compressed air.

3. Laitance and form release agents shall be thoroughly removed from all concrete surfaces.

4. Metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other non-porous surfaces shall be cleaned with chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

B. **Joint Priming**: Joint substrates shall be primed where indicated or where recommended by joint sealer manufacturer. Primer shall be applied so as to comply with joint sealer manufacturer's recommendations. Primers shall be confined to areas of joint sealer bond. Spillage or migration onto adjoining surfaces shall not be allowed.

C. **Masking Tape**: Masking tape shall be used where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Tape shall be removed immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. **General**: Unless otherwise indicated, comply with joint sealer manufacturers' printed installation instructions.

B. **Elastomeric Sealant Installation Standard**: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. **Solvent-Release-Curing Sealant Installation Standard**: Comply with requirements of ASTM C 804 for use of solvent-release-curing sealants.

D. **Latex Sealant Installation Standard**: Comply with requirements of ASTM C 790 for use of latex sealants.

E. **Acoustical Sealant Application Standard**: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.

F. **Installation of Sealant Backings**: Install sealant backings to comply with the following requirements:

1. Install joint-fillers of the types indicated to provide support of sealants during application and at position necessary to product the required cross-sectional shapes and depths.

    a. Do not leave gaps between ends of joint-fillers.

    b. Do not stretch, twist, puncture or tear joint-fillers.

    c. Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants and joint-fillers, compression seals or back of joints, where required to prevent third-side adhesion of sealant to back of joint.

3. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint-fillers.

G. **Installation of Sealants**: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

H. **Tooling of Nonsag Sealants**: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by the sealant manufacturer.

1. Concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.

2. Flush joint configuration per Figure 6B in ASTM C 962, where indicated.

3. Recessed joint configuration per Figure 6C in ASTM C 962, of recess depth and at locations indicated.

    a. Where necessary, use masking tape to protect adjacent surfaces of tooled joints.

I. **Installation of Preformed Foam Sealants**: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and complying with sealant manufacturer's directions for installation methods, materials and tools which produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

J. **Installation of Preformed Hollow Neoprene Gaskets**: Install gaskets, with minimum number of end joints, in joint recesses with edges free of spalls and sides straight and parallel, both within tolerances specified by gasket manufacturer. Apply manufacturer's recommended adhesive to joint substrates immediately prior to installing gaskets. For straight sections provide gaskets in continuous lengths; where changes in direction occur, adhesively splice gasket together to provide watertight joints. Recess gaskets below adjoining surfaces by 1/8 inch to 1/4 inch.

3.4 PROTECTION AND CLEANING

A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of substantial completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers and reseal joints with new materials to produce installations with repaired areas indistinguishable from original work.

B. Clean off excess sealants or sealant smears adjacent to joints as WORK progresses, by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

** END OF SECTION **

SECTION 07920 - SEALANTS AND CAULKING

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing sealants, caulking, and accessories.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03290 Joints in Concrete Structures

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. California Building Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

Fed. Spec. TT-S-001543A	Sealing Compound, Silicone Rubber Base, (For Caulking, Sealing and Glazing in Buildings and Other Structures).
Fed. Spec. TT-S-00230C(2)	Sealing Compound, Elastomeric Type, (For Caulking, Sealing, and Glazing in Buildings and Other Structures).

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Manufacturer's product data including catalogue cuts.
2. Manufacturer's installation instructions.
3. Certification that products comply with indicated requirements.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials:** Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from deleterious elements.

PART 2 - PRODUCTS

2.1 GENERAL

A. **General:** Only products certified as complying with the indicated requirements shall be provided.

B. **Products:** Products shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.

C. **Manufacturer's Recommendations:** Products shall be recommended by the manufacturer for the application indicated.

2.2 SEALANTS AND CAULKING MATERIALS

A. Caulking and sealing materials shall conform to the following requirements:

1. Sealant for exterior and interior use shall be 2-part polyurethane, gun grade.

2. Sealant for interior use shall be 1-part acrylic trypolymer sealant.

3. Sealants used with aluminum doors, windows, storefronts, and frames shall be silicone sealant conforming to Federal Specifications TT-S-001543A (Class A) and TT-S-00230C(2) (Type II, Class A).

4. Acoustic caulking compound shall be nonskinning synthetic polymer.

5. Acoustic sheet caulking shall be resilient synthetic polymer, self-adhesive, 1/8-inch thick sheet acoustic sealer.

6. Fire-resistant penetration sealants shall be a medium density fire-resistant foam that retains form and stability at high temperature and meets UL test requirements for fire rating required at location used.

7. Caulking tapes shall be of the butyl-base, vulcanized type.

8. Filler material shall be resilient, closed-cell polyethylene foam and/or bond breakers of proper size for joint widths and shall be compatible with sealant manufacturer's product.

9. Primers shall be as recommended by the manufacturer for caulking and sealants.

10. Cleaning and cleanup solvents shall be as recommended by the manufacturer for caulking and sealants.

2.3 MANUFACTURERS

A. Products shall be of the type and manufacture as indicated below (or equal):

1. **Sealant for Exterior and Interior Use:**

Products Research Corp. "210"
Progress Unlimited "Iso-Flex 2000"

2. **Sealant for Interior Use:**

Tremco's "Mono"
Dap "One-Part Acrylic"

3. **Acoustic Caulking Compound:**

Presstite "579.64"
Lowry "Acoustical Sealer"

4. **Acoustic Sheet Caulking:**

Lowry "Electrical Box Pad"
Presstite "579.6"

5. **Fire-resistant Penetration Sealant:**

Dow-Corning Corporation's "3-6548 Silicone RTV" foam
3M Corporation's "Fire Barrier Caulk CP 25"
Putty Corporation's "Fire Barrier Caulk CP 25"
Putty Corporation's "303"

PART 3 - EXECUTION

3.1 GENERAL

A. **General:** Products shall be installed in accordance with the manufacturer's installation instructions.

B. **Authorized Installers:** Caulking and sealants shall be complete systems, and shall be installed only by installers authorized and approved by the manufacturer.

C. **Acoustic Partition Joints:** Acoustic partition joints shall be made air and sound-tight with acoustic caulking material.

3.2 SEALANT FILLED JOINTS

A. **Manufacturer's Representative:** The WORK includes the services of the sealant manufacturer's representative (prior to sealant work) for inspection of the joints and for instructing the installer in the proper use of the materials.

B. **Surface Preparation:** Joints and spaces to be sealed shall be clean, dry, and free of dust, loose mortar, and other foreign materials. Ferrous metal surfaces shall be cleaned of rust, mill scale, and other coatings by wire brush, grinding, or sandblasting. Oil and grease shall be removed by cleaning in accordance with sealant manufacturer's recommendations. Protective coatings shall be removed from aluminum surfaces against which caulking or sealing compound is to be placed. Bituminous or resinous materials shall be removed from surfaces to receive caulking or sealants.

C. **Sealant Depth:** Sealant depth in joints shall be 1/2 the width of joint, but not less than 1/8-inch deep and 1/4-inch wide nor more than 1/2-inch deep and 1-inch wide. Joints shall have a rigid filler material installed to proper depth prior to application of sealant.

C. **Joints in Porous Materials:** Where required by the manufacturer, sides of joints of porous materials shall be primed immediately prior to caulking or sealing.

D. **Applications:** A full bead of sealant shall be applied to the joint under sufficient pressure, with the nozzle drawn across sealant, to completely fill the void space and to ensure complete wetting of contact area to obtain uniform adhesion. During application, the tip of the nozzle shall be kept at the bottom of the joint to ensure forcing the sealant to fill from the bottom to the top. Sealants shall be tooled immediately after exposure with caulking tool or soft bristled brush moistened with solvent. The finished sealant filled joint shall be slightly concave unless otherwise indicated.

E. **Cleaning:** After application of sealant and caulking materials, adjacent materials which have been soiled shall be cleaned and left in a neat, clean, undamaged or unstained condition. On porous surfaces, excess sealant shall be removed in accordance with the sealant or caulking manufacturer's printed instructions.

3.3 ACOUSTIC CAULKING

A. **Preparation:** Joints and surfaces shall be clean, dry, and free of loose materials.

B. **Concealed Joints:** Concealed joints in acoustic partitions including perimeters, intersections of walls and penetrations through finish work, and at conduit ends with boxes shall be sealed with acoustic caulking compound. Backs of electrical boxes shall be sealed with acoustic sheet caulking installed over holes and knock-outs.

** END OF SECTION **

SECTION 09800 - PROTECTIVE COATING

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A The WORK of this Section includes the protective coating of all indicated surfaces including surface preparation, pretreatment, coating application, touch-up, protection of surfaces not to be coated, cleanup, and all appurtenant work.

B. Definitions

1. The term “paint”, “coatings”, or “finishes” as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, except galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

2. The term “DFT” shall mean minimum dry film thickness, without any negative tolerance.

C. The following surfaces shall not be protective coated hereunder unless indicated.

1. Concrete except in chemical(s) containment areas
2. Stainless steel
3. Machined surfaces
4. Grease fittings
5. Glass
6. Equipment nameplates
7. Platform gratings, stair treads, door thresholds, and other walk surfaces

D. The coating system schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

E. Architectural Coatings (NOT USED)

1.2 RELATED SECTIONS (NOT USED)

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Building Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. References herein to "SSPC Specifications" or "SSPC" shall mean the published standards of the Steel Structures Painting Council, 40 24th Street, 6th Floor, Pittsburgh, PA 15222.

2. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers, P.O. Box 281340, Houston, TX 77218-8340.

3. **Commercial Standards:**

ANSI A13.1	Scheme for Identification of Piping Systems
ANSI/AWWA C105	Polyethylene Encasement for Ductile Iron Piping
ANSI/AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape-Hot-Applied
ANSI/AWWA C209	Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
ANSI/AWWA D102	Painting Steel Water-Storage Tanks

4. **Federal Specifications:**

TT-P-28	Paint, Aluminum, Heat Resisting ($1200^{O}F$)
DOD-P-23236	Military Specification, Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast

1.5 SHOP DRAWINGS AND SAMPLES

A. Submittals shall include the following information and be submitted at least 30 days prior to protective coating work.

1. **Coating Materials List:** The CONTRACTOR shall provide a coating materials list which indicates the manufacturer and the coating number, keyed to the coating systems herein, prior to or at the time of submittal of samples.

2. **Paint Manufacturer's Catalogue:** For each paint system to be used the CONTRACTOR shall submit manufacturer's catalogue containing the following data

a. Paint Manufacturer’s data sheet for each product used, including statements on the suitability of the material for the intended use.

b. Technical and performance information that demonstrates compliance with the system performance and material requirements.

c. Manufacturer's Instructions and recommendations on surface preparation, thinning, mixing, handling, applying and proper storage.

d. Colors available for each product (where applicable).

e. Compatibility of shop and field applied coatings (where applicable).

f. Material safety data sheet for each product used.

B. **Samples:**

1. Samples of all paint, finishes, and other coating materials shall be submitted on 82-inch by 11-inch sheet metal. Each sample shall be completely coated over its entire surface with one protective coating material, type, and color.

2. Two sets of color samples to match each color selected by the CONSTRUCTION MANAGER from the Manufacturer's standard color sheets. If custom mixed colors are indicated, the color samples shall be made using color formulations prepared to match the color samples furnished by the CONSTRUCTION MANAGER. The color formula shall be shown on the back of each color sample.

3. Qualifications of Painting Subcontractor

a. Copy of a valid State of California license as required for the application of coatings.

b. Five references which show that the painting subcontractor has demonstrated successful experience with the indicated coating systems in the recent past. Provide the name, address and telephone number of the owner of each installation. The CONTRACTOR shall obtain the references from the subcontractor and submit them to the CONSTRUCTION MANAGER.

1.6 SERVICES OF MANUFACTURER

A. For submerged and severe service coating systems, the CONTRACTOR shall require the paint manufacturer to furnish the following services:

1. The manufacturer's representative shall furnish at least 6 hours of on-site instruction in the proper surface preparation, use, mixing, application and curing of the coating systems.

2. The manufacturer's representative shall personally observe the start of surface preparation, mixing, and application of the coating materials.

3. The manufacturer's representative shall provide technical support to resolve field problems associated with manufacturer's products furnished under this Contract or the application thereof.

4. The manufacturer shall certify that these services have been furnished, and the CONTRACTOR shall submit the certification within 7 days of completion of each paint system.

1.7 INSPECTION AND TESTING

A. **General:** The CONTRACTOR shall give the CONSTRUCTION MANAGER a minimum of 3 days' advance notice of the start of any field surface preparation work or coating application work, and a minimum of 7 days' advance notice of the start of any shop surface preparation work.

B. All such work shall be performed only in the presence of the CONSTRUCTION MANAGER, unless the CONSTRUCTION MANAGER has granted prior approval to perform such work in its absence.

C. Inspection by the CONSTRUCTION MANAGER, or the waiver of inspection of any particular portion of the work, shall not relieve the CONTRACTOR of its responsibility to perform the work in accordance with these Specifications.

D. Scaffolding shall be erected and moved to locations where requested by the CONSTRUCTION MANAGER to facilitate inspection. Additional illumination shall be furnished to cover all areas to be inspected.

E. **Inspection Devices:** The CONTRACTOR shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. Dry-film thickness gauges shall be made available for the CONSTRUCTION MANAGER'S use at all times while coating is being done, until final acceptance of such coatings. The CONTRACTOR shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the CONSTRUCTION MANAGER.

F. **Holiday Testing:** The CONTRACTOR shall holiday test all coated ferrous surfaces inside a steel reservoir, or other surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems. Areas which contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested. In addition to the above the CONSTRUCTION MANAGER may test any surfaces for any number of times at no additional cost to CONTRACTOR. All defects so found shall be corrected by the CONTRACTOR at no additional cost to the OWNER.

1. Coatings With Thickness Exceeding 20 Mils: For surfaces having a total dry film coating thickness exceeding 20 mils: pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the indicated coating thickness.

2. Coatings With Thickness of 20 Mils or Less: For surfaces having a total dry film coating thickness of 20 mils or less: Tinker & Rasor Model M1 non-destructive type holiday detector, K-D Bird Dog, or equal shall be used. The unit shall operate at less than 75-volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flo, or equal, shall be added to the water prior to wetting the detector sponge.

G. **Film Thickness Testing:** On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gauge such as Mikrotest model FM, Elcometer model 111/1EZ, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.

H. **Surface Preparation:** Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standard TM-01-70 and TM-01-75.

1.8 WARRANTY INSPECTION

A. A warranty inspection may be conducted during the eleventh month following completion of all coating and painting work. The CONTRACTOR and a representative of the coating material manufacturer shall attend this inspection. All defective work shall be repaired in accordance with these specifications and to the satisfaction of the OWNER. The OWNER may, by written notice to the CONTRACTOR, reschedule the warranty inspection to another date within the one-year correction period, or may cancel the warranty inspection altogether. If a warranty inspection is not held, the CONTRACTOR shall not be relieved of its responsibilities under the Contract Documents.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.

B. Paint materials shall be carefully stored in a manner that will prevent damage and in an area that is protected from deleterious elements.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Suitability:** The CONTRACTOR shall use suitable coating materials as recommended by Manufacturer for the intended service.

B. **Compatibility:** In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

C. **Colors:** All colors and shades of colors of all coats of paint shall be as indicated or selected by the CONSTRUCTION MANAGER. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the CONSTRUCTION MANAGER.

D. **Substitute or "Or Equal" Products:**

1. The CONTRACTOR shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or-equal" material that said material meets the requirements and is equivalent or better than the listed materials in the following properties:

   a. Quality
   b. Durability
   c. Resistance to abrasion and physical damage
   d. Life expectancy
   e. Ability to recoat in future
   f. Solids content by volume
   g. Dry film thickness per coat
   h. Compatibility with other coatings
   I. Suitability for the intended service
   j. Resistance to chemical attack
   k. Temperature limitations in service and during application
   l. Type and quality of recommended undercoats and topcoats
   m. Ease of application
   n. Ease of repairing damaged areas
   o. Stability of colors

E. Protective coating materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the CONTRACTOR shall provide the name of least one successfully performing application of the proposed manufacturer's products in a project of comparable size and complexity constructed in the recent past.

F. The cost of all testing and analyzing proposed substitute materials that may be required by the CONSTRUCTION MANAGER shall be paid by the CONTRACTOR at no additional cost to the OWNER. If the proposed substitution requires changes in the contract work, the CONTRACTOR shall bear all such costs involved and the costs of allied trades affected by the substitution at no additional cost to the OWNER.

2.2 INDUSTRIAL COATING SYSTEMS

A. **Material Sources**: Each of the following manufacturers is capable of supplying many of the industrial coating materials indicated herein. Where manufacturers and paint numbers are listed, it is to show the type and quality of coatings that are required. Proposed substitute materials shall be considered as indicated above. All industrial coating materials shall be materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, water, and wastewater treatment plants.

1. Ameron
2. Carboline Coatings Company
3. Inorganic Coatings, Inc.
4. International (Courtaulds)
5. Tnemec Company

B. **System 1 - Alkyd Enamel:** High quality, gloss or semi-gloss, medium long oil alkyd finish shall have a minimum solids content of 49 percent by volume. Primer shall be as recommended by manufacturer.

1. Prime coat (DFT = 3 mils) Amercoat 5105, Tnemec 4-55, or equal.

2. Finish coats (two or more, DFT = 3 mils), Amercoat 5401 HSA, or 5405, Tnemec 2H, or equal.

3. Total system DFT = 6 mils.

C. **System 2 - Not Used**

D. **System 3 - Aluminum Silicone Resin:** Aluminum silicone resin material shall be suitable for a service temperature of up to 1,000 degrees F, and shall comply with Federal Specification TT-P-28.

1. Prime coat and finish coat (2 or more, DFT = 3 mils), Tnemec Series 39-1061, Amercoat 878, or equal.

2. Total system DFT = 3 mils.

E. **System 4 - Aliphatic Polyurethane:** Two component aliphatic acrylic polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, resistance to chemical fumes and severe weathering and with a minimum solids content of 58 percent by volume. Primer shall be a rust inhibitive two component epoxy coating with a minimum solids content of 68 percent by volume.

1. Prime coat (DFT = 4 mils), Amercoat 385, Carboline 893, Tnemec 69, or equal.

2. Finish coat (one or more, DFT = 3 mils), Amershield, Carboline 134 HS, Tnemec 74, or equal.

3. Total system DFT = 7 mils.

4. More than one finish coat shall be applied as necessary to produce a finish with uniform color and texture.

F. **System 5 - Inorganic Zinc/Polyurethane:** The inorganic zinc primer shall be a water or solvent based, self-curing, zinc silicate 2-component inorganic coating which contains at least 85 percent of metallic zinc by weight in the dried film, and is recommended by the coating manufacturer as a primer for this system. The intermediate coat shall be a high-build two component epoxy with a solids content of at least 70 percent by volume. Finish coats shall be a 2-component aliphatic acrylic or polyester polyurethane coating material that provides superior color and gloss retention,

resistance to chemical fumes and severe weathering, and a minimum solids content of 58 percent by volume.

1. Prime coat (DFT = 2 mil), Ameron Dimetcote 21-5 or 21-9, Inorganic Coatings 531, or equal.

2. Intermediate coat (DFT = 4 mils), Ameron 385, Inorganic Coatings P24, or equal.

3. Finish coats (one or more, DFT = 3 mils), Ameron Amershield, Inorganic Coatings 64, or equal.

4. Total system DFT = 10 mils.

5. Intermediate coat shall be applied in excess of 4 mils DFT or in more than one coat as necessary to completely cover the inorganic zinc primer and prevent application bubbling of the polyurethane finish coat.

6. More than one finish coat shall be applied as necessary to produce a finish with uniform color and texture.

7. If the inorganic zinc primer is used as a pre-construction or shop applied primer, all damaged and uncoated areas shall be spot abrasive blasted and coated after construction using the indicate material.

G. **System 6 - Inorganic Zinc, Water Based:** Water based, self curing, ethyl silicate shall be a two component inorganic coating material that contains at least 85 percent of metallic zinc by weight in the dried film.

1. Prime coat and finish coat (One, DFT = 3 mils), Ameron Dimetcote 21-5, Inorganic Coatings 531, or equal.

2. Total system DFT = 3 mils.

H. **System 7 - Acrylic Latex:** Single component, water based acrylic latex with a fungicide additive shall have a minimum solids content of 35 percent by volume. Prime coat shall be as recommended by manufacturer. The coating material shall be available in the ANSI safety colors.

1. Prime coat (DFT = 2 mils), as recommended by manufacturer.

2. Finish coats (2 or more, DFT = 6 mils), Ameron Amercoat 220, Carboline 3359, Tnemec 6, or equal.

3. Total system DFT = 8 mils.

I. **System 8 - Epoxy Equipment:** Two component, rust inhibitive polyamide cured epoxy coating material shall provide a recoatable finish that is available in a wide selection of colors. The coating material shall have a minimum solids content of 66 percent by volume and be resistant to service conditions of condensing moisture, splash and spillage of lubricating oils, and frequent washdown and cleaning.

1. Prime coat DFT = 3 mils, Ameron 385, Tnemec 69, or equal.

2. Prime coat, where shop applied. (DFT = 3 mils), universal primer, Ameron 185 HS, Tnemec 50-330 or 161, or equal.

3. Finish coat (2 or more, DFT =6 mils), Ameron 385, Tnemec 69, or equal.

4. Total system DFT = 6 mils.

J. **System 9 - Inorganic Zinc/Epoxy, Equipment:** The inorganic zinc primer shall be a water or solvent based, self curing, zinc silicate, two-component inorganic coating that contains at least 85 percent of metallic zinc by weight in the dried film, and is recommended by the coating manufacture as a primer for this system. The finish coats shall be a polyamide cured epoxy material with a minimum solids content of at least 80 percent by volume, and available in a large selection of colors.

1. Prime coat DFT =3 mils Ameron Dimetcote 21-5 or 21-9, Carboline carbozinc 7 WB, or equal.

2. Finish coats (2 or more, DFT = 9 mils) Ameron 400, Carboline 890, or equal.

3 Total system DFT = 12 mils.

K. **System 10 - Acrylic, Concrete:** The acrylic coating material shall be a single component, industrial grade, high molecular weight acrylic coating material shall have a minimum solids content of 35 percent by volume. The filler-sealer shall be a two component epoxy masonry sealer for wet and exterior exposure, with a solids content of at least 64 percent by volume. A 100 percent solids epoxy surface shall be used to fill holes and patch the concrete surface after abrasive blasting.

1. Prime coat (Filler-sealer), applied in two coats to the entire surface and worked into the surface with a squeegee to achieve a smooth, void-free surface, Tnemec 54-660, Ameron Nu-Klad 105A followed by Nu-Klad 114A (2 coats), or equal.

2. Finish coats (2 or more, DFT = 6 mils), Tnemec 6, Ameron Amercoat 220, or equal.

L. **System 11 - Aliphatic Polyurethane, Concrete:** Two component aliphatic polyester polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, and resistance to chemical fumes and severe weathering, and with a minimum solids content of 65 percent by volume. Filler-sealer compound shall be a two component epoxy material used to provide a smooth surface for the epoxy intermediate coat. The filler-sealer shall be applied to the entire concrete surface and worked into the concrete surface with a wide blade putty knife or squeegee. The intermediate coat shall be a high-build epoxy coating with a minimum solids content of 70 percent by volume.

1. Prime coat (Filler-sealer), Ameron Nu-Klad 105A followed by, Nu-Klad 114 Tnemec 54-660, or equal.

2. Intermediate coat (DFT = 4 mils), Ameron Amerlock 400, Tnemec 104 HS, or equal.

3. Finish coats (2 or more, DFT = 3 mils), Ameron Amershield, Tnemec 74, or equal.

M. **System 12 - Aliphatic Polyurethane, Fiber Glass:** Two-component aliphatic polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, and resistance to chemical fumes and severe weathering. A primer, tie coat, or mist coat shall be used as recommended by the manufacturer.

1. Prime coat (Tie coat), Ameron Amercoat 385, Tnemec 66, or equal.

2. Finish coats (2 or more, DFT = 3 mils), Ameron Amershield, Tnemec 74, or equal.

2.2 SUBMERGED AND SEVERE SERVICE COATING SYSTEMS

A. **Materials Sources:** The manufacturers' products listed in this paragraph are materials which satisfy the material descriptions of this paragraph and have a documented successful record for long term submerged or severe service conditions. Proposed substitute products shall be considered as indicated above.

B. **System 100 - Amine Cured Epoxy:** High build, amine cured, straight epoxy resin shall have a solids content of at least 80 percent by volume, and shall be suitable for long-term immersion service in potable water and wastewater. For potable water service, the coating material shall be listed by the NSF International as in compliance with NSF Standard 61B Drinking Water System Components - Health Effects.

1. Prime coat and finish coats (3 or more, DFT = 16 mils), Amercoat 395, Tnemec 139, or equal.

2. For coating of valves and non-submerged equipment, DFT = 12 mils.

C. **System 101 - Cold-Applied Tape:** Tape coating materials and procedures shall be in accordance with ANSI/AWWA C209. Prefabricated tape shall be Type II. The system shall consist of a primer layer, inner layer tape (35 mils), and an outer layer tape (35 mils). Total system DFT = 70 mils.

D. **System 102 - Polyamide Cured Epoxy:** High build, polyamide epoxy resin shall have a solids content of at least 56 percent by volume, and shall be suitable for long-term immersion in potable water and municipal wastewater. For potable water service, the coating material shall be listed by the NSF International as in compliance with NSF Standard 61.

1. Prime coat and finish coats (3 or more, DFT = 12 mils), Tnemec 20, or equal.

E. **System 103 - Coal Tar Epoxy:** High build, 2-component amine or polyamide cured coal tar epoxy shall have a solids content of at least 68 percent by volume, suitable for long term immersion in wastewater and for coating of buried surfaces, and conforming to DOD-P-23236, Class 2, or to SSPC Paint 16. Prime coats are for use as a shop primer only. Prime coat shall be omitted when both surface preparation and coating are to be performed in the field.

1. Finish coats (2 or more, DFT = 16 mils), Amercoat 78 HB, Tnemec 46 H-413, or equal.

2. Total system DFT = 16 mils.

F. **System 104 - Not Used**

G. **System 105 - Epoxy, Reservoirs:**

1. **Primer:** Solids content of 100 percent, NSF listed, compatible with finish coating, 3 mils.

2 Polyamide Cured Epoxy: High build polyamide cured epoxy coating shall have a solids content of at least 70 percent by volume and a finish coat color of white.

3. **Amine Cured Epoxy:** High build amine cured epoxy coating shall have a solids content of at least 78 percent by volume and with a finish coat color of white or ivory.

4. The epoxy coating material shall be either a polyamide-cured epoxy or an amine-cured epoxy suitable for long-term immersion service in reclaimed and potable water. The material shall and listed by NSF International as in compliance with NSF Standard 61 and shall conform with State and local health regulations and policies for service in potable water reservoirs. The CONTRACTOR shall submit a written certification that the proposed materials meet the above regulatory agency standards and policies. The material shall be applied with a primer if recommended by the coating manufacturer.

5. **Part A:** Products shall be as listed, or equal:

a.	Pre-coating, prior to erection. See Note (1) under Paragraph f.	(DFT = 3 mils)	Ameron Dimetcote 21-5, International Interline 982
b.	Finish coating, prior to erection. Top of roof rafters, girders, and other areas not accessible after erection.	(DFT = 9 mils)	Ameron Amercoat 395, International Interline 925
c.	Touch up, following erection. See Note (2) under Paragraph f.	(DFT = 3 mils)	
d.	Difficult-to-coat areas, following erection. See Note (3) under Paragraph f.	(DFT = 9 mils)	Ameron Amercoat 395, International Interline 925
e.	Finish Coats (2 or more)	(DFT = 9 mils)	Ameron 395, International Interline 925
f.	Notes:		
	(1) All lap roof plate edges, both sides, are to be pre-coated. If necessary, zinc primer exposed on exterior of roof may be removed prior to welding. Pre-coating shall extend at least 6 inches from plate edges.		
	(2) Touch-up coating shall be done for areas damaged during erection, or areas not pre-coated. The CONTRACTOR shall spot sandblast to SSPC-SP-5 - white metal blast cleaning, before application of coating. Material used for touch-up shall be the specified material, or a compatible primer recommended		

	by the manufacturer.
	(3) All edges, nuts, bolts, lap joints, weld seams and the roof rim angle shall receive one brush-applied coat prior to the application of the first complete spray coat.

6. **Part B:** Products shall be as listed, or equal:

a.	Difficult-to-coat areas. See Note (1) under Paragraph d.		Ameron Amercoat 395, International Interline 925
b.	Finish coats (2 or more). Finish coats to be applied at 4-6 mils DFT per coat. See Note (1) under Paragraph d.	(DFT = 12 mils)	Ameron Amercoat 395, International Interline 925
c.	Total system DFT = 12 mils		
d.	Notes:		
	(1) All edges, nuts, bolts, lap joints, and weld seams shall receive one brush-applied coat prior to the application of the first complete spray coat.		

7. **Curing Period:** Prior to immersion, the completed system shall be subjected to at least 240 hours of curing time with the metal temperature at a minimum of 70 degrees F, or 480 hours at a minimum of 60 degrees F, both conditions at a maximum relative humidity of 50 percent and under the forced ventilation conditions required by the paragraph entitled "Curing of Coatings, herein. More curing time or a higher temperature shall be provided if recommended by the epoxy coating manufacturer. If the environmental conditions do not provide the necessary minimum temperature, use heated air to provide the necessary heat for curing. Other combinations of curing time and temperature may be used if the coating manufacturer presents satisfactory documentation and test results to substantiate that the degree of curing is equal or greater than curing for 240 hours at 70 degrees F.

8. **Volatile Organic Compound Testing:** The completed interior reservoir coating system shall be tested for volatile organic compounds as specified herein.

H. **System 106 - Fusion Bonded Epoxy:** The coating material shall be a 100 percent powder epoxy, certified as compliant with NSF Standard 61, applied in accordance with the ANSI/AWWA C213 "AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines," except that the surface preparation shall be as specified in the coating system schedule of this Section. The coating shall be applied using the fluidized bed or electrostatic spray process.

1. Coating DFT = 16 mils, Scotchkote 134 (electrostatic) or 206N (fluidized bed), or equal, applied in one coat.

2. For coating of valves, DFT = 12 mils.

3. For field repairs, the use of a liquid epoxy will be permitted, applied in one coat to provide a DFT of 15 mils. The liquid epoxy shall be Scotchkote 312 or as recommended by the powder epoxy manufacturer.

I. **System 107 - Chemical Resistant Sheet Lining:**

1. **Materials:** The CONTRACTOR shall use natural rubber, chlorobutyl rubber, ethylene propylene diene monomer (EPDM) rubber, chloroprene polymer (neoprene) rubber, or chlorosulfonated polyethylene (Hypalon) rubber sheet lining materials as indicated herein. The shop drawing submittal shall contain technical information that confirms the suitability of the lining material system for long-term contact with each chemical to be stored. The service temperatures are expected to be up to 150 degrees F.

2. Neoprene sheet lining material shall be synthetic rubber formulated for steam curing at atmospheric pressure. The minimum lining thickness shall be 3/16 inch. The lining material shall be Polymeric Protective Linings BFG 2011 (59688), or equal.

3. Chlorobutyl sheet lining material shall be synthetic rubber formulated for steam curing at atmospheric pressure. The minimum lining thickness shall be 3/16-inch. The lining material shall be Polymeric BFG 1051 (60924), or equal.

4. Natural rubber (soft) sheet lining material shall be soft natural rubber formulated for steam curing at atmospheric pressure. The minimum lining thickness shall be 3/16 inch. The lining material shall be Polymeric BFG 2004 (83160), or equal.

5. Material rubber (hard) sheet lining material shall be a hard, natural rubber resistant to oxidizing agents and formulated for autoclave curing. The minimum lining thickness shall be 3/16 inch. The lining material shall be Polymeric BFG 1006 (8631), or equal.

6. EPDM sheet lining material shall be synthetic rubber suitable for use as a lining for 50 percent sulfuric acid solution and formulated for autoclave or steam curing under pressure. The lining material shall be Polymeric BFG 1039 (EP 156), or equal.

7. Hypalon sheet lining material shall be synthetic rubber suitable for use as a lining for 50 percent sulfuric acid solution. The lining material shall be Polymeric BFG 2045 (8706), or equal.

8. Primers, adhesives, activators, accelerators and other necessary materials shall be as specified by the sheet material manufacturer.

9. Metal Surface Preparation: Prior to abrasive blast cleaning the base metal shall be prepared as specified by the sheet lining material manufacturer's installation instructions. If the instructions differ from these specifications the higher degree of cleaning and surface preparation shall be provided. Abrasive blast cleaning shall be done in accordance with this Section.

10. Installation of lining materials shall be in accordance with the material manufacturer's written installation instructions. All interior surfaces shall be lined, including all piping, vents, fittings, flange faces, manhole covers and blind flanges.

11. The lining system shall be holiday tested in accordance with this Section before and after curing.

12. The lining system shall be cured by steam using the time and temperature as specified by the material manufacturer.

J. **System 108 - Epoxy, Concrete:** The coating material shall be an amino cured epoxy material suitable for long-term immersion in water and wastewater and for service where subjected to occasional splash and spillage of water and wastewater treatment chemicals. The finish coating material shall have a minimum solids content of 69 percent by volume. If used for potable water service the finish coating material shall be listed by the NSF International as in compliance with NSF Standard 61, and shall conform with state and local health regulations and policies for service in potable water. The filler-sealer shall be a 1000 percent solids amine-cured epoxy material with silica and inert fillers.

1. **Filler-sealer:** Plastic 9029 (applied by squeegee); Tnemec 69-1211 (6-8 mils) followed by Tnemec 63-1500; Ameron Nu-Klad 105A followed by Nu-Klad 114A (two coats) or equal.

2. Finish coats (two or more, DFT = 12 mils); Plasite 9133; Tnemec 69; Ameron Amercoat 395, or equal. On walking surfaces use a non-skid additive such as Ameron 886 in the final coat.

K. **System 109 - Not Used**

L. **System 110 - Not Used**

M. **System 111 - Vinyl Ester:** Vinyl ester resin coating material with an inert flake pigment suitable for immersion service in 30 percent hydrochloric acid and 30 percent sulfuric acid solutions.

1. Two or more coats (DFT = 40 mils), Plasite 4100, or equal. Use a prime coat as recommended by the material manufacturer.

N. **System 112 - Vinyl Ester, Concrete:** Vinyl ester resin coating material with an inert flake pigment suitable for immersion service in hydrochloric acid and sulfuric acid solutions. The filler-sealer shall be a 100 percent solids amine-cured epoxy or vinyl ester material with silica and inert fillers. The filler-sealer is applied to the entire concrete surface. A 100 percent solids epoxy or vinyl ester surfacer shall be used to fill holes and patch the concrete surface after abrasive blasting.

1. Prime coat (filler-sealer), applied in two coats using a squeegee to achieve a smooth void-free surface, Plasite 9028 MI, or equal.

2. Finish coats (two or more, DFT = 40 mils), Plasite 4100, or equal.

2.3 SPECIAL COATING SYSTEMS

A. **System 200 - PVC Tape:** Prior to wrapping the pipe with PVC tape, the pipe and fittings first shall be primed using a primer recommended by the PVC tape manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half-lapped, to a total thickness of 40 mils.

B. **System 201 - Rich Portland Cement Mortar:** Rich Portland cement mortar coating shall have a minimum thickness of 1/8-inch, followed by enclosure in an 8-mil thick polyethylene sheet with all joints and edges lapped and sealed with tape.

C. **System 203 - Epoxy Surfacing:** Two-component epoxy floor surfacing shall be formulated to resist many acids, alkalies, and solvents. Material shall be resistant to liquid alum, sodium hydroxide, and 50 percent sulfuric acid. Products shall be as follows, or equal:

1. Prime coat Nu-Klad 105; finish coat Nu-Klad 110 (1/4-inch thick), or equal.

D. **System 204 - Water-Retardant:** Two coats (or single coat if manufacturer recommends in writing) of a clear, non-staining, silane-modified-siloxane masonry water-retardant material. The water-retardant system after application shall be provided with not less than a five-year warranty on the performance of the product.

1. TAMMS Barricade Series; Rainguard "Blok-Lok"; or equal.

   Surfaces shall be cleaned with a chemical cleaner approved by the manufacturer and power wash. Surfaces shall be clean and dry before application of the material. Method and rate of application shall be in accordance with manufacturer's published instructions. A manufacturer's representative shall be present during applications if necessary for warranty.

E. **System 205 - Polyethylene Encasement:** Application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C.

F. **System 206 - Cement Mortar Coating:** A 1-1/2-inch minimum thickness mortar coating reinforced with 3/4-inch galvanized welded wire fabric shall be provided. The cement mortar shall contain no less than one part Type V cement to 3 parts sand. The cement mortar shall be cured by a curing compound meeting the requirements of "Liquid Membrane-Forming Compounds for Curing Concrete" ASTM C 309-81, Type II, white pigmented, or by enclosure in an 8-mil thick polyethylene sheet with all joints and edges lapped by at least 6 inches.

G. **System 207 - Not Used**

H. **System 208 - Aluminum Metal Isolation**: Two coats of a high build polyamide epoxy painting, such as Tnemec 66, or equal (8 mils). Total thickness of system DFT = 8.0 mils.

I. **System 209 - Alkyd-Wood:** Industrial quality, gloss or semi-gloss, medium long oil alkyd coating material with a minimum solids content of 49 percent by volume. Primer shall be an alkyd primer as recommended by the manufacturer.

1. Prime coat DFT = 3 mils
2. Finish coats (two or more, DFT = 3 mils), Amercoat 5401, Tnemec 2H, or equal.
3. Total system DFT = 6 mils.

J. **System 210 - Acrylic-Wood:** Single component, water-based acrylic latex coating material with a fungicide additive and a minimum solids content of 35 percent by volume. Primer shall be an alkyd primer as recommended by the manufacturer.

1. Prime coat DFT = 2 mils.

2. Finish coats (two or more, DFT = 6 mils), Amerguard 220, Carboline 3300, Tnemec 6, or equal.
3. Total system DFT = 8 mils.

K. **System 211 - Acrylic Drywall:** Single component, water-based acrylic latex coating material with a fungicide additive and a minimum solids content of 35 percent by volume. Primer shall be a PVA sealer as recommended by the manufacturer.

1. Prime coat DFT = 1.5 mils.
2. Finish coats (two or more, DFT = 6 mils), Amerguard 220, Carboline 3300, Tnemec 6, or equal.
3. Total system DFT = 7.5 mils.

PART 3 -- EXECUTION

3.1 WORKMANSHIP

A. Skilled craftsmen and experienced supervision shall be used on all WORK.

B. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure thorough cleaning and an adequate thickness of coating material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given to insure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures.

C. All damage to surface resulting from the WORK shall be cleaned, repaired, and refinished to original condition.

3.2 STORAGE, MIXING, AND THINNING OF MATERIALS

A. **Manufacturer's Recommendations:** Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

B. All protective coating materials shall be used within the manufacturer's recommended shelf life.

C. **Storage and Mixing:** Coating materials shall be stored under the conditions recommended by the Material Safety Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.3 PREPARATION FOR COATING

A. **General:** All surfaces to receive protective coatings shall be cleaned as indicated prior to application of coatings. The CONTRACTOR shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. All marred or abraded spots

on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application. Surfaces to be coated shall be dry and free of visible dust.

B. **Protection of Surfaces Not to be Coated:** Surfaces which are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations.

C. All hardware, lighting fixtures, switchplates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.

D. Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The CONTRACTOR shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

E. **Protection of Painted Surfaces:** Cleaning and coating shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly-coated surfaces.

3.4 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification:

1. **Solvent Cleaning (SSPC-SP1):** Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.

2. **Hand Tool Cleaning (SSPC-SP2):** Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.

3. **Power Tool Cleaning (SSPC-SP3):** Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.

4. **White Metal Blast Cleaning (SSPC-SP5):** Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.

5. **Commercial Blast Cleaning (SSPC-SP6):** Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.

6. **Brush-Off Blast Cleaning (SSPC-SP7):** Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust and paint which cannot be removed by a dull putty knife may remain.

7. **Near-White Blast Cleaning (SSPC-SP10):** Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.

3.5 METAL SURFACE PREPARATION (UNGALVANIZED)

A. The minimum abrasive blasting surface preparation shall be as specified in the coating system schedules included at the end of this Section. Where there is a conflict between these specifications and the coating manufacturer's printed recommendations for the intended service, the more stringent degree of cleaning shall apply.

B. Workmanship for metal surface preparation shall be in conformance with the current SSPC Standards and this Section. Blast cleaned surfaces shall match the standard samples available from the National Association of Corrosion Engineers, NACE Standard TM-01-70 - Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive and TM-01-75 - Visual Standard for Surfaces of New Steel Centrifugally Blast Cleaned with Steel Grits...

C. Oil, grease, welding fluxes and other surface contaminants shall be removed by solvent cleaning per SSPC-SP1 prior to blast cleaning.

D. All sharp edges shall be rounded or chamfered and all burrs, and surface defects and weld splatter shall be ground smooth prior to blast cleaning.

E. The type and size of abrasive shall be selected to produce a surface profile that meets the manufacturer's recommendation for the specific coating and service conditions. Abrasive shall not be used unless approved by the CONSTRUCTION MANAGER.

1. Submerged and Severe Service

a. Automated blasting systems shall not be used for surfaces that will be in submerged service but are acceptable for severe service.

b. Abrasives for submerged and severe service coatings shall be clean, hard, sharp cutting crushed: no metallic abrasives shall be used.

2. Other Services

a. Either automated or manual methods of blasting may be used.

b. Abrasives shall be clean, oil-free metallic abrasives, composed of at least 50 percent grit.

F. The CONTRACTOR shall comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.

G. Compressed air for air blast cleaning shall be supplied at adequate pressure from well maintained compressors equipped with oil/moisture separators which remove at least 95 percent of the contaminants.

H. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming or another approved method prior to painting.

I. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.

J. Damaged or defective coating shall be removed by the specified blast cleaning to meet the clean surface requirements before recoating.

K. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC-SP2, or SSPC-SP3 may be used.

L. Shop applied coatings of unknown composition shall be completely removed before the specified coatings are applied. Valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC-SP1 before the abrasive blast cleaning work has been started.

M. Shop primed equipment shall be solvent cleaned in the field before finish coats are applied.

3.6 SURFACE PREPARATION FOR GALVANIZED FERROUS METAL

A. Galvanized ferrous metal shall be alkaline cleaned per SSPC-SP1 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system to be used, followed by brush-off blast cleaning per SSPC-SP7.

B. Pretreatment coatings of surfaces shall be in accordance with the printed recommendations of the coating manufacturer.

3.7 SURFACE PREPARATION OF FERROUS SURFACES WITH EXISTING COATINGS, EXCLUDING STEEL RESERVOIR INTERIORS

A. **General:** All grease, oil, heavy chalk, dirt, or other contaminants shall be removed by solvent or detergent cleaning prior to abrasive blast cleaning. The generic type of the existing coatings shall be determined by laboratory testing.

B. **Abrasive Blast Cleaning:** The CONTRACTOR shall provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not specified in the schedule, deteriorated coatings shall be removed by abrasive blast cleaning to SSPC-SP6, Commercial Blast Cleaning. Areas of tightly adhering coatings shall be cleaned to SSPC-SP7, Brush-off Blast Cleaning, with the remaining thickness of existing coating not to exceed 3 mils.

C. **Incompatible Coatings:** If coatings to be applied are not compatible with existing coatings the CONTRACTOR shall apply intermediate coatings per the paint manufacturer's recommendation for the specified coating system or shall completely remove the existing coating prior to abrasive blast cleaning. A small trial application shall be conducted for compatibility prior to painting large areas.

D. **Unknown Coatings:** Coatings of unknown composition shall be completely removed prior to application of new coatings.

E. **Water Abrasive or Wet Abrasive Blast Cleaning:** Where indicated or where job site conditions do not permit dry abrasive blasting for industrial coating systems due to dust or air pollution considerations, water abrasive blasting or wet abrasive blasting may be used. In both methods, paint-compatible corrosion inhibitors shall be used, and coating application shall begin as soon as the surfaces are dry. Water abrasive blasting shall be done using high pressure water with sand injection. In both methods, the equipment used shall be commercially produced equipment with a successful service record. Wet blasting methods shall not be used for submerged and severe service coating systems unless indicated.

3.8 CONCRETE AND CONCRETE BLOCK MASONRY SURFACE PREPARATION

A. Surface preparation shall not begin until at least 30 days after the concrete or masonry has been placed.

B. All oil, grease, and form release and curing compounds shall be removed by detergent cleaning per SSPC-SP1 before abrasive blast cleaning.

C. Concrete, concrete block masonry surfaces and deteriorated concrete surfaces to be coated shall be abrasive blast cleaned to remove existing coatings, laitance, deteriorated concrete, and to roughen the surface equivalent to the surface of the No. 80 grit flint sandpaper.

D. If acid etching is required by the coating application instructions, the treatment shall be made after abrasive blasting. After etching, rinse surfaces with water and test the pH. The pH shall be between neutral and 8.

E. Surfaces shall be clean and as recommended by the coating manufacturer before coating is started.

F. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model DB, or equal.

3.9 PLASTIC, FIBER GLASS, AND NONFERROUS METALS SURFACE PREPARATION

A. Plastic and fiber glass surfaces shall be sanded or brush off blast cleaned prior to solvent cleaning with a chemical compatible with the coating system primer.

B. Non-ferrous metal surfaces shall be solvent-cleaned SSPC-SP1 followed by sanding or brush-off blast cleaning SSPC-SP7.

C. All surfaces shall be clean and dry prior to coating application.

3.10 ARCHITECTURAL CONCRETE BLOCK MASONRY SURFACE PREPARATION

A. The mortar surfaces shall be cured at least 14 days before surface preparation work is started.

B. Dust, dirt, grease, and other foreign matter shall be removed prior to abrasive blasting.

C. The masonry surfaces shall be prepared in accordance with the material manufacturer's printed instructions.

3.11 SHOP COATING REQUIREMENTS

A. Unless indicated otherwise, items of equipment, or parts of equipment which are not submerged in service, shall be shop primed and then finish coated in the field after installation with the indicated or approved color. The methods, materials, application equipment and all other details of shop painting shall comply with this section. If the shop primer requires topcoating within a specified period of time, the equipment shall be finish coated in the shop and then touch-up painted after installation.

B. All items of equipment, or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have all surface preparation and coating work performed in the field.

C. For certain pieces of equipment it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switchgear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the specified quality in the field. Such equipment shall be primed and finish coated in the shop and touched up in the field with the identical material after installation. The CONTRACTOR shall require the manufacturer of each such piece of equipment to certify as part of its shop drawings that the surface preparation is in accordance with these specifications. The coating material data sheet shall be submitted with the shop drawings for the equipment.

D. For certain small pieces of equipment the manufacturer may have a standard coating system which is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the shop drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.

E. Shop painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 2 months before topcoated, or less time if recommended by the coating manufacturer.

F. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturer's printed instructions.

G. The CONTRACTOR shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment shop drawings.

3.12 APPLICATION OF COATINGS

A. The application of protective coatings to steel substrates shall be in accordance with "Paint Application Specification No. 1, (SSPC-PA1)," Steel Structures Painting Council.

B. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The CONTRACTOR shall schedule such inspection with the CONSTRUCTION MANAGER in advance.

C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

D. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

E. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe painting for these areas.

F. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

G. Finish coats, including touch-up and damage repair coats shall be applied in a manner which will present a uniform texture and color matched appearance.

H. Coatings shall not be applied under the following conditions:

1. Temperature exceeding the manufacturer's recommended maximum and minimum allowable.
2. Dust or smoke laden atmosphere.
3. Damp or humid weather.
4. When the substrate or air temperature is less than 5 degrees F above the dewpoint.
5. When air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dewpoint within 8 hours after application of coating.
6. When wind conditions are not calm.

I. Dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Dept. of Commerce, Weather Bureau psychometric tables.

J. Steel piping shall be abrasive blast cleaned and primed before installation.

K. The finish coat on all work shall be applied after all concrete, masonry, and equipment installation is complete and the work areas are clean and dust free.

3.13 CURING OF COATINGS

A. The CONTRACTOR shall maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the stringent, prior to placing the completed coating system into service.

B. In the case of enclosed areas, forced air ventilation, using heated air if necessary, may be required until the coatings have fully cured.

C. **Forced Air Ventilation of Steel Reservoirs and Enclosed Hydraulic Structures:** Forced air ventilation is required for the application and curing of coatings on the interior surfaces of enclosed hydraulic structures. During application and curing periods continuously exhaust air from the lowest level of the structure using portable ducting. After all interior coating operations have been completed provide a final curing period for a minimum of 10 days, during which the forced ventilation system shall operate continuously. For additional requirements, refer to the specific coating system being used in the.

3.14 TESTING FOR VOLATILE ORGANIC COMPOUNDS IN POTABLE WATER RESERVOIRS

A. **General**: The CONTRACTOR shall provide the following services to ensure that the interior reservoir coatings or linings do not convey volatile organic compounds to the potable water.

B. **Selection of Coating or Lining Material**: The CONTRACTOR shall provide a coating or lining system that has a successful record in meeting the national, regional, and local regulations and policies pertaining to leaching of volatile organic compounds into potable water.

C. Before the coating or lining materials are used, the CONTRACTOR shall by letter notify the regulatory agency having jurisdiction. The letter shall describe the proposed materials, including brand names, catalog numbers, catalog technical data, application and curing instructions, and material safety data sheets.

D. The CONTRACTOR shall provide curing time, temperature and ventilations as required by the manufacturer or this Section, whichever is the more stringent requirement. In some cases, the CONTRACTOR may find it necessary to extend the curing time or ventilation time beyond the requirements in order to comply with the regulatory agency requirements or to reduce the leached organic compounds to the required levels. All costs in connection with any extended curing times required for curing shall be at no additional cost to the OWNER.

E. Following the curing or ventilation period, the CONTRACTOR shall clean, disinfect and fill the reservoir as specified.

F. A 7-day soaking period shall follow initial filling to determine the presence of any leached organics. Before the tank is placed into service, samples of the water in the tank will be taken by the CONSTRUCTION MANAGER and analyzed by a laboratory approved by the State of California or the EPA. Analyses will be for volatile organic compounds by EPA Method 524.1 - Volatile Organic Compounds in Water by Purge and Trap Gas Chromatography/Mass Spectrometry or 524-2 or equivalent (this test includes TCE, PCE, xylenes, toluene, ketones, carbon tetrachloride, and similar compounds).

G. If the test results are above either (1) 0.005 mg/l for TCE, 0.004 mg/l for PCE, 0.62 mg/l for xylenes, 0.10 mg/l for toluene, 0.75 mg/l for methyl-ethyl ketone (to be used as representative for all ketone compounds), 0.005 mg/l for carbon tetrachloride, or (2) the regulatory agency's recommended Action Level Limits, whichever is less, the CONTRACTOR shall drain the water from the tank and flush, refill, and retest at no additional cost to the OWNER. The CONTRACTOR shall provide as many curing, soaking, and flushing cycles as necessary to reduce the leached volatile organic compounds to levels below the requirements.]

3.15 IDENTIFICATION OF PIPING

A. Identification of piping shall be in accordance with Section 15030, "Piping Identification Systems."

B. Every valve or connection, where it may be possible for a worker to be exposed to a hazardous substance, shall be labeled per General Industry Safety Orders, Article 112 and 5194.

C. All unburied pipe in structures and in chemical pipe trenches shall be color-code painted. Colors shall be as selected by the CONSTRUCTION MANAGER, or as indicated.

3.16 COATING SYSTEM SCHEDULES - FERROUS METALS

A. **Coating System Schedule, Ferrous Metal - Not Galvanized:**

	Item	**Surface Prep.**	**System No.**
FM-1	All surfaces indoors and outdoors, exposed or covered, except those included below.	Commercial blast cleaning SSPC-SP6	(1) alkyd enamel
FM-1	All surfaces indoors and outdoors, exposed or covered, except those included below.	Commercial blast cleaning SSPC-SP6	(4) aliphatic polyurethane
FM-1	All surfaces indoors and outdoors, exposed or covered, except those included below.	Near white metal blast cleaning SSPC-SP10	(5) inorganic zinc/polyurethane
FM-2	(NOT USED)		
FM-3	Surfaces of equipment and ferrous surfaces submerged or intermittently submerged in potable water or utility water, including all surfaces lower than 2 feet above high water level and all surfaces inside enclosed hydraulic structures and vents (excluding shop-coated valves, couplings, pumps).	White metal blast cleaning SSPC-SP5	(100) amine-cured epoxy
FM-4	(NOT USED)		

	Item	Surface Prep.	System No.
FM-5	(NOT USED)		
FM-6	Buried small steel pipe.	Removal of dirt, grease, oil	(200) PVC tape
FM-7	Where indicated, ferrous surfaces in water passages of all valves 4-inch size and larger, exterior surfaces of submerged valves.	White metal blast cleaning SSPC-SP5	(100) amine-cured epoxy
FM-8	Where indicated, ferrous surfaces in water passages and submerged surfaces of all pumps which have discharge size of 4 inches or larger.	White metal blast cleaning	(100) amine-cured epoxy
FM-9	Ferrous surfaces of sleeve-couplings.	Solvent cleaning SSPC-SP1, followed by near-white metal blast cleaning SSPC-SP5	(106) fusion-bonded epoxy
FM-10	All ferrous surfaces of sluice gates, flap gates, and shear gate, including wall thimbles.	White metal blast cleaning SSPC-SP5	(100) amine-cured epoxy
FM-11	Buried surfaces that are not indicated to be coated elsewhere.	White metal blast cleaning SSPC-SP5	(100) amine-cured epoxy
FM-12	(NOT USED)		
FM-13	(NOT USED)		
FM-14	Structural steel, miscellaneous metalwork, and supports for prefabricated metal buildings	Per FM-1	Per FM-1
FM-15	Structural steel, miscellaneous metalwork, and supports for roof and facia support systems for buildings	Per FM-1	Per FM-1

	Item	Surface Prep.	System No.
FM-16	Surfaces of indoor equipment, not submerged.	Commercial blast cleaning SSPC-SP6	(8) epoxy, equipment
FM-17	The following existing equipment: Pumps P-103, P-104, all piping, painted electrical boxes, pipe supports, electrical supports, and all existing painted ferrous materials within the existing dry well shall be re-coated as part of this CONTRACT. Work excluded from this re-coating includes: existing non-painted services, structural steel supporting the multiple mezzanines and catwalks, and equipment outside the drywell.	Minimum preparation shall be the more stringent requirement of either the manufacturer's requirements for service preparation or per SSPC-SP2, hand tool cleaning removal of loose rust, mill scale, and loose paint, by hand chipping, scraping, sanding and wire brushing; not all mill scale, rust and paint may not be removed by this process, but loose mill scale, loose rust, loose paint and other detrimental foreign matter present shall be removed.	Prime and Recoat per FM-1 requirements
FM-18	Buried pipe couplings, valves, fittings, and flanged joints (where piping is plastic).	Removal of dirt, grease, oil	(201) rich Portland cement mortar
FM-19	Buried pipe couplings, valves, and flanged joints (where piping is ductile or cast iron, not tape-coated), including epoxy-coated surfaces.	As specified by reference specification	(205) polyethylene encasement
FM-20	Buried pipe couplings, valves, and flanged joints (where pipe is mortar-coated steel or reinforced concrete), including epoxy-coated surfaces.	Removal of dirt, grease, oil	(206 cement-mortar coating

B. **Coating System Schedule, Ferrous Metal - Galvanized:** Pretreatment coatings, barrier coatings, or washes shall be applied as recommended by the coating manufacturer. All galvanized surfaces except for the following items shall be coated unless coating is required by other Sections: (1) Floor gratings and frames, (2) Handrails, (3) Stair treads, (4) Chain link fencing and appurtenances.

	Item	Surface Prep.	System No.
FMG-1	All exposed surfaces indoors and outdoors, except those included below.	Solvent cleaning SSPC-SP1	(1) alkyd enamel
FMG-1	All exposed surfaces indoors and outdoors, except those included below.	Solvent cleaning SSPC-SP1	(4) aliphatic polyurethane
FMG-2	(NOT USED)		
FMG-3	Buried small steel pipe.	Removal of dirt, grease, oil	(200) PVC tape
FMG-4	Buried miscellaneous surfaces, couplings, valves, and flanged joints.	Removal of dirt, grease, oil	(201) rich Portland cement mortar
FMG-5	Indoor sheet metal flashings, exposed ducts.	Solvent cleaning SSPC-SP1	(1) alkyd enamel
FMG-6	Surfaces buried or submerged in water or wastewater, including all surfaces lower than two feet above high water level and all surfaces inside enclosed hydraulic structures and vents.	Solvent cleaning SSPC-SP1 followed by brush-off grade blast cleaning SSPC-SP7	(100) amine-cured epoxy

C. **Coating System Schedule, Steel Water Reservoir Interior**: (NOT USED)

D. **Coating System Schedule, Steel Digester Floating Covers and Digester Gasholders:** (NOT USED)

E. **Coating System Schedule, Interior Surfaces of Welded Steel Tanks:** (NOT USED)

3.17 COATING SYSTEM SCHEDULE, NON-FERROUS METAL, PLASTIC, FIBER GLASS

A. Where isolated non-ferrous parts are associated with equipment or piping, the CONTRACTOR shall use the coating system for the adjacent connected surfaces. Do not coat handrails, gratings, frames or hatches. Only primers recommended by the coating manufacturer shall be used.

	Item	Surface Prep.	System No.
NFM-1	All exposed surfaces, indoors and outdoors, except those included below.	Solvent cleaned SSPC-SP1	(1) alkyd enamel
NFM-1	All exposed surfaces, indoors and outdoors, except those included below.	Solvent cleaned SSPC-SP1	(4) aliphatic polyurethane
NFM-2	(NOT USED)		
NFM-3	Aluminum surfaces in contact with concrete, or with any other metal except galvanized ferrous metal.	Solvent cleaned SSPC-SP1	(208) aluminum metal isolation
NFM-4	Polyvinyl chloride plastic piping, indoors and outdoors, or in structures, not submerged.	Solvent cleaned SSPC-SP1	(7) acrylic latex
NFM-5	Fiber glass surfaces.	Per Paragraph [3.8]	(12) aliphatic polyurethane-fiber glass
NFM-6	Buried non-ferrous metal pipe.	Removal of dirt, grease, oil	(200) PVC tape

3.18 COATING SYSTEM SCHEDULE-CONCRETE

	Item	Surface Prep.	System No.
C-1	Exposed indoors and outdoors, as shown.	Per Paragraph 3.8	(10) acrylic, concrete
C-1	All surfaces indoors and outdoors, as indicated.	Per paragraph 3.8	(11) aliphatic polyurethane, concrete]
C-2	Submerged in water or wastewater including surfaces up to 2 feet above high water line and down to 2 feet below low water	Per Paragraph 3.8	(108) epoxy, concrete

	Item	Surface Prep.	System No.
	line and all surfaces in an enclosed structure, as shown.		
C-2	Submerged in wastewater including surfaces up to 2 feet above high water line and down to 2 feet below low water line and all surfaces in an enclosed structure, as shown.	Per Paragraph 3.8	(112) vinyl ester, concrete
C-3	Floor slab, exposure to chemicals, as shown.	Per Paragraph 3.8	(203) epoxy surfacing
C-4	Wall, floors, exposure to chemical splash, washdown, as indicated.	Per paragraph 3.8	(11) aliphatic polyurethane concrete
C-5	Interior surfaces of sewer manholes, including bottom, and metal appurtenances, for manholes indicated.	Per Paragraph 3.8	(12) vinyl ester, concrete
C-6	Specifier list of existing concrete surfaces which are required to be recoated as part of this work and as shown.	Specifier enter	Specifier enter

3.19 COATING SYSTEM SCHEDULE-CONCRETE BLOCK MASONRY (NOT USED)

** END OF SECTION **

SECTION 09810 - POLYETHYLENE TAPE COATING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The WORK of this Section includes providing a prefabricated, cold-applied, multilayer, polyethylene tape coating system for steel pipe.

B. Except as described in this Section, the coating system shall be in accordance with ANSI/AWWA C214 for straight pipe sections and ANSI/AWWA C209 for fittings, specials, and field joints.

1.2 RELATED SECTIONS

A. The WORK of the following Section applies to the WORK of this Section. Other Sections of the Specification, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02651 Steel Pipe, Lined and Coated
2. Section 02653 Fabricated Steel Pipe and Specials
3. Section 09800 Protective Coating

1.3 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.

B. References herein to "SSPC Specifications" or "SSPC" shall mean the published standards of the Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh, PA 15213.

C. **Commercial Standards:**

ANSI/AWWA C200	Steel Water Pipe 6 inches and larger
ANSI/AWWA C209	Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
ANSI/AWWA C214	Tape Coating Systems for the Exterior of Steel Water Pipelines

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. **Coating Materials List:** The CONTRACTOR shall submit a list of the tape coating materials which indicates the manufacturer, product numbers, and thickness of the materials.

2. **Materials Information:** For each material, the CONTRACTOR shall submit technical data sheets which itemize technical and performance information that indicates compliance with this Section.

3. **Samples:** Samples of the materials shall be submitted for testing by the ENGINEER. Each sample shall be clearly identified for catalog number, size, color, and other information required for testing.

1.5 FACTORY AND FIELD INSPECTION AND TESTING

A. The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture. This shall include costs for travel, meals, lodging, and car rental for two OWNER-designated inspectors for 2 days required to complete such inspections or observations exclusive of travel days, if the place of manufacture, fabrication and factory testing is more than fifty (50) miles outside the geographical limit of the City. The CONTRACTOR shall not be responsible for salary or salary-related costs of the inspectors.

B. The CONTRACTOR shall provide the CONSTRUCTION MANAGER a minimum of 14 days advance notice of the start of any shop coating work and a minimum of 3 days advance notice for field work.

C. Unless the CONSTRUCTION MANAGER has granted prior approval, all coating work shall be performed in the presence of the CONSTRUCTION MANAGER.

D. **Inspection Devices:** The CONTRACTOR shall furnish inspection devices that are calibrated and in good working condition for the detection of holidays and measurement of coating film thicknesses.

E. **Inspection:** The CONTRACTOR shall retain the services of trained technicians to test the coating system in the shop and field, and prepare reports, at no additional cost to the OWNER. As a minimum, the tests shall include holiday detection and coating film thickness.

F. Tape application to straight pipe sections shall be monitored using instrumentation devices that continuously measure and record the tape width drawdown and the tape temperature. Each tape application station shall be equipped with the instrumentation devices. The tape tensions and temperatures shall be controlled using the data obtained from the instrumentation devices.

G. **Manufacturer Representative:** The CONTRACTOR shall require the tape material manufacturer to furnish a qualified factory technical representative to visit the pipe coating shop for technical support at the beginning of the tape coating operation and as may be necessary to resolve shop or field problems.

H. **Holiday Detection:** Prior to application of the first layer of mechanical protection tape, the inner layer tape shall be electrically tested for coating flaws with a holiday detector approved by the CONSTRUCTION MANAGER. Holidays detected shall be immediately repaired and retested before application of the first layer of mechanical protection tape.

I. Immediately before the coated pipe is lowered into the trench, the CONTRACTOR shall provide a visual and holiday inspection of the coating on the underside of the pipe.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Materials shall be stored within the temperature ranges specified for application, using heated areas if necessary. Tape shall be stored at a minimum temperature of 70 degrees F.

B. Pipe shall be square-stacked no more than 2 high on padded supports or racks. Lifting equipment shall be padded and wide fabric slings shall be used. To the extent possible, the coated pipe shall be handled from the cut-back ends.

C. Tie down devices shall be padded where in contact with the pipe.

PART 2 -- PRODUCTS

2.1 COATING SYSTEMS

A. **Storage of Materials:** Materials shall be stored within the temperature ranges specified for application, using heated storage areas if necessary. Tape shall be stored at a minimum temperature of 70 degrees F.

B. **Mortar Coating:** A one-inch thick reinforced mortar coating shall be applied over the tape coat system. The mortar coating shall meet the requirements of ANSI/AWWA C205.

2.2 MANUFACTURERS

A. Products shall be of the following manufacture, type, and model (or equal):

1. **Straight Pipe:** Polyken Technologies

Primer	1029
Filler tape	939
Weld stripping tape	933-25 black
Inner layer tape	989-20 black
Middle layer tape	955-30 gray
Outer layer tape	956-30 white

2. **Fittings, Specials, and Field Joints:** Polyken Technologies

Primer	1029
Filler tape	939
Inner layer tape	930-50 black
Outer layer tape	955-30 white

PART 3 -- EXECUTION

3.1 TAPE APPLICATION

A. Tape coating materials shall be applied in accordance with this Section, the product application instructions of the tape manufacturer, and the field technical support instructions from the manufacturer.

3.2 WELD SURFACE PREPARATION

A. To provide for an effective, long-term bond between the tape coating system and the substrate, the following pipe weld surface preparation shall be provided.

1. Weld surfaces with a reinforcement greater than 1/32-inch and all longitudinal and coil splice welds shall be ground to provide a smooth surface with a reinforcement not exceeding 1/32-inch. The resulting weld surface shall have a cross-section shape that is free of discontinuities, abrupt changes in curvature, with no ridges or valleys that may promote bridging or disbondment of the tape from the substrate.

2. **Weld Stripping Tape:** Weld stripping tape, 6 inches wide, shall be used if any of the following conditions are present. The tape shall be applied with the center of the tape at the weld.

   a. If the CONTRACTOR elects to use stripping tape in lieu of grinding or part of the grinding required above. In such a case, the weld reinforcement shall not exceed 3/32-inch, and the weld surface shall have a cross-section shape that is free of discontinuities, abrupt changes in curvature, with no ridges or valleys that may promote bridging or disbondment of the tape from the substrate.

   b. If the initial pipe sections taped have indications that the inner tape layer is not bonding completely to the pipe at the welds.

   c. If the tape bond to the welds or adjacent surfaces is less than the tape bond to the pipe surface away from the welds.

3. Welds that have been prepared with a reinforcement not exceeding 1/32-inch, and a cross-section slope that is free of discontinuities, abrupt changes in curvature, with no ridges or valleys that may promote bridging or disbondment of the tape from the substrate require no additional preparation.

3.3 PIPE SURFACE PREPARATION

A. Surfaces to be coated shall be detergent cleaned in accordance with SSPC-SP1 prior to abrasive blasting.

B. All burrs, sharp edges, and weld splatter shall be removed prior to abrasive blasting.

C. Immediately before application of the primer, abrasive blasting shall be performed using sand, metallurgical slag, or a combination of steel grit and shot to produce a surface in conformance with SSPC-SP6. Steel grit shall comprise at least 60 percent of the working mix of abrasive, if a centrifugal wheel abrasive blaster is used. The prepared surface shall have a surface profile not exceeding 2 mils.

D. Abrasive blasting and primer application shall be done when the substrate surface is at least 5 degrees F above the dew point. Abrasive blasting, priming, and inner layer tape application shall be done during the same working day for each pipe section.

3.4 PIPE END PREPARATION

A. Coating cut-backs at the pipe ends shall be 6 inches, with the cuts parallel to the pipe ends. Exposed substrate surfaces shall be protected with a storage primer applied immediately after taping and before flash rusting of the surface.

B. Spiral or longitudinal pipe welds within two feet of the pipe ends shall be ground flush prior to abrasive blast cleaning.

C. Pipe ends that will be connected with sleeve-type couplings shall be epoxy coated for immersion service as specified in Section 09800. The cut-backs shall be greater than 6 inches at couplings to provide clearance between the coupling and tape. The epoxy coating shall extend at least 6 inches beyond each side of the sleeve coupling on the outside surface of the pipe.

3.5 APPLICATION OF TAPE

A. Pipe shell temperature shall be maintained within a range of 45 degrees F to 100 degrees F during application of the tape system.

B. Inner layer tapes shall be maintained at a minimum temperature of 70 degrees F during application. Middle and outer layer tapes shall be maintained at a minimum temperature of 90 degrees F during application.

C. Tape application tension shall be maintained at a value that produces a tape width reduction equal to 1.0 to 2.0 percent of the tape width during application, as recommended by the tape manufacturer. This width reduction shall be maintained simultaneously with the minimum tape temperature.

D. At the point of tape application, all tape, including weld stripping tape, shall be pressed onto the pipe with a pressure roller that maintains a constant pressure. Enough pressure shall be used to fully bond the tape at all welds.

E. Filler tape shall be used at lap joints, weld step-downs, and other discontinuities.

F. The tape application equipment and materials shall result in a fully bonded tape coating system, without blisters, voids, wrinkles or any areas that have a lack of bond to the pipe.

G. Succeeding layers of tape shall be applied so that the laps are staggered by at least two inches.

H. Before tape application, the primer shall be dried sufficiently so that the primer is in a tacky to dry condition.

I. Primer shall be applied while it is in a temperature range of 50 degrees F to 80 degrees F, using airless spray equipment and a drum agitator. The primer application shall be of uniform thickness on all pipe surfaces.

3.6 REPAIR PATCHES

A. Repair patches shall be applied by wrapping tape completely around the pipe, using the tape system for joints.

3.7 TAPE APPLICATION TO FITTINGS, SPECIALS, AND PIPE JOINTS

A. Filler tape shall be used to fill voids on fittings, specials, welds, and pipe joints.

B. All bell and spigot joints, lap joints, and other locations where voids will otherwise exist shall be provided specially shaped, filler tape applied after priming.

C. Field pipe joints shall be prepared as required by the paragraph entitled "Pipe Surface Preparation," except that shop blasted surfaces that have been coated with a storage primer or an epoxy coating may be power tool cleaned instead of abrasive blast cleaned. The power tool cleaning shall be done in accordance with SSPC-SP2. Pipe ends not effectively protected with a storage primer shall be abrasive blasted to SSPC-SP6.

** END OF SECTION **

SECTION 11000 - EQUIPMENT GENERAL PROVISIONS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing general requirements for the WORK of applicable Sections of these Specifications. Unless there are more restrictive requirements in the individual Sections, the provisions of this Section shall apply.

B. The WORK of this Section applies to the WORK of the following Sections:

1. Section 11175 Pumps, General
2. Equipment in Divisions 11, 13, 15 and 16.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 05120 Structural Steel
2. Section 05500 Miscellaneous Metalwork
3. Section 09800 Protective Coating
4. Section 11002 Equipment Supports, Grouting and Installation
5. Section 11005 Machine Alignment
6. Section 11020 Vibration and Critical Speed Limitations
7. Section 13300 Instrumentation and Control
8. Section 15000 Piping Components
9. Section 15020 Pipe Supports
10. Section 16030 Electrical Tests
11. Section 16040 Electric Motors
12. Section 16050 Basic Electrical Materials and Methods

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Mechanical Code (UMC)
2. Uniform Plumbing Code (UPC)
3. Uniform Fire Code (UFC)
4. National Electrical Code (NEC)
5. Uniform Building Code (UBC)

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the applicable standards of the following organizations apply to the WORK of this Section:

1. American Society for Testing and Materials (ASTM)
2. American Public Health Association (APHA)
3. American National Standards Institute (ANSI)
4. American Society of Mechanical Engineers (ASME)
5. American Water Works Association (AWWA)
6. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
7. American Welding Society (AWS)
8. National Fire Protection Association (NFPA)
9. National Electrical Manufacturers Association (NEMA)
10. Antifriction Bearing Manufacturers Association (ABMA)
11. American Gear Manufacturers Association (AGMA)

B. The current editions of the following apply to the WORK of this Section:

ABMA 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	Load Ratings and Fatigue Life for Roller Bearings
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy, and Other Special Alloys
ANSI B46.1	Surface Texture
ANSI S12.6	Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors
ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inch)
ANSI/ASME B31.1	Power Piping
ANSI/AWWA D100	Welded Steel Tanks for Water Storage
AWWA C206	Field Welding of Steel Water Pipe
ASTM A 48	Specification for Gray Iron Castings
ANSI A 58.1	Minimum Design Loads for Buildings and Other Structures
ASTM A 108	Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
ANSI/NFPA 70	National Electrical Code
MIL STD 167-2	Mechanical Vibrations of Shipboard Equipment (Reciprocating Machinery and Propulsion System and Shafting)

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Manufacturer's product data including catalogue cuts.

2. Equipment name, identification number and specification numbers.

3. Shop drawings showing details, dimensions, anchorage details, and installation of equipment with all special fittings, appurtenances and required clearances.

4. Shipping weights.

5. Calculations of equipment anchorage forces and anchorage details.

6. Certification that the single manufacturer accepts the indicated unit responsibilities.

7. Parts list with materials of construction by ASTM reference and grade.

8. List of at least 5 installations and telephone numbers, where identical equipment has been used.

9. Documentation of experience of specialist who will perform torsional and vibration analysis.

10. Torsional and lateral vibration analysis reports.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. Manufacturer's catalog including installation instructions.

2. Manufacturer's operating and maintenance procedures including lubricating instructions.

3. Manufacturer's certification that products comply with the indicated requirements.
4. Bearing L-10 life calculations.

5. Certification that products have been factory-tested and found to conform with the contract requirements.

6. Certification that the WORK has been field-tested and the WORK complies with the indicated requirements.

7. Equipment tolerances

8. Electrical data including control and wiring diagrams.

9. Address and telephone number of local service representative.

1.7 SERVICES OF MANUFACTURER

A. **Inspection, Startup, and Field Adjustment:** In accordance with the requirements of Sections 01660 and 01680, an authorized service representative of the manufacturer shall visit the site and witness the following:

1. Installation of the equipment.

2. Inspection, checking, and adjusting the equipment.

3. Startup and field-testing for proper operation.

4. Performing field adjustments to ensure that the equipment installation and operation comply with the Specifications.

B. **Instruction of OWNER'S Personnel**:

1. An authorized service representative of the manufacturer shall instruct the OWNER'S personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Training shall be specific to the models of equipment provided.

2. The representative shall have at least one year of qualified experience in training covering the relevant subjects described in paragraph 11000-1.7B.1. A resume for the representative shall be submitted to the CONSTRUCTION MANAGER.

3. Training shall be scheduled a minimum of 3 weeks in advance of the first session.

4. Proposed training material and a detailed outline of each lesson shall be developed in accordance with the requirements specified in Section 01300, and submitted to the CONSTRUCTION MANAGER for review. Comments from the CONSTRUCTION MANAGER shall be incorporated into the material.

5. Training materials shall remain with the trainees.

6. The OWNER may videotape the training sessions for later use with the OWNER'S personnel.

C. **Local Service:** The manufacturer shall have a local service agency (within 50 miles of the site) which maintains properly trained personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.

1.8 FACTORY INSPECTION AND TESTING

A. The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture. This shall include costs for travel, meals, lodging, and car rental for two OWNER-designated inspectors for the number of days indicated to complete such inspections or observations, if the place of manufacture, fabrication and factory testing is more than fifty (50) miles outside the geographical limit of the City. The CONTRACTOR shall not be responsible for salary or salary-related costs of the inspectors.

B. **Product Testing:** Products shall be tested at the factory for compliance with the indicated requirements. The CONTRACTOR shall provide the CONSTRUCTION MANAGER a written notification of testing dates at least 2 weeks in advance of testing, unless more advance notice is specified elsewhere.

C. **Balancing**: Rotating elements of equipment, except small, commercially packaged equipment, shall be statically and dynamically balanced at the factory prior to final assembly. The CONTRACTOR shall furnish certified copies of all test results.

1.9 FIELD TESTING

A. **Testing:** Products shall be field-tested for compliance with the indicated requirements.

B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness field tests.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials:** Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer. Materials delivered onsite without an approved submittal for verification shall be rejected and payment withheld.

B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

C. **Protection of Equipment**: Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment with anti-friction or sleeve bearings shall be stored in weather tight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers shall not be used to prevent accumulation of condensate in gears and bearings. Gears and bearings to be stored for extended periods shall be containerized suitable for export shipment.

D. **Investigation of Failed Products:** Prior to disposal of failed products, the CONTRACTOR shall investigate the causes of failure and submit a report to the CONSTRUCTION MANAGER, who will subsequently direct the CONTRACTOR for disposal.

1.11 UNIT RESPONSIBILITY

A. Equipment systems made up of two or more components shall be provided as a unit by the manufacturer of the driven equipment. The manufacturer of the driven equipment shall assume the unit responsibility. Unless otherwise indicated, the CONTRACTOR shall cause each system component to be furnished by the manufacturer with unit responsibility. The extent of the manufacturer's responsibilities shall include engineering the specified equipment, preparation of all submittal materials, coordinating manufacture and procurement, compatibility and shipment of all specified components, design of all equipment supports, providing installation and testing specialists to assist the CONTRACTOR in completing the installation and commissioning the equipment, furnishing factory certified specialists to train the OWNER's staff, and the production and submission of specified operation and maintenance manuals. The CONTRACTOR is responsible to the OWNER for performance of all systems as indicated. The CONTRACTOR shall ensure the submittal of a Certificate of Unit Responsibility signed by the manufacturer with unit responsibility.

1.12 TORSIONAL AND VIBRATION ANALYSIS

A. **Torsional Analysis**: The drive train shall be free from torsional criticals which produce combined (steady plus transient torque induced) stresses exceeding 30 percent of the material's elastic limit (but no more than 18 percent of the material's ultimate tensile strength) at any speed from 20 percent below to 30 percent above the operating speeds required by the specified operating conditions, or during startup, shutdown or drive control transients. In accordance with MIL STD 167-2, under no circumstances shall combined torsional steady state and transient vibratory stresses exceed 4 percent of the material's ultimate tensile strength, nor more than 50

percent of the material's fatigue limit, whichever is less. Stress concentration factors to be used in the equation:

$$S = Scf \times \frac{(G \times D \times \Delta\Theta)}{2L}$$

where:

S	=	stress, psi
Scf	=	stress concentration factor, dimensionless
D	=	minimum shaft diameter, inches, at point of concentration
$\Delta\Theta$	=	twist in shaft between adjacent masses, radians
L	=	effective length between masses, inches
G	=	shear modulus of material, lb/in^2

The Scf, to be applied at all the roots of all keyways and changes in shaft diameter shall be as follows:

Scf	Ratio of fillet radius to shaft diameter
4.3	0.0025
3.7	0.01
3.05	0.02
2.75	0.03
2.6	0.04
2.55	0.05 and greater

Values of Scf between data points in the table above shall be based upon a straight line interpolation.

One analysis is required for each piece of unique equipment and for each set of identical equipment assigned to the same application. This general requirement is applicable under the individual equipment specifications or the equipment type general specifications where more detailed torsional, vibration, critical speed, and/or shaft deflection analyses may be required.

The CONTRACTOR shall submit to the CONSTRUCTION MANAGER a torsional and lateral vibration analysis of the following equipment. The analysis shall be performed by a specialist who has performed, in the recent past, a torsional and lateral vibration analysis on at least one project of comparable size and complexity. The specialist shall be approved by the CONSTRUCTION MANAGER.

1. All engine drives.
2. All blowers and compressors with drives of 100 horsepower and over.
3. All vertical pumps with universal joints and extended shafts.
4. All equipment with variable speed drives, 25 horsepower and over.
5. All other equipment where indicated.

During construction and testing of all engine driven equipment and all gear driven equipment, the torsional analysis specialist shall visit the site and conduct a field torsiograph test on one randomly selected unit in each set of these equipment to verify the desktop torsional analysis. The test shall be conducted on selected accessible portions of the rotating equipment when operating throughout the full range of specified operating conditions.

B. **Field Vibration Analysis**: During construction and testing of all engine driven equipment and all 100 horsepower and larger motor driven equipment operating at less than 1,200 rpm, the above mentioned torsional analysis specialist shall make at least two site visits to analyze and measure the amount of equipment vibration and make a written recommendation for keeping the vibration at a safe limit. The vibration analysis is required for each piece of rotating equipment.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **General:** Only products meeting the indicated requirements shall be provided.

B. **Manufacturers:** Products shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.

C. **Products:** Materials shall be suitable for the intended purpose and free of defects and shall be recommended by the manufacturer for the application indicated.

D. No Endorsement: The listing of a manufacturer shall not be construed as an endorsement of a particular manufacturer's product, nor shall it be construed that a named manufacturer's standard product will comply with the indicated requirements. No preference is implied by the order of listing of named manufacturers, and the listings are not intended to be comprehensive. The manufacturer listings are only an indication that the OWNER and DESIGN CONSULTANT believe that the named manufacturers are capable of producing equipment and products which will satisfy the indicated requirements.

2.2 GENERAL REQUIREMENTS

A. **Noise Level:** When in operation, no piece of equipment shall exceed the OSHA noise level requirements for a one hour exposure.

B. **Personal Hearing Protection:** The WORK includes multiple sets of three pairs of high attenuation hearing protectors complying with the requirements of ANSI S12.6 and producing a noise level reduction of 25 dBA at a frequency of 500 Hz. The hearing protectors shall have fluid filled ear cushions and an adjustable, padded headband. One set of hearing protectors shall be stored in a weatherproof, labeled, steel cabinet which shall be mounted in a location near each noise producing equipment installation.]

C. **Service Factors:** Service factors shall be applied in the selection and design of mechanical power transmission components where so indicated in individual Sections. When not indicated there, minimum service factors shall be 1.25.

D. **Welding:** Except as otherwise indicated, welding shall comply with ANSI/AWWA D100 and AWWA C206 and the following:

1. Composite fabricated steel assemblies which are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds and shall prevent entrance of air or moisture.

2. Welding shall be by the metal-arc method or gas-shielded arc method described in the American Welding Society's "Welding Handbook" as supplemented by other AWS standards. Qualification of welders shall comply with AWS Standards.

3. In assembly and during welding, the component parts shall be clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall comply with the AWS code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions. Sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

E. **Identification of Equipment Items:** Each item of equipment shall have an indelible, legible identifying mark corresponding to the equipment number indicated.

F. **Vibration Level:** Except as otherwise indicated, equipment subject to vibration shall be provided with restrained spring-type vibration isolators or pads complying with the manufacturer's written recommendations.

G. **Shop Fabrication:** Shop fabrication shall be performed in accordance with the shop drawings.

H. **Tolerances:** The variation in length of members without machine finished ends and which are to be framed shall not exceed 1/16-inch for members 30 feet or less and shall not exceed 1/8-inch for members over 30 feet.

I. **Machine Finish:** The type of finish shall be the most suitable for the application in micro-inches complying with ANSI B46.1. The following finishes shall be used:

1. Surface roughness of surfaces in sliding contact shall not exceed 63 micro-inches.

2. Surface roughness shall not exceed 250 micro-inches except where a tight joint is indicated.

3. Surface roughness for other mechanical parts shall not exceed 500 micro-inches.

4. Surface roughness of contact surfaces of shafts and stems which pass through stuffing boxes and contact surfaces of bearings shall not exceed 32 micro-inches.

H. **Seismic Design:** The seismic design of equipment shall be based on the horizontal peak ground acceleration indicated in the Geotechnical Report or in accordance with California Building Code 2010 (CBC), whichever is greater. Unless otherwise indicated, Occupancy Category shall be III, and seismic design importance factors shall be I = 1.25, Ip = 1.5 in accordance with Table 11.5-1 per ASCE7-05. Determination of seismic forces and load combinations shall follow procedures in the ASCE7-05, Chapter 13.

2.3 EQUIPMENT SUPPORTS AND FOUNDATIONS

A. **Equipment Supports:** Equipment supports, anchors, and restrainers shall be designed for static, dynamic, wind, and seismic loads. The design horizontal peak ground acceleration shall be the greater of that indicated in the Geotechnical Report or as required by the California Building Code 2010. Unless otherwise indicated, Occupancy Category shall be III, and seismic design importance factors shall be I = 1.25, Ip = 1.5 in accordance with Table 11.5-1 per ASCE7-05. Determination of seismic forces and load combinations shall follow procedures in the ASCE7-05, Chapter 13.

B. **Equipment Foundations:** Unless otherwise indicated, equipment foundations shall conform to the requirements of Section 11002.

2.4 PIPE HANGERS, SUPPORTS, AND GUIDES

A. Pipe connections to equipment shall be supported, anchored, and guided to minimize stresses and loads on equipment flanges and equipment. Supports and hangers shall comply with the requirements of Section 15020.

2.5 FLANGES AND PIPE THREADS

A. Flanges on equipment shall comply with ANSI B16.1, Class 125; or B16.5, Class 150, unless otherwise indicated. Threaded flanges and fittings shall have standard taper pipe threads complying with ANSI/ASME B1.20.1.

2.6 COUPLINGS

A. Flexible couplings shall be provided between the driver and the driven equipment to accommodate slight angular misalignment, parallel misalignment, end float, and to minimize shock loads. Where required for vertical shafts, 3-piece spacer couplings or universal type couplings for extended shafts shall be installed.

B. The equipment manufacturer shall recommend the size and type of coupling required for each specific application.

C. Taper-lock bushings may be used where indicated.

D. Where universal type couplings are indicated, they shall be of the needle bearing type construction, equipped with commercial type grease fittings. Bearings shall be sized in accordance with ABMA 11, using a 1.25 service factor, for the same L-10 life expectancy as the driven equipment, but not less than 50,000 hours.

2.7 SHAFTING

A. **General:** All shafting shall be continuous between bearings and shall be sized properly to transmit the power required. Keyways shall be provided in accordance with standard practice.

B. **Materials:** Shafting materials shall be selected for the type of service and torque transmitted and the effect of corrosive gases, moisture, and fluids shall be considered. Unless otherwise specified, materials shall conform to the following:

1. Low carbon cold-rolled steel shafting: ASTM A 108, Grade 1018.

2. Medium carbon cold-rolled shafting: ASTM A 108, Grade 1045.

3. Corrosion-resistant shafting: stainless steel or Monel, whichever is most suitable for the intended service.

4. **Extended shafting:** carbon fiber/resin composite.

C. **Differential Settlement:** Where differential settlement between the driver and the driven equipment is indicated, an extension shaft with 2 sets of universal type couplings shall be provided.

2.8 BEARINGS

A. Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association, Inc. (ABMA).

B. Bearing selection shall include the following criteria: fitting practice, mounting, lubrication, sealing, static rating, and housing strength.

C. Re-lubricatable type bearings shall be equipped with an Alemite type hydraulic grease fitting in an accessible location.

D. All lubricated-for-life bearings shall be factory-lubricated with the manufacturer's best recommended grease to insure maximum bearing life and best performance.

E. Except where otherwise indicated, bearings for process equipment shall be selected for a minimum L-10 life expectancy of 50,000 hours for intermittent service and 100,000 hours for continuous service, in accordance with ABMA 9 or 11. Anti-friction bearings for pumps with discharge nozzle sizes 14 inches in diameter or greater, or pumps with a shaft diameter greater than 4 inches, shall be selected for an L-10 life expectancy of 100,000 hours in accordance with ABMA 9 or 11. Bearings for other elements in the rotating system such as motors, intermediate shaft bearings, right-angle gears, and flywheel bearings shall be selected using the same criteria as specified for the driven equipment, but not less than 50,000 hours. This requirement supersedes any specified bearing life in the detailed specification sections. Bearing selection shall be based upon the worst combination of continuous duty operating conditions specified and shall include both steady state and transient loads. Calculations supporting the selection of bearing sizes shall be included in the Owner’s Manual.

F. Bearing housings shall be of cast iron or steel and the bearing mounting arrangement shall be in accordance with the published standards of the manufacturer. Split-type housings may be used.

G. Unless otherwise indicated, sleeve-type bearings shall have a Babbitt or bronze liner.

2.9 GEARS AND GEAR DRIVES

A. Except as otherwise indicated, gears shall be of the helical or spiral-bevel type, designed and manufactured in accordance with AGMA Standards, with a minimum service factor of 1.7, a minimum L-10 bearing life of 60,000 hours at the worst combination of specified operating conditions, in accordance with ABMA 9 or 11, and a minimum efficiency of 94 percent. Worm gears shall not be used.

B. Gear speed reducers or increasers shall be of the enclosed type, oil- or grease-lubricated and fully sealed, with a breather to allow air to escape but keep dust and dirt out. The casing shall be of cast iron or heavy duty steel construction with lifting lugs and an inspection cover for each gear train. An oil level sight glass and an oil flow indicator shall be provided and installed for easy reading.

C. Gears and gear drives as part of an equipment assembly shall be shipped fully assembled for field installation.

D. Material selections shall comply with AGMA values and the manufacturer's recommendations. Input and output shafts shall be properly designed for the service and load requirements. Gears shall be computer-matched for minimum tolerance variation. The output shaft shall have 2 positive seals to prevent oil leakage.

E. Oil level and drain location shall be readily accessible. Oil coolers or heat exchangers with all required appurtenances shall be included where indicated.

F. Where gear drive input or output shafts connect to couplings or sprockets, the gear drive manufacturer shall supply matching key.

2.10 DRIVE CHAINS (NOT USED)

2.11 SPROCKETS (NOT USED)

2.12 V-BELT DRIVES

A. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI, MPTA, and RMA Standards.

B. Sheaves shall be machined from gray cast iron.

C. Sheaves shall be statically balanced. In applications where excessive vibration is expected, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 fpm shall be of materials and construction recommended by the manufacturer.

D. Sheaves shall be provided complete with taper-lock or QD bushings as required.

E. Finish bored sheaves shall be provided complete with keyseat and set screws.

F. Sliding motor bases shall be provided to adjust the tension of V-belts.

2.13 DRIVE GUARDS

A. Power transmission, prime movers, machines, shaft extensions, and moving machine parts shall be guarded. Unless otherwise indicated for corrosive environment, the guards shall be constructed of minimum 10 gauge expanded, flattened steel with smooth edges and corners, galvanized after fabrication and securely fastened. Where required for lubrication or maintenance, guards shall have hinged and latched access doors.

2.14 FLEXIBLE CONNECTORS AND DUAL PIPE COUPLINGS

A. Flexible connectors shall be installed in piping connections to engines, blowers, compressors, and other vibrating equipment in accordance with the requirements of the ANSI B31.1.

B. Dual pipe couplings, separated by an 18-inch pipe spool unless otherwise indicated, shall be installed on the suction and discharge of all pumps - inboard of the isolation valves. Dual pipe couplings, separated by not less than two pipe diameters nor more than 5 feet, shall be installed on all piping where it exits a structure. Couplings shall be restrained where required. Dual flexible pipe joints may be used where indicated in buried pipe applications in lieu of dual pipe couplings. Flexible connectors are not permitted where dual pipe couplings are specified.

2.15 INSULATING CONNECTIONS

A. Insulating bushings, unions, couplings, and flanges, shall comply with the requirements of Section 15000.

2.16 GASKETS AND PACKINGS

A. Gaskets shall comply with the requirements of Section 15000.

B. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron-type "V" packing shall be Garlock No. 432, John Crane "Everseal," or equal.

C. Packing around rotating shafts (other than valve stems) shall be "O"-rings, stuffing boxes, or mechanical seals, as recommended by the manufacturer.

2.17 TOOLS AND SPARE PARTS

A. **Tools:** The WORK includes one complete set of special tools recommended by the manufacturer for maintenance and repair of each separate type of equipment; tools shall be stored in tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.

B. **Spare Parts**: All equipment shall be furnished with the manufacturers' recommended spare parts, as indicated in the individual equipment Sections.

Spare parts shall be tagged by project equipment number and identified as to part number, equipment manufacturer, and subassembly component (if appropriate). Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts

with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a wooden box with hinged wooden cover and locking hasp. Hinges shall be strap type. The box shall be painted and identified with stenciled lettering stating the name of the equipment, equipment numbers, and the words "spare parts." A neatly typed inventory of spare parts shall be taped to the underside of the cover.

2.18 NAMEPLATES

A. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in accessible locations with stainless steel screws or drive pins. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.19 OVERLOAD PROTECTION

A. **General:** Where indicated, mechanical or electronic overload protection devices shall be installed on equipment.

B. **Mechanical System:** The overload protection shall be a mechanical device designed to provide reliable protection in the event of excessive overload. It shall be a ball detent type designed for long term repeatability and life. It shall be infinitely adjustable by a single adjusting nut which shall be tamper proof, and incorporate a torque monitoring and control system. It shall activate an alarm set for 85 percent, and a motor cutout switch set for 100 percent of maximum continuous running torque. A visual torque indicator shall be provided and oriented so that it may be read from the walkway. The dial shall be calibrated from 0 to 100 percent of maximum continuous running torque. The design of the torque limiter should initiate the mechanical disengagement of the drive upon overload. Each unit shall be suitable for outdoor and corrosive environments with a protective finish, corrosion inhibiting lubricants and a stainless steel cover.

C. **Electronic System:** Overload protection may be an Electronic Torque Monitoring Control System capable of displaying torque, rpm's, one level of overload, and two levels of overload of the drive system. It shall incorporate a time-delay for startup and a voltage monitoring and compensation circuit for up to ∀15 percent variation.

The overload device shall have an enclosure suitable for outdoor installation at temperatures of 0-70 degrees C, and relative humidity up to 95 percent. A visual torque dial shall be provided and oriented so that it can be easily read from the walkway.

The torque monitoring system shall be calibrated to include: alarm and shut down the system in the event the torque drops to 50 percent of normal running; alarm at 85 percent of maximum continuous running torque and shut down the motor at maximum continuous running torque of the equipment. The system shall be calibrated at the factory of the equipment manufacturer and it shall be capable of monitoring twice the maximum continuous running torque of the equipment.

D. **Definition**: For the purpose of these Specifications, "maximum continuous running torque" shall be defined as the lesser of: the motor continuous running torque rating, the gear drive continuous running torque rating, or the driven mechanism continuous running torque rating, not exceeding a service factor of 1.0.

E. **Manufacturers**: Overload protection devices shall be manufactured by the following (or equal):

1. American Autogard Corporation
2. Ferguson Machine Company

2.20 ANCHOR BOLTS, NUTS AND WASHERS

A. Unless otherwise indicated, anchor bolts, nuts and washers for anchoring equipment to foundations and connecting bolts for equipment assemblies supported by other assemblies shall conform to the requirements of Section 05500. Unless otherwise specified, the CONTRACTOR shall provide Type 316 stainless steel anchor bolts and washers, and Type 416 stainless steel or other corrosion resistant, non-galling alloy nuts . In ferrous chloride and ferric chloride containment areas, unless otherwise specified, provide Hastelloy C or Alloy 276 anchor bolts, nuts, washers and connecting bolts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. **General:** Products and equipment shall be installed in accordance with the manufacturer's written installation instructions, the requirements of this Section, the requirements of the individual equipment specifications, and as indicated.

B. **Alignment:** Journeymen millwrights shall perform alignment of equipment furnished under this Section and any referencing section. Carpenters, laborers or any other trades are specifically excluded from performing this work. In locations where such trades are not available, the CONTRACTOR shall retain the services of a firm specializing in this type of work to perform the setting and alignment work. The CONTRACTOR shall submit the qualifications of the proposed firm to the CONSTRUCTION MANAGER for acceptance prior to performing the work. The CONSTRUCTION MANAGER shall personally witness final alignment procedures for each item of equipment as a condition precedent to beginning any work required under Section 01660. Alignment techniques shall conform to the requirements of Section 11005.

C. **Lubricants:** The CONTRACTOR shall provide for each item of mechanical equipment a supply of the lubricant required for the commissioning period. Lubricants shall be of the type recommended by the equipment manufacturer and shall be products of the OWNER's current lubricant supplier. The CONTRACTOR shall limit the various types of lubricants by consolidating them, with the equipment manufacturer's approval, into the least number of different types. Not less than 90 days before the date shown in his construction schedule for starting, testing and adjusting equipment, the CONTRACTOR shall provide the OWNER with three copies of a list showing the required lubricants, after consolidation, for each item of mechanical equipment. The list shall show estimated quantity of lubricant needed for a full year's operation, assuming the equipment will be operating continuously.

3.2 COUPLINGS

A. Couplings shall be installed in accordance with the manufacturer's installation instructions.

3.3 INSULATING CONNECTIONS

Insulating connections shall be installed in accordance with the manufacturer's instructions.

3.4 PIPE HANGERS, SUPPORTS, AND GUIDES

A. Hangers, supports, and guides shall be installed in compliance with ANSI/ASME B31.1 and with Section 15020.

3.5 BOLTS AND MISCELLANEOUS METALS

A. Bolts, including anchor bolts, and miscellaneous metals shall comply with paragraph 11000-2.20 and Section 05500. Installation of equipment anchor bolts shall comply with Section 11002.

3.6 PACKAGED EQUIPMENT

A. When any system is provided as pre-packaged equipment, coordination shall include space and structural requirements, clearances, utility connections, signals, outputs and features required by the manufacturer including safety interlocks.

3.7 PROTECTIVE COATING

A. Equipment shall be painted and coated in accordance with Section 09800. Non-ferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.

** END OF SECTION **

SECTION 11002 - EQUIPMENT SUPPORTS, GROUTING AND INSTALLATION

PART 1--GENERAL

1.1 WORK OF THIS SECTION

A. This Section specifies minimum requirements for equipment supports, including concrete housekeeping pads, equipment bases, supports, anchorage, and accessories with weights greater than 200 pounds. If conflict exists between this Section and requirements of individual equipment manufacturers, the more restrictive requirements shall prevail.

B. The CONTRACTOR shall provide all supports, anchorage, and mounting of all equipment, unless otherwise specified in accordance with the manufacturers recommendations, and requirements of industry standards. Each piece of equipment shall be anchored to resist the greater of the maximum lateral and vertical forces required by the local governing code or by the manufacturer of the equipment, whichever is greater. This force shall be considered acting at the center of gravity of the piece under consideration. No equipment shall be anchored to vertical structural elements without written approval of the CONSTRUCTION MANAGER. The CONTRACTOR shall provide all elements required to resist the calculated forces described herein or required by the equipment manufacturer. The CONTRACTOR shall provide certification that for equipment, 20 horsepower and larger, anchor bolt calculations showing adequacy of bolt sizing and anchor embedment have been performed and signed by a registered structural or civil engineer.

1.2 SPECIFICATIONS AND STANDARDS

A. This Section contains references to the following documents. It is a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed document, the requirements of this Section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/HI 1.3.4	Centrifugal pumps, Horizontal Baseplate Design
ANSI/HI 1.4	Centrifugal Pumps B Installation, Operation and Maintenance
ANSI/HI 2.4	Vertical Pumps : Installation, Operation and Maintenance

Reference	Title
API 610, 1995	Centrifugal Pumps for Petroleum, Heavy Duty Chemical and Gas Industry Services
API RECOMMENDED PRACTICE 686	Recommended Practices for Machinery Installation and Installation Design
ASTM C531	Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, and Monolithic Surfacings.
ASTM C579	Compressive Strength of (Method/B) Chemical Resistant Mortars and Monolithic Surfacings.
ASTM C638	Tensile Properties of Plastics.
ASTM C882	Bond Strength of Epoxy-Resin Systems Used with Concrete
ASTM C884	Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay
ASTM C1181	Creep of Concrete in Compression
ASTM D2471	Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Resins
SSPC	Society for Protective Coatings Specifications, Vol. 2

1.3 SHOP DRAWINGS AND SAMPLES

A. The following information shall be submitted:

1. Shop drawings for all equipment bases and anchorage details.

2. Certification of anchor bolt calculations specified in paragraph 11002-1.1 B.

3. Machine and equipment base installation schedule with manufacturers' anchor bolt torque requirements, as specified in paragraph 11002-2.1.

4. Results of grout strength tests, as specified in paragraph 11002-3.2 E.

PART 2--PRODUCTS

2.1 GENERAL

A. Unless otherwise specified, equipment and drivers shall be rigidly mounted on a common cast iron or fabricated steel baseplate or soleplate grouted into place on concrete housekeeping pads. All equipment shall be mounted on concrete housekeeping pads. Under no circumstances shall equipment supports be grouted directly to concrete slabs or floors. Bases for equipment shall be

hot-dip galvanized after fabrication unless otherwise specified. Mounting pads for equipment shall have the zinc layer removed and shall be finished flat and parallel after galvanizing. Sole plates and leveling plates shall not be galvanized. Machined surfaces shall be protected with two layers of duct tape after machining and before shipment from the factory.

B. Prior to initiating any installation efforts, the CONTRACTOR shall produce a machine base schedule containing the expected dates for setting anchor bolts, casting housekeeping pads, preparation of housekeeping pads for grouting, grouting, and final anchor bolt clamping for each item of equipment. The schedule shall list the equipment, by equipment number, and shall be accompanied by written verification of anchor bolt clamping torque from the equipment manufacturer.

C. Installation practices shall follow the guidance presented in Chapters 4 and 5 of API Recommended Practice 686, unless superseded by more restrictive requirements of these specifications or manufacturer requirements.

2.2 CONCRETE HOUSEKEEPING PADS

A. Concrete housekeeping pads for equipment and floor penetrations shall be at least 2 inches larger in plan than the steel or cast base and not less than 6 inches above the finished floor elevation, and shall be shaped to drain liquids away from the base. Housekeeping pad details shall follow the requirements set forth on MWWD Standard Detail M-114A unless superseded by more restrictive requirements of these specifications or the requirements of the equipment manufacturer. All conduits, piping connections, drains, etc., serving the equipment, shall be enclosed by the concrete pad. Unless otherwise specified, no conduits, piping connections, drains, etc., will be accepted which rise directly from the floor.

2.3 EQUIPMENT BASES

A. **General**

1. Unless otherwise specified, mounting bases for equipment 20 horsepower and larger shall be a minimum of 1 inch thick. All bases shall have edges bearing on the grout surface rounded to a radius of not less than 2 inches to avoid producing stress risers on the grouted foundation. Grout pouring holes shall be provided in all bases and all bases shall have grout release holes. Except where vibration isolation systems are specified, all bases shall be grouted as specified in this Section. Internal stiffeners shall be provided and shall be designed to allow free flow of grout from one section of the base to another. The minimum acceptable opening in cross-bracing and stiffeners shall be 2 inches high by 6 inches in length. All welds shall be continuous and free from skips, blow holes, laps and pockets.
2. Equipment bases for horizontal pumps shall conform to the requirements of this Section, ANSI/HI 1.3.4, API 610 (paragraph 3.3), and shall provide common support for the pump and motor (and flywheel, if one is specified). In the event of conflict, the requirements of this Section shall govern. Eight positioning jackscrews shall be provided for all drivers and flywheels (if specified) for all horizontal pump baseplates. All bases for horizontal pumps shall be equipped with jackscrews for positioning and leveling the base prior to grouting.

3. Mounting holes for anchor bolts in the bases shall be drilled and not burned out and they shall not be open slots. All mounting studs shall be Type 316 stainless steel. Anchor bolts shall be as specified under paragraph 11002-2.6. A non-seize or non-galling compound shall be used on all threads.

4. Mounting pads for equipment shall be machined after all welding and stress relieving and shall be coplanar to 0.002 inch in all directions. Mounting pads shall extend not less than 1 inch on all sides beyond the position for the equipment.

5. Equipment bases - for vertical volute-type pumps weighing more than 2000 pounds - shall be soleplates or leveling boxes under individual feet or support brackets integral with the volute casting. Direct mounting of the volute on housekeeping pads will not be permitted. Sole plates, mounting blocks and baseplates weighing more than 1000 pounds shall be leveled with jackscrews incorporated into the fabrication. Jackscrews shall be located in thickened pads or otherwise in sufficient metal to provide ease in adjusting level.

6. The seismic design of equipment bases shall conform to the requirements of paragraph 11000-2.2J.

B. **Type I Bases:**

1. Type I bases shall be structural steel bases with thickened steel pads for doweling. The bases shall be rectangular in shape for equipment other than centrifugal refrigeration machines and pump bases, which may be "T" or "L" shaped to accommodate the equipment drive and accessories. Pump bases for split case pumps shall include supports for suction and discharge base ells, if required by the specified configuration. Perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimension of the base. Beam depth need not exceed 14 inches provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Terminations requiring connections to the base shall be nuts welded to the bottom side of the base and plugged with cork, plastic plugs or grease, or acorn nuts. Grout holes shall be provided for the bases of all equipment where vibration isolation is not specified.

C. **Type II/III Bases: (NOT USED)**

D. **Type IV Bases :**

1. Type IV bases shall be cast iron. Cast iron bases located within buildings do not require galvanizing but shall be sealed in accordance with the requirements for bleeding surfaces specified in Section 09800 prior to grouting. Terminations requiring connections to the base shall be nuts welded to the bottom side of the base and plugged with cork, plastic plugs or grease, or acorn nuts. In no case shall the fastener terminate only into the metal base.

E. **Sole Plates:**

1. Where sole plates are provided, the underside shall be scribed with the words “THIS SIDE DOWN” using welding rod material prior to milling the equipment mating surface flat to a tolerance of not less than 0.002/foot in all directions. Sole plates shall be designed to be installed in the housekeeping curbs shown.

2.4 GROUT FOR EQUIPMENT BASES

A. **Epoxy Grout:**

1. Unless otherwise specified, grout for equipment bases shall be non-shrinking epoxy grout conforming to the following requirements:

Test	Result
ASTM C531	Shrinkage shall be less than 0.080% and thermal expansion less than 17 x 10^{-6} in/in/^{o}F
ASTM C579	Strength shall be a minimum of 12,000 psi in 7 days when tested by method B, modified.
ASTM C882	Bond strength to Portland concrete shall be greater than 2000 PSI
ASTM C884	Epoxy grout shall pass the thermal compatibility test when overlaid on Portland cement concrete
ASTM D638	Tensile strength shall not be less than 1700 psi. Modulus of elasticity shall not be less than 1.8 x 10^{6} psi
ASTM C1181	Creep of the epoxy grout shall be less than 0.005 in/in with the test at 70^{o}F and 140^{o}F with a load of 400 psi
ASTM D2471	Peak exothermic temperature shall not exceed 110^{o}F when a specimen 6 inch diameter x 12 inches high is used. Gel time shall be a least 150 minutes

2. The vehicle shall be a two-component (liquid and hardener) system designed to yield the above characteristics when combined with the manufacturer's recommended aggregate system. The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperature as high as 150 degrees F, with a load of 1200 psi. Aggregate for equipment base grout shall be as furnished by the manufacturer of the epoxy grout mix.

B. **Cementitious Grout**

1. Cementitious grout for use with equipment supports for equipment rated 5 horsepower and smaller or weighing less than 1000 pounds, whichever is less, shall be non-shrink grout as specified in Section 03315. Procedures for leveling and clamping equipment shall be as specified in this Section.

2.5 EPOXY PRIMER

A. The epoxy primer shall be a lead free, chrome free, rust inhibitive, two-component epoxy primer specifically designed for use on metal substrates and in conjunction with epoxy grout. The epoxy primer shall be a product of the epoxy grout manufacturer.

2.6 ANCHOR BOLTS

A. Anchor bolts shall be as specified in paragraph 11000-2.20, set in PVC sleeves. Sleeves shall allow a free length projection of not less than fifteen bolt diameters above the concrete required to develop the strength of the bolt. Projection above the nut on the baseplate or soleplate shall be no more than 3/4 inch. Anchor bolts shall be located not less than 6 anchor bolt diameters from the foundation edge in all directions.

PART 3--EXECUTION

3.1 GENERAL

A. Pumps shall be installed in accordance with this Section and ANSI/HI 1.4 and ANSI/HI 2.4. Grouting of equipment bases shall take place prior to connecting any field piping or electrical and instrumentation systems. Unless the CONSTRUCTION MANAGER accepts an alternate installation procedure in writing, baseplates shall be grouted with the equipment removed.

B. Equipment that is not mounted on vibration isolators shall be anchored directly to the supporting floor system. In addition to the anchorage, all such equipment shall be internally designed so that all static and moving parts are anchored to the supporting framework to resist the all imposed forces. All forces shall be transmitted to the base in order to be anchored as required.

C. Connecting piping with flexible connections and/or expansion joints shall be anchored such that the intended uses of these joints are maintained in the piping system without imposing strain on the equipment connections. Where the equipment manufacturer requires a rigid connection between the machine and connecting piping systems (generally, this will be higher discharge head pumps), the flexible coupling shown may be deleted and the CONTRACTOR shall install the equipment in the following manner:

1. The equipment housekeeping pad shall be prepared as specified under paragraph 11002-3.2 B.

2. The baseplate, soleplate or leveling blocks supporting the equipment shall be installed, leveled, and grouted in place as specified.

3. The equipment shall be installed, aligned and doweled in place as specified.

4. The piping shall be installed and aligned to the equipment connections and the field piping connections without welding on the joints for one section of pipe between the equipment connection and the field piping and all valving. All flanged joints shall be bolted up and pressure tested.

5. All piping shall be fully supported by supports designed to accept their full weight.

6. The final sections of pipe shall be aligned with the equipment and field connections without the use of jacks, chain falls or other devices to force it into alignment.

7. The final piping joints shall be welded only after the previous steps have been completed and accepted by the CONSTRUCTION MANAGER.

D. Conduit and piping for future equipment shall be capped flush with the floor or concrete pad in such a manner to allow future connection.

E. The CONTRACTOR shall coordinate location of electrical conduit and piping penetrations within the concrete pad and equipment base. All penetrations shall stub-up on the same side of the equipment as required for connection to the equipment. Equipment drains shall be located as required for drainage from equipment.

F. Prior to commencing equipment installation work, the CONTRACTOR shall cause the manufacturer of the epoxy grout to be used for equipment installation to conduct a training school for the workmen to be using the product. The school shall be not less than 4 hours in length and shall cover all aspects of using the products from mixing to application. This requirement, however, shall not be construed as relieving the CONTRACTOR of overall responsibility for this portion of the work.

3.2 INSTALLATION

A. **Anchor Bolts:**

1. Prior to concrete placement**,** anchor bolts shall be accurately set according to the manufacturer's foundation drawings and firmly secured to prevent shifting during concrete placement. Drilled in anchor bolts will not be accepted. The bolts shall be embedded in the structural concrete to develop the full strength of the bolt. Concrete in housekeeping pads cannot be used for this purpose. All anchor bolts shall be dimensionally checked against the foundation drawings for proper length, diameter, thread length, thread projection, etc., by a representative of the equipment manufacturer prior to placing concrete. Prior to placing concrete for the housekeeping pad, plastic sleeves shall be placed around each bolt to provide for minor adjustment of bolt position prior to grouting. Sleeves shall be filled with a pliable, nonbonding material such as silicon rubber or wax to prevent contact between the concrete or grout and the anchor bolt. Bolt threads and projections in the sleeves (refer to paragraph 11002-2.6) above the structural slab shall be protected in the sleeve by heavily greasing or waxing the threads and shank with paste wax and wrapping with plastic sheeting. The protective wrapping shall be firmly secured with tie wires. The protective wrapping shall be removed prior to placing the grout.

2. The equipment manufacturer shall recommend the size of the anchor bolts for the equipment and shall also furnish the recommended tightening torque for the nuts; however, the minimum size bolt shall be 3/4 inch for equipment rated 20 to 100 horsepower, 1 inch for equipment rated over 100 to 300 horsepower and 1-1/4 inches for 300 to 500 horsepower. Anchor bolts for equipment rated over 500 horsepower shall be as recommended by the manufacturer of the equipment and as approved by the CONSTRUCTION MANAGER.

B. **Concrete Housekeeping Pad Preparation:**

1. After the concrete is fully cured (sample cylinders, as specified in Section 03300, shall be taken and tested for all housekeeping pads supporting equipment weighing more than 1000 pounds), the housekeeping pad shall be chipped approximately 3/4 inch to 1 inch to remove all laitance and defective or weak concrete. A light duty, hand held pneumatic chipper with a chisel type tool shall be used for chipping the foundation. Abrasive blast, bush-hammer, jack hammers with sharp chisels or needle gun preparation of concrete surfaces to be grouted are not acceptable. The amount of concrete removed shall be such that the final baseplate or soleplate elevation results in not less than 3 inches of grout between the surface of the housekeeping pad and lower baseplate flange or the underside of the soleplate.

2. All edges shall be chamfered 2 to 4 inches at a 45-degree angle. All dust, dirt, chips, oil, water, and any other contaminants shall be removed and cover the foundation shall be covered with protective plastic sheeting. The grout contact surface on the housekeeping pad shall be coated with one coat (not more than 5 mils) of catalyzed epoxy resin.

C. **Equipment Bases and Soleplates:**

1. All surfaces of equipment bases and soleplates to be in contact with epoxy grout shall be cleaned to SP-6 and shall be primed with epoxy primer within 8 hours of cleaning.

D. **Leveling and Shimming:**

1. All machinery shall be mounted and leveled by millwrights. All equipment bases and equipment shall be leveled against steel surfaces. Use of other materials for leveling purposes is strictly and specifically prohibited. Unless otherwise specified, baseplates, mounting blocks and soleplates weighing less than 1000 pounds shall be leveled on stainless steel blocks 4 inches square and 1-1/2 inches thick with a hole drilled in the center for the anchor bolt, placed under the base at every anchor bolt. Leveling shall be by use of mounting blocks machined flat on all horizontal surfaces and measuring not less than 4 inches wide horizontally and shims that shall extend not less than three inches beyond the base of the equipment. Mounting blocks shall be coated with a light oil just prior to beginning the leveling and grouting work. Using precut stainless steel shims coated with a light oil between the base and the steel blocks at the anchor bolts, the CONTRACTOR shall level the equipment baseplates, soleplates or mounting blocks against the anchor bolt nuts (finger tight only) to a maximum tolerance of 0.0005 in./ft or as otherwise required by the equipment manufacturer, if more stringent. Mounting surfaces for equipment shall be coplanar within 0.002 inch in any direction. The shims shall be placed so the tabs on the shims are easily accessible. A minimum of four shims per anchor bolt shall be used. The total shim thickness at each anchor bolt shall be at least 0.015 inch. Leveling shall be against anchor bolts prior to final grouting.

2. The CONTRACTOR shall level the equipment against the anchor bolt nuts to a maximum tolerance of 0.002 in./ft or as otherwise required by the equipment manufacturer, if more stringent. Leveling equipment shall be precision surveying equipment. Machinists' spirit levels will not be permitted for leveling purposes for any base plate or equipment foundation with a plan dimension greater than 4 feet.

3. Leveling nuts may be used for mounting equipment weighing less than 500 pounds. The CONTRACTOR shall level the equipment against the anchor bolt nuts to a maximum tolerance of 0.0005 in./ft or as otherwise required by the equipment manufacturer, if more stringent. Anchor bolt nuts shall be only finger tight during the leveling process. Wedges will not be allowed and under no circumstances shall shims be used as permanent support under baseplates, soleplates or leveling plates.

E. **Grouting:**

1. Grout forms shall be built of minimum of 3/4-inch thick waterproof plywood and shall be securely braced (minimum brace size shall be 2 inches x 4 inches). Forms shall provide a minimum of 2-inch hydrostatic head above the final elevation of the grout to assist in flow during installation.

2. Forms must be coated with three coats of paste wax on all areas that will come in contact with the grout to prevent the grout from bonding to the forms. Forms shall be waxed before assembly to prevent accidental application of wax to surfaces where the grout is to bond. Before any forms are installed, all concrete surfaces that will contact epoxy grout shall be free from any foreign material, such as oil, sand, water, grease, etc. Forms shall be liquid-tight. Any open spaces or cracks in forms, or at the joint between forms and the foundation, shall be sealed off, using sealant. All outside vertical and horizontal edges of the grout shall have 45-degree chamfers. Blockouts shall be provided at all shimming and leveling nut positions to allow removal of shimming equipment after the grout has cured. Jackscrews shall be coated with a light oil or other acceptable bond-breaking compound.

3. The 45-degree chamfer strip shall be located at the final elevation of the grout. The final elevation of the grout on baseplates with exposed I-beam or C-channel supports shall be at the top of the lower support flange. The top of the grout, on baseplates with solid sides and soleplates, shall be 1.0 inch above the bottom of the baseplate or the underside of the soleplate. The grout's final elevation shall not be so high as to bond the anchor bolt nut and washer.

4. The epoxy resin and hardener shall be mixed in accordance with the grout manufacturer's recommendations. Aggregate shall be slowly added to the mixer one bag at a time. The grout should be mixed only long enough to wet out all the aggregate. Grout shall be placed at the center of one end of the baseplate or soleplate and worked toward the ends in such a manner as to force the air out from beneath the baseplate or soleplate and out the vent holes, to eliminate voids. The grout shall be placed in a manner that avoids air entrapment using a head box to pour grout into the grout holes. When the head box is moved to the next grout hole, a 6-inch high standpipe shall be placed over the grout hole and filled with grout. The CONTRACTOR shall exercise care to never allow the grout to fall below the baseplate level once the grout has made contact with the baseplate. Grout placement shall be continuous until all portions of the space beneath the baseplate or soleplate have been filled. Subsequent batches of grout shall be prepared so as to be ready when the preceding batch has been placed. Under no circumstances shall the grouting operation be halted because of lack of grout mix. After the entire baseplate is full, 6-inch high standpipes shall be maintained over each grout hole, to continue purging of air. When the grout has started to take an initial set (determined by a noticeable increase in temperature and no flow of grout at the vent holes) the standpipes shall be removed and excess grout cleaned from all surfaces.

5. A grout sample shall be taken for each piece of equipment to be grouted. The sample shall be placed in a cylinder of sufficient size to yield three 2-inch x 2-inch x 2-inch test samples. The samples shall be tagged with the equipment number and ambient temperature at the time of placement. The samples shall be tested in accordance with the manufacturer's recommendations. Once the epoxy grout cylinder has been completely filled, it shall be placed next to the foundation of the equipment being grouted and allowed to cure for 48 hours. After 48 hours, the test cylinder shall be tested in accordance with the grout manufacturer's recommendations by an independent testing laboratory. The results shall be reported directly to the CONSTRUCTION MANAGER. Forms shall be removed only after the grout has cured sufficiently and upon specific permission from the CONSTRUCTION MANAGER.

F. **Completion:**

1. Upon acceptance by the CONSTRUCTION MANAGER and the equipment manufacturer's representative after the grout has reached sufficient strength, the shims shall be removed, and leveling nuts or jack screws backed off to allow the grout to fully support the equipment base, leveling block or soleplate. Removal of extended shimming material (direct mounted baseplates weighing 1000 pounds or less) shall be by sledge hammer, taking care not to damage the grout. Once shims have been removed, or jackscrews backed off, the anchor bolts shall be torqued, using calibrated indicating torque wrenches, to develop the full clamping force required by the equipment manufacturer. Anchor bolts shall be torqued in increments of not more than 25 percent of final value in an alternating pattern to avoid stress concentration on the grout surface. Pockets for access to shims, or leveling nuts shall be filled with grout mix and pointed after the anchor bolts have been torqued to final values.

END OF SECTION

SECTION 11005 - MACHINE ALIGNMENT

PART 1--GENERAL

1.1 WORK OF THIS SECTION

A. This Section specifies requirements for alignment of all new and modified mechanical equipment (such as P-103, P-104, and P-105) to be furnished or modified under this contract. Equipment with drivers 5 horsepower and less are specifically exempted from the requirements of this Section. This Section also includes requirements for alignment software and equipment to be furnished to the OWNER on commissioning of the project.

1.2 QUALITY ASSURANCE

A. **General:** All equipment shall be aligned using laser alignment equipment to the tolerances specified by the subject equipment manufacturer or the criteria specified in this Section, whichever is more stringent.

B. **Alignment Criteria:** Unless otherwise specified by more stringent manufacturer's requirements, all mechanical equipment affected by this specification shall be aligned to the following criteria:

Speed, rpm, maximum	**Couplings**		**Spacer Shafts offset, mils/ inch of shaft length**
	Offset (mils)	**Angularity (mils/inch)**	
600 and less	5.0	1.0	1.8
900	6.0	0.7	1.2
1200	2.5	0.5	0.9
1800	2.0	0.3	0.6
3600	1.0	0.2	0.3
7200	0.5	0.1	0.15

Notes: (1) Soft foot shall be not more than 2.0 mils for any speed. (2) Separately mounted equipment connected by offset universal joints are exempted from the offset and angularity requirements, but all units must be installed and leveled as specified in this Section.

C. **Alignment Equipment**

1. Alignment equipment used to perform the work required under this Section shall employ laser alignment techniques to achieve the required tolerances. The equipment shall be computer based and shall be compatible with Windows® based spreadsheets and databases. The

equipment shall employ a hand-held field computer using a graphic interface to determine actual alignment and necessary corrective action to bring equipment into required tolerance. The computer shall be powered by rechargeable NiCad batteries and shall be capable of storing up to 1000 machine measurement sets, complete with labels, graphics and comments. The link between field measurement instruments and the computer shall be through infrared transmission. Cable link-dependent equipment will not be acceptable. External interface between the field computer and other processors shall be by RS-232C serial cable ports.

2. The laser emitter shall be Class 2 type, FDA 21 CFR 1000 and 1040 compliant, powered by lithium ion batteries. The laser shall operate on a 670 nm wavelength and shall have a beam, divergence of less than 0.3 microradians at a power of not more than 1 microwatt. The laser receiver shall have 5 axis capability with a resolution of 0.04 mil offset and 10 micro radians angularity.

1.3 SPECIFICATIONS AND STANDARDS

A. This Section contains references to the following documents. They are a part of this Section and any referencing section as specified and modified. In the event of conflict between the requirements of this Section or any referencing section and those of the listed documents, the requirements of this Section or the referencing section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
Shaft Alignment Handbook	Shaft Alignment Handbook, second edition, John Piotrowski, Marcel Decker Inc.

PART 2--PRODUCTS

2.1 EQUIPMENT

A. Laser alignment equipment shall be Rotalign® Pro as manufactured by Ludeca, Inc., of Miami, Florida, or equal.

2.2 PRODUCTS TO BE FURNISHED TO OWNER:

A. The following shall be furnished to the OWNER upon completion of all alignment work for the project or appropriate portion thereof and prior to substantial completion of the project or portion thereof:

1. (NOT USED).

2. All alignment records, in both hard copy and electronic format. The hard copy shall be signed and dated by the technician performing the alignment work and shall be witnessed by the CONSTRUCTION MANAGER.

PART 3--EXECUTION

3.1 CONSTRUCTION

A. After machine base grouting as specified under Section 11002, all machines mounted on baseplates or sole plates specified above shall be aligned as specified under this Section. Machines supported on integral feet or support pads shall be leveled, grouted and aligned in the following order: driven machine; intermediate bearings or machines; and driver. All machines shall be aligned without any connections to piping, electrical and instrumentation systems. Upon completion of all field connections, alignment shall be rechecked to demonstrate no change. If change has occurred, the CONTRACTOR shall eliminate any external forces affecting machine alignment and repeat the alignment process. All machine alignment parameters shall be rechecked after the equipment has been brought to operating temperature by operation at specified conditions. Where required by other sections in these Contract Documents, factory authorized installation technicians representing the equipment manufacturer shall witness final alignment work. All alignment work shall be independently checked using the shaft and coupling spool method described in Shaft Alignment Handbook. After completion of all alignment work and acceptance in writing by factory installation technicians, all machines shall be doweled in place using tapered stainless steel dowels. Alignment work shall be performed by journeyman millwrights skilled in this type of work under the supervision of a technician trained in the use of the laser alignment by the manufacturer of the alignment equipment. The use of laborers, carpenters or apprentices for this work shall not be acceptable. All final results of the alignment work shall be subject to inspection and verification by the CONSTRUCTION MANAGER.

END OF SECTION

SECTION 11020 - VIBRATION AND CRITICAL SPEED LIMITATIONS

PART 1--GENERAL

1.1 WORK OF THIS SECTION

A. This Section specifies vibration and critical speed limitations for all new and modified rotating mechanical equipment such as P-103, P-104, and P-105. Factory and/or field testing and vibration measurements shall be taken when specified in the individual equipment specification sections.

1.2 VIBRATION LIMITATIONS

A. **General:** Vibration frequencies shall span the range from 5.0 to 5000 Hz. Where specified, measurements shall be obtained while the installed equipment is operating within the specified speed range.

B. **Centrifugal:**

1. **Machines with Sleeve Bearings:** Unless otherwise specified, centrifugal machines with sleeve bearing shafts shall not exhibit unfiltered RMS readings for vibration displacement in excess of the following:

Shaft speed range, rpm	Displacement, peak to peak, mils
Up to 900	3.5
901-1800	3.0
1801-3000	2.5
3001-4500	2.0
Above 4500	1.6

2. Displacement measurements shall be taken radially on the shaft at two points at each bearing, except for well pumps which shall be measured at top of motor. Measuring points shall be 90 degrees apart.

3. Machines with Antifriction Bearings: Unless otherwise specified, centrifugal machines with antifriction bearing shafts shall not exhibit unfiltered RMS readings for vibration velocity in excess of 0.12 inch per second. Velocity measurements shall be taken on one point of each bearing housing.

C. **Positive Displacement Machines:** Unless otherwise specified, positive displacement machines of the rotary, reciprocating and controlled volume types shall operate without any lateral or torsional vibration characteristics that may accelerate wear of the equipment. The CONTRACTOR shall provide manufacturer's certification that the manufacturer has inspected the

machine under operating conditions and found it to comply with the requirements of this paragraph.

1.3 CRITICAL SPEED REQUIREMENTS

A. Unless otherwise specified, rotating mechanical equipment shall not exhibit critical speeds within the specified range of operating speeds. Critical speeds for equipment with rigid rotor systems shall be at least 20 percent greater than maximum operating speed. Critical speeds for equipment with flexible shaft-rotor systems shall be at least 15 percent below minimum operating speed and 20 percent above maximum operating speed.

1.4 SHOP DRAWINGS AND SAMPLES

A. The following information shall be submitted:

1. Manufacturer's certified data showing location of critical speeds in relation to operating speeds.

PART 2--PRODUCTS (NOT USED)

PART 3--EXECUTION (NOT USED)

END OF SECTION

SECTION 11033 - VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing variable frequency drive (VFD) units, or called adjustable speed drive (ASD) units, with motors, controls, and accessories.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Division 13 Special Construction
2. Division 16 Electrical Specifications
3. Section 11219 Custom Engineered Vertical Variable Speed Non-Clog Pumps

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. NFPA 70, National Electrical Code (NEC), 2011

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. IEEE Standard 519 IEEE Recommended Practice and Requirements for Harmonic Control in Electrical Power Systems
2. NEMA ICS 7 Industrial Control and Systems - Adjustable Speed Drives
3. NEMA MG1 Motors and Generators
4. UL 508A and 508C The VFD shall be UL listed and carry the UL mark.

1.5 CONTRACTORS SUBMITTALS

A. Submittals shall be made in accordance with the Section 16050 Basic Electrical Materials and Methods. The submittals shall include the following:

1. Shop Drawings

a. Layout Drawings

(1) Layout drawings of the variable frequency drive system that include all cabinet or enclosure dimensions, access details, and weights.

(2) Layout drawings of panels or enclosures showing size, arrangement, color, and nameplates. Drawings shall include the physical arrangement of door-mounted devices located on the variable frequency drive enclosure. Sufficient detail shall be provided for locating conduit stub-ups. General "catalog data sheet" layout drawings which are not specific to the systems specified herein are not acceptable.

b. Single Line Diagrams: Complete single line diagrams indicating all devices comprising the variable frequency drive system including, but not limited to, circuit breakers, motor circuit protectors, contactors, instrument transformers, meters, relays, timers, control devices, and other equipment comprising the complete system. Electrical ratings of all equipment and devices shall be clearly indicated on these single line diagrams.

c. Control Diagrams

(1) Schematic and interconnection wiring diagrams of all electrical work, including terminal blocks and identification numbers, wire numbers and wire colors. These drawings shall be circuit specific for each motor-load combination.

(2) Logic diagrams identifying system control logic.

(3) Indicate all devices, regardless of their physical location, on these diagrams. The specific device location symbols and their respective legend shall also appear on these diagrams.

(4) Specific equipment names consistent with the Drawings shall appear on each respective diagram.

(5) Functional diagrams that identify major system functional blocks and interfaces. The diagrams shall note any special requirements or restrictions of the motor-load combination and shall show all interface wiring and points of connection to the VFD enclosure.

d. Calculations and Sketch

(1) Calculation of VFD/motor efficiencies at minimum, 1/3, 2/3, and 100 percent of the speeds required to meet the specified operating conditions. The system efficiency shall include power losses from the cooling system (if any), controls, contactors, line reactors, and filters.

(2) Continuous and fault ratings of drive and disconnecting means.

(3) Description of proposed factory test procedure and sketch of test setup.

(4) Manufacturer's statement that motor conforms to NEMA MG1, Part 31.

(5) Output reactor analysis per paragraph 2.4C.

e. Manufacturers Drawings

(1) Drawings submitted by the manufacturer shall be complete and documented to provide the OWNER with operations and maintenance capabilities.

(2) Relay and timer coil and respective contact identification numbers shall match those indicated on the Drawings.

f. Bill of Material: Complete Bills of Material with catalog data sheets and manuals for all equipment and devices comprising the variable frequency drive system. Where catalog cuts and other brochures depicting product characteristics are supplied, annotate to show product to be used on this project.

g. List of Spare Parts: A complete list of recommended spare parts. Include item descriptions, recommended quantities, and unit costs. The recommended list should be based on a maintenance plan where the OWNER will remove and replace failed items to the lowest replaceable module/component level.

2. Test Reports

a. Submit certified copies of manufacturer's test reports.

b. Submit factory bench-test data to indicate that the manufacturer's proposed equipment has been tested in the specified arrangement and found to achieve specified accuracy.

3. Operation, Maintenance and Installation Instructions: Furnish with the equipment at delivery Operation and Maintenance Manuals, installation instructions, and other documentation necessary for the installation, start-up, operation and maintenance of the system.

4. Programming Guides and Manuals: If the variable frequency drive systems require computer software or configuration, provide 4 copies of all programming guides/manuals. Flow charts and listings of software developed shall be submitted to the ENGINEER. Submit final flow charts and program listings no later than 6 weeks prior to factory testing of the system.

5. Record Drawings: Drawings of each of the above types representing the as-built condition of the equipment and software shall be delivered with the equipment at the jobsite. Final or corrected as-built drawings shall be delivered 4 weeks after field system acceptance. See General Requirements-As Built Drawings for further details.

1.6 SERVICES OF MANUFACTURER

A. Services of the manufacturer shall be provided as follows:

1. **Inspection, Startup and Field Adjustment:** An authorized service representative of the manufacturer shall visit the site for not less than one day per drive system to check the installation, supervise start-up, and supervise testing and adjustment of VFDs.

2. **Instruction of OWNER'S Personnel**: The authorized service representative shall instruct the OWNER'S personnel in the skills required for each Trade Group indicated and the duration indicated. This includes all aspects of drive operation and maintenance, including step-by-step troubleshooting procedures with necessary test equipment. Instruction of the OWNERS personnel shall be conducted separate from the start-up and testing activities. Each of the OWNERS Trade Groups will be instructed individually, and no more than six hours will be scheduled in one day. Durations of instruction are:

Trade Group	Class Hours	Field Hours
Electricians and Electronics Technicians	4	4
Operations and Plant Maintenance Technicians	4	4

1.7 FACTORY TESTING

A. **Component Tests:** All components shall be 100 percent tested. Components shall be burned-in for 168 hours at 125 degrees C and retested to detect any drift. All printed circuit boards shall be burned-in continuously for 168 hours at 65 degrees C. The printed circuit boards shall be tested after burn-in to insure they are functioning within specification. Every transistor shall have the following critical parameters tested at rated current: gating, turn-on, turn-off, high temperature, forward blocking, reverse blocking and waveform characteristics. All assembled phase cells shall be tested for cell balance at rated voltage, maximum current, maximum dV/dT and maximum dI/dT.

Control power shall be applied to microprocessors, printed circuit boards, diagnostic boards and similar devices including software to test for proper operation, sequencing, logic and diagnostics.

All wiring shall be checked for continuity and for compliance with the wiring diagrams.

All terminations and devices in the VFD unit shall be scanned with an infrared sensor while the VFD is energized at 100 percent power, to assure proper connections and satisfactory devices. A copy of the infrared scan results shall be furnished to the CONSTRUCTION MANAGER.

B. **System Tests:** Testing shall proceed in the order given below. For the combined drive and motor test, the motor available from VFD manufacturer that is similar to actual motor specified for this project and may be used for testing. The CONTRACTOR shall submit a sketch of the proposed test setup, along with a description of the proposed testing procedure to the CONSTRUCTION MANAGER for acceptance at least 10 weeks in advance of the proposed testing date. No tests shall be performed until the test procedure meets with the CONSTRUCTION MANAGER's approval. In addition, the CONTRACTOR shall furnish the CONSTRUCTION MANAGER with at least 4 weeks advance written notice of the date and location of the system tests. The

OWNER and the CONSTRUCTION MANAGER (at the option of either or both) reserve the right to witness the system tests.

1. The VFD shall be load-tested in a heat room maintained at 40 degrees C for 24 hours. The motor shall be cyclically loaded via the dynamometer as follows:

   75 percent full load current for 6 hours
   50 percent full load current for 6 hours
   100 percent full load current for 6 hours

   Failure of any major components during this test requires repair and commencement of a new test. Motor and dynamometer need not be in the elevated temperature room with the VFD.

C. **Harmonic Analysis:** Harmonic analysis shall be calculated at unit full load in accordance with Section 8 of IEEE 519. Computer model shall be based on single line diagram shown with source impedance delineated in terms of noncontributing short circuit amperes as tabulated below. Analysis shall be performed at the point of common coupling (PCC), determined from the plant single line diagram and accessible for field verification (see paragraph 11033-3.2A). Analysis shall show that sufficient filtering has been provided to limit the total harmonic distortion (THD) to limits set by IEEE 519. Results shall be either in table or graphic form.

Driven Equipment Name	Short Circuit Amps
Raw Sewage Pump 103, 104 and 105	Per short circuit study

1.8 VFD FEATURES:

A. The VFDs shall be provided with the following features:

1. Fused control circuit transformer and microprocessor for system logic sequencing and fault annunciation functions.
2. 4 to 20 mA process follower for input speed reference signal.
3. Adjustable minimum/maximum frequency limits. The minimum and maximum frequency limits shall be selected to match the entire operating speed range for each specific type of driven equipment. The minimum and maximum frequency limits shall be independently adjustable within the ranges selected. The maximum frequency shall be 66 hertz.
4. Independent timed linear acceleration and deceleration functions, adjustable as indicated.
5. Adjustable motor slip compensation based on motor current.
6. Terminal blocks for control and signal wires entering and leaving the controller.
7. All fuses shall be provided with blown fuse indicator lamps.
8. Current limit adjustable from 50 to 110 percent of motor rating.
9. Automatic re-start with defeat selector.
10. Capability of picking up a spinning load.
11. 4 to 20 mA isolated output signal for VFD speed.

1.9 FUNCTIONAL REQUIREMENTS

A. **Supply Power:** The VFD shall remain on line and operate without damage to either the VFD or its connected load during a supply power variation of plus 50 percent lasting for a period of up to 0.01 seconds and minus 100 percent lasting for a period of up to 0.5 seconds.

B. **Load:** The VFD system shall be capable of continuously driving the specified maximum motor load under the conditions specified herein. Variable-torque (VT) units shall be capable of delivering 115 percent of the specified load for up to 60 seconds in any one incident and up to 240 seconds per hour.

C. **Power Factor:** VFDs shall have a power factor (kW/kVA), at rated base speed and full load, of not less than 0.95 for 18 pulse systems, and of not less than 0.90 for systems with less than 18 pulses.

D. **Frequency and Voltage Regulation:** VFD inverter output frequency shall be regulated to within 0.6 hertz of the specified instrumentation signal/output frequency relationship. VFD inverter output voltage shall be regulated to within 1.0 percent of that value which will produce minimum motor heating at any operating frequency within the specified range.

E. **Frequency Range:** VFD shall be capable of satisfactory continuous operation with the specified load at any frequency between the frequency corresponding to minimum speed and 60 hertz.

F. **Ambient Noise:** Free field noise generated by the VFD shall not exceed 85 dBA at 3 feet out from any point on the VFD cabinet under any normal operating condition.

G. **dV/dt:** The peak voltage at the motor terminals shall be # 1.6 kV, and the rise time shall be 0.1s. Contractor shall be responsible for providing any filtering required to conform to this criteria. Filter losses shall be included in the efficiency calculation specified in paragraph 11033-2.1C.

1.10 PROTECTION:

A. **Overcurrent Protection:** The VFD system shall provide adjustable electronic current limit. Current limit shall be accurate to within 1.0 percent and shall smoothly limit motor speed at whatever value is necessary to limit motor current to that value.

The VFD shall also provide motor running overcurrent protection in compliance with NFPA 70. This function may be included in the electronic overload circuitry if suitably UL labeled.

B. **Short Circuit Protection:** The VFD shall be fully protected against load faults. Phase to phase, or phase to ground faults shall not damage the unit. Fault protection shall be based on a power source short circuit but no less than capacity of 65,000 amperes RMS symmetrical at the VFD power input terminals. Any impedance or other current limiting necessary to meet this requirement shall be provided as part of the VFD system, and any losses caused by current limiting devices shall be included in efficiency calculation for the VFD system.

C. **Line Voltage:** The VFD shall be protected against high and low line voltage on one or more phases.

D. **Internal Faults:** The VFD shall incorporate an internal fault monitoring system to detect malfunctions. This system shall be designed to protect the VFD from transient and sustained faults and to limit damage that may be caused by these faults.

E. **Motor Over-Temperature:** The VFD shall interface to the motor temperature switches and shall shut down if the motor becomes overheated. The VFD shall include all components necessary to sense a contact opening and disconnect the affected motor if the motor winding temperature exceeds maximum rated operating temperature.

PART 2 PRODUCTS

2.1 RAW SEWAGE PUMP VFDs

A. **General:**

1.	Number of drive units	-	3
2.	Driven equipment	-	Centrifugal Pump
3.	Driven equipment Specifications reference	-	11219
4.	Drive voltage	-	480 volts

B. **Service Conditions:**

The VFD shall be designed and constructed to operate continuously within the following service conditions:

1.	Elevation	-	zero to 3300 feet
2.	Ambient Temperature Range	-	5°C to 45°C
3.	Atmosphere	-	Non-condensing relative humidity to 95%
4.	AC Line Voltage Variation	-	480 volts plus or minus 10%
5.	AC Line Frequency Variation	-	60 hertz plus or minus 3 Hz

C. **Operating Conditions:**

1. Efficiency of VFD systems shall be not less than 95 percent at 60 hertz output driving the specified maximum load at 100 percent speed and 100 percent torque. Efficiency shall be defined as follows:

$$Efficiency = \frac{POWER\ \ IN(watts) - LOSSES(watts)}{POWER\ \ IN(watts)} 100\% \qquad \textbf{(1)}$$

where losses include input line reactor, rectifier, intermediate circuit, inverter, and output filter.

2. Distribution voltage shall be 480 volts, three phase, three wire, 60 Hz as indicated.

3. Rectifier input line current harmonics shall not exceed the values tabulated in IEEE 519.

4. The VFD shall be specifically designed for use with variable torque equipment or pumping loads, fully capable of at least a 10:1 infinitely adjustable speed range.

5. The control shall vary the output frequency between the frequency corresponding to minimum speed and 66 Hz. Soft-start control circuitry shall limit inrush current, not to exceed 110 percent of motor full load current, under all manual and automatic operating conditions. When power outage occurs, the drive system shall shut down in an orderly manner. Upon restoration of ac power, the motor shall restart automatically and run at a rate depending upon the reference requirements, by the sequencing logic controller.

2.2 GENERAL

A. **Basic Description:**

1. The VFD shall be solid state AC to AC inverter controlled device utilizing the latest isolated gate bipolar transistor (IGBT) technology.

2. The drive shall be an Ultra Low Harmonic Adjustable Speed AC Drive that is designed to comply with standard IEEE 519-1992 when installed into system that already is in compliance with the standard.

B. **Harmonics**

1. The Ultra Low Harmonic construction of the VFD shall not contribute any significant harmonics at the input terminals of the VFD, and shall maintain harmonics levels at the VFD‘s input terminals to levels at or below those listed in “Harmonic Control in Electrical Power Systems, IEEE Std. 519-1992.” in the system that already is in compliance with the said standard.

2. All harmonic management devices must be internal to the VFD enclosure and supplied as a complete solution.

3. The VFD shall have an active line supply unit which controls the waveform of the input current and reduces the low order harmonic current drawn from the power line. Line currents and voltages shall be nearly sinusoidal. IGBTs shall be used in the rectified and inverter circuits.

4. Each input phase of the VFD shall incorporate a symmetrical LCL filter arranged in a T-configuration. The inductors are to be series power components that carry the full current of the VFD.

5. The input current to the VFD shall have a total harmonic content less than 5% of full rated capability at the input terminals of the VFD on power system sized according to IEEE 519-1992 at line voltage unbalance up to 3% and under all motor load conditions.

6. The VFD shall operate at fundamental power factor 1.0 on the supply side under all motor load conditions.

7. The input power factor shall be programmable from 0.8 lagging to 0.8 leading, allowing the VFD to be used as a compensating device for installations that are excessively inductive or excessively capacitive in reactive power. The reactive power required by other loads connected to the same distribution system may be compensated for by the providing that VFD has sufficient capacity for reactive and active loads.

8. The VFD's design shall not compensate for existing harmonic content in the distribution system.

C. **Motor:** The motor shall be squirrel cage inverter duty type in accordance with Section 16040.

D. **Basic Features:** The VFD controller shall have the following basic features:

1. The door of each power unit shall include:

   a. Input disconnect handle integrally interlocked with power unit door.
   b. One manual speed control potentiometer.
   c. One 3-position mode selector switch marked "HAND-OFF-AUTOMATIC".
   d. A "Power On" light.
   e. A speed indicating meter with a range of 0 to 110 percent of full speed.
   f. One elapsed time meter with five digits, without reset.
   g. One VFD fault reset push-button.
   h. One ammeter with a range of 0 to 125 percent of drive current rating.
   i. One output voltmeter with a range of 0 - 600 volt.
   j. VFD fault diagnostics.
   k. Indicating lights to show running and ready status.
   l. Refer to control diagram(s) for additional devices.
   m. RS232 and MODBUS communication port.

2. Switches in the door shall control the drive as follows:

   a. With the "HAND-OFF-AUTOMATIC" switch in the "HAND" position, the drive shall be manually started and stopped by the "START-STOP" switch and the drive output speed shall be controlled by the manual potentiometer.

   b. With the "HAND-OFF-AUTOMATIC" switch in the "AUTOMATIC" position, the drive shall start when an external isolated contact closes and its speed shall be controlled by a 4-20 mA external reference signal.

3. The VFD shall be selectable to provide automatic restart after a trip condition resulting from overcurrent, overvoltage, under voltage, or over-temperature. For safety, the drive shall shut down and require manual reset and restart if the automatic reset/restart function is not successful within a maximum of three attempts within a short time period.

4. Speed Profile: Individual adjustable settings for start, stop, entry, slope, and minimum and maximum speed points. Speed reference shall be from an external 4 - 20 mA DC signal.

5. Control Circuit: Fused 120 VAC control transformer and control relays for system logic functions. For system logic, see electrical drawings.

6. Provision for an external 4 to 20 mA DC speed reference input signal. VFD manufacturer shall provide a signal current isolator to ensure signal and galvanic isolation of the grounded or ungrounded input speed reference signal. Where indicated, a frequency proportional 4-20 mA powered output signal shall be provided for external use and wired out to terminals.

7. Status control and alarm inputs and outputs, each consisting of SPDT electrically isolated auxiliary contacts rated 5 amp at 120 VAC. Status, control and alarm inputs and outputs shall be provided as indicated on the contract documents and specified in Section 13300.

   The VFD shall be provided with a fault annunciation system which shall indicate the cause of any shutdown. Annunciator shall identify the first fault in those cases where multiple faults occur between manual or automatic resets and shall be visible without opening the VFD cabinet. If an English language annunciator is not provided, an engraved nameplate shall be provided on the cabinet face with explanations of each fault code. As a minimum, the following faults shall be annunciated:

   a. External fault
   b. Input power loss
   c. DC bus undervoltage
   d. DC bus overvoltage
   e. Motor stalled
   f. Motor overload
   g. Drive overtemperature
   h. Drive overcurrent
   I. Ground fault
   j. Output short
   k. Transistor short
   l. Drive controller hardware fault
   m. Drive controller software fault
   n. Drive configuration error

   VFD internal faults and motor over-temperature or failure shall latch in the trip mode and shall require operator intervention to reset the drive. External VFD faults such as input power loss shall allow for automatic re-start.

   Status outputs shall consist of three separate unpowered outputs; two run status outputs, and a VFD enable output. VFD enable status contacts shall monitor the emergency (coast to a stop) circuit. Wiring shall be as required by the electrical control diagrams.

8. Automatic and safety inputs, each consisting of a remote contact closure rated 5 amp at 120 VAC maximum, complying with Section 16050.

   Opening of the automatic input remote contact shall cause the motor speed to ramp down to zero speed by controlled deceleration. Opening of the safety input remote contact shall cause the motor speed to coast to a complete stop. Wiring shall be as required by the electrical control diagrams.

9. For VFDs larger than 200 horsepower, a critical frequency avoidance circuit shall be provided to allow up to three selectable bands of operating frequencies (with programmable band widths) at which the VFD will not operate continuously in order to avoid system resonant vibrations.

10. Independent timed linear acceleration and deceleration functions, adjustable from 4 to 300 seconds.

11. Terminal blocks for wires entering and leaving the VFD unit. Terminals shall be identified with alpha- numeric characters identical to the terminal identifiers indicated on the schematic and connection diagrams.

12. Frequency regulator to operate within the following tolerances:

    a. Frequency regulator span shall be 4 mA at minimum speed and 20 mA at maximum speed.

    b. Frequency regulator accuracy shall be within 1.0 percent of span.

    c. Frequency regulator deadband shall be within 0.5 percent of span.

    d. Frequency regulator repeatability shall be within 0.5 percent of span.

    e. Frequency reference signal input resistance shall not exceed 250 ohms.

13. All integrated circuit boards shall be coated for corrosion protection. All components shall be solid state controls. All circuit boards shall be arranged for ease of removal in case of repair.

E. **Warranty:** Warranty period shall cover 24 months from date of startup, not to exceed 30 months from date of shipment. During this period repairs, including parts and labor, shall be provided at no cost to the OWNER.

2.3 ENCLOSURE

A. The enclosure shall be a dead-front, freestanding assembly with cabinet base and maximum dimensions as indicated. Working height shall be not greater than 74 inches. Doors shall be 12 gauge sheet steel with full length piano hinges. Removable lifting angles shall be provided.

Unless otherwise indicated the enclosure shall have gasketed doors and door openings. Enclosure shall be front or side access only, as indicated. No rear access shall be provided. Enclosure shall be suitable for either top or bottom cable entry as indicated.

Enclosure shall be NEMA Type 1 with gasket and painted ANSI 61. Inside shall be white. The exterior of stainless steel enclosures shall not be painted.

2.4 PROTECTIVE FEATURES

A. The controller shall include the following protective features:

1. For each programmed warning and fault protection function, the VFD shall display a message in complete English words or Standard English abbreviations. The five (5) most recent fault messages and times shall be stored in the VFD's fault history.

2. The VFD shall include internal MOVs for phase to phase and phase to ground line voltage transient protection.

3. Output short circuit and ground fault protection rated for 100,000 amps without relying on line fuses shall be provided per UL508C.

4. Motor phase loss protection shall be provided.

5. The VFD shall provide electronic motor overload protection qualified per UL508C.

6. Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated voltage or undervoltage at 65% of min. rated voltage.

7. The VFD shall protect itself against input phase loss.

8. A power loss ride through feature shall allow the VFD to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.

9. Stall protection shall be programmable to provide a warning or stop the VFD after the motor has operated above a programmed torque level for a programmed time limit.

10. Underload protection shall be programmable to provide a warning or stop the VFD after the motor has operated below a selected underload curve for a programmed time limit.

11. Over-temperature protection shall provide a warning if the power module temperature is less than 5°C below the over-temperature trip level.

12. Input terminals shall be provided for connecting a motor thermistor (PTC type) to the VFD's protective monitoring circuitry. An input shall also be programmable to monitor an external relay or switch contact.

B. Drive shall be provided with a main circuit breaker or input fused disconnect switch, mechanically interlocked with the drive cabinet door. Interlock shall be provided with defeater. Unless otherwise indicated, circuit breaker or fuse shall have a minimum short circuit interrupting capacity of 65,000 RMS symmetrical amps.

C. Output reactor shall be provided as required to limit **dv/dt** damage to motor windings. Acceptable analysis proving reactor is not necessary, because of length of feeder cable run and switching frequency, is an acceptable alternative.

D. Provide motor protection relay manufactured by GE Multilin 469 series.

2.5 CONTROL DEVICES

A. Pilot devices and instruments shall be flush mounted on a VFD unit door. Pilot devices shall be heavy duty with contacts rated 10 amp minimum at 600 VAC. Indicating lights shall be "push-to-test" type. Lens colors shall be in accordance with Section 13300. Door-mounted indicating lights shall be removable without removing related wiring. The control units of a given type and size shall be made interchangeable. Relays shall be hermetically sealed.

2.6 DIAGNOSTICS

A. The VFD shall be provided with the following diagnostics:

1. Lights to indicate failure of converter or invertor
2. Lights to indicate presence of gate pulses on converter and invertor
3. Indication of the following fault conditions:

    a. No fault
    b. Blown power fuse
    c. Control power failure
    d. Under-voltage
    e. Instantaneous overcurrent
    f. Sustained overload
    g. Over-temperature
    h. Output over-voltage

4. Meter with switch to test the following control signals:

    a. Frequency command
    b. Voltage command
    c. Motor voltage feedback
    d. Invertor bus voltage
    e. Current command
    f. Current feedback
    g. Converter command
    h. Filtered invertor bus voltage

5. Circuitry for the following test modes:

    a. Manual operation of the invertor through each firing sequence to test power circuit and logic.
    b. Operation of the drive open circuit.

2.7 NAMEPLATES, TOOLS AND SPARE PARTS

A. **Nameplates**: Nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in accessible locations. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the equipment performance ratings.

B. **Tools**: The WORK includes special tools necessary for maintenance and repair; tools shall be stored in tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.

C. **Spare Parts:** The WORK includes the following spare parts for each VFD:

1. 1 printed circuit board of each type used
2. 1 complete inverter bridge phase cell with snubbers
3. 1 complete converter bridge phase cell
4. 5 spare light bulbs (i.e. LEDs) of each type used
5. 3 spare fuses of each type used
6. 2 cans of aerosol spray touch-up paint

2.8 MANUFACTURERS

A. The VFD manufacturing facility shall be ISO 9001 and ISO 14001 certified.

B. VFD shall be manufactured by ABB, model ACS800-37-0610-5+ C129 550 HP, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Drives shall be installed in accordance with approved procedures submitted with the shop drawings, manufacturer's recommendations, and as indicated.

B. General installation requirements shall comply with Section 16030.

C. **Schedule:**

Variable Frequency Drives

Driven Equipment		Motor Control Center		Horse-Power	Converter Pulses
Tag No.	Name	Tag No.	Circuit No.		
VFD-P103	Pump 103 VFD	MCC-A	N/A	550	Active Front End Drive
VFD-P104	Pump 104 VFD	MCC-B	N/A	550	Active Front End Drive
VFD-P105	Pump 105 VFD	MCC-A	N/A	550	Active Front End Drive

3.2 FIELD TEST

A. Field measurement of the harmonic indices shall be performed at unit full load using a harmonic analyzer (Hewlett Packard, or equal) with CTs with rated accuracy at 400 hertz. Harmonic indices shall be measured at the PCC. Tests shall prove that sufficient filtering has been provided to limit the harmonic distortion to limits set by IEEE 519. Results shall be tabulated and included with test results required in accordance with paragraph 11000-1.6A5.

B. Provide field testing of installed VFD per the requirements of Section 1.9 FUNCTIONAL REQUIREMENTS above.

** END OF SECTION **

SECTION 11175 - PUMPS, GENERAL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing general requirements for pumps and pumping appurtenances both new and modified, and providing special tools and spare parts.

B. The WORK also includes coordination of design, assembly, testing and installation.

C. The WORK of this Section applies to the WORK of the following Sections:

1. Section 11219 Custom Engineered Vertical Variable-Speed Non-Clog Pumps

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 11000 Equipment, General Provisions
2. Section 11002 Equipment Supports, Grouting and Installation
3. Section 11005 Machine Alignment
4. Section 11020 Vibration and Critical Speed Limitations

1.3 SPECIFICATIONS AND STANDARDS

A. Specifications and standards shall comply with Section 11000 and shall include the following:

AISC	American Institute of Steel Construction, Manual of Steel Construction, Allowable Stress Design - 9th Edition
AISI 1045	Steel
ANSI/ASME B73.1	Specifications for Horizontal End Suction Centrifugal Pumps for Chemical Process
ANSI/ASME B73.2	Specifications for Vertical In-Line Centrifugal Pumps for Chemical Process
ANSI/AWWA E101	Deep Well Vertical Turbine Pumps - Line Shaft and Submersible Types
ANSI/HI 1.1-1.6	Centrifugal Pumps
ANSI/HI 2.1-2.6	Vertical Pumps
ANSI/HI 3.1-3.6	Rotary Pumps

ANSI/HI 6.1-6.6	Reciprocating Pumps
ANSI/HI 7.1-7.5	Controlled Volume Pumps
ANSI/HI 9.1-9.5	Pumps - General Guidelines
ANSI/HI 9.3.3	Pumps - Polymer Material Selection
ANSI/HI 9.6.1	Centrifugal and Vertical Pumps for NPSH Margin
ANSI/HI 9.6.3	Centrifugal/Vertical Pumps Allowable Operating Region
ANSI/HI 9.6.4	Centrifugal and Vertical Pumps. Vibration Measurements and Allowable Values.
ANSI/HI 9.8	Pump Intake Design Standard
ANSI/IEEE 112	Test Procedure for Polyphase Induction Motors and Generators
ANSI/IEEE 115	Test Procedure for Synchronous Machines
API 610, 1995	Centrifugal Pumps for Petroleum, Heavy Duty Chemical and Gas Industry Services
ASME Code	ASME Boiler and Pressure Vessel Code
ASTM A 53	Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
ASTM A128	Steel Castings, Austenitic Manganese
ASTM A 216	Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service
ASTM A217	Steel Castings, Austenitic and Martensitic Stainless and Alloy
ASTM A 276	Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A 278	Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650º F (345º C)
ASTM A 283	Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 322	Specification for Steel Bars, Alloy, Standard Grades
ASTM A 395	Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
ASTM A 470	Specification for Vacuum-Treated Carbon and Alloy Forgings for Turbine Rotors and Shafts

ASTM A 536	Specification for Ductile Iron Castings
ASTM A 571	Austenitic Ductile Iron Castings for Pressure-Containing Parts Suitable for Low Temperature Service
ASTM A 576	Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM A 743	Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, and Nickel-Base Corrosion-Resistant for General Application
ASTM A 744	Castings, Iron Chromium-Nickel, Corrosion Resistant, for Severe Service
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings
ASTM B 148	Aluminum Bronze Sand Castings
ASTM B 505	Copper-Base Alloy Continuous Castings
ASTM B 584	Copper Alloy Sand Castings for General Applications
ASTM E 448	Recommended Practices for Scleroscope Hardness Testing of Metallic Materials
AWS-B3.0	Welding Procedures and Performance Qualifications
AWS-Dl.1	Structural Welding Code--Steel
Hydraulic Institute	(See applicable ANSI/HI Standard) Standards
ISO 9001	Quality Systems
ISO 10816	Mechanical Vibration--Evaluation of Machine Vibration by Measurement on Non-rotating Parts--Part 1: General Guidelines, Annex B, Table B.1. Zone A, Class I, II or III, as applicable. For the purposes of this specification, Annex B of ISO 10816, Part 1 shall form a part of this specification and ISO 10816, Part 1.
NEMA MG1	Motors and Generators
UL 674	Motors and Generators, Electric, for Use in Hazardous Locations, Class 1, Groups C and D, Class II, Groups E, F and G

1.4 SHOP DRAWINGS AND SAMPLES

A. In addition to the requirements of Section 11000 and the material listed in the detailed specification, the following shall be submitted:

1. At least one successfully operating installation of comparable size and complexity (including no cavitation, damaging vibration or shaft damage within the first three years of operation) designed and installed in the recent past by the proposed pump manufacturer, with address and telephone numbers.

2. A Certificate of Unit Responsibility Assignment signed by officers of both the CONTRACTOR and the pump manufacturer corporations, attesting to the assignment of responsibility in accordance with these Contract Documents. ***No other submittal material will be reviewed until the certificate has been received and found to be in conformance with these requirements.***

3. A copy of this specification section and the referencing section and all other applicable specification sections governing the pump, drive and motor, supports and specified appurtenances. The specification copies shall be complete with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. ***Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.***

4. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal**.** If no changes are required, the drawing or drawings shall be marked *"**no changes required**"*. ***Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.***

5. Documentation of certification in accordance with ISO 9001 as specified under paragraph 11175-2.1A.

6. Predicted pump performance curves for each condition point specified showing head, power, efficiency, and NPSH required on the ordinate plotted against capacity (in mgd) on the abscissa. Pump inlet, bowl, column and discharge head losses for column pumps shall be shown as separate curves. Curves for variable speed pumps shall be provided at 100-rpm intervals between the minimum and maximum speeds required to achieve the specified operating conditions. Manufacturer's recommended operating range for stable operation and prevention of surge, cavitation and vibration. Under no circumstances shall the manufacturer's recommended operating range be less than that required to meet the pump operating conditions specified.

7. NPSHR margin calculations performed in accordance with paragraph 11175-1.9G.2 or 3 as applicable and including the information required under paragraph 11175-1.9G.1.

8. Motor submittal information as specified in paragraph 16040-1.5. In addition, this information shall include certified calculations for motor rotor and frame reed frequencies, as specified under paragraph 11175-1.9H.

9. Complete description and sketch of proposed test setup for factory test if a factory test is required by the terms of these specifications, at least 10 weeks in advance of the proposed test date. Submittal material shall include sample calculations and proposed test log format. Submittal shall be in accordance with paragraph 11175-1.7C.6.

10. Information required under Section 11020.

11. Drawings showing general dimensions and confirming the size of pumps, motors, drives, flywheels (if required), and specified appurtenances; piping connections; construction details of equipment; wiring diagrams; and weight of equipment.

12. Variable-speed drive information as required under Sections 11033 if the equipment specified includes variable speed capability.

13. Drive unit support calculations and data if the drive is separately supported and if the analysis under the requirements of paragraph 11175-1.10 is required by the terms of these specifications.

14. Qualifications of the design professional performing the mass elastic design analyses specified under paragraph 11175-1.10 if the subject analysis is required by the terms of these specifications.

15. Critical speed calculations and mass elastic systems analyses for pumps as specified in paragraphs 11175-1.9C or 11175-1.10, if the subject analyses are required by the terms of these specifications.

16. Manufacturer's design and calculations for intermediate shafting, if intermediate shafting is required. Show shaft lengths, location of bearing supports, and shaft critical speed.

17. Shaft deflection calculations to demonstrate compliance with paragraph 11175-1.10 if shaft deflection calculations are required by the terms of these specifications.

18. Calculations justifying the dimensions of flywheels, if flywheels are required.

19. Details of the pump and drive unit foundation, including type, size, number, and arrangement of anchor bolts, dimensional drawings of the sole and base-plates, and all other information required under Section 11002.

20. If factory tests are required by the terms of these specifications, certification of satisfactory testing of each unit as specified. The certified material shall include copies of test logs and resulting performance curves at least four weeks prior to shipping the units from the factory. Manufacturer's reports on hydrostatic tests, including calibration test results on all instruments used to conduct the factory hydrostatic and performance tests.

21. Results of motor rotor, frame and assembly bump tests, certified as specified under paragraph 11175-1.9H, along with the design professional's supplementary report as specified under paragraph 11175-1.10B.

22. Vibration measurement results as specified in paragraph 11175-3.5.

1.5 OWNER'S MANUAL

A. In addition to the requirements of Section 11000, the following shall be included in the OWNER'S MANUAL submittal:

1. Manufacturer's written guarantee that pumping equipment operates with efficiencies, heads and flow ranges indicated and meets vibration and critical speed limitations indicated.

2. Drive unit support calculations and data if the drive is separately supported and if the analysis under the requirements of paragraph 11175-1.10 is required by the terms of these specifications.

3. Critical speed calculations and mass elastic systems analyses for pumps as specified in paragraphs 11175-1.9C or 11175-1.10, if the subject analyses are required by the terms of these specifications.

4. Shaft deflection calculations to demonstrate compliance with paragraph 11175-1.10 if shaft deflection calculations are required by the terms of these specifications.

5. Calculations justifying the dimensions of flywheels, if flywheels are required.

6. Performance guarantee as specified in paragraph 11175-1.7C if a Performance Guarantee has been specified.

7. Balance logs for pumps with nozzles sizes 6 inches in diameter and greater, certified, signed and notarized in accordance with paragraph 11175-2.7.

8. If factory tests are required by the terms of these specifications, certified copies of test logs and resulting performance curves. Manufacturer's reports on hydrostatic tests, including calibration test results on all instruments used to conduct the factory hydrostatic and performance tests.

9. Vibration measurement results as specified in paragraph 11175-3.5.

1.6 SERVICES OF MANUFACTURER

A. Services of manufacturer shall be provided in accordance with Section 11000, this Section, and the detailed pump specifications.

1.7 FACTORY TESTING

A. The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture. This shall include costs for travel, meals, lodging, and car rental for two OWNER-designated inspectors for the number of days

indicated to complete such inspections or observations, if the place of manufacture, fabrication and factory testing is more than fifty (50) miles outside the geographical limit of the City. The CONTRACTOR shall not be responsible for salary or salary-related costs of the inspectors.

B. **Performance Curves:** Centrifugal pumps shall have a continuously rising curve toward the shut-off head and in no case shall the required horsepower at any point on the performance curve exceed the rated horsepower of the motor or engine. The allowable operating region for all centrifugal and axial flow pumps shall comply with the requirements of paragraph 11175-1.9.

C. **Performance Confirmation:** Pumps, drives, and motors shall be factory-tested to confirm specified requirements in accordance with the applicable ANSI/HI Pump Standards Test Code for Centrifugal, Vertical, Rotary, and Reciprocating Pumps, and test data shall be recorded. Tests shall be performed on all pumps and motors of sizes 25 horsepower and larger. Prototype model tests will not be acceptable.

1. Test data shall include the following:

    a. Hydrostatic test results

    b. Hydraulic test results with, unless otherwise specified, a minimum of 10 readings between shutoff head and 25 percent above design capacity.

    c. Certified pump curves showing head/flow, horsepower, efficiency and NPSHR curves.

    d. Certification that the pump horsepower demand will not exceed the rated motor horsepower beyond a 1.0 service rating at any point on the curve.

    e. Motor test results

    f. NPSH margin test results, if NPSH margin tests are required

2. **Factory Tests of Motors**: All pump motors of sizes 25 horsepower and larger, shall be assembled, tested, and certified at the factory and the working clearances checked to insure that all parts are properly fitted. The tests shall comply with ANSI/IEEE 112 and ANSI/IEEE 115 standards, including heat, running and efficiency tests.

3. **Hydrostatic Tests:** All pressure sustaining parts shall be subjected to factory hydrostatic tests. Hydrostatic tests for centrifugal and axial flow pumps shall conform to the requirements of API 610.

4. **Performance Guarantee:** Unless specified otherwise, pump performance, including NPSHR for centrifugal and axial flow pumps, shall be guaranteed by the pump manufacturer to the most restrictive tolerances set forth in the applicable ANSI/HI Standard. The guarantee shall be in writing, shall be signed by an officer of the manufacturing corporation and shall be notarized. Under no circumstances shall deviations from specified operating conditions, though allowed by the referenced standards, result in overload of the driver furnished with the equipment, nor shall such deviations result in power requirements greater than the driver's nameplate rating.

5. **Factory Witnessed Tests:** Unless otherwise specified, pumps, variable speed drives (if any), and motors, for pumping units 150 horsepower and larger, shall be factory tested as complete, assembled units and witnessed by a representative of the CONSTRUCTION MANAGER and of the OWNER.

6. The CONTRACTOR shall submit a sketch of the proposed witnessed test setup, along with a description of the proposed testing procedure to the CONSTRUCTION MANAGER for acceptance at least 10 weeks in advance of the proposed test date. No tests shall be performed until the test procedure meets with the CONSTRUCTION MANAGER'S approval. In addition, the CONTRACTOR shall furnish the CONSTRUCTION MANAGER with at least 4 weeks advance written notice of the date and location of the witnessed performance tests.

7. **Witnessed Tests:** Witnessed pump performance tests shall be in accordance with the applicable ANSI/HI test standard. NPSHR tests shall also be performed for centrifugal and axial flow pumps to confirm the data used to establish NPSHA margin as specified in paragraph 11175-1.9G. NPSHR tests for column type (axial flow and vertical turbine) pumps shall be performed using the method described for Figure 2.6.3 or Figure 2.6.4 in ANSI/HI 2.6. All NPSHR tests shall extend from 10 percent to 120 percent of Best Efficiency Flow at full speed, or to not less than 10 percent (in terms of flow) past the flow at Operating Condition B, whichever is greater. Not less than ten data points shall be developed during the test. Failure to achieve guaranteed performance (capacity and head, efficiency or NPSHR) shall be cause for rejection. Tolerances shall be the most restrictive set forth in the applicable standard. All test procedures shall be in strict conformance with the referenced standards, except prediction of performance of a trimmed impeller from test data of the larger impeller will not be permitted. If trimming is required, the pump shall be retested. Under no circumstances shall deviations from specified operating conditions, though allowed by the referenced standards, result in overload of the driver furnished with the equipment, nor shall such deviations result in power requirements greater than the driver' nameplate rating.

8. **Non-Witnessed Tests:** Where non-witnessed tests are permitted, centrifugal and axial flow pumps shall be tested in accordance with ANSI/HI 1.6 or 2.6, as applicable. Not less than ten data points shall be developed during the test. NPSHR tests shall also be performed to confirm the data used to establish NPSHA margin as specified in paragraph 11175-1.9G. NPSHR tests for column type (axial flow and vertical turbine) pumps shall be performed using the method described for Figure 2.6.3 or Figure 2.6.4 in ANSI/HI 2.6. All NPSHR tests shall extend from 10 percent to 120 percent of Best Efficiency Flow at full speed, or to not less than 10 percent (in terms of flow) past the flow at Operating Condition B, whichever is greater. Failure to achieve guaranteed performance (capacity and head, efficiency or NPSHR) shall be cause for rejection. Tolerances and restrictions shall be as set forth above for witnessed tests. The CONTRACTOR shall furnish the CONSTRUCTION MANAGER with not less than two weeks' advance written notice of the date and place of the non-witnessed tests.

9. In the event of failure of any pump to meet any of the specified requirements or efficiencies, the CONTRACTOR shall make all necessary modifications, repairs, or replacements to conform to the requirements of the Contract Documents and such pump shall be retested at no additional cost to the OWNER, until found satisfactory.

10. All test results (data sheets, test logs and generated performance curves) shall be signed and certified correct by an officer of the manufacturing corporation and shall be notarized.

11. Upon completion of testing, curves shall be produced showing pump performance (head, efficiency, NPSHR (if applicable), and power required versus capacity) at full speed and predicted performance at speeds required to meet all other indicated operating conditions. The test results shall be certified and notarized as noted above and submitted to the CONSTRUCTION MANAGER. The pumps shall not be shipped until authorized, in writing, by the CONSTRUCTION MANAGER. Final acceptance of the equipment will depend on satisfactory operation after installation.

1.8 FIELD TESTS

A. All pumping units, both new and modified shall be field tested after installation to demonstrate proper operation, without excessive noise, vibration, cavitation, and overheating of bearings. The field testing shall be performed in the presence of an experienced field representative of the manufacturer of the equipment, who shall certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation and shall witness the following:

1. Startup, checking, and operation of the equipment over the entire speed range. For pumps smaller than 50 horsepower without variable speed drives, the vibration shall be within the limits specified in Section 11020 and the vibration shall be recorded at a minimum of 4 pumping conditions which have been reviewed by the CONSTRUCTION MANAGER. Vibration requirements for pumps 50 horsepower and larger and all pumps with variable speed drives are specified in paragraph 11175-3.5.

2. Pump performance shall be documented by obtaining concurrent readings, showing motor voltage, amperage, pump suction head, and pump discharge head, for at least 4 pumping conditions at the respective pump rpm. Each power lead to the motor shall be checked for proper current balance.

3. Determination of bearing temperatures by a contact-type thermometer. A running time of at least 20 minutes shall be maintained for this test, unless liquid volume available is insufficient for a complete test.

4. Ensure that electrical and instrumentation testing complies with Sections 13300 and Division 16 Sections.

Additional field testing requirements are specified in Section 11000, Part 1, and may be specified in the individual equipment specifications.

1.9 DESIGN REQUIREMENTS FOR CENTRIFUGAL AND AXIAL FLOW PUMPING EQUIPMENT

A. **General:** Provisions and requirements contained in this paragraph (1.9) apply specifically to centrifugal and axial flow pumps, both vertical and horizontal, commonly falling into the generic types covered by ANSI/HI 1.1 through 1.6 and 2.1 through 2.6. More restrictive requirements, where found in individual pump specifications, shall supercede requirements of this paragraph. This paragraph does not apply, except by specific reference, to positive displacement pumps of any type.

Centrifugal and axial flow pumping equipment shall conform to the requirements of paragraph 2.1.1, API 610. All components in the rotating elements in the drive train, including equipment supports and supports for rotating elements, shall be selected and designed to function without damage or disassembly at reverse rotational speeds up to 150 percent of maximum operational speed during flow reversals through the pump. The complete pumping unit shall operate without overload on any component at any point along the pump's entire full-speed operating curve. Pumps required by virtue of the specified operating conditions to operate against a closed or throttled valve for any period of time exceeding five seconds, shall be furnished with drivers sized to operate continuously at the power requirement for that condition even though the power requirements at the rated condition may be less.

B. **Pump Selection:** Pumps shall be selected to place all specified continuous duty operating conditions within the manufacturer's Allowable Operating Range as defined in ANSI/HI 9.6.3. Unless otherwise specified in individual pump specifications, rated conditions and all other continuous duty full speed operating conditions specified in the detailed pump specifications shall fall within the manufacturer's Preferred Operating Range as defined in ANSI/HI 9.6.3. The Preferred Operating Range shall be not less than that specified in paragraph 2.1.12, API 610. Proposed pump selections shall be selected to allow not less than a five percent increase in head, as specified in paragraph 2.1.4 of API 610. Variable speed operation to achieve this objective will not be considered. Pump selections proposing maximum diameter impellers for the proposed pump model and casing size will not be accepted.

Pumping equipment shall be suitable for the operating modes described in the detailed pump specifications and other relevant portions of the Contract Documents.

All pumps shall be designed in accordance with applicable portions of ANSI/HI 1.1 - 1.6, 2.1 - 2.6 and ANSI/HI 9.1 - 9.6 and the requirements of this Section. The pumps shall be specifically designed to pump the fluids described in the detailed pump specifications and shall operate without clogging or fouling caused by material in the pumped fluid at any operating condition within the range of service specified.

The pumps shall operate without cavitation or damaging vibration over the entire specified range of flow and head conditions and shall be specifically selected for NPSHR characteristics conforming to the requirements of paragraph 11175-1.9G.

Unless otherwise indicated, the pump head capacity curves shall slope in one continuous curve within the specified operating conditions. No points of reverse slope inflection capable of causing unstable operation will be permitted within the specified zone of continuous duty operation. Pumps with head/capacity curves as described in paragraph 9.6.3.3.12 of ANSI/HI 9.6.3 are specifically prohibited if these characteristics will cause unstable operation within the specified range of operating conditions and where startup/shutdown conditions entail operation against a slow opening/closing valve.

C. **Critical Speeds and Natural Frequencies:** Unless otherwise specified for variable speed pumping equipment or for custom engineered pumping equipment, the complete pumping unit, including all related frames, supports, enclosures, and casings, shall be free from dangerous critical speeds from 20 percent below to 30 percent above the operating speeds required to achieve the performance characteristics specified.

The logarithmic decrement for each damped natural frequency within this range shall be greater than +0.3.

Unless otherwise specified, the CONTRACTOR shall furnish documentation under paragraph 11175-1.4 demonstrating compliance with this requirement for all pumping equipment with discharge nozzle sizes 6 inches in diameter and greater.

D. **Impeller Clearances and Keyways:** The radial clearance between the tip of the impeller vane and diffuser or volute vanes shall be not less than 3 percent and 6 percent, respectively, of impeller diameter. The ratio of liquid channel widths (diffuser or volute/impeller) shall be not less than 1.15 nor more than 1.3 for diffuser pumps and 1.4 B 1.5 for volute-type pumps.

Impeller keyways for multistage diffuser-type pumps shall be cut at differing positions on the impeller shaft to avoid multiple simultaneous vane passing pulses.

E. **Component Design Criteria:**

1. **General:** Unless otherwise indicated, combined stresses in steel frames and supports shall not exceed those permitted by the AISC Manual of Steel Construction. Combined stresses in cast, forged, rolled or fabricated pressure retaining components, frames and supports shall not exceed that allowed for the given material in Section VIII, Division 1 of the ASME Code. Design pressures for pressure-retaining parts shall be not less than twice the pump's shutoff head at the manufacturer's listed maximum operating speed.
   The term "combined stresses" in this paragraph (1.9) shall mean the sum of all operating stresses, including stresses induced by dynamic and static forces as developed via the analysis procedures stipulated in this section. Dynamic forces shall include both steady state and transient stresses induced by operating conditions.

2. **Anchorage:** Unless otherwise indicated, anchor bolts for vertical volute-type and vertical axial flow pumps shall be designed to restrain twice the forces developed by operation of the pump at maximum speed against a closed valve with no restraint at the pump inlet and discharge flanges.

   Bases for horizontal pumps shall be designed in accordance with paragraph 11175-2.5, and shall provide common support for the pump and motor (and flywheel, if one is specified).

   All vertical (column type) pumps with unit weights (including drive, if supported by the pump) weighing more than 1,000 pounds and all volute type pumps with nozzle sizes 16 inches in diameter and greater and all separately supported motors shall be supported on a sole plate provided by the pump manufacturer. Sole plates shall be designed in accordance with paragraph 11175-2.6.

   Anchor bolts and connecting bolts for all assemblies supported by other assemblies furnished under this Section or sections referencing this Section, shall be designed in accordance with the requirements of this Section, Section 11000, and the individual pump specifications. Anchor bolts, nuts and washers shall comply with paragraph 11175-2.2.

3. **Torsional and Combined Shaft Stresses:** The pump rotor shall be free from torsional criticals and shall comply with all stress requirements indicated in paragraph 11000-1.12A. Additional requirements are indicated in paragraph 11000-1.12.

4. **Shaft Deflection:** Pump shafts on volute type pumps shall be designed to provide sufficient stiffness to operate without distortion or damaging vibration throughout the range of service specified. Shaft deflection at the face (impeller side) of the shaft seal shall be limited to no more than 1.5 mils at any continuous operating condition within the zone described by the specified continuous duty operating conditions. Deflection at the shaft seal shall be calculated using the relationship set forth in paragraph 11175-1.10D.3.

5. **Bearings:** Unless otherwise specified, anti-friction bearings shall be selected for an L-10 life expectancy in accordance with the requirements specified in paragraph 11000-2.8. Radial loads shall be calculated in accordance with the provisions set forth in paragraph 11175-1.10.

F. **Rotor and Critical Speed Analysis and System Design:** Requirements for the rotor and critical speed analysis and system design are specified in paragraph 11175-1.10.

G. **Net Positive Suction Head Required Limitations:**

1. **General:** Pumps furnished under this section and sections referencing this section shall be selected for NPSHR (Net Positive Suction Head Required) characteristics using the suction energy methodology set forth in ANSI/HI 9.6.1. NPSHR characteristics for the candidate pump shall be based upon documented test data not more than five years old, performed on a pump not more than two nominal pump diameters larger or smaller than the proposed pump with an impeller of the same geometry as that proposed for the pump to be used for the subject application, and operating at the same speed as the pump for the proposed application. The CONTRACTOR shall document the basis for NPSH characteristics as set forth in this paragraph.

   Individual restrictions shall apply to NPSH margin as set forth below, depending upon the type of pumping equipment and the fluid to be pumped. The detailed specification sections provide NPSHA (Net Positive Suction Head Available or wet well elevation) information for anticipated operating conditions for each application. This information is generally referenced to a specific elevation, stated in terms of project datum. It shall be the CONTRACTOR's responsibility to adjust the NPSHA information to the elevation of the pump impeller eye for the specific pump model and size proposed for the application. NPSHR, as used in the following paragraphs, shall mean the NPSHR at the impeller eye, determined in accordance with ANSI/HI 1.6 or 2.6, as applicable for the proposed pump. The CONTRACTOR shall document the method used to determine NPSHR for the proposed pump and justifying compliance with the NPSH margin limitations established under this paragraph in material submitted under paragraph 11175-1.4. The documentation shall include justification of the NPSHR tests used to develop NPSHR characteristics, including the following:

   a. Date, test procedure, and test logs of original NPSHR information used to project requirements for pump selected for the application.

   b. Test pump size, impeller diameter, impeller model, eye diameter, and speed.

   c. Calculations projecting NPSHR test information to NPSHR curve information for pump proposed for the application.

d. Calculations demonstrating compliance with the NPSH margin requirements established in this paragraph.

The CONTRACTOR, using suction energy rules in selecting pumps proposed for each application, shall apply criteria set forth in the individual paragraphs below. Percentages stated below shall apply to pump capacity on the selected pump's head/capacity curve at the speed required to achieve the specified operating condition.

The CONTRACTOR shall submit the manufacturer's suction energy calculations justifying the proposed pumps selections with the material required under paragraph 11175-1.4.

2. **Pumps Used for Solids Bearing Liquids:** The following restrictions shall apply to pumps specified for wastewater, stormwater, primary effluent, return mixed liquor, RAS, and trickling filter service:

a. A minimum NPSHA/NPSHR margin ratio of 1.3 shall apply at any operating condition within 85 percent and 115 percent of the best efficiency capacity. The minimum acceptable NPSHA/NPSHR margin ratio at any other locations on the pump's head/capacity curve shall be 1.8.

b. Notwithstanding item a above, the manufacturer shall use the methodology in ANSI/HI 9.6.1 to determine the proposed pump's suction energy. In determining the proposed pump's suction energy, the inlet nozzle size shall be increased by two nozzle sizes to account for impeller design considerations. In employing the suction energy method, the minimum NPSHA/NPSHR ratio shall be not less than that recommended in ANSI/HI 9.6.1 or item a., above, whichever is greater. For submersible and wet pit pumps, suction nozzle size shall be the impeller eye diameter of the proposed pump.

c. If the proposed pump's suction energy, as determined in item b, falls into the "high" or "very high" region, as determined from Figure 3 in ANSI/HI 9.6.1, the minimum acceptable NPSHA/NPSHR margin ratios shall be 1.5 and 2.0, respectively.

3. **Pumps Used for Clear Liquids:** The methodology set forth in ANSI/HI 9.6.1 shall be employed for determining NPSHA margin for pumps to be used on liquids which do not normally contain solids, such as potable and process water, heating water, and secondary and tertiary effluent pumping service. The acceptable minimum NPSHA less NPSHR margin shall be 5 feet at any specified operating condition falling within 85 percent and 115 percent of best efficiency capacity at the speed required to achieve the specified operating condition, and not less than 8 feet for any specified operating condition falling outside that zone. Suction nozzle size for wet pit and column-type pumps shall be the impeller eye diameter of the proposed pump.

H. **Motor Selection:** Unless otherwise specified, pumps shall be electric motor driven. Electric motors shall conform to the requirements set forth in Section 16040 or shall be as specified in the detailed pump specification. All motors shall be selected to be non-overloading at any operating point along the pump's full speed operating curve, including all points located beyond specified operating conditions. Motors furnished with pumps specified for operation at variable speed shall be inverter duty types conforming to the requirements of Section 16040 and shall be compatible with the variable speed equipment furnished with the pump.

In addition to the information submitted under the requirements of Section 16040, the CONTRACTOR shall provide certified reed frequency calculations for both the motor rotor and frame for motors driving "Custom Engineered" pumps, with the data to be submitted under paragraph 11175-1.4. Upon completion of construction of the motors driving "Custom Engineered" pumps for this project, each rotor and frame and the completed assembly shall be given a bump test to confirm the reed frequency calculations. The results of the bump test, certified by an officer of the manufacturing corporation and notarized, shall be furnished to the design professional responsible for the rotor and critical speed analysis (paragraph 11175-1.10) and submitted under paragraph 11175-1.4 and included in the Owner's Manual.

1.10 ROTOR AND CRITICAL SPEED ANALYSIS AND SYSTEM DESIGN

A. **General:** New and modified existing pumps shall be subject to the analysis. Differences, if they exist, shall be identified (example impeller shaft differences). The requirements of this paragraph shall apply to all variable speed pumping systems with pump nozzle sizes 12 inches in diameter and greater, all pumping unit specifications where the words "Custom Engineered" appear in the title or in paragraph 1.1A of the specification section, and elsewhere when a detailed pump specification makes reference to this paragraph. In addition, overhung shaft pumps operating in single volute casings shall be subject to analysis for shaft deflection in accordance with the terms of this paragraph.

B. **Requirements:** The complete pumping unit, including rotating elements, frames, supports, and all related structural elements, including pump, motor and bearing supports, shall be subjected to a lateral rotordynamic analysis, including a rotordynamic critical speed analysis, to identify and eliminate harmful resonant conditions.

The complete pumping unit rotating element, including pump, motor, intermediate shaft and flywheel rotors (if specified), and all other elements in the power train or powered via the power train, shall be designed to limit torsional stresses.

The torsional and rotordynamic analyses shall together be termed the pumping equipment's mass elastic design. The mass elastic design shall be the product of a registered design professional who has been responsible for the design of at least one successfully operating mass elastic design of comparable size and complexity in the recent past. The CONTRACTOR shall submit the qualifications of the proposed design professional as a part of the initial submittal information required under paragraph 11175-1.4.

Upon completion and receipt of certified results of the bump tests required for the motor rotor, frame and assembly specified under paragraph 11175-1.9H, the design professional shall review the data and submit a supplemental report either accepting the test results or recommending alterations to assembly structures to adjust for differences between calculated values used for the original analyses and actual values determined subsequent to motor fabrication.

Reports, calculations and recommendations resulting from the required analyses shall bear the design professional's original signature and professional registration seal. All reports, recommendations and calculations produced under this paragraph shall be submitted as specified in paragraph 11175-1.4. The format and documentation for the reports shall follow the requirements of ANSI/HI 9.6.4.

If the CONTRACTOR proposes the use of alternative methods for the required analyses, documentation shall be submitted justifying the substitution. The documentation shall include justification that product results will be equivalent to that specified and with an equivalent level of accuracy. The location and description of projects of an equivalent size where the procedure has been employed and the length of time these projects have been in actual service shall also be included.

C. **Critical Speeds:** Process sensitivities are such that operation of variable speed pumps at infinitely variable speed within the specified operational conditions is an absolute requirement. The CONTRACTOR is advised and warned that any remedy imposing a locked-out speed interval or intervals will not be considered an acceptable remedy for identified critical speeds. The CONTRACTOR shall adjust component sizes, and/or provide appropriate energy absorbing devices or other approved remedies to eliminate critical speeds within the operating range required to meet specified performance requirements.

D. **Methodology:**

1. **Rotordynamic Analysis:** The rotor dynamic analysis shall follow the procedure prescribed in Corbo and Malanoski, 1998, and shall include the following features:

   a. The procedure shall consider all speeds required to operate the equipment within the envelope of continuous operating conditions specified.

   b. The procedure shall produce Campbell diagrams for both wet and dry conditions.

   c. The procedure shall consider variations in assumed coefficients for seal and wearing ring clearances (Lomakin effect), bearing damping and stiffness, rotor imbalance (up to 10 percent of rotor disc weight at each disc position), impeller destabilizing forces, rotor shaft bending, hydraulic imbalance at not less than five operating conditions within the envelope of continuous operating conditions specified in addition to the specified operating conditions, and impeller vane/diffuser (cutwater) vane clearance. Unless specifically accepted by the OWNER, the range in variation of component characteristics shall comply with the ranges recommended in Corbo and Malanoski, 1998.

   d. The final report shall include a three-dimensional graphic presentation of shaft distortion and rotor element performance at identified critical speeds within the pump's operating range.

2. **Torsional Vibration:** The methodology used for evaluation of the mass elastic system and shaft combined stresses shall follow the approach prescribed in Corbo and Malanoski, 1996, using either the Matrix-Eigenvalue or Holzer methods for determining natural frequencies. The computer analysis results shall be verified by hand calculations for the fundamental frequency and for mode shapes. Exciting frequencies to be considered during the analysis shall be 0.5, 1, and 2 times running speed, vane passing frequencies for the pump impeller/cutwater-diffuser vane combinations, line and twice line frequency, motor pole frequency and motor starting transients. Forcing function magnitudes used for the analysis shall be not less that 10 percent of the maximum transmitted torque. The analysis shall also include evaluation of control pulse frequencies induced by the variable frequency drive. The analysis report shall include a statement produced by the variable frequency drive

manufacturer detailing all control pulse frequencies generated by the equipment between 1/4 and 18 times motor running speed.

The stress analysis procedure shall be based upon a finite element analysis technique using a digital computer program that has been successfully field calibrated with at least one installation of comparable size and complexity in the recent past. Unless otherwise justified by documentation supported by independent studies, the analysis procedure shall use the range of factors recommended in Corbo and Malanoski, 1996. The CONTRACTOR shall produce a Campbell-type interference diagram showing the relationship between operating range, natural frequencies and exciting frequencies.

The analysis shall include a time-integration study showing transient peak stresses resulting from startup, shutdown and motor control transients if synchronous drives are specified. The diagrams shall include calculated stresses throughout the range of frequencies considered in the analysis. Tomographic diagrams, displaying colorimetrically peak stresses at all positions in the pump shaft and all frames, including roots at changes in section and keyways or other stress concentrating locations, shall be provided with the analysis report. The diagram shall indicate operating speeds identified that produce the peak stresses and shall be specific for speeds inducing identified peak stresses at keyways, changes in section and at connections to other components.

3. **Shaft Radial Load and Deflection:**

a. **Overhung Shaft Pumps:** Shaft radial loads and deflection for overhung shaft pumps operating in single volute casings shall be calculated using the following relationship:

$$\Delta_{MAX} = \frac{R}{3E}\left[\frac{a^2c - abc}{I_c} + \frac{1}{I_a}\left(\frac{b^3 - 3a^2b}{2} + a^2\right)\right]$$

Where:

Δmax = deflection, inches, at the outboard (impeller side) face of the shaft seal

E = modulus of elasticity, psi
30×10^6 for carbon steel
28×10^6 for 316 stainless steel
Alternate materials: as accepted by OWNER

a = shaft length, inches, from the centroid of the impeller profile (from inlet to discharge nozzle) to the centerline of the radial bearing

b = shaft length, inches, from the centroid of the impeller profile (from inlet to discharge nozzle) to outboard (impeller side) face of shaft seal

c = shaft length between centerline of bearings, inches

I_a = moment of inertia of the shaft at section a, in^4

I_c = moment of inertia of the shaft at section c, in^4

R = radial force, pounds, at any specified operating condition or any operating condition within the envelope of specified operating conditions resulting in peak loads imposed on the shaft:

$$R = (K)(H)(D)(Y) + W$$

where:

K = Radial thrust factor. K shall vary with flow and specific speed in accordance with the following:

Q/Q_{BEP}	K, N_S = 2000	K, N_S = 3500
0.0	0.31	0.38
0.1	0.30	0.375
0.2	0.28	0.36
0.3	0.26	0.345
0.4	0.24	0.325
0.5	0.22	0.3
0.6	0.18	0.27
0.7	0.15	0.23
0.8	0.12	0.185
0.9	0.08	0.14
1.0	0.05	0.09
1.1	0.06	0.12
1.2	0.11	0.17
1.3	0.20	0.25

NOTES:

1. *Q/Q_{BEP} in the table is the ratio of flow at the operating condition to flow developed by the pump at best efficiency*

2. *N_S in the table is specific speed, as defined in ANSI/HI 1.1 - 1.6*

3. *K for pumps with specific speeds between 2000 and 3500 shall be established by a straight line interpolation from the above values.*

4. *K for pumps with specific speeds greater than 3500 shall be established by a straight line extrapolation from the above values. The manufacturer is at liberty to use differing values of K from that above so long as they are greater than those listed in the table. Under no circumstances will lesser values of K be acceptable.*

H = Head (psi) developed by the pump at any specified duty point, including operating conditions within the envelope of conditions specified

D = Mean impeller diameter, inches

Y = Impeller width, inches, at discharge, including shrouds

W = Impeller weight with wearing ring, pounds (W = 0 if vertical pump)

Radial loads calculated in accordance with the above procedure shall be used for bearing life calculations as required under paragraph 11175-1.9E.5.

Flexural stress calculations shall be based upon the loading criteria specified above and shall be incorporated into the combined stress calculations specified under paragraph 11175-1.9E.3.

b. **Impeller between Bearings Pumps:** Shaft deflection for single volute pumps with the impeller mounted between bearings such as for split case centrifugal pumps shall be calculated in accordance with the following formula:

$$\Delta_{max} = \frac{(R_x)(3L^2 - 4x^2)}{48EI}$$

Where:

Δmax = deflection, inches, at the face (impeller side) of the shaft seal

R = radial force, as defined above

L = distance between bearings, inches

E = modulus of elasticity for the shaft material, as defined above

I = shaft moment of inertia at the bearings, inches^4

x = distance between bearing and seal face (impeller side), inches

4. **Reference Documents:** The Corbo and Malanoski documents referenced in paragraphs 11175-1.10D.1 and 11175-1.10D.2. are available from the City of San Diego, Metropolitan Wastewater Department, on an as-needed basis, to those with the need to know as determined by the CITY:

a. Corbo and Malanoski, 1996 Practical Design Against Torsional Vibration. From *Proceedings of the 25th Turbomachinery Symposium*, Turbomachinery Laboratory, Texas A & M University, College Station, TX, pp.189-222, 1996.

b. Corbo and Malanoski, 1998 — Pump Rotordynamics Made Simple. From *Proceedings of the 15th International Pump Users Symposium*, Turbomachinery Laboratory, Texas A & M University, College Station, TX, pp.167-204, 1998.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **General:** Pumping equipment shall comply with this Section, the detailed pump specification, and Section 11000. In addition, the pump manufacturer and the pump manufacturing site shall be certified under ISO 9001. Evidence of the required certifications shall be included with the initial submittal under paragraph 11175-1.4.

B. **Combinations of Equipment:** Pumping equipment shall be new and shall incorporate all necessary mechanisms, couplings, electric motor and drives, shafts, appurtenances, and mounting.

C. **Tools:** Tools shall comply with Section 11000 and shall include one pressure grease gun for each type of grease required for pumps and motors.

D. **Spare Parts:** Spare parts shall include for each pump 1 complete sets of seals, packing, gaskets, nuts, bolts, washers, wear rings, lantern ring removal tools, and a set of spare bearings as well as all parts indicated in the detailed pump specifications.

E. **Nameplates:** Nameplates shall comply with Section 11000 and shall indicate rated head and flow, impeller size and pump speed. Flywheel nameplates shall include manufacturer, serial number, model, weight, and moment of inertia.

2.2 MATERIALS

A. **General:** Materials used in the pumping equipment shall be suitable for the intended application and shall be free from defects. **Materials of construction specified under the individual pump sections take precedence. Materials of construction not specified in the individual pump sections shall conform to the requirements listed below. However, where the individual pump sections and this Section are silent with respect to materials of construction of any component, material selection shall follow the requirements of Table H-1, API 610, Materials Class I-1.**

1. **Cast Iron:** Close-grained gray cast iron conforming to ASTM A 48, with 2 to 3 percent nickel added to the cast iron for raw sewage, wastewater and sludge applications. Pressure class shall be suitable for the application but shall be not less than Class 30 for pumps 4-inch and larger.

2. **Ductile Iron (where indicated):** ASTM A 395.

3. **Pressure Casings, Inner Casing Parts such as Bowls, Diffusers and Diaphragms, and Impellers:** Cast iron conforming to the requirements of API 610, Materials Class I-1 and paragraph 2.2A.1 above.

4. **Stainless Steel Pump Impellers (where indicated):** Cast Type 316 stainless steel conforming to API 610, Materials Class S-8.

5. **Bronze Pump Impellers (where indicated):** ASTM B 62 or ASTM B 584.

6. **Pump Shafts:** Stainless steel, Type 316 unless higher strength is required.

7. All shaft sleeves for packed boxes, fretting seals and inter-stage seals shall be Type 316 stainless steel conforming to API 610, Materials Class S-8 requirements.

8. Miscellaneous Stainless Steel Parts: Type 316 except Type 304 in septic environments.

9. **Internal Fastener Parts of All Types in Wetted Areas:** Type 316 stainless steel conforming to API 610, Materials Class S-5.

10. **Discharge Heads and Suction Cans:** Carbon steel conforming to the requirements of API 610, Materials Class I-1.

11. **Anchor Bolts, Nuts and Washers:** Materials shall be as specified in paragraph 11000-2.20.

B. **General Quality:** Details of manufacture and assembly of equipment furnished under the individual pump sections and this Section shall follow the requirements of API 610 with respect to the following features (paragraph references, API 610):

1. Alignment aids (paragraph 2.1.24).

2. Removal of rotating element (paragraph 2.1.25).

3. Jackscrews for assistance in alignment on all base-plates and equipment supports (paragraph 5.3.7.3.4).

4. Castings (paragraph 2.11.2).

5. Welding (paragraph 2.11.3).

C. **Wearing Rings:** Unless otherwise specified, centrifugal and axial flow pumps shall be fitted with both stationary and rotating wearing rings. Wearing rings shall be of hard faced Type 316 stainless steel and shall conform to the requirements of API 610, paragraph 2.6.2, Material class S-8. Maximum wearing ring clearances shall not exceed 150 percent of the values stated in Table 2-2, API 610. Provisions shall be made for adjustment of wearing ring clearance via adjusting screws and shims in the back head design. L-form wearing rings are not acceptable for wastewater, sewage, stormwater, thickener overflow, mixed sludge, digester circulation, digested sludge, waste activated sludge, return activated sludge or primary effluent pumping service. Wearing rings shall be the axial type with a wear allowance of 0.25 inches minimum. Minimum wearing ring hardness on the rotating ring shall be 350 (BHN), with the stationary ring not less than 100 hardness points greater.

D. **Spacer Coupling:** Horizontal pump and electric motor shall be connected with a flexible coupling which will not transmit backlash. The coupling shall be selected to provide sufficient gap between the pump and motor shafts to allow complete withdrawal and removal of the pump backhead, frame and rotor without disturbing the motor when the coupling is removed. Couplings shall comply with paragraph 11000-2.6.

E. **Protective Coatings:** Pumps shall be protected with coatings as specified in Section 09800, unless otherwise specified in the individual equipment specifications.

2.3 ACCESSORIES

A. **Solenoid Valves:** Pumps shall include solenoid valves at the inlet of water, oil lubrication, and cooling water connections. Solenoid valves shall be continuous time rated for the voltage and service conditions indicated.

B. **Pressure Gauges:** Pressure gauges shall be installed at pump suction and discharge lines except sump pumps and hot water circulating pumps. Pressure gauges shall comply with Section 13300 and shall be mounted at a location selected to minimize the effect of vibrations.

C. **Pump Suctions:** Compound gauges shall be installed at pump suctions and where subject to shock or vibrations, the pressure gauges shall be wall-mounted or attached to Type 316 stainless steel channel floor stands located where they will not impede pump maintenance access and connected to the pump by means of flexible connectors.

D. **Variable Speed Drives:** Where indicated, variable speed drives, drive motors, speed control equipment, and accessories shall comply with Sections 11033.

E. **Local Control Panels:** The NEMA rating of local control panels shall comply with the area designations of Section 16050, unless indicated otherwise.

F. **Lifting Eyes:** Pumps and nozzles shall be provided with lifting eyes to permit removal and/or disassembly.

2.4 PUMP REQUIREMENTS

A. Pumps shall comply with the following:

1. **Lubrication:** Except as otherwise indicated, line shaft bearings of vertical turbine mixed flow, and propeller pumps shall be utility water-lubricated and deep-well pumps and pumps with enclosed line shafts shall have fresh water- or oil-lubricated bearings and seals.

2. **Handholes:** Handholes on pump casings shall be designed to follow the contours of the casing to avoid any obstructions in the water passage.

3. **Umbrellas:** For column pumps, the inlet wet well design is based upon the geometric relationships described in ANSI/HI 9.8, and a bell intake velocity of 5.5 fps shall be assumed. If the bell intake velocity for a proposed pump will exceed 5.5 fps, the CONTRACTOR shall require the pump manufacturer to furnish an umbrella fitted to the pump inlet bell that will effectively reduce the intake velocity to 5.5 fps, at no additional cost to the OWNER.

4. **Drains:** Gland seals, air valves, and cooling water drains, and drains from variable speed drive equipment shall be piped to the nearest floor drain, with galvanized steel pipe or copper tube; an air separation complying with the Uniform Plumbing Code shall be provided.

5. **Grease Lubrication:** Unless otherwise specified, all vertical propeller, mixed-flow, and turbine pumps, (other than deep well pumps), shall be equipped with a stainless steel tube designed for lubrication of bottom bearing.

6. **Stuffing Boxes:** Where shaft packing is indicated, stuffing boxes shall be tapped to permit introduction of flush/cooling liquid and shall hold a minimum of five rows of packing. Stuffing boxes shall be face attached. Stuffing box and shaft shall be suitable for field installation, without machining or other modifications, of the mechanical seal indicated for the applicable pump and operating conditions. Unless otherwise indicated, lantern rings shall be bronze, packing shall be die-molded packing rings of non-asbestos material suitable for the intended service and as recommended by the manufacturer, and glands shall be bronze, two piece split construction.

   Stuffing boxes shall be face attached. Stuffing boxes and shaft shall be suitable for field installation, without machining or other modifications of the mechanical seal indicated for the applicable pump and operating conditions.

   Lantern rings shall be of two-piece construction and shall be provided with tapped holes to facilitate removal. Lantern rings shall be drilled and tapped 1/4 NC-20. Threaded lantern ring removal tools shall be provided with spare parts for each pump. Seals shall be flushed with utility water cleaned by means of a solids separator, or with process water. Except as otherwise indicated, the packing material shall be interlaced Teflon braiding, containing 50 percent ultra fine graphite impregnation complying with the following:

   Shaft speeds - up to 2500 fpm
   Temperature - up to 500 degrees F
   pH range - 1 to 14

7. **Mechanical Seals:** Shafts for pumps shall have a single cartridge type mechanical seal cooled by product water routed from the backhead area into the stuffing box through a machined clearance. Pump/empeller shall be designed to provide pressure above suction pressure, to the stuffing box area to allow seal flush/vent line to function. Stationary seal face shall be solid tungsten or silicon carbide. Rotating seal face shall be carbon. Seal shall be manufactured by AESSEAL, Inc. CURC type, no exceptions.

   Contractor shall provide a seal vent/flush line, of no smaller than 3/8" I. D. tubing from the seal flush connection, on the cartridge seal gland, through a 3-way valve, to a connection on the suction side of the pump.

B. **Bearing Temperatures**: Where possible, the bearing temperature at the worst loading condition and ambient temperature shall not exceed 150 degrees F. Where this is not possible, all exposed bearings shall be effectively shielded with permanent metal safety guards to prevent accidental contact by operators.

2.5 SOLE PLATES FOR VERTICAL CENTRIFUGAL AND AXIAL FLOW PUMPS

A. Sole plates for vertical column type pumps and separately mounted vertical pumps, shall be designed to be installed on the concrete foundation curbs shown and shall be milled flat to within 0.002-inch per foot in all directions on the face mating with the pump support. Prior to milling, sole plates shall have the words "THIS SIDE DOWN" permanently affixed to the underside using welding rod material. Unless otherwise specified, sole plates shall comply with Section 11002.

2.6 BASEPLATES AND DRIVE UNIT SUPPORTS

A. Base-plates for horizontal pumps shall be fabricated and finished in accordance with paragraph 3.3, API 610. All base-plates shall be designed for grouting on the housekeeping pads specified.

B. Drive unit supports for separately mounted vertical pump drives shall be of fabricated steel, ASTM A36. Drive unit supports shall be designed to span an opening in the floor sufficient to allow removal for the complete pump. Rolled steel beams shall be provided to stiffen the support and a fabricated steel drive unit support pedestal with a plate milled flat within two light bands shall be provided to mate with the drive enclosure. The support shall be designed to be supported on a sole plate embedded in a housekeeping pad at the edges of the floor opening or as indicated. Other details for the drive unit support shall be as indicated.

C. Unless otherwise specified, base plates and drive unit supports shall comply with Section 11002.

2.7 BALANCE

A. Balancing for centrifugal and axial flow pumps with nozzle sizes 6 inches in diameter and greater shall conform to the requirements set forth in API 610, paragraph 2.8.4.1. All balance logs, certified correct and signed by an officer of the manufacturing corporation and notarized, shall be included in the Owner's Manual.

2.8 MANUFACTURERS

A. Products of the type indicated shall be manufactured by the following (or equal):

1. **Self-Aligning, Self-Centering, Single Rotary Cartridge Type Mechanical Seals:**

Chesterton 155
AES

PART 3 -- EXECUTION

3.1 GENERAL

A. Installation shall comply with Section 11000, the requirements of this Section, and the requirements of the detailed pump specifications. Equipment with pump nozzle sizes 12 inches in diameter and greater shall be installed under the presence of a factory authorized installation specialist or specialists. Under no circumstances shall any installation procedures take place without the installation specialists present. Equipment and anchor bolt installation procedures shall conform to the requirements of Section 11002.

3.2 SOLE PLATES

A. Sole plates, if provided as required by this Section, where required by the equipment manufacturer's recommendation, or any section referencing this section, shall be leveled in the presence of a factory authorized installation specialist to a maximum tolerance of 0.002-inches/foot in all directions. Where the equipment manufacturer requires more stringent tolerances, those tolerances shall prevail.

3.3 ALIGNMENT

A. Equipment furnished under this Section and any referencing section shall be aligned as specified in Section 11005.

3.4 TESTING

A. Field testing shall be performed as specified in Part 1 of this Section. Testing also shall conform to the requirements of paragraph 11000-1.7A. For all units with variable speed drives and any unit with pump nozzle size 12 inches in diameter and greater, the testing procedure shall be a plan developed jointly by the CONTRACTOR and the equipment manufacturer to demonstrate performance of each item of equipment at all specified operating conditions.

3.5 VIBRATION

A. Vibration of installed pumps shall be measured in accordance with ISO 10816 for all pumps with variable speed drives and pumps with shaft power requirements 50 horsepower and greater. An independent testing laboratory specializing in this work, retained by the CONTRACTOR but acceptable to the CONSTRUCTION MANAGER, shall perform the measurements and shall submit the results directly to the CONSTRUCTION MANAGER. **RMS vibration velocity on any component when the pump is operating at any specified continuous duty operating condition shall not exceed the limits established for the appropriate machine by Tables 2-5 and 2-6 in API 610.** Vibration limits for pumps used for wastewater, grit, and sludge service shall be 150 percent of that established in the referenced tables. For all other installed pumps, vibration at the specified continuous duty operating conditions shall be measured by the independent testing laboratory noted above, and shall not exceed the limits specified in Section 11020. Vibration measurement results shall be included in the Owner's Manual.

3.6 TRAINING

A. Training shall conform to the requirements of paragraph 11000-1.7B and the individual equipment specifications. Unless otherwise indicated, the training requirement is waived for constant speed pumping equipment with nozzle sizes 4 inches in diameter and smaller and for all centrifugal and axial flow pumps with connected power requirements 10 horsepower and less. The training session for maintenance personnel shall include complete field and shop disassembly and subsequent reassembly of one complete pumping unit selected by the CONSTRUCTION MANAGER.

** END OF SECTION **

SECTION 11219 - CUSTOM ENGINEERED VERTICAL VARIABLE SPEED NON-CLOG PUMPS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. **General:** The WORK of this Section includes providing custom engineered vertical variable speed non-clog centrifugal pumps for pumping fluids containing unscreened sewage solids. Each pumping unit shall consist of a pump, intermediate shafting and couplings, electric motor, motor support, variable-frequency drive, and all appurtenances to provide a complete pumping system.

Equipment furnished under this Section shall conform to the requirements of this Section and the Related Sections.

Existing pumps P-103 and P-104 are Fairbanks Morse, Series 16” 2416, Serial Number K4C1- 062086, and currently have 23” impellers installed. The CONTRACTOR shall replace the existing 23” impellers and replace them with 25” impellers which shall meet the hydraulic requirements of this Section. Refurbished assemblies shall be complete with wear rings, case wear wings, pump bearings, seals, and all associated ancillary equipment for a complete, functional, and refurbished pump to like new condition.

The CONTRACTOR shall provide an all new pump assembly for P-105 which shall be of the same manufacturer and size of the refurbished pumps P-103 and P-104.

In-lieu of installing new impellers on P-103 and P-104, the CONTRACTOR may elect to replace the entire pump assemblies and provide a matching pump for P-105, complete with any piping modifications required, any anchorage modifications, in accordance with these specifications, and at no additional cost to the CITY. Any required changes to accommodate the new pumps shall be submitted to the CITY for approval, and require that the CONTRACTOR have their associated documents stamped by their Registered California Engineer responsible for the changes.

Existing Pumps P-103 and P-104 shall have their line shaft assemblies completely replaced with new lines shaft designed to handle the greater torque of the pumps and P-105 shall require a new line shaft assembly.

B. **Type:** Each pump shall be of the vertical dry pit bottom-suction volute-casing type. Impellers shall be enclosed non-clog Francis or mixed-flow configuration with two or more vanes designed specifically to pump unscreened wastewater with stringy organic solids and grit. The pumps shall be designed so that the impeller, back head, frame, and pump shaft can be removed as a complete unit without disturbing the connecting piping, casing, or motor. The pump and motor shall each be supported on separate cast iron or fabricated steel bases.

C. **Unit Responsibility:** The CONTRACTOR shall cause the equipment specified under this Section, including the variable speed drive specified under Section 11033 and the motors, to be furnished by the CONTRACTOR, as provided in Section 11000. The CONTRACTOR shall furnish a Certificate of Unit Responsibility Assignment as provided in Section 11175.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 11000 Equipment, General Requirements
2. Section 11002 Equipment Supports, Grouting and Installation
3. Section 11033 Variable Frequency Drives
4. Section 11175 Pumps, General

1.3 SPECIFICATIONS AND STANDARDS

A. Specifications and standards shall comply with Sections 11000 and 11175. Where this Section is silent on any subject, item or equipment, the requirements of Section 11175 shall govern.

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance to the provisions of Sections 11000 and 11175:

1. Data on temperature and vibration monitoring systems.

1.5 OWNER'S MANUAL

A. OWNER'S MANUAL requirements shall be as set forth in Sections 11000 and 11175.

1.6 SERVICES OF MANUFACTURER

A. Services of the manufacturer shall be provided in accordance with Section 11175 and as follows:

1. **Inspection, Startup and Field Adjustment:** An authorized service representative of the manufacturer shall visit the site for not less than 2 days to check the installation, supervise start-up, and supervise testing and adjustment of pumps.

2. **Instruction of OWNER'S Personnel:** The authorized service representative shall instruct the OWNER'S personnel in the skills required for each Trade Group indicated and the duration indicated. This includes all aspects of pump operation and maintenance, including step-by-step troubleshooting procedures with necessary test equipment. Instruction shall include, but not be limited to, review of operation and maintenance manual; installation and removal of pumps, motors and shafts; service and replacement of bearings; service and flushing of seal water system; replacement and service of seals; daily maintenance requirements; and long-term maintenance provisions. Instruction of the OWNER'S personnel shall be conducted separate from the start-up and testing activities. Each of the OWNER'S Trade Groups will be instructed individually, and no more than six hours will be scheduled in one day. Durations of instruction are:

Trade Group	Class Hours	Field Hours
Electricians	3	3
Electronics Technicians	3	3
Operations	3	3
Plant Maint. Technicians	3	3

1.7 FACTORY TESTS

A. Each pump shall be factory tested in accordance with the requirements established in Section 11175 and shall be a witnessed test.

1.8 FLUID TO BE PUMPED

A. The fluid to be pumped is municipal wastewater from a sanitary wastewater collection system. The fluid is anticipated to range between 64 degrees F and 78 degrees F and contain up to 300 mg/L of solids consisting of grit and organic material with small quantities of petroleum products and animal fats and greases. Owing to the presence of grit, the fluid is expected to be somewhat abrasive.

1.9 SYSTEM CONFIGURATION AND OPERATION

A. The pumps will be installed in a dry pit and obtain the fluid to be pumped via the indicated piping connected to a trench type wet well designed in accordance with the requirements of ANSI/HI 9.8.

B. The pumps will be operated at variable speed in response to the control system specified in Section 13300. Generally, the pumps will be controlled to match pumping rate to the rate of flow entering the pumping station, by controlling the wet well liquid surface elevation to mimic the normal depth vs. flow curve in the influent sewer. The number of pumps in service will be altered as required to achieve this objective and control liquid levels. As pumps are placed in service or taken out of service, all pumps will operate at the same speed, following the fluctuations in signal strength from the wet well level control system.

1.10 PERFORMANCE CRITERIA

A. Performance of pumps furnished under this Section shall be guaranteed under the terms of paragraph 11175-1.7C. Field vibration shall be measured in accordance with requirements specified in Section 11175. Non-conforming pumps will be rejected.

PART 2 -- PRODUCTS

2.1 PUMP NAME: Main Sewage Pumps P-103 through P-105

A. **General:** Each custom engineered vertical non-clog pump will be driven at variable speed using the output from a single variable frequency drive. The pumps will discharge through conventional spring-loaded check valves to a common manifold which will connect to the station force main.

Custom engineered vertical variable-speed non-clog pumps shall conform to the following requirements:

1.	Number of pumping units	-	3
2.	Location	-	Dry Well
3.	Service	-	Sewage
4.	Operation	-	continuous
5.	Drive	-	variable speed

B. **Operating Conditions:** Pumping equipment furnished under this Section shall be required to produce the specified flows and discharge heads under the conditions set forth as follows:

1. **Condition A:** Full Speed - Maximum Head Operation (See Notes a and f):

Capacity, gpm	-	8715
Total head, feet	-	145
NPSHA, feet	-	34

2. **Condition B:** Full Speed - Minimum Head Operation (See Notes b and f):

Capacity, gpm	-	from pump H/Q curve
Total head, feet	-	116
NPSHA, feet	-	34

3. **Condition C:** Reduced Speed - Maximum Head Operation (See Notes c and f):

Capacity, gpm	-	4028
Total head, feet	-	76
NPSHA, feet	-	34
Pump speed	-	Reduced

4. **Condition D:** Reduced Speed - Minimum Head Operation (See Notes d and f):

Capacity, gpm	-	6806
Total head, feet	-	68
NPSHA, feet	-	34
Pump speed	-	Reduced

5. **Condition E:** Reduced Speed - Startup/Shutdown (See Notes e and f):

Capacity, gpm	-	0
Total head, feet	-	82
NPSHA, feet	-	34
Pump speed	-	Minimum

NOTES:

a. Condition A shall be taken as the rated, continuous-duty operating condition with the pump operating ***at maximum speed against maximum anticipated system head.*** *Performance at the rated condition shall be guaranteed in accordance with Section 11175. Condition A has been selected to obtain the rated pumping capacity for the installation. It is not intended that the pumps be selected for maximum efficiency at Condition A. Pumps furnished under this Section should be selected to achieve Condition A performance, but also operate continuously without objectionable vibration or cavitation at the head specified under Condition B. Condition A may be located in the Allowable Operating Region as established by the pump manufacturer in accordance with ANSI/HI 9.6.3 and listed in the manufacturer=s published application data for the specific model proposed for this application.*

b. Condition B is presented to indicate operating conditions when the pump is operating at ***maximum speed against minimum anticipated system head,*** *assuming a hypothetical head-capacity curve. Pumps with head-capacity curves steeper than that assumed will produce less flow at lower head. The reverse will occur with pumps having a shallower head-capacity curve.* ***Proposed pump selections meeting this discharge head requirement by operating the equipment at less than full speed will be rejected. Condition B shall be used for pump selection. Condition B shall be located within the Preferred Operating Region as established by the pump manufacturer in accordance with ANSI/HI 9.6.3 and listed in the manufacturer's published application data for the specific model proposed for this application.*** *NPSHA, as listed for Condition B is calculated on a pumped flow of 20.2 mgd.*

c. Condition C is the anticipated continuous duty minimum speed condition when the pump is operating ***against maximum anticipated system head.*** *Pumps furnished under this specification shall be capable of sustained (24 hours per day) operation at this condition within the requirements set forth in Section 11175. Condition C shall be located within the Preferred Operating Region as established by the pump manufacturer in accordance with ANSI/HI 9.6.3 and listed in the manufacturer's published application data for the specific model proposed for this application.*

d. Condition D is the anticipated continuous duty minimum speed condition when the pump is operating ***against minimum anticipated system head.*** *Pumps furnished under this specification shall be capable of sustained (24 hours per day) operation at this condition within the requirements set forth in Section 11175. Condition D shall be located within the Preferred Operating Region as established by the pump manufacturer in accordance with ANSI/HI 9.6.3 and listed in the manufacturer's published application data for the specific model proposed for this application.*

e. Condition E represents the expected momentary (startup/shutdown) condition. Pumps furnished under this Specification will operate for no more than 30 seconds at this condition when initiating or terminating a service cycle. The maximum anticipated number of service cycles is twice per hour.

f. Total head in the above tabulation is the algebraic difference between the discharge head and suction head as defined in ANSI/HI 1.1 - 1.6. Net positive suction head available (NPSHA) in the above tabulation is referred to the pump inlet piping at centerline elevation (project datum) as shown and is calculated in accordance ANSI/HI 1.3 for average barometric pressure and maximum temperature conditions. NPSHA at the pump impeller eye can be determined by adjusting the given value by proposed pump dimensions and the indicated requirements for pump installation details. An allowance of five feet has been included for the presence of volatile constituents in the pumped fluid. Required NPSHA margin shall be as specified in Section 11175.

g. The pumps will be operated at variable speed in response to the control system specified in Section 13300. To permit the pump to operate at or near best efficiency during reduced-speed operation, it is preferred that the rated condition lie to the right of the best efficiency point on the pump's head capacity curve.

h. Maximum expected surge pressure is 300 psig.

C. **Design Requirements**:

1. **General:** The pumps shall be specifically designed to pump the fluid described in paragraph 11219-1.8, and shall comply with the requirements specified in Section 11175.

   Variable-speed drives furnished for this application shall be specifically designed to start and accelerate motors, shafting, pumps and entrained water when operating against the conditions specified in paragraph 11219-2.1B.

   The rotor and critical speed analysis requirements specified in paragraph 11175-1.10, Rotor and Critical Speed Analysis and System Design, apply to the driven and drive equipment, including supports and appurtenances, furnished under this Section.

   The pumps shall be provided with suitable lifting hooks and a hoist sling, if required, so that each pump can be removed in one piece.

2.	Minimum solid sphere capable of passing through pump (in. dia.)	-	5.25
3.	Max pump speed (rpm)	-	890
4.	Max pump efficiency at max speed, minimum (percent)	-	82.5
5.	Rotating moment of inertia (WK^2) ($lb\text{-}ft^2$)	-	350
6.	Max motor size (hp)	-	500

D. **Pump Dimensions:**

1.	Min size of suction flange (in)	-	18
2.	Min size of discharge. flange (in)	-	16
3.	Flange rating (psig)	-	125

2.2 PUMP REQUIREMENTS

A. **General**: Construction of custom engineered vertical variable-speed non-clog pumps shall conform to the requirements set forth in Section 11175, except as described in the following paragraphs.

B. **Materials:**

1. Seal	-	mechanical seal per Section 11175
2. Motor support shapes	-	Rolled steel, ASTM A283
3. Motor support plates	-	Steel, ASTM A36

C. **Pump Shafts**: The pump shaft shall be designed for the stresses and deflection limitations set forth in paragraph 11175-1.10.

D. **Impeller and Casing**: The impeller and casing shall be a non-clog design. The impeller shall be an enclosed Francis or mixed-flow configuration with two or more vanes and front and rear shrouds. Semi-open impellers will not be allowed. The leading edges of the impeller vanes and casing cutwater shall be smooth and rounded and configured to avoid accumulation of stringy materials and to pass solids. Impeller passages shall be designed specifically to pass solids found in unscreened municipal wastewater and to avoid cavitation. Vane overlap shall be minimized to permit efficient release of solids to the volute passages. All water passages shall be smooth and free from hollows, cracks, pin holes and projections. The impeller shall be firmly keyed to the shaft and held firmly in place by a threaded, cast stainless steel locknut designed to prevent stringy material from catching on it. The arrangement shall be such that the impeller cannot unscrew or loosen by torque from either forward or reverse rotation. The finished impeller with its wearing ring attached shall be statically and dynamically balanced.

The casing nozzle shall be fitted with a handhole not less than four inches in diameter. The handhole cover shall have surfaces which exactly match the inner contours of the casing waterway. The casing shall be foot-mounted for installation on the support base. The mounting foot shall have provisions for bolting and doweling to the base. A tapped, valved and plugged connection shall be provided at the nozzle for a pressure gage.

E. **Inlet Nozzle**: Pumps with inlet diameters 18 inches and less shall be fitted with inlet elbows designed to efficiently conduct the liquid into the impeller entrance. The elbow shall be fitted with a handhole not less than 6 inches in diameter. Pumps with inlet diameters 20 inches and greater shall have an inlet nozzle suitable for connection to the inlet draft tube indicated. The nozzle shall be fitted with a handhole not less than 8 inches in diameter. Handhole covers shall have surfaces which exactly match the inner contours of the elbow or nozzle waterway.

F. **Frame**: The frame shall be designed to carry both radial and thrust bearings. Openings shall be provided adjacent to the stuffing box. The connection between the backhead and frame shall have self-registering and centering fits. The frame shall be drilled and tapped for a 1-inch seal water drain to an external drain system.

G. **Supports**: Equipment supports shall be as specified in Sections 11175 and 11002.

H. **Drive and Motor:** Variable speed drive with vertical, heavy-duty, electric motor suitable for 460-volt, 3-phase, 60-Hz ac power supply, in accordance with Sections 11033 and 16040. The motor shall be supported independently on structural members with maintenance access to the upper intermediate coupling. As indicated in Section 11033, the motor shall be equipped with a winding temperature protection system and elements for monitoring bearing temperature or vibration. The variable speed drive shall be as described in Section 11033.

I. **Balancing**: The rotating assembly, including coupling, shaft, impeller with wearing rings and impeller nut, shall be dynamically balanced prior to final assembly. Balancing shall conform to the requirements specified in Section 11175.

Maximum Speed, rpm	Maximum Amplitude peak to peak, mils
600	3.5
720	3.0
900	2.5
1200	2.0

The CONTRACTOR shall furnish certified copies of all logs to demonstrate that all rotating elements have been balanced in accordance with these Specifications.

J. **Intermediate Shaft and Couplings**: Each pump shall be provided with a single section of tubular shafting and two flexible couplings for connection to the motor driver or flywheel. The shafting and couplings shall be designed with an application factor of 1.5 based upon the manufacturer=s standard application criteria. Shaft offset shall be between 2 and 12 degrees. Shafting shall be composite carbon fiber reinforced synthetic resin type as manufactured by ABB or equal. Shafting shall be complete, with a shaft guard which shall extend 3 feet above the pump frame and elsewhere as specified. Guards shall conform to paragraph 11000-2.13.

K. **Suction and Discharge Connections**: Suction and discharge connections shall be flanged, ANSI B16.1, Class 250. Flanges shall be flat faced. Bolt holes shall straddle the horizontal and vertical center lines. Provide 90-degree suction elbow for pumps with inlet connections 18 inches in diameter and smaller. Provide gasket between elbow and pump inlet. Cap screws or bolts connecting the suction elbow to the casing shall be Type 316 stainless steel, ASTM A 276.

L. **Motor Maintenance Platform**: (NOT USED)

M. **Temperature and Vibration Monitoring System**: Temperature and vibration monitoring system shall consist of primary elements, indicators, alarm switches and shutdown switches for each pump and motor. System shall monitor pump bearing housing radial vibration and temperature and shall monitor motor upper and lower bearing temperatures or vibration as indicated.

2.3 FLYWHEEL (NOT USED)

2.4 MOTOR SUPPORTS

A. Each motor shall be supported by a heavy, rigid fabricated steel base plate bolted to a fabricated steel frame designed to span the opening specified in the motor room floor over the pump. The base plate design shall conform in all respects to the criteria established in the AISC Manual. Welding shall be performed by welders certified in accordance with AWS B-3.0 and shall conform to AWS B-3.0 and AWS D-1.1. All welds shall be ground smooth and shall be free from skips, laps, blowholes and gas pockets. The base plate shall be finished flat and shall be suitable for bolting and doweling the motor in position after field alignment. The drive unit support shall be designed to safely carry the drive unit weight and the weight of the vertical shafting plus the dynamic loads associated with the operation and code requirements specified herein. The base plate shall be suitable for doweling to the fabricated steel frame after field alignment. The final design shall conform to the concepts indicated and be subject to review and acceptance by the engineer responsible for the dynamic analyses specified under paragraph 11175-1.10. The fabricated steel frame shall be welded into an assembly that supports the base plate under all sides, and cast into the reinforced concrete around the opening in the motor room floor to form a curb. The frame shall be stress relieved after fabrication and all support surfaces intended for connection to the base plate shall be finished flat and parallel to the base plate.

B. Equipment supports, anchors, and restrainers shall be designed for static, dynamic, wind, and seismic loads. The design horizontal peak ground acceleration shall be the greater of that indicated in the Geotechnical Report or as required by the California Building Code 2010. Unless otherwise indicated, Occupancy Category shall be III, and seismic design importance factors shall be I = 1.25, Ip = 1.5 in accordance with Table 11.5-1 per ASCE7-05. Determination of seismic forces and load combinations shall follow procedures in the ASCE7-05, Chapter 13. The supports shall be designed for seismic loadings by a registered structural engineer licensed to practice in the State of California. Calculations and supporting data shall be provided with the OWNER'S Manual.

C. The pumping unit manufacturer shall be completely responsible for the adequacy of the motor supports, including coordination with the dynamic analyses required under this Section. This requirement, however, is not to be construed as relieving the CONTRACTOR of his responsibility for this portion of the work.

2.5 PAINTING

A. All external surfaces of the pump, and motor shall be coated as specified in Section 09800. All interior wetted surfaces of the pump shall be coated as specified in Section 09800.

2.6 NAMEPLATES, TOOLS AND SPARE PARTS

A. **Nameplates and Tools**: The WORK includes providing nameplates and tools in accordance with Section 11175.

B. **Spare Parts**: The WORK includes the following spare parts per pump:

1. 1 - impeller, complete with wearing ring
2. 1 - set all bearings
3. 1 - set, wearing rings
4. 1 - shaft sleeve
5. 1 – mechanical seal

2.7 MANUFACTURERS

A. Pursuant to the limitations described in paragraph 11000-2.1D, candidate pump manufacturers include, Ebara, Fairbanks Morse, Ingersoll Dresser, Morris, and Patterson, or equal.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Pumping equipment shall be installed in accordance with approved procedures submitted with the shop drawings and as indicated.

B. General installation requirements shall be as indicated in Section 11175.

** END OF SECTION **

SECTION 11293 - SLUICE AND SHEAR GATES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing sluice and shear gates, where indicated, with manual operators, frames, wall thimbles, bracing, mountings and coatings

B. The WORK requires that one manufacturer accept responsibility for furnishing all gates of one type as indicated but without altering or modifying the CONTRACTOR'S responsibilities under the Contract Documents.

C. The WORK additionally requires that the one manufacturer who accepts the indicated responsibility for a certain type of gate shall manufacture all gates of that type.

1.2 RELATED SECTIONS (Not Used)

1.3 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Manufacturer's certification that frames and slides have been tested and withstand the maximum heads indicated.

PART 2 -- PRODUCTS

2.1 SLUICE GATES

A. **General:** Gates shall be new and of current manufacture and they shall be adequately braced to prevent warping and bending under the intended usage. Gates shall be furnished with a handwheel, crank-operated floor-stand mounted and shall have 2:1 gear ratio. Gates shall comply with ANSI/AWWA C501, except as otherwise indicated.

B. **Coating:** Gates, wall thimbles, and accessories shall be epoxy-coated complying with Section 09800. Machined surfaces shall be protected during sandblasting and coating.

C. **Frames and Slides:** Gate frames and slides shall be manufactured of cast iron. Slides and frames shall have machined seating faces, and the maximum clearance between seating surfaces, with the slide in the closed position, shall be 0.004 inches. Sufficient adjustable wedging shall be included to ensure proper watertightness complying with ANSI/AWWA C-501. Seating faces shall be of Naval bronze complying with ASTM B21 and fasteners, anchor bolts, studs, and adjusting screws shall be stainless steel complying with Section 05500. Operating nuts shall be of bronze conforming to ASTM B 584.

D. **Stems:** Stems shall be of Type 316 stainless steel conforming to ASTM A 276 and shall be provided with adjustable bronze bushed stem guides designed to ensure that the L/R ratio of the stem does not exceed 200.

E. **Operating Mechanism:**

1. **General:** Operators shall be weatherproof, equipped with stem covers, and shall be mounted on cast-iron or fabricated steel pedestals. The pedestal shall have base or bracket area designed to distribute the load to the supporting concrete structure. The center line of a manual operator shall be approximately 3 feet above the base of the pedestal. Sluice gate hoist heads shall be cast iron. The operating nut shall be of solid bronze conforming to ASTM B 584. Roller or ball bearings shall be included for thrust. Bearings and stem shall be provided with a lubrication system. Clockwise movement of the handwheel shall close the gate.

2. **Crank:** The unit shall be designed for a maximum of 40 lb on the crank to operate the gate. The operating crank shall be readily removable to facilitate the use of a portable power operator. The direction of crank rotation to open the gate shall be indicated on the lifting mechanism.

F. **Wall Thimbles:** Except as otherwise indicated, sluice gates shall be provided with cast iron, F-pattern, wall thimbles to match the thickness of the walls in which they are installed. These thimbles shall be supplied by the manufacturer of the gates, and they shall fit the bolt dimensions of the gates. All studs shall be of stainless steel Type [304] [316] complying with Section 05500.

G. **Sealant:** The sealant shall be a Butyl Rubber Acetate mastic as recommended by the manufacturer of the gates.

2.2 SHEAR GATES

A. **Construction:** Shear gates shall be constructed with cast iron and include bronze seat and disc rings, and flanged frame equipped with a minimum 3-ft handle with wall hook. Ferrous parts of the gate and frame shall be shop coated with epoxy complying with Section 09800. Mounting hardware, if required, shall be stainless steel Type 316 complying with Section 05500.

2.3 MANUFACTURERS

A. Gates shall be manufactured by one of the following (or equal):

1. **Sluice Gates:**

Rodney Hunt;
Hydro Gate Corp.;
Waterman Industries.

2. **Shear Gates:**

Mueller,
Waterman

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Installation shall comply with the manufacturer's written instructions and as indicated.

B. Prior to setting each gate, a 1/8-inch thick layer of mastic grade polysulfide elastomeric sealant shall be applied to the back of the gate frame. After setting the gate, the nuts shall be run down on the anchor bolts far enough to make them snug and to cause the rubber sealant to begin to ooze out but without stress on to the frame. Excess sealant at the edges shall be removed. The sealant shall be allowed to cure for at least 7 days, after which the anchor bolt nuts shall be tightened to their final positions. If gaskets are being used, they shall be installed over the studs in one piece, or dovetailed and cemented with a liquid-type gasket material.

3.2 FIELD TESTING

A. Sluice gates shall be tested for leakage in accordance with the provisions of ANSI/AWWA C501. Leakage allowance for gates shall not exceed 0.1 gpm/ft of seating perimeter under 20 feet of seating head, and 0.2 gpm/ft under 20 feet of unseating head.

B. If leakage exceeds the indicated criteria, modifications and corrections shall be made under the supervision of manufacturer's representative at no additional cost to the OWNER.

** END OF SECTION **

SECTION 13300 - INSTRUMENTATION AND CONTROL

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APPENDICES

SECTION 13300 - INSTRUMENTATION AND CONTROL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes the general specification and requirements for the instrumentation and control WORK under this and other applicable Specifications. The WORK also includes providing instrumentation and all related wiring as shown in these Contract Documents.

B. All PLC programming shall be provided by the CONTRACTOR.

C. All corresponding DCS programming shall be provided by the CONTRACTOR in accordance with City Standard Section 13400. Programming and functionality of DCS logic shall be based on the requirements of this section and the additional corresponding sub-sections of Section 13400. The CONTRACTOR shall provide all corresponding DCS submittals relevant to the implementation of Section 13300 and additional corresponding requirements of 13400 including logic programming, development of HMI/ Graphic User Interface (GUI) screens, and historian data logging. The existing data link between Pump station 64 and Pump station 65 is shown on the contract drawings.

The Contractor shall work with Emerson Process Management Power and Water Solutions (Emerson).

For Emerson Scope of Work, please contact the following people:

Robert Eberle, Manager North America Water Pursuits
Water Automation Solutions
Emerson Process Management Power & Water Solutions, Inc.
200 Beta Drive | Pittsburgh, PA 15238
T (412)-963-4839 | F (412)-963-4447
Robert.Eberle@Emerson.com

Or

Mike Rinaldi, Proposal Engineer
Water Automation Solutions
Emerson Process Management Power & Water Solutions, Inc.
200 Beta Drive | Pittsburgh, PA 15238
T (412)-963-3613 | F (412)-963-4447
Michael.Rinaldi@Emerson.com

D. All interim programming and communication protocols between equipment shall be the responsibility of the CONTRACTOR.

E. The CONTRACTOR shall be responsible for the design, procurement, installation, testing, training, and documentation for instrumentation and control systems provided under this Contract. The CONTRACTOR shall be responsible for interfacing with the PLC components, including installing and terminating PLC inputs and outputs (I/O), providing power, addition and modification of points on the existing data link to the DCS, and for installing and testing all equipment.

F. The CONTRACTOR shall be responsible for providing instrument submittals to be used in the generation of panel wiring diagrams and loop drawings which depict the interconnection between instruments, panels, valve actuators, MCCs, and the PLC.

G. The Design Engineer will incorporate the CONTRACTOR's data and generate complete loop drawings for each measuring or control loop. The loop shall include a minimum of 3 sheets as required in paragraph 1.5 B.3. The CONTRACTOR shall furnish redlines for the Project-wide Loop Drawing Submittal (PLDS) that completely defines and documents the contents of each monitoring, alarming, interlock, and control loop associated with equipment provided under the instrumentation sections, equipment provided under sections in other Divisions, existing, and OWNER-furnished equipment that is to be incorporated into the I&C.

H. All control system field tests including loop tests, plant commissioning, and plant startup, shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall provide competent personnel including electrical engineer, I&C engineer, and process engineer during all field tests. The CONTRACTOR shall be responsible for providing field and control room personnel to witness the simulation of field inputs associated with the PLC I/O and points that are data linked to the DCS. The CONTRACTOR shall be responsible for providing all competent personnel and NIST certified, current within a year, equipment (current drivers, jumpers, read out devices, oscilloscopes, voltage-resistance meters, etc.) required to perform the loop test simulations. All devices used shall be traceable to the National Institute of Standards and Technology (NIST).

I. The CONTRACTOR shall perform field engineering design as required for mounting and supporting all field mounted components. The CONTRACTOR shall develop any additional schematic and interconnection diagrams which may be required for complete and operable instrumentation.

J. The CONTRACTOR shall provide all components, system installation services, as well as all required and specified ancillary services in connection with the I&C system. The system includes all materials, labor, tools and documentation required to furnish, install, test and place in operation a complete and operable I&C system as shown and/or specified in the contract drawings. The CONTRACTOR shall include, but is not limited to, witnessing the functional testing of all control loops ensuring instruments and wiring for each loop have been correctly installed. The CONTRACTOR shall also ensure, amongst other tasks that, all wires are correctly numbered, drawings are correctly updated and within the required time frame and that all parties concerned work to the project time line to meet project milestones. During commissioning the CONTRACTOR shall coordinate between the relevant subcontractors to ensure that the necessary stage of completion is reached by all involved parties and all functional tests have been performed by all involved parties and all functional tests have been performed satisfactorily before that particular phase of the project is scheduled for commissioning. This shall include polarity and functional tests of all field devices, all data communication links are functional and all devices being controlled and monitored are adequately represented on the graphic display including any associated functions, which may be required.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 09800 Protective Coating
2. Division 11 Equipment, as applicable
3. Division 15 Mechanical, as applicable
4. Division 16 Electrical, as applicable

1.3 CODES

A. WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Fire Code
2. National Electrical Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ANSI/ASME B 16.5	Pipe Flanges and Flanged Fittings
API RP-550	Manual on Installation of Refinery Instruments and Control Systems, Part 1 - Process Instrumentation and Control Sections 1 Through 13
ASTM A 105	Specification for Forgings, Carbon Steel for Piping Components
ASTM A 193	Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A 194	Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A 283	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes, and Bars
ASTM A 312	Stainless Steel Piping
ISA-RP60.6	Nameplates, Labels, and Tags for Control Centers
ISA-RP7.1	Pneumatic Control Circuit Pressure Test
ISA-RP12.6	Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations
ISA-S5.1	Instrument Symbols and Identification
ISA-S5.4	Instrument Loop Diagrams
ISA-S12.4	Instrument Purging for Reduction of Hazardous Area Classification
ISA-S20	Specification Forms for Process Measurement and Control Instrumentation; Primary Elements and Control Valves
ANSI - B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ANSI/AWWA C207	Steel Pipe Flanges for Waterworks Service - Sizes 4 In Through 144 In.
ANSI/AWWA C701	Cold-Water Meters - Turbine Type for Customer Service
ANSI/AWWA C702	Cold-Water Meters - Compound Type
AWWA C704	Cold-Water Meters - Propeller Type for Main Line Applications
ASTM A 126	Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
ASTM B 61	Specification for Steam or Valve Bronze Castings
ANSI/AWWA	Ductile-Iron and Gray-Iron Fittings, 3-In Through C110/A21.10 48-In for Water and Other Liquids
ASME REPORT	Fluid Meters, Sixth Edition, 1971

1.5 SHOP DRAWINGS AND SAMPLES

A. **Presubmittal Conference:**

1. The CONTRACTOR shall arrange and conduct a Presubmittal Conference within 60 days after award of the Contract. The purpose of the Presubmittal Conference is to review and approve the manner in which the CONTRACTOR intends to carry out his responsibilities for shop drawing submittal on the WORK to be provided under this Section. The CONTRACTOR and the CONSTRUCTION MANAGER shall attend. Both the CONTRACTOR and the CONSTRUCTION MANAGER may invite additional parties at their discretion.

2. The CONTRACTOR shall allot one, 4-hour day for the Conference

3. The CONTRACTOR shall prepare the following for discussion at the Conference:

   a. List of equipment and materials for the instrumentation systems, including proposed manufacturer names and model numbers.

   b. List of proposed clarifications to the indicated requirements plus a brief written explanation of each exception.

   c. One complete example of each type of submittal proposed.

   d. A flow chart showing the steps the CONTRACTOR will take in preparing and coordinating each submittal to the CONSTRUCTION MANAGER.

   e. A bar chart type schedule for the WORK provided under this Section, covering the time period beginning with the conference and ending after startup and training. Dates for the beginning and ending of submittal preparation, submittal review, design, fabrication, programming, factory testing, delivery to the site, installation, field testing, and training shall be scheduled. The schedule shall be subdivided into major items or groups of items which are on the same schedule.

4. The CONTRACTOR shall furnish 3 copies of all the items above to the CONSTRUCTION MANAGER.

5. The CONTRACTOR shall take formal minutes of the Conference, including all events, questions, and resolutions. Prior to adjournment, all parties must concur with the accuracy of the minutes and sign accordingly.

B. **Shop Drawings:**

1. **General:**

   a. Preparation of shop drawings shall not commence until adjournment of the Presubmittal Conference.

   b. Preliminary Shop Drawings shall be submitted as a single package at one time within 90 days of the commencement data stated in the Notice to Proceed.

   c. Both paper (hard copy) and electronic copies are required for both

Preliminary and Final Shop Drawing submittals.

d. In the Contract Documents, all systems, meters, instruments, and other elements are represented by symbology derived from the latest version of ANSI/ISA S5.1. The nomenclature and numbers indicated herein shall be used exclusively in all shop drawings. No manufacturer's standard symbology or nomenclature shall replace those indicated in the Contract Documents.

e. During the period of shop drawing preparation, the CONTRACTOR shall maintain a direct, informal liaison with the CONSTRUCTION MANAGER for exchange of technical information. As a result of the exchange, certain minor refinements and revisions to the indicated systems may be authorized informally by the CONSTRUCTION MANAGER but these shall not alter the WORK or cause increase or decrease in the Contract Price. During informal exchanges, no statement by the CONSTRUCTION MANAGER shall be construed as approval of any component or method or exception to or variation from these Contract Documents.

2. **Submittals:**

a. Preliminary Submittal: Four copies of the preliminary submittal shall be provided for the City's review. Documents shall be in PDF format.

b. Final Submittal: All documents, including design and O&M documents, shall be provided on CD-ROM. One set of CD-ROMS shall contain the native file formats (MicroStation, MS Word, MS Excel, etc.), and the other in PDF format, using the same file name with "PDF" or "TIF" as the file extension. Four copies of the final submittal shall be provided.

c. Each document shall be indexed, and a database table in Excel shall be provided which includes the following data for each document

(1) Document file name

(2) Document description

(3) Hard Copy Catalog No. (used by facility document coordinator)

(4) Document Type:

(a) Shop drawings
i) P&IDs
ii) Loop Drawings
iii) Instrument Data Sheets
iv) Other

(b) Manufacturer's data

(c) Maintenance instructions

(d) Training

(5) Facility Name

(6) Specification Number

(7) Process Name

(8) Unit Process Number

d. Electronic Document Submittal Requirements:

(1) All documents shall be submitted in electronic format, including shop drawings manufacturer's data and O&M manuals.

(2) Documents shall be in Adobe Acrobat PDF format, version as specified by the Contract Manager. Vendor and Contractor shop drawings developed under the Contract shall be in Bentley MicroStation (.DGN) format. Documents in electronic format (WordPerfect, Microsoft Word, Excel, Lotus, etc.) shall be electronically converted to standard PDF format. In order to minimize file size, drawing conversion from MicroStation files to Acrobat PDF shall be in monochrome.

(3) Deviation from this standard will be accepted only if advance approval is given by the Owner

(4) Documents not available in electronic format shall be scanned at 300 dpi, bitonal (black and white) for documents without graphics, or 150 dpi color for documents with graphics where color is required for legibility, and converted into Adobe Acrobat (PDF). Scanned image enhancement software shall be used. PDF sub-format shall be full Image + Hidden Text PDF file format.

(5) All PDF documents shall be reviewed, and corrected if necessary, for orientation and legibility.

(6) Individual document files shall not exceed 3 megabytes in size.

e. Paper Document Submittal Requirements

(1) All shop drawings shall include the letterhead or title block of the CONTRACTOR. The title block shall include, as a minimum, the CONTRACTOR registered business name and address, project name, drawing name, revision level, and personnel responsible for the content of the drawing.

(2) Shop drawing copies shall be submitted as standard size 3-ring, loose-leaf, vinyl plastic binders suitable for bookshelf storage. Maximum binder size shall be 2 inches.

(3) A complete index shall be placed at the front of each binder.

(4) A separate technical brochure or bulletin shall be included for each instrument, meter system, and other element. The brochures shall be indexed by systems or loops. If, within a single system or loop, a single item is employed more than once, one brochure may cover all identical uses of that item in the system. Each brochure shall include a list of tag numbers to which it applies. System groups shall be separated by labeled tags.

(5) All shop drawings shall be produced in using MicroStation CAD formats. Each shop drawing submittal shall include the requisite number of hard copies and one (1) MicroStation electronic copy. Upon completion of this project, the Contractor shall submit four (4) electronic copies of all current shop drawings.

3. **Loop Diagrams:** The Design Engineer will provide the necessary drafting based on the CONTRACTORS redlines. The CONTRACTOR shall be responsible for the accuracy of the information within the loop drawings. Upon completion of the Design Engineer s loop drawings, the CONTRACTOR shall review and upon satisfaction of the accuracy of the documents shall provide a letter to the OWNER stating that the loop drawings properly reflect the projects as-built condition. Sample loop drawings are provided at the end of this Section in ***Appendix D – Sample Loop Drawings***. The PLDS shall be a singular complete bound package submitted 80 days prior to SUBSTANTIAL COMPLETION. Loop diagrams shall be provided conforming to ISA 5.4 to verify the DCS interfaces with all instrumentation and devices being provided or installed under the project. The loop diagrams shall also define all interfaces with equipment provided by area Contractors. The following three-sheet format is required:

a. Sheet 1: A device schedule developed from an electronic spreadsheet or database file, which will be submitted with the loop diagrams. The table will show the following:

(1) Device tag number, with Prefix, Unit Process, ISA Tag Prefix, Tag No. (a three or four-digit number based on the loop number) and Tag suffix

(2) Equipment Service

(3) Device Type

(4) Location

(5) Device Manufacturer

(6) Model No.

(7) Spec. No.

(8) Area Contractor (if applicable
(9) Submittal No.

(10) Calibrated Range/Remarks

(11) Data Sheet No.

(12) I/O Signal type (AI, AO, DI, or DO)

(13) Signal Level

(14) Device Range (full available instrument range)

(15) Engineering Units

(16) Process Set Point

(17) Loop Diagram No., reflecting the field instrument tag number.

(18) Loop Drawing File Name

(19) Interconnect Drawing File Name

b. Sheet 2: Loop drawing meeting the Requirements of ANSI/ISA S5.4, except that intermediate terminal junction boxes may omitted and be shown on Page 3 for clarity. Butt splices and wire nuts shall be shown on as-builts, with the corresponding termination housing (JB, LB, etc. shown on Sheet 3.

c. Sheet 3: (Expansion sheet - required if the number of intermediate devices or terminal junction boxes exceeds what can be legibly shown on Sheet 2). Abbreviated diagram showing instrument, wire and cable numbers, intermediate terminal junction boxes, and PCM terminations. Wire identification numbers will reflect the field instrument tag number, and not the DCS I/O number.

d. DCS I/O tag numbers will generally reflect the device tag number. Each I/O tag number will be unique. The tag prefix will be based on ISA-5.4, with the following additional special acronyms:

Acronym	**Signal Use**
YL	Ready Signals/ Status
ZL	In Computer status
ZSO	Device Open
ZSC	Device Closed
YL	Motor Run
HS	Equipment Start/Stop

4. **Technical brochures, bulletins and data sheets containing**:

a. Fully completed ISA S20 data sheets

b. Component functional descriptions

c. Locations or assembly at which component is to be installed

d. Materials of a component's parts which will be in contact with process fluids or gases

5. Shop Drawings of differential pressure producing flow tubes and elements, showing the device's proportions and performance. The CONTRACTOR shall furnish a certified curve from the manufacturer showing flow versus differential pressure for each flow metering device furnished. Where applicable, the following data shall be furnished for each device:

   a. Coefficient values and tolerances

   b. Effects of upstream configuration

   c. Head loss as a function of the velocity head expended

   d. Test results from a recognized hydraulic laboratory showing that the discharge coefficient is within 0.75 percent of standard for each meter. Documentation tabulating tests of at least 30 different meters of the same type which show compliance with the two standard deviation tests in ASME "Fluid Meters," Sixth Edition, will be an acceptable alternative.

6. Schematic and wiring diagrams for control circuits shall be submitted in two stages. Initially, schematic control diagrams shall show complete details on the circuit interrelationships of all devices within and outside each Control Panel. Subsequent to acceptance of all schematic control diagrams, by the CONSTRUCTION MANAGER, piping and wiring diagrams shall be submitted. The diagrams shall consist of component layout drawings to scale, showing numbered terminals on components together with the unique number of the wire to be connected to each terminal. Piping and wiring diagrams shall show terminal assignments from all primary measurement devices, such as flow meters, and to all final control devices, such as pumps, valves, chemical feeders and local control panels. Wiring diagrams shall include MCC Panel, circuit, and breaker number for each power feed

7. Assembly and construction drawings for each alarm annunciator, local indicating panel and for other special enclosed assemblies for field installation. These drawings shall include dimensions, identification of all components, surface preparation and finish data, and nameplates. These drawings also shall include enough other details, including prototype photographs, to define exactly the style and overall appearance of the assembly; a finish treatment sample shall be included.

8. Installation, mounting, and anchoring details for all components and assemblies to be field-mounted, including conduit connection or entry details.

9. Complete control panel layouts, all drawn to a 1-1/2 inch=1 foot scale showing:

a. Physical arrangements which define and quantify the physical groupings of annunciators, hand stations, recorders, indicators, pilot lights and all other instrumentation devices associated with control panel sections, auxiliary panels, subpanels and racks.

b. All cutout locations fully dimensioned. All outside panel dimensions shall be shown.

c. Locations of back-of-panel stiffeners.

d. Terminal point locations for all panel and back-of-panel piping and wiring connections. Terminations shall be coded with identifiers for wiring and piping connections for all electric, hydraulic and pneumatic terminations.

e. Nameplate engraving list.

f. A complete and detailed bill of material list shall be submitted for each field mounted device or assembly as well as cabinet assemblies and subassemblies. Bills of material shall include all items within an enclosure. An incomplete submittal shall be rejected and no further evaluation performed until a complete and detailed bill of material is submitted

1.6 OWNER'S MANUAL

A. The Owner's Manual shall be submitted in both paper and electronic format. Electronic format shall conform to the Electronic Document Submittal Requirements for Shop Drawings.

B. Information included in the OWNER'S MANUAL:

1. Two copies of the OWNER'S MANUAL shall be submitted after acceptance of all submittals under Paragraph 1.5. One set will be returned to the CONTRACTOR with comments.

2. Final copies of the OWNER'S MANUAL, after revision, shall be submitted to the CONSTRUCTION MANAGER 15 days prior to startup.

C. The following shall be included in the OWNER'S MANUAL in accordance with Section 01300:

1. Installation, connection, operating, troubleshooting, maintenance, and overhaul instructions from the manufacturer.

2. Exploded or details views of all instruments, assemblies, and accessory components.

3. Parts lists and ordering instructions.

4. Wiring diagrams.

5. A list of spare parts for 1 year operation recommended by the manufacturers of all analog equipment.

1.7 AS-BUILT DRAWINGS

A. As-built drawings shall be prepared with the following exceptions and changes:

1. The CONTRACTOR shall keep current an approved set of complete loop diagrams and schematic diagrams which shall include all field and panel wiring, all piping and tubing runs, all routing, all mounting details, all point-to-point diagrams with cable, wire, tube and termination numbers. These drawings shall include all instruments and all instrument elements for the complete instrument loop as provided under Divisions 11, 13, 14, 15, and 16 of this Contract.

2. One set of original drawings and two copies of each as-built drawing under this Section shall be submitted to the CONSTRUCTION MANAGER after completion of field checkout but before placing the systems in service for the OWNER'S use.

3. Drawings shall also be submitted in electronic format (MicroStation)

1.8 SERVICES OF MANUFACTURER

A. **Calibration, Testing and Startup**: A technical service representative of the manufacturer shall visit the site and perform the following on all flow meters and analyzers.

1. Inspection, checking and calibrating the equipment.
2. Startup and field testing for proper operation.

3. Performing field adjustments to ensure that installation and operation comply with the Specifications.

B. **Instruction of OWNER'S Personnel**: The manufacturer's technical service representative shall instruct the OWNER'S personnel as indicated in Paragraph 3.4.

1.9 SPECIAL GUARANTEE

A. The CONTRACTOR shall guarantee the WORK of this section for two years following final acceptance of the WORK. In making any warranty repairs, the CONTRACTOR shall utilize technical service personnel designated by the manufacturer of the failed device. Repairs shall be completed within 5 days after written notification by the OWNER.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials**: Products delivered to the site for incorporation into the WORK of this Section shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

1.11 ENVIRONMENTAL CONDITIONS

A. **General:** All instrumentation and control system components and associated wiring shall be suitable for use in a treatment facility environment where there may be high energy AC fields, DC control pulses, and varying ground potentials between transducers and system components. The system design shall be adequate to provide proper protection against interferences from all such possible situations.

B. **Field Situated Equipment:** The instrumentation and control system shall be installed on a wastewater treatment plant site. All devices shall be designed to exist in environments rated (G2)(G3)(GX) per ISA S71.04. The system design shall be adequate to provide proper protection the environment typically associated with these facilities. As a minimum, the instrumentation and control systems shall be designed and constructed for satisfactory operation and low maintenance requirements under the following environmental conditions:

1. Temperature Range: 0 through 50 degrees C (32 through 122 degrees F)
2. Thermal Shock: 0.55 degrees C per minute (1.0 degrees F per minute)
3. Relative Humidity: 20 through 95 percent (non-condensing)

C. **Control Room Situated Equipment:** Control rooms shall be air conditioned to achieve the environmental noted in item B herein. (No positive control of relative humidity is provided.) In the event of a failure of the air conditioning system, all components of the instrumentation and control system shall be rated to operate in an environment where the ambient temperature is 15 through 35 degrees C (59 through 95 degrees F) and the relative humidity is 20 to 95 percent (non-condensing).

D. **Noise Tolerance:** The instrumentation and control system components shall not exceed a dB level of 55 when monitored 3-feet away from the devices. If upon testing it is found that this limit is exceeded at the option of the CONSTRUCTION MANAGER and at no additional cost to the OWNER, devices shall be replaced in order to achieve a maximum level of 55 dB or sound absorption materials shall be added.

1.12 CABLE NUMBERING

A. The first two characters denote the facility or area number.

B. The second group of characters identifies the device being served.

C. The third section uses one of the four suffixes in the table below. Where multiple circuits of the same type are routed to the same endpoint, the suffix will be P1, P2, as required.

D. At each device or termination point, the circuit identification number is appended with the individual wire number. For Direct-Current (DC) circuits only, wire polarity is shown in parentheses as (+) or (-).

E. Spaces are not allowed, and letters are not case-sensitive, and written in upper case.

SUFFIX	CIRCUIT TYPE	EXAMPLE
(A)	24 v dc analog (4-20 mA)	01FIT022(A)-1(+)

(C)	120 volt AC control	05P320(C)-2
(D)	24v dc digital status or control	55LSH201(D)-1(+)
(P)	Power (120 volt, 480 V, 5 KV, 15 KV, etc.)	01MCC6101(P)-2

PART 2 -- PRODUCTS

2.1 GENERAL

A. All meters, all instruments, and all other components shall be of the most recent field-proven models marketed by their manufacturers at the time of submittal of the shop drawings unless otherwise indicated.

B. Panel mounted instruments shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be of one manufacturer.

C. Outdoor instrumentation shall be suitable for operation in the ambient conditions at the equipment installation locations. Heating, cooling, and dehumidifying devices shall be incorporated with the outdoor instrumentation in order to maintain it within its rated environmental operating ranges. The CONTRACTOR shall provide all power wiring for these devices. Outdoor enclosures suitable for the environment shall be provided.

D. All instrumentation in hazardous areas shall be intrinsically safe or be approved for use in the particular hazardous classification in which it is to be installed.

E. Mercury switches and components containing liquid mercury shall not be used.

F. Analog measurements and control signals shall be electrical and shall vary in direct linear proportion to the measured variable, except as indicated. Electrical signals outside control board(s) shall be 4 to 20 milliamperes DC except as noted. Signals within enclosures shall be 1-5 volts DC unless otherwise specified. Dropping resistors shall be installed at all field side terminations in the control panels to ensure loop integrity.

G. The accuracy of each instrumentation system or loop shall be expressed as a probable maximum error; this shall be the square-root of the sum of the squares of certified "accuracies" of the designated components in each system, expressed as a percentage of the actual span or value of the measured variable. Each individual instrument shall have a minimum accuracy of ± 0.5 percent of full scale and a minimum repeatability of ± 0.25 percent of full scale unless otherwise indicated. Instruments which do not conform to or improve upon these criteria are not acceptable.

H. Control panels shall be provided with redundant power supplies which are configured in a fault-tolerant manner to prevent interruption of service upon failure and interruption of service necessitated by the replacement of a power supply. All power supplies shall have an excess rated capacity of 40 percent. The failure of a power supply shall be annunciated locally and shall generate an alarm to the DCS.

I. Each control loop shall be individually fused.

2.2 CONTROL PANELS

A. **General:** Control panels, including those furnished by equipment manufacturers, and shall be provided according to the following requirements.

1. Where indicated, control panels shall be provided with all required taps, fittings, rotameters, regulation and alarm interlocks to enable the implementation of a purge system which is in conformance with ISA-S12.4 Type Z requirements. Dimensions shall be in accordance with manufacturer's requirements. Elevations and horizontal spacing shall be subject to CONSTRUCTION MANAGER'S approval.

2. All control panels which require NEMA 3 or 4 ratings will be provided with window kits to preserve the panel's integrity and enable operations ready access to information.

3. Panels shall be fabricated, piped and wired by fully qualified workmen who are properly trained, experienced and supervised.

4. See Appendix C for control panels to be provided under this Contract.

B. **Materials**:

1. Panel section faces shall be #10 gage minimum thickness steel for free standing panels and #14 gage minimum thickness steel for smaller panels. All materials shall be selected for levelness and smoothness.

2. Relay rack high density type panels shall utilize standard relay racks with 14 gage steel frame and supports.

3. Structural Shapes and Strap Steel: ASTM A 283.

4. Bolting Material: Commercial quality carbon steel bolts, nuts and washers, all ½-inch diameter with UNC threads. Carriage bolts shall be used for attaching end plates. All other bolts shall be hex head machine bolts. All nuts shall be hot pressed hex, American Standard, heavy. Standard wrought washers shall be used for foundation bolts and attachments to building structures. All other bolted joints shall have S.A.E. standard lock washers.

C. **Fabrication**:

1. End plates, top plates and top closure panels shall be furnished when required. End plates, top plates and top closure panels shall be removable with countersunk bolts to match panels. Top closure panels shall be furnished in lengths which match the widths of standard panels, except that one top closure panel may extend across two 4-feet 6-inches wide or five 2-feet 0-inches wide standard panels. The vertical joints of these panels shall align with the vertical joints of the standard panels.

2. End closure or rear closure doors shall be provided. Such doors shall be flush fitting and gasketed and be of the hinged lift-off type with lockable door handles. A common key shall be provided for all doors on one panel assembly. Where

removable access panels are indicated, they shall be furnished with dished handle fasteners. Screw driver 1/4 turn type fasteners are not acceptable.

a. The flanged edges of all panels shall be straight and smooth. Corners shall be welded and ground smooth.

b. The face of the panel shall be true and level after flanging.

c. All panel cut-outs and holes may be cut or drilled by any standard method that will not cause deformation. Burrs shall be ground smooth.

d. Adjacent panels shall be assembled with faces flush. Gaps or cracks shall not be visible from the front of the assembled instrument board.

e. Stiffeners shall be welded to the back of panels, as required to prevent panel deformation due to the weight of front of panel mounted instruments.

f. Panels shall be self-supporting as defined below.

D. **Framework and Supports:**

1. The rear of each panel section shall have a steel framework for supporting conduit, tubing, wireways, switches, air piping and all instrument accessory items such as relay or terminal enclosures, transducers, pressure switches, valves and air relays. The main frame work shall be constructed of standard structural shapes. Special shapes such as "Unistrut" may be used for secondary supports. Framework must not interfere with instrument connections or access needed for maintenance or adjustments.

2. Steel framework shall extend 2-feet 8-inches back of the panel face unless otherwise required. Where indicated, individual adjustable leg supports shall be provided at the back of the framework so that the entire panel shall be self-supporting.

E. **Finish**:

1. **Preparation:** The front and rear face of the panel, both sides and the edges of all flanges, and the periphery of all openings shall be prepared as follows.

a. All high spots, burrs, and rough spots shall be ground smooth.

b. The surfaces shall be sanded or sandblasted to a smooth, clean bright finish.

c. All traces of oil shall be removed with a solvent.

2. **Finishing:**

a. A 3-mils dry coat of Amercoat 185 or equal primer shall be applied over the entire panel surface immediately after solvent cleaning.

b. Wet sand, dry, and then quick glaze spot putty on the front of the panel only. Dry, then wet sand again and dry.

c. Apply a second 3-mils dry coat of alkyd enamel primer to the front of the panel.

d. Wet sand to smooth clear finish, then dry.

e. At least two 3-mil dry coats of air-dry, satin finish, alkyd enamel shall be applied over the entire surface. Color to be as selected by CONSTRUCTION MANAGER.

f. The CONTRACTOR shall furnish two 1-pint containers of the enamel to the CONSTRUCTION MANAGER.

3. **Instrument Finishing:**

a. The final coats applied to painted surface of instrument cases, doors, or bezels which are visible from the front of panels shall be manufacturer's standard unless otherwise indicated. Black japan or "crinkle" finishes on instrument cases are not acceptable

F. **Mounting of Instruments:**

1. The CONTRACTOR shall provide cut-outs, and shall mount all instrument items indicated to be panel mounted, including any instruments indicated to be furnished by other manufacturers.
2. The CONTRACTOR shall also mount, behind the panels, other instrument accessory items as indicated.
3. Rear of panel mounted equipment shall be installed with due regard to commissioning adjustments, servicing requirements and cover removal.
4. Wiring shall be kept clear of spare space to give maximum space for future additions.

G. **Piping Requirements for Control Panels**:

1. General:

a. The CONTRACTOR shall provide terminal connections near the top, rear of the panel for all tubing and piping which connect to instruments, valves, air supply and other pressure leads external to the panel. Terminal connections for tubing shall be bulkhead tube unions. Those for pipe shall be threaded couplings, plugged for shipping purposes.

b. Each terminal connection shall have an engraved metal or plastic plate with a terminal and instrument tag number affixed nearby.

c. The CONTRACTOR shall provide the air supply pressure reducing station, all instrument and supply piping and all pneumatic tubing or piping to terminal connections and between instruments located within the confines of the panel and supporting framework.

2. Air Supply Piping (NOT USED)

H. **Electrical Requirements for Control Panels**:

1. The CONTRACTOR shall provide all wiring, conduit, wireways, and switches required to make instruments and other panel electrical devices operational. Conduit, wireways, junction boxes and fittings shall be installed for all signal wire, all thermocouple and resistance thermometer lead wire including those between temperature sensors and temperature indicators.

2. Each terminal connection shall have a plastic plate with a terminal and instrument tag number. All wiring shall be identified with stamped tubular wire markers.

3. Freestanding panels shall be provided with switched 100-watt incandescent back-of-panel lights which are powered from a source independent from that which powers the panel devices. One light shall be provided for every 4 feet of panel width and shall be mounted inside in the top of the back-of-panel area.

4. Freestanding panels shall be provided with a 15-amp, 120 volt service outlet circuit within the back-of-panel area which are powered from a source independent from that which powers the panel devices. The circuit shall be provided with one 3-wire, 120-volt, 15-ampere, duplex receptacle for every 4 feet of panel width spaced evenly along the back-of-panel area. As a minimum, 2 duplex outlets shall be provided for each panel.

5. Smaller panels shall be sized to adequately dissipate heat generated by equipment mounted in or on the panel.

6. Where smaller panels are mounted outside or in unshaded areas, they shall be provided with thermostatically controlled heaters capable of maintaining inside temperatures above 40 degrees F.
7. Smaller panels shall be provided with a hand-switch controlled 100-watt incandescent light and a breaker protected 120-volt, 15-amp duplex receptacle.

8. **Wiring Methods:** Wiring methods and materials for all panels shall be in accordance with the NEC requirements for General Purpose unless otherwise indicated. Opening wiring in close cabinet type panels is allowed when indicated.

9. **Construction:**

   a. Wire for 115-volt circuits shall be No. 14 AWG stranded with Type THWN or THHN insulation. All terminals for external wiring connections shall be suitable for No. 12 AWG wire.

   b. Flexible conduit is not acceptable.

   c. Conduit fittings shall be cast fittings.

   d. Soldered or pressure crimped wire splicing in conduits shall be acceptable.

   e. For case grounding, panels shall be provided with a 1/4-inch by 1-inch copper ground buss completed with solderless connector for one No. 4 AWG bare stranded copper cable. The CONTRACTOR shall connect the copper cable to

a system ground loop.

f. Single case annunciator units with no remote logic which are installed at the top of a panel may be considered as being a terminal box when top of panel wire entry is indicated. If bottom of panel entry is indicated, terminal box shall be provided at the bottom of the panel and wired to the annunciator. Terminals shall be identified with plastic marker strips.

g. Terminal boxes for incoming and outgoing signal leads shall be located at the top or bottom of the panel as indicated or as otherwise required.

10. **Power Supply Wiring:**

a. Unless otherwise indicated, all instruments, all alarm systems, and all motor controls shall operate on 24 VDC circuits.

b. The CONTRACTOR shall furnish terminal box connections for the main power supply entry as indicated.

c. Power supply switches for alarm units shall be three pole type, arranged to open both the power and alarm circuits. Each annunciator shall be equipped with a separate switch.

d. Instruments located on a single panel section which serve one process unit may be connected to a common branch power circuit. The number of branch circuits shall be such that no circuit load exceeds 10 amps. Different panel sections and instruments serving different process units shall not use common branch circuits. A 15-amp, two-pole circuit breaker shall be provided in each branch circuit. When instruments do not come equipped with integral fuses, the panel fabricator shall furnish and install fuses as required for the protection of individual instrument against fault currents. Fuses shall be mounted on the back of the panel, in a fuse holder, with each fuse identified by a service name tag.

e. Each potentiometer type instrument, electronic transducer, controller or analyzer shall have an individual disconnect switch. Disconnect switches shall have metal or plastic tags listing the associated instrument tag numbers. Individual plug and cord set power supply connections may be used without switches when indicated.

f. Where alarm units are single unit types, one switch may be used to disconnect not more than six alarm units located on the same or adjacent panels.

11. **Annunciator Alarm Wiring:** (NOT USED)

12. **Signal Wiring:**

a. Computer and Non-Computer Use:
Signal wire shall be twisted shielded pair or triads in conduit or troughs. Cable shall be constructed of No. 16 AWG copper signal wires with THWN or THHN insulation. Color code for instrument signal wiring shall be:

(1) Positive - Black (+)

(2) Signal Ground Negative - White (-)

(3) Equipment Ground - Green

(4) Ungrounded - Red

(5) Energized by voltage sound external to panel - Yellow

(6) DC circuit - Blue

b. Multiconductor cables where indicated shall consist of No. 16 AWG copper signal wires twisted in pairs, with 600 volt fault insulation. A copper drain wire shall be provided for the bundle with a wrap of aluminum polyester shield. The overall bundle jacket shall be PVC.

c. Multi-conductor cables, wireways and conduit shall provide for 10 percent allocation of spare, unused signal wires in addition to the indicated requirements.

13. Thermocouple Wiring (NOT USED)

14. **Terminal Blocks:** Terminal blocks shall be molded plastic with barriers and box lug terminals, and shall be rated 15 amperes at 600-volts. White marking strips, fastened securely to the molded sections, shall be provided and wire numbers or circuit identifications shall be marked thereon with permanent marking fluid.

I. **Color Conventions:** Lens covers for indicating lights on all panels will be colored as follows:

1. Red-ON when;

- Motor not running (STOPPED)
- Valve CLOSED (not fully opened)
- Device not energized.
- Circuit breaker OPENED

2. Green-ON when;

- Motor running in forward direction (fast speed for multi-speed motors).
- Valve OPEN (not fully closed)
- Device energized.
- Circuit breaker CLOSED

3. White-ON when;

- Power available
- System in AUTOMATIC mode.
- Monitoring taking place.

4. Amber-ON when;

- Malfunction trip.
- Equipment locked out.
- Alarm condition

J. **Nameplates:** Nameplates shall be provided for instruments, function titles for each group of instruments, and other components mounted on the front panel(s) as indicated. A nameplate shall be provided for each signal transducer, signal converter, signal isolator, and electronic trip mounted inside the panel(s). Nameplates shall be descriptive to define the function and system of such element. These nameplates shall be of the same material as those on the front of the panel(s). Adhesives shall be used for attaching nameplates. Nameplates shall be fabricated from black face white-center laminated engraving plastic. Painted surfaces shall be prepared to allow permanent bonding of adhesives. Colors, lettering, styles, abbreviations and sizes shall be in conformance with ISA-RP60.6 with an intended viewing distance of 3 feet to 6 feet.

K. **Factory Inspection:**

1. Panels shall be inspected for compliance with requirements at the factory before shipment to the site. The CONTRACTOR shall notify the CONSTRUCTION MANAGER 2 weeks in advance of the testing date. A representative of the CONSTRUCTION MANAGER will visit the factory to make the inspection.

2. CONTRACTOR shall perform the following tests prior to arrival of the CONSTRUCTION MANAGER:

   a. All alarm circuits rung out to determine their operability.

   b. Electrical circuits checked for continuity and where applicable, operability.

   c. Nameplates checked for correct spelling and correct size of letters.

   d. Other test required to place the panel in an operating condition.

3. It shall be the responsibility of the CONTRACTOR to furnish all necessary testing devices and sufficient manpower to perform the tests required by the CONSTRUCTION MANAGER to determine conformance to the requirement of the Contract documents.

4. If the above tests have not been performed prior to the arrival of the CONSTRUCTION MANAGER, the CONTRACTOR shall reimburse the OWNER for the cost of the extra time required for the inspector's services and travel expenses.

L. **Shipment:**

1. Panels shall be crated for shipment using a heavy framework and skids. Panel sections shall be cushioned to protect the finish of the instruments and panel during shipment. Instruments which are shipped with the panel shall have suitable shipping stops and cushioning material installed to protect instrument parts from mechanical shock damage during shipment. Each panel crate shall be provided with

removable lifting lugs to facilitate handling

2.3 GENERAL INSTRUMENTATION ENCLOSURE COMPONENTS

A. **Signal Isolators, Converters, and Power Supplies:** Signal isolators shall be provided in each measurement and control loop, wherever required, to match adjacent component impedances, or where feedback paths may be generated or to maintain loop integrity when the removal of a component of a loop is required. Signal converters shall be provided where required to resolve any signal incompatibilities. Signal power supplies shall be provided to supply sufficient power to each loop component.

B. **General Purpose Relays:** General purpose relays in the Control Panels shall be plug-in type with contacts rated 10 amperes at 120 volts ac; quantity and type of contacts shall be as indicated. Each relay shall be enclosed in a clear plastic heat and shock resistant dust cover. Sockets for relays shall have screw type terminals.

C. **Time Delay Relays:** Time delay relays shall be electronic on-delay or off-delay type with contacts rated 10-amperes at 120-volts AC. Units shall include adjustable dials with graduated scales covering the indicated time range.

D. **Slave Relays:** Slave relays shall be provided when the number or type of contacts indicated exceed the contact capacity of the indicated relays and timers.

E. **Circuit Breakers:** Circuit breakers shall be single pole, 120-volt, 15 ampere rating or as required to protect wiring and equipment. Circuit breakers shall be mounted inside the panels as shown.

2.4 FLOW MEASURING SYSTEMS (NOT USED)

2.5 FLOW DETECTION SWITCHES (NOT USED)

2.6 LEVEL MEASURING SYSTEMS (NOT USED)

2.7 LEVEL DETECTION SWITCHES (NOT USED)

2.8 PRESSURE MEASURING SYSTEMS

A. **Electronic Pressure Transmitters:** Electronic pressure transmitters shall be two wire devices with continuously adjustable span, zero ad damping adjustments, integral indicators scaled in engineering units, solid state circuitry and 4-20 mA outputs. Accuracy shall be plus or minus 0.25 percent of calibrated span. Process wetted and body materials shall be 316 SS. Process connections shall be ½-inch NPT. Electronic pressure transmitters shall be SMAR to match existing.

See Appendix C for a schedule of required devices for this Contract.

B. **Local Pressure Measuring Systems:** Gauges shall have Type 316 stainless steel movement and stainless steel or alloy case. Except as otherwise indicated, gauges shall have a 3-1/2-inch dial, 1/4-inch threaded connection, a Type 316 stainless steel snubber adapter, and a shut-off valve. Gauges shall be calibrated to read with an accuracy of ± 1 percent to 150 percent of the indicated pressure. Gauges shall be vibration and shock

resistant. Gauges on liquid service should have cases filled with a suitable liquid. Gauges attached to systems containing chemical solutions, corrosive fluids, sludge, sewage, or other liquids containing solids, shall be equipped with diaphragm seals, or equal protective pressure or vacuum sensing devices, and comply with the following:

For:	Suction Sewage except as otherwise indicated	Seals shall be fabricated with PVC body for removable mounting and rated at 200 psi, with Type 316 stainless steel bolts and nuts, ½-inch inlet, ¼-inch outlet, liquidfilled with Teflon diaphragm for pressure service and proper elastomer diaphragm for vacuum service.

See Appendix C for a schedule of required devices for this Contract.

C. **Diaphragm Seals for Pressure Measuring Systems:** Diaphragm seals shall consist of bottom housing, lower ring, diaphragm capsule, fill screw, flushing connection, and a top housing. The diaphragm seal shall attach to the inlet connection of a pressure instrument to isolate its measuring element from the process fluid. The space between the diaphragm and the instruments pressure element shall be solidly filled with a suitable liquid.

Displacement of the liquid fill in the pressure element through the movement of the diaphragm shall transmit process pressure changes directly to a gauge, transmitter, switch or any other pressure instrument. The diaphragm seal shall have a removable bottom housing to permit the servicing of the need to refill. All exposed surfaces, housings, and diaphragm shall be constructed of 316 stainless steel.

See Appendix C for a schedule of required devices for this Contract.

D. **Annular Ring Seals for Pressure Measuring Systems:** Where seal elements are used to isolate pipeline flow media from a gauge the sensor shall be flanged and bolted directly into ANSI flanged pipelines. Face to face shall not be greater than a wafer style of a butterfly valve. The flanges shall have thru bolt holes to enable positive alignment in the pipeline. Flanges shall conform to pipe specifications. Inside diameter of the sensor shall be the same as the mating pipe with a full thru uninterrupted flow. There shall be no dead ends or crevices and flow passage shall make the sensor self-cleaning. Wetted parts (liner) shall be capable for continuous duty handling a slurry containing up to 15% solids.

The Pressure Sensing Ring shall measure pressure for 360 degrees F around the full inside circumference of the pipeline. The sensing ring shall also be clamped into the body for the full radial width of the sensor. Pressure shall be transmitted to the gauge by a locked in and sealed fluid such as ethylene glycol or silicone oil. The sensor shall have an auxiliary tapped and plugged port to allow connection or other equipment. Annular ring seals for pressure measuring systems shall be Red Valve to match existing.

See Appendix C for a schedule of required devices for this Contract.

2.9 PRESSURE DETECTION SWITCHES

A. **Diaphragm Piston Pressure Switches:** Pressure switches shall consist of a pressure transducer and a precision switch. Pressure transducer shall be the diaphragm piston type with wetted materials as recommended by the switch manufacturer. Piston shall be backed by a cylinder disc to permit 10 times over range pressure without affecting

calibration. Range spring and piston shall be isolated from process fluids by the diaphragm. Switch shall be provided with two 3/4-inch conduit connections. The pressure transducer shall be selected so that setpoint falls between 30 and 70 percent of maximum range. Approximate setpoint and, if applicable, reset point shall be indicated on calibrated scales. Repeatability and sensitivity shall be 1.0 percent of operating range or better. Unless otherwise specified, switches shall be non-adjustable deadband type. Diaphragm piston pressure switches shall be SOR to match existing.

See Appendix C for a schedule of required devices for this Contract.

B. **Differential Pressure Switch:** Differential pressure sensing switches shall be single-pole, double-throw with an adjustable differential range. Minimum differentials shall be less than 10 percent of range. Differential pressure switches shall be able to withstand surge pressure 1.5 times range or better. Each pressure switch shall have a visible scale contact operation. Pressure switches shall have a contact rating of 10 amperes at 125 volts AC. Pressure switches shall be snap-action switches and shall be in general purpose enclosures. A 316SS three valve manifold shall be supplied with each switch. Differential pressure switches shall be Barksdale to match existing.

See Appendix C for a schedule of required devices for this Contract.

2.10 TEMPERATURE MEASURING SYSTEMS

A. **RTD Temperature Measuring Systems:** Temperature transmitters shall be two wire devices with continuously adjustable span and zero adjustments, integral direct reading indicator, solid state circuitry and 4-20 mA output linearly proportional to the specified temperature span. Accuracy including temperature element shall be ± 0.1 percent of span. The temperature sensor shall be a spring loaded platinum RTD with Type 316 stainless steel Thermowells. The RTD and Thermowells length shall be as required or as indicated. The RTD and Thermowells shall be directly or remotely mounted as indicated. All necessary RTD wire shall be provided in conformance with the instrument manufacturer's recommendations. Temperature transmitters shall be SMAR to match existing.

See Appendix C for a schedule of required devices for this Contract.

B. **Bimetallic Dial Temperature Measuring Systems:** Temperature indicators shall have 5-inch nominal diameter "all single" indicating scales, Type 316 stainless steel stems, and be suitable for stainless steel wells. Accuracy shall be plus or minus 1 percent of full range. Bimetallic dial temperature indicators shall be TEL-TRU to match existing.

See Appendix C for a schedule of required devices for this Contract.

C. **Thermowells** (NOT USED)

2.11 TEMPERATURE DETECTION SWITCHES (NOT USED)

2.12 PROCESS ANALYSIS MEASURING SYSTEMS (NOT USED)

2.13 SAFETY MONITORING SYSTEMS (NOT USED)

2.14 CONTROL PANEL INSTRUMENTATION

A. **Bar Graph Indicators** (NOT USED)

B. **Digital Indicators**:

1. Digital indicators shall be self-contained instruments that display process signals directly in engineering units. The unit shall be suitable for panel mounting and shall utilize an LED display where numerals are no less than 0.5-inch height.
2. The input signal to the digital process indicator shall be 4-20 mA DC or 1-5 VDC. The input sample rate of the unit shall be a minimum of 2 per second. The unit shall have an auto-zeroing feature and shall have provisions for field adjustable scaling and offset. Accuracy shall be plus or minus 1 least significant digit. Input power to the digital indicator shall be 120 VAC, 60 Hz.

C. **Totalizers** (NOT USED)

D. **Current Alarm Trip Switches**: (NOT USED)

E. **Selector and Pushbutton Switches**: Selector and pushbutton switches shall be rated 10 A at 600 volts, shall be heavy-duty, oil-tight, and shall have the number of positions and poles indicated. Operators shall be corrosion resistant.

F. **Indicating Lights**: Indication lights shall be LED push-to-test type and shall be heavy-duty, oil-tight. Each light shall have a screwed-on glass lens approximately 1-inch in diameter. Each light shall have a factory-engraved legend plate as indicated. Indicating lights shall be 120 VAC type with transformers for use with LED.

G. **Alarm Annunciator Systems**: (NOT USED)

H. **Proportional Plus Manual Reset Process Controllers** (NOT USED)

2.15 NEW REMOTE I/O DROP AND EXISTING PROGRAMMABLE LOGIC CONTROLLER (PLC):

A. Where required, the CONTRACTOR shall furnish, install, program, test, calibrate, fully configure and place into operation the new remote I/O drop and integrate with the existing Programmable Logic Controllers (PLCs) as specified herein. These requirements also pertain to all PLCs provided under Divisions 11, 15, and 16.

B. **General:** The CONTRACTOR shall furnish all necessary interconnecting cables, all accessories, and all appurtenances as indicated herein or as required for proper operation of the system. All major remote I/O components of the system shall be of the same manufacturer and PLC family product line. All equipment shall be housed in an enclosure or control panel suitable for the intended operation and location. The PLC system shall be capable of tolerating and capable of riding through a power interruption of 8 milliseconds or less without interruption of normal operation. The PLC system shall be Allen Bradley to match existing.

C. **Construction:** The remote I/O system shall be provided with a housing or chassis with enough slots to handle all power supplies, I/O cards, and communication modules. Chassis wired logic is not acceptable. The unit shall be capable of operating in a hostile industrial

environment (i.e., heat, electrical transients, RFI, vibration, etc.) without fans, air conditioning, or electrical filtering (up to 60 degrees C and 95 percent humidity).

D. **Design:** The unit shall be furnished with I/O (input/output) modules suitable for interfacing with new and existing field devices. The PLC I/O modules shall be 4-20 mA signals for analog inputs and analog outputs and shall be 24 VDC and/or 120 VAC signals for discrete inputs and discrete outputs. The unit shall provide internal fault analysis with a fail-safe mode and a dry contact output for remote location alarming, and a local indicator on the PLC frame in the event of a fault in the PLC.

E. **Central Processor:** (NOT USED)

F. **Memory:** (NOT USED)

G. **Controller:** The unit shall have its control strategies programmed in a "ladder logic" language. It shall be easily reprogrammed with a laptop computer as specified below. The PLC system shall be programmed by the CONTRACTOR to perform the specified control strategies and monitoring functions. Two documented copies, in hardcopy and electronic format, of the operating PLC program(s) shall be furnished to the OWNER which shall allow direct, step-by-step, reloading of the PLC system program(s). The ladder logic shall reflect equipment name designations used in the PLC as well as the Contract Drawing equipment name designations (i.e., timer "Q" in the Contract Drawing may become timer OL in PLC program).

H. **Power Supply:** The PLC shall be provided with all requisite power supplies and shall operate at the following:

1. 120V ac RMS plus or minus 15 percent continuously.

2. 120V ac RMS plus or minus 30 percent maximum 30 seconds.

3. 120V ac RMS plus or minus 100 percent maximum milliseconds.

4. Line spikes at 1000V ac (5000 micro-seconds duration; 0.05 percent maximum duty cycle).

I. **Input/Output Modules:** All I/O housings and I/O modules shall be of rugged construction with modules in place. Sufficient input and sufficient output modules shall be provided with the unit to implement the specified control functions plus a reserve capacity of 25 percent of the total provided. All I/O shall be arranged in a distributed I/O configuration such that the failure of any I/O card will not affect multiple items of the same equipment.

1. **Discrete Input Modules:** Defined as contact closure inputs from devices external to the programmable logic controller module. Input modules shall be shielded from short time constant noise and 60-Hz pickup. Individual inputs shall be optically isolated for low energy common mode transients to 1500 volts peak from user's wiring or other I/O Modules. The modules shall have LED lights to indicate a discrete input.

2. **Discrete Output Modules:** Defined as contact closure outputs for ON/OFF

operation of devices external to the programmable logic controller module. The output modules shall be fused (typically 5-amp at 115V ac) with blown fuse indicator lights. The output modules shall be optically isolated from inductively generated, normal mode and low energy, common mode transients to 1500 volt peak. All output modules shall have LED lights to indicate output has been cycled ON by the controller.

3. **Analog Input Modules:** Defined as analog inputs for 1 to 5 VDC or 4 to 20 mA dc signals, where an analog to digital conversion is performed and the digital result is entered into the processor. New inputs shall be provided for every scan.

4. **Analog Output Modules:** Defined as analog output for 1 to 5 VDC or 4 20 mA dc signals, where a digital to analog conversion is performed and the analog result is produced as an output. New outputs shall be produced on every scan.

J. **Data Access Panel:** (NOT USED)

K. **Communications:** If the unit is required to interface with the DCS via a datalink, is shall be done so by an RS422 or RS232 serial link. The serial link type used shall be determined by distances. The PLC system shall be provided with all appurtenances to support this requirement. The communications protocol shall be MODBUS with the PLC configured in a slave mode. The DCS will operate in the master mode.

L. **Programming Laptop:** All programming shall be accomplished with a laptop computer. The laptop shall be capable of being directly plugged into the PLC system without the requirements of additional hardware. All programming, all monitoring, all searching, and all editing shall be accomplished with the laptop. These functions shall be capable of being done both "on line" while the PLC processor is scanning or "off line" while the PLC processor is not scanning. The laptop shall display multiple series and parallel contacts, coils, timers, counters, and calculation functions. The laptop shall also be able to monitor the status of all inputs, all outputs, all timers, all counters, and all coils. It shall have the capability to disable/force all inputs, all outputs, and all coils to simulate system operation. It shall also indicate "power flow" through all elements and include a search function to locate any element and its program location. The PLC processor status information, such as error indication and amount of memory remaining, shall be shown on the laptop screen. The CONTRACTOR shall provide one new laptop complete with manuals to the OWNER to enable future system support. The laptop shall be turned over to the OWNER at START-UP.

M. **PLC Control System Software:** The CONTRACTOR shall provide the City a licensed copy of the software required for the installation of the new remote I/O drop, the PLC is existing and associated PLC software license is not required to be provided to the City. The programmer must have their own software licenses to perform the programming and commissioning work required for the new remote I/O and the existing PLC, the City will not provide the CONTRACTOR with any software. It is the intent of this specification to have the PLC System Supplier furnish his latest generation, standard, field proven, fully debugged and supported software package for this application with a minimum of additions or changes. Customized or specially written software shall be furnished if required to meet all of the functional requirements specified herein. Any custom applications software required shall be fully integrated into the basic software and shall not require unique command structures. Software specified herein is described in broad,

functional categories. The System Supplier shall furnish a complete software package including the functional requirements specified herein along with whatever additional software is required by the supplier for proper and efficient operation of the PLC Control System. No attempt has been made to list all software or list all characteristics of software required by the System Supplier to meet the functional requirements specified herein.

1. **General:** The software package shall provide a system capable of controlling system level activities and a higher level process control language allowing the operator to monitor and control the process through an interactive human interface. The software environment shall support a multi-programming atmosphere allowing concurrent execution of more than one program in a background/foreground mode or multi-tasking mode.

2. Throughout the execution of all software modules, the operator shall be presented with all of the command or operation choices available at that point in the program using sufficient verbiage or symbols to make the choices self-explanatory and unambiguous. Question and answer or fill-in-the-blank requests shall only be permitted where file names, tag names, or other unique text or numerical information is required.

3. System-level software shall include a real time operating system, a calendar/time program, a file management program and a system of diagnostic routines in addition to any compilers, editors, loaders, or assemblers required to support the process control software language.

4. All programs shall be self-configuring, such that they obtain the size and configuration of the system from parameters contained in the various files created during system generation. No parameters related to the hardware configuration shall be hard coded into any of the software.

5. **System Level Software:** System-level software shall include a complete and unmodified operating system furnished by the System Supplier that provides system-level functions as specified herein. Operating system software shall function automatically without operator intervention, except as required to establish file names and similar information.

6. **Operating System Software:** The real-time operating system software shall be the standard uncorrupted product of the host computer and shall provide the following minimum functions:

    a. Respond to demands from a program request or to demands from an operator.

    b. Dynamic allocation of the resources available in the system. These resources shall include main memory usage, computation time, peripheral usage, and I/O channel usage.

    c. Allotment of system resources on the basis of task priority levels such that a logical allocation of resources and suitable response times are assured.

    d. Queuing of requests in order of priority if one or more requested resources are unavailable.

e. Resolution of contending requests for the same resource in accordance with priority.

f. Service requests for execution of one program by another.

g. Transfer data between programs as requested.

h. Management of all information transfers to and from peripheral devices.

i. Control and recovery from all program fault conditions.

j. Diagnose and report real-time hardware device errors.

7. Program execution shall be scheduled on a priority basis. A multilevel priority interrupt structure is required. A program interrupted by a higher priority program shall be entered into a list of pending programs. Its execution shall be resumed once it becomes the currently highest priority program. Initiation of programs shall, as a minimum, be activated in the following ways:

   a. In response to external interrupts.

   b. At a scheduled time of the day.

   c. On an elapsed time interval basis.

   d. On request by another program.

   e. On request from the data access panel.

8. The system shall allow periodic programs to be scheduled. The allocation of resources to a time scheduled program shall be based on its relative priority and the availability of computer system resources.
9. **Start-up and Restart:** Software shall be provided which initializes and brings a computer or any microprocessor based hardware unit from an inactive condition to a state of operational readiness.

   Initialization shall include determination of computer system status prior to start-up of initializing operating system software and initializing application software. Initialization shall also include the loading of all memory resident software, initialization of timers, counters, and queues, and initialization of all dynamic database values.

10. **Shutdown:** The software shall provide an orderly shutdown capability for shutdowns resulting from equipment failure, including computer processor failure, primary power failure, or a manually entered shutdown command. When the loss of primary power is sensed, a high-priority hardware interrupt shall initiate software for an immediate, orderly shutdown. When a shutdown occurs in response to a command or malfunction, the software shall control the affected hardware quickly and automatically to a secure state.

11. **Diagnostics:** Diagnostic programs shall be furnished with the software package to detect and isolate hardware problems and assist maintenance personnel in discovering the causes for system failures. The system manufacturer's standard diagnostic routines shall be used as much as possible. Diagnostic software and test programs shall be furnished for each significant component in the system.
Diagnostic routines shall test for power supply, central processing unit, memory, and I/O bus failures as a minimum.

12. **Calendar/Time Program:** The calendar/time program shall update the second, minute, hour, day, month and year in the operating system and transfer accurate time and date information to all system level and application software. Variations in the number of days in each month and in leap years shall be handled automatically by the program. The operator shall be able to set or correct the time and date from the data access panel, only at the highest security level.

N. **Operator Interface**: System-level software shall provide for creation and modification of alphanumeric displays, compression of display information for storage, and linking of dynamic files to database variables. Each display screen shall be able to be made up of static and dynamic alphanumeric information. The system shall be furnished with standard displays as specified herein. The system shall be capable of storing and utilizing all standard display formats.

Additionally, all display screens shall include a dedicated area that shall display the current time and date, and at least one line for system-level messages.

O. **Standard Displays:** The operator interface systems shall include at least the following standard, non-configurable displays.

1. Current Alarm Summary--As specified in the alarm processing section of this document.

2. System Overview--Displaying the current status of major systems hardware components including the input/output hardware.

3. Menu Displays--Indicating the various displays and application level choice available to the operator.

4. Point Displays--Detailed displays in a standard format for all types of points in the system. Any point in the system shall be able to be displayed indicating all parameters associated with the point. Each entry in the display shall be labeled in engineering units.

P. **Algorithms:** System software shall support the implementation of algorithms for the determinations of control actions and special calculations involving analog and discrete inputs. These algorithms shall be capable of outputting positional or incremental control outputs or providing the product of calculations. The algorithms shall include alarm checks where appropriate. As a minimum, the following types of algorithms shall be provided.

1. A calculator algorithm which performs functions such as summing several variables, raising to a power, roots, dividing, multiplying, and subtracting.

2. A switch algorithm which reads the current value from its input address and stored it as the value of its output address. Two types of switches shall be accommodated, 2 outputs with one input and one output with 2 inputs

3. A 3 mode Proportional-integral-Derivative (PID) controller algorithm, with each of the 3 modes independently adjustable. The algorithm shall support both direct and reverse acting modes.

4. Algorithms for lead, lag, dead time, and ration compensators.

5. Algorithms to perform integration and totalization of analog process variables.

6. Algorithms that drive the set point of a controller shall include provisions for bumpless transfer, which shall be implemented by use of a bias value.

7. Algorithms shall be implemented and modified in the system at any time through the use of interactive software modules in a manner consistent with other interactive modules and shall not require any direct source of code changes.

Q. Alarm Processing

1. Alarm processing software shall be provided to recognize and report alarm events and conditions to the Local Control Panel in an organized, unambiguous, clear, and convenient manner. Alarms shall be classified into at least 2 priority levels and at least 2 independent classes.

2. Alarm processing software shall generate alarms for the following conditions:

   a. Discrete input or output change of state is defined as an alarm in the control software.

   b. Analog value exceeding alarm limits defined in the control software.

   c. Analog rate of change exceeding limits defined in the control software.

   d. Failure of the PLC processor, mass memory device, process input/output hardware, or other major hardware component.

   Alarms shall be generated in each case above at the time of occurrence and at the time the condition returns to normal.

R. **Testing:** The CONSTRUCTION MANAGER shall witness testing of the PLC system. Solid-state logic systems shall be tested as complete assemblies. Testing of individual components or modules shall not be acceptable.

S. **Training:** A manufacturer's representative shall supply two 8-hour days of on-site training for the OWNER'S personnel. The training shall include but not be restricted to, operation of programming unit, trouble shooting of system hardware and software, and program development.

T. **Seven Day Acceptance Test:** After startup has been completed, the System shall undergo a 7-day acceptance test. The System must run continuously for 7 consecutive days.

During this period, all System functions shall be exercised. Any System interruption and accompanying component, subsystem, or program failure shall be logged for cause of failure, as well as time of occurrence and duration of each failure. A failure shall cause termination of the 7-day acceptance test. When the cause of a failure has been corrected, a new 7-day acceptance test shall be started.

Each time the CONTRACTOR's technician is required to respond to a System malfunction, he must complete a report which shall include details concerning the nature of the complaint or malfunction and the resulting repair action required and taken.

U. **Operations and Maintenance Manuals:** The CONTRACTOR shall furnish to the OWNER 5 complete sets of operation and maintenance manuals. The manuals shall include date, information drawings, etc., for the system, subsystem, and all components, and shall include names, addresses and telephone numbers of equipment suppliers, representatives and repair facilities.

This shall include a complete description of the recommended operating procedures, maintenance procedures, and spare/replacement parts list for equipment items with catalog data, diagrams, and drawings or cuts describing the equipment. Each set shall include full size assembly and wiring diagrams; drawings showing "as-build" conditions shall be furnished to the OWNER.

2.16 MISCELLANEOUS INSTRUMENTS

A. Vibration Sensor: The vibration sensor shall be a Bentley Nevada 330525 Velomitor XA Piexo-Velocity Sensor with 1900/27 meter/transmitter with a 4-20mA output or equal and the CONTRACTOR shall provide the latest available product offered by the manufacturer.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The CONTRACTOR shall employ installers who are skilled and experienced in the installation and connection of all elements, all instruments, all accessories, and all assemblies provided under this Contract.

B. The CONTRACTOR shall install all instruments according to the manufacturer's installation instructions and the following:

1. Perform field engineering as required for mounting and supporting all field mounted components.

2. Prepare any additional schematic and interconnection diagrams required for installation.

3. Assemble and interconnect instrument components disconnected for shipping purposes.

4. Remove all temporary supports, bracing, and padding inserted in instrument control panels and other equipment to prevent damage during shipping, storage, or installation.

5. All piping shall be field measured prior to fabrication and erection. Any significant discrepancies between drawings and field conditions shall be reported to the CONSTRUCTION MANAGER. The OWNER will not be responsible for any costs to the CONTRACTOR for rework because of CONTRACTOR failure to take measurements prior to fabrication.

6. Adequately support and protect capillary tubing. All extra tubing shall be carefully coiled, tied, and protected at the instrument location.

C. (NOT USED)

D. It is the intent of the Contract Documents that all wiring external to Control Panels be provided under the requirements of Division 16. Further, it is the general intent that all 4-20 mA signal circuits, process equipment control wiring, signal wiring to field instruments, and Control Panel input and output wiring, be provided under Division 16 and be terminated and identified under Division 13.

E. The CONTRACTOR's attention is directed to the electrical and mechanical schematics and details of this project. Referral to these portions of the Contract Documents shall be required in order to understand the full intent and scope of work required.

F. Monitoring and control system configurations are diagrammatic only. Locations of equipment are approximate unless dimensioned on the drawings. Exact locations and routing of wiring and cables shall be governed by structural conditions, physical interferences, and locations of electrical terminations on equipment.

G. Where job conditions require minor changes in approximated locations and arrangements, the CONTRACTOR shall make such changes without additional cost to the OWNER.

H. All instruments shall be located and installed for ready access by the OWNER'S operation and maintenance staff. The OWNER reserves the right to require minor changes in location of equipment prior to roughing without any additional cost to the OWNER.

I. Meters shall be installed in easily accessible locations and orientated for ease of reading and maintenance, and where shown, for balancing flow. Wherever possible, meters shall be inserted in such a way to comply with the manufacturer’s recommendations. Meters, shut-off and balancing valves shall be properly supported. In-line meters shall be installed to ensure full-line flow and not less than the manufacturer’s recommended head at all times.

3.2 CONTROL PANEL SIGNAL AND CONTROL CIRCUIT WIRING

A. **Wiring Installation:** All wires shall be in plastic wireways except (1) field wiring, (2) wiring between mating blocks in adjacent sections, (3) wiring from components on a swing-out panel to components on the fixed structure, and (4) wiring to panel-mounted components. Wiring from components on a swing-out panel to other components on fixed

panels shall be tied into bundles with nylon wire ties, and shall be secured to panels at both sides of the "hinge loop" so that conductors are not strained at the terminals.

B. Wiring to control devices on the front panels shall be tied together at short intervals with nylon wire ties and secured to the inside face of the panel using adhesive mounts.

C. Wiring to rear terminals on panel-mount instruments shall be in plastic wireways secured to horizontal brackets above or below the instruments in about the same plane as the rear of the instruments.

D. **Wire Marking:** Each signal, control, alarm, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on all shop drawings. These numbers shall be marked on all conductors at every terminal using white numbered wire markers which shall be permanently marked heat-shrink plastic.

3.3 INSTRUMENT CABLE TESTS

A. **General:** The following tests shall be performed on each instrumentation and control system cable. All tests shall be end-to-end tests of installed cables with the ends supported in free air, not adjacent to any grounded object. All test data shall be recorded on forms which are available from the CONSTRUCTION MANAGER. Complete records of all tests shall be made and delivered to the CONSTRUCTION MANAGER. Each form shall be signed by the [CONSTRUCTION MANAGER or the CONSTRUCTION MANAGER's Representative] who witnessed the testing.

B. Continuity tests shall be performed by measuring wire/shield loop resistance of each signal cable as the wires, taken one at a time, are shorted to the channel shield. No loop resistance measurement shall vary by more than plus or minus 2 ohms from the calculated average loop resistance value.

C. Insulation resistance tests shall be performed by using a 500 volt megometer to measure the insulation resistance between each channel wire, between each channel wire and the channel shield, between individual channel shields in a multichannel cable, between each individual channel shield and the overall cable shield in a multi- channel cable, between each wire and ground, and between each shield and ground. Values of resistance less than 1 megohms shall be unacceptable.

3.4 INSTALLATION, CALIBRATION, TESTING, PRECOMMISSIONING, STARTUP AND INSTRUCTION

A. **Installation and Connection:** The CONTRACTOR shall install and connect all field-mounted components and assemblies under the following criteria:

1. Process sensing lines and air signal tubing shall be installed to the installation of conduit indicated under Section 16050. Individual tubes shall be run parallel and near the surfaces from which they are supported. Supports shall be used at intervals not longer than 3 feet of tubing.

2. Bends shall be formed with the proper tool and to uniform radii and shall be made without deforming or thinning the walls of the tubing. Plastic clips shall be used to

hold individual plastic tubes parallel. Ends of tubing shall be square-cut and cleaned before insertion into fittings. Bulkhead fittings shall be provided at all panels requiring pipe or tubing entries.

3. All flexible cables and all capillary tubing shall be provided in flexible conduits. Lengths shall be sufficient to withdraw the cables and tubing for periodic maintenance.

4. (NOT USED)

5. All power and all signal wires shall be terminated with spade type lugs.

6. All connectors shall be, as a minimum, water tight.

7. After all installation and connections have been completed, a technical field representative of the CONTRACTOR shall check the WORK for polarity of electric power and signal connections, leaks at all process connections, and conformance with requirements. The technical field representative shall certify in writing to the CONTRACTOR that each loop and system meets requirements.

8. All wire and all cable shall be connected from terminal to terminal without splices, arranged in a neat manner and securely supported in cable groups. All wiring shall be protected from sharp edges and corners.

B. **Calibration:** All analog instrumentation and all control system equipment shall be calibrated and tested after installation to verify that requirements are satisfied. The CONTRACTOR shall provide all necessary labor, tools, and equipment to calibrate and test each instrument in accordance with the manufacturer's instructions. Each instrument shall be calibrated at a minimum of three points using test equipment to simulate inputs and read outputs. All test equipment and all instruments used to simulate inputs and read outputs shall be suitable for the purpose intended and shall have an accuracy better than the required accuracy of the instrument being calibrated. Test equipment shall have accuracies traceable to the NIST as applicable. All analog instruments shall be calibrated and tested in place without removal. Test data, applicable accuracy requirements, all instrument manufacturer published performance specifications and all permissible tolerances at each point of calibration shall be entered on test forms available from the CONSTRUCTION MANAGER. These test forms shall verify compliance with all. A report shall be delivered to the CONSTRUCTION MANAGER for each instrument, certifying that the instrument has been calibrated in the presence of the CONSTRUCTION MANAGER or the CONSTRUCTION MANAGER's designated representative and meets contract and system requirements.

C. **Analog Loop Tests:** The CONTRACTOR shall be responsible for loop checking and testing all instrumentation loops with this project. The CONTRACTOR shall coordinate all loop check functions with the CSP to ensure that a single total loop check is conducted. The intent of the loop checks is to confirm and document each loop's component specification conformance up to and including all field-situated CSP devices. The CSP will have all control room personnel present to witness and confirm loop check results at the CRT level. The CONTRACTOR shall provide all necessary labor, tools, and equipment to field test, inspect and adjust each instrument to its indicated performance requirement in

accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirement, or any published manufacturer performance specification for functional and operational parameters, whether or not indicated in the Contract Documents, shall be repaired or replaced, at the discretion of the CONSTRUCTION MANAGER at no additional cost to the OWNER.

1. At least 15 days before installation testing begins, the CONTRACTOR shall submit to the CONSTRUCTION MANAGER a detailed description, in duplicate, of the installation tests to be conducted to demonstrate correct installation of the instrumentation and control system and the anticipated dates the testing will occur.

2. Controllers and electronic function modules, shall be tested and exercised by the CONTRACTOR to demonstrate correct operation, first individually and then collectively as functional analog networks. Each hardwired analog control network shall be tested to verify proper performance within indicated accuracy tolerances. Accuracy tolerances for each analog network are defined as the root-mean-square-summation of individual component accuracy tolerances. Individual component accuracy tolerances shall be as indicated by contract requirements, or by published manufacturer accuracy specifications, whenever contract accuracy tolerances are not indicated.

3. Each analog network shall be tested by applying simulated inputs to the first element(s). Simulated sensor inputs corresponding to 10 percent, 50 percent, and 90 percent of span shall be applied, and the resulting outputs read to verify compliance to network accuracy tolerance requirements. Continuously variable analog inputs shall be applied to verify the proper operation of discrete devices. Temporary settings shall be made on controllers, alarms, etc., during analog loop tests. All analog loop test data shall be recorded on test forms, which include calculated root-mean-square-summation system accuracy tolerance requirements for each output.

4. (NOT USED)

5. When installation tests have been successfully completed for all individual instruments and all separate analog control networks, a certified copy of all test forms signed by the CONSTRUCTION MANAGER or the CONSTRUCTION MANAGER's representative as a witness, with test data entered, shall be submitted together with a clear and unequivocal statement that all instrumentation has been success fully calibrated, fully inspected, and fully tested.

D. **System Pre-commissioning:** The CONTRACTOR shall responsible for demonstrating the operability of all systems provided under this specification. The CSP will assist and coordinate the operability assessment with the CONTRACTOR. Pre-commissioning shall commence after acceptance of all wire, all calibrating and loop tests, and all inspections have been conducted. Pre-commissioning shall demonstrate proper operation of all systems with process equipment operating over full operating ranges under actual operating conditions.

1. The CONTRACTOR shall develop and submit to the CONSTRUCTION MANAGER for approval a Pre-Commissioning Plan which describes detailed test procedures, checklists, blank forms and data to be recorded, test equipment to be

used and calculated tolerance limits.

2. System pre-commissioning activities shall include the use of water to establish service conditions that simulate, to the greatest extent possible, normal final control element operating conditions in terms of applied process loads, operating ranges and environmental conditions. Final control elements, control panels, and ancillary equipment shall be tested under start-up and steady-state operating conditions to verify that proper and stable control is achieved using motor control center and local field mounted control circuits. All hardwired and software control circuit interlocks and alarms shall be operational. The control of final control elements and ancillary equipment shall be tested using both manual and automatic (where provided) control circuits. The stable steady-state operation of final control elements running under the control of field mounted automatic analog controllers or software based controllers shall be assured by adjusting the controllers, as required, to eliminate oscillatory final control element operation. The transient stability of final control elements operating under the control of field mounted, and software based automatic analog controllers shall be verified by applying control signal disturbances, monitoring the amplitude and decay rate of control parameter oscillations (if any) and making necessary controller adjustments, as required, to eliminate excessive oscillatory amplitudes and decay rates.

3. All electronic control stations incorporating proportional, integral or differential control circuits shall be optimally tuned, experimentally, by applying control signal disturbances and adjusting the gain, reset or rate setting(s) as required to achieve a proper response. Measured final control element variable position/speed setpoint settings shall be compared to measured final control element position/speed values at 10 percent, 50 percent and 90 percent of span and the results checked against indicated accuracy tolerances. Accuracy tolerances are defined as the root-mean-square summation of individual component accuracy tolerances.

   Individual component accuracy tolerances shall be as indicated in the Contract Documents or as specified by published manufacturer accuracy specifications whenever not indicated.

4. The CONTRACTOR shall submit an instrumentation and control system pre-commissioning completion report which shall state that all Contract requirements have been met and which shall include a listing of all instrumentation and all control system maintenance and repair activities conducted during the pre-commissioning testing. The CONSTRUCTION MANAGER must accept the instrumentation and control system pre-commissioning testing before the seven day operational testing may begin. Final acceptance of the control system shall coincide with final acceptance of the WORK.

E. **7-Day Operational Testing:** The CONTRACTOR shall furnish his own personnel, electrical personnel, and any instrument manufacturers' representatives as required during the testing period to produce a fully operational system.

F. **Instruction:** The CONTRACTOR shall train the OWNER'S maintenance personnel in the maintenance, calibration and repair of all instruments provided under this contract.

1. The training shall be scheduled a minimum of 3 weeks in advance of the first

session. The training shall be performed concurrent with the pre-commissioning in subparagraph D.

2. The training shall be performed by qualified representatives of the instrument manufacturers and shall be specific to each instrument model provided. Instructors shall have at least 2 years of training experience.

3. Each training class shall be a minimum of 8 hours in duration and shall cover Operational Theory, Maintenance, Trouble Shooting/Repair, and Calibration of the instrument.

4. Proposed training material, including resumes for the proposed instructors and a detailed outline of each lesson shall be submitted to the CONSTRUCTION MANAGER at least 30 days in advance of when the lesson is to be given. The CONSTRUCTION MANAGER shall review the submitted data for suitability and provide comments which shall be incorporated into the course.

5. Within 10 days after the completion of each lesson the CONTRACTOR shall present to the CONSTRUCTION MANAGER the following:

   a. A list of all OWNER personnel that attended the lesson.

   b. An evaluation of OWNER personnel knowledge through written testing or equivalent.

   c. A copy of text utilized during the lesson with all notes, diagrams, and comments.

3.5 PROCESS CONTROL STRATEGIES

A. The control strategies shown in Appendix A complement the Process and Instrumentation Diagrams (P&IDs). All materials and components shall be furnished, whether explicitly indicated or not, to effect the functional requirements defined on the P&IDs and in the process control strategy descriptions. The CONTRACTOR shall utilize the control strategies as a resource in generating control narratives to be included in the analog hardware submittal.

B. Common functions that are generally applicable to all strategies or to similar strategies are described under the heading “General Functions”. These functions are not repeated in the descriptions for each strategy.

C. (NOT USED)

3.6 DCS INPUT/OUTPUT (I/O) SUMMARY

A. **General:** The I/O list contained in Appendix B itemizes all inputs and outputs to and from the DCS, both hardwired and data linked, which are furnished by the Contractor. The following appendixes are for the Contractors reference to develop the programming required for this project.

Appendix B1 – Existing IO Card Summary

Appendix B2 – Existing Real IO and Associated DCS Data
Appendix B3 – Existing Pump Data Communicated
Appendix B4 – Existing Pump Station Ancillary Data Communicated
Appendix B5 – New Remote I/O and Associated DCS Data
Appendix B6 – New Pump Data Communicated

The contractor shall provide a final master I/O list (one for real I/O points, and the other with soft points) with all fields completed and deleted points removed.

3.7 INSTRUMENT SUMMARY

A. **General:** The Instrument Summary (IS) shown in Appendix C itemizes the instrumentation devices, including control panels, to be furnished under this contract. Specific device requirements for the instrumentation referenced in Part 2 shall be included in the instrument summary such as meter size, ranges, scales, set points, NEMA ratings, flange sizes, pipe connection sizes, material types, probe types, etc.

B. Each column on the Instrument Summary is defined as follows:

1. Tag Number: The identifier assigned to a device which performs a function in the control system. The CONTRACTOR shall use this identifier in tagging devices in the field.

2. Loop Number: The number assigned to the control loop associated with the device.

3. Description: A process-oriented functional description which defines the measured/monitored/controlled parameter and the associated process/process equipment.

4. P&ID Drawing Number: The Process and Instrumentation drawing upon which the device appears.

5. Technical Specification Number: The number associated with the technical specification which describes the requirements associated with the device.
6. Specification Section Number: The specification section under which the device shall be provided.

7. Control Panel Number: The designation of the control panel where the device resides.

8. Control Panel Reference Number: The drawing or schedule number associated with the control panel's face-plate representation.

9. Mechanical Drawing Number: The mechanical drawing upon which the device appears.

10. Electrical Drawing Number: The electrical drawing upon which the device appears.

11. Installation Detail Number: The designation of the installation detail defining the installation requirements associated with the device.

3.8 SAMPLE LOOPS

A. **General:** Sample loops are presented at the end of this Section in Appendix D to show the formatting and layout of the loops per City's current standards so that the CONTRACTOR can comply with the requirements of this specification.

3.9 EXISTING LOOPS

A. **General:** The projects existing loop diagrams are presented at the end of this Section in Appendix E – Existing Loops. These shall be used as a basis by the CONTRACTOR in preparing redlines. The CONTRACTOR shall field verify the accuracy of all the existing loops and provide corrections as required. These Loops are not per City's Standards current standards and additional information will need to be provided by the CONTRACTOR per Section 13300.

B. The CONTRACTOR shall return all of the existing pump 1 and 2 associated loops with a red x drawn across the demolished items to reflect as-built conditions.

3.10 EXISTING PLC LADDER LOGIC (REV 3-17-2011)

A. General: The projects existing PLC Ladder Logic is presented at the end of this Section in Appendix F – Existing PLC Ladder Logic (rev 3-17-2001). The CONTRACTOR shall modify the program in accordance with the CONTRACT DOCUMENTS.

** END OF SECTION **

APPENDIX A - CONTROL STRATEGIES

SECTION 13300 - INSTRUMENTATION AND CONTROL

LEGEND

PCM - Process Control Module (Transmits process data to and from the field and provides plant automation)

DCS - Distributed Control System (Plant Computer Control System)

UPS - Uninterruptable Power System (Provides battery back-up power to the PCM)

DH – Data Highway (Plant process network where PCM, workstation, and historian communications take place)

DIN - District Information Network (Fiber Optic Transmission to COMC)

LCP - Local Control Panels

PID - Proportional-Integral-Derivative

PLC - Programmable Logic Controller

PROJECT OVERALL CONTROL SYSTEM STRATEGY OVERVIEW

Pump Station No. 65 (PS-65) is an existing sewage pumping station that receives incoming sewage flow into a wetwell and then pumps the flow to Pump Station No. 64. This project shall upgrade existing pumps P-103 and P-104 from constant speed to variable speed pumping and shall also add a third new pump P-105 that shall also have variable speed pumping. A new remote I/O panel shall be provided for all the new I/O points.

Existing pumps P-101 and P-102 are constant speed pumps and shall be demolished along with all associated PLC and DCS logic.

GENERAL CONTROL AND MONITORING

These control strategies are not intended to be all-inclusive operational procedures for the operation of the complete facility. In general, control and monitoring functionality is as follows:

1. Alarm monitoring and generation, process sequencing, automatic control of auxiliary systems and equipment interlocking control strategies are resident within the DCS.
2. Fault tolerant PCM(s) communicate with the DH and contain enhanced DCS automatic control algorithms for process sequencing control based on level, pressure, flow, or other conditions.
3. The DCS workstations shall serve as the operation staff's "window" into the process, enabling operations to locally monitor, interrogate, and manipulate plant processes.

4. The DCS shall provide reporting, historian, diagnostic, client access and other file server functions.
5. The DCS provides information to the District Information Network (DIN) via the communication link between DCS and DIN
6. All alarms shall be fail safe and activate upon loss of power.

COMMON DCS/PLC FUNCTIONS

Common functions and terms for basic monitoring and control operations are provided as a standard of implementation for the control system. These terms and functions address items that are typical for process control loops and most operator initiated actions. These functions are not necessarily repeated in each individual control strategy. Unless otherwise stated they are considered a part of each implemented control strategy.

Provision shall be made to include certain control functions that apply to all analog inputs, virtual variables, analog controllers and discrete control whether or not shown on the P&IDs, even though one or more of the functions may be disabled by the user for a given data base point:

1. **Verification of Digital Outputs**: In Semi-Auto and Auto mode each command will be monitored for the desired results before proceeding to the next step and if the sired results are not achieved in a certain predetermined time an alarm will be generated. The operator will have the ability to override and move to the next stage.
2. **Analog Data Scaling**: This control function shall scale all analog inputs to a common span and shall normalize the digital representation of each analog input to a percent of the operating span. The processed value shall be expressed as a binary number that specifies the analog input's position on a straight line lying between zero and full scale as defined for a given input by the zero span values in the data base.
3. **Amplitude Limit Check**: This control function shall perform dual level, high/low amplitude limit checking and shall identify a limit violation every time a measured or virtual variable goes out-of-limits and returns back into limits. The control unction shall determine the time at which each limit excursion occurred. A dead-band shall be provided on each limit and shall be expressed as a percentage of span or in engineering units.
4. **Engineering Unit Conversion**: This control function shall convert scaled analog data to engineering units by means of the following equation:

$$Y = (H - L)\ (D/DH) + L$$

where:

Y = value in engineering units

H = high value of span, expressed in engineering units

L = low value of span, expressed in engineering units

D = digitized scale input value in counts

DH = full scale digitized value in counts

5. **Discrete Event Monitor**: This control function shall monitor an alarm (where appropriate) all discrete status changes.
6. **Manual Control**: It shall be possible for the operator or plant engineer to interrupt any sequence, loop or automatic operation and operate the same manually from remote.

The following terms are used in the descriptions of DCS/PLC functions:

1. **Operator Settings (Set points)**: Operator set or entered values that are adjustable or set from operator displays. Examples of operator set or entered values are controller set points, batch set points, timers, counters, mode selection, etc. Specific values that are required to be operator settable are noted (bracketed [ ]) in the process control strategy descriptions. Unless otherwise stated to be tunable or fixed, a set point value is operator settable.
2. **Tunable Values**: Tunable values are set points that are adjustable at password protected engineer level displays without requiring any PLC or DCS software reconfiguration. Examples of tunable values are tunable time settings, tunable alarm set points, PID tuning constants, etc. These values are not adjustable from operator level displays. Tunable values are also identified and their preliminary values are shown in brackets [xxx].
3. **Fixed Values**: Fixed values are constants that are contained within the PLC or DCS control logic normally inaccessible by the DCS system. Modification of fixed values requires a modification to the control logic via the PLC programming, configuration and diagnostics software package.
4. **Displayed Values**: The term “displayed” means that the value, or information referred to, is displayed in an easily read and understood format on the DCS workstation. Values are identified by their device tag reference and associated equipment number. For analog variables the value is tagged and its associated engineering units are displayed.
5. **Hardware Interlocks**: Hardware interlocks refer to interlocks directly wired within the electrical control circuits of equipment that, when activated, shall cause the equipment to shutdown or otherwise prevent operation of the equipment. Hardware interlocks do not necessarily pass through or depend on the PLC or DCS to be operable.

   Hardware interlocks may also be derived by local control panels or switches wired directly to the PLC or DCS to provide direct hardwired alarm status to the PLC or DCS for processing.
6. **Software Interlocks**: Software interlocks refer to interlocks that are generated by the PLC or DCS logic or otherwise pass through the PLC or DCS. Software interlocks are not operable when the PLC is not operable or if for some reason equipment is operated while by-passing the PLC logic.
7. **Hardware Generated Alarms**: Hardware generated alarms are alarms that are generated external to the PLC by equipment such as local control panels, analytical devices and process switches.

a. Direct wired alarms that do not depend on the PLC or DCS to be operable. An example would be a High H2S level signal from the H2S monitor and wired directly to an alarm light or horn.

b. Direct PLC wired alarms such as a High-High pressure switch that interfaces directly with the PLC.

8. **Software Generated Alarms**: Alarms that are processed or generated by PLC or DCS logic are referred as software generated. Software generated alarms are displayed on the DCS workstation alarm screens and are available for archiving.

9. **Local Automatic Control Mode**: Local automatic control refers to control logic performed in a local control panel independent of the PLC or DCS. An example is a standalone blower package that, when in the local automatic control mode, automatically controls the blower to maintained air pressure within a fixed dead band.

10. **Local Manual Control Mode**: Local manual control refers to the mode where operators control equipment from the equipment location. Examples are hoist and trolley that may be stopped or started from the compressor's local control panel (LCP), or a gate that may be opened or closed from the gate operator.

11. **DCS Automatic Control Mode**: In DCS automatic mode equipment is controlled automatically per predetermined control schemes residing in the DCS usually without operator intervention. However, in some cases the operators may be required to initiate certain automatic functions, or enter set points.

12. **DCS Manual Control Mode**: DCS manual control refers to the remote manual control of equipment from the DCS workstation. In this mode, the operators override the DCS automatic control logic but, usually, DCS safety interlock logic remains in effect.

13. **DCS Override Control**: DCS override control refers to the ability to override specific software interlocks and initiate control actions. Software interlocks or permissives that can be overridden are identified within the individual control strategies. Override control is an abnormal control operation and a "SAFETY INTERLOCK OVERRIDE ALARM" shall be initiated for the specific override condition whenever an override command is in effect.

COMMON DCS/PLC SOFTWARE FUNCTIONS

To provide for a standard of implementation, various software control and monitoring functions are defined. The standard functions may not be fully delineated within each control strategy, however, unless otherwise stated the standard function shall be utilized to provide the defined alarm, action, display or control action.

The following provides for common PLC and DCS software functions:

1. All equipment status items monitored by the DCS/PLC and generated within the DCS/PLC control strategies are displayed at the DCS. Unless otherwise specified the following is displayed for each equipment item:

   a. Equipment READY status

b. Equipment RUNNING or ON status

c. Equipment OFF status

d. Equipment FAILURE alarm

e. Equipment FAIL-TO-OPERATE alarm

f. Equipment OUT-OF-SERVICE

2. All analog inputs transmitted to the DCS shall have instrument bad/failure indications or alarms when the input is below 0 percent or above 100 percent.

3. All discrete alarm and failure inputs are alarmed by the DCS application software and displayed at the DCS. Each discrete alarm input shall have an associated alarm delay that prevents nuisance tripping. A discrete alarm shall be generated based on a tunable set point of 10 seconds after the discrete event is initiated.

4. Where alarms are specified in the control strategy descriptions, those alarms are initiated by the DCS control logic based on the applicable analog input signals. User tunable trip points shall be provided for each analog input to establish High- High, High, Low, Low-Low, and Rate-Of-Change events. Each trip point shall be provided with a user tunable dead band for set and reset operations. Individual signal trip points shall be provided with a tunable delay to alarm activation.

5. DCS alarm activation and annunciation shall adhere to a priority hierarchy that is established and maintained at the DCS system. Each alarm shall have an associated priority level defined as:

   Level 1 - Life Threatening or Danger Conditions

   Level 2 - Critical process alarms that shall create a plant shutdown condition, cause a critical process failure or severely hinder plant operation.

   Level 3 - Minor process alarms associated with warning conditions and minor equipment failures.

   Level 4 - Informational alarms shall not hinder operation or cause equipment failure.

6. All process related analog inputs are trended at the discretion of the operator.

7. All flow inputs and equipment run times are totalized, recorded and displayed at the DCS. Totalizers are resettable at the engineer level only.

8. **Displays**: DCS system shall have adequate number of displays for each system to enable the operator to effectively monitor and control the system. Displays are grouped functionally for ease of operation. Both analog and discrete functions associated with an item of equipment or a group of equipment shall be provided on the same display. Displays shall show process graphics, alarms, equipment status, system mode of operation, control strategy implementation, etc.

9. Most interlocks, permissives and start sequences are provided at the DCS level. Unless otherwise stated or shown, all discrete outputs shall be provided as follows:

    a. For equipment START functions, the PLC or DCS shall issue a maintained START command until a RUNNING state is detected or the START command is removed.

    b. When a momentary command is required, the PLC or DCS shall issue the command for a minimum 2 seconds, then remove the signal.

10. For equipment that the DCS/PLC is allowed to control, the DCS/PLC shall provide a FAILTO-OPERATE alarm if the equipment fails to comply with a DCS/PLC command signal. The (START, STOP, OPEN, CLOSE) shall has been present for more than a tunable time period. In this event, the command shall be removed subsequent to the expiration of the tunable time period.

11. In the event of a DCS system failure the system shall retain the last command from the DCS system for all equipment that is in service. All interlocks are enabled during a DCS communications or systems failure.

12. All PID control functions (P, PI, and PID) are provided with standard analog controller functions and operator interfaces including, but not limited to, the following:

    a. AUTO/MANUAL mode selection: In AUTO, the output of controller shall be based on the PID control calculation. In MANUAL, the output of the controller shall be operator adjustable. Transfer between operational modes shall be bumpless.

    b. LOCAL/REMOTE set point selection: In LOCAL, the set point shall be operator adjustable from the equipment. In REMOTE, the set point shall be adjustable from a REMOTE set point input.

    c. Set point, process variable, and controller output shall be displayed. Provisions shall be included to prevent reset windup.

    d. Dead band limits shall be placed on PID control algorithms to avoid hunting and continuous change actions. Dead band limits shall maintain a constant control until the process variable exceeds the dead band boundaries. A dead band value of zero shall disable the dead band.

    e. Bumpless transition shall be provided when PID is invoked after a transition from manual to PID control or when pump start logic utilizes minimum speed controls for starting applications. The transition from current speed to calculated speed shall be provided as a user tunable set point percentage per second value.

13. When main equipment is tagged OUT-OF-SERVICE, a DCS function, all associated equipment and devices are automatically placed in OUT-OF-SERVICE status and their alarms inhibited until the tagged equipment is tagged IN SERVICE. Associated equipment for each piece of main equipment shall be determined on a case by case basis.

14. **Verification of Result**: Whenever a command is issued, DCS/PLC shall verify that its command is implemented before proceeding to the next step, e.g., a valve open command is issued, the DCS/PLC software shall verify that the valve open limit switch is activated after a preset time, before proceeding to the next step in the program. If no verification is received an alarm will be generated and operator intervention will be necessary to resume the automatic operation.

PROCESS AND CONTROL STRATEGIES

65.1 General Description

Pump Station No. 65 (PS-65) is an existing sewage pumping station that receives incoming sewage flow into a wetwell and then pumps the flow to Pump Station No. 64. This project shall upgrade existing pumps P-103 and P-104 from constant speed to variable speed pumping and shall also add a third new pump P-105 that shall also have variable speed pumping. A new remote I/O panel shall be provided for all the new I/O points.

Existing pumps P-101 and P-102 are constant speed pumps and shall be demolished along with all associated PLC and DCS logic.

The existing pump station can be manually controlled and monitored by a remote DCS system. In the event of a failure of the DCS system while in manual mode, the local PLC takes over and controls the processes. The DCS system is located remotely at Pump Station 64 and the PLC is located locally at Pump Station 65. The PLC at PS-65 receives all the Stations I/O and then messages and receives all required information to the DCS system. Much of the Stations automatic control logic resides in the PLC and the CONTRACTOR shall refer to the existing Ladder Logic in Appendix F for further clarifications on existing logic.

All PLC programming shall be provided by the CONTRACTOR.

All corresponding DCS programming shall be provided by the CONTRACTOR in accordance with City Standard Section 13400. Programming and functionality of DCS logic shall be based on the requirements of this section and the additional corresponding sub-sections of Section 13400. The CONTRACTOR shall provide all corresponding DCS submittals relevant to the implementation of Section 13300 and additional corresponding requirements of 13400 including logic programming, development of HMI/ Graphic User Interface (GUI) screens, and historian data logging. The existing data link between Pump station 64 and Pump station 65 is shown on the contract drawings.

All interim programming and communication protocols between equipment shall be the responsibility of the CONTRACTOR.

The following legend shall be used for tagging throughout this document.

TAG	**x**
P-103	3
P-104	4
P-105	5

The instrumentation and control for the main sewage pumps is broken up into five major equipment categories below: MCC, Pump and Piping, Motor, VFD, and I/O Drops.

65.1.1 MCC:

The existing MCC cabinet houses the breaker, motor starter, controls, and an existing GE 269Plus Multilin mounted to the face of the door.

The existing hardwired controls for P-103 and P-104 soft-start are not salvageable for the new motor control scheme and shall be neatly removed from the MCC cabinet. All the indication lights and pushbuttons mounted on the face of the MCC door will also not be required for the new control scheme. The CONTRACTOR shall demolish the existing Multilins and new Multilin shall be provided with the new VFD enclosure. All five existing Multilins shall be salvaged and return to the City. The associated buckets for P-101 thru P-104 shall get new doors.

The new hardwired pump controls shall be located in the new VFD cabinets. The existing circuits for pumps P-103 & P-104 must be identified in the existing MCC bucket by the CONTRACTOR and wired cleanly on terminal blocks (TBs) within the MCC or rewired directly from the new VFD to the PLC. The circuits shown below are currently wired to the PLC and conduit and wiring shall remain intact from the MCC to the PLC or shall be rewired directly from the new VFD to the PLC. From the TBs within the MCC, new wiring and conduit shall extend to the new VFD cabinet pump controls.

The following existing I/O circuits shall be reused:

DCS Tag	***Description***
HS10xC	*(Existing tag HS104B shall change to HS104C)* *Pump Start:* DO to run the pump. The DO requires the following PLC permissives: checks to see if the pump is available, confirms number of start/stops is not excessive, and confirms lead/lag logic (Note, programmer to delete old logic verifying the smaller pumps are not running). Contact will be wired to the new VFD controls and routed via the associated MCC TBs.
YA10xD	*Pump Shut Down:* This DI is currently the Multilin and Soft Start Common Fail Alarm. This upgrade project shall reconfigure the hardwiring so that this it is a common alarm that will be tripped on abnormal RTD temperatures generated from the Multilin Alarm, check valve alarm, and VFD trouble alarm. Contact will come from the new pump controls inside the VFD cabinet and routed via the associated MCC TBs.
YL10xA	*Pump Running:* DI will come from the VFD running contact and routed via the associated MCC TBs.
JL10xA	*(Existing Tag ZL10xA)* *Control Power On:* This was formally Pump in Hand which was redundant since the HOA in Auto input is below. Control power on

will provide added logic that the pump is available. Contact will come from new pump controls inside the VFD cabinet and routed via the associated MCC TBs.

ZL10xB — *HOA Switch – Pump Auto:* DI, indicating the HOA selector switch is in Automatic computer control. Contact will come from the new VFD controls and routed via the associated MCC TBs.

The associated tags above for the new P-105 logic will be similar, but wired directly from the VFD enclosure to the new remote I/O drop.

Additional controls wired to the MCC:

Field Tag — ***Description***

HS10x — LOS: The existing pumps P-103 & P-104 have an on/off selector switch and tagged HS10xB which conflicts with existing tagging. It is located in the field next to the pump. This will be replaced with a new LOS and be retagged HS10x. The LOS shall lockout the control power. The existing wiring terminates in TBs within the MCC and the wiring and conduits shall be extended to the new VFD cabinet. P-105 will get a new LOS and wired directly to the VFD.

PLC data sent to the DCS: Logic for the existing pumps P-103 and P-104 will remain mostly intact, and logic for P-105 will be new. The following logic shall reside in the PLC.

DCS Tag — ***Description***

YA10xA — *Pump Fail to Start:* Pump was called to run but did not run within the specified time (5 sec).

YA10xB — *Pump Fail to Stop:* Pump was called to stop but did not stop within the specified time (5 sec).

YA10xC — *Check Valve Fail:* Alarms if the pump is running and the check valve does not open within the specified time (30 sec) or if the pump is turned off and the check valve does not closed within the specified time (30 sec).

YA10xE — *Pump AB Shut Down:* Allen-Bradley PLC calling for the pumps to shutdown based on the following permissives:

PLC Automatic Mode	DCS Manual Mode
High-High Vibr. Up & Lwr	-
Low-Low Suction Press: This logic exists for P103 & P-104 and shall be removed as it is no longer required for variable speed pumping.	-

PLC Automatic Mode	DCS Manual Mode
High-High Discharge Press	-
Multilin Alarm	*Multilin Alarm*
Pump Called to Start Failure	*Pump Called to Start Failure*
Pump Called to Stop Failure	*Pump Called to Stop Failure*

YL10xB *Lead-Lag Status:* See Section **65.04 Overview of Strategy**.

YL10xC *Pump Service Mode Status:* Confirms if the pump is in or out of service.

YL10xD *Pump Control Mode Status:* Confirms if the pump is in PLC control vs DCS Manual Mode.

YL10xE *Pump Available:* Pump is available if all of the following conditions are clear:

PLC Automatic Mode	DCS Manual Mode
HOA Switch at PS-65	HOA Switch at PS-65
Control Power On: This is a new DI and will require additional programming.	Control Power On: This is a new DI and will require additional programming.
PLC Automatic Mode Bit	PLC Manual Mode Bit
Out of Service	Out of Service
Previous Shutdown not Reset	Previous Shutdown not Reset
Check Valve not fully Closed	-
Pumps been off for less than 60 seconds	-
Exceed no. s/s per hour	-

KI10x *Pump Accumulated Run Time:* Records the accumulated length of time the pump has run.

DCS Data sent to PLC: The following logic shall reside in the DCS.

DCS Tag ***Description***

HS10xA *Lead-Lag Select:* Allows the operator to select the pump as the lead pumps. See **65.04 Overview of Strategy** below for further information. HS-103A is existing and HS104A and HS105A is new.

HS10xB *(Existing tag HS104A shall change to HS104B, HS105B is new) Control Mode:* Allows the operator to place a pump in PLC control or DCS Manual Mode.

HS10xD *(Existing tag HS104C shall change to HS104D, HS105D is new) Service Mode Command:* Allows the operator to place a pump in or out of service.

HS10xE *(Existing tag HS104D shall change to HS104E, HS105E is new)* *Allen-Bradley Shutdown Reset:* Allows the operator to reset faulted conditions.

HS10xF *(Existing tag HS104E shall change to HS104F, HS105F is new)* *Accumulated Runtime Reset:* Allows the operator to reset the pumps accumulated run time.

Soft Start: The existing soft start system for pumps P-101 thru P-104 shall be demolished from the MCC bucket.

Breaker: The existing breakers for pumps P-101 thru P-104 shall be demolished. New breakers shall be installed for pumps P-103 thru P-105 in the existing space provided in the MCC. New cable and conduit will be required from the MCC breakers to the VFDs.

65.1.2 Pump and Piping: Pump volutes P-103 & P-104 are existing and shall get new impellers. The existing field instrumentation attached to the pumps and associated piping shall be kept intact as much as possible for the existing pumps. The new pump P-105 will require similar instrumentation.

Bearing Temperatures RTDs: The pumps have an upper and lower bearing with temperature RTDs. These signals are wired to the Multilin. RTDs for pumps P-103 and P-104 are existing. RTDs for pump P-105 shall be new.

PLC Data sent to DCS:

DCS Tag ***Description***

TI10xG *Upper Bearing Temperature:* MODBUS communication from the Multilin to the PLC. (PLC transmits Deg C, DCS converts to Deg F)

TI10xH *Lower Bearing Temperature:* MODBUS communication from the Multilin to the PLC. (PLC transmits Deg C, DCS converts to Deg F)

Bearing high temperature alarms trip points are located in the DCS.

Field Tag ***Description***

TE10xG *Upper Bearing Temperature:* RTD wire to the Multilin.
TE10xH *Lower Bearing Temperature:* RTD wire to the Multilin.

Vibration Sensors: The existing pumps have an upper and lower bearing with vibration sensors, a Bentley Nevada Velomitor XA 330525, mounted in the vicinity. These raw instrument signals are sent to a specialty card in the existing PLC-5 Remote I/O (RIO) Rack, a Bentley Nevada 2201-03/03 card. There are a total of two cards with four channels each. They are being utilized by all four existing pumps. The existing vibration sensors for pumps P-101 thru P-104 and the existing associated Bentley Nevada cards from the I/O rack shall be salvaged and returned to the City. The vibration sensors for pumps P-103 thru P-105 shall be new and provide a 4-20mA signal wired directly to the new remote I/O panel and associated analog card.

PLC Data sent to DCS:

DCS Tag	*Description*
VI10xA	*Upper Bearing Vibration:* In/Sec Peak
VAH10xA	*Upper Bearing High Vibration:* 1.5 In/Sec Peak
VAHH10xA	*Upper Bearing High-High Vibration:* 2.5 In/Sec Peak
VI10xB	*Lower Bearing Vibration:* In/Sec Peak
VAH10xB	*Lower Bearing High Vibration:* 1.5 In/Sec Peak
VAHH10xB	*Lower Bearing High-High Vibration:* 2.5 In/Sec Peak

Field Tag	*Description*
VE/VT 10xA	*Upper Bearing Vibration Sensor: 4-20mA*
VE/VT 10xB	*Lower Bearing Vibration Sensor: 4-20mA*

Check Valve Closed Position Switch: The discharge piping for pumps P-103 and P-104 have a limit switch on the check valve with a normally open contact that is wired to the PLC as an input. A contact that is normally closed when the check valve is open will be used for pumps P-103 thru P-105 for the new hardwired controls in the VFD enclosure. The discharge check valve for P-105 will require a limit switch. New cable and conduit shall be added to bring the check valve closed signal to the VFD panel.

DCS Tag	*Description*
ZLC10x	*Check Valve Closed:* DI indicating that the check valve has closed.

Suction Pressure: The suction piping to pumps P-103 and P-104 have a suction pressure indicator and transmitter. This will be reutilized with no changes. It is a loop powered device with a 4-20mA signal to the PLC. P-105 will require a similar suction pressure indicator and transmitter. Existing suction pressure interlock logic shall be replaced with low level logic instead in the PLC and DCS because of variable speed pumping. Suction pressure and alarms will be an indication only for pumps P-103 thru P-105.

DCS Tag	*Description*
PI10xA	*Suction Pressure Indication:* PSIG
PAL10x	*Suction Pressure Low:* This is derived from the pressure indication analog signal. Set to trip at 2.5psi.
PALL10x	*Suction Pressure Low-Low:* Similar to above but set lower. Set to trip at 0.5psi.

Field Tag	*Description*
PIT10xA	*Suction Pressure Indication and Transmitter:* 4-20mA loop powered device.

Discharge Pressure: The discharge piping from the pumps P-103 and P-104 have a pressure indicator and transmitter. It is a loop powered device with a 4-20mA signal to the PLC. P-105 will require a similar discharge pressure indicator and transmitter.

DCS Tag	***Description***
PI10xB	*Discharge Pressure Indication:* PSIG
PAH10x	*Discharge Pressure High:* This is derived from the pressure indication analog signal and discharge flowrate. Set per table below:

MGD	TDH (ft)
0 - 15	120
15 - 21	120 to 145 linear ramp
21 - 22	145 to 160 linear ramp
22 - inf	160

PAHH10x	*Discharge Pressure High-High:* This is derived from the pressure indication analog signal and discharge flowrate. This will shut down the pumps if triggered. Set per the table below:

MGD	TDH (ft)
0 - 21	150
21 -	N/A, do not trigger alarm since it would shut down the pump with a nuisance trip. Only the PAH would trigger indicating that the pressure is high.

Field Tag	***Description***
PIT10xB	*Discharge Pressure Indication and Transmitter:* 4-20mA loop powered device.

Seal Water: The seal water system for the existing pumps has been partially demolished and abandon. The new and existing pumps do not require seal water.

DCS Tag	***Description***
FAL10x	*Seal Water Low Flow:* This existing input is no longer required and hardwiring shall be removed from PLC input and be made a spare point. Existing programming has made this point always true thus making it non-functional. All traces of this point in the PLC and DCS logic shall be permanently removed.

65.1.3 Motor: The existing 400hp motors for pumps P-103 and P-104 shall be replaced with new 500hp motors. New pump P-105 shall also have a 500hp motor.

Winding RTDs: There shall be a total of two winding RTDs per phase for a total of six winding temperate RTDs.

The following six temperature indications are via MODBUS communication from the Multilin to the PLC. (PLC transmits Deg C, DCS converts to Deg F)

DCS Tag	***Description***
TI10xA	*Motor Winding Temperature A*
TI10xB	*Motor Winding Temperature B*
TI10xC	*Motor Winding Temperature C*
TI10xD	*Motor Winding Temperature D*
TI10xE	*Motor Winding Temperature E*
TI10xF	*Motor Winding Temperature F*

Field Tag	***Description***
TE10xA	*Motor Winding Temperature A:* RTD wire to the Multilin.
TE10xB	*Motor Winding Temperature B:* RTD wire to the Multilin.
TE10xC	*Motor Winding Temperature C:* RTD wire to the Multilin.
TE10xD	*Motor Winding Temperature D:* RTD wire to the Multilin.
TE10xE	*Motor Winding Temperature E:* RTD wire to the Multilin.
TE10xF	*Motor Winding Temperature F:* RTD wire to the Multilin.

Bearing RTDs:

DCS Tag	***Description***
TI10xI	*Motor Bearing Temperature I*
TI10xJ	*Motor Bearing Temperature J*

Field Tag	***Description***
TE10xI	*Motor Bearing Temperature I:* RTD wire to the Multilin.
TE10xJ	*Motor Bearing Temperature J:* RTD wire to the Multilin.

Communications:

DCS Tag	***Description***
YA10xG	*Multilin Common Alarm: From GE 469 Multilin (or approved equal) programmable output contact, alarm settings to be determined during commissioning.*

Space Heater: The new motors will require a space heater when not in use.

Manufacturer Recommendations: If the CONTRACTOR'S chosen motor manufacturer requires additional motor protective devices beyond the CONTRACT DOCUMENTS, than the CONTRACTOR shall incorporate them into the motor protection scheme at no additional cost the CITY.

65.1.4 VFD: A new stand alone VFD cabinet will be installed in the vicinity of the motors for pumps P-103 thru P-105. This new panel will house the VFD along with all the control wiring. A new Multilin shall be provided and mounted to the front of the VFD enclosure.

The Multilins shall communicate to the PLC remote I/O drop via MODBUS. The new motors will utilize 6 winding temperate RTDs, and two motor bearing RTDs. The PLC takes that data and resends six winding temperatures and two bearing temperatures to the DCS system. The DCS system determines the high temperature setpoints. For all field devices wired to the Multilin, see Sections **65.1.2 Pump** and **65.1.3 Motor** above.

New Controls: Utilizes a fail safe wiring scheme when practical. See CONTRACT DOCUMENTS sheet E-9 for the pump control schematic.

New Hardwired Controls: See new control schematic.

Field Tag	***Description***
HS10xG	*HOA Switch:* Allows the operator to run the pump in local manual Hand; or allows the operator to switch to Auto for computer control; or allows the operator to turn the pump off.
HS10xH	*Start PB:* Allows the operator to start the pump when in Hand.
HS10xI	*Stop PB:* Allows the operator to stop the pump when in Hand.
HS10xJ	*Reset:* Allows the operator to reset the alarms in the VFD and Multilin controls.
KQI10x	*Run Time:* Displace the total accumulative run time of the pump.
SC10xB	*Speed Control:* Allows the operator to control the speed of the pump when in Hand.
SI10xB	*Speed Indication:* Provides the operator feedback as to the speed of the pump.

Status Information:
VFD HMI: Information and control per manufacturer.

Control Power On: Provides the operator with feedback that the pump has control power.

Pump Ready-Off: Provides the operator with feedback that the control circuit has no alarms, the pump is not running, and the pump is ready to be started.

Pump Running: Provides the operator with feedback the VFD is driving the pump (i.e. running).

VFD Trouble Alarm: Alarm from VFD. See manufacturer for programming VFD.

Check Valve Alarm: Alarms if the pump is running and the check valve failed to open for more than the preset time (0-30 seconds).

RTD High Temp Alarm: Alarms if the Multilin determines the pump shall be shut down due to a high RTD temperature. See manufacturer for programming the Multilin.

The following are new items required for the VFD control panel and the associated I/O shall be wired to the new Remote I/O Drop.

DCS Tag	***Description***
SC10x	*Pump Speed Control:* 4-20mA output, controls the pump speed when in computer control.
SI10x	*Pump Speed Indication:* 4-20mA input, provides VFD speed feedback to the PLC and DCS.
HS10xK	*VFD/Multilin Reset:* DO reset the alarms in the VFD and Multilin controls.

Communications: VFDs shall communicate via MODBUS and an RS485 connections daisy chained to each other and terminated at the new remote I/O drops communication card.

DCS Tag	***Description***
YA10xH	*VFD Common Alarm*

65.1.5 I/O Drop: The existing PLC has two existing I/O drops. One of the existing drops has 4 spare slots for I/O. A new remote I/O drop shall be provided adjacent the existing PLC panel. This new panel shall have the I/O drop daisy chained from one of the existing I/O remote racks.

The new Remote I/O drop will contain the following:

- (1) Power Card
- (1) MODBUS Communication Card
- (1) Digital Input Card
- (1) Digital Output Card
- (2) Analog Input Cards
- (1) Analog Output Cards.

New I/O (Qty):

- DI: 5
- DO: 4
- AI: 11
- AO: 3

65.02 Related Equipment

1. P-101: Existing
2. P-102: Existing
3. P-103: Changing out 400hp Motor to 500hp.
4. P-104: Changing out 400hp Motor to 500hp.

5. P-105: New Pump and Motor 500hp.
6. VFD-103: New
7. VFD-104: New
8. VFD-105: New
9. Remote I/O Drop 3: New
10. Valves G-121: Contractor to demolish, (Contractor shall remove all associated programing)

65.03 References

1. Contract Drawings:
   a. Electrical Plans
   b. Control Diagrams
   c. P&IDs

2. Contract Specifications:
   a. Appendix B1 thru B6 for I/O Lists
   b. Appendix E for Existing Loops
   c. Appendix F for Existing PLC Program (3/17/2011)

65.04 Overview of Strategy

Pumps P-103 thru P-105 are 500Hp pumps controlled by VFDs. The Operator can designate any pump as Lead, Lag, or Standby Pump.

While in automatic mode, and there is a failure that causes one of the operating pumps to shutdown, the program shall automatically assign the next lag or standby pump to automatically take over the duty.

Note, Mode 3 shall have an internal on/off permissive bit. The programmer shall initially set the logic bit as off, so as to inhibit mode 3 from operating. The City is performing an analysis of the forcemain to determine if hydraulically the forcemain can handle the extra pressure of 3 pumps running due to the age of the pipe. This logic bit shall not be available to the operators on the HMI screen.

See table below for setpoints.

Mode 0: Def: No pumps are operating

Rising Level, Start Mode L1 Start PID at 100%: If the pump station's pumping mode is Mode 0; and the level rises beyond the setpoint for more than 30 seconds; then the pump mode shall be switched to Mode L1, and start the Mode L1 PID at 100%.

Mode L1: Def: Large 500Hp Pump (Designated Lead Pump) is operating

Rising Level, Start Mode L2 PID at 80%: If the pump station's pumping mode is Mode L1; and the level rises beyond the setpoint for more than 30 seconds; then the pump mode shall be switched to Mode L2. Start the L2 Lag Pump PID output for the VFD at 80% and allow the PID to maintain the level setpoint, while at the same time the

L1 Lead Pump shall ramp down at (1%/sec) until the VFD output matches the Lag Pump, then both pumps shall ramp up and down in unison per the Mode L2 PID control.

***Rising Level, PID Off, Set VFD to 100%:** If the pump station's pumping mode is Mode L1; and the level rises beyond the setpoint for more than 30 seconds; then the PID output control shall be forced to 100% VFD pumping speed.

***Falling Level, PID On, Start PID at 100%:** If the pump station's pumping mode is Mode L1; and the level falls beyond the setpoint for more than 30 second then remove the forced output of the PID control. Start the PID output for the Mode L1 VFD at 100% and then allow the PID to maintain the level setpoint.

Mode L1: PID Level Setpoint: This is the level setpoint to be maintained while under Mode 1 PID level control.

***Rising Level, PID On, Start PID at 70%:** If the pump station's pumping mode is Mode L1; and the level rises beyond the setpoint for more than 30 second then remove the forced output of the PID control. Start the PID output for the Mode L1 VFD at 70% and then allow the PID to maintain the level setpoint.

***Falling Level, PID Off, Set VFD to 70%:** If the pump station's pumping mode is Mode L1; and the level falls beyond the setpoint for more than 30 seconds; then the PID output control shall be forced to 70% VFD pumping speed.

Falling Level, Mode L1 Off, Start Mode 0: If the pump station's pumping mode is Mode L1; and the level falls beyond the setpoint for more than 30 seconds; then the pump mode shall be switched to Mode 0, and then stop Mode L1 pump. (Note, do not start Mode S1 at this point.)

Mode L2: Def: Large 500Hp Pump (Designated Lead and Lag Pump) is operating

Rising Level, Start Mode L3, Set VFD to 100%: If the pump station's pumping mode is Mode L2; and the level rises beyond the setpoint for more than 30 seconds; then the pump mode shall be switched to Mode L3. Start the L3 Standby Pump VFD at 100%. All three pumps will maintain 100% VFD pumping speed.

***Rising Level, PID Off, Set VFD to 100%:** If the pump station's pumping mode is Mode L2; and the level rises beyond the setpoint for more than 30 seconds; then the PID output control shall be forced to 100% VFD pumping speed.

***Falling Level, PID On, Start PID at 100%:** If the pump station's pumping mode is Mode L2; and the level falls beyond the setpoint for more than 30 second then remove the forced output of the PID control. Start the PID output for the Mode L2 VFD at 100% and then allow the PID to maintain the level setpoint.

PID Level Setpoint: This is the level setpoint to be maintained while under Mode 2 PID level control.

***Rising Level, PID On, Start PID at 80%:** If the pump station's pumping mode is Mode L2; and the level rises beyond the setpoint for more than 30 second then remove the forced output of the PID control. Start the PID output for the Mode L2 VFD at 70% and then allow the PID to maintain the level setpoint.

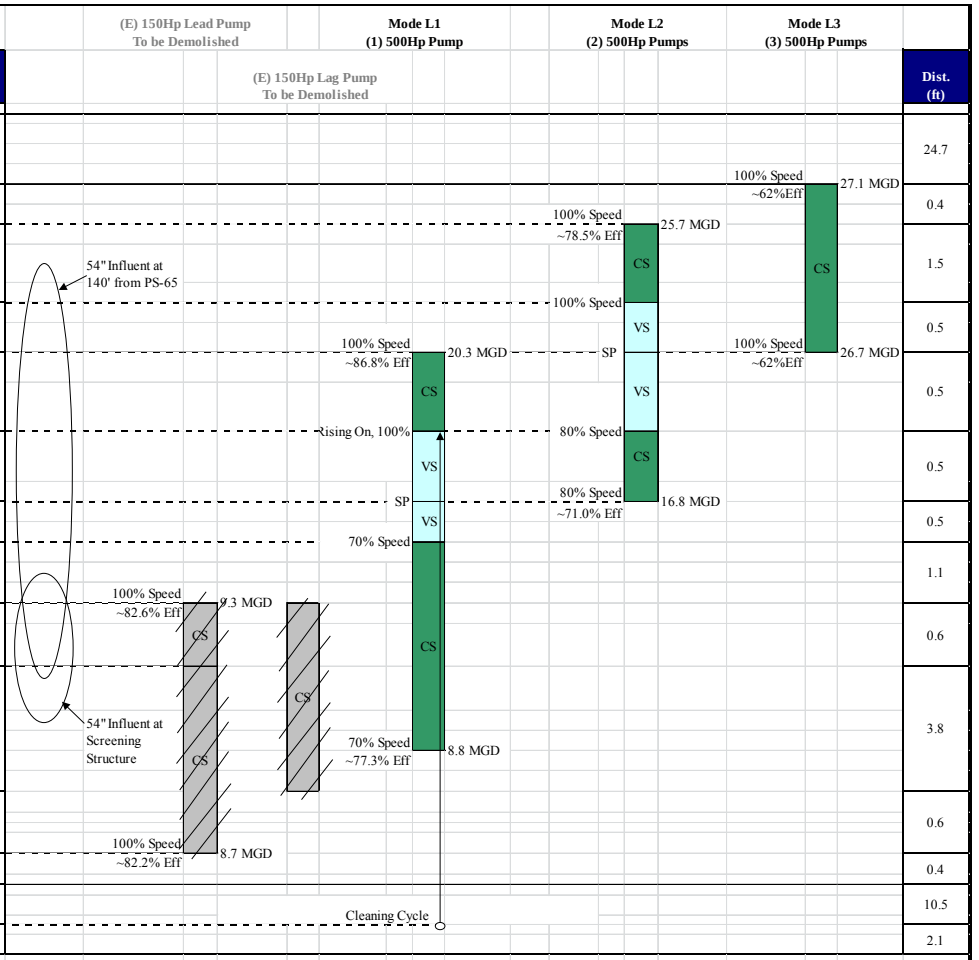
***Falling Level, PID Off, Set VFD to 80%:** If the pump station's pumping mode is Mode L2; and the level falls beyond the setpoint for more than 30 seconds; then the PID output control shall be forced to 70% VFD pumping speed.

Falling Level, Mode 2 Off, Start Mode L1 PID at 80%: If the pump station's pumping mode is Mode L2; and the level falls beyond the setpoint for more than 30 seconds; then the pump mode shall be switched to Mode L1, Stop Mode L2 Lag pump. Start the PID output for the Mode L1 VFD at 80% and then allow the PID to maintain the level setpoint.

Mode L3: Def: Large 500Hp Pump (Designated Lead, Lag, and Standby Pump) is operating

Falling Level, Mode 3 Off, Start Mode 2 PID at 100%: If the pump station's pumping mode is Mode L3; and the level falls beyond the setpoint for more than 30 seconds; then the pump mode shall be switched to Mode L2, Stop Mode L3 Standby pump. Start the PID output for the Mode L2 VFD at 100% and then allow the PID to maintain the level setpoint.

Location (Or PLC Level Logic)	Elev.	Above Screening FF	Wetwell FF	Dist. (ft)
Spill at PS-65 Catch Basin	14.10	34.10	47.65	
Wetwell Catwalks	-9.00	11.00	24.55	
High-High Wetwell Level Alarm (HHWL Alarm) Overflow Weir	-9.50	10.50	24.05	24.7
High Wetwell Level (HWL Alarm)	-10.50	9.45	23.00	0.4
Mode L2: Rising Level, Start Mode L3, Set VFD to 100%	**-11.00**	**9.00**	**22.55**	
Top of 54" Pipe 140' away (See Sheet 24989-04-D), d/D = 1 (ie not a full pipe upstream to the north and below this wetwell operating pt.)	-12.31	7.69	21.24	1.5
***Mode L2: Rising Level, PID Off, Set VFD to 100%** ***Mode L2: Falling Level, PID On, Start PID at 100%**	**-12.50**	**7.50**	**21.05**	
Mode L1: Rising Level, Start Mode L2 PID at 80% **Mode L2: PID Level Setpoint** **Mode L3: Falling Level, Mode L3 Off, Start Mode L2 PID at 100%**	**-13.00**	**7.00**	**20.55**	0.5
Mode 0: Rising Level Start Mode L1 PID at 100% ***Mode L1: Rising Level, PID Off, Set VFD to 100%** ***Mode L1: Falling Level, PID On, Start PID at 100%** ***Mode L2: Rising Level, PID On, Start PID at 80%** ***Mode L2: Falling Level, PID Off, Set VFD to 80%**	**-13.50**	**6.50**	**20.05**	0.5
Mode L1: PID Level Setpoint **Mode L2: Falling Level, Mode 2 Off, Start Mode L1 PID at 80%**	**-14.00**	**6.00**	**19.55**	0.5
***Mode L1: Rising Level, PID On, Start PID at 70%** ***Mode L1: Falling Level, PID Off, Set VFD to 70%**	**-14.50**	**5.50**	**19.05**	0.5
Influent Sewer d/D = 1	-14.75	5.25	18.80	1.1
(E) Start Lag 150Hp Pump (SP shall be removed)	-15.60	4.40	17.95	0.6
(E) Start Lead 150Hp Pump (SP Shall be removed)	-16.20	3.80	17.35	3.8
Influent Sewer d/D = 0	-19.25	0.75	14.30	
Mode L1: Falling Level, Mode L1 Off, Start Mode 0	**-19.50**	**0.50**	**14.05**	
Screening Structure Finished Floor (E) Stop Lag 150Hp Pump (SP shall be removed)	-20.00	0.00	13.55	
(E) Low Wetwell Level (LWL Alarm)	-20.50	-0.50	13.05	0.6
(E) Stop Lead 150Hp Pump (SP shall be removed)	-20.60	-0.60	12.95	0.4
(N) Low Wetwell Level (LWL Alarm)	-21.00	-1.00	12.55	10.5
500-hp Pump Volute Center Line	-21.50	-1.50	12.05	
Bottom of Suction Bell	-31.47	-11.47	2.08	2.1
Wetwell Finished Floor	-33.55	-13.55	0.00	



Nomenclature

Mode 0 = No pumps operating.
Mode L1 = Large 500Hp Pump (Designated Lead Pump)
Mode L2 = Large 500Hp Pump (Designated Lead and Lag Pump)
Mode L3 = Large 500Hp Pump (Designated Lead, Lag, and Stand-by Pump)
OOS = Out of Service VFD = Variable Frequency Drive MGD = Million Gallons per Day
PID = Proportional Integral Derivative

CS = Constant Speed
Eff = Pumping Efficiency
FF = Finished Floor
VS = Variable Speed
d/D =Ratio of wetwell level above pipe invert over pipe diameter.

Notes

1. Vertical dimensions have no scale.
2. Rising or Falling Level is descriptive only and is based on current pumping mode and application of PLC timer delay of 30 seconds on logic operating points.
3. With multiple pump operation, pumps will ramp up and down in unison.
4. Hydraulically Mode L3 should never occur but shall be programmed regardless.

* These logic points should be similarly achieved with proper PID tuning parameters but shall be programmed regardless to force the PID output. +/- 6" from level setpoint is easily achievable with variable speed drives and proper PID tuning. At a level above 6" from the setpoint the PID tuning parameters would have the control loop at a pump speed of 100%. At levels below 6" from the setpoint the PID tuning parameters would have the control loop at the specified minimum speed setpoint.

65.05 Local Control

All local control for the pumps is at the VFD panel when in Hand. There is also a LOS at the pump.

65.06 DCS Control DCS Manual Control

Operators may manually run the pumps from the DCS workstation when the pumps are available for remote control. They can also adjust operator setpoints from the DCS.

65.07 PLC Automatic Control

Pumps shall be run by PLC control for normal operations.

65.08 Failure Modes

Common Pump Alarm is the only hardwired alarm point to the PLC and will shutdown the pump and the next lag or standby pump shall automatically take over the duty.

Alarms generated by the PLC logic, Alarms YA10xA thru YA10xE are discussed in sections above.

65.09 Software Interlocks

See sections above.

65.10 Restart after Power Failure Strategy

Upon power restoring, the Pump Station should revert to “Mode 0”, thus if the level is calling for a pump to start, after 30 seconds Mode L1 will first cycle on. PLC logic can only start one pump at a time and cycle thru the pump modes one at a time. The built in delays from one mode to the next will effectively stagger the pump starts. A loss of power will cause the VFD and Multilins to trip. The DCS/PLC should automatically send a reset signal to automatically reset the devices.

65.11 Phased Shutdown on Power Failure

N/A.

65.12 Out of Service

Any of the pumps P-103 thru P-105 shall be able to be placed out of service via the DCS workstation.

65.13 Setpoints and Alarms

TAG	DESCRIPTION	PRIORITY
YA10xA	*Pump Fail to Start*	2
YA10xB	*Pump Fail to Stop*	2
YA10xC	*Check Valve Fail*	2
YA10xD	*Common Alarm*	2
YA10xE	*Pump AB Shut Down*	2
PAH10x	*Discharge Pressure High*	1
PAHH10x	*Discharge Pressure High-High*	2
VAH10xA	*Upper Bearing High Vibration*	1
VAHH10xA	*Upper Bearing High-High Vibration*	2
VAH10xB	*Lower Bearing High Vibration*	1
VAHH10xB	*Lower Bearing High-High Vibration*	2
TAH10xG	*Upper Bearing Temperature High Alarm*	1
TAHH10xG	*Upper Bearing Temperature High-High Alarm*	2
TAH10xH	*Lower Bearing Temperature High Alarm*	1
TAHH10xH	*Lower Bearing Temperature High-High Alarm*	2
TAH10xI	*Motor Bearing I Temperature High Alarm*	1
TAHH10xI	*Motor Bearing I Temperature High-High Alarm*	2
TAH10xJ	*Motor Bearing J Temperature High Alarm*	1
TAHH10xJ	*Motor Bearing J Temperature High-High Alarm*	2
TAH10xA	*Motor Winding Temperature A High Alarm*	2
TAH10xB	*Motor Winding Temperature B High Alarm*	2
TAH10xC	*Motor Winding Temperature C High Alarm*	2
TAH10xD	*Motor Winding Temperature D High Alarm*	2
TAH10xE	*Motor Winding Temperature E High Alarm*	2
TAH10xF	*Motor Winding Temperature F High Alarm*	2
LAL10	Low Water Alarm	1

Alarm Priority Definitions:

Level 3 - Life Threatening or Danger Conditions

Level 2 - Critical process alarms that shall create a plant shutdown condition, cause a critical process failure or severely hinder plant operation.

Level 1 - Minor process alarms associated with warning conditions and minor equipment failures.

Level 0 - Informational alarms shall not hinder operation or cause equipment failure.

Analog points shall have two alarm priorities, one for high alarms and the second for low alarms.

65.14 Communications Interfaces

Communication is available via MODBUS for the three new VFDs, and the three new Multilins. The CONTRACTOR shall provide up to 20 signals for each device to be determined during construction at the discretion of the City and what is available from the manufacturer.

Appendix B-1
Existing I/O Card Summary

RIO DROP 1					
POS ADD	**SLOT**	**TYPE**	**DESCRIPTION**	**QTY POINTS**	**ADDRESS PREFIX**
-	0	COMM	REMOTE I/O ADAPER	-	-
0	1	DI	AC INPUT 120V	16	I:010
1	2	DO	AC OUTPUT 120V	16	O:011
2	3	DI	AC INPUT 120V	16	I:012
3	4	DI	AC INPUT 120V	16	I:013
4	5	DI	AC INPUT 120V	16	I:014
5	6	DI	AC INPUT 120V	16	I:015
6	7	AI	ANALOG INPUT	8	N16
7	8	AI	ANALOG INPUT	8	N18
8	9	DI	AC INPUT 120V	16	I:020
9	10	COMM	PROSOFT	-	N23
10	11	COMM	BENTLY NEVADA SYSTEM MONITOR	-	N24
11	12	AI	BENTLY NEVADA 4 CHANNEL MONITOR	4	N24
12	13	AI	BENTLY NEVADA 4 CHANNEL MONITOR	4	N24
13	14	AI	ANALOG INPUT	8	N:38
14	15	COMM	PROSOFT COMM INTERFACE	-	(TO DCS)
15	16	DO	AC OUTPUT 12/120V	16	O:027

RIO DROP 2					
POS ADD	**SLOT**	**TYPE**	**DESCRIPTION**	**QTY POINTS**	**ADDRESS PREFIX**
-	0	COMM	REMOTE I/O ADAPER	-	-
0	1	PWR	POWER SUPPLY	-	-
1	2	DI	DC INPUT 10-20V	16	I:031
2	3	DI	AC INPUT 120V	16	I:032
3	4	DI	AC INPUT 120V	16	I:033
4	5	-	EMPTY	-	-
5	6	-	EMPTY	-	-
6	7	-	EMPTY	-	-
7	8	-	EMPTY	-	-

Appendix B2
Existing PLC I/O and Associated DCS Data

PLC DATABASE													LOOP DRAWINGS						
PLC ORDER	ADDRESS	RACK	POS ADD	SLOT	DROP	TAG (PLC I/O) "-" UNASSIGNED	(WRITE TO DCS) ADDRESS	TAG	SCOPE	DESCRIPTION	TYPE	DESCRIPTION FROM PLC	FIELD DEVICE TAG "-" UNASSIGNED	LOOP NO	TBs	REFERENCE/ NOTES 2004 LOOPS	2004 ATS	2000 REV 0	1997 AS-BUILTS ELECTRICAL
1	I:010/0	1	0	1	0	-	N32:0/0	I65FAL1A	Global	Pump Room Supply Fan SF-1 Normal	DI	Pump Room Supply Fan SF-1 Fail	FSL_1A	1	TB2: 1,2			X	
2	I:010/1	1	0	1	1	-	N32:0/3	I65FAL3A	Global	Meter Vault Supply Fan SF-3 Normal	DI	Meter Vault Supply Fan SF-3 Fail	FSL_3A	3	TB2: 3,4			X	
3	I:010/2	1	0	1	2	-	N32:0/5	I65FAL4	Global	Screening Room Supply Fan SF-4 Normal	DI	Screening Room Supply Fan SF-4 Fail	FSL_4	4	TB2: 5,6			X	
4	I:010/3	1	0	1	3	-	N32:0/6	I65FAL5	Global	Screening Room Supply Fan SF-5 Normal	DI	Screening Room Supply Fan SF-5 Fail	FSL_5	5	TB2: 7,8			X	
5	I:010/4	1	0	1	4	-	N32:0/1	I65FAL1B	Global	MCP Room Exhaust Fan EF-1 Normal	DI	MCP Room Exhaust Fan EF-1 Fail	FSL_1B	1	TB2: 9,10			X	
6	I:010/5	1	0	1	5	-	N32:0/2	I65FAL2B	Global	MCP Room Exhaust Fan EF-2 Normal	DI	MCP Room Exhaust Fan EF-2 Fail	FSL_2B	2	TB2: 11,12			X	
7	I:010/6	1	0	1	6	-	N32:0/4	I65FAL3B	Global	Meter Vault Exhaust Fan EF-3 Normal	DI	Meter Vault Exhaust Fan EF-3 Fail	FSL_3B	3	TB2: 13,14			X	
8	I:010/7	1	0	1	7	-	N32:0/7	I65FAL8	Global	Odor Control System Exhaust Fan EF-8 Normal	DI	Odor Control System Exhaust Fan EF-8 Fail	FSL_8	8	TB2: 15,16			X	
9	I:010/10	1	0	1	10	-	N32:10/13	I65LALL940	Global	Class "A" Water Ai Gap Tank T-940 Level Normal	DI	Class "A" Water Ai Gap Tank T-940 Low-Low Level	LSLL_940	940	TB2: 17,18			X	
10	I:010/11	1	0	1	11	-	N32:10/14	I65UA940	Global	Class "A" Water Ai Gap Tank T-940 Normal	DI	Class "A" Water Ai Gap Tank T-940 Fail	UCP-940 R1	940	TB2: 19,20			X	
11	I:010/12	1	0	1	12	-	N32:10/15	I65LALL950	Global	Class "B" Water Ai Gap Tank T-950 Level Normal	DI	Class "B" Water Ai Gap Tank T-950 Low-Low Level	LSLL_950	950	TB2: 21,22			X	
12	I:010/13	1	0	1	13	-	N32:11/0	I65UA950	Global	Class "B" Water Ai Gap Tank T-950 Normal	DI	Class "B" Water Ai Gap Tank T-950 Fail	UCP-950 R1	950	TB2: 23,24			X	
13	I:010/14	1	0	1	14	-	N32:0/15	I65LAHH25	Global	Operational Wet Well 1 Level Normal	DI	Operational Wet Well 1 High-High Level	LSHH_25	25	TB2: 25, 26	X			
14	I:010/15	1	0	1	15	-	N32:1/0	I65LAHH26	Global	Operational Wet Well 2 Level Normal	DI	Operational Wet Well 2 High-High Level	LSHH_26	26	TB2: 27, 28	X			
15	I:010/16	1	0	1	16	-	N32:1/1	I65LAHH27	Global	Overflow Wet Well Level Normal	DI	Overflow Wet Well High-High Level	LSHH_27	27	TB2: 29, 30	X			
16	I:010/17	1	0	1	17	-	N32:7/13	I65ZLC141	Global	Plug Valve V-141 Closed	DI	Plug Valve V-141 Closed	ZSC_141	141	TB2: 31,32			X	
17	O:011/0	1	1	2	0	HS-101	N/A	N/A	N/A	N/A	DO	Pump 101 Call	CR1	101	TB2: 161, 162			X	REF FOR TAG NAME
18	O:011/1	1	1	2	1	HS-102	N/A	N/A	N/A	N/A	DO	Pump 102 Call	CR2	102	TB2: 163, 164			X	REF FOR TAG NAME
19	O:011/2	1	1	2	2	HS-103	N/A	N/A	N/A	N/A	DO	Pump 103 Call	CR3	103	TB2: 165, 166			X	REF FOR TAG NAME
20	O:011/3	1	1	2	3	HS-104	N/A	N/A	N/A	N/A	DO	Pump 104 Call	CR4	104	TB2: 167, 168			X	REF FOR TAG NAME
21	O:011/4	1	1	2	4	-	N/A	N/A	N/A	N/A	DO	Spare Output	-	-	TB2: 169,170, WIRE DISC			X	ASGND ALRM SHTDWN 101
22	O:011/5	1	1	2	5	-	N/A	N/A	N/A	N/A	DO	Spare Output	-	-	TB2: 171,172, WIRE DISC			X	ASGND ALRM SHTDWN 102
23	O:011/6	1	1	2	6	-	N/A	N/A	N/A	N/A	DO	Spare Output	-	-	TB2: 173,174, WIRE DISC			X	ASGND ALRM SHTDWN 103
24	O:011/7	1	1	2	7	-	N/A	N/A	N/A	N/A	DO	Spare Output	-	-	TB2: 175,176, WIRE DISC			X	ASGND ALRM SHTDWN 104
25	O:011/10	1	1	2	10	-	N/A	N/A	N/A	N/A	DO	Drywell Gas Alarm	-	10	TB2: 178, 179	X			
26	O:011/11	1	1	2	11	-	N/A	N/A	N/A	N/A	DO	Screenings Facility Gas Alarm	-	20	TB2: 177, 180	X			
27	O:011/12	1	1	2	12	-	N/A	N/A	N/A	N/A	DO	Meter Vault Gas Alarm	-	60	TB2: 181, 182	X			
28	O:011/13	1	1	2	13	-	N/A	N/A	N/A	N/A	DO	Seal Water Pump 305 Call	-	301	TB2: 183, 184	X			
29	O:011/14	1	1	2	14	-	N/A	N/A	N/A	N/A	DO	Seal Water Pump 306 Call	-	301	TB2: 185, 186	X			
30	O:011/15	1	1	2	15	-	N/A	N/A	N/A	N/A	DO	Spare Output	-	-					
31	O:011/16	1	1	2	16	-	N/A	N/A	N/A	N/A	DO	Spare Output	-	-					
32	O:011/17	1	1	2	17	-	N32:0/8	I65LALL10	Global	Wet Well Level Normal	DO	Wet Well Low-Low Level	LALL_10	10	NUETRAL TB: 192	X			
33	I:012/0	1	2	3	0	-	N32:0/9	I65PALL10B	Global	Wet Well Bubbler Normal Pressure	DI	Wet Well Bubbler Low-Low Pressure	-	10	TB2: 33, 34	X			
34	I:012/1	1	2	3	1	-	N32:0/10	I65UA10A	Global	Drywell Air Quality Normal	DI	Drywell Air Quality Alarm	-	10	TB2: 35,36	X			
35	I:012/2	1	2	3	2	-	N32:0/11	I65UA10B	Global	Drywell Combustible Gas Normal	DI	Drywell Combustible Gas Alarm	-	10	TB2: 37,38	X			
36	I:012/3	1	2	3	3	-	N32:0/13	I65UA20A	Global	Screenings Facility Air Quality Normal	DI	Screenings Facility Air Quality Alarm	-	10	TB2: 39,40	X			
37	I:012/4	1	2	3	4	-	N32:0/14	I65UA20B	Global	Screenings Facility Combustible Gas Normal	DI	Screenings Facility Combustible Gas Alarm	-	10	TB2: 41, 42	X			
38	I:012/5	1	2	3	5	-	N32:1/3	I65LAH50	Global	Pump Room Sump Level Normal	DI	Pump Room Sump High Level	LSH_50	50	TB2: 43, 44	X			
39	I:012/6	1	2	3	6	-	N32:1/4	I65LAHH50	Global	Pump Room Sump Level Normal	DI	Pump Room Sump High-High Level	LSHH_50	50	TB2: 45, 46	X			
40	I:012/7	1	2	3	7	-	N32:1/5	I65LAH60	Global	Meter Vault Sump Level Normal	DI	Meter Vault Sump High Level	-	60	TB2: 3, 48	X			
41	I:012/10	1	2	3	10	-	N32:1/6	I65UA60A	Global	Meter Vault Air Quality Normal	DI	Meter Vault Air Quality Alarm	-	60	TB2: 49, 50	X			
42	I:012/11	1	2	3	11	-	N32:1/7	I65UA60B	Global	Meter Vault Combustible Gas Normal	DI	Meter Vault Combustible Gas Alarm	-	60	TB2: 51,52	X			
43	I:012/12	1	2	3	12	-	N32:1/8	I65UA81	Global	Plant Air Supply System Normal	DI	Plant Air Supply System Fail	-	81	TB2: 53,54			X	
44	I:012/13	1	2	3	13	-	N32:2/9	I65YA101D	Global	Pump 101 Multilin Normal	DI	Pump 101 Multilin Common Alarm	OA_101A	101	TB2: 55,56			X	FIELD TAG NAME
45	I:012/14	1	2	3	14	-	N32:2/11	I65YL101A	Global	Pump 101 Run	DI	Pump 101 Run	OL_101A	101	TB2: 57,58			X	
46	I:012/15	1	2	3	15	-	N32:3/2	I65ZLC101	Global	Pump 101 Discharge Check Valve Open	DI	Pump 101 Discharge Check Valve Closed	ZSC_101	101	TB2: 59,60			X	
47	I:012/16	1	2	3	16	-					DI	Pump 101 Seal Water Low Flow	FSL_101	101	TB2: 61,62			X	
48	I:012/17	1	2	3	17	-	N32:8/5	I65ZL211	Global	Slide Gate G-211 Remote Control	DI	Slide Gate G-211 Remote	HS_211	211	TB2: 63 OR 64			X	TB2: 63,64 (LL_101)
49	I:013/0	1	3	4	0	-	N32:3/15	I65YA102D	Global	Pump 102 Multilin Normal	DI	Pump 102 Multilin Common Alarm	OA_102A	102	TB2: 65,66			X	FIELD TAG NAME
50	I:013/1	1	3	4	1	-	N32:4/1	I65YL102A	Global	Pump 102 Run	DI	Pump 102 Run	OL_102A	102	TB2: 67,68			X	
51	I:013/2	1	3	4	2	-	N32:4/8	I65ZLC102	Global	Pump 102 Discharge Valve Open	DI	Pump 102 Discharge Check Valve Closed	ZSC_102	102	TB2: 69,70			X	
52	I:013/3	1	3	4	3	-					DI	Pump 102 Seal Water Low Flow	FSL_102	102	TB2: 71,72			X	TB2: 71,72
53	I:013/4	1	3	4	4	-	N32:8/11	I65ZL212	Global	Slide Gate G-212 Remote Control	DI	Slide Gate G-212 Remote	HS_212	212	TB2: 73 OR 74			X	TB2: 73,74 (LL_102)
54	I:013/5	1	3	4	5	-	N32:5/5	I65YA103D	Global	Pump 103 Multilin Normal	DI	Pump 103 Multilin Common Alarm	OA_103A	103	TB2: 75,76			X	FIELD TAG NAME
55	I:013/6	1	3	4	6	-	N32:5/7	I65YL103A	Global	Pump 103 Run	DI	Pump 103 Run	OL_103A	103	TB2: 77,78			X	
56	I:013/7	1	3	4	7	-	N32:5/14	I65ZLC103	Global	Pump 103 Discharge Check Valve Open	DI	Pump 103 Discharge Check Valve Closed	ZSC_103	103	TB2: 79,80			X	
57	I:013/10	1	3	4	10	-					DI	Pump 103 Seal Water Low Flow	FSL_103	103	TB2: 81,82			X	TB2: 81,82
58	I:013/11	1	3	4	11	-	N32:9/1	I65ZL213	Global	Slide Gate G-213 Remote Control	DI	Slide Gate G-213 Remote	HS_213	213	TB2: 83,84			X	TB2: 83,84 (LL_103)
59	I:013/12	1	3	4	12	-	N32:6/11	I65YA104D	Global	Pump 104 Multilin Normal	DI	Pump 104 Multilin Common Alarm	OA_104A	104	TB2: 85,86			X	FIELD TAG NAME
60	I:013/13	1	3	4	13	-	N32:6/13	I65YL104A	Global	Pump 104 Run	DI	Pump 104 Run	OL_104A	104	TB2: 87,88			X	
61	I:013/14	1	3	4	14	-	N32:7/4	I65ZLC104	Global	Pump 104 Discharge Check Valve Open	DI	Pump 104 Discharge Check Valve Closed	ZSC_104	104	TB2: 89,90			X	
62	I:013/15	1	3	4	15	-					DI	Pump 104 Seal Water Low Flow	FSL_104	104	TB2: 91,92			X	TB2: 91,92
63	I:013/16	1	3	4	16	-	N32:9/15	I65ZL232	Global	Sluice Gate G-232 Remote Control	DI	Sluice Gate G-232 Remote	HS_232	232	TB2: 93,94			X	TB2: 93,94 (LL_104)
64	I:013/17	1	3	4	17	-	N32:7/6	I65ZLO111	Global	Sluice Gate G-111 Open	DI	Sluice Gate G-111 Open	ZSO_111	111	TB2: 95,96			X	
65	I:014/0	1	4	5	0	-	N32:7/5	I65ZLC111	Global	Sluice Gate G-111 Closed	DI	Sluice Gate G-111 Closed	ZSC_111	111	TB2: 97			X	
66	I:014/1	1	4	5	1	-	N32:7/8	I65ZLO121	Global	Sluice Gate G-121 Open	DI	Sluice Gate G-121 Open	ZSO_121	121	TB2: 99,100			X	
67	I:014/2	1	4	5	2	-	N32:7/7	I65ZLC121	Global	Sluice Gate G-121 Closed	DI	Sluice Gate G-121 Closed	ZSC_121	121	TB2: 102			X	
68	I:014/3	1	4	5	3	-	N32:0/12	I65PALL20	Global	Bar Screen Pressure Normal	DI	Bar Screen Bubbler Low-Low Pressure	-	20	TB2: 103, 104	X			
69	I:014/4	1	4	5	4	-	N32:8/7	I65ZLO211	Global	Slide Gate G-211 Open	DI	Slide Gate G-211 Open	ZSO_211	211	TB2: 105,106			X	
70	I:014/5	1	4	5	5	-	N32:8/6	I65ZLC211	Global	Slide Gate G-211 Closed	DI	Slide Gate G-211 Closed	ZSC_211	211	TB2: 108			X	
71	I:014/6	1	4	5	6	-	N32:8/13	I65ZLO212	Global	Slide Gate G-212 Open	DI	Slide Gate G-212 Open	ZSO_212	212	TB2: 109,110			X	
72	I:014/7	1	4	5	7	-	N32:8/12	I65ZLC212	Global	Slide Gate G-212 Closed	DI	Slide Gate G-212 Closed	ZSC_212	212	TB2: 112			X	
73	I:014/10	1	4	5	10	-	N32:9/3	I65ZLO213	Global	Slide Gate G-213 Open	DI	Slide Gate G-213 Open	ZSO_213	213	TB2: 113,114			X	
74	I:014/11	1	4	5	11	-	N32:9/2	I65ZLC213	Global	Slide Gate G-213 Closed	DI	Slide Gate G-213 Closed	ZSC_213	213	TB2: 116			X	
75	I:014/12	1	4	5	12	-	N32:9/5	I65ZLO221	Global	Slide Gate G-221 Open	DI	Slide Gate G-221 Open	ZSO_221	221	TB2: 117,118			X	
76	I:014/13	1	4	5	13	-	N32:9/4	I65ZLC221	Global	Slide Gate G-221 Closed	DI	Slide Gate G-221 Closed	ZSC_221	221	TB2: 120			X	
77	I:014/14	1	4	5	14	-	N32:9/7	I65ZLO222	Global	Slide Gate G-222 Open	DI	Slide Gate G-222 Open	ZSO_222	222	TB2: 121,122			X	
78	I:014/15	1	4	5	15	-	N32:9/6	I65ZLC222	Global	Slide Gate G-222 Closed	DI	Slide Gate G-222 Closed	ZSC_222	222	TB2: 124			X	
79	I:014/16	1	4	5	16	-	N32:9/9	I65ZLO223	Global	Slide Gate G-223 Open	DI	Slide Gate G-223 Open	ZSO_223	223	TB2: 125,126			X	
80	I:014/17	1	4	5	17	-	N32:9/8	I65ZLC223	Global	Slide Gate G-223 Closed	DI	Slide Gate G-223 Closed	ZSC_223	223	TB2: 128			X	
81	I:015/0	1	5	6	0	-	N32:9/11	I65ZLO231	Global	Slide Gate G-231 Open	DI	Slide Gate G-231 Open	ZSO_231	231	TB2: 129,130			X	
82	I:015/1	1	5	6	1	-	N32:9/10	I65ZLC231	Global	Slide Gate G-231 Closed	DI	Slide Gate G-231 Closed	ZSC_231	231	TB2: 132			X	
83	I:015/2	1	5	6	2	-	N32:10/1	I65ZLO232	Global	Sluice Gate G-232 Open	DI	Sluice Gate G-232 Open	ZSO_232	232	TB2: 133,134			X	
84	I:015/3	1	5	6	3	-	N32:10/0	I65ZLC232	Global	Sluice Gate G-232 Closed	DI	Sluice Gate G-232 Closed	ZSC_232	232	TB2: 136			X	
85	I:015/4	1	5	6	4	-	N32:10/3	I65ZLO233	Global	Slide Gate G-233 Open	DI	Slide Gate G-233 Open	ZSO_233	233	TB2: 137,138			X	
86	I:015/5	1	5	6	5	-	N32:10/2	I65ZLC233	Global	Slide Gate G-233 Closed	DI	Slide Gate G-233 Closed	ZSC_233	233	TB2: 140			X	
87	I:015/6	1	5	6	6	-	N32:10/4	I65LALL300	Global	Air Gap Tank T-300 Level Normal	DI	Air Gap Tank T-300 Low Low Level	LSLL_300	300	TB2: 141, 142	X			
88	I:015/7	1	5	6	7	-	N32:10/5	I65PAH301	Global	Hydropneumatic Tank T-301 Pressure Normal	DI	Hydropneumatic Tank T-301 High Pressure	PSHL_301	301	TB2: 143, 144	X			
89	I:015/10	1	5	6	10	-	N32:10/6	I65PAL301	Global	Hydropneumatic Tank T-301 Pressure Normal	DI	Hydropneumatic Tank T-301 Low Pressure	PSHL_301	301	TB2: 146	X			
90	I:015/11	1	5	6	11	-	N32:10/7	I65LAL410B	Global	Hypo Bulk Storage Tank T-410 Level Normal	DI	Hypo Bulk Storage Tank T-410 Low Level	LSL_410A	410	TB2: 149, 148	X			

Appendix B2
Existing PLC I/O and Associated DCS Data

PLC DATABASE													LOOP DRAWINGS					
PLC ORDER	ADDRESS	RACK	POS ADD	SLOT	DROP	TAG (PLC I/O) "-" UNASSIGNED	(WRITE TO DCS) ADDRESS	TAG	SCOPE	DESCRIPTION	TYPE	DESCRIPTION FROM PLC	FIELD DEVICE TAG "-" UNASSIGNED	LOOP NO	TBs	REFERENCE/ NOTES 2004 LOOPS	2004 ATS	2000 REV 0	1997 AS-BUILTS ELECTRICAL
91	I:015/12	1	5	6	12	-	N32:10/8	I65LAL420B	Global	Caustic Bulk Storage Tank T-420 Level Normal	DI	Caustic Bulk Storage Tank T-420 Low Level	LSL_420A	420	TB2: 149, 150	X			
92	I:015/13	1	5	6	13	-	N32:10/10	I65FAH442	Global	Chemical Storage Area Eyewash Shower Normal	DI	Chemical Storage Area Eyewash Shower Alarm	FSH_442	442	TB2: 155, 152	X			
93	I:015/14	1	5	6	14	-	N32:10/9	I65FAH441	Global	Odor Control Area Eyewash Shower Normal	DI	Odor Control Area Eyewash Shower Alarm	FSH_441	441	TB2: 153, 154	X			
94	I:015/15	1	5	6	15	-	N32:10/11	I65FAH443	Global	Blower Bldg Eyewash Shower Normal	DI	Blower Bldg Eyewash Shower Alarm	FSH_443	443	TB2: 147, 156	X			
95	I:015/16	1	5	6	16	-	N32:10/12	I65FAH444	Global	Mechanical Bldg Eyewash Shower Normal	DI	Mechanical Bldg Eyewash Shower Alarm	FSH_444	444	TB2: 157, 158	X			
96	I:015/17	1	5	6	17	-	N32:7/14	I65ZLO141	Global	Plug Valve V-141 Open	DI	Plug Valve V-141 Open	ZSO_141	141	TB2: 160			X	
97	N16:4	1	6	7	4	LI_10	N32:52	I65LI10	Global	Wet Well Level	AI	Operational Wet Well Level	LIT_10	10	TB3: 2 & HART INPUT	X			
98	N16:5	1	6	7	5	PI_101B	N32:76	I65PI101B	Global	Pump 101 Discharge Pressure	AI	Pump 101 Discharge Pressure	PIT_101B	101	TB3: 5 & HART INPUT	X			
99	N16:6	1	6	7	6	PI_101A	N32:74	I65PI101A	Global	Pump 101 Suction Pressure	AI	Pump 101 Suction Pressure	PIT_101A	101	TB3: 8 & HART INPUT	X			
100	N16:7	1	6	7	7	PI_102B	N32:102	I65PI102B	Global	Pump 102 Discharge Pressure	AI	Pump 102 Discharge Pressure	PIT_102B	102	TB3: 11 & HART INPUT	X			
101	N16:8	1	6	7	8	PI_102A	N32:100	I65PI102A	Global	Pump 102 Suction Pressure	AI	Pump 102 Suction Pressure	PIT_102A	102	TB3: 14 & HART INPUT	X			
102	N16:9	1	6	7	9	PI_103B	N32:128	I65PI103B	Global	Pump 103 Discharge Pressure	AI	Pump 103 Discharge Pressure	PIT_103B	103	TB3: 17 & HART INPUT	X			
103	N16:10	1	6	7	10	PI_103A	N32:126	I65PI103A	Global	Pump 103 Suction Pressure	AI	Pump 103 Suction Pressure	PIT_103A	103	TB3: 20 & HART INPUT	X			
104	N16:11	1	6	7	11	PI_104B	N32:154	I65PI104B	Global	Pump 104 Discharge Pressure	AI	Pump 104 Discharge Pressure	PIT_104B	104	TB3: 23 & HART INPUT	X			
105	N18:4	1	7	8	4	PI_104A	N32:152	I65PI104A	Global	Pump 104 Suction Pressure	AI	Pump 104 Suction Pressure	PIT_104A	104	TB3: 26 & HART INPUT	X			
106	N18:5	1	7	8	5	LI_20	N32:54	I65LI20	Global	Bar Screen Channel Differential Level	AI	Bar Screen Channel D ifferential Level	LIT_20	20	TB3: 29 & HART INPUT	X			
107	N18:6	1	7	8	6	FI_601	N32:182	I65FI601	Global	Force Main Discharge Flow Rate	AI	Force Main Discharge Flow Rate	FIT_601	601	TB3: 31,32,33	X			
108	N18:7	1	7	8	7	PI_401	N32:176	I65PI401	Global	Force Main Discharge Pressure	AI	Force Main Discharge Pressure	PIT_401	401	TB3:3 5 & HART INPUT	X			
109	N18:8	1	7	8	8	-					AI	Spare Input	-	-					
110	N18:9	1	7	8	9	-					AI	Spare Input	-	-					
111	N18:10	1	7	8	10	-					AI	Spare Input	-	-					
112	N18:11	1	7	8	11	AI_8	N32:50	I65AI8	Global	Odor Control System pH	AI	Odor Control System pH	AIT_8	8	TB4: 34,35,36	X			
113	I:020/0	1	8	9	0	-	N32:1/2	I65UA43	Global	Odor Control Blower Normal	DI	Odor Control Blower Fail	-	-					
114	I:020/1	1	8	9	1	-	N32:7/12	I65ZL141	Global	Plug Valve V-141 Remote Control	DI	Plug Valve V-141 Remote	ZSL_141	141	TB "NEW"			X	TB2: 195
115	I:020/2	1	8	9	2	-	N32:3/0	I65ZL101A	Global	Pump 101 Hand	DI	Pump 101 Hand	HS_101D	101	TB1A: 5			X	
116	I:020/3	1	8	9	3	-	N32:3/1	I65ZL101B	Global	Pump 101 Auto	DI	Pump 101 Auto	HS_101D	101	TB1A: 6,LI			X	
117	I:020/4	1	8	9	4	-	N32:4/6	I65ZL102A	Global	Pump 102 Hand	DI	Pump 102 Hand	HS_102D	102	TB1A: 7			X	
118	I:020/5	1	8	9	5	-	N32:4/7	I65ZL102B	Global	Pump 102 Auto	DI	Pump 102 Auto	HS_102D	102	TB1A: 8,LI			X	
119	I:020/6	1	8	9	6	-	N32:5/12	I65ZL103A	Global	Pump 103 Hand	DI	Pump 103 Hand	HS_103D	103	TB1A: 9			X	
120	I:020/7	1	8	9	7	-	N32:5/13	I65ZL103B	Global	Pump 103 Auto	DI	Pump 103 Auto	HS_103D	103	TB1A: 10,LI			X	
121	I:020/10	1	8	9	10	-	N32:7/2	I65ZL104A	Global	Pump 104 Hand	DI	Pump 104 Hand	HS_104D	104	TB1A: 11			X	
122	I:020/11	1	8	9	11	-	N32:7/3	I65ZL104B	Global	Pump 104 Auto	DI	Pump 104 Auto	HS_104D	104	TB1A: 12,LI			X	
123	I:020/12	1	8	9	12	-					DI	Spare Input	-	-					
124	I:020/13	1	8	9	13	-					DI	Spare Input	-	-					
125	I:020/14	1	8	9	14	-					DI	Spare Input	-	-					
126	I:020/15	1	8	9	15	-					DI	Spare Input	-	-					
127	I:020/16	1	8	9	16	-					DI	Spare Input	-	-					
128	I:020/17	1	8	9	17	-					DI	Spare Input	-	-					
129	N23:0	1	9	10	COM	-	N32:78	I65TI101A	Global	Pump 101 Motor Winding Temp A	AI-COM	Pump 101 Motor Winding Temp A (Deg C)	TE_101A	101	MULTILIN TB: 1,2,3,4	X			
130	N23:1	1	9	10	COM	-	N32:80	I65TI101B	Global	Pump 101 Motor Winding Temp B	AI-COM	Pump 101 Motor Winding Temp B (Deg C)	TE_101B	101	MULTILIN TB: 5,6,7,8	X			
131	N23:2	1	9	10	COM	-	N32:82	I65TI101C	Global	Pump 101 Motor Winding Temp C	AI-COM	Pump 101 Motor Winding Temp C (Deg C)	TE_101C	101	MULTILIN TB: 9,10,11,12	X			
132	N23:3	1	9	10	COM	-	N32:84	I65TI101D	Global	Pump 101 Motor Winding Temp D	AI-COM	Pump 101 Motor Winding Temp D (Deg C)	TE_101D	101	MULTILIN TB: 71,70,69,68	X			
133	N23:4	1	9	10	COM	-	N32:86	I65TI101E	Global	Pump 101 Motor Winding Temp E	AI-COM	Pump 101 Motor Winding Temp E (Deg C)	TE_101E	101	MULTILIN TB: 67,66,65,64	X			
134	N23:5	1	9	10	COM	-	N32:88	I65TI101F	Global	Pump 101 Motor Winding Temp F	AI-COM	Pump 101 Motor Winding Temp F (Deg C)	TE_101F	101	MULTILIN TB: 63,62,61,60	X			
135	N23:6	1	9	10	COM	-	N32:90	I65TI101G	Global	Pump 101 Bearing Temp G	AI-COM	Pump 101 Bearing Temp G (Deg C)	TE_101G	101	MULTILIN TB: 13,14,15,16	X			
136	N23:7	1	9	10	COM	-	N32:92	I65TI101H	Global	Pump 101 Bearing Temp H	AI-COM	Pump 101 Bearing Temp H (Deg C)	TE_101H	101	MULTILIN TB: 17,18,19,20	X			
137	N23:8	1	9	10	COM	-	N32:104	I65TI102A	Global	Pump 102 Motor Winding Temp A	AI-COM	Pump 102 Motor Winding Temp A (Deg C)	TE_102A	102	MULTILIN TB: 1,2,3,4	X			
138	N23:9	1	9	10	COM	-	N32:106	I65TI102B	Global	Pump 102 Motor Winding Temp B	AI-COM	Pump 102 Motor Winding Temp B (Deg C)	TE_102B	102	MULTILIN TB: 5,6,7,8	X			
139	N23:10	1	9	10	COM	-	N32:108	I65TI102C	Global	Pump 102 Motor Winding Temp C	AI-COM	Pump 102 Motor Winding Temp C (Deg C)	TE_102C	102	MULTILIN TB: 9,10,11,12	X			
140	N23:11	1	9	10	COM	-	N32:110	I65TI102D	Global	Pump 102 Motor Winding Temp D	AI-COM	Pump 102 Motor Winding Temp D (Deg C)	TE_102D	102	MULTILIN TB: 71,70,69,68	X			
141	N23:12	1	9	10	COM	-	N32:112	I65TI102E	Global	Pump 102 Motor Winding Temp E	AI-COM	Pump 102 Motor Winding Temp E (Deg C)	TE_102E	102	MULTILIN TB: 67,66,65,64	X			
142	N23:13	1	9	10	COM	-	N32:114	I65TI102F	Global	Pump 102 Motor Winding Temp F	AI-COM	Pump 102 Motor Winding Temp F (Deg C)	TE_102F	102	MULTILIN TB: 63,62,61,60	X			
143	N23:14	1	9	10	COM	-	N32:116	I65TI102G	Global	Pump 102 Bearing Temp G	AI-COM	Pump 102 Bearing Temp G (Deg C)	TE_102G	102	MULTILIN TB: 13,14,15,16	X			
144	N23:15	1	9	10	COM	-	N32:118	I65TI102H	Global	Pump 102 Bearing Temp H	AI-COM	Pump 102 Bearing Temp H (Deg C)	TE_102H	102	MULTILIN TB: 17,18,19,20	X			
145	N23:16	1	9	10	COM	-	N32:130	I65TI103A	Global	Pump 103 Motor Winding Temp A	AI-COM	Pump 103 Motor Winding Temp A (Deg C)	TE_103A	103	MULTILIN TB: 1,2,3,4	X			
146	N23:17	1	9	10	COM	-	N32:132	I65TI103B	Global	Pump 103 Motor Winding Temp B	AI-COM	Pump 103 Motor Winding Temp B (Deg C)	TE_103B	103	MULTILIN TB: 5,6,7,8	X			
147	N23:18	1	9	10	COM	-	N32:134	I65TI103C	Global	Pump 103 Motor Winding Temp C	AI-COM	Pump 103 Motor Winding Temp C (Deg C)	TE_103C	103	MULTILIN TB: 9,10,11,12	X			
148	N23:19	1	9	10	COM	-	N32:136	I65TI103D	Global	Pump 103 Motor Winding Temp D	AI-COM	Pump 103 Motor Winding Temp D (Deg C)	TE_103D	103	MULTILIN TB: 71,70,69,68	X			
149	N23:20	1	9	10	COM	-	N32:138	I65TI103E	Global	Pump 103 Motor Winding Temp E	AI-COM	Pump 103 Motor Winding Temp E (Deg C)	TE_103E	103	MULTILIN TB: 67,66,65,64	X			
150	N23:21	1	9	10	COM	-	N32:140	I65TI103F	Global	Pump 103 Motor Winding Temp F	AI-COM	Pump 103 Motor Winding Temp F (Deg C)	TE_103F	103	MULTILIN TB: 63,62,61,60	X			
151	N23:22	1	9	10	COM	-	N32:142	I65TI103G	Global	Pump 103 Bearing Temp G	AI-COM	Pump 103 Bearing Temp G (Deg C)	TE_103G	103	MULTILIN TB: 13,14,15,16	X			
152	N23:23	1	9	10	COM	-	N32:144	I65TI103H	Global	Pump 103 Bearing Temp H	AI-COM	Pump 103 Bearing Temp H (Deg C)	TE_103H	103	MULTILIN TB: 17,18,19,20	X			
153	N23:24	1	9	10	COM	-	N32:156	I65TI104A	Global	Pump 104 Motor Winding Temp A	AI-COM	Pump 104 Motor Winding Temp A (Deg C)	TE_104A	104	MULTILIN TB: 1,2,3,4	X			
154	N23:25	1	9	10	COM	-	N32:158	I65TI104B	Global	Pump 104 Motor Winding Temp B	AI-COM	Pump 104 Motor Winding Temp B (Deg C)	TE_104B	104	MULTILIN TB: 5,6,7,8	X			
155	N23:26	1	9	10	COM	-	N32:160	I65TI104C	Global	Pump 104 Motor Winding Temp C	AI-COM	Pump 104 Motor Winding Temp C (Deg C)	TE_104C	104	MULTILIN TB: 9,10,11,12	X			
156	N23:27	1	9	10	COM	-	N32:162	I65TI104D	Global	Pump 104 Motor Winding Temp D	AI-COM	Pump 104 Motor Winding Temp D (Deg C)	TE_104D	104	MULTILIN TB: 71,70,69,68	X			
157	N23:28	1	9	10	COM	-	N32:164	I65TI104E	Global	Pump 104 Motor Winding Temp E	AI-COM	Pump 104 Motor Winding Temp E (Deg C)	TE_104E	104	MULTILIN TB: 67,66,65,64	X			
158	N23:29	1	9	10	COM	-	N32:166	I65TI104F	Global	Pump 104 Motor Winding Temp F	AI-COM	Pump 104 Motor Winding Temp F (Deg C)	TE_104F	104	MULTILIN TB: 63,62,61,60	X			
159	N23:30	1	9	10	COM	-	N32:168	I65TI104G	Global	Pump 104 Bearing Temp G	AI-COM	Pump 104 Bearing Temp G (Deg C)	TE_104G	104	MULTILIN TB: 13,14,15,16	X			
160	N23:31	1	9	10	COM	-	N32:170	I65TI104H	Global	Pump 104 Bearing Temp H	AI-COM	Pump 104 Bearing Temp H (Deg C)	TE_104H	104	MULTILIN TB: 17,18,19,20	X			
161	N23:40	1	9	10	COM	-					AI-COM	Wet well #1 Pumps 1-3, 0-17FT.	-	-					
162	N24:0/15	1	10	11	COM	-					AI-COM	Bently Nevada Power Up	N/A	-					
163	N24:3	1	11	12	COM	-	N32:94	I65VI101A	Global	Pump 101 Upper Bearing Vibration	AI-COM	Bently Nevada Monitor 1 Channel 1 Data	VT_101A	101	TB4: 4,5,6			X	
164	N24:4	1	11	12	COM	-	N32:96	I65VI101B	Global	Pump 101 Lower Bearing Vibration	AI-COM	Bently Nevada Monitor 1 Channel 2 Data	VT_101B	101	TB4: 19,20,21			X	
165	N24:5	1	11	12	COM	-	N32:120	I65VI102A	Global	Pump 102 Upper Bearing Vibration	AI-COM	Bently Nevada Monitor 1 Channel 3 Data	VT_102A	102	TB4: 7,8,9			X	
166	N24:6	1	11	12	COM	-	N32:122	I65VI102B	Global	Pump 102 Lower Bearing Vibration	AI-COM	Bently Nevada Monitor 1 Channel 4 Data	VT_102B	102	TB4: 10,11,12			X	
167	N24:12	1	12	13	COM	-	N32:146	I65VI103A	Global	Pump 103 Upper Bearing Vibration	AI-COM	Bently Nevada Monitor 2 Channel 1 Data	VT_103A	103	TB4: 13,14,15			X	
168	N24:13	1	12	13	COM	-	N32:148	I65VI103B	Global	Pump 103 Lower Bearing Vibration	AI-COM	Bently Nevada Monitor 2 Channel 2 Data	VT_103B	103	TB4: 16,17,18			X	
169	N24:14	1	12	13	COM	-	N32:172	I65VI104A	Global	Pump 104 Upper Bearing Vibration	AI-COM	Bently Nevada Monitor 2 Channel 3 Data	VT_104A	104	TB4: 22,23,24			X	
170	N24:15	1	12	13	COM	-	N32:174	I65VI104B	Global	Pump 104 Lower Bearing Vibration	AI-COM	Bently Nevada Monitor 2 Channel 4 Data	VT_104B	104	TB4: 25,26,27			X	
171	N38:4	1	13	14	4						AI	H2S stack	-	-					
172	N38:5	1	13	14	5						AI	H2S barscreen room	-	-					
173	N38:6	1	13	14	6						AI	Wet Well #1 Level	-	-					
174	N38:7	1	13	14	7						AI	Wet Well #2 Level	-	-					
175	N38:8	1	13	14	8						AI	Bleach Level	-	-					
176	N38:9	1	13	14	9						AI	Spare Input	-	-					
177	N38:10	1	13	14	10						AI	Spare Input	-	-					
178	N38:11	1	13	14	11						AI	Spare Input	-	-					
179	O:027/0	1	15	16	0	-	N/A	N/A	N/A	N/A	DO	Spare Output	-	-					
180	O:027/1	1	15	16	1	-	N/A	N/A	N/A	N/A	DO	Spare Output	-	-					

PLC DATABASE													LOOP DRAWINGS						
PLC ORDER	ADDRESS	RACK	POS ADD	SLOT	DROP	TAG (PLC I/O) "-" UNASSIGNED	(WRITE TO DCS) ADDRESS	TAG	SCOPE	DESCRIPTION	TYPE	DESCRIPTION FROM PLC	FIELD DEVICE TAG "-" UNASSIGNED	LOOP NO	TBs	REFERENCE/ NOTES 2004 LOOPS	2004 ATS	2000 REV 0	1997 AS-BUILTS ELECTRICAL
181	O:027/2	1	15	16	2	-	N/A	N/A	N/A	N/A	DO	Spare Output	-	-					
182	O:027/3	1	15	16	3	-	N/A	N/A	N/A	N/A	DO	Stop Sluice Gate G-232	HS_232F	232	WIRED DIRECT TO VALVE			X	
183	O:027/4	1	15	16	4	-	N/A	N/A	N/A	N/A	DO	Sluice Gate G-232 Open Call	-	232	TB1A: 21			X	
184	O:027/5	1	15	16	5	-	N/A	N/A	N/A	N/A	DO	Sluice Gate G-232 Close Call	-	232	TB1A: 22			X	
185	O:027/6	1	15	16	6	-	N/A	N/A	N/A	N/A	DO	Slide Gate G-211 Open Call	-	211	TB1A: 23			X	
186	O:027/7	1	15	16	7	-	N/A	N/A	N/A	N/A	DO	Slide Gate G-211 Close Call	-	211	TB1A: 24			X	
187	O:027/10	1	15	16	10	-	N/A	N/A	N/A	N/A	DO	Slide Gate G-212 Open Call	-	212	TB1A: 25			X	
188	O:027/11	1	15	16	11	-	N/A	N/A	N/A	N/A	DO	Slide Gate G-212 Close Call	-	212	TB1A: 26			X	
189	O:027/12	1	15	16	12	-	N/A	N/A	N/A	N/A	DO	Slide Gate G-213 Open Call	-	213	TB1A: 27			X	
190	O:027/13	1	15	16	13	-	N/A	N/A	N/A	N/A	DO	Slide Gate G-213 Close Call	-	213	TB1A: 28			X	
191	O:027/14	1	15	16	14	-	N/A	N/A	N/A	N/A	DO	Plug Valve V-141 Open Call	-	141	TB1A: 29			X	
192	O:027/15	1	15	16	15	-	N/A	N/A	N/A	N/A	DO	Plug Valve V-141 Close Call	-	141	TB1A: 30			X	
193	O:027/16	1	15	16	16	-	N/A	N/A	N/A	N/A	DO	PLC Normal	-	-					
194	O:027/17	1	15	16	17	-	N/A	N/A	N/A	N/A	DO	Spare Output	-	-					
195	I:031/2	2	1	2	0	-	N32:11/11			UPS Off	DI	UPS On	-	-					
196	I:031/3	2	1	2	1	-	N32:11/12			UPS Not On Battery	DI	UPS On Battery	-	-					
197	I:031/4	2	1	2	2	-	N32:11/13			UPS Not On Bypass	DI	UPS On Bypass	-	-					
198	I:031/5	2	1	2	3	-	N32:11/14			UPS Not Low Battery	DI	UPS Low Battery	-	-					
199		2	1	2	4	-					DI	Spare Input	-	-					
200		2	1	2	5	-					DI	Spare Input	-	-					
201		2	1	2	6	-					DI	Spare Input	-	-					
202		2	1	2	7	-					DI	Spare Input	-	-					
203		2	1	2	10	-					DI	Spare Input	-	-					
204		2	1	2	11	-					DI	Spare Input	-	-					
205		2	1	2	12	-					DI	Spare Input	-	-					
206		2	1	2	13	-					DI	Spare Input	-	-					
207		2	1	2	14	-					DI	Spare Input	-	-					
208		2	1	2	15	-					DI	Spare Input	-	-					
209		2	1	2	16	-					DI	Spare Input	-	-					
210		2	1	2	17	-					DI	Spare Input	-	-					
211	I:032/0	2	2	3	0	-	N32:11/15			Main Service A Breaker Open	DI	Main Service Breaker A open	-	-	OUT0		X		
212	I:032/1	2	2	3	1	-	N32:12/0			Main Service B Breaker Open Status	DI	Main Service B Breaker Open	-	-	OUT1		X		
213	I:032/2	2	2	3	2	-	N32:12/1			Tie Breaker Open	DI	Tie Breaker Open	-	-	OUT2		X		
214	I:032/3	2	2	3	3	-	N32:12/2			Main Service A not Available	DI	Main Service A Not Available	-	-	OUT3		X		
215	I:032/4	2	2	3	4	-	N32:12/3			Main Service B Not Available	DI	Main Service B Not Available	-	-	OUT4		X		
216	I:032/5	2	2	3	5	-	N32:12/4			UPS Trouble	DI	UPS Trouble	-	-	OUT5		X		
217	I:032/6	2	2	3	6	-	N32:12/5			Main Service A Breaker Tripped	DI	Main Service A Breaker Tripped	-	-	OUT6		X		
218	I:032/7	2	2	3	7	-	N32:12/6			Main Service B Breaker Tripped	DI	Main Service B Breaker Tripped	-	-	OUT7		X		
219	I:032/10	2	2	3	10	-	N32:12/7			Tie Breaker Tripped	DI	Tie Breaker Tripped	-	-	OUT8		X		
220	I:032/11	2	2	3	11	-	N32:12/8			Transfer System Fail	DI	Transfer System Fail	-	-	OUT9		X		
221	I:032/12	2	2	3	12	-	N32:12/9			Auto/Manual Switch Manual Mode	DI	Auto/Manual Switch Manual Mode	-	-	OUT10		X		
222	I:032/13	2	2	3	13	-	N32:12/10			Auto/Manual Switch Auto Mode	DI	Auto/Manual Switch Auto Mode	-	-	OUT11		X		
223	I:032/14	2	2	3	14	-	N32:12/11			Service Selector Switch Service A Normal Source	DI	Service Selector Switch Service A Normal Source	-	-	OUT12		X		
224	I:032/15	2	2	3	15	-	N32:12/12			Service Selector Switch Service B Normal Source	DI	Service Selector Switch Service B Normal Source	-	-	OUT13		X		
225	I:032/16	2	2	3	16	-	N32:12/13			86 Lockout Relay Tripped	DI	86 Lockout Relay Tripped	-	-	OUT14		X		
226	I:032/17	2	2	3	17	-	N32:12/14			PLC General Fault Status	DI	PLC General Fault Relay	-	-	OUT15		X		
227	I:033/0	2	3	4	0	-	N32:12/15			Main Service A Relay Failure	DI	Main Service A Relay Failure	-	-					
228	I:033/1	2	3	4	1	-	N32:13/0			Main Service B Relay Failure	DI	Main Service B Relay Failure	-	-					
229	I:033/2	2	3	4	2	-	N32:13/1			Auto-Throwover System(PLC Heartbeat)	DI	Auto-Throwover System (PLC Heartbeat)	-	-					
230	I:033/3	2	3	4	3	-	N32:13/2			Power Quality Relay Fault	DI	Power Quality Relay Fault	-	-					
231		2	3	4	4	-					DI	Spare Input	-	-					
232		2	3	4	5	-					DI	Spare Input	-	-					
233		2	3	4	6	-					DI	Spare Input	-	-					
234		2	3	4	7	-					DI	Spare Input	-	-					
235		2	3	4	10	-					DI	Spare Input	-	-					
236		2	3	4	11	-					DI	Spare Input	-	-					
237		2	3	4	12	-					DI	Spare Input	-	-					
238		2	3	4	13	-					DI	Spare Input	-	-					
239		2	3	4	14	-					DI	Spare Input	-	-					
240		2	3	4	15	-					DI	Spare Input	-	-					
241		2	3	4	16	-					DI	Spare Input	-	-					
242		2	3	4	17	-					DI	Spare Input	-	-					
243	I:017/0	?	?	?	0	-					DI	Spare Input	-	-					
244	I:017/1	?	?	?	1	-					DI	Spare Input	-	-					
245	I:017/2	?	?	?	2	-					DI	Spare Input	-	-					
246	I:017/3	?	?	?	3	-					DI	Spare Input	-	-					
247	I:017/4	?	?	?	4	-					DI	Spare Input	-	-					
248	I:017/5	?	?	?	5	-					DI	Spare Input	-	-					
249	I:017/6	?	?	?	6	-					DI	Spare Input	-	-					
250	I:017/7	?	?	?	7	-					DI	Spare Input	-	-					
251	I:017/10	?	?	?	10	-					DI	Spare Input	-	-					
252	I:017/11	?	?	?	11	-					DI	Spare Input	-	-					
253	I:017/12	?	?	?	12	-	N32:8/0	I65LALL151	Global	Surge Tank T-151 Level Normal	DI	Surge Tank T-151 Low-Low Level	-	151	TB2: 196, 197			X	
254	I:017/13	?	?	?	13	-	N32:8/1	I65ZLO151	Global	Surge Tank T-151 Valve Open	DI	Surge Tank T-151 Valve Open	ZS0_151	151	TB2: 198, 199			X	
255	I:017/14	?	?	?	14	-	N32:7/15	I65LAHH151	Global	Surge Tank T-151 Level Normal	DI	Surge Tank T-151 High High Level	-	151	TB2: 200,201			X	
256	I:017/15	?	?	?	15	-					DI	Surge Tank T-151 High High Level	-	151					
257	I:017/16	?	?	?	16	-					DI	Surge Tank T-151 High High Level	-	151					
258	I:017/17	?	?	?	17	-					DI	Surge Tank T-151 High High Level	-	151					

PLC ORDER	DCS																							
	DCS ORDER	PTID	RT	TB	BB	ENGLISH DESCRIPTION	EU/ST	EV/RS	SOURCE	CD	HW	AP	LC	HL/AR	LL/BP	CV	CI	CHARST	CRD	GP	QC	SL	CUST6/COMMENTS	LOOP NO
1	1	I65FAL1A	DL			PUMP RM SUPPLY FAN SF1 FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A001FYA-	QLC	01	1	03		001
2	4	I65FAL3A	DL			METER VLT SUPPLY FAN SF3 FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A003FYA-	QLC	01	1	03		003
3	6	I65FAL4	DL			SCRNNGS RM SUPP FAN SF4 FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A004FYA-	QLC	01	1	03		004
4	7	I65FAL5	DL			SCRNNGS RM SUPP FAN SF5 FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A005FYA-	QLC	01	1	03		005
5	2	I65FAL1B	DL			MCC/PUMP RM EXHST FAN EF1 FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A001FYA-	QLC	01	1	03		001
6	3	I65FAL2B	DL			MCC/PUMP RM EXHST FAN EF2 FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A002FYA-	QLC	01	1	03		002
7	5	I65FAL3B	DL			METER VLT EXHST FAN EF3 FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A003FYA-	QLC	01	1	03		003
8	8	I65FAL8	DL			O CNTRL SYST XHST FAN EF8 FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A008FYA-	QLC	01	1	03		008
9	173	I65LALL940	DL			A WTR A GAP TNK T940 LVL LOLO	NORMAL	LO-LO	PLC	67	0000	2	1	0	0	0	0	A940CLA-	QLC	01	1	03		940
10	174	I65UA940	DL			A WTR A GAP/H-PNUE TNK FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A940CEA-	QLC	01	1	03		940
11	175	I65LALL950	DL			B WTR A GAP TNK T950 LVL LOLO	NORMAL	LO-LO	PLC	67	0000	2	1	0	0	0	0	A950CLA-	QLC	01	1	03		950
12	176	I65UA950	DL			B WTR A GAP/H-PNUE TNK FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A950CEA-	QLC	01	1	03		950
13	16	I65LAHH25	DL			OP WW 1 LVL HI-HI FLOAT SWTCH	NORMAL	HI-HI	PLC	67	0000	2	1	0	0	0	0	A025CLA-	QLC	01	1	03		025
14	17	I65LAHH26	DL			OP WW 2 LVL HI-HI FLOAT SWTCH	NORMAL	HI-HI	PLC	67	0000	2	1	0	0	0	0	A026CLA-	QLC	01	1	03		026
15	18	I65LAHH27	DL			OFLOW WW LVL HI-HI FLOAT SWTCH	NORMAL	HI-HI	PLC	67	0000	2	1	0	0	0	0	A027CLA-	QLC	01	1	03		027
16	125	I65ZLC141	DL			FORCE MAIN VLV V141 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A141VZC-	QLC	01	1	03	Keystone Valve	141
17	251	I65HS101C	DC			PMP101 DCS MANUAL RUN CMD	RUNCMD	STPCMD	DCS	67	0000	0	0	0	0	0	0	A101MHS-	QLC	01	1	03		101
18	256	I65HS102B	DC			PMP102 DCS MANUAL RUN CMD	RUNCMD	STPCMD	DCS	67	0000	0	0	0	0	0	0	A102MHS-	QLC	01	1	03		102
19	262	I65HS103C	DC			PMP103 DCS MANUAL RUN CMD	RUNCMD	STPCMD	DCS	67	0000	0	0	0	0	0	0	A103MHS-	QLC	01	1	03		103
20	267	I65HS104B	DC			PMP104 DCS MANUAL RUN CMD	RUNCMD	STPCMD	DCS	67	0000	0	0	0	0	0	0	A104MHS-	QLC	01	1	03		104
21																								
22																								
23																								
24																								
25																								
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27																								
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29																								
30																								
31																								
32																								
33	10	I65PALL10B	DL			WWELL BBBLR PNL CP10 PRS LOLO	NORMAL	LO-LO	PLC	67	0000	2	1	0	0	0	0	A010CPA-	QLC	01	1	03		010
34	11	I65UA10A	DL			DWELL POOR AIR QUAL DETECT	NORMAL	ALARM	PLC	67	0000	3	1	0	0	0	0	A010CEA-	QLC	01	1	03		010
35	12	I65UA10B	DL			DWELL EXPL HAZRD SHTDWN	NORMAL	ALARM	PLC	67	0000	3	1	0	0	0	0	A010CEA-	QLC	01	1	03		010
36	14	I65UA20A	DL			SCRNNGS POOR AIR QUAL DETECT	NORMAL	ALARM	PLC	67	0000	3	1	0	0	0	0	A020CEA-	QLC	01	1	03		020
37	15	I65UA20B	DL			SCRNNGS EXPL HAZRD SHTDWN	NORMAL	SHTDWN	PLC	67	0000	3	1	0	0	0	0	A020CEA-	QLC	01	1	03		020
38	20	I65LAH50	DL			PMP RM SUMP LVL HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A050CLA-	QLC	01	1	03		050
39	21	I65LAHH50	DL			PMP RM HI-HI FLOAT SWTCH	NORMAL	HI-HI	PLC	67	0000	2	1	0	0	0	0	A050CLA-	QLC	01	1	03		050
40	22	I65LAH60	DL			METER VLT SUMP LVL HI	NORMAL	HIGH	PLC	67	0000	2	1	0	0	0	0	A060CLA-	QLC	01	1	03		060
41	23	I65UA60A	DL			METER VLT POOR AIR QUAL DETECT	NORMAL	ALARM	PLC	67	0000	3	1	0	0	0	0	A060CEA-	QLC	01	1	03		060
42	24	I65UA60B	DL			METER VLT EXPL HAZRD SHTDWN	NORMAL	SHTDWN	PLC	67	0000	3	1	0	0	0	0	A060CEA-	QLC	01	1	03		060
43	25	I65UA81	DL			PLANT AIR SUPP SYST FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A081CEA-	QLC	01	1	03		081
44	41	I65YA101D	DL			PMP101 MTR STRTR MULTILIN ALRM	NORMAL	ALARM	PLC	67	0000	2	1	0	0	0	0	A101MYA-	QLC	01	1	03	MULTILIN 269 PLUS MMR	101
45	43	I65YL101A	DL			PMP101 RUNNING STAT	ON	OFF	PLC	67	0000	0	0	0	0	0	0	A101MYS-	QLC	01	1	03		101
46	50	I65ZLC101	DL			PMP101 DSCH CHECK VLV POS	OPENED	CLOSED	PLC	67	0000	0	0	0	0	0	0	A101MZO-	QLC	01	1	03		101
47	29	I65FAL101	DL			PMP101 SEAL WTR LOW FLOW	NORMAL	LOW	PLC	67	0000	0	1	0	0	0	0	A101MFA-	QLC	01	1	03		101
48	133	I65ZL211	DL			B SCRN ME201 GTE G211 L/R POS	LOCAL	REMOTE	PLC	67	0000	0	0	0	0	0	0	A211GZL-	QLC	01	1	03		211
49	63	I65YA102D	DL			PMP102 MTR STRTR MULTILIN ALRM	NORMAL	ALARM	PLC	67	0000	2	1	0	0	0	0	A102MYA-	QLC	01	1	03	MULTILIN 269 PLUS MMR	102
50	65	I65YL102A	DL			PMP102 RUNNING STAT	ON	OFF	PLC	67	0000	0	0	0	0	0	0	A102MYS-	QLC	01	1	03		102
51	72	I65ZLC102	DL			PMP102 DSCH CHECK VLV POS	OPENED	CLOSED	PLC	67	0000	0	0	0	0	0	0	A102MZO-	QLC	01	1	03		102
52	51	I65FAL102	DL			PMP102 SEAL WTR LOW FLOW	NORMAL	LOW	PLC	67	0000	0	1	0	0	0	0	A102MFA-	QLC	01	1	03		102
53	139	I65ZL212	DL			B SCRN ME202 GTE G212 L/R POS	LOCAL	REMOTE	PLC	67	0000	0	0	0	0	0	0	A212GZL-	QLC	01	1	03		212
54	85	I65YA103D	DL			PMP103 MTR STRTR MULTILIN ALRM	NORMAL	ALARM	PLC	67	0000	2	1	0	0	0	0	A103MYA-	QLC	01	1	03	MULTILIN 269 PLUS MMR	103
55	87	I65YL103A	DL			PMP103 RUNNING STAT	ON	OFF	PLC	67	0000	0	0	0	0	0	0	A103MYS-	QLC	01	1	03		103
56	94	I65ZLC103	DL			PMP103 DSCH CHECK VLV POS	OPENED	CLOSED	PLC	67	0000	0	0	0	0	0	0	A103MZO-	QLC	01	1	03		103
57	73	I65FAL103	DL			PMP103 SEAL WTR LOW FLOW	NORMAL	LOW	PLC	67	0000	0	1	0	0	0	0	A103MFA-	QLC	01	1	03		103
58	145	I65ZL213	DL			B SCRN ME203 GTE G213 L/R POS	LOCAL	REMOTE	PLC	67	0000	0	0	0	0	0	0	A213GZL-	QLC	01	1	03		213
59	107	I65YA104D	DL			PMP104 MTR STRTR MULTILIN ALRM	NORMAL	ALARM	PLC	67	0000	2	1	0	0	0	0	A104MYA-	QLC	01	1	03	MULTILIN 269 PLUS MMR	104
60	109	I65YL104A	DL			PMP104 RUNNING STAT	ON	OFF	PLC	67	0000	0	0	0	0	0	0	A104MYS-	QLC	01	1	03		104
61	116	I65ZLC104	DL			PMP104 DSCH CHECK VLV POS	OPENED	CLOSED	PLC	67	0000	0	0	0	0	0	0	A104MZO-	QLC	01	1	03		104
62	95	I65FAL104	DL			PMP104 SEAL WTR LOW FLOW	NORMAL	LOW	PLC	67	0000	0	1	0	0	0	0	A104MFA-	QLC	01	1	03		104
63	159	I65ZL232	DL			SCRNNGS SLU GTE G232 L/R POS	LOCAL	REMOTE	PLC	67	0000	0	0	0	0	0	0	A232GZL-	QLC	01	1	03		232
64	118	I65ZLO111	DL			OP WW SLU GTE G111 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A111GZO-	QLC	01	1	03		111
65	117	I65ZLC111	DL			OP WW SLU GTE G111 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A111GZC-	QLC	01	1	03		111
66	120	I65ZLO121	DL			OP/OFLOW WW SLU GTE G121 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A121GZO-	QLC	01	1	03		121
67	119	I65ZLC121	DL			OP/OFLOW WW SLU GTE G121 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A121GZC-	QLC	01	1	03		121
68	13	I65PALL20	DL			B SCRN BBBLR PNL CP20 PRS LOLO	NORMAL	LO-LO	PLC	67	0000	2	1	0	0	0	0	A020CPA-	QLC	01	1	03		020
69	135	I65ZLO211	DL			B SCRN ME201 GTE G211 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A211GZO-	QLC	01	1	03		211
70	134	I65ZLC211	DL			B SCRN ME201 GTE G211 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A211GZC-	QLC	01	1	03		211
71	141	I65ZLO212	DL			B SCRN ME202 GTE G212 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A212GZO-	QLC	01	1	03		212
72	140	I65ZLC212	DL			B SCRN ME202 GTE G212 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A212GZC-	QLC	01	1	03		212
73	147	I65ZLO213	DL			B SCRN ME203 GTE G213 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A213GZO-	QLC	01	1	03		213
74	146	I65ZLC213	DL			B SCRN ME203 GTE G213 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A213GZC-	QLC	01	1	03		213
75	149	I65ZLO221	DL			B SCRN ME201 GTE G221 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A221GZO-	QLC	01	1	03		221
76	148	I65ZLC221	DL			B SCRN ME201 GTE G221 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A221GZC-	QLC	01	1	03		221
77	151	I65ZLO222	DL			B SCRN ME202 GTE G222 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A222GZO-	QLC	01	1	03		222
78	150	I65ZLC222	DL			B SCRN ME202 GTE G222 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A222GZC-	QLC	01	1	03		222
79	153	I65ZLO223	DL			B SCRN ME203 GTE G223 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A223GZO-	QLC	01	1	03		223
80	152	I65ZLC223	DL			B SCRN ME203 GTE G223 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A223GZC-	QLC	01	1	03		223
81	155	I65ZLO231	DL			OPERATIONAL WW GTE G231 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A231GZO-	QLC	01	1	03		231
82	154	I65ZLC231	DL			OP WW GTE G231 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A231GZC-	QLC	01	1	03		231
83	161	I65ZLO232	DL			SCRNNGS SLU GTE G232 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A232GZO-	QLC	01	1	03		232
84	160	I65ZLC232	DL			SCRNNGS SLU GTE G232 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A232GZC-	QLC	01	1	03		232
85	163	I65ZLO233	DL			OFLOW WW GTE G233 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A233GZO-	QLC	01	1	03		233
86	162	I65ZLC233	DL			OFLOW WW GTE G233 CLSD	CLOSED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A233GZC-	QLC	01	1	03		233
87	164	I65LALL300	DL			S WTR A GAP TNK T300 LVL LOLO	NORMAL	LO-LO	PLC	67	0000	2	1	0	0	0	0	A300CLA-	QLC	01	1	03		300
88	165	I65PAH301	DL			S WTR H-PNEU TNK T301 PRS HI	NORMAL	HIGH	PLC	67	0000	2	1	0	0	0	0	A301CPA-	QLC	01	1	03		301
89	166	I65PAL301	DL			S WTR H-PNEU TNK T301 PRS LOW	NORMAL	LOW	PLC	67	0000	2	1	0	0	0	0	A301CPA-	QLC	01	1	03		301
90	167	I65LAL410B	DL			HYPO BULK ST TNK T410 LVL LOW	NORMAL	LOW	PLC	67	0000	2	1	0	0	0	0	A410CLA-	QLC	01	1	03		410

Appendix B2
Existing PLC I/O and Associated DCS Data

PLC ORDER	DCS																								
	DCS ORDER	PTID	RT	TB	BB	ENGLISH DESCRIPTION	EU/ST	EV/RS	SOURCE	CD	HW	AP	LC	HL/AR	LL/BP	CV	CI	CHARST	CRD	GP	QC	SL	CUST6/COMMENTS	LOOP NO
91	168	I65LAL420B	DL			CSTC BULK ST TNK T420 LVL LOW	NORMAL	LOW	PLC	67	0000	2	1	0	0	0	0	A420CLA-	QLC	01	1	03		420
92	170	I65FAH442	DL			CHEM ST EMRGNCY EYEWSH/SHWR	NORMAL	ALARM	PLC	67	0000	3	1	0	0	0	0	A442CEA-	QLC	01	1	03		442
93	169	I65FAH441	DL			O CNTRL EMRGNCY EYEWSH/SHWR	NORMAL	ALARM	PLC	67	0000	3	1	0	0	0	0	A441CEA-	QLC	01	1	03		441
94	171	I65FAH443	DL			BLWR BLDG EMRGNCY EYEWSH/SHWR	NORMAL	ALARM	PLC	67	0000	3	1	0	0	0	0	A443CEA-	QLC	01	1	03		443
95	172	I65FAH444	DL			MECH BLDG EMRGNCY EYEWSH/SHWR	NORMAL	ALARM	PLC	67	0000	3	1	0	0	0	0	A444CEA-	QLC	01	1	03		444
96	126	I65ZLO141	DL			FORCE MAIN VLV V141 OPND	OPENED	TRAVEL	PLC	67	0000	0	0	0	0	0	0	A141VZO-	QLC	01	1	03	Keystone Valve	141
97	179	I65LI10	AI	20	0	OPERATIONAL WW LVL	FEET	-	PLC	67	0000	32	41			0	0	A010CLT-	QLC	01	1	03		010
98	191	I65PI101B	AI	75	0	PMP101 DSCH PRS	PSIG	-	PLC	67	0000	0	0	0	0	0	0	A101MPT-	QLC	01	1	03	Rosemount 1151 Smart/0-100 p	101
99	190	I65PI101A	AI	15	0	PMP101 SUCTION PRS	PSIG	-	PLC	67	0000	0	0	0	0	0	0	A101MPT-	QLC	01	1	03	Rosemount 1151 Smart/0-15 ps	101
100	203	I65PI102A	AI	15	0	PMP102 SUCTION PRS	PSIG	-	PLC	67	0000	0	0	0	0	0	0	A102MPT-	QLC	01	1	03	Rosemount 1151 Smart/0-15 ps	102
101	204	I65PI102B	AI	75	0	PMP102 DSCH PRS	PSIG	-	PLC	67	0000	0	0	0	0	0	0	A102MPT-	QLC	01	1	03	Rosemount 1151 Smart/0-100 p	102
102	217	I65PI103B	AI	75	0	PMP103 DSCH PRS	PSIG	-	PLC	67	0000	0	0	0	0	0	0	A103MPT-	QLC	01	1	03	Rosemount 1151 Smart/0-100 p	103
103	216	I65PI103A	AI	15	0	PMP103 SUCTION PRS	PSIG	-	PLC	67	0000	0	0	0	0	0	0	A103MPT-	QLC	01	1	03	Rosemount 1151 Smart/0-15 ps	103
104	230	I65PI104B	AI	75	0	PMP104 DSCH PRS	PSIG	-	PLC	67	0000	0	0	0	0	0	0	A104MPT-	QLC	01	1	03	Rosemount 1151 Smart/0-100 p	104
105	229	I65PI104A	AI	15	0	PMP104 SUCTION PRS	PSIG	-	PLC	67	0000	0	0	0	0	0	0	A104MPT-	QLC	01	1	03	Rosemount 1151 Smart/0-15 ps	104
106	180	I65LI20	AI	10	0	BAR SCREEN CH DIFF LVL	FEET	-	PLC	67	0000	32	41			0	0	A020CLT-	QLC	01	1	03		020
107	244	I65FI601	AI	2000	0	FORCE MAIN DSCH FLOW RATE	GPM	-	PLC	67	0000	0	0	0	0	0	0	A601CFT-	QLC	01	1	03	Krohne IFC 080SH/IFC080FH;	601
108	241	I65PI401	AI	75	0	FORCE MAIN DSCH PRS	PSIG	-	PLC	67	0000	34	1			0	0	A401CPT-	QLC	01	1	03	Rosemount 1151 Smart/0-100 p	401
109																								
110																								
111																								
112	178	I65AI8	AI	14	0	O CNTRL SYST pH	pH	-	PLC	67	0000	34	1			0	0	A008CAT-	QLC	01	1	03	GLI Model 63	008
113																								
114	124	I65ZL141	DL			FORCE MAIN VLV V141 L/R POS	LOCAL	REMOTE	PLC	67	0000	0	0	0	0	0	0	A141GZL-	QLC	01	1	03	Keystone Valve	141
115	48	I65ZL101A	DL			PMP101 HOA SWTCH POS - HAND	HAND	OTHER	PLC	67	0000	0	0	0	0	0	0	A101MZH-	QLC	01	1	03		101
116	49	I65ZL101B	DL			PMP101 HOA SWTCH POS - COMPUTR	REMOTE	OTHER	PLC	67	0000	0	0	0	0	0	0	A101MZA-	QLC	01	1	03		101
117	70	I65ZL102A	DL			PMP102 HOA SWTCH POS - HAND	HAND	OTHER	PLC	67	0000	0	0	0	0	0	0	A102MZH-	QLC	01	1	03		102
118	71	I65ZL102B	DL			PMP102 HOA SWTCH POS - COMPUTR	REMOTE	OTHER	PLC	67	0000	0	0	0	0	0	0	A102MZA-	QLC	01	1	03		102
119	92	I65ZL103A	DL			PMP103 HOA SWTCH POS - HAND	HAND	OTHER	PLC	67	0000	0	0	0	0	0	0	A103MZH-	QLC	01	1	03		103
120	93	I65ZL103B	DL			PMP103 HOA SWTCH POS - COMPUTR	REMOTE	OTHER	PLC	67	0000	0	0	0	0	0	0	A103MZA-	QLC	01	1	03		103
121	114	I65ZL104A	DL			PMP104 HOA SWTCH POS - HAND	HAND	OTHER	PLC	67	0000	0	0	0	0	0	0	A104MZH-	QLC	01	1	03		104
122	115	I65ZL104B	DL			PMP104 HOA SWTCH POS - COMPUTR	REMOTE	OTHER	PLC	67	0000	0	0	0	0	0	0	A104MZA-	QLC	01	1	03		104
123																								
124																								
125																								
126																								
127																								
128																								
129	192	I65TI101A	AI	400	0	PMP101 MTR WINDING TMP RTD A	DEG F	-	PLC	67	0000	32	41			0	0	A101MTT-	QLC	01	1	03		101
130	193	I65TI101B	AI	400	0	PMP101 MTR WINDING TMP RTD B	DEG F	-	PLC	67	0000	32	41			0	0	A101MTT-	QLC	01	1	03		101
131	194	I65TI101C	AI	400	0	PMP101 MTR WINDING TMP RTD C	DEG F	-	PLC	67	0000	32	41			0	0	A101MTT-	QLC	01	1	03		101
132	195	I65TI101D	AI	400	0	PMP101 MTR WINDING TMP RTD D	DEG F	-	PLC	67	0000	32	41			0	0	A101MTT-	QLC	01	1	03		101
133	196	I65TI101E	AI	400	0	PMP101 MTR WINDING TMP RTD E	DEG F	-	PLC	67	0000	32	41			0	0	A101MTT-	QLC	01	1	03		101
134	197	I65TI101F	AI	400	0	PMP101 MTR WINDING TMP RTD F	DEG F	-	PLC	67	0000	32	41			0	0	A101MTT-	QLC	01	1	03		101
135	198	I65TI101G	AI	400	0	PMP101 BEARING TMP RTD G	DEG F	-	PLC	67	0000	32	41			0	0	A101MTT-	QLC	01	1	03		101
136	199	I65TI101H	AI	400	0	PMP101 BEARING TMP RTD H	DEG F	-	PLC	67	0000	32	41			0	0	A101MTT-	QLC	01	1	03		101
137	205	I65TI102A	AI	400	0	PMP102 MTR WINDING TMP RTD A	DEG F	-	PLC	67	0000	32	41			0	0	A102MTT-	QLC	01	1	03		102
138	206	I65TI102B	AI	400	0	PMP102 MTR WINDING TMP RTD B	DEG F	-	PLC	67	0000	32	41			0	0	A102MTT-	QLC	01	1	03		102
139	207	I65TI102C	AI	400	0	PMP102 MTR WINDING TMP RTD C	DEG F	-	PLC	67	0000	32	41			0	0	A102MTT-	QLC	01	1	03		102
140	208	I65TI102D	AI	400	0	PMP102 MTR WINDING TMP RTD D	DEG F	-	PLC	67	0000	32	41			0	0	A102MTT-	QLC	01	1	03		102
141	209	I65TI102E	AI	400	0	PMP102 MTR WINDING TMP RTD E	DEG F	-	PLC	67	0000	32	41			0	0	A102MTT-	QLC	01	1	03		102
142	210	I65TI102F	AI	400	0	PMP102 MTR WINDING TMP RTD F	DEG F	-	PLC	67	0000	32	41			0	0	A102MTT-	QLC	01	1	03		102
143	211	I65TI102G	AI	400	0	PMP102 BEARING TMP RTD G	DEG F	-	PLC	67	0000	32	41			0	0	A102MTT-	QLC	01	1	03		102
144	212	I65TI102H	AI	400	0	PMP102 BEARING TMP RTD H	DEG F	-	PLC	67	0000	32	41			0	0	A102MTT-	QLC	01	1	03		102
145	218	I65TI103A	AI	400	0	PMP103 MTR WINDING TMP RTD A	DEG F	-	PLC	67	0000	32	41			0	0	A103MTT-	QLC	01	1	03		103
146	219	I65TI103B	AI	400	0	PMP103 MTR WINDING TMP RTD B	DEG F	-	PLC	67	0000	32	41			0	0	A103MTT-	QLC	01	1	03		103
147	220	I65TI103C	AI	400	0	PMP103 MTR WINDING TMP RTD C	DEG F	-	PLC	67	0000	32	41			0	0	A103MTT-	QLC	01	1	03		103
148	221	I65TI103D	AI	400	0	PMP103 MTR WINDING TMP RTD D	DEG F	-	PLC	67	0000	32	41			0	0	A103MTT-	QLC	01	1	03		103
149	222	I65TI103E	AI	400	0	PMP103 MTR WINDING TMP RTD E	DEG F	-	PLC	67	0000	32	41			0	0	A103MTT-	QLC	01	1	03		103
150	223	I65TI103F	AI	400	0	PMP103 MTR WINDING TMP RTD F	DEG F	-	PLC	67	0000	32	41			0	0	A103MTT-	QLC	01	1	03		103
151	224	I65TI103G	AI	400	0	PMP103 BEARING TMP RTD G	DEG F	-	PLC	67	0000	32	41			0	0	A103MTT-	QLC	01	1	03		103
152	225	I65TI103H	AI	400	0	PMP103 BEARING TMP RTD H	DEG F	-	PLC	67	0000	32	41			0	0	A103MTT-	QLC	01	1	03		103
153	231	I65TI104A	AI	400	0	PMP104 MTR WINDING TMP RTD A	DEG F	-	PLC	67	0000	32	41			0	0	A104MTT-	QLC	01	1	03		104
154	232	I65TI104B	AI	400	0	PMP104 MTR WINDING TMP RTD B	DEG F	-	PLC	67	0000	32	41			0	0	A104MTT-	QLC	01	1	03		104
155	233	I65TI104C	AI	400	0	PMP104 MTR WINDING TMP RTD C	DEG F	-	PLC	67	0000	32	41			0	0	A104MTT-	QLC	01	1	03		104
156	234	I65TI104D	AI	400	0	PMP104 MTR WINDING TMP RTD D	DEG F	-	PLC	67	0000	32	41			0	0	A104MTT-	QLC	01	1	03		104
157	235	I65TI104E	AI	400	0	PMP104 MTR WINDING TMP RTD E	DEG F	-	PLC	67	0000	32	41			0	0	A104MTT-	QLC	01	1	03		104
158	236	I65TI104F	AI	400	0	PMP104 MTR WINDING TMP RTD F	DEG F	-	PLC	67	0000	32	41			0	0	A104MTT-	QLC	01	1	03		104
159	237	I65TI104G	AI	400	0	PMP104 BEARING TMP RTD G	DEG F	-	PLC	67	0000	32	41			0	0	A104MTT-	QLC	01	1	03		104
160	238	I65TI104H	AI	400	0	PMP104 BEARING TMP RTD H	DEG F	-	PLC	67	0000	32	41			0	0	A104MTT-	QLC	01	1	03		104
161																								
162																								
163	200	I65VI101A	AI	2	0	PMP101 UP BRNG VIB (IN/SEC PK)	IPS PK	-	PLC	67	0000	0	0	0	0	0	0	A101MVT-	QLC	01	1	03	BENTLEY NEVADA 2201-03/0	101
164	201	I65VI101B	AI	2	0	PMP101 LO BRNG VIB (IN/SEC PK)	IPS PK	-	PLC	67	0000	0	0	0	0	0	0	A101MVT-	QLC	01	1	03	BENTLEY NEVADA 2201-03/0	101
165	213	I65VI102A	AI	2	0	PMP102 UP BRNG VIB (IN/SEC PK)	IPS PK	-	PLC	67	0000	0	0	0	0	0	0	A102MVT-	QLC	01	1	03	BENTLEY NEVADA 2201-03/0	102
166	214	I65VI102B	AI	2	0	PMP102 LO BRNG VIB (IN/SEC PK)	IPS PK	-	PLC	67	0000	0	0	0	0	0	0	A102MVT-	QLC	01	1	03	BENTLEY NEVADA 2201-03/0	102
167	226	I65VI103A	AI	2	0	PMP103 UP BRNG VIB (IN/SEC PK)	IPS PK	-	PLC	67	0000	0	0	0	0	0	0	A103MVT-	QLC	01	1	03	BENTLEY NEVADA 2201-03/0	103
168	227	I65VI103B	AI	2	0	PMP103 LO BRNG VIB (IN/SEC PK)	IPS PK	-	PLC	67	0000	0	0	0	0	0	0	A103MVT-	QLC	01	1	03	BENTLEY NEVADA 2201-03/0	103
169	239	I65VI104A	AI	2	0	PMP104 UP BRNG VIB (IN/SEC PK)	IPS PK	-	PLC	67	0000	0	0	0	0	0	0	A104MVT-	QLC	01	1	03	BENTLEY NEVADA 2201-03/0	104
170	240	I65VI104B	AI	2	0	PMP104 LO BRNG VIB (IN/SEC PK)	IPS PK	-	PLC	67	0000	0	0	0	0	0	0	A104MVT-	QLC	01	1	03	BENTLEY NEVADA 2201-03/0	104
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PLC ORDER	DCS																							
	DCS ORDER	PTID	RT	TB	BB	ENGLISH DESCRIPTION	EU/ST	EV/RS	SOURCE	CD	HW	AP	LC	HL/AR	LL/BP	CV	CI	CHARST	CRD	GP	QC	SL	CUST6/COMMENTS	LOOP NO
181																								
182	284	I65HS232B	DC			SCRNNGS SLU GTE G232 STP CMD	STOP	READY	DCS	67	0000	0	0	0	0	0	0	A232GHS-	QLC	01	1	03		232
183	283	I65HS232A	DC			SCRNNGS SLU GTE G232 OPN CMD	OPEN	READY	DCS	67	0000	0	0	0	0	0	0	A232GHS-	QLC	01	1	03		232
184	285	I65HS232C	DC			SCRNNGS SLU GTE G232 CLS CMD	CLOSE	READY	DCS	67	0000	0	0	0	0	0	0	A232GHS-	QLC	01	1	03		232
185	274	I65HS211A	DC			B SCRN ME201 GTE G211 OPN CMD	OPEN	READY	DCS	67	0000	0	0	0	0	0	0	A211GHS-	QLC	01	1	03		211
186	275	I65HS211B	DC			B SCRN ME201 GTE G211 CLS CMD	CLOSE	READY	DCS	67	0000	0	0	0	0	0	0	A211GHS-	QLC	01	1	03		211
187	277	I65HS212A	DC			B SCRN ME202 GTE G212 OPN CMD	OPEN	READY	DCS	67	0000	0	0	0	0	0	0	A212GHS-	QLC	01	1	03		212
188	278	I65HS212B	DC			B SCRN ME202 GTE G212 CLS CMD	CLOSE	READY	DCS	67	0000	0	0	0	0	0	0	A212GHS-	QLC	01	1	03		212
189	280	I65HS213A	DC			B SCRN ME203 GTE G213 OPN CMD	OPEN	READY	DCS	67	0000	0	0	0	0	0	0	A213GHS-	QLC	01	1	03		213
190	281	I65HS213B	DC			B SCRN ME203 GTE G213 CLS CMD	CLOSE	READY	DCS	67	0000	0	0	0	0	0	0	A213GHS-	QLC	01	1	03		213
191	271	I65HS141A	DC			FORCE MAIN VLV V141 OPN CMD	OPEN	READY	DCS	67	0000	0	0	0	0	0	0	A141VHS-	QLC	01	1	03		141
192	272	I65HS141B	DC			FORCE MAIN VLV V141 CLS CMD	CLOSE	READY	DCS	67	0000	0	0	0	0	0	0	A141VHS-	QLC	01	1	03		141
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253	128	I65LALL151	DL			SURGE CNTRL TNK T151 LVL LOLO	NORMAL	LO-LO	PLC	67	0000	2	1	0	0	0	0	A151CLA-	QLC	01	1	03	Analog on Top of Tnk/UCP 151	151
254	129	I65ZLO151	DL			SURGE CNTRL TNK T151 VLV POS	OPENED	CLOSED	PLC	67	0000	0	0	0	0	0	0	A151VZO-	QLC	01	1	03	Sewage Valve (Not Air Valve)	151
255	127	I65LAHH151	DL			SURGE CNTRL TNK T151 LVL HI-HI	NORMAL	HI-HI	PLC	67	0000	2	1	0	0	0	0	A151CLA-	QLC	01	1	03	Analog on Top of Tnk/UCP 151	151
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PLC ORDER	DCS																						
	PTID	MODBUS NODE	MODBUS REG	OFFSET MODBUS ADDR	PLC REG/ ADDR	PROSOFT REG/ ADDR	FC	MNEMONIC	REG TYPE	Eng Units Being Sent	CONVERSION TYPE	CONVERSION CODE	GAIN	BIAS	PTID	Eng Value at 32-bit Signed Integer "-16K"	Eng Value at 32-bit Signed Integer "+16K"	CUST23/QLC REG ADDRESS	PS 65 RFP647 FDI (.2)_CUST24/QLC ALGO	QLC Card HW ADDR	QLC Card SW ADDR	PTID	PHW
1	I65FAL1A	1	40001.00	0000.00	N32:0/15	0000.00	3	RHR	HOLDING REG						I65FAL1A			G0000	QLCGPIN 901	A8H	150H	I65FAL1A	336 (150H)
2	I65FAL3A	1	40001.03	0000.03	N32:0/12	0000.03	3	RHR	HOLDING REG						I65FAL3A			G0000	QLCGPIN 901	A8H	150H	I65FAL3A	336 (150H)
3	I65FAL4	1	40001.05	0000.05	N32:0/10	0000.05	3	RHR	HOLDING REG						I65FAL4			G0000	QLCGPIN 901	A8H	150H	I65FAL4	336 (150H)
4	I65FAL5	1	40001.06	0000.06	N32:0/9	0000.06	3	RHR	HOLDING REG						I65FAL5			G0000	QLCGPIN 901	A8H	150H	I65FAL5	336 (150H)
5	I65FAL1B	1	40001.01	0000.01	N32:0/14	0000.01	3	RHR	HOLDING REG						I65FAL1B			G0000	QLCGPIN 901	A8H	150H	I65FAL1B	336 (150H)
6	I65FAL2B	1	40001.02	0000.02	N32:0/13	0000.02	3	RHR	HOLDING REG						I65FAL2B			G0000	QLCGPIN 901	A8H	150H	I65FAL2B	336 (150H)
7	I65FAL3B	1	40001.04	0000.04	N32:0/11	0000.04	3	RHR	HOLDING REG						I65FAL3B			G0000	QLCGPIN 901	A8H	150H	I65FAL3B	336 (150H)
8	I65FAL8	1	40001.07	0000.07	N32:0/8	0000.07	3	RHR	HOLDING REG						I65FAL8			G0000	QLCGPIN 901	A8H	150H	I65FAL8	336 (150H)
9	I65LALL940	1	40011.13	0010.13	N32:10/2	0010.13	3	RHR	HOLDING REG						I65LALL940			G0010	QLCGPIN 901	A8H	150H	I65LALL940	336 (150H)
10	I65UA940	1	40011.14	0010.14	N32:10/1	0010.14	3	RHR	HOLDING REG						I65UA940			G0010	QLCGPIN 901	A8H	150H	I65UA940	336 (150H)
11	I65LALL950	1	40011.15	0010.15	N32:10/0	0010.15	3	RHR	HOLDING REG						I65LALL950			G0010	QLCGPIN 901	A8H	150H	I65LALL950	336 (150H)
12	I65UA950	1	40012.00	0011.00	N32:11/15	0011.00	3	RHR	HOLDING REG						I65UA950			G0011	QLCGPIN 901	A8H	150H	I65UA950	336 (150H)
13	I65LAHH25	1	40001.15	0000.15	N32:0/0	0000.15	3	RHR	HOLDING REG						I65LAHH25			G0000	QLCGPIN 901	A8H	150H	I65LAHH25	336 (150H)
14	I65LAHH26	1	40002.00	0001.00	N32:1/15	0001.00	3	RHR	HOLDING REG						I65LAHH26			G0001	QLCGPIN 901	A8H	150H	I65LAHH26	336 (150H)
15	I65LAHH27	1	40002.01	0001.01	N32:1/14	0001.01	3	RHR	HOLDING REG						I65LAHH27			G0001	QLCGPIN 901	A8H	150H	I65LAHH27	336 (150H)
16	I65ZLC141	1	40008.13	0007.13	N32:7/2	0007.13	3	RHR	HOLDING REG						I65ZLC141			G0007	QLCGPIN 901	A8H	150H	I65ZLC141	336 (150H)
17	I65HS101C	1	40251.04	0250.04	N33:0/11	0250.04	16	PMR	HOLDING REG						I65HS101C			G0050	QLCGPOUT 902	A8H	150H	I65HS101C	336 (150H)
18	I65HS102B	1	40251.09	0250.09	N33:0/6	0250.09	16	PMR	HOLDING REG						I65HS102B			G0050	QLCGPOUT 902	A8H	150H	I65HS102B	336 (150H)
19	I65HS103C	1	40251.15	0250.15	N33:0/0	0250.15	16	PMR	HOLDING REG						I65HS103C			G0050	QLCGPOUT 902	A8H	150H	I65HS103C	336 (150H)
20	I65HS104B	1	40252.04	0251.04	N33:1/11	0251.04	16	PMR	HOLDING REG						I65HS104B			G0051	QLCGPOUT 902	A8H	150H	I65HS104B	336 (150H)
21																							
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33	I65PALL10B	1	40001.09	0000.09	N32:0/6	0000.09	3	RHR	HOLDING REG						I65PALL10B			G0000	QLCGPIN 901	A8H	150H	I65PALL10B	336 (150H)
34	I65UA10A	1	40001.10	0000.10	N32:0/5	0000.10	3	RHR	HOLDING REG						I65UA10A			G0000	QLCGPIN 901	A8H	150H	I65UA10A	336 (150H)
35	I65UA10B	1	40001.11	0000.11	N32:0/4	0000.11	3	RHR	HOLDING REG						I65UA10B			G0000	QLCGPIN 901	A8H	150H	I65UA10B	336 (150H)
36	I65UA20A	1	40001.13	0000.13	N32:0/2	0000.13	3	RHR	HOLDING REG						I65UA20A			G0000	QLCGPIN 901	A8H	150H	I65UA20A	336 (150H)
37	I65UA20B	1	40001.14	0000.14	N32:0/1	0000.14	3	RHR	HOLDING REG						I65UA20B			G0000	QLCGPIN 901	A8H	150H	I65UA20B	336 (150H)
38	I65LAH50	1	40002.03	0001.03	N32:1/12	0001.03	3	RHR	HOLDING REG						I65LAH50			G0001	QLCGPIN 901	A8H	150H	I65LAH50	336 (150H)
39	I65LAHH50	1	40002.04	0001.04	N32:1/11	0001.04	3	RHR	HOLDING REG						I65LAHH50			G0001	QLCGPIN 901	A8H	150H	I65LAHH50	336 (150H)
40	I65LAH60	1	40002.05	0001.05	N32:1/10	0001.05	3	RHR	HOLDING REG						I65LAH60			G0001	QLCGPIN 901	A8H	150H	I65LAH60	336 (150H)
41	I65UA60A	1	40002.06	0001.06	N32:1/9	0001.06	3	RHR	HOLDING REG						I65UA60A			G0001	QLCGPIN 901	A8H	150H	I65UA60A	336 (150H)
42	I65UA60B	1	40002.07	0001.07	N32:1/8	0001.07	3	RHR	HOLDING REG						I65UA60B			G0001	QLCGPIN 901	A8H	150H	I65UA60B	336 (150H)
43	I65UA81	1	40002.08	0001.08	N32:1/7	0001.08	3	RHR	HOLDING REG						I65UA81			G0001	QLCGPIN 901	A8H	150H	I65UA81	336 (150H)
44	I65YA101D	1	40003.09	0002.09	N32:2/6	0002.09	3	RHR	HOLDING REG						I65YA101D			G0002	QLCGPIN 901	A8H	150H	I65YA101D	336 (150H)
45	I65YL101A	1	40003.11	0002.11	N32:2/4	0002.11	3	RHR	HOLDING REG						I65YL101A			G0002	QLCGPIN 901	A8H	150H	I65YL101A	336 (150H)
46	I65ZLC101	1	40004.02	0003.02	N32:3/13	0003.02	3	RHR	HOLDING REG						I65ZLC101			G0003	QLCGPIN 901	A8H	150H	I65ZLC101	336 (150H)
47	I65FAL101	1	40002.13	0001.13	N32:1/2	0001.13	3	RHR	HOLDING REG						I65FAL101			G0001	QLCGPIN 901	A8H	150H	I65FAL101	336 (150H)
48	I65ZL211	1	40009.05	0008.05	N32:8/10	0008.05	3	RHR	HOLDING REG						I65ZL211			G0008	QLCGPIN 901	A8H	150H	I65ZL211	336 (150H)
49	I65YA102D	1	40004.15	0003.15	N32:3/0	0003.15	3	RHR	HOLDING REG						I65YA102D			G0003	QLCGPIN 901	A8H	150H	I65YA102D	336 (150H)
50	I65YL102A	1	40005.01	0004.01	N32:4/14	0004.01	3	RHR	HOLDING REG						I65YL102A			G0004	QLCGPIN 901	A8H	150H	I65YL102A	336 (150H)
51	I65ZLC102	1	40005.08	0004.08	N32:4/7	0004.08	3	RHR	HOLDING REG						I65ZLC102			G0004	QLCGPIN 901	A8H	150H	I65ZLC102	336 (150H)
52	I65FAL102	1	40004.03	0003.03	N32:3/12	0003.03	3	RHR	HOLDING REG						I65FAL102			G0003	QLCGPIN 901	A8H	150H	I65FAL102	336 (150H)
53	I65ZL212	1	40009.11	0008.11	N32:8/4	0008.11	3	RHR	HOLDING REG						I65ZL212			G0008	QLCGPIN 901	A8H	150H	I65ZL212	336 (150H)
54	I65YA103D	1	40006.05	0005.05	N32:5/10	0005.05	3	RHR	HOLDING REG						I65YA103D			G0005	QLCGPIN 901	A8H	150H	I65YA103D	336 (150H)
55	I65YL103A	1	40006.07	0005.07	N32:5/8	0005.07	3	RHR	HOLDING REG						I65YL103A			G0005	QLCGPIN 901	A8H	150H	I65YL103A	336 (150H)
56	I65ZLC103	1	40006.14	0005.14	N32:5/1	0005.14	3	RHR	HOLDING REG						I65ZLC103			G0005	QLCGPIN 901	A8H	150H	I65ZLC103	336 (150H)
57	I65FAL103	1	40005.09	0004.09	N32:4/6	0004.09	3	RHR	HOLDING REG						I65FAL103			G0004	QLCGPIN 901	A8H	150H	I65FAL103	336 (150H)
58	I65ZL213	1	40010.01	0009.01	N32:9/14	0009.01	3	RHR	HOLDING REG						I65ZL213			G0009	QLCGPIN 901	A8H	150H	I65ZL213	336 (150H)
59	I65YA104D	1	40007.11	0006.11	N32:6/4	0006.11	3	RHR	HOLDING REG						I65YA104D			G0006	QLCGPIN 901	A8H	150H	I65YA104D	336 (150H)
60	I65YL104A	1	40007.13	0006.13	N32:6/2	0006.13	3	RHR	HOLDING REG						I65YL104A			G0006	QLCGPIN 901	A8H	150H	I65YL104A	336 (150H)
61	I65ZLC104	1	40008.04	0007.04	N32:7/11	0007.04	3	RHR	HOLDING REG						I65ZLC104			G0007	QLCGPIN 901	A8H	150H	I65ZLC104	336 (150H)
62	I65FAL104	1	40006.15	0005.15	N32:5/0	0005.15	3	RHR	HOLDING REG						I65FAL104			G0005	QLCGPIN 901	A8H	150H	I65FAL104	336 (150H)
63	I65ZL232	1	40010.15	0009.15	N32:9/0	0009.15	3	RHR	HOLDING REG						I65ZL232			G0009	QLCGPIN 901	A8H	150H	I65ZL232	336 (150H)
64	I65ZLO111	1	40008.06	0007.06	N32:7/9	0007.06	3	RHR	HOLDING REG						I65ZLO111			G0007	QLCGPIN 901	A8H	150H	I65ZLO111	336 (150H)
65	I65ZLC111	1	40008.05	0007.05	N32:7/10	0007.05	3	RHR	HOLDING REG						I65ZLC111			G0007	QLCGPIN 901	A8H	150H	I65ZLC111	336 (150H)
66	I65ZLO121	1	40008.08	0007.08	N32:7/7	0007.08	3	RHR	HOLDING REG						I65ZLO121			G0007	QLCGPIN 901	A8H	150H	I65ZLO121	336 (150H)
67	I65ZLC121	1	40008.07	0007.07	N32:7/8	0007.07	3	RHR	HOLDING REG						I65ZLC121			G0007	QLCGPIN 901	A8H	150H	I65ZLC121	336 (150H)
68	I65PALL20	1	40001.12	0000.12	N32:0/3	0000.12	3	RHR	HOLDING REG						I65PALL20			G0000	QLCGPIN 901	A8H	150H	I65PALL20	336 (150H)
69	I65ZLO211	1	40009.07	0008.07	N32:8/8	0008.07	3	RHR	HOLDING REG						I65ZLO211			G0008	QLCGPIN 901	A8H	150H	I65ZLO211	336 (150H)
70	I65ZLC211	1	40009.06	0008.06	N32:8/9	0008.06	3	RHR	HOLDING REG						I65ZLC211			G0008	QLCGPIN 901	A8H	150H	I65ZLC211	336 (150H)
71	I65ZLO212	1	40009.13	0008.13	N32:8/2	0008.13	3	RHR	HOLDING REG						I65ZLO212			G0008	QLCGPIN 901	A8H	150H	I65ZLO212	336 (150H)
72	I65ZLC212	1	40009.12	0008.12	N32:8/3	0008.12	3	RHR	HOLDING REG						I65ZLC212			G0008	QLCGPIN 901	A8H	150H	I65ZLC212	336 (150H)
73	I65ZLO213	1	40010.03	0009.03	N32:9/12	0009.03	3	RHR	HOLDING REG						I65ZLO213			G0009	QLCGPIN 901	A8H	150H	I65ZLO213	336 (150H)
74	I65ZLC213	1	40010.02	0009.02	N32:9/13	0009.02	3	RHR	HOLDING REG						I65ZLC213			G0009	QLCGPIN 901	A8H	150H	I65ZLC213	336 (150H)
75	I65ZLO221	1	40010.05	0009.05	N32:9/10	0009.05	3	RHR	HOLDING REG						I65ZLO221			G0009	QLCGPIN 901	A8H	150H	I65ZLO221	336 (150H)
76	I65ZLC221	1	40010.04	0009.04	N32:9/11	0009.04	3	RHR	HOLDING REG						I65ZLC221			G0009	QLCGPIN 901	A8H	150H	I65ZLC221	336 (150H)
77	I65ZLO222	1	40010.07	0009.07	N32:9/8	0009.07	3	RHR	HOLDING REG						I65ZLO222			G0009	QLCGPIN 901	A8H	150H	I65ZLO222	336 (150H)
78	I65ZLC222	1	40010.06	0009.06	N32:9/9	0009.06	3	RHR	HOLDING REG						I65ZLC222			G0009	QLCGPIN 901	A8H	150H	I65ZLC222	336 (150H)
79	I65ZLO223	1	40010.09	0009.09	N32:9/6	0009.09	3	RHR	HOLDING REG						I65ZLO223			G0009	QLCGPIN 901	A8H	150H	I65ZLO223	336 (150H)
80	I65ZLC223	1	40010.08	0009.08	N32:9/7	0009.08	3	RHR	HOLDING REG						I65ZLC223			G0009	QLCGPIN 901	A8H	150H	I65ZLC223	336 (150H)
81	I65ZLO231	1	40010.11	0009.11	N32:9/4	0009.11	3	RHR	HOLDING REG						I65ZLO231			G0009	QLCGPIN 901	A8H	150H	I65ZLO231	336 (150H)
82	I65ZLC231	1	40010.10	0009.10	N32:9/5	0009.10	3	RHR	HOLDING REG						I65ZLC231			G0009	QLCGPIN 901	A8H	150H	I65ZLC231	336 (150H)
83	I65ZLO232	1	40011.01	0010.01	N32:10/14	0010.01	3	RHR	HOLDING REG						I65ZLO232			G0010	QLCGPIN 901	A8H	150H	I65ZLO232	336 (150H)
84	I65ZLC232	1	40011.00	0010.00	N32:10/15	0010.00	3	RHR	HOLDING REG						I65ZLC232			G0010	QLCGPIN 901	A8H	150H	I65ZLC232	336 (150H)
85	I65ZLO233	1	40011.03	0010.03	N32:10/12	0010.03	3	RHR	HOLDING REG						I65ZLO233			G0010	QLCGPIN 901	A8H	150H	I65ZLO233	336 (150H)
86	I65ZLC233	1	40011.02	0010.02	N32:10/13	0010.02	3	RHR	HOLDING REG						I65ZLC233			G0010	QLCGPIN 901	A8H	150H	I65ZLC233	336 (150H)
87	I65LALL300	1	40011.04	0010.04	N32:10/11	0010.04	3	RHR	HOLDING REG						I65LALL300			G0010	QLCGPIN 901	A8H	150H	I65LALL300	336 (150H)
88	I65PAH301	1	40011.05	0010.05	N32:10/10	0010.05	3	RHR	HOLDING REG						I65PAH301			G0010	QLCGPIN 901	A8H	150H	I65PAH301	336 (150H)
89	I65PAL301	1	40011.06	0010.06	N32:10/9	0010.06	3	RHR	HOLDING REG						I65PAL301			G0010	QLCGPIN 901	A8H	150H	I65PAL301	336 (150H)
90	I65LAL410B	1	40011.07	0010.07	N32:10/8	0010.07	3	RHR	HOLDING REG						I65LAL410B			G0010	QLCGPIN 901	A8H	150H	I65LAL410B	336 (150H)

PLC ORDER	DCS																					
	PTID	MODBUS NODE	MODBUS REG	OFFSET MODBUS ADDR	PLC REG/ ADDR	PROSOFT REG/ ADDR	FC	MNEMONIC	REG TYPE	Eng Units Being Sent	CONVERSION TYPE	CONVERSION CODE	GAIN	BIAS	PTID	Eng Value at 32-bit Signed Integer "-16K"	Eng Value at 32-bit Signed Integer "+16K"	CUST23/QLC REG ADDRESS	PS 65 RFP647 FDI (.2)_CUST24/QLC ALGO	QLC Card HW ADDR	QLC Card SW ADDR	PTID	PHW
91	I65LAL420B	1	40011.08	0010.08	N32:10/7	0010.08	3	RHR	HOLDING REG						I65LAL420B			G0010	QLCGPIN 901	A8H	150H	I65LAL420B	336 (150H)
92	I65FAH442	1	40011.10	0010.10	N32:10/5	0010.10	3	RHR	HOLDING REG						I65FAH442			G0010	QLCGPIN 901	A8H	150H	I65FAH442	336 (150H)
93	I65FAH441	1	40011.09	0010.09	N32:10/6	0010.09	3	RHR	HOLDING REG						I65FAH441			G0010	QLCGPIN 901	A8H	150H	I65FAH441	336 (150H)
94	I65FAH443	1	40011.11	0010.11	N32:10/4	0010.11	3	RHR	HOLDING REG						I65FAH443			G0010	QLCGPIN 901	A8H	150H	I65FAH443	336 (150H)
95	I65FAH444	1	40011.12	0010.12	N32:10/3	0010.12	3	RHR	HOLDING REG						I65FAH444			G0010	QLCGPIN 901	A8H	150H	I65FAH444	336 (150H)
96	I65ZLO141	1	40008.14	0007.14	N32:7/1	0007.14	3	RHR	HOLDING REG						I65ZLO141			G0007	QLCGPIN 901	A8H	150H	I65ZLO141	336 (150H)
97	I65LI10	1	40053	0052	N32:52	0052	3	RHR	HOLDING REG	FEET	LINEAR	1	1	0	I65LI10	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0103	QLCAIN 903	A8H	150H	I65LI10	336 (150H)
98	I65PI101B	1	40077	0076	N32:76	0076	3	RHR	HOLDING REG	PSIG	LINEAR	1	1	0	I65PI101B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0139	QLCAIN 903	A8H	150H	I65PI101B	336 (150H)
99	I65PI101A	1	40075	0074	N32:74	0074	3	RHR	HOLDING REG	PSIG	LINEAR	1	1	0	I65PI101A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0136	QLCAIN 903	A8H	150H	I65PI101A	336 (150H)
100	I65PI102A	1	40101	0100	N32:100	0100	3	RHR	HOLDING REG	PSIG	LINEAR	1	1	0	I65PI102A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0177	QLCAIN 904	A8H	150H	I65PI102A	336 (150H)
101	I65PI102B	1	40103	0102	N32:102	0102	3	RHR	HOLDING REG	PSIG	LINEAR	1	1	0	I65PI102B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0180	QLCAIN 904	A8H	150H	I65PI102B	336 (150H)
102	I65PI103B	1	40129	0128	N32:128	0128	3	RHR	HOLDING REG	PSIG	LINEAR	1	1	0	I65PI103B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0221	QLCAIN 905	A8H	150H	I65PI103B	336 (150H)
103	I65PI103A	1	40127	0126	N32:126	0126	3	RHR	HOLDING REG	PSIG	LINEAR	1	1	0	I65PI103A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0218	QLCAIN 905	A8H	150H	I65PI103A	336 (150H)
104	I65PI104B	1	40155	0154	N32:154	0154	3	RHR	HOLDING REG	PSIG	LINEAR	1	1	0	I65PI104B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0312	QLCAIN 906	A8H	150H	I65PI104B	336 (150H)
105	I65PI104A	1	40153	0152	N32:152	0152	3	RHR	HOLDING REG	PSIG	LINEAR	1	1	0	I65PI104A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0309	QLCAIN 906	A8H	150H	I65PI104A	336 (150H)
106	I65LI20	1	40055	0054	N32:54	0054	3	RHR	HOLDING REG	FEET	LINEAR	1	1	0	I65LI20	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0106	QLCAIN 903	A8H	150H	I65LI20	336 (150H)
107	I65FI601	1	40183	0182	N32:182	0182	3	RHR	HOLDING REG	GPM	LINEAR	1	1	0	I65FI601	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0356	QLCAIN 907	A8H	150H	I65FI601	336 (150H)
108	I65PI401	1	40177	0176	N32:176	0176	3	RHR	HOLDING REG	PSIG	LINEAR	1	1	0	I65PI401	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0345	QLCAIN 906	A8H	150H	I65PI401	336 (150H)
109																							
110																							
111																							
112	I65AI8	1	40051	0050	N32:50	0050	3	RHR	HOLDING REG	pH	LINEAR	1	1	0	I65AI8	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0100	QLCAIN 903	A8H	150H	I65AI8	336 (150H)
113																							
114	I65ZL141	1	40008.12	0007.12	N32:7/3	0007.12	3	RHR	HOLDING REG						I65ZL141			G0007	QLCGPIN 901	A8H	150H	I65ZL141	336 (150H)
115	I65ZL101A	1	40004.00	0003.00	N32:3/15	0003.00	3	RHR	HOLDING REG						I65ZL101A			G0003	QLCGPIN 901	A8H	150H	I65ZL101A	336 (150H)
116	I65ZL101B	1	40004.01	0003.01	N32:3/14	0003.01	3	RHR	HOLDING REG						I65ZL101B			G0003	QLCGPIN 901	A8H	150H	I65ZL101B	336 (150H)
117	I65ZL102A	1	40005.06	0004.06	N32:4/9	0004.06	3	RHR	HOLDING REG						I65ZL102A			G0004	QLCGPIN 901	A8H	150H	I65ZL102A	336 (150H)
118	I65ZL102B	1	40005.07	0004.07	N32:4/8	0004.07	3	RHR	HOLDING REG						I65ZL102B			G0004	QLCGPIN 901	A8H	150H	I65ZL102B	336 (150H)
119	I65ZL103A	1	40006.12	0005.12	N32:5/3	0005.12	3	RHR	HOLDING REG						I65ZL103A			G0005	QLCGPIN 901	A8H	150H	I65ZL103A	336 (150H)
120	I65ZL103B	1	40006.13	0005.13	N32:5/2	0005.13	3	RHR	HOLDING REG						I65ZL103B			G0005	QLCGPIN 901	A8H	150H	I65ZL103B	336 (150H)
121	I65ZL104A	1	40008.02	0007.02	N32:7/13	0007.02	3	RHR	HOLDING REG						I65ZL104A			G0007	QLCGPIN 901	A8H	150H	I65ZL104A	336 (150H)
122	I65ZL104B	1	40008.03	0007.03	N32:7/12	0007.03	3	RHR	HOLDING REG						I65ZL104B			G0007	QLCGPIN 901	A8H	150H	I65ZL104B	336 (150H)
123																							
124																							
125																							
126																							
127																							
128																							
129	I65TI101A	1	40079	0078	N32:78	0078	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI101A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0142	QLCAIN 903	A8H	150H	I65TI101A	336 (150H)
130	I65TI101B	1	40081	0080	N32:80	0080	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI101B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0145	QLCAIN 903	A8H	150H	I65TI101B	336 (150H)
131	I65TI101C	1	40083	0082	N32:82	0082	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI101C	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0150	QLCAIN 904	A8H	150H	I65TI101C	336 (150H)
132	I65TI101D	1	40085	0084	N32:84	0084	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI101D	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0153	QLCAIN 904	A8H	150H	I65TI101D	336 (150H)
133	I65TI101E	1	40087	0086	N32:86	0086	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI101E	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0156	QLCAIN 904	A8H	150H	I65TI101E	336 (150H)
134	I65TI101F	1	40089	0088	N32:88	0088	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI101F	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0159	QLCAIN 904	A8H	150H	I65TI101F	336 (150H)
135	I65TI101G	1	40091	0090	N32:90	0090	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI101G	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0162	QLCAIN 904	A8H	150H	I65TI101G	336 (150H)
136	I65TI101H	1	40093	0092	N32:92	0092	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI101H	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0165	QLCAIN 904	A8H	150H	I65TI101H	336 (150H)
137	I65TI102A	1	40105	0104	N32:104	0104	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI102A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0183	QLCAIN 904	A8H	150H	I65TI102A	336 (150H)
138	I65TI102B	1	40107	0106	N32:106	0106	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI102B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0186	QLCAIN 904	A8H	150H	I65TI102B	336 (150H)
139	I65TI102C	1	40109	0108	N32:108	0108	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI102C	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0189	QLCAIN 904	A8H	150H	I65TI102C	336 (150H)
140	I65TI102D	1	40111	0110	N32:110	0110	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI102D	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0192	QLCAIN 904	A8H	150H	I65TI102D	336 (150H)
141	I65TI102E	1	40113	0112	N32:112	0112	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI102E	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0195	QLCAIN 904	A8H	150H	I65TI102E	336 (150H)
142	I65TI102F	1	40115	0114	N32:114	0114	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI102F	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0200	QLCAIN 905	A8H	150H	I65TI102F	336 (150H)
143	I65TI102G	1	40117	0116	N32:116	0116	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI102G	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0203	QLCAIN 905	A8H	150H	I65TI102G	336 (150H)
144	I65TI102H	1	40119	0118	N32:118	0118	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI102H	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0206	QLCAIN 905	A8H	150H	I65TI102H	336 (150H)
145	I65TI103A	1	40131	0130	N32:130	0130	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI103A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0224	QLCAIN 905	A8H	150H	I65TI103A	336 (150H)
146	I65TI103B	1	40133	0132	N32:132	0132	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI103B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0227	QLCAIN 905	A8H	150H	I65TI103B	336 (150H)
147	I65TI103C	1	40135	0134	N32:134	0134	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI103C	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0230	QLCAIN 905	A8H	150H	I65TI103C	336 (150H)
148	I65TI103D	1	40137	0136	N32:136	0136	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI103D	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0233	QLCAIN 905	A8H	150H	I65TI103D	336 (150H)
149	I65TI103E	1	40139	0138	N32:138	0138	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI103E	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0236	QLCAIN 905	A8H	150H	I65TI103E	336 (150H)
150	I65TI103F	1	40141	0140	N32:140	0140	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI103F	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0239	QLCAIN 905	A8H	150H	I65TI103F	336 (150H)
151	I65TI103G	1	40143	0142	N32:142	0142	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI103G	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0242	QLCAIN 905	A8H	150H	I65TI103G	336 (150H)
152	I65TI103H	1	40145	0144	N32:144	0144	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI103H	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0245	QLCAIN 905	A8H	150H	I65TI103H	336 (150H)
153	I65TI104A	1	40157	0156	N32:156	0156	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI104A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0315	QLCAIN 906	A8H	150H	I65TI104A	336 (150H)
154	I65TI104B	1	40159	0158	N32:158	0158	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI104B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0318	QLCAIN 906	A8H	150H	I65TI104B	336 (150H)
155	I65TI104C	1	40161	0160	N32:160	0160	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI104C	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0321	QLCAIN 906	A8H	150H	I65TI104C	336 (150H)
156	I65TI104D	1	40163	0162	N32:162	0162	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI104D	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0324	QLCAIN 906	A8H	150H	I65TI104D	336 (150H)
157	I65TI104E	1	40165	0164	N32:164	0164	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI104E	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0327	QLCAIN 906	A8H	150H	I65TI104E	336 (150H)
158	I65TI104F	1	40167	0166	N32:166	0166	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI104F	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0330	QLCAIN 906	A8H	150H	I65TI104F	336 (150H)
159	I65TI104G	1	40169	0168	N32:168	0168	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI104G	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0333	QLCAIN 906	A8H	150H	I65TI104G	336 (150H)
160	I65TI104H	1	40171	0170	N32:170	0170	3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI104H	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0336	QLCAIN 906	A8H	150H	I65TI104H	336 (150H)
161																							
162																							
163	I65VI101A	1	40095	0094	N32:94	0094	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI101A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0168	QLCAIN 904	A8H	150H	I65VI101A	336 (150H)
164	I65VI101B	1	40097	0096	N32:96	0096	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI101B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0171	QLCAIN 904	A8H	150H	I65VI101B	336 (150H)
165	I65VI102A	1	40121	0120	N32:120	0120	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI102A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0209	QLCAIN 905	A8H	150H	I65VI102A	336 (150H)
166	I65VI102B	1	40123	0122	N32:122	0122	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI102B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0212	QLCAIN 905	A8H	150H	I65VI102B	336 (150H)
167	I65VI103A	1	40147	0146	N32:146	0146	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI103A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0300	QLCAIN 906	A8H	150H	I65VI103A	336 (150H)
168	I65VI103B	1	40149	0148	N32:148	0148	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI103B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0303	QLCAIN 906	A8H	150H	I65VI103B	336 (150H)
169	I65VI104A	1	40173	0172	N32:172	0172	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI104A	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0339	QLCAIN 906	A8H	150H	I65VI104A	336 (150H)
170	I65VI104B	1	40175	0174	N32:174	0174	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI104B	16/32 Signed/Unsigned Integer Representati	16/32 Signed/Unsigned Integer Representat	S0342	QLCAIN 906	A8H	150H	I65VI104B	336 (150H)
171																							
172																							
173																							
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179																							
180																							

Appendix B2
Existing PLC I/O and Associated DCS Data

PLC ORDER	DCS																					
	PTID	MODBUS NODE	MODBUS REG	OFFSET MODBUS ADDR	PLC REG/ ADDR	PROSOFT REG/ ADDR	FC	MNEMONIC	REG TYPE	Eng Units Being Sent	CONVERSION TYPE	CONVERSION CODE	GAIN	BIAS	PTID	Eng Value at 32-bit Signed Integer "-16K"	Eng Value at 32-bit Signed Integer "+16K"	CUST23/QLC REG ADDRESS	PS 65 RFP647 FDI (.2)_CUST24/QLC ALGO	QLC Card HW ADDR	QLC Card SW ADDR	PTID	PHW
181																							
182	I65HS232B	1	40253.05	0252.05	N33:2/10	0252.05	16	PMR	HOLDING REG						I65HS232B			G0052	QLCGPOUT 902	A8H	150H	I65HS232B	336 (150H)
183	I65HS232A	1	40253.04	0252.04	N33:2/11	0252.04	16	PMR	HOLDING REG						I65HS232A			G0052	QLCGPOUT 902	A8H	150H	I65HS232A	336 (150H)
184	I65HS232C	1	40253.06	0252.06	N33:2/9	0252.06	16	PMR	HOLDING REG						I65HS232C			G0052	QLCGPOUT 902	A8H	150H	I65HS232C	336 (150H)
185	I65HS211A	1	40252.11	0251.11	N33:1/4	0251.11	16	PMR	HOLDING REG						I65HS211A			G0051	QLCGPOUT 902	A8H	150H	I65HS211A	336 (150H)
186	I65HS211B	1	40252.12	0251.12	N33:1/3	0251.12	16	PMR	HOLDING REG						I65HS211B			G0051	QLCGPOUT 902	A8H	150H	I65HS211B	336 (150H)
187	I65HS212A	1	40252.14	0251.14	N33:1/1	0251.14	16	PMR	HOLDING REG						I65HS212A			G0051	QLCGPOUT 902	A8H	150H	I65HS212A	336 (150H)
188	I65HS212B	1	40252.15	0251.15	N33:1/0	0251.15	16	PMR	HOLDING REG						I65HS212B			G0051	QLCGPOUT 902	A8H	150H	I65HS212B	336 (150H)
189	I65HS213A	1	40253.01	0252.01	N33:2/14	0252.01	16	PMR	HOLDING REG						I65HS213A			G0052	QLCGPOUT 902	A8H	150H	I65HS213A	336 (150H)
190	I65HS213B	1	40253.02	0252.02	N33:2/13	0252.02	16	PMR	HOLDING REG						I65HS213B			G0052	QLCGPOUT 902	A8H	150H	I65HS213B	336 (150H)
191	I65HS141A	1	40252.08	0251.08	N33:1/7	0251.08	16	PMR	HOLDING REG						I65HS141A			G0051	QLCGPOUT 902	A8H	150H	I65HS141A	336 (150H)
192	I65HS141B	1	40252.09	0251.09	N33:1/6	0251.09	16	PMR	HOLDING REG						I65HS141B			G0051	QLCGPOUT 902	A8H	150H	I65HS141B	336 (150H)
193																							
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253	I65LALL151	1	40009.00	0008.00	N32:8/15	0008.00	3	RHR	HOLDING REG						I65LALL151			G0008	QLCGPIN 901	A8H	150H	I65LALL151	336 (150H)
254	I65ZLO151	1	40009.01	0008.01	N32:8/14	0008.01	3	RHR	HOLDING REG						I65ZLO151			G0008	QLCGPIN 901	A8H	150H	I65ZLO151	336 (150H)
255	I65LAHH151	1	40008.15	0007.15	N32:7/0	0007.15	3	RHR	HOLDING REG						I65LAHH151			G0007	QLCGPIN 901	A8H	150H	I65LAHH151	336 (150H)
256																							
257																							
258																							

Appendix B3
Existing Pump Data Communicated

PLC DATABASE				DCS DATABASE																	
Address	Symbol	Scope	Description	DCS ORDER	PTID	RT	TB	BB	ENGLISH DESCRIPTION	EU/ST	EV/RS	SOURCE	CD	HW	AP	LC	HL/AR	LL/BP	CV	CI	CHARST
N32:1/13	I65FAL101	Global	Pump 101 Seal Water Flow Normal																		
N32:1/14	I65PAH101	Global	Pump 101 Discharge Pressure Normal	30	I65PAH101	DL			PMP101 DSCH PRS HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A101MPA-
N32:1/15	I65PAHH101	Global	Pump 101 Discharge Pressure Normal	31	I65PAHH101	DL			PMP101 DSCH PRS HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A101MPA-
N32:2/0	I65PAL101	Global	Pump 101 Suction Pressure Normal	32	I65PAL101	DL			PMP101 SUCTION PRS LOW	NORMAL	LOW	PLC	67	0000	0	1	0	0	0	0	A101MPA-
N32:2/1	I65PALL101	Global	Pump 101 Suction Pressure Normal	33	I65PALL101	DL			PMP101 SUCTION PRS LOLO	NORMAL	LO-LO	PLC	67	0000	1	1	0	0	0	0	A101MPA-
N32:2/2	I65VAH101A	Global	Pump 101 Upper Bearing Vibration Normal	34	I65VAH101A	DL			PMP101 UP BEARING VIB HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A101MVA-
N32:2/3	I65VAH101B	Global	Pump 101 Lower Bearing Vibration Normal	35	I65VAH101B	DL			PMP101 LO BEARING VIB HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A101MVA-
N32:2/4	I65VAHH101A	Global	Pump 101 Upper Bearing Vibration Normal	36	I65VAHH101A	DL			PMP101 UP BEARING VIB HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A101MVA-
N32:2/5	I65VAHH101B	Global	Pump 101 Lower Bearing Vibration Normal	37	I65VAHH101B	DL			PMP101 LO BEARING VIB HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A101MVA-
N32:2/6	I65YA101A	Global	Pump 101 Fail To Start	38	I65YA101A	DL			PMP101 FAIL TO RUN	FTRUN	NORMAL	PLC	67	0000	2	1	1	0	0	0	A101MYA-
N32:2/7	I65YA101B	Global	Pump 101 Fail To Stop	39	I65YA101B	DL			PMP101 FAIL TO STOP	FTSTP	NORMAL	PLC	67	0000	2	1	1	0	0	0	A101MYA-
N32:2/8	I65YA101C	Global	Pump 101 Discharge Valve Normal	40	I65YA101C	DL			PMP101 DSCH CHECK VLV FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A101MYA-
N32:2/10	I65YA101E	Global	Pump 101 Normal	42	I65YA101E	DL			PMP101 AB SHTDWN	NORMAL	SHTDWN	PLC	67	0000	2	1	0	0	0	0	A101MYA-
N32:2/12	I65YL101B	Global	Pump 101 Lead	44	I65YL101B	DL			PMP101 LD-LAG STAT	LEAD	LAG	PLC	67	0000	0	0	0	0	0	0	A101MYQ-
N32:2/13	I65YL101C	Global	Pump 101 Out Of Service	45	I65YL101C	DL			PMP101 SVC MODE STAT	OUTSVC	INSVC	PLC	67	0000	0	0	0	0	0	0	A101MYQ-
N32:2/14	I65YL101D	Global	Pump 101 PLC Control	46	I65YL101D	DL			PMP101 CNTRL MODE STAT	PLC	DCS	PLC	67	0000	0	0	0	0	0	0	A101MYQ-
N32:2/15	I65YL101E	Global	Pump 101 Available	47	I65YL101E	DL			PMP101 AVAIL	AVAIL	NAVAIL	PLC	67	0000	0	0	0	0	0	0	A101MYQ-
N32:3/3	I65FAL102	Global	Pump 102 Seal Water Flow Normal																		
N32:3/4	I65PAH102	Global	Pump 102 Discharge Pressure Normal	52	I65PAH102	DL			PMP102 DSCH PRS HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A102MPA-
N32:3/5	I65PAHH102	Global	Pump 102 Discharge Pressure Normal	53	I65PAHH102	DL			PMP102 DSCH PRS HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A102MPA-
N32:3/6	I65PAL102	Global	Pump 102 Suction Pressure Normal	54	I65PAL102	DL			PMP102 SUCTION PRS LOW	NORMAL	LOW	PLC	67	0000	0	1	0	0	0	0	A102MPA-
N32:3/7	I65PALL102	Global	Pump 102 Suction Pressure Normal	55	I65PALL102	DL			PMP102 SUCTION PRS LOLO	NORMAL	LO-LO	PLC	67	0000	1	1	0	0	0	0	A102MPA-
N32:3/8	I65VAH102A	Global	Pump 102 Upper Bearing Vibration Normal	56	I65VAH102A	DL			PMP102 UP BEARING VIB HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A102MVA-
N32:3/9	I65VAH102B	Global	Pump 102 Lower Bearing Vibration Normal	57	I65VAH102B	DL			PMP102 LO BEARING VIB HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A102MVA-
N32:3/10	I65VAHH102A	Global	Pump 102 Upper Bearing Vibration Normal	58	I65VAHH102A	DL			PMP102 UP BEARING VIB HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A102MVA-
N32:3/11	I65VAHH102B	Global	Pum 102 Lower Bearing Vibration Normal	59	I65VAHH102B	DL			PMP102 LO BEARING VIB HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A102MVA-
N32:3/12	I65YA102A	Global	Pump 102 Fail To Start	60	I65YA102A	DL			PMP102 FAIL TO RUN	FTRUN	NORMAL	PLC	67	0000	2	1	1	0	0	0	A102MYA-
N32:3/13	I65YA102B	Global	Pump 102 Fail To Stop	61	I65YA102B	DL			PMP102 FAIL TO STOP	FTSTP	NORMAL	PLC	67	0000	2	1	1	0	0	0	A102MYA-
N32:3/14	I65YA102C	Global	Pump 102 Discharge Valve Normal	62	I65YA102C	DL			PMP102 DSCH CHECK VLV FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A102MYA-
N32:4/0	I65YA102E	Global	Pump 102 Normal	64	I65YA102E	DL			PMP102 AB SHTDWN	NORMAL	SHTDWN	PLC	67	0000	2	1	0	0	0	0	A102MYA-
N32:4/2	I65YL102B	Global	Pump 102 Lead	66	I65YL102B	DL			PMP102 LD-LAG STAT	LEAD	LAG	PLC	67	0000	0	0	0	0	0	0	A102MYQ-
N32:4/3	I65YL102C	Global	Pump 102 Out Of Service	67	I65YL102C	DL			PMP102 SVC MODE STAT	OUTSCV	INSVC	PLC	67	0000	0	0	0	0	0	0	A102MYQ-
N32:4/4	I65YL102D	Global	Pump 102 PLC Control	68	I65YL102D	DL			PMP102 CNTRL MODE STAT	PLC	DCS	PLC	67	0000	0	0	0	0	0	0	A102MYQ-
N32:4/5	I65YL102E	Global	Pump 102 Available	69	I65YL102E	DL			PMP102 AVAIL	AVAIL	NAVAIL	PLC	67	0000	0	0	0	0	0	0	A102MYQ-
N32:4/9	I65FAL103	Global	Pump 103 Seal Water Flow Normal																		
N32:4/10	I65PAH103	Global	Pump 103 Discharge Pressure Normal	74	I65PAH103	DL			PMP103 DSCH PRS HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A103MPA-
N32:4/11	I65PAHH103	Global	Pump 103 Discharge Pressure Normal	75	I65PAHH103	DL			PMP103 DSCH PRS HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A103MPA-
N32:4/12	I65PAL103	Global	Pump 103 Suction Pressure Normal	76	I65PAL103	DL			PMP103 SUCTION PRS LOW	NORMAL	LOW	PLC	67	0000	0	1	0	0	0	0	A103MPA-
N32:4/13	I65PALL103	Global	Pump 103 Suction Pressure Normal	77	I65PALL103	DL			PMP103 SUCTION PRS LOLO	NORMAL	LO-LO	PLC	67	0000	1	1	0	0	0	0	A103MPA-
N32:4/14	I65VAH103A	Global	Pump 103 Upper Bearing Vibration Normal	78	I65VAH103A	DL			PMP103 UP BEARING VIB HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A103MVA-
N32:4/15	I65VAH103B	Global	Pump 103 Lower Bearing Vibration Normal	79	I65VAH103B	DL			PMP103 LO BEARING VIB HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A103MVA-
N32:5/0	I65VAHH103A	Global	Pump 103 Upper Bearing Vibration Normal	80	I65VAHH103A	DL			PMP103 UP BEARING VIB HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A103MVA-
N32:5/1	I65VAHH103B	Global	Pump 103 Lower Bearing Vibration Normal	81	I65VAHH103B	DL			PMP103 LO BEARING VIB HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A103MVA-
N32:5/2	I65YA103A	Global	Pump 103 Fail To Start	82	I65YA103A	DL			PMP103 FAIL TO RUN	FTRUN	NORMAL	PLC	67	0000	2	1	1	0	0	0	A103MYA-
N32:5/3	I65YA103B	Global	Pump 103 Fail To Stop	83	I65YA103B	DL			PMP103 FAIL TO STOP	FTSTP	NORMAL	PLC	67	0000	2	1	1	0	0	0	A103MYA-
N32:5/4	I65YA103C	Global	Pump 103 Discharge Valve Normal	84	I65YA103C	DL			PMP103 DSCH CHECK VLV FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A103MYA-
N32:5/6	I65YA103E	Global	Pump 103 Normal	86	I65YA103E	DL			PMP103 AB SHTDWN	NORMAL	SHTDWN	PLC	67	0000	2	1	0	0	0	0	A103MYA-
N32:5/8	I65YL103B	Global	Pump 103 Lead	88	I65YL103B	DL			PMP103 LD-LAG STAT	LEAD	LAG	PLC	67	0000	0	0	0	0	0	0	A103MYQ-
N32:5/9	I65YL103C	Global	Pump 103 Out Of Service	89	I65YL103C	DL			PMP103 SVC MODE STAT	OUTSVC	INSVC	PLC	67	0000	0	0	0	0	0	0	A103MYQ-
N32:5/10	I65YL103D	Global	Pump 103 PLC Control	90	I65YL103D	DL			PMP103 CNTRL MODE STAT	PLC	DCS	PLC	67	0000	0	0	0	0	0	0	A103MYQ-
N32:5/11	I65YL103E	Global	Pump 103 Available	91	I65YL103E	DL			PMP103 AVAIL	AVAIL	NAVAIL	PLC	67	0000	0	0	0	0	0	0	A103MYQ-
N32:5/15	I65FAL104	Global	Pump 104 Seal Water Flow Normal																		
N32:6/0	I65PAH104	Global	Pump 104 Discharge Pressure Normal	96	I65PAH104	DL			PMP104 DSCH PRS HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A104MPA-
N32:6/1	I65PAHH104	Global	Pump 104 Discharge Pressure Normal	97	I65PAHH104	DL			PMP104 DSCH PRS HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A104MPA-
N32:6/2	I65PAL104	Global	Pump 104 Suction Pressure Normal	98	I65PAL104	DL			PMP104 SUCTION PRS LOW	NORMAL	LOW	PLC	67	0000	0	1	0	0	0	0	A104MPA-
N32:6/3	I65PALL104	Global	Pump 104 Suction Pressure Normal	99	I65PALL104	DL			PMP104 SUCTION PRS LOLO	NORMAL	LO-LO	PLC	67	0000	1	1	0	0	0	0	A104MPA-
N32:6/4	I65VAH104A	Global	Pump 104 Upper Bearing Vibration Normal	100	I65VAH104A	DL			PMP104 UP BEARING VIB HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A104MVA-
N32:6/5	I65VAH104B	Global	Pump 104 Lower Bearing Vibration Normal	101	I65VAH104B	DL			PMP104 LO BEARING VIB HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A104MVA-
N32:6/6	I65VAHH104A	Global	Pump104 Upper Bearing Vibration Normal	102	I65VAHH104A	DL			PMP104 UP BEARING VIB HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A104MVA-
N32:6/7	I65VAHH104B	Global	Pump 104 Lower Bearing Vibration Normal	103	I65VAHH104B	DL			PMP104 LO BEARING VIB HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A104MVA-
N32:6/8	I65YA104A	Global	Pump 104 Fail To Start	104	I65YA104A	DL			PMP104 FAIL TO RUN	FTRUN	NORMAL	PLC	67	0000	2	1	1	0	0	0	A104MYA-
N32:6/9	I65YA104B	Global	Pump 104 Fail To Stop	105	I65YA104B	DL			PMP104 FAIL TO STOP	FTSTP	NORMAL	PLC	67	0000	2	1	1	0	0	0	A104MYA-
N32:6/10	I65YA104C	Global	Pump 104 Discharge Valve Normal	106	I65YA104C	DL			PMP104 DSCH CHECK VLV FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A104MYA-
N32:6/12	I65YA104E	Global	Pump 104 Normal	108	I65YA104E	DL			PMP104 AB SHTDWN	NORMAL	SHTDWN	PLC	67	0000	2	1	0	0	0	0	A104MYA-
N32:6/14	I65YL104B	Global	Pump 104 Lead	110	I65YL104B	DL			PMP104 LD-LAG STAT	LEAD	LAG	PLC	67	0000	0	0	0	0	0	0	A104MYQ-
N32:6/15	I65YL104C	Global	Pump 104 Out Of Service	111	I65YL104C	DL			PMP104 SVC MODE STAT	OUTSVC	INSVC	PLC	67	0000	0	0	0	0	0	0	A104MYQ-
N32:7/0	I65YL104D	Global	Pump 104 PLC Control	112	I65YL104D	DL			PMP104 CNTRL MODE STAT	PLC	DCS	PLC	67	0000	0	0	0	0	0	0	A104MYQ-
N32:7/1	I65YL104E	Global	Pump 104 Available	113	I65YL104E	DL			PMP104 AVAIL	AVAIL	NAVAIL	PLC	67	0000	0	0	0	0	0	0	A104MYQ-
N32:56	I65LY100A	Global	Lead 150 HP Pump Start Setpoint	181	I65LY100A	AI	20	0	150 HP LD PMP STRT STPNT	FEET	-	PLC	67	0000	0	0	0	0	0	0	A100ZLQ-
N32:58	I65LY100B	Global	Lead 150 HP Pump Stop Setpoint	182	I65LY100B	AI	20	0	150 HP LD PMP STP STPNT	FEET	-	PLC	67	0000	0	0	0	0	0	0	A100ZLQ-
N32:60	I65LY100C	Global	Lag 150 HP Pump Start Setpoint	183	I65LY100C	AI	20	0	150 HP LAG PMP STRT STPNT	FEET	-	PLC	67	0000	0	0	0	0	0	0	A100ZLQ-
N32:62	I65LY100D	Global	Lag 150 HP Pump Stop Setpoint	184	I65LY100D	AI	20	0	150 HP LAG PMP STP STPNT	FEET	-	PLC	67	0000	0	0	0	0	0	0	A100ZLQ-
N32:64	I65LY100E	Global	Lead 400 HP Pump Start Setpoint	185	I65LY100E	AI	20	0	400 HP LD PMP STRT STPNT	FEET	-	PLC	67	0000	0	0	0	0	0	0	A100ZLQ-
N32:66	I65LY100F	Global	Lead 400 HP Pump Stop Setpoint	186	I65LY100F	AI	20	0	400 HP LD PMP STP STPNT	FEET	-	PLC	67	0000	0	0	0	0	0	0	A100ZLQ-
N32:68	I65LY100G	Global	Lag 400 HP Pump Start Setpoint	187	I65LY100G	AI	20	0	400 HP LAG PMP STRT STPNT	FEET	-	PLC	67	0000	0	0	0	0	0	0	A100ZLQ-
N32:70	I65LY100H	Global	Lag 400 HP Pump Stop Setpoint	188	I65LY100H	AI	20	0	400 HP LAG PMP STP STPNT	FEET	-	PLC	67	0000	0	0	0	0	0	0	A100ZLQ-
N32:72	I65KI101	Global	Pump 101 Run Time	189	I65KI101	AI	32767	0	PMP101 ACCUM RUNTIME	HRS	-	PLC	67	0000	0	0	0	0	0	0	A101MKQ-
N32:98	I65KI102	Global	Pump 102 Run Time	202	I65KI102	AI	32767	0	PMP102 ACCUM RUNTIME	HRS	-	PLC	67	0000	0	0	0	0	0	0	A102MKQ-
N32:124	I65KI103	Global	Pump 103 Run Time	215	I65KI103	AI	32767	0	PMP103 ACCUM RUNTIME	HRS	-	PLC	67	0000	0	0	0	0	0	0	A103MKQ-
N32:150	I65KI104	Global	Pump 104 Run Time	228	I65KI104	AI	32767	0	PMP104 ACCUM RUNTIME	HRS	-	PLC	67	0000	0	0	0	0	0	0	A104MKQ-
N33:0/2	I65HS101A	Global	Pump 101 Lead 150 HP	249	I65HS101A	DC			PMP101 LD-LAG SELECT	LEAD	LAG	DCS	67	0000	0	0	0	0	0	0	A101MHQ-
N33:0/3	I65HS101B	Global	Pump 101 PLC Control	250	I65HS101B	DC			PMP101 CNTRL MODE	AUTO	MANUAL	DCS	67	0000	0	0	0	0	0	0	A101MHQ-
N33:0/4	I65HS101C	Global	Pump 101 DCS Manual Start																		
N33:0/5	I65HS101D	Global	Pump 101 Out Of Service	252	I65HS101D	DC			PMP101 SVC MODE CMD	OUTSVC	INSVC	DCS	67	0000	0	0	0	0	0	0	A101MHQ-
N33:0/6	I65HS101E	Global	Pump 101 Reset	253	I65HS101E	DC			PMP101 AB SHTDWN RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A101MHQ-
N33:0/7	I65HS101F	Global	Pump 101 Reset Run Time Meter	254	I65HS101F	DC			PMP101 ACCUM RUNTIME RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A101MHQ-
N33:0/8	I65HS102A	Global	Pump 102 PLC Control	255	I65HS102A	DC			PMP102 CNTRL MODE	AUTO	MANUAL	DCS	67	0000	0	0	0	0	0	0	A102MHQ-
N33:0/9	I65HS102B	Global	Pump 102 DCS Manual Start																		
N33:0/10	I65HS102C	Global	Pump 102 Out Of Service	257	I65HS102C	DC			PMP102 SVC MODE CMD	OUTSVC	INSVC	DCS	67	0000	0	0	0	0	0	0	A102MHQ-
N33:0/11	I65HS102D	Global	Pump 102 Reset	258	I65HS102D	DC			PMP102 AB SHTDWN RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A102MHQ-

Appendix B3
Existing Pump Data Communicated

PLC DATABASE				DCS DATABASE																	
Address	Symbol	Scope	Description	DCS ORDER	PTID	RT	TB	BB	ENGLISH DESCRIPTION	EU/ST	EV/RS	SOURCE	CD	HW	AP	LC	HL/AR	LL/BP	CV	CI	CHARST
N33:0/12	I65HS102E	Global	Pump 102 Reset Run Time Meter	259	I65HS102E	DC			PMP102 ACCUM RUNTIME RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A102MHQ-
N33:0/13	I65HS103A	Global	Pump 103 Lead 400 HP	260	I65HS103A	DC			PMP103 LD-LAG SELECT	LEAD	LAG	DCS	67	0000	0	0	0	0	0	0	A103MHQ-
N33:0/14	I65HS103B	Global	Pump 103 PLC Control	261	I65HS103B	DC			PMP103 CNTRL MODE	AUTO	MANUAL	DCS	67	0000	0	0	0	0	0	0	A103MHQ-
N33:0/15	I65HS103C	Global	Pump 103 DCS Manual Start																		
N33:1/0	I65HS103D	Global	Pump 103 Out Of Service	263	I65HS103D	DC			PMP103 SVC MODE CMD	OUTSVC	INSVC	DCS	67	0000	0	0	0	0	0	0	A103MHQ-
N33:1/1	I65HS103E	Global	Pump 103 Reset	264	I65HS103E	DC			PMP103 AB SHTDWN RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A103MHQ-
N33:1/2	I65HS103F	Global	Pump 103 Reset Run Time Meter	265	I65HS103F	DC			PMP103 ACCUM RUNTIME RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A103MHQ-
N33:1/3	I65HS104A	Global	Pump 104 PLC Control	266	I65HS104A	DC			PMP104 CNTRL MODE	AUTO	MANUAL	DCS	67	0000	0	0	0	0	0	0	A104MHQ-
N33:1/4	I65HS104B	Global	Pump 104 DCS Manual Start																		
N33:1/5	I65HS104C	Global	Pump 104 Out Of Service	268	I65HS104C	DC			PMP104 SVC MODE CMD	OUTSVC	INSVC	DCS	67	0000	0	0	0	0	0	0	A104MHQ-
N33:1/6	I65HS104D	Global	Pump 104 Reset	269	I65HS104D	DC			PMP104 AB SHTDWN RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A104MHQ-
N33:1/7	I65HS104E	Global	Pump 104 Reset Run Time Meter	270	I65HS104E	DC			PMP104 ACCUM RUNTIME RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A104MHQ-
N33:50	I65LC100A	Global	Lead 150 HP Start Setpoint	288	I65LC100A	AL	20	0	150 HP LD PMP STRT STPNT DMND	FEET	-	DCS	67	0000	0	0	0	0	0	0	A100ZLQ-
N33:52	I65LC100B	Global	Lead 150 HP Stop Setpoint	289	I65LC100B	AL	20	0	150 HP LD PMP STP STPNT DMND	FEET	-	DCS	67	0000	0	0	0	0	0	0	A100ZLQ-
N33:54	I65LC100C	Global	Lag 150 HP Start Setpoint	290	I65LC100C	AL	20	0	150 HP LAG PMP STRT STPNT DMND	FEET	-	DCS	67	0000	0	0	0	0	0	0	A100ZLQ-
N33:56	I65LC100D	Global	Lag 150 HP Stop Setpoint	291	I65LC100D	AL	20	0	150 HP LAG PMP STP STPNT DMND	FEET	-	DCS	67	0000	0	0	0	0	0	0	A100ZLQ-
N33:58	I65LC100E	Global	Lead 400 HP Start Setpoint	292	I65LC100E	AL	20	0	400 HP LD PMP STRT STPNT DMND	FEET	-	DCS	67	0000	0	0	0	0	0	0	A100ZLQ-
N33:60	I65LC100F	Global	Lead 400 HP Stop Setpoint	293	I65LC100F	AL	20	0	400 HP LD PMP STP STPNT DMND	FEET	-	DCS	67	0000	0	0	0	0	0	0	A100ZLQ-
N33:62	I65LC100G	Global	Lag 400 HP Start Setpoint	294	I65LC100G	AL	20	0	400 HP LAG PMP STRT STPNT DMND	FEET	-	DCS	67	0000	0	0	0	0	0	0	A100ZLQ-
N33:64	I65LC100H	Global	Lag 400 HP Stop Setpoint	295	I65LC100H	AL	20	0	400 HP LAG PMP STP STPNT DMND	FEET	-	DCS	67	0000	0	0	0	0	0	0	A100ZLQ-

Appendix B3
Existing Pump Data Communicated

DCS DATABASE																						
DCS ORDER	GP	QC	SL	CUST6/ COMMENTS	LOOP NO	PTID	MODBUS NODE	MODBUS REG	OFFSET MODBUS ADDR	PLC REG/ADDR	PROSOFT REG/ADDR	FC	MNEMONIC	REG TYPE	Eng Units Being Sent	CONVERSION TYPE	CONVERSION CODE	GAIN	BIAS	PTID	Eng Value at 32-bit Signed Integer "-16K"	Eng Value at 32-bit Signed Integer "+16K"
					100																	
30	01	1	03		101	I65PAH101	1	40002.14	0001.14	N32:1/1	0001.14	3	RHR	HOLDING REG						I65PAH101		
31	01	1	03		101	I65PAHH101	1	40002.15	0001.15	N32:1/0	0001.15	3	RHR	HOLDING REG						I65PAHH101		
32	01	1	03		101	I65PAL101	1	40003.00	0002.00	N32:2/15	0002.00	3	RHR	HOLDING REG						I65PAL101		
33	01	1	03		101	I65PALL101	1	40003.01	0002.01	N32:2/14	0002.01	3	RHR	HOLDING REG						I65PALL101		
34	01	1	03		101	I65VAH101A	1	40003.02	0002.02	N32:2/13	0002.02	3	RHR	HOLDING REG						I65VAH101A		
35	01	1	03		101	I65VAH101B	1	40003.03	0002.03	N32:2/12	0002.03	3	RHR	HOLDING REG						I65VAH101B		
36	01	1	03		101	I65VAHH101A	1	40003.04	0002.04	N32:2/11	0002.04	3	RHR	HOLDING REG						I65VAHH101A		
37	01	1	03		101	I65VAHH101B	1	40003.05	0002.05	N32:2/10	0002.05	3	RHR	HOLDING REG						I65VAHH101B		
38	01	1	03		101	I65YA101A	1	40003.06	0002.06	N32:2/9	0002.06	3	RHR	HOLDING REG						I65YA101A		
39	01	1	03		101	I65YA101B	1	40003.07	0002.07	N32:2/8	0002.07	3	RHR	HOLDING REG						I65YA101B		
40	01	1	03		101	I65YA101C	1	40003.08	0002.08	N32:2/7	0002.08	3	RHR	HOLDING REG						I65YA101C		
42	01	1	03		101	I65YA101E	1	40003.10	0002.10	N32:2/5	0002.10	3	RHR	HOLDING REG						I65YA101E		
44	01	1	03		101	I65YL101B	1	40003.12	0002.12	N32:2/3	0002.12	3	RHR	HOLDING REG						I65YL101B		
45	01	1	03		101	I65YL101C	1	40003.13	0002.13	N32:2/2	0002.13	3	RHR	HOLDING REG						I65YL101C		
46	01	1	03		101	I65YL101D	1	40003.14	0002.14	N32:2/1	0002.14	3	RHR	HOLDING REG						I65YL101D		
47	01	1	03		101	I65YL101E	1	40003.15	0002.15	N32:2/0	0002.15	3	RHR	HOLDING REG						I65YL101E		
					102																	
52	01	1	03		102	I65PAH102	1	40004.04	0003.04	N32:3/11	0003.04	3	RHR	HOLDING REG						I65PAH102		
53	01	1	03		102	I65PAHH102	1	40004.05	0003.05	N32:3/10	0003.05	3	RHR	HOLDING REG						I65PAHH102		
54	01	1	03		102	I65PAL102	1	40004.06	0003.06	N32:3/9	0003.06	3	RHR	HOLDING REG						I65PAL102		
55	01	1	03		102	I65PALL102	1	40004.07	0003.07	N32:3/8	0003.07	3	RHR	HOLDING REG						I65PALL102		
56	01	1	03		102	I65VAH102A	1	40004.08	0003.08	N32:3/7	0003.08	3	RHR	HOLDING REG						I65VAH102A		
57	01	1	03		102	I65VAH102B	1	40004.09	0003.09	N32:3/6	0003.09	3	RHR	HOLDING REG						I65VAH102B		
58	01	1	03		102	I65VAHH102A	1	40004.10	0003.10	N32:3/5	0003.10	3	RHR	HOLDING REG						I65VAHH102A		
59	01	1	03		102	I65VAHH102B	1	40004.11	0003.11	N32:3/4	0003.11	3	RHR	HOLDING REG						I65VAHH102B		
60	01	1	03		102	I65YA102A	1	40004.12	0003.12	N32:3/3	0003.12	3	RHR	HOLDING REG						I65YA102A		
61	01	1	03		102	I65YA102B	1	40004.13	0003.13	N32:3/2	0003.13	3	RHR	HOLDING REG						I65YA102B		
62	01	1	03		102	I65YA102C	1	40004.14	0003.14	N32:3/1	0003.14	3	RHR	HOLDING REG						I65YA102C		
64	01	1	03		102	I65YA102E	1	40005.00	0004.00	N32:4/15	0004.00	3	RHR	HOLDING REG						I65YA102E		
66	01	1	03		102	I65YL102B	1	40005.02	0004.02	N32:4/13	0004.02	3	RHR	HOLDING REG						I65YL102B		
67	01	1	03		102	I65YL102C	1	40005.03	0004.03	N32:4/12	0004.03	3	RHR	HOLDING REG						I65YL102C		
68	01	1	03		102	I65YL102D	1	40005.04	0004.04	N32:4/11	0004.04	3	RHR	HOLDING REG						I65YL102D		
69	01	1	03		102	I65YL102E	1	40005.05	0004.05	N32:4/10	0004.05	3	RHR	HOLDING REG						I65YL102E		
					103																	
74	01	1	03		103	I65PAH103	1	40005.10	0004.10	N32:4/5	0004.10	3	RHR	HOLDING REG						I65PAH103		
75	01	1	03		103	I65PAHH103	1	40005.11	0004.11	N32:4/4	0004.11	3	RHR	HOLDING REG						I65PAHH103		
76	01	1	03		103	I65PAL103	1	40005.12	0004.12	N32:4/3	0004.12	3	RHR	HOLDING REG						I65PAL103		
77	01	1	03		103	I65PALL103	1	40005.13	0004.13	N32:4/2	0004.13	3	RHR	HOLDING REG						I65PALL103		
78	01	1	03		103	I65VAH103A	1	40005.14	0004.14	N32:4/1	0004.14	3	RHR	HOLDING REG						I65VAH103A		
79	01	1	03		103	I65VAH103B	1	40005.15	0004.15	N32:4/0	0004.15	3	RHR	HOLDING REG						I65VAH103B		
80	01	1	03		103	I65VAHH103A	1	40006.00	0005.00	N32:5/15	0005.00	3	RHR	HOLDING REG						I65VAHH103A		
81	01	1	03		103	I65VAHH103B	1	40006.01	0005.01	N32:5/14	0005.01	3	RHR	HOLDING REG						I65VAHH103B		
82	01	1	03		103	I65YA103A	1	40006.02	0005.02	N32:5/13	0005.02	3	RHR	HOLDING REG						I65YA103A		
83	01	1	03		103	I65YA103B	1	40006.03	0005.03	N32:5/12	0005.03	3	RHR	HOLDING REG						I65YA103B		
84	01	1	03		103	I65YA103C	1	40006.04	0005.04	N32:5/11	0005.04	3	RHR	HOLDING REG						I65YA103C		
86	01	1	03		103	I65YA103E	1	40006.06	0005.06	N32:5/9	0005.06	3	RHR	HOLDING REG						I65YA103E		
88	01	1	03		103	I65YL103B	1	40006.08	0005.08	N32:5/7	0005.08	3	RHR	HOLDING REG						I65YL103B		
89	01	1	03		103	I65YL103C	1	40006.09	0005.09	N32:5/6	0005.09	3	RHR	HOLDING REG						I65YL103C		
90	01	1	03		103	I65YL103D	1	40006.10	0005.10	N32:5/5	0005.10	3	RHR	HOLDING REG						I65YL103D		
91	01	1	03		103	I65YL103E	1	40006.11	0005.11	N32:5/4	0005.11	3	RHR	HOLDING REG						I65YL103E		
					104																	
96	01	1	03		104	I65PAH104	1	40007.00	0006.00	N32:6/15	0006.00	3	RHR	HOLDING REG						I65PAH104		
97	01	1	03		104	I65PAHH104	1	40007.01	0006.01	N32:6/14	0006.01	3	RHR	HOLDING REG						I65PAHH104		
98	01	1	03		104	I65PAL104	1	40007.02	0006.02	N32:6/13	0006.02	3	RHR	HOLDING REG						I65PAL104		
99	01	1	03		104	I65PALL104	1	40007.03	0006.03	N32:6/12	0006.03	3	RHR	HOLDING REG						I65PALL104		
100	01	1	03		104	I65VAH104A	1	40007.04	0006.04	N32:6/11	0006.04	3	RHR	HOLDING REG						I65VAH104A		
101	01	1	03		104	I65VAH104B	1	40007.05	0006.05	N32:6/10	0006.05	3	RHR	HOLDING REG						I65VAH104B		
102	01	1	03		104	I65VAHH104A	1	40007.06	0006.06	N32:6/9	0006.06	3	RHR	HOLDING REG						I65VAHH104A		
103	01	1	03		104	I65VAHH104B	1	40007.07	0006.07	N32:6/8	0006.07	3	RHR	HOLDING REG						I65VAHH104B		
104	01	1	03		104	I65YA104A	1	40007.08	0006.08	N32:6/7	0006.08	3	RHR	HOLDING REG						I65YA104A		
105	01	1	03		104	I65YA104B	1	40007.09	0006.09	N32:6/6	0006.09	3	RHR	HOLDING REG						I65YA104B		
106	01	1	03		104	I65YA104C	1	40007.10	0006.10	N32:6/5	0006.10	3	RHR	HOLDING REG						I65YA104C		
108	01	1	03		104	I65YA104E	1	40007.12	0006.12	N32:6/3	0006.12	3	RHR	HOLDING REG						I65YA104E		
110	01	1	03		104	I65YL104B	1	40007.14	0006.14	N32:6/1	0006.14	3	RHR	HOLDING REG						I65YL104B		
111	01	1	03		104	I65YL104C	1	40007.15	0006.15	N32:6/0	0006.15	3	RHR	HOLDING REG						I65YL104C		
112	01	1	03		104	I65YL104D	1	40008.00	0007.00	N32:7/15	0007.00	3	RHR	HOLDING REG						I65YL104D		
113	01	1	03		104	I65YL104E	1	40008.01	0007.01	N32:7/14	0007.01	3	RHR	HOLDING REG						I65YL104E		
181	01	1	03		100	I65LY100A	1	40057	0056	N32:56	0056	3	RHR	HOLDING REG	FEET	LINEAR	1	1	0	I65LY100A	16/32 Signed/Unsigned	16/32 Signed/Uns
182	01	1	03		100	I65LY100B	1	40059	0058	N32:58	0058	3	RHR	HOLDING REG	FEET	LINEAR	1	1	0	I65LY100B	16/32 Signed/Unsigned	16/32 Signed/Uns
183	01	1	03		100	I65LY100C	1	40061	0060	N32:60	0060	3	RHR	HOLDING REG	FEET	LINEAR	1	1	0	I65LY100C	16/32 Signed/Unsigned	16/32 Signed/Uns
184	01	1	03		100	I65LY100D	1	40063	0062	N32:62	0062	3	RHR	HOLDING REG	FEET	LINEAR	1	1	0	I65LY100D	16/32 Signed/Unsigned	16/32 Signed/Uns
185	01	1	03		100	I65LY100E	1	40065	0064	N32:64	0064	3	RHR	HOLDING REG	FEET	LINEAR	1	1	0	I65LY100E	16/32 Signed/Unsigned	16/32 Signed/Uns
186	01	1	03		100	I65LY100F	1	40067	0066	N32:66	0066	3	RHR	HOLDING REG	FEET	LINEAR	1	1	0	I65LY100F	16/32 Signed/Unsigned	16/32 Signed/Uns
187	01	1	03		100	I65LY100G	1	40069	0068	N32:68	0068	3	RHR	HOLDING REG	FEET	LINEAR	1	1	0	I65LY100G	16/32 Signed/Unsigned	16/32 Signed/Uns
188	01	1	03		100	I65LY100H	1	40071	0070	N32:70	0070	3	RHR	HOLDING REG	FEET	LINEAR	1	1	0	I65LY100H	16/32 Signed/Unsigned	16/32 Signed/Uns
189	01	1	03		101	I65KI101	1	40073	0072	N32:72	0072	3	RHR	HOLDING REG	HRS	LINEAR	1	1	0	I65KI101	16/32 Signed/Unsigned	16/32 Signed/Uns
202	01	1	03		102	I65KI102	1	40099	0098	N32:98	0098	3	RHR	HOLDING REG	HRS	LINEAR	1	1	0	I65KI102	16/32 Signed/Unsigned	16/32 Signed/Uns
215	01	1	03		103	I65KI103	1	40125	0124	N32:124	0124	3	RHR	HOLDING REG	HRS	LINEAR	1	1	0	I65KI103	16/32 Signed/Unsigned	16/32 Signed/Uns
228	01	1	03		104	I65KI104	1	40151	0150	N32:150	0150	3	RHR	HOLDING REG	HRS	LINEAR	1	1	0	I65KI104	16/32 Signed/Unsigned	16/32 Signed/Uns
249	01	1	03		101	I65HS101A	1	40251.02	0250.02	N33:0/13	0250.02	16	PMR	HOLDING REG						I65HS101A		
250	01	1	03		101	I65HS101B	1	40251.03	0250.03	N33:0/12	0250.03	16	PMR	HOLDING REG						I65HS101B		
252	01	1	03		101	I65HS101D	1	40251.05	0250.05	N33:0/10	0250.05	16	PMR	HOLDING REG						I65HS101D		
253	01	1	03		101	I65HS101E	1	40251.06	0250.06	N33:0/9	0250.06	16	PMR	HOLDING REG						I65HS101E		
254	01	1	03		101	I65HS101F	1	40251.07	0250.07	N33:0/8	0250.07	16	PMR	HOLDING REG						I65HS101F		
255	01	1	03		102	I65HS102A	1	40251.08	0250.08	N33:0/7	0250.08	16	PMR	HOLDING REG						I65HS102A		
257	01	1	03		102	I65HS102C	1	40251.10	0250.10	N33:0/5	0250.10	16	PMR	HOLDING REG						I65HS102C		
258	01	1	03		102	I65HS102D	1	40251.11	0250.11	N33:0/4	0250.11	16	PMR	HOLDING REG						I65HS102D		

Appendix B3
Existing Pump Data Communicated

DCS DATABASE																					
DCS ORDER	GP	QC	SL	CUST6/ COMMENTS	LOOP NO	PTID	MODBUS NODE	MODBUS REG	OFFSET MODBUS ADDR	PLC REG/ADDR	PROSOFT REG/ADDR	FC	MNEMONIC	REG TYPE	Eng Units Being Sent	CONVERSION TYPE	CONVERSION CODE	GAIN	BIAS	PTID	Eng Value at 32-bit Signed Integer "-16K"	Eng Value at 32-bit Signed Integer "+16K"
259	01	1	03		102	I65HS102E	1	40251.12	0250.12	N33:0/3	0250.12	16	PMR	HOLDING REG						I65HS102E		
260	01	1	03		103	I65HS103A	1	40251.13	0250.13	N33:0/2	0250.13	16	PMR	HOLDING REG						I65HS103A		
261	01	1	03		103	I65HS103B	1	40251.14	0250.14	N33:0/1	0250.14	16	PMR	HOLDING REG						I65HS103B		
263	01	1	03		103	I65HS103D	1	40252.00	0251.00	N33:1/15	0251.00	16	PMR	HOLDING REG						I65HS103D		
264	01	1	03		103	I65HS103E	1	40252.01	0251.01	N33:1/14	0251.01	16	PMR	HOLDING REG						I65HS103E		
265	01	1	03		103	I65HS103F	1	40252.02	0251.02	N33:1/13	0251.02	16	PMR	HOLDING REG						I65HS103F		
266	01	1	03		104	I65HS104A	1	40252.03	0251.03	N33:1/12	0251.03	16	PMR	HOLDING REG						I65HS104A		
268	01	1	03		104	I65HS104C	1	40252.05	0251.05	N33:1/10	0251.05	16	PMR	HOLDING REG						I65HS104C		
269	01	1	03		104	I65HS104D	1	40252.06	0251.06	N33:1/9	0251.06	16	PMR	HOLDING REG						I65HS104D		
270	01	1	03		104	I65HS104E	1	40252.07	0251.07	N33:1/8	0251.07	16	PMR	HOLDING REG						I65HS104E		
288	01	1	03		100	I65LC100A	1	40301	0300	F27:1	0300	16	PMR	HOLDING REG	FEET	LINEAR	1	1	0	I65LC100A	16/32 Signed/Unsigned	16/32 Signed/Uns
289	01	1	03		100	I65LC100B	1	40303	0302	F27:2	0302	16	PMR	HOLDING REG	FEET	LINEAR	1	1	0	I65LC100B	16/32 Signed/Unsigned	16/32 Signed/Uns
290	01	1	03		100	I65LC100C	1	40305	0304	F27:3	0304	16	PMR	HOLDING REG	FEET	LINEAR	1	1	0	I65LC100C	16/32 Signed/Unsigned	16/32 Signed/Uns
291	01	1	03		100	I65LC100D	1	40307	0306	F27:4	0306	16	PMR	HOLDING REG	FEET	LINEAR	1	1	0	I65LC100D	16/32 Signed/Unsigned	16/32 Signed/Uns
292	01	1	03		100	I65LC100E	1	40309	0308	F27:5	0308	16	PMR	HOLDING REG	FEET	LINEAR	1	1	0	I65LC100E	16/32 Signed/Unsigned	16/32 Signed/Uns
293	01	1	03		100	I65LC100F	1	40311	0310	F27:6	0310	16	PMR	HOLDING REG	FEET	LINEAR	1	1	0	I65LC100F	16/32 Signed/Unsigned	16/32 Signed/Uns
294	01	1	03		100	I65LC100G	1	40313	0312	F27:7	0312	16	PMR	HOLDING REG	FEET	LINEAR	1	1	0	I65LC100G	16/32 Signed/Unsigned	16/32 Signed/Uns
295	01	1	03		100	I65LC100H	1	40315	0314	F27:8	0314	16	PMR	HOLDING REG	FEET	LINEAR	1	1	0	I65LC100H	16/32 Signed/Unsigned	16/32 Signed/Uns

Appendix B3
Existing Pump Data Communicated

DCS DATABASE						
DCS ORDER	CUST23/QLC REG ADDRESS	PS 65 RFP647 FDI (.2)_CUST24/ QLC ALGO	QLC Card HW ADDR	QLC Card SW ADDR	PTID	PHW
30	G0001	QLCGPIN 901	A8H	150H	I65PAH101	336 (150H)
31	G0001	QLCGPIN 901	A8H	150H	I65PAHH101	336 (150H)
32	G0002	QLCGPIN 901	A8H	150H	I65PAL101	336 (150H)
33	G0002	QLCGPIN 901	A8H	150H	I65PALL101	336 (150H)
34	G0002	QLCGPIN 901	A8H	150H	I65VAH101A	336 (150H)
35	G0002	QLCGPIN 901	A8H	150H	I65VAH101B	336 (150H)
36	G0002	QLCGPIN 901	A8H	150H	I65VAHH101A	336 (150H)
37	G0002	QLCGPIN 901	A8H	150H	I65VAHH101B	336 (150H)
38	G0002	QLCGPIN 901	A8H	150H	I65YA101A	336 (150H)
39	G0002	QLCGPIN 901	A8H	150H	I65YA101B	336 (150H)
40	G0002	QLCGPIN 901	A8H	150H	I65YA101C	336 (150H)
42	G0002	QLCGPIN 901	A8H	150H	I65YA101E	336 (150H)
44	G0002	QLCGPIN 901	A8H	150H	I65YL101B	336 (150H)
45	G0002	QLCGPIN 901	A8H	150H	I65YL101C	336 (150H)
46	G0002	QLCGPIN 901	A8H	150H	I65YL101D	336 (150H)
47	G0002	QLCGPIN 901	A8H	150H	I65YL101E	336 (150H)
52	G0003	QLCGPIN 901	A8H	150H	I65PAH102	336 (150H)
53	G0003	QLCGPIN 901	A8H	150H	I65PAHH102	336 (150H)
54	G0003	QLCGPIN 901	A8H	150H	I65PAL102	336 (150H)
55	G0003	QLCGPIN 901	A8H	150H	I65PALL102	336 (150H)
56	G0003	QLCGPIN 901	A8H	150H	I65VAH102A	336 (150H)
57	G0003	QLCGPIN 901	A8H	150H	I65VAH102B	336 (150H)
58	G0003	QLCGPIN 901	A8H	150H	I65VAHH102A	336 (150H)
59	G0003	QLCGPIN 901	A8H	150H	I65VAHH102B	336 (150H)
60	G0003	QLCGPIN 901	A8H	150H	I65YA102A	336 (150H)
61	G0003	QLCGPIN 901	A8H	150H	I65YA102B	336 (150H)
62	G0003	QLCGPIN 901	A8H	150H	I65YA102C	336 (150H)
64	G0004	QLCGPIN 901	A8H	150H	I65YA102E	336 (150H)
66	G0004	QLCGPIN 901	A8H	150H	I65YL102B	336 (150H)
67	G0004	QLCGPIN 901	A8H	150H	I65YL102C	336 (150H)
68	G0004	QLCGPIN 901	A8H	150H	I65YL102D	336 (150H)
69	G0004	QLCGPIN 901	A8H	150H	I65YL102E	336 (150H)
74	G0004	QLCGPIN 901	A8H	150H	I65PAH103	336 (150H)
75	G0004	QLCGPIN 901	A8H	150H	I65PAHH103	336 (150H)
76	G0004	QLCGPIN 901	A8H	150H	I65PAL103	336 (150H)
77	G0004	QLCGPIN 901	A8H	150H	I65PALL103	336 (150H)
78	G0004	QLCGPIN 901	A8H	150H	I65VAH103A	336 (150H)
79	G0004	QLCGPIN 901	A8H	150H	I65VAH103B	336 (150H)
80	G0005	QLCGPIN 901	A8H	150H	I65VAHH103A	336 (150H)
81	G0005	QLCGPIN 901	A8H	150H	I65VAHH103B	336 (150H)
82	G0005	QLCGPIN 901	A8H	150H	I65YA103A	336 (150H)
83	G0005	QLCGPIN 901	A8H	150H	I65YA103B	336 (150H)
84	G0005	QLCGPIN 901	A8H	150H	I65YA103C	336 (150H)
86	G0005	QLCGPIN 901	A8H	150H	I65YA103E	336 (150H)
88	G0005	QLCGPIN 901	A8H	150H	I65YL103B	336 (150H)
89	G0005	QLCGPIN 901	A8H	150H	I65YL103C	336 (150H)
90	G0005	QLCGPIN 901	A8H	150H	I65YL103D	336 (150H)
91	G0005	QLCGPIN 901	A8H	150H	I65YL103E	336 (150H)
96	G0006	QLCGPIN 901	A8H	150H	I65PAH104	336 (150H)
97	G0006	QLCGPIN 901	A8H	150H	I65PAHH104	336 (150H)
98	G0006	QLCGPIN 901	A8H	150H	I65PAL104	336 (150H)
99	G0006	QLCGPIN 901	A8H	150H	I65PALL104	336 (150H)
100	G0006	QLCGPIN 901	A8H	150H	I65VAH104A	336 (150H)
101	G0006	QLCGPIN 901	A8H	150H	I65VAH104B	336 (150H)
102	G0006	QLCGPIN 901	A8H	150H	I65VAHH104A	336 (150H)
103	G0006	QLCGPIN 901	A8H	150H	I65VAHH104B	336 (150H)
104	G0006	QLCGPIN 901	A8H	150H	I65YA104A	336 (150H)
105	G0006	QLCGPIN 901	A8H	150H	I65YA104B	336 (150H)
106	G0006	QLCGPIN 901	A8H	150H	I65YA104C	336 (150H)
108	G0006	QLCGPIN 901	A8H	150H	I65YA104E	336 (150H)
110	G0006	QLCGPIN 901	A8H	150H	I65YL104B	336 (150H)
111	G0006	QLCGPIN 901	A8H	150H	I65YL104C	336 (150H)
112	G0007	QLCGPIN 901	A8H	150H	I65YL104D	336 (150H)
113	G0007	QLCGPIN 901	A8H	150H	I65YL104E	336 (150H)
181	S0109	QLCAIN 903	A8H	150H	I65LY100A	336 (150H)
182	S0112	QLCAIN 903	A8H	150H	I65LY100B	336 (150H)
183	S0115	QLCAIN 903	A8H	150H	I65LY100C	336 (150H)
184	S0118	QLCAIN 903	A8H	150H	I65LY100D	336 (150H)
185	S0121	QLCAIN 903	A8H	150H	I65LY100E	336 (150H)
186	S0124	QLCAIN 903	A8H	150H	I65LY100F	336 (150H)
187	S0127	QLCAIN 903	A8H	150H	I65LY100G	336 (150H)
188	S0130	QLCAIN 903	A8H	150H	I65LY100H	336 (150H)
189	S0133	QLCAIN 903	A8H	150H	I65KI101	336 (150H)
202	S0174	QLCAIN 904	A8H	150H	I65KI102	336 (150H)
215	S0215	QLCAIN 905	A8H	150H	I65KI103	336 (150H)
228	S0306	QLCAIN 906	A8H	150H	I65KI104	336 (150H)
249	G0050	QLCGPOUT 902	A8H	150H	I65HS101A	336 (150H)
250	G0050	QLCGPOUT 902	A8H	150H	I65HS101B	336 (150H)
252	G0050	QLCGPOUT 902	A8H	150H	I65HS101D	336 (150H)
253	G0050	QLCGPOUT 902	A8H	150H	I65HS101E	336 (150H)
254	G0050	QLCGPOUT 902	A8H	150H	I65HS101F	336 (150H)
255	G0050	QLCGPOUT 902	A8H	150H	I65HS102A	336 (150H)
257	G0050	QLCGPOUT 902	A8H	150H	I65HS102C	336 (150H)
258	G0050	QLCGPOUT 902	A8H	150H	I65HS102D	336 (150H)

Appendix B3
Existing Pump Data Communicated

DCS DATABASE						
DCS ORDER	CUST23/QLC REG ADDRESS	PS 65 RFP647 FDI (.2)_CUST24/ QLC ALGO	QLC Card HW ADDR	QLC Card SW ADDR	PTID	PHW
259	G0050	QLCGPOUT 902	A8H	150H	I65HS102E	336 (150H)
260	G0050	QLCGPOUT 902	A8H	150H	I65HS103A	336 (150H)
261	G0050	QLCGPOUT 902	A8H	150H	I65HS103B	336 (150H)
263	G0051	QLCGPOUT 902	A8H	150H	I65HS103D	336 (150H)
264	G0051	QLCGPOUT 902	A8H	150H	I65HS103E	336 (150H)
265	G0051	QLCGPOUT 902	A8H	150H	I65HS103F	336 (150H)
266	G0051	QLCGPOUT 902	A8H	150H	I65HS104A	336 (150H)
268	G0051	QLCGPOUT 902	A8H	150H	I65HS104C	336 (150H)
269	G0051	QLCGPOUT 902	A8H	150H	I65HS104D	336 (150H)
270	G0051	QLCGPOUT 902	A8H	150H	I65HS104E	336 (150H)
288	S0365	QLCAOUT 908	A8H	150H	I65LC100A	336 (150H)
289	S0368	QLCAOUT 908	A8H	150H	I65LC100B	336 (150H)
290	S0371	QLCAOUT 908	A8H	150H	I65LC100C	336 (150H)
291	S0374	QLCAOUT 908	A8H	150H	I65LC100D	336 (150H)
292	S0377	QLCAOUT 908	A8H	150H	I65LC100E	336 (150H)
293	S0380	QLCAOUT 908	A8H	150H	I65LC100F	336 (150H)
294	S0383	QLCAOUT 908	A8H	150H	I65LC100G	336 (150H)
295	S0386	QLCAOUT 908	A8H	150H	I65LC100H	336 (150H)

Appendix B4
Existing Pump Station Ancillary Data Communicated

PLC DATABASE				DCS DATABASE																				
Address	Symbol	Scope	Description	DCS ORDER	PTID	RT	TB	BB	ENGLISH DESCRIPTION	EU/ST	EV/RS	SOURCE	CD	HW	AP	LC	HL/AR	LL/BP	CV	CI	CHARST	CRD	GP	QC	SL
				9	I65LALL10	DL			OPERATIONAL WW LVL LOLO	NORMAL	LO-LO	PLC	67	0000	2	1	0	0	0	0	A010CLA-	QLC	01	1	03
				19	I65UA43	DL			O CNTRL SYST BLWR FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A043CEA-	QLC	01	1	03
N32:1/9	I65YA100A	Global	PLC #1 Normal	26	I65YA100A	DL			PLC RACK 1 PROCESSOR FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A100PEA-	QLC	01	1	03
N32:1/10	I65YA100B	Global	PLC #2 Normal	27	I65YA100B	DL			PLC RACK 2 PROCESSOR FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A100PEA-	QLC	01	1	03
N32:1/12	I65YC100A	Global	Modbus Heartbeat	28	I65YC100A	DL			MODBUS HEARTBEAT READ CMD	STATE1	STATE2	PLC	67	0000	0	0	0	0	0	0	A100PYQ-	QLC	01	1	03
N32:7/9	I65YA141A	Global	Plug Valve V-141 Fail To Open	121	I65YA141A	DL			FORCE MAIN VLV V141 FTO	FTOPN	NORMAL	PLC	67	0000	2	1	1	0	0	0	A141VYA-	QLC	01	1	03
N32:7/10	I65YA141B	Global	Plug Valve V-141 Fail To Close	122	I65YA141B	DL			FORCE MAIN VLV V141 FTC	FTCLS	NORMAL	PLC	67	0000	2	1	1	0	0	0	A141VYA-	QLC	01	1	03
N32:7/11	I65YL141	Global	Plug Valve V-141 Available	123	I65YL141	DL			FORCE MAIN VLV V141 AVAIL	AVAIL	NAVAIL	PLC	67	0000	0	0	0	0	0	0	A141VYQ-	QLC	01	1	03
N32:8/2	I65YA211A	Global	Slide Gate G-211 Fail To Open	130	I65YA211A	DL			B SCRN ME201 GTE G211 FTO	FTOPN	NORMAL	PLC	67	0000	2	1	1	0	0	0	A211GYA-	QLC	01	1	03
N32:8/3	I65YA211B	Global	Slide Gate G-211 Fail To Close	131	I65YA211B	DL			B SCRN ME201 GTE G211 FTC	FTCLS	NORMAL	PLC	67	0000	2	1	1	0	0	0	A211GYA-	QLC	01	1	03
N32:8/4	I65YL211	Global	Slide Gate G-211 Available	132	I65YL211	DL			B SCRN ME201 GTE G211 AVAIL	AVAIL	NAVAIL	PLC	67	0000	0	0	0	0	0	0	A211GYQ-	QLC	01	1	03
N32:8/8	I65YA212A	Global	Slide Gate G-212 Fail To Open	136	I65YA212A	DL			B SCRN ME202 GTE G212 FTO	FTOPN	NORMAL	PLC	67	0000	2	1	1	0	0	0	A212GYA-	QLC	01	1	03
N32:8/9	I65YA212B	Global	Slide Gate G-212 Fail To Close	137	I65YA212B	DL			B SCRN ME202 GTE G212 FTC	FTCLS	NORMAL	PLC	67	0000	2	1	1	0	0	0	A212GYA-	QLC	01	1	03
N32:8/10	I65YL212	Global	Slide Gate G-212 Available	138	I65YL212	DL			B SCRN ME202 GTE G212 AVAIL	AVAIL	NAVAIL	PLC	67	0000	0	0	0	0	0	0	A212GYQ-	QLC	01	1	03
N32:8/14	I65YA213A	Global	Slide Gate G-213 Fail To Open	142	I65YA213A	DL			B SCRN ME203 GTE G213 FTO	FTOPEN	NORMAL	PLC	67	0000	2	1	1	0	0	0	A213GYA-	QLC	01	1	03
N32:8/15	I65YA213B	Global	Slide Gate G-213 Fail To Close	143	I65YA213B	DL			B SCRN ME203 GTE G213 FTC	FTCLS	NORMAL	PLC	67	0000	2	1	1	0	0	0	A213GYA-	QLC	01	1	03
N32:9/0	I65YL213	Global	Slide Gate G-213 Available	144	I65YL213	DL			B SCRN ME203 GTE G213 AVAIL	AVAIL	NAVAIL	PLC	67	0000	0	0	0	0	0	0	A213GYQ-	QLC	01	1	03
N32:9/12	I65YA232A	Global	Sluice Gate G-232 Fail To Open	156	I65YA232A	DL			SCRNNGS SLU GTE G232 FTO	FTOPN	NORMAL	PLC	67	0000	2	1	1	0	0	0	A232GYA-	QLC	01	1	03
N32:9/13	I65YA232B	Global	Sluice Gate G-232 Fail To Close	157	I65YA232B	DL			SCRNNGS SLU GTE G232 FTC	FTCLS	NORMAL	PLC	67	0000	2	1	1	0	0	0	A232GYA-	QLC	01	1	03
N32:9/14	I65YL232	Global	Sluice Gate G-232 Available	158	I65YL232	DL			SCRNNGS SLU GTE G232 AVAIL	AVAIL	NAVAIL	PLC	67	0000	0	0	0	0	0	0	A232GYQ-	QLC	01	1	03
?				177	I2HS100A	DL			STAGGER DELAY PERMISSIVE	DELAY	NORMAI	PLC	67	0000	0	0	0	0	0	0	A100----	QLC	01	1	03
N32:178	I65FI402	Global	Hypo Caustic Flow To Vessel #1	242	I65FI402	AI	1	0	HYPO-CAUSTC FLW RATE TO VSSL1	GPM	-	PLC	67	0000	34	1	0.75	-1	0	0	A402CFT-	QLC	01	1	03
N32:180	I65FI403	Global	Hypo Caustic Flow To Vessel #2	243	I65FI403	AI	1	0	HYPO-CAUSTC FLW RATE TO VSSL2	GPM	-	PLC	67	0000	34	1	0.75	-1	0	0	A403CFT-	QLC	01	1	03
N32:184	I65FQI601A	Global	Current Force Main Totalized Flow	245	I65FQI601A	AI	30	0	CURR FORCE MAIN DSCH ACCUM FLW	MGALS	-	PLC	67	0000	0	0	0	0	0	0	A601CFQ-	QLC	01	1	03
N32:186	I65FQI601B	Global	Previous Force Main Totalized Flow	246	I65FQI601B	AI	30	0	PREV FORCE MAIN DSCH ACCUM FLW	MGALS	-	PLC	67	0000	0	0	0	0	0	0	A601CFQ-	QLC	01	1	03
N33:0/0	I65KC100	Global	Reset Plc Clock	247	I65KC100	DC			PLC SYST CLOCK RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A100ZKQ-	QLC	01	1	03
N33:0/1	I65YC100B	Global	DCS Heartbeat	248	I65YC100B	DC			MODBUS HEARTBEAT WRITE CMD	STATE1	STATE2	DCS	67	0000	0	0	0	0	0	0	A100PYQ-	QLC	01	1	03
N33:1/10	I65HS141C	Global	Plug Valve V-141 Reset	273	I65HS141C	DC			FORCE MAIN VLV V141 RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A141VHQ-	QLC	01	1	03
N33:1/13	I65HS211C	Global	Slide Gate G-211 Reset	276	I65HS211C	DC			B SCRN ME201 GTE G211 RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A211GHQ-	QLC	01	1	03
N33:2/0	I65HS212C	Global	Slide Gate G-212 Reset	279	I65HS212C	DC			B SCRN ME202 GTE G212 RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A212GHQ-	QLC	01	1	03
N33:2/3	I65HS213C	Global	Slide Gate G-213 Reset	282	I65HS213C	DC			B SCRN ME203 GTE G213 RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A213GHQ-	QLC	01	1	03
N33:2/7	I65HS232D	Global	Sluice Gate G-232 Reset	286	I65HS232D	DC			SCRNNGS SLU GTE G232 RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A232GHQ-	QLC	01	1	03
N/A	N/A	N/A	N/A	287	I65YA100C	DL			MODBUS COMMUNICATIONS FAIL	FAIL	NORMAL	DCS	67	0000	2	1	1	0	0	0	A100PEA-	QLC	01	1	03

Appendix B4
Existing Pump Station Ancillary Data Communicated

	DCS DATABASE															
DCS ORDER	CUST6/COMMENTS	LOOP NO	PTID	MODBUS NODE	MODBUS REG	OFFSET MODBUS ADDR	PLC REG/ADDR	PROSOFT REG/ADDR	FC	MNEMONIC	REG TYPE	Eng Units Being Sent	CONVERSION TYPE	CONVERSION CODE	GAIN	BIAS
9		010	I65LALL10	1	40001.08	0000.08	N32:0/7	0000.08	3	RHR	HOLDING REG					
19		043	I65UA43	1	40002.02	0001.02	N32:1/13	0001.02	3	RHR	HOLDING REG					
26		100	I65YA100A	1	40002.09	0001.09	N32:1/6	0001.09	3	RHR	HOLDING REG					
27		100	I65YA100B	1	40002.10	0001.10	N32:1/5	0001.10	3	RHR	HOLDING REG					
28		100	I65YC100A	1	40002.12	0001.12	N32:1/3	0001.12	3	RHR	HOLDING REG					
121		141	I65YA141A	1	40008.09	0007.09	N32:7/6	0007.09	3	RHR	HOLDING REG					
122		141	I65YA141B	1	40008.10	0007.10	N32:7/5	0007.10	3	RHR	HOLDING REG					
123		141	I65YL141	1	40008.11	0007.11	N32:7/4	0007.11	3	RHR	HOLDING REG					
130		211	I65YA211A	1	40009.02	0008.02	N32:8/13	0008.02	3	RHR	HOLDING REG					
131		211	I65YA211B	1	40009.03	0008.03	N32:8/12	0008.03	3	RHR	HOLDING REG					
132		211	I65YL211	1	40009.04	0008.04	N32:8/11	0008.04	3	RHR	HOLDING REG					
136		212	I65YA212A	1	40009.08	0008.08	N32:8/7	0008.08	3	RHR	HOLDING REG					
137		212	I65YA212B	1	40009.09	0008.09	N32:8/6	0008.09	3	RHR	HOLDING REG					
138		212	I65YL212	1	40009.10	0008.10	N32:8/5	0008.10	3	RHR	HOLDING REG					
142		213	I65YA213A	1	40009.14	0008.14	N32:8/1	0008.14	3	RHR	HOLDING REG					
143		213	I65YA213B	1	40009.15	0008.15	N32:8/0	0008.15	3	RHR	HOLDING REG					
144		213	I65YL213	1	40010.00	0009.00	N32:9/15	0009.00	3	RHR	HOLDING REG					
156		232	I65YA232A	1	40010.12	0009.12	N32:9/3	0009.12	3	RHR	HOLDING REG					
157		232	I65YA232B	1	40010.13	0009.13	N32:9/2	0009.13	3	RHR	HOLDING REG					
158		232	I65YL232	1	40010.14	0009.14	N32:9/1	0009.14	3	RHR	HOLDING REG					
177		100	I2HS100A	1	40012.01	0011.01	N32:11/14	0011.01	3	RHR	HOLDING REG					
242	Rotameter Setpoint at 0.75 gpm	402	I65FI402	1	40179	0178	N32:178	0178	3	RHR	HOLDING REG	GPM	LINEAR	1	1	0
243	Rotameter Setpoint at 0.75 gpm	403	I65FI403	1	40181	0180	N32:180	0180	3	RHR	HOLDING REG	GPM	LINEAR	1	1	0
245		601	I65FQI601A	1	40185	0184	N32:184	0184	3	RHR	HOLDING REG	MGALS	LINEAR	1	1	0
246		601	I65FQI601B	1	40187	0186	N32:186	0186	3	RHR	HOLDING REG	MGALS	LINEAR	1	1	0
247		100	I65KC100	1	40251.00	0250.00	N33:0/15	0250.00	16	PMR	HOLDING REG					
248		100	I65YC100B	1	40251.01	0250.01	N33:0/14	0250.01	16	PMR	HOLDING REG					
273		141	I65HS141C	1	40252.10	0251.10	N33:1/5	0251.10	16	PMR	HOLDING REG					
276		211	I65HS211C	1	40252.13	0251.13	N33:1/2	0251.13	16	PMR	HOLDING REG					
279		212	I65HS212C	1	40253.00	0252.00	N33:2/15	0252.00	16	PMR	HOLDING REG					
282		213	I65HS213C	1	40253.03	0252.03	N33:2/12	0252.03	16	PMR	HOLDING REG					
286		232	I65HS232D	1	40253.07	0252.07	N33:2/8	0252.07	16	PMR	HOLDING REG					
287		100	I65YA100C	1	N/A	N/A	N/A	N/A	3	RHR	HOLDING REG					

Appendix B4
Existing Pump Station Ancillary Data Communicated

DCS ORDER	DCS DATABASE								
	PTID	Eng Value at 32-bit Signed Integer "-16K"	Eng Value at 32-bit Signed Integer "+16K"	CUST23/QLC REG ADDRESS	PS 65 RFP647 FDI (.2) CUST24/QLC ALGO	QLC Card HW ADDR	QLC Card SW ADDR	PTID	PHW
9	I65LALL10			G0000	QLCGPIN 901	A8H	150H	I65LALL10	336 (150H)
19	I65UA43			G0001	QLCGPIN 901	A8H	150H	I65UA43	336 (150H)
26	I65YA100A			G0001	QLCGPIN 901	A8H	150H	I65YA100A	336 (150H)
27	I65YA100B			G0001	QLCGPIN 901	A8H	150H	I65YA100B	336 (150H)
28	I65YC100A			G0001	QLCGPIN 901	A8H	150H	I65YC100A	336 (150H)
121	I65YA141A			G0007	QLCGPIN 901	A8H	150H	I65YA141A	336 (150H)
122	I65YA141B			G0007	QLCGPIN 901	A8H	150H	I65YA141B	336 (150H)
123	I65YL141			G0007	QLCGPIN 901	A8H	150H	I65YL141	336 (150H)
130	I65YA211A			G0008	QLCGPIN 901	A8H	150H	I65YA211A	336 (150H)
131	I65YA211B			G0008	QLCGPIN 901	A8H	150H	I65YA211B	336 (150H)
132	I65YL211			G0008	QLCGPIN 901	A8H	150H	I65YL211	336 (150H)
136	I65YA212A			G0008	QLCGPIN 901	A8H	150H	I65YA212A	336 (150H)
137	I65YA212B			G0008	QLCGPIN 901	A8H	150H	I65YA212B	336 (150H)
138	I65YL212			G0008	QLCGPIN 901	A8H	150H	I65YL212	336 (150H)
142	I65YA213A			G0008	QLCGPIN 901	A8H	150H	I65YA213A	336 (150H)
143	I65YA213B			G0008	QLCGPIN 901	A8H	150H	I65YA213B	336 (150H)
144	I65YL213			G0009	QLCGPIN 901	A8H	150H	I65YL213	336 (150H)
156	I65YA232A			G0009	QLCGPIN 901	A8H	150H	I65YA232A	336 (150H)
157	I65YA232B			G0009	QLCGPIN 901	A8H	150H	I65YA232B	336 (150H)
158	I65YL232			G0009	QLCGPIN 901	A8H	150H	I65YL232	336 (150H)
177	I2HS100A				QLCGPIN 901	A8H	150H	I2HS100A	336 (150H)
242	I65FI402	16/32 Signed/Unsigned Integer Representation Alternative Not Choser	16/32 Signed/Unsigned Integer Representation Alternative Not Choser	S0350	QLCAIN 907	A8H	150H	I65FI402	336 (150H)
243	I65FI403	16/32 Signed/Unsigned Integer Representation Alternative Not Choser	16/32 Signed/Unsigned Integer Representation Alternative Not Choser	S0353	QLCAIN 907	A8H	150H	I65FI403	336 (150H)
245	I65FQI601A	16/32 Signed/Unsigned Integer Representation Alternative Not Choser	16/32 Signed/Unsigned Integer Representation Alternative Not Choser	S0359	QLCAIN 907	A8H	150H	I65FQI601A	336 (150H)
246	I65FQI601B	16/32 Signed/Unsigned Integer Representation Alternative Not Choser	16/32 Signed/Unsigned Integer Representation Alternative Not Choser	S0362	QLCAIN 907	A8H	150H	I65FQI601B	336 (150H)
247	I65KC100			G0050	QLCGPOUT 902	A8H	150H	I65KC100	336 (150H)
248	I65YC100B			G0050	QLCGPOUT 902	A8H	150H	I65YC100B	336 (150H)
273	I65HS141C			G0051	QLCGPOUT 902	A8H	150H	I65HS141C	336 (150H)
276	I65HS211C			G0051	QLCGPOUT 902	A8H	150H	I65HS211C	336 (150H)
279	I65HS212C			G0052	QLCGPOUT 902	A8H	150H	I65HS212C	336 (150H)
282	I65HS213C			G0052	QLCGPOUT 902	A8H	150H	I65HS213C	336 (150H)
286	I65HS232D			G0052	QLCGPOUT 902	A8H	150H	I65HS232D	336 (150H)
287	I65YA100C			N/A	QLCGPOUT 902	A8H	150H	I65YA100C	336 (150H)

Appendix B5
New Remote I/O and Associated DCS Data

PLC DATABASE													LOOP DRAWINGS			DCS						
PLC ORDER	ADDRESS	RACK	POS ADD	SLOT	DROP	TAG (PLC I/O)	(WRITE TO DCS) ADDRESS	TAG	SCOPE	DESCRIPTION	TYPE	DESCRIPTION FROM PLC	FIELD DEVICE TAG "-" UNASSIGNED	LOOP NO	TBs	DCS ORDER	PTID	RT	TB	BB	ENGLISH DESCRIPTION	EU/ST
1		3	2	3	0	I65YA105F		I65YA105D	Global	Pump 105 Normal	DI	Pump 105 Alarm	OA_105A	105		1	I65YA105D	DL			PMP105 ALRM	NORMAL
2		3	2	3	1	I65YL105F		I65YL105A	Global	Pump 105 Run	DI	Pump 105 Run	OL_105A	105		2	I65YL105A	DL			PMP105 RUNNING STAT	ON
3		3	2	3	2	I65ZLC105E		I65ZLC105	Global	Pump 105 Discharge Check Valve Open	DI	Pump 105 Discharge Check Valve Closed	ZSC_105	105		3	I65ZLC105	DL			PMP105 DSCH CHECK VLV POS	OPENED
4		3	2	3	3	I65JL105A		I65JL105	Global	Pump 105 Control Power Or	DI	Pump 105 Control Power Or	CR2-1	105		4	I65JL105	DL			PMP105 CONTROL PWR ON	POWER ON
5		3	2	3	4	I65ZL105D		I65ZL105B	Global	Pump 105 Auto	DI	Pump 105 Auto	HS_105D	105		5	I65ZL105B	DL			PMP105 HOA SWTCH POS - COMPUTR	REMOTE
6		3	2	3	5	Spare					DI					6						
7		3	2	3	6	Spare					DI					7						
8		3	2	3	7	Spare					DI					8						
9		3	2	3	10	Spare					DI					9						
10		3	2	3	11	Spare					DI					10						
11		3	2	3	12	Spare					DI					11						
12		3	2	3	13	Spare					DI					12						
13		3	2	3	14	Spare					DI					13						
14		3	2	3	15	Spare					DI					14						
15		3	2	3	16	Spare					DI					15						
16		3	2	3	17	Spare					DI					16						
17		3	3	4	0	I65HS105M	N/A	N/A	N/A	N/A	DO	Pump 105 Call	N/A	105		17	I65HS105C	DC			PMP105 DCS MANUAL RUN CMD	RUNCMD
18		3	3	4	1	I65HS103L	N/A	N/A	N/A	N/A	DO	Pump 103 VFD/Multilin Reset	N/A	103		18	I65HS103K	DC			PMP103 VFD/MULTILIN RESET CMD	
19		3	3	4	2	I65HS104L	N/A	N/A	N/A	N/A	DO	Pump 104 VFD/Multilin Reset	N/A	104		19	I65HS104K	DC			PMP104 VFD/MULTILIN RESET CMD	
20		3	3	4	3	I65HS105L	N/A	N/A	N/A	N/A	DO	Pump 105 VFD/Multilin Reset	N/A	105		20	I65HS105K	DC			PMP105 VFD/MULTILIN RESET CMD	
21		3	3	4	4	Spare	N/A	N/A	N/A	N/A	DO					21	N/A					
22		3	3	4	5	Spare	N/A	N/A	N/A	N/A	DO					22	N/A					
23		3	3	4	6	Spare	N/A	N/A	N/A	N/A	DO					23	N/A					
24		3	3	4	7	Spare	N/A	N/A	N/A	N/A	DO					24	N/A					
25		3	3	4	10	Spare	N/A	N/A	N/A	N/A	DO					25	N/A					
26		3	3	4	11	Spare	N/A	N/A	N/A	N/A	DO					26	N/A					
27		3	3	4	12	Spare	N/A	N/A	N/A	N/A	DO					27	N/A					
28		3	3	4	13	Spare	N/A	N/A	N/A	N/A	DO					28	N/A					
29		3	3	4	14	Spare	N/A	N/A	N/A	N/A	DO					29	N/A					
30		3	3	4	15	Spare	N/A	N/A	N/A	N/A	DO					30	N/A					
31		3	3	4	16	Spare	N/A	N/A	N/A	N/A	DO					31	N/A					
32		3	3	4	17	Spare	N/A	N/A	N/A	N/A	DO					32	N/A					
33		3	4	5	4	I65SI103A		I65SI103	Global	Pump 103 Speed Indicatior	AI	Pump 103 Speed Indicatior	SI_103B	103		33	I65SI103	AI	100	0	PMP103 SPEED IND	PERCENT
34		3	4	5	5	I65SI104A		I65SI104	Global	Pump 104 Speed Indicatior	AI	Pump 104 Speed Indicatior	SI_104B	104		34	I65SI104	AI	100	0	PMP104 SPEED IND	PERCENT
35		3	4	5	6	I65VI103C		I65VI103A	Global	Pump 103 Upper Bearing Vibration	AI	Pump 103 Upper Bearing Vibration	VT_103A	103		35	I65VI103A	AI	2	0	PMP103 UP BRNG VIB (IN/SEC PK)	IPS PK
36		3	4	5	7	I65VI103D		I65VI103B	Global	Pump 103 Lower Bearing Vibration	AI	Pump 103 Lower Bearing Vibration	VT_103B	103		36	I65VI103B	AI	2	0	PMP103 LO BRNG VIB (IN/SEC PK)	IPS PK
37		3	4	5	8	I65VI104C		I65VI104A	Global	Pump 104 Upper Bearing Vibration	AI	Pump 104 Upper Bearing Vibration	VT_104A	104		37	I65VI104A	AI	2	0	PMP104 UP BRNG VIB (IN/SEC PK)	IPS PK
38		3	4	5	9	I65VI104D		I65VI104B	Global	Pump 104 Lower Bearing Vibration	AI	Pump 104 Lower Bearing Vibration	VT_104B	104		38	I65VI104B	AI	2	0	PMP104 LO BRNG VIB (IN/SEC PK)	IPS PK
39		3	4	5	10	Spare					AI					39						
40		3	4	5	11	Spare					AI					40						
41		3	5	6	4	I65PI105C		I65PI105B	Global	Pump 105 Discharge Pressure	AI	Pump 105 Discharge Pressure	PIT_105B	105		41	I65PI105B	AI	75	0	PMP105 DSCH PRS	PSIG
42		3	5	6	5	I65PI105D		I65PI105A	Global	Pump 105 Suction Pressure	AI	Pump 105 Suction Pressure	PIT_105A	105		42	I65PI105A	AI	15	0	PMP105 SUCTION PRS	PSIG
43		3	5	6	6	I65SI105A		I65SI105	Global	Pump 105 Speed Indicatior	AI	Pump 105 Speed Indicatior	SI_105B	105		43	I65SI105	AI	100	0	PMP105 SPEED IND	PERCENT
44		3	5	6	7	I65VI105C		I65VI105A	Global	Pump 105 Upper Bearing Vibration	AI	Pump 105 Upper Bearing Vibration	VT_105A	105		44	I65VI105A	AI	2	0	PMP105 UP BRNG VIB (IN/SEC PK)	IPS PK
45		3	5	6	8	I65VI105D		I65VI105B	Global	Pump 105 Lower Bearing Vibration	AI	Pump 105 Lower Bearing Vibration	VT_105B	105		45	I65VI105B	AI	2	0	PMP105 LO BRNG VIB (IN/SEC PK)	IPS PK
46		3	5	6	9	Spare					AI					46						
47		3	5	6	10	Spare					AI					47						
48		3	5	6	11	Spare					AI					48						
49		3	6	7	1	I65SC103A	N/A	N/A	N/A	N/A	AO	Pump 103 Speed Commanc	N/A	103		49	I65SC103				PMP103 SPEED CMD	PERCENT
50		3	6	7	2	I65SC104A	N/A	N/A	N/A	N/A	AO	Pump 104 Speed Commanc	N/A	104		50	I65SC104				PMP104 SPEED CMD	PERCENT
51		3	6	7	3	Spare	N/A	N/A	N/A	N/A	AO					51						
52		3	6	7	4	Spare	N/A	N/A	N/A	N/A	AO					52						
53		3	7	8	1	I65SC105A	N/A	N/A	N/A	N/A	AO	Pump 105 Speed Commanc	N/A	105		53	I65SC105				PMP105 SPEED CMD	PERCENT
54		3	7	8	2	Spare	N/A	N/A	N/A	N/A	AO					54						
55		3	7	8	3	Spare	N/A	N/A	N/A	N/A	AO					55						
56		3	7	8	4	Spare	N/A	N/A	N/A	N/A	AO					56						
57						-		I65TI103I	Global	Pump 103 Motor Bearing Temp I	AI-COM	Pump 103 Motor Bearing Temp I (Deg C)	TE_103I	103		57	I65TI103I	AI	400	0	PMP103 MTR BEARING TMP RTD I	DEG F
58						-		I65TI103J	Global	Pump 103 Motor Bearing Temp J	AI-COM	Pump 103 Motor Bearing Temp J (Deg C)	TE_103J	103		58	I65TI103J	AI	400	0	PMP103 MTR BEARING TMP RTD J	DEG F
59						-		I65TI104I	Global	Pump 104 Motor Bearing Temp I	AI-COM	Pump 104 Motor Bearing Temp I (Deg C)	TE_104I	104		59	I65TI104I	AI	400	0	PMP104 MTR BEARING TMP RTD I	DEG F
60						-		I65TI104J	Global	Pump 104 Motor Bearing Temp J	AI-COM	Pump 104 Motor Bearing Temp J (Deg C)	TE_104J	104		60	I65TI104J	AI	400	0	PMP104 MTR BEARING TMP RTD J	DEG F
61						-		I65TI105A	Global	Pump 105 Motor Winding Temp A	AI-COM	Pump 105 Motor Winding Temp A (Deg C)	TE_105A	105		61	I65TI105A	AI	400	0	PMP105 MTR WINDING TMP RTD A	DEG F
62						-		I65TI105B	Global	Pump 105 Motor Winding Temp B	AI-COM	Pump 105 Motor Winding Temp B (Deg C)	TE_105B	105		62	I65TI105B	AI	400	0	PMP105 MTR WINDING TMP RTD B	DEG F
63						-		I65TI105C	Global	Pump 105 Motor Winding Temp C	AI-COM	Pump 105 Motor Winding Temp C (Deg C)	TE_105C	105		63	I65TI105C	AI	400	0	PMP105 MTR WINDING TMP RTD C	DEG F
64						-		I65TI105D	Global	Pump 105 Motor Winding Temp D	AI-COM	Pump 105 Motor Winding Temp D (Deg C)	TE_105D	105		64	I65TI105D	AI	400	0	PMP105 MTR WINDING TMP RTD D	DEG F
65						-		I65TI105E	Global	Pump 105 Motor Winding Temp E	AI-COM	Pump 105 Motor Winding Temp E (Deg C)	TE_105E	105		65	I65TI105E	AI	400	0	PMP105 MTR WINDING TMP RTD E	DEG F
66						-		I65TI105F	Global	Pump 105 Motor Winding Temp F	AI-COM	Pump 105 Motor Winding Temp F (Deg C)	TE_105F	105		66	I65TI105F	AI	400	0	PMP105 MTR WINDING TMP RTD F	DEG F
67						-		I65TI105G	Global	Pump 105 Upper Bearing Temp G	AI-COM	Pump 105 Upper Bearing Temp G (Deg C)	TE_105G	105		67	I65TI105G	AI	400	0	PMP105 BEARING TMP RTD G	DEG F
68						-		I65TI105H	Global	Pump 105 Lower Bearing Temp H	AI-COM	Pump 105 Lower Bearing Temp H (Deg C)	TE_105H	105		68	I65TI105H	AI	400	0	PMP105 BEARING TMP RTD H	DEG F
69						-		I65TI105I	Global	Pump 105 Motor Bearing Temp I	AI-COM	Pump 105 Motor Bearing Temp I (Deg C)	TE_105I	105		69	I65TI105I	AI	400	0	PMP105 MTR BEARING TMP RTD I	DEG F
70						-		I65TI105J	Global	Pump 105 Motor Bearing Temp J	AI-COM	Pump 105 Motor Bearing Temp J (Deg C)	TE_105J	105		70	I65TI105J	AI	400	0	PMP105 MTR BEARING TMP RTD J	DEG F

Appendix B5
New Remote I/O and Associated DCS Data

DCS ORDER	DCS																																	
	EV/RS	SOURCE	CD	HW	AP	LC	HL/AR	LL/BP	CV	CI	CHARST	CRD	GP	QC	SL	CUST6/COMMENTS	LOOP NO	PTID	MODBUS NODE	MODBUS REG	OFFSET MODBUS ADDR	PLC REG/ ADDR	PROSOFT REG/ ADDR	FC	MNEMONIC	REG TYPE	Eng Units Being Sent	CONVERSION TYPE	CONVERSION CODE	GAIN	BIAS	PTID
1	ALARM	PLC	67	0000	2	1	0	0	0	0	A105MYA-	QLC	01	1	03		105	I65YA105D	3					3	RHR	HOLDING REG						I65YA105D
2	OFF	PLC	67	0000	0	0	0	0	0	0	A105MYS-	QLC	01	1	03		105	I65YL105A	3					3	RHR	HOLDING REG						I65YL105A
3	CLOSED	PLC	67	0000	0	0	0	0	0	0	A105MZO-	QLC	01	1	03		105	I65ZLC105	3					3	RHR	HOLDING REG						I65ZLC105
4	OTHER	PLC	67	0000	0	0	0	0	0	0	A105MZH-	QLC	01	1	03		105	I65ZL105A	3					3	RHR	HOLDING REG						I65ZL105A
5	OTHER	PLC	67	0000	0	0	0	0	0	0	A105MZA-	QLC	01	1	03		105	I65ZL105B	3					3	RHR	HOLDING REG						I65ZL105B
6																			3														
7																			3														
8																			3														
9																			3														
10																			3														
11																			3														
12																			3														
13																			3														
14																			3														
15																			3														
16																			3														
17	STPCMD	DCS	67	0000	0	0	0	0	0	0	A105MHS-	QLC	01	1	03		105	I65HS105C	3					16	PMR	HOLDING REG						I65HS105C
18		DCS															103	I65HS103K	3														I65HS103K
19		DCS															104	I65HS104K	3														I65HS104K
20		DCS															105	I65HS105K	3														I65HS105K
21																			3														
22																			3														
23																			3														
24																			3														
25																			3														
26																			3														
27																			3														
28																			3														
29																			3														
30																			3														
31																			3														
32																			3														
33		PLC															103	I65SI103	3								PERCENT						I65SI103
34		PLC															104	I65SI104	3								PERCENT						I65SI104
35	-	PLC	67	0000	0	0	0	0	0	0	A103MVT-	QLC	01	1	03		103	I65VI103A	1	40147	0146		0146	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI103A
36	-	PLC	67	0000	0	0	0	0	0	0	A103MVT-	QLC	01	1	03		103	I65VI103B	1	40149	0148		0148	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI103B
37	-	PLC	67	0000	0	0	0	0	0	0	A104MVT-	QLC	01	1	03		103	I65VI104A	1	40147	0146		0146	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI104A
38	-	PLC	67	0000	0	0	0	0	0	0	A104MVT-	QLC	01	1	03		103	I65VI104B	1	40149	0148		0148	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI104B
39																			3														
40																			3														
41	-	PLC	67	0000	0	0	0	0	0	0	A105MPT-	QLC	01	1	03		105	I65PI105B	3					3	RHR	HOLDING REG	PSIG	LINEAR	1	1	0	I65PI105B
42	-	PLC	67	0000	0	0	0	0	0	0	A105MPT-	QLC	01	1	03		105	I65PI105A	3					3	RHR	HOLDING REG	PSIG	LINEAR	1	1	0	I65PI105A
43		PLC															105	I65SI105	3								PERCENT						I65SI105
44	-	PLC	67	0000	0	0	0	0	0	0	A105MVT-	QLC	01	1	03		105	I65VI105A	1	40147	0146		0146	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI105A
45	-	PLC	67	0000	0	0	0	0	0	0	A105MVT-	QLC	01	1	03		105	I65VI105B	1	40149	0148		0148	3	RHR	HOLDING REG	IPS PK	LINEAR	1	1	0	I65VI105B
46																			3														
47																			3														
48																			3														
49		PLC															103	I65SC103	3								PERCENT						I65SC103
50		PLC															104	I65SC104	3								PERCENT						I65SC104
51																			3														
52																			3														
53		PLC															105	I65SC105	3								PERCENT						I65SC105
54																			3														
55																			3														
56																			3														
57	-	PLC	67	0000	32	41			0	0	A103MTT-	QLC	01	1	03		103	I65TI103I	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI103I
58	-	PLC	67	0000	32	41			0	0	A103MTT-	QLC	01	1	03		103	I65TI103J	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI103J
59	-	PLC	67	0000	32	41			0	0	A104MTT-	QLC	01	1	03		104	I65TI104I	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI104I
60	-	PLC	67	0000	32	41			0	0	A104MTT-	QLC	01	1	03		104	I65TI104J	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI104J
61	-	PLC	67	0000	32	41			0	0	A105MTT-	QLC	01	1	03		105	I65TI105A	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI105A
62	-	PLC	67	0000	32	41			0	0	A105MTT-	QLC	01	1	03		105	I65TI105B	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI105B
63	-	PLC	67	0000	32	41			0	0	A105MTT-	QLC	01	1	03		105	I65TI105C	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI105C
64	-	PLC	67	0000	32	41			0	0	A105MTT-	QLC	01	1	03		105	I65TI105D	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI105D
65	-	PLC	67	0000	32	41			0	0	A105MTT-	QLC	01	1	03		105	I65TI105E	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI105E
66	-	PLC	67	0000	32	41			0	0	A105MTT-	QLC	01	1	03		105	I65TI105F	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI105F
67	-	PLC	67	0000	32	41			0	0	A105MTT-	QLC	01	1	03		105	I65TI105G	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI105G
68	-	PLC	67	0000	32	41			0	0	A105MTT-	QLC	01	1	03		105	I65TI105H	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI105H
69	-	PLC	67	0000	32	41			0	0	A105MTT-	QLC	01	1	03		105	I65TI105I	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI105I
70	-	PLC	67	0000	32	41			0	0	A105MTT-	QLC	01	1	03		105	I65TI105J	3					3	RHR	HOLDING REG	DEG F	LINEAR	1	1	0	I65TI105J

Appendix B5
New Remote I/O and Associated DCS Data

DCS ORDER	DCS							
	Eng Value at 32-bit Signed Integer "-16K	Eng Value at 32-bit Signed Integer "+16	CUST23/QLC REG ADDRESS	PS 65 RFP647 FDI (.2)_CUST24/QLC ALGO	QLC Card HW ADDR	QLC Card SW ADDR	PTID	PHW
1					A8H	150H	I65YA105D	336 (150H)
2					A8H	150H	I65YL105A	336 (150H)
3					A8H	150H	I65ZLC105	336 (150H)
4					A8H	150H	I65ZL105A	336 (150H)
5					A8H	150H	I65ZL105B	336 (150H)
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17					A8H	150H	I65HS105C	336 (150H)
18							I65HS103K	
19							I65HS104K	
20							I65HS105K	
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Represen	S0300	QLCAIN 906	A8H	150H	I65VI103A	336 (150H)
36	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Represen	S0303	QLCAIN 906	A8H	150H	I65VI103B	336 (150H)
37	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Represen	S0300	QLCAIN 906	A8H	150H	I65VI103A	336 (150H)
38	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Represen	S0303	QLCAIN 906	A8H	150H	I65VI103B	336 (150H)
39								
40								
41	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65PI105B	336 (150H)
42	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65PI103A	336 (150H)
43								
44	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Represen	S0300	QLCAIN 906	A8H	150H	I65VI103A	336 (150H)
45	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Represen	S0303	QLCAIN 906	A8H	150H	I65VI103B	336 (150H)
46								
47								
48								
49							I65SC103	
50							I65SC104	
51								
52								
53							I65SC105	
54								
55								
56								
57	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI103I	336 (150H)
58	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI103J	336 (150H)
59	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI104I	336 (150H)
60	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI104J	336 (150H)
61	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI105A	336 (150H)
62	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI105B	336 (150H)
63	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI105C	336 (150H)
64	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI105D	336 (150H)
65	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI105E	336 (150H)
66	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI105F	336 (150H)
67	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI105G	336 (150H)
68	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI105H	336 (150H)
69	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Choser			A8H	150H	I65TI105I	336 (150H)
70	16/32 Signed/Unsigned Integer Represent	16/32 Signed/Unsigned Integer Representation Alternative Not Chosen			A8H	150H	I65TI105J	336 (150H)

Appendix B6
New Pump Data Communicated

PLC DATABASE				DCS DATABASE																	
Address	Symbol	Scope	Description	DCS ORDER	PTID	RT	TB	BB	ENGLISH DESCRIPTION	EU/ST	EV/RS	SOURCE	CD	HW	AP	LC	HL/AR	LL/BP	CV	CI	CHARST
	I65YA103G	Global	Multilin 103 Common Alarm	1	I65YA103G	DL			MULITILIN 103 COMMON ALARM			PLC	67	0000	2	1		0	0	0	A103MYA-
	I65YA103H	Global	VFD 103 Common Alarm	2	I65YA103H	DL			VFD 103 COMMON ALARM			PLC	67	0000	2	1		0	0	0	A103MYA-
	I65HS104A	Global	Pump 104 Lead 500 HP	3	I65HS104A	DC			PMP104 LD-LAG SELECT	LEAD	LAG	DCS	67	0000	0	0	0	0	0	0	A104MHQ-
	I65HS104B	Global	Pump 104 PLC Control	4	I65HS104B	DC			PMP104 CNTRL MODE	AUTO	MANUAL	DCS	67	0000	0	0	0	0	0	0	A104MHQ-
	I65HS104D	Global	Pump 104 Out Of Service	5	I65HS104D	DC			PMP104 SVC MODE CMD	OUTSVC	INSVC	DCS	67	0000	0	0	0	0	0	0	A104MHQ-
	I65HS104E	Global	Pump 104 Reset	6	I65HS104E	DC			PMP104 AB SHTDWN RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A104MHQ-
	I65HS104F	Global	Pump 104 Reset Run Time Meter	7	I65HS104F	DC			PMP104 ACCUM RUNTIME RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A104MHQ-
	I65YA104G	Global	Multilin 104 Common Alarm	8	I65YA104G	DL			MULITILIN 104 COMMON ALARM			PLC	67	0000	2	1		0	0	0	A104MYA-
	I65YA104H	Global	VFD 104 Common Alarm	9	I65YA104H	DL			VFD 104 COMMON ALARM			PLC	67	0000	2	1		0	0	0	A104MYA-
	I65PAH105	Global	Pump 105 Discharge Pressure Normal	10	I65PAH105	DL			PMP105 DSCH PRS HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A105MPA-
	I65PAHH105	Global	Pump 105 Discharge Pressure Normal	11	I65PAHH105	DL			PMP105 DSCH PRS HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A105MPA-
	I65PAL105	Global	Pump 105 Suction Pressure Normal	12	I65PAL105	DL			PMP105 SUCTION PRS LOW	NORMAL	LOW	PLC	67	0000	0	1	0	0	0	0	A105MPA-
	I65PALL105	Global	Pump 105 Suction Pressure Normal	13	I65PALL105	DL			PMP105 SUCTION PRS LOLO	NORMAL	LO-LO	PLC	67	0000	1	1	0	0	0	0	A105MPA-
	I65VAH105A	Global	Pump 105 Upper Bearing Vibration Normal	14	I65VAH105A	DL			PMP105 UP BEARING VIB HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A105MVA-
	I65VAH105B	Global	Pump 105 Lower Bearing Vibration Normal	15	I65VAH105B	DL			PMP105 LO BEARING VIB HI	NORMAL	HIGH	PLC	67	0000	0	1	0	0	0	0	A105MVA-
	I65VAHH105A	Global	Pump 105 Upper Bearing Vibration Normal	16	I65VAHH105A	DL			PMP105 UP BEARING VIB HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A105MVA-
	I65VAHH105B	Global	Pump 105 Lower Bearing Vibration Normal	17	I65VAHH105B	DL			PMP105 LO BEARING VIB HI-HI	NORMAL	HI-HI	PLC	67	0000	1	1	0	0	0	0	A105MVA-
	I65YA105A	Global	Pump 105 Fail To Start	18	I65YA105A	DL			PMP105 FAIL TO RUN	FTRUN	NORMAL	PLC	67	0000	2	1	1	0	0	0	A105MYA-
	I65YA105B	Global	Pump 105 Fail To Stop	19	I65YA105B	DL			PMP105 FAIL TO STOP	FTSTP	NORMAL	PLC	67	0000	2	1	1	0	0	0	A105MYA-
	I65YA105C	Global	Pump 105 Discharge Valve Normal	20	I65YA105C	DL			PMP105 DSCH CHECK VLV FAIL	NORMAL	FAIL	PLC	67	0000	2	1	0	0	0	0	A105MYA-
	I65YA105E	Global	Pump 105 Normal	21	I65YA105E	DL			PMP105 AB SHTDWN	NORMAL	SHTDWN	PLC	67	0000	2	1	0	0	0	0	A105MYA-
	I65YL105B	Global	Pump 105 Lead	22	I65YL105B	DL			PMP105 LD-LAG STAT	LEAD	LAG	PLC	67	0000	0	0	0	0	0	0	A105MYQ-
	I65YL105C	Global	Pump 105 Out Of Service	23	I65YL105C	DL			PMP105 SVC MODE STAT	OUTSVC	INSVC	PLC	67	0000	0	0	0	0	0	0	A105MYQ-
	I65YL105D	Global	Pump 105 PLC Control	24	I65YL105D	DL			PMP105 CNTRL MODE STAT	PLC	DCS	PLC	67	0000	0	0	0	0	0	0	A105MYQ-
	I65YL105E	Global	Pump 105 Available	25	I65YL105E	DL			PMP105 AVAIL	AVAIL	NAVAIL	PLC	67	0000	0	0	0	0	0	0	A105MYQ-
	I65KI105	Global	Pump 105 Run Time	26	I65KI105	AI	32767	0	PMP105 ACCUM RUNTIME	HRS	-	PLC	67	0000	0	0	0	0	0	0	A105MKQ-
	I65HS105A	Global	Pump 105 Lead 500 HP	27	I65HS105A	DC			PMP105 LD-LAG SELECT	LEAD	LAG	DCS	67	0000	0	0	0	0	0	0	A105MHQ-
	I65HS105B	Global	Pump 105 PLC Control	28	I65HS105B	DC			PMP105 CNTRL MODE	AUTO	MANUAL	DCS	67	0000	0	0	0	0	0	0	A105MHQ-
	I65HS105D	Global	Pump 105 Out Of Service	29	I65HS105D	DC			PMP105 SVC MODE CMD	OUTSVC	INSVC	DCS	67	0000	0	0	0	0	0	0	A105MHQ-
	I65HS105E	Global	Pump 105 Reset	30	I65HS105E	DC			PMP105 AB SHTDWN RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A105MHQ-
	I65HS105F	Global	Pump 105 Reset Run Time Meter	31	I65HS105F	DC			PMP105 ACCUM RUNTIME RESET	RESET	READY	DCS	67	0000	0	0	0	0	0	0	A105MHQ-
	I65YA105G	Global	Multilin 105 Common Alarm	32	I65YA105G	DL			MULITILIN 105 COMMON ALARM			PLC	67	0000	2	1		0	0	0	A105MYA-
	I65YA105H	Global	VFD 105 Common Alarm	33	I65YA105H	DL			VFD 105 COMMON ALARM			PLC	67	0000	2	1		0	0	0	A105MYA-

Appendix B6
New Pump Data Communicated

	DCS DATABASE																				
DCS ORDER	CRD	GP	QC	SL	CUST6/ COMMENTS	LOOP NO	PTID	MODBUS NODE	MODBUS REG	OFFSET MODBUS ADDR	PLC REG/ADDR	PROSOFT REG/ADDR	FC	MNEMONIC	REG TYPE	Eng Units Being Sent	CONVERSION TYPE	CONVERSION CODE	GAIN	BIAS	PTID	Eng Value at 32-bit Signed Integer "-16K"
1	QLC	01	1	03		103	I65YA103G	3					3	RHR	HOLDING REG						I65YA103G	
2	QLC	01	1	03		103	I65YA103H	3					3	RHR	HOLDING REG						I65YA103H	
3	QLC	01	1	03		104	I65HS104A	3					16	PMR	HOLDING REG						I65HS104A	
4	QLC	01	1	03		104	I65HS104B	3					16	PMR	HOLDING REG						I65HS104B	
5	QLC	01	1	03		104	I65HS104D	3					16	PMR	HOLDING REG						I65HS104D	
6	QLC	01	1	03		104	I65HS104E	3					16	PMR	HOLDING REG						I65HS104E	
7	QLC	01	1	03		104	I65HS104F	3					16	PMR	HOLDING REG						I65HS104F	
8	QLC	01	1	03		104	I65YA104G	3					3	RHR	HOLDING REG						I65YA104G	
9	QLC	01	1	03		104	I65YA104H	3					3	RHR	HOLDING REG						I65YA104H	
10	QLC	01	1	03		105	I65PAH105	3					3	RHR	HOLDING REG						I65PAH105	
11	QLC	01	1	03		105	I65PAHH105	3					3	RHR	HOLDING REG						I65PAHH105	
12	QLC	01	1	03		105	I65PAL105	3					3	RHR	HOLDING REG						I65PAL105	
13	QLC	01	1	03		105	I65PALL105	3					3	RHR	HOLDING REG						I65PALL105	
14	QLC	01	1	03		105	I65VAH105A	3					3	RHR	HOLDING REG						I65VAH105A	
15	QLC	01	1	03		105	I65VAH105B	3					3	RHR	HOLDING REG						I65VAH105B	
16	QLC	01	1	03		105	I65VAHH103A	3					3	RHR	HOLDING REG						I65VAHH105A	
17	QLC	01	1	03		105	I65VAHH105B	3					3	RHR	HOLDING REG						I65VAHH105B	
18	QLC	01	1	03		105	I65YA105A	3					3	RHR	HOLDING REG						I65YA105A	
19	QLC	01	1	03		105	I65YA105B	3					3	RHR	HOLDING REG						I65YA105B	
20	QLC	01	1	03		105	I65YA105C	3					3	RHR	HOLDING REG						I65YA105C	
21	QLC	01	1	03		105	I65YA105E	3					3	RHR	HOLDING REG						I65YA105E	
22	QLC	01	1	03		105	I65YL105B	3					3	RHR	HOLDING REG						I65YL105B	
23	QLC	01	1	03		105	I65YL105C	3					3	RHR	HOLDING REG						I65YL105C	
24	QLC	01	1	03		105	I65YL105D	3					3	RHR	HOLDING REG						I65YL105D	
25	QLC	01	1	03		105	I65YL105E	3					3	RHR	HOLDING REG						I65YL105E	
26	QLC	01	1	03		105	I65KI105	3					3	RHR	HOLDING REG	HRS	LINEAR	1	1	0	I65KI105	16/32 Signed/Unsigned I
27	QLC	01	1	03		105	I65HS105A	3					16	PMR	HOLDING REG						I65HS105A	
28	QLC	01	1	03		105	I65HS105B	3					16	PMR	HOLDING REG						I65HS105B	
29	QLC	01	1	03		105	I65HS105D	3					16	PMR	HOLDING REG						I65HS105D	
30	QLC	01	1	03		105	I65HS105E	3					16	PMR	HOLDING REG						I65HS105E	
31	QLC	01	1	03		105	I65HS105F	3					16	PMR	HOLDING REG						I65HS105F	
32	QLC	01	1	03		105	I65YA105G	3					3	RHR	HOLDING REG						I65YA105G	
33	QLC	01	1	03		105	I65YA105H	3					3	RHR	HOLDING REG						I65YA105H	

Appendix B6
New Pump Data Communicated

	DCS DATABASE						
DCS ORDER	Eng Value at 32-bit Signed Integer "+16K"	CUST23/QLC REG ADDRESS	PS 65 RFP647 FDI (.2)_CUST24/ QLC ALGO	QLC Card HW ADDR	QLC Card SW ADDR	PTID	PHW
1				A8H	150H	I65YA103G	336 (150H)
2				A8H	150H	I65YA103H	336 (150H)
3				A8H	150H	I65HS104A	336 (150H)
4				A8H	150H	I65HS104B	336 (150H)
5				A8H	150H	I65HS104D	336 (150H)
6				A8H	150H	I65HS104E	336 (150H)
7				A8H	150H	I65HS104F	336 (150H)
8				A8H	150H	I65YA104G	336 (150H)
9				A8H	150H	I65YA104H	336 (150H)
10				A8H	150H	I65PAH105	336 (150H)
11				A8H	150H	I65PAHH105	336 (150H)
12				A8H	150H	I65PAL105	336 (150H)
13				A8H	150H	I65PALL105	336 (150H)
14				A8H	150H	I65VAH105A	336 (150H)
15				A8H	150H	I65VAH105B	336 (150H)
16				A8H	150H	I65VAHH105A	336 (150H)
17				A8H	150H	I65VAHH105B	336 (150H)
18				A8H	150H	I65YA105A	336 (150H)
19				A8H	150H	I65YA105B	336 (150H)
20				A8H	150H	I65YA105C	336 (150H)
21				A8H	150H	I65YA105E	336 (150H)
22				A8H	150H	I65YL105B	336 (150H)
23				A8H	150H	I65YL105C	336 (150H)
24				A8H	150H	I65YL105D	336 (150H)
25				A8H	150H	I65YL105E	336 (150H)
26	16/32 Signed/Unsigned Integer Representation Alternative Not Ch			A8H	150H	I65KI105	336 (150H)
27				A8H	150H	I65HS105A	336 (150H)
28				A8H	150H	I65HS105B	336 (150H)
29				A8H	150H	I65HS105D	336 (150H)
30				A8H	150H	I65HS105E	336 (150H)
31				A8H	150H	I65HS105F	336 (150H)
32				A8H	150H	I65YA105G	336 (150H)
33				A8H	150H	I65YA105H	336 (150H)

1	2	3	4	5	6	7		9	10	11	12	13	14	15	16	17
TAG #	LOOP #	DESCRIPTION	P&ID DWG. NO.	TECHNICAL SPEC. #	TECHNICAL SECTION. #	CONTROL PANEL #	CONTROL PANEL REF#	MECH. DWG. #	ELEC. DWG. #	INSTALLATION DWG#,DETAIL#	NEMA RATING	SERVICE / LINE SIZE	RANGE	RATING	ALARM / TRIP SET POINT	ADDITIONAL COMMENTS
PROCESS PRESSURE GAUGES																
PI-105	105	Pump 105, Suction Pressure	I-5	13300	2.9	N/A	N/A	M-1 & M-2	E-13	PER 13300	NEMA 4X		0-15 psi	150 psi	N/A	
PRESSURE TRANSMITTERS																
PIT-105A	105	Pump 105, Suction Pressure Transmitter	I-5	13300	2.8	N/A	N/A	M-1 & M-2	E-13	PER 13300	NEMA 4X		0-15 psi	150 psi	N/A	
PIT-105B	105	Pump 105, Dischrage Pressure Transmitter	I-5	13300	2.8	N/A	N/A	M-1 & M-2	E-13	PER 13300	NEMA 4X		0-75 psi	150 psi	N/A	
VIBRATION TRANSMITTER																
VT-103A	103	Pump 103, Upper Bearing Vibration Transmitter	I-4	13300	2.16	N/A	N/A	-	E-13	PER 13300	NEMA 4X		0-2 IPS Peak	-	N/A	
VT-103B	103	Pump 103, Lower Bearing Vibration Transmitter	I-4	13300	2.16	N/A	N/A	-	E-13	PER 13300	NEMA 4X		0-2 IPS Peak	-	N/A	
VT-104A	104	Pump 104, Upper Bearing Vibration Transmitter	I-4	13300	2.16	N/A	N/A	-	E-13	PER 13300	NEMA 4X		0-2 IPS Peak	-	N/A	
VT-104B	104	Pump 104, Lower Bearing Vibration Transmitter	I-4	13300	2.16	N/A	N/A	-	E-13	PER 13300	NEMA 4X		0-2 IPS Peak	-	N/A	
VT-105A	105	Pump 105, Upper Bearing Vibration Transmitter	I-5	13300	2.16	N/A	N/A	-	E-13	PER 13300	NEMA 4X		0-2 IPS Peak	-	N/A	
VT-105B	105	Pump 105, Lower Bearing Vibration Transmitter	I-5	13300	2.16	N/A	N/A	-	E-13	PER 13300	NEMA 4X		0-2 IPS Peak	-	N/A	

LOOP NO:
05F7331

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP	MODEL NO	SPEC NO	AREA CONTRACTOR	SUBMITTAL NO	REMARKS
P	05	FCV	7331		BLOWER 1 CONTROL VALVE	SET POINT	CONTROL VALVE	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	FIC	7331		BLOWER 1 CONTROL VALVE	SET POINT	DCS	05PCM03C	WESTINGHOUSE	WDPFII	13300	ORION	43	
P	05	ZI	7331		BLOWER 1 CONTROL VALVE	POSITION	DCS	05PCM03C	WESTINGHOUSE	WDPFII	13300	ORION	43	
P	05	ZL	7331		BLOWER 1 CONTROL VALVE	REMOTE	DCS	05PCM03C	WESTINGHOUSE	WDPFII	13300	ORION	43	
P	05	ZT	7331		BLOWER 1 CONTROL VALVE	POSITION	CONTROL VALVE	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	HS	7331	A	BLOWER 1 CONTROL VALVE	LOCAL/REMOTE	3-WAY SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	HS	7331	B	BLOWER 1 CONTROL VALVE	OPEN/CLOSE	2-WAY SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	HS	7331	C	BLOWER 1 CONTROL VALVE	STOP	3-WAY SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	HS	7331	D	BLOWER 1 CONTROL VALVE	OPEN/CLOSE	2-WAY SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	ZSC	7331		BLOWER 1 CONTROL VALVE	VALVE CLOSED	LIMIT SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	ZSO	7331		BLOWER 1 CONTROL VALVE	VALVE OPENED	LIMIT SWITCH	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	ZLC	7331		BLOWER 1 CONTROL VALVE	VALVE CLOSED	INDICATOR	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	
P	05	ZLO	7331		BLOWER 1 CONTROL VALVE	VALVE OPENED	INDICATOR	05FCV7331	EIM CONTROLS	TEC2000	15101	ORION	46	

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIGNAL	SIGNAL LEVEL	DEVICE RANGE	ENGR UNITS	PROC SET PT	AREA LOOP DIAGRAM NO	P&ID DWG NO	LOOP FILENAME	INTERCONNECT FILENAME
P	05	FCV	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	0-100	PCT	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	FIC	7331		BLOWER 1 CONTROL VALVE	N/A	AO	4-20 MA	0-100	PCT	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZI	7331		BLOWER 1 CONTROL VALVE	N/A	AI	4-20 MA	0-100	PCT	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZL	7331		BLOWER 1 CONTROL VALVE	N/A	DI	24 VDC	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZT	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	0-100	PCT	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	HS	7331	A	BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	HS	7331	B	BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	HS	7331	C	BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	HS	7331	D	BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZSC	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZSO	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZLC	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003
P	05	ZLO	7331		BLOWER 1 CONTROL VALVE	S20.50	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05F7331	5-I-24	P05F7331.002	P05F7331.003

REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-500
FLOW & PIPING PLAN:	5-M-4 & 5-M-100
ELECTRICAL SINGLE LINE:	5-E-14 & 5-E-17
ELECTRICAL POWER PLAN:	5-E-101, 130
CONTROL WIRING:	5-E-23
EIM CONTROLS:	TEC-3102-0000

DESTROY ALL PRINTS BEARING EARLIER DATE

REV	DATE	DESCRIPTION	BY	CKD	APPROVAL ENGR	APPROVAL MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS BUILT	TP	RS	LB	JS

LEE&RO, Inc.

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE
GRIT AERATION BLOWER 1
CONTROL VALVE

FILE 05F7331.001

LOOP NO.	DWG NO.	SHEET	REV
05F7331	LD-PLWTP05F7331	1 OF 3	C

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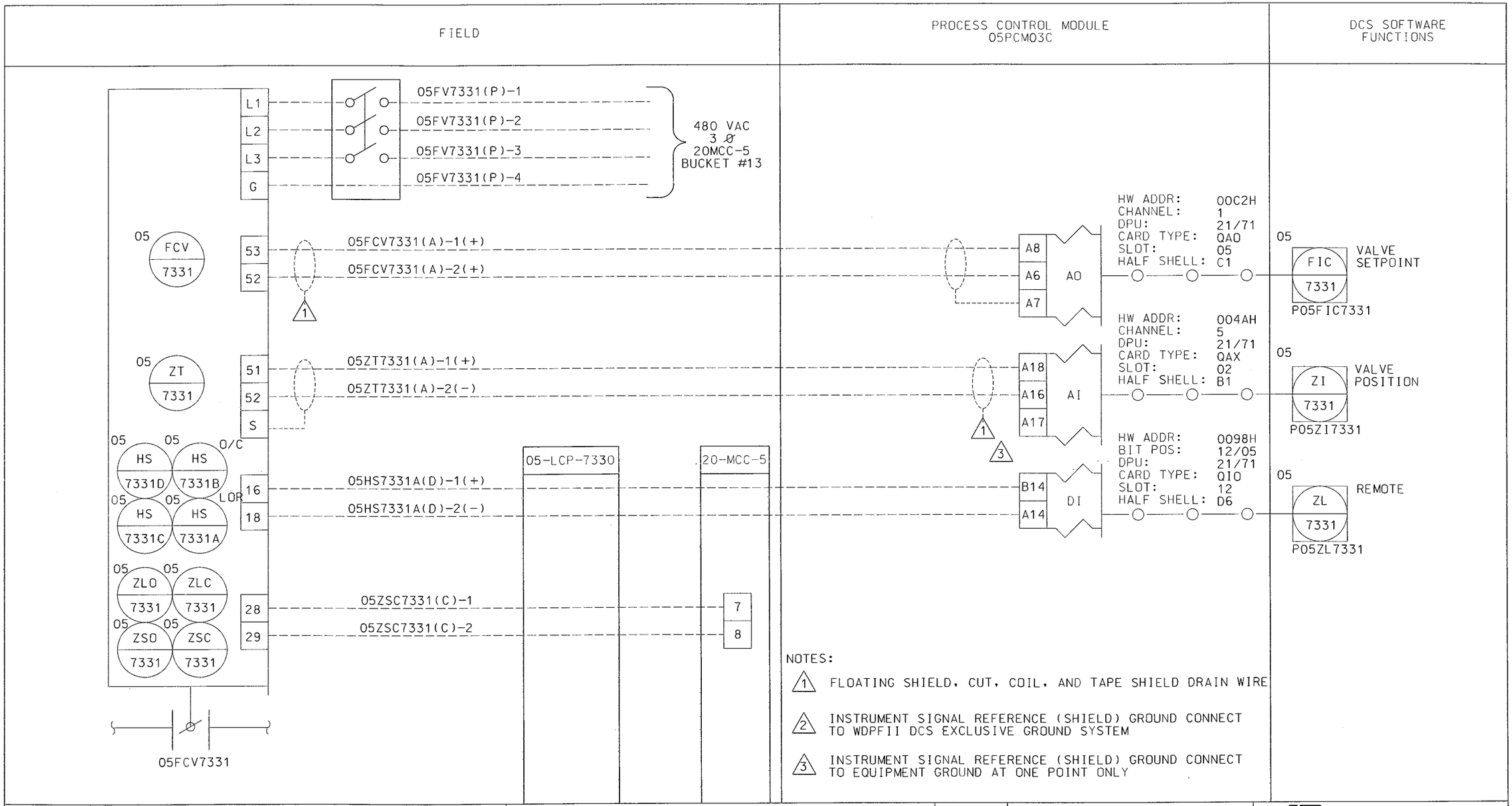

REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-500
FLOW & PIPING PLAN:	5-M-4 & 5-M-100
ELECTRICAL SINGLE LINE:	5-E-14 & 5-E-17
ELECTRICAL POWER PLAN:	5-E-101, 130
CONTROL WIRING:	5-E-23
EIM CONTROLS:	TEC-3102-0000

DESTROY ALL PRINTS BEARING EARLIER DATE

REV	DATE	DESCRIPTION	BY	CKD	APPROVAL ENGR	APPROVAL MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS BUILT	TP	RS	LB	JS

LEE&RO. Inc.
San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INSTRUMENT LOOP DIAGRAM
GRIT AERATION BLOWER 1
CONTROL VALVE

FILE 05F7331.002

LOOP NO.	DWG NO.	SHEET	REV
05F7331	LD-PLWTP05F7331	2 OF 3	C

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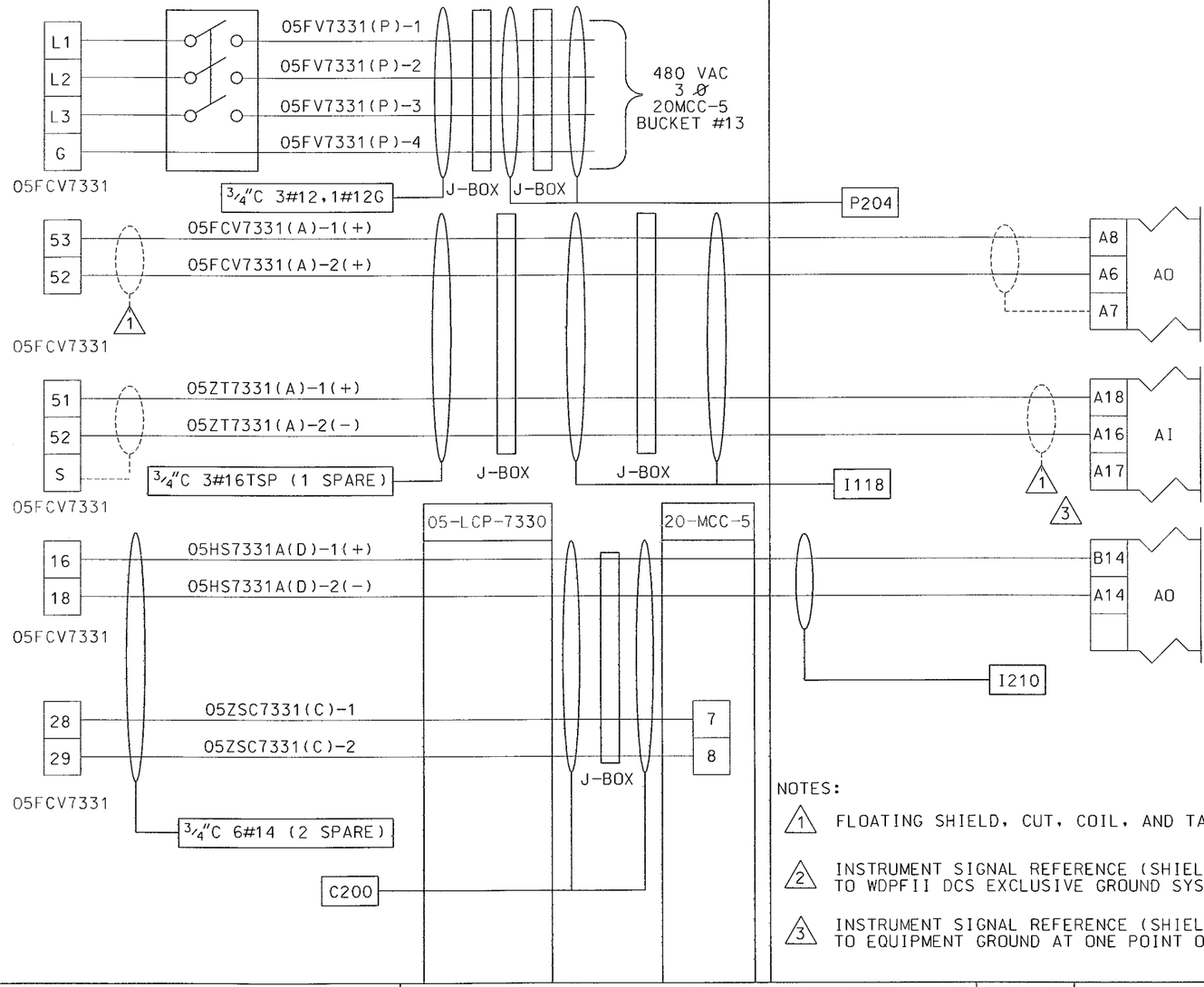
FIELD	PROCESS CONTROL MODULE 05PCM03C	DCS SOFTWARE FUNCTIONS



NOTES:

1. FLOATING SHIELD, CUT, COIL, AND TAPE SHIELD DRAIN WIRE
2. INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO WDPFII DCS EXCLUSIVE GROUND SYSTEM
3. INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO EQUIPMENT GROUND AT ONE POINT ONLY

REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-500
FLOW & PIPING PLAN:	5-M-4 & 5-M-100
ELECTRICAL SINGLE LINE:	5-E-14 & 5-E-17
ELECTRICAL POWER PLAN:	5-E-101, 130
CONTROL WIRING:	5-E-23
EIM CONTROLS:	TEC-3102-0000

DESTROY ALL PRINTS BEARING EARLIER DATE

REV	DATE	DESCRIPTION	BY	CKD	APPROVAL ENGR	APPROVAL MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS BUILT	TP	RS	LB	JS

LEE&RO, Inc.
San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INTERCONNECTION DIAGRAM
GRIT AERATION BLOWER 1
CONTROL VALVE

FILE 05F7331.003

LOOP NO.	DWG NO.	SHEET	REV
05F7331	LD-PLWTP05F7331	3 OF 3	C

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LOOP NO:
05F7359

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP	MODEL NO	SPEC NO	AREA CONTRACTOR	SUBMITTAL NO	REMARKS
P	05	FIT	7359		GRIT AERATION BLOWER FLOWMETER	AIR FLOW	FLOW METER	05FIT7359	FCI	ST98-2	13300	ORION	13	
P	05	FI	7359		GRIT AERATION BLOWER FLOWMETER	AIR FLOW	DCS	05PCMO3C	WESTINGHOUSE	WDPFII	13300	ORION	43	

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIGNAL	SIGNAL LEVEL	DEVICE RANGE	ENGR UNITS	PROC SET PT	AREA LOOP DIAGRAM NO	P&ID DWG NO	LOOP FILENAME	INTERCONNECT FILENAME
P	05	FIT	7359		GRIT AERATION BLOWER FLOWMETER	S20.60	N/A	N/A	0-100	PCT	N/A	LD-PLWTP05F7359	5-I-24	P057359.002	P057359.003
P	05	FI	7359		GRIT AERATION BLOWER FLOWMETER	N/A	AI	4-20 MA	0-100	PCT	N/A	LD-PLWTP05F7359	5-I-24	P057359.002	P057359.003

REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-101
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL EQUIPMENT:	5-E-17
ELECTRICAL PANEL SCHEDULE:	5-E-504
ELECTRICAL CONDUIT PLAN & SCHEDULE:	5-E-101 & 5-E-500

DESTROY ALL PRINTS BEARING EARLIER DATE

REV	DATE	DESCRIPTION	BY	CKD	APPROVAL ENGR	APPROVAL MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS BUILT	TP	RS	LB	JS

LEE&RO, Inc.
San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE
GRIT AERATION BLOWER
FLOW METER

FILE 05F7359.001

LOOP NO.	DWG NO.	SHEET	REV
05F7359	LD-PLWTP05F7359	1 OF 3	C

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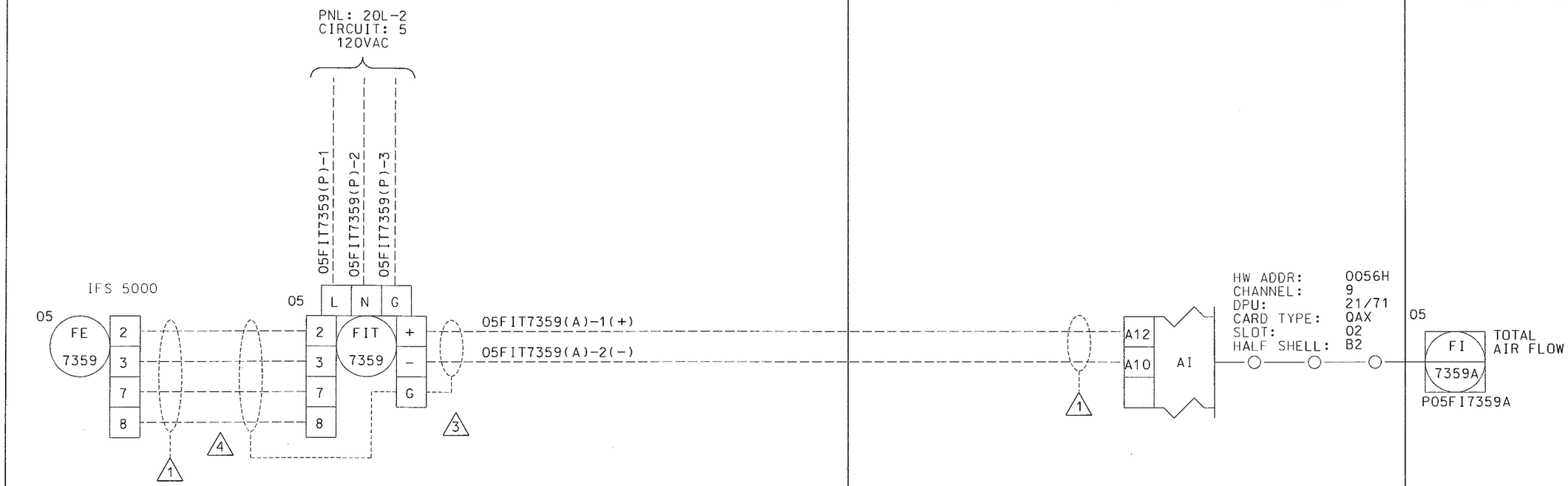


NOTES:

1. FLOATING SHIELD, CUT, COIL, AND TAPE SHIELD DRAIN WIRE
2. INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO WDPFII DCS EXCLUSIVE GROUND SYSTEM
3. INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO EQUIPMENT GROUND AT ONE POINT ONLY
4. CABLE SUPPLIED BY MANUFACTURER WHEN REMOTE LOCATION OF IFC IS REQUIRED

REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-101
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL EQUIPMENT:	5-E-17
ELECTRICAL PANEL SCHEDULE:	5-E-504
ELECTRICAL CONDUIT PLAN & SCHEDULE:	5-E-101 & 5-E-500

DESTROY ALL PRINTS BEARING EARLIER DATE

REV	DATE	DESCRIPTION	BY	CKD	APPROVAL ENGR	APPROVAL MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS BUILT	TP	RS	LB	JS

LEE&RO, Inc.
San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

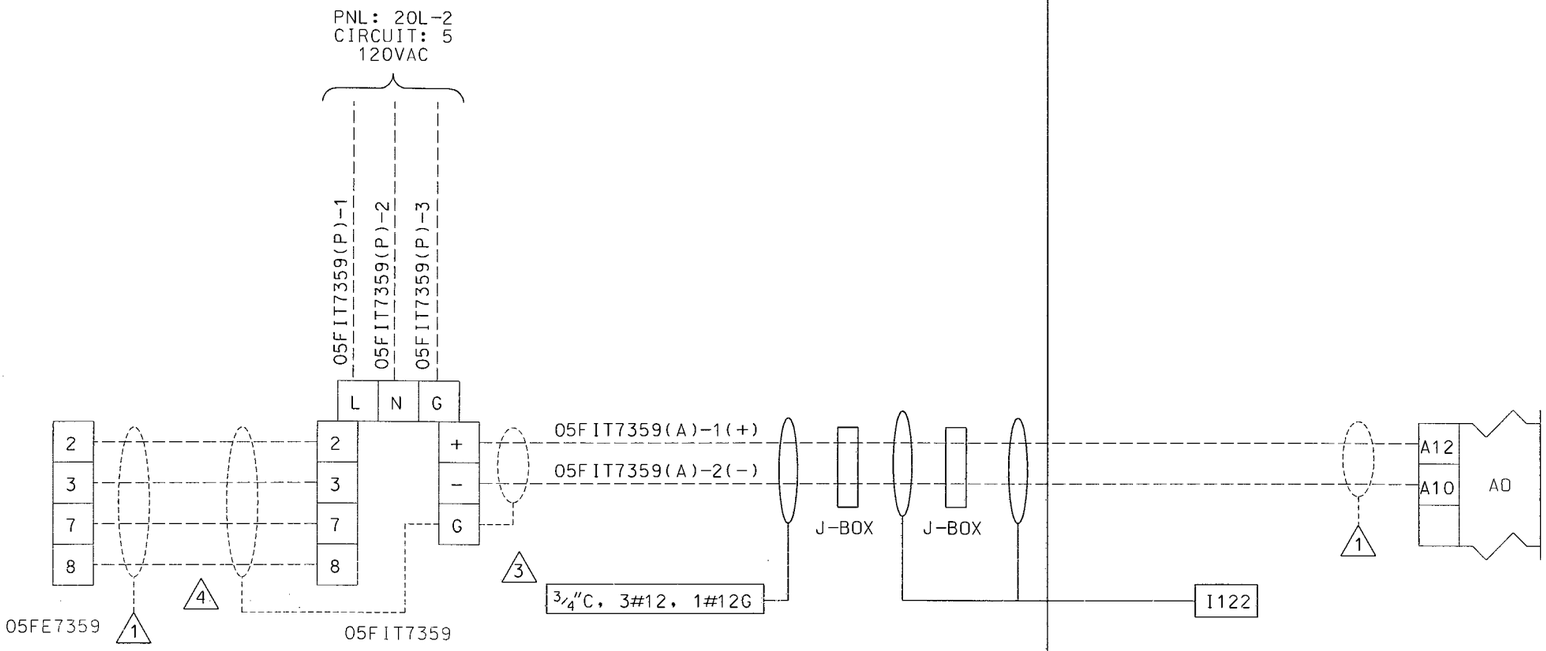
INSTRUMENT LOOP DIAGRAM
GRIT AERATION BLOWER
FLOW METER

FILE 05F7359.002

LOOP NO.	DWG NO.	SHEET	REV
05F7359	LD-PLWTP05F7359	2 OF 3	C

N:\PROJ\823\PREVIOUS PROJECTS\823-Air Blower Facility\Design\elect\05f7359.ref
6/25/2009 1:16:03 PM Daniel Park

FIELD	PROCESS CONTROL MODULE 05PCM03C	DCS SOFTWARE FUNCTIONS



NOTES:

1. FLOATING SHIELD, CUT, COIL, AND TAPE SHIELD DRAIN WIRE
2. INSTRUMENT SIGNAL REFERENCE (SHIELD) GROUND CONNECT TO WDPFII DCS EXCLUSIVE GROUND SYSTEM
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REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-101
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL EQUIPMENT:	5-E-17
ELECTRICAL PANEL SCHEDULE:	5-E-504
ELECTRICAL CONDUIT PLAN & SCHEDULE:	5-E-101 & 5-E-500

DESTROY ALL PRINTS BEARING EARLIER DATE

REV	DATE	DESCRIPTION	BY	CKD	APPROVAL ENGR	APPROVAL MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS BUILT	TP	RS	LB	JS

LEE&RO, Inc.
San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INTERCONNECTION DIAGRAM
GRIT AERATION BLOWER
FLOW METER

FILE 05F7359 .003

LOOP NO.	DWG NO.	SHEET	REV
05F7359	LD-PLWTP05F7359	3 OF 3	C

N:\PROJ\823\PREVIOUS PROJECTS\823-Air Blower Facility\Design\elect\05f7359.ref
6/25/2009 1:16:07 PM Daniel Park

LOOP NO:
05P7330

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP	MODEL NO	SPEC NO	AREA CONTRACTOR	SUBMITTAL NO	REMARKS
P	05	PSH	7330		AERATION BLOWER 1	DISCH PRESS	PRESS SWITCH	5-GAB-7330	SOR	14N	13300	ORION		
P	05	PAH	7330		AERATION BLOWER 1	DISCH PRESS	DCS	05PCM03C	WESTINGHOUSE	WDPFII	13400	ORION	43	
P	05	PAH	7330	A	AERATION BLOWER 1	DISCH PRESS	PILOT LIGHT	05LCP7330	AB	800H-QRH10A	13300	ORION	46	

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIGNAL	SIGNAL LEVEL	DEVICE RANGE	ENGR UNITS	PROC SET PT	AREA LOOP DIAGRAM NO	P&ID DWG NO	LOOP FILENAME	INTERCONNECT FILENAME
P	05	PSH	7330		AERATION BLOWER 1	S20.42	N/A	N/A	0-25	PSI	15 (RISING)	LD-PLWTP05P7330	5-I-24	P05P7330.002	P05P7330.003
P	05	PAH	7330		AERATION BLOWER 1	N/A	DI	24 VDC	N/A	N/A	N/A	LD-PLWTP05P7330	5-I-24	P05P7330.002	P05P7330.003
P	05	PAH	7330	A	AERATION BLOWER 1	N/A	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05P7330	5-I-24	P05P7330.002	P05P7330.003

REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-500
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15
ELECTRICAL POWER PLAN:	5-E-101
CONTROL WIRING:	5-E-23
GARDNER DENVER CONTROLS:	VP1024154

DESTROY ALL PRINTS BEARING EARLIER DATE

REV	DATE	DESCRIPTION	BY	CKD	APPROVAL ENGR	APPROVAL MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
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C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS

LEE&RO, Inc.
San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE
GRIT AERATION BLOWER 1 DISCH PRESS

FILE 05P7330.001

LOOP NO.	DWG NO.	SHEET	REV
05P7330	LD-PLWTP05P7330	1 OF 3	C

N:\PROJ\823\PREVIOUS PROJECTS\823-Air Blower Facility\Design\Velecf\05p7330.ref
6/25/2009 1:17:21 PM Daniel Park

FIELD	05-LCP-7330	PROCESS CONTROL MODULE 05PCM03C	DCS SOFTWARE FUNCTIONS

REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-500
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15
ELECTRICAL POWER PLAN:	5-E-101
CONTROL WIRING:	5-E-23
GARDNER DENVER CONTROLS:	VP1024154

DESTROY ALL PRINTS BEARING EARLIER DATE

REV	DATE	DESCRIPTION	BY	CKD	APPROVAL ENGR	APPROVAL MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS

LEE&RO, Inc.
San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INSTRUMENT LOOP DIAGRAM
GRIT AERATION BLOWER 1 DISCH PRESS

FILE 05P7330.002

LOOP NO.	DWG NO.	SHEET	REV
05P7330	LD-PLWTP05P7330	2 OF 3	C

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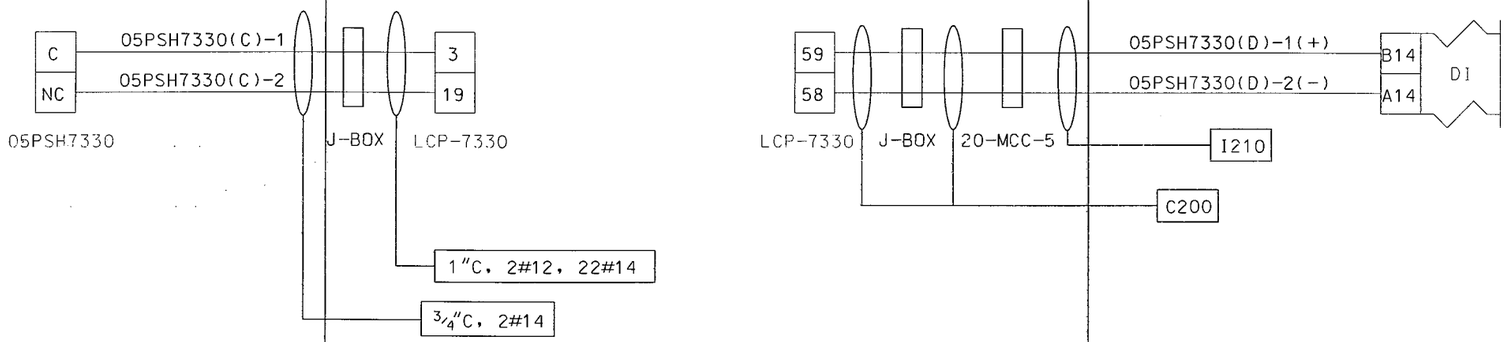
6/25/2009 1:17:26 PM
Daniel Park

FIELD	05-LCP-7330	PROCESS CONTROL MODULE 05PCM03C	DCS SOFTWARE FUNCTIONS



REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-500
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15
ELECTRICAL POWER PLAN:	5-E-101
CONTROL WIRING:	5-E-23
GARDNER DENVER CONTROLS:	VP1024154

DESTROY ALL PRINTS BEARING EARLIER DATE						
REV	DATE	DESCRIPTION	BY	CKD	APPROVAL ENGR	APPROVAL MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS

LEE&RO, Inc.
San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INTERCONNECTION DIAGRAM
GRIT AERATION BLOWER 1 DISCH PRESS

FILE 05P7330.003

LOOP NO.	DWG NO.	SHEET	REV
05P7330	LD-PLWTP05P7330	3 OF 3	C

N:\PROJ\823\PREVIOUS PROJECTS\823-Air Blower Facility\Design\elect\05p7330.ref
4/25/2009 1:17:29 PM Daniel Park

LOOP NO:
05PD7330

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP	MODEL NO	SPEC NO	AREA CONTRACTOR	SUBMITTAL NO	REMARKS
P	05	PDSH	7330		AERATION BLOWER 1	HI FILTER PRES	PRESS SWITCH	5-GAB-7330	SOR	107AL	13300	ORION	N/A	RFP-02
P	05	PDAH	7330		AERATION BLOWER 1	HI FILTER PRES	DCS	05PCM03C	WESTINGHOUSE	WDPFII	13400	ORION	43	
P	05	PDAH	7330	A	AERATION BLOWER 1	HI FILTER PRES	PILOT LIGHT	05LCP7330	AB	800H-QRH10A	13300	ORION	46	

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIGNAL	SIGNAL LEVEL	DEVICE RANGE	ENGR UNITS	PROC SET PT	AREA LOOP DIAGRAM NO	P&ID DWG NO	LOOP FILENAME	INTERCONNECT FILENAME
P	05	PDSH	7330		AERATION BLOWER 1	S20.42	N/A	N/A	0-12	IWC	8 IWC INCR	LD-PLWTP05PD7330	5-I-24	P05PD7330.004	P05PD7330.003
P	05	PDAH	7330		AERATION BLOWER 1	N/A	DI	24 VDC	N/A	N/A	N/A	LD-PLWTP05PD7330	5-I-24	P05PD7330.004	P05PD7330.003
P	05	PDAH	7330	A	AERATION BLOWER 1	N/A	N/A	N/A	N/A	N/A	N/A	LD-PLWTP05PD7330	5-I-24	P05PD7330.004	P05PD7330.003

REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-500
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15
ELECTRICAL POWER PLAN:	5-E-101
CONTROL WIRING:	5-E-23
GARDNER DENVER CONTROLS:	VP1024154

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVAL	
REV	DATE	DESCRIPTION	BY	CKD	ENGR	MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS

LEE&RO, Inc.
San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE
GRIT AERATION BLOWER 1 FILTER PRESS

FILE 05PD7330.001

LOOP NO.	DWG NO.	SHEET	REV
05PD7330	LD-PLWTP05PD7330	1 OF 3	C

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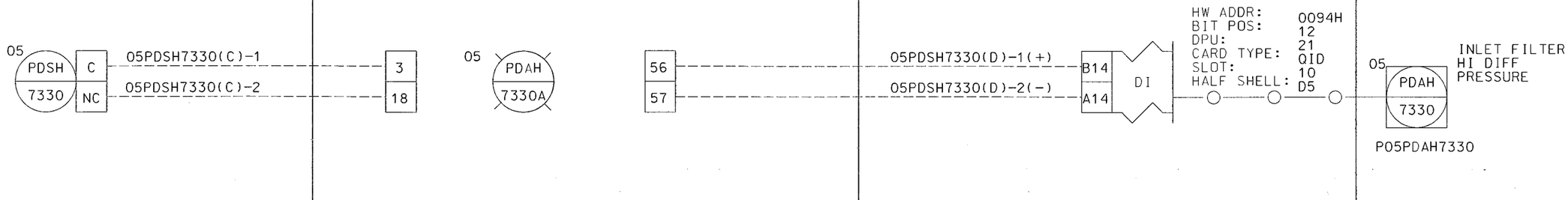
6/25/2009 1:18:26 PM Daniel Park

FIELD	05-LCP-7330	PROCESS CONTROL MODULE 05PCM03C	DCS SOFTWARE FUNCTIONS



REFERENCE DRAWINGS	
P & ID:	5-I-24
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FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15
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POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INSTRUMENT LOOP DIAGRAM
GRIT AERATION BLOWER 1 FILTER PRESS

FILE 05PD7330.002

LOOP NO.	DWG NO.	SHEET	REV
05PD7330	LD-PLWTP05PD7330	2 OF 3	C

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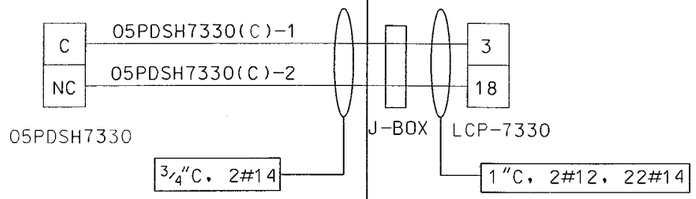
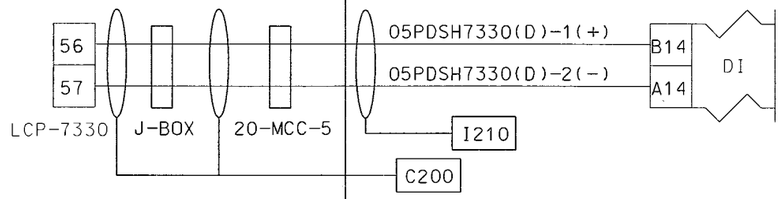
FIELD	05-LCP-7330	PROCESS CONTROL MODULE 05PCM03C	DCS SOFTWARE FUNCTIONS





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C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS

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POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INTERCONNECTION DIAGRAM
GRIT AERATION BLOWER 1 FILTER PRESS

FILE 05PD7330.003

LOOP NO.	DWG NO.	SHEET	REV
05PD7330	LD-PLWTP05PD7330	3 OF 3	C

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6/25/2009 1:18:33 PM Daniel Park

LOOP NO:
05T7330

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP	MODEL NO	SPEC NO	AREA CONTRACTOR	SUBMITTAL NO	REMARKS
P	05	TE	7330	A	AERATION BLOWER 1	INLET BEARING	RTD	5-GAB-7330	LAMSON	300RGA1354	11372	ORION	46	
P	05	TE	7330	B	AERATION BLOWER 1	OUTLET BEARING	RTD	5-GAB-7330	LAMSON	300RGA1354	11372	ORION	46	
P	05	TAH	7330		AERATION BLOWER 1	HI TEMP	DCS	05PCM03C	WESTINGHOUSE	WDPFII	13400	ORION	43	
P	05	TAHH	7330		AERATION BLOWER 1	HI HI TEMP	DCS	05PCM03C	WESTINGHOUSE	WDPFII	13400	ORION	43	
P	05	TI	7330	A	AERATION BLOWER 1	INLET BEARING	PANEL METER	5-GAB-7330	RED LION	PAXT0000	11372	ORION	46	
P	05	TI	7330	B	AERATION BLOWER 1	OUTLET BEARING	PANEL METER	5-GAB-7330	RED LION	PAXT0000	11372	ORION	46	
P	05	TAHH	7330	A	AERATION BLOWER 1	HI HI INL BEAR	PILOT LIGHT	05LCP7330	AB	800H-QRH10A	11372	ORION	46	
P	05	TAHH	7330	B	AERATION BLOWER 1	HI HI OUT BEAR	PILOT LIGHT	05LCP7330	AB	800H-QRH10A	11372	ORION	46	

N	UP NO	TAG PRE	TAG NO	TAG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIGNAL	SIGNAL LEVEL	DEVICE RANGE	ENGR UNITS	PROC SET PT	AREA LOOP DIAGRAM NO	P&ID DWG NO	LOOP FILENAME	INTERCONNECT FILENAME
P	05	TE	7330	A	AERATION BLOWER 1	S20.13A	N/A	MIL VOLT	400	DEG F	N/A	LD-PLWTP05T7330	5-I-24	P05T7330.002	P05T7330.003
P	05	TE	7330	B	AERATION BLOWER 1	S20.13A	N/A	MIL VOLT	400	DEG F	N/A	LD-PLWTP05T7330	5-I-24	P05T7330.002	P05T7330.003
P	05	TAH	7330		AERATION BLOWER 1	N/A	DI	24 VDC	N/A	N/A	N/A	LD-PLWTP05T7330	5-I-24	P05T7330.002	P05T7330.003
P	05	TAHH	7330		AERATION BLOWER 1	N/A	DI	24 VDC	N/A	N/A	N/A	LD-PLWTP05T7330	5-I-24	P05T7330.002	P05T7330.003
P	05	TI	7330	A	AERATION BLOWER 1	N/A	N/A	MIL VOLT	N/A	N/A	N/A	LD-PLWTP05T7330	5-I-24	P05T7330.002	P05T7330.003
P	05	TI	7330	B	AERATION BLOWER 1	N/A	N/A	MIL VOLT	N/A	N/A	N/A	LD-PLWTP05T7330	5-I-24	P05T7330.002	P05T7330.003
P	05	TAHH	7330	A	AERATION BLOWER 1	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PLWTP05T7330	5-I-24	P05T7330.002	P05T7330.003
P	05	TAHH	7330	B	AERATION BLOWER 1	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PLWTP05T7330	5-I-24	P05T7330.002	P05T7330.003

REFERENCE DRAWINGS	
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DESTROY ALL PRINTS BEARING EARLIER DATE

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C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS

LEE&RO, Inc.
San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INSTRUMENT LOOP DIAGRAM DEVICE SCHEDULE
GRIT AERATION BLOWER 1 BEARING TEMP

FILE 05T7330.001

LOOP NO.	DWG NO.	SHEET	REV
05T7330	LD-PLWTP05T7330	1 OF 3	C

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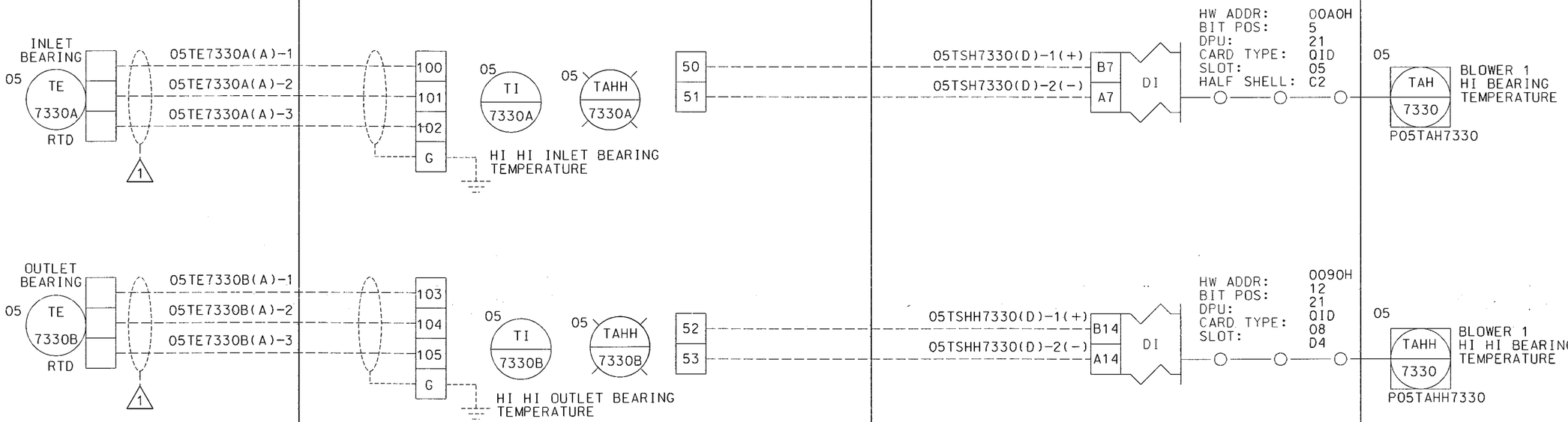
FIELD	05-LCP-7330	PROCESS CONTROL MODULE 05PCM03C	DCS SOFTWARE FUNCTIONS



NOTES:

1. FLOATING SHIELD, CUT, COIL, AND TAPE SHIELD DRAIN WIRE

REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-500
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15
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REV	DATE	DESCRIPTION	BY	CKD	APPROVAL ENGR	APPROVAL MGR
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C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS

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POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INSTRUMENT LOOP DIAGRAM
GRIT AERATION BLOWER 1 BEARING TEMP

FILE 05T7330.002

LOOP NO.	DWG NO.	SHEET	REV
05T7330	LD-PLWTP05T7330	2 OF 3	C

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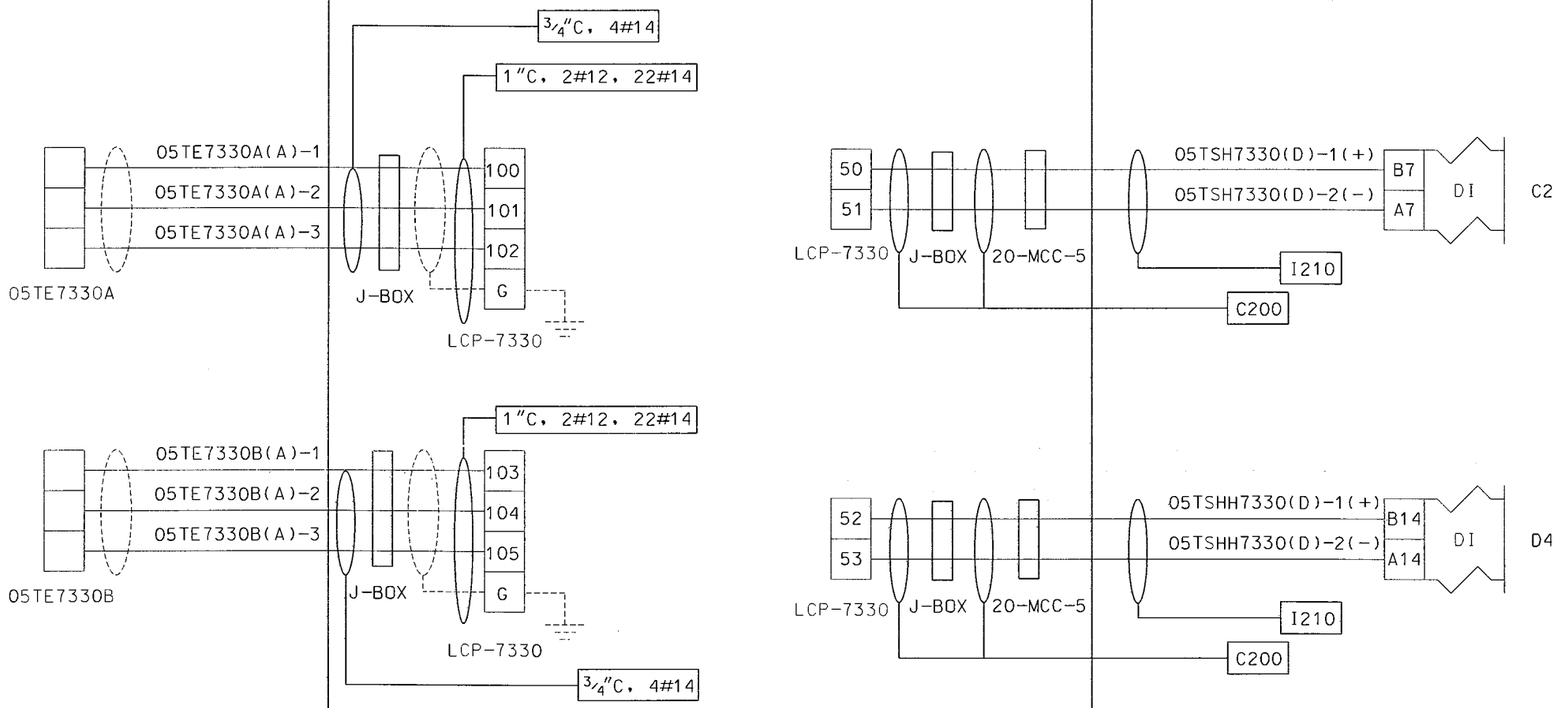
FIELD	05-LCP-7330	PROCESS CONTROL MODULE 05PCM03C	DCS SOFTWARE FUNCTIONS



REFERENCE DRAWINGS	
P & ID:	5-I-24
ELECTRICAL/CONDUIT DWG:	5-E-500
FLOW & PIPING PLAN:	5-M-14 & 5-M-100
ELECTRICAL SINGLE LINE:	5-E-13, 5-E-17, AND 5-E-15
ELECTRICAL POWER PLAN:	5-E-101
CONTROL WIRING:	5-E-23
GARDNER DENVER CONTROLS:	VP1024154

DESTROY ALL PRINTS BEARING EARLIER DATE

REV	DATE	DESCRIPTION	BY	CKD	APPROVAL ENGR	APPROVAL MGR
A	9-7-07	ISSUED FOR REVIEW	TP	RS	LB	JS
B	9-10-07	ISSUED FOR CONSTRUCTION	TP	RS	LB	JS
C	10-10-07	ISSUED FOR AS-BUILT	TP	RS	LB	JS

LEE&RO, Inc.
San Diego, California

POINT LOMA GRIT AERATION SYSTEMS PROJECT
METROPOLITAN WASTEWATER DEPARTMENT
CITY OF SAN DIEGO, CALIFORNIA

CIP NO. 46-943.0

INTERCONNECTION DIAGRAM
GRIT AERATION BLOWER 1 BEARING TEMP

FILE 05T7330.003

LOOP NO.	DWG NO.	SHEET	REV
05T7330	LD-PLWTP05T7330	3 OF 3	C

LOOP NO: 65Y1A

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	Ø01	A	SF-1	SF-1 FAIL	ALARM	PLC-1Ø0						EXISTING
I	65	BTR		TR	SF-1	SF-1 FAIL	RELAY	MCC-C	SQ "D" COMPANY	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	Ø01	A	SF-1	N/A	DI	120VAC				LD-PS65Y1A-2		LD-PS65Y1A	LD-PS65Y1A-3
I	65	BTR		TR	SF-1	N/A	N/A	120VAC				LD-PS65Y1A-2		LD-PS65Y1A	LD-PS65Y1A-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	2/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1/1/0							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

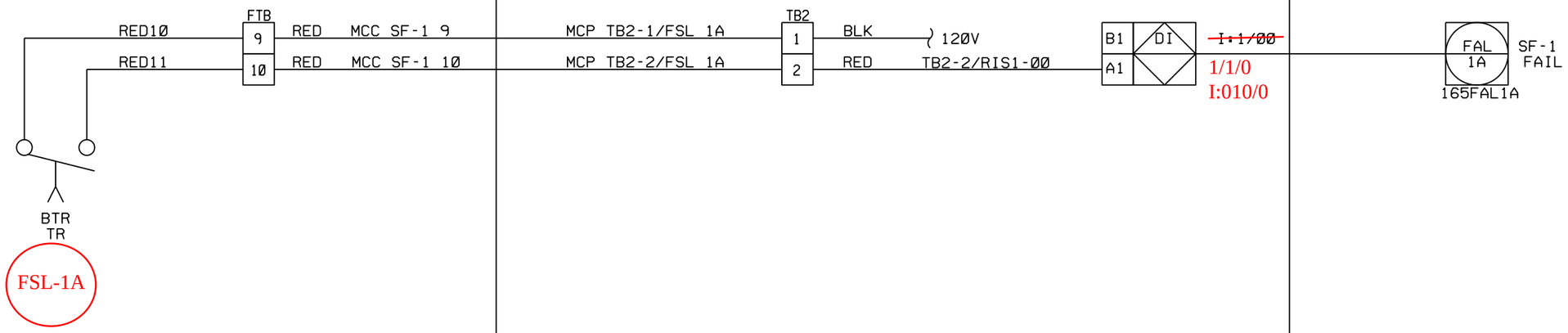
BROWN AUTOMATION JOB• 9079

FILE NAME: 65Y1A-1

LOOP DIAGRAM SCHEDULE
PUMP ROOM SUPPLY FAN SF-1 FAILURE

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y1A	65Y1A-1	LD-PS65Y1A	1	OF	3	Ø

MCCC SF-1	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1/1/0							

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP ROOM SUPPLY FAN SF-1 FAILURE

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y1A-2

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65Y1A	65Y1A-2	LD-PS65Y1A	2	OF	3	0

LOOP NO: 65Y3A

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	Ø03	A	SF-3	SF-3 FAIL	ALARM	PLC-1ØØ						EXISTING
I	65	BTR		A	SF-3	SF-3 FAIL	RELAY	FIELD	SQ "D" COMPANY	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	Ø03	A	SF-3	N/A	DI	12ØVAC				LD-PS65Y3A-2		LD-PS65Y3A	LD-PS65Y3A-3
I	65	BTR		A	SF-3	N/A	N/A	12ØVAC				LD-PS65Y3A-2		LD-PS65Y3A	LD-PS65Y3A-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	2/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1/1/1							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

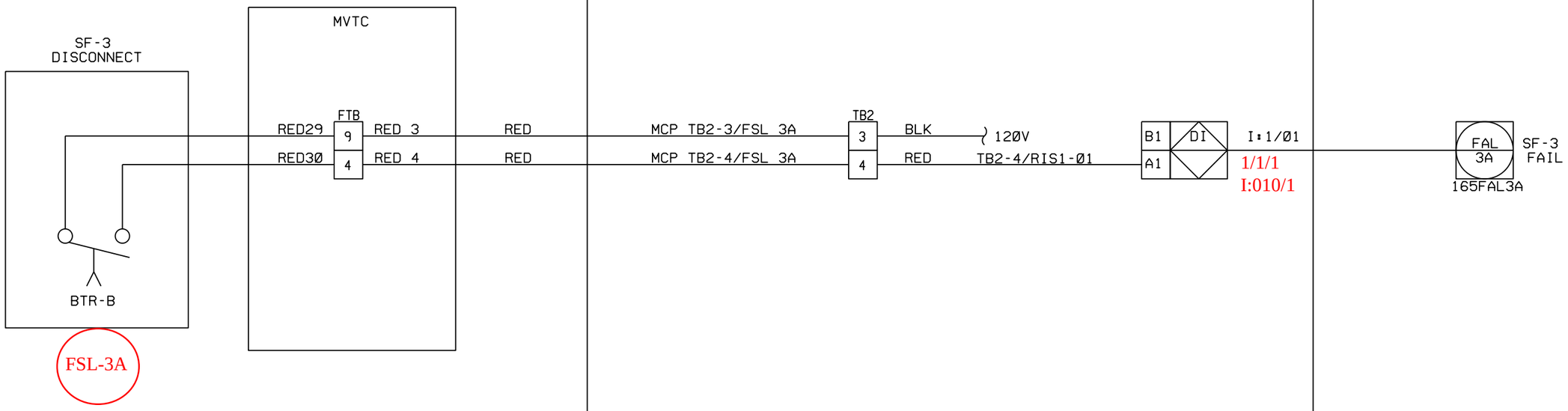
BROWN AUTOMATION JOB• 9079

LOOP DIAGRAM SCHEDULE
METER VAULT SUPPLY FAN SF-3 FAILURE

FILE NAME: 65Y3A-1

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y3A	65Y3A-1	LD-PS65Y3A	1 OF	3	Ø

FIELD METER VAULT SF-3 | MCP PLC-100 | COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS

TBD

REV NO	DATE	DESTROY ALL PRINTS BEARING EARLIER DATE	BY	CKD	APPROVALS PROJ ENGR	PROJ MGR
Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
METER VAULT SUPPLY FAN SF-3 FAILURE

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y3A-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y3A	65Y3A-2	LD-PS65Y3A	2	OF	3	Ø

1/1/1

LOOP NO: 65Y4

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	Ø04		SF-4	SF-4 FAIL	ALARM	PLC-1ØØ						EXISTING
I	65	BTR		TR	SF-4	SF-4 FAIL	RELAY	MCC-C	SQ "D" COMPANY	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	Ø04		SF-4	N/A	DI	12ØVAC				LD-PS65Y4-2		LD-PS65Y4	LD-PS65Y4-3
I	65	BTR		TR	SF-4	N/A	N/A	12ØVAC				LD-PS65Y4-2		LD-PS65Y4	LD-PS65Y4-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	2/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

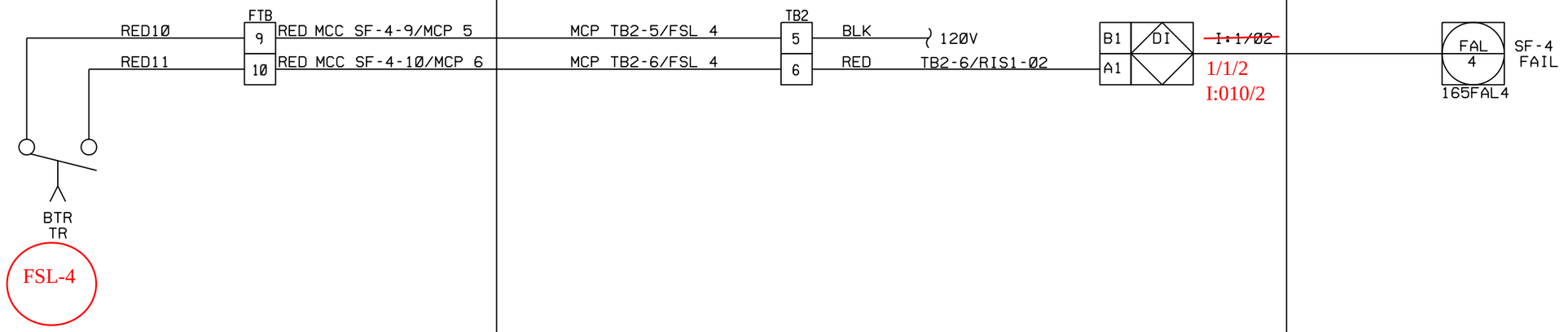
FILE NAME: 65Y4-1

LOOP DIAGRAM SCHEDULE
SCREENING ROOM SUPPLY FAN SF-4 FAILURE

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y4	65Y4-1	LD-PS65Y4	1 OF	3	Ø

1/1/2

MCCC SF-4	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1/1/2							

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
SCREENING ROOM SUPPLY FAN SF-4 FAILURE

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y4-2

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65Y4	65Y4-2	LD-PS65Y4	2	OF	3	Ø

LOOP NO: 65Y5

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	Ø05		SF-5	SF-5 FAIL	ALARM	PLC-1ØØ						EXISTING
I	65	BTR		TR	SF-5	SF-5 FAIL	RELAY	MCC-C	SQ "D" COMPANY	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	Ø05		SF-5	N/A	DI	12ØVAC				LD-PS65Y5-2		LD-PS65Y5	LD-PS65Y5-3
I	65	BTR		TR	SF-5	N/A	N/A	12ØVAC				LD-PS65Y5-2		LD-PS65Y5	LD-PS65Y5-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
Ø	2/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

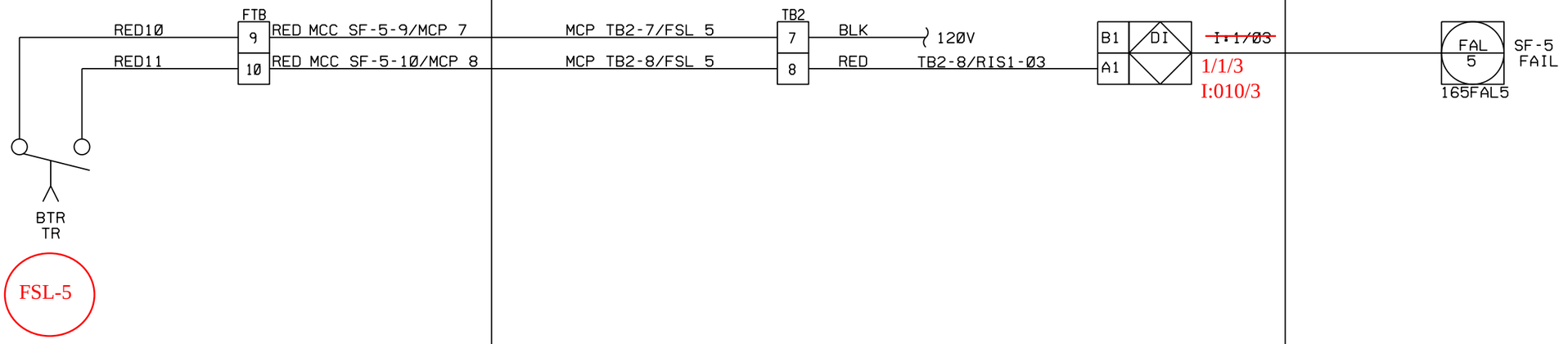
LOOP DIAGRAM SCHEDULE
SCREENING ROOM SUPPLY FAN SF-5 FAILURE

FILE NAME: 65Y5-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y5	65Y5-1	LD-PS65Y5	1	OF	3	Ø

1/1/3

MCCC SF-5	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS

TBD

REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

DESTROY ALL PRINTS BEARING EARLIER DATE

APPROVALS

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION.

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
SCREENING ROOM SUPPLY FAN SF-5 FAILURE

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y5-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y5	65Y5-2	LD-PS65Y5	2	OF	3	Ø

1/1/3

LOOP NO: 65Y1B

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	Ø01	B	EF-1	EF-1 FAIL	ALARM	PLC-1Ø0						EXISTING
I	65	BTR		TR	EF-1	EF-1 FAIL	RELAY	MCC-C	SQ "D" COMPANY	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	Ø01	B	EF-1	N/A	DI	120VAC				LD-PS65Y1B-2		LD-PS65Y1B	LD-PS65Y1B-3
I	65	BTR		TR	EF-1	N/A	N/A	120VAC				LD-PS65Y1B-2		LD-PS65Y1B	LD-PS65Y1B-3

REFERENCE DRAWINGS

TBD

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
Ø	2/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

DESTROY ALL PRINTS BEARING EARLIER DATE

WESTINGHOUSE ELECTRONIC
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

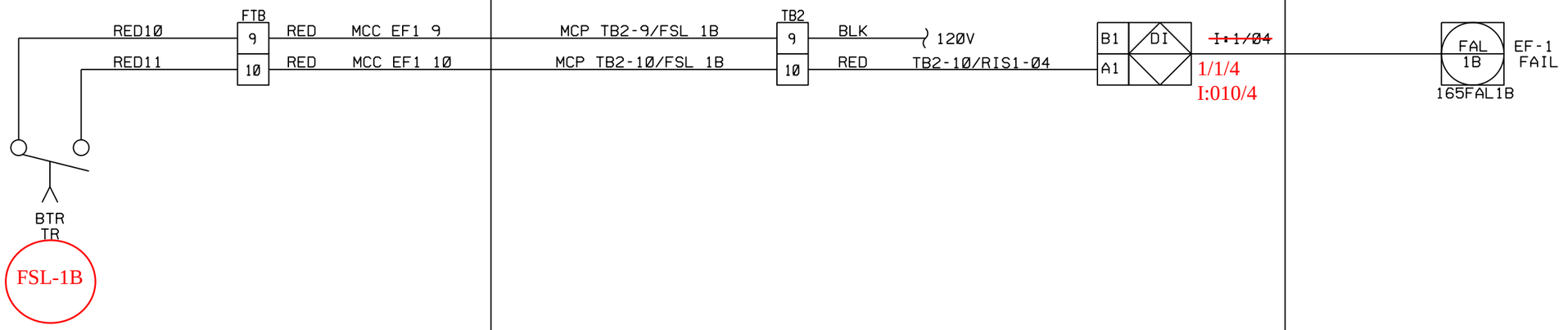
FILE NAME: 65Y1B-1

LOOP DIAGRAM SCHEDULE
MCP ROOM EXHAUST FAN EF-1 FAILURE

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y1B	65Y1B-1	LD-PS65Y1B	1	OF	3	Ø

1/1/4

MCCC EF-1	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1/1/4							

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB• 9079

FILE NAME: 65Y1B-2

INSTRUMENT LOOP DIAGRAM
MCP ROOM EXHAUST FAN EF-1 FAILURE

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y1B	65Y1B-2	LD-PS65Y1B	2 OF	3	Ø

LOOP NO: 65Y2B

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	Ø02	B	EF-2	EF-2 FAIL	ALARM	PLC-1Ø0						EXISTING
I	65	BTR		TR	EF-2	EF-2 FAIL	RELAY	MCC-C	SQ "D" COMPANY	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	Ø02	B	EF-2	N/A	DI	120VAC				LD-PS65Y2B-2		LD-PS65Y2B	LD-PS65Y2B-3
I	65	BTR		TR	EF-2	N/A	N/A	120VAC				LD-PS65Y2B-2		LD-PS65Y2B	LD-PS65Y2B-3

REFERENCE DRAWINGS

TBD

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
Ø	2/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

DESTROY ALL PRINTS BEARING EARLIER DATE

WESTINGHOUSE ELECTRONIC PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
MCP ROOM EXHAUST FAN EF-2 FAILURE

WESTINGHOUSE PROJECT NO. C0137

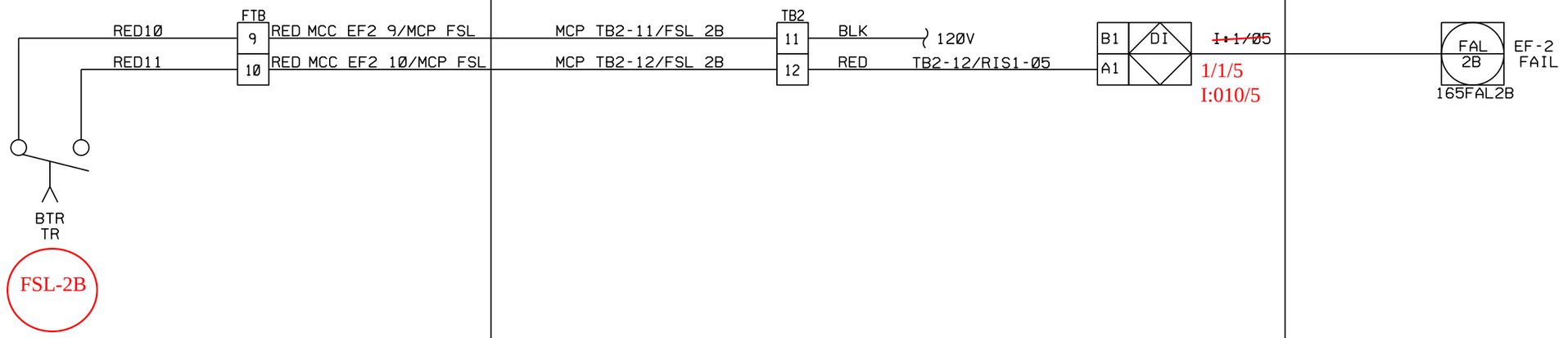
BROWN AUTOMATION JOB* 9079

FILE NAME: 65Y2B-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y2B	65Y2B-1	LD-PS65Y2B	1	OF	3	Ø

1/1/5

MCCC EF-2	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1/1/5							

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y2B-2

INSTRUMENT LOOP DIAGRAM
MCP ROOM EXHAUST FAN EF-2 FAILURE

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y2B	65Y2B-2	LD-PS65Y2B	2 OF	3	Ø

LOOP NO: 65Y3B

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	Ø03	B	EF-3	EF-3 FAIL	ALARM	PLC-1Ø0						EXISTING
I	65	BTR		B	EF-3	EF-3 FAIL	RELAY	FIELD	SQ "D" COMPANY	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	Ø03	B	EF-3	N/A	DI	120VAC				LD-PS65Y3B-2		LD-PS65Y3B	LD-PS65Y3B-3
I	65	BTR		B	EF-3	N/A	N/A	120VAC				LD-PS65Y3B-2		LD-PS65Y3B	LD-PS65Y3B-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
Ø	2/Ø0	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRONIC PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB* 9079

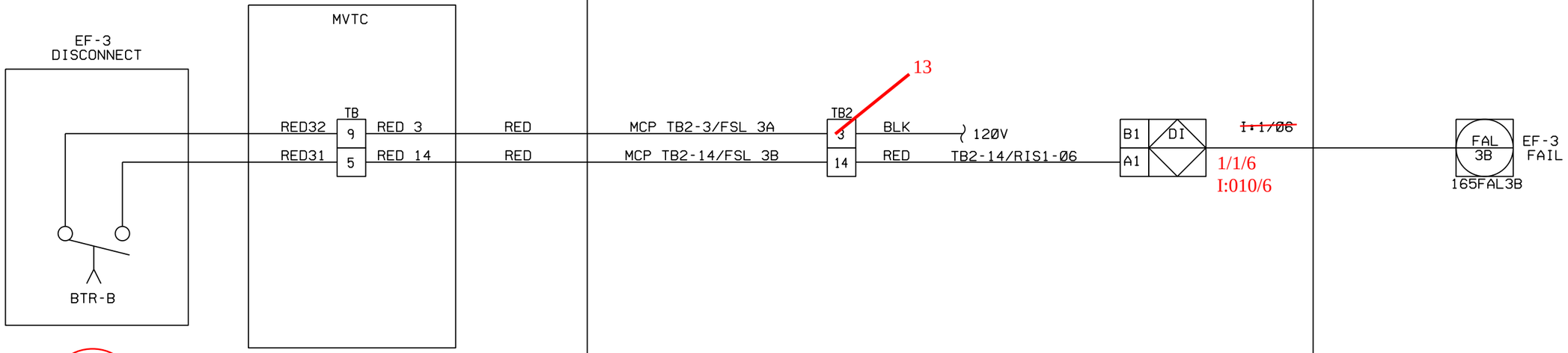
FILE NAME: 65Y3B-1

LOOP DIAGRAM SCHEDULE
METER VAULT EXHAUST FAN EF-3 FAILURE

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y3B	65Y3B-1	LD-PS65Y3B	1	OF	3	Ø

1/1/6

FIELD METER VAULT EF-3	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

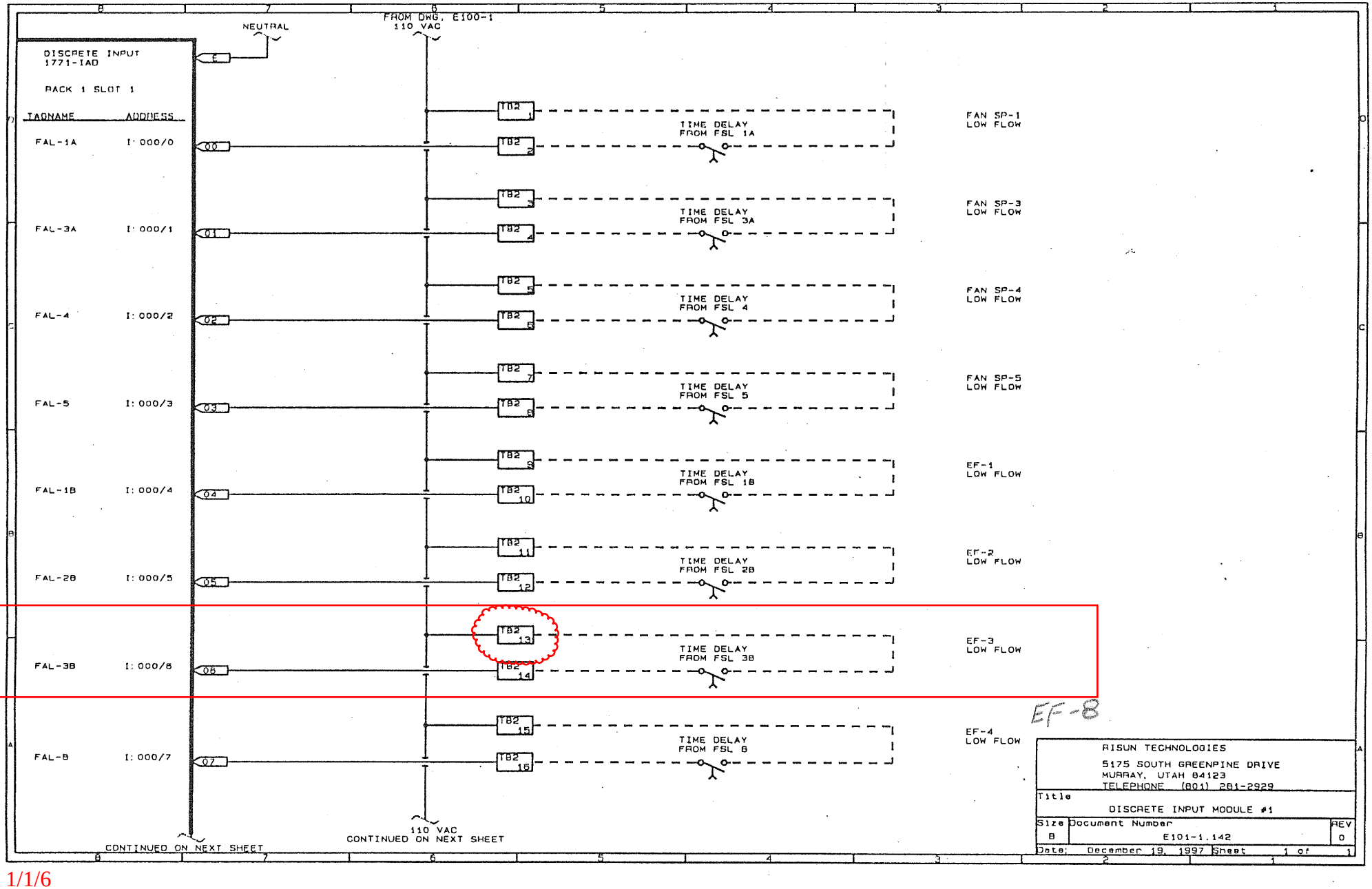
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB• 9079
FILE NAME• 65Y3B-2

INSTRUMENT LOOP DIAGRAM
METER VAULT EXHAUST FAN EF-3 FAILURE

LOOP NO.	CAD FILE•	DWG NO.	SH	OF	SH	REV
65Y3B	65Y3B-2	LD-PS65Y3B	2	OF	3	Ø

1/1/6


NEUTRAL
FROM DWG. E100-1
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 1
TAGNAME
ADDRESS
FAL-1A
I:000/0
FAL-3A
I:000/1
FAL-4
I:000/2
FAL-5
I:000/3
FAL-1B
I:000/4
FAL-2B
I:000/5
FAL-3B
I:000/6
FAL-8
I:000/7
TIME DELAY FROM FSL 1A
TIME DELAY FROM FSL 3A
TIME DELAY FROM FSL 4
TIME DELAY FROM FSL 5
TIME DELAY FROM FSL 1B
TIME DELAY FROM FSL 2B
TIME DELAY FROM FSL 3B
TIME DELAY FROM FSL 8
FAN SP-1 LOW FLOW
FAN SP-3 LOW FLOW
FAN SP-4 LOW FLOW
FAN SP-5 LOW FLOW
EF-1 LOW FLOW
EF-2 LOW FLOW
EF-3 LOW FLOW
EF-4 LOW FLOW
EF-8
CONTINUED ON NEXT SHEET
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #1
Size B
Document Number E101-1.142
REV 0
Date: December 19, 1997
Sheet 1 of 1

1/1/6

LOOP NO: 65Y8

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	Ø08		EF-8	EF-8 FAIL	ALARM	PLC-1ØØ						EXISTING
I	65	BTR1		TR1	EF-8	EF-8 FAIL	RELAY	MCC-C	SQ "D" COMPANY	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	Ø08		EF-8	N/A	DI	12ØVAC				LD-PS65Y8-2		LD-PS65Y8	LD-PS65Y8-3
I	65	BTR1		TR1	EF-8	N/A	N/A	12ØVAC				LD-PS65Y8-2		LD-PS65Y8	LD-PS65Y8-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
Ø	2/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

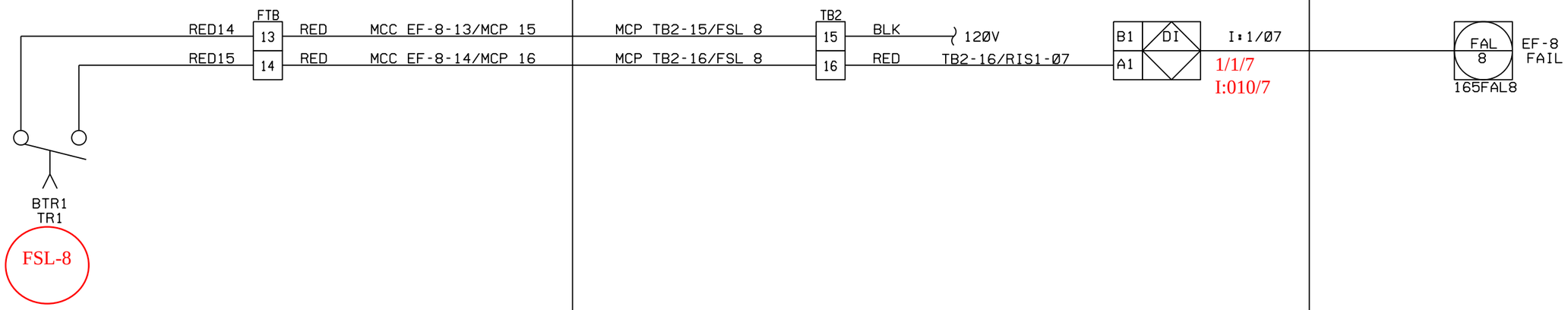
LOOP DIAGRAM SCHEDULE
ODOR CONTROL SYSTEM EXHAUST FAN EF-8 FAILURE

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y8-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y8	65Y8-1	LD-PS65Y8	1	OF	3	Ø

1/1/7

MCCC EF-8	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1/1/7							

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
ODOR CONTROL SYSTEM EXHAUST FAN EF-8 FAILURE

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y8-2

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65Y8	65Y8-2	LD-PS65Y8	2	OF	3	Ø

LOOP NO: 65L50

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LAH	50		PUMP ROOM	SUMP LEVEL HIGH	STATUS	PLC-100						EXISTING
I	65	LAHH	50		PUMP ROOM	FLOAT LEVEL HI-HI	STATUS	PLC-100						EXISTING
I	65	TB2	N/A		PUMP ROOM	SUMP LEVEL HIGH	CONTACTS	UCP-50	RHOMBUS TECH.	*3221-W101-H6A17D19FK				EXISTING
I	65	LSHH	50		PUMP ROOM	FLOAT LEVEL HI-HI	SWITCH	FIELD						EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LAH	50		PUMP ROOM	N/A	DI	120VAC				LD-PS65L50-2		LD-PS65L50	LD-PS65L50-3
I	65	LAHH	50		PUMP ROOM	N/A	DI	120VAC				LD-PS65L50-2		LD-PS65L50	LD-PS65L50-3
I	65	TB2	N/A		PUMP ROOM	N/A	N/A	120VAC				LD-PS65L50-2		LD-PS65L50	LD-PS65L50-3
I	65	LSHH	50		PUMP ROOM	N/A	N/A	120VAC				LD-PS65L50-2		LD-PS65L50	LD-PS65L50-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

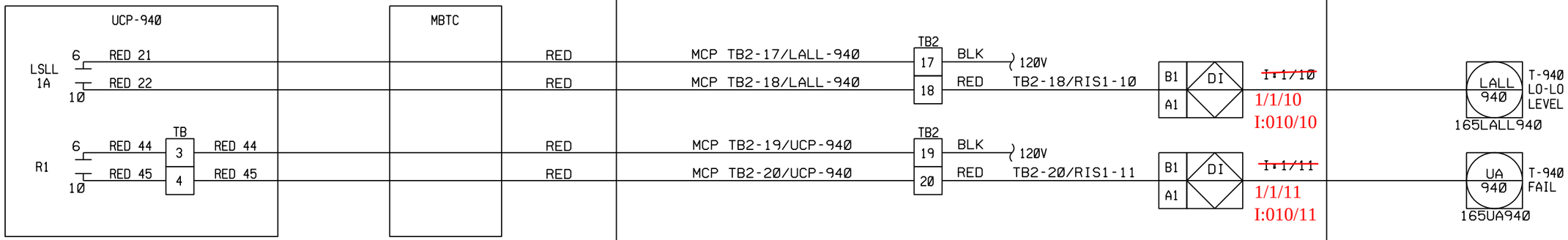
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP ROOM FLOAT & SUMP

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L50-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L50	65L50-1	LD-PS65L50	1	OF	3	0

1/1/10 & 11



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1/1/10 & 11							

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION.

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
CLASS "A" WATER AIR GAP TANK T-940Ø

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y940-2

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65Y940	65Y940-2	LD-PS65Y940	2	OF	3	Ø

LOOP NO: 65Y950

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LALL	950		T-950	T-950 LO-LO	STATUS	PLC-100						EXISTING
I	65	UA	950		T-950	T-950 FAIL	ALARM	PLC-100						EXISTING
I	65	LSLL	1	A	T-950	T-950 LO-LO	RELAY	UCP-90						EXISTING
I	65	RI			T-950	T-950 FAIL	RELAY	UCP-90						EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LALL	950		T-950	N/A	DI	120VAC				LD-PS65Y950-2		LD-PS65Y950	LD-PS65Y950-3
I	65	UA	950		T-950	N/A	DI	120VAC				LD-PS65Y950-2		LD-PS65Y950	LD-PS65Y950-3
I	65	LSLL	1	A	T-950	N/A	N/A	120VAC				LD-PS65Y950-2		LD-PS65Y950	LD-PS65Y950-3
I	65	RI			T-950	N/A	N/A	120VAC				LD-PS65Y950-2		LD-PS65Y950	LD-PS65Y950-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

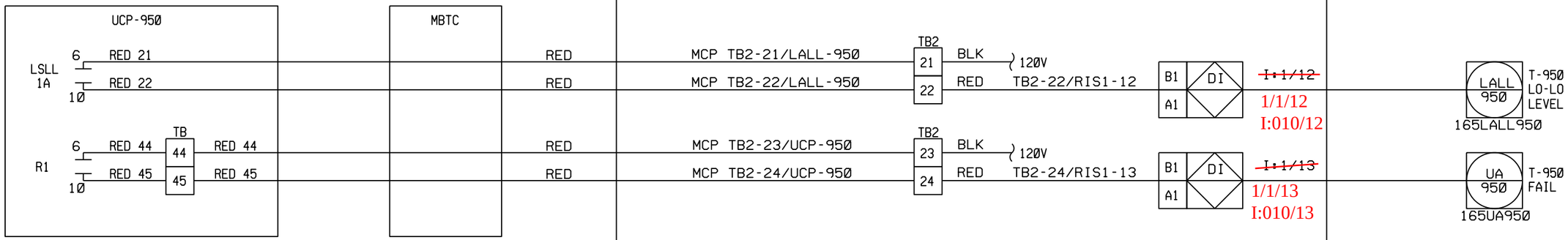
BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y950-1

LOOP DIAGRAM SCHEDULE
CLASS "B" WATER AIR GAP TANK T-950

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y950	65Y950-1	LD-PS65Y950	1	OF	3	0

1/1/12 & 13



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1/1/12 & 13							

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION.
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
CLASS "B" WATER AIR GAP TANK T-950

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y950-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y950	65Y950-2	LD-PS65Y950	2 OF	3	Ø

LOOP NO: 65L25

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LAHH	25		WETWELL *1	HI-HI LEVEL	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	LSHH	25		WETWELL *1	HI-HI LEVEL	SWITCH	FIELD	FLYGHT	ENM-10	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LAHH	25		WETWELL *1	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65L25	N/A	65L25-2	65L25-3
I	65	LSHH	25		WETWELL *1	S20.20	N/A	120VAC	N/A	N/A	N/A	LD-PS65L25	N/A	65L25-2	65L25-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: N/A	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-19	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/1/14							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
OPERATIONAL WET WELL *1 LEVEL FLOAT SW.

FILE NAME: 65L25-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L25	65L25-1	LD-PS65L25	1	OF	3	1

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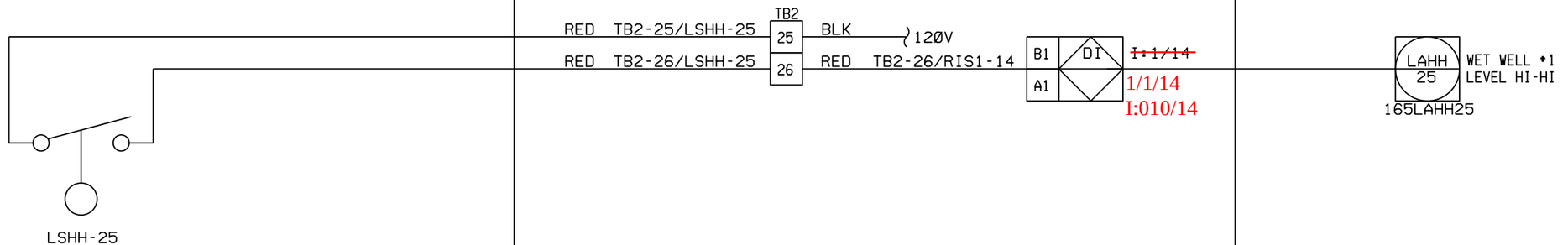
FIELD OPERATIONAL WET WELL *1	MCP PLC-100	DCS



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: N/A	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-19	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/1/14							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
OPERATIONAL WETWELL *1 LEVEL FLOAT SWITCH

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L25-2

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65L25	65L25-2	LD-PS65L25	2	OF	3	1

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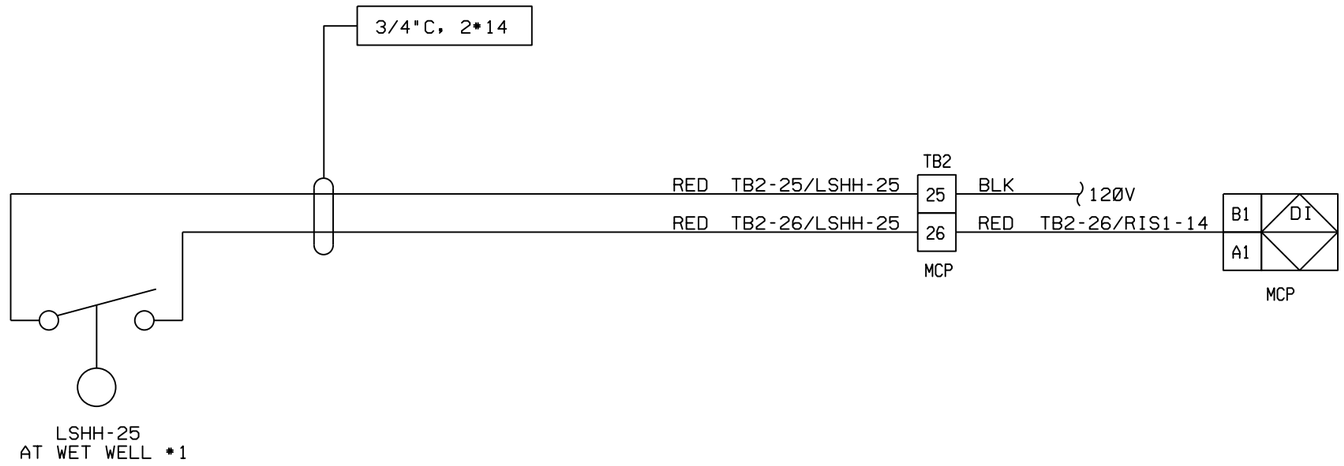

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: N/A	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-19	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/Ø4	AS-BUILT	JG			
1/1/14							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L25-3

INSTRUMENT LOOP DIAGRAM
OPERATIONAL WETWELL *1 LEVEL FLOAT SWITCH

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65L25	65L25-3	LD-PS65L25	3	OF	3	1

LOOP NO: 65L26

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LAHH	26		WETWELL *2	HI-HI LEVEL	ALARM	DCS	WESTINGHOUSE	WDPF II	WPC		EXISTING	EXISTING
I	65	LSHH	26		WETWELL *2	HI-HI LEVEL	SWITCH	FIELD	FLYGHT	ENM-10	N/A	EXISTING	EXISTING	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LAHH	26		WETWELL *2	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65L26	N/A	65L26-2	65L26-3
I	65	LSHH	26		WETWELL *2	S20.20	N/A	120VAC	N/A	N/A	N/A	LD-PS65L26	N/A	65L26-2	65L26-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: N/A	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-19	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/1/15							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
OPERATIONAL WET WELL *2 LEVEL FLOAT SW.

FILE NAME: 65L26-1

LOOP NO.	CAD FILE:	DWG NO. LD-PS65L26	SH	SH	REV
65L26	65L26-1		1 OF	3	1

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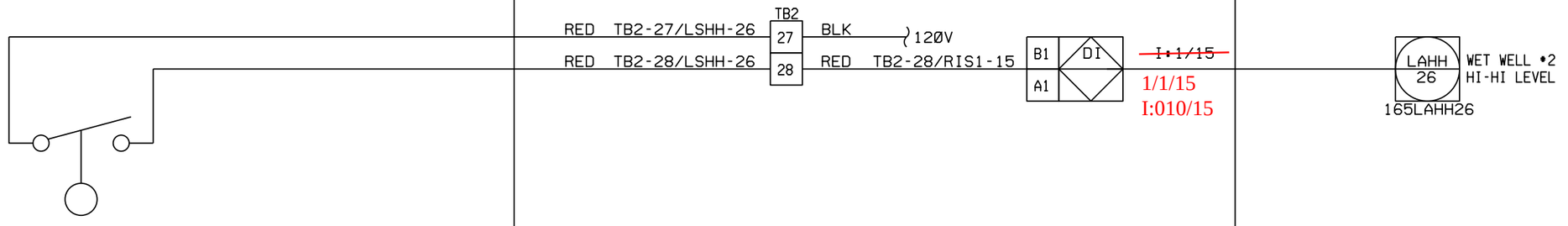
FIELD OPERATIONAL WET WELL *2	MCP PLC-100	COMPUTER SCREEN



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: N/A	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-19	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/1/15							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
OPERATIONAL WETWELL *2 FLOAT SWITCH

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L26-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L26	65L26-2	LD-PS65L26	2	OF	3	1

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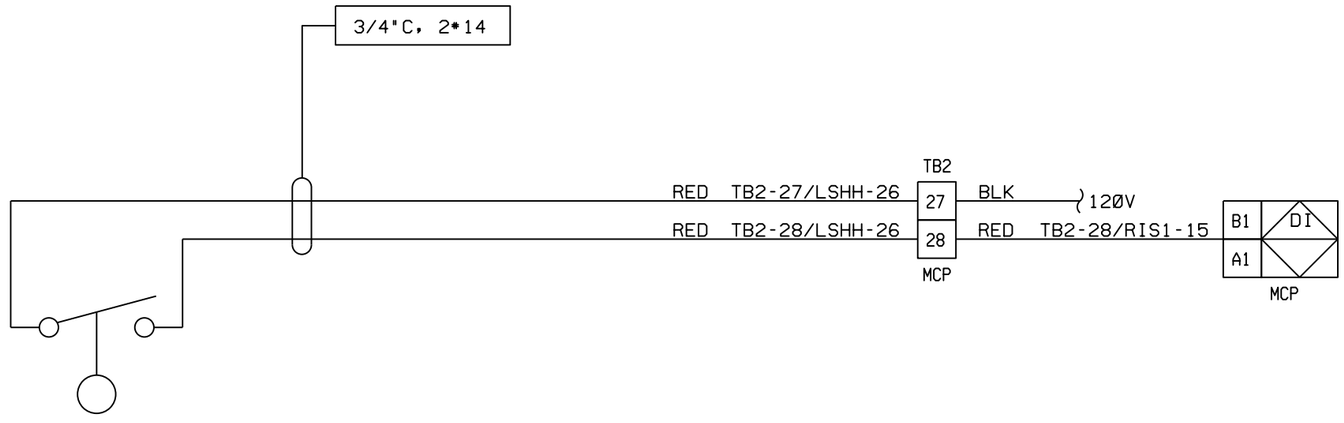

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: N/A	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-19	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/1/15							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

INSTRUMENT LOOP DIAGRAM
OPERATIONAL WETWELL *2 FLOAT SWITCH

FILE NAME: 65L26-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65L26	65L26-3	LD-PS65L26	3 OF	3	1

LOOP NO: 65L27

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LAHH	27		OVERFLOW WETWELL	HI-HI LEVEL	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	EXISTING
I	65	LSHH	27		OVERFLOW WETWELL	HI- HI LEVEL	SWITCH	FIELD	FLYGHT	EMN-10	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LAHH	27		OVERFLOW WETWELL	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65L27	N/A	65L27-2	65L27-3
I	65	LSHH	27		OVERFLOW WETWELL	S20.20	N/A	120VAC	N/A	N/A	N/A	LD-PS65L27	N/A	65L27-2	65L27-3

REFERENCE DRAWINGS
P&ID: N/A
ELECTRICAL PLAN DRAWING: E-19
CONDUIT SCHEDULE: E-11.1
1/1/16

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	11/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
OVERFLOW WET WELL LEVEL FLOAT SW.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L27-1

LOOP NO.	CAD FILE:	DWG NO. LD-PS65L27	SH	SH	REV
65L27	65L27-1		1 OF	3	1

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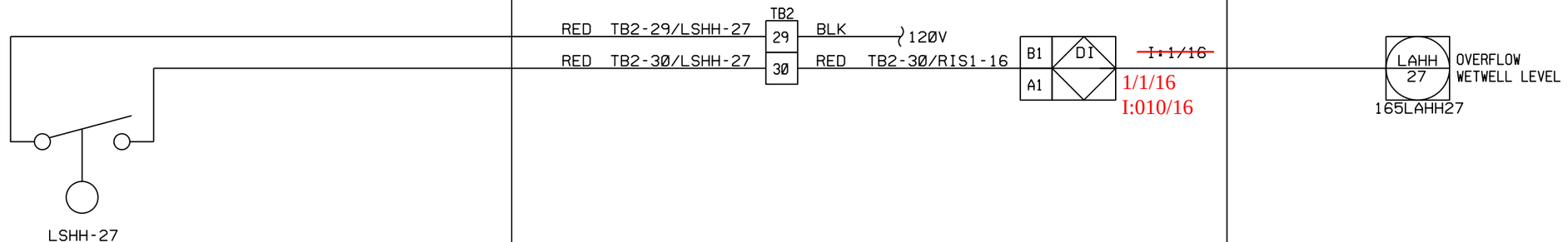
FIELD OVERFLOW WETWELL	MCP PLC-100	COMPUTER SCREEN



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: N/A	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-19	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/1/16							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

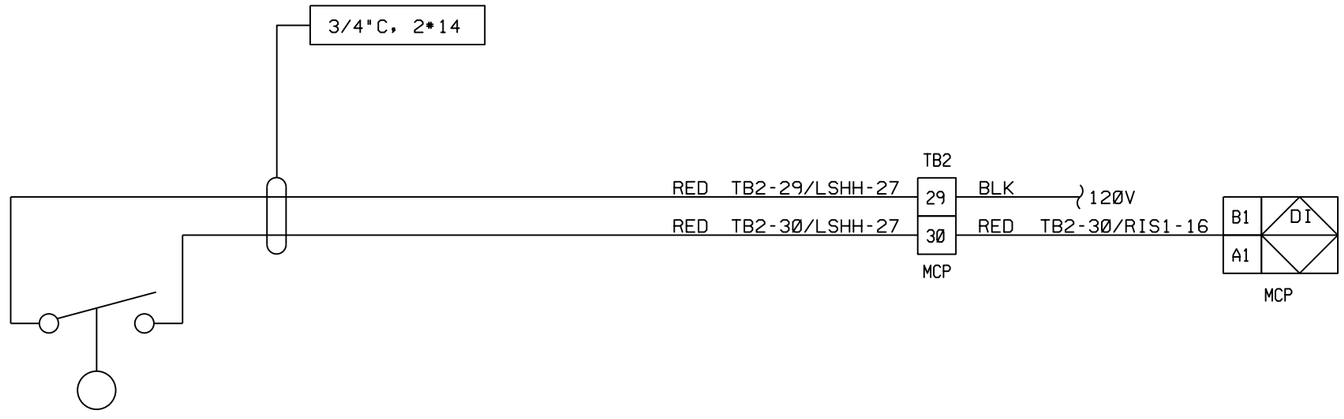
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
OVERFLOW WETWELL LEVEL FLOAT SWITCH

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L27-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65L27	65L27-2	LD-PS65L27	2 OF	3	1

11-DEC-2008 11:59 chris R:\mwske\comnet\loops\project\ps65\65l27-2.dgn



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: N/A	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-19	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/1/16							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

INSTRUMENT LOOP DIAGRAM
OVERFLOW WETWELL LEVEL FLOAT SWITCH

FILE NAME: 65L27-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65L27	65L27-3	LD-PS65L27	3 OF	3	1

LOOP NO: 65Y141

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZLC	141		FORCE MAIN VALVE	V-141 CLOSED	STATUS	PLC-100	TBD					EXISTING
I	65	ZLO	141		FORCE MAIN VALVE	V-141 OPEN	STATUS	PLC-100	TBD					EXISTING
I	65	ZL	141		FORCE MAIN VALVE	V-141 LOCAL	STATUS	PLC-100	TBD					NEW
I	65	HS	141	A	FORCE MAIN VALVE	V-141 CLOSED	COMMAND	PLC-100	TBD					EXISTING
I	65	HS	141	B	FORCE MAIN VALVE	V-141 OPEN	COMMAND	PLC-100	TBD					EXISTING
I	65	ZSC	141		FORCE MAIN VALVE	V-141 CLOSED	SWITCH	FIELD	TBD					EXISTING
I	65	ZSO	141		FORCE MAIN VALVE	V-141 OPEN	SWITCH	FIELD	TBD					EXISTING
I	65	ZSL	141		FORCE MAIN VALVE	V-141 LOCAL	SWITCH	FIELD	TBD					EXISTING
I	65	HS	141	C	FORCE MAIN VALVE	V-141 OPEN	SWITCH	FIELD	TBD					EXISTING
I	65	HS	141	D	FORCE MAIN VALVE	V-141 CLOSED	SWITCH	FIELD	TBD					EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZLC	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZLO	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZL	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	A	FORCE MAIN VALVE	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	B	FORCE MAIN VALVE	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSC	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSO	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSL	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	C	FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	D	FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

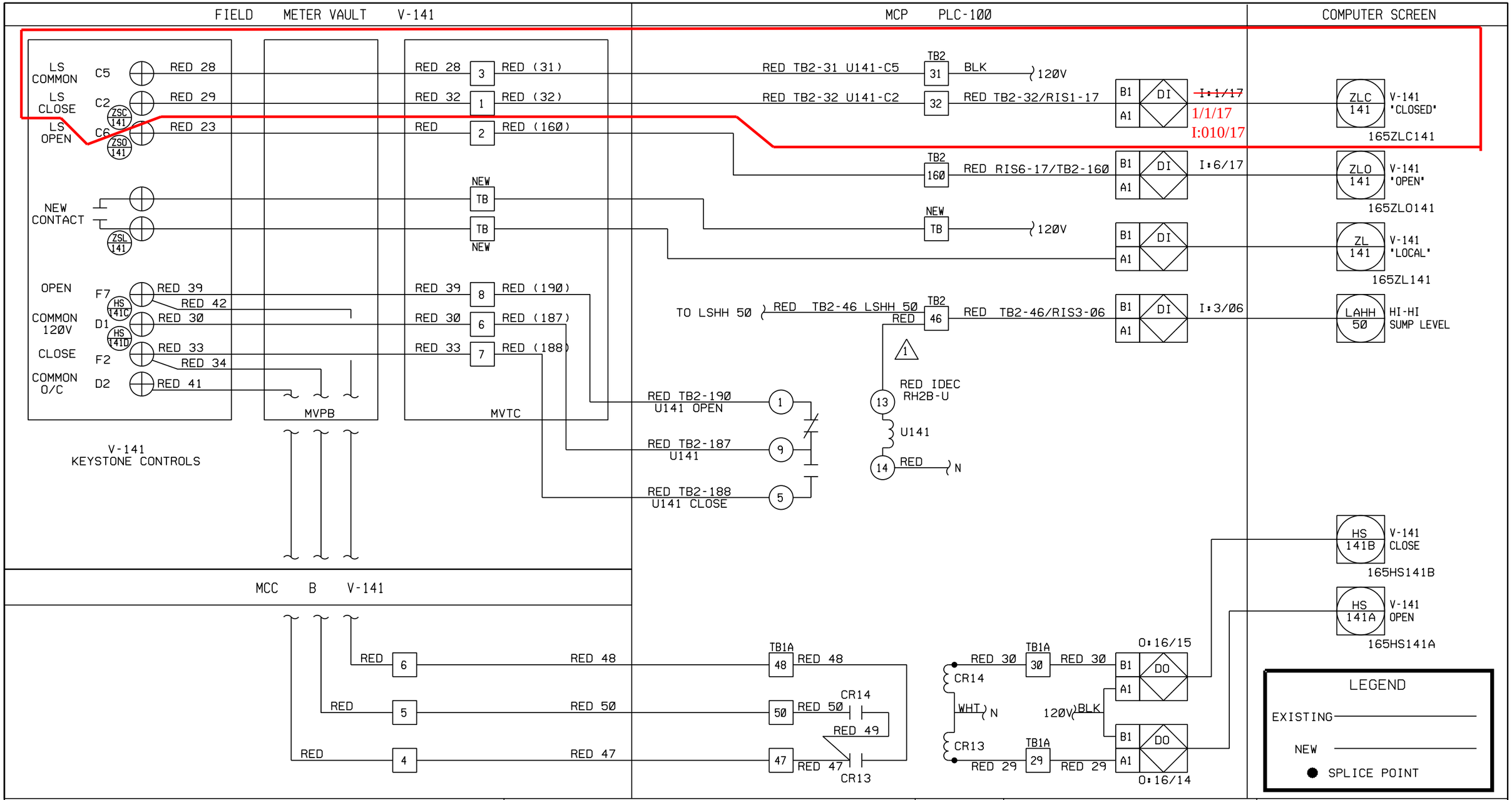
BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
FORCE MAIN VALVE V-141

FILE NAME: 65Y141-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y141	65Y141-1	LD-PS65Y141	1	OF	3	0

1/1/17



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO. PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y141-2

INSTRUMENT LOOP DIAGRAM
FORCE MAIN VALVE V-141

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y141	65Y141-2	LD-PS65Y141	2 OF	3	Ø

1/1/17

LOOP NO: 65Y101

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	101	C	P-101	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	101	A	P-101	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	101	B	P-101	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	101	A	P-101	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	101	D	P-101	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	101		P-101	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	101	D	P-101	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-101	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	101	D	P-101	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	101		P-101	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	101	C	P-101	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZL	101	A	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZL	101	B	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	YL	101	A	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	YA	101	D	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZLC	101		P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	HS	101	D	P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	BTR	NA		P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	YS	101	D	P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZSC	101		P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

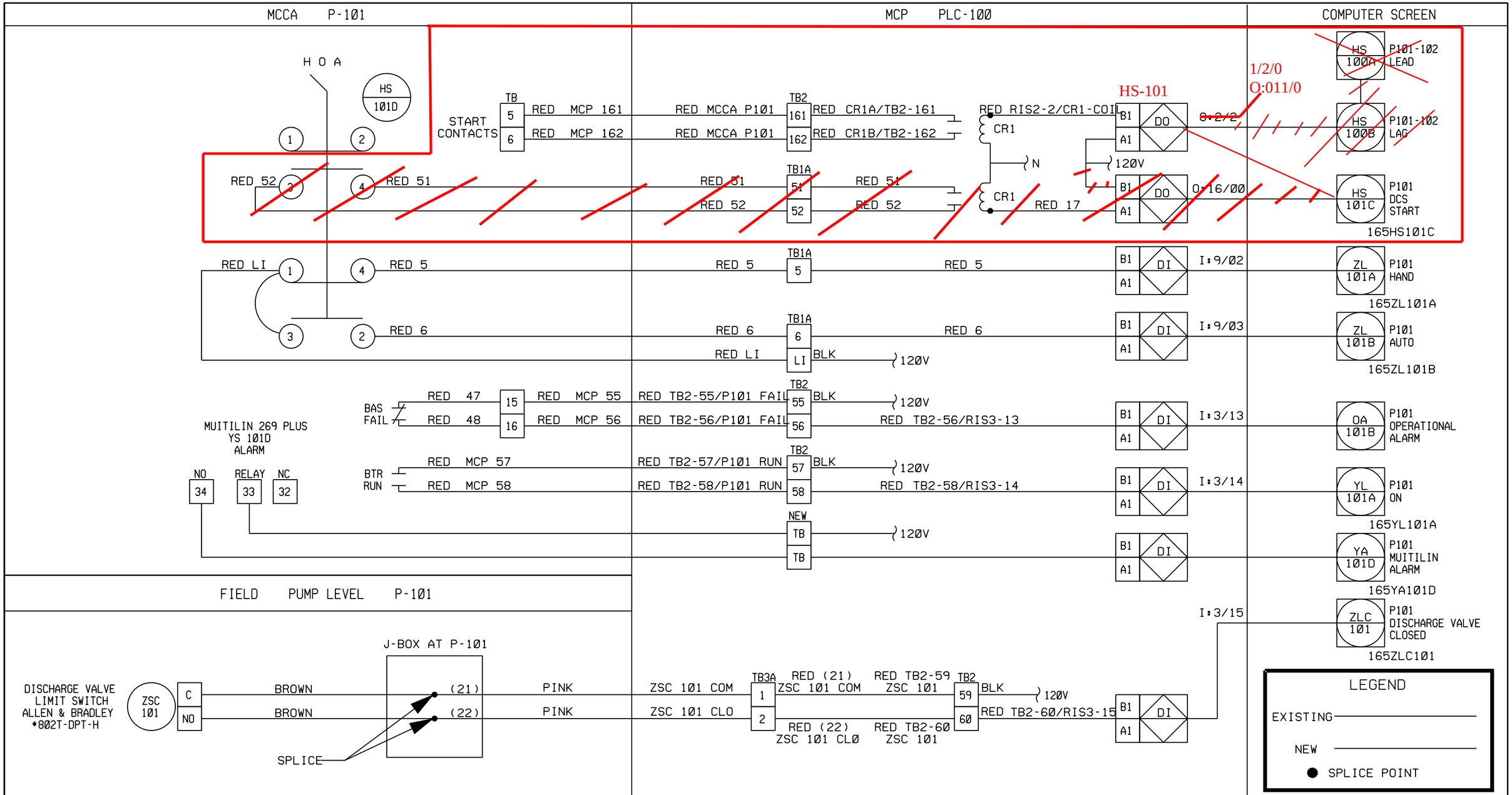
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-101

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y101-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y101	65Y101-1	LD-PS65Y101	1	OF	3	0

1/2/0



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

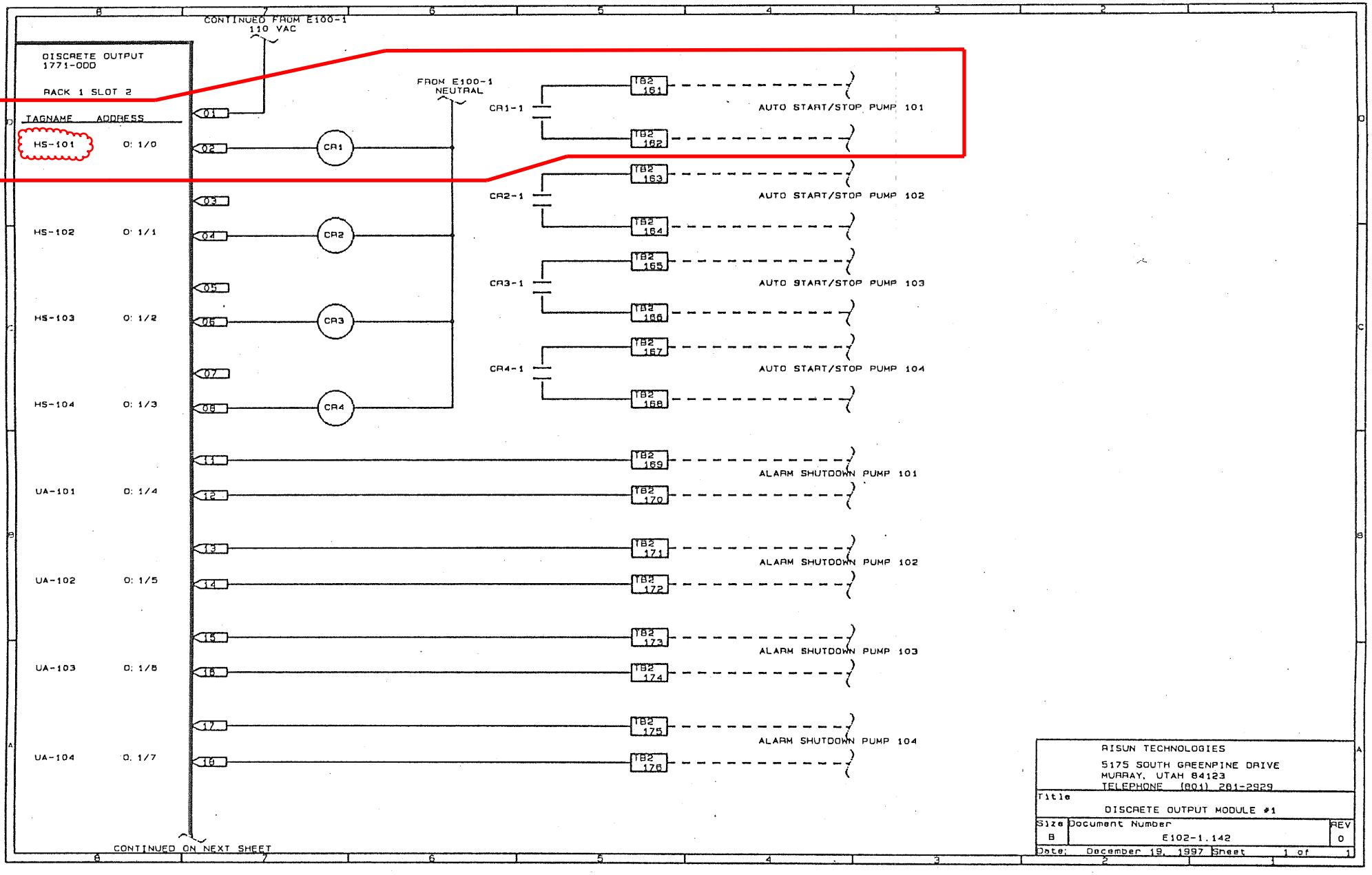
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-101

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y101-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y101	65Y101-2	LD-PS65Y101	2	OF	3	0

1/2/0


CONTINUED FROM E100-1
110 VAC
DISCRETE OUTPUT
1771-ODD
RACK 1 SLOT 2
TAGNAME ADDRESS
HS-101 O: 1/0
HS-102 O: 1/1
HS-103 O: 1/2
HS-104 O: 1/3
UA-101 O: 1/4
UA-102 O: 1/5
UA-103 O: 1/6
UA-104 O: 1/7
FROM E100-1
NEUTRAL
CR1
CR2
CR3
CR4
CR1-1
CR2-1
CR3-1
CR4-1
TB2 161
TB2 162
TB2 163
TB2 164
TB2 165
TB2 166
TB2 167
TB2 168
TB2 169
TB2 170
TB2 171
TB2 172
TB2 173
TB2 174
TB2 175
TB2 176
AUTO START/STOP PUMP 101
AUTO START/STOP PUMP 102
AUTO START/STOP PUMP 103
AUTO START/STOP PUMP 104
ALARM SHUTDOWN PUMP 101
ALARM SHUTDOWN PUMP 102
ALARM SHUTDOWN PUMP 103
ALARM SHUTDOWN PUMP 104
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE OUTPUT MODULE #1
Size B
Document Number E102-1.142
REV 0
Date: December 19, 1997 Sheet 1 of 1

1/2/0

LOOP NO: 65Y102

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	102	C	P-102	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	102	A	P-102	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	102	B	P-102	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	102	A	P-102	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	102	D	P-102	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	102		P-102	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	102	D	P-102	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-102	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	102	D	P-102	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	102		P-102	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	102	C	P-102	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZL	102	A	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZL	102	B	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	YL	102	A	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	YA	102	D	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZLC	102		P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	HS	102	D	P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	BTR	NA		P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	YS	102	D	P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZSC	102		P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-102

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y102-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y102	65Y102-1	LD-PS65Y102	1	OF	3	0

1/2/1

MCCB P-102 | MCP PLC-100 | COMPUTER SCREEN

H O A

HS 102D

1 2 3 4

RED 54 | RED 53

START CONTACTS

TB 5 RED MCP 163 | 6 RED MCP 164

TB2 163 RED MCCB P102 RED CR2A/TB2-163 | 164 RED MCCB P102 RED CR2A/TB2-164

TB1A 53 RED 53 RED 53 | 54 RED 54 RED 54

RED RIS2-4/CR2-COIL

CR2

N

CR2 RED 18

120V

HS-102

B1 A1 DO O:2/4

B1 A1 DO O:16/01

1/2/1
O:011/1

HS 100A P101-102 LEAD

HS 100B P101-102 LAG

HS 102C P102 DCS START

102B

I65HS102C

I65HS102B

RED LI | 1 4 RED 7 | 3 2 RED 8

TB1A 7 RED 7 RED 7

TB1A 8 RED 8 RED 8 | LI RED LI 120V

B1 A1 DI I:9/04

B1 A1 DI I:9/05

ZL 102A P102 HAND

165ZL102A

ZL 102B P102 AUTO

165ZL102B

MUITILIN 269 PLUS
YS 102D
ALARM

NO 34 | RELAY 33 | NC 32

BAS FAIL: RED 47 15 RED MCP 65 | RED 48 16 RED MCP 66

TB2 65 RED TB2-65/P102 FAIL BLK 120V | 66 RED TB2-66/P102 FAIL RED TB2-66/RIS4-00

B1 A1 DI I:4/00

OA 102B P102 OPERATIONAL ALARM

BTR RUN: RED MCP 67 | RED MCP 68

TB2 67 RED TB2-67/P102 RUN BLK 120V | 68 RED TB2-68/P102 RUN RED TB2-68/RIS4-01

B1 A1 DI I:4/01

YL 102A P102 ON

165YL102A

NEW TB TB 120V

B1 A1 DI

YA 102D P102 MUITILIN ALARM

165YA102D

I:4/02

ZLC 102 P102 DISCHARGE VALVE CLOSED

165ZLC102

FIELD PUMP LEVEL P-102

J-BOX AT P-102

DISCHARGE VALVE LIMIT SWITCH ALLEN & BRADLEY *802T-DPT-H

ZSC 102 C NO

RED (31) PINK | RED (32) PINK

SPLICE

ZSC 102 COM | ZSC 102 CLO

TB3A 11 12

RED (31) ZSC 102 COM | RED (32) ZSC 102 CLØ

RED TB2-69 ZSC 1021 | RED TB2-70 ZSC 1021

TB2 69 70

BLK 120V

RED TB2-70/RIS4-02

B1 A1 DI

LEGEND

EXISTING

NEW

SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO. PROCESS CONTROL DIVISION

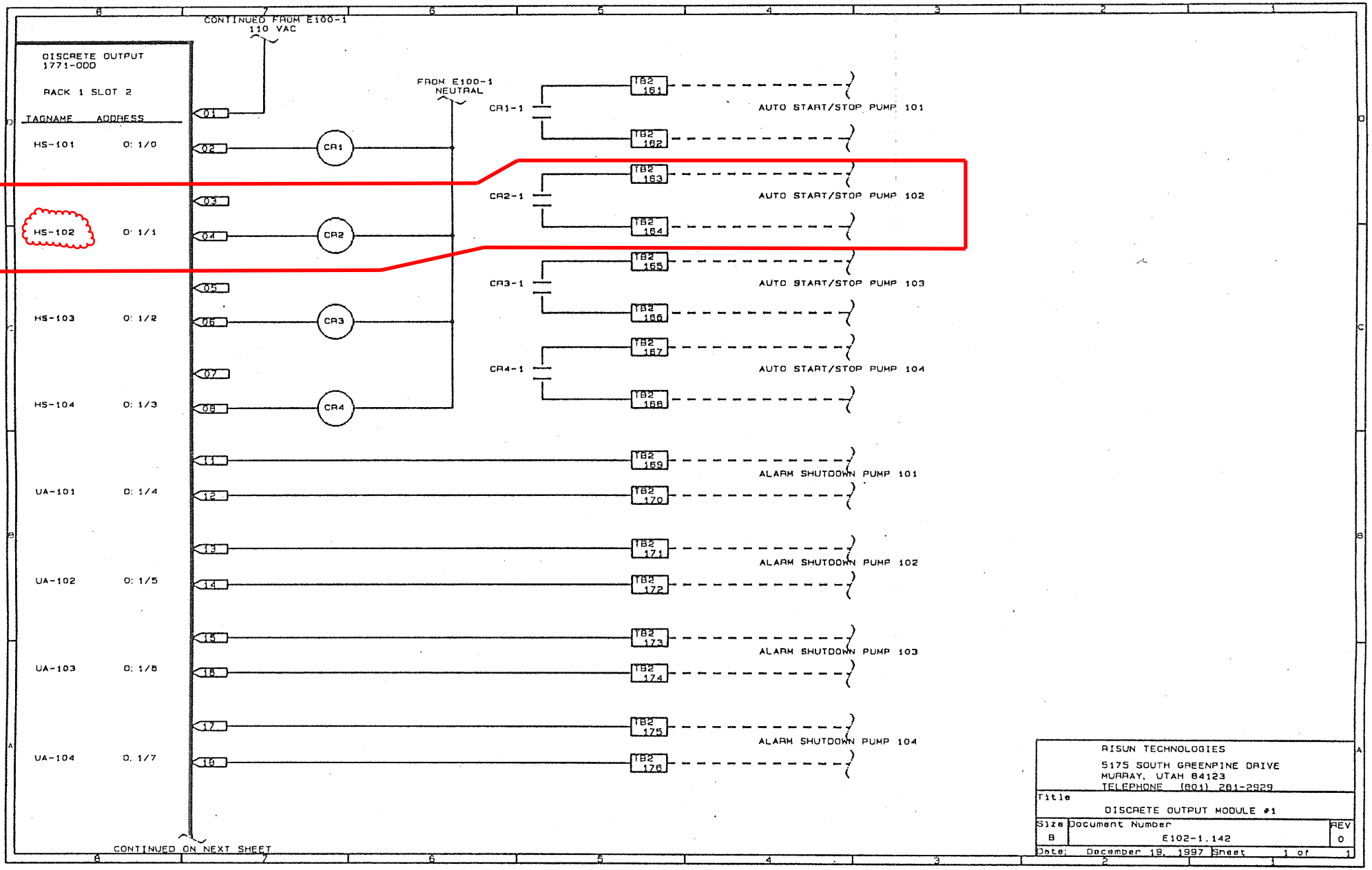
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-102

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y102-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y102	65Y102-2	LD-PS65Y102	2	OF	3	Ø

1/2/1


CONTINUED FROM E100-1
110 VAC
DISCRETE OUTPUT
1771-ODD
RACK 1 SLOT 2
TAGNAME ADDRESS
HS-101 O: 1/0
HS-102 O: 1/1
HS-103 O: 1/2
HS-104 O: 1/3
UA-101 O: 1/4
UA-102 O: 1/5
UA-103 O: 1/6
UA-104 O: 1/7
FROM E100-1
NEUTRAL
CR1
CR2
CR3
CR4
CR1-1
CR2-1
CR3-1
CR4-1
AUTO START/STOP PUMP 101
AUTO START/STOP PUMP 102
AUTO START/STOP PUMP 103
AUTO START/STOP PUMP 104
ALARM SHUTDOWN PUMP 101
ALARM SHUTDOWN PUMP 102
ALARM SHUTDOWN PUMP 103
ALARM SHUTDOWN PUMP 104
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE OUTPUT MODULE #1
Size B
Document Number E102-1.142
REV 0
Date: December 19, 1997 Sheet 1 of 1

1/2/1

LOOP NO: 65Y103

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	103	C	P-103	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	103	A	P-103	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	103	B	P-103	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	103	A	P-103	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	103	D	P-103	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	103		P-103	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	103	D	P-103	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-103	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	103	D	P-103	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	103		P-103	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	103	C	P-103	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZL	103	A	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZL	103	B	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	YL	103	A	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	YA	103	D	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZLC	103		P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	HS	103	D	P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	BTR	NA		P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	YS	103	D	P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZSC	103		P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

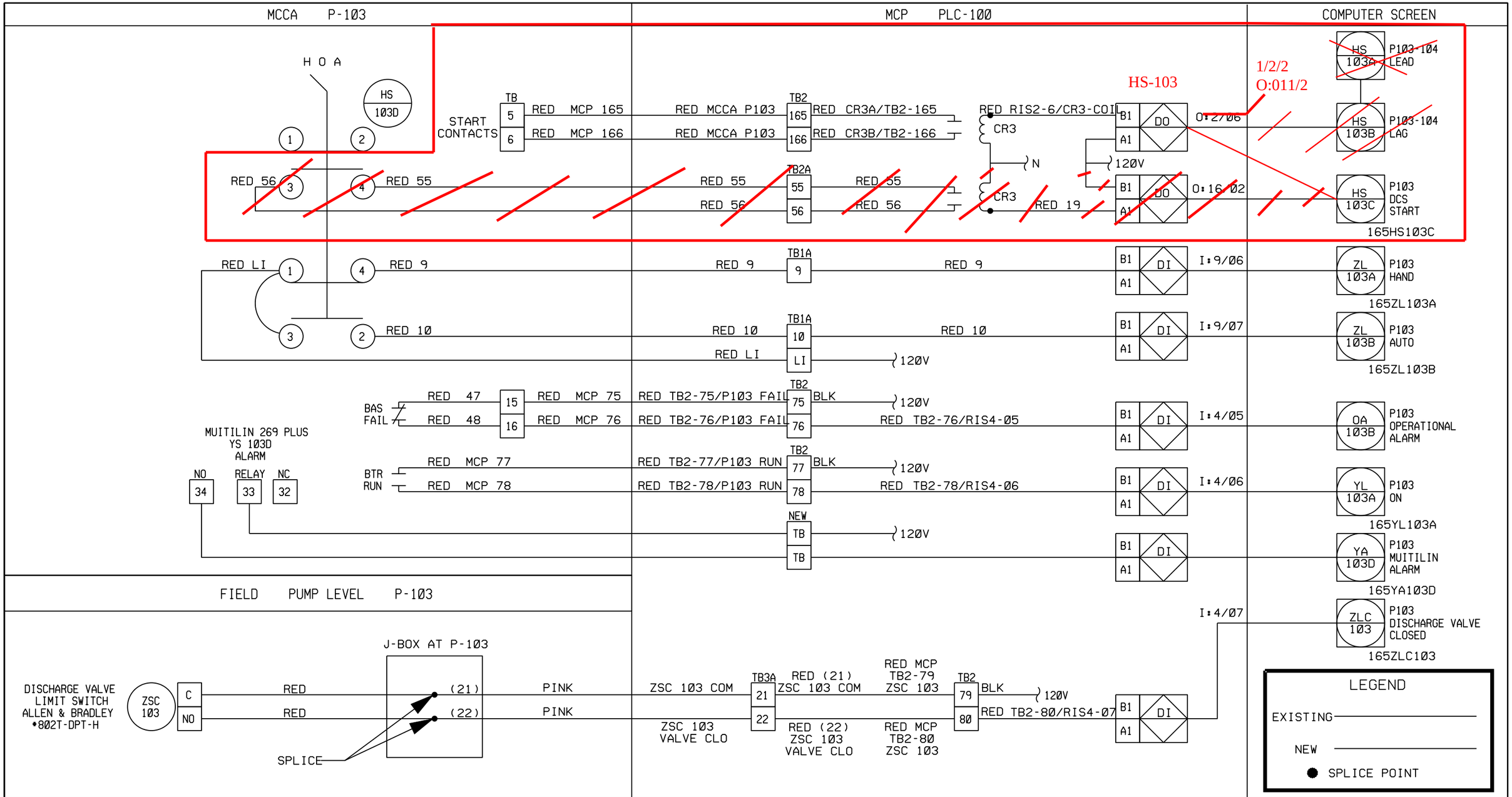
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-103

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y103-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y103	65Y103-1	LD-PS65Y103	1	OF	3	0

1/2/2



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

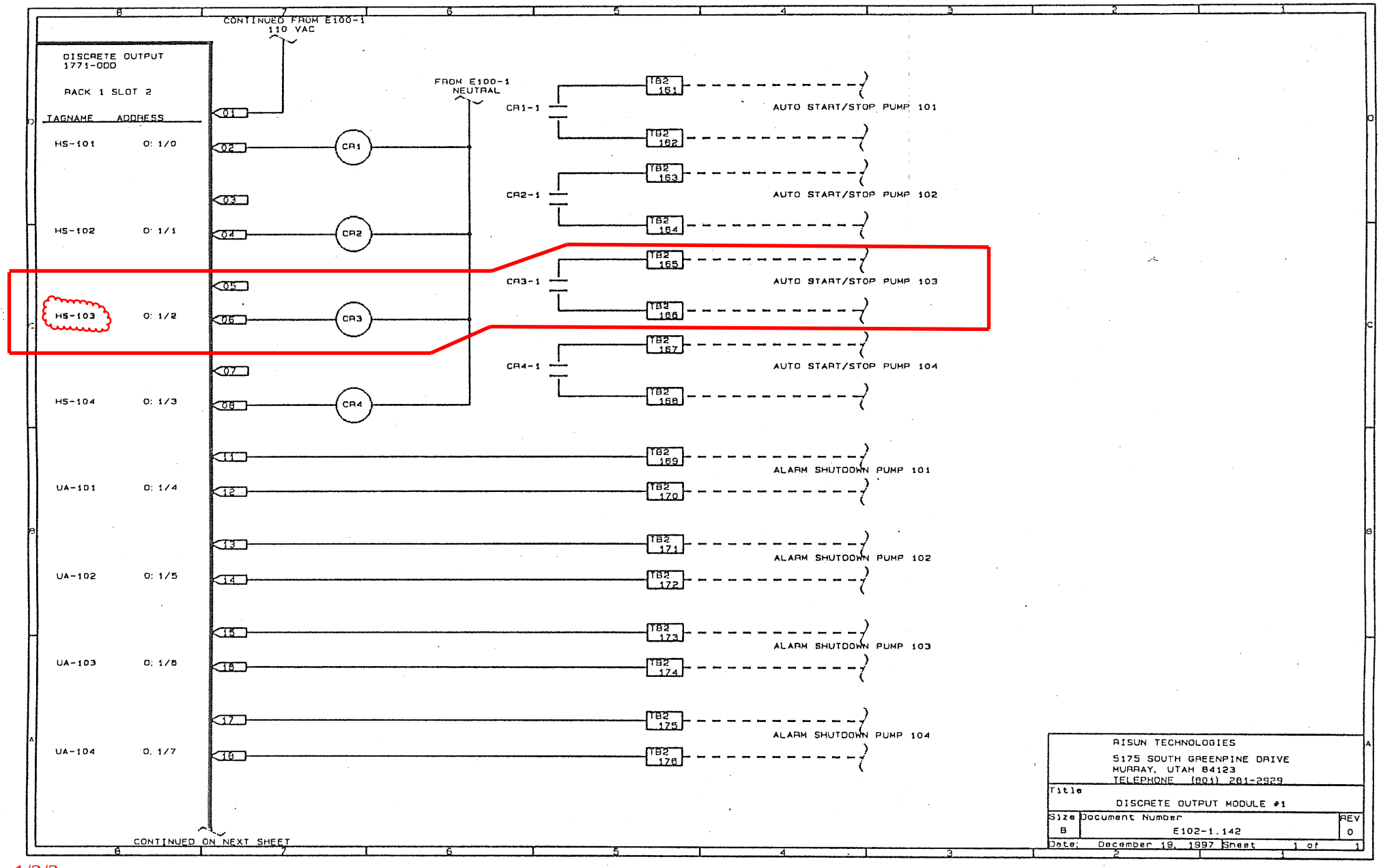
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-103

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y103-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y103	65Y103-2	LD-PS65Y103	2 OF	3	0

1/2/2


CONTINUED FROM E100-1
110 VAC
DISCRETE OUTPUT
1771-ODD
RACK 1 SLOT 2
TAGNAME ADDRESS
HS-101 O: 1/0
HS-102 O: 1/1
HS-103 O: 1/2
HS-104 O: 1/3
UA-101 O: 1/4
UA-102 O: 1/5
UA-103 O: 1/6
UA-104 O: 1/7
FROM E100-1
NEUTRAL
CR1
CR2
CR3
CR4
CR1-1
CR2-1
CR3-1
CR4-1
TB2 161
TB2 162
TB2 163
TB2 164
TB2 165
TB2 166
TB2 167
TB2 168
TB2 169
TB2 170
TB2 171
TB2 172
TB2 173
TB2 174
TB2 175
TB2 176
AUTO START/STOP PUMP 101
AUTO START/STOP PUMP 102
AUTO START/STOP PUMP 103
AUTO START/STOP PUMP 104
ALARM SHUTDOWN PUMP 101
ALARM SHUTDOWN PUMP 102
ALARM SHUTDOWN PUMP 103
ALARM SHUTDOWN PUMP 104
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE OUTPUT MODULE #1
Size B
Document Number E102-1.142
REV 0
Date: December 19, 1997
Sheet 1 of 1

1/2/2

LOOP NO: 65Y104

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	104	C	P-104	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	104	A	P-104	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	104	B	P-104	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	104	A	P-104	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	104	D	P-104	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	104		P-104	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	104	D	P-104	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-104	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	104	D	P-104	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	104		P-104	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	104	C	P-104	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZL	104	A	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZL	104	B	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	YL	104	A	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	YA	104	D	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZLC	104		P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	HS	104	D	P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	BTR	NA		P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	YS	104	D	P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZSC	104		P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

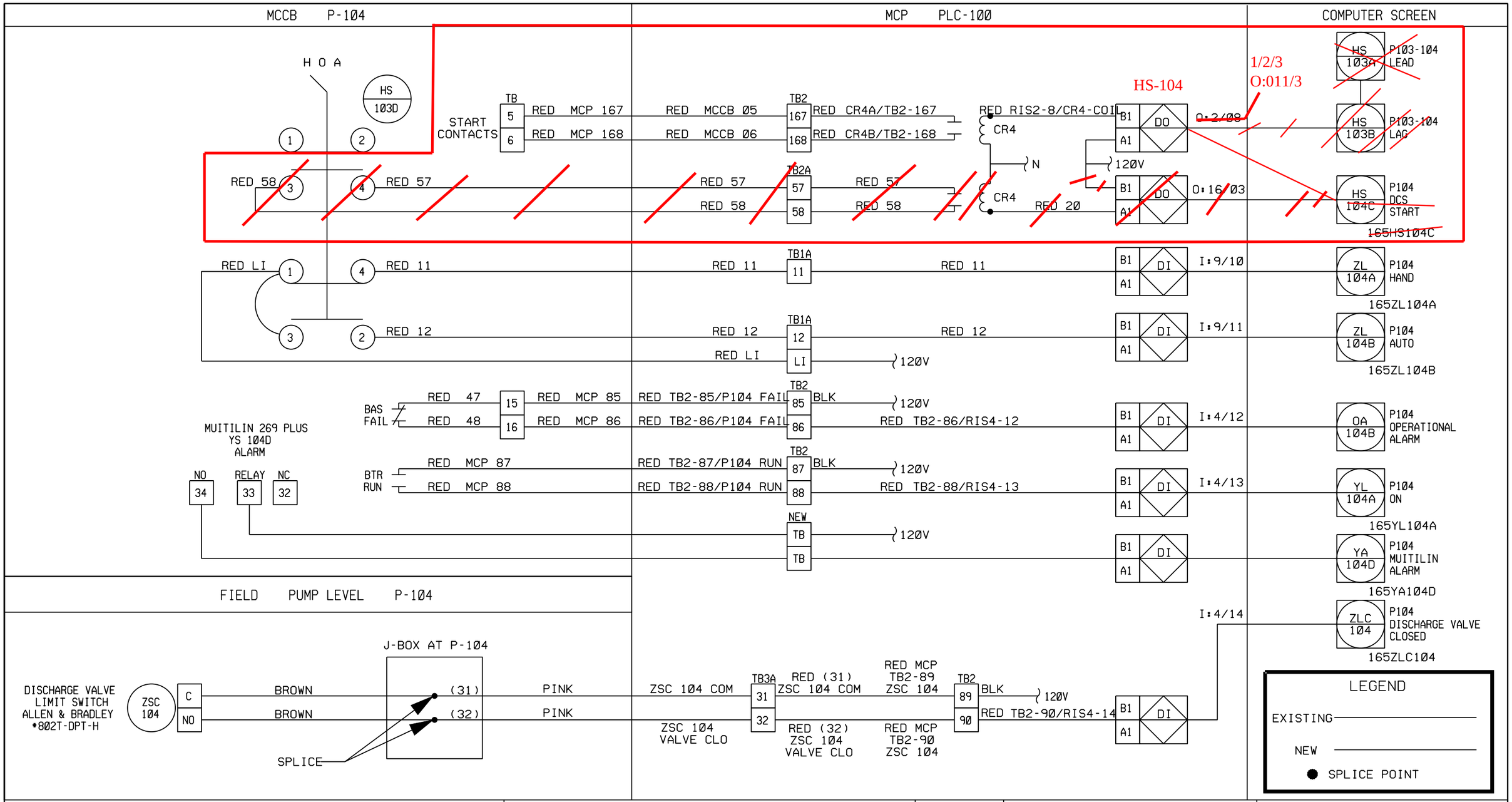
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-104

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y104-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y104	65Y104-1	LD-PS65Y104	1	OF	3	0

1/2/3



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

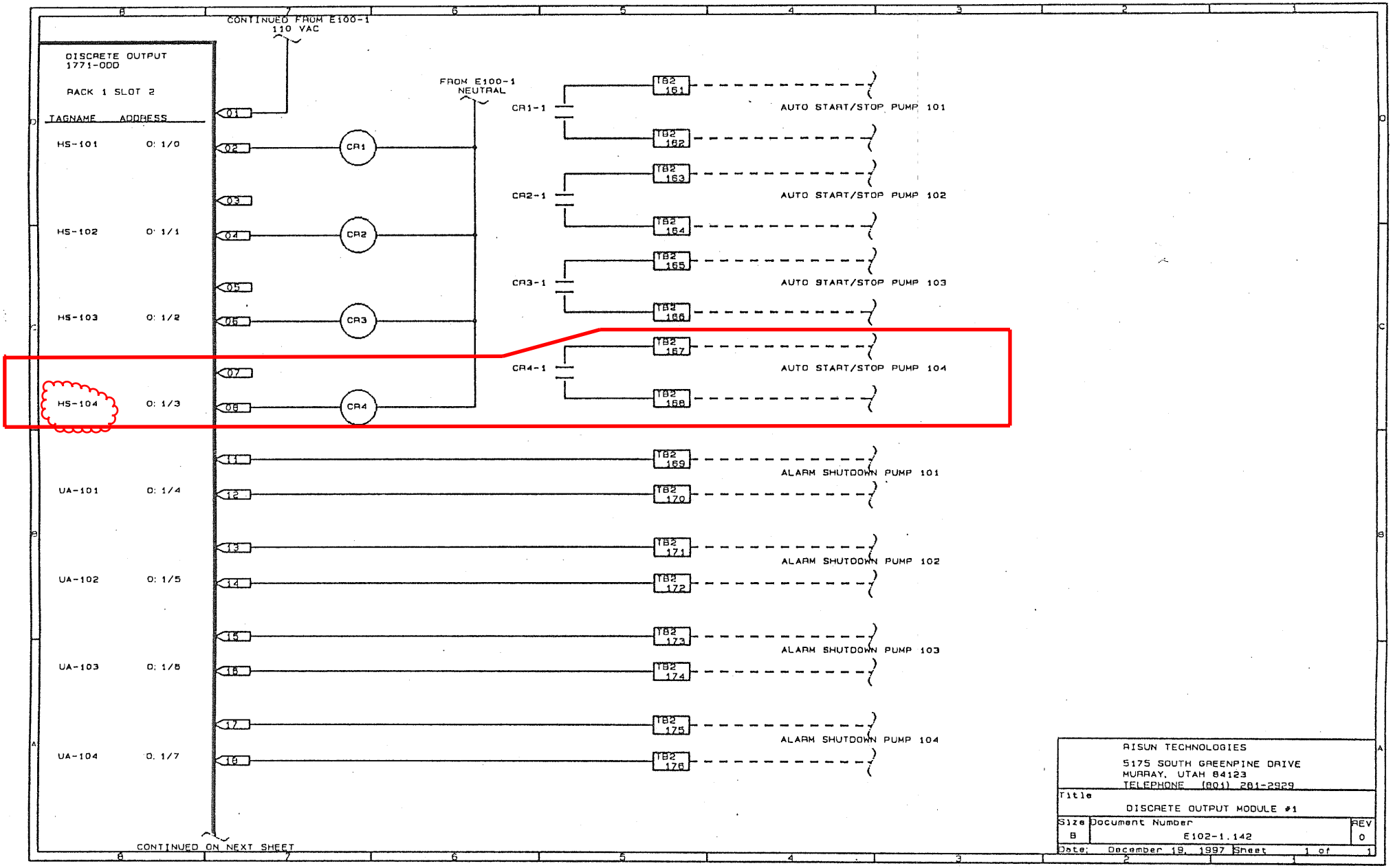
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-104

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y104-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y104	65Y104-2	LD-PS65Y104	2 OF	3	Ø

1/2/3


CONTINUED FROM E100-1
110 VAC
DISCRETE OUTPUT
1771-ODD
RACK 1 SLOT 2
TAGNAME ADDRESS
HS-101 O: 1/0
HS-102 O: 1/1
HS-103 O: 1/2
HS-104 O: 1/3
UA-101 O: 1/4
UA-102 O: 1/5
UA-103 O: 1/6
UA-104 O: 1/7
FROM E100-1
NEUTRAL
CR1
CR2
CR3
CR4
CR1-1
CR2-1
CR3-1
CR4-1
AUTO START/STOP PUMP 101
AUTO START/STOP PUMP 102
AUTO START/STOP PUMP 103
AUTO START/STOP PUMP 104
ALARM SHUTDOWN PUMP 101
ALARM SHUTDOWN PUMP 102
ALARM SHUTDOWN PUMP 103
ALARM SHUTDOWN PUMP 104
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE OUTPUT MODULE #1
Size B
Document Number E102-1.142
REV 0
Date: December 19, 1997 Sheet 1 of 1

1/2/3

LOOP NO: 65V101

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	VAH	101	A	P-101	UPPER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	101	A	P-101	UPPER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAH	101	B	P-101	LOWER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	101	B	P-101	LOWER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VT	101	A	P-101	UPPER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING
I	65	VT	101	B	P-101	LOWER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	VAH	101	A	P-101	N/A	AI	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3
I	65	VAHH	101	A	P-101	N/A	AI	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3
I	65	VAH	101	B	P-101	N/A	AI	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3
I	65	VAHH	101	B	P-101	N/A	AI	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3
I	65	VT	101	A	P-101	N/A	N/A	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3
I	65	VT	101	B	P-101	N/A	N/A	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
PUMP P-101 UPPER & LOWER VIBRATION

FILE NAME: 65V101-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65V101	65V101-1	LD-PS65V101	1	OF	3	0

1/2/4

FIELD PUMP LEVEL P-101 | MCP PLC-100 | COMPUTER SCREEN

VIBRATION TRANSMITTER
BENTLY NEVADA
*21128-03-01

VT 101A (+ RED, - BLK)
VT 101B (+ RED, - BLK)

J-BOX
CABLE
AT P-101

RED TB4-4
BLK TB4-6
RED TB4-19
BLK TB4-21

TB4
4, 5, 6, 19, 21, 20
WHT, BLK, GRN, BLK, WHT, GRN

BENTLY NEVADA
2201/03-03
B1, A1, VI

BENTLY NEVADA
2201/03-03
B1, A1, VI

P-101
UPPER BEARING
VIB. HI
165VAH101A

P-10
UPPER BEARING
VIB. HI-HI
165VAHH101A

P-101
LOWER BEARING
VIB. HI
165VAH101B

P-10
LOWER BEARING
VIB. HI-HI
165VAHH101B

FIELD MCCA P-101

1
2
WIRE IS DISCONNECTED

RED1 RED MCCA-01
BLK2 RED MCCA-02

TB2
169 RED RIS2-11/TB2-169
170 RED RIS2-12/TB2-170

B1, A1, DO

1/2/4
O:011/4
~~O:2/11~~
~~O:2/12~~

~~ALARM SHUTDOWN~~
SPARE

LEGEND
EXISTING
NEW
SPLICE POINT

REFERENCE DRAWINGS
TBD

REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

DESTROY ALL PRINTS BEARING EARLIER DATE
APPROVALS

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-101 UPPER & LOWER BEARING VIBRATION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65V101-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65V101	65V101-2	LD-PS65V101	2	OF	3	0

1/2/4

LOOP NO: 65V102

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	VAH	102	A	P-102	UPPER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	102	A	P-102	UPPER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAH	102	B	P-102	LOWER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	102	B	P-102	LOWER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VT	102	A	P-102	UPPER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING
I	65	VT	102	B	P-102	LOWER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	VAH	102	A	P-102	N/A	AI	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3
I	65	VAHH	102	A	P-102	N/A	AI	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3
I	65	VAH	102	B	P-102	N/A	AI	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3
I	65	VAHH	102	B	P-102	N/A	AI	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3
I	65	VT	102	A	P-102	N/A	N/A	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3
I	65	VT	102	B	P-102	N/A	N/A	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

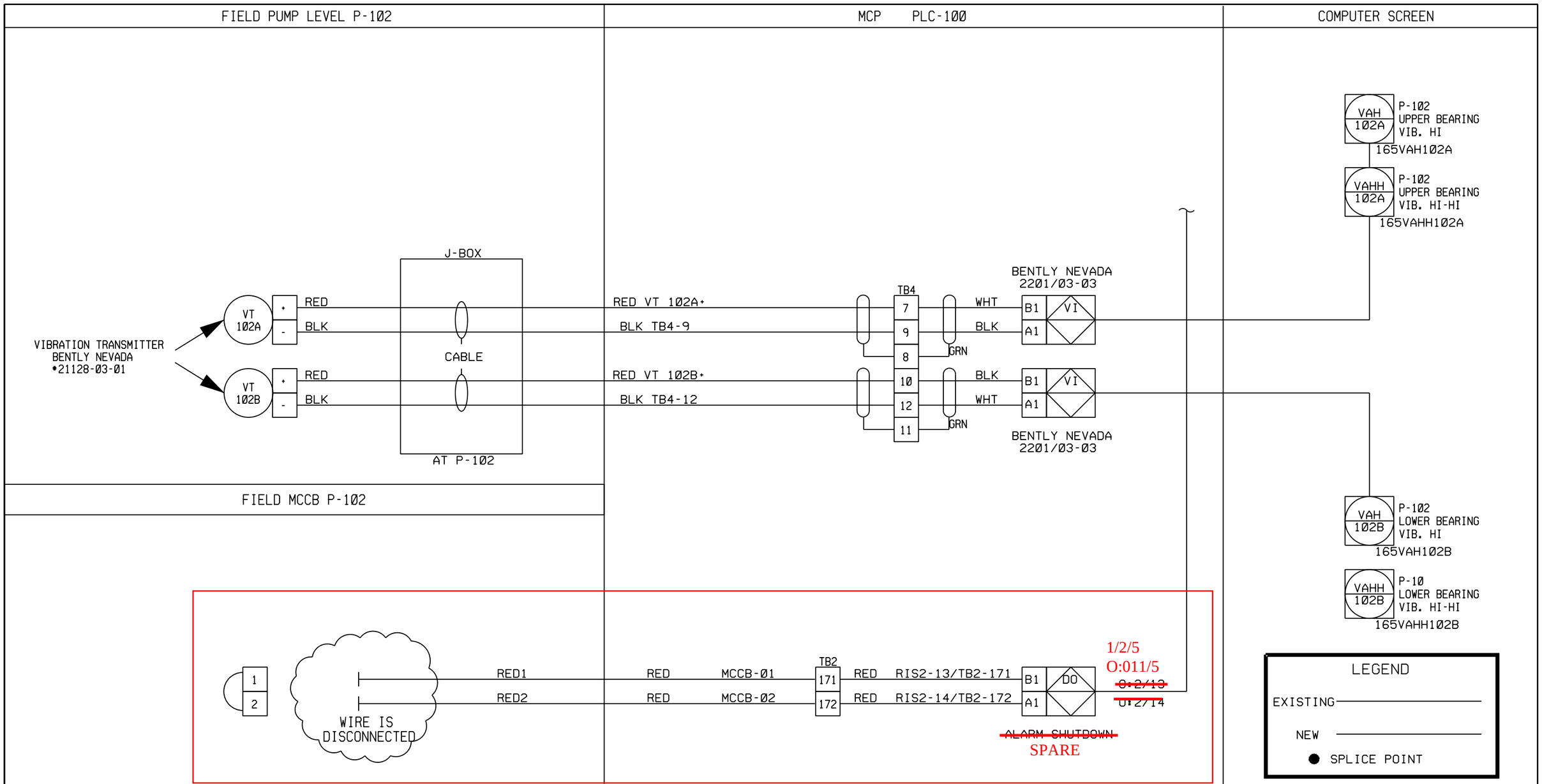
BROWN AUTOMATION JOB# 9079

FILE NAME: 65V102-1

LOOP DIAGRAM SCHEDULE
PUMP P-102 UPPER & LOWER VIBRATION

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65V102	65V102-1	LD-PS65V102	1	OF	3	0

1/2/5



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-102 UPPER & LOWER BEARING VIBRATION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65V102-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65V102	65V102-2	LD-PS65V102	2 OF	3	0

1/2/5

LOOP NO: 65V103

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	VAH	103	A	P-103	UPPER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	103	A	P-103	UPPER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAH	103	B	P-103	LOWER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	103	B	P-103	LOWER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VT	103	A	P-103	UPPER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING
I	65	VT	103	B	P-103	LOWER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	VAH	103	A	P-103	N/A	AI	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3
I	65	VAHH	103	A	P-103	N/A	AI	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3
I	65	VAH	103	B	P-103	N/A	AI	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3
I	65	VAHH	103	B	P-103	N/A	AI	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3
I	65	VT	103	A	P-103	N/A	N/A	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3
I	65	VT	103	B	P-103	N/A	N/A	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

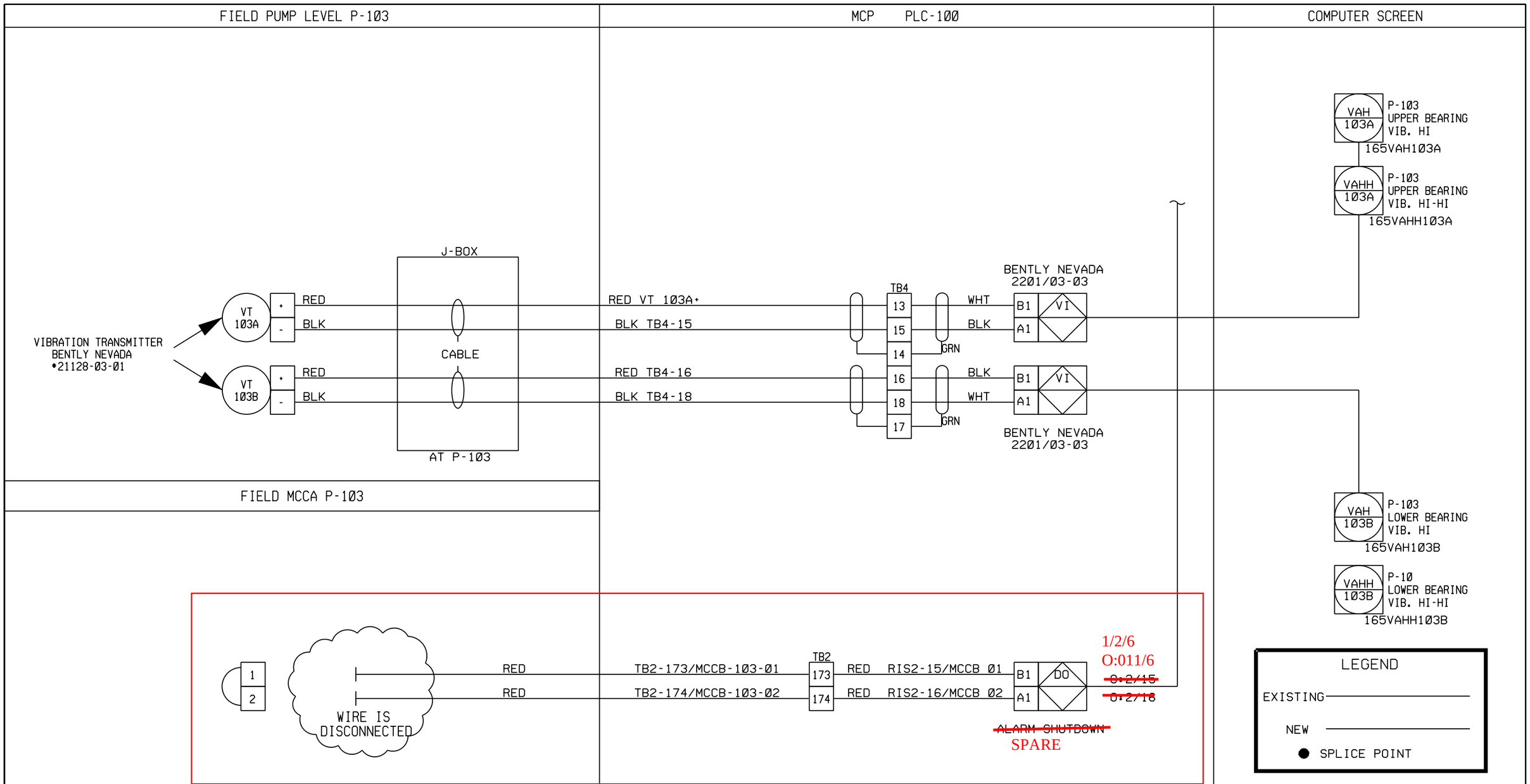
BROWN AUTOMATION JOB# 9079

FILE NAME: 65V103-1

LOOP DIAGRAM SCHEDULE
PUMP P-103 UPPER & LOWER VIBRATION

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65V103	65V103-1	LD-PS65V103	1	OF	3	0

1/2/6



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-103 UPPER & LOWER BEARING VIBRATION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65V103-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65V103	65V103-2	LD-PS65V103	2 OF	3	0

1/2/6

LOOP NO: 65V104

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	VAH	104	A	P-104	UPPER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	104	A	P-104	UPPER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAH	104	B	P-104	LOWER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	104	B	P-104	LOWER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VT	104	A	P-104	UPPER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING
I	65	VT	104	B	P-104	LOWER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	VAH	104	A	P-104	N/A	AI	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3
I	65	VAHH	104	A	P-104	N/A	AI	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3
I	65	VAH	104	B	P-104	N/A	AI	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3
I	65	VAHH	104	B	P-104	N/A	AI	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3
I	65	VT	104	A	P-104	N/A	N/A	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3
I	65	VT	104	B	P-104	N/A	N/A	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
PUMP P-104 UPPER & LOWER VIBRATION

FILE NAME: 65V104-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65V104	65V104-1	LD-PS65V104	1	OF	3	0

1/2/7

FIELD PUMP LEVEL P-104

MCP PLC-100

COMPUTER SCREEN

VIBRATION TRANSMITTER
BENTLY NEVADA
*21128-03-01

VT 104A
VT 104B

RED
BLK
RED
BLK

J-BOX
CABLE
AT P-104

BLK TB4-22
RED TB4-24
RED TB4-25
BLK TB4-27

TB4
22
24
23
25
27
26

BLK
WHT
GRN
BLK
WHT
GRN

BENTLY NEVADA
2201/03-03
B1
A1
VI

BENTLY NEVADA
2201/03-03
B1
A1
VI

VAH 104A
P-104
UPPER BEARING
VIB. HI
165VAH104A

VAHH 104A
P-104
UPPER BEARING
VIB. HI-HI
165VAHH104A

VAH 104B
P-104
LOWER BEARING
VIB. HI
165VAH104B

VAHH 104B
P-10
LOWER BEARING
VIB. HI-HI
165VAHH104B

FIELD MCCB P-104

1
2
RED MCP 88
RED MCP 87

NOT CORRECT, SEE LOOP V103 FOR EXAMPLE

RED MCCB-104-01
RED MCCB-104-02

TB2
175
176

RED RIS2-17/TB2-175
RED RIS2-18/TB2-176

B1
A1
DO

~~ALARM SHUTDOWN~~
SPARE

1/2/7
O:011/7
~~0.2/17~~
~~0.2/18~~

LEGEND

EXISTING

NEW

SPLICE POINT

REFERENCE DRAWINGS

TBD

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
DESTROY ALL PRINTS BEARING EARLIER DATE						
0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

1/2/7

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-104 UPPER & LOWER BEARING VIBRATION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65V104-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65V104	65V104-2	LD-PS65V104	2 OF	3	0

LOOP NO: 65A10

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	UA	10	A	DRYWELL	POOR AIR	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	UA	10	B	DRYWELL	COMB. GAS S/D	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	AS	10	A	DRYWELL	POOR AIR	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING
I	65	AS	10	B	DRYWELL	COMB. GAS S/D	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	UA	10	A	DRYWELL	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A10	I-12	65A10-2	65A10-3
I	65	UA	10	B	DRYWELL	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A10	I-12	65A10-2	65A10-3
I	65	AS	10	A	DRYWELL	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A10	I-12	65A10-2	65A10-3
I	65	AS	10	B	DRYWELL	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A10	I-12	65A10-2	65A10-3

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REFERENCE DRAWINGS

P&ID: I-12
CONTROL WIRING DIAGRAMS: E-10
ELECTRICAL PLAN DRAWING: E-12
CONDUIT SCHEDULE: E-11.1 NOTE 26

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	10/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

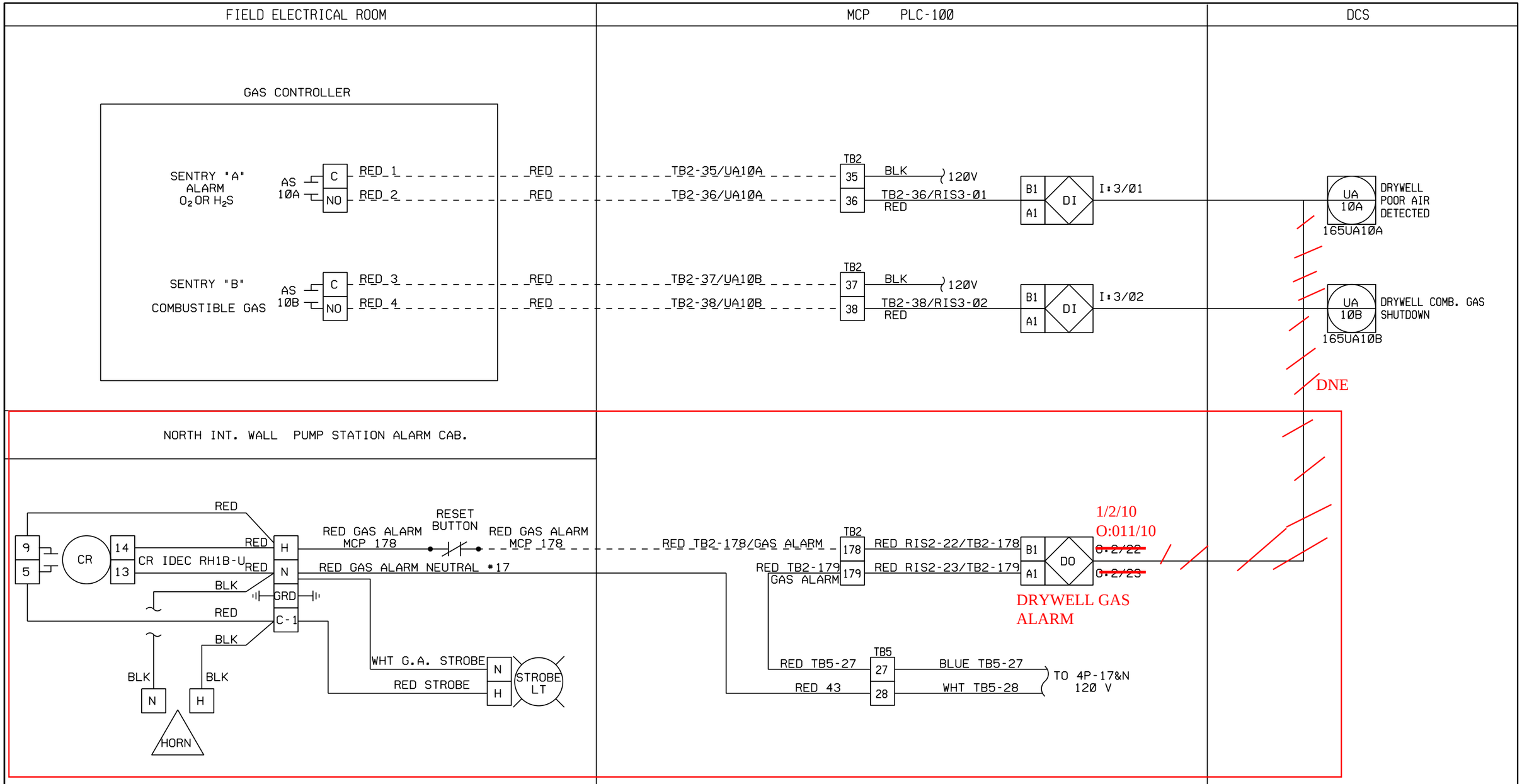
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
DRYWELL GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A10-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A10	65A10-1	LD-PS65A10	1	OF	3	1

1/2/10



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/2/10							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
DRYWELL GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A10-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65A10	65A10-2	LD-PS65A10	2 OF	3	1

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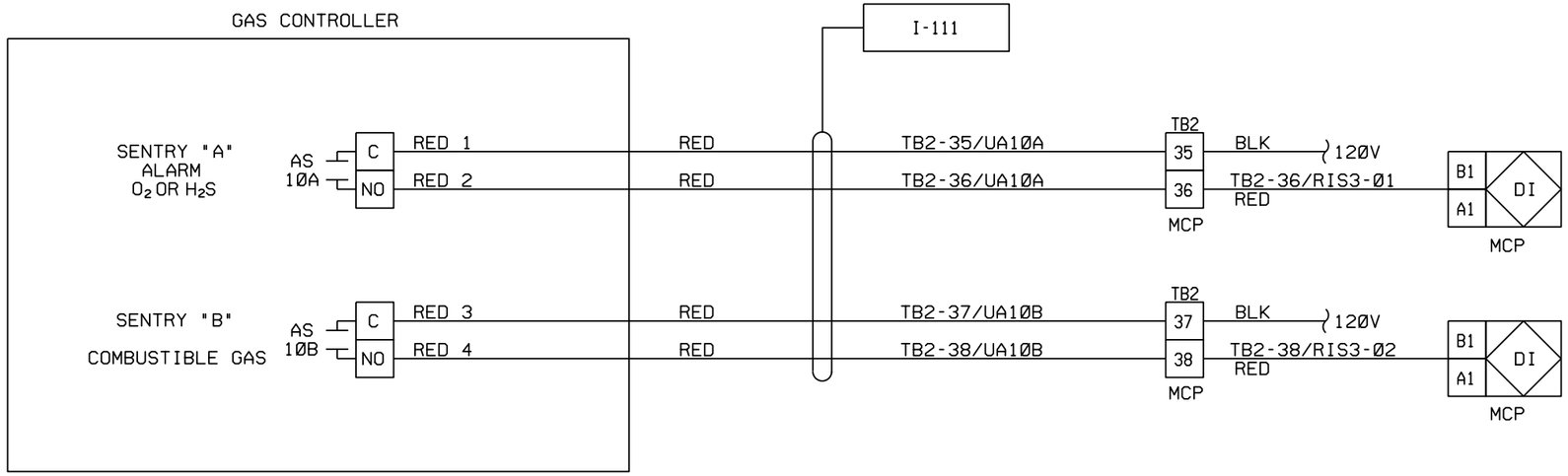

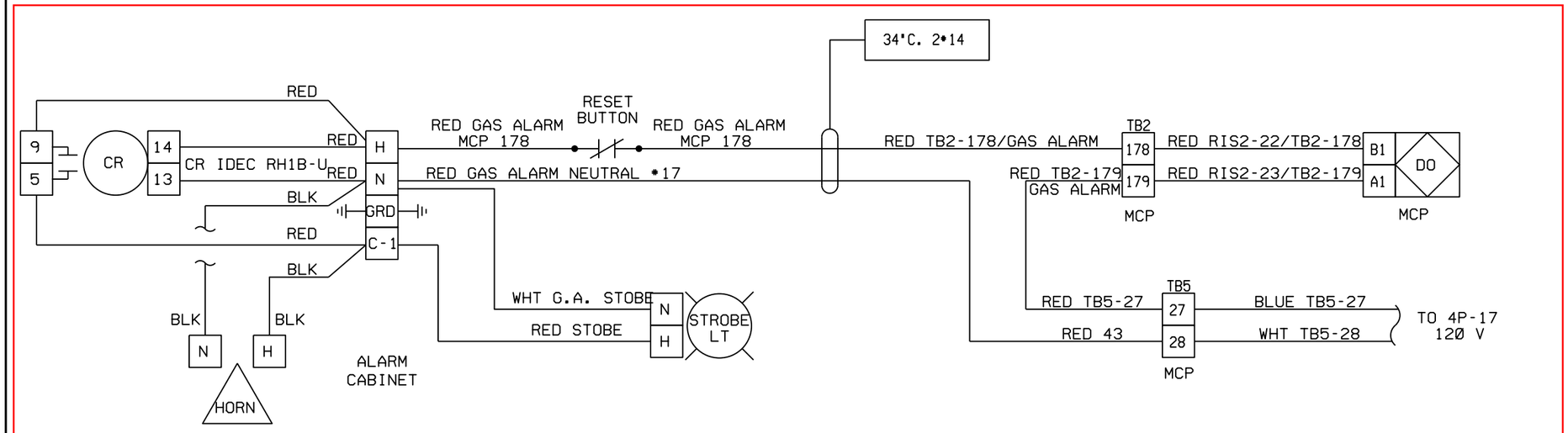

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/2/10							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
DRYWELL GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB• 9079
FILE NAME: 65A10-3

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A10	65A10-3	LD-PS65A10	3	OF	3	1

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LOOP NO: 65A20

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	UA	20	A	SCREENING FAC.	POOR AIR	ALARM	PLC-100	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	UA	20	B	SCREENING FAC.	COMB. GAS S/D	ALARM	PLC-100	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	AS	20	A	SCREENING FAC.	POOR AIR	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING
I	65	AS	20	B	SCREENING FAC.	COMB. GAS S/D	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	UA	20	A	SCREENING FAC.	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A20	I-12	65A20-2	65A20-3
I	65	UA	20	B	SCREENING FAC.	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A20	I-12	65A20-2	65A20-3
I	65	AS	20	A	SCREENING FAC.	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A20	I-12	65A20-2	65A20-3
I	65	AS	20	B	SCREENING FAC.	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A20	I-12	65A20-2	65A20-3

REFERENCE DRAWINGS
P&ID: I-12
CONTROL WIRING DIAGRAMS: E-10
ELECTRICAL PLAN DRAWING: E-18 & E-12
CONDUIT SCHEDULE: E-11.1 NOTE 26

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	10/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
SCREENING FACILITY GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A20-1

LOOP NO.	CAD FILE:	DWG NO. LD-PS65A20	SH		SH	REV
65A20	65A20-1		1	OF	3	1

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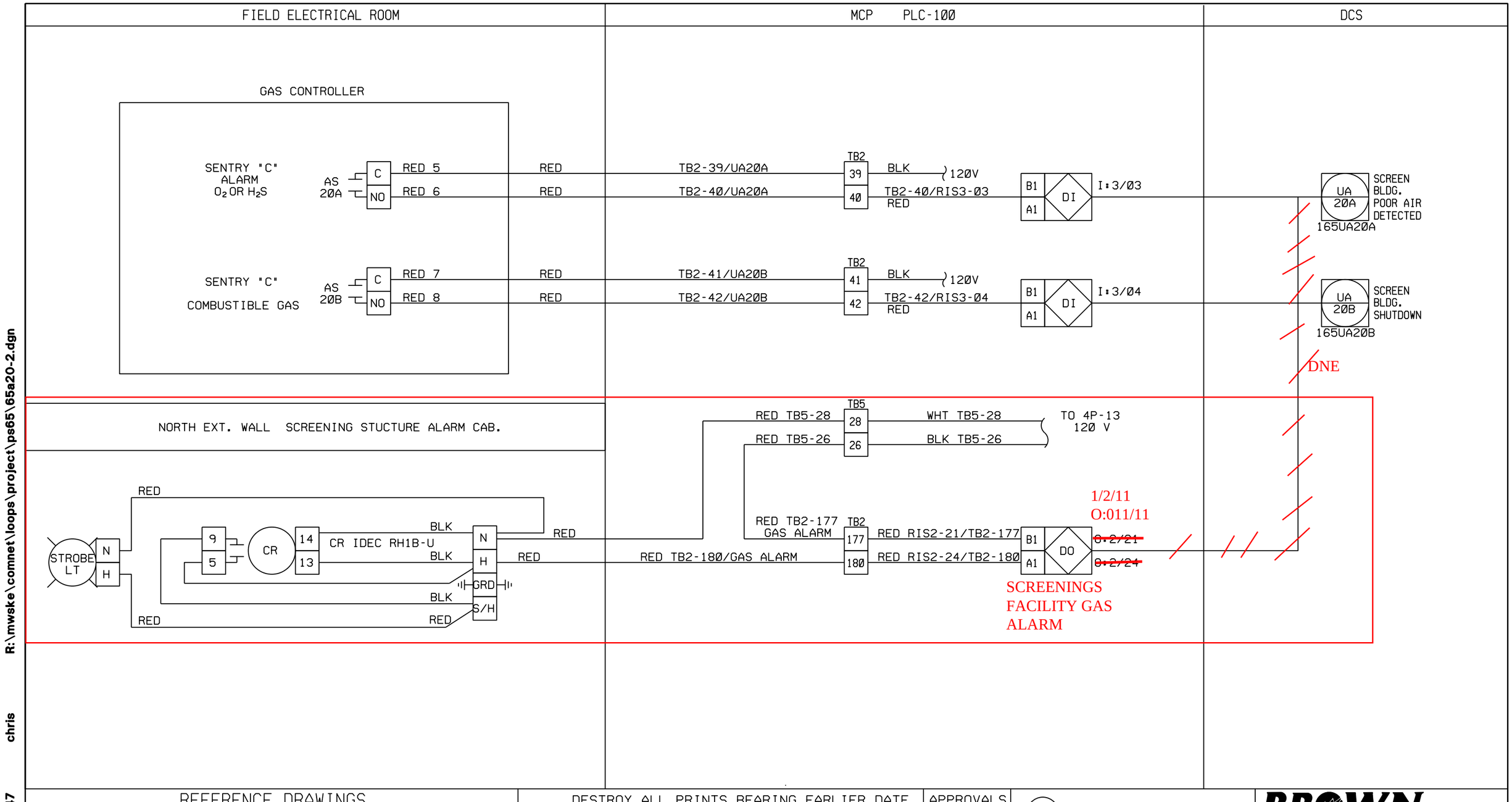

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-18 & E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/2/11							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
SCREENING FACILITY GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A20-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A20	65A20-2	LD-PS65A20	2	OF	3	1

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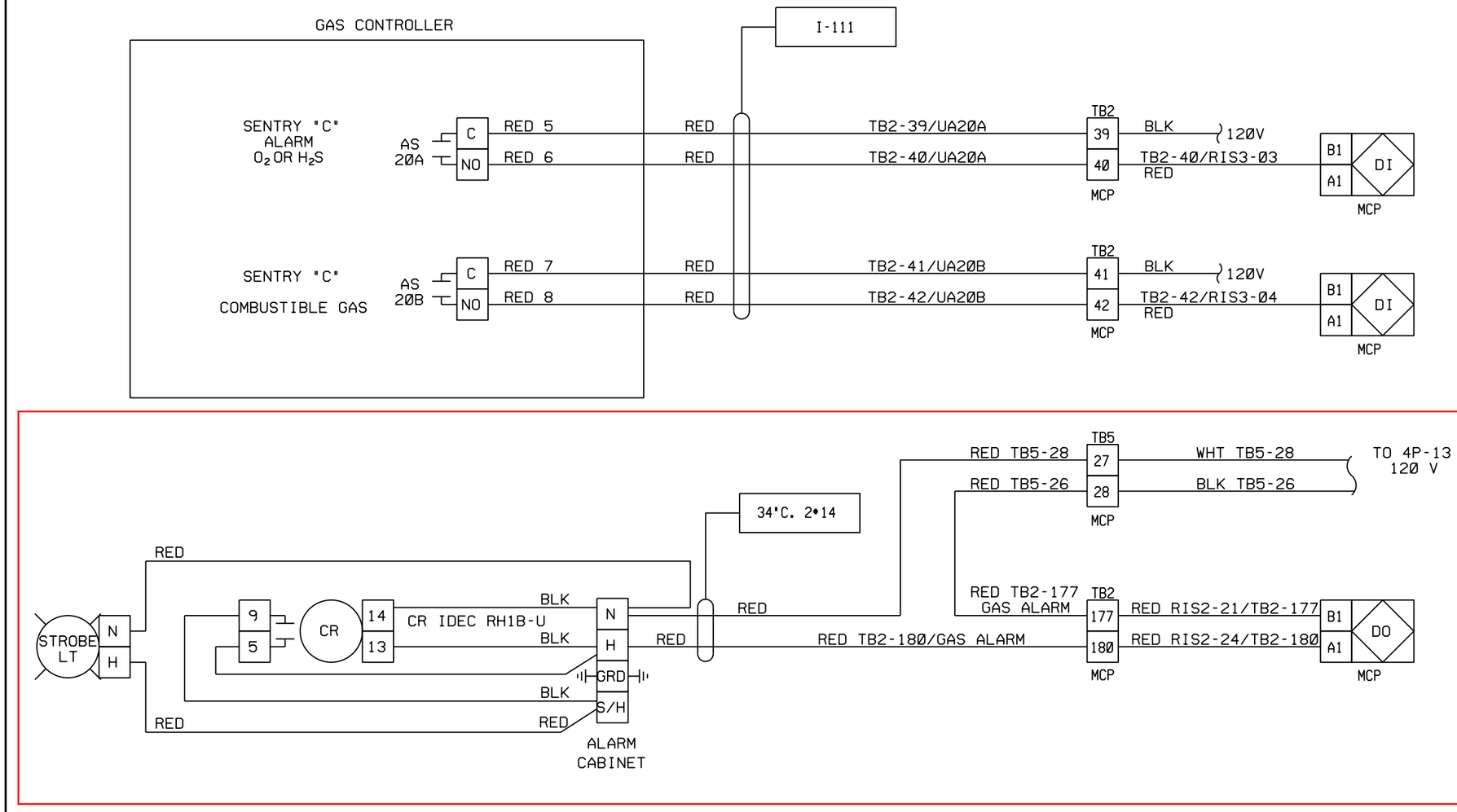

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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-18 & E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/2/11							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
SCREENING FAC. GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB• 9079
FILE NAME: 65A20-3

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A20	65A20-3	LD-PS65A20	3	OF	3	1

LOOP NO: 65A60

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	UA	60	A	METER VAULT	POOR AIR	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	UA	60	B	METER VAULT	COMB. GAS S/D	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	AS	60	A	METER VAULT	POOR AIR	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING
I	65	AS	60	B	METER VAULT	COMB. GAS S/D	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	UA	60	A	METER VAULT	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A60	I-12	65A60-2	65A60-3
I	65	UA	60	B	METER VAULT	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A60	I-12	65A60-2	65A60-3
I	65	AS	60	A	METER VAULT	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A60	I-12	65A60-2	65A60-3
I	65	AS	60	B	METER VAULT	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A60	I-12	65A60-2	65A60-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-20 & E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/2/12							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
LOOP DIAGRAM SCHEDULE
METER VAULT GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A60-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A60	65A60-1	LD-PS65A60	1	OF	3	1

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FIELD ELECTRICAL ROOM | MCP PLC-100 | DCS

GAS CONTROLLER

SENTRY "D" ALARM O_2 OR H_2S — AS 60A — C / NO — RED 9 / RED 10 — RED / RED — TB2-49/UA60A / TB2-50/UA60A — TB2 49 / 50 — BLK / RED — 120V — TB2-50/RIS3-10 — B1 / A1 DI — I:3/10 — UA 60A — METER VAULT POOR AIR DETECTED — 165UA60A

SENTRY "D" COMBUSTIBLE GAS — AS 60B — C / NO — RED 11 / RED 12 — RED / RED — TB2-51/UA60B / TB2-52/UA60B — TB2 51 / 52 — BLK / RED — 120V — TB2-52/RIS3-11 — B1 / A1 DI — I:3/11 — UA 60B — METER VAULT SHUTDOWN — 165UA60B

DNE

SOUTH EXT. WALL BLOWER BLDG. METER VAULT ALARM CAB.

HORN — H / N — BLK / BLK

STROBE LT — H / N — RED / RED

TB — GRD / N / H 181 / RST 182 / S/H

RED — WHT MP. 15 N. — TO 4P-15&N 120V

RED — RED MP. 15 HOT

RED — RED MCP 181 — RED TB2-181/GAS ALARM — TB2 181 — RED RIS2-25/TB2-181 — B1 / A1 DO — 1/2/12 O:011/12 ~~O:2/25~~ ~~O:2/26~~

RED — RED MCP 182 M.V. ALARM — RED TB2-182/GAS ALARM — TB2 182 — RED RIS2-26/TB2-182

METER VAULT GAS ALARM

9 / 5 — CR — 13 / 14 — CR IDEC RH1B-U

RESET BUTTON

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-20 & E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/2/12							

WESTINGHOUSE ELECTRIC CORP. PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
METER VAULT GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB: 9079
FILE NAME: 65A60-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A60	65A60-2	LD-PS65A60	2	OF	3	1

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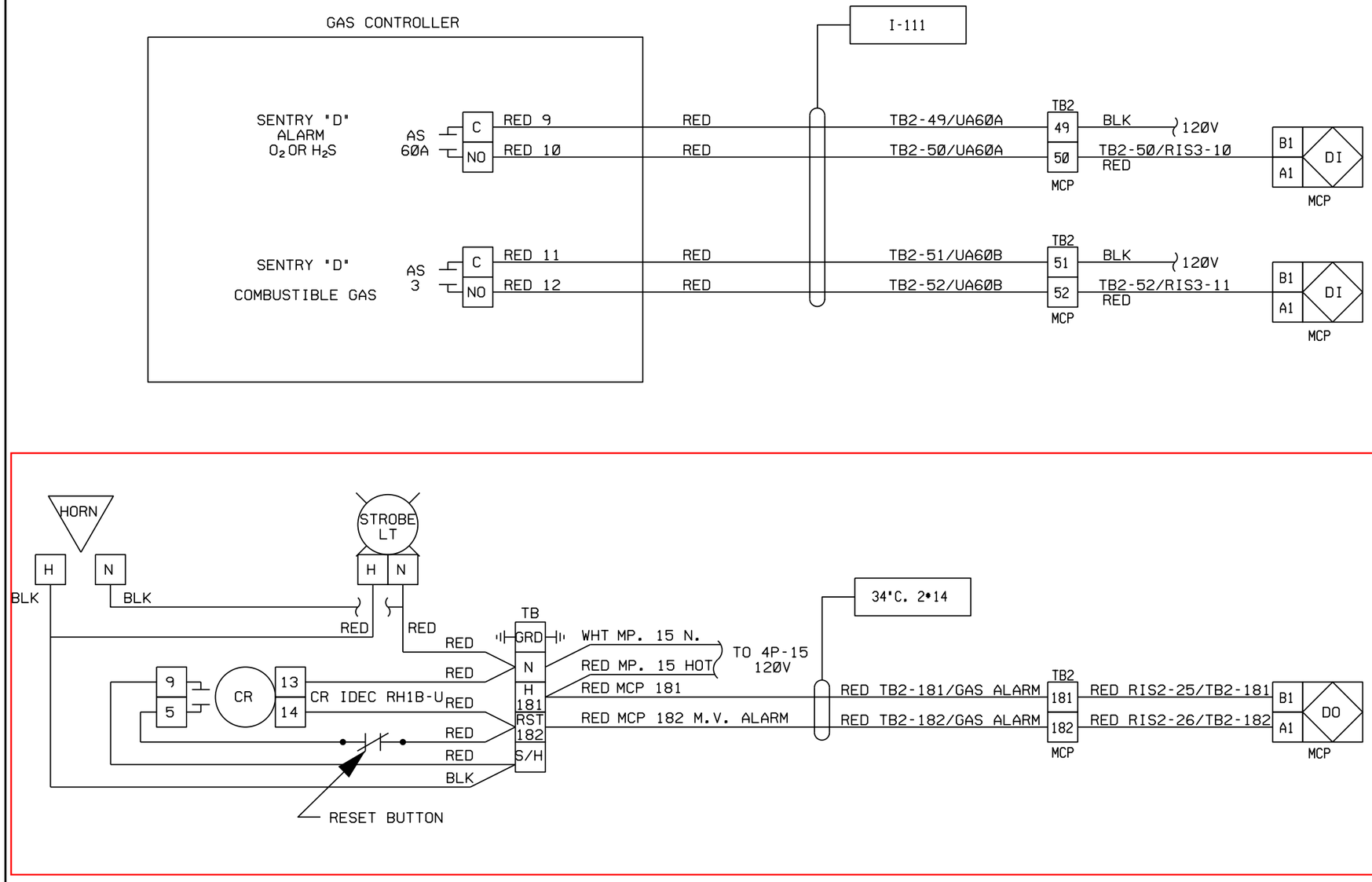

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-20 & E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/2/12							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB• 9079
FILE NAME: 65A60-3

INSTRUMENT LOOP DIAGRAM
METER VAULT GAS DETECTION

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A60	65A60-3	LD-PS65A60	3	OF	3	1

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LOOP NO: 65P301

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	PAH	301		HYDRO-TANK	T-301 HI-PRESS.	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PAL	301		HYDRO-TANK	T-301 LO PRESS.	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PSHL	301		HYDRO-TANK	T-301 HI-LO PRESS.	PRESS.SW.	FIELD	SOR	55V2-EF5 N4-C2A-RR	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	PAH	301		HYDRO-TANK	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65P301	I-5	65P301-2	65P301-3
I	65	PAL	301		HYDRO-TANK	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65P301	I-5	65P301-2	65P301-3
I	65	PSHL	301		HYDRO-TANK	S20.26	N/A	120VAC	N/A	N/A	N/A	LD-PS65P301	I-5	65P301-2	65P301-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-5	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/2/13 & 14							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
SEAL WATER HYDRO PNEUMATIC TANK T-301 PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P301-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65P301	65P301-1	LD-PS65P301	1	OF	3	1

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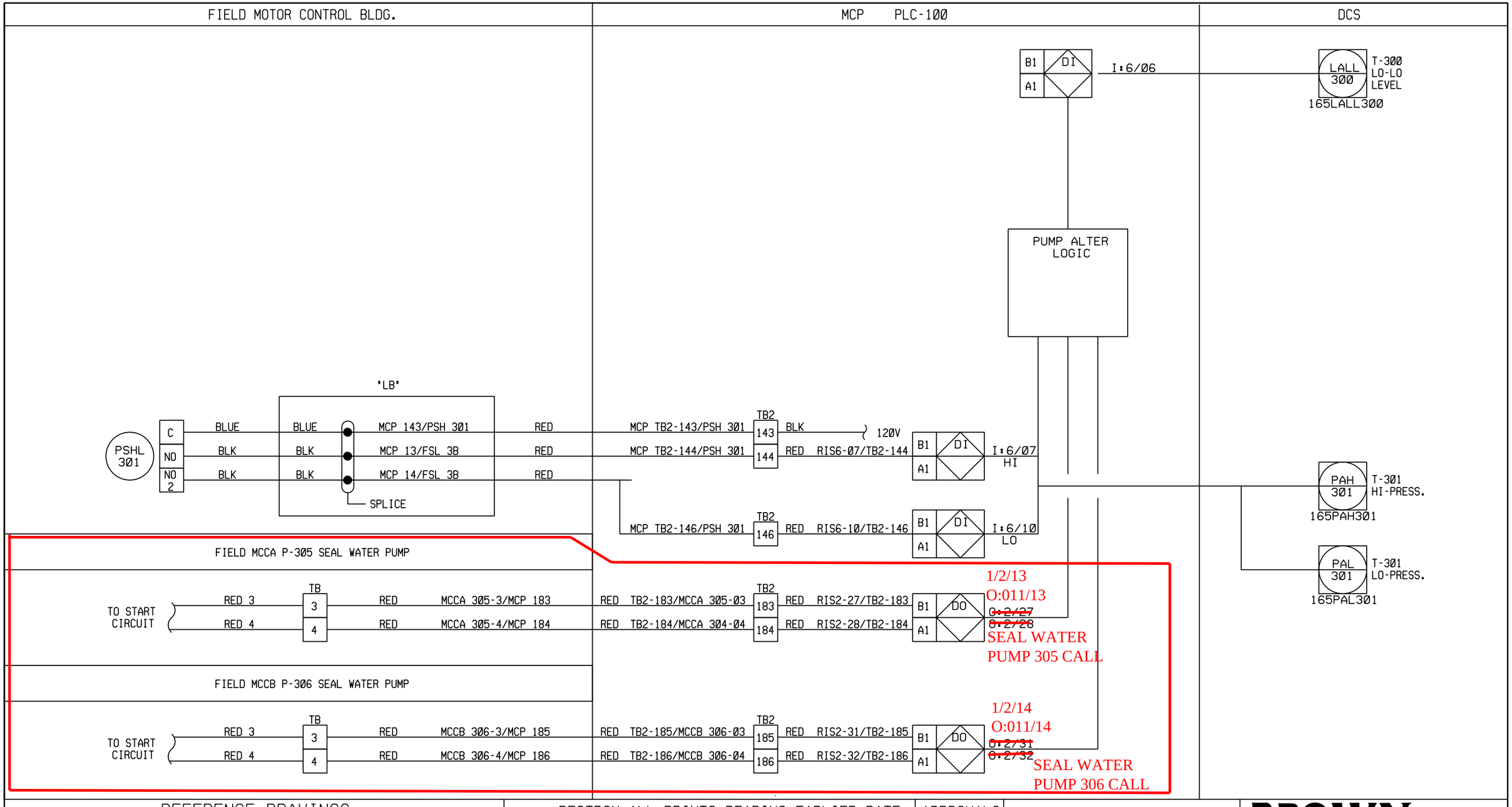


REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-5	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/2/13 & 14							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

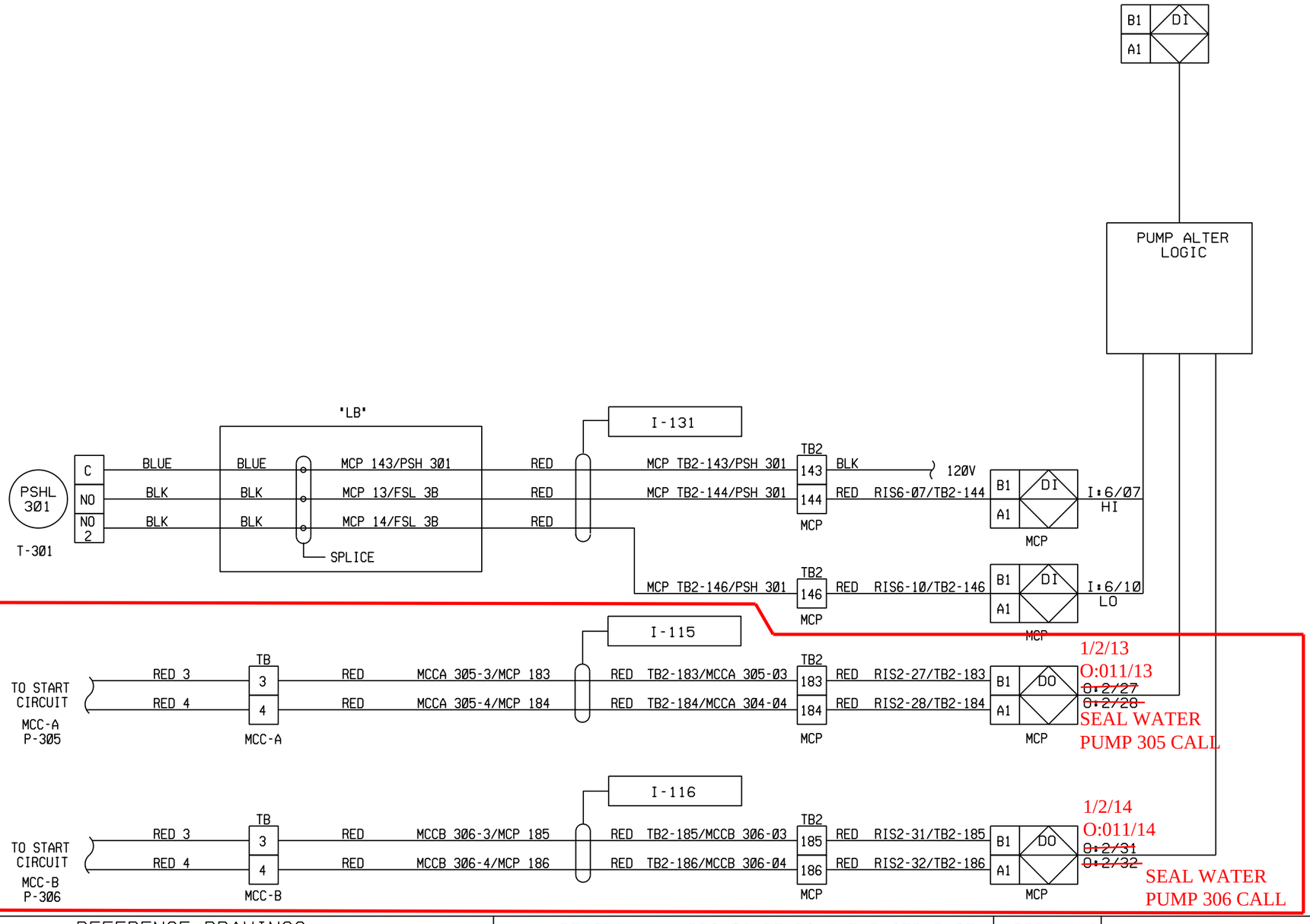
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P301-2

INSTRUMENT LOOP DIAGRAM
SEAL WATER HYDROPNEUMATIC TANK T-301 PRESSURE

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65P301	65P301-2	LD-PS65P301	2 OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-5	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/2/13 & 14							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
SEAL WATER HYDROPNEUMATIC TANK T-301 PRESSURE

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P301-3

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65P301	65P301-3	LD-PS65P301	3	OF	3	1

LOOP NO: 65L10

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LALL	10		OPER. WET WELL	LEVEL LO-LO	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	LIT	10		OPER. WET WELL	LEVEL LO-LO	TRANSMITTER	CP-10	ROSEMOUNT	1151DP5S 52B3MH	N/A	N/A	N/A	EXISTING
I	65	LAHH	10		OPER. WET WELL	ALARM	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LALL	10		OPER. WET WELL	N/A	N/A	N/A	N/A	N/A	N/A	LD-PS65L10	I-4	65L10-2	65L10-3
I	65	LIT	10		OPER. WET WELL	S20.20	AI	4-20MA	0-750	I.W.C	N/A	LD-PS65L10	I-4	65L10-2	65L10-3
I	65	LAHH	10		OPER. WET WELL	N/A	N/A	N/A	N/A	N/A	N/A	LD-PS65L10	I-4	65L10-2	65L10-3

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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/2/17							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

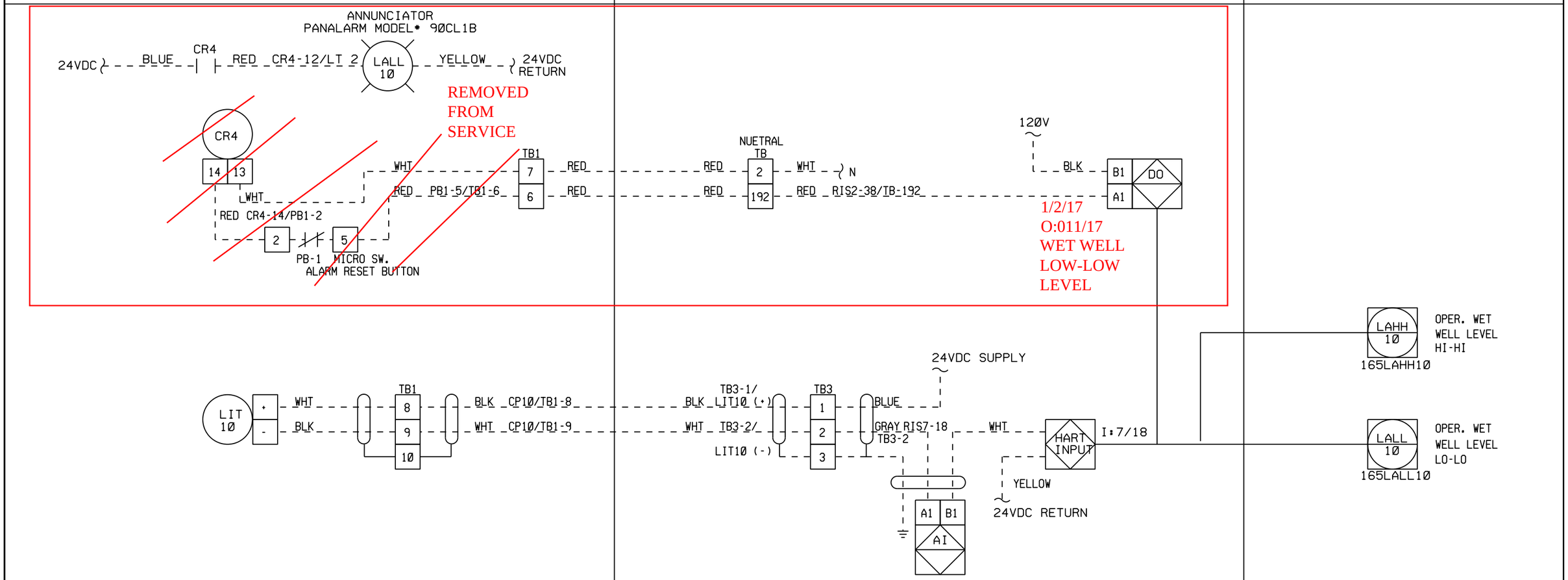
WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
OPERATIONAL WET WELL LEVEL

FILE NAME: 65L10-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L10	65L10-1	LD-PS65L10	1	OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/2/17							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

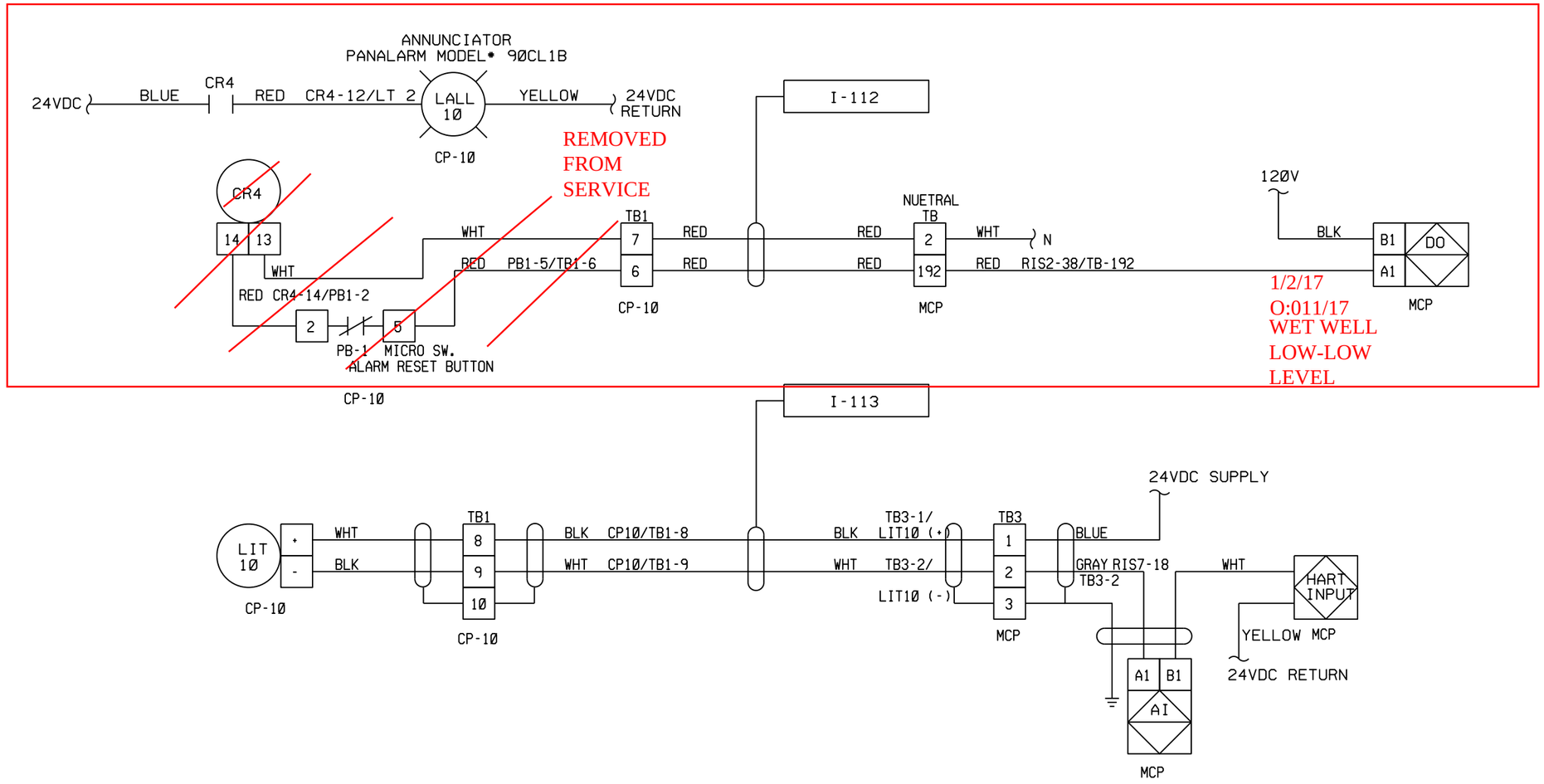
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L10-2

INSTRUMENT LOOP DIAGRAM
OPERATIONAL WET WELL LEVEL

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65L10	65L10-2	LD-PS65L10	2 OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/2/17							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
OPERATIONAL WET WELL LEVEL

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L10-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65L10	65L10-3	LD-PS65L10	3	OF 3	1

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LOOP NO: 65P10B

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	PALL	10	B	BUBBLER PNL. CP-10	AIR PRESS. LO-LO	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	CR-2	N/A		BUBBLER PNL. CP-10	AIR PRESS. LO-LO	RELAY	CP-10	IDEC	RH3B-U	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	PALL	10	B	BUBBLER PNL. CP-10	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65P10B	I-4	65P10B-2	65P10B-3
I	65	CR-2	N/A		BUBBLER PNL. CP-10	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65P10B	I-4	65P10B-2	65P10B-3

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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE				APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/3/0							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
BUBBLER CONTROL PANEL CP-10 PRESS.

FILE NAME: 65P10B-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65P10B	65P10B-1	LD-PS65P10B	1	OF	3	1

FIELD BUBBLER PANEL CP-10	MCP PLC-100	DCS

REMOVED FROM SERVICE

CR2
5 RED TB1-3/CR4-5 — TB1 3 — RED CP10/TB1-3
12 RED TB1-4/CR2-12 — TB1 4 — RED CP10/TB1-4
IDEC• RH3B-U

RED TB2-33/CP10-03 — TB2 33 — BLK ~ 120V
RED TB2-34/CP10-04 — TB2 34 — RED TB2-34/RIS3-00

B1 DI A1
~~I•3/00~~
1/3/0
I:012/0

PALL 10B
CP-10 AIR PRESSURE LO-LO
165PALL10B

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/3/0							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

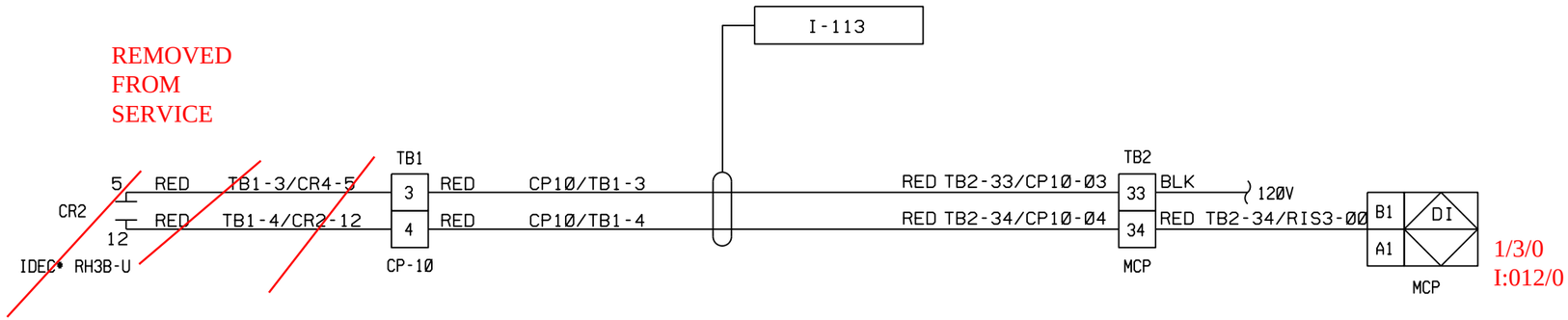
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
BUBBLER CONTROL PANEL CP-10 PRESSURE

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB• 9079
FILE NAME: 65P10B-2

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65P10B	65P10B-2	LD-PS65P10B	2	OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/3/0							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

INSTRUMENT LOOP DIAGRAM
BUBBLER CONTROL PANEL CP-10 PRESSURE

FILE NAME: 65P10B-3

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65P10B	65P10B-3	LD-PS65P10B	3	OF	3	1

LOOP NO: 65A10

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	UA	10	A	DRYWELL	POOR AIR	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	UA	10	B	DRYWELL	COMB. GAS S/D	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	AS	10	A	DRYWELL	POOR AIR	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING
I	65	AS	10	B	DRYWELL	COMB. GAS S/D	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	UA	10	A	DRYWELL	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A10	I-12	65A10-2	65A10-3
I	65	UA	10	B	DRYWELL	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A10	I-12	65A10-2	65A10-3
I	65	AS	10	A	DRYWELL	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A10	I-12	65A10-2	65A10-3
I	65	AS	10	B	DRYWELL	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A10	I-12	65A10-2	65A10-3

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REFERENCE DRAWINGS

P&ID: I-12
CONTROL WIRING DIAGRAMS: E-10
ELECTRICAL PLAN DRAWING: E-12
CONDUIT SCHEDULE: E-11.1 NOTE 26

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	10/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
DRYWELL GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A10-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A10	65A10-1	LD-PS65A10	1	OF	3	1

1/3/1 & 2

FIELD ELECTRICAL ROOM | MCP PLC-100 | DCS

GAS CONTROLLER

SENTRY "A" ALARM O_2 OR H_2S — AS 10A — C / NO — RED_1 — RED — TB2-35/UA10A — TB2 35 — BLK — 120V
RED_2 — RED — TB2-36/UA10A — TB2 36 — TB2-36/RIS3-01 RED — B1 / A1 DI — ~~I:3/01~~ 1/3/1 I:012/1 — UA 10A DRYWELL POOR AIR DETECTED — 165UA10A

SENTRY "B" COMBUSTIBLE GAS — AS 10B — C / NO — RED_3 — RED — TB2-37/UA10B — TB2 37 — BLK — 120V
RED_4 — RED — TB2-38/UA10B — TB2 38 — TB2-38/RIS3-02 RED — B1 / A1 DI — ~~I:3/02~~ 1/3/2 I:012/2 — UA 10B DRYWELL COMB. GAS SHUTDOWN — 165UA10B

DNE

NORTH INT. WALL PUMP STATION ALARM CAB.

9 / 5 — CR — 14 / 13 — CR IDEC RH1B-U
RED — H — RED GAS ALARM MCP 178 — RESET BUTTON — RED GAS ALARM MCP 178 — RED TB2-178/GAS ALARM — TB2 178 — RED RIS2-22/TB2-178 — B1 / A1 DO — O:2/22 / O:2/23
RED — N — RED GAS ALARM NEUTRAL *17 — RED TB2-179 GAS ALARM — TB2 179 — RED RIS2-23/TB2-179
BLK — GRD
RED — C-1
BLK
BLK — N — HORN — BLK — H
WHT G.A. STROBE — N
RED STROBE — H — STROBE LT
RED TB5-27 — TB5 27 — BLUE TB5-27 — TO 4P-17&N 120 V
RED 43 — TB5 28 — WHT TB5-28

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/3/1 & 2							

WESTINGHOUSE ELECTRIC CORP. PROCESS CONTROL DIVISION

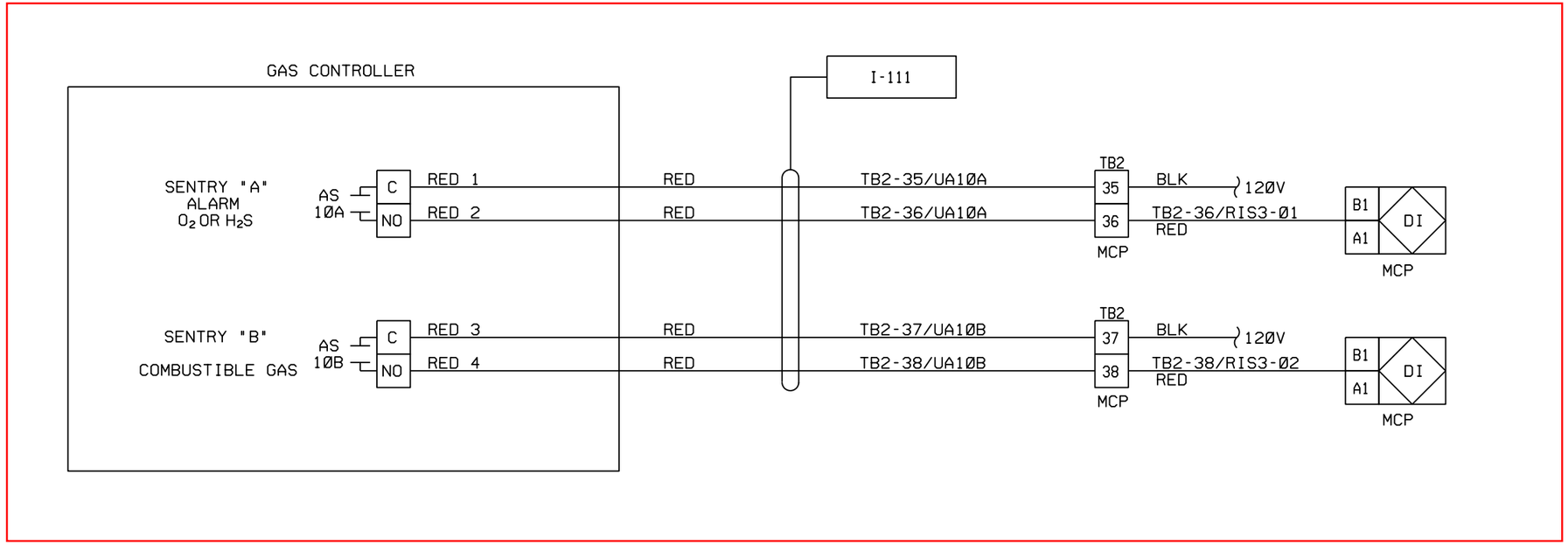
BROWN AUTOMATION, INC. EMPLOYEE OWNED

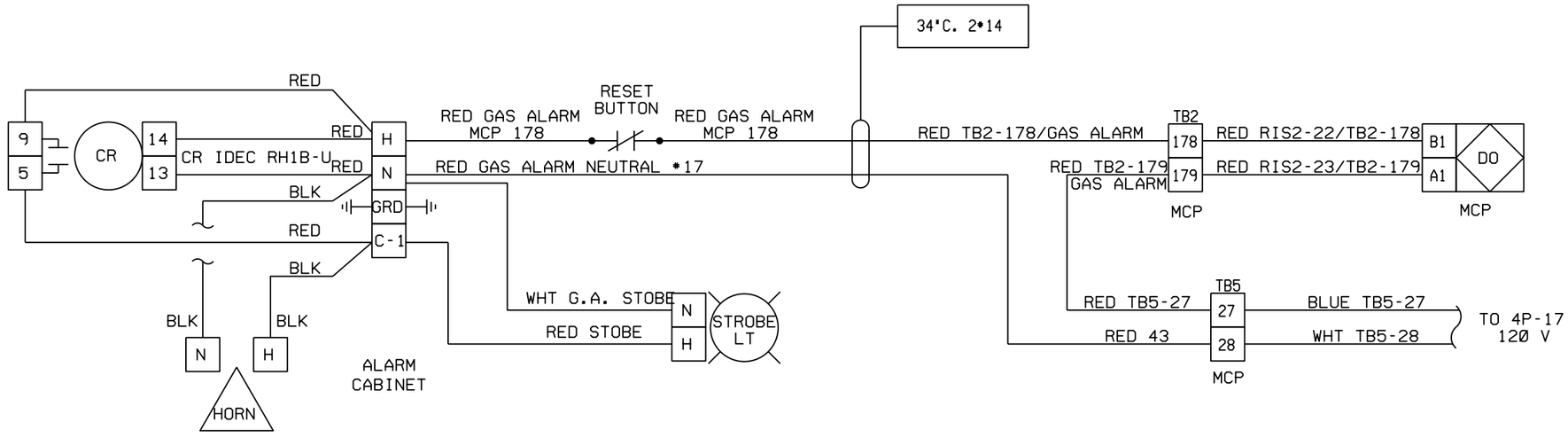
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
DRYWELL GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A10-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65A10	65A10-2	LD-PS65A10	2	OF 3	1





REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/3/1 & 2							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
DRYWELL GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB• 9079
FILE NAME: 65A10-3

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65A10	65A10-3	LD-PS65A10	3	OF	3	1

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LOOP NO: 65A20

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	UA	20	A	SCREENING FAC.	POOR AIR	ALARM	PLC-100	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	UA	20	B	SCREENING FAC.	COMB. GAS S/D	ALARM	PLC-100	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	AS	20	A	SCREENING FAC.	POOR AIR	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING
I	65	AS	20	B	SCREENING FAC.	COMB. GAS S/D	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	UA	20	A	SCREENING FAC.	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A20	I-12	65A20-2	65A20-3
I	65	UA	20	B	SCREENING FAC.	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A20	I-12	65A20-2	65A20-3
I	65	AS	20	A	SCREENING FAC.	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A20	I-12	65A20-2	65A20-3
I	65	AS	20	B	SCREENING FAC.	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A20	I-12	65A20-2	65A20-3

REFERENCE DRAWINGS
P&ID: I-12
CONTROL WIRING DIAGRAMS: E-10
ELECTRICAL PLAN DRAWING: E-18 & E-12
CONDUIT SCHEDULE: E-11.1 NOTE 26

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	10/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
SCREENING FACILITY GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A20-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A20	65A20-1	LD-PS65A20	1	OF	3	1

1/3/3 & 4

FIELD ELECTRICAL ROOM | MCP PLC-100 | DCS

GAS CONTROLLER

SENTRY "C"
ALARM
O_2 OR H_2S

AS 20A — C, NO — RED 5, RED 6 — RED, RED — TB2-39/UA20A, TB2-40/UA20A — TB2 39, 40 — BLK, TB2-40/RIS3-03 RED — 120V — DI B1, A1 — ~~I:3/03~~ 1/3/3 I:012/3 — UA 20A — SCREEN BLDG. POOR AIR DETECTED — 165UA20A

SENTRY "C"
COMBUSTIBLE GAS

AS 20B — C, NO — RED 7, RED 8 — RED, RED — TB2-41/UA20B, TB2-42/UA20B — TB2 41, 42 — BLK, TB2-42/RIS3-04 RED — 120V — DI B1, A1 — ~~I:3/04~~ 1/3/4 I:012/4 — UA 20B — SCREEN BLDG. SHUTDOWN — 165UA20B

DNE

NORTH EXT. WALL SCREENING STUCTURE ALARM CAB.

RED TB5-28 — TB5 28 — WHT TB5-28 — TO 4P-13 120 V

RED TB5-26 — TB5 26 — BLK TB5-26

RED TB2-177 GAS ALARM — TB2 177 — RED RIS2-21/TB2-177 — DO B1 — O:2/21

RED TB2-180/GAS ALARM — TB2 180 — RED RIS2-24/TB2-180 — DO A1 — O:2/24

RED — STROBE LT N, H — RED

RED — 9, 5 — CR — 14, 13 — CR IDEC RH1B-U — BLK — N — RED

BLK — H — RED

BLK — GRD

BLK — S/H — RED

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-18 & E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/3/3 & 4							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
SCREENING FACILITY GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A20-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A20	65A20-2	LD-PS65A20	2	OF	3	1

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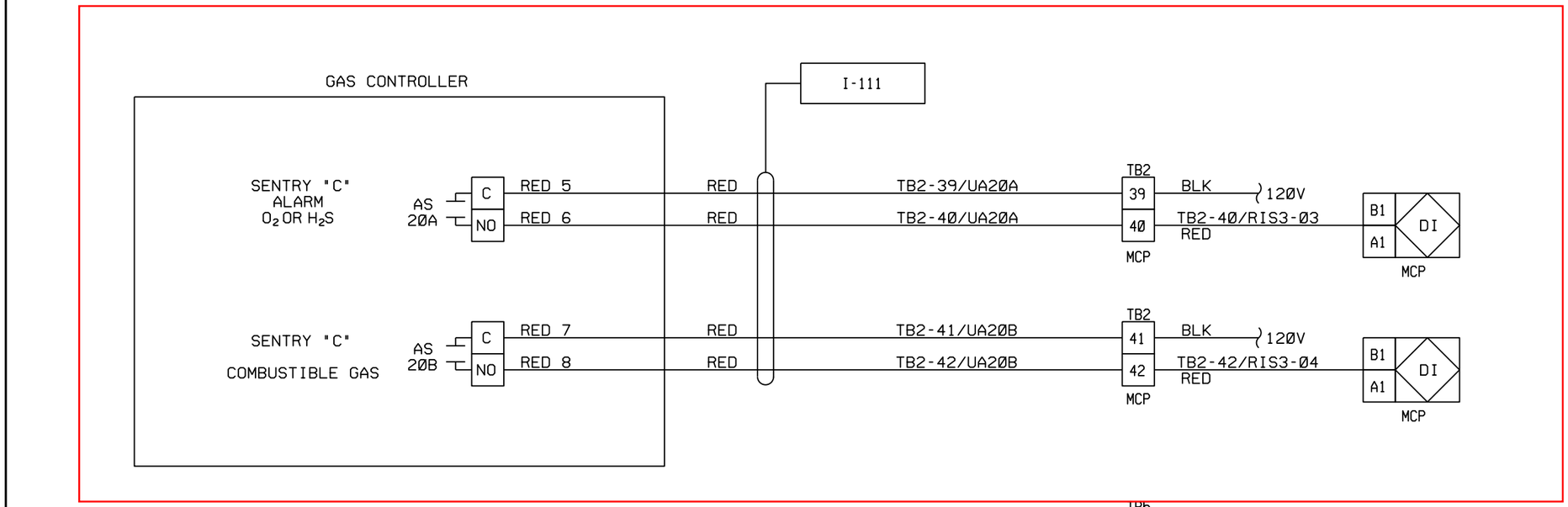

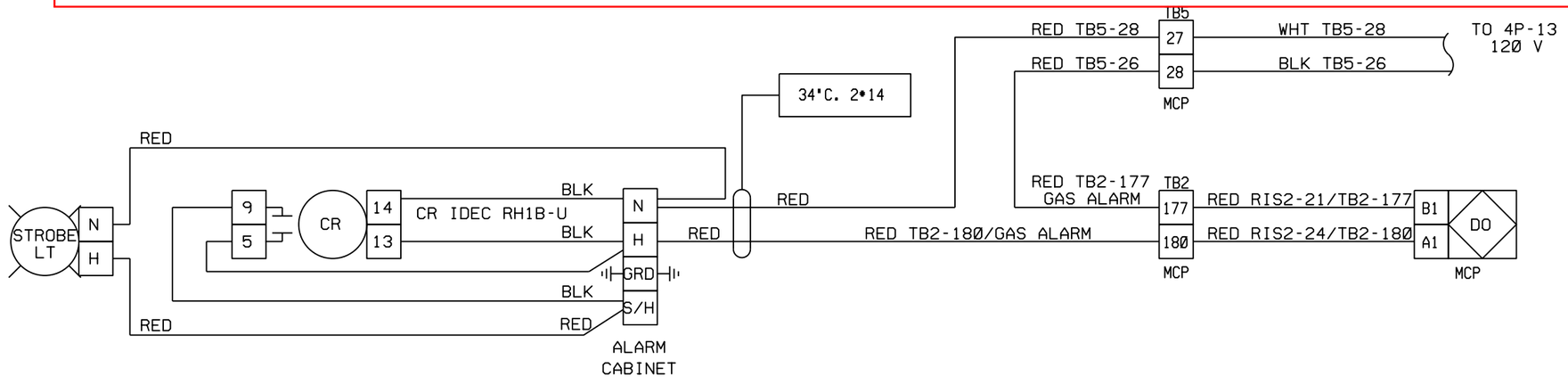

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-18 & E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/3/3 & 4							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
SCREENING FAC. GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB• 9079
FILE NAME: 65A20-3

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A20	65A20-3	LD-PS65A20	3	OF	3	1

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LOOP NO: 65L50

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LAH	50		PUMP ROOM	SUMP LEVEL HIGH	STATUS	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	LAHH	50		PUMP ROOM	SUMP LEVEL HI-HI	STATUS	DCS	WESTINGHOUSE	WDFP II	13400	WPC	PS65-200	
I	65	TB2	N/A		PUMP ROOM	SUMP LEVEL HIGH	CONTACTS	UCP-50	RHOMBUS TECH.	*3221-W101-H6A17D19FK	N/A	N/A	N/A	EXISTING
I	65	LSHH	50		PUMP ROOM	SUMP LEVEL HI-HI	SWITCH	FIELD	FLYGHT	ENM-10	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LAH	50		PUMP ROOM	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65L50	I-5	65L50-2	65L50-3
I	65	LAHH	50		PUMP ROOM	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65L50	I-5	65L50-2	65L50-3
I	65	LSH	50		PUMP ROOM	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65L50	I-5	65L50-2	65L50-3
I	65	LSHH	50		PUMP ROOM	S20.20	N/A	120VAC	N/A	N/A	N/A	LD-PS65L50	I-5	65L50-2	65L50-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-5	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/3/5 & 6							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

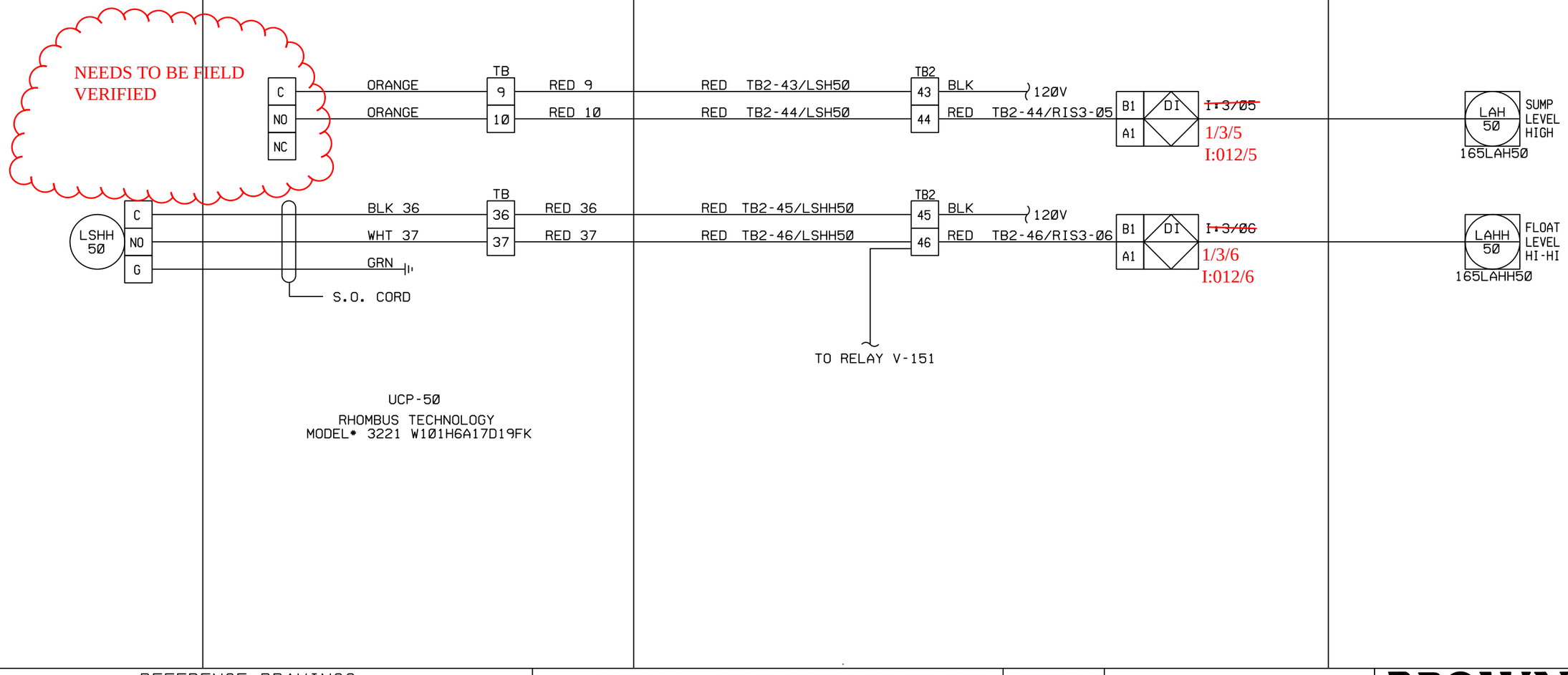
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP ROOM FLOAT & SUMP

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB: 9079
FILE NAME: 65L50-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L50	65L50-1	LD-PS65L50	1	OF	3	1

FIELD SUMP PUMP LEVEL	PUMP LEVEL UCP-50	MCP PLC-100	DCS



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-5	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/3/5 & 6							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP ROOM FLOAT & SUMP LEVEL

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB* 9079
FILE NAME: 65L50-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L50	65L50-2	LD-PS65L50	2	OF	3	1

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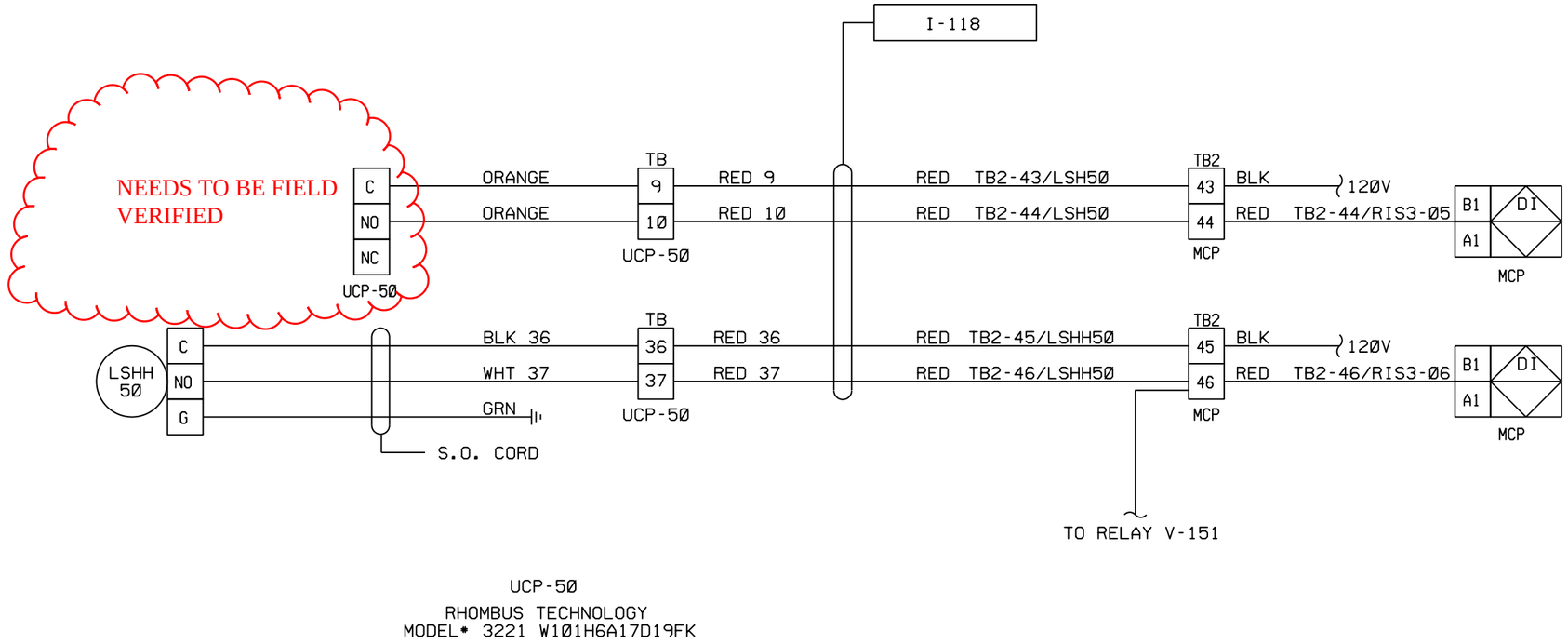

UCP-50

RHOMBUS TECHNOLOGY
MODEL* 3221 W101H6A17D19FK

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-5 TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/3/5 & 6							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP ROOM FLOAT & SUMP LEVEL

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB* 9079
FILE NAME: 65L50-3

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L50	65L50-3	LD-PS65L50	3	OF	3	0

LOOP NO: 65L60

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LAH	60		METER VAULT	HI LEVEL	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	LSH	60		METER VAULT	HI LEVEL	RELAY	UCP-60	RHOMBUS	*3221	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LAH	60		METER VAULT	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65L60	I-5	65L60-2	65L60-3
I	65	LSH	60		METER VAULT	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65L60	I-5	65L60-2	65L60-3

REFERENCE DRAWINGS
P&ID: I-5
ELECTRICAL PLAN DRAWING: E-20
CONDUIT SCHEDULE: E-11.1

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	11/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
METER VAULT SUMP LEVEL

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L60-1

LOOP NO.	CAD FILE:	DWG NO. LD-PS65L60	SH	SH	REV
65L60	65L60-1		1 OF	3	1

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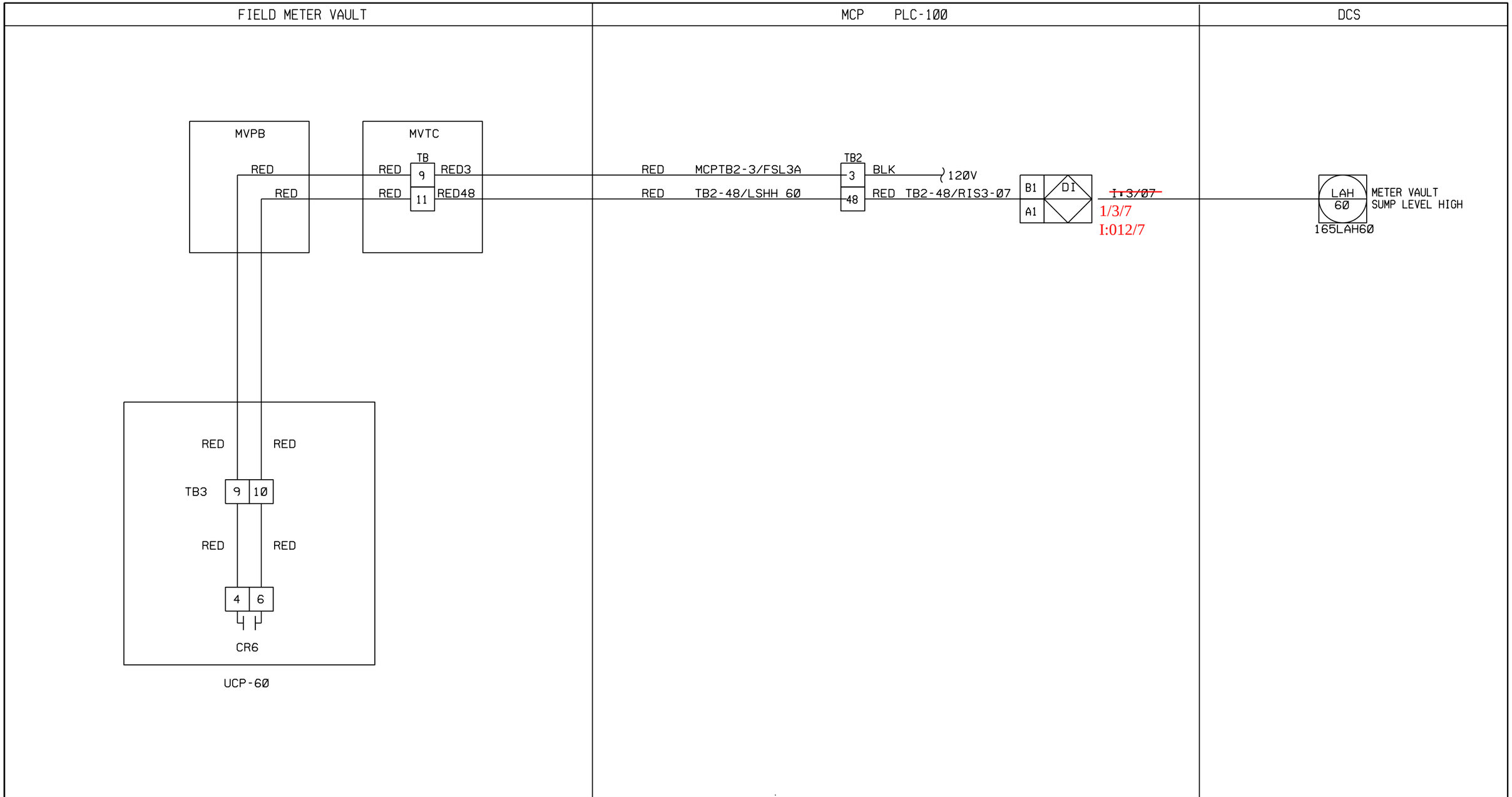
1/3/7



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-5	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-20	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/3/7							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

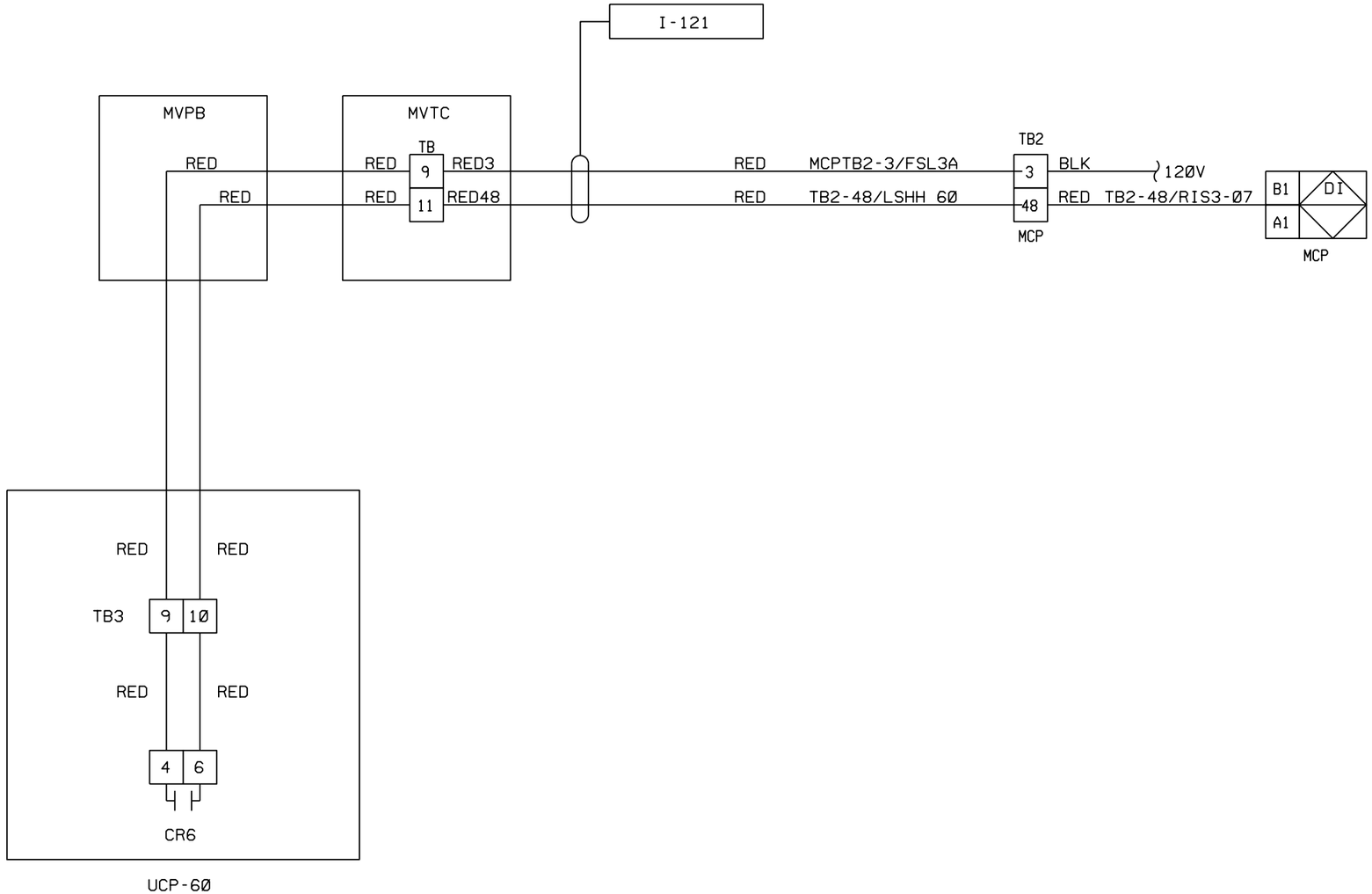
WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB: 9079

INSTRUMENT LOOP DIAGRAM
METER VAULT SUMP LEVEL

FILE NAME: 65L60-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L60	65L60-2	LD-PS65L60	2	OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-5	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-20	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/3/7							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L60-3

INSTRUMENT LOOP DIAGRAM
METER VAULT SUMP LEVEL

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65L60	65L60-3	LD-PS65L60	3 OF	3	1

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LOOP NO: 65A60

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	UA	60	A	METER VAULT	POOR AIR	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	UA	60	B	METER VAULT	COMB. GAS S/D	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	AS	60	A	METER VAULT	POOR AIR	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING
I	65	AS	60	B	METER VAULT	COMB. GAS S/D	CONTACT	GAS CONTROLLER	SMC	5301	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	UA	60	A	METER VAULT	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A60	I-12	65A60-2	65A60-3
I	65	UA	60	B	METER VAULT	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65A60	I-12	65A60-2	65A60-3
I	65	AS	60	A	METER VAULT	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A60	I-12	65A60-2	65A60-3
I	65	AS	60	B	METER VAULT	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65A60	I-12	65A60-2	65A60-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-20 & E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/3/10 &11							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
LOOP DIAGRAM SCHEDULE
METER VAULT GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A60-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A60	65A60-1	LD-PS65A60	1	OF	3	1

11-DEC-2008 11:48 chris R:\mwske\comnet\loops\project\ps65\65a60-1.dgn

FIELD ELECTRICAL ROOM | MCP PLC-100 | DCS

GAS CONTROLLER

SENTRY "D" ALARM O_2 OR H_2S — AS 60A — C / NO — RED 9 / RED 10 — RED / RED — TB2-49/UA60A / TB2-50/UA60A — TB2 49 / 50 — BLK / RED — 120V — TB2-50/RIS3-10 — B1 / A1 — DI — ~~I:3/10~~ 1/3/10 I:012/10 — UA 60A — METER VAULT POOR AIR DETECTED — 165UA60A

SENTRY "D" COMBUSTIBLE GAS — AS 60B — C / NO — RED 11 / RED 12 — RED / RED — TB2-51/UA60B / TB2-52/UA60B — TB2 51 / 52 — BLK / RED — 120V — TB2-52/RIS3-11 — B1 / A1 — DI — ~~I:3/11~~ 1/3/11 I:012/11 — UA 60B — METER VAULT SHUTDOWN — 165UA60B

DNE

SOUTH EXT. WALL BLOWER BLDG. METER VAULT ALARM CAB.

HORN — H / N — BLK / BLK

STROBE LT — H / N — RED / RED

TB — GRD — WHT MP. 15 N. — TO 4P-15&N 120V

N — RED MP. 15 HOT

H 181 — RED MCP 181 — RED TB2-181/GAS ALARM — TB2 181 — RED RIS2-25/TB2-181 — B1 / A1 — DO — O:2/25 / O:2/26

RST 182 — RED MCP 182 M.V. ALARM — RED TB2-182/GAS ALARM — TB2 182 — RED RIS2-26/TB2-182

S/H — BLK

9 / 5 — CR — 13 / 14 — CR IDEC RH1B-U

RESET BUTTON

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-20 & E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/3/10 & 11							

WESTINGHOUSE ELECTRIC CORP. PROCESS CONTROL DIVISION

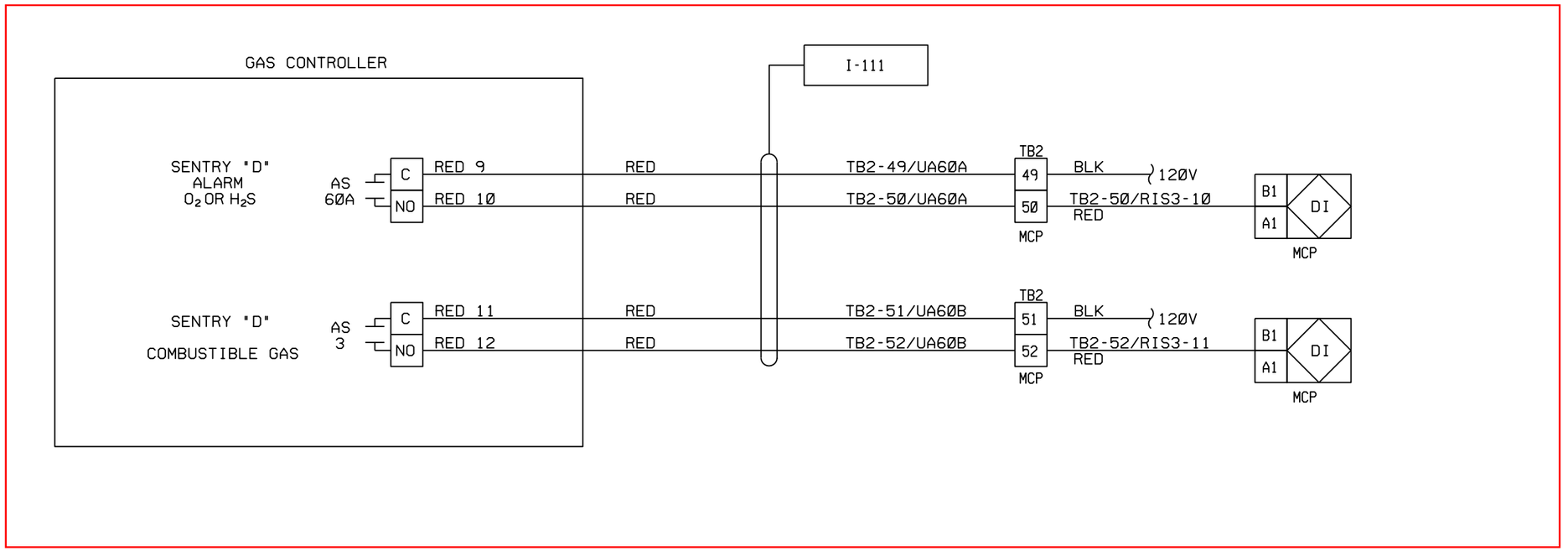
BROWN AUTOMATION, INC. EMPLOYEE OWNED

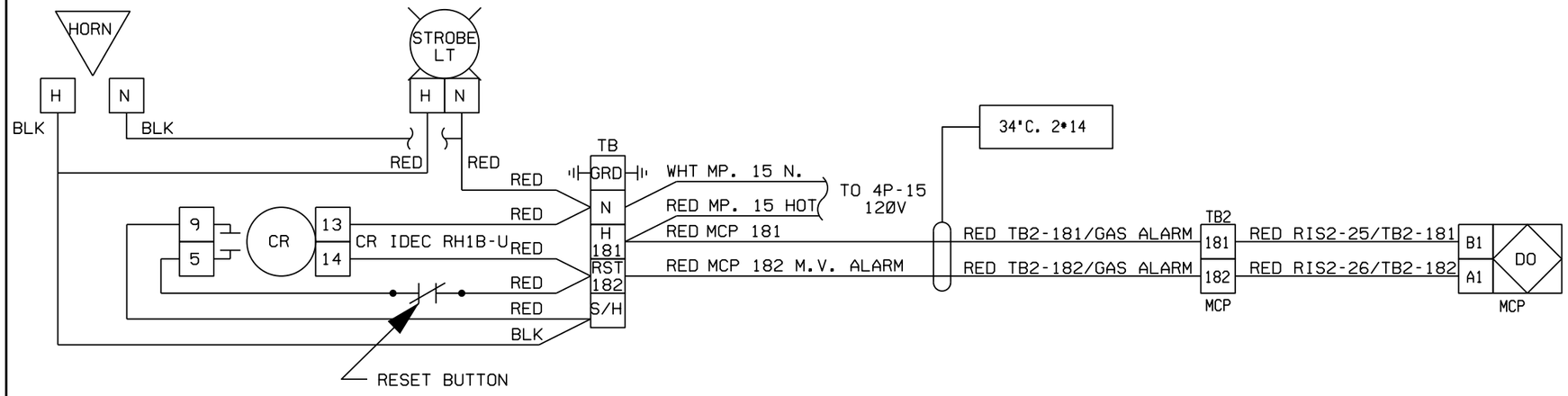
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
METER VAULT GAS DETECTION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A60-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65A60	65A60-2	LD-PS65A60	2	OF	3	1





REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
CONTROL WIRING DIAGRAMS: E-10	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRICAL PLAN DRAWING: E-20 & E-12	1	10/04	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1 NOTE 26							
1/3/10 & 11							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB• 9079
FILE NAME: 65A60-3

INSTRUMENT LOOP DIAGRAM
METER VAULT GAS DETECTION

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65A60	65A60-3	LD-PS65A60	3	OF 3	1

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chris
11-DEC-2008 11:48

LOOP NO: 65Y81

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	UA	81		PLANT AIR COMP.	AIR SYSTEM FAIL	ALARM	PLC-100						EXISTING
I	65	R2	N/A		PLANT AIR COMP.	AIR SYSTEM FAIL	RELAY	UCP-81						EXISTING
I	65	R3	N/A		PLANT AIR COMP.	AIR SYSTEM FAIL	RELAY	UCP-81						EXISTING
I	65	R4	N/A		PLANT AIR COMP.	AIR SYSTEM FAIL	RELAY	UCP-81						EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	UA	81		PLANT AIR COMP.	N/A	DI	120 VAC				LD-PS65Y81-2		LD-PS65Y81	LD-PS65Y81-3
I	65	R2	N/A		PLANT AIR COMP.	N/A	N/A	120 VAC				LD-PS65Y81-2		LD-PS65Y81	LD-PS65Y81-3
I	65	R3	N/A		PLANT AIR COMP.	N/A	N/A	120 VAC				LD-PS65Y81-2		LD-PS65Y81	LD-PS65Y81-3
I	65	R4	N/A		PLANT AIR COMP.	N/A	N/A	120 VAC				LD-PS65Y81-2		LD-PS65Y81	LD-PS65Y81-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

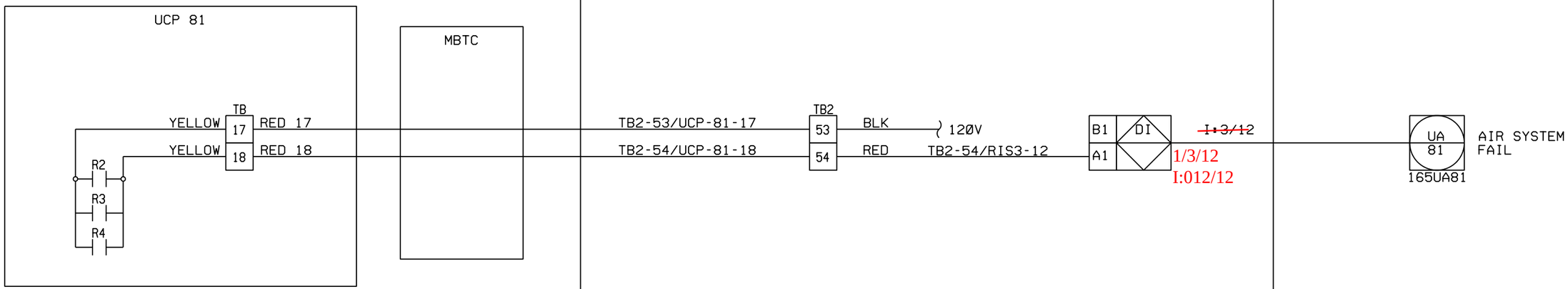
LOOP DIAGRAM SCHEDULE
PLANT AIR SUPPLY SYSTEM FAILURE

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y81-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y81	65Y81-1	LD-PS65Y81	1	OF	3	0

1/3/12

FIELD MECH. BLDG. EQUIPMENT ROOM	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS

TBD

REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

DESTROY ALL PRINTS BEARING EARLIER DATE

APPROVALS

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION.

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PLANT AIR SUPPLY SYSTEM FAILURE

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y81-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y81	65Y81-2	LD-PS65Y81	2	OF	3	Ø

1/3/12

LOOP NO: 65Y101

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	101	C	P-101	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	101	A	P-101	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	101	B	P-101	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	101	A	P-101	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	101	D	P-101	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	101		P-101	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	101	D	P-101	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-101	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	101	D	P-101	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	101		P-101	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	101	C	P-101	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZL	101	A	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZL	101	B	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	YL	101	A	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	YA	101	D	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZLC	101		P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	HS	101	D	P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	BTR	NA		P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	YS	101	D	P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZSC	101		P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

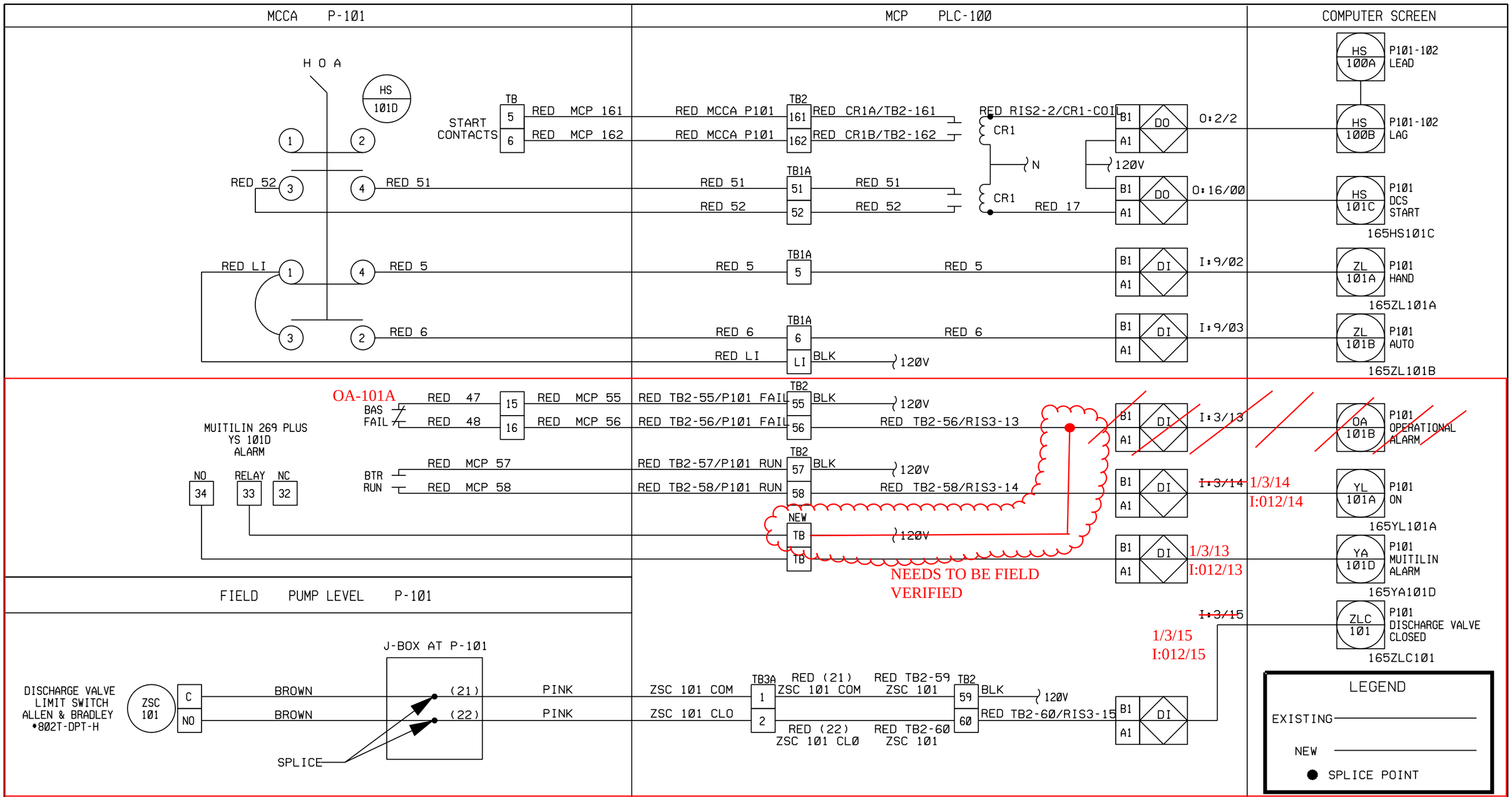
BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
PUMP P-101

FILE NAME: 65Y101-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y101	65Y101-1	LD-PS65Y101	1	OF	3	0

1/3/13, 14 & 15



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

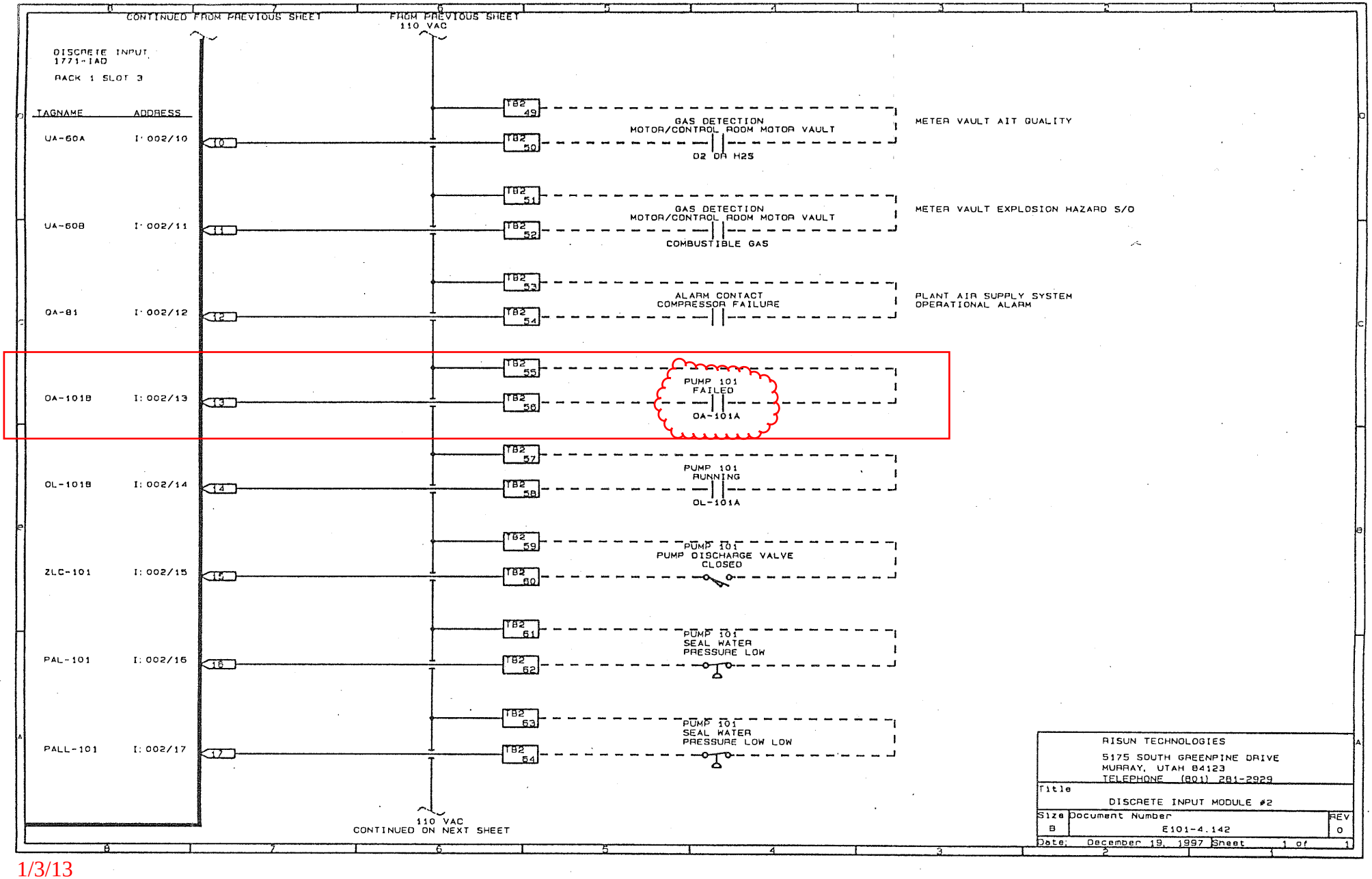
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-101

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y101-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y101	65Y101-2	LD-PS65Y101	2	OF	3	0

1/3/13, 14 & 15


CONTINUED FROM PREVIOUS SHEET
FROM PREVIOUS SHEET
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 3
TAGNAME
ADDRESS
UA-60A
I:002/10
UA-60B
I:002/11
QA-81
I:002/12
QA-101B
I:002/13
QL-101B
I:002/14
ZLC-101
I:002/15
PAL-101
I:002/16
PALL-101
I:002/17
GAS DETECTION
MOTOR/CONTROL ROOM MOTOR VAULT
O2 OR H2S
METER VAULT AIT QUALITY
GAS DETECTION
MOTOR/CONTROL ROOM MOTOR VAULT
COMBUSTIBLE GAS
METER VAULT EXPLOSION HAZARD S/D
ALARM CONTACT
COMPRESSOR FAILURE
PLANT AIR SUPPLY SYSTEM
OPERATIONAL ALARM
PUMP 101
FAILED
QA-101A
PUMP 101
RUNNING
QL-101A
PUMP 101
PUMP DISCHARGE VALVE
CLOSED
PUMP 101
SEAL WATER
PRESSURE LOW
PUMP 101
SEAL WATER
PRESSURE LOW LOW
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #2
Size B
Document Number E101-4.142
REV 0
Date: December 19, 1997
Sheet 1 of 1

1/3/13

LOOP NO: 65F101

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	101		P-101	SEAL WATER FLOW LO	STATUS	PLC-100						EXISTING
I	65	FSL	101		P-101	SEAL WATER FLOW LO	SWITCH	FIELD	TBD	TBD				NEW

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	101		P-101	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65F101-2		LD-PS65F101	LD-PS65F101-3
I	65	FSL	101		P-101	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65F101-2		LD-PS65F101	LD-PS65F101-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

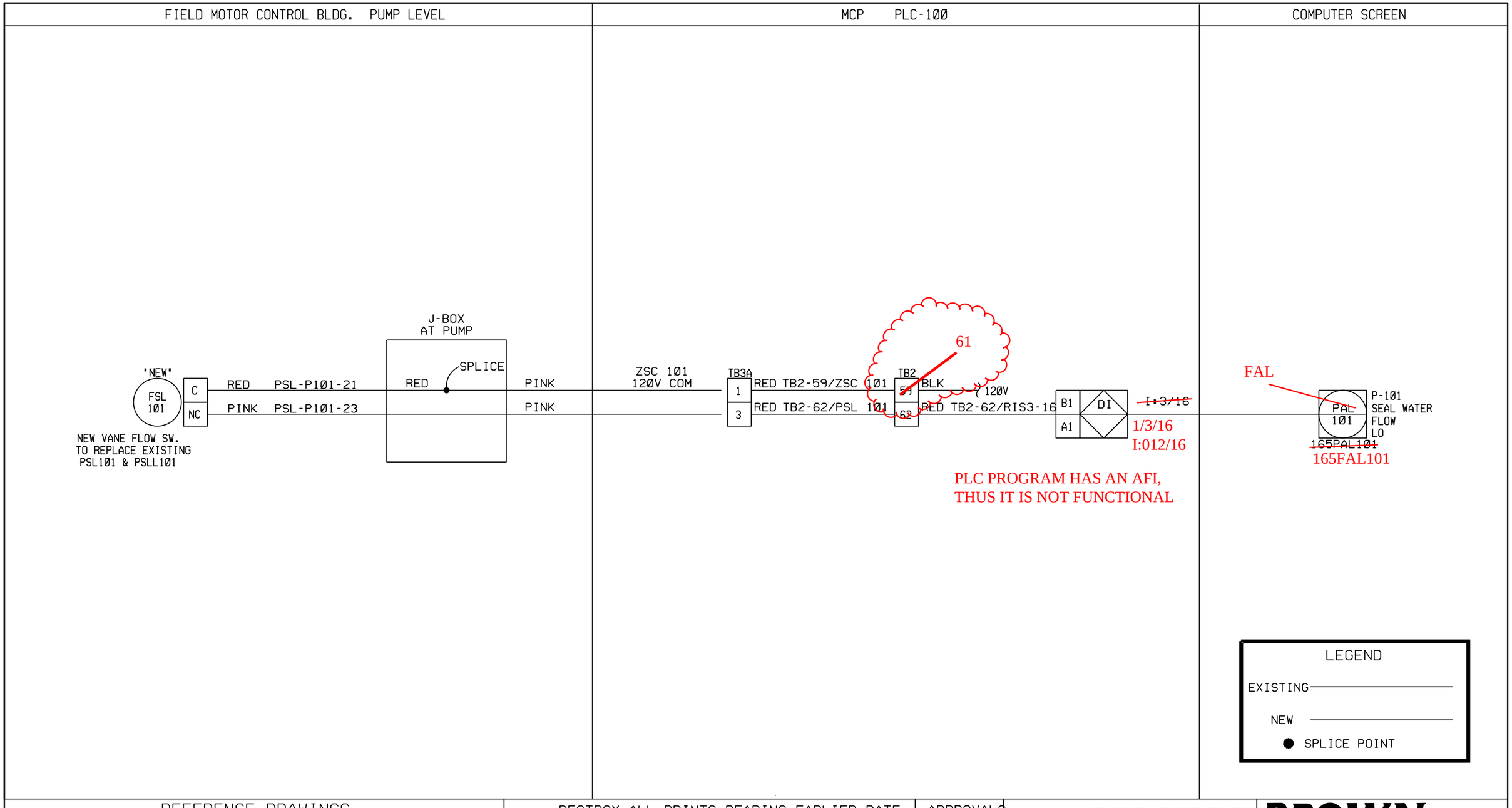
BROWN AUTOMATION JOB# 9079

FILE NAME: 65F101-1

LOOP DIAGRAM SCHEDULE
PUMP P-101 SEAL WATER FLOW

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F101	65F101-1	LD-PS65F101	1	OF	3	0

1/3/16



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65F101-2

INSTRUMENT LOOP DIAGRAM
PUMP P-101 SEAL WATER FLOW

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F101	65F101-2	LD-PS65F101	2	OF	3	Ø

1/3/16

LOOP NO: 65Y211

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	211		G-211	G-211 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	211		G-211	G-211 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	211		G-211	G-211 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	211	A	G-211	G-211 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	211	B	G-211	G-211 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	211		G-211	G-211 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	211	C	G-211	G-211 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	211	D	G-211	G-211 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	211		G-211	G-211 CLOSED	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	211		G-211	G-211 OPEN	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	211		G-211	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZLC	211		G-211	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZLO	211		G-211	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	A	G-211	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	B	G-211	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211		G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	C	G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	D	G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZSC	211		G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZSO	211		G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y211-1

LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-201 SLIDE GATE G-211

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y211	65Y211-1	LD-PS65Y211	1	OF	3	0

1/3/17

FIELD SCREEN BLDG.	MCCA G-211	MCP PLC-100	COMPUTER SCREEN

HS 211
31
30
NEW TB
63 OR 64
120V
"NEW"
B1 DI 1/3/17
A1 I:012/17
"NEW"
ZL 211 G-211 REMOTE
165ZL211

6 RED 10
ZSC 211
ZSO 211
6C
2 RED 9
2C RED
RED 18 CLOSED RED 18C
5 5C
RED 17 RED 17C
1 1C
OPEN
RED 18
RED 17
RED 16
18 RED MCP 108/G211-6
17 RED MCP 106/G211-2
16 RED MCP 105/G211-2C
MCCA 211-2 G211-18C
MCCA 211-3 G211-17C
2
3
TB2 108 RED RIS5-05/TB2-108
TB2 106 RED RIS5-04/TB2-106
105 BLK 120V
B1 DI I:5/05
A1
B1 DI I:5/04
A1
ZLC 211 G-211 CLOSED
165ZLC211
ZLO 211 G-211 OPEN
165ZLO211

HS 211C
HS 211D
4 RED 4
8 RED 8
20 RED 20
CL1 RED CL1
H2/CL2 RED CL2
MCCA 211-6 G211-4
MCCA 211-2 G211-8
MCCA 211-4 G211-20
MCCA 211-1 G211-CL1
MCCA 211-X2 G211-CL2
6
5
4
1
X2
RED 36
RED 38
RED 35
TB1A 36 RED 36
38 RED 38 CR8
RED 37
35 RED 35 CR7
RED 24 TB1A 24 RED 24
CR8
WHT N
CR7
120V BLK
RED 23 TB1A 23 RED 23
B1 DO O:16/07
A1
B1 DO O:16/06
A1
HS 211B G-211 CLOSE
165HS211B
HS 211A G-211 OPEN
165HS211A

LIMITORQUE
ID# NONE

LEGEND
EXISTING
NEW
SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

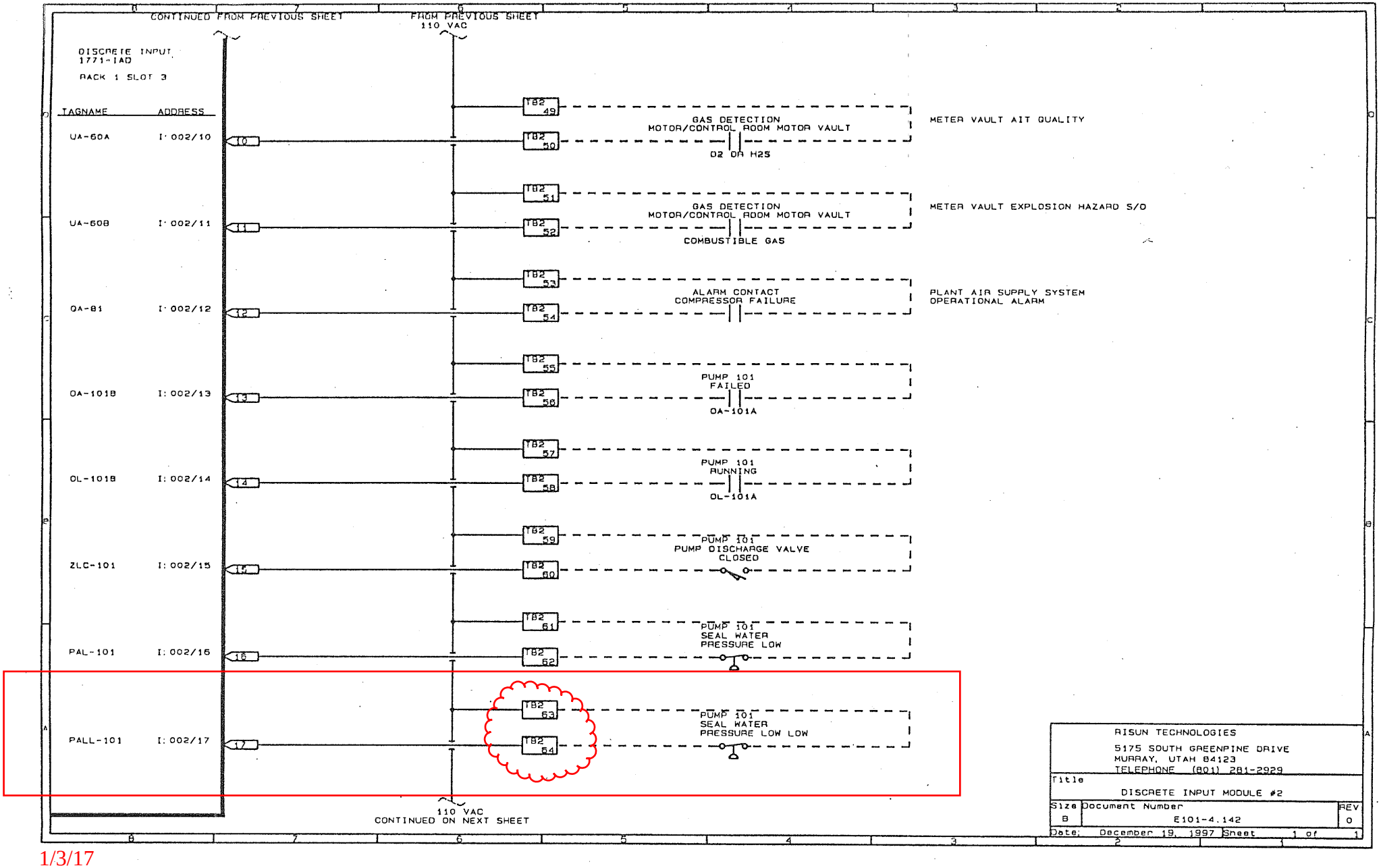
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y211-2

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-201 SLIDE GATE G-211

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y211	65Y211-2	LD-PS65Y211	2	OF	3	Ø

1/3/17


CONTINUED FROM PREVIOUS SHEET
FROM PREVIOUS SHEET
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 3
TAGNAME
ADDRESS
UA-60A
I:002/10
UA-60B
I:002/11
QA-81
I:002/12
QA-101B
I:002/13
QL-101B
I:002/14
ZLC-101
I:002/15
PAL-101
I:002/16
PALL-101
I:002/17
GAS DETECTION
MOTOR/CONTROL ROOM MOTOR VAULT
O2 OR H2S
METER VAULT AIT QUALITY
GAS DETECTION
MOTOR/CONTROL ROOM MOTOR VAULT
COMBUSTIBLE GAS
METER VAULT EXPLOSION HAZARD S/D
ALARM CONTACT
COMPRESSOR FAILURE
PLANT AIR SUPPLY SYSTEM
OPERATIONAL ALARM
PUMP 101
FAILED
QA-101A
PUMP 101
RUNNING
QL-101A
PUMP 101
PUMP DISCHARGE VALVE
CLOSED
PUMP 101
SEAL WATER
PRESSURE LOW
PUMP 101
SEAL WATER
PRESSURE LOW LOW
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #2
Size B
Document Number E101-4.142
REV 0
Date: December 19, 1997
Sheet 1 of 1

1/3/17

LOOP NO: 65Y102

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	102	C	P-102	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	102	A	P-102	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	102	B	P-102	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	102	A	P-102	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	102	D	P-102	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	102		P-102	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	102	D	P-102	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-102	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	102	D	P-102	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	102		P-102	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	102	C	P-102	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZL	102	A	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZL	102	B	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	YL	102	A	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	YA	102	D	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZLC	102		P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	HS	102	D	P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	BTR	NA		P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	YS	102	D	P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZSC	102		P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-102

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y102-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y102	65Y102-1	LD-PS65Y102	1	OF	3	0

1/4/0, 1, 2

MCCB P-102 | MCP PLC-100 | COMPUTER SCREEN

H O A
HS 102D
1 2
RED 54 3 4 RED 53
RED LI 1 4 RED 7
3 2 RED 8

START CONTACTS
TB 5 RED MCP 163
6 RED MCP 164
RED MCCB P102 → TB2 163 RED CR2A/TB2-163
RED MCCB P102 → TB2 164 RED CR2A/TB2-164
RED 53 → TB1A 53 RED 53
RED 54 → 54 RED 54
RED 7 → TB1A 7 RED 7
RED 8 → TB1A 8 RED 8
RED LI → LI 120V

RED RIS2-4/CR2-COIL → CR2 → N
CR2 → RED 18
B1 A1 DO O:2/4 — HS 100A P101-102 LEAD; HS 100B P101-102 LAG
120V
B1 A1 DO O:16/01 — HS 102C P102 DCS START
165HS102C
B1 A1 DI I:9/04 — ZL 102A P102 HAND
165ZL102A
B1 A1 DI I:9/05 — ZL 102B P102 AUTO
165ZL102B

OA-102A

MUITILIN 269 PLUS
YS 102D
ALARM
NO 34 RELAY 33 NC 32

BAS FAIL
RED 47 15 RED MCP 65 → TB2 65 RED TB2-65/P102 FAIL → BLK 120V
RED 48 16 RED MCP 66 → 66 RED TB2-66/P102 FAIL → RED TB2-66/RIS4-00

BTR RUN
RED MCP 67 → TB2 67 RED TB2-67/P102 RUN → BLK 120V
RED MCP 68 → 68 RED TB2-68/P102 RUN → RED TB2-68/RIS4-01

NEW TB → 120V
TB

B1 A1 DI ~~I:4/00~~ — OA 102B P102 OPERATIONAL ALARM
B1 A1 DI ~~I:4/01~~ 1/4/1 I:013/1 — YL 102A P102 ON
165YL102A
B1 A1 DI 1/4/0 I:013/0 — YA 102D P102 MUITILIN ALARM
165YA102D
~~I:4/02~~ — ZLC 102 P102 DISCHARGE VALVE CLOSED
165ZLC102
1/4/2 I:013/2

NEEDS TO BE FIELD VERIFIED

FIELD PUMP LEVEL P-102

J-BOX AT P-102

DISCHARGE VALVE LIMIT SWITCH ALLEN & BRADLEY *802T-DPT-H
ZSC 102 C NO
RED (31) PINK
RED (32) PINK
SPLICE

ZSC 102 COM → TB3A 11 RED (31) ZSC 102 COM → RED TB2-69 ZSC 1021 → TB2 69 BLK 120V
ZSC 102 CLO → 12 RED (32) ZSC 102 CLØ → RED TB2-70 ZSC 1021 → 70 RED TB2-70/RIS4-02

LEGEND
EXISTING
NEW
SPLICE POINT

REFERENCE DRAWINGS
TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

APPROVALS

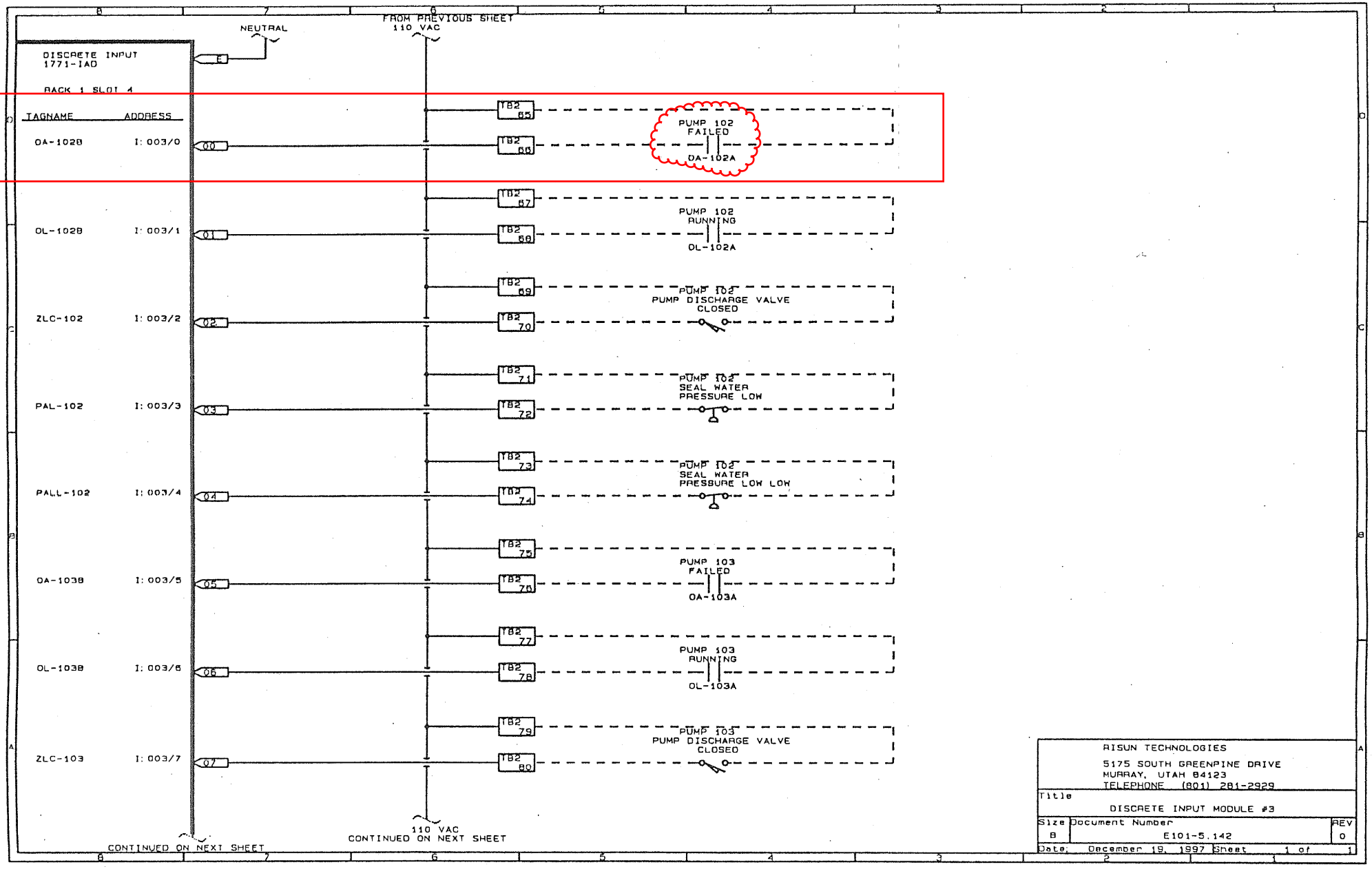
WESTINGHOUSE ELECTRIC CO. PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-102

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y102-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y102	65Y102-2	LD-PS65Y102	2	OF	3	Ø

1/4/0, 1, 2


NEUTRAL
FROM PREVIOUS SHEET
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 4
TAGNAME
ADDRESS
OA-102B
I:003/0
OL-102B
I:003/1
ZLC-102
I:003/2
PAL-102
I:003/3
PALL-102
I:003/4
OA-103B
I:003/5
OL-103B
I:003/6
ZLC-103
I:003/7
PUMP 102 FAILED
OA-102A
PUMP 102 RUNNING
OL-102A
PUMP 102 PUMP DISCHARGE VALVE CLOSED
PUMP 102 SEAL WATER PRESSURE LOW
PUMP 102 SEAL WATER PRESSURE LOW LOW
PUMP 103 FAILED
OA-103A
PUMP 103 RUNNING
OL-103A
PUMP 103 PUMP DISCHARGE VALVE CLOSED
CONTINUED ON NEXT SHEET
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #3
Size B
Document Number E101-5.142
REV 0
Date: December 19, 1997
Sheet 1 of 1

LOOP NO: 65F102

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	102		P-102	SEAL WATER FLOW LO	STATUS	PLC-100						EXISTING
I	65	FSL	102		P-102	SEAL WATER FLOW LO	SWITCH	FIELD	TBD	TBD				NEW

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	102		P-102	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65F102-2		LD-PS65F102	LD-PS65F102-3
I	65	FSL	102		P-102	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65F102-2		LD-PS65F102	LD-PS65F102-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRONIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

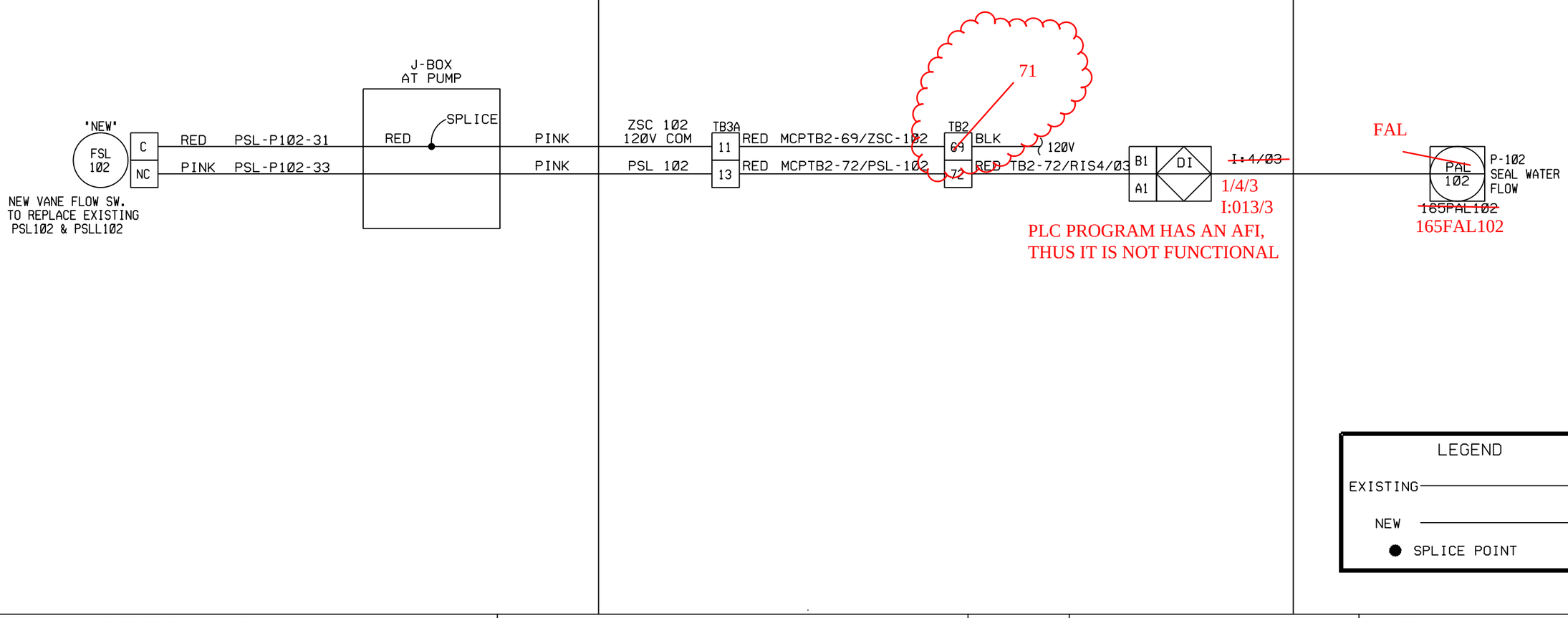
FILE NAME: 65F102-1

LOOP DIAGRAM SCHEDULE
PUMP P-102 SEAL WATER FLOW

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F102	65F102-1	LD-PS65F102	1	OF	3	0

1/4/3

FIELD MOTOR CONTROL BLDG. PUMP LEVEL	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION.

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

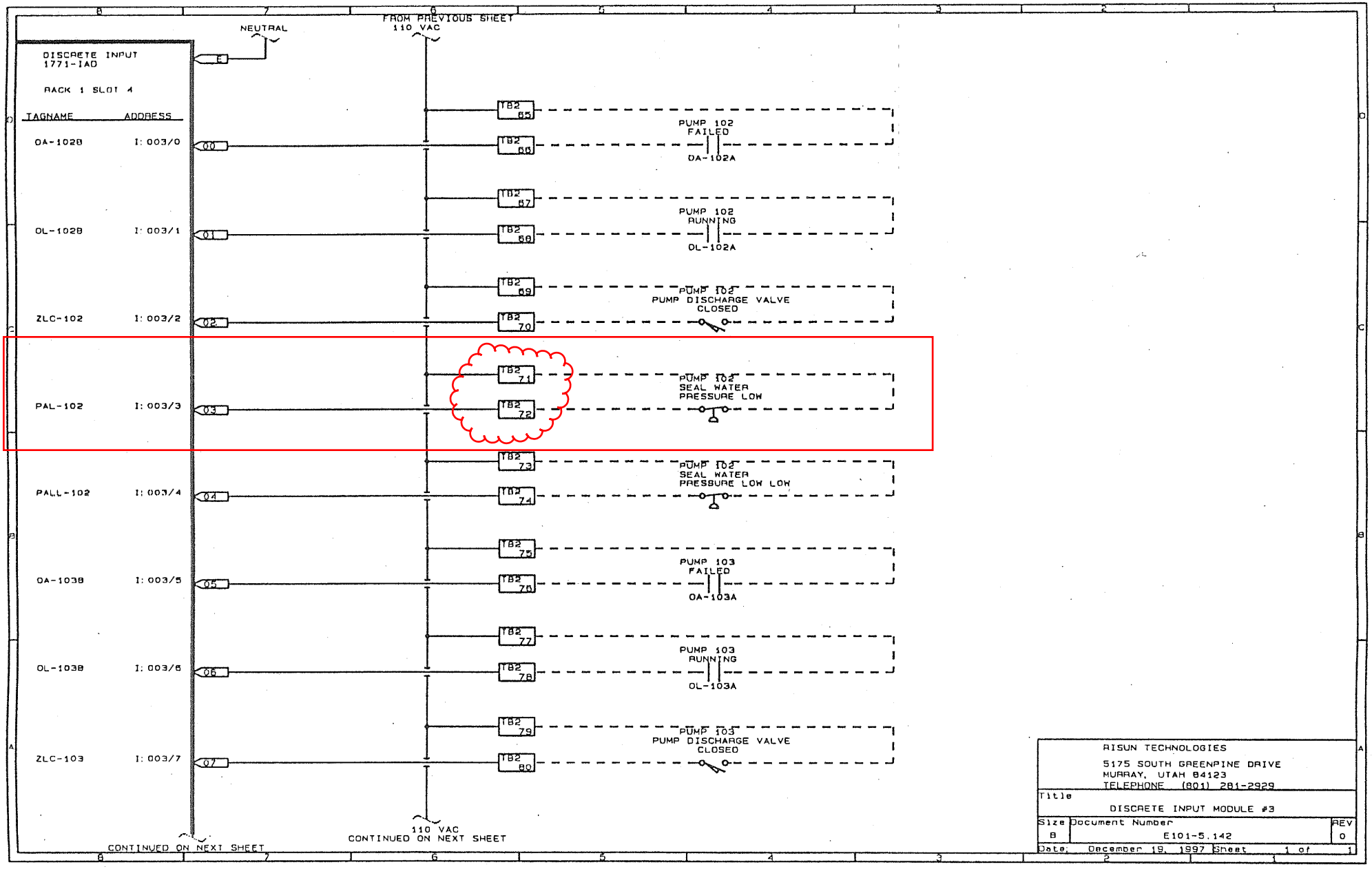
BROWN AUTOMATION JOB# 9079

INSTRUMENT LOOP DIAGRAM
PUMP P-102 SEAL WATER FLOW

FILE NAME: 65F102-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F102	65F102-2	LD-PS65F102	2	OF	3	Ø

1/4/3


NEUTRAL
FROM PREVIOUS SHEET
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 4
TAGNAME
ADDRESS
OA-102B
I:003/0
OL-102B
I:003/1
ZLC-102
I:003/2
PAL-102
I:003/3
PALL-102
I:003/4
OA-103B
I:003/5
OL-103B
I:003/6
ZLC-103
I:003/7
PUMP 102 FAILED
OA-102A
PUMP 102 RUNNING
OL-102A
PUMP 102 PUMP DISCHARGE VALVE CLOSED
PUMP 102 SEAL WATER PRESSURE LOW
PUMP 102 SEAL WATER PRESSURE LOW LOW
PUMP 103 FAILED
OA-103A
PUMP 103 RUNNING
OL-103A
PUMP 103 PUMP DISCHARGE VALVE CLOSED
CONTINUED ON NEXT SHEET
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #3
Size B
Document Number E101-5.142
REV 0
Date: December 19, 1997
Sheet 1 of 1

1/4/3

LOOP NO: 65Y212

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	212		G-212	G-212 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	212		G-212	G-212 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	212		G-212	G-212 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	212	A	G-212	G-212 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	212	B	G-212	G-212 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	212		G-212	G-212 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	212	C	G-212	G-212 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	212	D	G-212	G-212 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	212		G-212	G-212 CLOSED	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	212		G-212	G-212 OPEN	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	212		G-212	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZLC	212		G-212	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZLO	212		G-212	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	A	G-212	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	B	G-212	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212		G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	C	G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	D	G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZSC	212		G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZSO	212		G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y212-1

LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-202 SLIDE GATE G-212

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y212	65Y212-1	LD-PS65Y212	1	OF	3	0

1/4/4

FIELD SCREEN BLDG.	MCCB G-212	MCP PLC-100	COMPUTER SCREEN

HS 212
31
30
TB2: 73 OR 74
NEW
TB
120V
"NEW"
B1
A1
DI
1/4/4
I:013/4
"NEW"
ZL 212
G-212 REMOTE
165ZL212

6 RED 6 — RED 19 — 19 RED — MCP 112/G212-6 — MCP TB2-112/G212-6 — TB2 112 RED — RIS5-07/TB2-112 — B1/A1 DI I:5/07 — ZLC 212 G-212 CLOSED — 165ZLC212

6C

2 RED 2 — RED 18 — 18 RED — MCP 110/G212-2 — MCP TB2-110/G212-2 — TB2 110 RED — RIS5-06/TB2-110 — B1/A1 DI I:5/06 — ZLO 212 G-212 OPEN — 165ZLO212

2C RED 2 — RED 17 — 17 RED — MCP 109/G212-2C — MCP TB2-109/G212-2C — 109 BLK — 120V

5C RED 18C — OPEN — RED 18 — MCCB 212-2 G212-18C — 2

1C RED 17C — CLOSED — RED 17 — MCCB 212-3 G212-17C — 3

HS 212C
HS 212D

4 RED 4 — MCCB 212-6 G212-4 — 6 — RED 40 — TB1A 40 RED 40

8 RED 8 — MCCB 212-5 G212-8 — 5 — RED 42 — 42 RED 42 — CR10

RED 41

20 RED 20 — MCCB 212-4 G212-20 — 4 — RED 39 — 39 RED 39 — CR11

CL1 RED L1 — MCCB 212-1 G212-CL1 — 1

H2/CL2 RED L2 — MCCB 212-X2 G212-X2 — X2

CR10 — RED 26 — TB1A 26 RED 26 — B1/A1 DO O:16/11 — HS 212B G-212 CLOSE — 165HS212B

WHT N — 120V BLK

CR9 — RED 25 — TB1A 25 RED 25 — B1/A1 DO O:16/10 — HS 212A G-212 OPEN — 165HS212A

LIMITORQUE
ID# 48940455-417
F-M30-W04-03P6

LEGEND
EXISTING
NEW
SPLICE POINT

REFERENCE DRAWINGS
TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

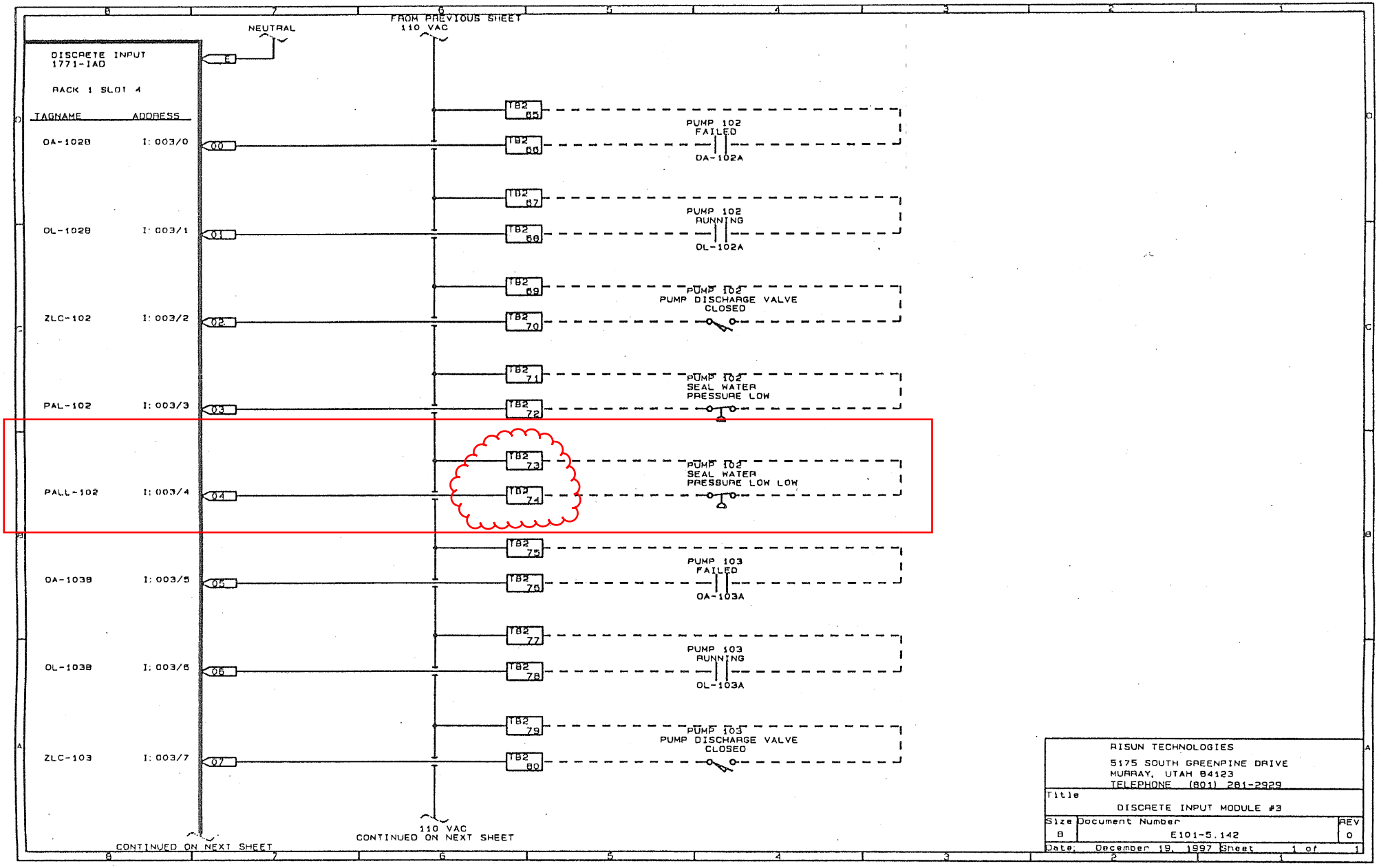
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-202 SLIDE GATE G-212

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y212-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y212	65Y212-2	LD-PS65Y212	2	OF	3	0

1/4/4


NEUTRAL
FROM PREVIOUS SHEET
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 4
TAGNAME
ADDRESS
OA-102B
I:003/0
OL-102B
I:003/1
ZLC-102
I:003/2
PAL-102
I:003/3
PALL-102
I:003/4
OA-103B
I:003/5
OL-103B
I:003/6
ZLC-103
I:003/7
PUMP 102 FAILED
OA-102A
PUMP 102 RUNNING
OL-102A
PUMP 102 PUMP DISCHARGE VALVE CLOSED
PUMP 102 SEAL WATER PRESSURE LOW
PUMP 102 SEAL WATER PRESSURE LOW LOW
PUMP 103 FAILED
OA-103A
PUMP 103 RUNNING
OL-103A
PUMP 103 PUMP DISCHARGE VALVE CLOSED
CONTINUED ON NEXT SHEET
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #3
Size B
Document Number E101-5.142
REV 0
Date: December 19, 1997
Sheet 1 of 1

1/4/4

LOOP NO: 65Y103

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	103	C	P-103	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	103	A	P-103	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	103	B	P-103	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	103	A	P-103	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	103	D	P-103	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	103		P-103	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	103	D	P-103	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-103	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	103	D	P-103	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	103		P-103	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	103	C	P-103	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZL	103	A	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZL	103	B	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	YL	103	A	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	YA	103	D	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZLC	103		P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	HS	103	D	P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	BTR	NA		P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	YS	103	D	P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZSC	103		P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

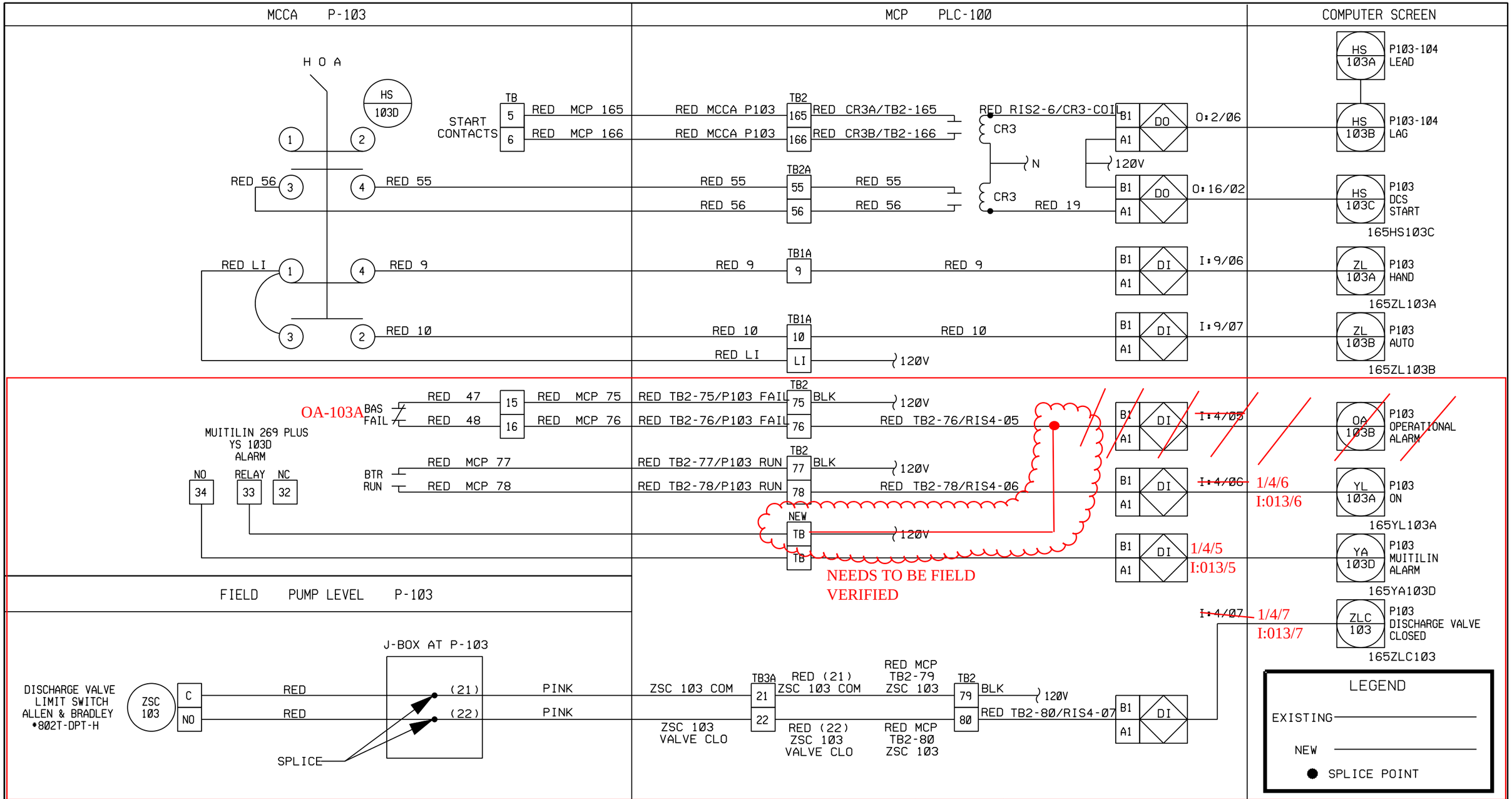
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-103

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y103-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y103	65Y103-1	LD-PS65Y103	1	OF	3	0

1/4/5, 6, 7



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TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE PROCESS CONTROL DIVISION

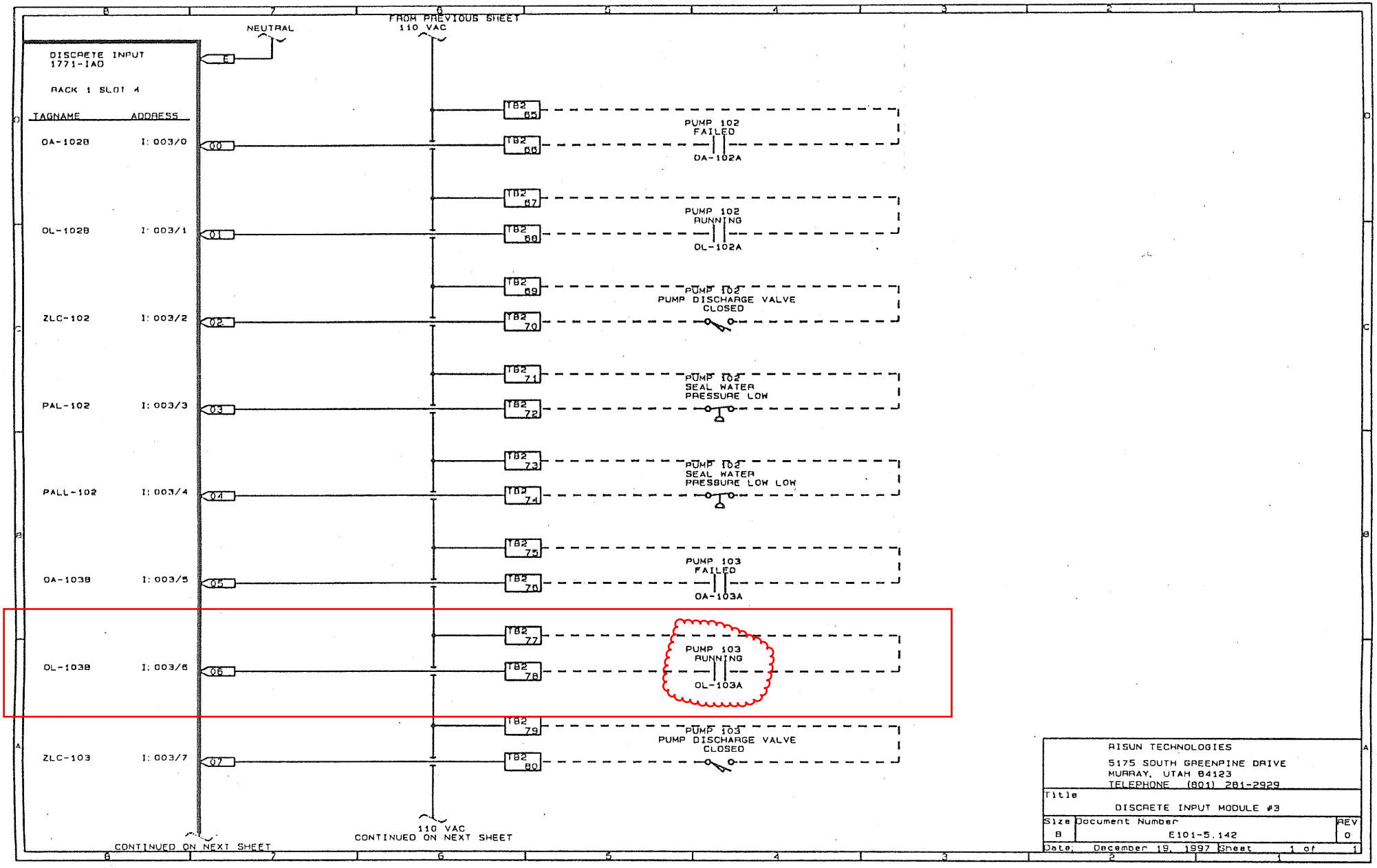
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-103

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y103-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y103	65Y103-2	LD-PS65Y103	2 OF	3	Ø

1/4/5, 6, 7


NEUTRAL
FROM PREVIOUS SHEET
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 4
TAGNAME
ADDRESS
OA-102B
I:003/0
OL-102B
I:003/1
ZLC-102
I:003/2
PAL-102
I:003/3
PALL-102
I:003/4
OA-103B
I:003/5
OL-103B
I:003/6
ZLC-103
I:003/7
PUMP 102 FAILED
OA-102A
PUMP 102 RUNNING
OL-102A
PUMP 102 PUMP DISCHARGE VALVE CLOSED
PUMP 102 SEAL WATER PRESSURE LOW
PUMP 102 SEAL WATER PRESSURE LOW LOW
PUMP 103 FAILED
OA-103A
PUMP 103 RUNNING
OL-103A
PUMP 103 PUMP DISCHARGE VALVE CLOSED
CONTINUED ON NEXT SHEET
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #3
Size B
Document Number E101-5.142
REV 0
Date: December 19, 1997
Sheet 1 of 1

1/4/5

LOOP NO: 65F103

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	103		P-103	SEAL WATER FLOW LO	STATUS	PLC-100						EXISTING
I	65	FSL	103		P-103	SEAL WATER FLOW LO	SWITCH	FIELD	TBD	TBD				NEW

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	103		P-103	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65F103-2		LD-PS65F103	LD-PS65F103-3
I	65	FSL	103		P-103	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65F103-2		LD-PS65F103	LD-PS65F103-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRONIC
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

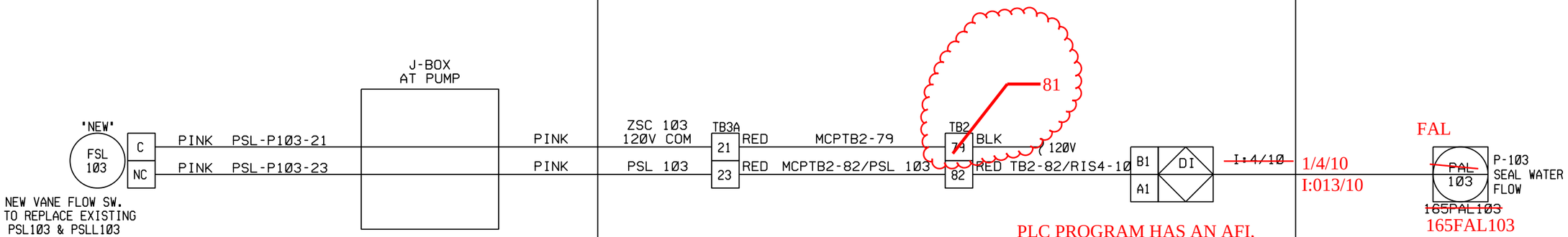
BROWN AUTOMATION JOB# 9079

FILE NAME: 65F103-1

LOOP DIAGRAM SCHEDULE
PUMP P-103 SEAL WATER FLOW

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F103	65F103-1	LD-PS65F103	1	OF	3	0

FIELD MOTOR CONTROL BLDG. PUMP LEVEL	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION.

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

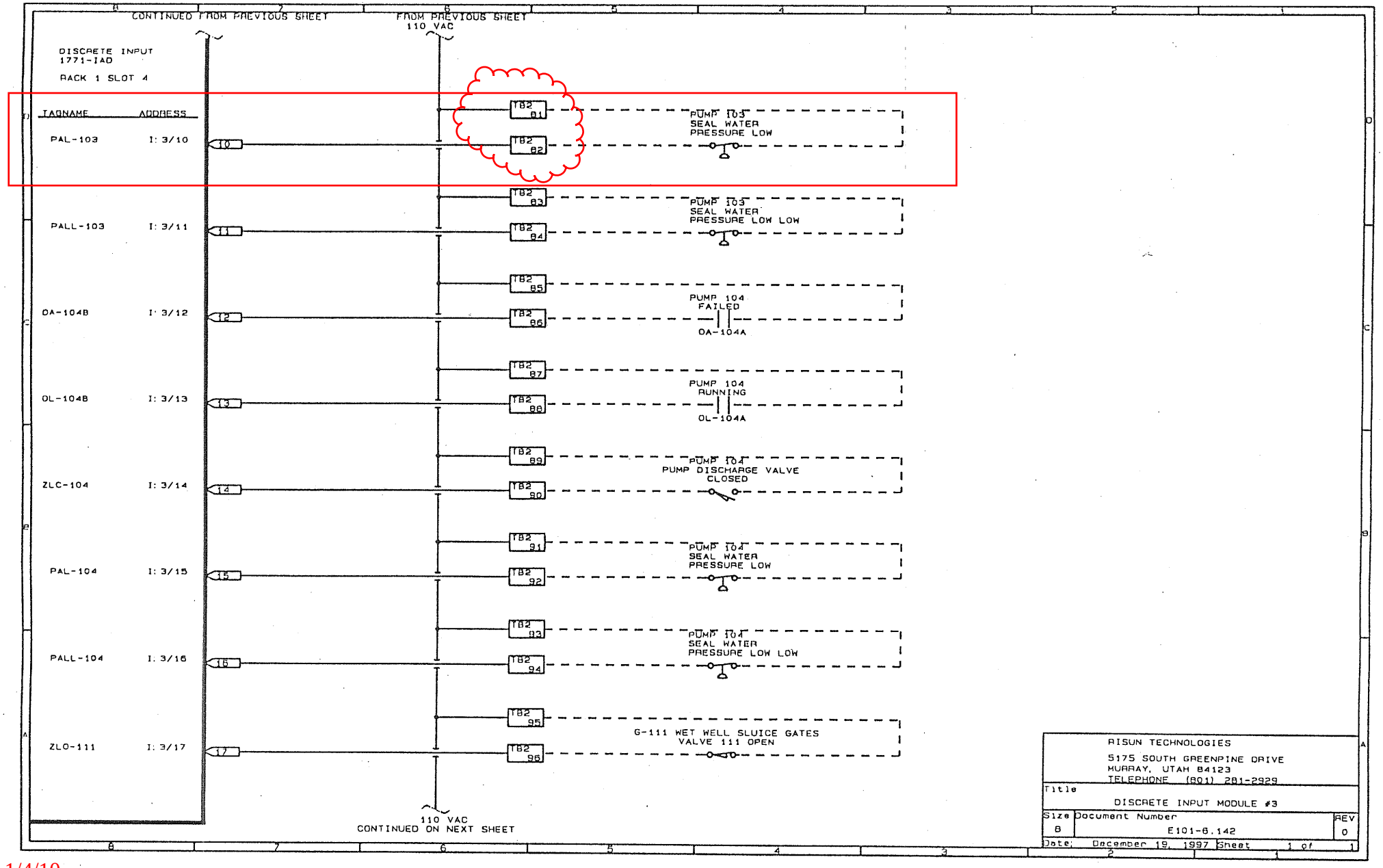
BROWN AUTOMATION JOB# 9079

INSTRUMENT LOOP DIAGRAM
PUMP P-1Ø3 SEAL WATER FLOW

FILE NAME: 65F1Ø3-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65F1Ø3	65F1Ø3-2	LD-PS65F1Ø3	2 OF	3	Ø

1/4/10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FROM PREVIOUS SHEET
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 4
TAGNAME
ADDRESS
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I: 3/10
PALL-103
I: 3/11
DA-104B
I: 3/12
OL-104B
I: 3/13
ZLC-104
I: 3/14
PAL-104
I: 3/15
PALL-104
I: 3/16
ZLO-111
I: 3/17
PUMP 103 SEAL WATER PRESSURE LOW
PUMP 103 SEAL WATER PRESSURE LOW LOW
PUMP 104 FAILED
DA-104A
PUMP 104 RUNNING
OL-104A
PUMP 104 PUMP DISCHARGE VALVE CLOSED
PUMP 104 SEAL WATER PRESSURE LOW
PUMP 104 SEAL WATER PRESSURE LOW LOW
G-111 WET WELL SLUICE GATES VALVE 111 OPEN
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #3
Size
B
Document Number
E101-6.142
REV
0
Date: December 19, 1997
Sheet 1 of 1

1/4/10

LOOP NO: 65Y213

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	213		G-213	G-213 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	213		G-213	G-213 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	213		G-213	G-213 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	213	A	G-213	G-213 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	213	B	G-213	G-213 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	213		G-213	G-213 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	213	C	G-213	G-213 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	213	D	G-213	G-213 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	213		G-213	G-213 CLOSED	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	213		G-213	G-213 OPEN	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	213		G-213	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZLC	213		G-213	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZLO	213		G-213	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	A	G-213	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	B	G-213	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213		G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	C	G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	D	G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZSC	213		G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZSO	213		G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y213-1

LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-203 SLIDE GATE G-213

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y213	65Y213-1	LD-PS65Y213	1	OF	3	0

1/4/11

FIELD SCREEN BLDG.	MCCC G-213	MCP PLC-100	COMPUTER SCREEN

HS 213 — 31 / 30

TB2: 83 OR 84 — NEW TB 116 — 120V — "NEW" B1/A1 DI 1/4/11 I:013/11 — "NEW" ZL 213 G-213 REMOTE — 165ZL213

6 RED 6 — RED 18 — 18 RED MCP 116/G213-6 — MCP TB2-116/G213-6 — TB2 116 RED RIS5-11/TB2-116 — B1/A1 DI I:5/11 — ZLC 213 G-213 CLOSED — 165ZLC213

6C

2 RED 2 — RED 17 — 17 RED MCP 114/G213-2 — MCP TB2-114/G213-2 — TB2 114 RED RIS5-10/TB2-114 — B1/A1 DI I:5/10 — ZLO 213 G-213 OPEN — 165ZLO213

2C RED 2 — RED 16 — 16 RED MCP 113/G213-2C — MCP TB2-113/G213-2C — 113 BLK — 120V

5C RED 18C — OPEN — RED 18 — MCCC 213-2 G213-18C — 2

1C RED 17C — CLOSED — RED 17 — MCCC 213-3 G213-17C — 3

HS 213C / HS 213D

4 RED 4 — MCCC 213-6 G213-4 — 6 — RED 44 — TB1A 44 RED 44

8 RED 8 — MCCC 213-5 G213-8 — 5 — RED 46 — 46 RED 46 CR12 — RED 45 — 43 RED 43 CR11

20 RED 20 — MCCC 213-4 G213-20 — 4 — RED 43

CL1 RED L1 — MCCC 213-1 G213-CL1 — 1

H2/CL2 RED L2 — MCCC 213-X2 G213-CL2 — X2

RED 28 — TB1A 28 — RED 28 — CR12 — WHT N — 120V BLK — CR11 — TB1A 27 — RED 27 — RED 27 — B1/A1 DO O:16/13 — HS 213B G-213 CLOSE — 165HS213B — B1/A1 DO O:16/12 — HS 213A G-213 OPEN — 165HS213A

LIMITORQUE
ID# NONE

LEGEND
EXISTING
NEW
SPLICE POINT

REFERENCE DRAWINGS
TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

1/4/11

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-203 SLIDE GATE G-213

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y213-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
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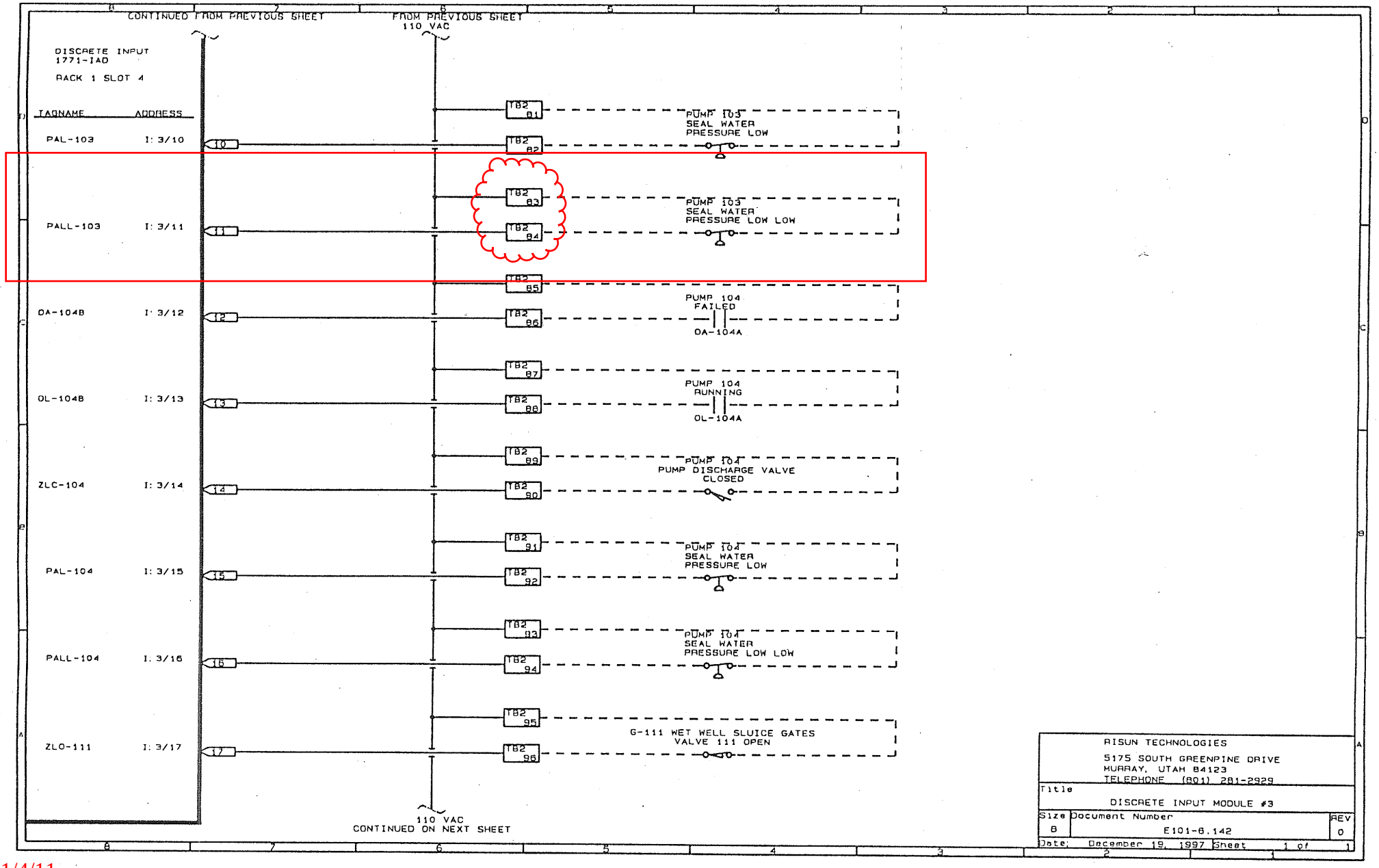
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FROM PREVIOUS SHEET
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 4
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ADDRESS
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I:3/10
PALL-103
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DA-104B
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ZLC-104
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PAL-104
I:3/15
PALL-104
I:3/16
ZLO-111
I:3/17
TB2 01
TB2 02
PUMP 103
SEAL WATER
PRESSURE LOW
TB2 03
TB2 04
PUMP 103
SEAL WATER
PRESSURE LOW LOW
TB2 05
TB2 06
PUMP 104
FAILED
DA-104A
TB2 07
TB2 08
PUMP 104
RUNNING
OL-104A
TB2 09
TB2 10
PUMP 104
PUMP DISCHARGE VALVE
CLOSED
TB2 91
TB2 92
PUMP 104
SEAL WATER
PRESSURE LOW
TB2 93
TB2 94
PUMP 104
SEAL WATER
PRESSURE LOW LOW
TB2 95
TB2 96
G-111 WET WELL SLUICE GATES
VALVE 111 OPEN
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #3
Size
B
Document Number
E101-6.142
REV
0
Date: December 19, 1997
Sheet 1 of 1

1/4/11

LOOP NO: 65Y104

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	104	C	P-104	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	104	A	P-104	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	104	B	P-104	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	104	A	P-104	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	104	D	P-104	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	104		P-104	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	104	D	P-104	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-104	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	104	D	P-104	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	104		P-104	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	104	C	P-104	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZL	104	A	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZL	104	B	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	YL	104	A	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	YA	104	D	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZLC	104		P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	HS	104	D	P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	BTR	NA		P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	YS	104	D	P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZSC	104		P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-104

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y104-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y104	65Y104-1	LD-PS65Y104	1	OF	3	0

1/4/12, 13, 14

MCCB P-104 | MCP PLC-100 | COMPUTER SCREEN

H O A
HS 103D
1 2
RED 58 3 4 RED 57
RED LI 1 4 RED 11
3 2 RED 12

START CONTACTS
TB 5 RED MCP 167
6 RED MCP 168

RED MCCB Ø5 → TB2 167 RED CR4A/TB2-167
RED MCCB Ø6 → TB2 168 RED CR4B/TB2-168

RED 57 → TB2A 57 RED 57
RED 58 → 58 RED 58

RED 11 → TB1A 11 RED 11
RED 12 → TB1A 12 RED 12
RED LI → LI 120V

RED RIS2-8/CR4-COIL
CR4
N
CR4 RED 20
120V

B1 A1 DO O:2/Ø8 → HS 1Ø3A P1Ø3-1Ø4 LEAD
B1 A1 DO O:2/Ø8 → HS 1Ø3B P1Ø3-1Ø4 LAG
B1 A1 DO O:16/Ø3 → HS 1Ø4C P1Ø4 DCS START
165HS104C
B1 A1 DI I:9/1Ø → ZL 1Ø4A P1Ø4 HAND
165ZL104A
B1 A1 DI I:9/11 → ZL 1Ø4B P1Ø4 AUTO
165ZL104B

MUITILIN 269 PLUS YS 104D ALARM
OA-104A BAS FAIL
RED 47 15 RED MCP 85
RED 48 16 RED MCP 86
RED TB2-85/P104 FAIL → TB2 85 BLK → 120V
RED TB2-86/P104 FAIL → TB2 86 BLK
RED TB2-86/RIS4-12
B1 A1 DI I:4/12 → OA 1Ø4B P1Ø4 OPERATIONAL ALARM

NO 34 RELAY 33 NC 32
BTR RUN
RED MCP 87
RED MCP 88
RED TB2-87/P104 RUN → TB2 87 BLK → 120V
RED TB2-88/P104 RUN → TB2 88 BLK
RED TB2-88/RIS4-13
B1 A1 DI ~~I:4/13~~ 1/4/13 I:013/13 → YL 1Ø4A P1Ø4 ON
165YL104A
NEW TB TB → 120V
B1 A1 DI 1/4/12 I:013/12 → YA 1Ø4D P1Ø4 MUITILIN ALARM
165YA104D

NEEDS TO BE FIELD VERIFIED

FIELD PUMP LEVEL P-104

J-BOX AT P-104
DISCHARGE VALVE LIMIT SWITCH ALLEN & BRADLEY *802T-DPT-H
ZSC 104 C NO
BROWN (31) PINK
BROWN (32) PINK
SPLICE

ZSC 104 COM → TB3A 31 RED (31) ZSC 104 COM → RED MCP TB2-89 ZSC 104 → TB2 89 BLK → 120V
ZSC 104 VALVE CLO → 32 RED (32) ZSC 104 VALVE CLO → RED MCP TB2-90 ZSC 104 → 90 RED TB2-90/RIS4-14
B1 A1 DI ~~I:4/14~~ 1/4/14 I:013/14 → ZLC 1Ø4 P1Ø4 DISCHARGE VALVE CLOSED
165ZLC104

LEGEND
EXISTING
NEW
SPLICE POINT

REFERENCE DRAWINGS
TBD

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

DESTROY ALL PRINTS BEARING EARLIER DATE

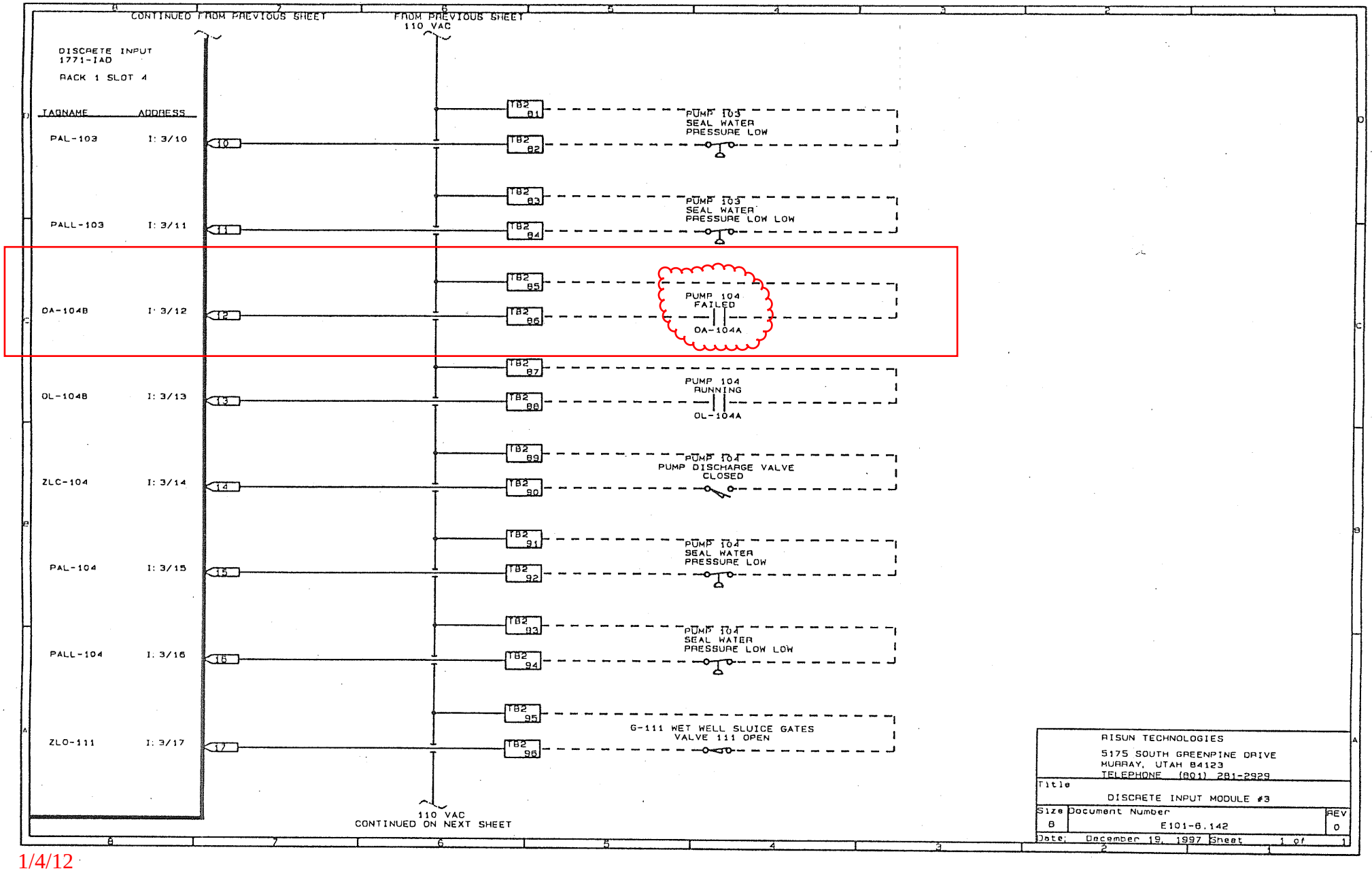
WESTINGHOUSE ELECTRIC CO. PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-104

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y104-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y104	65Y104-2	LD-PS65Y104	2	OF	3	Ø

1/4/12, 13, 14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FROM PREVIOUS SHEET
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 4
TAGNAME
ADDRESS
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I: 3/10
PALL-103
I: 3/11
DA-104B
I: 3/12
OL-104B
I: 3/13
ZLC-104
I: 3/14
PAL-104
I: 3/15
PALL-104
I: 3/16
ZLO-111
I: 3/17
PUMP 103 SEAL WATER PRESSURE LOW
PUMP 103 SEAL WATER PRESSURE LOW LOW
PUMP 104 FAILED
DA-104A
PUMP 104 RUNNING
OL-104A
PUMP 104 PUMP DISCHARGE VALVE CLOSED
PUMP 104 SEAL WATER PRESSURE LOW
PUMP 104 SEAL WATER PRESSURE LOW LOW
G-111 WET WELL SLUICE GATES VALVE 111 OPEN
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #3
Size
B
Document Number
E101-6.142
REV
0
Date: December 19, 1997
Sheet 1 of 1

1/4/12

LOOP NO: 65F104

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAL	104		P-104	SEAL WATER FLOW	STATUS	PLC-100						EXISTING
I	65	FSL	104		P-104	SEAL WATER FLOW	SWITCH	FIELD	TBD	TBD				NEW

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAL	104		P-104	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65F104-2		LD-PS65F104	LD-PS65F104-3
I	65	FSL	104		P-104	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65F104-2		LD-PS65F104	LD-PS65F104-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRONIC
PROCESS CONTROL DIVISION,
BROWN AUTOMATION, INC.
EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

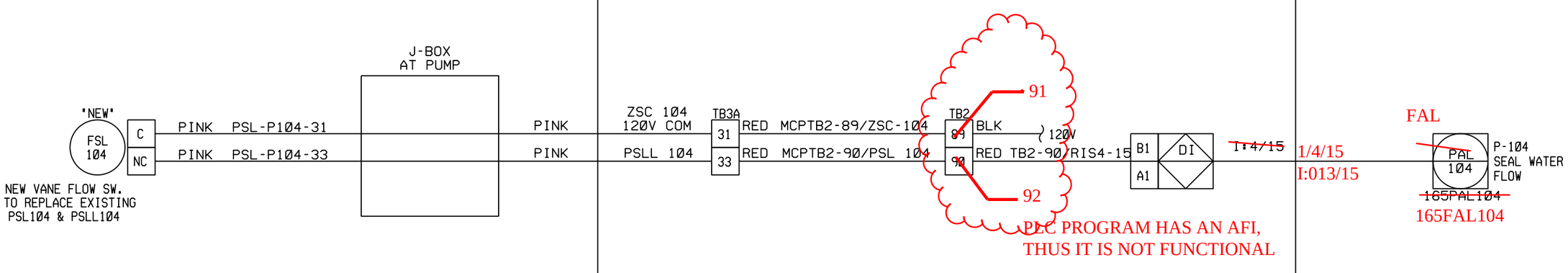
WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65F104-1

LOOP DIAGRAM SCHEDULE
PUMP P-104 SEAL WATER FLOW

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F104	65F104-1	LD-PS65F104	1	OF	3	0

1/4/15

FIELD MOTOR CONTROL BLDG. PUMP LEVEL	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

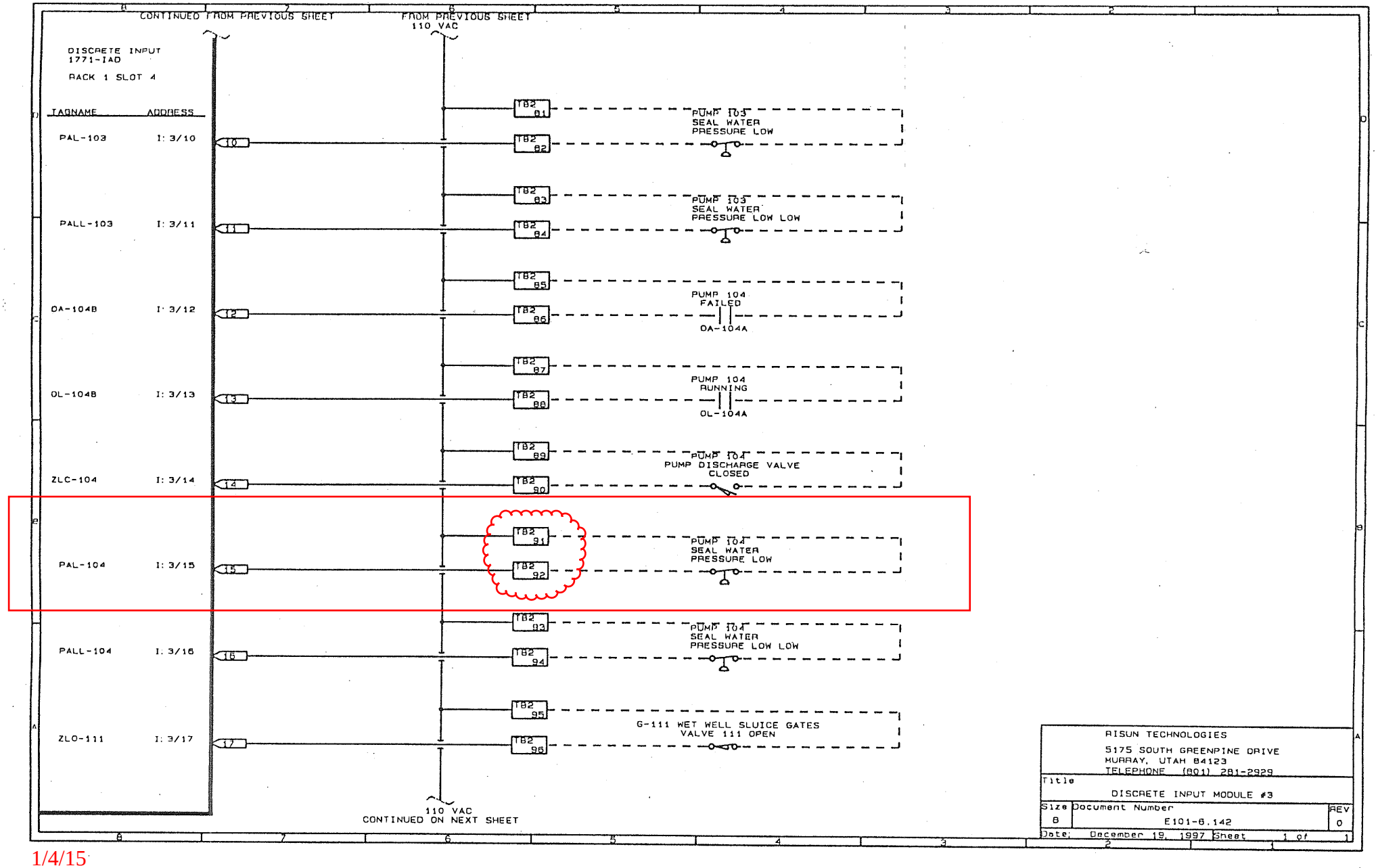
WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65 DCS INSTALLATION CITY OF SAN DIEGO, CALIFORNIA	WESTINGHOUSE PROJECT NO. C0137 BROWN AUTOMATION JOB# 9079
INSTRUMENT LOOP DIAGRAM PUMP P-104 SEAL WATER FLOW	FILE NAME: 65F104-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65F104	65F104-2	LD-PS65F104	2 OF	3	Ø

1/4/15


CONTINUED FROM PREVIOUS SHEET
FROM PREVIOUS SHEET
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 4
TAGNAME
ADDRESS
PAL-103
I:3/10
PALL-103
I:3/11
DA-104B
I:3/12
OL-104B
I:3/13
ZLC-104
I:3/14
PAL-104
I:3/15
PALL-104
I:3/16
ZLO-111
I:3/17
PUMP 103 SEAL WATER PRESSURE LOW
PUMP 103 SEAL WATER PRESSURE LOW LOW
PUMP 104 FAILED
DA-104A
PUMP 104 RUNNING
OL-104A
PUMP 104 PUMP DISCHARGE VALVE CLOSED
PUMP 104 SEAL WATER PRESSURE LOW
PUMP 104 SEAL WATER PRESSURE LOW LOW
G-111 WET WELL SLUICE GATES VALVE 111 OPEN
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #3
Size B
Document Number E101-6.142
REV 0
Date: December 19, 1997
Sheet 1 of 1

1/4/15

LOOP NO: 65Y232

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	232		G-232	G-232 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	232		G-232	G-232 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	232		G-232	G-232 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	232	A	G-232	G-232 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	232	B	G-232	G-232 STOP	COMMAND	PLC-100	TBD	TBD				NEW
I	65	HS	232	C	G-232	G-232 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	232	D	G-232	G-232 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	232	E	G-232	G-232 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	232	F	G-232	G-232 STOP	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	232		G-232	G-232 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	232		G-232	G-232 CLOSED	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	232		G-232	G-232 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	232		G-232	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZLC	232		G-232	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZLO	232		G-232	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	A	G-232	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	B	G-232	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	C	G-232	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	D	G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	E	G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	F	G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232		G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZSC	232		G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZSO	232		G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y232-1

LOOP DIAGRAM SCHEDULE
SCREENING FACILITY SLUICE GATE G-232

LOOP NO.	CAD FILE:	DWG NO. LD-PS65Y232	SH 1 OF SH 3	REV
65Y232	65Y232-1			0

1/4/16

FIELD SCREEN BLDG.	MCCC G-232	MCP PLC-100	COMPUTER SCREEN

HS 232 — 31, 30 — TB2: 93 OR 94 (NEW TB) — 120V — "NEW" B1/A1 DI 1/4/16 I:013/16 — "NEW" ZL 232 G-232 REMOTE — 165ZL232

6 RED 10 — ZSC 232 / ZSO 232 — 6C — 2 RED 9 — 2C RED 8 — RED 18 OPEN RED 6 5 5C — RED 17 CLOSED RED 7 1 1C — HS 232D / HS 232E

RED 18	18	RED	MCP 136/G232-6	RED	MCP TB2-136 G-232-6	TB2 136	RED	RIS6-03/TB2-136	B1/A1 DI I:6/03 → ZLC 232 G-232 CLOSED → 165ZLC232
RED 17	17	RED	MCP 134/G232-2	RED	MCP TB2-134 G-232-2	TB2 134	RED	RIS6-02/TB2-134	B1/A1 DI I:6/02 → ZLO 232 G-232 OPEN → 165ZLO232
RED 16	16	RED	MCP 133/G232-2C	RED	MCP TB2-133 G-232-2C	133	BLK	120V	
MCCC 232-2 G-232-18C	2								
MCCC 232-3 G-232-17C	3								

4 RED 4 — MCCC 232-6 G-232-4 — 6 — RED 32 — TB1A 32 RED 32

8 RED 8 — MCCC 232-5 G-232-8 — 5 — RED 34 — 34 RED 34 CR6 — RED 33 — 31 RED 31 CR5

20 RED — MCCC 232-4 G-232-20 — 4 — RED 31 — 31 RED 31 CR5

CL1 RED — MCCC 232-1 G-232-CL1 — 1

H2/CL2 RED 2 — MCCC 232-X2 G-232-CL2 — X2

RED 22 — TB1A 22 RED 22 — B1/A1 DO O:16/05 → HS 232C G-232 CLOSE → 165HS232C

CR6 — WHT N — 120V BLK

CR5 — TB1A 21 RED 21 — RED 21 — B1/A1 DO O:16/04 → HS 232A G-232 OPEN → 165HS232A

"NEW" B1/A1 DO → "NEW" HS 232B G-232 STOP → 165HS232B

25, 24 — HS 232F

LIMITORQUE
ID* 28930456-277
F-M40-V00-03P1

LEGEND
EXISTING ———
NEW ———
● SPLICE POINT

REFERENCE DRAWINGS
TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

APPROVALS

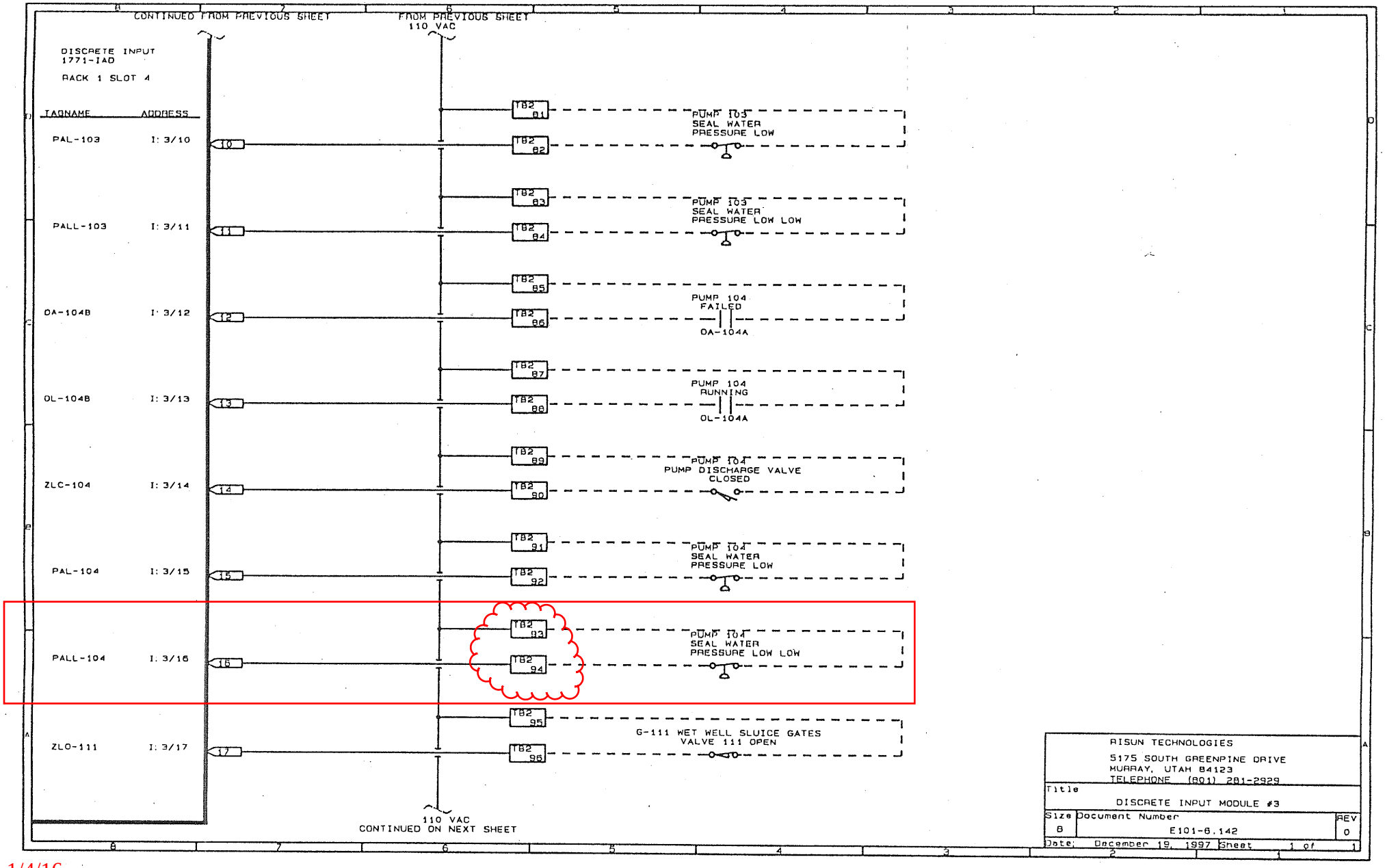
WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
SCREENING FAC. SLUICE GATE G-232

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y232-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y232	65Y232-2	LD-PS65Y232	2	OF	3	0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FROM PREVIOUS SHEET
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RACK 1 SLOT 4
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PALL-103
I:3/11
DA-104B
I:3/12
OL-104B
I:3/13
ZLC-104
I:3/14
PAL-104
I:3/15
PALL-104
I:3/16
ZLO-111
I:3/17
PUMP 103 SEAL WATER PRESSURE LOW
PUMP 103 SEAL WATER PRESSURE LOW LOW
PUMP 104 FAILED
DA-104A
PUMP 104 RUNNING
OL-104A
PUMP 104 PUMP DISCHARGE VALVE CLOSED
PUMP 104 SEAL WATER PRESSURE LOW
PUMP 104 SEAL WATER PRESSURE LOW LOW
G-111 WET WELL SLUICE GATES VALVE 111 OPEN
110 VAC
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #3
Size
B
Document Number
E101-6.142
REV
0
Date: December 19, 1997
Sheet 1 of 1

1/4/16

LOOP NO: 65Y111

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZLC	111		G-111	G-111 CLOSED	STATUS	PLC-100						EXISTING
I	65	ZLO	111		G-111	G-111 OPEN	STATUS	PLC-100						EXISTING
I	65	ZSC	111		G-111	G-111 CLOSED	SWITCH	FIELD	LIMITORQUE					EXISTING
I	65	ZSO	111		G-111	G-111 OPEN	SWITCH	FIELD	LIMITORQUE					EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZLC	111		G-111	N/A	DI	120 VAC				LD-PS65Y111-2		LD-PS65Y111	LD-PS65Y111-3
I	65	ZLO	111		G-111	N/A	DI	120 VAC				LD-PS65Y111-2		LD-PS65Y111	LD-PS65Y111-3
I	65	ZSC	111		G-111	N/A	N/A	120 VAC				LD-PS65Y111-2		LD-PS65Y111	LD-PS65Y111-3
I	65	ZSO	111		G-111	N/A	N/A	120 VAC				LD-PS65Y111-2		LD-PS65Y111	LD-PS65Y111-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

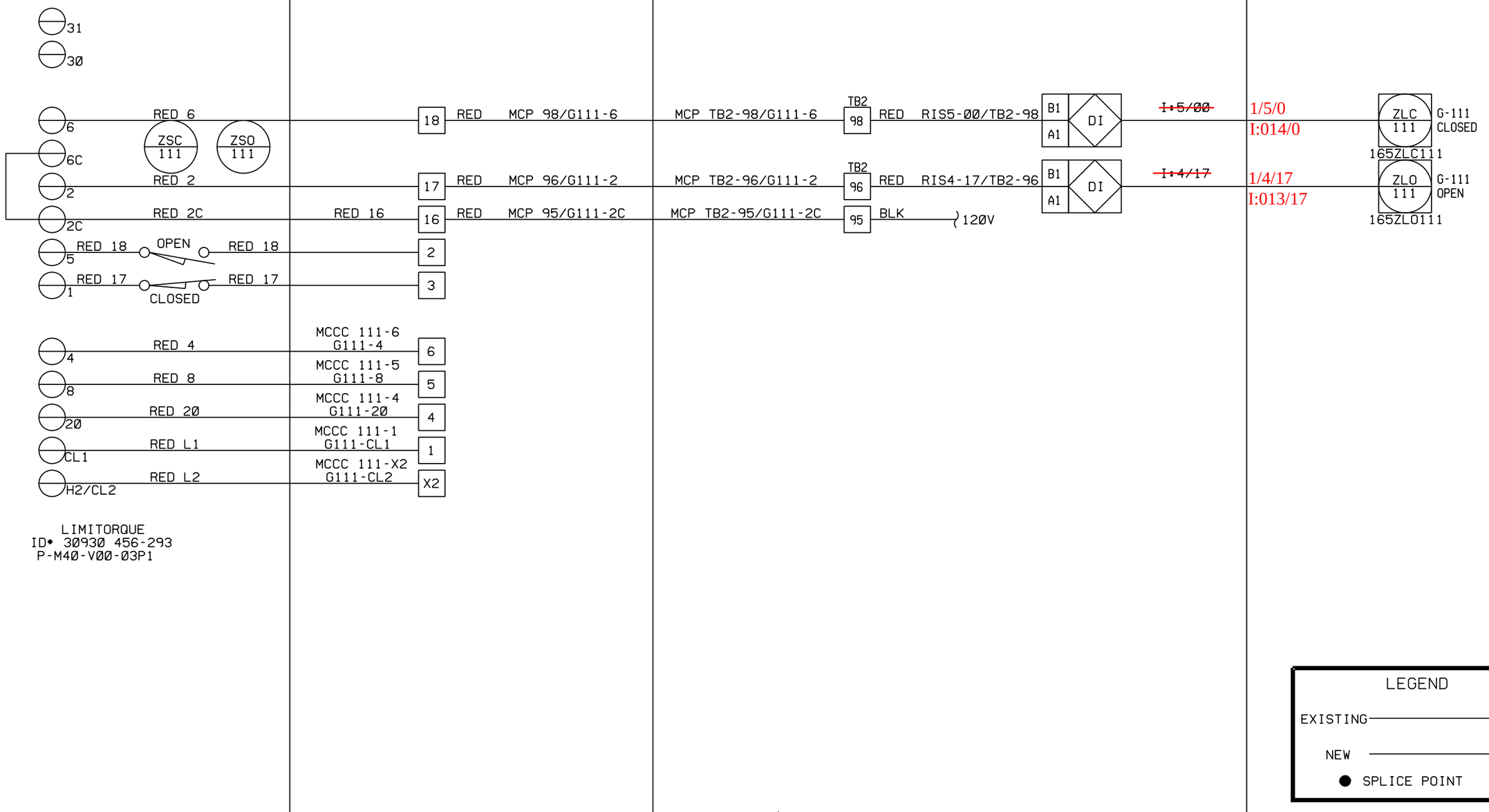
LOOP DIAGRAM SCHEDULE
OPERATIONAL WET WELL SLUICE GATE G-111

FILE NAME: 65Y111-1

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y111	65Y111-1	LD-PS65Y111	1 OF	3	0

1/4/17 & 1/5/0

FIELD WET WELL AREA	MCCC G-111	MCP PLC-100	COMPUTER SCREEN



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1/4/17 & 1/5/0							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
OPERATIONAL WET WELL SLUICE GATE G-111

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y111-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y111	65Y111-2	LD-PS65Y111	2	OF	3	0

LOOP NO: 65Y121

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZLC	121		G-121	G-121 CLOSED	STATUS	PLC-100						EXISTING
I	65	ZLO	121		G-121	G-121 OPEN	STATUS	PLC-100						EXISTING
I	65	ZSC	121		G-121	G-121 CLOSED	SWITCH	FIELD	LIMITORQUE					EXISTING
I	65	ZSO	121		G-121	G-121 OPEN	SWITCH	FIELD	LIMITORQUE					EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZLC	121		G-121	N/A	DI	120 VAC				LD-PS65Y121-2		LD-PS65Y121	LD-PS65Y121-3
I	65	ZLO	121		G-121	N/A	DI	120 VAC				LD-PS65Y121-2		LD-PS65Y121	LD-PS65Y121-3
I	65	ZSC	121		G-121	N/A	N/A	120 VAC				LD-PS65Y121-2		LD-PS65Y121	LD-PS65Y121-3
I	65	ZSO	121		G-121	N/A	N/A	120 VAC				LD-PS65Y121-2		LD-PS65Y121	LD-PS65Y121-3

REFERENCE DRAWINGS

TBD

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

DESTROY ALL PRINTS BEARING EARLIER DATE

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

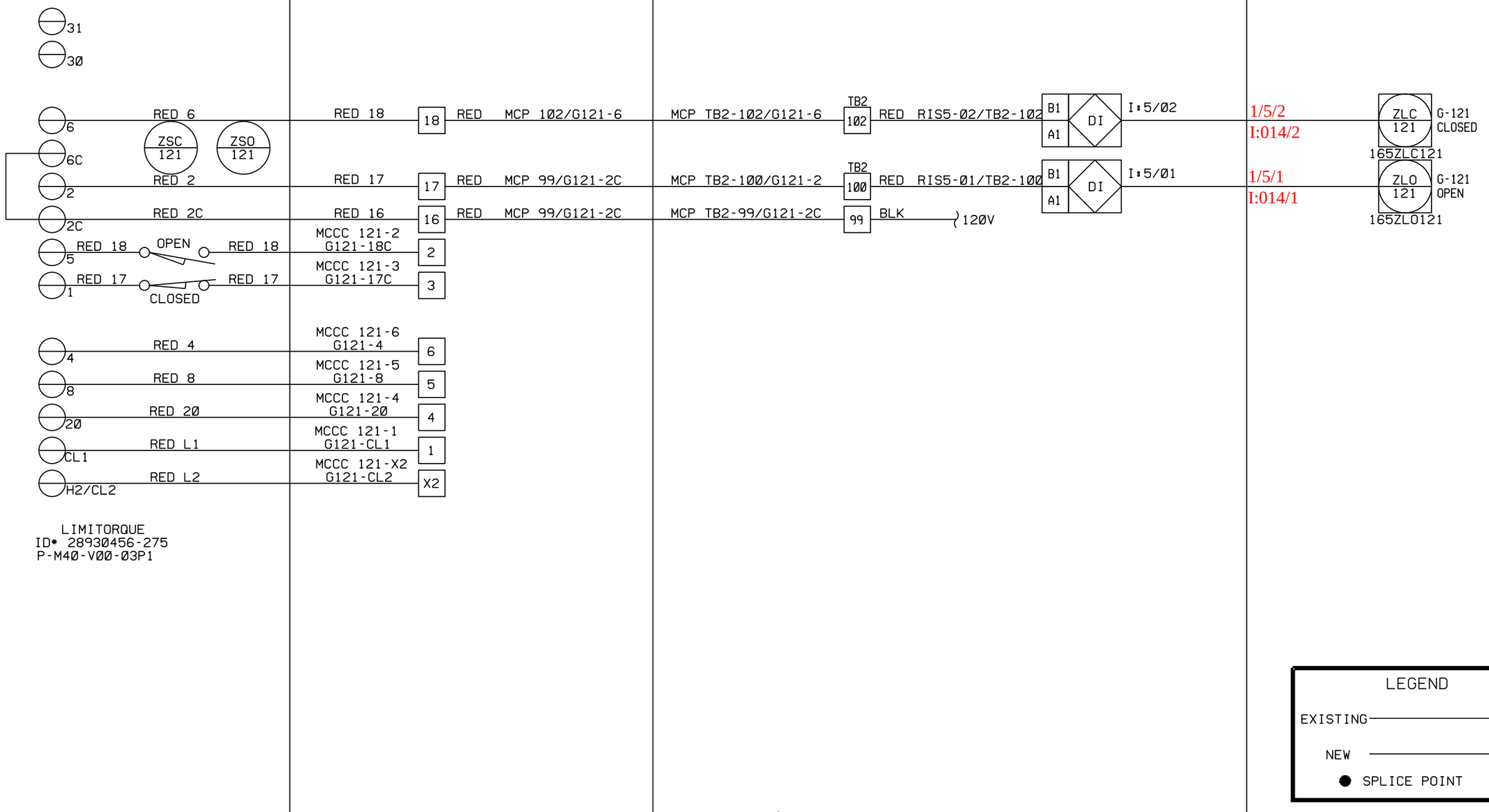
LOOP DIAGRAM SCHEDULE
OPERATIONAL/OVERFLOW WET WELL SLUICE GATE G-121

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y121-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y121	65Y121-1	LD-PS65Y121	1	OF	3	0

1/5/1 & 2

FIELD WET WELL AREA	MCCC G-121	MCP PLC-100	COMPUTER SCREEN



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/Ø2	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB* 9079
FILE NAME: 65Y121-2

INSTRUMENT LOOP DIAGRAM
OPERATIONAL/OVERFLOW WET WELL SLUICE GATE G-121

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y121	65Y121-2	LD-PS65Y121	2	OF	3	Ø

1/5/1 & 2

LOOP NO: 65P20

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	PALL	20		BUBBLER PNL. CP-20	AIR PRESS. LO-LO	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	CR-1	N/A		BUBBLER PNL. CP-20	AIR PRESS. LO-LO	RELAY	CP-20	IDEC	RH3B-U	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	PALL	20		BUBBLER PNL. CP-20	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65P20	I-2	65P20-2	65P20-3
I	65	CR-1	N/A		BUBBLER PNL. CP-20	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65P20	I-2	65P20-2	65P20-3

REFERENCE DRAWINGS	REV NO	DATE	DESTROY ALL PRINTS BEARING EARLIER DATE	BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
P&ID: I-2							
ELECTRICAL PLAN DRAWING: E-12	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/5/3							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

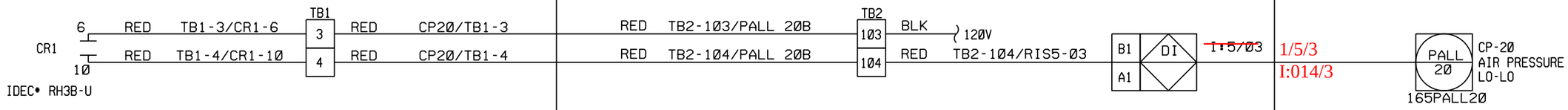
LOOP DIAGRAM SCHEDULE
BUBBLER CONTROL PANEL CP-20 PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P20-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65P20	65P20-1	LD-PS65P20	1	OF	3	1

11-DEC-2008 12:13 chris R:\mwske\comnet\loops\project\ps65\65p20-1.dgn

FIELD BUBBLER PANEL CP-20	MCP PLC-100	DCS



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-2	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/5/3							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
BUBBLER CONTROL PANEL CP-20 PRESSURE

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P20-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65P20	65P20-2	LD-PS65P20	2	OF	3	1

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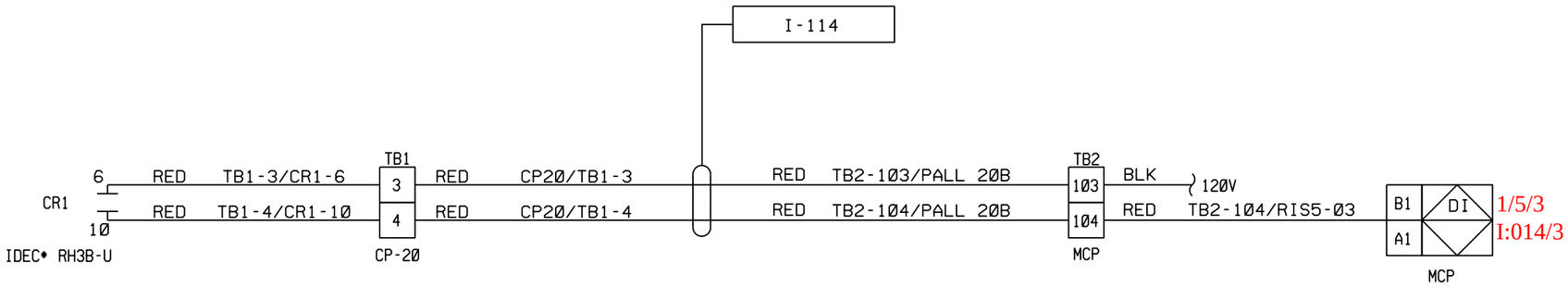


REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-2	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/5/3							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB: 9079
FILE NAME: 65P20-3

INSTRUMENT LOOP DIAGRAM
BUBBLER CONTROL PANEL CP-20 PRESSURE

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65P20	65P20-3	LD-PS65P20	3	OF	3	1

LOOP NO: 65Y211

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	211		G-211	G-211 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	211		G-211	G-211 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	211		G-211	G-211 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	211	A	G-211	G-211 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	211	B	G-211	G-211 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	211		G-211	G-211 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	211	C	G-211	G-211 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	211	D	G-211	G-211 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	211		G-211	G-211 CLOSED	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	211		G-211	G-211 OPEN	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	211		G-211	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZLC	211		G-211	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZLO	211		G-211	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	A	G-211	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	B	G-211	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211		G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	C	G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	D	G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZSC	211		G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZSO	211		G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

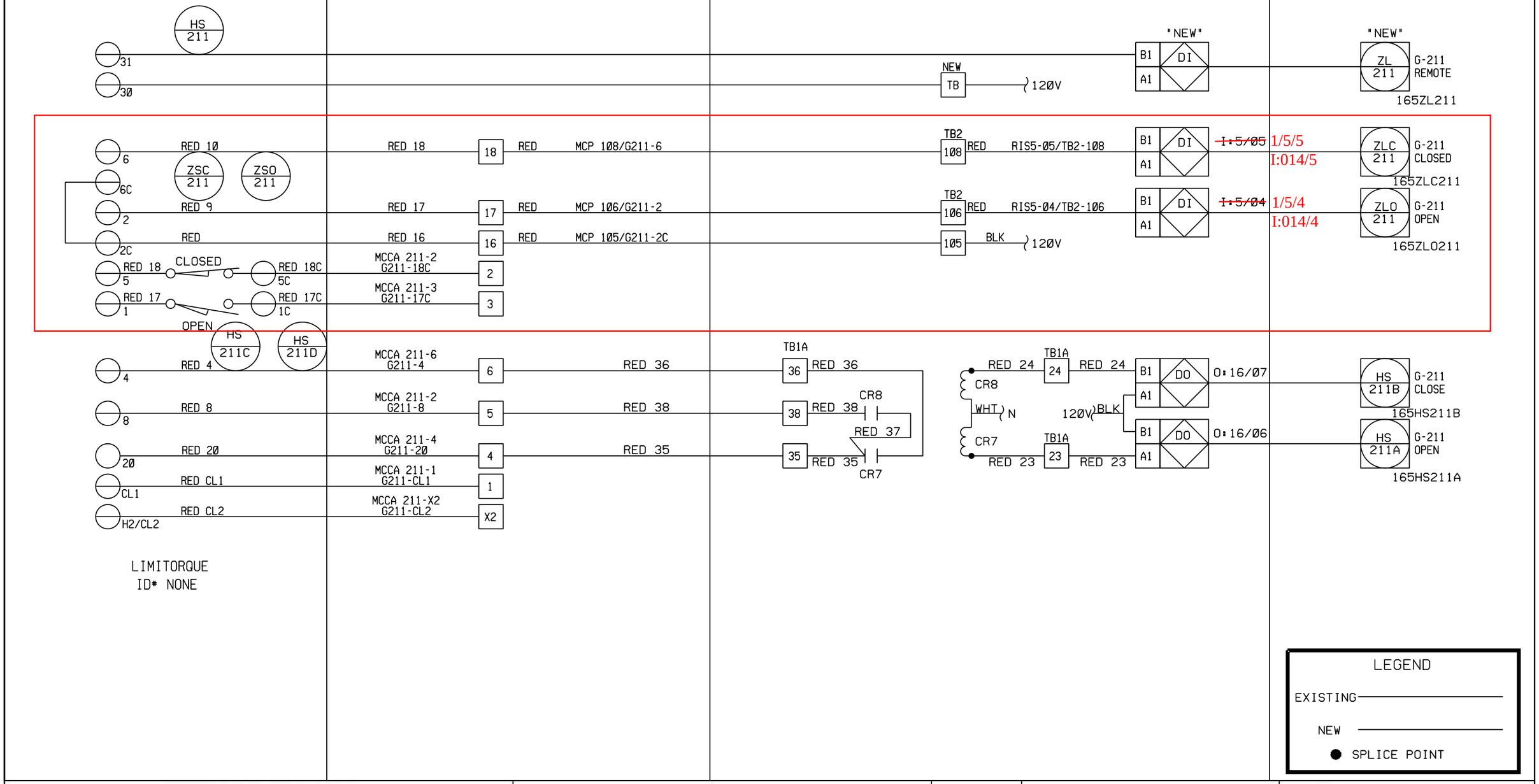
FILE NAME: 65Y211-1

LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-201 SLIDE GATE G-211

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y211	65Y211-1	LD-PS65Y211	1	OF	3	0

1/5/4 & 5

FIELD SCREEN BLDG.	MCCA G-211	MCP PLC-100	COMPUTER SCREEN



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1/5/4 & 5							

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-201 SLIDE GATE G-211

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y211-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y211	65Y211-2	LD-PS65Y211	2	OF	3	Ø

LOOP NO: 65Y212

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	212		G-212	G-212 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	212		G-212	G-212 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	212		G-212	G-212 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	212	A	G-212	G-212 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	212	B	G-212	G-212 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	212		G-212	G-212 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	212	C	G-212	G-212 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	212	D	G-212	G-212 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	212		G-212	G-212 CLOSED	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	212		G-212	G-212 OPEN	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	212		G-212	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZLC	212		G-212	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZLO	212		G-212	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	A	G-212	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	B	G-212	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212		G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	C	G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	D	G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZSC	212		G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZSO	212		G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

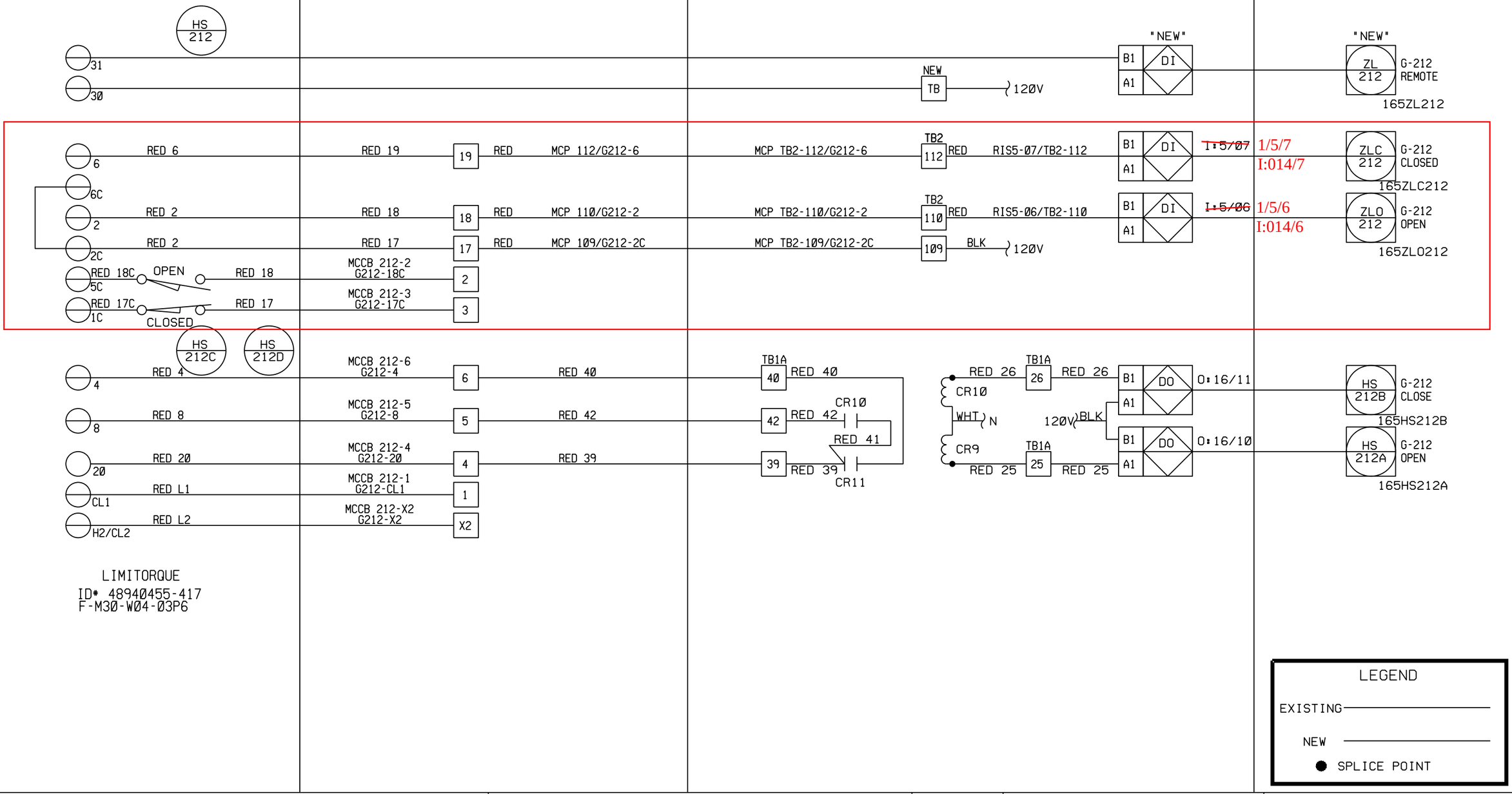
FILE NAME: 65Y212-1

LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-202 SLIDE GATE G-212

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y212	65Y212-1	LD-PS65Y212	1	OF	3	0

1/5/6 & 7

FIELD SCREEN BLDG.	MCCB G-212	MCP PLC-100	COMPUTER SCREEN



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1/5/6 & 7							

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-202 SLIDE GATE G-212

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y212-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y212	65Y212-2	LD-PS65Y212	2	OF	3	0

LOOP NO: 65Y213

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	213		G-213	G-213 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	213		G-213	G-213 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	213		G-213	G-213 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	213	A	G-213	G-213 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	213	B	G-213	G-213 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	213		G-213	G-213 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	213	C	G-213	G-213 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	213	D	G-213	G-213 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	213		G-213	G-213 CLOSED	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	213		G-213	G-213 OPEN	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	213		G-213	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZLC	213		G-213	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZLO	213		G-213	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	A	G-213	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	B	G-213	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213		G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	C	G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	D	G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZSC	213		G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZSO	213		G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

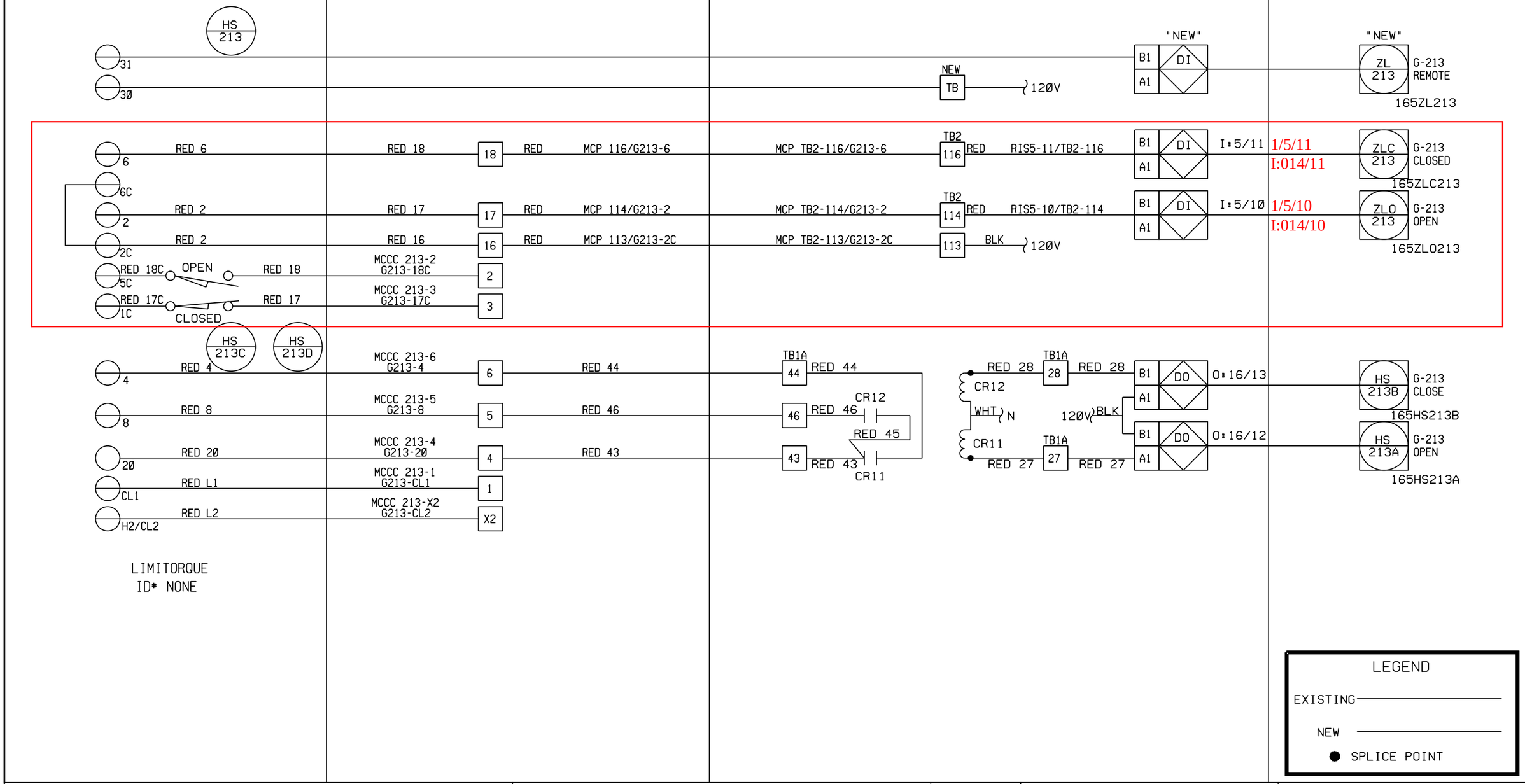
FILE NAME: 65Y213-1

LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-203 SLIDE GATE G-213

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y213	65Y213-1	LD-PS65Y213	1	OF	3	0

1/5/10 & 11

FIELD SCREEN BLDG.	MCCC G-213	MCP PLC-100	COMPUTER SCREEN



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1/5/10 & 11							

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-203 SLIDE GATE G-213

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y213-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y213	65Y213-2	LD-PS65Y213	2 OF	3	Ø

LOOP NO: 65Y221

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZLC	221		G-221	G-221 CLOSED	STATUS	PLC-100						EXISTING
I	65	ZLO	221		G-221	G-221 OPEN	STATUS	PLC-100						EXISTING
I	65	ZSC	221		G-221	G-221 CLOSED	SWITCH	FIELD	LIMITORQUE					EXISTING
I	65	ZSO	221		G-221	G-221 OPEN	SWITCH	FIELD	LIMITORQUE					EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZLC	221		G-221	N/A	DI	120 VAC				LD-PS65Y221-2		LD-PS65Y221	LD-PS65Y221-3
I	65	ZLO	221		G-221	N/A	DI	120 VAC				LD-PS65Y221-2		LD-PS65Y221	LD-PS65Y221-3
I	65	ZSC	221		G-221	N/A	N/A	120 VAC				LD-PS65Y221-2		LD-PS65Y221	LD-PS65Y221-3
I	65	ZSO	221		G-221	N/A	N/A	120 VAC				LD-PS65Y221-2		LD-PS65Y221	LD-PS65Y221-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

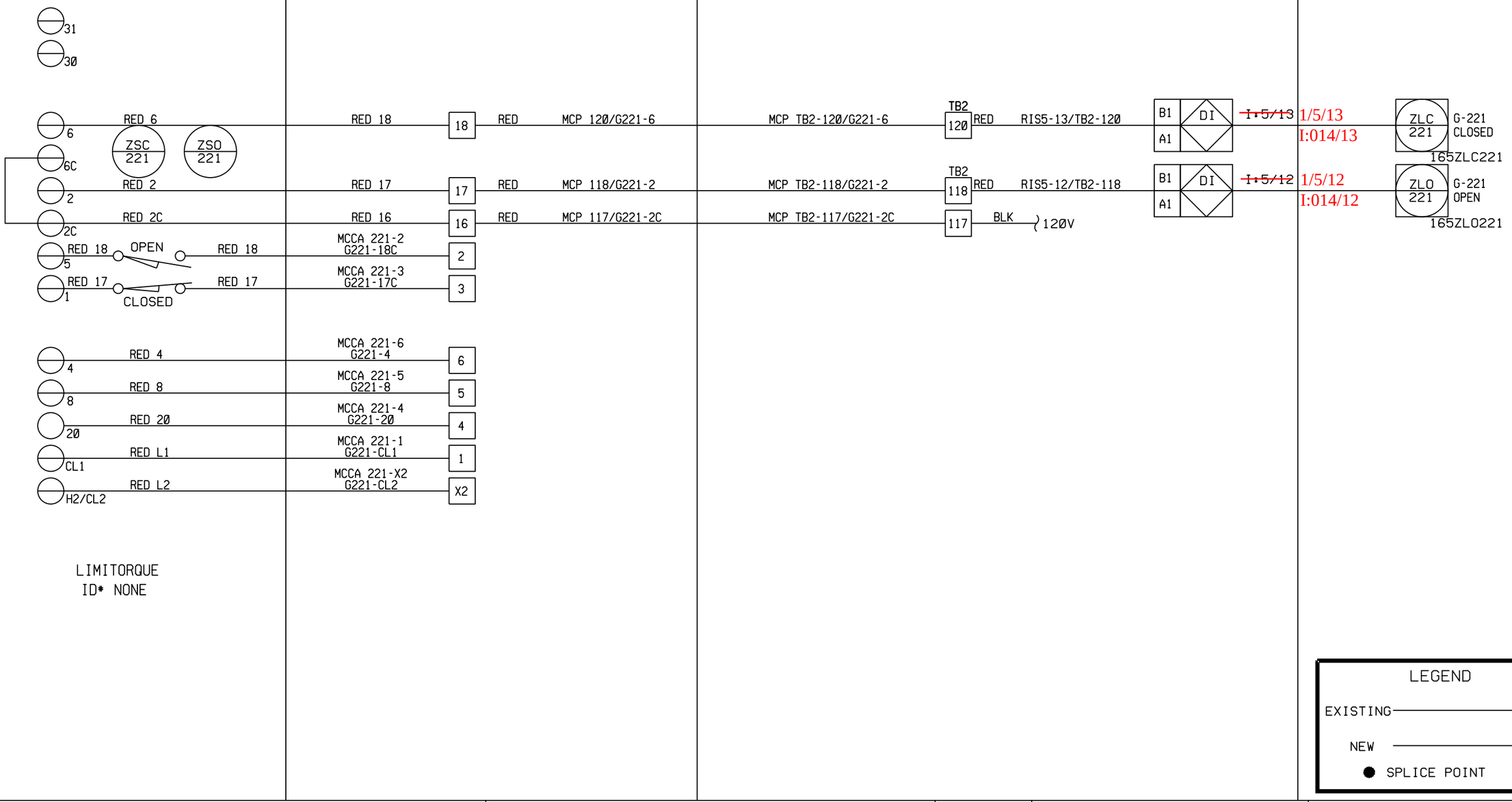
FILE NAME: 65Y221-1

LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-201 SLIDE GATE G-221

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y221	65Y221-1	LD-PS65Y221	1	OF	3	0

1/5/12 & 13

FIELD SCREEN BLDG.	MCCA G-221	MCP PLC-100	COMPUTER SCREEN



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1/5/12 & 13							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-201 SLIDE GATE G-221

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB* 9079
FILE NAME: 65Y221-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y221	65Y221-2	LD-PS65Y221	2 OF	3	Ø

LOOP NO: 65Y222

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZLC	222		G-222	G-222 CLOSED	STATUS	PLC-100						EXISTING
I	65	ZLO	222		G-222	G-222 OPEN	STATUS	PLC-100						EXISTING
I	65	ZSC	222		G-222	G-222 CLOSED	SWITCH	FIELD	LIMITORQUE					EXISTING
I	65	ZSO	222		G-222	G-222 OPEN	SWITCH	FIELD	LIMITORQUE					EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZLC	222		G-222	N/A	DI	120 VAC				LD-PS65Y222-2		LD-PS65Y222	LD-PS65Y222-3
I	65	ZLO	222		G-222	N/A	DI	120 VAC				LD-PS65Y222-2		LD-PS65Y222	LD-PS65Y222-3
I	65	ZSC	222		G-222	N/A	N/A	120 VAC				LD-PS65Y222-2		LD-PS65Y222	LD-PS65Y222-3
I	65	ZSO	222		G-222	N/A	N/A	120 VAC				LD-PS65Y222-2		LD-PS65Y222	LD-PS65Y222-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

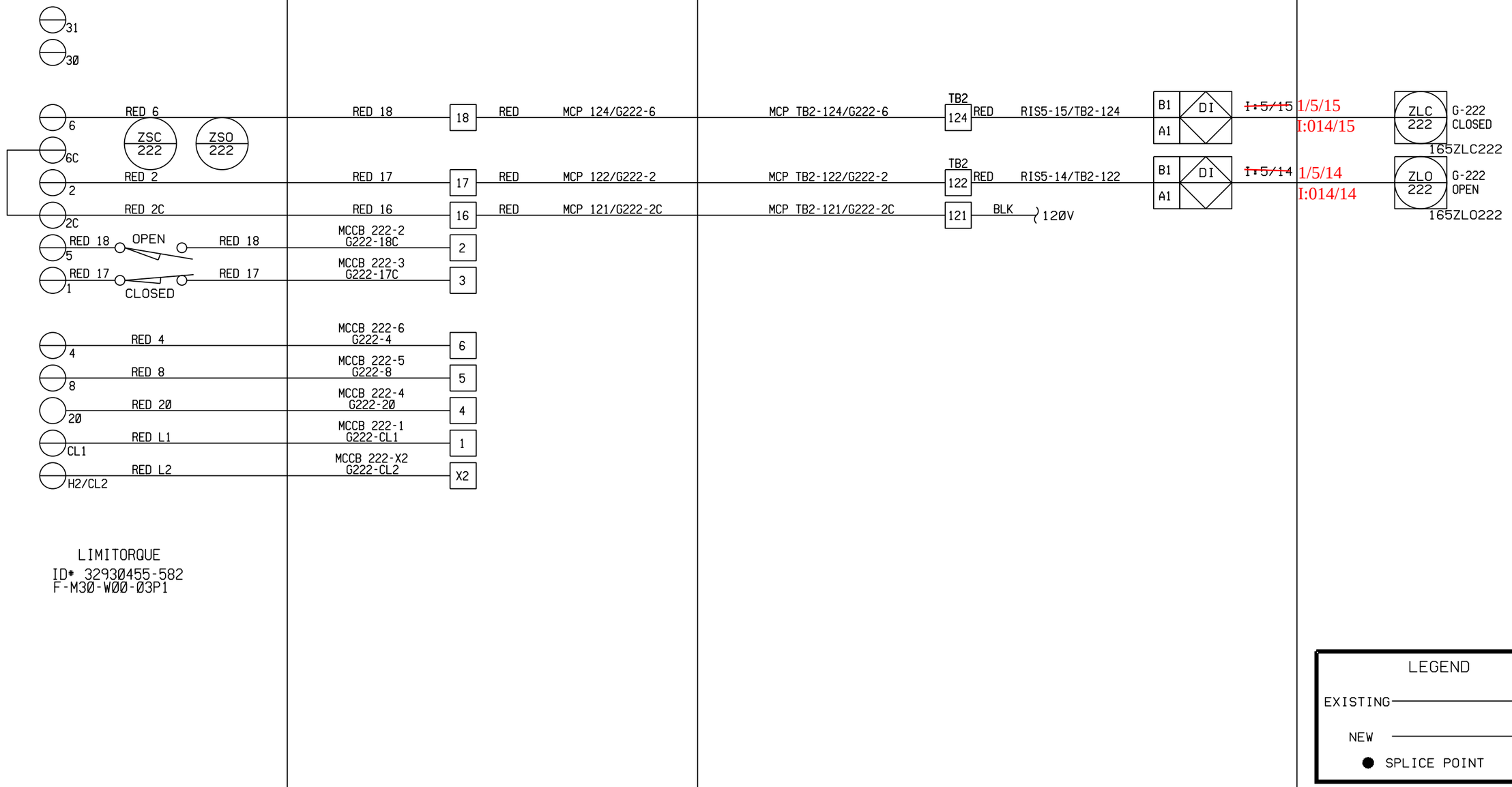
FILE NAME: 65Y222-1

LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-202 SLIDE GATE G-222

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y222	65Y222-1	LD-PS65Y222	1	OF	3	0

1/5/14 & 15

FIELD SCREEN BLDG.	MCCB G-222	MCP PLC-100	COMPUTER SCREEN



LIMITORQUE
ID# 32930455-582
F-M30-W00-03P1

LEGEND

EXISTING ——————

NEW ——————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y222-2

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-202 SLIDE GATE G-222

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y222	65Y222-2	LD-PS65Y222	2	OF	3	0

1/5/14 & 15

LOOP NO: 65Y223

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZLC	223		G-223	G-223 CLOSED	STATUS	PLC-100						EXISTING
I	65	ZLO	223		G-223	G-223 OPEN	STATUS	PLC-100						EXISTING
I	65	ZSC	223		G-223	G-223 CLOSED	SWITCH	FIELD	LIMITORQUE					EXISTING
I	65	ZSO	223		G-223	G-223 OPEN	SWITCH	FIELD	LIMITORQUE					EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZLC	223		G-223	N/A	DI	120 VAC				LD-PS65Y223-2		LD-PS65Y223	LD-PS65Y223-3
I	65	ZLO	223		G-223	N/A	DI	120 VAC				LD-PS65Y223-2		LD-PS65Y223	LD-PS65Y223-3
I	65	ZSC	223		G-223	N/A	N/A	120 VAC				LD-PS65Y223-2		LD-PS65Y223	LD-PS65Y223-3
I	65	ZSO	223		G-223	N/A	N/A	120 VAC				LD-PS65Y223-2		LD-PS65Y223	LD-PS65Y223-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

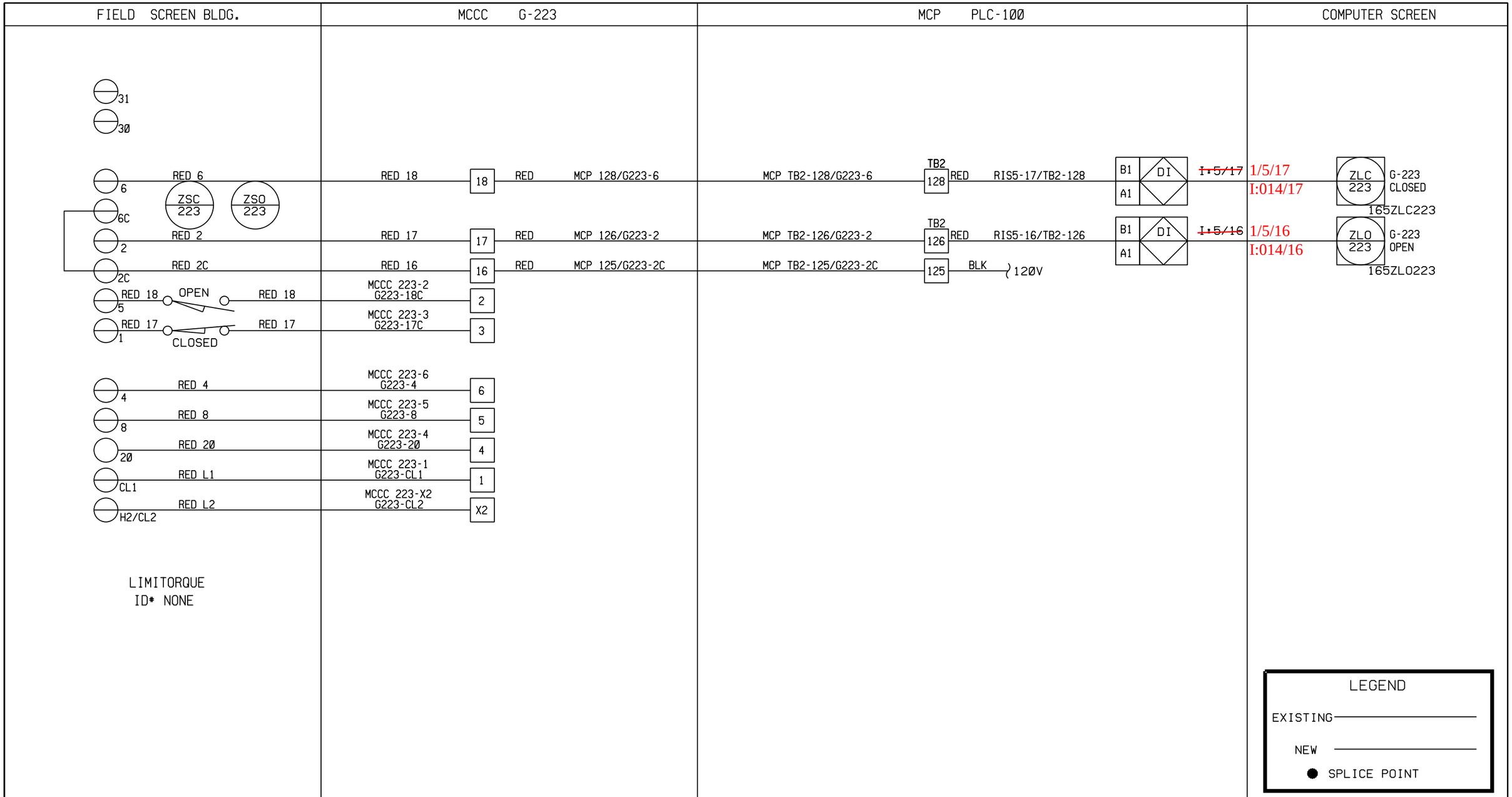
BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y223-1

LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-203 SLIDE GATE G-223

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y223	65Y223-1	LD-PS65Y223	1	OF	3	0

1/5/16 & 17



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y223-2

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-203 SLIDE GATE G-223

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y223	65Y223-2	LD-PS65Y223	2	OF	3	0

1/5/16 & 17

LOOP NO: 65Y231

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZLC	231		G-231	G-231 CLOSED	STATUS	PLC-100						EXISTING
I	65	ZLO	231		G-231	G-231 OPEN	STATUS	PLC-100						EXISTING
I	65	ZSC	231		G-231	G-231 CLOSED	SWITCH	FIELD	LIMITORQUE					EXISTING
I	65	ZSO	231		G-231	G-231 OPEN	SWITCH	FIELD	LIMITORQUE					EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZLC	231		G-231	N/A	DI	120 VAC				LD-PS65Y231-2		LD-PS65Y231	LD-PS65Y231-3
I	65	ZLO	231		G-231	N/A	DI	120 VAC				LD-PS65Y231-2		LD-PS65Y231	LD-PS65Y231-3
I	65	ZSC	231		G-231	N/A	N/A	120 VAC				LD-PS65Y231-2		LD-PS65Y231	LD-PS65Y231-3
I	65	ZSO	231		G-231	N/A	N/A	120 VAC				LD-PS65Y231-2		LD-PS65Y231	LD-PS65Y231-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

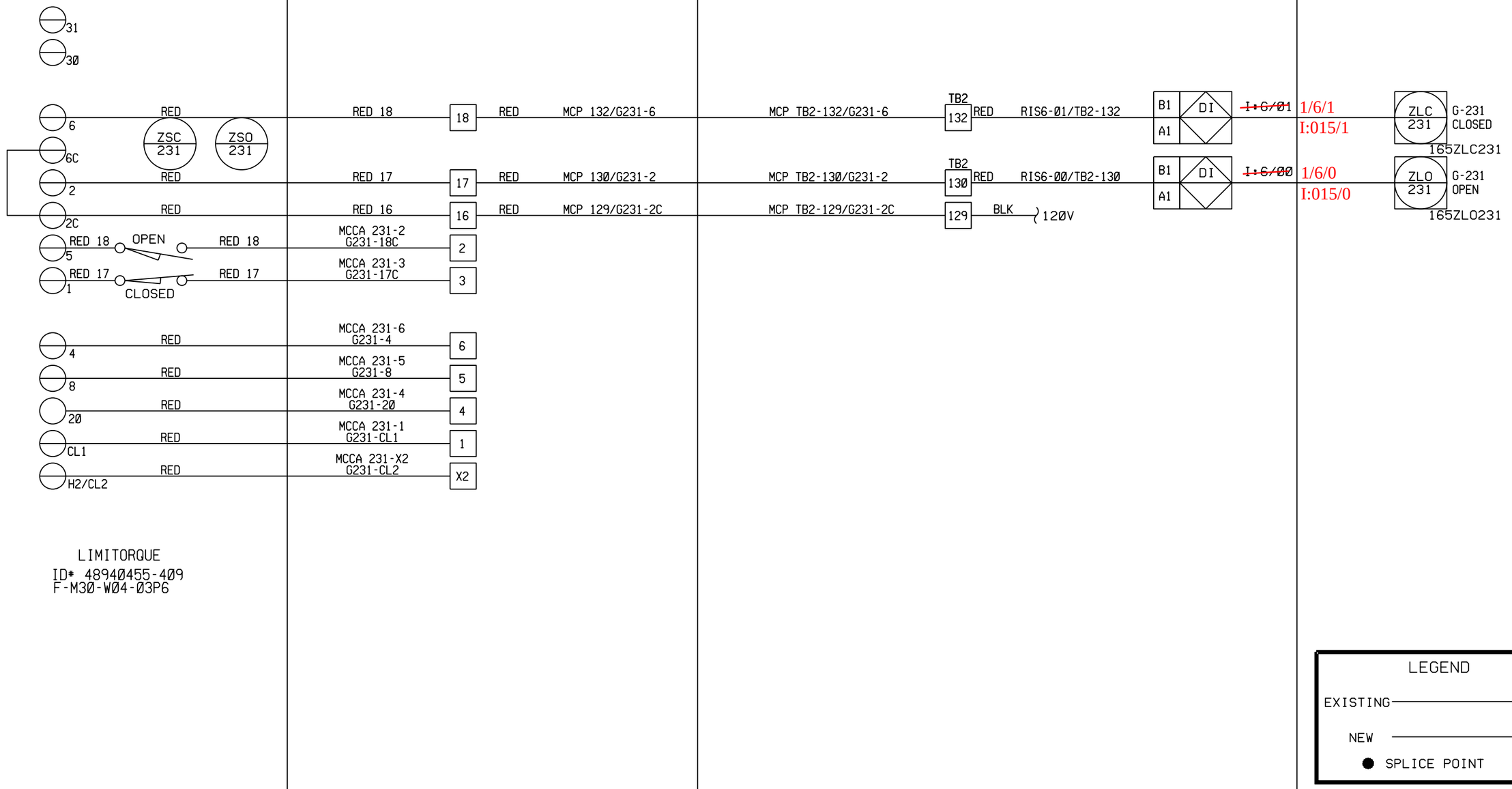
LOOP DIAGRAM SCHEDULE
OPERATIONAL WET WELL SLIDE GATE G-231

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y231-1

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y231	65Y231-1	LD-PS65Y231	1 OF	3	0

1/6/0 & 1

FIELD SCREEN BLDG.	MCCA G-231	MCP PLC-100	COMPUTER SCREEN



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1/6/0 & 1							

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y231-2

INSTRUMENT LOOP DIAGRAM
OPERATIONAL WET WELL SLIDE GATE G-231

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y231	65Y231-2	LD-PS65Y231	2 OF	3	0

LOOP NO: 65Y232

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	232		G-232	G-232 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	232		G-232	G-232 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	232		G-232	G-232 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	232	A	G-232	G-232 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	232	B	G-232	G-232 STOP	COMMAND	PLC-100	TBD	TBD				NEW
I	65	HS	232	C	G-232	G-232 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	232	D	G-232	G-232 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	232	E	G-232	G-232 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	232	F	G-232	G-232 STOP	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	232		G-232	G-232 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	232		G-232	G-232 CLOSED	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	232		G-232	G-232 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	232		G-232	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZLC	232		G-232	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZLO	232		G-232	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	A	G-232	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	B	G-232	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	C	G-232	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	D	G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	E	G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	F	G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232		G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZSC	232		G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZSO	232		G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

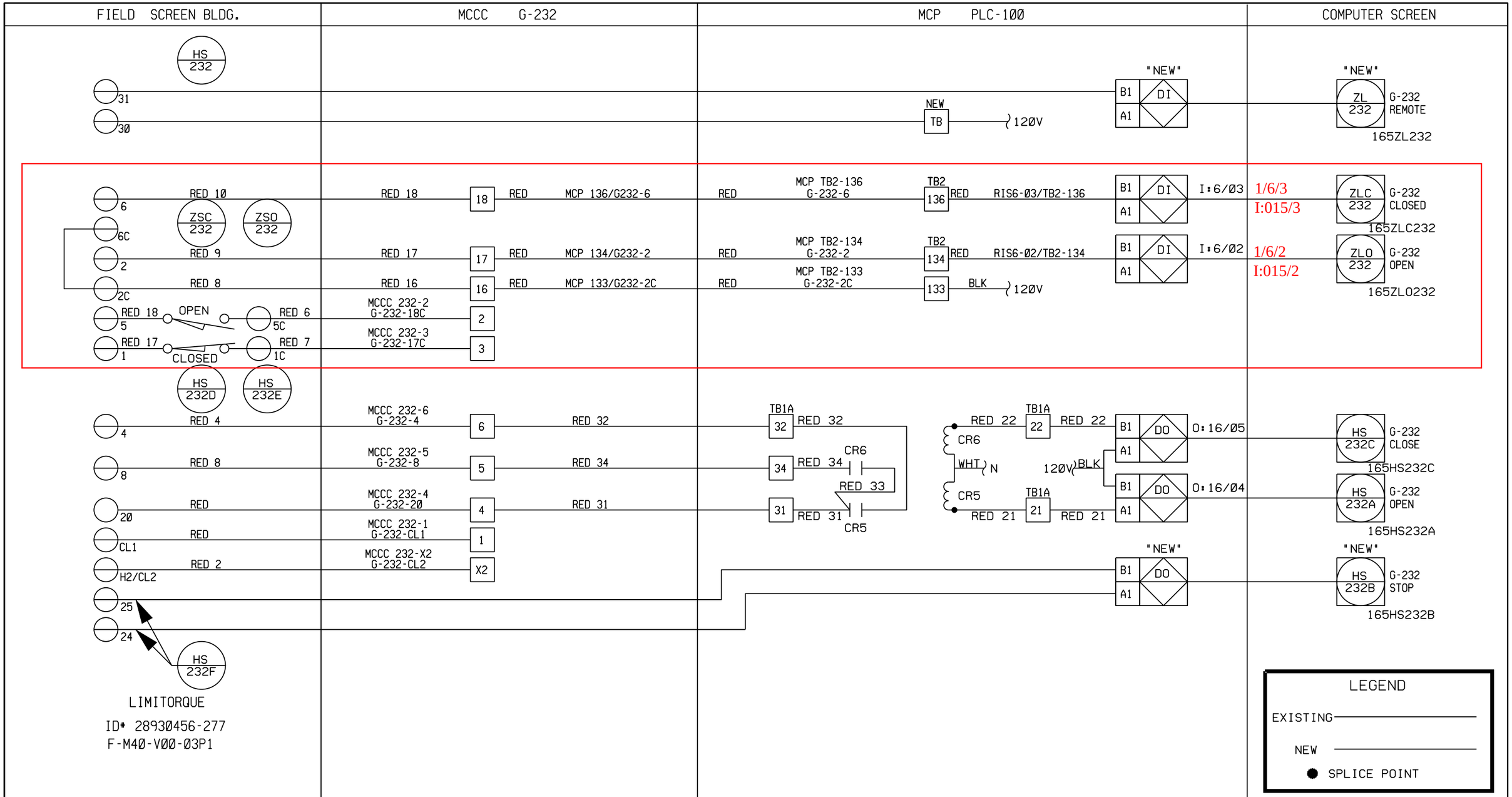
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y232-1

LOOP DIAGRAM SCHEDULE
SCREENING FACILITY SLUICE GATE G-232

LOOP NO.	CAD FILE:	DWG NO. LD-PS65Y232	SH 1 OF SH 3	REV
65Y232	65Y232-1			0

1/6/2 & 3



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
SCREENING FAC. SLUICE GATE G-232

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y232-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y232	65Y232-2	LD-PS65Y232	2 OF	3	0

1/6/2 & 3

LOOP NO: 65Y233

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZLC	233		G-233	G-233 CLOSED	STATUS	PLC-100						EXISTING
I	65	ZLO	233		G-233	G-233 OPEN	STATUS	PLC-100						EXISTING
I	65	ZSC	233		G-233	G-233 CLOSED	SWITCH	FIELD	LIMITORQUE					EXISTING
I	65	ZSO	233		G-233	G-233 OPEN	SWITCH	FIELD	LIMITORQUE					EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZLC	233		G-233	N/A	DI	120 VAC				LD-PS65Y233-2		LD-PS65Y233	LD-PS65Y233-3
I	65	ZLO	233		G-233	N/A	DI	120 VAC				LD-PS65Y233-2		LD-PS65Y233	LD-PS65Y233-3
I	65	ZSC	233		G-233	N/A	N/A	120 VAC				LD-PS65Y233-2		LD-PS65Y233	LD-PS65Y233-3
I	65	ZSO	233		G-233	N/A	N/A	120 VAC				LD-PS65Y233-2		LD-PS65Y233	LD-PS65Y233-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

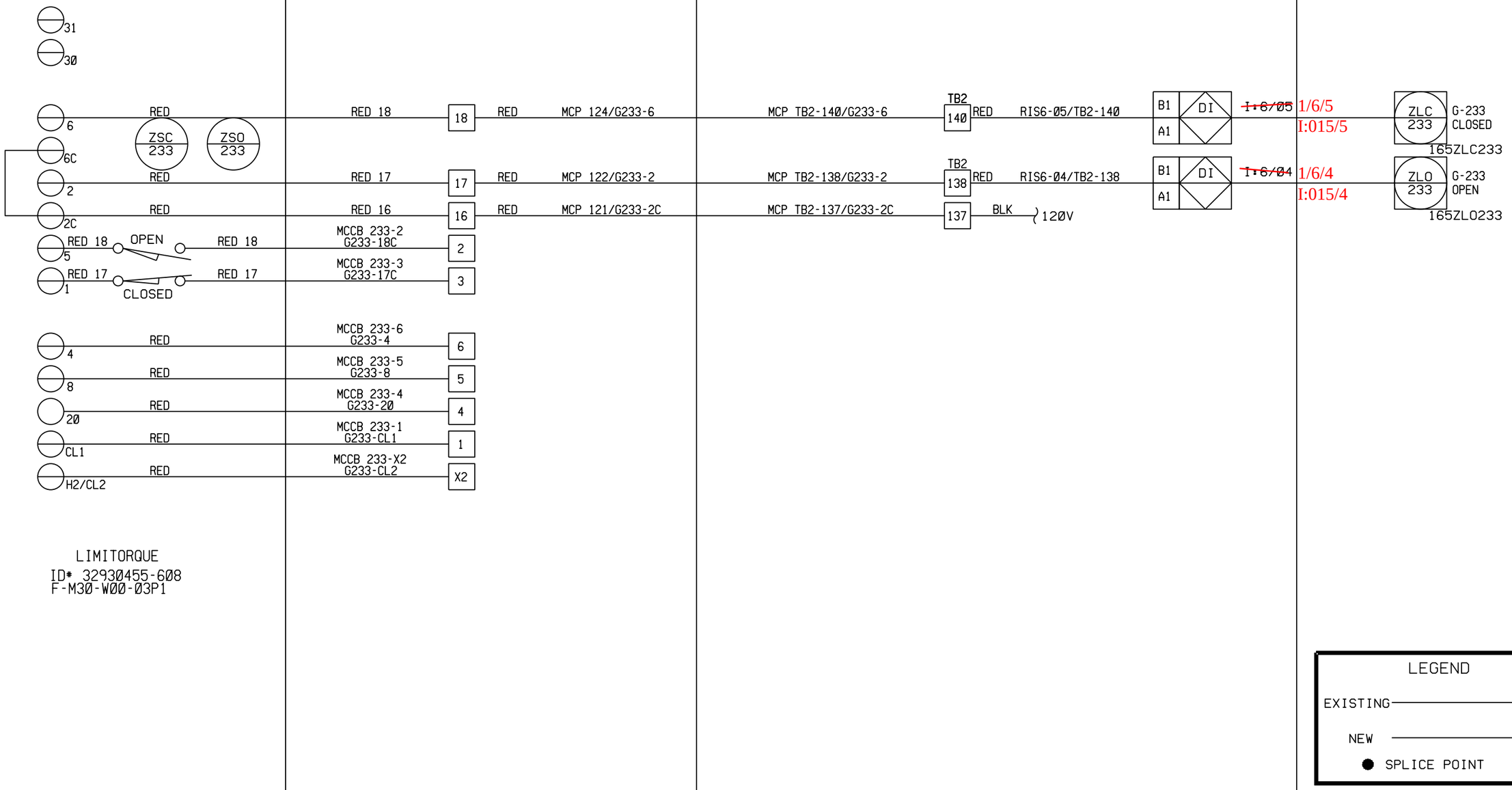
FILE NAME: 65Y233-1

LOOP DIAGRAM SCHEDULE
OVERFLOW WET WELL SLIDE GATE G-233

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y233	65Y233-1	LD-PS65Y233	1 OF	3	0

1/6/4 & 5

FIELD SCREEN BLDG.	MCCB G-233	MCP PLC-100	COMPUTER SCREEN



LIMITORQUE
ID# 32930455-608
F-M30-W00-03P1

LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS

TBD

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

DESTROY ALL PRINTS BEARING EARLIER DATE

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
OVERFLOW WET WELL SLIDE GATE G-233

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y233-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y233	65Y233-2	LD-PS65Y233	2	OF	3	0

1/6/4 & 5

LOOP NO: 65L300

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LALL	300		AIR GAP TANK	T-300 LO-LO LEVEL	STATUS	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	LSLL	300		AIR GAP TANK	T-300 LO-LO LEVEL	CONDUCTIVITY PROBE	FIELD	WARWICK	3N3A	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LALL	300		AIR GAP TANK	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65L300	I-5	65L300-2	65L300-3
I	65	LSLL	300		AIR GAP TANK	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65L300	I-5	65L300-2	65L300-3

REFERENCE DRAWINGS	REV NO	DATE	DESTROY ALL PRINTS BEARING EARLIER DATE	BY	CKD	APPROVALS PROJ ENGR	PROJ MGR
P&ID: I-5							
ELECTRICAL PLAN DRAWING: E-12	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/6/6							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
SEAL WATER AIR GAP TANK T-300 LEVEL

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L300-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L300	65L300-1	LD-PS65L300	1	OF	3	1

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MCPTB2-141/LALL 30Ø — TB2 141 — BLK — 120V

MCPTB2-142/LALL 30Ø — TB2 142 — RED RIS6-06/TB2-142

B1 / A1 DI — ~~I:6/06~~ — 1/6/6 — I:015/6

LALL 3ØØ — T-3ØØ LO-LO LEVEL — 165LALL3ØØ

RED — RED

6 | 8

WARWICK CONTROL RELAY

PUMP ALTER LOGIC

J-BOX WEST WALL

PRB — RED — RED — 4 COIL 2 — WHT — N

GND REF. — RED — RED — 5 — 1 — BLK — 120V

G — GREEN — GRND

LSLL 3ØØ

WARWICK MODEL* 3N3A CONDUCTIVITY LEVEL PROBE

HYDROPNEUMATIC TANK PRESSURE HI / LO SEE LOOP 65P3Ø1

B1 / A1 DI — I:6/Ø7

B1 / A1 DI — I:6/1Ø

START / STOP SEAL WATER PUMPS 3Ø5/6 SEE LOOP 65P3Ø1

B1 / A1 DO — I:2/27 — I:2/28

B1 / A1 DO — I:2/31 — I:2/32

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-5	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/Ø4	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP. PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

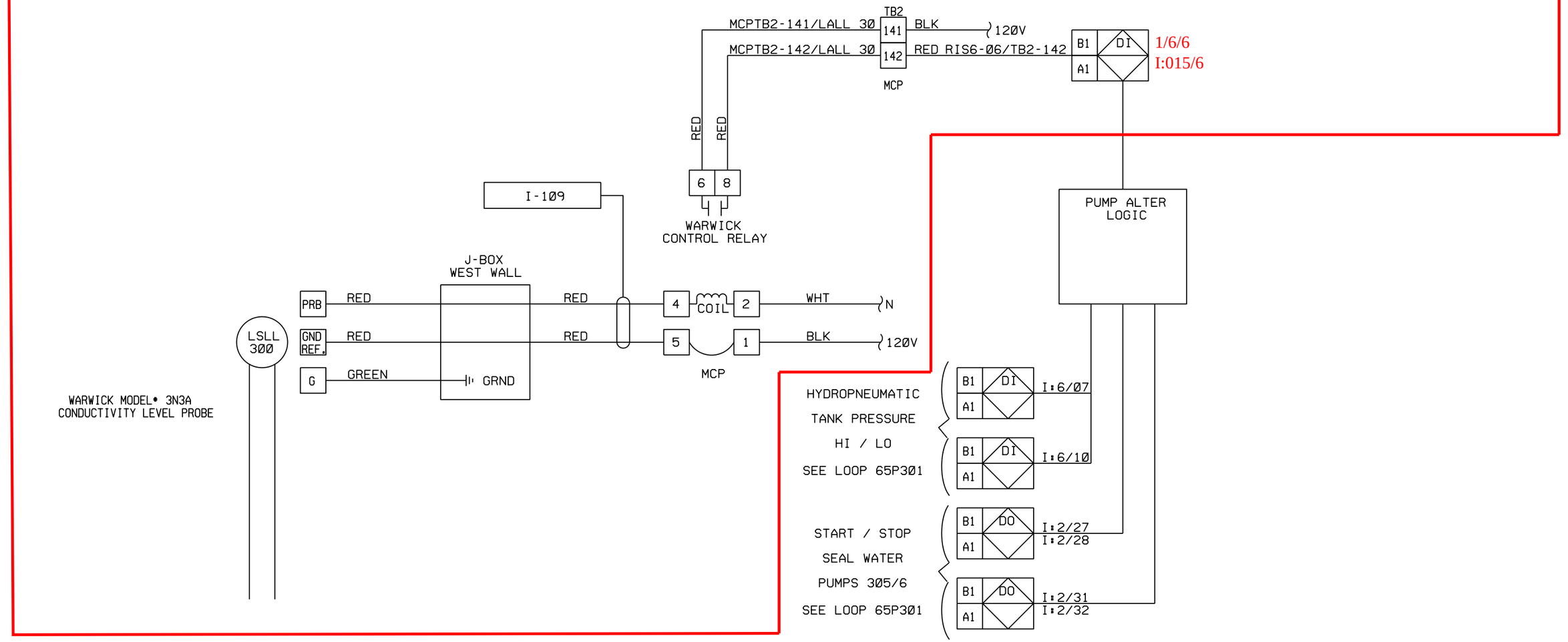
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
SEAL WATER AIR GAP TANK T-3ØØ LEVEL

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L3ØØ-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65L3ØØ	65L3ØØ-2	LD-PS65L3ØØ	2 OF	3	1

1/6/6



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-5	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/6/6							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB* 9079

INSTRUMENT LOOP DIAGRAM
SEAL WATER AIR GAP TANK T-300 LEVEL

FILE NAME: 65L300-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65L300	65L300-3	LD-PS65L300	3 OF	3	1

LOOP NO: 65P301

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	PAH	301		HYDRO-TANK	T-301 HI-PRESS.	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PAL	301		HYDRO-TANK	T-301 LO PRESS.	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PSHL	301		HYDRO-TANK	T-301 HI-LO PRESS.	PRESS.SW.	FIELD	SOR	55V2-EF5 N4-C2A-RR	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	PAH	301		HYDRO-TANK	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65P301	I-5	65P301-2	65P301-3
I	65	PAL	301		HYDRO-TANK	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65P301	I-5	65P301-2	65P301-3
I	65	PSHL	301		HYDRO-TANK	S20.26	N/A	120VAC	N/A	N/A	N/A	LD-PS65P301	I-5	65P301-2	65P301-3

REFERENCE DRAWINGS	REV NO	DATE	DESTROY ALL PRINTS BEARING EARLIER DATE	BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
P&ID: I-5							
ELECTRICAL PLAN DRAWING: E-12	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/6/7 & 10							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
SEAL WATER HYDRO PNEUMATIC TANK T-301 PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P301-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65P301	65P301-1	LD-PS65P301	1	OF	3	1

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FIELD MOTOR CONTROL BLDG. | MCP PLC-100 | DCS

B1 DI A1 — I:6/06

LALL 300 — T-300 LO-LO LEVEL — 165LALL300

PUMP ALTER LOGIC

'LB'

PSHL 301 — C, NO, NO 2

BLUE — BLUE — MCP 143/PSH 301 — RED — MCP TB2-143/PSH 301 — TB2 143 — BLK — 120V

BLK — BLK — MCP 13/FSL 3B — RED — MCP TB2-144/PSH 301 — TB2 144 — RED — RIS6-07/TB2-144 — B1 DI A1 — ~~I:6/07~~ HI — 1/6/7 I:015/7

BLK — BLK — MCP 14/FSL 3B — RED

SPLICE

PAH 301 — T-301 HI-PRESS. — 165PAH301

MCP TB2-146/PSH 301 — TB2 146 — RED — RIS6-10/TB2-146 — B1 DI A1 — ~~I:6/10~~ LO — 1/6/10 I:015/10

PAL 301 — T-301 LO-PRESS. — 165PAL301

FIELD MCCA P-305 SEAL WATER PUMP

TO START CIRCUIT — TB 3, 4 — RED 3, RED 4 — RED — MCCA 305-3/MCP 183, MCCA 305-4/MCP 184 — RED — TB2-183/MCCA 305-03, TB2-184/MCCA 304-04 — TB2 183, 184 — RED — RIS2-27/TB2-183, RIS2-28/TB2-184 — B1 DO A1 — O:2/27, O:2/28

FIELD MCCB P-306 SEAL WATER PUMP

TO START CIRCUIT — TB 3, 4 — RED 3, RED 4 — RED — MCCB 306-3/MCP 185, MCCB 306-4/MCP 186 — RED — TB2-185/MCCB 306-03, TB2-186/MCCB 306-04 — TB2 185, 186 — RED — RIS2-31/TB2-185, RIS2-32/TB2-186 — B1 DO A1 — O:2/31, O:2/32

REFERENCE DRAWINGS

P&ID: I-5

ELECTRICAL PLAN DRAWING: E-12

CONDUIT SCHEDULE: E-11.1

1/6/7 & 10

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	11/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP. PROCESS CONTROL DIVISION

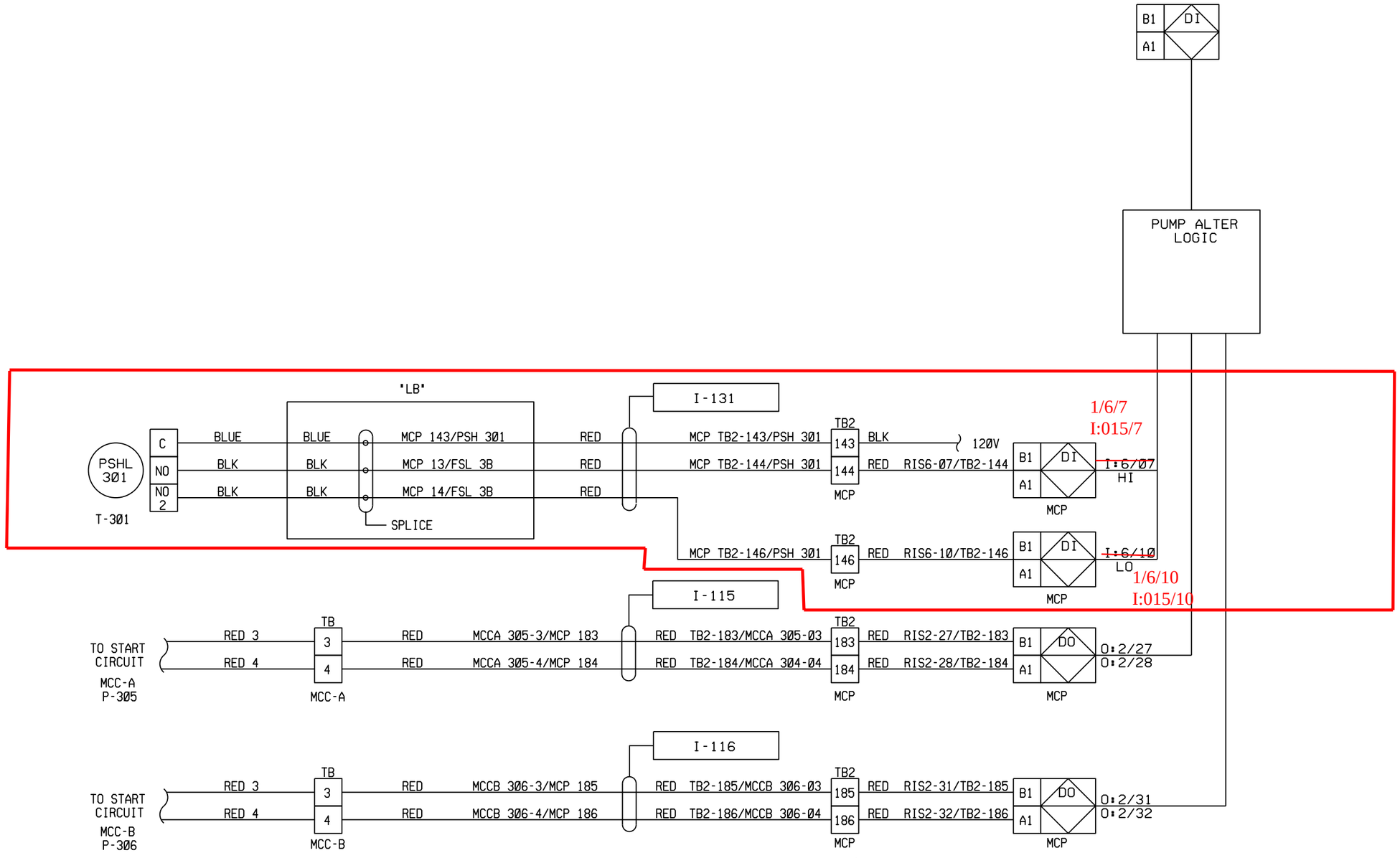
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P301-2

INSTRUMENT LOOP DIAGRAM
SEAL WATER HYDROPNEUMATIC TANK T-301 PRESSURE

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65P301	65P301-2	LD-PS65P301	2	OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-5	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/6/7 & 10							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
SEAL WATER HYDROPNEUMATIC TANK T-301 PRESSURE

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P301-3

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65P301	65P301-3	LD-PS65P301	3	OF	3	1

LOOP NO: 65L410

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LAL	410	B	STORAGE TANK T-410	LO LEVEL	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	LSL	410	A	STORAGE TANK T-410	LO LEVEL	SWITCH	FIELD	MILLTRONICS	HYDRORANGER1	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LAL	410	B	STORAGE TANK T-410	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65L410	I-9	65L410-2	65L410-3
I	65	LSL	410	A	STORAGE TANK T-410	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65L410	I-9	65L410-2	65L410-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-9	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/6/11							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
HYPO BULK STORAGE TANK T-410 LEVEL

FILE NAME: 65L410-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L410	65L410-1	LD-PS65L410	1	OF	3	1

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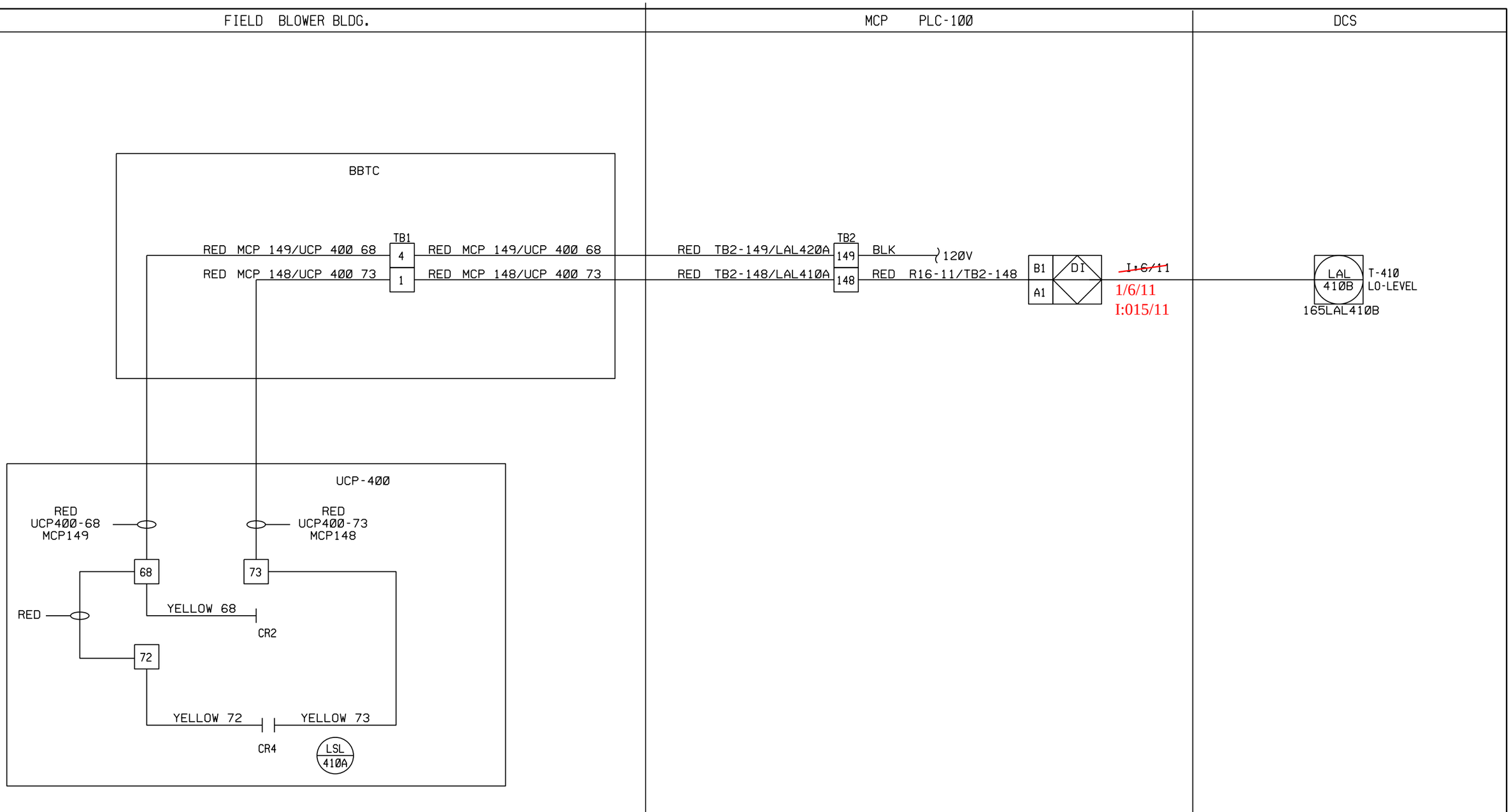


REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-9	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/6/11							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

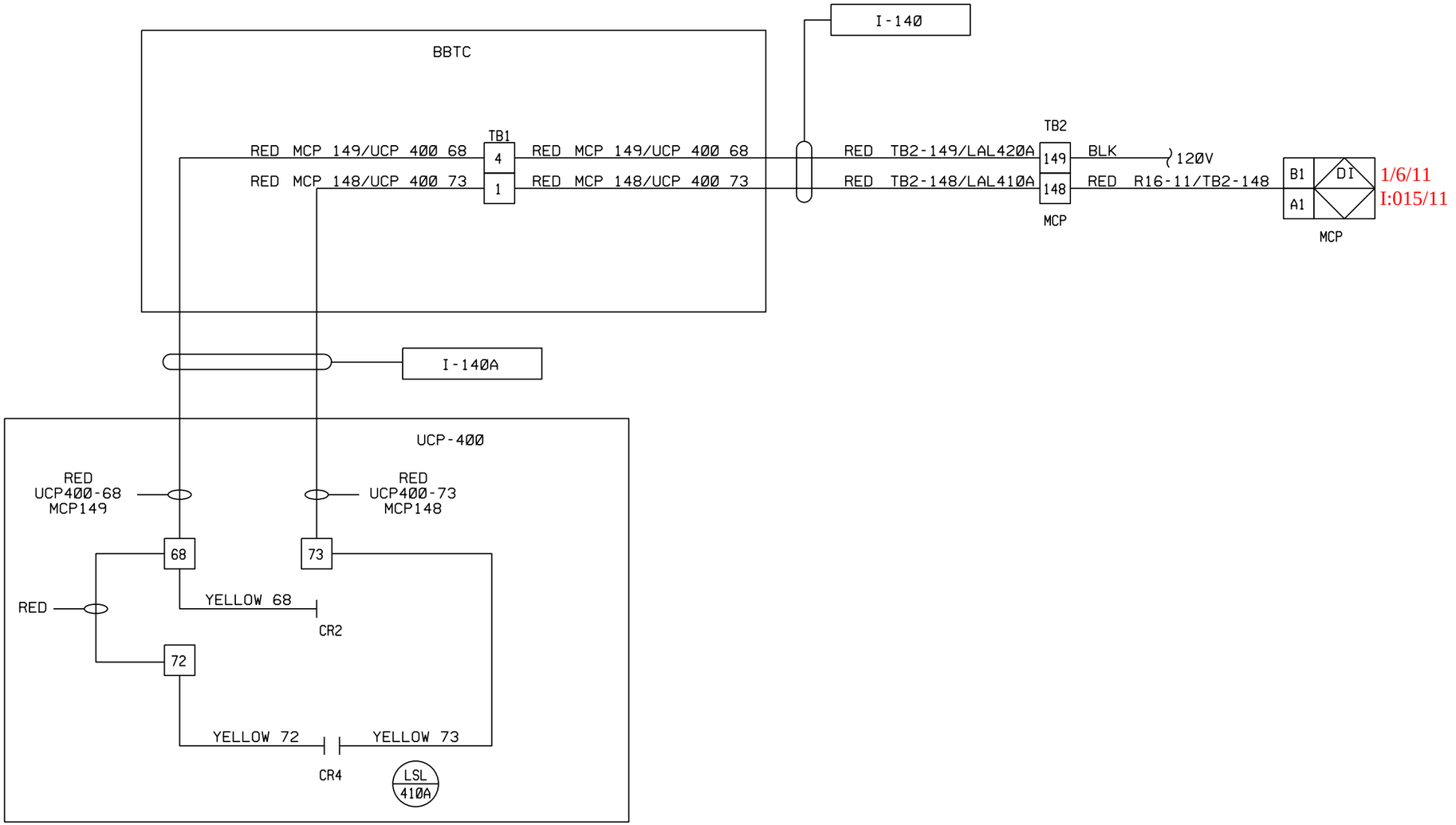
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L410-2

INSTRUMENT LOOP DIAGRAM
HYPO BULK STORAGE TANK T410 LEVEL

LOOP NO.	CAD FILE:	DWG NO. LD-PS65L410	SH	SH	REV
65L410	65L410-2		2 OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-9	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/6/11							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L410-3

INSTRUMENT LOOP DIAGRAM
HYPO BULK STORAGE TANK T410 LEVEL

LOOP NO.	CAD FILE:	DWG NO. LD-PS65L410	SH	SH	REV
65L410	65L410-3		3 OF	3	1

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LOOP NO: 65L420

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LAL	420	B	STORAGE TANK T-420	LO LEVEL	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	LSL	420	A	STORAGE TANK T-420	LO LEVEL	SWITCH	FIELD	MILLTRONICS	HYDRORANGER1	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LAL	420	B	STORAGE TANK T-420	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65L420	I-9	65L420-2	65L420-3
I	65	LSL	420	A	STORAGE TANK T-420	N/A	N/A	120VAC	N/A	N/A	N/A	LD-PS65L420	I-9	65L420-2	65L420-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-9	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/6/12							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
CAUSTIC BULK STORAGE TANK T-420 LEVEL

FILE NAME: 65L420-1

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65L420	65L420-1	LD-PS65L420	1	OF	3	1

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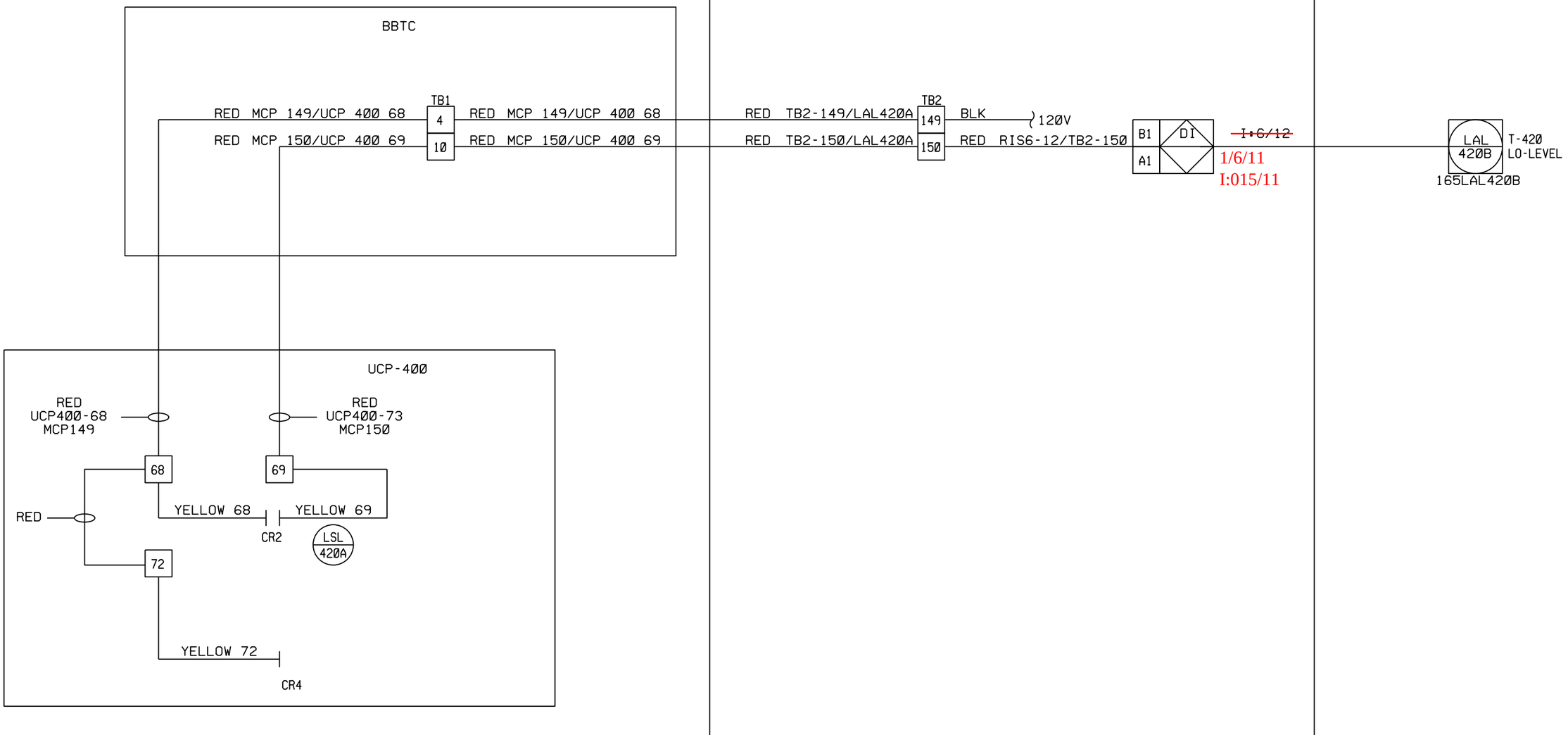

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-9	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/6/12							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L420-2

INSTRUMENT LOOP DIAGRAM
CAUSTIC BULK STORAGE TANK T420 LEVEL

LOOP NO.	CAD FILE:	DWG NO. LD-PS65L420	SH	SH	REV
65L420	65L420-2		2 OF	3	1

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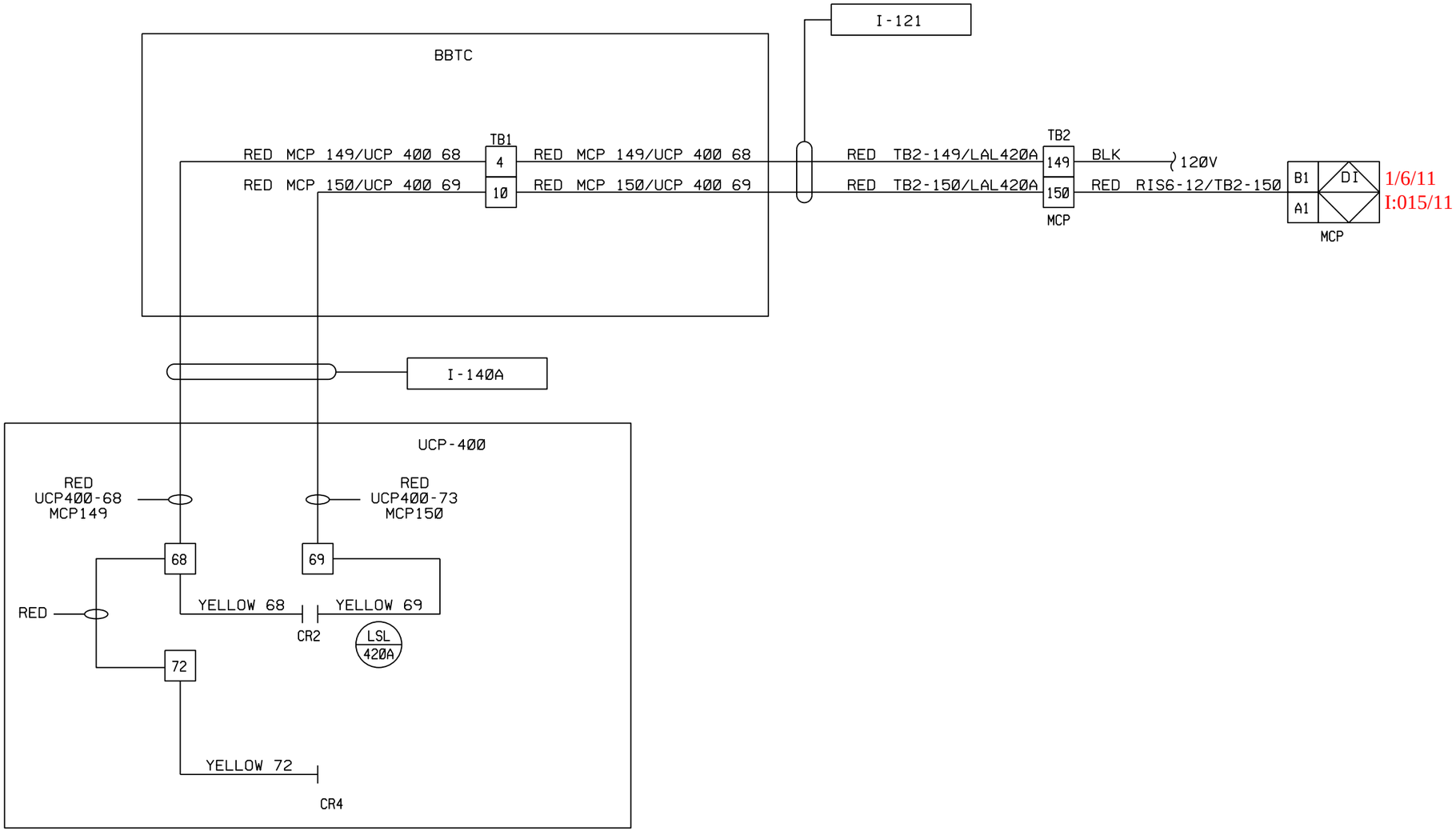

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-9	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/6/12							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L420-3

INSTRUMENT LOOP DIAGRAM
CAUSTIC BULK STORAGE TANK T420 LEVEL

LOOP NO.	CAD FILE:	DWG NO. LD-PS65L420	SH	SH	REV
65L420	65L420-3		3 OF	3	0

11-DEC-2008 12:01 chris R:\mwske\comnet\loops\project\ps65\65l420-3.dgn

LOOP NO: 65F442

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAH	442		EYEWASH	EYEWASH ALARM	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	FSH	442		EYEWASH	EYEWASH ALARM	SWITCH	FIELD	FLOWTECH	V6EPB-B648-ON	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAH	442		EYEWASH	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65F442	I-12	65F442-2	65F442-3
I	65	FSH	442		EYEWASH	S20.28	N/A	120VAC	0-2	GPM	1 GPM	LD-PS65F442	I-12	65F442-2	65F442-3

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chris
11-DEC-2008 11:51

REFERENCE DRAWINGS

P&ID: I-12

ELECTRICAL PLAN DRAWING: E-21

CONDUIT SCHEDULE: E11.1

1/6/13

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	10/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

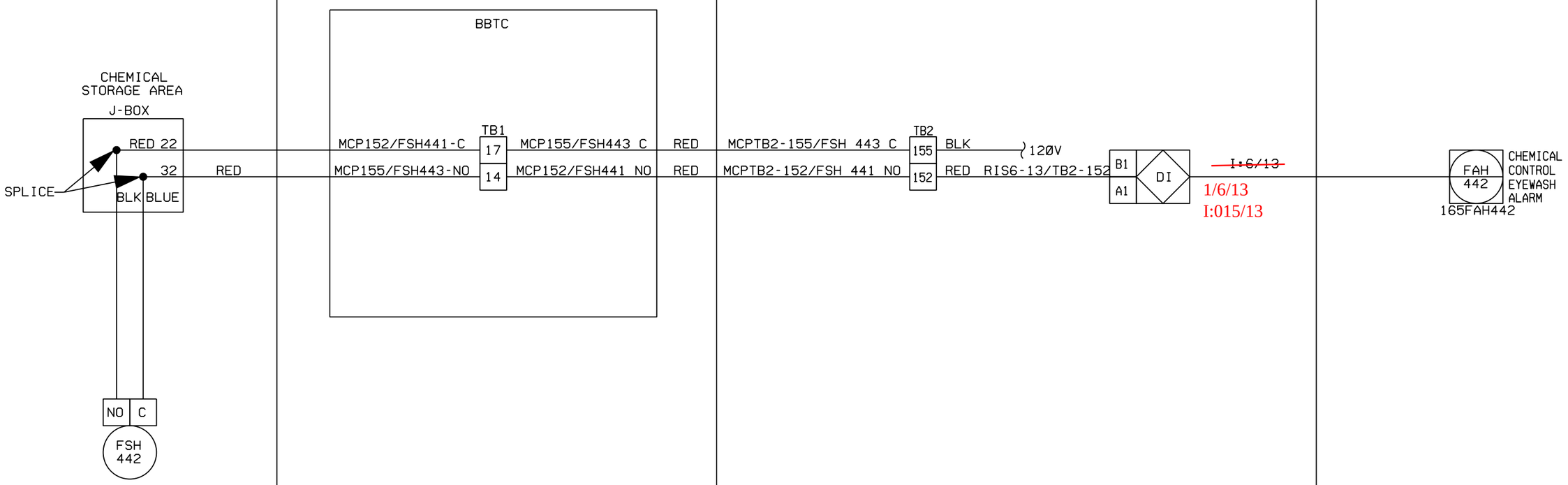
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
CHEMICAL STORAGE AREA EMERG. EYEWASH/SHOWER

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65F442-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F442	65F442-1	LD-PS65F442	1	OF	3	1

FIELD	BLOWER BLDG.	MCP PLC-100	DCS



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E11.1	1	10/04	AS-BUILT	JG			
1/6/13							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

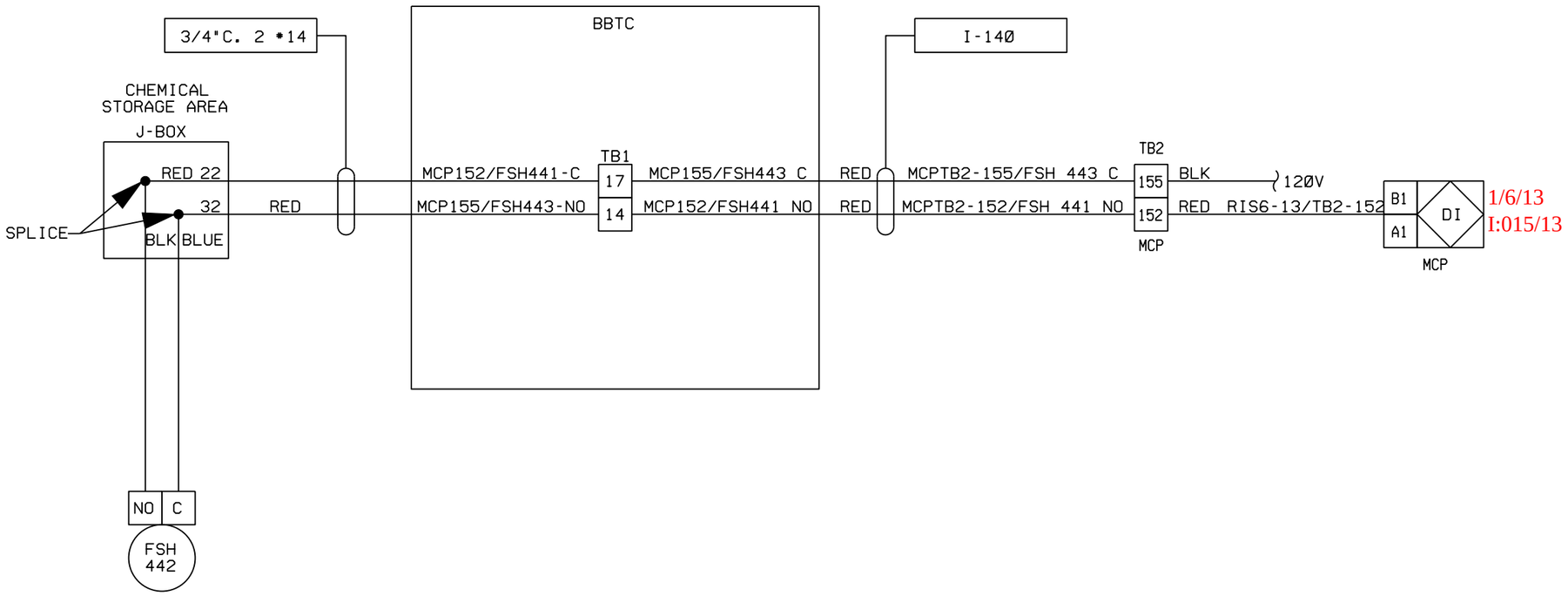
BROWN AUTOMATION JOB: 9079

INSTRUMENT LOOP DIAGRAM
CHEMICAL STORAGE AREA EMERG. EYE WASH/SHOWER

FILE NAME: 65F442-2

LOOP NO.	CAD FILE:	DWG NO.	SH	REV
65F442	65F442-2	LD-PS65F442	2 OF 3	2

11-DEC-2008 11:51 chris R:\mwske\comnet\loops\project\ps65\65f442-2.dgn



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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E11.1	1	10/04	AS-BUILT	JG			
1/6/13							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65F442-3

INSTRUMENT LOOP DIAGRAM
CHEMICAL STORAGE AREA EMERG. EYE WASH/SHOWER

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65F442	65F442-3	LD-PS65F442	3	OF	3	1

11-DEC-2008 11:51 chris R:\mwske\comnet\loops\project\ps65\65f442-3.dgn

LOOP NO: 65F441

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAH	441		EYEWASH	EYEWASH ALARM	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS64-200	
I	65	FSH	441		EYEWASH	EYEWASH ALARM	SWITCH	FIELD	FLOWTECH	V6EPB-B648-ON	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAH	441		EYEWASH	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65F441	I-12	65F441-2	65F441-3
I	65	FSH	441		EYEWASH	S20.28	N/A	120VAC	0-2	GPM	1 GPM	LD-PS65F441	I-12	65F441-2	65F441-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E11.1	1	10/04	AS-BUILT	JG			
1/6/14							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

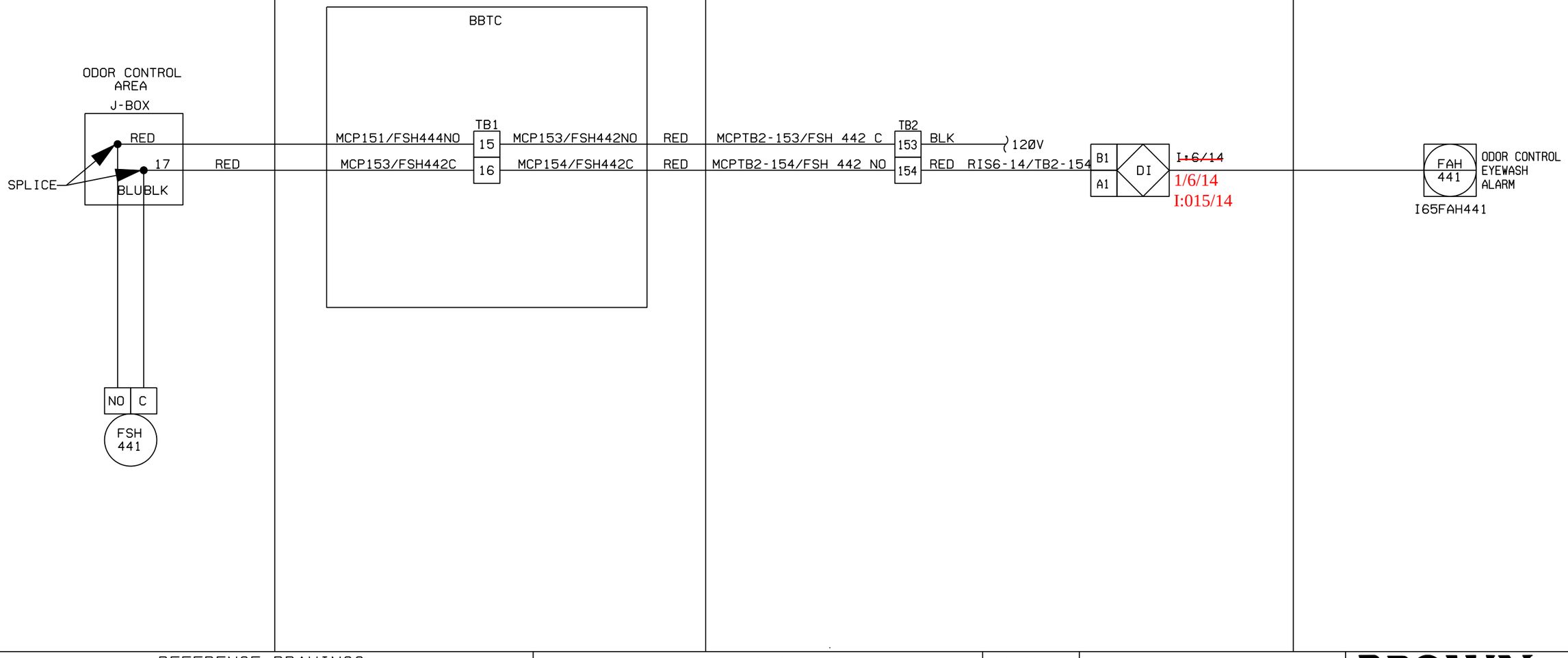
LOOP DIAGRAM SCHEDULE
ODOR CONTROL AREA EMERG. EYEWASH/SHOWER

FILE NAME: 65F441-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F441	65F441-1	LD-PS65F441	1	OF	3	1

11-DEC-2008 11:50 chris R:\mwske\comnet\loops\project\ps65\65f441-1.dgn

FIELD	FIELD ELECTRICAL ROOM	MCP PLC-100	DCS



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E11.1	1	10/04	AS-BUILT	JG			
1/6/14							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

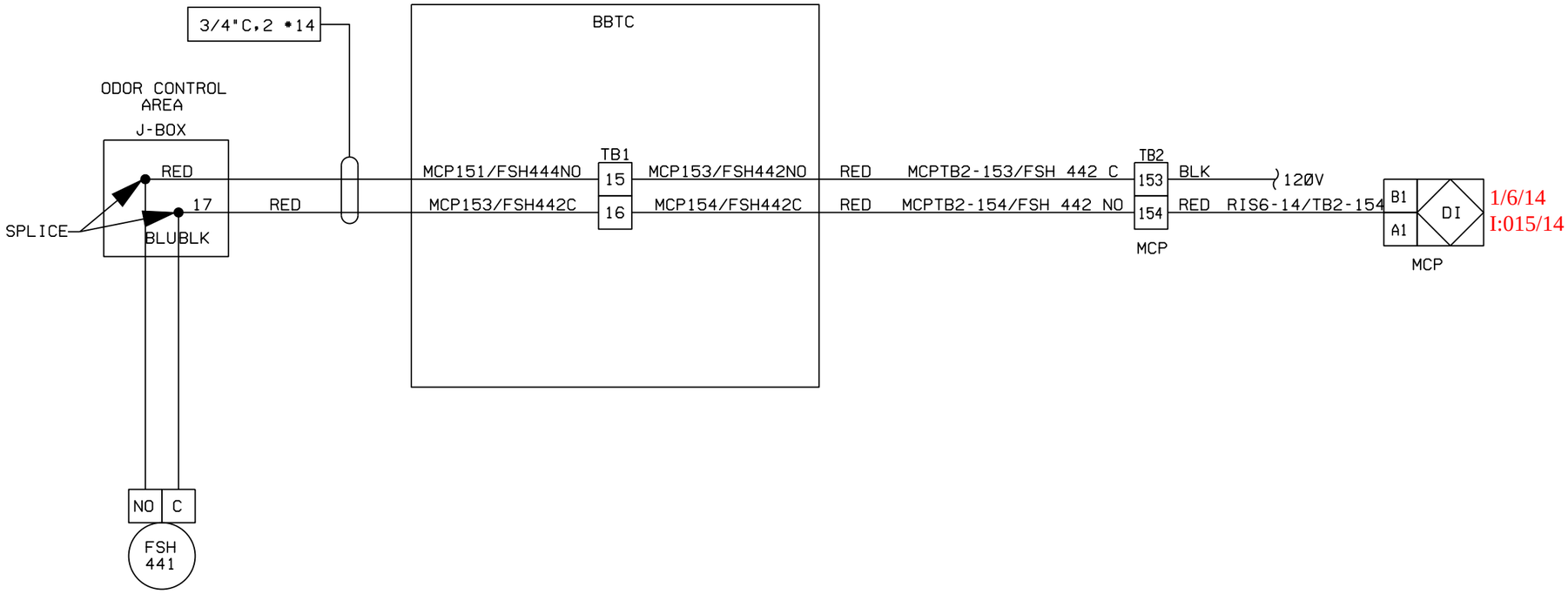
BROWN AUTOMATION JOB# 9079

INSTRUMENT LOOP DIAGRAM
ODOR CONTROL AREA EMERG. EYE WASH/SHOWER

FILE NAME: 65F441-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65F441	65F441-2	LD-PS65F441	2 OF	3	1

11-DEC-2008 11:50 chris R:\mwske\comnet\loops\project\ps65\65f441-2.dgn



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E11.1	1	10/04	AS-BUILT	JG			
1/6/14							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

INSTRUMENT LOOP DIAGRAM
ODOR CONTROL AREA EMERG. EYE WASH/SHOWER

FILE NAME: 65F441-3

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65F441	65F441-3	LD-PS65F441	3	OF	3	1

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LOOP NO: 65F443

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAH	443		EYEWASH	EYEWASH ALARM	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	FSH	443		EYEWASH	EYEWASH ALARM	SWITCH	FIELD	FLOWTECH	V6EPB-B648-ON	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAH	443		EYEWASH	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65F443	I-12	65F443-2	65F443-3
I	65	FSH	443		EYEWASH	S20.28	N/A	120VAC	0-2	GPM	1 GPM	LD-PS65F443	I-12	65F443-2	65F443-3

REFERENCE DRAWINGS	REV NO	DATE	DESTROY ALL PRINTS BEARING EARLIER DATE	BY	CKD	APPROVALS PROJ ENGR	PROJ MGR
P&ID: I-12							
ELECTRICAL PLAN DRAWING: E-21	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E11.1	1	10/04	AS-BUILT	JG			
1/6/15							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
BLOWER BLDG. EMERG. EYEWASH/SHOWER

FILE NAME: 65F443-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F443	65F443-1	LD-PS65F443	1	OF	3	1

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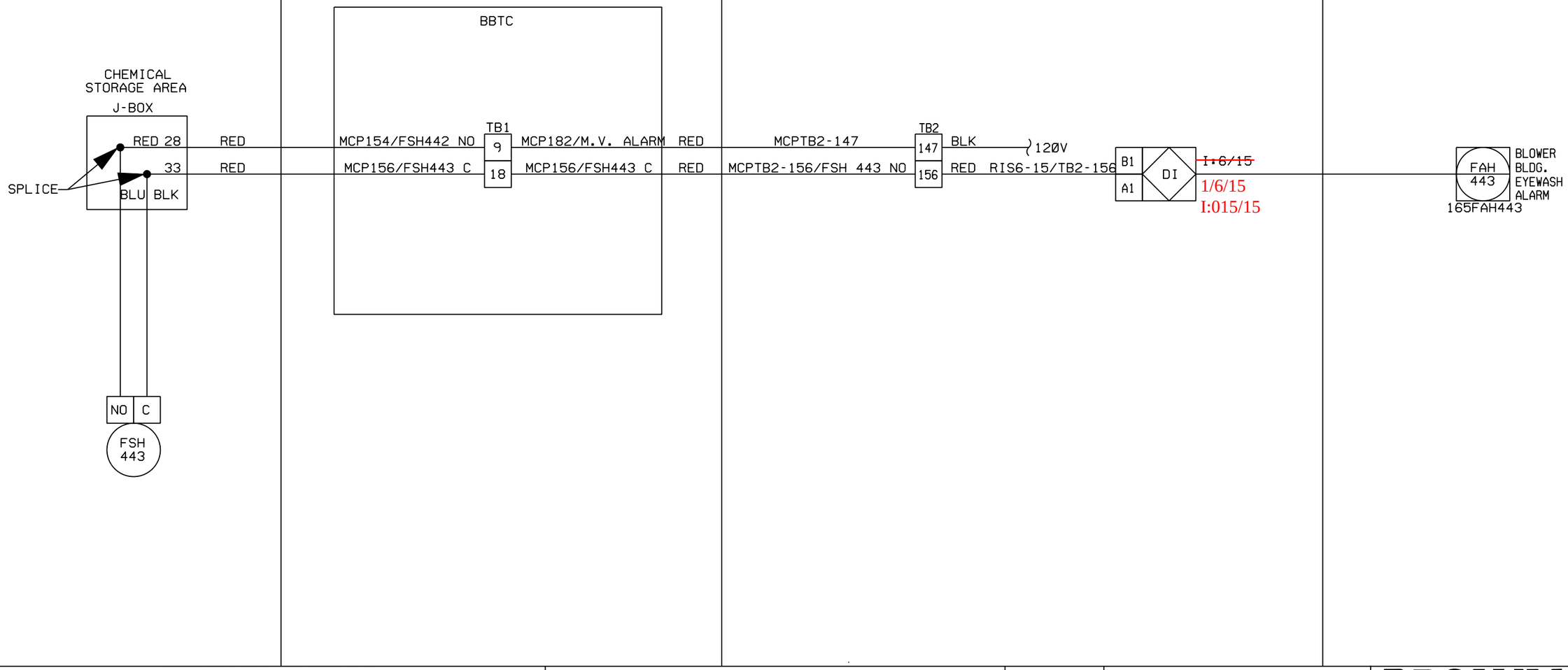
FIELD	BLOWER BLDG.	MCP PLC-100	DCS



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E11.1	1	10/04	AS-BUILT	JG			
1/6/15							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

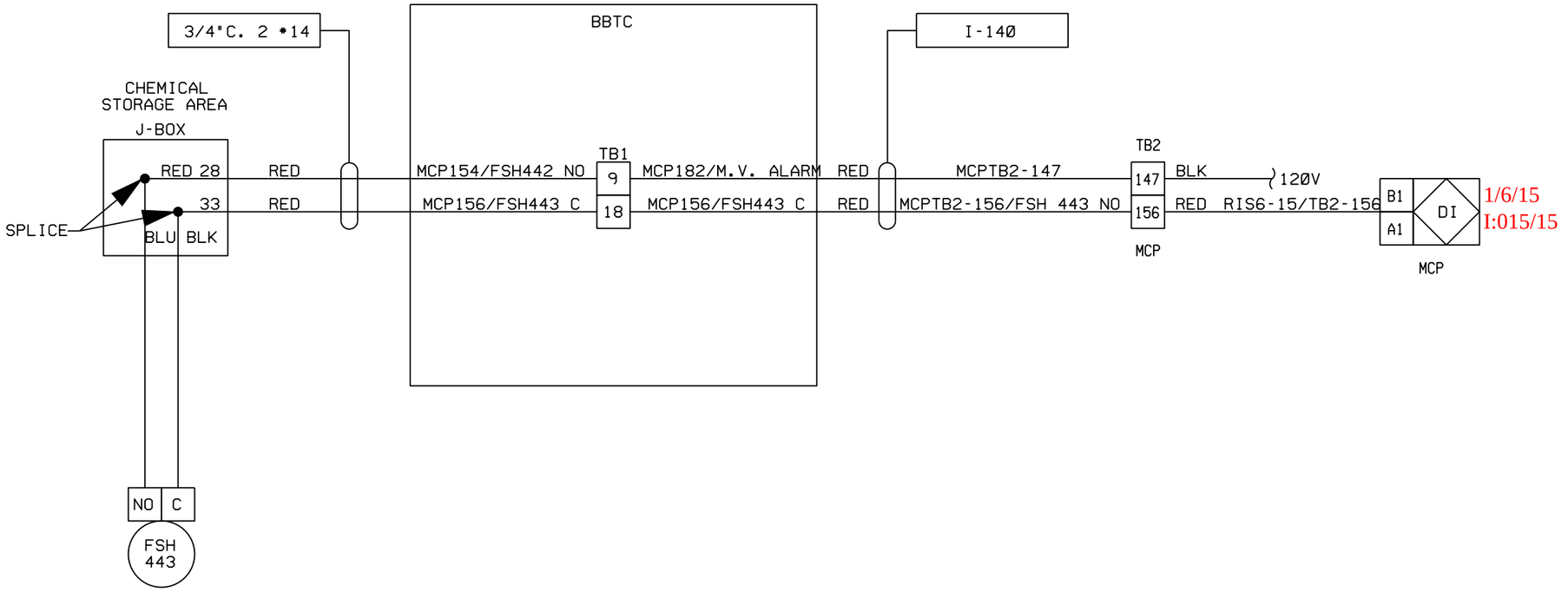
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
BLOWER BLDG. EMERG. EYE WASH/SHOWER

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65F443-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F443	65F443-2	LD-PS65F443	2	OF	3	1



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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-21	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E11.1	1	10/04	AS-BUILT	JG			
1/6/15							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
BLOWER BLDG. EMERG. EYE WASH/SHOWER

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65F443-3

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65F443	65F443-3	LD-PS65F443	3	OF	3	1

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LOOP NO: 65F444

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FAH	444		EYEWASH	EYEWASH ALARM	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	FSH	444		EYEWASH	EYEWASH ALARM	SWITCH	FIELD	FLOWTECH	V6EPB-B648-ON	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FAH	444		EYEWASH	N/A	DI	120VAC	N/A	N/A	N/A	LD-PS65F444	N/A	65F444-2	65F444-3
I	65	FSH	444		EYEWASH	S20.28	N/A	120VAC	0-2	GPM	1 GPM	LD-PS65F444	N/A	65F444-2	65F444-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-22	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E11.1	1	10/04	AS-BUILT	JG			
1/6/16							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
MECHANICAL BLDG. EMERG. EYEWASH/SHOWER

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB: 9079
FILE NAME: 65F444-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F444	65F444-1	LD-PS65F444	1	OF	3	1

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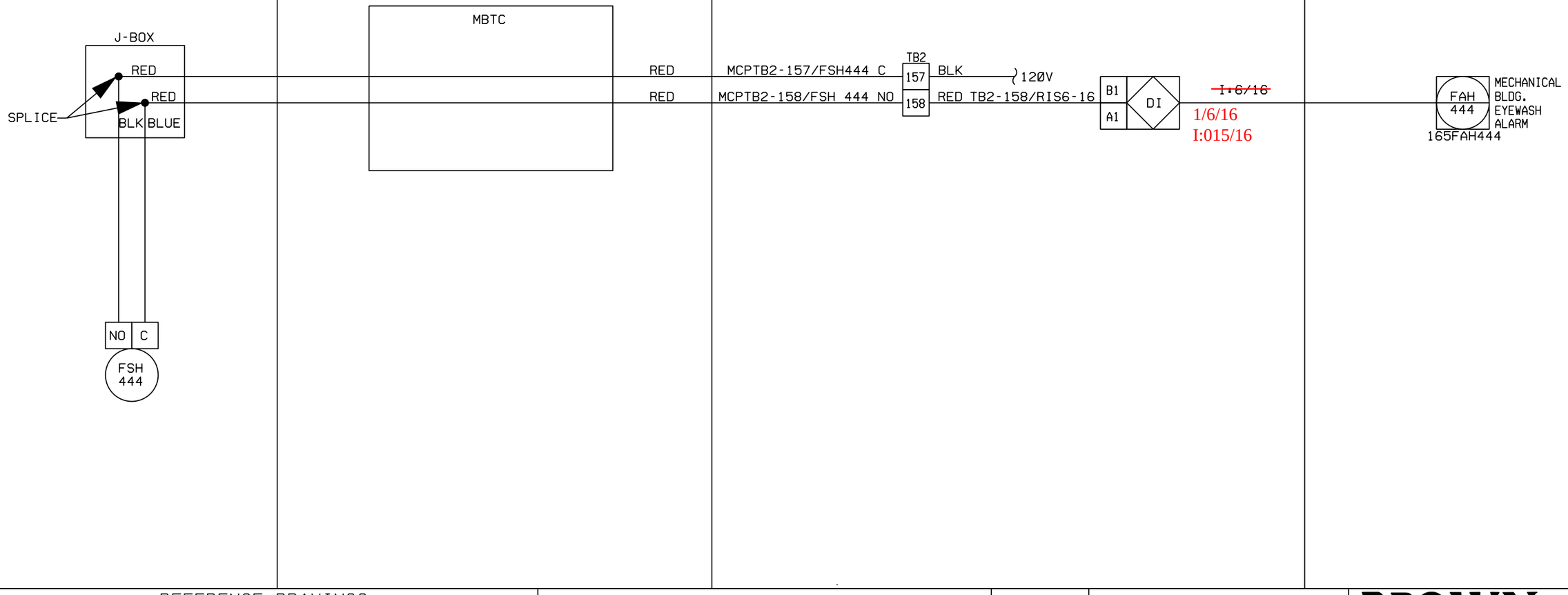
MECH. BLDG. SHOP	MECHANICAL BLDG. EQUIPMENT ROOM	MCP PLC-100	DCS



REFERENCE DRAWINGS
P&ID: I-12
ELECTRICAL PLAN DRAWING: E-22
CONDUIT SCHEDULE: E11.1
1/6/16

REV NO	DATE	DESTROY ALL PRINTS BEARING EARLIER DATE	BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
1	1Ø/Ø4	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

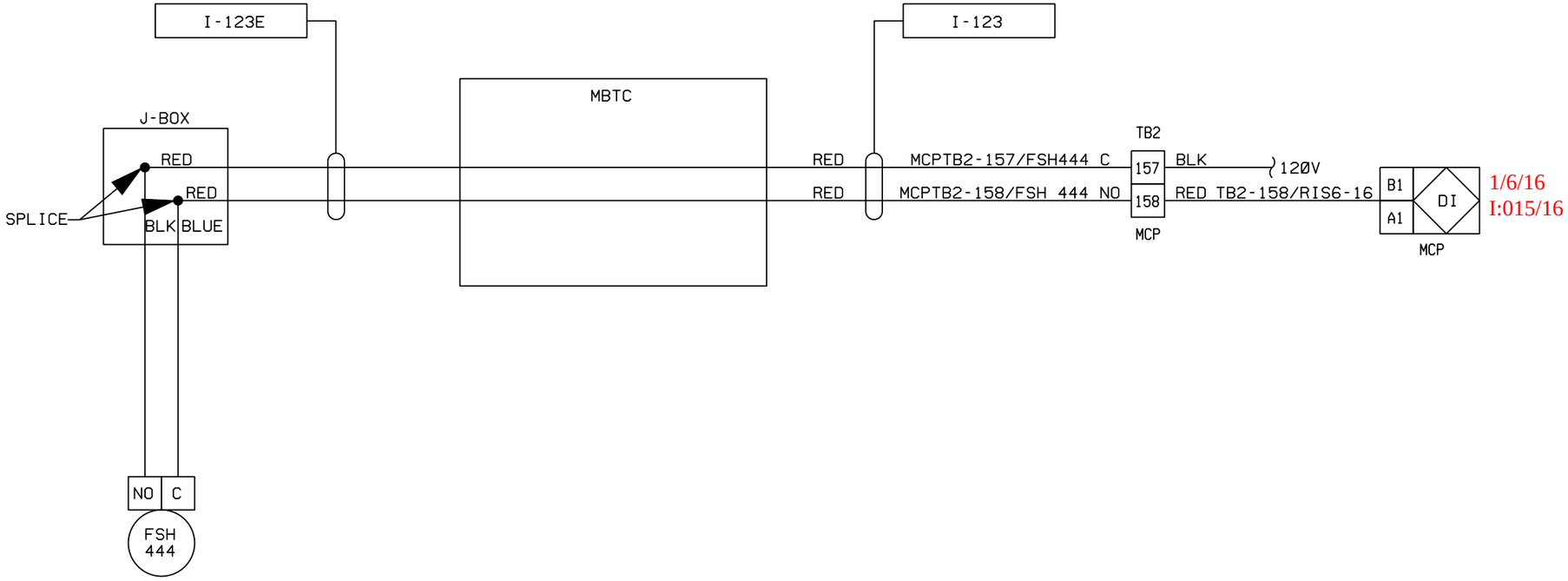
BROWN AUTOMATION JOB# 9079

INSTRUMENT LOOP DIAGRAM
MECHANICAL BLDG. EMERG. EYE WASH/SHOWER

FILE NAME: 65F444-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65F444	65F444-2	LD-PS65F444	2 OF	3	1

11-DEC-2008 11:52 chris R:\mwske\comnet\loops\project\ps65\65f444-2.dgn



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chris
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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-12	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-22	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E11.1	1	10/04	AS-BUILT	JG			
1/6/16							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

INSTRUMENT LOOP DIAGRAM
MECHANICAL BLDG. EMERG. EYE WASH/SHOWER

FILE NAME: 65F444-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65F444	65F444-3	LD-PS65F444	3 OF	3	1

LOOP NO: 65Y141

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZLC	141		FORCE MAIN VALVE	V-141 CLOSED	STATUS	PLC-100	TBD					EXISTING
I	65	ZLO	141		FORCE MAIN VALVE	V-141 OPEN	STATUS	PLC-100	TBD					EXISTING
I	65	ZL	141		FORCE MAIN VALVE	V-141 LOCAL	STATUS	PLC-100	TBD					NEW
I	65	HS	141	A	FORCE MAIN VALVE	V-141 CLOSED	COMMAND	PLC-100	TBD					EXISTING
I	65	HS	141	B	FORCE MAIN VALVE	V-141 OPEN	COMMAND	PLC-100	TBD					EXISTING
I	65	ZSC	141		FORCE MAIN VALVE	V-141 CLOSED	SWITCH	FIELD	TBD					EXISTING
I	65	ZSO	141		FORCE MAIN VALVE	V-141 OPEN	SWITCH	FIELD	TBD					EXISTING
I	65	ZSL	141		FORCE MAIN VALVE	V-141 LOCAL	SWITCH	FIELD	TBD					EXISTING
I	65	HS	141	C	FORCE MAIN VALVE	V-141 OPEN	SWITCH	FIELD	TBD					EXISTING
I	65	HS	141	D	FORCE MAIN VALVE	V-141 CLOSED	SWITCH	FIELD	TBD					EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZLC	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZLO	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZL	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	A	FORCE MAIN VALVE	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	B	FORCE MAIN VALVE	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSC	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSO	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSL	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	C	FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	D	FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y141-1

LOOP DIAGRAM SCHEDULE
FORCE MAIN VALVE V-141

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y141	65Y141-1	LD-PS65Y141	1	OF	3	0

1/6/17

FIELD METER VAULT V-141

MCP PLC-100

COMPUTER SCREEN

LS COMMON C5 RED 28
LS CLOSE C2 RED 29
LS OPEN C6 RED 23
ZSC 141
ZSO 141
NEW CONTACT
ZSL 141
OPEN F7 RED 39
HS 141C
RED 42
COMMON 120V D1 RED 30
HS 141D
CLOSE F2 RED 33
RED 34
COMMON O/C D2 RED 41

V-141
KEYSTONE CONTROLS

MVPB

RED 28 3 RED (31)
RED 32 1 RED (32)
RED 2 RED (160)
NEW TB
TB NEW
RED 39 8 RED (190)
RED 30 6 RED (187)
RED 33 7 RED (188)

MVTC

RED TB2-31 U141-C5 TB2 31 BLK 120V
RED TB2-32 U141-C2 32 RED TB2-32/RIS1-17
TB2 160 RED RIS6-17/TB2-160
NEW TB 120V
TO LSHH 50 RED TB2-46 LSHH 50 RED TB2 46 RED TB2-46/RIS3-06

B1 A1 DI I:1/17
B1 A1 DI ~~I:6/17~~ 1/6/17 I:015/17
B1 A1 DI
B1 A1 DI I:3/06

ZLC 141 V-141 "CLOSED" 165ZLC141
ZLO 141 V-141 "OPEN" 165ZLO141
ZL 141 V-141 "LOCAL" 165ZL141
LAHH 50 HI-HI SUMP LEVEL

RED TB2-190 U141 OPEN 1
RED TB2-187 U141 9
RED TB2-188 U141 CLOSE 5

1
RED IDEC RH2B-U
13 U141 14 RED N

MCC B V-141

RED 6 RED 48 TB1A 48 RED 48
RED 5 RED 50 50 RED 50 CR14
RED 49
RED 4 RED 47 47 RED 47 CR13

RED 30 TB1A 30 RED 30 CR14
WHT N 120V BLK
CR13 TB1A 29 RED 29 RED 29

B1 A1 DO O:16/15
B1 A1 DO O:16/14

HS 141B V-141 CLOSE 165HS141B
HS 141A V-141 OPEN 165HS141A

LEGEND
EXISTING
NEW
SPLICE POINT

REFERENCE DRAWINGS
TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

APPROVALS

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y141-2

INSTRUMENT LOOP DIAGRAM
FORCE MAIN VALVE V-141

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y141	65Y141-2	LD-PS65Y141	2 OF	3	Ø

1/6/17

LOOP NO: 65L10

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LALL	10		OPER. WET WELL	LEVEL LO-LO	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	LIT	10		OPER. WET WELL	LEVEL LO-LO	TRANSMITTER	CP-10	ROSEMOUNT	1151DP5S 52B3MH	N/A	N/A	N/A	EXISTING
I	65	LAHH	10		OPER. WET WELL	ALARM	ALARM	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LALL	10		OPER. WET WELL	N/A	N/A	N/A	N/A	N/A	N/A	LD-PS65L10	I-4	65L10-2	65L10-3
I	65	LIT	10		OPER. WET WELL	S20.20	AI	4-20MA	0-750	I.W.C	N/A	LD-PS65L10	I-4	65L10-2	65L10-3
I	65	LAHH	10		OPER. WET WELL	N/A	N/A	N/A	N/A	N/A	N/A	LD-PS65L10	I-4	65L10-2	65L10-3

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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/04							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
OPERATIONAL WET WELL LEVEL

FILE NAME: 65L10-1

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65L10	65L10-1	LD-PS65L10	1 OF	3	1

FIELD BUBBLIER PANEL CP-10 | MCP PLC-100 | DCS

ANNUNCIATOR
PANALARM MODEL* 90CL1B

24VDC — BLUE — CR4 — RED — CR4-12/LT 2 — LALL 10 — YELLOW — 24VDC RETURN

CR4 (14, 13)
WHT
RED CR4-14/PB1-2
2 — PB-1 MICRO SW. ALARM RESET BUTTON — 5
RED PB1-5/TB1-6

TB1: 7 — RED — RED — NUETRAL TB 2 — WHT — N
TB1: 6 — RED — RED — 192 — RED — RIS2-38/TB-192

120V — BLK — B1 / A1 — DO

LIT 10 (+, -)
WHT — TB1: 8 — BLK — CP10/TB1-8
BLK — TB1: 9 — WHT — CP10/TB1-9
TB1: 10

24VDC SUPPLY
TB3-1/LIT10 (+) — BLK — TB3: 1 — BLUE
TB3-2/LIT10 (-) — WHT — TB3: 2 — GRAY RIS7-18 — WHT — HART INPUT — I:7/18
TB3: 3
YELLOW
24VDC RETURN
A1 / B1 / AI
LI-10
1/7/4
N16:4

LAHH 10 — 165LAHH10 — OPER. WET WELL LEVEL HI-HI
LALL 10 — 165LALL10 — OPER. WET WELL LEVEL LO-LO

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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/04							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

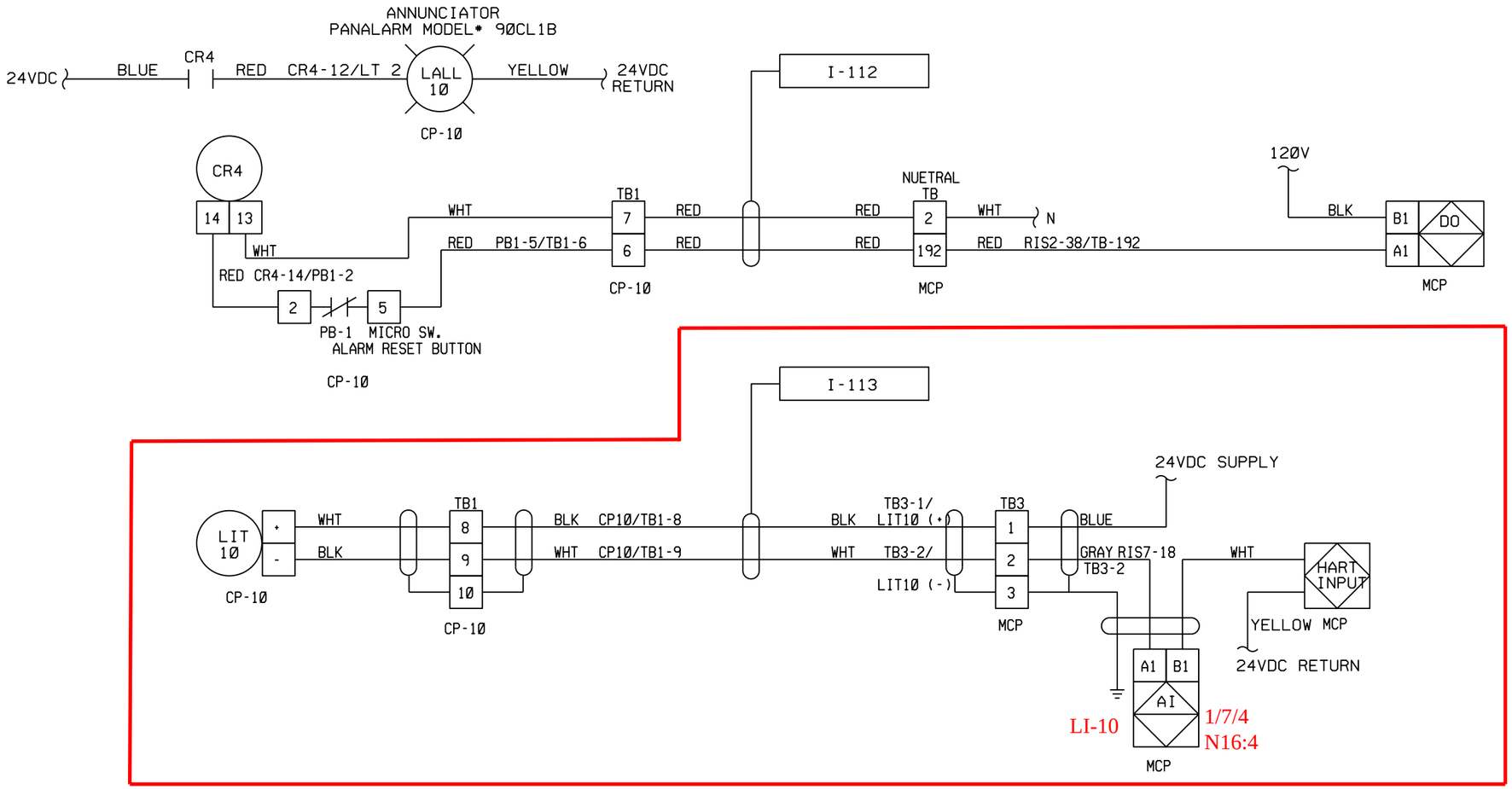
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L10-2

INSTRUMENT LOOP DIAGRAM
OPERATIONAL WET WELL LEVEL

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L10	65L10-2	LD-PS65L10	2	OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/04							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L10-3

INSTRUMENT LOOP DIAGRAM
OPERATIONAL WET WELL LEVEL

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65L10	65L10-3	LD-PS65L10	3	OF 3	1

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LOOP NO: 65P101

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	PI	101	A	P-101	SUCTION PRESS.	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PI	101	B	P-101	DISCHARGE PRESS.	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PIT	101	A	P-101	SUCTION PRESS.	PRES.TRANSM.	FIELD	ROSEMOUNT	1151 GP 6S5B1M4	N/A	N/A	N/A	EXISTING
I	65	PIT	101	B	P-101	DISCHARGE PRESS.	PRES.TRANSM.	FIELD	ROSEMOUNT	1151 GP 6S5B1M4	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	PI	101	A	P-101	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65P101	I-3	65P101-2	65P101-3
I	65	PI	101	B	P-101	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65P101	I-3	65P101-2	65P101-3
I	65	PIT	101	A	P-101	S20.23	N/A	4-20MA	N/A	N/A	N/A	LD-PS65P101	I-3	65P101-2	65P101-3
I	65	PIT	101	B	P-101	S20.23	N/A	4-20MA	N/A	N/A	N/A	LD-PS65P101	I-3	65P101-2	65P101-3

REFERENCE DRAWINGS
P&ID: I-3
ELECTRICAL PLAN DRAWING: E-16
CONDUIT SCHEDULE: E-11.1
1/7/05 & 06

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	11/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-101 DISCHARGE & SUCTION PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P101-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65P101	65P101-1	LD-PS65P101	1	OF	3	1

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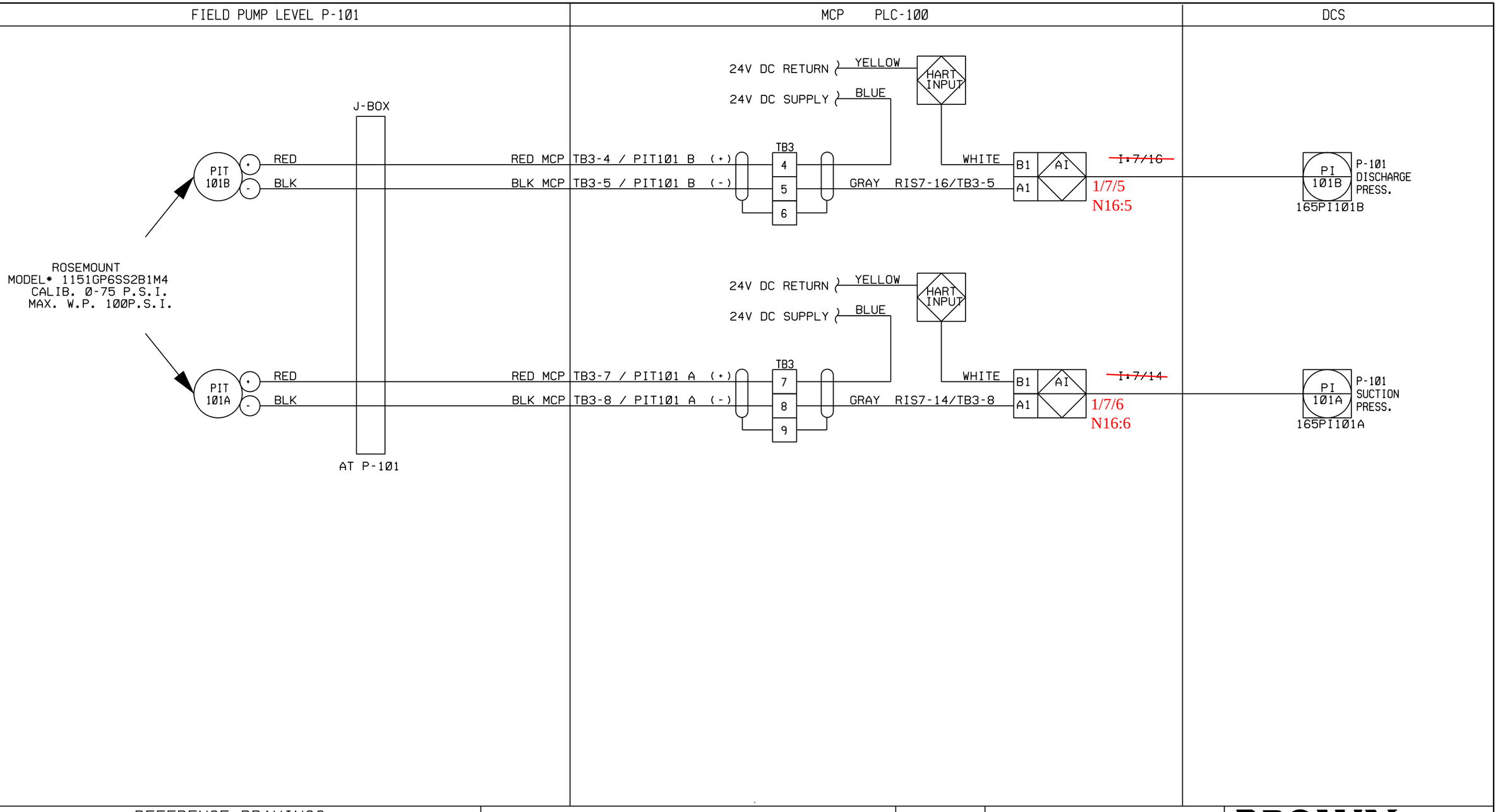


REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/05 & 06							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

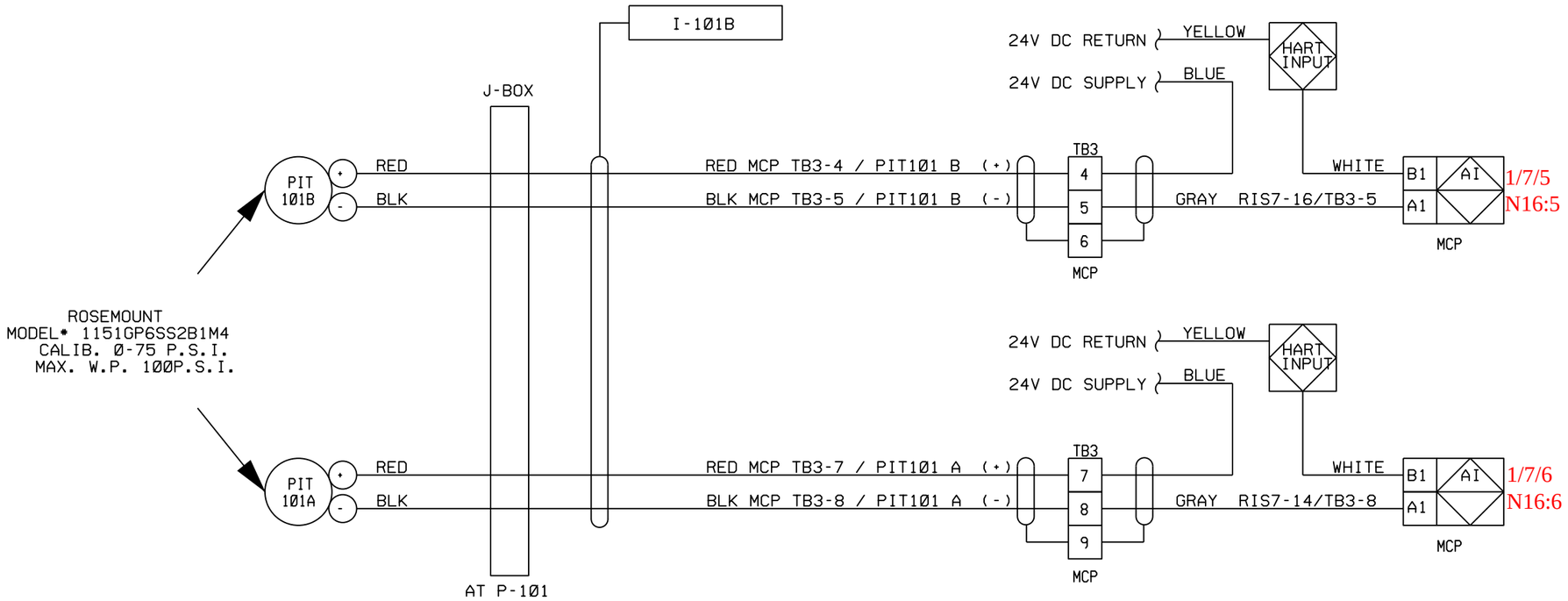
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-101 DISCHARGE & SUCTION PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P101-2

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65P101	65P101-2	LD-PS65P101	2	OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/05 & 06							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-101 DISCHARGE & SUCTION PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P101-3

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65P101	65P101-3	LD-PS65P101	3	OF	3	1

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LOOP NO: 65P102

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	PI	102	A	P-102	SUCTION PRESS.	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PI	102	B	P-102	DISCHARGE PRESS.	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PIT	102	A	P-102	SUCTION PRESS.	PRES.TRANSM.	FIELD	ROSEMOUNT	1151 GP 6S5B1M4	N/A	N/A	N/A	EXISTING
I	65	PIT	102	B	P-102	DISCHARGE PRESS.	PRES.TRANSM.	FIELD	ROSEMOUNT	1151 GP 6S5B1M4	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	PI	102	A	P-102	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65P102	I-3	65P102-2	65P102-3
I	65	PI	102	B	P-102	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65P102	I-3	65P102-2	65P102-3
I	65	PIT	102	A	P-102	S20.23	N/A	4-20MA	N/A	N/A	N/A	LD-PS65P102	I-3	65P102-2	65P102-3
I	65	PIT	102	B	P-102	S20.23	N/A	4-20MA	N/A	N/A	N/A	LD-PS65P102	I-3	65P102-2	65P102-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/07 & 08							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-102 DISCHARGE & SUCTION PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P102-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65P102	65P102-1	LD-PS65P102	1	OF	3	1

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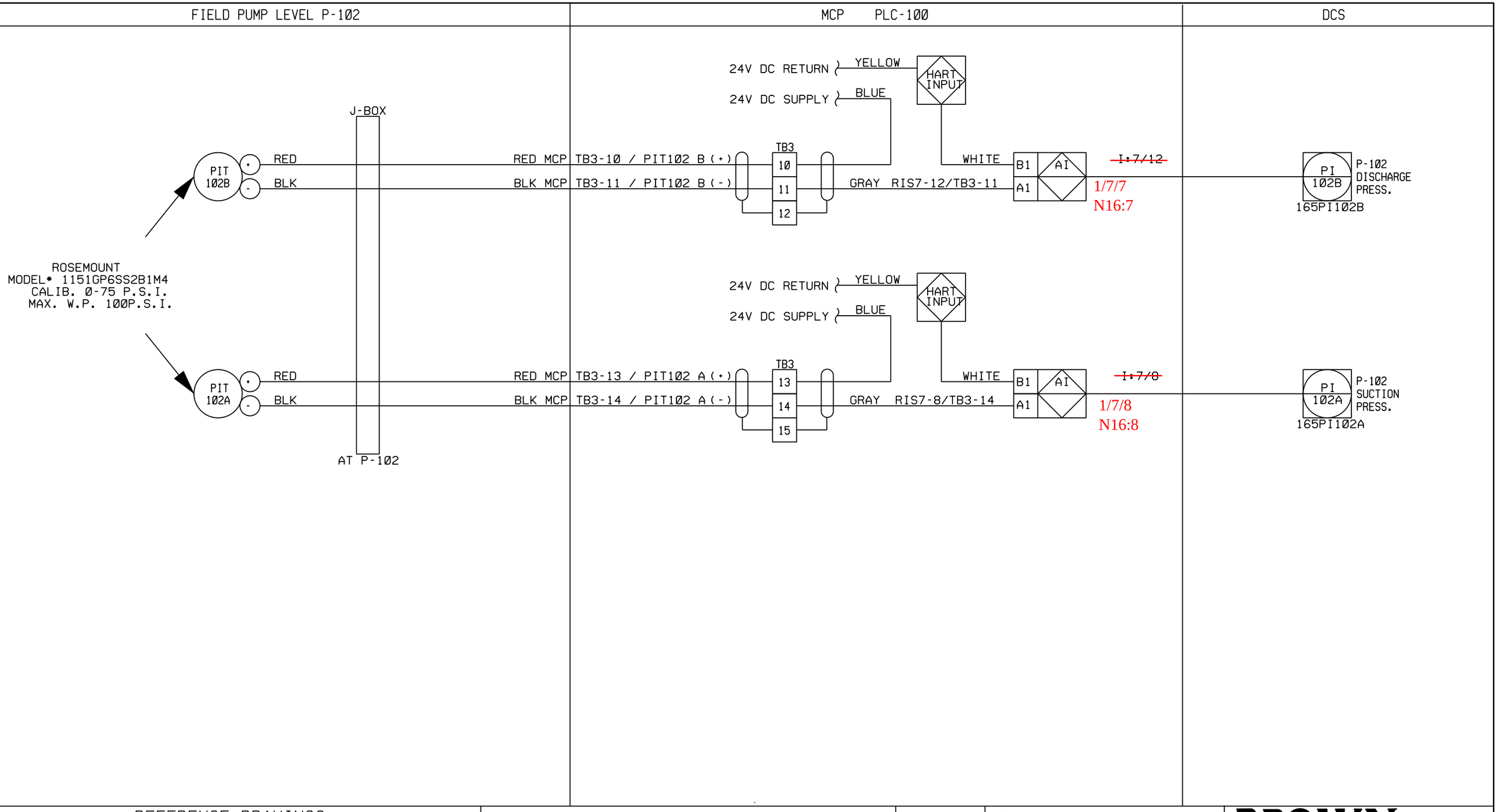


REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/07 & 08							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

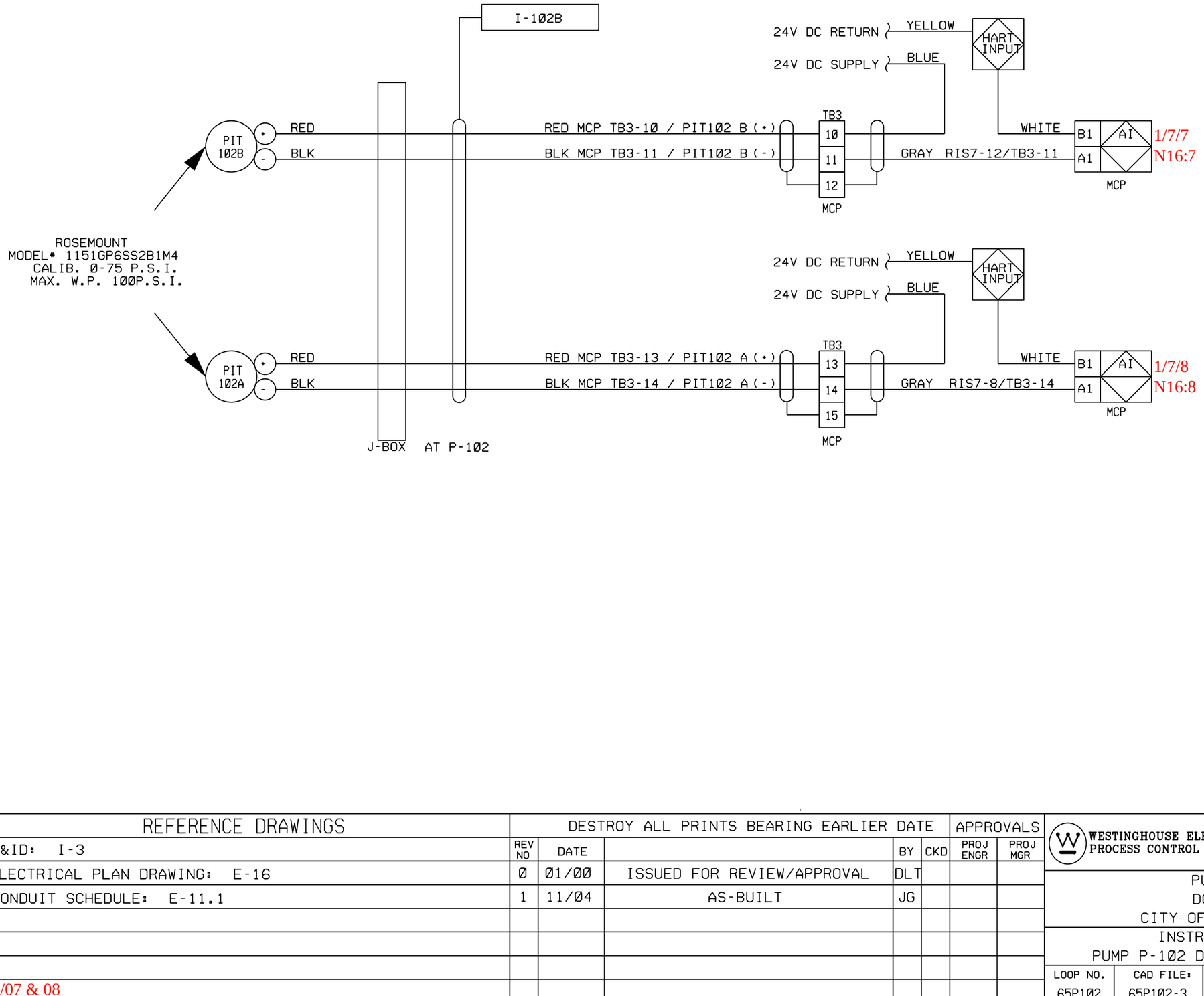
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-102 DISCHARGE & SUCTION PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P102-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65P102	65P102-2	LD-PS65P102	2 OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/07 & 08							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-102 DISCHARGE & SUCTION PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P102-3

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65P102	65P102-3	LD-PS65P102	3	OF	3	1

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LOOP NO: 65P103

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	PI	103	A	P-103	SUCTION PRESS.	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PI	103	B	P-103	DISCHARGE PRESS.	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PIT	103	A	P-103	SUCTION PRESS.	PRES.TRANSM.	FIELD	ROSEMOUNT	1151 GP 6S5B1M4	N/A	N/A	N/A	EXISTING
I	65	PIT	103	B	P-103	DISCHARGE PRESS.	PRES.TRANSM.	FIELD	ROSEMOUNT	1151 GP 6S5B1M4	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	PI	103	A	P-103	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65P103	I-3	65P103-2	65P103-3
I	65	PI	103	B	P-103	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65P103	I-3	65P103-2	65P103-3
I	65	PIT	103	A	P-103	S20.23	N/A	4-20MA	N/A	N/A	N/A	LD-PS65P103	I-3	65P103-2	65P103-3
I	65	PIT	103	B	P-103	S20.23	N/A	4-20MA	N/A	N/A	N/A	LD-PS65P103	I-3	65P103-2	65P103-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/09 & 10							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

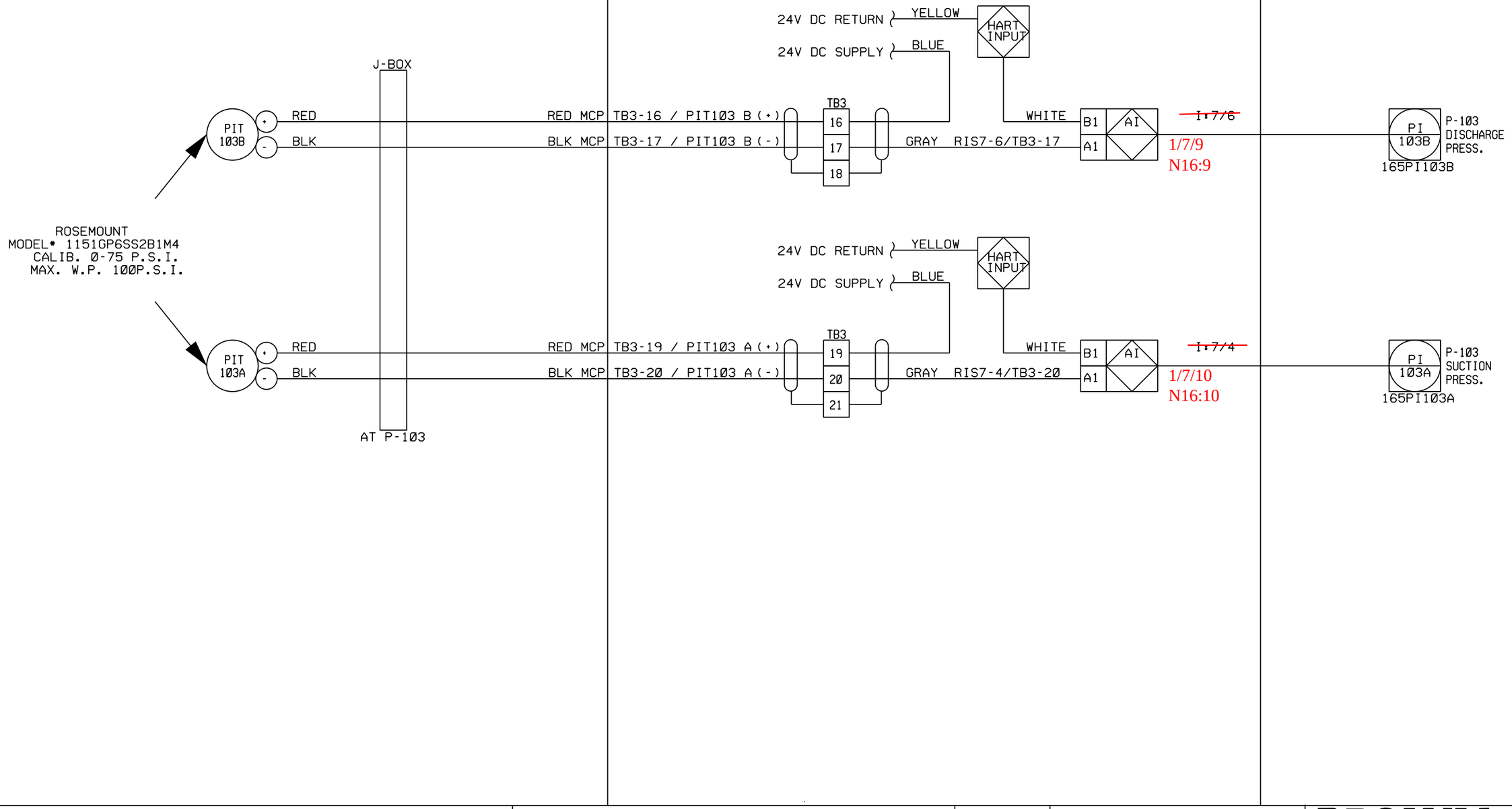
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-103 DISCHARGE & SUCTION PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P103-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65P103	65P103-1	LD-PS65P103	1	OF	3	1

FIELD PUMP LEVEL P-103 | MCP PLC-100 | DCS



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/09 & 10							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-103 DISCHARGE & SUCTION PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P103-2

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65P103	65P103-2	LD-PS65P103	2	OF	3	1

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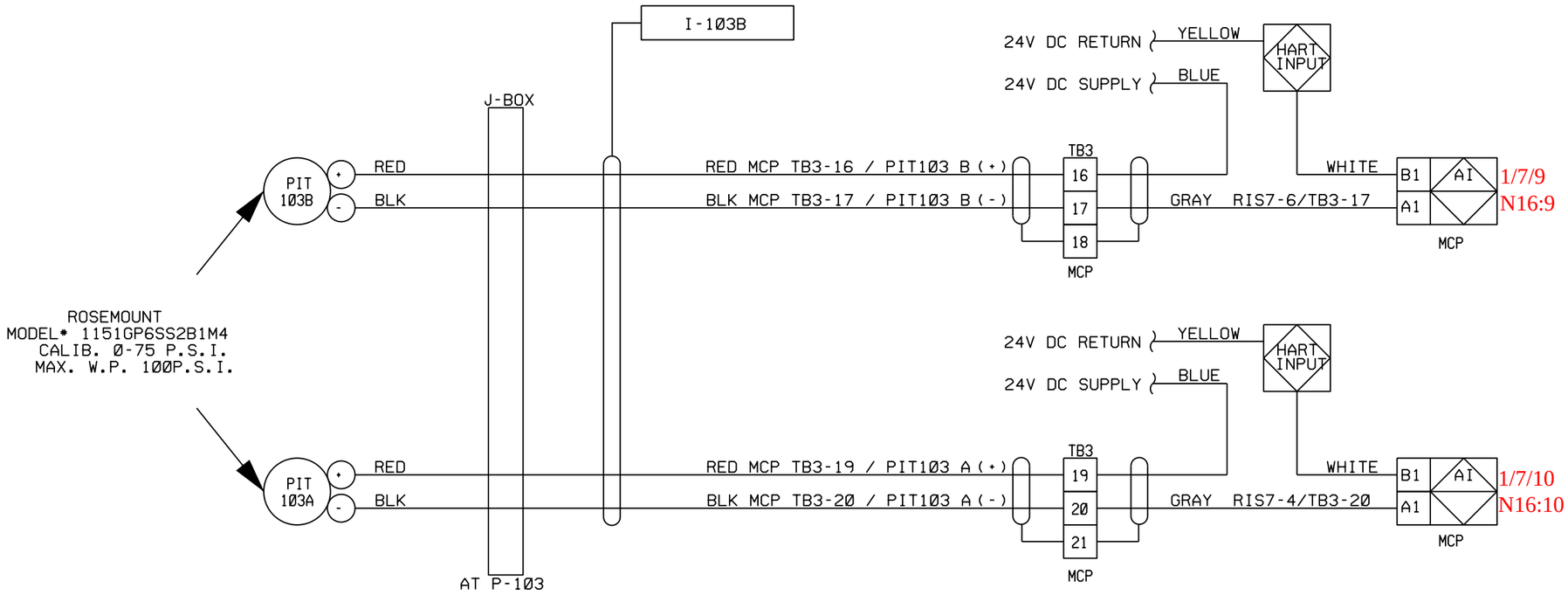

REFERENCE DRAWINGS		DESTROY ALL PRINTS BEARING EARLIER DATE				APPROVALS	
P&ID: I-3 TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/09 & 10							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-103 DISCHARGE & SUCTION PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P103-3

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65P103	65P103-3	LD-PS65P103	3	OF	3	1

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LOOP NO: 65P104

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	PI	104	A	P-104	SUCTION PRESS.	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PI	104	B	P-104	DISCHARGE PRESS.	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	PIT	104	A	P-104	SUCTION PRESS.	PRES.TRANSM.	FIELD	ROSEMOUNT	1151 GP 6S5B1M4	N/A	N/A	N/A	EXISTING
I	65	PIT	104	B	P-104	DISCHARGE PRESS.	PRES.TRANSM.	FIELD	ROSEMOUNT	1151 GP 6S5B1M4	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	PI	104	A	P-104	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65P104	I-4	65P104-2	65P104-3
I	65	PI	104	B	P-104	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65P104	I-4	65P104-2	65P104-3
I	65	PIT	104	A	P-104	S20.23	N/A	4-20MA	N/A	N/A	N/A	LD-PS65P104	I-4	65P104-2	65P104-3
I	65	PIT	104	B	P-104	S20.23	N/A	4-20MA	N/A	N/A	N/A	LD-PS65P104	I-4	65P104-2	65P104-3

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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/7/11 & 1/8/04							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

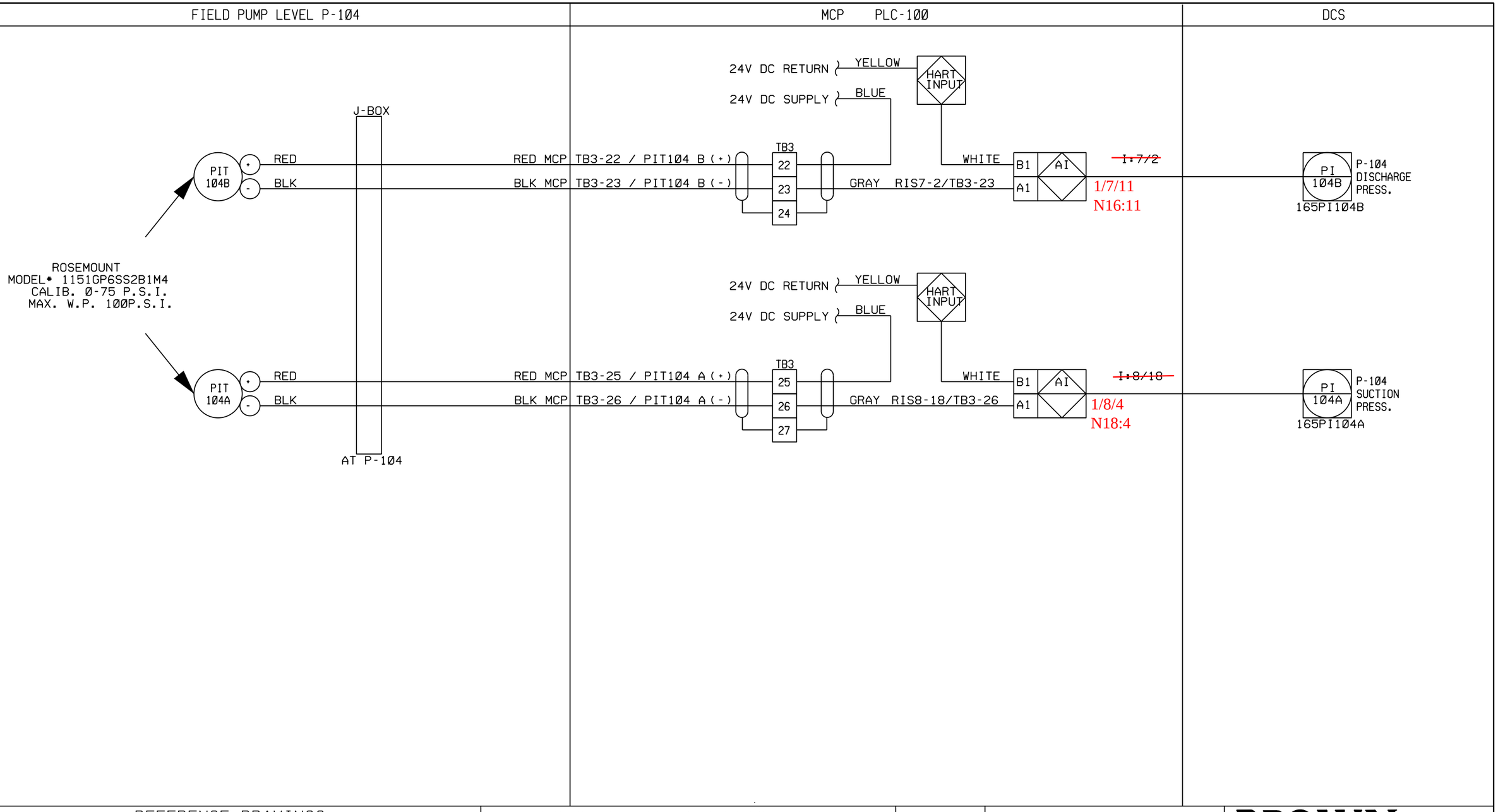
WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
PUMP P-104 DISCHARGE & SUCTION PRESS.

FILE NAME: 65P104-1

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65P104	65P104-1	LD-PS65P104	1 OF	3	1



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P&ID: I-4 TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/Ø4	AS-BUILT	JG			
1/7/11 & 1/8/04							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

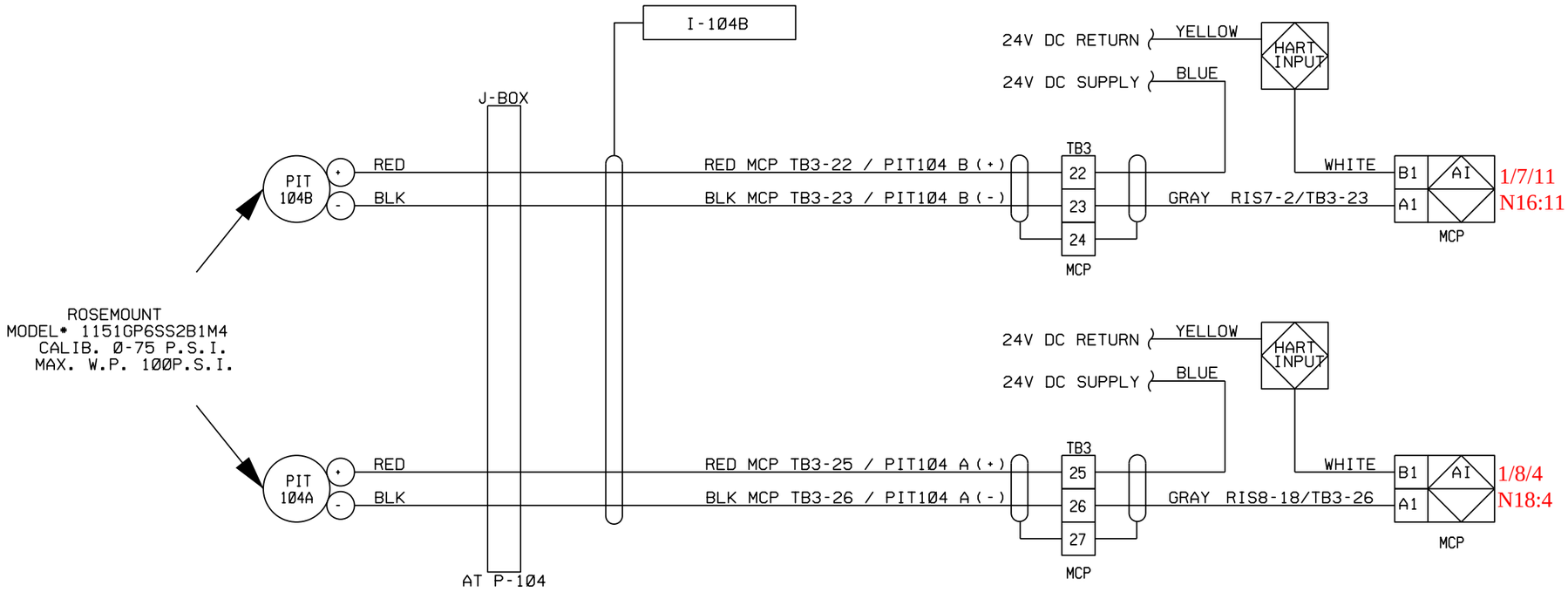
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-1Ø4 DISCHARGE & SUCTION PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P1Ø4-2

LOOP NO.	CAD FILE:	DWG NO.	SH		SH	REV
65P1Ø4	65P1Ø4-2	LD-PS65P1Ø4	2	OF	3	1



REFERENCE DRAWINGS		DESTROY ALL PRINTS BEARING EARLIER DATE				APPROVALS	
P&ID: I-3 TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-16	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/Ø4	AS-BUILT	JG			
1/7/11 & 1/8/04							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-1Ø4 DISCHARGE & SUCTION PRESS.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB* 9079
FILE NAME: 65P1Ø4-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65P1Ø4	65P1Ø4-3	LD-PS65P1Ø4	3 OF	3	1

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LOOP NO: 65L20

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LI	20		BAR SCREENS CHANNEL	DIFF. LEVEL	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	LIT	20		BAR SCREENS CHANNEL	DIFF. LEVEL	LEVEL TRANSMITTER	CP-20	ROSEMOUNT	1151DP4S 5263M4	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LI	20		BAR SCREENS CHANNEL	N/A	AI	4-20MA	0-750	N/A	N/A	LD-PS65L20	I-2	65L20-2	65L20-3
I	65	LIT	20		BAR SCREENS CHANNEL	S20.20	N/A	4-20MA	0-750	N/A	N/A	LD-PS65L20	I-2	65L20-2	65L20-3

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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-2	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			

1/8/05

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

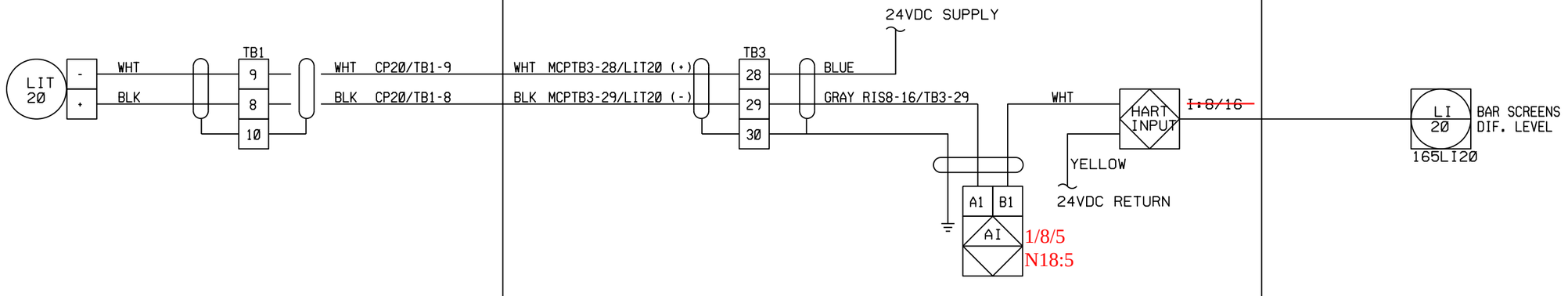
WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
BAR SCREENS CHANNEL DIFF. LEVEL

FILE NAME: 65L20-1

LOOP NO.	CAD FILE:	DWG NO. LD-PS65L20	SH		SH	REV
65L20	65L20-1		1	OF	3	1



REFERENCE DRAWINGS
P&ID: I-2
ELECTRICAL PLAN DRAWING: E-12
CONDUIT SCHEDULE: E-11.1

DESTROY ALL PRINTS BEARING EARLIER DATE						
REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	11/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

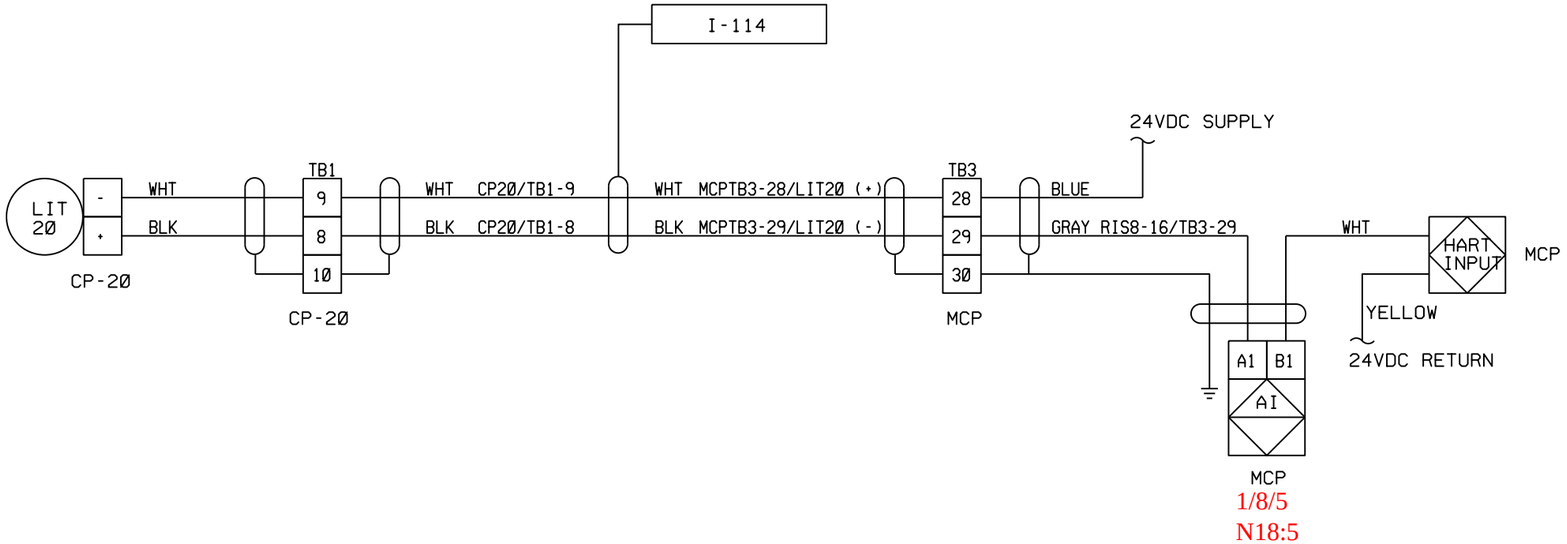
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L20-2

INSTRUMENT LOOP DIAGRAM
BAR SCREENS CHANNEL DIFF. LEVEL

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65L20	65L20-2	LD-PS65L20	2	OF	3	1

1/8/05



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ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/8/05							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65L20-3

INSTRUMENT LOOP DIAGRAM
BAR SCREENS CHANNEL DIFF. LEVEL

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65L20	65L20-3	LD-PS65L20	3 OF	3	1

11-DEC-2008 11:56 chris R:\mwske\comnet\loops\project\ps65\65l20-3.dgn

LOOP NO: 65F601

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	FQI	601	A	FORCE MAIN DISCH.	TOTALIZIED FLOW	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	FI	601		FORCE MAIN DISCH.	DISCHARGE FLOW	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	FIT	601		FORCE MAIN DISCH.	TOTAL FLOW	TRANSMITTER	FIELD	KRONE	ALTOFLUX IFC 080 F/H	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	FQI	601	A	FORCE MAIN DISCH.	N/A	AI	4-20 MA	N/A	N/A	N/A	LD-PS65F601	I-4	65F601-2	65F601-3
I	65	FI	601		FORCE MAIN DISCH.	N/A	AI	4-20 MA	0-2000	GPM	N/A	LD-PS65F601	I-4	65F601-2	65F601-3
I	65	FIT	601		FORCE MAIN DISCH.	S20.23	N/A	4-20 MA	0-2000	GPM	N/A	LD-PS65F601	I-4	65F601-2	65F601-3

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-20	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/8/06							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

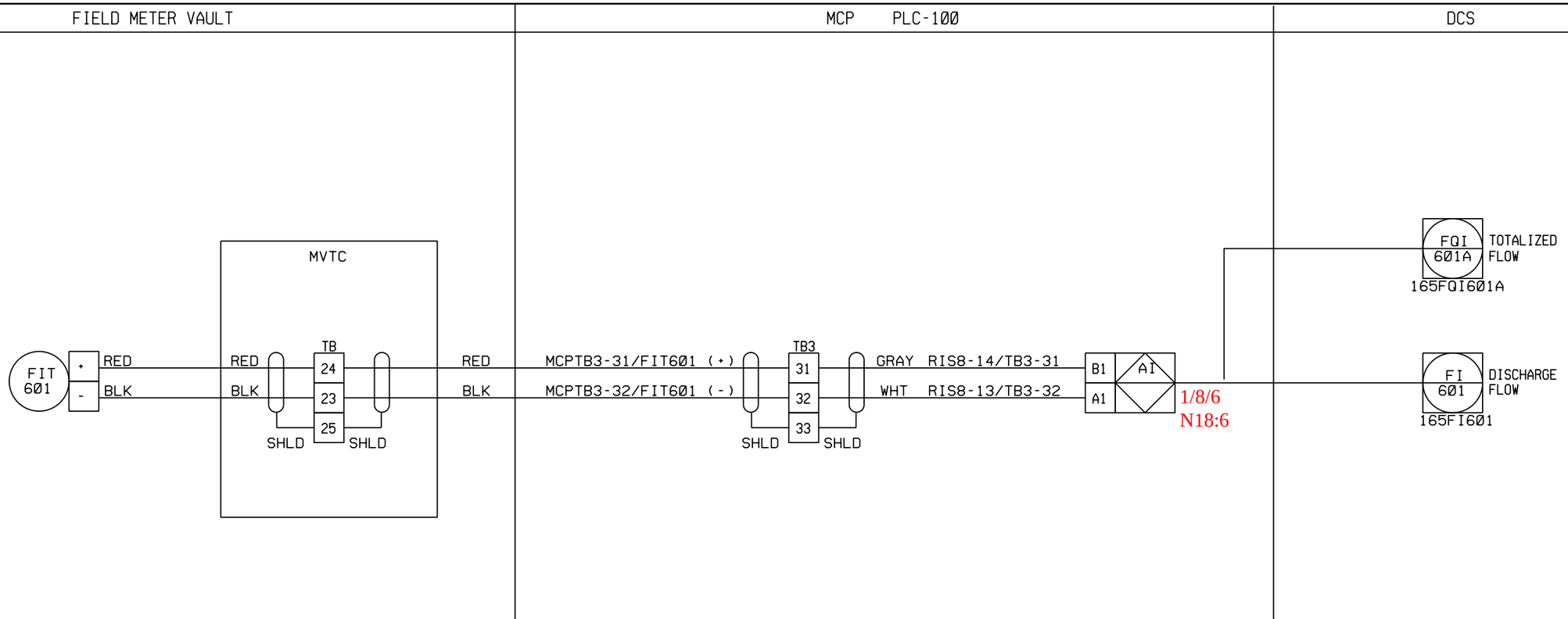
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
FORCE MAIN DISCHARGE FLOW

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65F601-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65F601	65F601-1	LD-PS65F601	1	OF	3	1

11-DEC-2008 11:55 chris R:\mwske\comnet\loops\project\ps65\65f601-1.dgn



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
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ELECTRICAL PLAN DRAWING: E-20	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/8/06							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

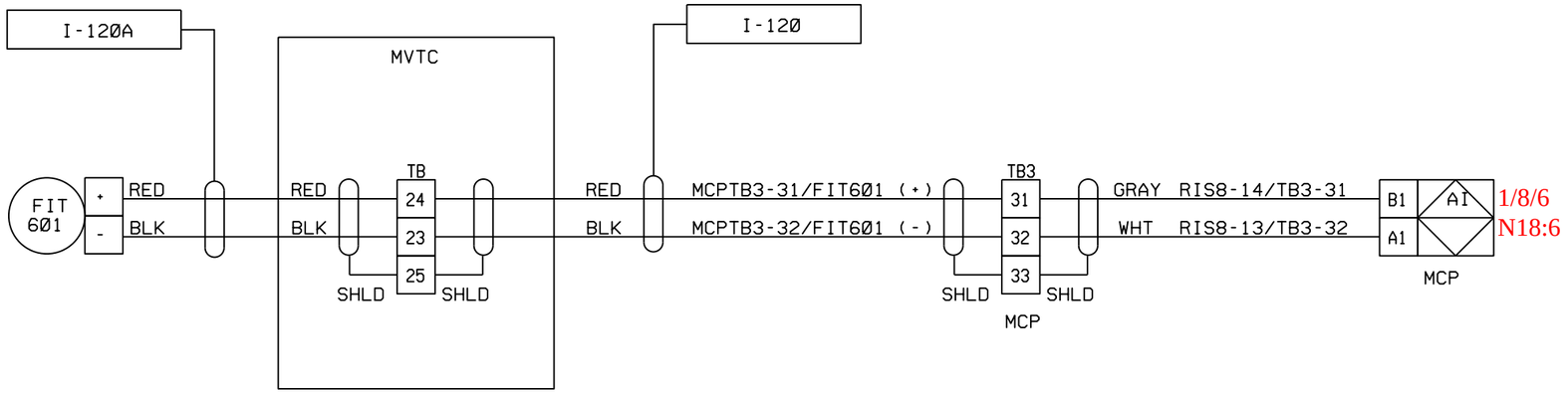
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
FORCE MAIN DISCHARGE FLOW

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65F601-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65F601	65F601-2	LD-PS65F601	2 OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-20	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/8/06							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
FORCE MAIN DISCHARGE FLOW

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65F601-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65F601	65F601-3	LD-PS65F601	3 OF	3	1

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LOOP NO: 65P401

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	PI	401		FORCE MAIN	DISCH. PRESS.	INDICATOR	DCS	WESTINGHOUSE	WPDF II	13400	WPC	PS65-200	
I	65	PIT	401		FORCE MAIN	DISCH. PRESS.	TRANSMITTER	FIELD	ROSEMOUNT	1151 SMART	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	PI	401		FORCE MAIN	N/A	AI	4-20 MA	N/A	N/A	N/A	LD-PS65P401	I-4	65P401-2	65P401-3
I	65	PIT	401		FORCE MAIN	S20.20	N/A	4-20 MA	N/A	N/A	N/A	LD-PS65P401	I-4	65P401-2	65P401-3

REFERENCE DRAWINGS
P&ID: I-4
ELECTRICAL PLAN DRAWING: E-14
CONDUIT SCHEDULE: E-11.1

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	11/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
FORCE MAIN DISCHARGE PRESSURE

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P401-1

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65P401	65P401-1	LD-PS65P401	1 OF	3	1

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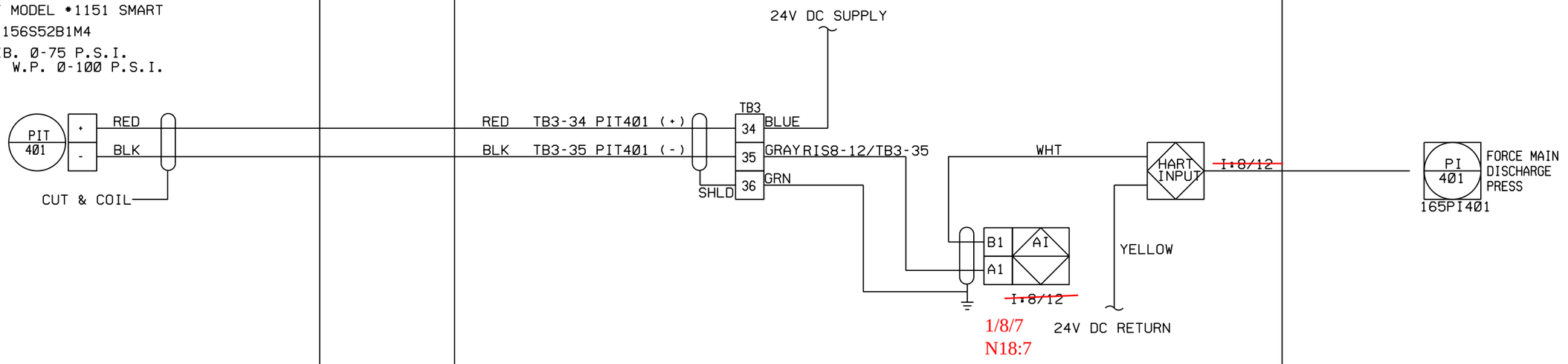
1/8/07

FIELD 2ND LEVEL AT MOTOR CONTROL BLDG.	CP-10	MCP PLC-100	DCS

ROSEMOUNT MODEL *1151 SMART
* 1156S52B1M4
CALIB. 0-75 P.S.I.
MAX. W.P. 0-100 P.S.I.



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-14	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/8/07							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN EMPLOYEE OWNED
AUTOMATION, INC.

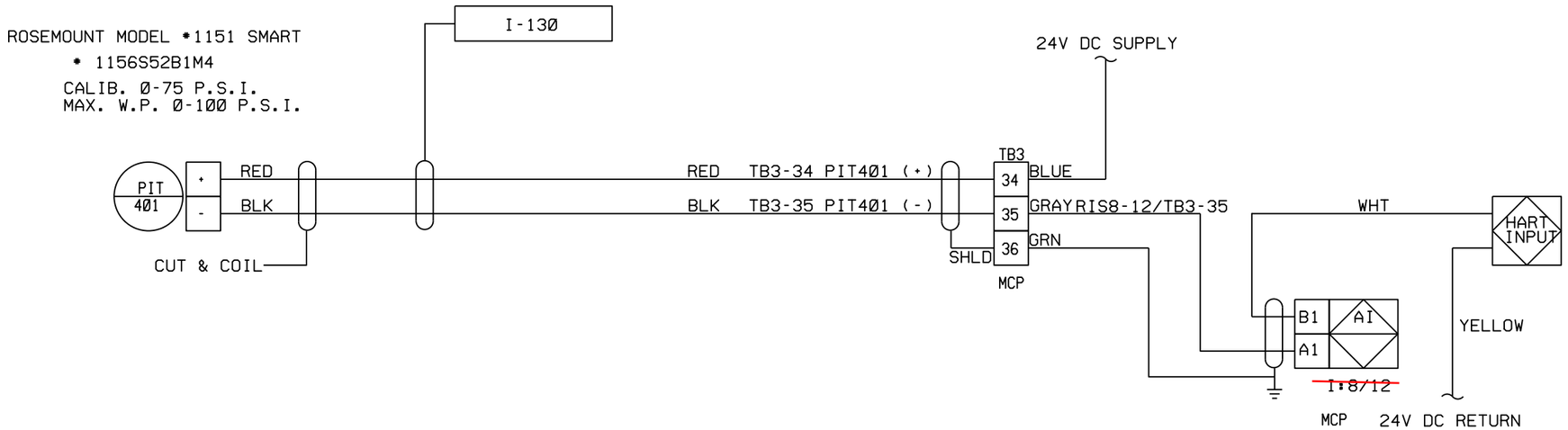
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P401-2

INSTRUMENT LOOP DIAGRAM
FORCE MAIN DISCHARGE PRESS

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65P401	65P401-2	LD-PS65P401	2	OF	3	1

11-DEC-2008 12:15 chris R:\mwske\comnet\loops\project\ps65\65p401-2.dgn



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-4	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-14	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/8/07							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65P401-3

INSTRUMENT LOOP DIAGRAM
FORCE MAIN DISCHARGE PRESS

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65P401	65P401-3	LD-PS65P401	3	OF 3	1

11-DEC-2008 12:15 chris R:\mwske\comnet\loops\project\ps65\65p401-3.dgn

LOOP NO: 65A8

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	AI	8		ODOR CONTROL SYS	PH	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	AIT	8		ODOR CONTROL SYS	PH	TRANSMITTER	FIELD	GLI INTERNATIONAL	P63A	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	AI	8		ODOR CONTROL SYS	N/A	AI	4-20 MA	0-14	PH	N/A	LD-PS65A8	I-10	65A8-2	65A8-3
I	65	AIT	8		ODOR CONTROL SYS	520.3	N/A	4-20 MA	0-14	PH	N/A	LD-PS65A8	I-10	65A8-2	65A8-3

R:\mwske\comnet\loops\project\ps65\65a8-1.dgn
chris
11-DEC-2008 11:46

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
P&ID I-10							
ELECTRICAL PLAN E-21	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE E-11.1	1	10/04	AS-BUILT	JG			
1/8/11							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

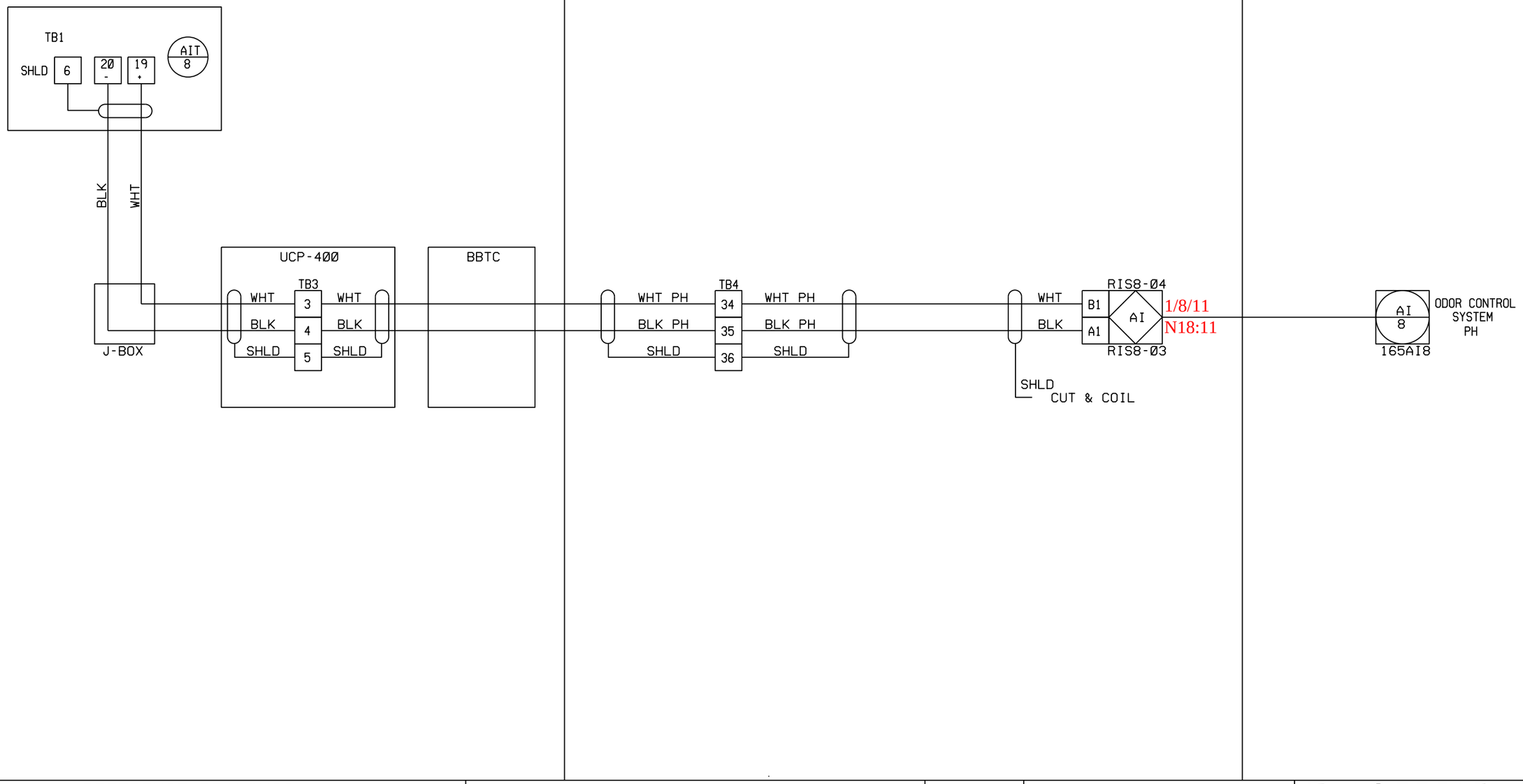
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A8-1

LOOP DIAGRAM SCHEDULE
ODOR CONTROL SYSTEM PH

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65A8	65A8-1	LD-PS65A8	1 OF	3	1



REFERENCE DRAWINGS
P&ID I-10
ELECTRICAL PLAN E-21
CONDUIT SCHEDULE E-11.1
1/8/11

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	10/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

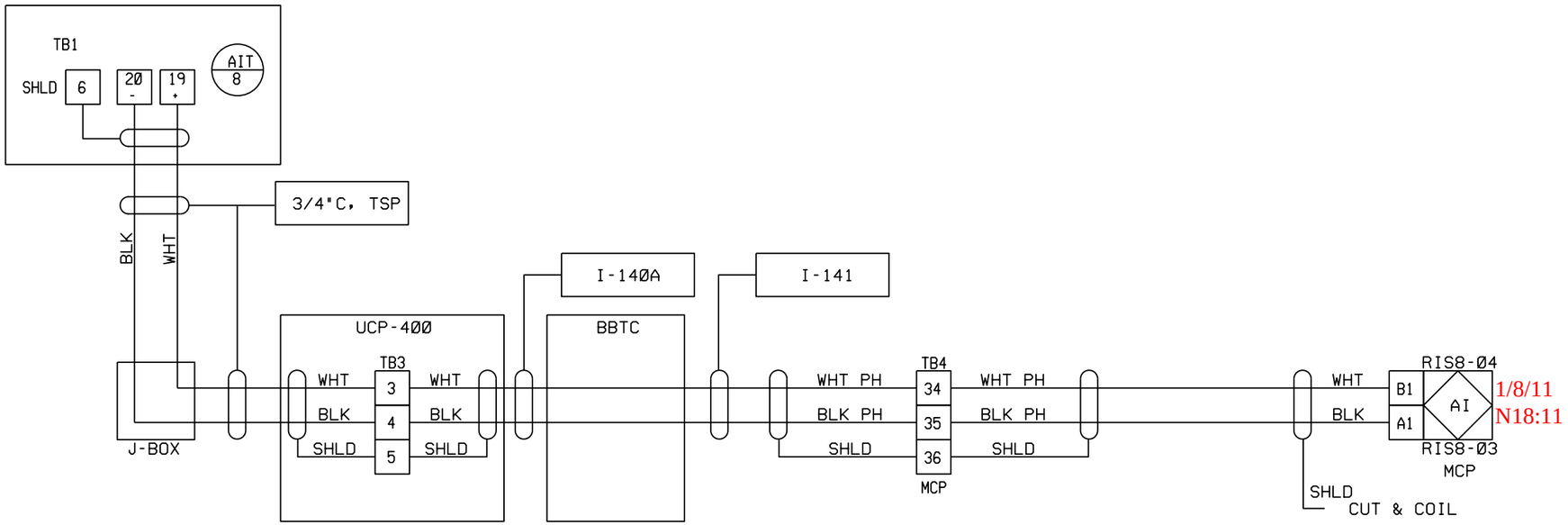
WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

INSTRUMENT LOOP DIAGRAM
ODOR CONTROL SYSTEM PH

FILE NAME: 65A8-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65A8	65A8-2	LD-PS65A8	2 OF	3	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID I-10	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN E-21	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE E-11.1	1	10/04	AS-BUILT	JG			
1/8/11							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
ODOR CONTROL SYSTEM PH

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65A8-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65A8	65A8-3	LD-PS65A8	3 OF	3	1

11-DEC-2008 11:46 chris R:\mwske\comnet\loops\project\ps65\65a8-3.dgn

LOOP NO: 65Y141

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZLC	141		FORCE MAIN VALVE	V-141 CLOSED	STATUS	PLC-100	TBD					EXISTING
I	65	ZLO	141		FORCE MAIN VALVE	V-141 OPEN	STATUS	PLC-100	TBD					EXISTING
I	65	ZL	141		FORCE MAIN VALVE	V-141 LOCAL	STATUS	PLC-100	TBD					NEW
I	65	HS	141	A	FORCE MAIN VALVE	V-141 CLOSED	COMMAND	PLC-100	TBD					EXISTING
I	65	HS	141	B	FORCE MAIN VALVE	V-141 OPEN	COMMAND	PLC-100	TBD					EXISTING
I	65	ZSC	141		FORCE MAIN VALVE	V-141 CLOSED	SWITCH	FIELD	TBD					EXISTING
I	65	ZSO	141		FORCE MAIN VALVE	V-141 OPEN	SWITCH	FIELD	TBD					EXISTING
I	65	ZSL	141		FORCE MAIN VALVE	V-141 LOCAL	SWITCH	FIELD	TBD					EXISTING
I	65	HS	141	C	FORCE MAIN VALVE	V-141 OPEN	SWITCH	FIELD	TBD					EXISTING
I	65	HS	141	D	FORCE MAIN VALVE	V-141 CLOSED	SWITCH	FIELD	TBD					EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZLC	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZLO	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZL	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	A	FORCE MAIN VALVE	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	B	FORCE MAIN VALVE	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSC	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSO	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSL	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	C	FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	D	FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

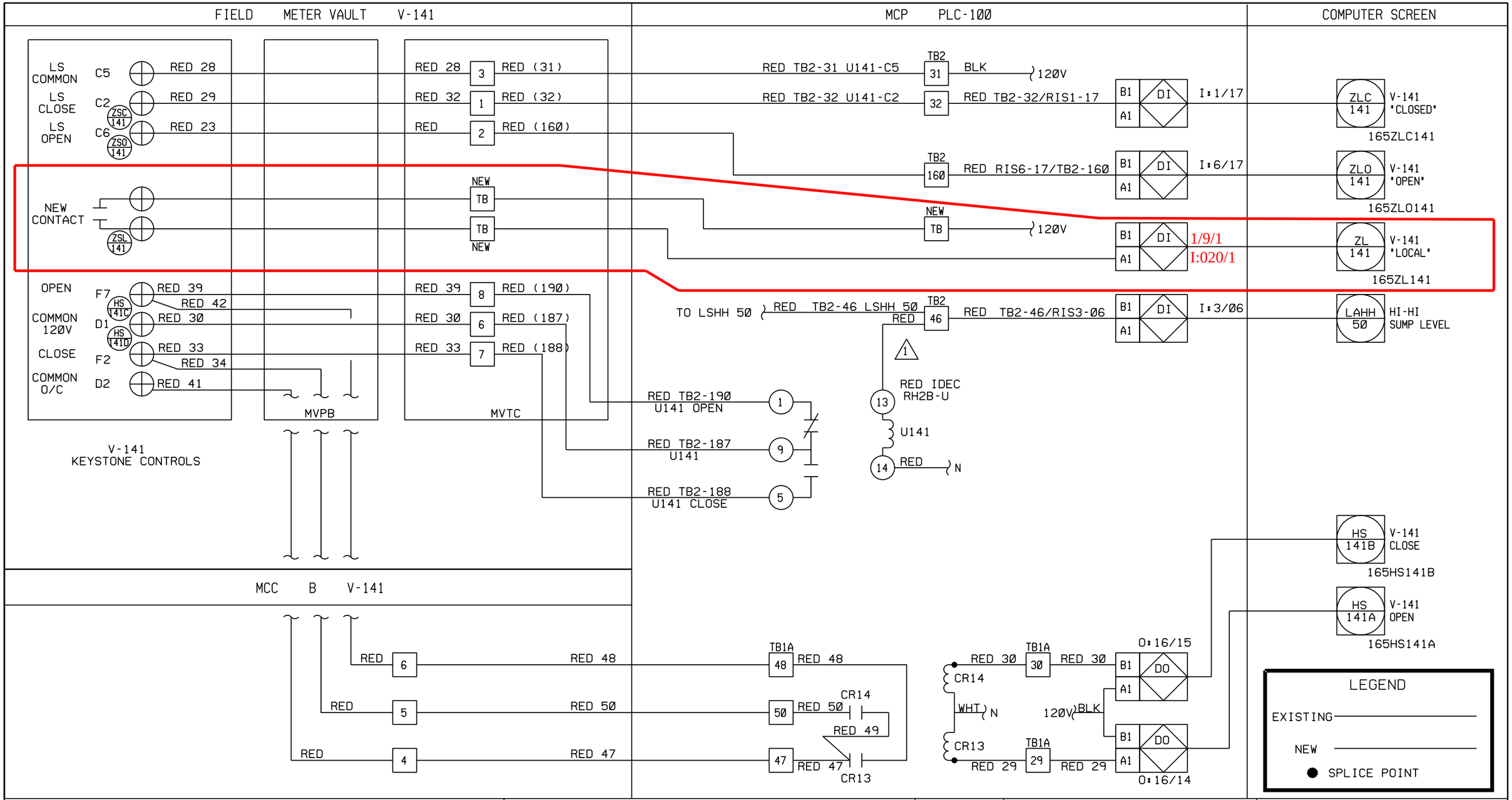
BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
FORCE MAIN VALVE V-141

FILE NAME: 65Y141-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y141	65Y141-1	LD-PS65Y141	1	OF	3	0

1/9/1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

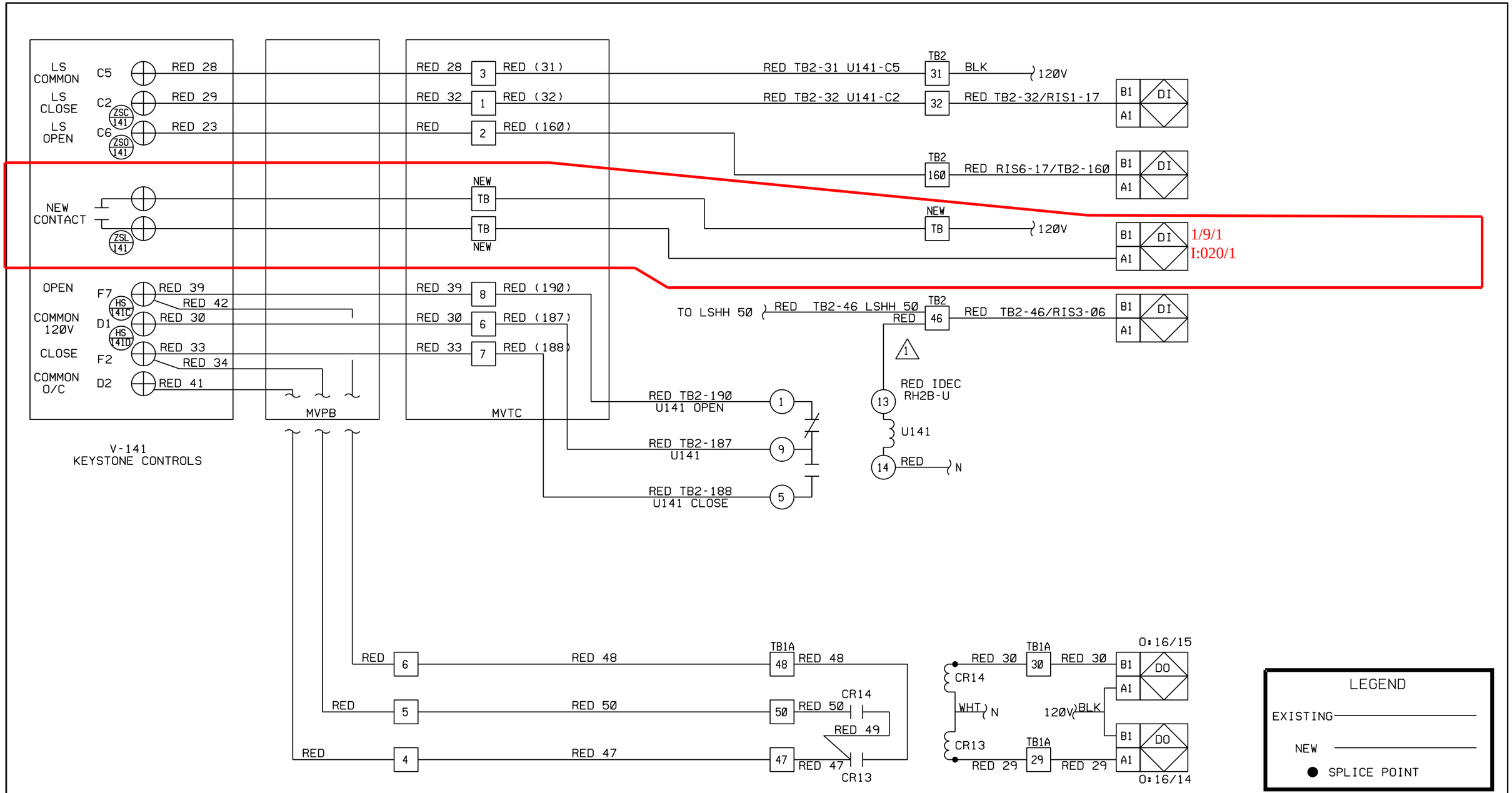
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y141-2

INSTRUMENT LOOP DIAGRAM
FORCE MAIN VALVE V-141

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y141	65Y141-2	LD-PS65Y141	2 OF	3	0

1/9/1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

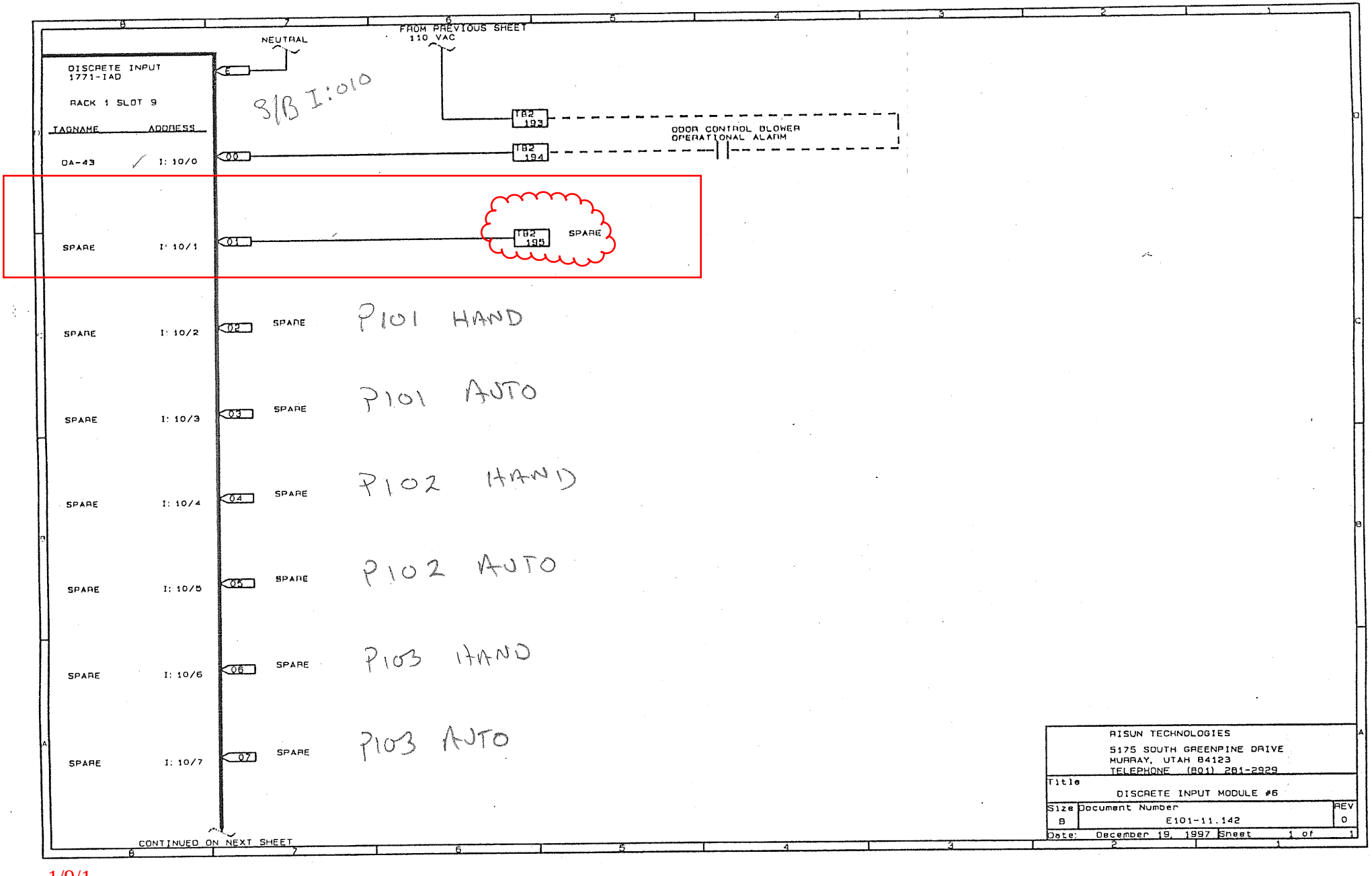
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y141-3

INSTRUMENT LOOP DIAGRAM
FORCE MAIN VALVE V-141

LOOP NO.	CAD FILE:	DWG NO. LD-PS65Y141	SH	SH	REV
65Y141	65Y141-3		3 OF	3	Ø

1/9/1


NEUTRAL
FROM PREVIOUS SHEET
110 VAC
DISCRETE INPUT
1771-IAD
RACK 1 SLOT 9
TAGNAME
ADDRESS
S/B I:010
TB2
193
ODOR CONTROL BLOWER
OPERATIONAL ALARM
TB2
194
OA-43
I: 10/0
00
SPARE
I: 10/1
01
TB2
195
SPARE
SPARE
I: 10/2
02
SPARE
P101 HAND
SPARE
I: 10/3
03
SPARE
P101 AUTO
SPARE
I: 10/4
04
SPARE
P102 HAND
SPARE
I: 10/5
05
SPARE
P102 AUTO
SPARE
I: 10/6
06
SPARE
P103 HAND
SPARE
I: 10/7
07
SPARE
P103 AUTO
CONTINUED ON NEXT SHEET
RISUN TECHNOLOGIES
5175 SOUTH GREENPINE DRIVE
MURRAY, UTAH 84123
TELEPHONE (801) 281-2929
Title
DISCRETE INPUT MODULE #6
Size
B
Document Number
E101-11.142
REV
0
Date: December 19, 1997
Sheet 1 of 1

1/9/1

LOOP NO: 65Y101

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	101	C	P-101	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	101	A	P-101	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	101	B	P-101	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	101	A	P-101	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	101	D	P-101	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	101		P-101	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	101	D	P-101	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-101	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	101	D	P-101	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	101		P-101	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	101	C	P-101	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZL	101	A	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZL	101	B	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	YL	101	A	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	YA	101	D	P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZLC	101		P-101	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	HS	101	D	P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	BTR	NA		P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	YS	101	D	P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3
I	65	ZSC	101		P-101	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y101-2		LD-PS65Y101	LD-PS65Y101-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

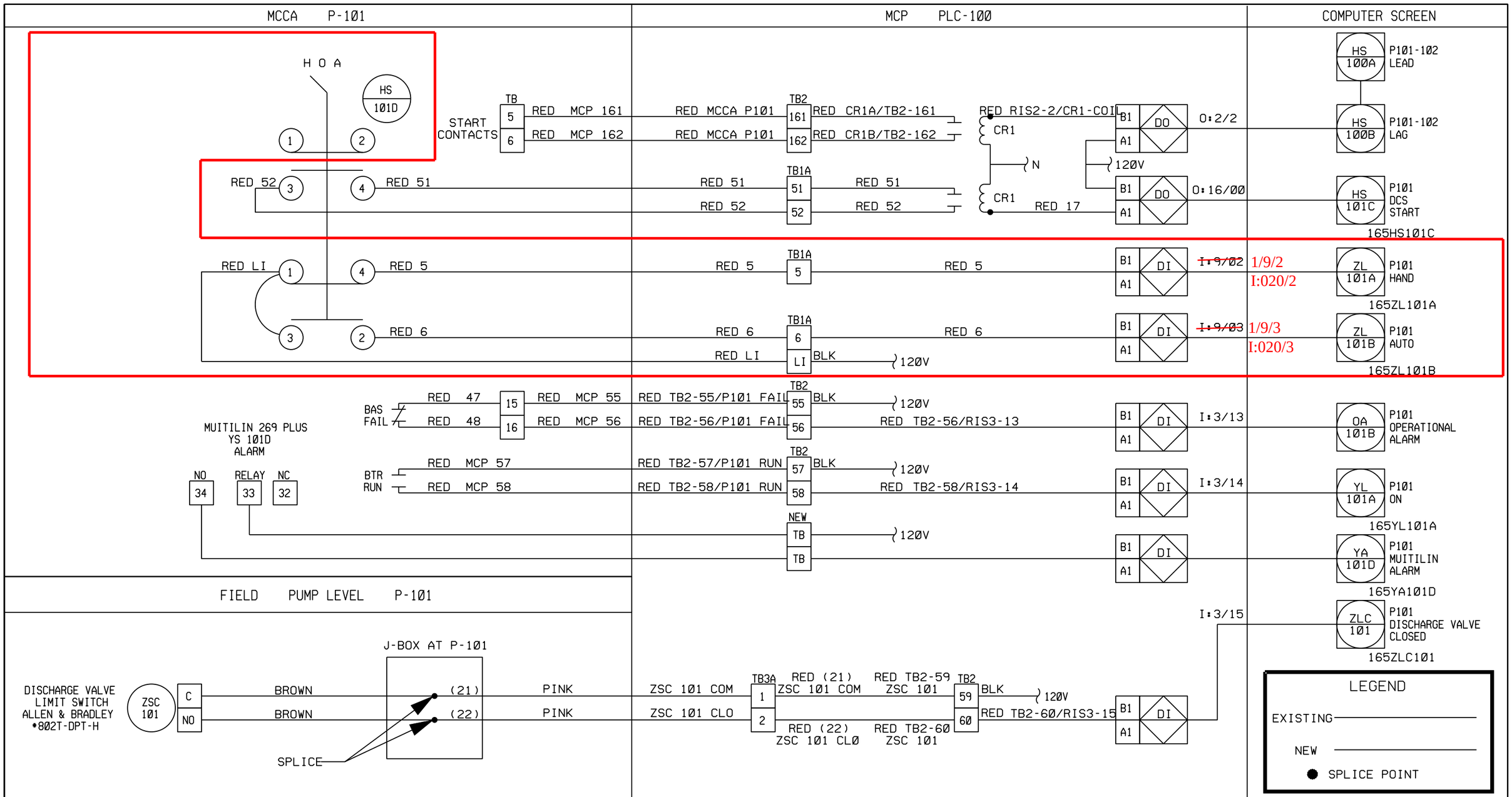
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-101

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y101-1

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y101	65Y101-1	LD-PS65Y101	1 OF	3	0

1/9/2 & 3



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION

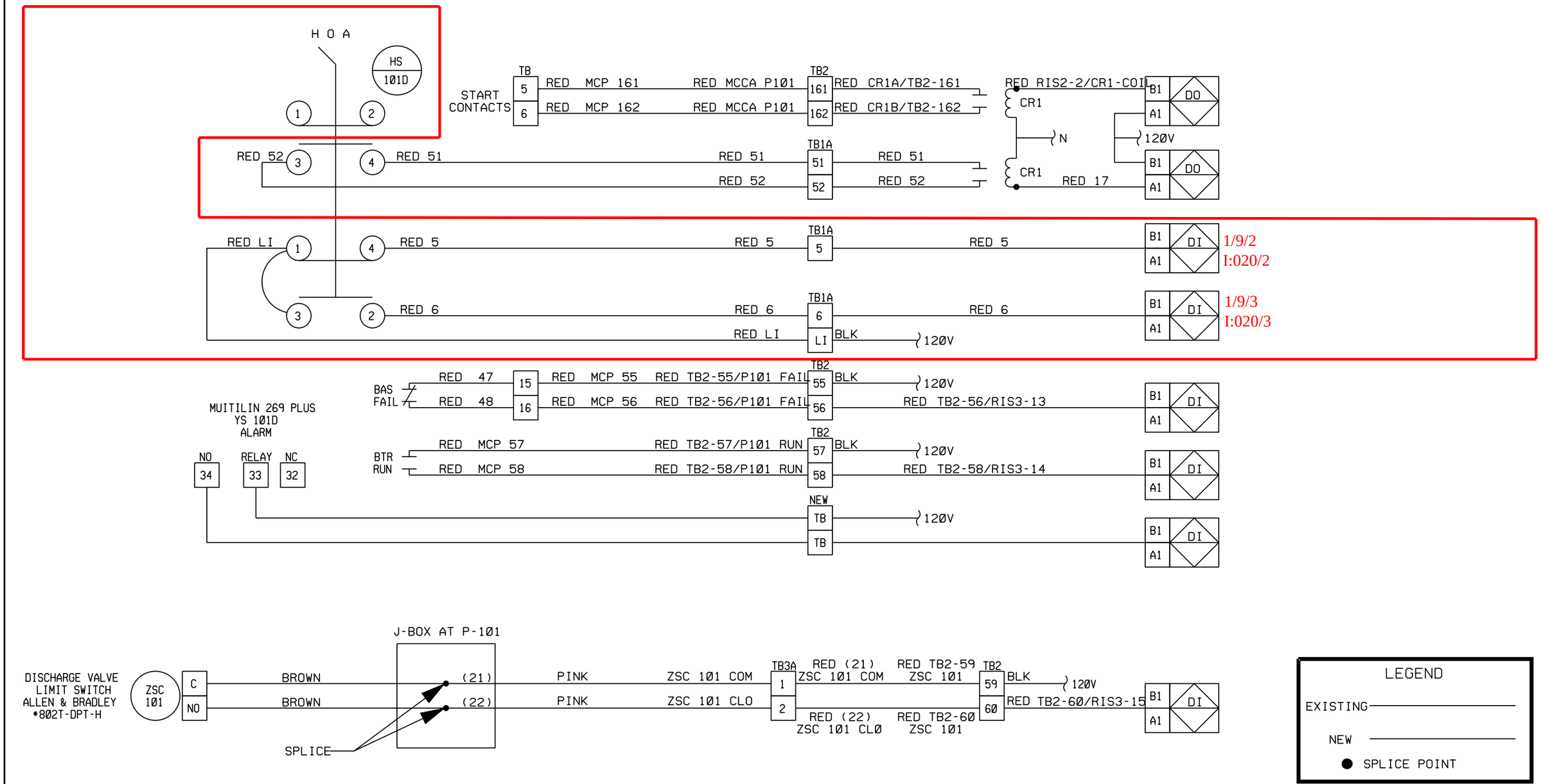
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-101

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y101-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y101	65Y101-2	LD-PS65Y101	2	OF	3	0

1/9/2 & 3



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-1Ø1

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y1Ø1-3

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y1Ø1	65Y1Ø1-3	LD-PS65Y1Ø1	3	OF	3	Ø

1/9/2 & 3

LOOP NO: 65Y102

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	102	C	P-102	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	102	A	P-102	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	102	B	P-102	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	102	A	P-102	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	102	D	P-102	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	102		P-102	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	102	D	P-102	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-102	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	102	D	P-102	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	102		P-102	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	102	C	P-102	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZL	102	A	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZL	102	B	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	YL	102	A	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	YA	102	D	P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZLC	102		P-102	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	HS	102	D	P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	BTR	NA		P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	YS	102	D	P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3
I	65	ZSC	102		P-102	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y102-2		LD-PS65Y102	LD-PS65Y102-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-102

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y102-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y102	65Y102-1	LD-PS65Y102	1	OF	3	0

1/9/4 & 5

MCCB P-102 | MCP PLC-100 | COMPUTER SCREEN

H O A
HS 102D
1 2
RED 54 3 4 RED 53
START CONTACTS
TB 5 RED MCP 163
6 RED MCP 164
RED MCCB P102 → TB2 163 RED CR2A/TB2-163
RED MCCB P102 → TB2 164 RED CR2A/TB2-164
RED 53 → TB1A 53 RED 53
RED 54 → TB1A 54 RED 54
RED RIS2-4/CR2-COIL → CR2 → N
CR2 → RED 18
120V
B1 A1 DO O:2/4 → HS 100A P101-102 LEAD
B1 A1 DO O:2/4 → HS 100B P101-102 LAG
B1 A1 DO O:16/01 → HS 102C P102 DCS START
165HS102C

RED LI 1 4 RED 7
3 2 RED 8
RED 7 → TB1A 7 RED 7
RED 8 → TB1A 8 RED 8
RED LI → TB1A LI 120V
B1 A1 DI ~~I:9/04~~ 1/9/4 I:020/4 → ZL 102A P102 HAND
165ZL102A
B1 A1 DI ~~I:9/05~~ 1/9/5 I:020/5 → ZL 102B P102 AUTO
165ZL102B

MUITILIN 269 PLUS
YS 102D
ALARM
NO 34 RELAY 33 NC 32

BAS FAIL
RED 47 15 RED MCP 65
RED 48 16 RED MCP 66
RED TB2-65/P102 FAIL → TB2 65 BLK → 120V
RED TB2-66/P102 FAIL → TB2 66 RED TB2-66/RIS4-00
B1 A1 DI I:4/00 → OA 102B P102 OPERATIONAL ALARM

BTR RUN
RED MCP 67
RED MCP 68
RED TB2-67/P102 RUN → TB2 67 BLK → 120V
RED TB2-68/P102 RUN → TB2 68 RED TB2-68/RIS4-01
B1 A1 DI I:4/01 → YL 102A P102 ON
165YL102A

NEW TB TB → 120V
B1 A1 DI → YA 102D P102 MUITILIN ALARM
165YA102D

FIELD PUMP LEVEL P-102

J-BOX AT P-102
DISCHARGE VALVE LIMIT SWITCH ALLEN & BRADLEY *802T-DPT-H
ZSC 102 C NO
RED (31) PINK
RED (32) PINK
SPLICE
ZSC 102 COM → TB3A 11 RED (31) ZSC 102 COM → RED TB2-69 ZSC 1021 → TB2 69 BLK → 120V
ZSC 102 CLO → TB3A 12 RED (32) ZSC 102 CLØ → RED TB2-70 ZSC 1021 → TB2 70 RED TB2-70/RIS4-02
B1 A1 DI I:4/02 → ZLC 102 P102 DISCHARGE VALVE CLOSED
165ZLC102

LEGEND
EXISTING
NEW
SPLICE POINT

REFERENCE DRAWINGS
TBD

REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

DESTROY ALL PRINTS BEARING EARLIER DATE
APPROVALS

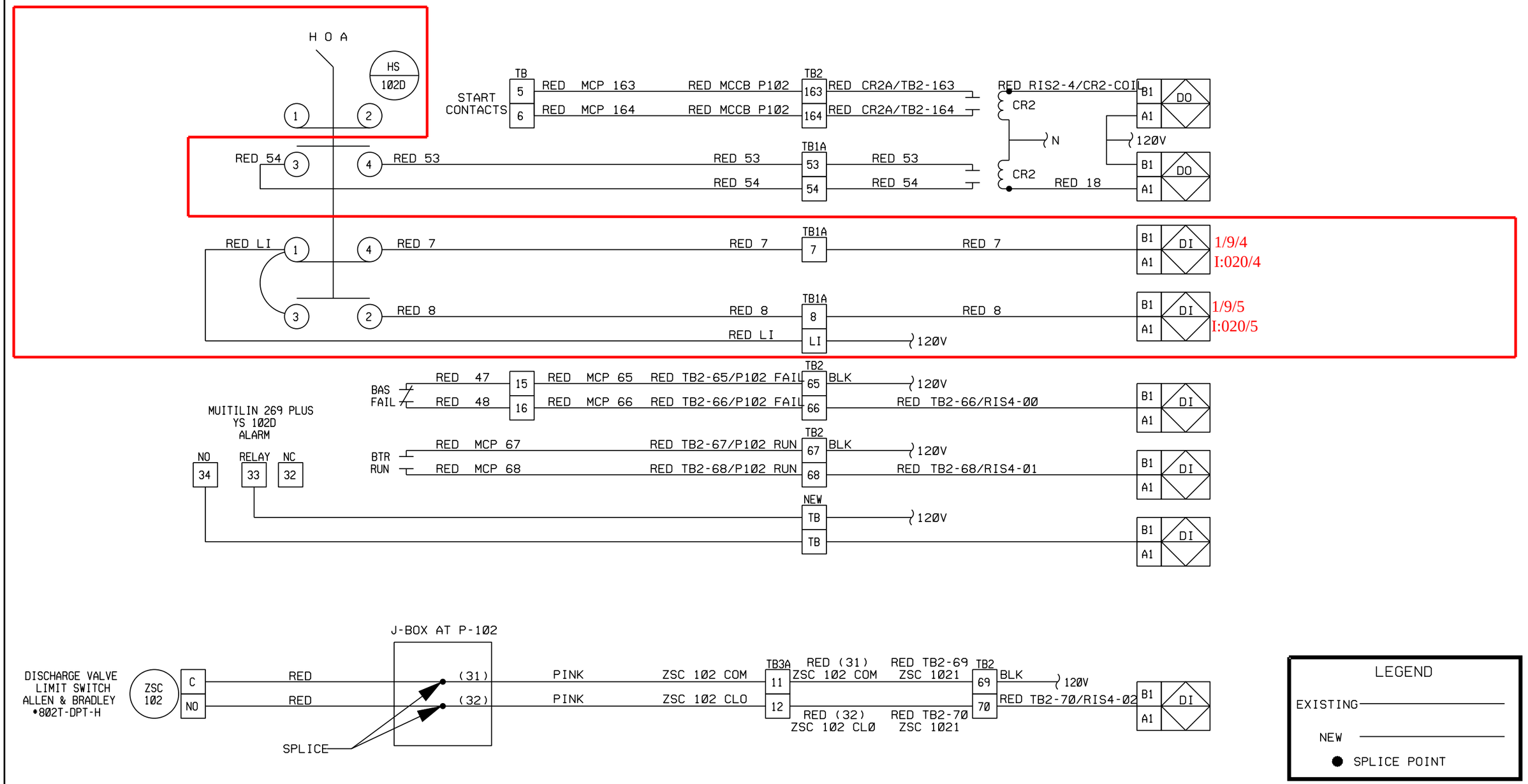
WESTINGHOUSE ELECTRIC CO. PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-102

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y102-2

LOOP NO. 65Y102 | CAD FILE: 65Y102-2 | DWG NO. LD-PS65Y102 | SH 2 OF 3 | REV Ø

1/9/4 & 5



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y102-3

INSTRUMENT LOOP DIAGRAM
PUMP P-102

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y102	65Y102-3	LD-PS65Y102	3 OF	3	0

1/9/4 & 5

LOOP NO: 65Y103

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	103	C	P-103	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	103	A	P-103	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	103	B	P-103	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	103	A	P-103	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	103	D	P-103	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	103		P-103	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	103	D	P-103	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-103	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	103	D	P-103	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	103		P-103	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	103	C	P-103	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZL	103	A	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZL	103	B	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	YL	103	A	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	YA	103	D	P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZLC	103		P-103	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	HS	103	D	P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	BTR	NA		P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	YS	103	D	P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3
I	65	ZSC	103		P-103	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y103-2		LD-PS65Y103	LD-PS65Y103-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

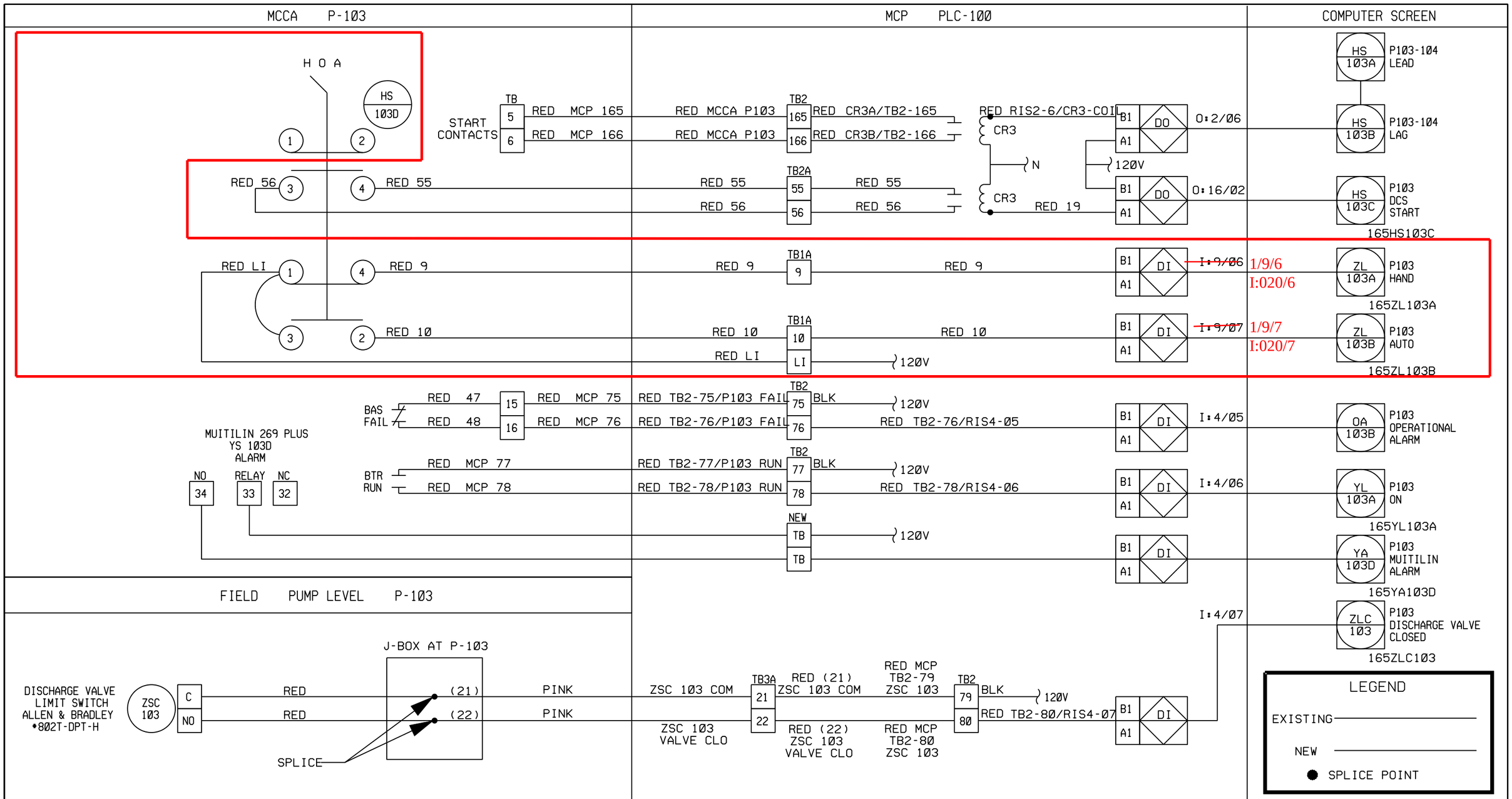
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-103

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y103-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y103	65Y103-1	LD-PS65Y103	1	OF	3	0

1/9/6 & 7



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

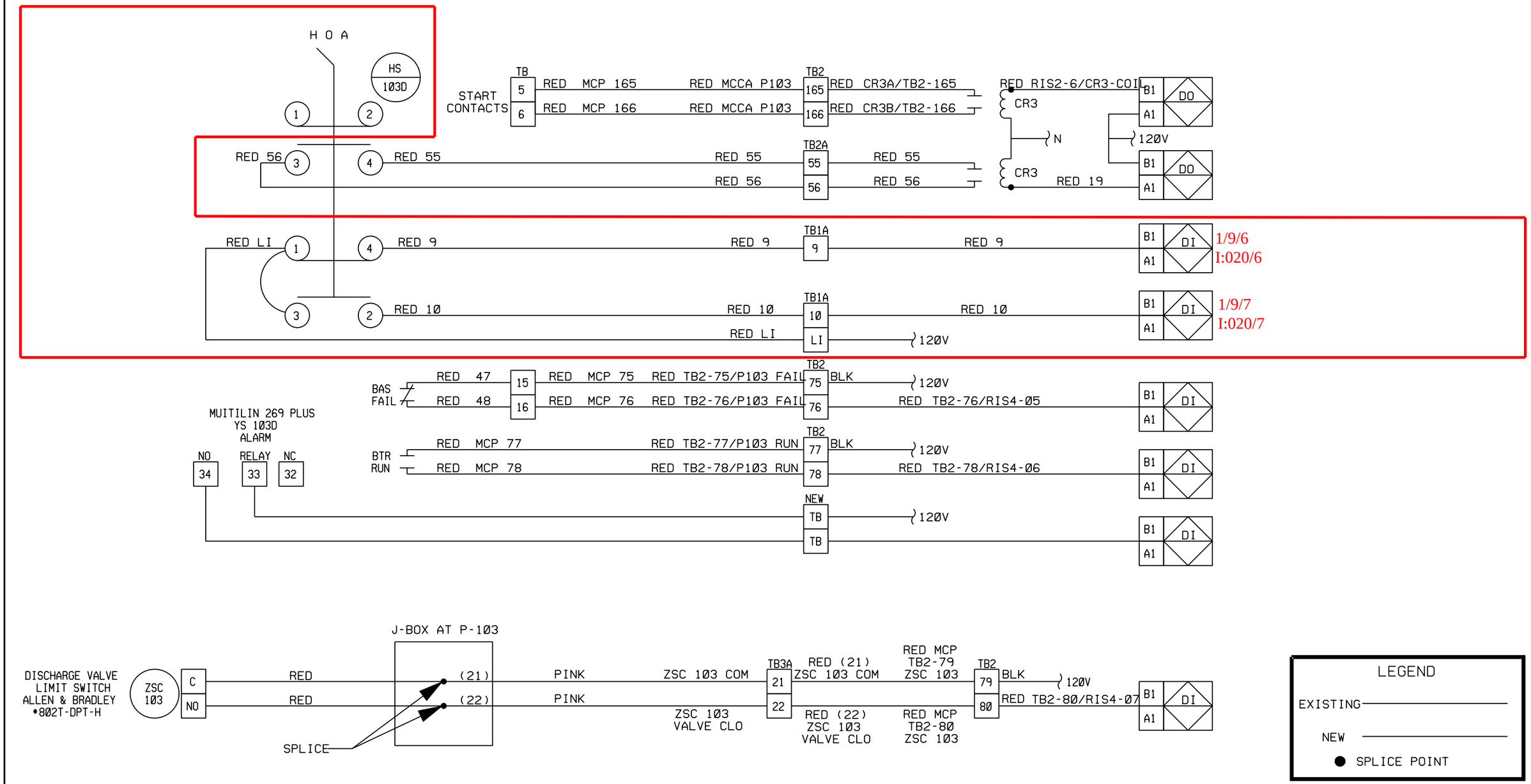
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-103

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y103-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y103	65Y103-2	LD-PS65Y103	2 OF	3	0

1/9/6 & 7



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y103-3

INSTRUMENT LOOP DIAGRAM
PUMP P-103

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y103	65Y103-3	LD-PS65Y103	3 OF	3	0

1/9/6 & 7

LOOP NO: 65Y104

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	HS	104	C	P-104	DCS START	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	ZL	104	A	P-104	HAND	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZL	104	B	P-104	AUTO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YL	104	A	P-104	ON	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	YA	104	D	P-104	MULTLIN ALARM	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	104		P-104	DISCH. VALVE CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	104	D	P-104	H/O/A	SWITCH	MCC A	TBD	TBD				EXISTING
I	65	BTR	NA		P-104	ON	RELAY	MCC A	TBD	TBD				EXISTING
I	65	YS	104	D	P-104	MULTLIN ALARM	SWITCH	MCC A	MULTLIN	269 PLUS				EXISTING
I	65	ZSC	104		P-104	DISCH. VALVE CLOSED	SWITCH	FIELD	ALLEN & BRADLEY	802 DPT-H				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	HS	104	C	P-104	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZL	104	A	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZL	104	B	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	YL	104	A	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	YA	104	D	P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZLC	104		P-104	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	HS	104	D	P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	BTR	NA		P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	YS	104	D	P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3
I	65	ZSC	104		P-104	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y104-2		LD-PS65Y104	LD-PS65Y104-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

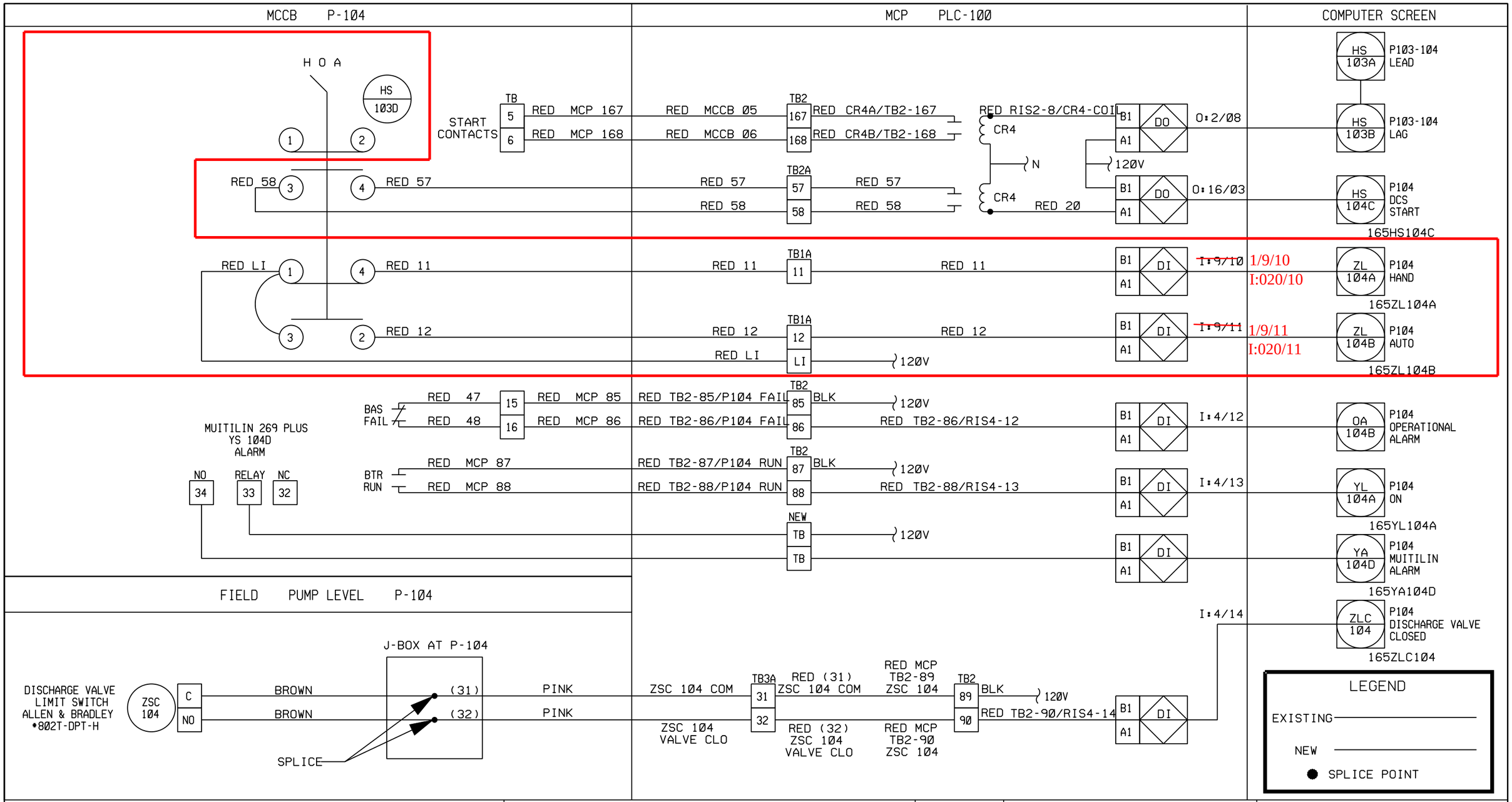
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-104

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y104-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y104	65Y104-1	LD-PS65Y104	1	OF	3	0

1/9/10 & 11



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO. PROCESS CONTROL DIVISION

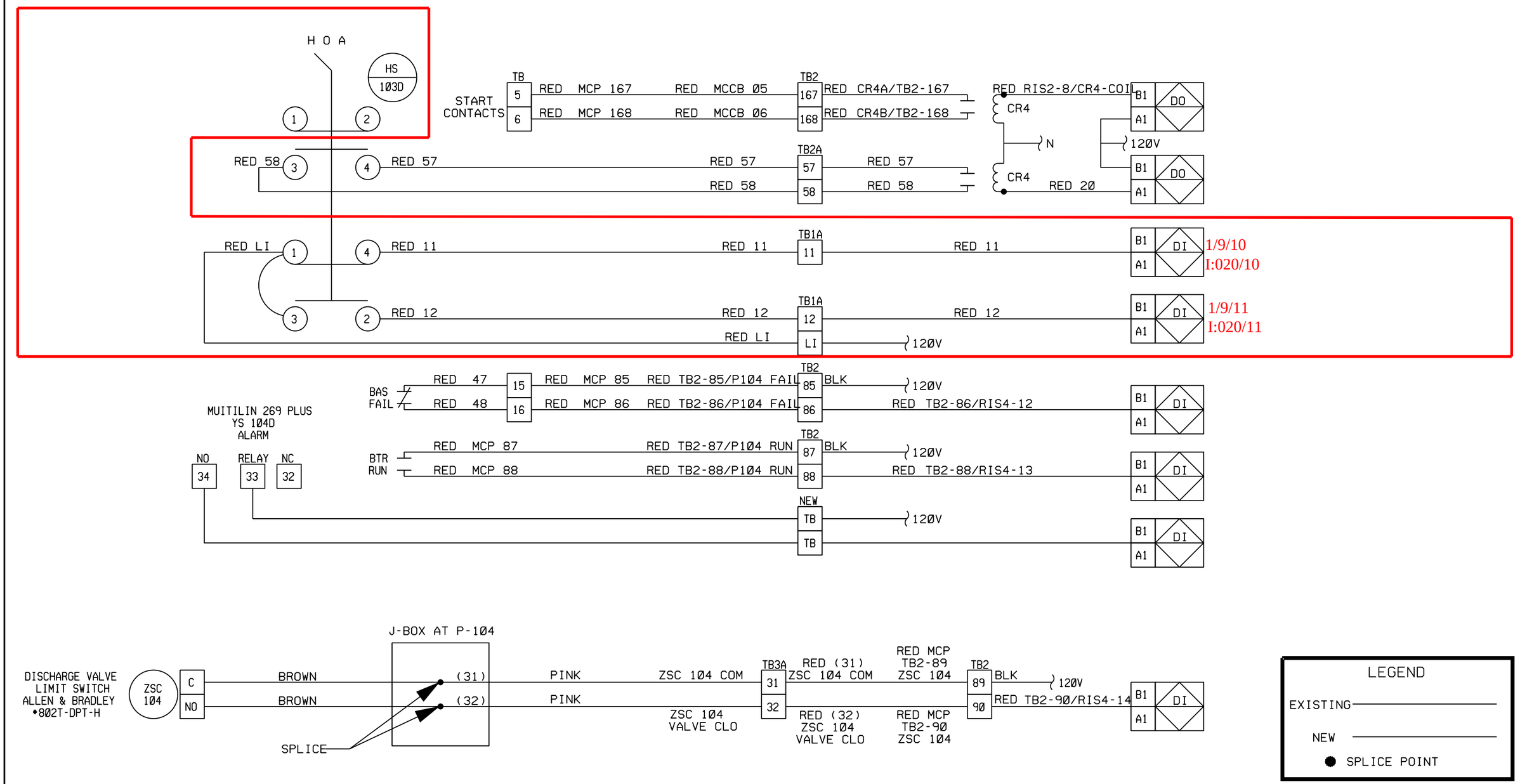
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA
INSTRUMENT LOOP DIAGRAM
PUMP P-104

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y104-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y104	65Y104-2	LD-PS65Y104	2	OF	3	0

1/9/10 & 11



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y104-3

INSTRUMENT LOOP DIAGRAM
PUMP P-104

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y104	65Y104-3	LD-PS65Y104	3 OF	3	Ø

1/9/10 & 11

LOOP NO: 65T101

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	TI	101	A	P-101	WINDING TEMP. A	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	101	B	P-101	WINDING TEMP. B	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	101	C	P-101	WINDING TEMP. C	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	101	D	P-101	WINDING TEMP. D	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	101	E	P-101	WINDING TEMP. E	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	101	F	P-101	WINDING TEMP. F	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	101	G	P-101	BEARING TEMP. G	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	101	H	P-101	BEARING TEMP. H	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	TI	101	A	P-101	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TI	101	B	P-101	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TI	101	C	P-101	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TI	101	D	P-101	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TI	101	E	P-101	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TI	101	F	P-101	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TI	101	G	P-101	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TI	101	H	P-101	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4

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chris
11-DEC-2008 12:16

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/10 - COM							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-101 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T101-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65T101	65T101-1	LD-PS65T101	1	OF	4	1

LOOP NO: 65T101

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	TE	101	A	P-101	WINDING TEMP. A	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	101	B	P-101	WINDING TEMP. B	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	101	C	P-101	WINDING TEMP. C	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	101	D	P-101	WINDING TEMP. D	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	101	E	P-101	WINDING TEMP. E	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	101	F	P-101	WINDING TEMP. F	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	101	G	P-101	BEARING TEMP. G	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	101	H	P-101	BEARING TEMP. H	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	TE	101	A	P-101	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TE	101	B	P-101	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TE	101	C	P-101	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TE	101	D	P-101	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TE	101	E	P-101	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TE	101	F	P-101	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TE	101	G	P-101	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4
I	65	TE	101	H	P-101	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T101	I-3	65T101-3	65T101-4

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REFERENCE DRAWINGS
P&ID: I-3
ELECTRICAL PLAN DRAWING: E-12
CONDUIT SCHEDULE: E-11.1
1/10 - COM

DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	11/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-101 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T101-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65T101	65T101-2	LD-PS65T101	2	OF	4	1

MOTOR *101 | MCCA P-101 | MCP PLC-100 | DCS

MULTILIN 269 PLUS

TE 101A: C1 / T1 / T1
- BLUE → 1
- RED → 2
- BLK → 3
- MCCA P101 RTD1
- RTD 1
- 4

TE 101B: C11 / T11 / T11
- BLUE → 5
- RED → 6
- BLK → 7
- MCCA P101 RTD2
- RTD 2
- 8

TE 101C: C2 / T2 / T2
- BLUE → 9
- RED → 10
- BLK → 11
- MCCA P101 RTD3
- RTD 3
- 12

TE 101D: C22 / T22 / T22
- BLUE → 71
- RED → 70
- BLK → 69
- MCCA P101 RTD4
- RTD 4
- 68

TE 101E: C3 / T3 / T3
- BLUE → 67
- RED → 66
- BLK → 65
- MCCA P101 RTD5
- RTD 5
- 64

TE 101F: C33 / T33 / T33
- BLUE → 63
- RED → 62
- BLK → 61
- MCCA P101 RTD6
- RTD 6
- 60

TE 101G:
- RTD-7A-13 RED → 13
- RTD-7A-14 BLUE → 14
- RTD-7A-15 BLK → 15
- RTD 7
- 16

TE 101H:
- RTD-8A-17 RED → 17
- RTD-8A-18 BLUE → 18
- RTD-8A-19 BLK → 19
- RTD 8
- 20

RS 485
- 47A (+)
- 46B (-)
- 88 SHLD
- BLK, WHT → TO MCCB P-102
- BLK → MCCA P101/47
- WHT → MCCA P101/46
- TO MCCA P-103

TO MCCA P-103
- BLK TB4-2/VT101A
- WHT TB4-1/VT101A-1

TB4
- 2 → BLUE → B1
- 1 → WHITE → A1
- 3

RS 485

DCS:
- TI 101A — P-101 WINDING TEMP. — 165TI101A
- TI 101B — P-101 WINDING TEMP. — 165TI101B
- TI 101C — P-101 WINDING TEMP. — 165TI101C
- TI 101D — P-101 WINDING TEMP. — 165TI101D
- TI 101E — P-101 WINDING TEMP. — 165TI101E
- TI 101F — P-101 WINDING TEMP. — 165TI101F
- TI 101G — P-101 BEARING TEMP. — 165TI101G
- TI 101H — P-101 BEARING TEMP. — 165TI101H

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/10 - COM							

WESTINGHOUSE ELECTRIC CORP. PROCESS CONTROL DIVISION

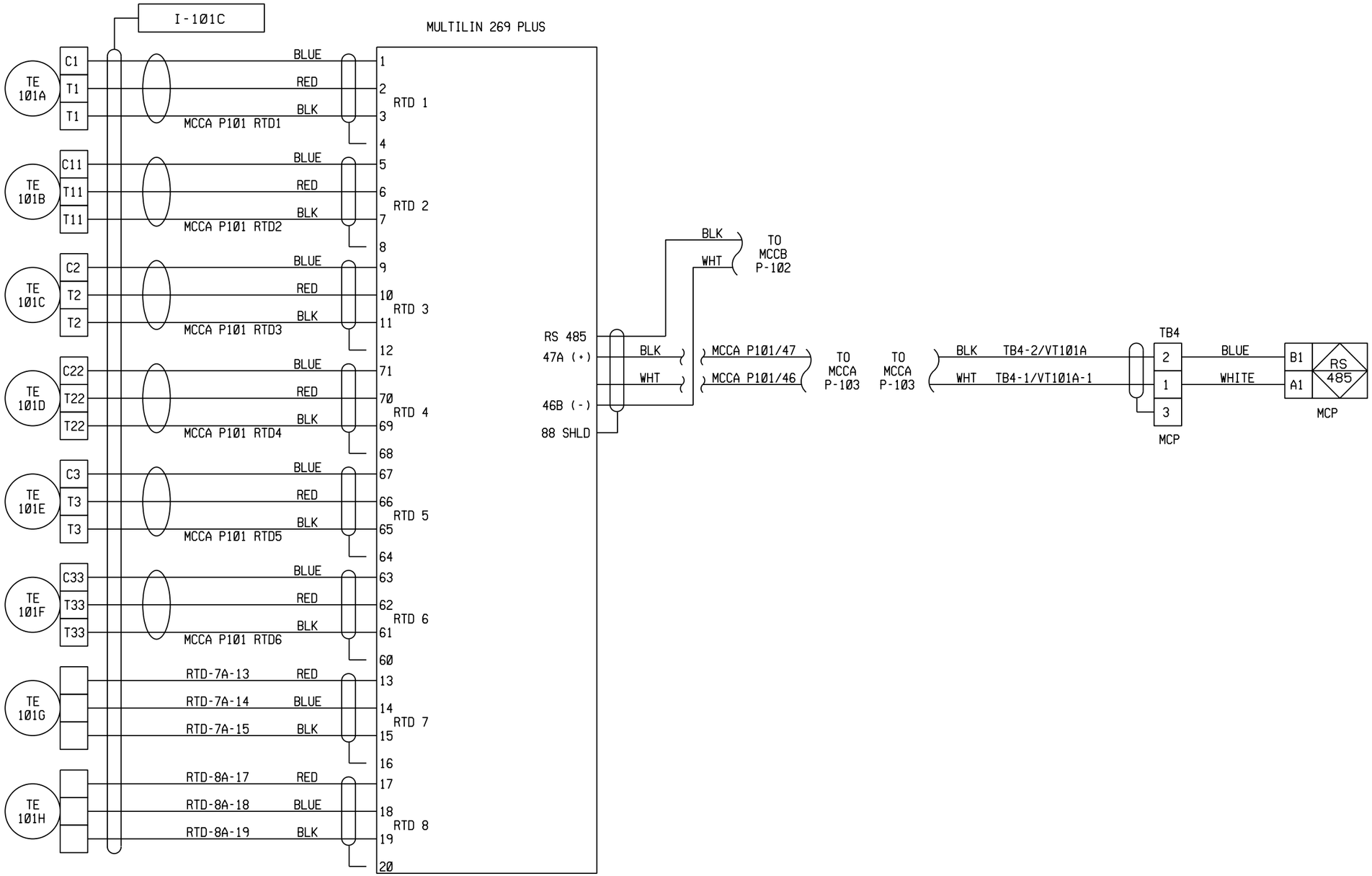
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-101 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T101-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65T101	65T101-3	LD-PS65T101	3 OF	4	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079

INSTRUMENT LOOP DIAGRAM
PUMP P-101 BEARING & MOTOR WINDING TEMP.

FILE NAME: 65T101-4

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65T101	65T101-4	LD-PS65T101	4 OF	4	1

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LOOP NO: 65T102

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	TI	102	A	P-102	WINDING TEMP. A	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	102	B	P-102	WINDING TEMP. B	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	102	C	P-102	WINDING TEMP. C	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	102	D	P-102	WINDING TEMP. D	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	102	E	P-102	WINDING TEMP. E	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	102	F	P-102	WINDING TEMP. F	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	102	G	P-102	BEARING TEMP. G	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	102	H	P-102	BEARING TEMP. H	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	TI	102	A	P-102	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TI	102	B	P-102	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TI	102	C	P-102	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TI	102	D	P-102	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TI	102	E	P-102	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TI	102	F	P-102	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TI	102	G	P-102	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TI	102	H	P-102	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4

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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/10 - COM							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-102 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T102-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65T102	65T102-1	LD-PS65T102	1	OF	4	1

LOOP NO: 65T102

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	TE	102	A	P-102	WINDING TEMP. A	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	102	B	P-102	WINDING TEMP. B	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	102	C	P-102	WINDING TEMP. C	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	102	D	P-102	WINDING TEMP. D	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	102	E	P-102	WINDING TEMP. E	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	102	F	P-102	WINDING TEMP. F	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	102	G	P-102	BEARING TEMP. G	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	102	H	P-102	BEARING TEMP. H	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	TE	102	A	P-102	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TE	102	B	P-102	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TE	102	C	P-102	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TE	102	D	P-102	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TE	102	E	P-102	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TE	102	F	P-102	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TE	102	G	P-102	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4
I	65	TE	102	H	P-102	S20.12	N/A	OHMS	S20.12	N/A	N/A	LD-PS65T102	I-3	65T102-3	65T102-4

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/10 - COM							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-102 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB: 9079
FILE NAME: 65T102-2

LOOP NO.	CAD FILE:	DWG NO. LD-PS65T102	SH	SH	REV
65T102	65T102-2		2 OF	4	1

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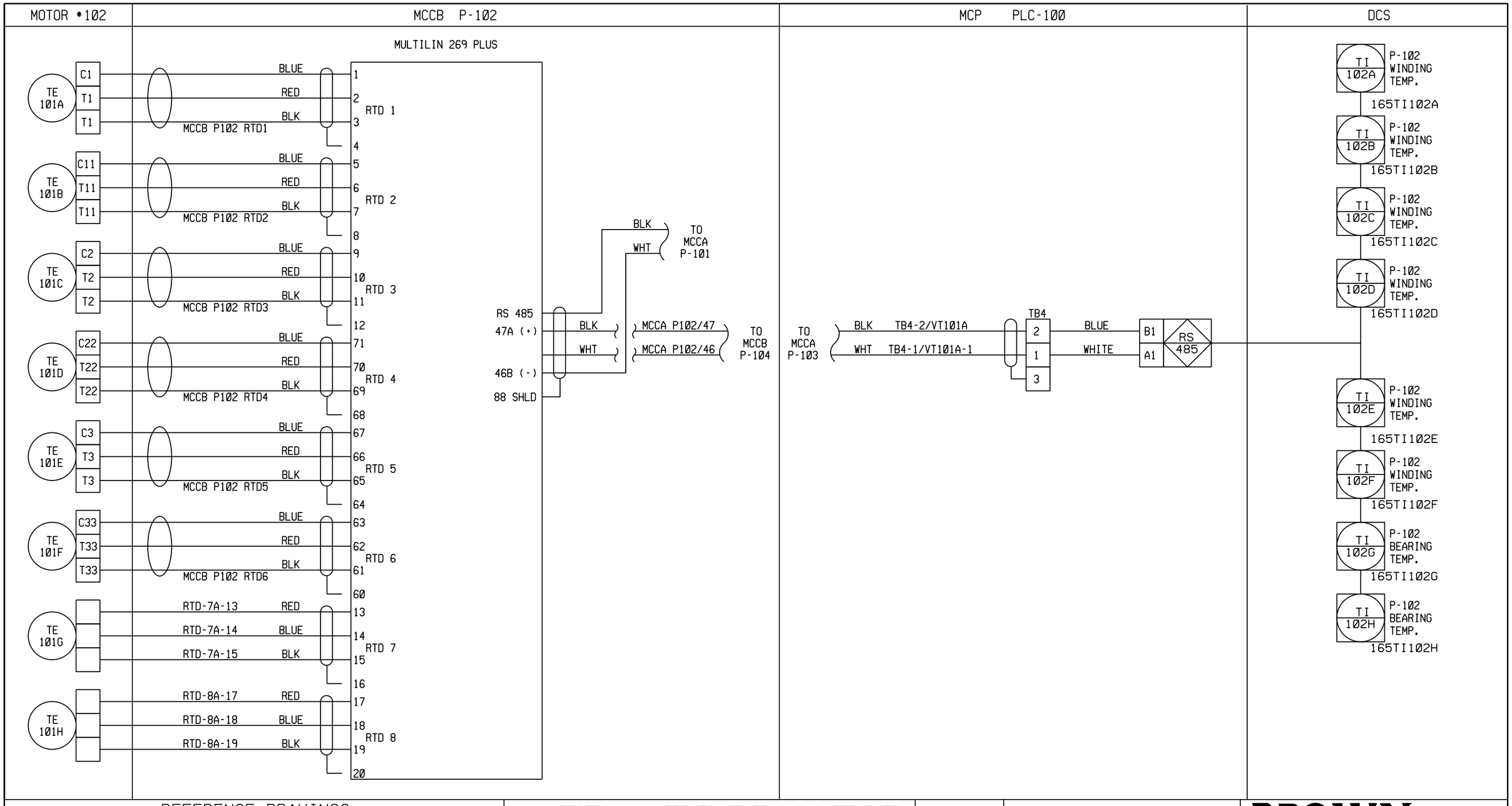

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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/10 - COM							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

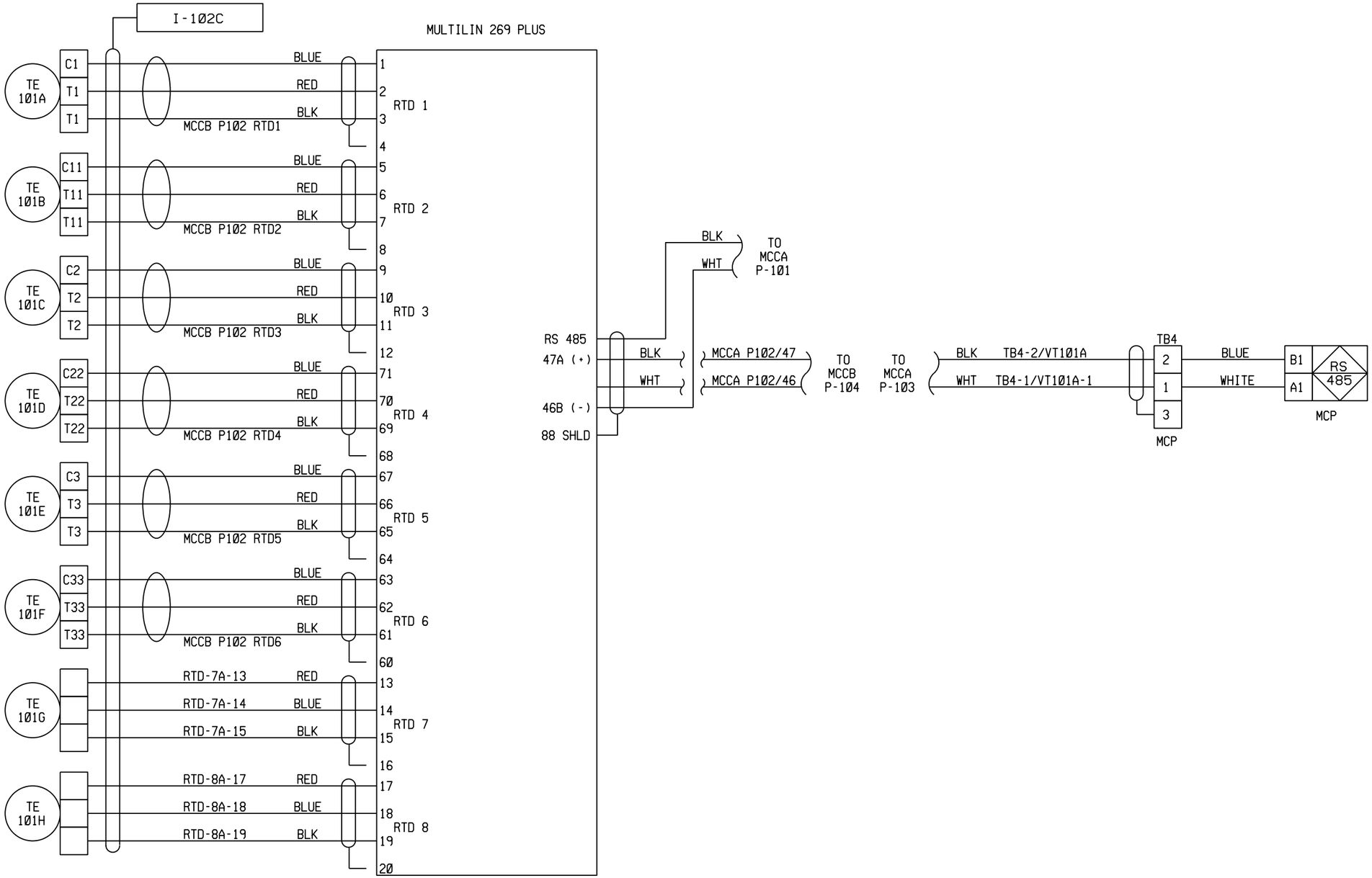
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-102 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T102-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65T102	65T102-3	LD-PS65T102	3 OF	4	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
P&ID: I-3	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
ELECTRICAL PLAN DRAWING: E-12	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
CONDUIT SCHEDULE: E-11.1	1	11/04	AS-BUILT	JG			
1/10 - COM							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T102-4

INSTRUMENT LOOP DIAGRAM
PUMP P-102 BEARING & MOTOR WINDING TEMP.

LOOP NO.	CAD FILE:	DWG NO. LD-PS65T102	SH	SH	REV
65T102	65T102-4		4 OF	4	1

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LOOP NO: 65T103

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	TI	103	A	P-103	WINDING TEMP. A	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	103	B	P-103	WINDING TEMP. B	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	103	C	P-103	WINDING TEMP. C	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	103	D	P-103	WINDING TEMP. D	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	103	E	P-103	WINDING TEMP. E	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	103	F	P-103	WINDING TEMP. F	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	103	G	P-103	BEARING TEMP. G	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	103	H	P-103	BEARING TEMP. H	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	TI	103	A	P-103	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TI	103	B	P-103	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TI	103	C	P-103	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TI	103	D	P-103	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TI	103	E	P-103	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TI	103	F	P-103	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TI	103	G	P-103	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TI	103	H	P-103	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4

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REFERENCE DRAWINGS

P&ID: I-3
ELECTRIC PLAN DRAWING: E-12
CONDUIT SCHEDULE: E-11.1

1/10 - COM

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	1/05	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-103 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T103-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65T103	65T103-1	LD-PS65T103	1	OF	4	1

LOOP NO: 65T103

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	TE	103	A	P-103	WINDING TEMP. A	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	103	B	P-103	WINDING TEMP. B	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	103	C	P-103	WINDING TEMP. C	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	103	D	P-103	WINDING TEMP. D	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	103	E	P-103	WINDING TEMP. E	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	103	F	P-103	WINDING TEMP. F	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	103	G	P-103	BEARING TEMP. G	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	103	H	P-103	BEARING TEMP. H	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	TE	103	A	P-103	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TE	103	B	P-103	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TE	103	C	P-103	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TE	103	D	P-103	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TE	103	E	P-103	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TE	103	F	P-103	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TE	103	G	P-103	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4
I	65	TE	103	H	P-103	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T103	I-3	65T103-3	65T103-4

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
P&ID: I-3	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRIC PLAN DRAWING: E-12	1	1/05	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1							
1/10 - COM							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

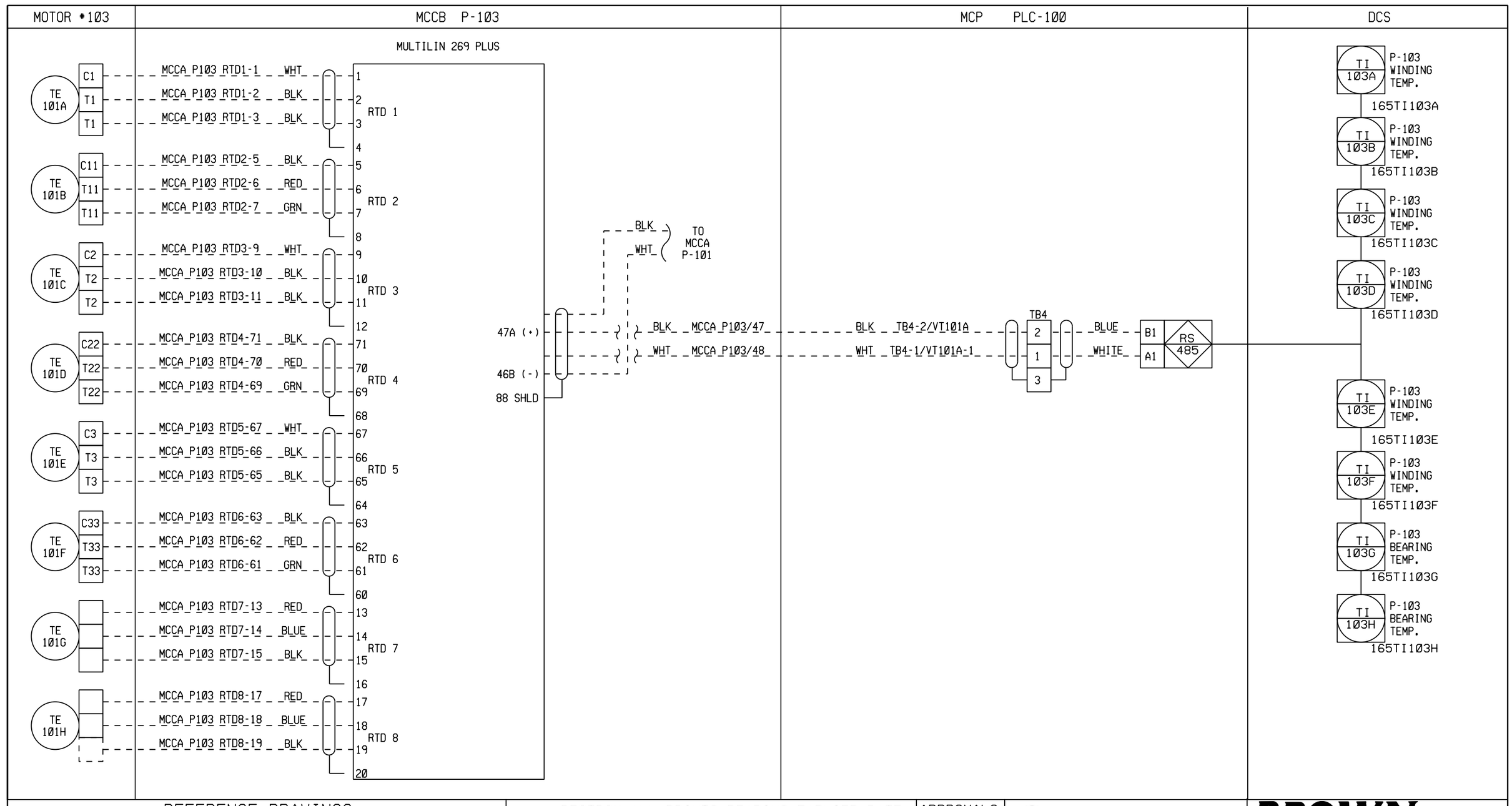
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-103 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T103-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65T103	65T103-2	LD-PS65T103	2	OF	4	1



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REFERENCE DRAWINGS

P&ID: I-3

ELECTRIC PLAN DRAWING: E-12

CONDUIT SCHEDULE: E-11.1

1/10 - COM

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	1/05	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

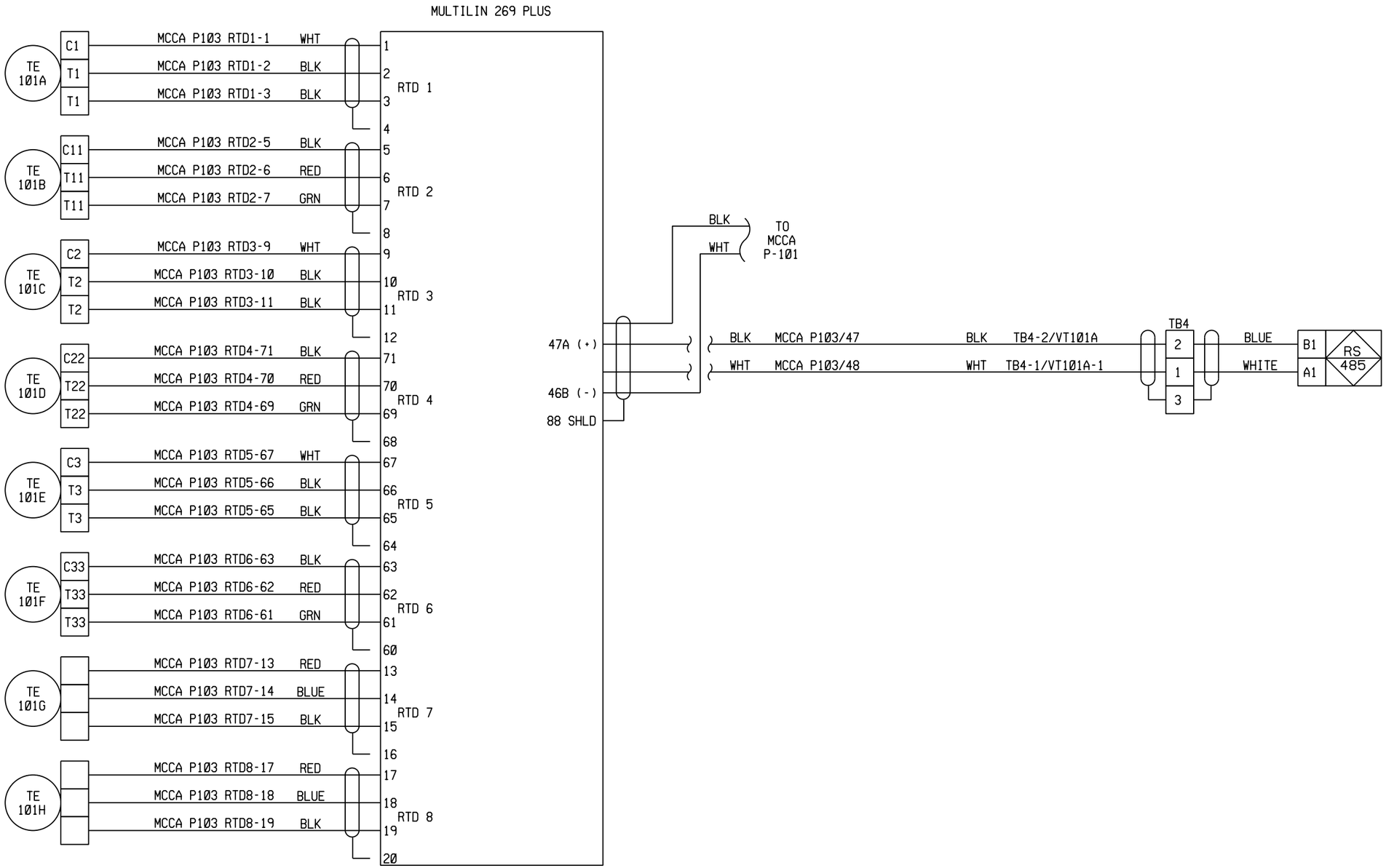
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-103 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T103-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65T103	65T103-3	LD-PS65T103	3 OF	4	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
P&ID: I-3	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRIC PLAN DRAWING: E-12	1	1/05	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1							
1/10 - COM							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T103-4

INSTRUMENT LOOP DIAGRAM
PUMP P-103 BEARING & MOTOR WINDING TEMP.

LOOP NO.	CAD FILE:	DWG NO. LD-PS65T103	SH	SH	REV
65T103	65T103-4		4 OF	4	1

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LOOP NO: 65T104

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	TI	104	A	P-104	WINDING TEMP. A	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	104	B	P-104	WINDING TEMP. B	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	104	C	P-104	WINDING TEMP. C	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	104	D	P-104	WINDING TEMP. D	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	104	E	P-104	WINDING TEMP. E	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	104	F	P-104	WINDING TEMP. F	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	104	G	P-104	BEARING TEMP. G	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	
I	65	TI	104	H	P-104	BEARING TEMP. H	INDICATOR	DCS	WESTINGHOUSE	WDPF II	13400	WPC	PS65-200	

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	TI	104	A	P-104	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TI	104	B	P-104	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TI	104	C	P-104	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TI	104	D	P-104	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TI	104	E	P-104	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TI	104	F	P-104	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TI	104	G	P-104	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TI	104	H	P-104	N/A	AI	4-20MA	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4

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REFERENCE DRAWINGS

P&ID: I-4
ELECTRIC PLAN DRAWING: E-12
CONDUIT SCHEDULE: E-11.1

1/10 - COM

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	1/05	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-104 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T104-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65T104	65T104-1	LD-PS65T104	1	OF	4	1

LOOP NO: 65T104

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	TE	104	A	P-104	WINDING TEMP. A	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	104	B	P-104	WINDING TEMP. B	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	104	C	P-104	WINDING TEMP. C	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	104	D	P-104	WINDING TEMP. D	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	104	E	P-104	WINDING TEMP. E	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	104	F	P-104	WINDING TEMP. F	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	104	G	P-104	BEARING TEMP. G	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING
I	65	TE	104	H	P-104	BEARING TEMP. H	RTD	FIELD	N/A	N/A	N/A	N/A	N/A	EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	TE	104	A	P-104	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TE	104	B	P-104	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TE	104	C	P-104	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TE	104	D	P-104	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TE	104	E	P-104	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TE	104	F	P-104	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TE	104	G	P-104	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4
I	65	TE	104	H	P-104	S20.12	N/A	OHMS	N/A	N/A	N/A	LD-PS65T104	I-4	65T104-3	65T104-4

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REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
P&ID: I-4	0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRIC PLAN DRAWING: E-12	1	1/05	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1							
1/10 - COM							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

LOOP DIAGRAM SCHEDULE
PUMP P-104 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T104-2

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65T104	65T104-2	LD-PS65T104	2	OF	4	1

MOTOR *104	MCCB P-104	MCP PLC-100	DCS

400 H.P.

MULTILIN 269 PLUS

TE 101A	C1 / T1 / T1	BLUE / RED / BLK	MCCB P104 RTD1	RTD 1
TE 101B	C11 / T11 / T11	BLUE / RED / BLK	MCCB P104 RTD2	RTD 2
TE 101C	C2 / T2 / T2	BLUE / RED / BLK	MCCB P104 RTD3	RTD 3
TE 101D	C22 / T22 / T22	BLUE / RED / BLK	MCCB P104 RTD4	RTD 4
TE 101E	C3 / T3 / T3	BLUE / RED / BLK	MCCB P104 RTD5	RTD 5
TE 101F	C33 / T33 / T33	BLUE / RED / BLK	MCCB P104 RTD6	RTD 6
TE 101G		RTD-7A-13 RED / RTD-7A-14 BLUE / RTD-7A-15 BLK		RTD 7
TE 101H		RTD-8A-17 RED / RTD-8A-18 BLUE / RTD-8A-19 BLK		RTD 8

MULTILIN 269 PLUS terminals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 71, 70, 69, 68, 67, 66, 65, 64, 63, 62, 61, 60, 13, 14, 15, 16, 17, 18, 19, 20

RS 485
47A (+)
46B (-)
88 SHLD

END OF LINE RESISTOR

BLK
WHT

TO MCCB P-102

TO MCCA P-103

BLK TB4-2/VT101A
WHT TB4-1/VT101A-1

TB4: 2, 1, 3

BLUE
WHITE

RS 485: B1, A1

DCS:

- TI 104A — P-104 WINDING TEMP. — 165TI104A
- TI 104B — P-104 WINDING TEMP. — 165TI104B
- TI 104C — P-104 WINDING TEMP. — 165TI104C
- TI 104D — P-104 WINDING TEMP. — 165TI104D
- TI 104E — P-104 WINDING TEMP. — 165TI104E
- TI 104F — P-104 WINDING TEMP. — 165TI104F
- TI 104G — P-104 BEARING TEMP. — 165TI104G
- TI 104H — P-104 BEARING TEMP. — 165TI104H

REFERENCE DRAWINGS

- P&ID: I-4
- ELECTRIC PLAN DRAWING: E-12
- CONDUIT SCHEDULE: E-11.1

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1	1/05	AS-BUILT	JG			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

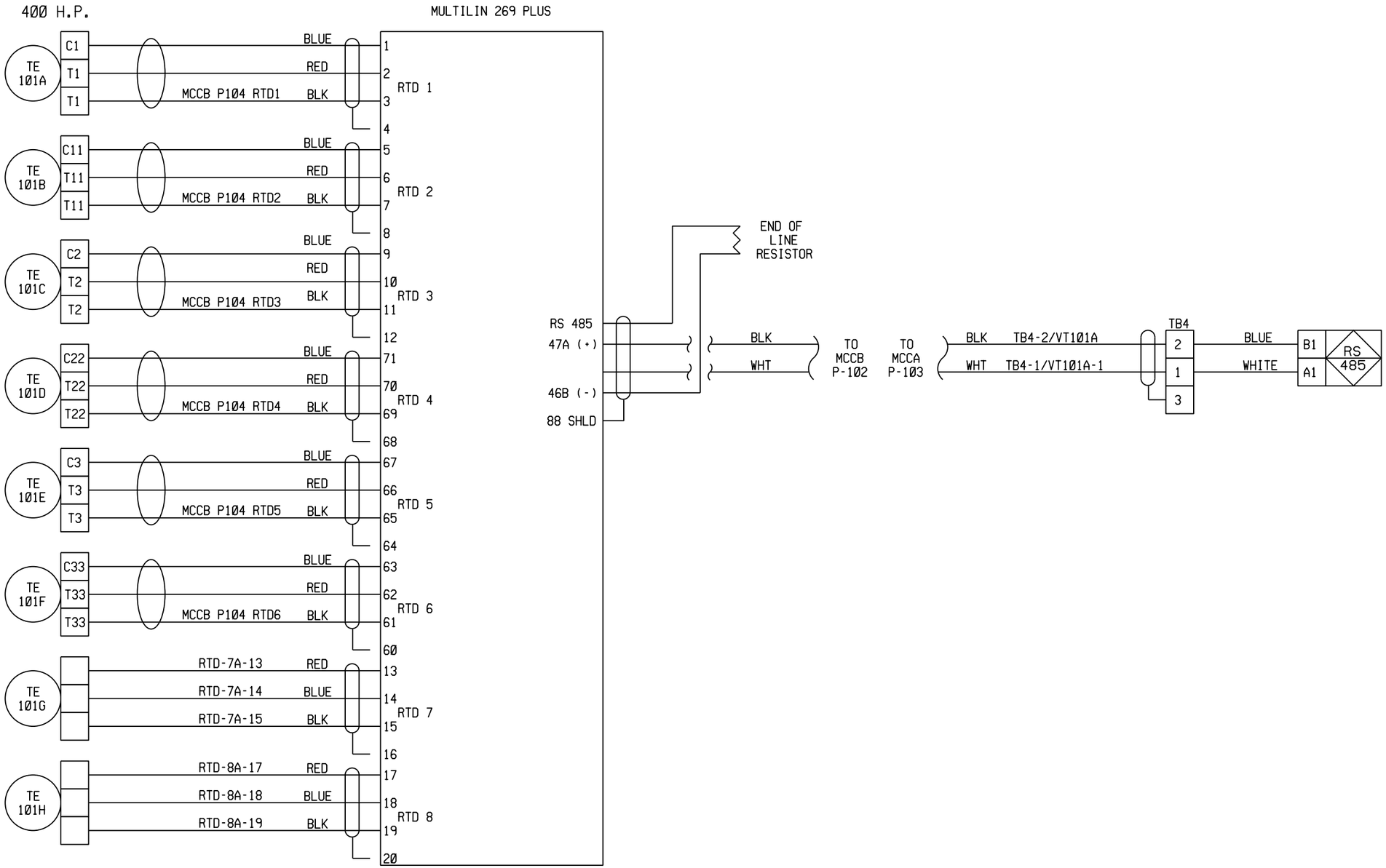
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-104 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T104-3

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65T104	65T104-3	LD-PS65T104	3 OF	4	1



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
P&ID: I-4	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
ELECTRIC PLAN DRAWING: E-12	1	1/05	AS-BUILT	JG			
CONDUIT SCHEDULE: E-11.1							
1/10 - COM							

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-104 BEARING & MOTOR WINDING TEMP.

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65T104-4

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65T104	65T104-4	LD-PS65T104	4 OF	4	1

LOOP NO: 65V101

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	VAH	101	A	P-101	UPPER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	101	A	P-101	UPPER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAH	101	B	P-101	LOWER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	101	B	P-101	LOWER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VT	101	A	P-101	UPPER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING
I	65	VT	101	B	P-101	LOWER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	VAH	101	A	P-101	N/A	AI	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3
I	65	VAHH	101	A	P-101	N/A	AI	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3
I	65	VAH	101	B	P-101	N/A	AI	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3
I	65	VAHH	101	B	P-101	N/A	AI	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3
I	65	VT	101	A	P-101	N/A	N/A	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3
I	65	VT	101	B	P-101	N/A	N/A	4-20MA				LD-PS65V101-2		LD-PS65V101	LD-PS65V101-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

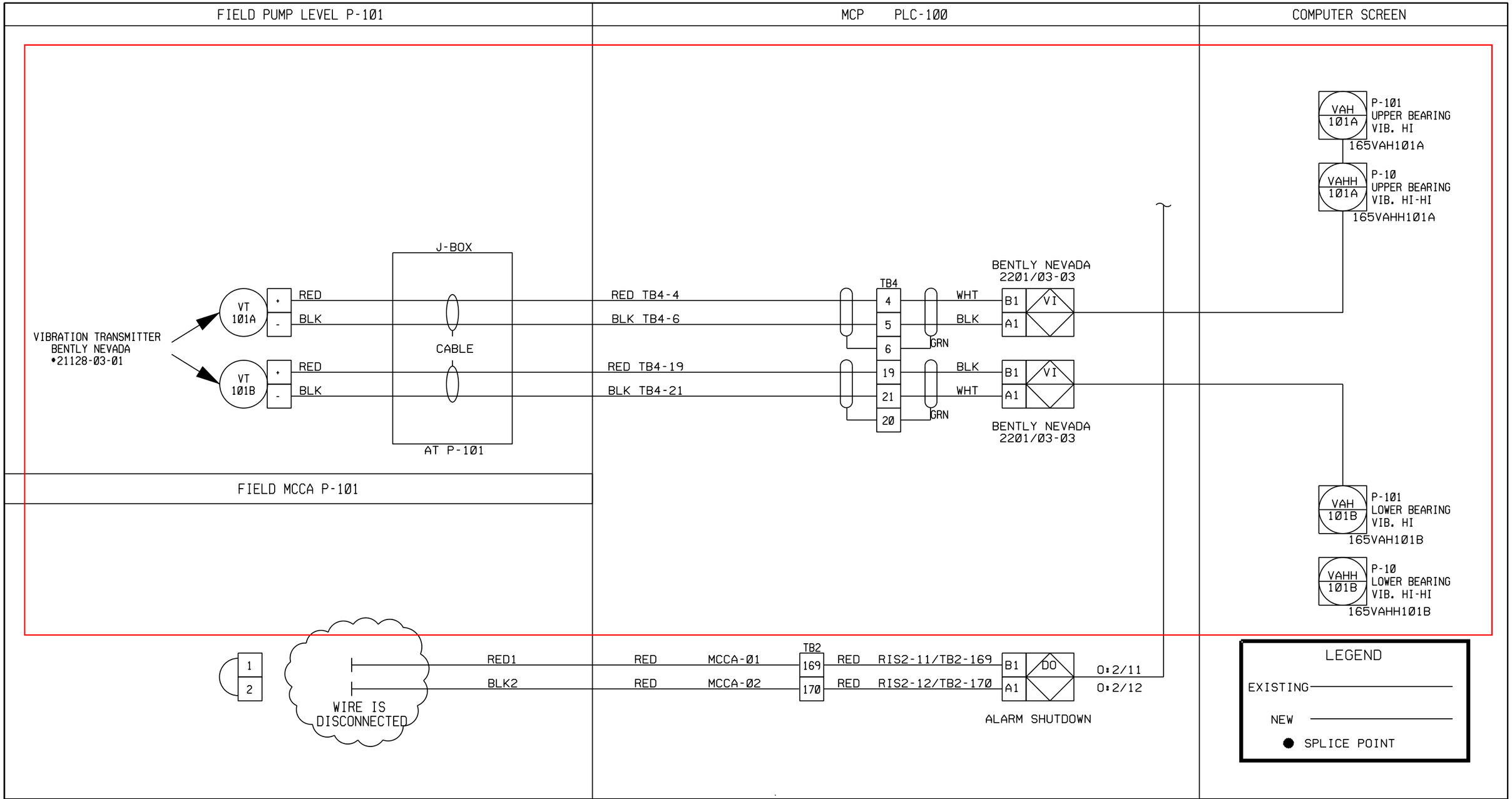
WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
PUMP P-101 UPPER & LOWER VIBRATION

FILE NAME: 65V101-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65V101	65V101-1	LD-PS65V101	1	OF	3	0

1/12 - COM



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-101 UPPER & LOWER BEARING VIBRATION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65V101-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65V101	65V101-2	LD-PS65V101	2 OF	3	0

1/12 - COM

LOOP NO: 65V102

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	VAH	102	A	P-102	UPPER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	102	A	P-102	UPPER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAH	102	B	P-102	LOWER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	102	B	P-102	LOWER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VT	102	A	P-102	UPPER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING
I	65	VT	102	B	P-102	LOWER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	VAH	102	A	P-102	N/A	AI	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3
I	65	VAHH	102	A	P-102	N/A	AI	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3
I	65	VAH	102	B	P-102	N/A	AI	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3
I	65	VAHH	102	B	P-102	N/A	AI	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3
I	65	VT	102	A	P-102	N/A	N/A	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3
I	65	VT	102	B	P-102	N/A	N/A	4-20MA				LD-PS65V102-2		LD-PS65V102	LD-PS65V102-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

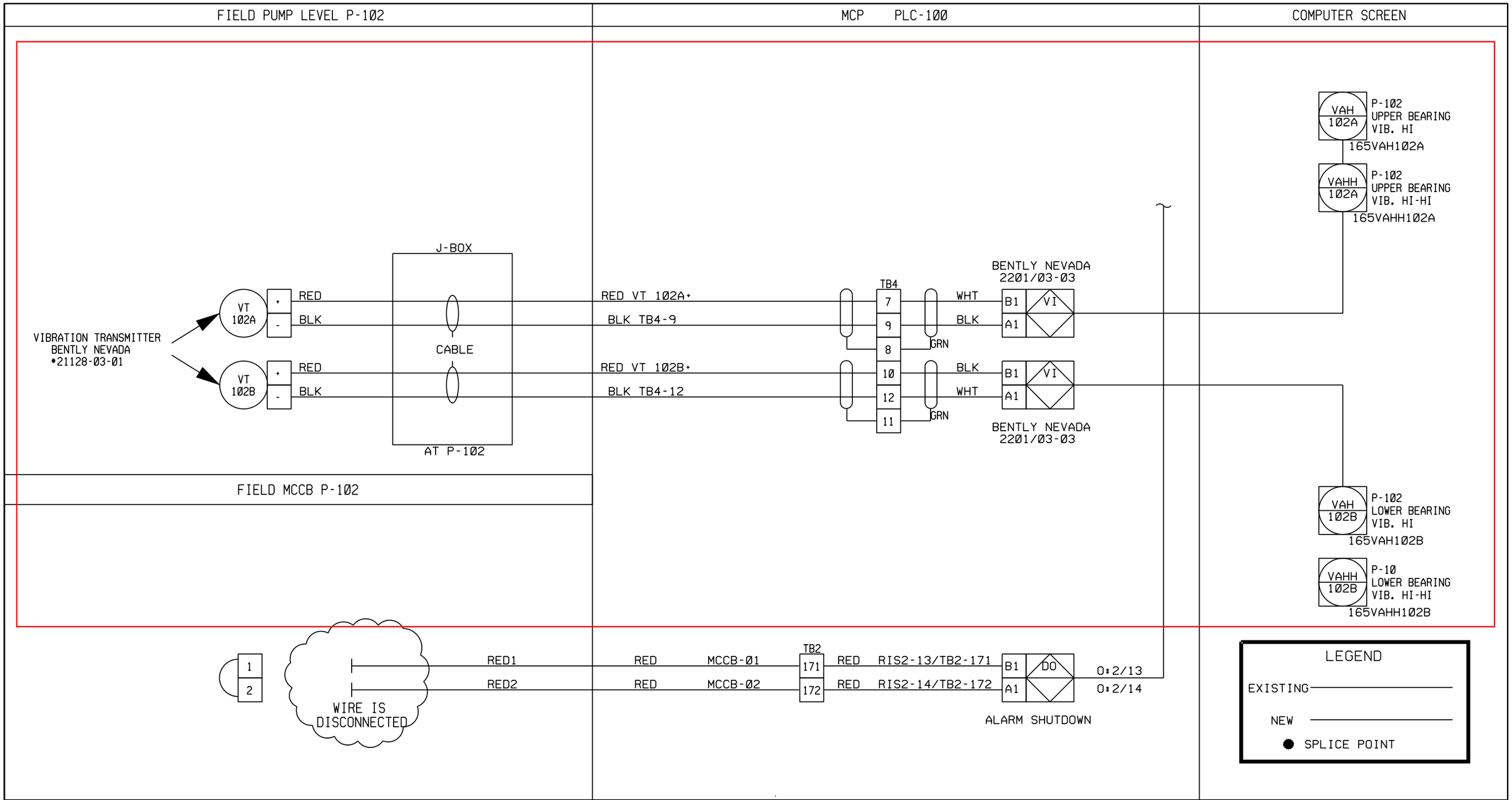
BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
PUMP P-102 UPPER & LOWER VIBRATION

FILE NAME: 65V102-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65V102	65V102-1	LD-PS65V102	1	OF	3	0

1/12 - COM



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-102 UPPER & LOWER BEARING VIBRATION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65V102-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65V102	65V102-2	LD-PS65V102	2 OF	3	0

1/12 - COM

LOOP NO: 65V103

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	VAH	103	A	P-103	UPPER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	103	A	P-103	UPPER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAH	103	B	P-103	LOWER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	103	B	P-103	LOWER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VT	103	A	P-103	UPPER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING
I	65	VT	103	B	P-103	LOWER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	VAH	103	A	P-103	N/A	AI	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3
I	65	VAHH	103	A	P-103	N/A	AI	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3
I	65	VAH	103	B	P-103	N/A	AI	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3
I	65	VAHH	103	B	P-103	N/A	AI	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3
I	65	VT	103	A	P-103	N/A	N/A	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3
I	65	VT	103	B	P-103	N/A	N/A	4-20MA				LD-PS65V103-2		LD-PS65V103	LD-PS65V103-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

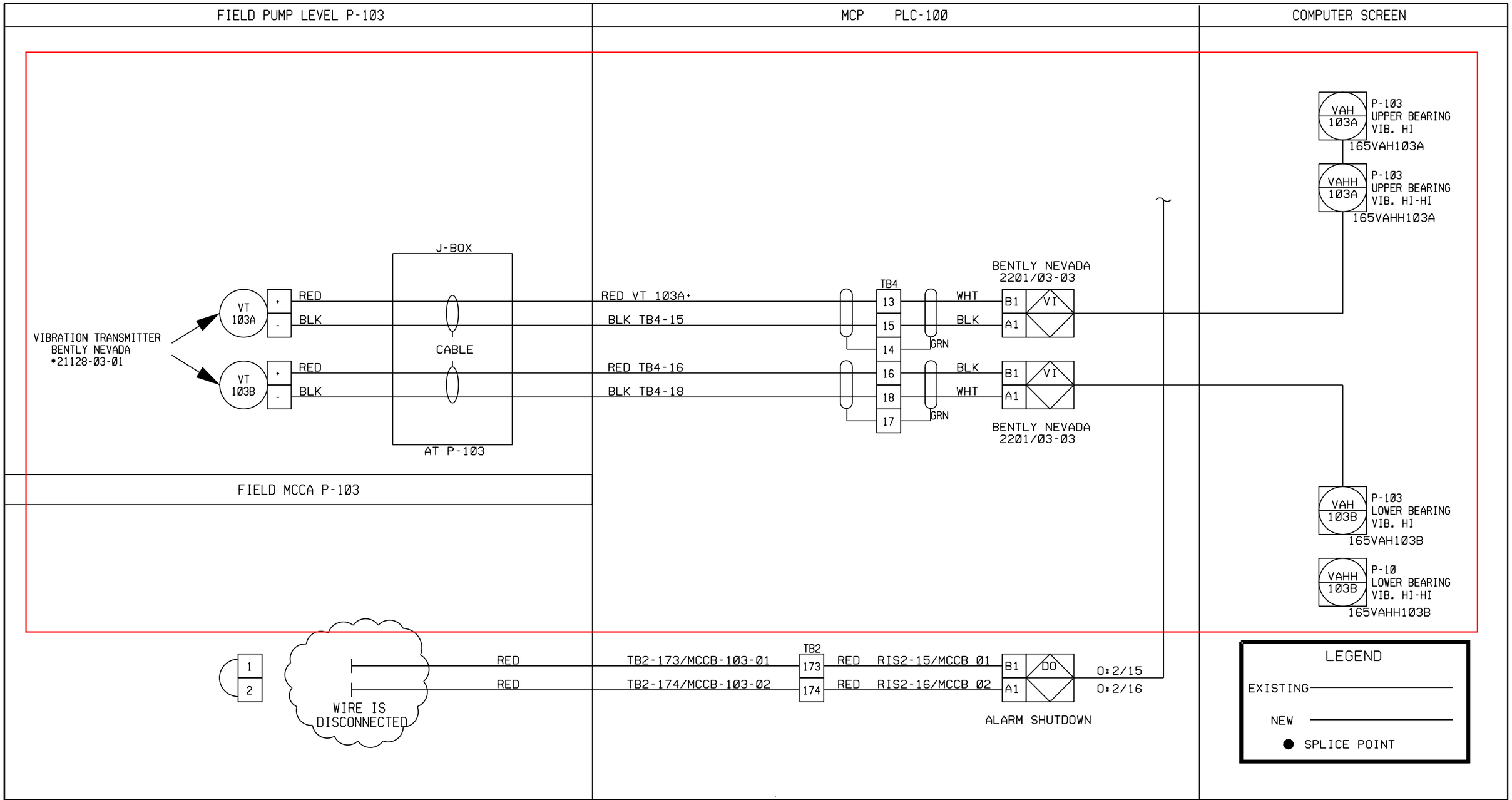
BROWN AUTOMATION JOB# 9079

FILE NAME: 65V103-1

LOOP DIAGRAM SCHEDULE
PUMP P-103 UPPER & LOWER VIBRATION

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65V103	65V103-1	LD-PS65V103	1	OF	3	0

1/12 - COM



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-103 UPPER & LOWER BEARING VIBRATION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65V103-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65V103	65V103-2	LD-PS65V103	2 OF	3	0

1/13 - COM

LOOP NO: 65V104

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	VAH	104	A	P-104	UPPER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	104	A	P-104	UPPER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAH	104	B	P-104	LOWER BEARING VIB. HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VAHH	104	B	P-104	LOWER BEARING VIB. HI-HI	INDICATOR	PLC-100	BENTLY NEVADA	2201/03-03				EXISTING
I	65	VT	104	A	P-104	UPPER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING
I	65	VT	104	B	P-104	LOWER BEARING	VIB. TRANSM.	FIELD	BENTLY NEVADA	2112B-03-01				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	VAH	104	A	P-104	N/A	AI	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3
I	65	VAHH	104	A	P-104	N/A	AI	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3
I	65	VAH	104	B	P-104	N/A	AI	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3
I	65	VAHH	104	B	P-104	N/A	AI	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3
I	65	VT	104	A	P-104	N/A	N/A	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3
I	65	VT	104	B	P-104	N/A	N/A	4-20MA				LD-PS65V104-2		LD-PS65V104	LD-PS65V104-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

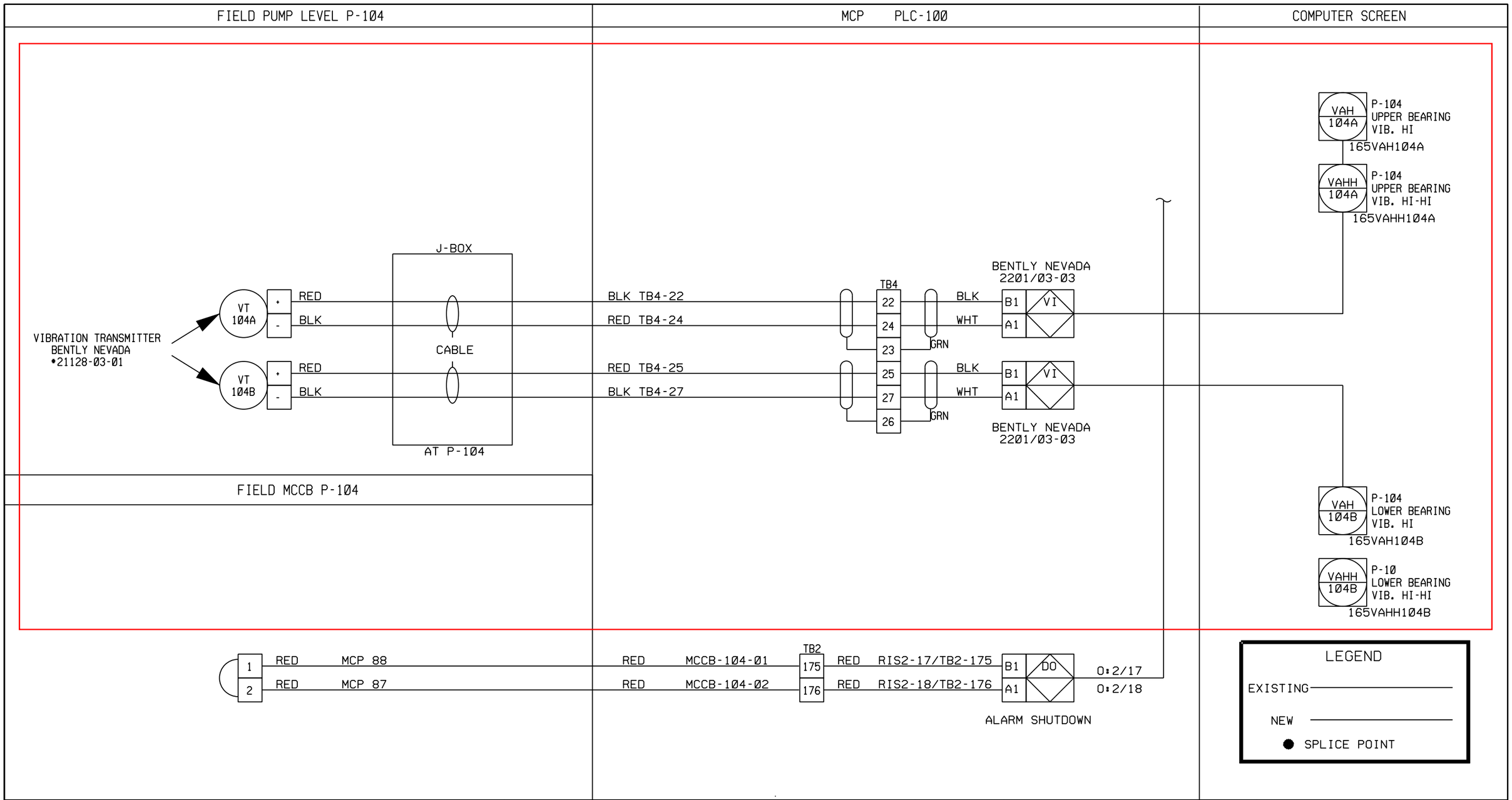
BROWN AUTOMATION JOB# 9079

LOOP DIAGRAM SCHEDULE
PUMP P-104 UPPER & LOWER VIBRATION

FILE NAME: 65V104-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65V104	65V104-1	LD-PS65V104	1	OF	3	0

1/13 - COM



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
PUMP P-104 UPPER & LOWER BEARING VIBRATION

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65V104-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65V104	65V104-2	LD-PS65V104	2 OF	3	0

LOOP NO: 65Y232

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	232		G-232	G-232 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	232		G-232	G-232 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	232		G-232	G-232 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	232	A	G-232	G-232 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	232	B	G-232	G-232 STOP	COMMAND	PLC-100	TBD	TBD				NEW
I	65	HS	232	C	G-232	G-232 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	232	D	G-232	G-232 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	232	E	G-232	G-232 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	232	F	G-232	G-232 STOP	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	232		G-232	G-232 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	232		G-232	G-232 CLOSED	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	232		G-232	G-232 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	232		G-232	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZLC	232		G-232	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZLO	232		G-232	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	A	G-232	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	B	G-232	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	C	G-232	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	D	G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	E	G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232	F	G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	HS	232		G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZSC	232		G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3
I	65	ZSO	232		G-232	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y232-2		LD-PS65Y232	LD-PS65Y232-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

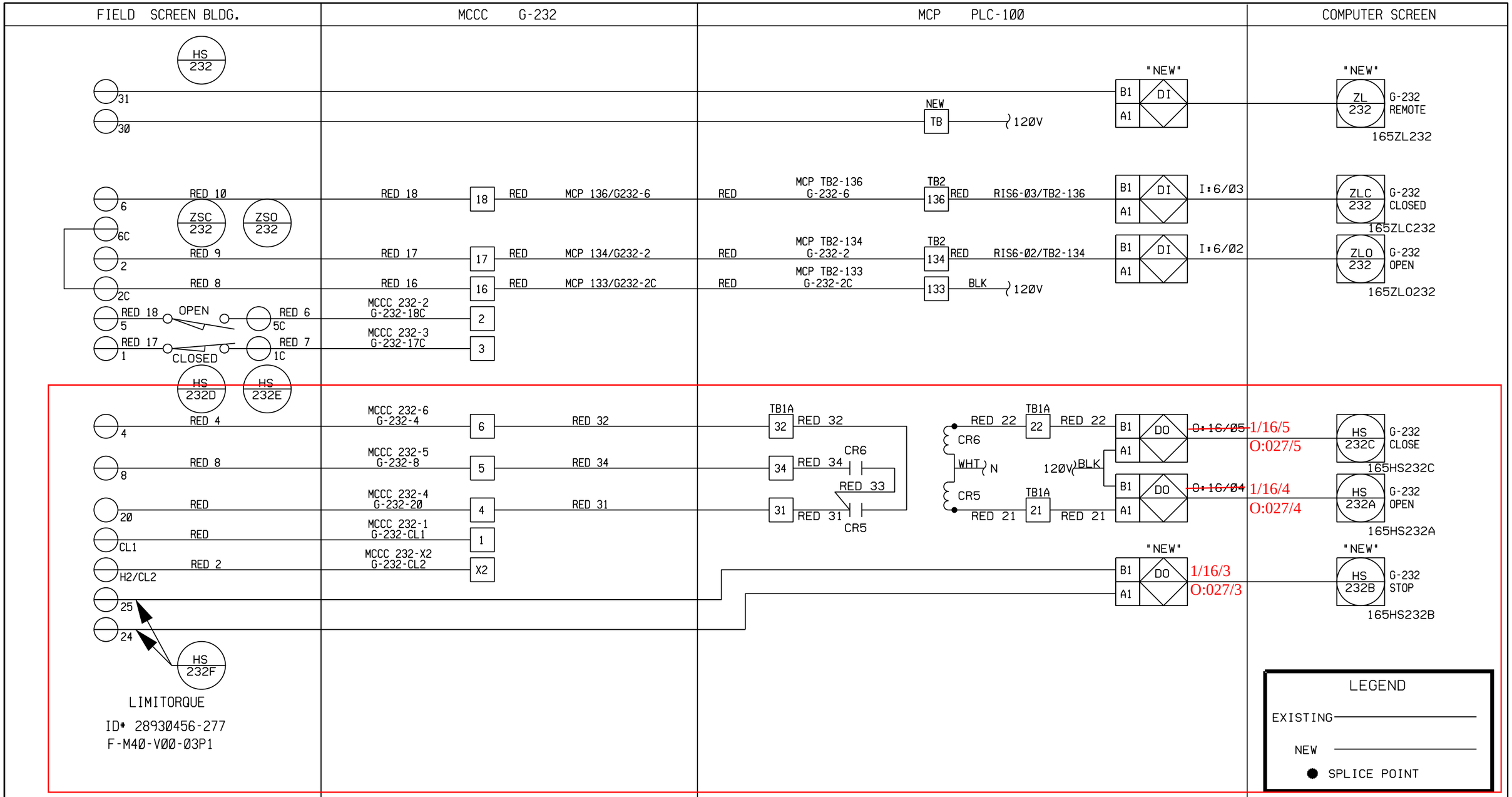
PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y232-1

LOOP DIAGRAM SCHEDULE
SCREENING FACILITY SLUICE GATE G-232

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y232	65Y232-1	LD-PS65Y232	1	OF	3	0

1/16/3, 4, & 5



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORPORATION
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y232-2

INSTRUMENT LOOP DIAGRAM
SCREENING FAC. SLUICE GATE G-232

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y232	65Y232-2	LD-PS65Y232	2	OF	3	0

1/16/3, 4, & 5

LOOP NO: 65Y211

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	211		G-211	G-211 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	211		G-211	G-211 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	211		G-211	G-211 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	211	A	G-211	G-211 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	211	B	G-211	G-211 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	211		G-211	G-211 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	211	C	G-211	G-211 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	211	D	G-211	G-211 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	211		G-211	G-211 CLOSED	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	211		G-211	G-211 OPEN	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	211		G-211	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZLC	211		G-211	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZLO	211		G-211	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	A	G-211	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	B	G-211	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211		G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	C	G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	HS	211	D	G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZSC	211		G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3
I	65	ZSO	211		G-211	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y211-2		LD-PS65Y211	LD-PS65Y211-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

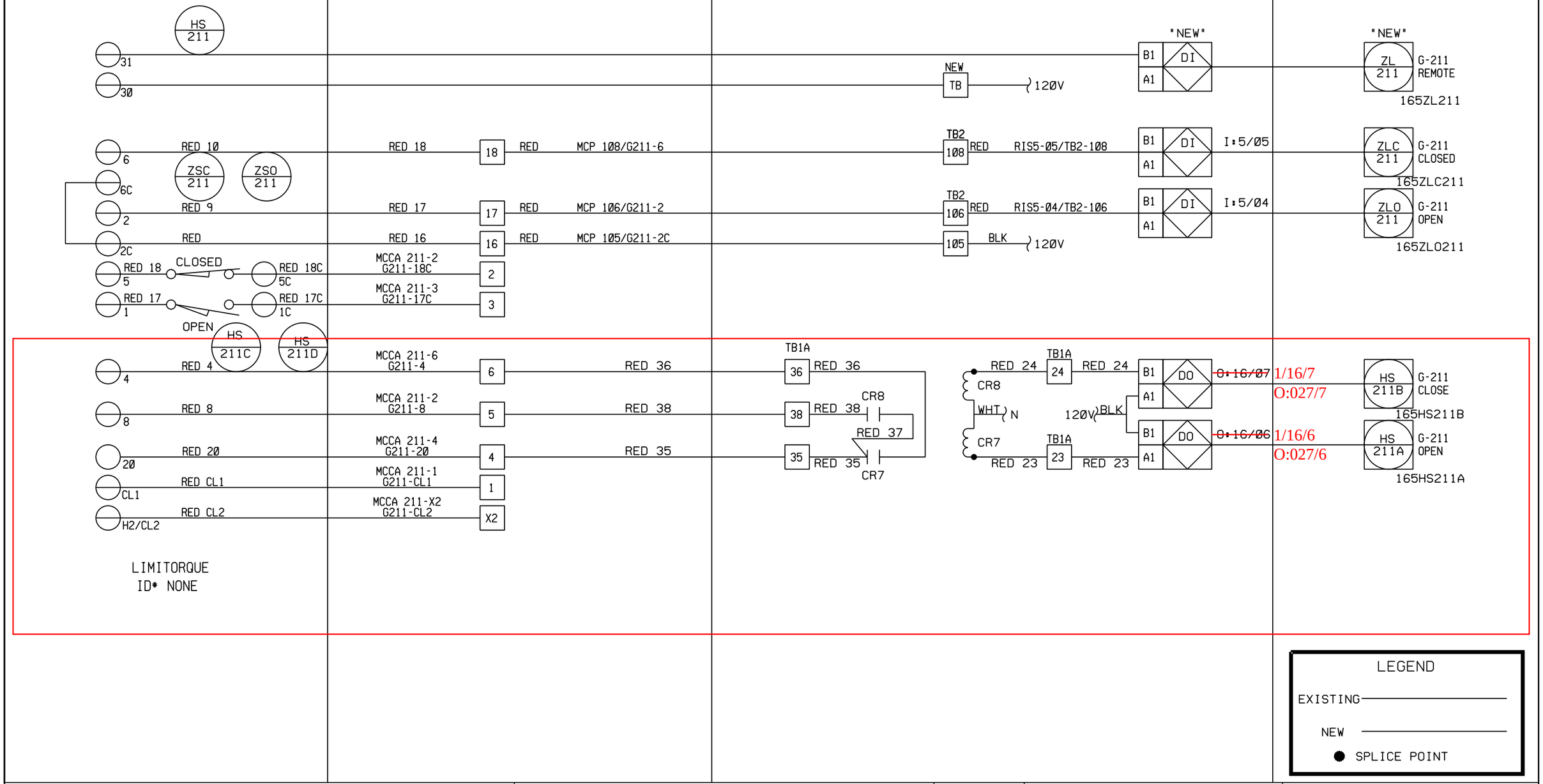
FILE NAME: 65Y211-1

LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-201 SLIDE GATE G-211

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y211	65Y211-1	LD-PS65Y211	1	OF	3	0

1/16/6 & 7

FIELD SCREEN BLDG.	MCCA G-211	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

1/16/6 & 7

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y211-2

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-201 SLIDE GATE G-211

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y211	65Y211-2	LD-PS65Y211	2	OF	3	Ø

LOOP NO: 65Y212

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	212		G-212	G-212 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	212		G-212	G-212 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	212		G-212	G-212 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	212	A	G-212	G-212 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	212	B	G-212	G-212 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	212		G-212	G-212 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	212	C	G-212	G-212 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	212	D	G-212	G-212 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	212		G-212	G-212 CLOSED	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	212		G-212	G-212 OPEN	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	212		G-212	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZLC	212		G-212	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZLO	212		G-212	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	A	G-212	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	B	G-212	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212		G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	C	G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	HS	212	D	G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZSC	212		G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3
I	65	ZSO	212		G-212	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y212-2		LD-PS65Y212	LD-PS65Y212-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

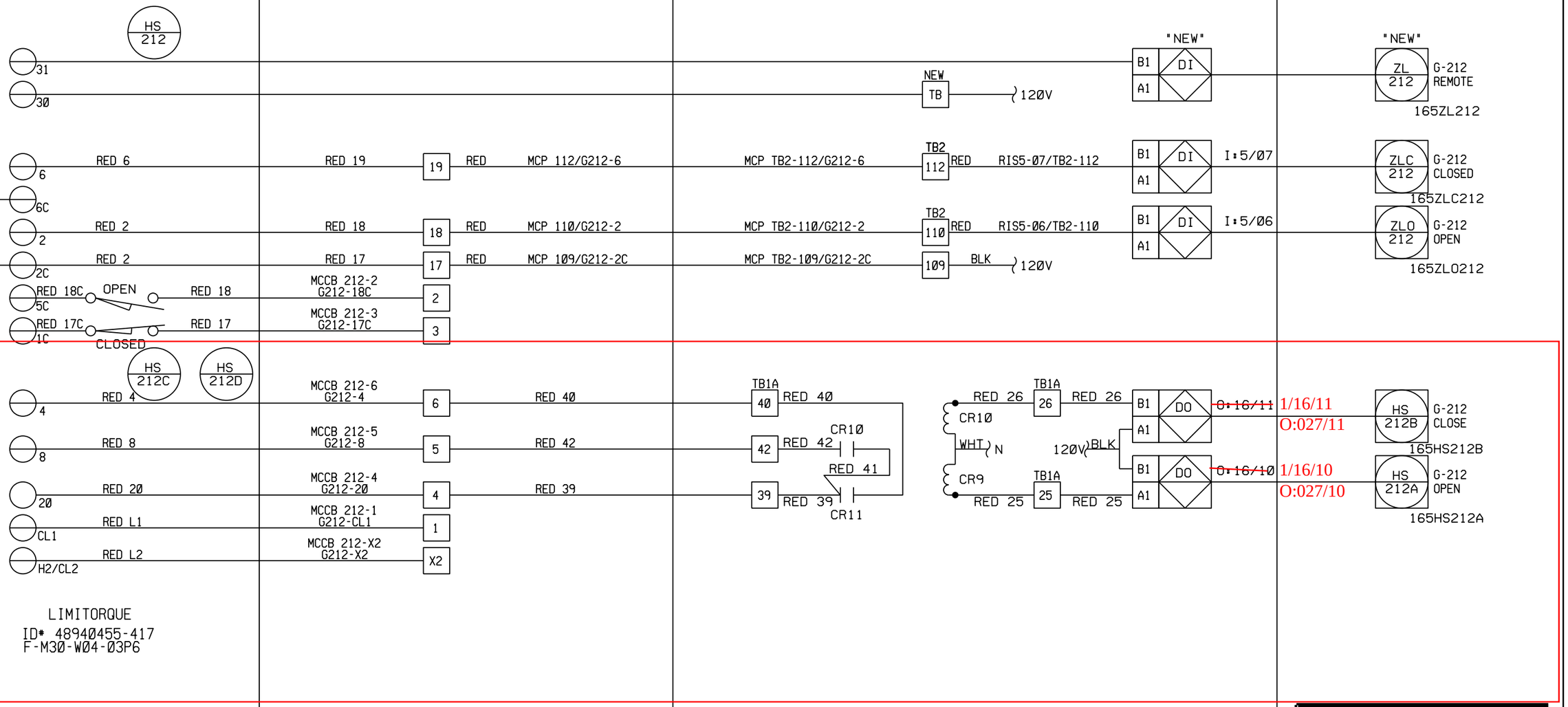
FILE NAME: 65Y212-1

LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-202 SLIDE GATE G-212

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y212	65Y212-1	LD-PS65Y212	1	OF	3	0

1/16/10& 11

FIELD SCREEN BLDG.	MCCB G-212	MCP PLC-100	COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

1/16/10& 11

WESTINGHOUSE ELECTRIC CO. PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y212-2

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-202 SLIDE GATE G-212

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y212	65Y212-2	LD-PS65Y212	2 OF	3	0

LOOP NO: 65Y213

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZL	213		G-213	G-213 REMOTE	STATUS	PLC-100	TBD	TBD				NEW
I	65	ZLC	213		G-213	G-213 CLOSED	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	213		G-213	G-213 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	HS	213	A	G-213	G-213 OPEN	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	213	B	G-213	G-213 CLOSE	COMMAND	PLC-100	TBD	TBD				EXISTING
I	65	HS	213		G-213	G-213 REMOTE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	213	C	G-213	G-213 CLOSE	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	HS	213	D	G-213	G-213 OPEN	SWITCH	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSC	213		G-213	G-213 CLOSED	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING
I	65	ZSO	213		G-213	G-213 OPEN	CONTACTS	FIELD	LIMITORQUE	TBD				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZL	213		G-213	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZLC	213		G-213	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZLO	213		G-213	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	A	G-213	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	B	G-213	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213		G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	C	G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	HS	213	D	G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZSC	213		G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3
I	65	ZSO	213		G-213	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y213-2		LD-PS65Y213	LD-PS65Y213-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

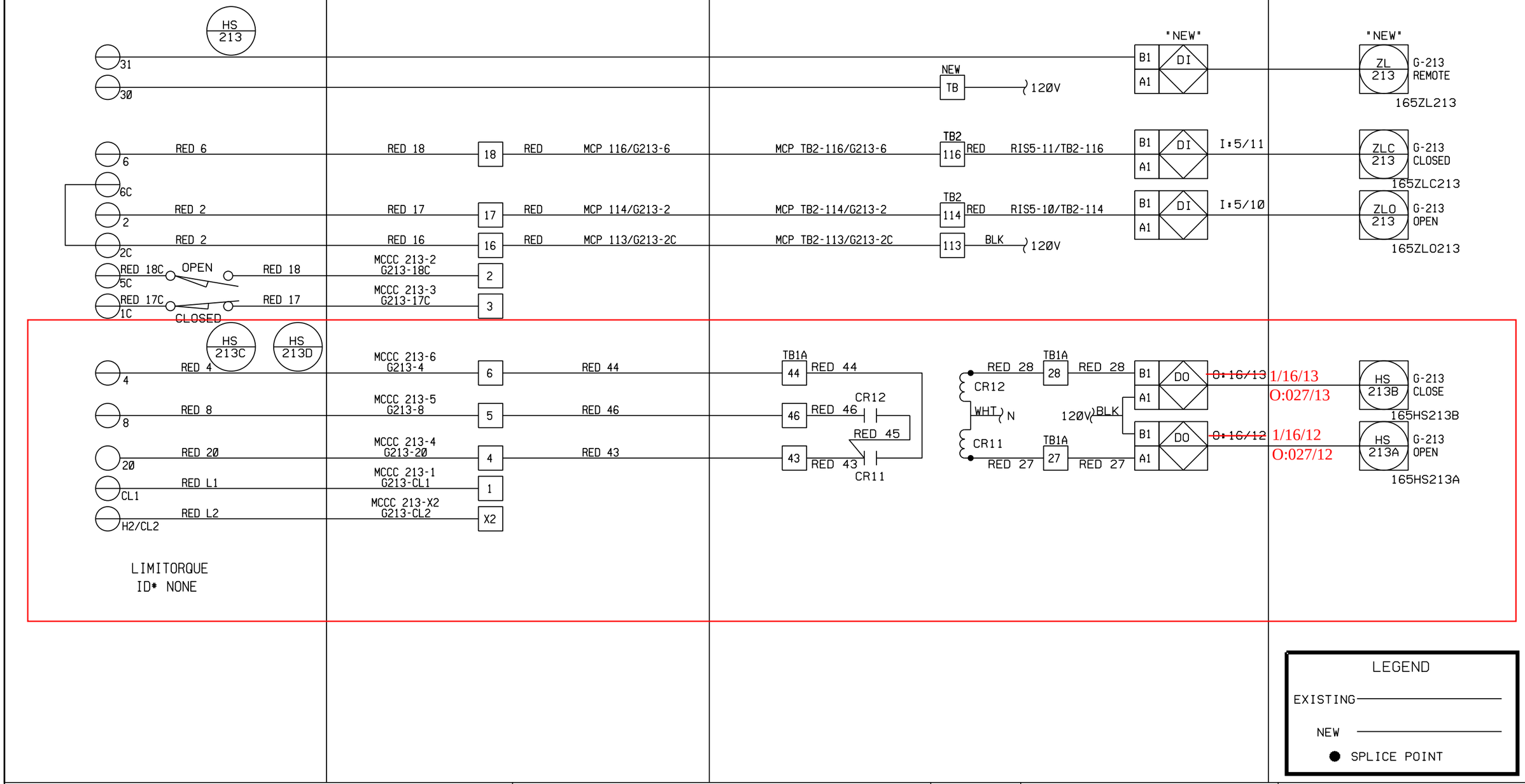
LOOP DIAGRAM SCHEDULE
BAR SCREEN ME-203 SLIDE GATE G-213

FILE NAME: 65Y213-1

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y213	65Y213-1	LD-PS65Y213	1	OF	3	0

1/16/12& 13

FIELD SCREEN BLDG.	MCCC G-213	MCP PLC-100	COMPUTER SCREEN



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			
1/16/12& 13							

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION
BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
BAR SCREEN ME-203 SLIDE GATE G-213

WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y213-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y213	65Y213-2	LD-PS65Y213	2 OF	3	0

LOOP NO: 65Y141

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	ZLC	141		FORCE MAIN VALVE	V-141 CLOSED	STATUS	PLC-100	TBD					EXISTING
I	65	ZLO	141		FORCE MAIN VALVE	V-141 OPEN	STATUS	PLC-100	TBD					EXISTING
I	65	ZL	141		FORCE MAIN VALVE	V-141 LOCAL	STATUS	PLC-100	TBD					NEW
I	65	HS	141	A	FORCE MAIN VALVE	V-141 CLOSED	COMMAND	PLC-100	TBD					EXISTING
I	65	HS	141	B	FORCE MAIN VALVE	V-141 OPEN	COMMAND	PLC-100	TBD					EXISTING
I	65	ZSC	141		FORCE MAIN VALVE	V-141 CLOSED	SWITCH	FIELD	TBD					EXISTING
I	65	ZSO	141		FORCE MAIN VALVE	V-141 OPEN	SWITCH	FIELD	TBD					EXISTING
I	65	ZSL	141		FORCE MAIN VALVE	V-141 LOCAL	SWITCH	FIELD	TBD					EXISTING
I	65	HS	141	C	FORCE MAIN VALVE	V-141 OPEN	SWITCH	FIELD	TBD					EXISTING
I	65	HS	141	D	FORCE MAIN VALVE	V-141 CLOSED	SWITCH	FIELD	TBD					EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	ZLC	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZLO	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZL	141		FORCE MAIN VALVE	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	A	FORCE MAIN VALVE	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	B	FORCE MAIN VALVE	N/A	DO	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSC	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSO	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	ZSL	141		FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	C	FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3
I	65	HS	141	D	FORCE MAIN VALVE	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y141-2		LD-PS65Y141	LD-PS65Y141-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

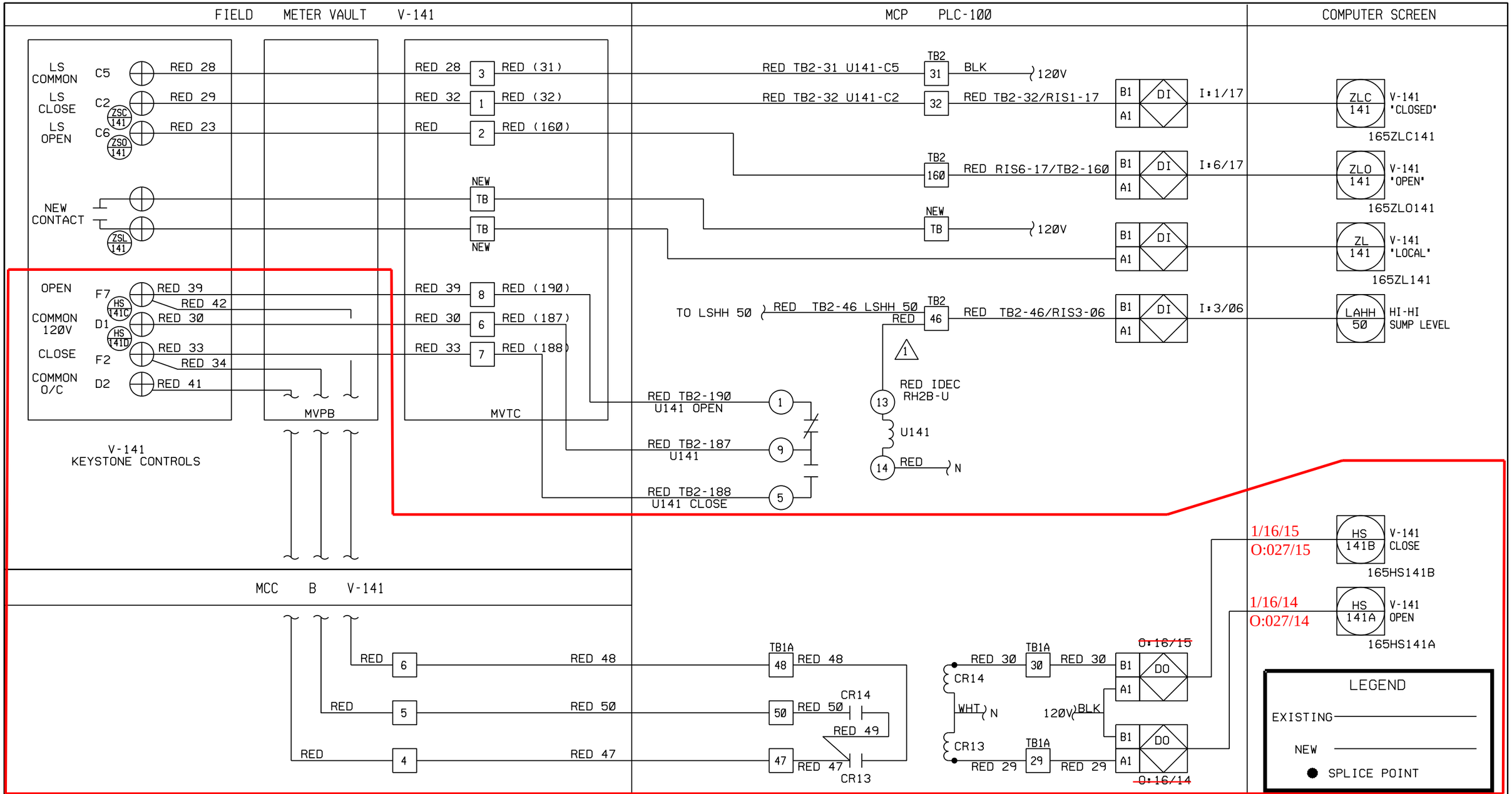
BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y141-1

LOOP DIAGRAM SCHEDULE
FORCE MAIN VALVE V-141

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y141	65Y141-1	LD-PS65Y141	1	OF	3	0

1/16/14 & 15



REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	0	01/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

INSTRUMENT LOOP DIAGRAM
FORCE MAIN VALVE V-141

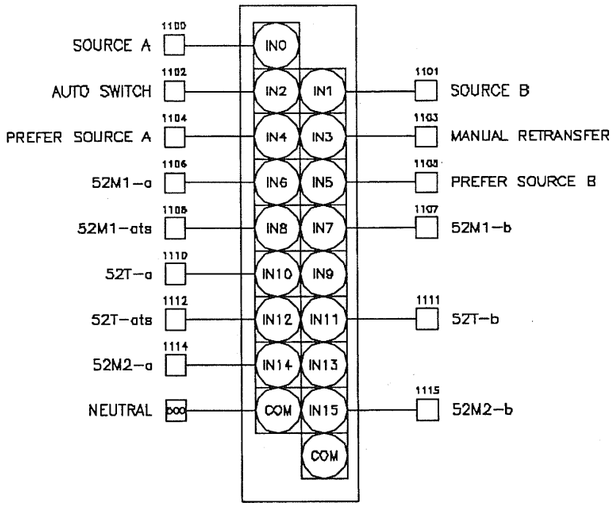
WESTINGHOUSE PROJECT NO. C0137
BROWN AUTOMATION JOB# 9079
FILE NAME: 65Y141-2

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y141	65Y141-2	LD-PS65Y141	2 OF	3	0

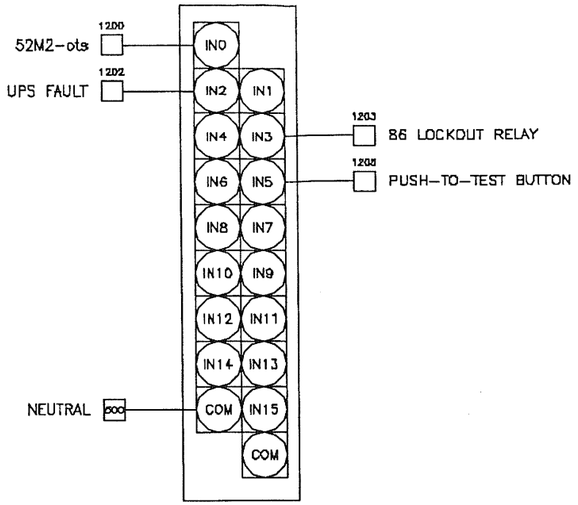
1/16/14 & 15

REV	DESCRIPTION	BY	DATE

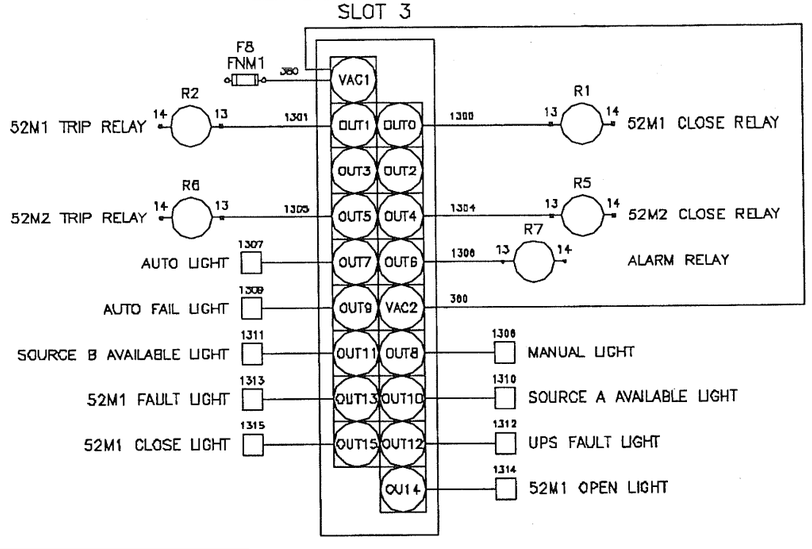
16PT 120 VAC INPUT CARD
ALLEN BRADLEY 1746-IA16
SLOT 1



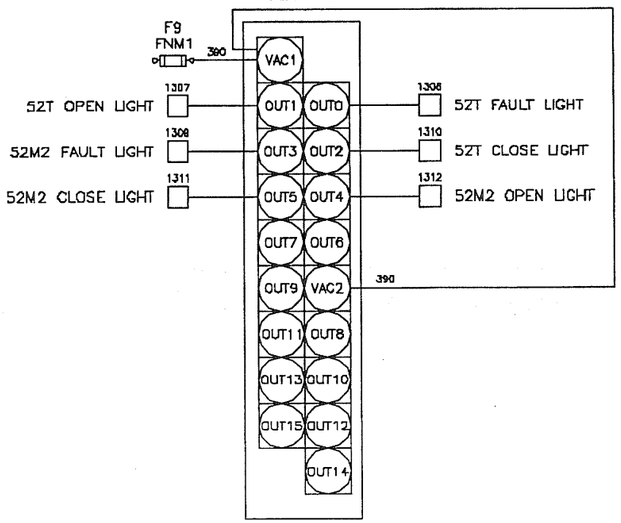
16PT 120 VAC INPUT CARD
ALLEN BRADLEY 1746-IA16
SLOT 2



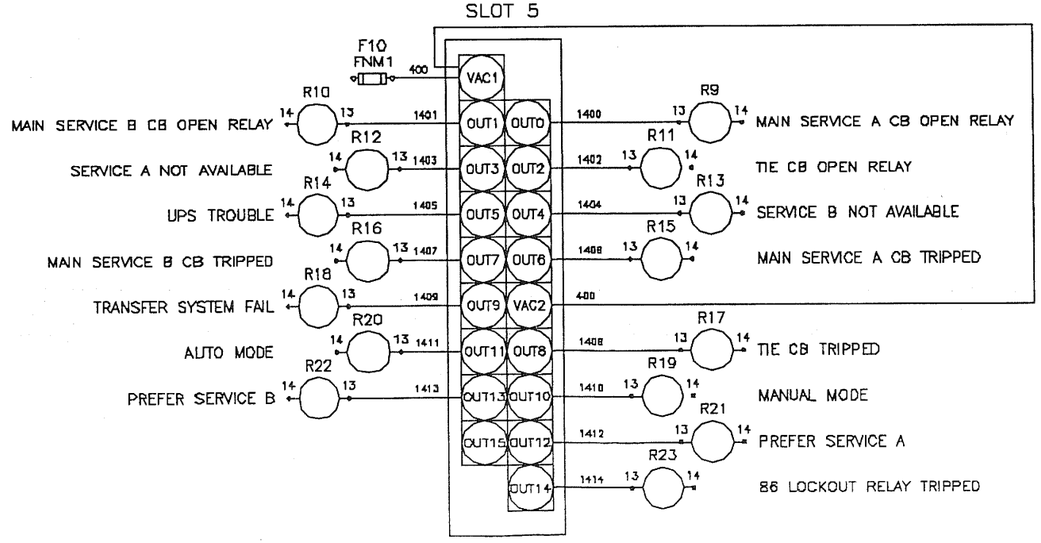
16PT 120 VAC OUTPUT CARD
ALLEN BRADLEY 1746-OW16
SLOT 3



16PT 120 VAC INPUT CARD
ALLEN BRADLEY 1746-OW16
SLOT 4



16PT 120 VAC OUTPUT CARD
ALLEN BRADLEY 1746-OW16
SLOT 5



JOB NAME:	SAN DIEGO PUMP STATIO #65	EQUIPMENT DESIGNATION:	AUTOMATIC TRANSFER CONTROLS
JOB LOCATION:	SAN DIEGO, CA	EQUIPMENT TYPE:	
DRAWN BY:	RAS	DRAWING TYPE:	PLC I/O WIRING DIAGRAM
ENGR:	RAS		SQUARE D COMPANY / Schneider Electric
DATE:	6/23/03	DWG#	17963808-001
DRAWING STATUS:	RECORD	PG 4 OF 10	REV E

2/3/0 THRU 17

LOOP NO: 65Y151

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	SERVICE DESCRIPTION	DEVICE TYPE	LOCATION	DEVICE MANUF'R/SUPP.	MODEL NO	SPEC. NO	AREA CONTRACTOR	SUBMITTAL NO.	REMARKS
I	65	LAHH	151		SURGE TANK T-151	T-151 HI-HI	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	LALL	151		SURGE TANK T-151	T-151 LO-LO	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	ZLO	151		SURGE TANK T-151	T-151 OPEN	STATUS	PLC-100	TBD	TBD				EXISTING
I	65	CR7	N/A		SURGE TANK T-151	T-151 HI-HI	RELAY	UCP-151	TBD	TBD				EXISTING
I	65	CR8	151		SURGE TANK T-151	T-151 LO-LO	RELAY	UCP-151	TBD	TBD				EXISTING
I	65	ZSO	151		SURGE TANK T-151	T-151 OPEN	SWITCH	FIELD	SQ. "D" COMPANY	C 54B2				EXISTING

N	UP*	TAG PRE	TAG NO	TG LR	EQUIPMENT SERVICE	DATA SH NO	I/O SIG	SIGNAL LEVEL	DEVICE RANGE	ENG UNITS	PROC ST PT	LOOP DWG NO	P&ID DWG NO	LOOP FILE NAME	INTERCONNECT FILE NAME
I	65	LAHH	151		SURGE TANK T-151	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y151-2		LD-PS65Y151	LD-PS65Y151-3
I	65	LALL	151		SURGE TANK T-151	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y151-2		LD-PS65Y151	LD-PS65Y151-3
I	65	ZLO	151		SURGE TANK T-151	N/A	DI	120 VAC	N/A	N/A	N/A	LD-PS65Y151-2		LD-PS65Y151	LD-PS65Y151-3
I	65	CR7	N/A		SURGE TANK T-151	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y151-2		LD-PS65Y151	LD-PS65Y151-3
I	65	CR8	151		SURGE TANK T-151	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y151-2		LD-PS65Y151	LD-PS65Y151-3
I	65	ZSO	151		SURGE TANK T-151	N/A	N/A	120 VAC	N/A	N/A	N/A	LD-PS65Y151-2		LD-PS65Y151	LD-PS65Y151-3

REFERENCE DRAWINGS

TBD

DESTROY ALL PRINTS BEARING EARLIER DATE

REV NO	DATE		BY	CKD	APPROVALS PROJ ENGR	APPROVALS PROJ MGR
0	2/00	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CORP.
PROCESS CONTROL DIVISION

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

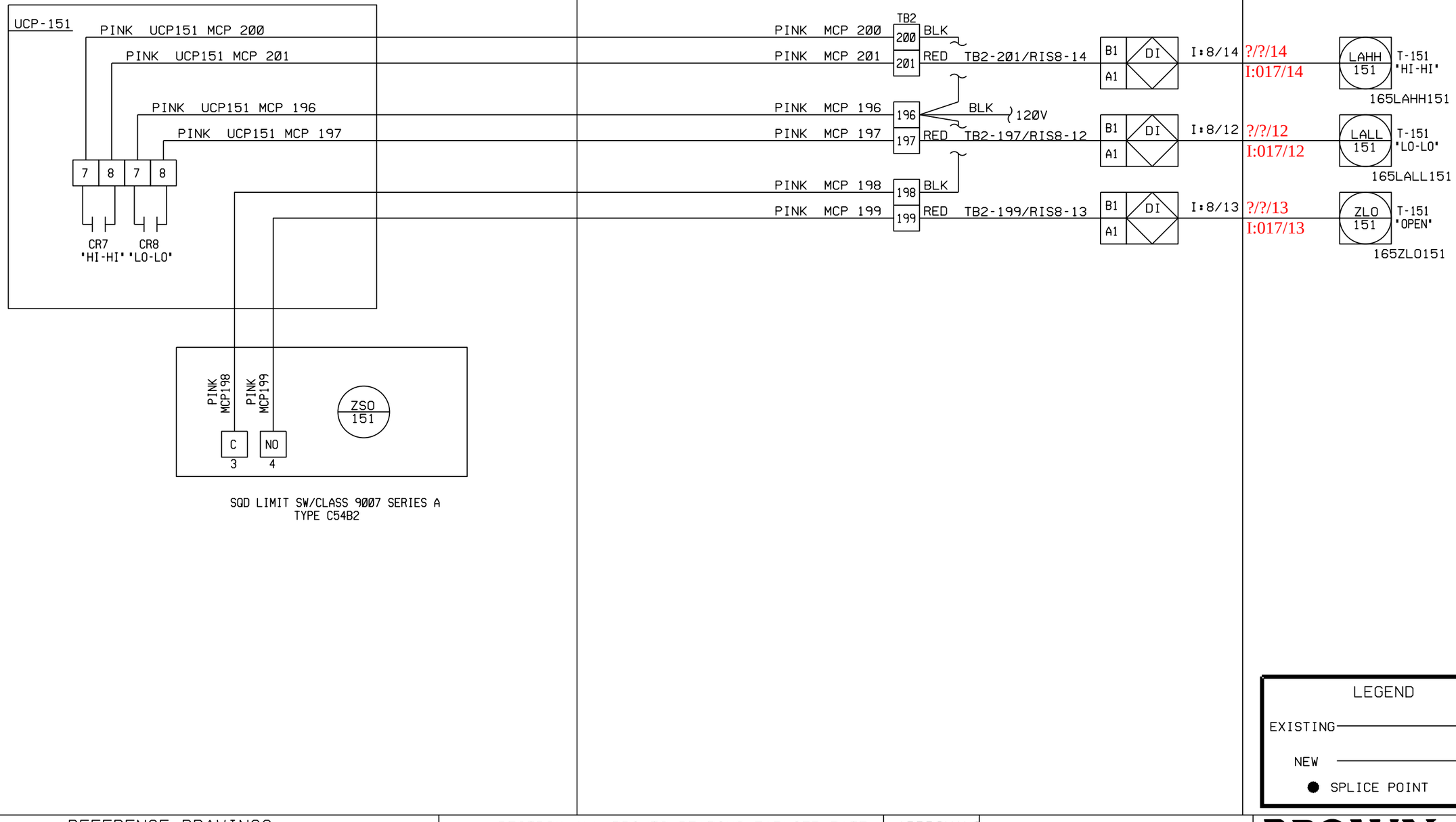
FILE NAME: 65Y151-1

LOOP DIAGRAM SCHEDULE
SURGE CONTROL TANK T-151

LOOP NO.	CAD FILE:	DWG NO.	SH	OF	SH	REV
65Y151	65Y151-1	LD-PS65Y151	1	OF	3	0

?/?/12 THRU 14

FIELD SURGE TANK T-151 / UCP 151 | MCP PLC-100 | COMPUTER SCREEN



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			
?/?/12 THRU 14							

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION.

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

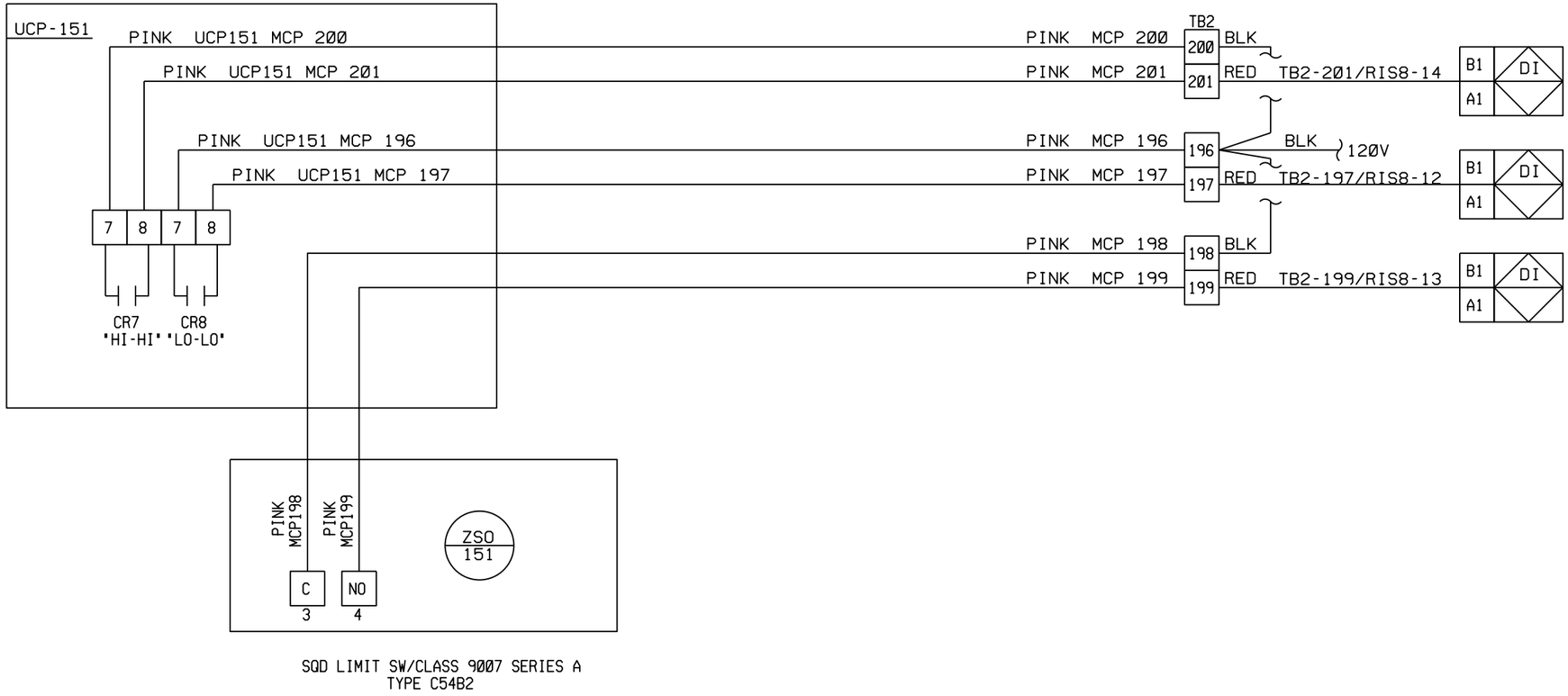
WESTINGHOUSE PROJECT NO. C0137

BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y151-2

INSTRUMENT LOOP DIAGRAM
SURGE CONTROL TANK T-151

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y151	65Y151-2	LD-PS65Y151	2 OF	3	Ø



LEGEND

EXISTING ———————

NEW ———————

● SPLICE POINT

REFERENCE DRAWINGS	DESTROY ALL PRINTS BEARING EARLIER DATE					APPROVALS	
TBD	REV NO	DATE		BY	CKD	PROJ ENGR	PROJ MGR
	Ø	Ø1/ØØ	ISSUED FOR REVIEW/APPROVAL	DLT			

WESTINGHOUSE ELECTRIC CO.
PROCESS CONTROL DIVISION.

BROWN AUTOMATION, INC. EMPLOYEE OWNED

PUMP STATION 65
DCS INSTALLATION
CITY OF SAN DIEGO, CALIFORNIA

WESTINGHOUSE PROJECT NO. C0137

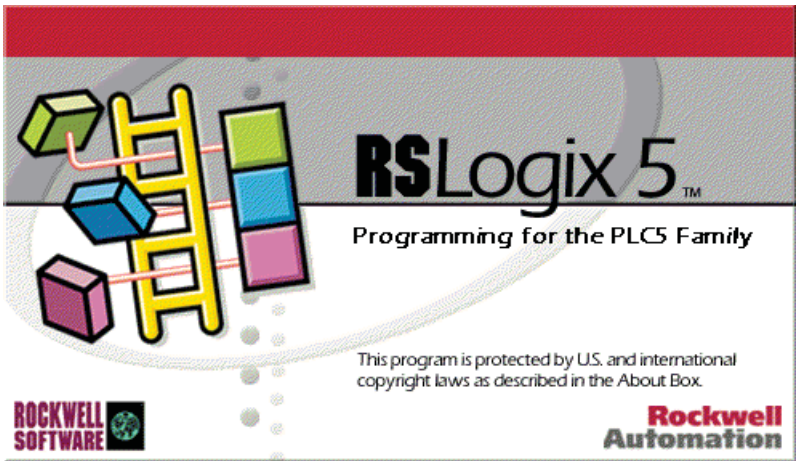
BROWN AUTOMATION JOB# 9079

FILE NAME: 65Y151-3

INSTRUMENT LOOP DIAGRAM
SURGE CONTROL TANK T-151

LOOP NO.	CAD FILE:	DWG NO.	SH	SH	REV
65Y151	65Y151-3	LD-PS65Y151	3	OF 3	Ø

RSLogix 5 Project Report



Processor Information

Processor Type: PLC5/40 C H 49152

Processor Name: PS65

Total Memory Used: 9907 WORDS

Program Files: 25

Data Files: 42

PS65

Chassis_1

Rack: 0
Size: 4 Slot Chassis
Addressing Mode: 1 Slot

Slot	Module Type	Module Description
0		
1		
2		
3		

Processor Type: PLC5/40 Series C Rev H

Channel #	Channel Type
Channel 0:	System Point To Point
Channel 1A:	Data Highway Plus
Channel 1B:	Scanner
Channel 2A:	Inactive Channel
Channel 2B:	Inactive Channel

Channel 0 - System (Point to Point)

Baud Rate	19.2K
Bits Per Char	8
Stop Bits	1
Nak Receive	3
ACK Timeout	50
Detect Duplicate Messages	Yes
Message Application Timeout	30 seconds
Parity	None
Error Detect	BCC
Control	No Handshaking
DF1 Inquires	3
Attn Character	27
DiagnosticFile	0

Channel 1A - Data Highway Plus

Baud Rate	57.6 kBaud
Node Address	0
Link ID	0
Global Status Flags File	0
DiagnosticFile	0

Channel 1B - Scanner

Baud Rate	57.6 kBaud
Complimentary I/O Enabled	Disabled
DiagnosticFile	35

Chassis Scan List:

Position	Rack Address	Starting Group	Rack Size
0	1	0	FULL Rack
1	2	0	FULL Rack
2	3	0	FULL Rack

Channel 2A - Inactive Channel

Channel 2B - Inactive Channel

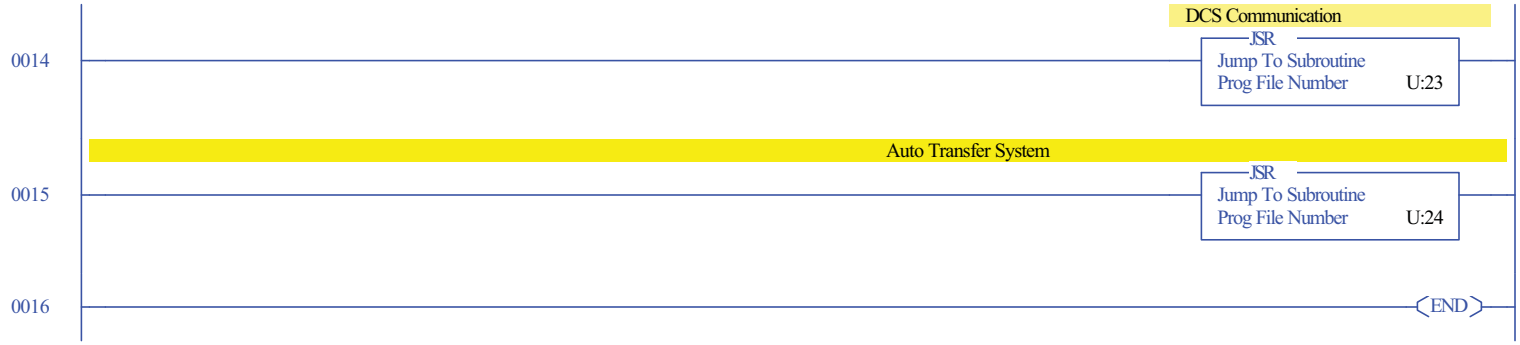
Program File List

Name	Number	Type	Rungs	Debug	Bytes	Elements	Class1	Class2	Class3	Class4
[SYSTEM]	0	SYS	0	No	224	112	RW	RW	RW	RW
MAIN	2	Ladder File	17	No	82	17	RW	RW	RW	RW
BCM MAIN	3	Ladder File	11	No	404	76	RW	RW	RW	RW
BCM PRI	4	Ladder File	4	No	147	19	RW	RW	RW	RW
BCM SEC	5	Ladder File	3	No	114	14	RW	RW	RW	RW
BCM DIAG	6	Ladder File	7	No	266	53	RW	RW	RW	RW
BCM LOAD	7	Ladder File	14	No	288	27	RW	RW	RW	RW
BCM STORE	8	Ladder File	14	No	288	27	RW	RW	RW	RW
ANALOG IN	9	Ladder File	34	No	1224	180	RW	RW	RW	RW
MULTILIN	10	Ladder File	4	No	395	55	RW	RW	RW	RW
BENTLY	11	Ladder File	11	No	449	65	RW	RW	RW	RW
SEQUENCE	12	Ladder File	43	No	2153	389	RW	RW	RW	RW
PUMP 101	13	Ladder File	30	No	867	155	RW	RW	RW	RW
PUMP 102	14	Ladder File	30	No	867	155	RW	RW	RW	RW
PUMP 103	15	Ladder File	32	No	970	174	RW	RW	RW	RW
PUMP 104	16	Ladder File	32	No	950	169	RW	RW	RW	RW
STI	17	Ladder File	2	No	35	5	RW	RW	RW	RW
FLOW TOTAL	18	Ladder File	3	No	95	12	RW	RW	RW	RW
SEAL WATER	19	Ladder File	8	No	220	40	RW	RW	RW	RW
GATES	20	Ladder File	39	No	1348	254	RW	RW	RW	RW
CLOCK	21	Ladder File	2	No	52	9	RW	RW	RW	RW
MISC	22	Ladder File	4	No	83	19	RW	RW	RW	RW
DCS COMM	23	Ladder File	274	No	4417	551	RW	RW	RW	RW
ATS	24	Ladder File	30	No	436	63	RW	RW	RW	RW

Data File List

Name	Number	Type	Scope	Debug	Words/Elements	Last	Class1	Class2	Class3	Class4
OUTPUT	0	O	Global	No	128/128	O:177	RW	RW	RW	RW
INPUT	1	I	Global	No	128/128	I:177	RW	RW	RW	RW
STATUS	2	S	Global	No	128/128	S:127	RW	RW	RW	RW
BINARY	3	B	Global	No	10/10	B3:9	RW	RW	RW	RW
TIMER	4	T	Global	No	696/232	T4:231	RW	RW	RW	RW
COUNTER	5	C	Global	No	36/12	C5:11	RW	RW	RW	RW
CONTROL	6	R	Global	No	15/5	R6:4	RW	RW	RW	RW
INTEGER	7	N	Global	No	5/5	N7:4	RW	RW	RW	RW
FLOAT	8	F	Global	No	140/70	F8:69	RW	RW	RW	RW
BLK XFER	9	BT	Global	No	114/19	BT9:18	RW	RW	RW	RW
BCM READ	10	N	Global	No	65/65	N10:64	RW	RW	RW	RW
BCM WRITE	11	N	Global	No	65/65	N11:64	RW	RW	RW	RW
BCM LOAD	12	N	Global	No	690/690	N12:689	RW	RW	RW	RW
BCM STORE	13	N	Global	No	821/821	N13:820	RW	RW	RW	RW
BCM DIAG	14	C	Global	No	18/6	C14:5	RW	RW	RW	RW
AI160 WRIT	15	N	Global	No	37/37	N15:36	RW	RW	RW	RW
AI160 READ	16	N	Global	No	15/15	N16:14	RW	RW	RW	RW
AI170 WRIT	17	N	Global	No	37/37	N17:36	RW	RW	RW	RW
AI170 READ	18	N	Global	No	15/15	N18:14	RW	RW	RW	RW
M-LIN READ	19	N	Global	No	64/64	N19:63	RW	RW	RW	RW
M-LIN CNFG	20	N	Global	No	60/60	N20:59	RW	RW	RW	RW
M-LIN CMND	21	N	Global	No	50/50	N21:49	RW	RW	RW	RW
M-LIN WRIT	22	N	Global	No	64/64	N22:63	RW	RW	RW	RW
M-LIN DATA	23	N	Global	No	100/100	N23:99	RW	RW	RW	RW
BN DATA	24	N	Global	No	20/20	N24:19	RW	RW	RW	RW
BN CFG 1	25	N	Global	No	29/29	N25:28	RW	RW	RW	RW
BN CFG 2	26	N	Global	No	29/29	N26:28	RW	RW	RW	RW
SETPOINTS	27	F	Global	No	76/38	F27:37	RW	RW	RW	RW
PUMP START	28	B	Global	No	34/34	B28:33	RW	RW	RW	RW
MDBUS CNFG	29	N	Global	No	40/40	N29:39	RW	RW	RW	RW
DCS READ	30	N	Global	No	64/64	N30:63	RW	RW	RW	RW
DCS WRITE	31	N	Global	No	64/64	N31:63	RW	RW	RW	RW
TO DCS	32	N	Global	No	250/250	N32:249	RW	RW	RW	RW
FROM DCS	33	N	Global	No	100/100	N33:99	RW	RW	RW	RW
MODBUS ERR	34	N	Global	No	20/20	N34:19	RW	RW	RW	RW
CONFIG	35	N	Global	No	40/40	N35:39	RW	RW	RW	RW
IOSTAT	36	N	Global	No	48/48	N36:47	RW	RW	RW	RW
IOCONFIG	37	N	Global	No	37/37	N37:36	RW	RW	RW	RW
IOCONFIG	38	N	Global	No	15/15	N38:14	RW	RW	RW	RW
	40	B	Global	No	24/24	B40:23	RW	RW	RW	RW
	41	B	Global	No	17/17	B41:16	RW	RW	RW	RW


0000
BCM Main Subroutine
JSR
Jump To Subroutine
Prog File Number U:3
0001
Read Analog Inputs
JSR
Jump To Subroutine
Prog File Number U:9
0002
Read Multilin
JSR
Jump To Subroutine
Prog File Number U:10
0003
Read Bently Nevada
JSR
Jump To Subroutine
Prog File Number U:11
0004
Pump Sequencing
JSR
Jump To Subroutine
Prog File Number U:12
0005
Pump 101
JSR
Jump To Subroutine
Prog File Number U:13
0006
Pump 102
JSR
Jump To Subroutine
Prog File Number U:14
0007
Pump 103
JSR
Jump To Subroutine
Prog File Number U:15
0008
Pump 104
JSR
Jump To Subroutine
Prog File Number U:16
0009
Flow Totalizer
JSR
Jump To Subroutine
Prog File Number U:18
0010
Seal Water Pumps
JSR
Jump To Subroutine
Prog File Number U:19
0011
Gate Control
JSR
Jump To Subroutine
Prog File Number U:20
0012
Set Clock
JSR
Jump To Subroutine
Prog File Number U:21
0013
Misc
JSR
Jump To Subroutine
Prog File Number U:22


DCS Communication
0014
JSR
Jump To Subroutine
Prog File Number U:23
Auto Transfer System
0015
JSR
Jump To Subroutine
Prog File Number U:24
0016
END

This is the main program file for the BCM module. The module is read to determine if the processor is primary or secondary and the appropriate sub-routine is called. Refer to the A-B manual for the BCM module for a complete description of the operation.

0000

BCM Packet Length

MOV
Move
Source 11
11<
Dest N7:0
11<

This rung will obtain status information from the BCM and when the processor is secondary it will also obtain data from the BCM.

0001

BCM BTR EN BT9:0 EN
BCM BTW EN BT9:1 EN

BTR
Block Transfer Read
Module Type Generic Block Transfer
Rack 000
Group 0
Module 0
Control Block BT9:0
Data File N10:1
Length 0
Continuous No
Setup Screen
EN DN ER

This rung determines primary/secondary functionalitiy of the processor.

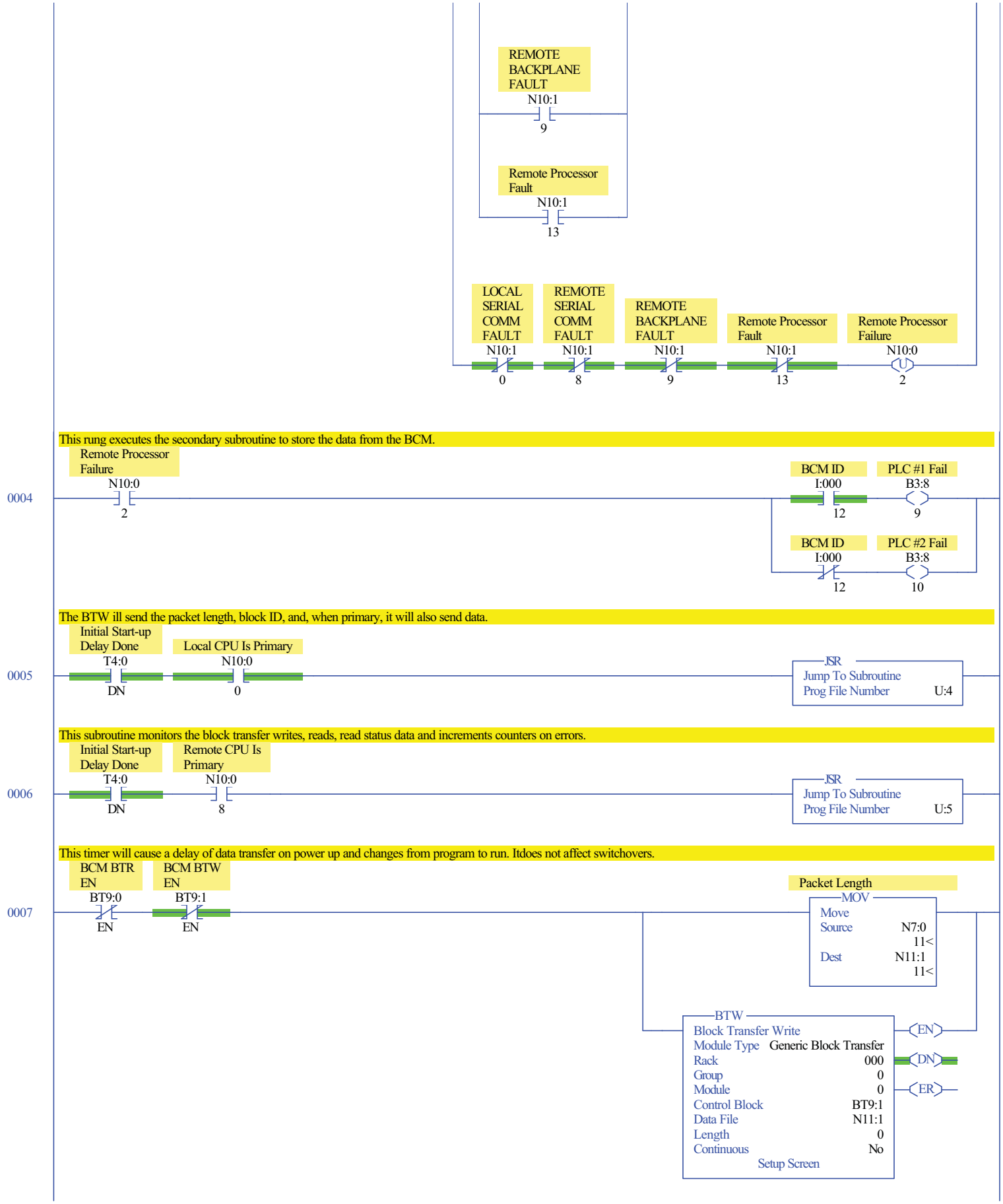
0002

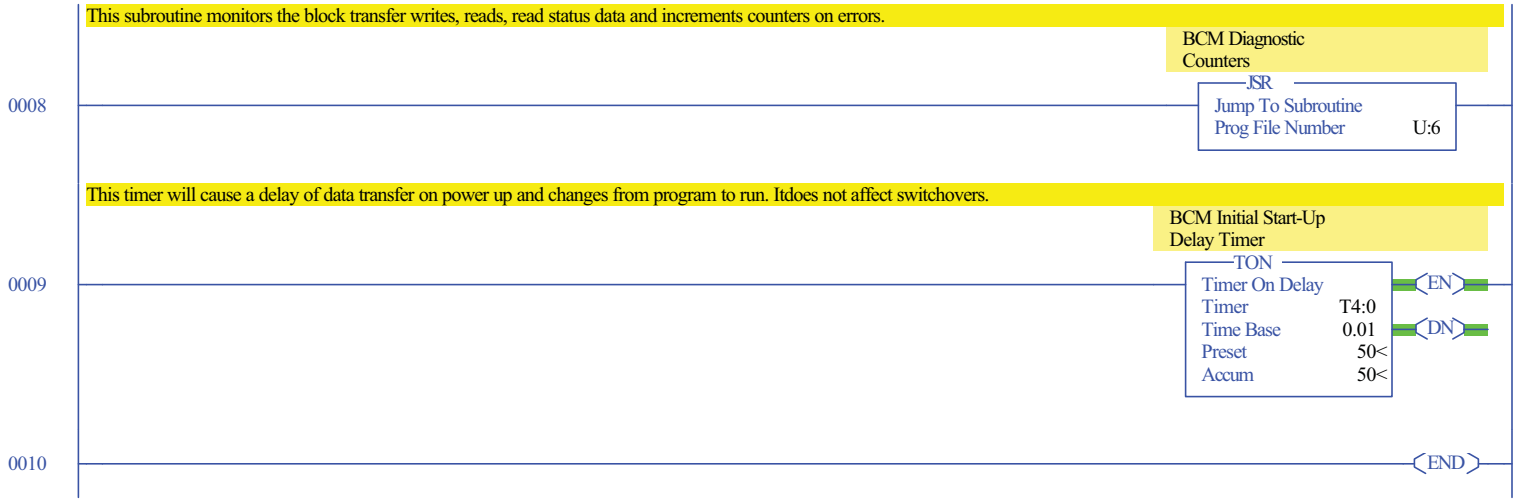
BCM BTR DN BT9:0 DN
Initial Start-up Delay Done T4:0 DN
BCM Status - Local CPU Is Primary N10:1 6
BCM Status - Remote CPU Is Primary N10:1 14
Local CPU Is Primary N10:0 (L) 0
Remote CPU Is Primary N10:0 (U) 8
BCM Status - Local CPU Is Primary N10:1 6
BCM Status - Remote CPU Is Primary N10:1 14
Remote CPU Is Primary N10:0 (L) 8
Local CPU Is Primary N10:0 (U) 0
BCM Status - Local CPU Is Primary N10:1 6
BCM Status - Remote CPU Is Primary N10:1 14
Local CPU Is Primary N10:0 (U) 0
BCM Status - Local CPU Is Primary N10:1 6
BCM Status - Remote CPU Is Primary N10:1 14
Remote CPU Is Primary N10:0 (U) 8

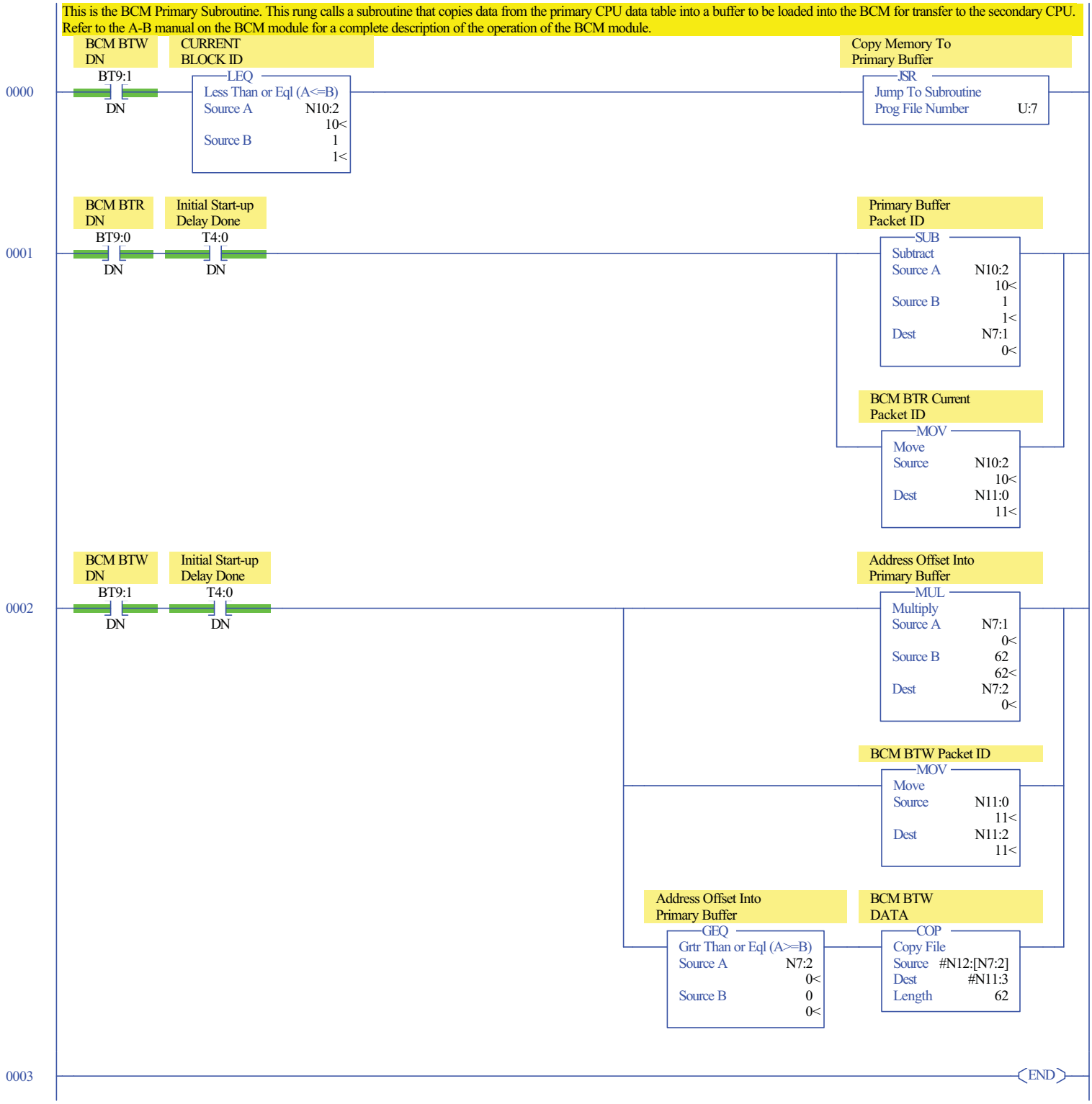
This rung executes the primary subroutine to load the data into the BCM.

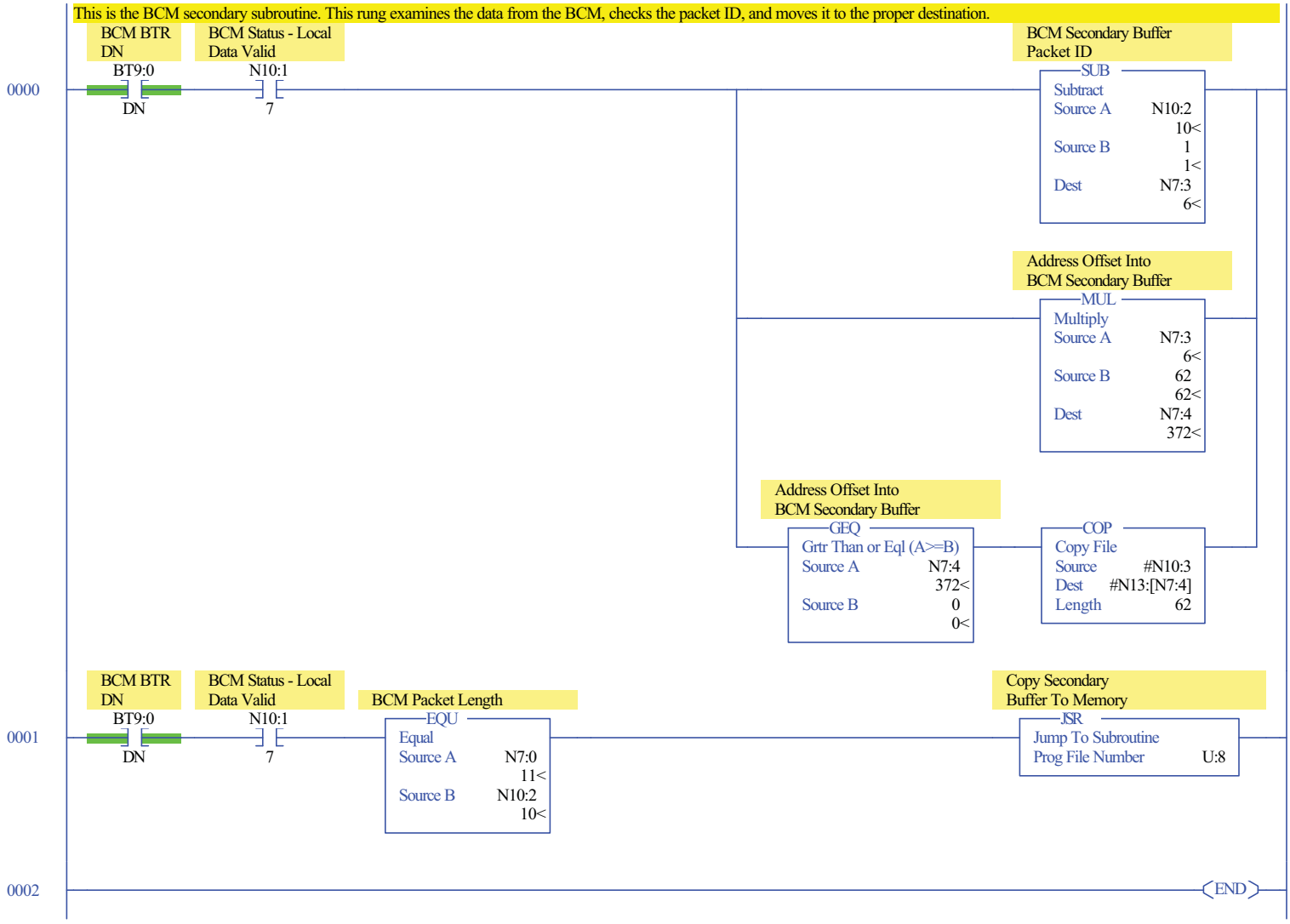
0003

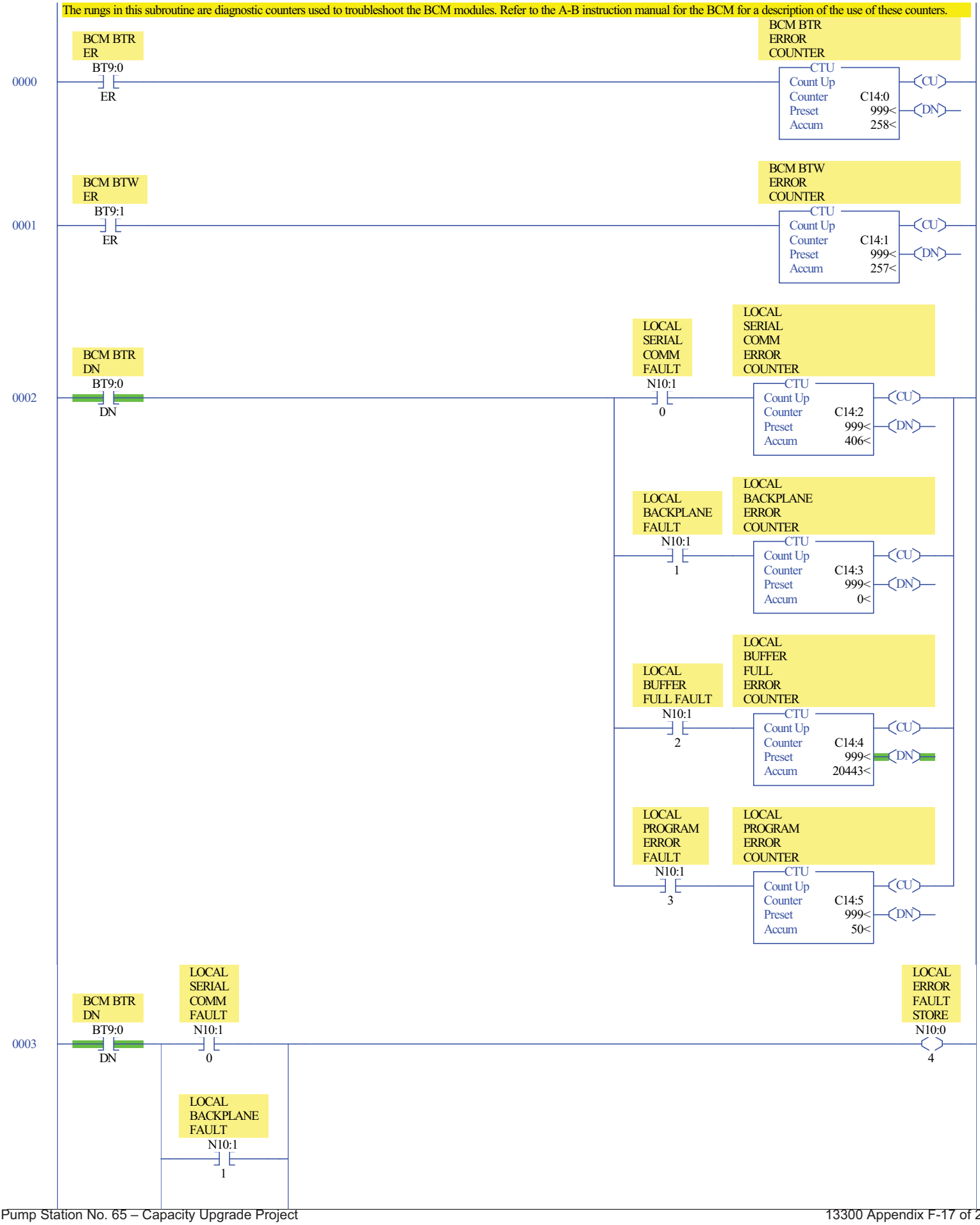
Initial Start-up Delay Done T4:0 DN
Local CPU Is Primary N10:0 0
BCM BTR DN BT9:0 DN
LOCAL SERIAL COMM FAULT N10:1 0
Remote Processor Failure N10:0 (L) 2
REMOTE SERIAL COMM FAULT N10:1 8

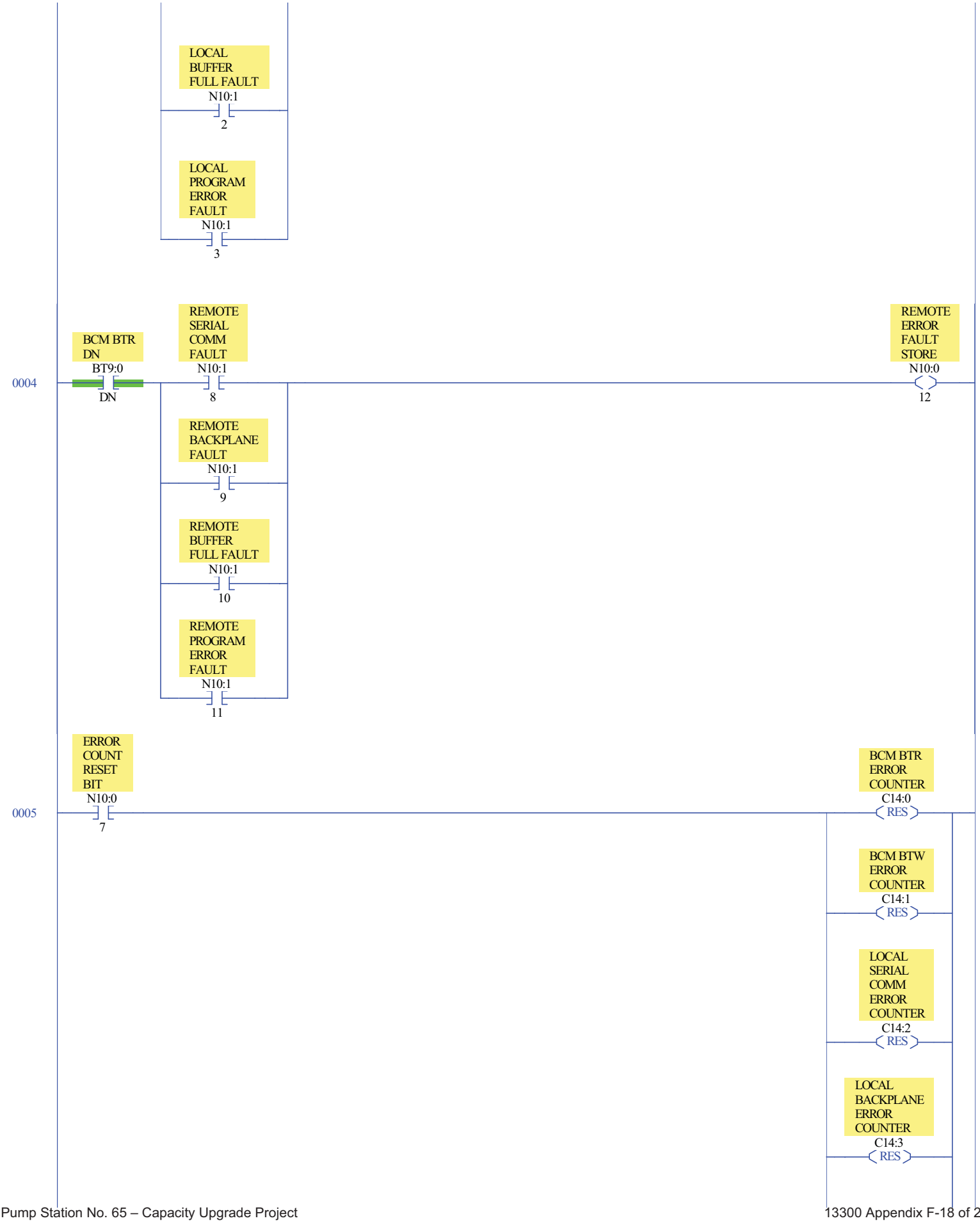

REMOTE BACKPLANE FAULT
N10:1
9
Remote Processor Fault
N10:1
13
LOCAL SERIAL COMM FAULT
N10:1
0
REMOTE SERIAL COMM FAULT
N10:1
8
REMOTE BACKPLANE FAULT
N10:1
9
Remote Processor Fault
N10:1
13
Remote Processor Failure
N10:0
U
2
This rung executes the secondary subroutine to store the data from the BCM.
0004
Remote Processor Failure
N10:0
2
BCM ID
I:000
12
PLC #1 Fail
B3:8
9
BCM ID
I:000
12
PLC #2 Fail
B3:8
10
The BTW ill send the packet length, block ID, and, when primary, it will also send data.
0005
Initial Start-up Delay Done
T4:0
DN
Local CPU Is Primary
N10:0
0
JSR
Jump To Subroutine
Prog File Number U:4
This subroutine monitors the block transfer writes, reads, read status data and increments counters on errors.
0006
Initial Start-up Delay Done
T4:0
DN
Remote CPU Is Primary
N10:0
8
JSR
Jump To Subroutine
Prog File Number U:5
This timer will cause a delay of data transfer on power up and changes from program to run. Itdoes not affect switchovers.
0007
BCM BTR EN
BT9:0
EN
BCM BTW EN
BT9:1
EN
Packet Length
MOV
Move
Source N7:0
11<
Dest N11:1
11<
BTW
Block Transfer Write
Module Type Generic Block Transfer
Rack 000
Group 0
Module 0
Control Block BT9:1
Data File N11:1
Length 0
Continuous No
Setup Screen
EN
DN
ER


This subroutine monitors the block transfer writes, reads, read status data and increments counters on errors.
BCM Diagnostic Counters
0008
JSR
Jump To Subroutine
Prog File Number U:6
This timer will cause a delay of data transfer on power up and changes from program to run. Itdoes not affect switchovers.
BCM Initial Start-Up Delay Timer
0009
TON
Timer On Delay
Timer T4:0
Time Base 0.01
Preset 50<
Accum 50<
EN
DN
0010
END


This is the BCM Primary Subroutine. This rung calls a subroutine that copies data from the primary CPU data table into a buffer to be loaded into the BCM for transfer to the secondary CPU. Refer to the A-B manual on the BCM module for a complete description of the operation of the BCM module.
0000
BCM BTW DN
BT9:1
DN
CURRENT BLOCK ID
LEQ
Less Than or Eql (A<=B)
Source A N10:2 10<
Source B 1 1<
Copy Memory To Primary Buffer
JSR
Jump To Subroutine
Prog File Number U:7
0001
BCM BTR DN
BT9:0
DN
Initial Start-up Delay Done
T4:0
DN
Primary Buffer Packet ID
SUB
Subtract
Source A N10:2 10<
Source B 1 1<
Dest N7:1 0<
BCM BTR Current Packet ID
MOV
Move
Source N10:2 10<
Dest N11:0 11<
0002
BCM BTW DN
BT9:1
DN
Initial Start-up Delay Done
T4:0
DN
Address Offset Into Primary Buffer
MUL
Multiply
Source A N7:1 0<
Source B 62 62<
Dest N7:2 0<
BCM BTW Packet ID
MOV
Move
Source N11:0 11<
Dest N11:2 11<
Address Offset Into Primary Buffer
GEQ
Grtr Than or Eql (A>=B)
Source A N7:2 0<
Source B 0 0<
BCM BTW DATA
COP
Copy File
Source #N12:[N7:2]
Dest #N11:3
Length 62
0003
END


This is the BCM secondary subroutine. This rung examines the data from the BCM, checks the packet ID, and moves it to the proper destination.
BCM BTR DN
BT9:0
DN
BCM Status - Local Data Valid
N10:1
7
0000
BCM Secondary Buffer Packet ID
SUB
Subtract
Source A N10:2 10<
Source B 1 1<
Dest N7:3 6<
Address Offset Into BCM Secondary Buffer
MUL
Multiply
Source A N7:3 6<
Source B 62 62<
Dest N7:4 372<
Address Offset Into BCM Secondary Buffer
GEQ
Grtr Than or Eql (A>=B)
Source A N7:4 372<
Source B 0 0<
COP
Copy File
Source #N10:3
Dest #N13:[N7:4]
Length 62
BCM BTR DN
BT9:0
DN
BCM Status - Local Data Valid
N10:1
7
BCM Packet Length
EQU
Equal
Source A N7:0 11<
Source B N10:2 10<
0001
Copy Secondary Buffer To Memory
JSR
Jump To Subroutine
Prog File Number U:8
0002
END


The rungs in this subroutine are diagnostic counters used to troubleshoot the BCM modules. Refer to the A-B instruction manual for the BCM for a description of the use of these counters.
0000
BCM BTR ER
BT9:0
ER
BCM BTR ERROR COUNTER
CTU
Count Up
Counter C14:0
Preset 999
Accum 258
CU
DN
0001
BCM BTW ER
BT9:1
ER
BCM BTW ERROR COUNTER
CTU
Count Up
Counter C14:1
Preset 999
Accum 257
CU
DN
0002
BCM BTR DN
BT9:0
DN
LOCAL SERIAL COMM FAULT
N10:1
0
LOCAL SERIAL COMM ERROR COUNTER
CTU
Count Up
Counter C14:2
Preset 999
Accum 406
CU
DN
LOCAL BACKPLANE FAULT
N10:1
1
LOCAL BACKPLANE ERROR COUNTER
CTU
Count Up
Counter C14:3
Preset 999
Accum 0
CU
DN
LOCAL BUFFER FULL FAULT
N10:1
2
LOCAL BUFFER FULL ERROR COUNTER
CTU
Count Up
Counter C14:4
Preset 999
Accum 20443
CU
DN
LOCAL PROGRAM ERROR FAULT
N10:1
3
LOCAL PROGRAM ERROR COUNTER
CTU
Count Up
Counter C14:5
Preset 999
Accum 50
CU
DN
0003
BCM BTR DN
BT9:0
DN
LOCAL SERIAL COMM FAULT
N10:1
0
LOCAL BACKPLANE FAULT
N10:1
1
LOCAL ERROR FAULT STORE
N10:0
4


LOCAL BUFFER FULL FAULT
N10:1
2
LOCAL PROGRAM ERROR FAULT
N10:1
3
0004
BCM BTR DN
BT9:0
DN
REMOTE SERIAL COMM FAULT
N10:1
8
REMOTE BACKPLANE FAULT
N10:1
9
REMOTE BUFFER FULL FAULT
N10:1
10
REMOTE PROGRAM ERROR FAULT
N10:1
11
REMOTE ERROR FAULT STORE
N10:0
12
0005
ERROR COUNT RESET BIT
N10:0
7
BCM BTR ERROR COUNTER
C14:0
RES
BCM BTW ERROR COUNTER
C14:1
RES
LOCAL SERIAL COMM ERROR COUNTER
C14:2
RES
LOCAL BACKPLANE ERROR COUNTER
C14:3
RES


LOCAL
BUFFER
FULL
ERROR
COUNTER
C14:4
RES
LOCAL
PROGRAM
ERROR
COUNTER
C14:5
RES
0006
END

LAD 7 - BCM LOAD --- Total Rungs in File = 14

The following rungs block the data for transfer by the BCM module to the secondary processor.

0000

BCM BTW DN
BT9:1
DN

COP
Copy File
Source #O:011
Dest #N12:32
Length 1

The following rungs block the data for transfer by the BCM module to the secondary processor.

0001

BCM BTW DN
BT9:1
DN

COP
Copy File
Source #O:027
Dest #N12:33
Length 1

The following rungs block the data for transfer by the BCM module to the secondary processor.

0002

BCM BTW DN
BT9:1
DN

COP
Copy File
Source #B3:0
Dest #N12:34
Length 10

The following rungs block the data for transfer by the BCM module to the secondary processor.

0003

BCM BTW DN
BT9:1
DN

COP
Copy File
Source #B28:0
Dest #N12:44
Length 34

Copy Timers FromMemory To BCM Write Buffer

0004

BCM BTW DN
BT9:1
DN

COP
Copy File
Source #T4:1
Dest #N12:128
Length 231

Copy Counters From Memory To BCM Write Buffer

0005

BCM BTW DN
BT9:1
DN

COP
Copy File
Source #C5:0
Dest #N12:359
Length 12

CopyAnalog Input 160 From Memory To BCM Write Buffer

0006

BCM BTW DN
BT9:1
DN

COP
Copy File
Source #N16:0
Dest #N12:371
Length 15

Copy Analog Input 170 From Memory To BCM Write Buffer

0007

BCM BTW DN
BT9:1
DN

COP
Copy File
Source #N18:0
Dest #N12:386
Length 15


Copy Multilin Data From Memory To BCM Write Buffer
BCM BTW DN
BT9:1
DN
0008
COP
Copy File
Source #N23:0
Dest #N12:401
Length 100
Copy Bentley-Nevada Data From Memory To BCM Write Buffer
BCM BTW DN
BT9:1
DN
0009
COP
Copy File
Source #N24:0
Dest #N12:501
Length 20
Copy DCS From Memory To BCM Write Buffer
BCM BTW DN
BT9:1
DN
0010
COP
Copy File
Source #N33:0
Dest #N12:521
Length 100
BCM BTW DN
BT9:1
DN
0011
COP
Copy File
Source #N37:0
Dest #N12:621
Length 20
BCM BTW DN
BT9:1
DN
0012
COP
Copy File
Source #N38:0
Dest #N12:641
Length 15
0013
END

The following rungs unblock the data received by the secondary processor over the BCM link. Input Data from BCM to Memory

0000

BCM BTR DN
BT9:0
DN

COP
Copy File
Source #N13:32
Dest #O:011
Length 1

The following rungs unblock the data received by the secondary processor over the BCM link. Input Data from BCM to Memory

0001

BCM BTR DN
BT9:0
DN

COP
Copy File
Source #N13:33
Dest #O:027
Length 1

The following rungs unblock the data received by the secondary processor over the BCM link. Input Data from BCM to Memory

Copy Storage Bits From BCM Read Buffer To Memory

0002

BCM BTR DN
BT9:0
DN

COP
Copy File
Source #N13:34
Dest #B3:0
Length 10

The following rungs unblock the data received by the secondary processor over the BCM link. Input Data from BCM to Memory

Copy Pump Start Shift Registers From BCM Read Buffer To Memory

0003

BCM BTR DN
BT9:0
DN

COP
Copy File
Source #N13:44
Dest #B28:0
Length 34

Copy Timers From BCM Read Buffer To Memory

0004

BCM BTR DN
BT9:0
DN

COP
Copy File
Source #N13:128
Dest #T4:1
Length 231

Copy Counters From BCM Read Buffer To Memory

0005

BCM BTR DN
BT9:0
DN

COP
Copy File
Source #N13:359
Dest #C5:0
Length 12

Read data block

0006

BCM BTR DN
BT9:0
DN

COP
Copy File
Source #N13:371
Dest #N16:0
Length 15

Read data block

0007

BCM BTR DN
BT9:0
DN

COP
Copy File
Source #N13:386
Dest #N18:0
Length 15

LAD 8 - BCM STORE --- Total Rungs in File = 14

These rungs write the configuration data to the analog input cards and read the analog data from the cards. The configuration data is stored in the data files of the block transfer writes (BTW) and the analog data is stored in the data files of the block transfmer reads (BTR). All analog data is in the range of 0-4095.

0000

Analog Input 160 Power Up Bit N16:0 0

Analog Input 160 BTW Enable BT9:2 EN

First scan of ladder or SFC step S:1 15

Analog Input 160 Block Transfer Write Control Block

BTW

Block Transfer Write	
Module Type	Generic Block Transfer
Rack	001
Group	6
Module	0
Control Block	BT9:2
Data File	N15:0
Length	37
Continuous	No

Setup Screen

EN DN ER

0001

Analog Input 160 BTW Enable BT9:2 EN

Analog Input 160 BTR Enable BT9:3 EN

Analog Input 160 Block Transfer Read Control Block

BTR

Block Transfer Read	
Module Type	Generic Block Transfer
Rack	001
Group	6
Module	0
Control Block	BT9:3
Data File	N16:0
Length	15
Continuous	No

Setup Screen

EN DN ER

0002

Analog Input 170 Power Up Bit N18:0 0

Analog Input 170 BTW Enable BT9:4 EN

First scan of ladder or SFC step S:1 15

Analog Input 170 Block Transfer Write Control Block

BTW

Block Transfer Write	
Module Type	Generic Block Transfer
Rack	001
Group	7
Module	0
Control Block	BT9:4
Data File	N17:0
Length	37
Continuous	No

Setup Screen

EN DN ER

0003

Analog Input 170 BTW Enable BT9:4 EN

Analog Input 170 BTR Enable BT9:5 EN

Analog Input 170 Block Transfer Read Control Block

BTR

Block Transfer Read	
Module Type	Generic Block Transfer
Rack	001
Group	7
Module	0
Control Block	BT9:5
Data File	N18:0
Length	15
Continuous	No

Setup Screen

EN DN ER

These rungs scale the raw analog data to engineering units. The results are stored as floating point values.

0004

Read data block N38:0 0

BT9:17 EN

First scan of ladder or SFC step S:1 15

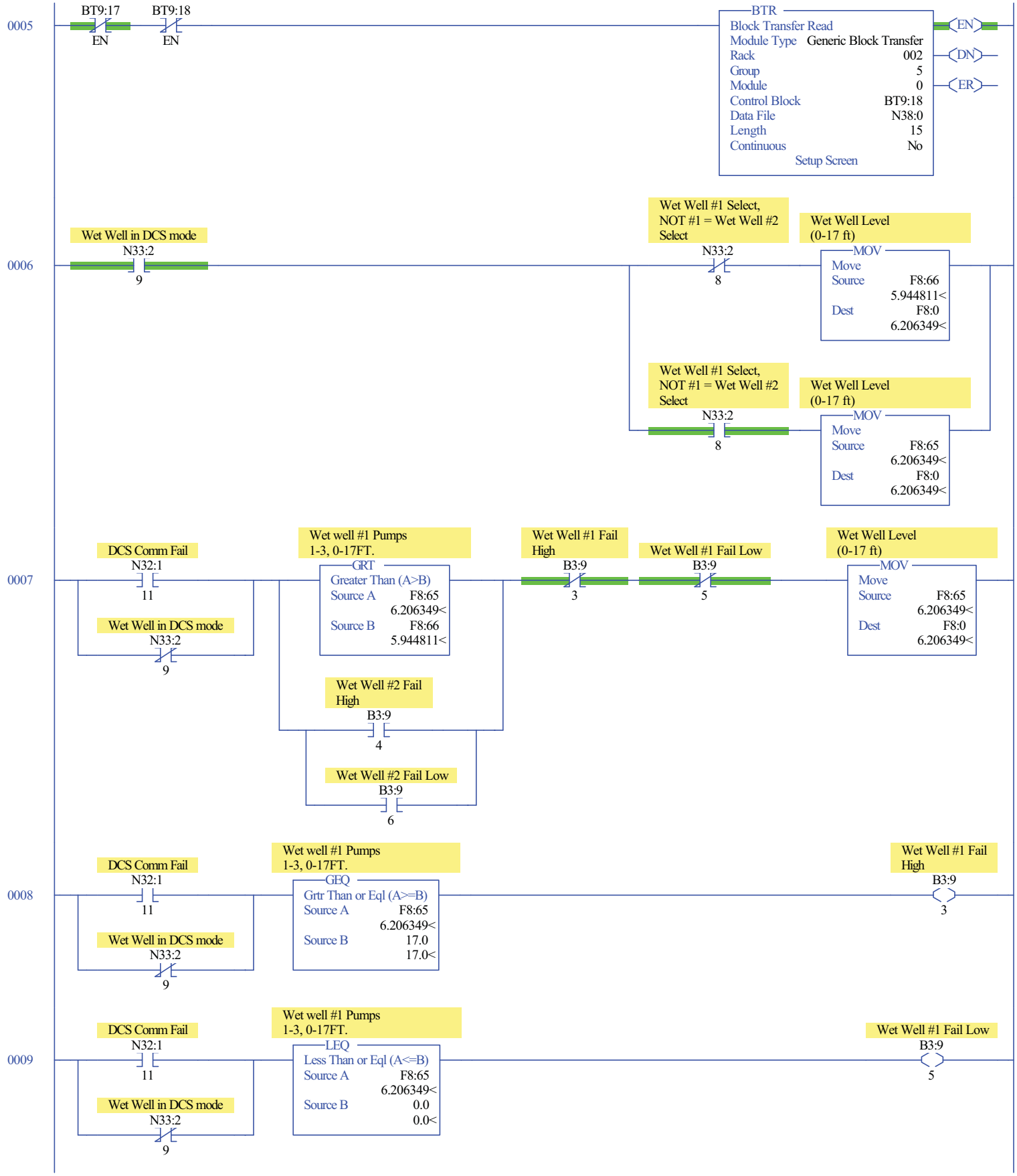
BTW

Block Transfer Write	
Module Type	Generic Block Transfer
Rack	002
Group	5
Module	0
Control Block	BT9:17
Data File	N37:0
Length	37
Continuous	No

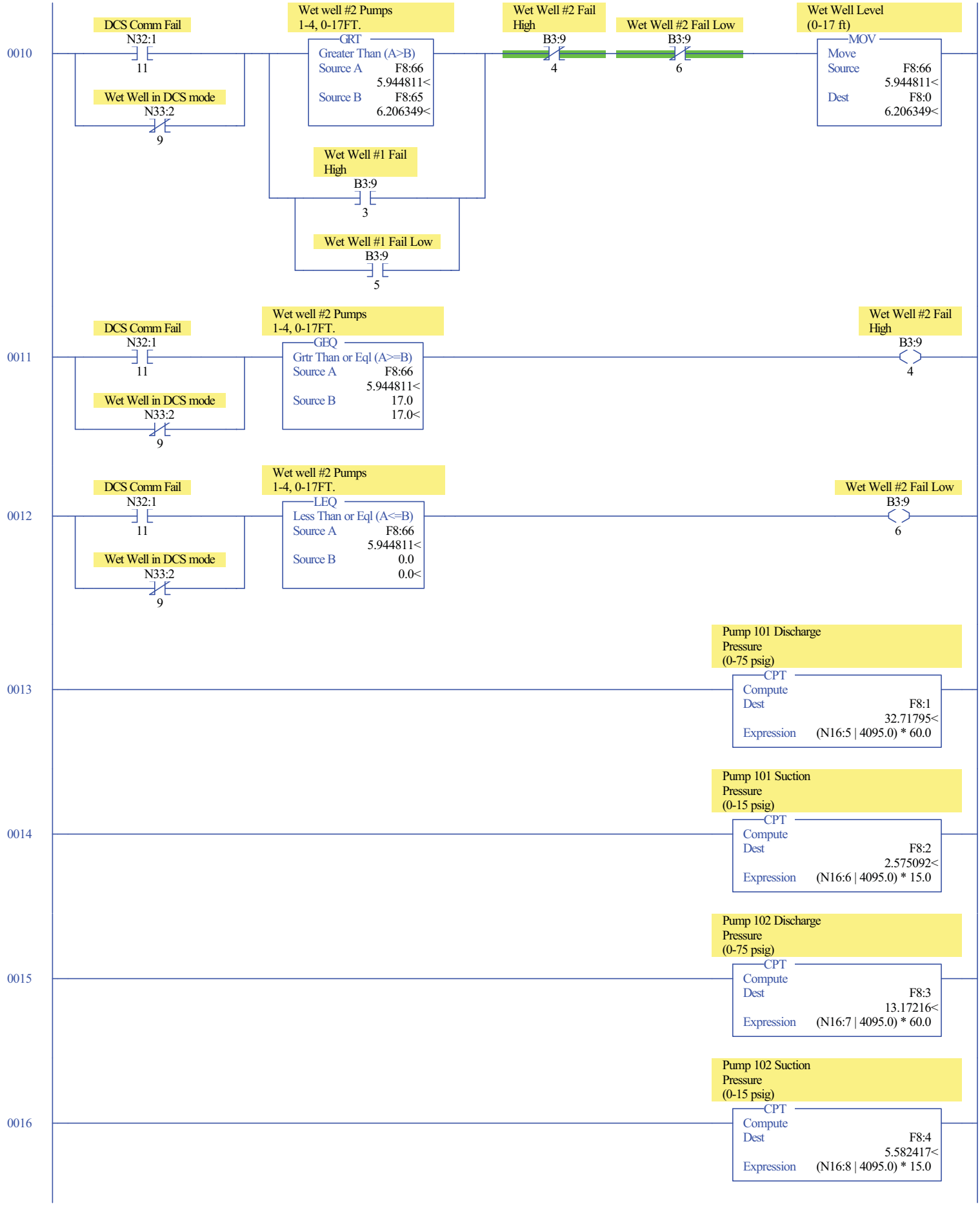
Setup Screen

EN DN ER

LAD 9 - ANALOG IN --- Total Rungs in File = 34



LAD 9 - ANALOG IN --- Total Rungs in File = 34



LAD 9 - ANALOG IN --- Total Rungs in File = 34


Hypo Caustic Flow To
Vessel #2
(0-1 gpm)
0025
CPT
Compute
Dest F8:14
0.557265<
Expression (N18:10 | 4095.0) * 1.0
Odor Control System
pH
(0-14 pH)
0026
CPT
Compute
Dest F8:15
8.294018<
Expression (N18:11 | 4095.0) * 14.0
H2S stack
0027
CPT
Compute
Dest F8:63
0.02442003<
Expression (N38:4 | 4095.0) * 100.0
H2S barscreen Room
0028
CPT
Compute
Dest F8:64
-0.5372406<
Expression (N38:5 | 4095.0) * 100.0
Wet well #1 Pumps
1-3, 0-17FT.
0029
CPT
Compute
Dest F8:65
6.206349<
Expression (N38:6 | 4095.0) * 17.0
Wet well #2 Pumps
1-4, 0-17FT.
0030
CPT
Compute
Dest F8:66
5.944811<
Expression (N38:7 | 4095.0) * 17.0
Bleach Level
0031
CPT
Compute
Dest F8:67
6.388278<
Expression (N38:8 | 4095.0) * 8.0
Barscreen H2S
0032
CPT
Compute
Dest F8:68
-0.5372406<
Expression (N38:5 | 4095.0) * 100.0
0033
END

This file contains the logic to read the data from the Multilins via a Prosoft module. Refer to the manuals of the Prosoft modules for a description of operation. Refer to the Multilin manual for the memory map of the Multilin. The program logic writes the command to read the Multilin to the Prosoft module and then reads the data.

0000

Multilin Comm Module
BTR Enable
BT9:10
EN

Multilin Comm Module
BTW Enable
BT9:11
EN

Multilin Comm Module
Block Transfer Read
Control Block

BTR
Block Transfer Read
Module Type Generic Block Transfer
Rack 002
Group 1
Module 0
Control Block BT9:10
Data File N19:0
Length 64
Continuous No
Setup Screen
EN
DN
ER

Multilin Comm Module
Read Block ID

EQU
Equal
Source A N19:0
2<
Source B -1
-1<

COP
Copy File
Source #N19:2
Dest #N23:60
Length 34

Multilin Comm Module
Read Block ID

EQU
Equal
Source A N19:0
2<
Source B 1
1<

Pump 101 Motor
Winding Temp A
(Deg C)

COP
Copy File
Source #N19:2
Dest #N23:0
Length 8

Multilin Comm Module
Read Block ID

EQU
Equal
Source A N19:0
2<
Source B 2
2<

Pump 102 Motor
Winding Temp A
(Deg C)

COP
Copy File
Source #N19:2
Dest #N23:8
Length 8

Multilin Comm Module
Read Block ID

EQU
Equal
Source A N19:0
2<
Source B 3
3<

Pump 103 Motor
Winding Temp A
(Deg C)

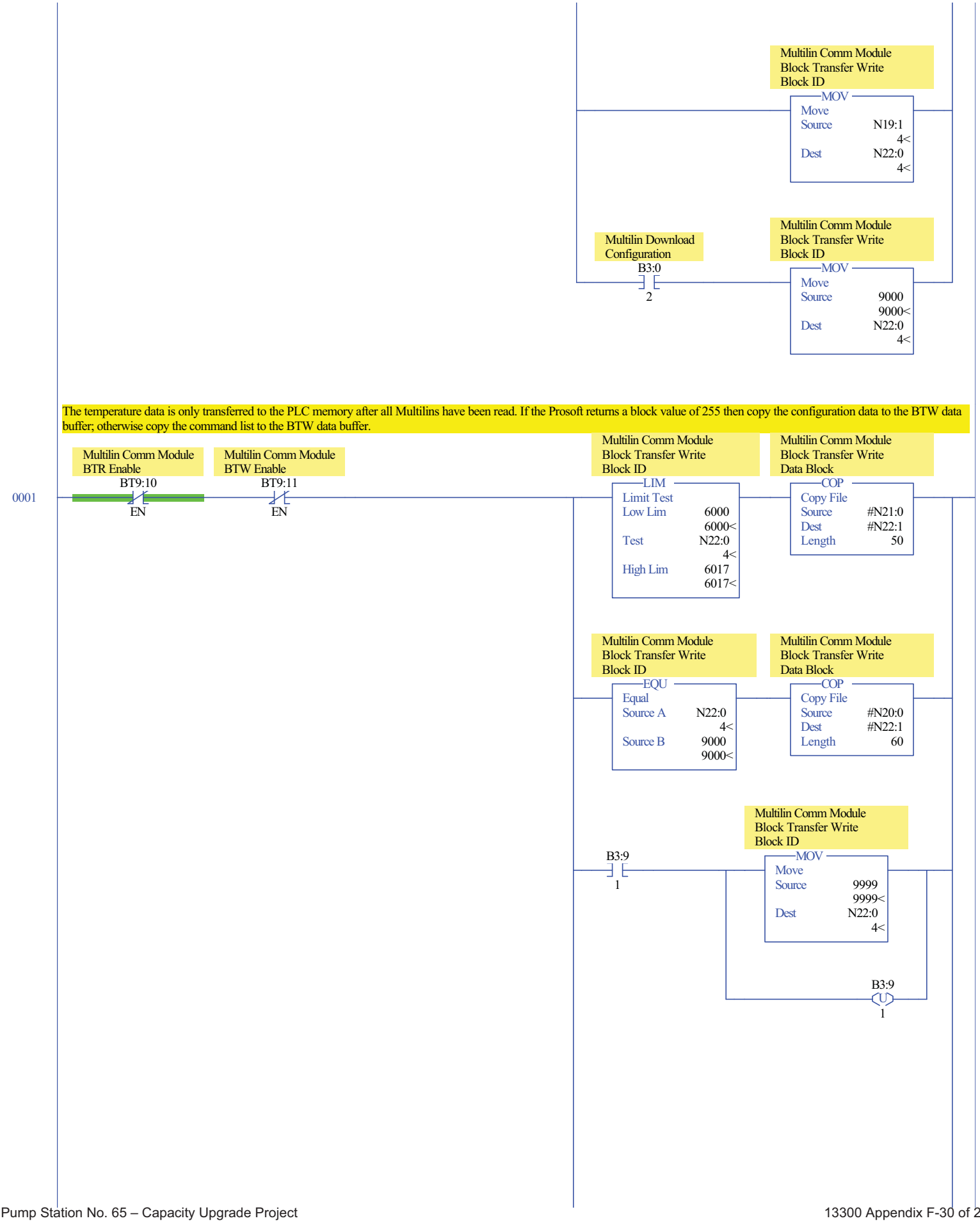
COP
Copy File
Source #N19:2
Dest #N23:16
Length 8

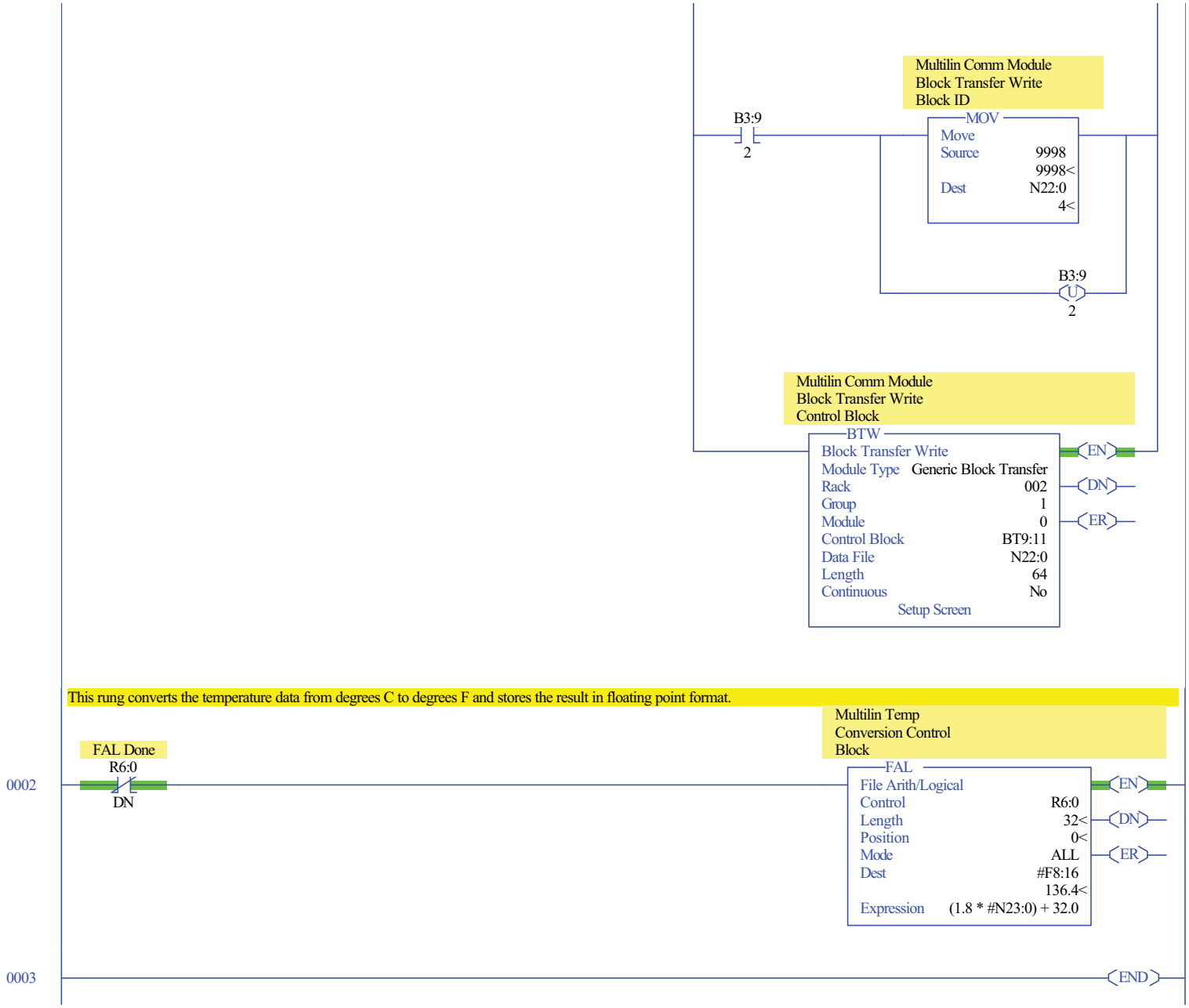
Multilin Comm Module
Read Block ID

EQU
Equal
Source A N19:0
2<
Source B 4
4<

Pump 104 Motor
Winding Temp A
(Deg C)

COP
Copy File
Source #N19:2
Dest #N23:24
Length 8


Multilin Comm Module
Block Transfer Write
Block ID
MOV
Move
Source N19:1
4<
Dest N22:0
4<
Multilin Download
Configuration
B3:0
2
Multilin Comm Module
Block Transfer Write
Block ID
MOV
Move
Source 9000
9000<
Dest N22:0
4<
The temperature data is only transferred to the PLC memory after all Multilins have been read. If the Prosoft returns a block value of 255 then copy the configuration data to the BTW data buffer; otherwise copy the command list to the BTW data buffer.
Multilin Comm Module
BTR Enable
BT9:10
EN
Multilin Comm Module
BTW Enable
BT9:11
EN
0001
Multilin Comm Module
Block Transfer Write
Block ID
LIM
Limit Test
Low Lim 6000
6000<
Test N22:0
4<
High Lim 6017
6017<
Multilin Comm Module
Block Transfer Write
Data Block
COP
Copy File
Source #N21:0
Dest #N22:1
Length 50
Multilin Comm Module
Block Transfer Write
Block ID
EQU
Equal
Source A N22:0
4<
Source B 9000
9000<
Multilin Comm Module
Block Transfer Write
Data Block
COP
Copy File
Source #N20:0
Dest #N22:1
Length 60
Multilin Comm Module
Block Transfer Write
Block ID
B3:9
1
MOV
Move
Source 9999
9999<
Dest N22:0
4<
B3:9
U
1


Multilin Comm Module
Block Transfer Write
Block ID
B3:9
2
MOV
Move
Source 9998
9998<
Dest N22:0
4<
B3:9
U
2
Multilin Comm Module
Block Transfer Write
Control Block
BTW
Block Transfer Write
Module Type Generic Block Transfer
Rack 002
Group 1
Module 0
Control Block BT9:11
Data File N22:0
Length 64
Continuous No
Setup Screen
EN
DN
ER
This rung converts the temperature data from degrees C to degrees F and stores the result in floating point format.
Multilin Temp
Conversion Control
Block
FAL Done
R6:0
DN
0002
FAL
File Arith/Logical
Control R6:0
Length 32<
Position 0<
Mode ALL
Dest #F8:16
136.4<
Expression (1.8 * #N23:0) + 32.0
EN
DN
ER
0003
END

These rungs read the vibration data from the Bentley-Nevada modules. Refer to the Bentley-Nevada manuals for a description of operation.

0000

Bently Nevada BTR Enable
BT9:12
EN

Bently Nevada Monitor 1 BTW Enable
BT9:13
EN

Bently Nevada Monitor 2 BTW Enable
BT9:14
EN

Bently Nevada BTR Control Block

BTR
Block Transfer Read
Module Type Generic Block Transfer
Rack 002
Group 2
Module 0
Control Block BT9:12
Data File N24:0
Length 20
Continuous No
Setup Screen
EN
DN
ER

0001

Bently Nevada Power Up
N24:0
15

Configure Bently Nevada
B3:0
0

Bently Nevada BTR Enable
BT9:12
EN

Bently Nevada Monitor 1 BTW Enable
BT9:13
EN

Bently Nevada Monitor 2 BTW Enable
BT9:14
EN

Bently Nevada Monitor 1 BTW Control Block

BTW
Block Transfer Write
Module Type Generic Block Transfer
Rack 002
Group 2
Module 0
Control Block BT9:13
Data File N25:0
Length 29
Continuous No
Setup Screen
EN
DN
ER

Bently Nevada Monitor 2 BTW Control Block

BTW
Block Transfer Write
Module Type Generic Block Transfer
Rack 002
Group 2
Module 0
Control Block BT9:14
Data File N26:0
Length 29
Continuous No
Setup Screen
EN
DN
ER

These rungs scale the data read from the Bentley-Nevada modules to engineering uints. The B-N modules returns the data in the 10 low order bits of the data word. The 6 high order bits are masked out and the results are scaled to engineering units and stored as floating point values. If a channel fails, the last valid measurement is retained.

0002

Bently Nevada BTR Done
BT9:12
DN

Bently Nevada Monitor 1 Channel 1 Not OK
N24:3
15

Pump 101 Upper Bearing Vibration (In/Sec Peak)

CPT
Compute
Dest F8:48
0.02<
Expression (N24:3 AND 1023) * 0.002

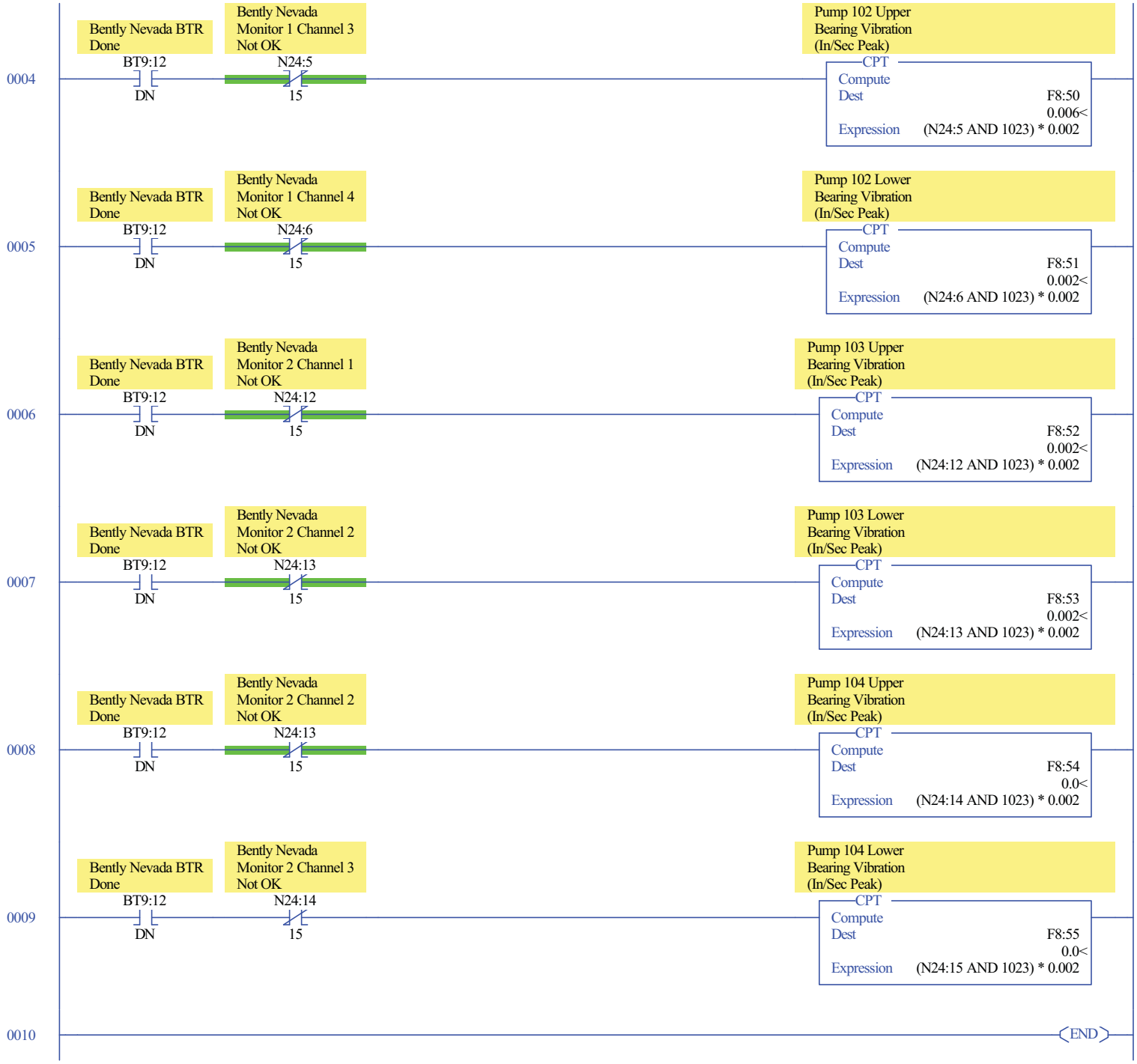
0003

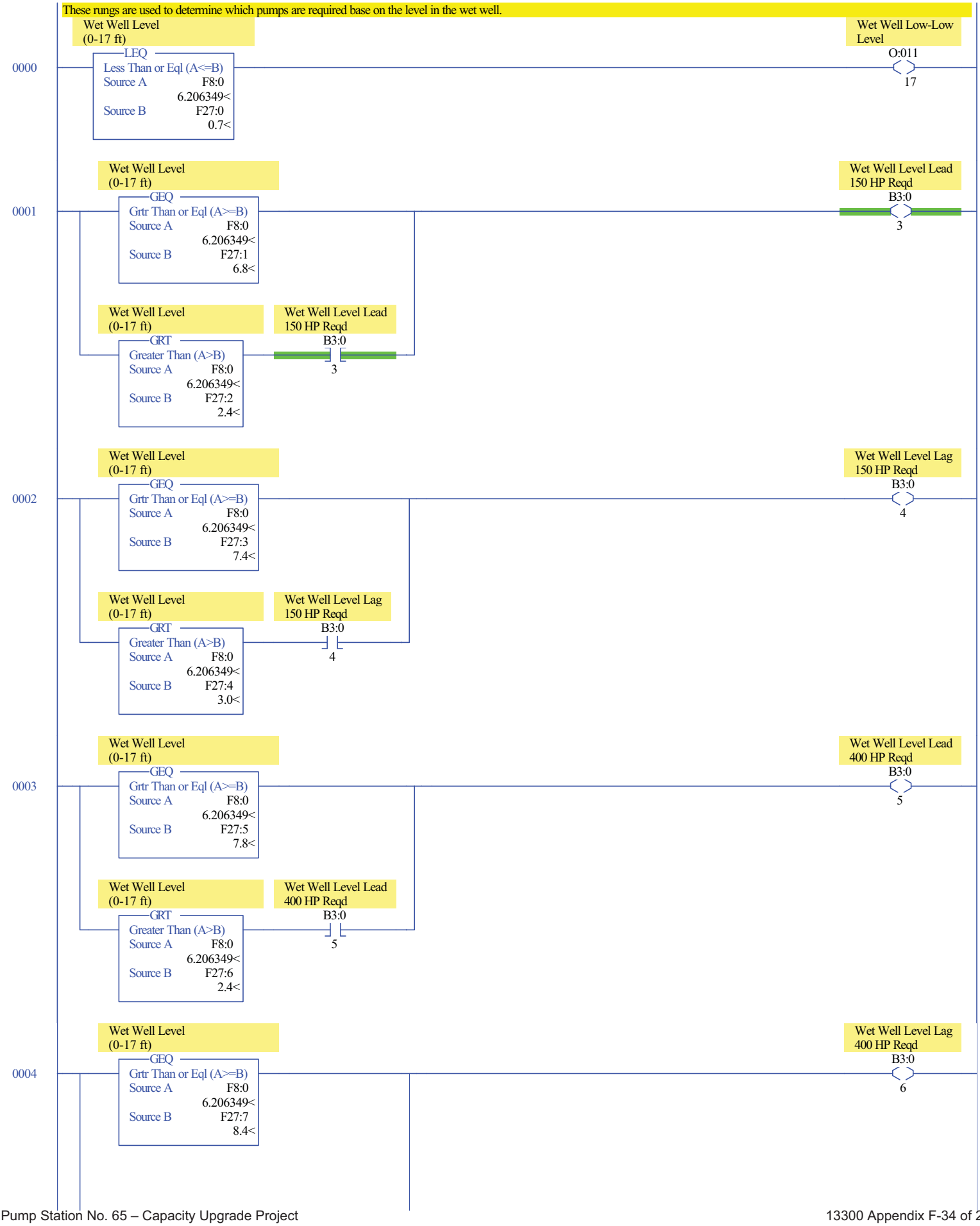
Bently Nevada BTR Done
BT9:12
DN

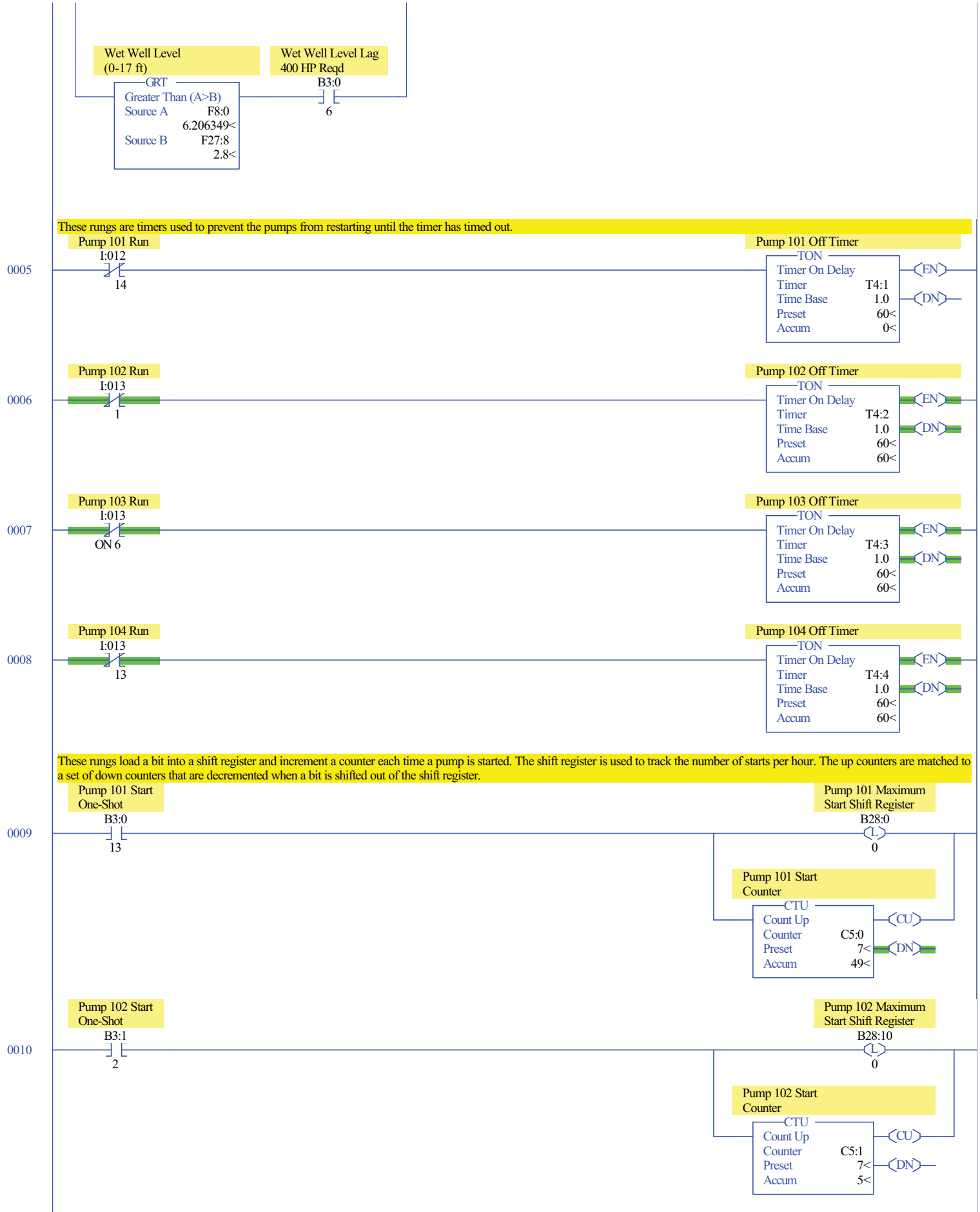
Bently Nevada Monitor 1 Channel 2 Not OK
N24:4
15

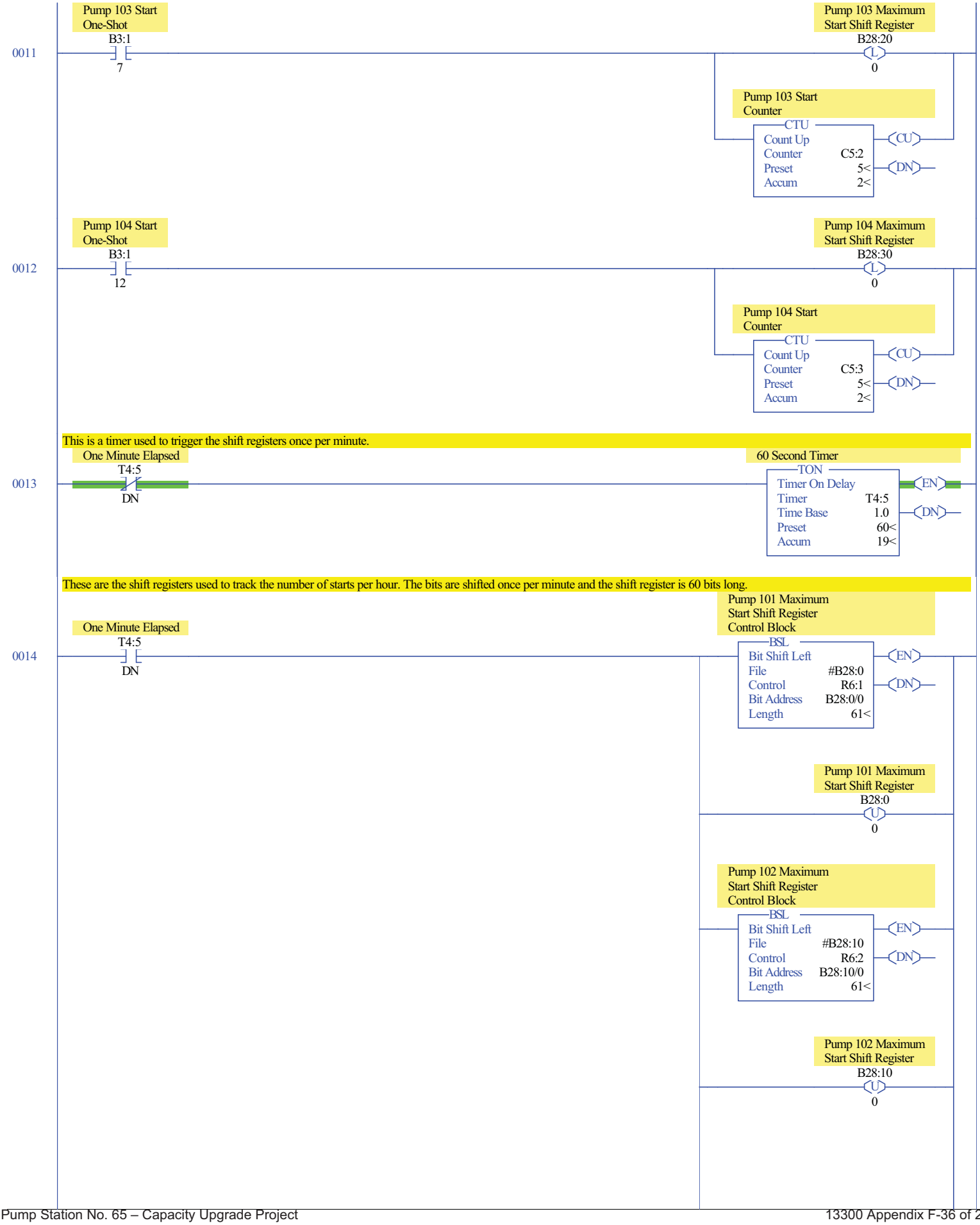
Pump 101 Lower Bearing Vibration (In/Sec Peak)

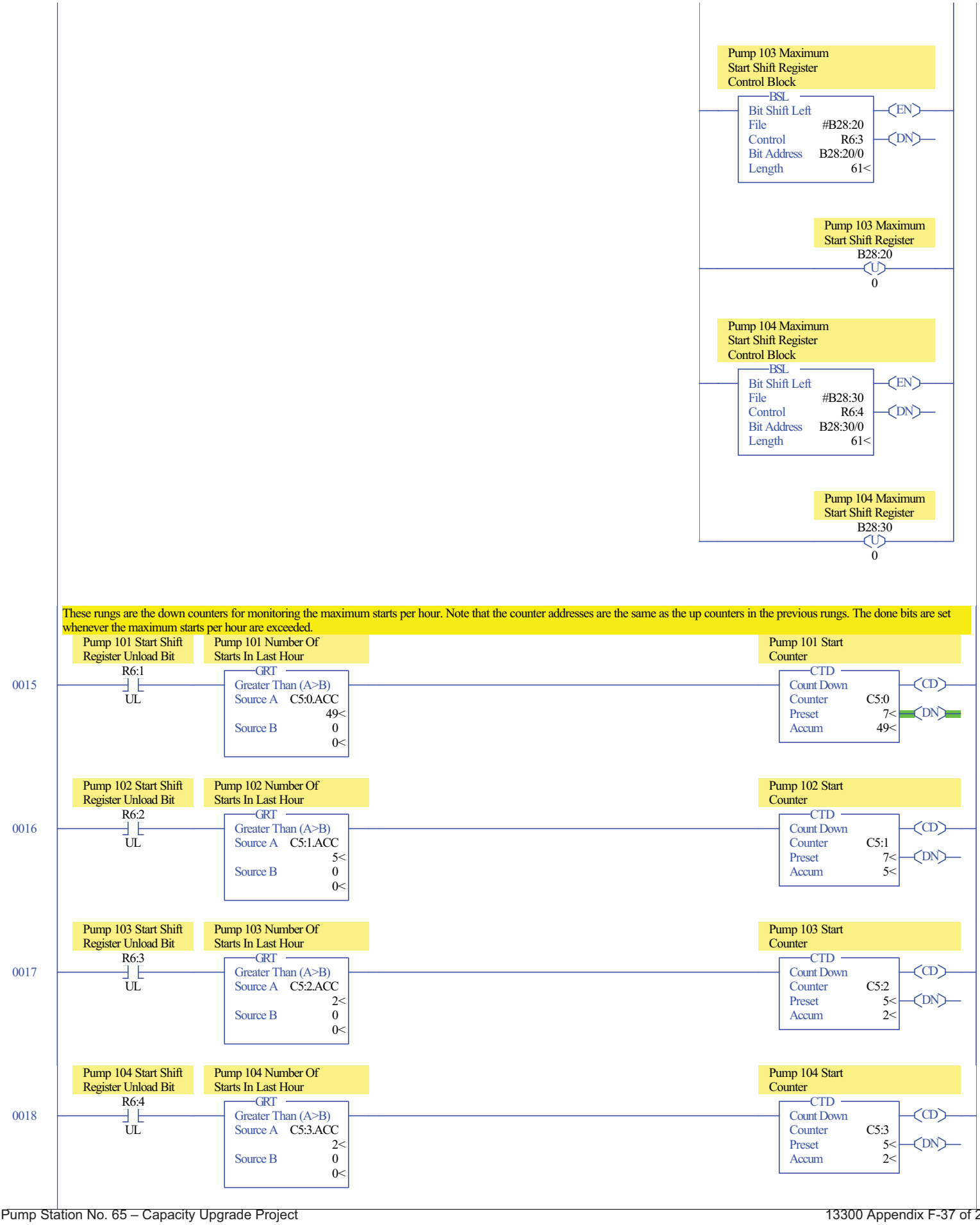
CPT
Compute
Dest F8:49
0.068<
Expression (N24:4 AND 1023) * 0.002

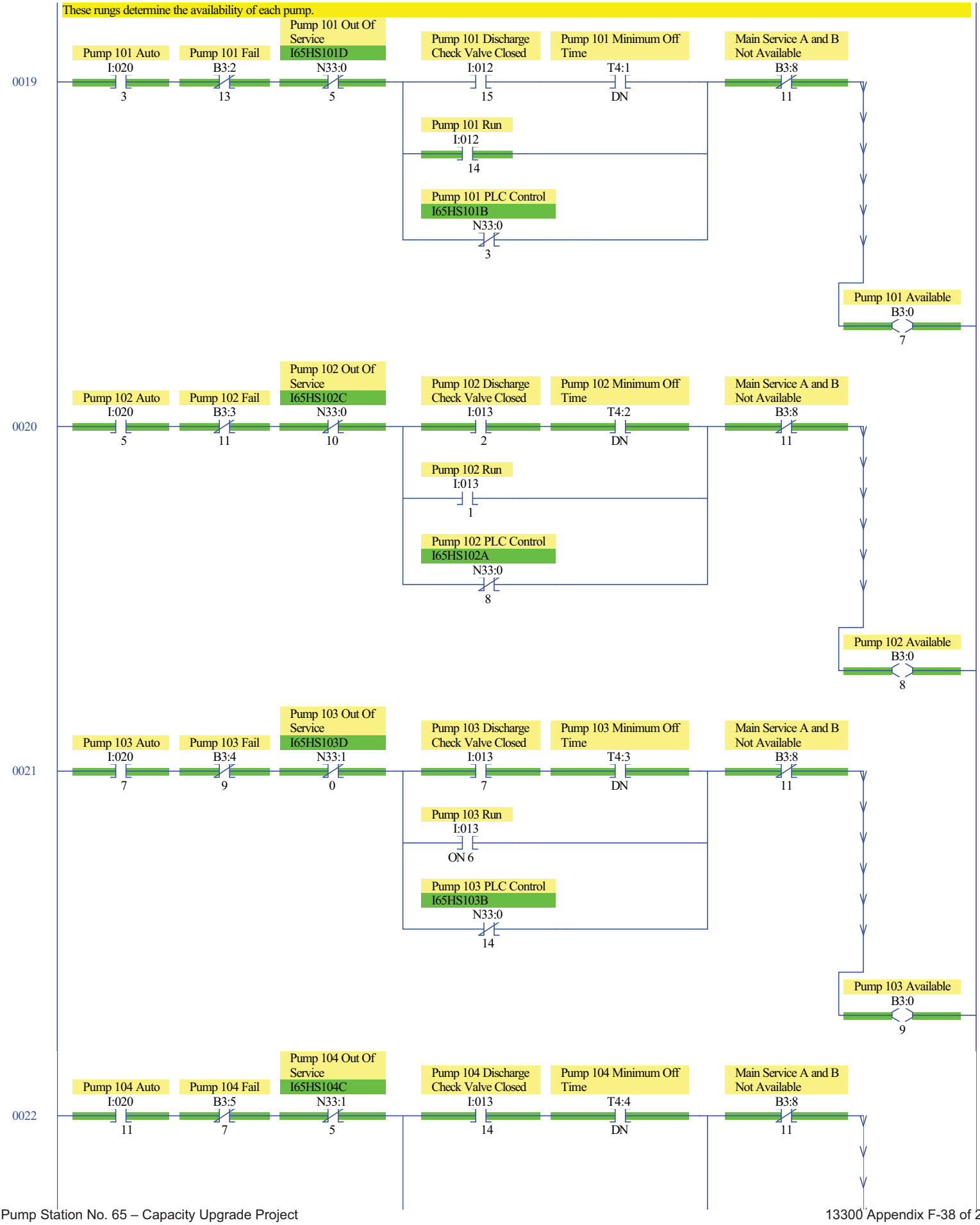

0004
Bently Nevada BTR Done
BT9:12
DN
Bently Nevada Monitor 1 Channel 3 Not OK
N24:5
15
Pump 102 Upper Bearing Vibration (In/Sec Peak)
CPT
Compute
Dest F8:50
0.006<
Expression (N24:5 AND 1023) * 0.002
0005
Bently Nevada BTR Done
BT9:12
DN
Bently Nevada Monitor 1 Channel 4 Not OK
N24:6
15
Pump 102 Lower Bearing Vibration (In/Sec Peak)
CPT
Compute
Dest F8:51
0.002<
Expression (N24:6 AND 1023) * 0.002
0006
Bently Nevada BTR Done
BT9:12
DN
Bently Nevada Monitor 2 Channel 1 Not OK
N24:12
15
Pump 103 Upper Bearing Vibration (In/Sec Peak)
CPT
Compute
Dest F8:52
0.002<
Expression (N24:12 AND 1023) * 0.002
0007
Bently Nevada BTR Done
BT9:12
DN
Bently Nevada Monitor 2 Channel 2 Not OK
N24:13
15
Pump 103 Lower Bearing Vibration (In/Sec Peak)
CPT
Compute
Dest F8:53
0.002<
Expression (N24:13 AND 1023) * 0.002
0008
Bently Nevada BTR Done
BT9:12
DN
Bently Nevada Monitor 2 Channel 2 Not OK
N24:13
15
Pump 104 Upper Bearing Vibration (In/Sec Peak)
CPT
Compute
Dest F8:54
0.0<
Expression (N24:14 AND 1023) * 0.002
0009
Bently Nevada BTR Done
BT9:12
DN
Bently Nevada Monitor 2 Channel 3 Not OK
N24:14
15
Pump 104 Lower Bearing Vibration (In/Sec Peak)
CPT
Compute
Dest F8:55
0.0<
Expression (N24:15 AND 1023) * 0.002
0010
END

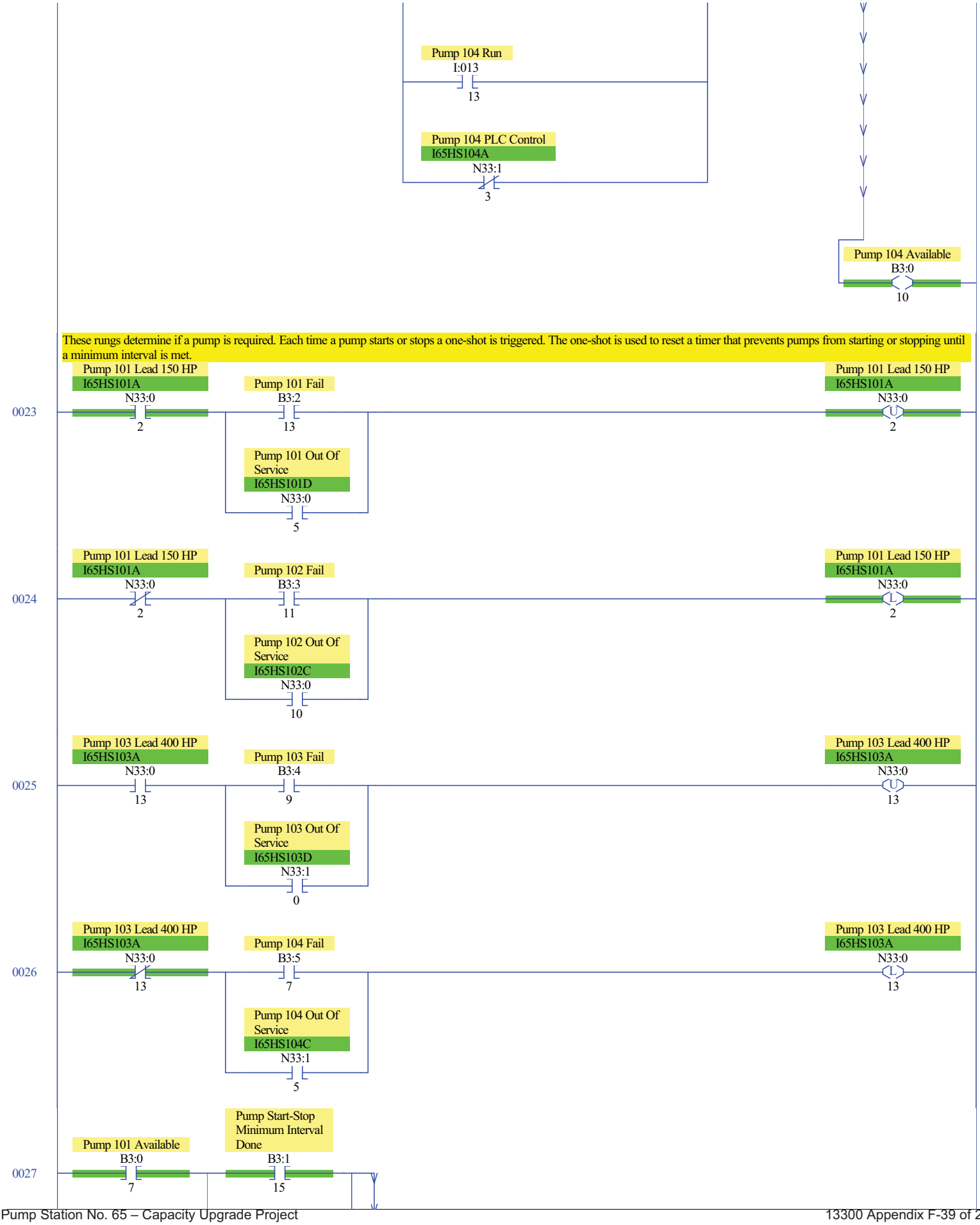

These rungs are used to determine which pumps are required base on the level in the wet well.
Wet Well Level (0-17 ft)
LEQ
Less Than or Eql (A<=B)
Source A F8:0 6.206349<
Source B F27:0 0.7<
Wet Well Low-Low Level
O:011
17
0000
Wet Well Level (0-17 ft)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:0 6.206349<
Source B F27:1 6.8<
Wet Well Level Lead 150 HP Reqd
B3:0
3
Wet Well Level (0-17 ft)
GRT
Greater Than (A>B)
Source A F8:0 6.206349<
Source B F27:2 2.4<
Wet Well Level Lead 150 HP Reqd
B3:0
3
0001
Wet Well Level (0-17 ft)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:0 6.206349<
Source B F27:3 7.4<
Wet Well Level Lag 150 HP Reqd
B3:0
4
Wet Well Level (0-17 ft)
GRT
Greater Than (A>B)
Source A F8:0 6.206349<
Source B F27:4 3.0<
Wet Well Level Lag 150 HP Reqd
B3:0
4
0002
Wet Well Level (0-17 ft)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:0 6.206349<
Source B F27:5 7.8<
Wet Well Level Lead 400 HP Reqd
B3:0
5
Wet Well Level (0-17 ft)
GRT
Greater Than (A>B)
Source A F8:0 6.206349<
Source B F27:6 2.4<
Wet Well Level Lead 400 HP Reqd
B3:0
5
0003
Wet Well Level (0-17 ft)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:0 6.206349<
Source B F27:7 8.4<
Wet Well Level Lag 400 HP Reqd
B3:0
6
0004

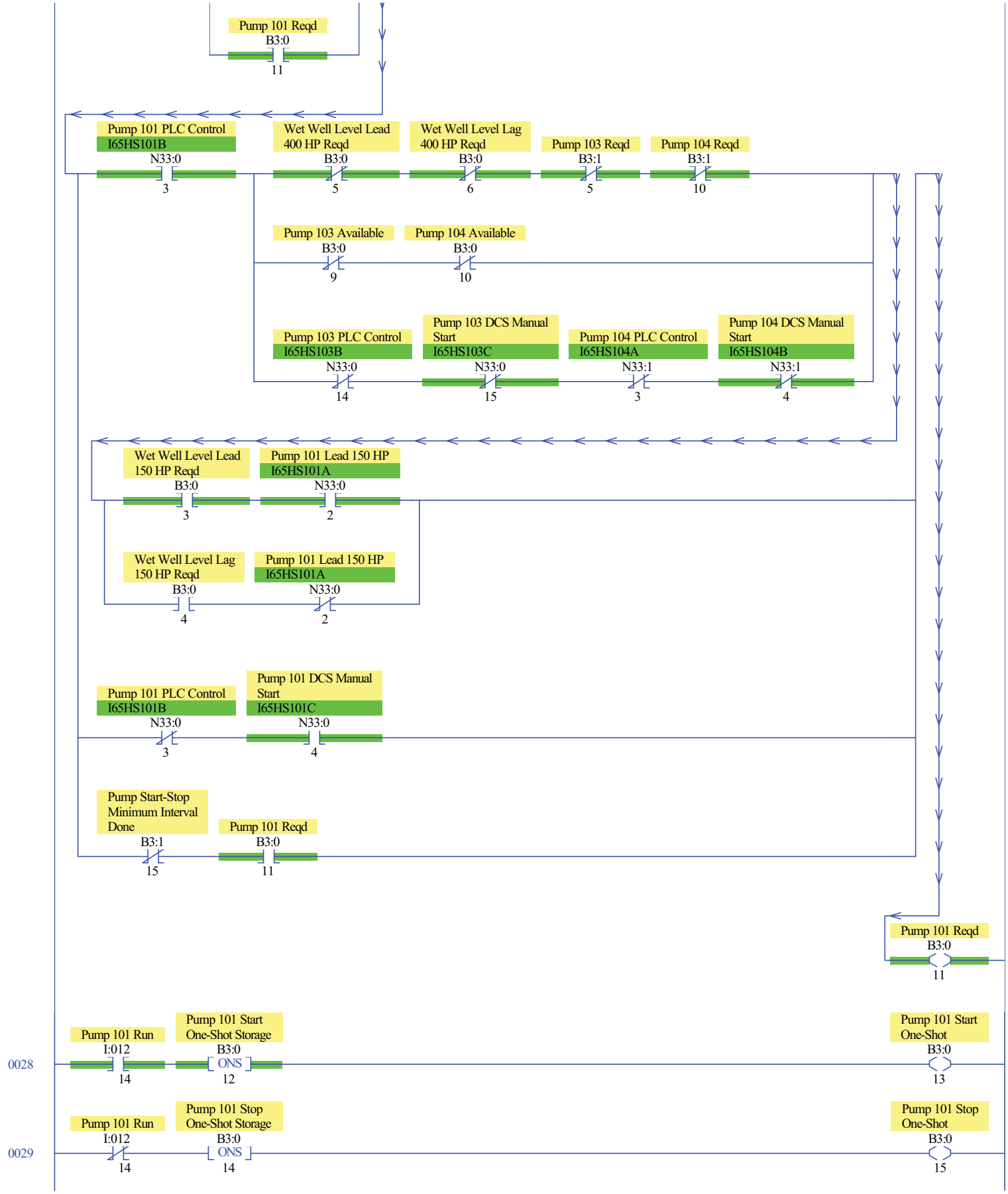

Wet Well Level
(0-17 ft)
GRT
Greater Than (A>B)
Source A F8:0
6.206349<
Source B F27:8
2.8<
Wet Well Level Lag
400 HP Reqd
B3:0
6
These rungs are timers used to prevent the pumps from restarting until the timer has timed out.
0005
Pump 101 Run
I:012
14
Pump 101 Off Timer
TON
Timer On Delay
Timer T4:1
Time Base 1.0
Preset 60<
Accum 0<
EN
DN
0006
Pump 102 Run
I:013
1
Pump 102 Off Timer
TON
Timer On Delay
Timer T4:2
Time Base 1.0
Preset 60<
Accum 60<
EN
DN
0007
Pump 103 Run
I:013
ON 6
Pump 103 Off Timer
TON
Timer On Delay
Timer T4:3
Time Base 1.0
Preset 60<
Accum 60<
EN
DN
0008
Pump 104 Run
I:013
13
Pump 104 Off Timer
TON
Timer On Delay
Timer T4:4
Time Base 1.0
Preset 60<
Accum 60<
EN
DN
These rungs load a bit into a shift register and increment a counter each time a pump is started. The shift register is used to track the number of starts per hour. The up counters are matched to a set of down counters that are decremented when a bit is shifted out of the shift register.
0009
Pump 101 Start
One-Shot
B3:0
13
Pump 101 Maximum
Start Shift Register
B28:0
L
0
Pump 101 Start
Counter
CTU
Count Up
Counter C5:0
Preset 7<
Accum 49<
CU
DN
0010
Pump 102 Start
One-Shot
B3:1
2
Pump 102 Maximum
Start Shift Register
B28:10
L
0
Pump 102 Start
Counter
CTU
Count Up
Counter C5:1
Preset 7<
Accum 5<
CU
DN


Pump 103 Start
One-Shot
B3:1
7
0011
Pump 103 Maximum
Start Shift Register
B28:20
L
0
Pump 103 Start
Counter
CTU
Count Up
Counter C5:2
Preset 5<
Accum 2<
CU
DN
Pump 104 Start
One-Shot
B3:1
12
0012
Pump 104 Maximum
Start Shift Register
B28:30
L
0
Pump 104 Start
Counter
CTU
Count Up
Counter C5:3
Preset 5<
Accum 2<
CU
DN
This is a timer used to trigger the shift registers once per minute.
One Minute Elapsed
T4:5
DN
0013
60 Second Timer
TON
Timer On Delay
Timer T4:5
Time Base 1.0
Preset 60<
Accum 19<
EN
DN
These are the shift registers used to track the number of starts per hour. The bits are shifted once per minute and the shift register is 60 bits long.
One Minute Elapsed
T4:5
DN
0014
Pump 101 Maximum
Start Shift Register
Control Block
BSL
Bit Shift Left
File #B28:0
Control R6:1
Bit Address B28:0/0
Length 61<
EN
DN
Pump 101 Maximum
Start Shift Register
B28:0
U
0
Pump 102 Maximum
Start Shift Register
Control Block
BSL
Bit Shift Left
File #B28:10
Control R6:2
Bit Address B28:10/0
Length 61<
EN
DN
Pump 102 Maximum
Start Shift Register
B28:10
U
0

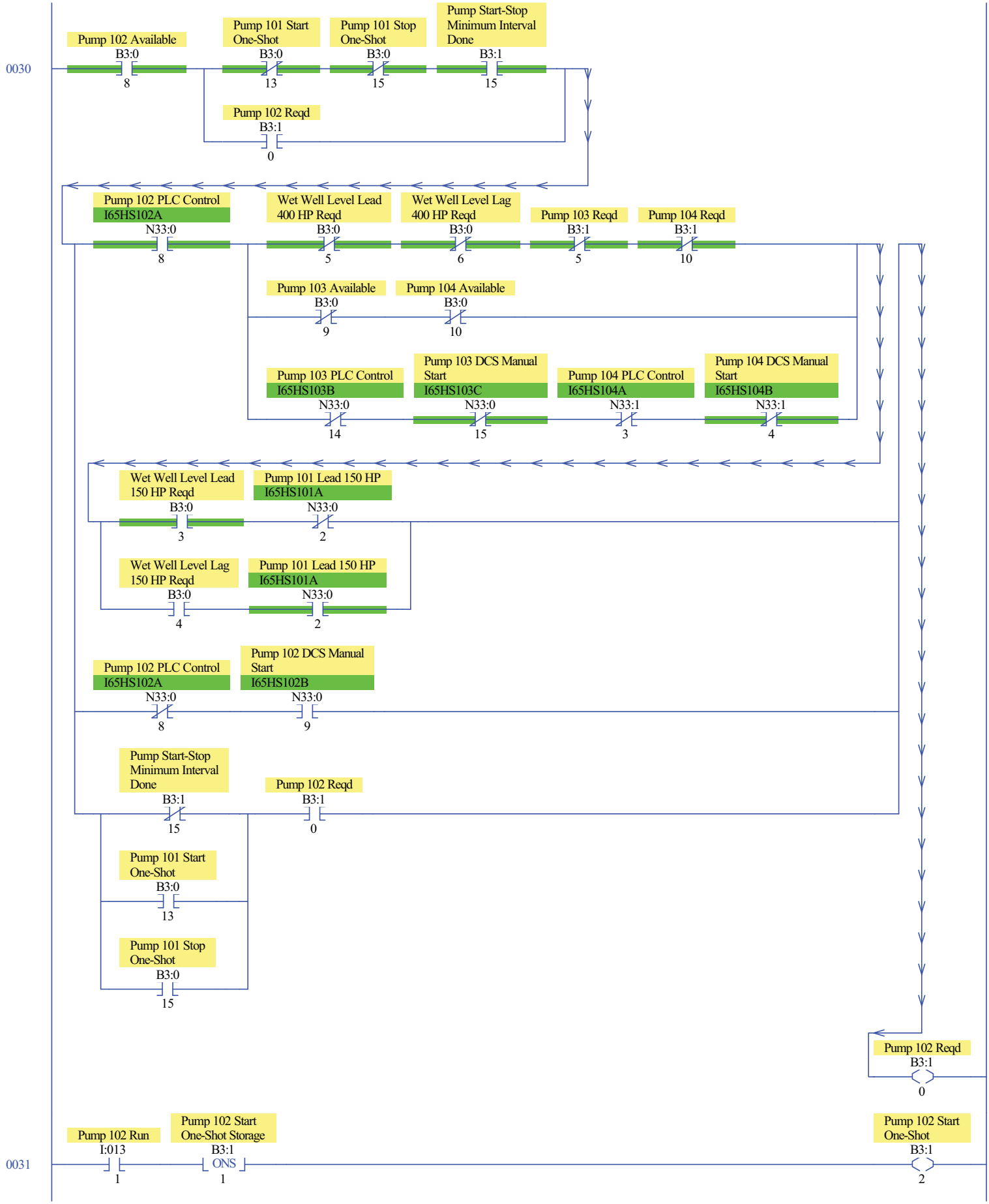

Pump 103 Maximum Start Shift Register Control Block
BSL
Bit Shift Left
File #B28:20
Control R6:3
Bit Address B28:20/0
Length 61<
EN
DN
Pump 103 Maximum Start Shift Register
B28:20
U
0
Pump 104 Maximum Start Shift Register Control Block
BSL
Bit Shift Left
File #B28:30
Control R6:4
Bit Address B28:30/0
Length 61<
EN
DN
Pump 104 Maximum Start Shift Register
B28:30
U
0
These rungs are the down counters for monitoring the maximum starts per hour. Note that the counter addresses are the same as the up counters in the previous rungs. The done bits are set whenever the maximum starts per hour are exceeded.
0015
Pump 101 Start Shift Register Unload Bit
R6:1
UL
Pump 101 Number Of Starts In Last Hour
GRT
Greater Than (A>B)
Source A C5:0.ACC 49<
Source B 0 0<
Pump 101 Start Counter
CTD
Count Down
Counter C5:0
Preset 7<
Accum 49<
CD
DN
0016
Pump 102 Start Shift Register Unload Bit
R6:2
UL
Pump 102 Number Of Starts In Last Hour
GRT
Greater Than (A>B)
Source A C5:1.ACC 5<
Source B 0 0<
Pump 102 Start Counter
CTD
Count Down
Counter C5:1
Preset 7<
Accum 5<
CD
DN
0017
Pump 103 Start Shift Register Unload Bit
R6:3
UL
Pump 103 Number Of Starts In Last Hour
GRT
Greater Than (A>B)
Source A C5:2.ACC 2<
Source B 0 0<
Pump 103 Start Counter
CTD
Count Down
Counter C5:2
Preset 5<
Accum 2<
CD
DN
0018
Pump 104 Start Shift Register Unload Bit
R6:4
UL
Pump 104 Number Of Starts In Last Hour
GRT
Greater Than (A>B)
Source A C5:3.ACC 2<
Source B 0 0<
Pump 104 Start Counter
CTD
Count Down
Counter C5:3
Preset 5<
Accum 2<
CD
DN

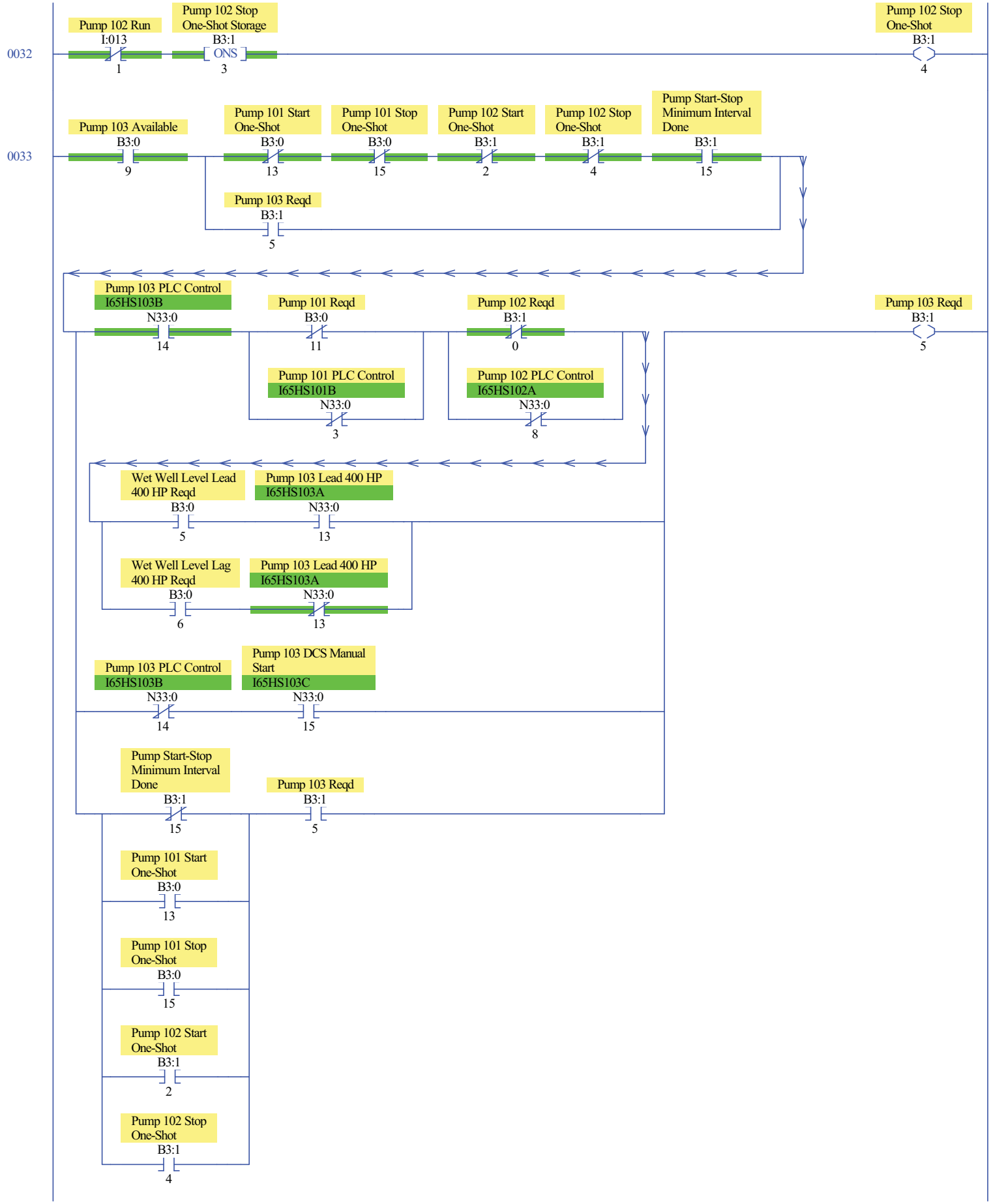

These rungs determine the availability of each pump.
0019
Pump 101 Auto
I:020
3
Pump 101 Fail
B3:2
13
Pump 101 Out Of Service
I65HS101D
N33:0
5
Pump 101 Discharge Check Valve Closed
I:012
15
Pump 101 Minimum Off Time
T4:1
DN
Main Service A and B Not Available
B3:8
11
Pump 101 Run
I:012
14
Pump 101 PLC Control
I65HS101B
N33:0
3
Pump 101 Available
B3:0
7
0020
Pump 102 Auto
I:020
5
Pump 102 Fail
B3:3
11
Pump 102 Out Of Service
I65HS102C
N33:0
10
Pump 102 Discharge Check Valve Closed
I:013
2
Pump 102 Minimum Off Time
T4:2
DN
Main Service A and B Not Available
B3:8
11
Pump 102 Run
I:013
1
Pump 102 PLC Control
I65HS102A
N33:0
8
Pump 102 Available
B3:0
8
0021
Pump 103 Auto
I:020
7
Pump 103 Fail
B3:4
9
Pump 103 Out Of Service
I65HS103D
N33:1
0
Pump 103 Discharge Check Valve Closed
I:013
7
Pump 103 Minimum Off Time
T4:3
DN
Main Service A and B Not Available
B3:8
11
Pump 103 Run
I:013
ON 6
Pump 103 PLC Control
I65HS103B
N33:0
14
Pump 103 Available
B3:0
9
0022
Pump 104 Auto
I:020
11
Pump 104 Fail
B3:5
7
Pump 104 Out Of Service
I65HS104C
N33:1
5
Pump 104 Discharge Check Valve Closed
I:013
14
Pump 104 Minimum Off Time
T4:4
DN
Main Service A and B Not Available
B3:8
11

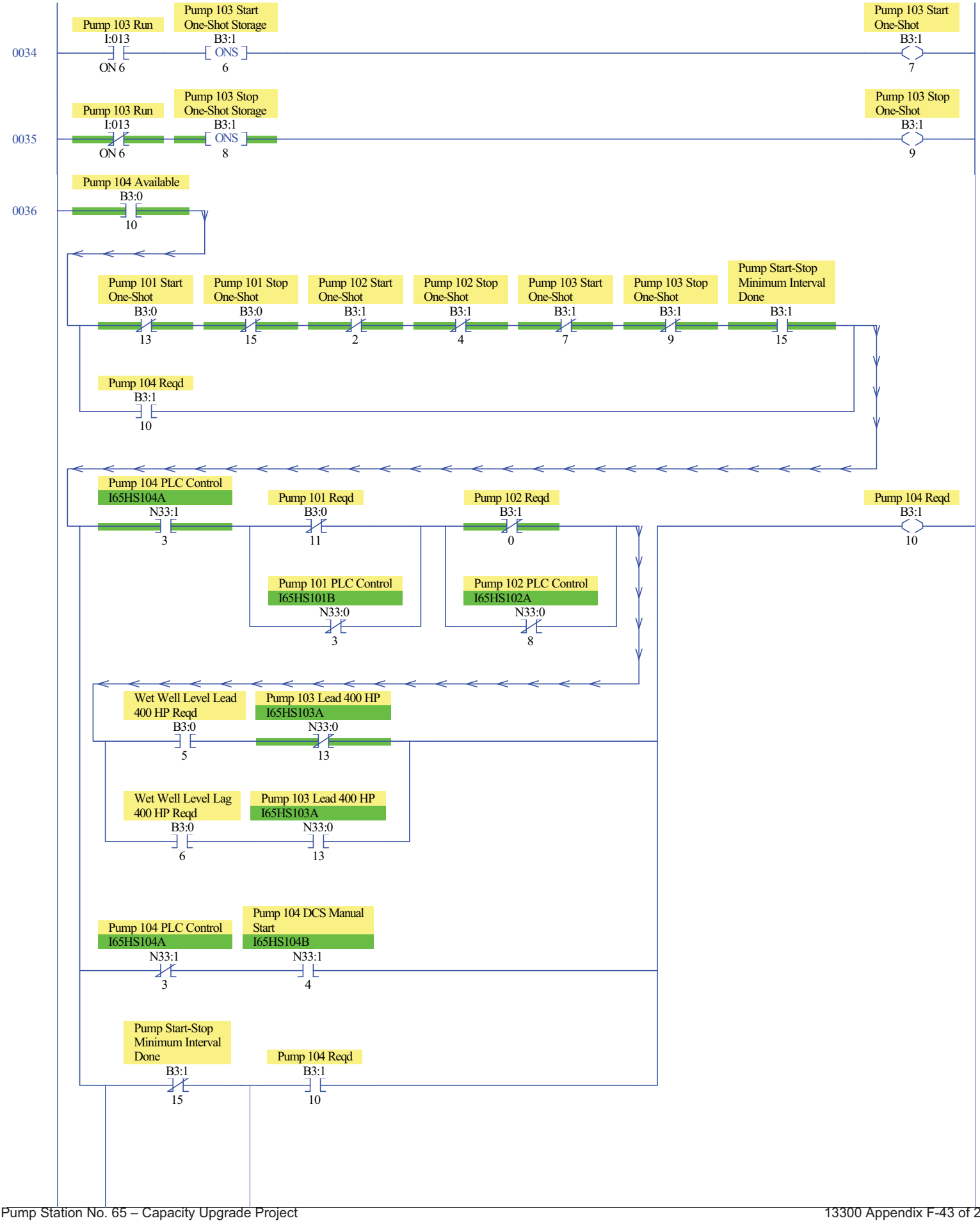

Pump 104 Run
I:013
13
Pump 104 PLC Control
I65HS104A
N33:1
3
Pump 104 Available
B3:0
10
These rungs determine if a pump is required. Each time a pump starts or stops a one-shot is triggered. The one-shot is used to reset a timer that prevents pumps from starting or stopping until a minimum interval is met.
0023
Pump 101 Lead 150 HP
I65HS101A
N33:0
2
Pump 101 Fail
B3:2
13
Pump 101 Out Of Service
I65HS101D
N33:0
5
Pump 101 Lead 150 HP
I65HS101A
N33:0
U
2
0024
Pump 101 Lead 150 HP
I65HS101A
N33:0
2
Pump 102 Fail
B3:3
11
Pump 102 Out Of Service
I65HS102C
N33:0
10
Pump 101 Lead 150 HP
I65HS101A
N33:0
L
2
0025
Pump 103 Lead 400 HP
I65HS103A
N33:0
13
Pump 103 Fail
B3:4
9
Pump 103 Out Of Service
I65HS103D
N33:1
0
Pump 103 Lead 400 HP
I65HS103A
N33:0
U
13
0026
Pump 103 Lead 400 HP
I65HS103A
N33:0
13
Pump 104 Fail
B3:5
7
Pump 104 Out Of Service
I65HS104C
N33:1
5
Pump 103 Lead 400 HP
I65HS103A
N33:0
L
13
0027
Pump 101 Available
B3:0
7
Pump Start-Stop Minimum Interval Done
B3:1
15


Pump 101 Reqd
B3:0
11
Pump 101 PLC Control
I65HS101B
N33:0
3
Wet Well Level Lead
400 HP Reqd
B3:0
5
Wet Well Level Lag
400 HP Reqd
B3:0
6
Pump 103 Reqd
B3:1
5
Pump 104 Reqd
B3:1
10
Pump 103 Available
B3:0
9
Pump 104 Available
B3:0
10
Pump 103 PLC Control
I65HS103B
N33:0
14
Pump 103 DCS Manual
Start
I65HS103C
N33:0
15
Pump 104 PLC Control
I65HS104A
N33:1
3
Pump 104 DCS Manual
Start
I65HS104B
N33:1
4
Wet Well Level Lead
150 HP Reqd
B3:0
3
Pump 101 Lead 150 HP
I65HS101A
N33:0
2
Wet Well Level Lag
150 HP Reqd
B3:0
4
Pump 101 Lead 150 HP
I65HS101A
N33:0
2
Pump 101 PLC Control
I65HS101B
N33:0
3
Pump 101 DCS Manual
Start
I65HS101C
N33:0
4
Pump Start-Stop
Minimum Interval
Done
B3:1
15
Pump 101 Reqd
B3:0
11
Pump 101 Reqd
B3:0
11
0028
Pump 101 Run
I:012
14
Pump 101 Start
One-Shot Storage
B3:0
ONS
12
Pump 101 Start
One-Shot
B3:0
13
0029
Pump 101 Run
I:012
14
Pump 101 Stop
One-Shot Storage
B3:0
ONS
14
Pump 101 Stop
One-Shot
B3:0
15

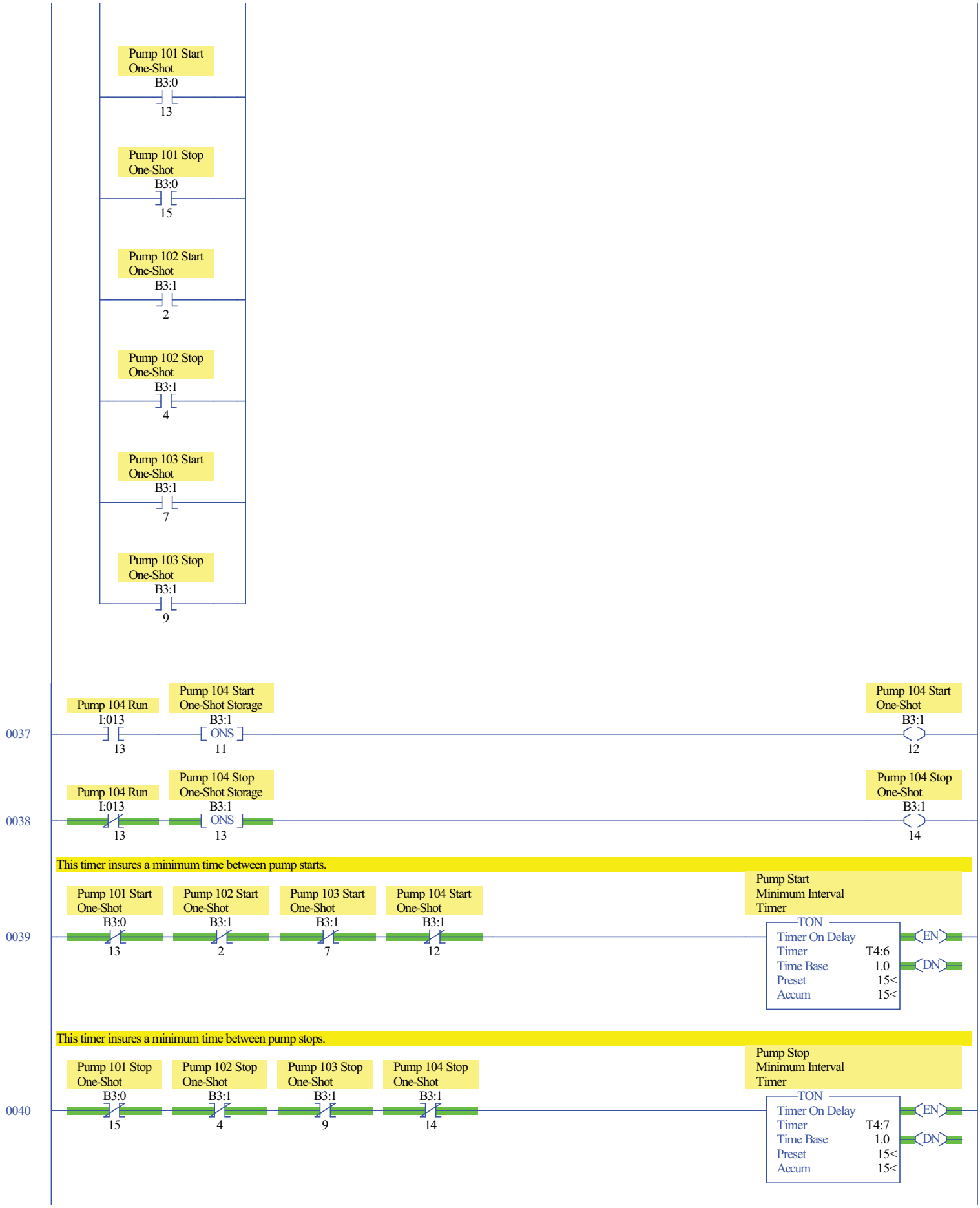
LAD 12 - SEQUENCE --- Total Rungs in File = 43



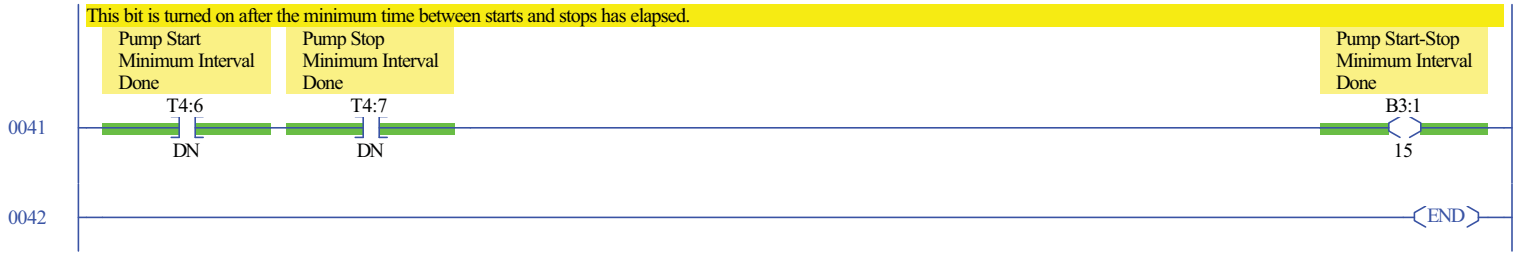

0032
Pump 102 Run
I:013
1
Pump 102 Stop
One-Shot Storage
B3:1
ONS
3
Pump 102 Stop
One-Shot
B3:1
4
0033
Pump 103 Available
B3:0
9
Pump 101 Start
One-Shot
B3:0
13
Pump 101 Stop
One-Shot
B3:0
15
Pump 102 Start
One-Shot
B3:1
2
Pump 102 Stop
One-Shot
B3:1
4
Pump Start-Stop
Minimum Interval
Done
B3:1
15
Pump 103 Reqd
B3:1
5
Pump 103 PLC Control
I65HS103B
N33:0
14
Pump 101 Reqd
B3:0
11
Pump 102 Reqd
B3:1
0
Pump 103 Reqd
B3:1
5
Pump 101 PLC Control
I65HS101B
N33:0
3
Pump 102 PLC Control
I65HS102A
N33:0
8
Wet Well Level Lead
400 HP Reqd
B3:0
5
Pump 103 Lead 400 HP
I65HS103A
N33:0
13
Wet Well Level Lag
400 HP Reqd
B3:0
6
Pump 103 Lead 400 HP
I65HS103A
N33:0
13
Pump 103 PLC Control
I65HS103B
N33:0
14
Pump 103 DCS Manual
Start
I65HS103C
N33:0
15
Pump Start-Stop
Minimum Interval
Done
B3:1
15
Pump 103 Reqd
B3:1
5
Pump 101 Start
One-Shot
B3:0
13
Pump 101 Stop
One-Shot
B3:0
15
Pump 102 Start
One-Shot
B3:1
2
Pump 102 Stop
One-Shot
B3:1
4


0034
Pump 103 Run
I:013
ON 6
Pump 103 Start One-Shot Storage
B3:1
ONS
6
Pump 103 Start One-Shot
B3:1
7
0035
Pump 103 Run
I:013
ON 6
Pump 103 Stop One-Shot Storage
B3:1
ONS
8
Pump 103 Stop One-Shot
B3:1
9
0036
Pump 104 Available
B3:0
10
Pump 101 Start One-Shot
B3:0
13
Pump 101 Stop One-Shot
B3:0
15
Pump 102 Start One-Shot
B3:1
2
Pump 102 Stop One-Shot
B3:1
4
Pump 103 Start One-Shot
B3:1
7
Pump 103 Stop One-Shot
B3:1
9
Pump Start-Stop Minimum Interval Done
B3:1
15
Pump 104 Reqd
B3:1
10
Pump 104 PLC Control
I65HS104A
N33:1
3
Pump 101 Reqd
B3:0
11
Pump 102 Reqd
B3:1
0
Pump 104 Reqd
B3:1
10
Pump 101 PLC Control
I65HS101B
N33:0
3
Pump 102 PLC Control
I65HS102A
N33:0
8
Wet Well Level Lead 400 HP Reqd
B3:0
5
Pump 103 Lead 400 HP
I65HS103A
N33:0
13
Wet Well Level Lag 400 HP Reqd
B3:0
6
Pump 103 Lead 400 HP
I65HS103A
N33:0
13
Pump 104 PLC Control
I65HS104A
N33:1
3
Pump 104 DCS Manual Start
I65HS104B
N33:1
4
Pump Start-Stop Minimum Interval Done
B3:1
15
Pump 104 Reqd
B3:1
10

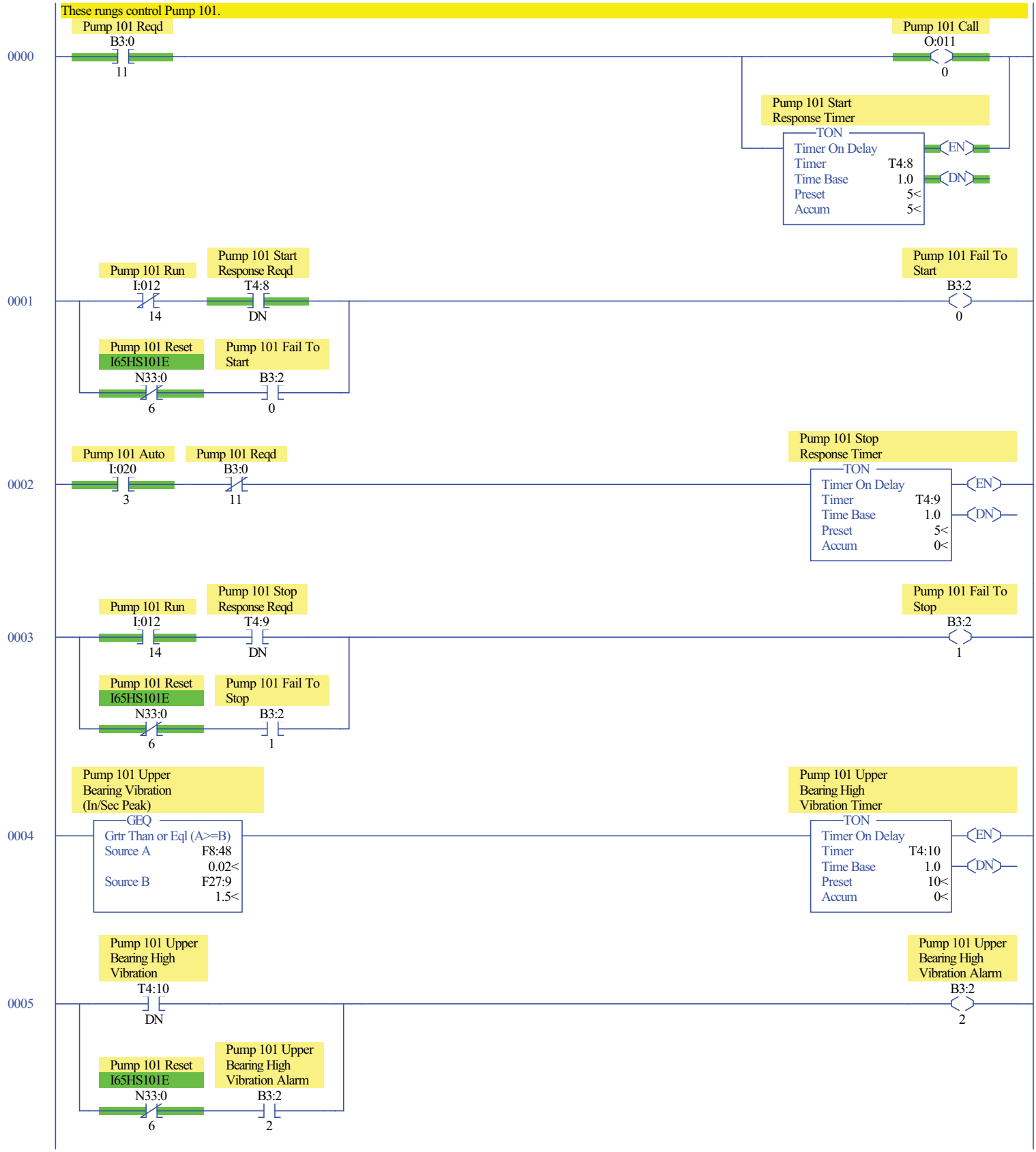
LAD 12 - SEQUENCE --- Total Rungs in File = 43

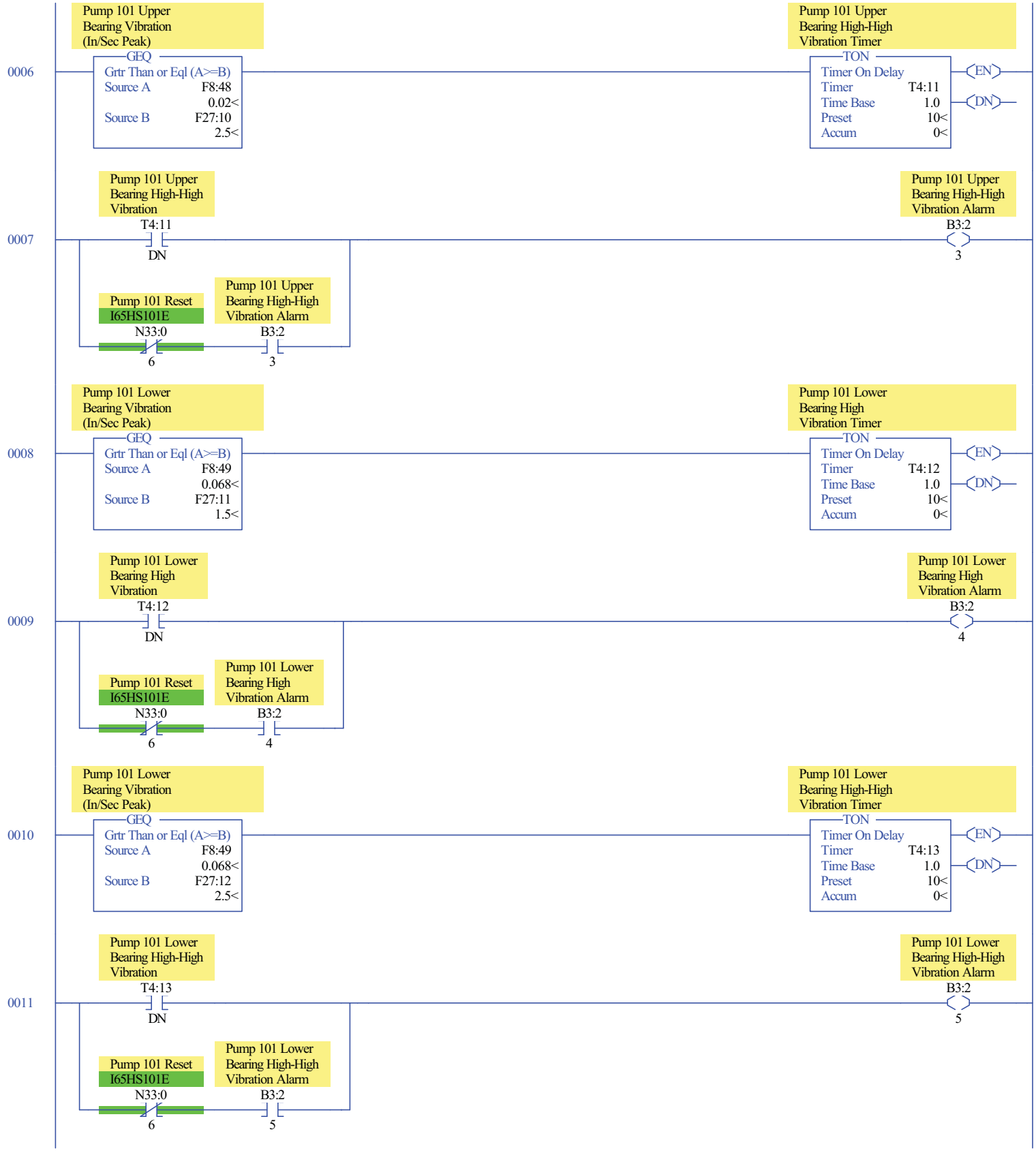


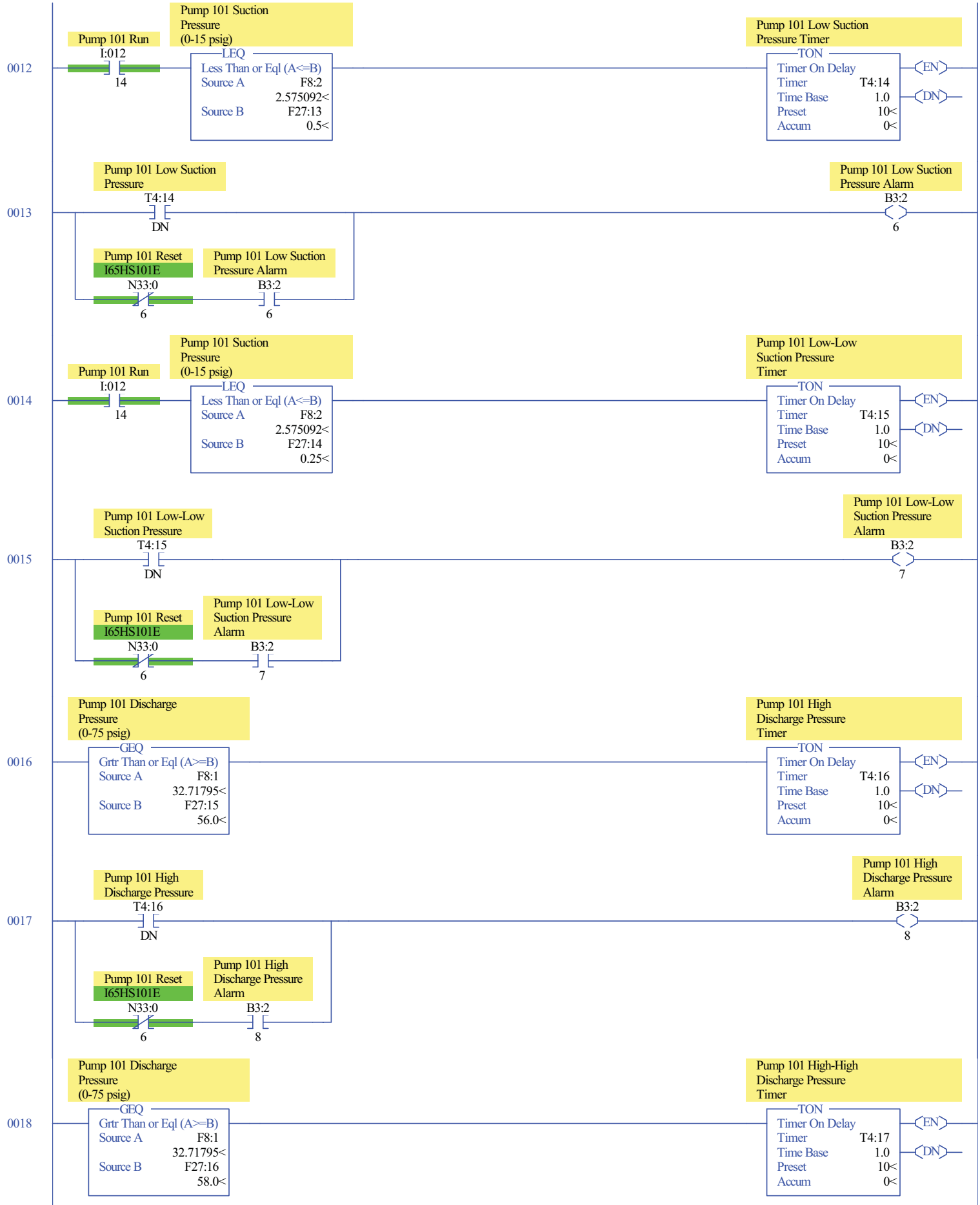
LAD 12 - SEQUENCE --- Total Rungs in File = 43



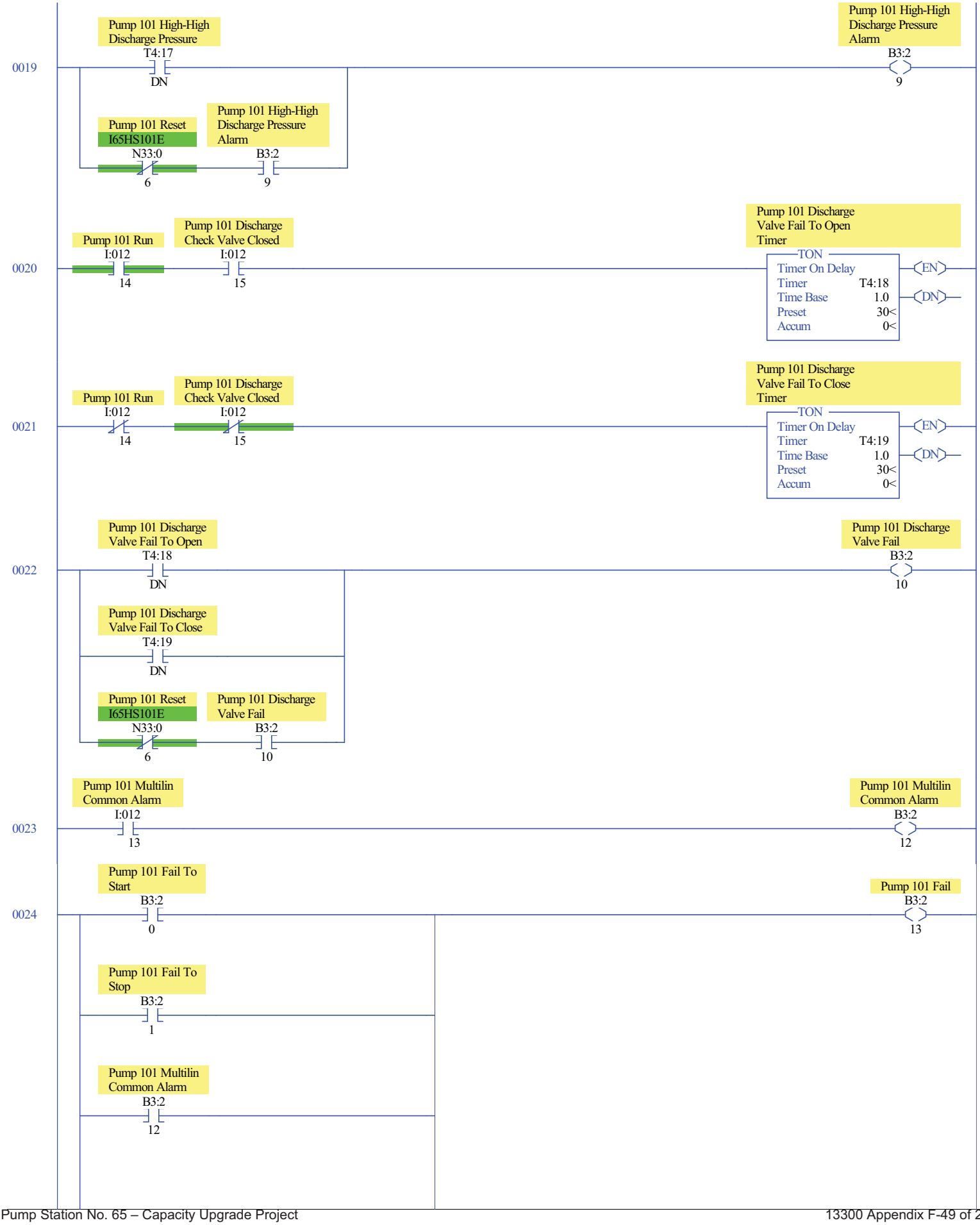
LAD 13 - PUMP 101 --- Total Rungs in File = 30



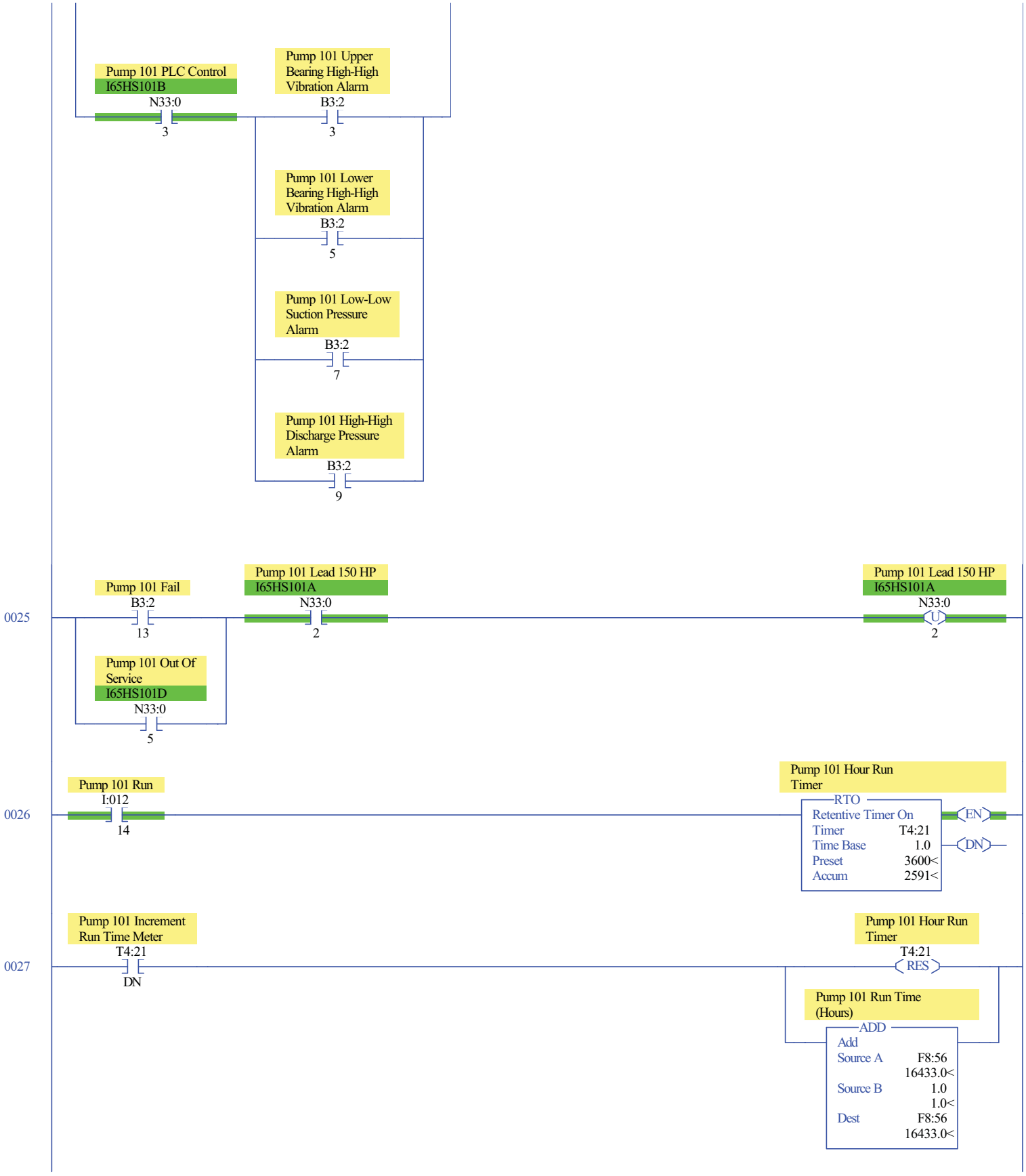

Pump 101 Upper Bearing Vibration (In/Sec Peak)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:48 0.02<
Source B F27:10 2.5<
Pump 101 Upper Bearing High-High Vibration Timer
TON
Timer On Delay
Timer T4:11
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0006
Pump 101 Upper Bearing High-High Vibration
T4:11
DN
Pump 101 Upper Bearing High-High Vibration Alarm
B3:2
3
Pump 101 Reset
I65HS101E
N33:0
6
Pump 101 Upper Bearing High-High Vibration Alarm
B3:2
3
0007
Pump 101 Lower Bearing Vibration (In/Sec Peak)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:49 0.068<
Source B F27:11 1.5<
Pump 101 Lower Bearing High Vibration Timer
TON
Timer On Delay
Timer T4:12
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0008
Pump 101 Lower Bearing High Vibration
T4:12
DN
Pump 101 Lower Bearing High Vibration Alarm
B3:2
4
Pump 101 Reset
I65HS101E
N33:0
6
Pump 101 Lower Bearing High Vibration Alarm
B3:2
4
0009
Pump 101 Lower Bearing Vibration (In/Sec Peak)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:49 0.068<
Source B F27:12 2.5<
Pump 101 Lower Bearing High-High Vibration Timer
TON
Timer On Delay
Timer T4:13
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0010
Pump 101 Lower Bearing High-High Vibration
T4:13
DN
Pump 101 Lower Bearing High-High Vibration Alarm
B3:2
5
Pump 101 Reset
I65HS101E
N33:0
6
Pump 101 Lower Bearing High-High Vibration Alarm
B3:2
5
0011


0012
Pump 101 Run
I:012
14
Pump 101 Suction Pressure (0-15 psig)
LEQ
Less Than or Eql (A<=B)
Source A F8:2 2.575092<
Source B F27:13 0.5<
Pump 101 Low Suction Pressure Timer
TON
Timer On Delay
Timer T4:14
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0013
Pump 101 Low Suction Pressure
T4:14
DN
Pump 101 Low Suction Pressure Alarm
B3:2
6
Pump 101 Reset
I65HS101E
N33:0
6
Pump 101 Low Suction Pressure Alarm
B3:2
6
0014
Pump 101 Run
I:012
14
Pump 101 Suction Pressure (0-15 psig)
LEQ
Less Than or Eql (A<=B)
Source A F8:2 2.575092<
Source B F27:14 0.25<
Pump 101 Low-Low Suction Pressure Timer
TON
Timer On Delay
Timer T4:15
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0015
Pump 101 Low-Low Suction Pressure
T4:15
DN
Pump 101 Low-Low Suction Pressure Alarm
B3:2
7
Pump 101 Reset
I65HS101E
N33:0
6
Pump 101 Low-Low Suction Pressure Alarm
B3:2
7
0016
Pump 101 Discharge Pressure (0-75 psig)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:1 32.71795<
Source B F27:15 56.0<
Pump 101 High Discharge Pressure Timer
TON
Timer On Delay
Timer T4:16
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0017
Pump 101 High Discharge Pressure
T4:16
DN
Pump 101 High Discharge Pressure Alarm
B3:2
8
Pump 101 Reset
I65HS101E
N33:0
6
Pump 101 High Discharge Pressure Alarm
B3:2
8
0018
Pump 101 Discharge Pressure (0-75 psig)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:1 32.71795<
Source B F27:16 58.0<
Pump 101 High-High Discharge Pressure Timer
TON
Timer On Delay
Timer T4:17
Time Base 1.0
Preset 10<
Accum 0<
EN
DN

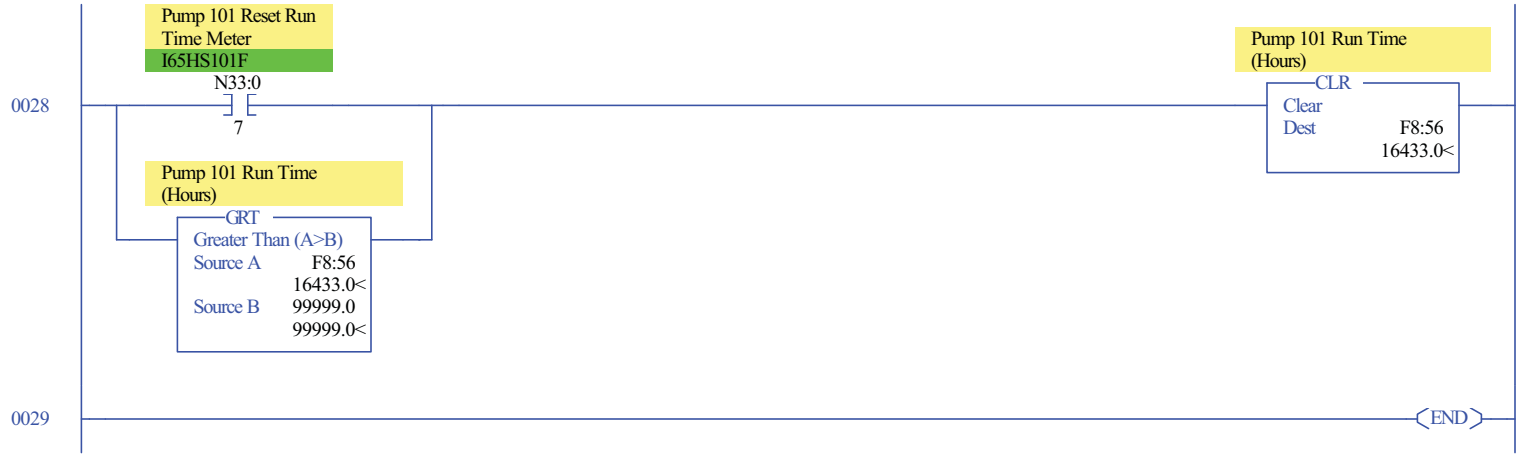
LAD 13 - PUMP 101 --- Total Rungs in File = 30

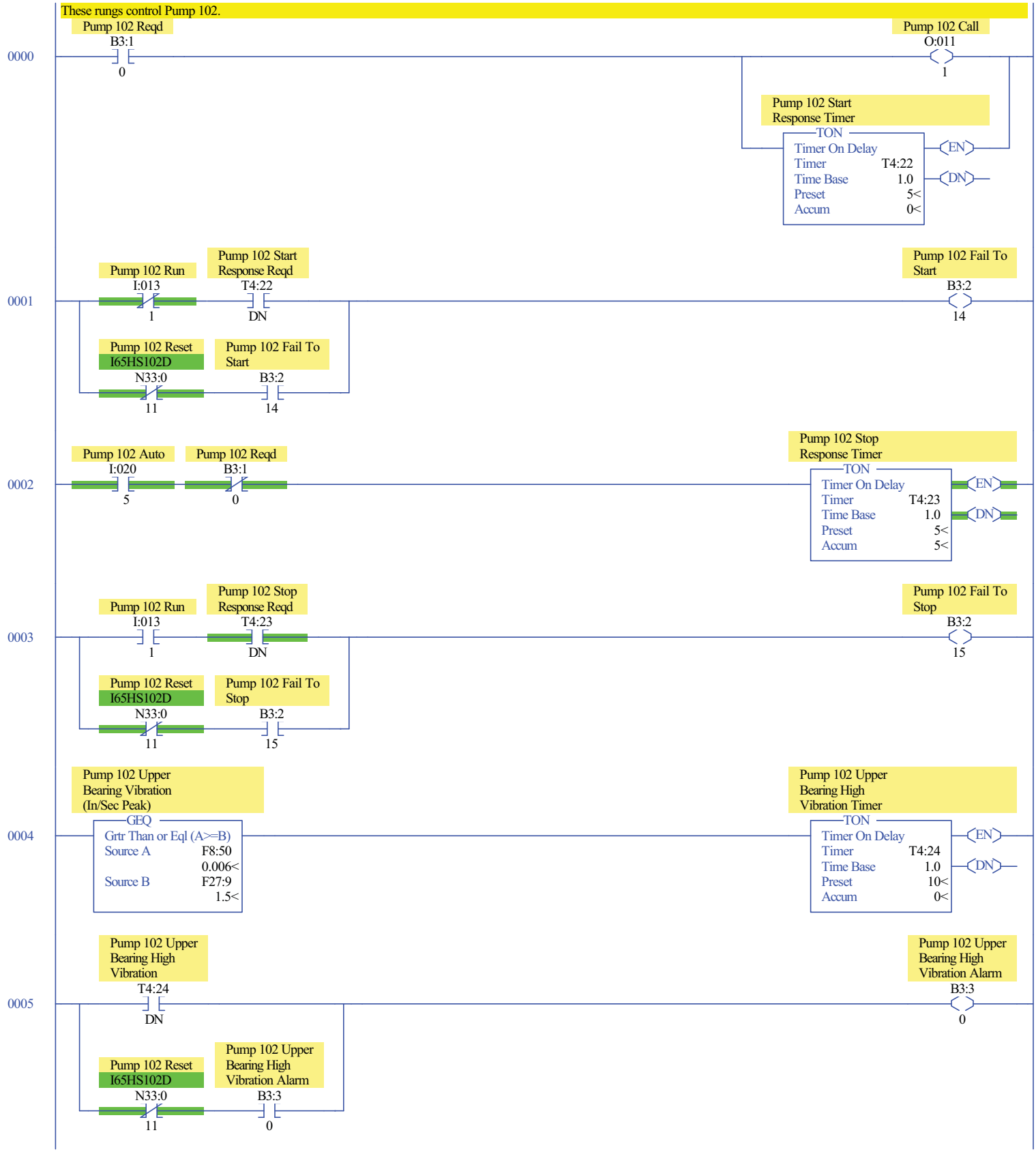


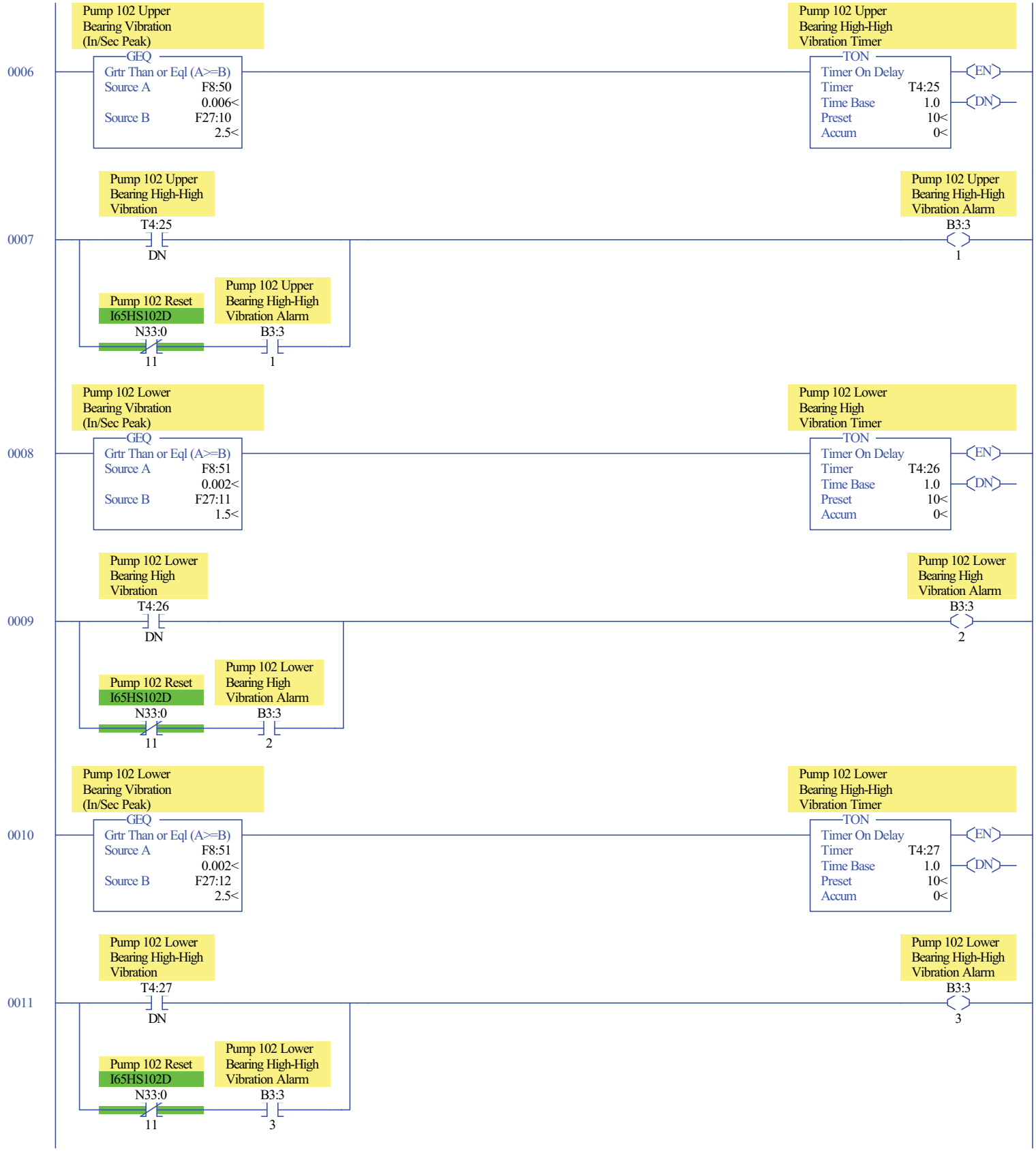
LAD 13 - PUMP 101 --- Total Rungs in File = 30

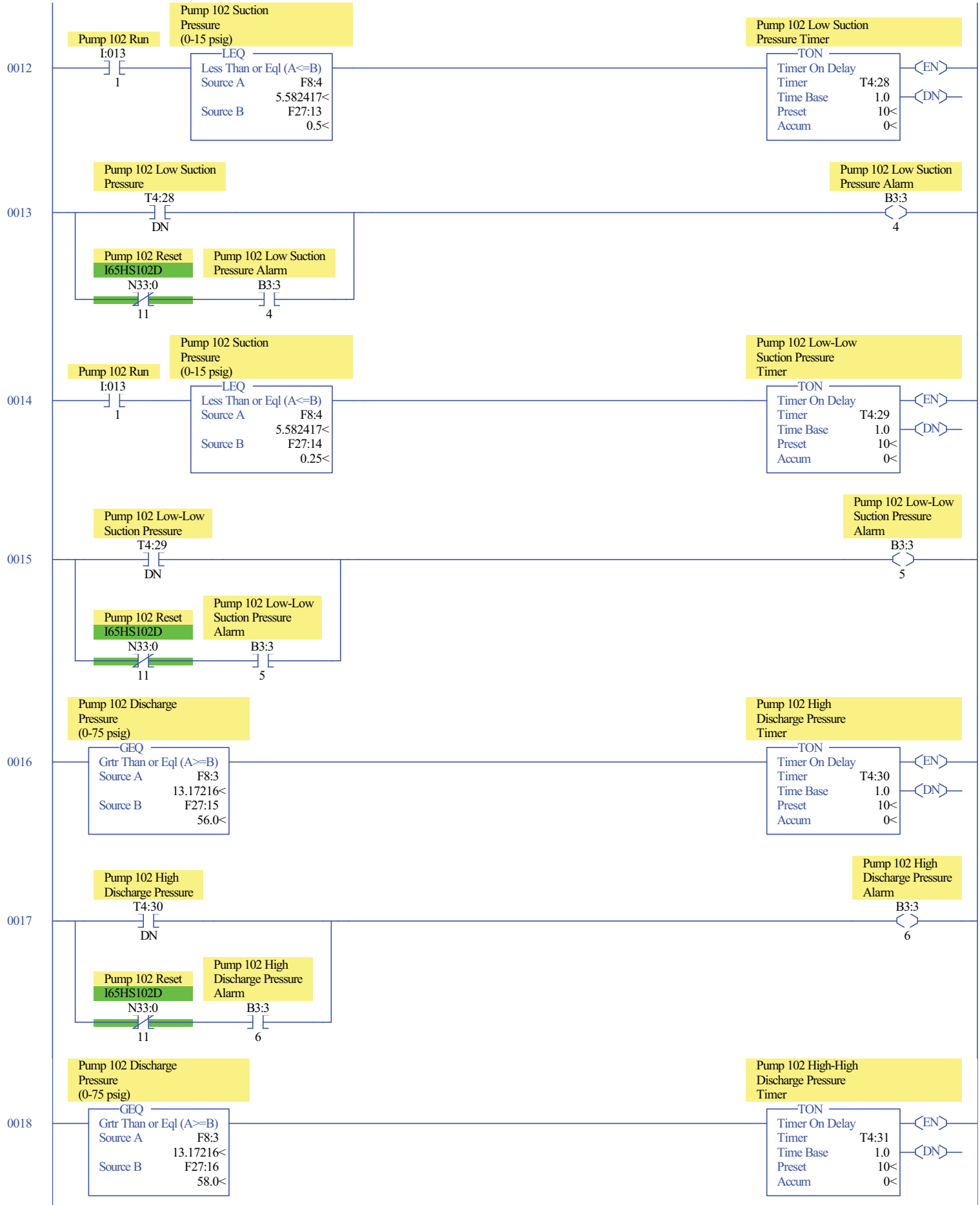


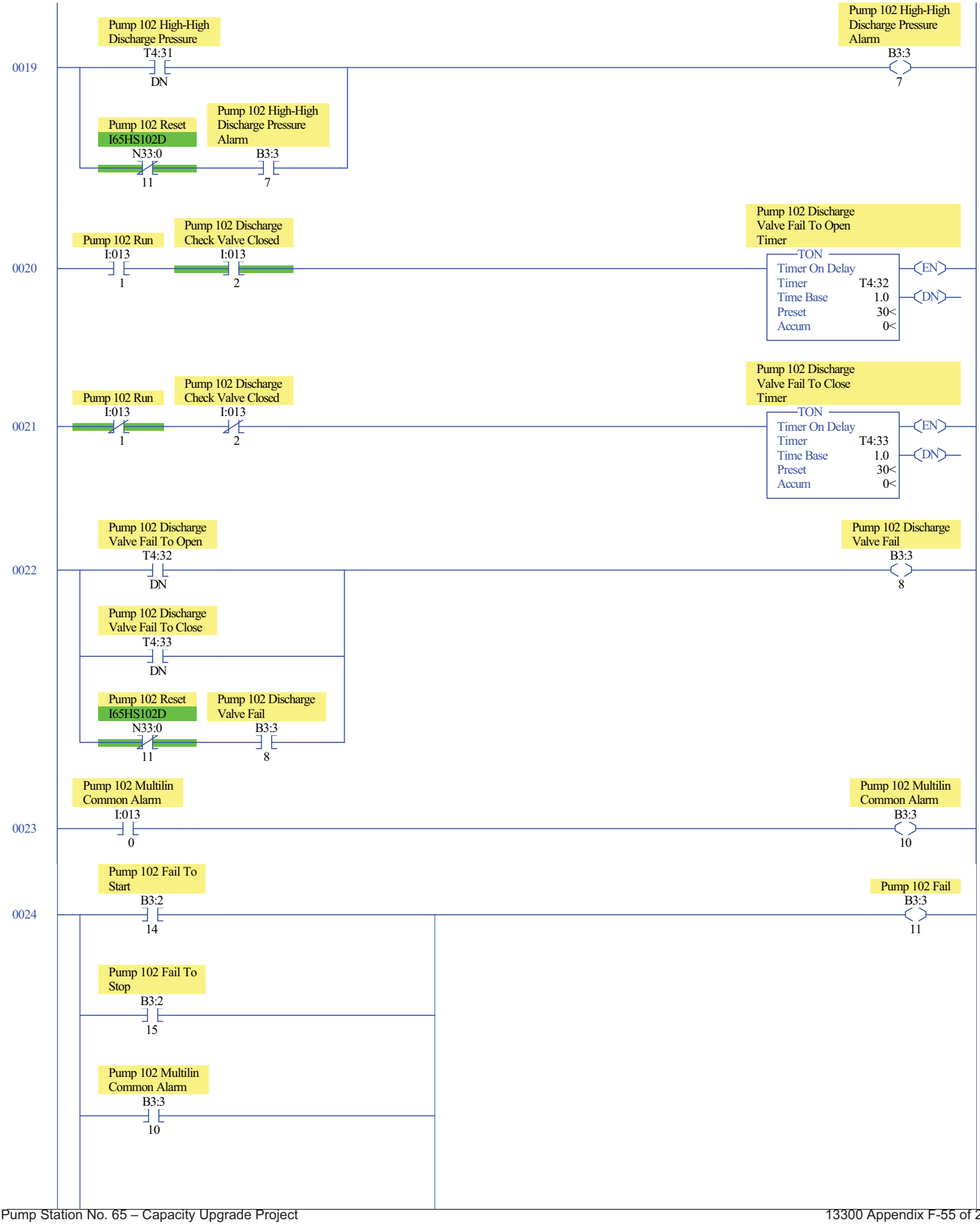
LAD 13 - PUMP 101 --- Total Rungs in File = 30

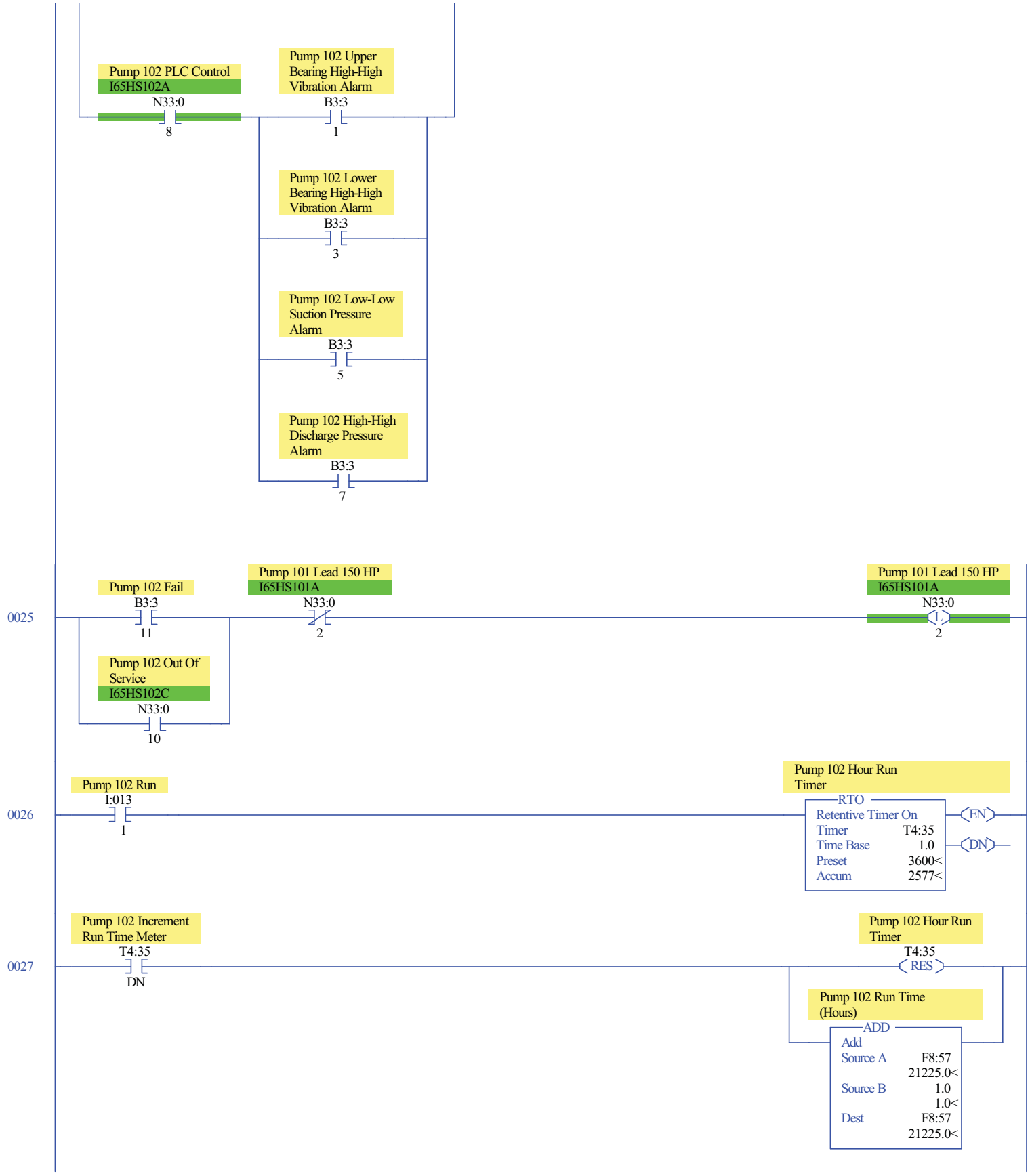



These rungs control Pump 102.
Pump 102 Reqd
B3:1
0
Pump 102 Call
O:011
1
Pump 102 Start Response Timer
TON
Timer On Delay
Timer T4:22
Time Base 1.0
Preset 5<
Accum 0<
EN
DN
0000
Pump 102 Run
I:013
1
Pump 102 Start Response Reqd
T4:22
DN
Pump 102 Fail To Start
B3:2
14
Pump 102 Reset
I65HS102D
N33:0
11
Pump 102 Fail To Start
B3:2
14
0001
Pump 102 Auto
I:020
5
Pump 102 Reqd
B3:1
0
Pump 102 Stop Response Timer
TON
Timer On Delay
Timer T4:23
Time Base 1.0
Preset 5<
Accum 5<
EN
DN
0002
Pump 102 Run
I:013
1
Pump 102 Stop Response Reqd
T4:23
DN
Pump 102 Fail To Stop
B3:2
15
Pump 102 Reset
I65HS102D
N33:0
11
Pump 102 Fail To Stop
B3:2
15
0003
Pump 102 Upper Bearing Vibration (In/Sec Peak)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:50
0.006<
Source B F27:9
1.5<
Pump 102 Upper Bearing High Vibration Timer
TON
Timer On Delay
Timer T4:24
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0004
Pump 102 Upper Bearing High Vibration
T4:24
DN
Pump 102 Upper Bearing High Vibration Alarm
B3:3
0
Pump 102 Reset
I65HS102D
N33:0
11
Pump 102 Upper Bearing High Vibration Alarm
B3:3
0
0005

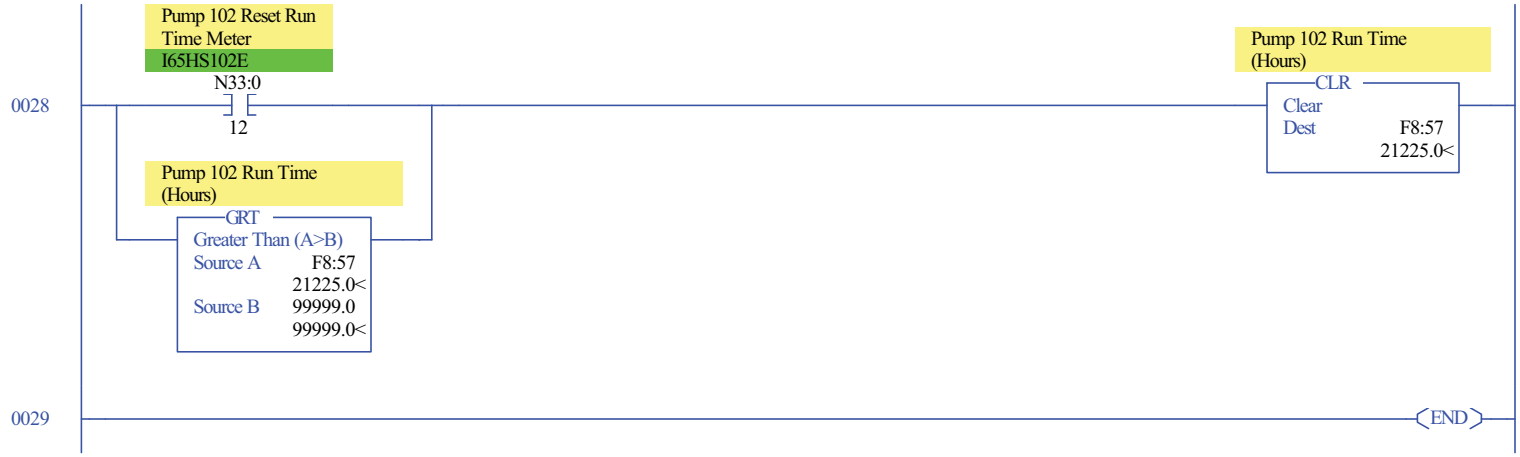

Pump 102 Upper Bearing Vibration (In/Sec Peak)
0006
GEQ
Grtr Than or Eql (A>=B)
Source A F8:50 0.006<
Source B F27:10 2.5<
Pump 102 Upper Bearing High-High Vibration Timer
TON
Timer On Delay
Timer T4:25
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
Pump 102 Upper Bearing High-High Vibration
T4:25
DN
Pump 102 Upper Bearing High-High Vibration Alarm
B3:3
1
Pump 102 Reset
I65HS102D
N33:0
11
Pump 102 Upper Bearing High-High Vibration Alarm
B3:3
1
Pump 102 Lower Bearing Vibration (In/Sec Peak)
0008
GEQ
Grtr Than or Eql (A>=B)
Source A F8:51 0.002<
Source B F27:11 1.5<
Pump 102 Lower Bearing High Vibration Timer
TON
Timer On Delay
Timer T4:26
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
Pump 102 Lower Bearing High Vibration
T4:26
DN
Pump 102 Lower Bearing High Vibration Alarm
B3:3
2
Pump 102 Reset
I65HS102D
N33:0
11
Pump 102 Lower Bearing High Vibration Alarm
B3:3
2
Pump 102 Lower Bearing Vibration (In/Sec Peak)
0010
GEQ
Grtr Than or Eql (A>=B)
Source A F8:51 0.002<
Source B F27:12 2.5<
Pump 102 Lower Bearing High-High Vibration Timer
TON
Timer On Delay
Timer T4:27
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
Pump 102 Lower Bearing High-High Vibration
T4:27
DN
Pump 102 Lower Bearing High-High Vibration Alarm
B3:3
3
Pump 102 Reset
I65HS102D
N33:0
11
Pump 102 Lower Bearing High-High Vibration Alarm
B3:3
3


0012
Pump 102 Run
I:013
1
Pump 102 Suction Pressure (0-15 psig)
LEQ
Less Than or Eql (A<=B)
Source A F8:4 5.582417<
Source B F27:13 0.5<
Pump 102 Low Suction Pressure Timer
TON
Timer On Delay
Timer T4:28
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0013
Pump 102 Low Suction Pressure
T4:28
DN
Pump 102 Low Suction Pressure Alarm
B3:3
4
Pump 102 Reset
I65HS102D
N33:0
11
Pump 102 Low Suction Pressure Alarm
B3:3
4
0014
Pump 102 Run
I:013
1
Pump 102 Suction Pressure (0-15 psig)
LEQ
Less Than or Eql (A<=B)
Source A F8:4 5.582417<
Source B F27:14 0.25<
Pump 102 Low-Low Suction Pressure Timer
TON
Timer On Delay
Timer T4:29
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0015
Pump 102 Low-Low Suction Pressure
T4:29
DN
Pump 102 Low-Low Suction Pressure Alarm
B3:3
5
Pump 102 Reset
I65HS102D
N33:0
11
Pump 102 Low-Low Suction Pressure Alarm
B3:3
5
0016
Pump 102 Discharge Pressure (0-75 psig)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:3 13.17216<
Source B F27:15 56.0<
Pump 102 High Discharge Pressure Timer
TON
Timer On Delay
Timer T4:30
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0017
Pump 102 High Discharge Pressure
T4:30
DN
Pump 102 High Discharge Pressure Alarm
B3:3
6
Pump 102 Reset
I65HS102D
N33:0
11
Pump 102 High Discharge Pressure Alarm
B3:3
6
0018
Pump 102 Discharge Pressure (0-75 psig)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:3 13.17216<
Source B F27:16 58.0<
Pump 102 High-High Discharge Pressure Timer
TON
Timer On Delay
Timer T4:31
Time Base 1.0
Preset 10<
Accum 0<
EN
DN

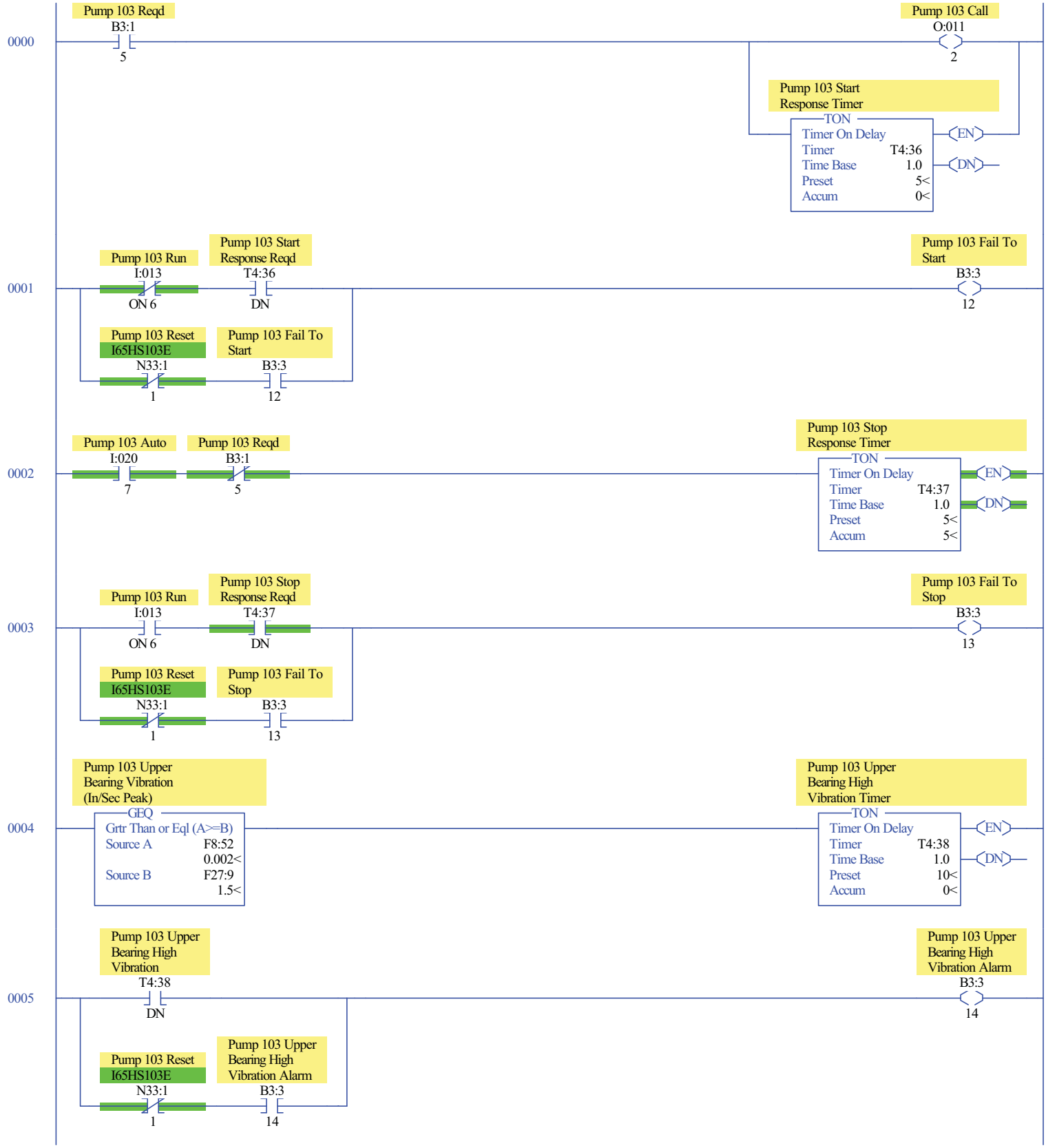

0019
Pump 102 High-High Discharge Pressure
T4:31
DN
Pump 102 High-High Discharge Pressure Alarm
B3:3
7
Pump 102 Reset
I65HS102D
N33:0
11
Pump 102 High-High Discharge Pressure Alarm
B3:3
7
0020
Pump 102 Run
I:013
1
Pump 102 Discharge Check Valve Closed
I:013
2
Pump 102 Discharge Valve Fail To Open Timer
TON
Timer On Delay
Timer T4:32
Time Base 1.0
Preset 30<
Accum 0<
EN
DN
0021
Pump 102 Run
I:013
1
Pump 102 Discharge Check Valve Closed
I:013
2
Pump 102 Discharge Valve Fail To Close Timer
TON
Timer On Delay
Timer T4:33
Time Base 1.0
Preset 30<
Accum 0<
EN
DN
0022
Pump 102 Discharge Valve Fail To Open
T4:32
DN
Pump 102 Discharge Valve Fail
B3:3
8
Pump 102 Discharge Valve Fail To Close
T4:33
DN
Pump 102 Reset
I65HS102D
N33:0
11
Pump 102 Discharge Valve Fail
B3:3
8
0023
Pump 102 Multilin Common Alarm
I:013
0
Pump 102 Multilin Common Alarm
B3:3
10
0024
Pump 102 Fail To Start
B3:2
14
Pump 102 Fail
B3:3
11
Pump 102 Fail To Stop
B3:2
15
Pump 102 Multilin Common Alarm
B3:3
10

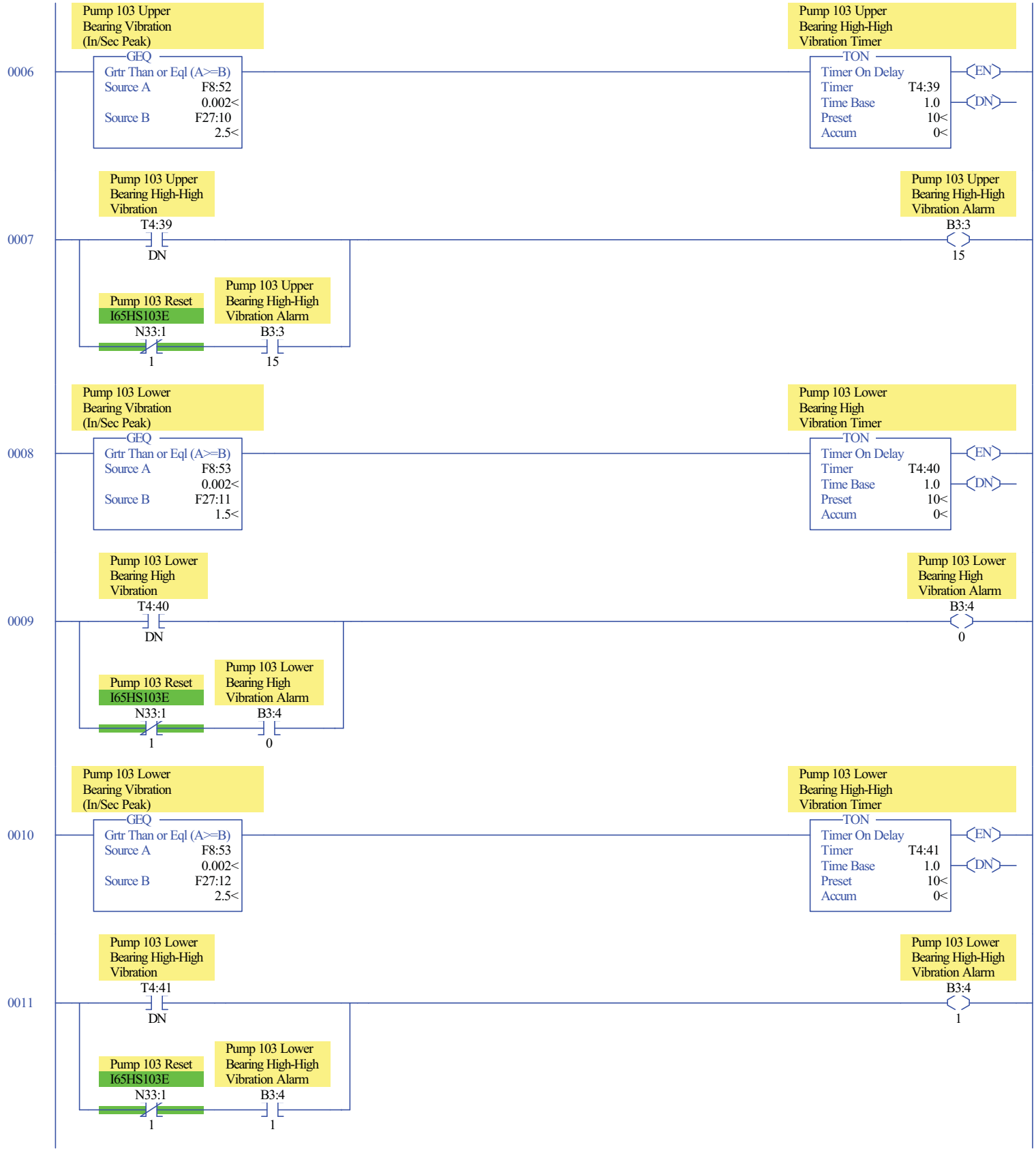

Pump 102 PLC Control
I65HS102A
N33:0
8
Pump 102 Upper Bearing High-High Vibration Alarm
B3:3
1
Pump 102 Lower Bearing High-High Vibration Alarm
B3:3
3
Pump 102 Low-Low Suction Pressure Alarm
B3:3
5
Pump 102 High-High Discharge Pressure Alarm
B3:3
7
0025
Pump 102 Fail
B3:3
11
Pump 101 Lead 150 HP
I65HS101A
N33:0
2
Pump 101 Lead 150 HP
I65HS101A
N33:0
L
2
Pump 102 Out Of Service
I65HS102C
N33:0
10
0026
Pump 102 Run
I:013
1
Pump 102 Hour Run Timer
RTO
Retentive Timer On
Timer T4:35
Time Base 1.0
Preset 3600<
Accum 2577<
EN
DN
0027
Pump 102 Increment Run Time Meter
T4:35
DN
Pump 102 Hour Run Timer
T4:35
RES
Pump 102 Run Time (Hours)
ADD
Add
Source A F8:57
21225.0<
Source B 1.0
1.0<
Dest F8:57
21225.0<

LAD 14 - PUMP 102 --- Total Rungs in File = 30

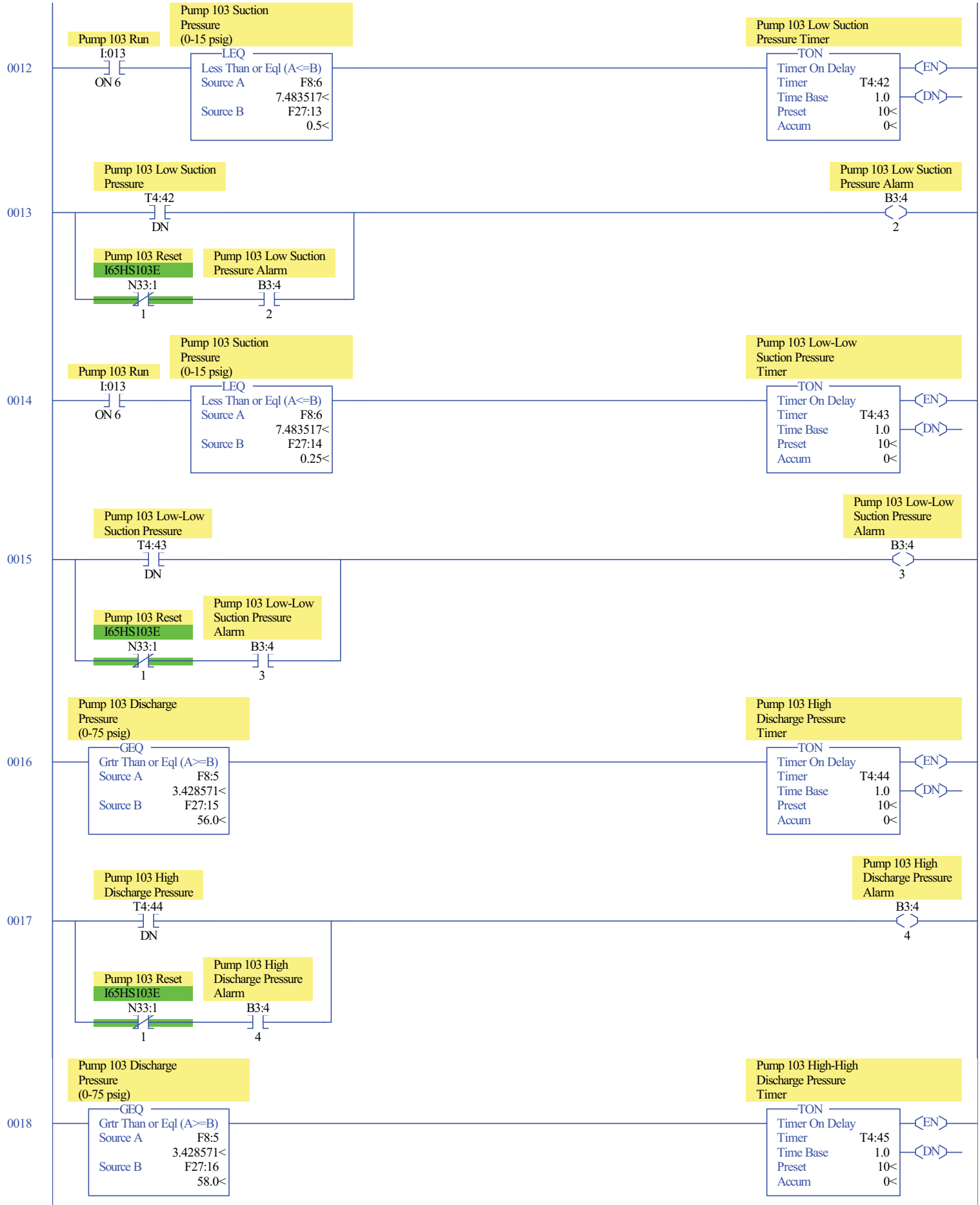


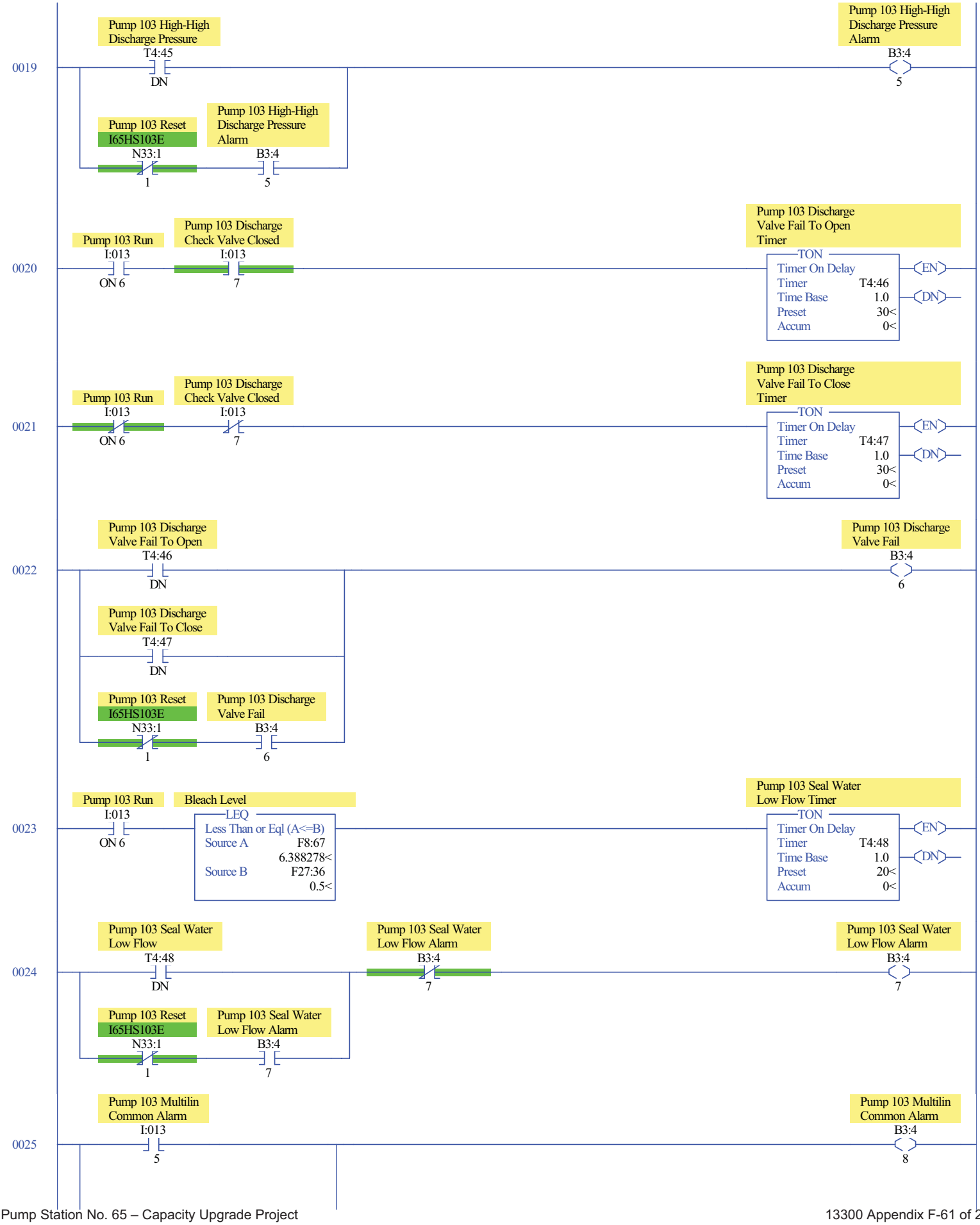
LAD 15 - PUMP 103 --- Total Rungs in File = 32

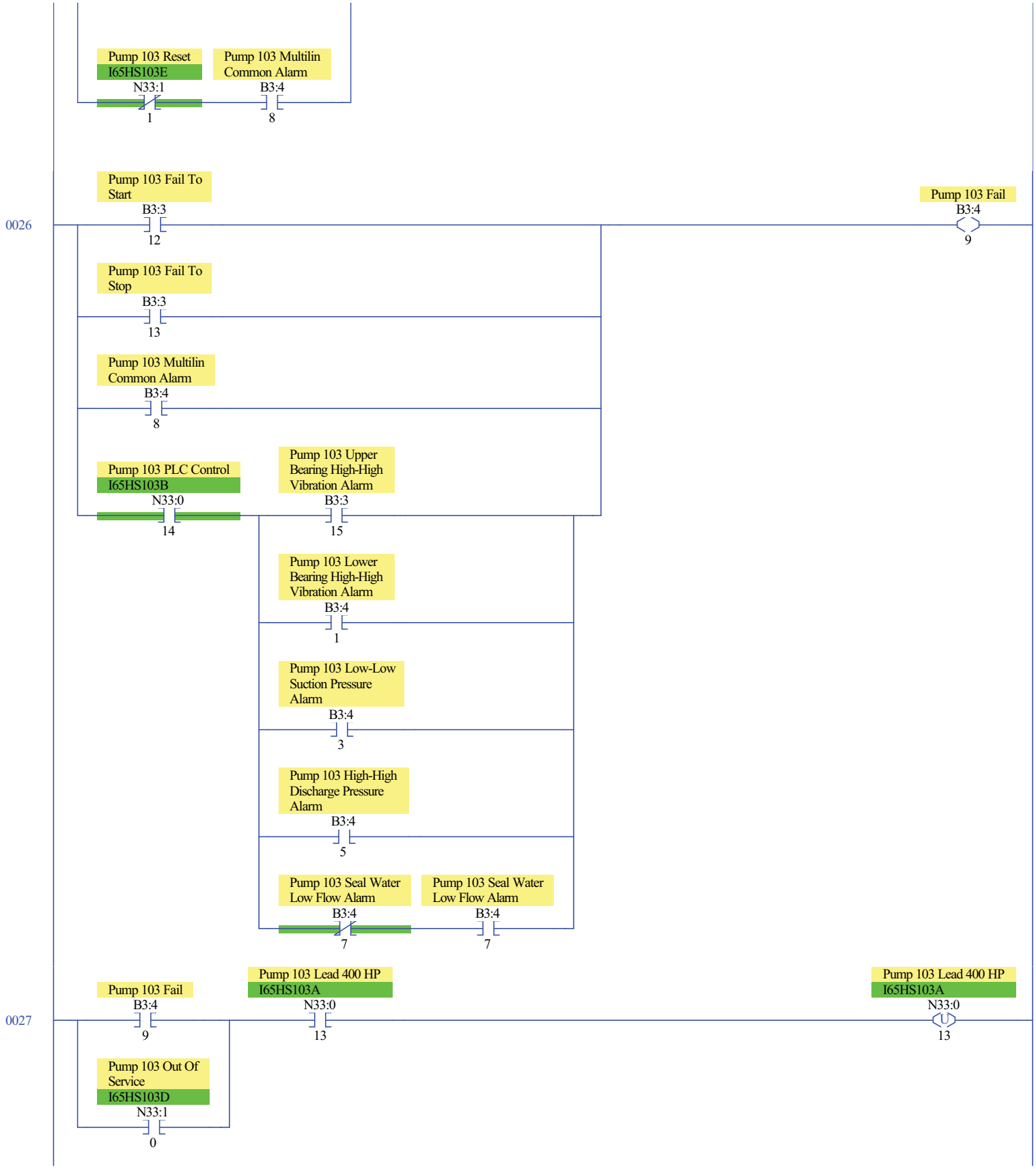



Pump 103 Upper Bearing Vibration (In/Sec Peak)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:52 0.002<
Source B F27:10 2.5<
Pump 103 Upper Bearing High-High Vibration Timer
TON
Timer On Delay
Timer T4:39
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0006
Pump 103 Upper Bearing High-High Vibration
T4:39
DN
Pump 103 Upper Bearing High-High Vibration Alarm
B3:3
15
Pump 103 Reset
I65HS103E
N33:1
1
Pump 103 Upper Bearing High-High Vibration Alarm
B3:3
15
0007
Pump 103 Lower Bearing Vibration (In/Sec Peak)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:53 0.002<
Source B F27:11 1.5<
Pump 103 Lower Bearing High Vibration Timer
TON
Timer On Delay
Timer T4:40
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0008
Pump 103 Lower Bearing High Vibration
T4:40
DN
Pump 103 Lower Bearing High Vibration Alarm
B3:4
0
Pump 103 Reset
I65HS103E
N33:1
1
Pump 103 Lower Bearing High Vibration Alarm
B3:4
0
0009
Pump 103 Lower Bearing Vibration (In/Sec Peak)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:53 0.002<
Source B F27:12 2.5<
Pump 103 Lower Bearing High-High Vibration Timer
TON
Timer On Delay
Timer T4:41
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0010
Pump 103 Lower Bearing High-High Vibration
T4:41
DN
Pump 103 Lower Bearing High-High Vibration Alarm
B3:4
1
Pump 103 Reset
I65HS103E
N33:1
1
Pump 103 Lower Bearing High-High Vibration Alarm
B3:4
1
0011

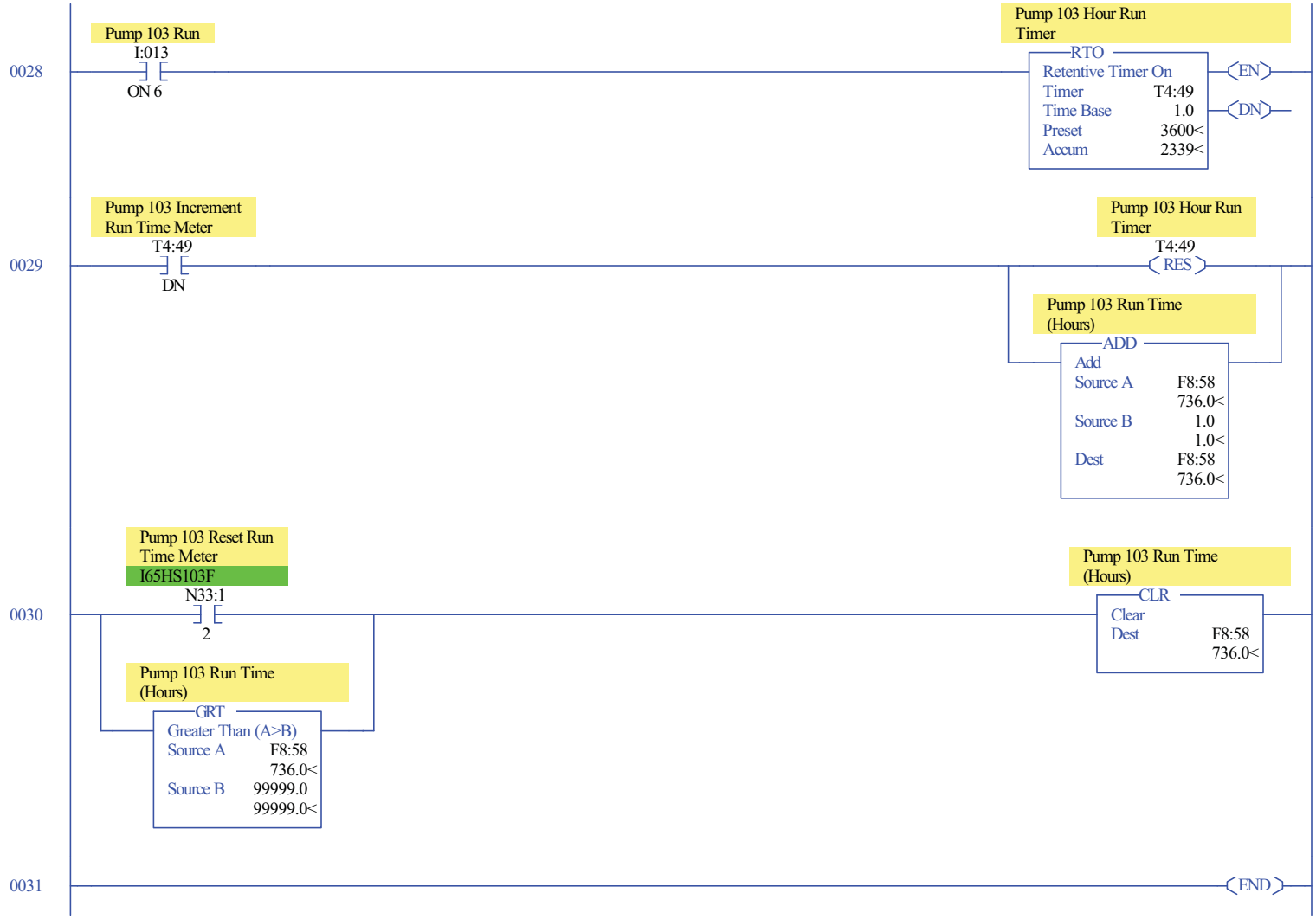
LAD 15 - PUMP 103 --- Total Rungs in File = 32



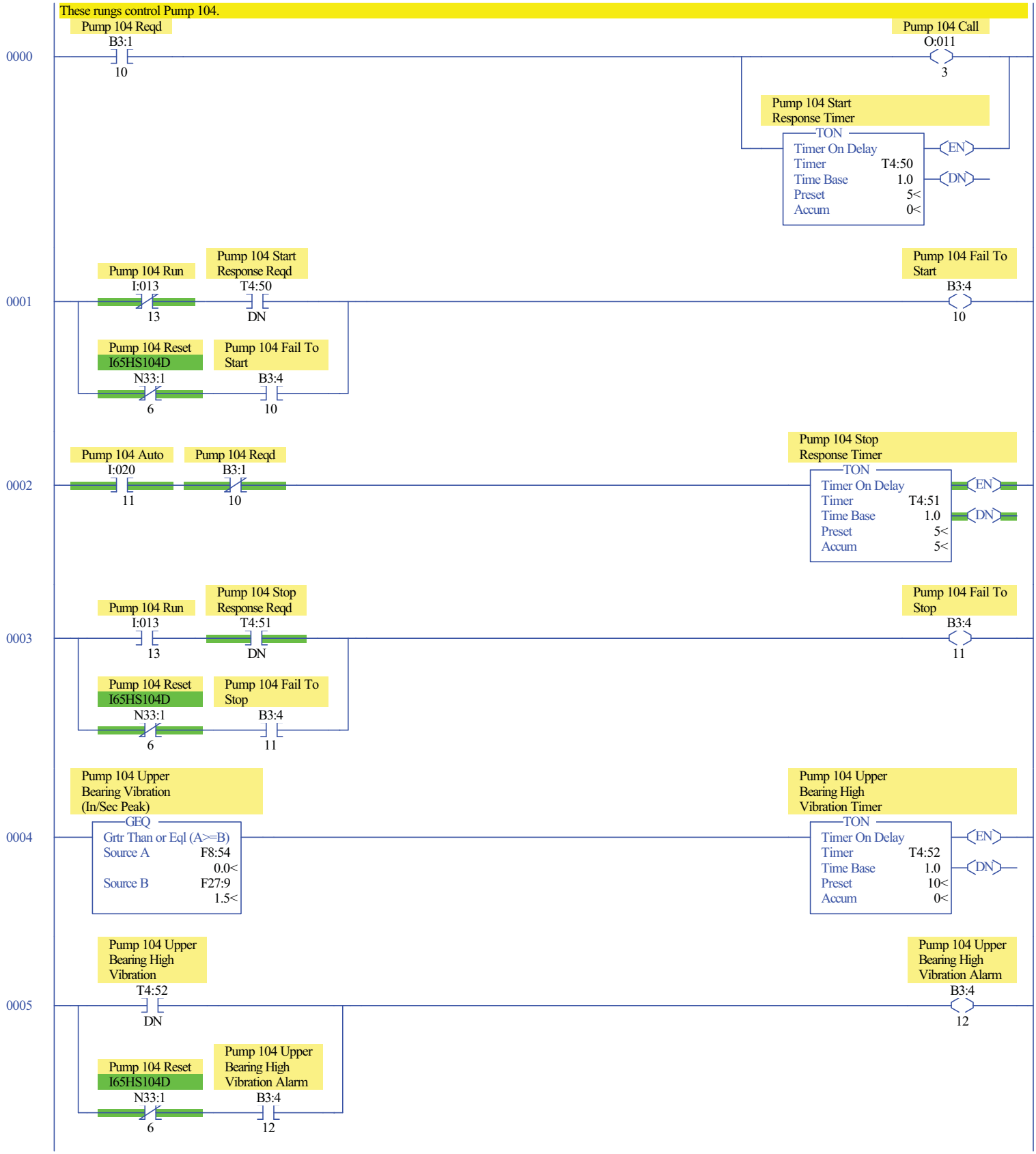

0019
Pump 103 High-High Discharge Pressure
T4:45
DN
Pump 103 High-High Discharge Pressure Alarm
B3:4
5
Pump 103 Reset
I65HS103E
N33:1
1
Pump 103 High-High Discharge Pressure Alarm
B3:4
5
0020
Pump 103 Run
I:013
ON 6
Pump 103 Discharge Check Valve Closed
I:013
7
Pump 103 Discharge Valve Fail To Open Timer
TON
Timer On Delay
Timer T4:46
Time Base 1.0
Preset 30<
Accum 0<
EN
DN
0021
Pump 103 Run
I:013
ON 6
Pump 103 Discharge Check Valve Closed
I:013
7
Pump 103 Discharge Valve Fail To Close Timer
TON
Timer On Delay
Timer T4:47
Time Base 1.0
Preset 30<
Accum 0<
EN
DN
0022
Pump 103 Discharge Valve Fail To Open
T4:46
DN
Pump 103 Discharge Valve Fail
B3:4
6
Pump 103 Discharge Valve Fail To Close
T4:47
DN
Pump 103 Reset
I65HS103E
N33:1
1
Pump 103 Discharge Valve Fail
B3:4
6
0023
Pump 103 Run
I:013
ON 6
Bleach Level
LEQ
Less Than or Eql (A<=B)
Source A F8:67
6.388278<
Source B F27:36
0.5<
Pump 103 Seal Water Low Flow Timer
TON
Timer On Delay
Timer T4:48
Time Base 1.0
Preset 20<
Accum 0<
EN
DN
0024
Pump 103 Seal Water Low Flow
T4:48
DN
Pump 103 Seal Water Low Flow Alarm
B3:4
7
Pump 103 Seal Water Low Flow Alarm
B3:4
7
Pump 103 Reset
I65HS103E
N33:1
1
Pump 103 Seal Water Low Flow Alarm
B3:4
7
0025
Pump 103 Multilin Common Alarm
I:013
5
Pump 103 Multilin Common Alarm
B3:4
8

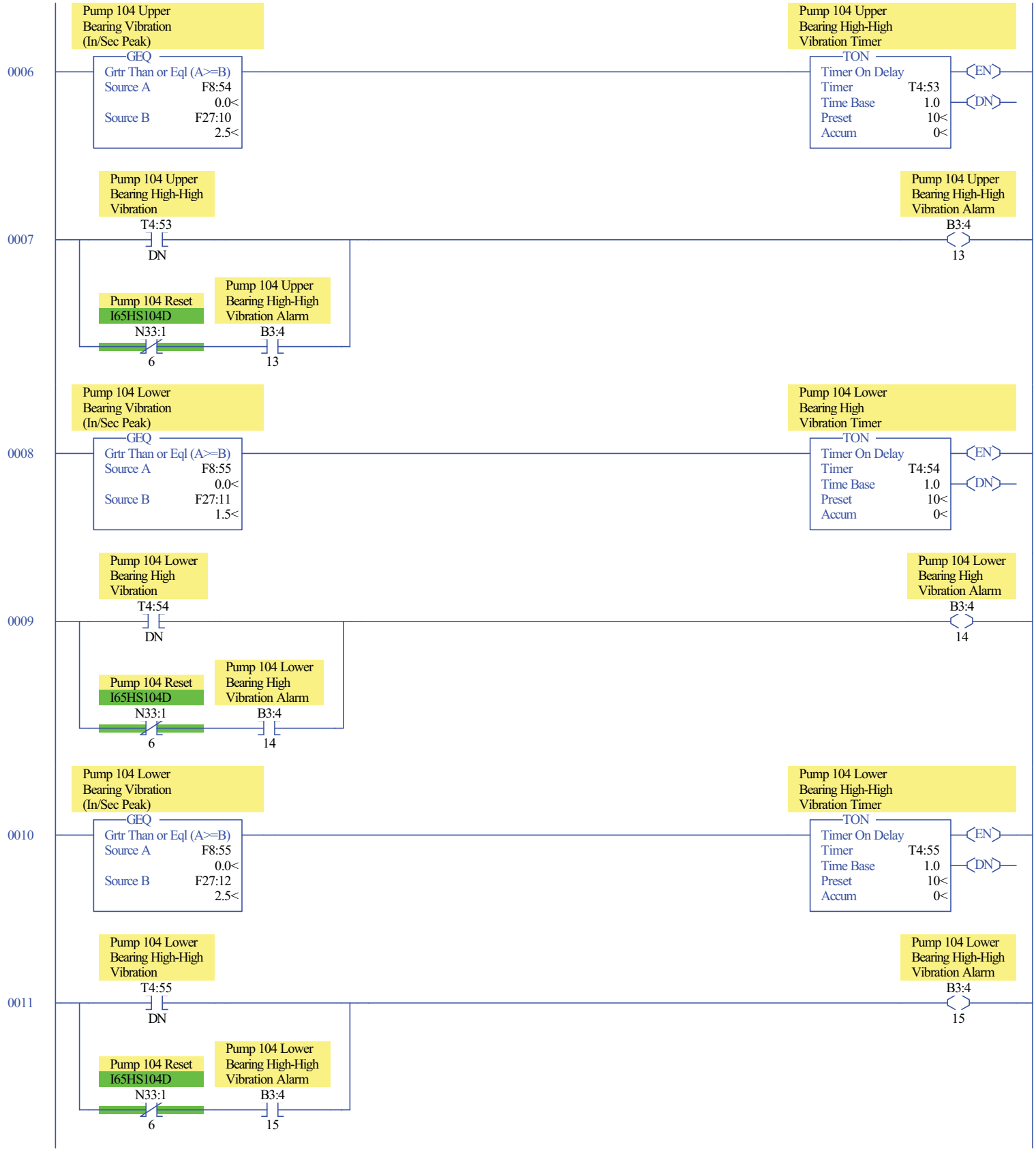

Pump 103 Reset
I65HS103E
N33:1
1
Pump 103 Multilin Common Alarm
B3:4
8
0026
Pump 103 Fail To Start
B3:3
12
Pump 103 Fail To Stop
B3:3
13
Pump 103 Multilin Common Alarm
B3:4
8
Pump 103 PLC Control
I65HS103B
N33:0
14
Pump 103 Upper Bearing High-High Vibration Alarm
B3:3
15
Pump 103 Lower Bearing High-High Vibration Alarm
B3:4
1
Pump 103 Low-Low Suction Pressure Alarm
B3:4
3
Pump 103 High-High Discharge Pressure Alarm
B3:4
5
Pump 103 Seal Water Low Flow Alarm
B3:4
7
Pump 103 Seal Water Low Flow Alarm
B3:4
7
Pump 103 Fail
B3:4
9
0027
Pump 103 Fail
B3:4
9
Pump 103 Out Of Service
I65HS103D
N33:1
0
Pump 103 Lead 400 HP
I65HS103A
N33:0
13
Pump 103 Lead 400 HP
I65HS103A
N33:0
13

LAD 15 - PUMP 103 --- Total Rungs in File = 32

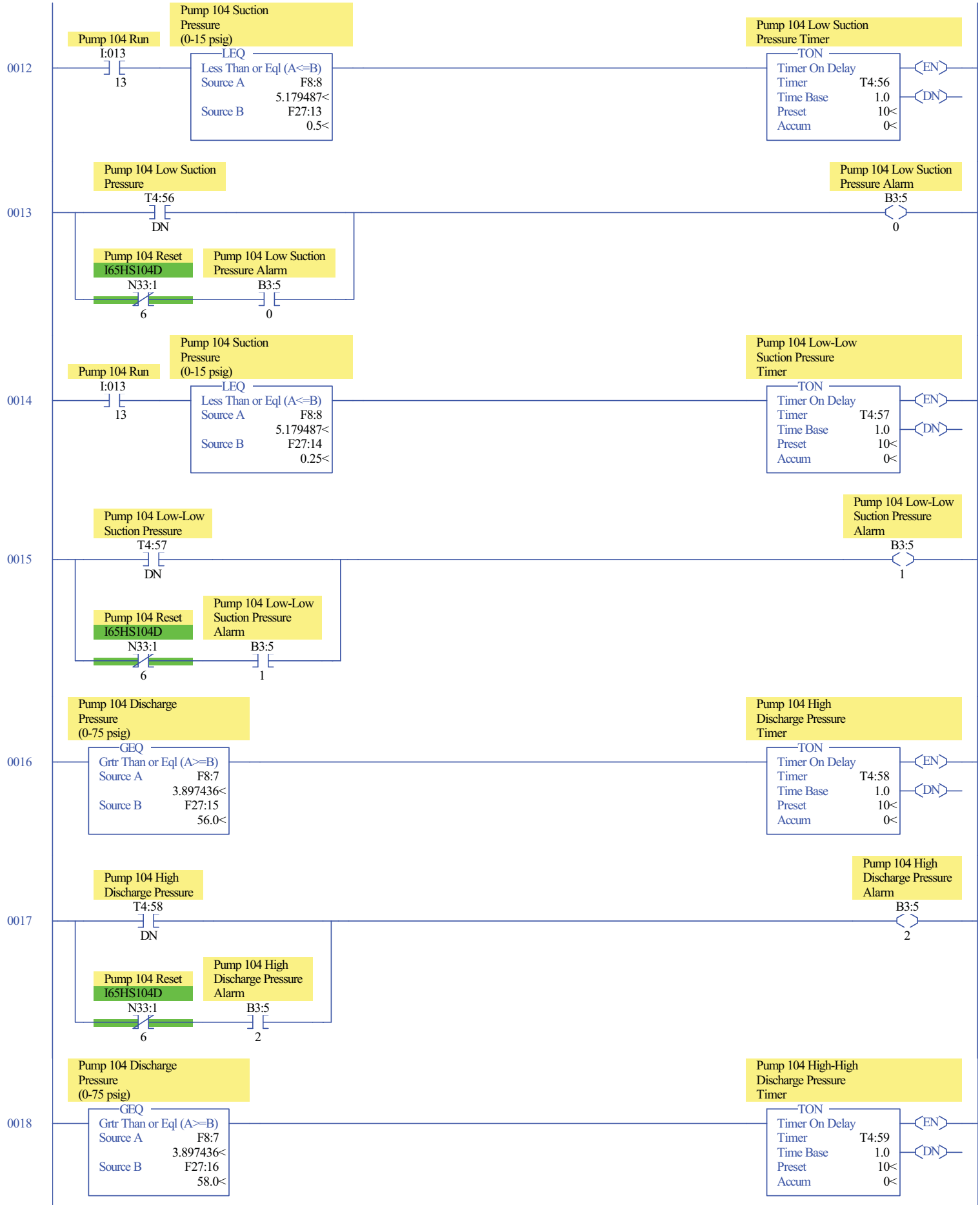


LAD 16 - PUMP 104 --- Total Rungs in File = 32

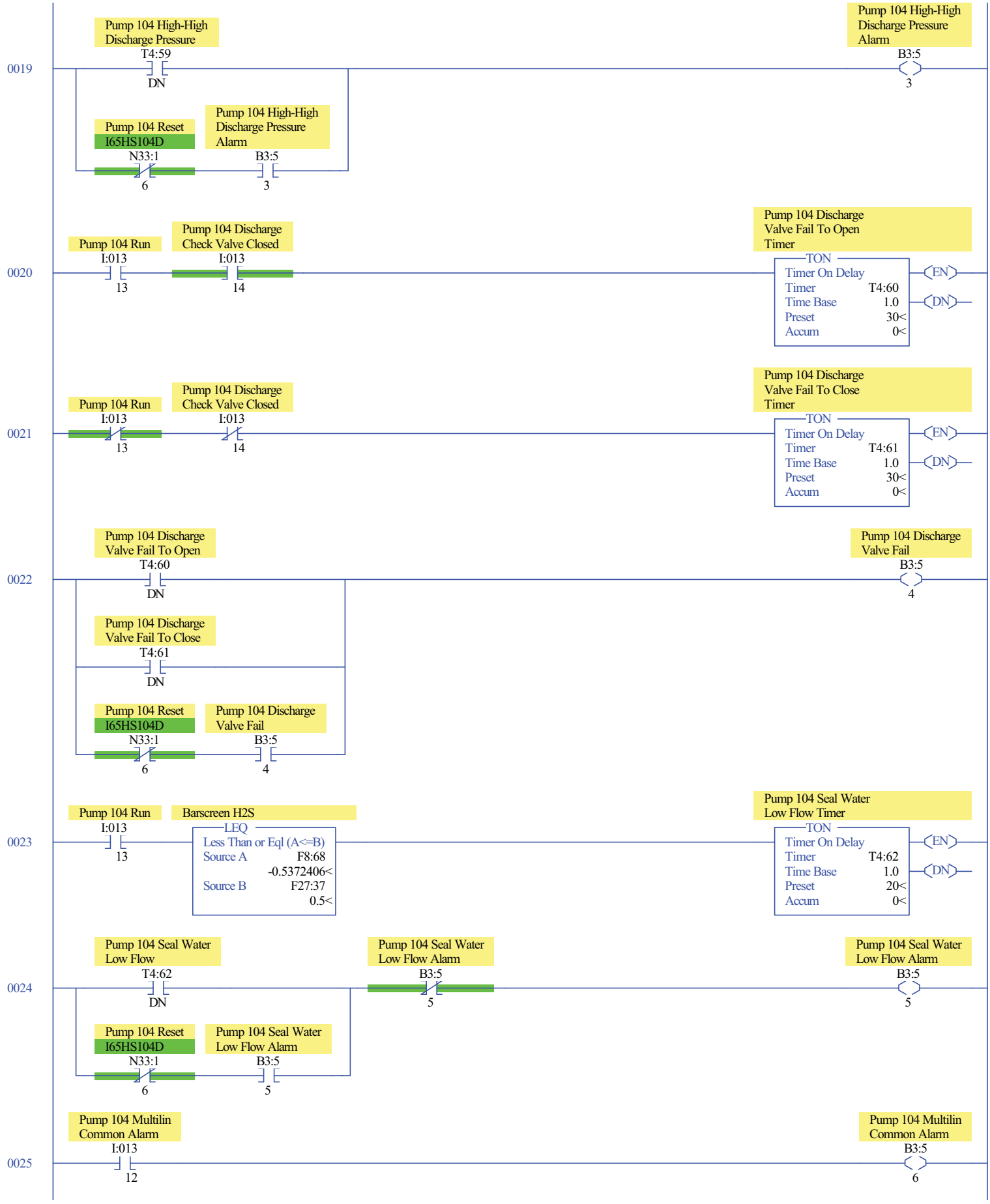


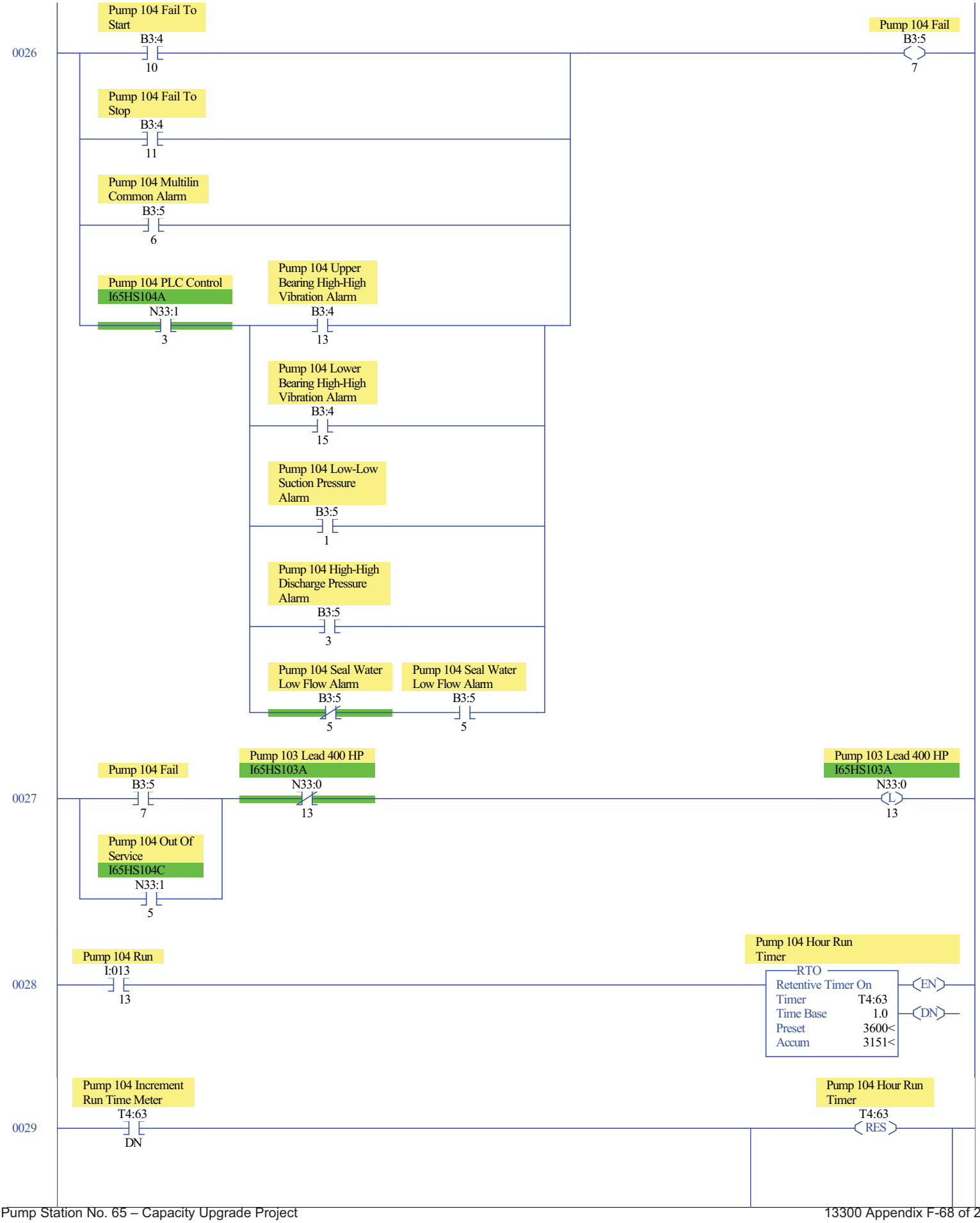

Pump 104 Upper Bearing Vibration (In/Sec Peak)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:54 0.0<
Source B F27:10 2.5<
Pump 104 Upper Bearing High-High Vibration Timer
TON
Timer On Delay
Timer T4:53
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0006
Pump 104 Upper Bearing High-High Vibration
T4:53
DN
Pump 104 Upper Bearing High-High Vibration Alarm
B3:4
13
0007
Pump 104 Reset
I65HS104D
N33:1
6
Pump 104 Upper Bearing High-High Vibration Alarm
B3:4
13
Pump 104 Lower Bearing Vibration (In/Sec Peak)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:55 0.0<
Source B F27:11 1.5<
Pump 104 Lower Bearing High Vibration Timer
TON
Timer On Delay
Timer T4:54
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0008
Pump 104 Lower Bearing High Vibration
T4:54
DN
Pump 104 Lower Bearing High Vibration Alarm
B3:4
14
0009
Pump 104 Reset
I65HS104D
N33:1
6
Pump 104 Lower Bearing High Vibration Alarm
B3:4
14
Pump 104 Lower Bearing Vibration (In/Sec Peak)
GEQ
Grtr Than or Eql (A>=B)
Source A F8:55 0.0<
Source B F27:12 2.5<
Pump 104 Lower Bearing High-High Vibration Timer
TON
Timer On Delay
Timer T4:55
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0010
Pump 104 Lower Bearing High-High Vibration
T4:55
DN
Pump 104 Lower Bearing High-High Vibration Alarm
B3:4
15
0011
Pump 104 Reset
I65HS104D
N33:1
6
Pump 104 Lower Bearing High-High Vibration Alarm
B3:4
15

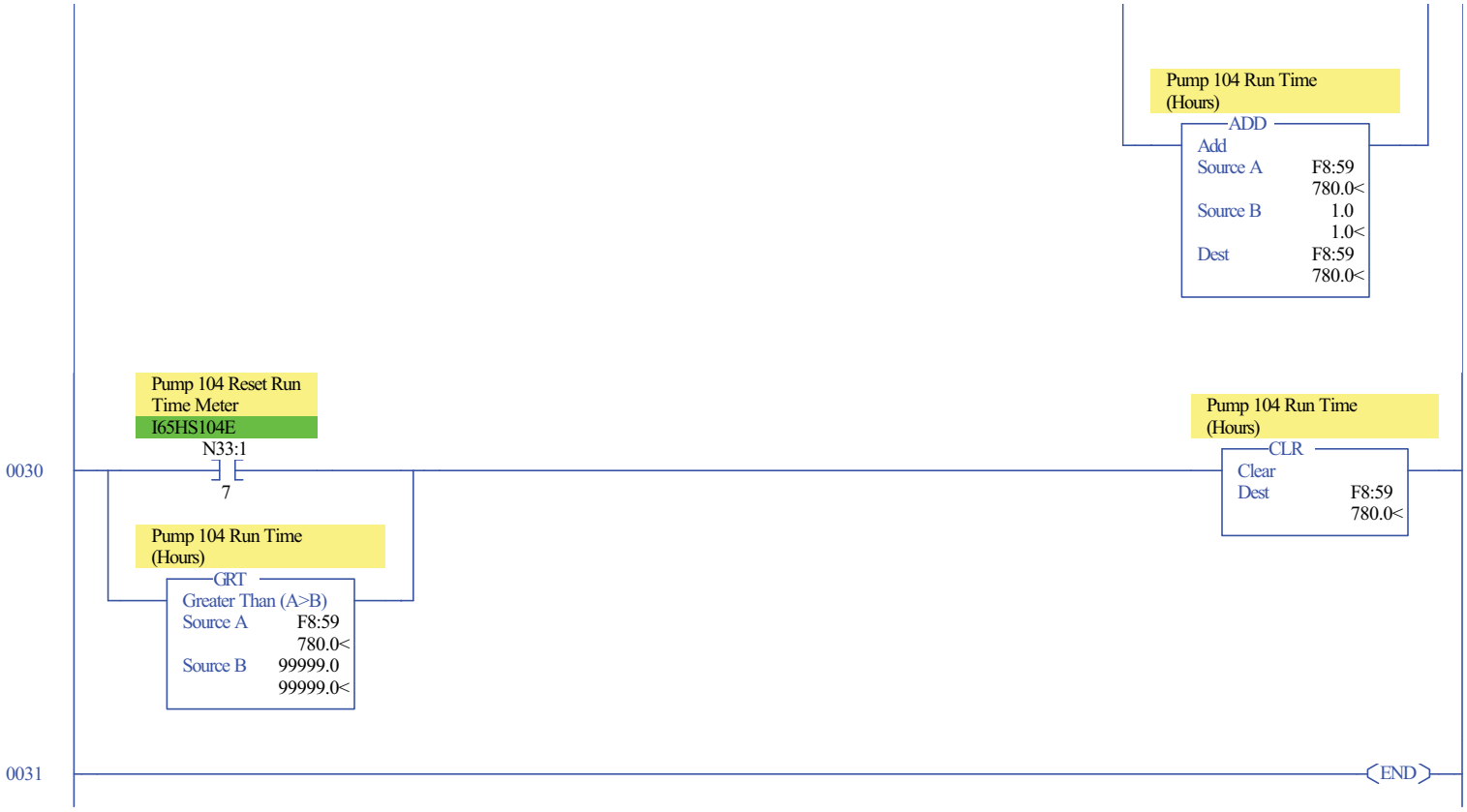
LAD 16 - PUMP 104 --- Total Rungs in File = 32

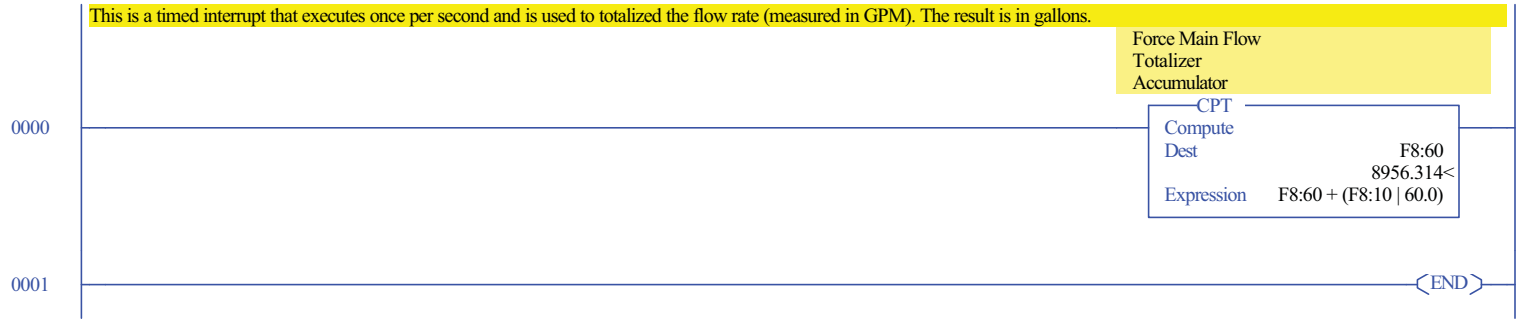


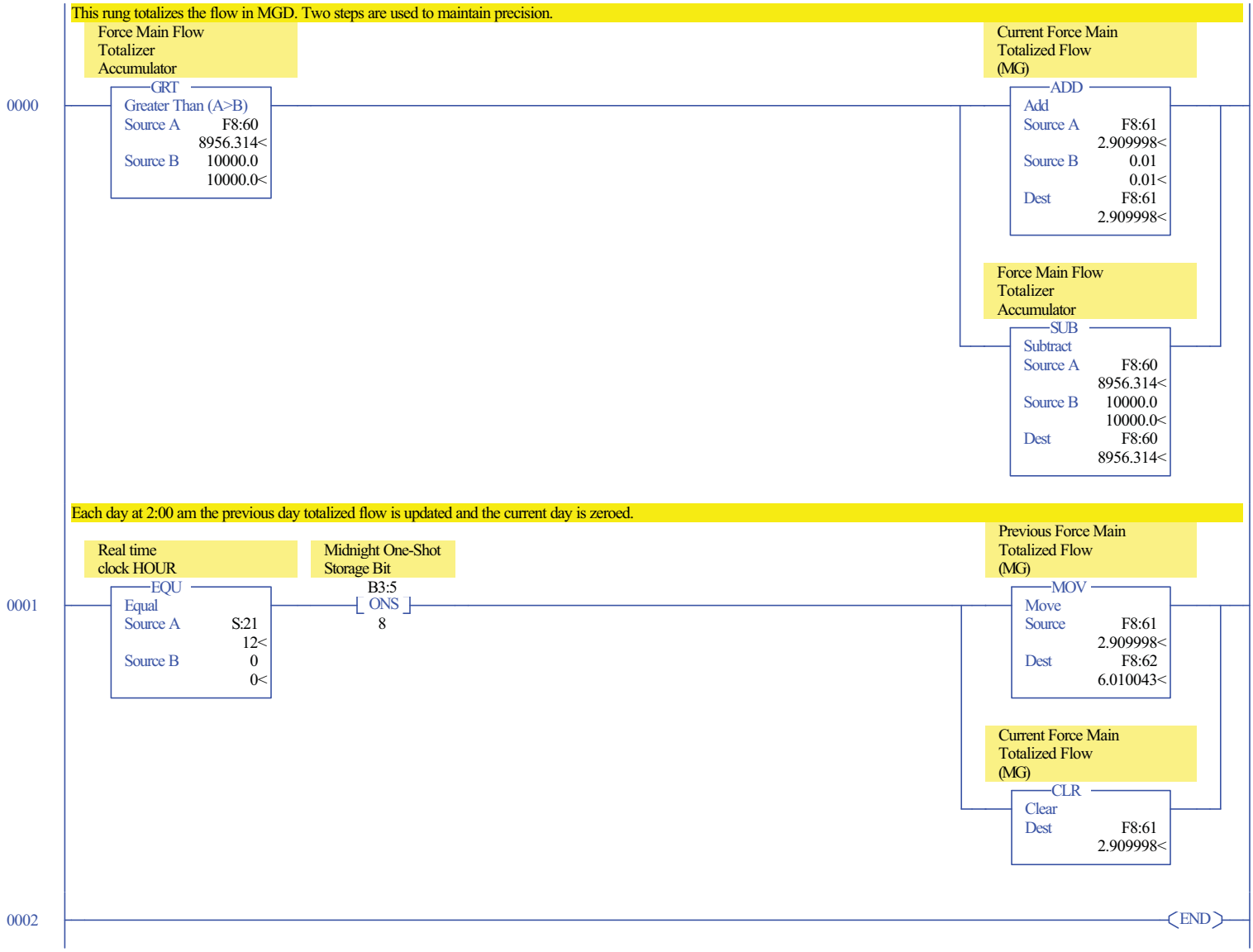
LAD 16 - PUMP 104 --- Total Rungs in File = 32

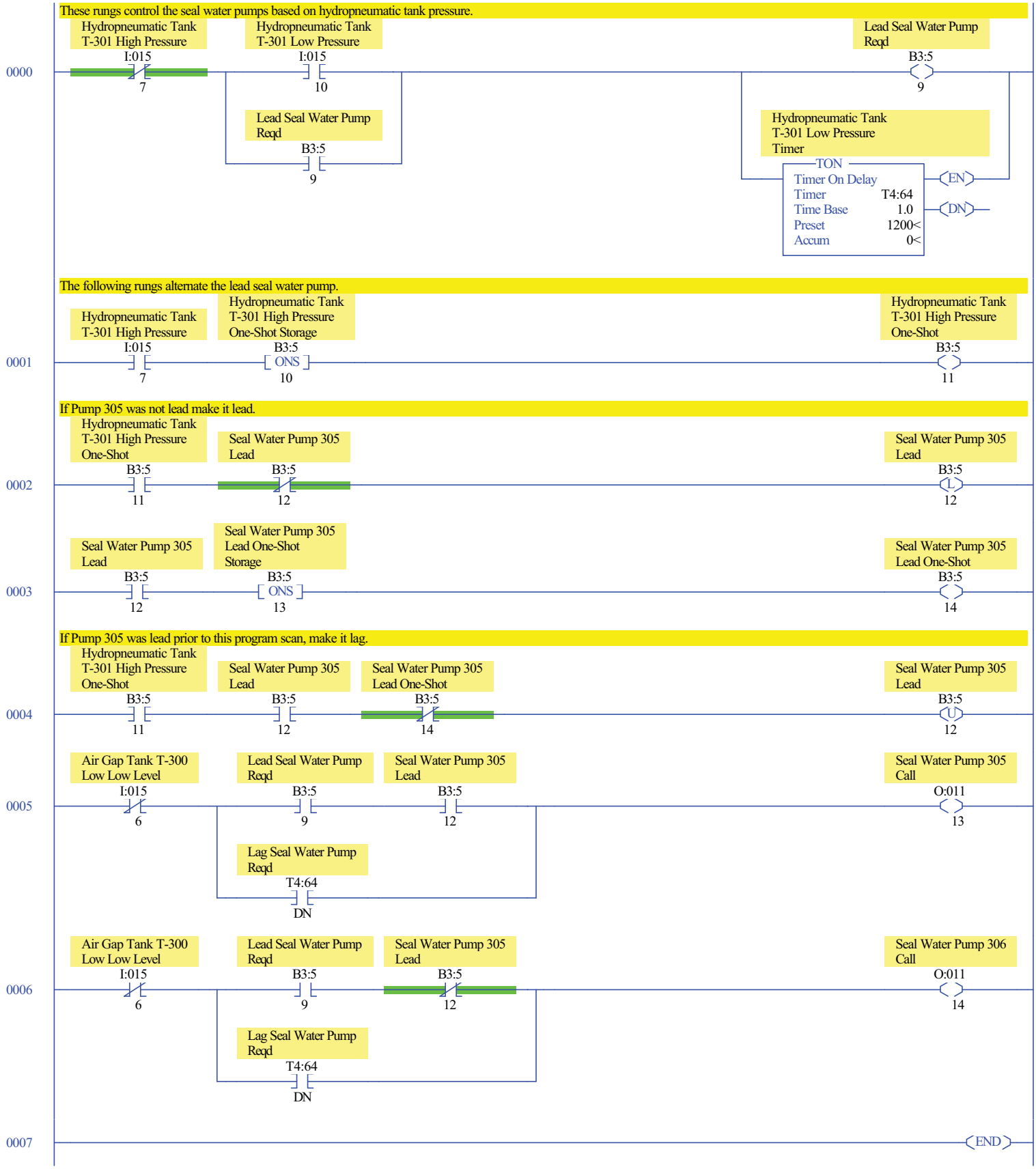


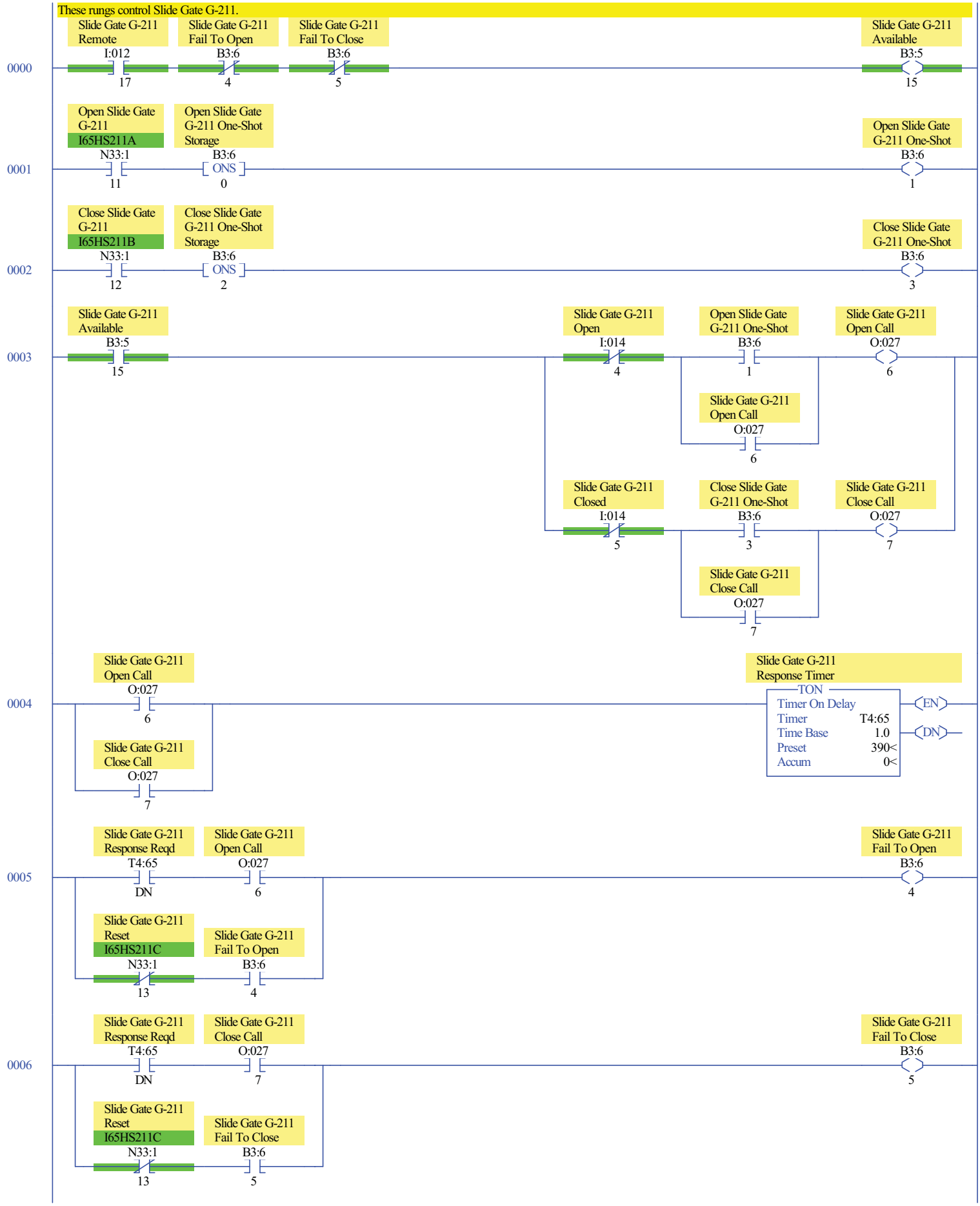

0026
Pump 104 Fail To Start
B3:4
10
Pump 104 Fail To Stop
B3:4
11
Pump 104 Multilin Common Alarm
B3:5
6
Pump 104 PLC Control
I65HS104A
N33:1
3
Pump 104 Upper Bearing High-High Vibration Alarm
B3:4
13
Pump 104 Lower Bearing High-High Vibration Alarm
B3:4
15
Pump 104 Low-Low Suction Pressure Alarm
B3:5
1
Pump 104 High-High Discharge Pressure Alarm
B3:5
3
Pump 104 Seal Water Low Flow Alarm
B3:5
5
Pump 104 Seal Water Low Flow Alarm
B3:5
5
Pump 104 Fail
B3:5
7
0027
Pump 104 Fail
B3:5
7
Pump 104 Out Of Service
I65HS104C
N33:1
5
Pump 103 Lead 400 HP
I65HS103A
N33:0
13
Pump 103 Lead 400 HP
I65HS103A
N33:0
L
13
0028
Pump 104 Run
I:013
13
Pump 104 Hour Run Timer
RTO
Retentive Timer On
Timer T4:63
Time Base 1.0
Preset 3600<
Accum 3151<
EN
DN
0029
Pump 104 Increment Run Time Meter
T4:63
DN
Pump 104 Hour Run Timer
T4:63
RES

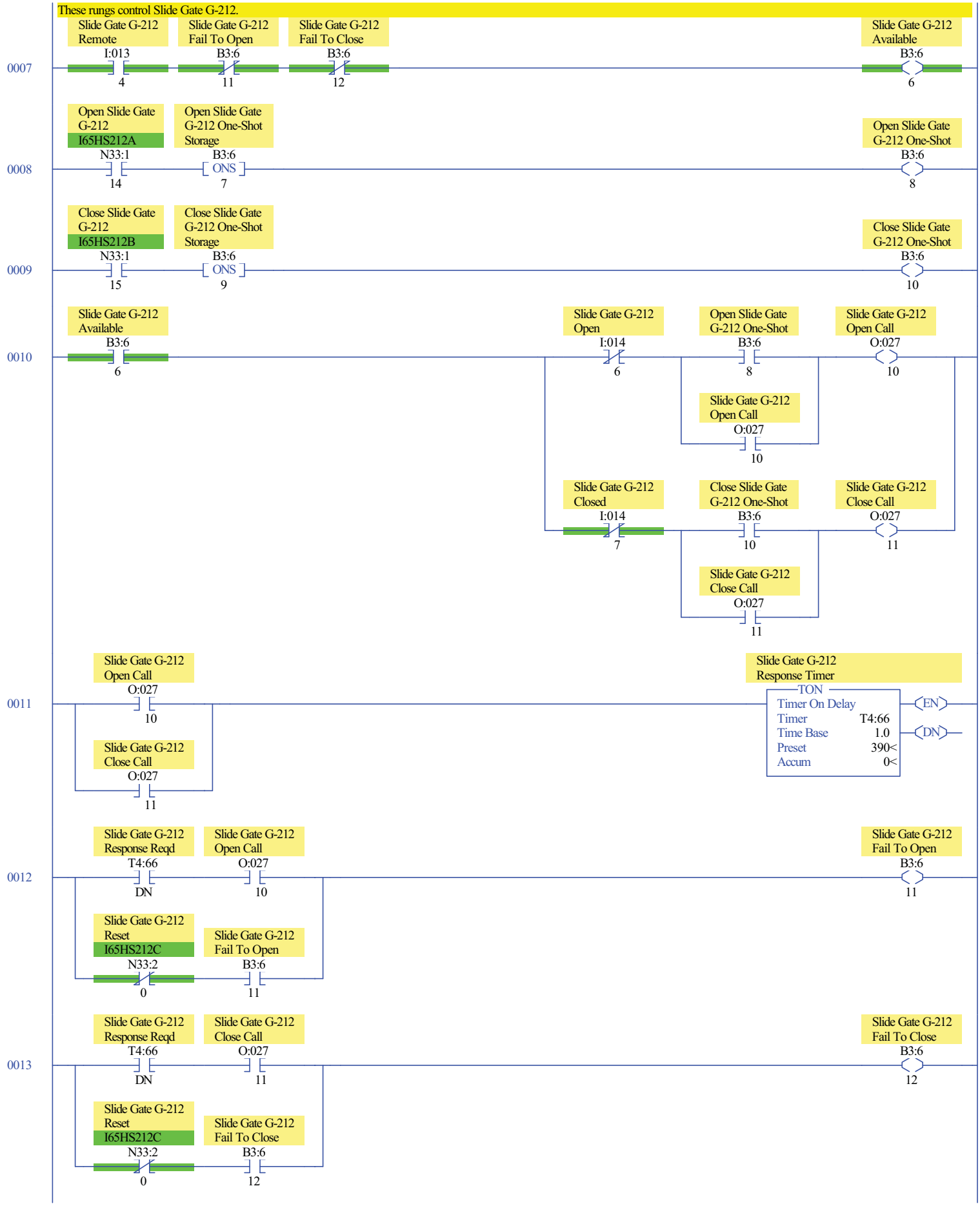

Pump 104 Run Time
(Hours)
ADD
Add
Source A F8:59
780.0<
Source B 1.0
1.0<
Dest F8:59
780.0<
Pump 104 Reset Run
Time Meter
I65HS104E
N33:1
7
0030
Pump 104 Run Time
(Hours)
GRT
Greater Than (A>B)
Source A F8:59
780.0<
Source B 99999.0
99999.0<
Pump 104 Run Time
(Hours)
CLR
Clear
Dest F8:59
780.0<
0031
END

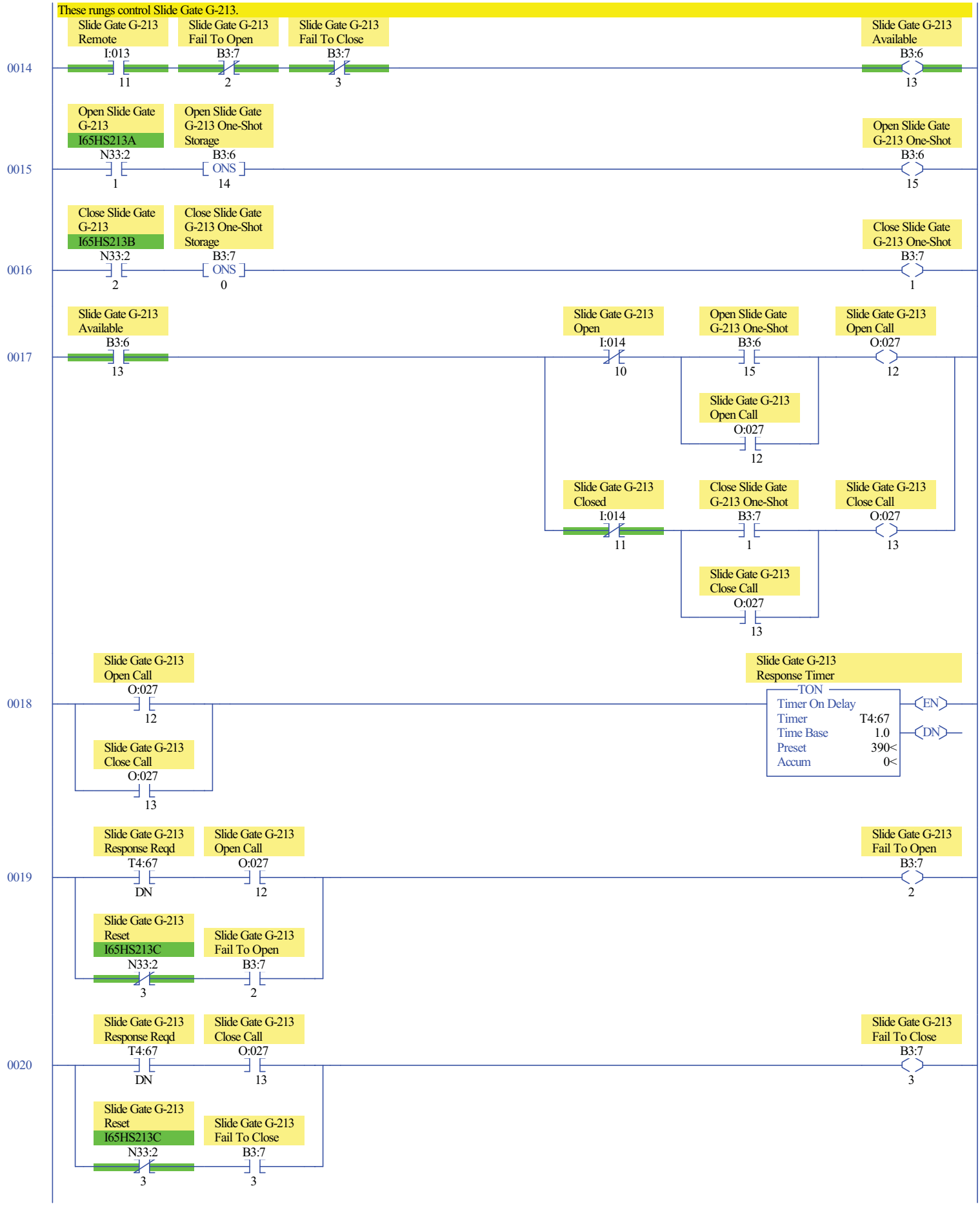

This is a timed interrupt that executes once per second and is used to totalized the flow rate (measured in GPM). The result is in gallons.
Force Main Flow
Totalizer
Accumulator
0000
CPT
Compute
Dest
F8:60
8956.314<
Expression
F8:60 + (F8:10 | 60.0)
0001
END

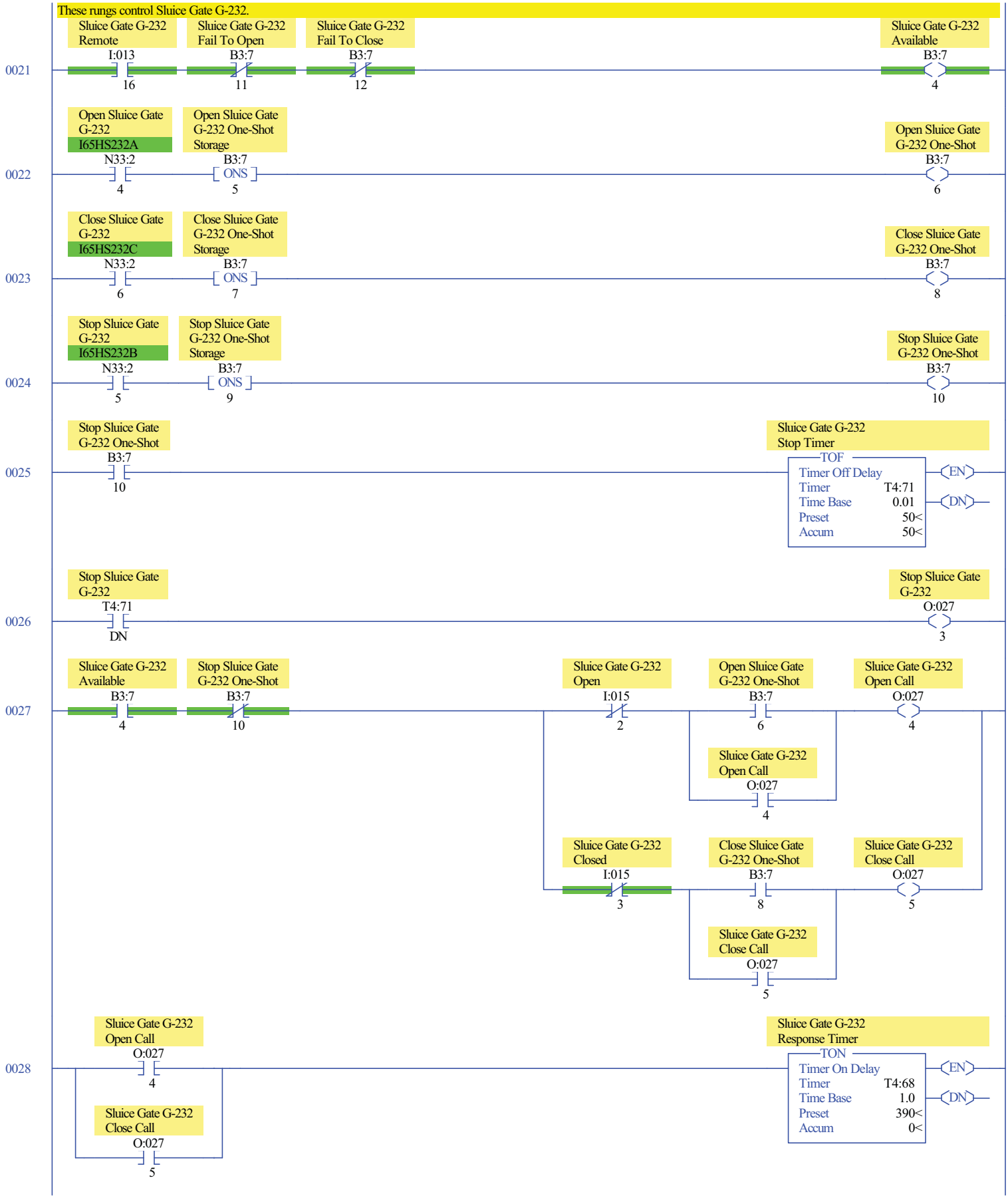

This rung totalizes the flow in MGD. Two steps are used to maintain precision.
Force Main Flow Totalizer Accumulator
0000
GRT
Greater Than (A>B)
Source A F8:60 8956.314<
Source B 10000.0 10000.0<
Current Force Main Totalized Flow (MG)
ADD
Add
Source A F8:61 2.909998<
Source B 0.01 0.01<
Dest F8:61 2.909998<
Force Main Flow Totalizer Accumulator
SUB
Subtract
Source A F8:60 8956.314<
Source B 10000.0 10000.0<
Dest F8:60 8956.314<
Each day at 2:00 am the previous day totalized flow is updated and the current day is zeroed.
Real time clock HOUR
Midnight One-Shot Storage Bit
0001
EQU
Equal
Source A S:21 12<
Source B 0 0<
B3:5
ONS
8
Previous Force Main Totalized Flow (MG)
MOV
Move
Source F8:61 2.909998<
Dest F8:62 6.010043<
Current Force Main Totalized Flow (MG)
CLR
Clear
Dest F8:61 2.909998<
0002
END

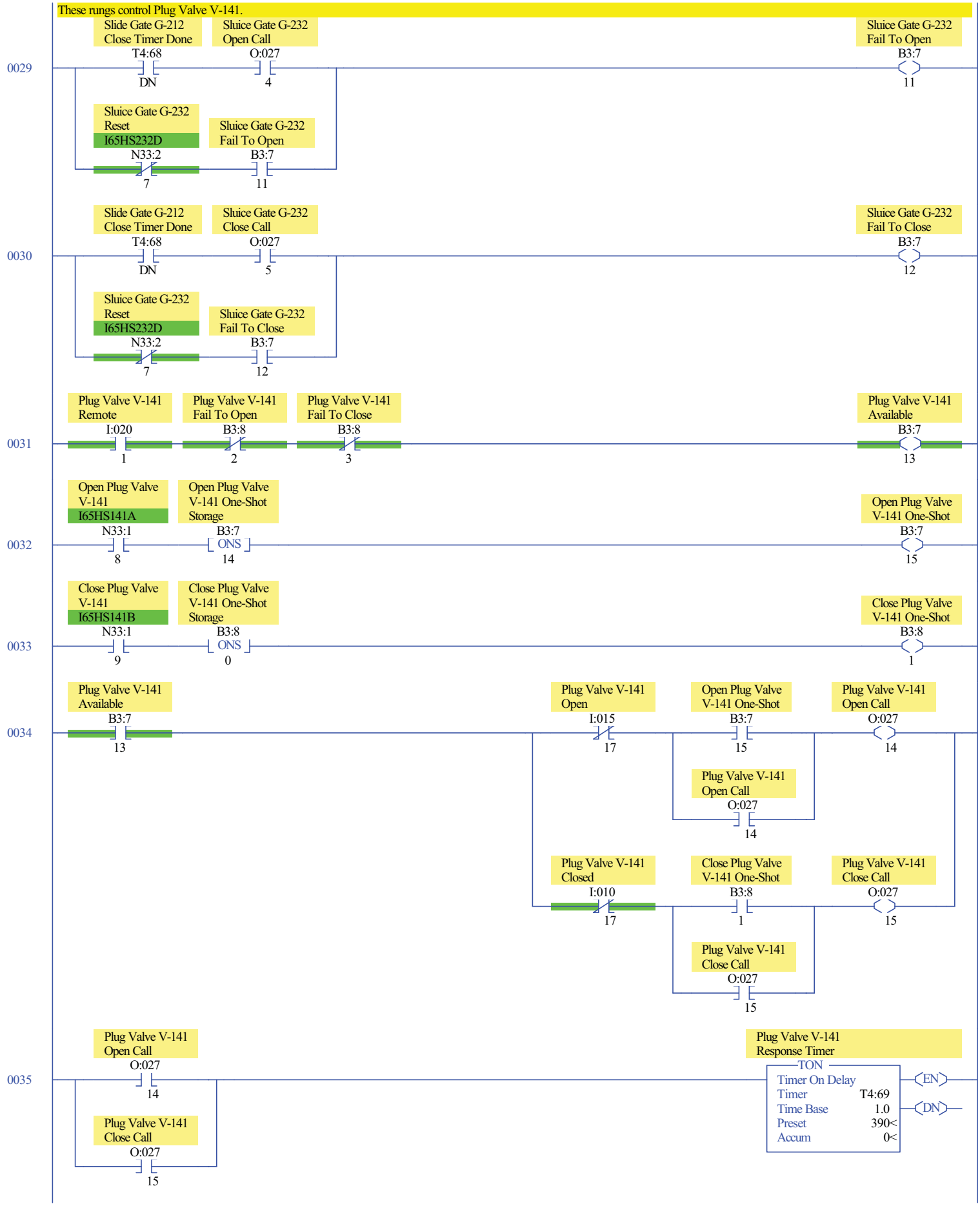

These rungs control the seal water pumps based on hydropneumatic tank pressure.
Hydropneumatic Tank T-301 High Pressure
I:015
7
Hydropneumatic Tank T-301 Low Pressure
I:015
10
Lead Seal Water Pump Reqd
B3:5
9
Lead Seal Water Pump Reqd
B3:5
9
Hydropneumatic Tank T-301 Low Pressure Timer
TON
Timer On Delay
Timer T4:64
Time Base 1.0
Preset 1200<
Accum 0<
EN
DN
0000
The following rungs alternate the lead seal water pump.
Hydropneumatic Tank T-301 High Pressure
I:015
7
Hydropneumatic Tank T-301 High Pressure One-Shot Storage
B3:5
ONS
10
Hydropneumatic Tank T-301 High Pressure One-Shot
B3:5
11
0001
If Pump 305 was not lead make it lead.
Hydropneumatic Tank T-301 High Pressure One-Shot
B3:5
11
Seal Water Pump 305 Lead
B3:5
12
Seal Water Pump 305 Lead
B3:5
L
12
0002
Seal Water Pump 305 Lead
B3:5
12
Seal Water Pump 305 Lead One-Shot Storage
B3:5
ONS
13
Seal Water Pump 305 Lead One-Shot
B3:5
14
0003
If Pump 305 was lead prior to this program scan, make it lag.
Hydropneumatic Tank T-301 High Pressure One-Shot
B3:5
11
Seal Water Pump 305 Lead
B3:5
12
Seal Water Pump 305 Lead One-Shot
B3:5
14
Seal Water Pump 305 Lead
B3:5
U
12
0004
Air Gap Tank T-300 Low Low Level
I:015
6
Lead Seal Water Pump Reqd
B3:5
9
Seal Water Pump 305 Lead
B3:5
12
Seal Water Pump 305 Call
O:011
13
Lag Seal Water Pump Reqd
T4:64
DN
0005
Air Gap Tank T-300 Low Low Level
I:015
6
Lead Seal Water Pump Reqd
B3:5
9
Seal Water Pump 305 Lead
B3:5
12
Seal Water Pump 306 Call
O:011
14
Lag Seal Water Pump Reqd
T4:64
DN
0006
END
0007

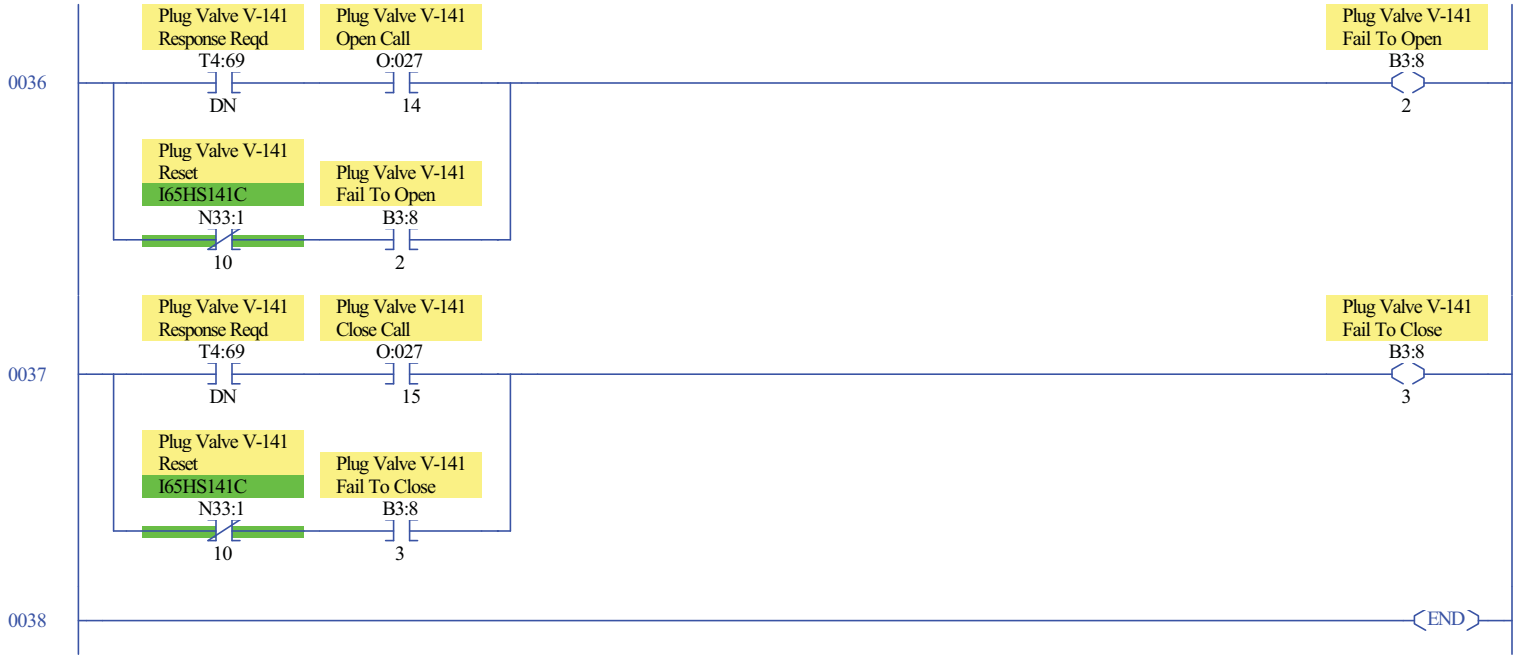

These rungs control Slide Gate G-211.
0000
Slide Gate G-211 Remote
I:012
17
Slide Gate G-211 Fail To Open
B3:6
4
Slide Gate G-211 Fail To Close
B3:6
5
Slide Gate G-211 Available
B3:5
15
0001
Open Slide Gate G-211 I65HS211A
N33:1
11
Open Slide Gate G-211 One-Shot Storage
B3:6
ONS
0
Open Slide Gate G-211 One-Shot
B3:6
1
0002
Close Slide Gate G-211 I65HS211B
N33:1
12
Close Slide Gate G-211 One-Shot Storage
B3:6
ONS
2
Close Slide Gate G-211 One-Shot
B3:6
3
0003
Slide Gate G-211 Available
B3:5
15
Slide Gate G-211 Open
I:014
4
Open Slide Gate G-211 One-Shot
B3:6
1
Slide Gate G-211 Open Call
O:027
6
Slide Gate G-211 Open Call
O:027
6
Slide Gate G-211 Closed
I:014
5
Close Slide Gate G-211 One-Shot
B3:6
3
Slide Gate G-211 Close Call
O:027
7
Slide Gate G-211 Close Call
O:027
7
0004
Slide Gate G-211 Open Call
O:027
6
Slide Gate G-211 Close Call
O:027
7
Slide Gate G-211 Response Timer
TON
Timer On Delay
Timer T4:65
Time Base 1.0
Preset 390
Accum 0
EN
DN
0005
Slide Gate G-211 Response Reqd
T4:65
DN
Slide Gate G-211 Open Call
O:027
6
Slide Gate G-211 Fail To Open
B3:6
4
Slide Gate G-211 Reset I65HS211C
N33:1
13
Slide Gate G-211 Fail To Open
B3:6
4
0006
Slide Gate G-211 Response Reqd
T4:65
DN
Slide Gate G-211 Close Call
O:027
7
Slide Gate G-211 Fail To Close
B3:6
5
Slide Gate G-211 Reset I65HS211C
N33:1
13
Slide Gate G-211 Fail To Close
B3:6
5


These rungs control Slide Gate G-212.
0007
Slide Gate G-212 Remote
I:013
4
Slide Gate G-212 Fail To Open
B3:6
11
Slide Gate G-212 Fail To Close
B3:6
12
Slide Gate G-212 Available
B3:6
6
0008
Open Slide Gate G-212
I65HS212A
N33:1
14
Open Slide Gate G-212 One-Shot Storage
B3:6
ONS
7
Open Slide Gate G-212 One-Shot
B3:6
8
0009
Close Slide Gate G-212
I65HS212B
N33:1
15
Close Slide Gate G-212 One-Shot Storage
B3:6
ONS
9
Close Slide Gate G-212 One-Shot
B3:6
10
0010
Slide Gate G-212 Available
B3:6
6
Slide Gate G-212 Open
I:014
6
Open Slide Gate G-212 One-Shot
B3:6
8
Slide Gate G-212 Open Call
O:027
10
Slide Gate G-212 Open Call
O:027
10
Slide Gate G-212 Closed
I:014
7
Close Slide Gate G-212 One-Shot
B3:6
10
Slide Gate G-212 Close Call
O:027
11
Slide Gate G-212 Close Call
O:027
11
0011
Slide Gate G-212 Open Call
O:027
10
Slide Gate G-212 Close Call
O:027
11
Slide Gate G-212 Response Timer
TON
Timer On Delay
Timer T4:66
Time Base 1.0
Preset 390
Accum 0
EN
DN
0012
Slide Gate G-212 Response Reqd
T4:66
DN
Slide Gate G-212 Open Call
O:027
10
Slide Gate G-212 Fail To Open
B3:6
11
Slide Gate G-212 Reset
I65HS212C
N33:2
0
Slide Gate G-212 Fail To Open
B3:6
11
0013
Slide Gate G-212 Response Reqd
T4:66
DN
Slide Gate G-212 Close Call
O:027
11
Slide Gate G-212 Fail To Close
B3:6
12
Slide Gate G-212 Reset
I65HS212C
N33:2
0
Slide Gate G-212 Fail To Close
B3:6
12

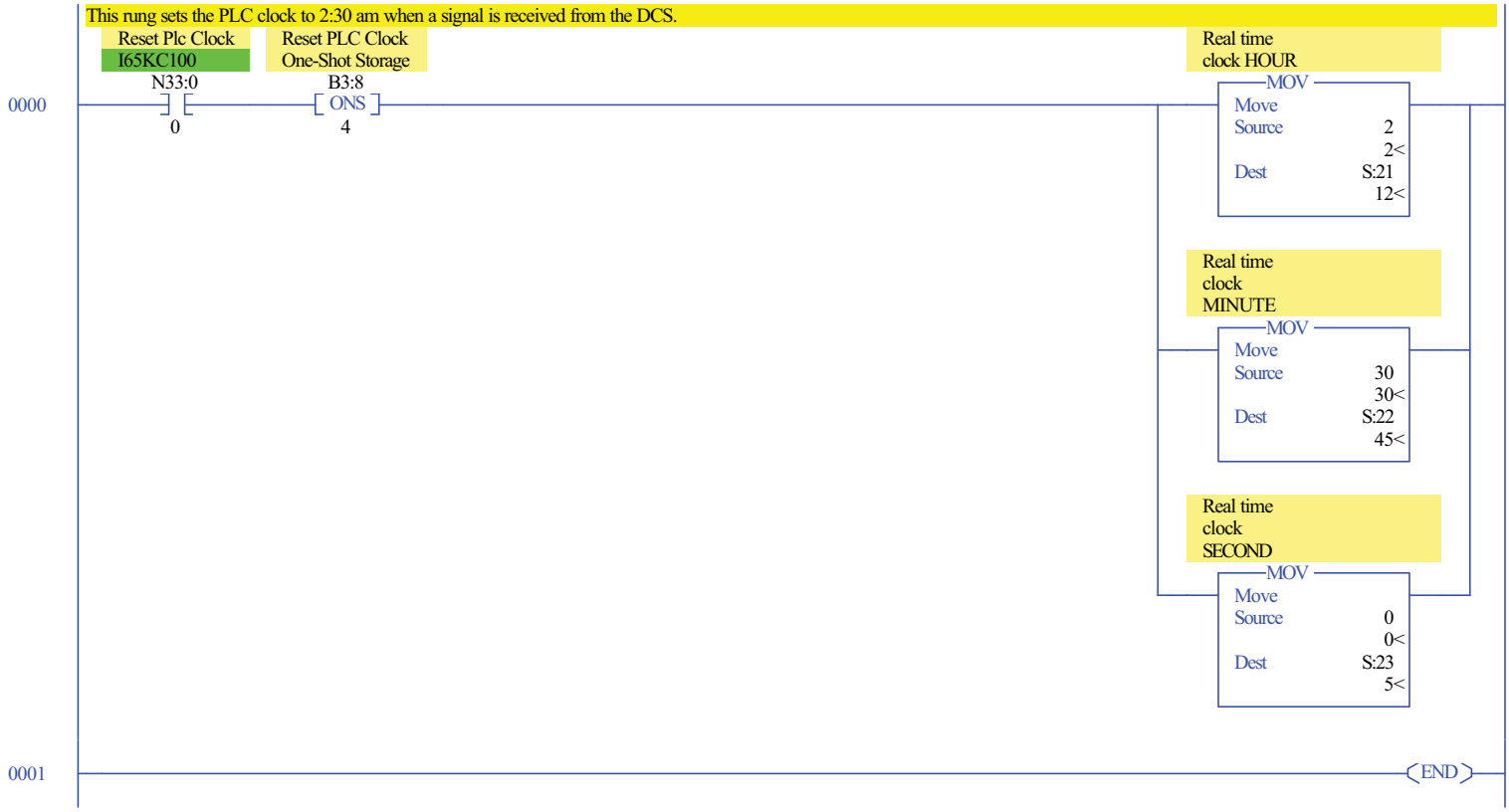

These rungs control Slide Gate G-213.
0014
Slide Gate G-213 Remote
I:013
11
Slide Gate G-213 Fail To Open
B3:7
2
Slide Gate G-213 Fail To Close
B3:7
3
Slide Gate G-213 Available
B3:6
13
0015
Open Slide Gate G-213
I65HS213A
N33:2
1
Open Slide Gate G-213 One-Shot Storage
B3:6
ONS
14
Open Slide Gate G-213 One-Shot
B3:6
15
0016
Close Slide Gate G-213
I65HS213B
N33:2
2
Close Slide Gate G-213 One-Shot Storage
B3:7
ONS
0
Close Slide Gate G-213 One-Shot
B3:7
1
0017
Slide Gate G-213 Available
B3:6
13
Slide Gate G-213 Open
I:014
10
Open Slide Gate G-213 One-Shot
B3:6
15
Slide Gate G-213 Open Call
O:027
12
Slide Gate G-213 Open Call
O:027
12
Slide Gate G-213 Closed
I:014
11
Close Slide Gate G-213 One-Shot
B3:7
1
Slide Gate G-213 Close Call
O:027
13
Slide Gate G-213 Close Call
O:027
13
0018
Slide Gate G-213 Open Call
O:027
12
Slide Gate G-213 Close Call
O:027
13
Slide Gate G-213 Response Timer
TON
Timer On Delay
Timer T4:67
Time Base 1.0
Preset 390<
Accum 0<
EN
DN
0019
Slide Gate G-213 Response Reqd
T4:67
DN
Slide Gate G-213 Open Call
O:027
12
Slide Gate G-213 Fail To Open
B3:7
2
Slide Gate G-213 Reset
I65HS213C
N33:2
3
Slide Gate G-213 Fail To Open
B3:7
2
0020
Slide Gate G-213 Response Reqd
T4:67
DN
Slide Gate G-213 Close Call
O:027
13
Slide Gate G-213 Fail To Close
B3:7
3
Slide Gate G-213 Reset
I65HS213C
N33:2
3
Slide Gate G-213 Fail To Close
B3:7
3

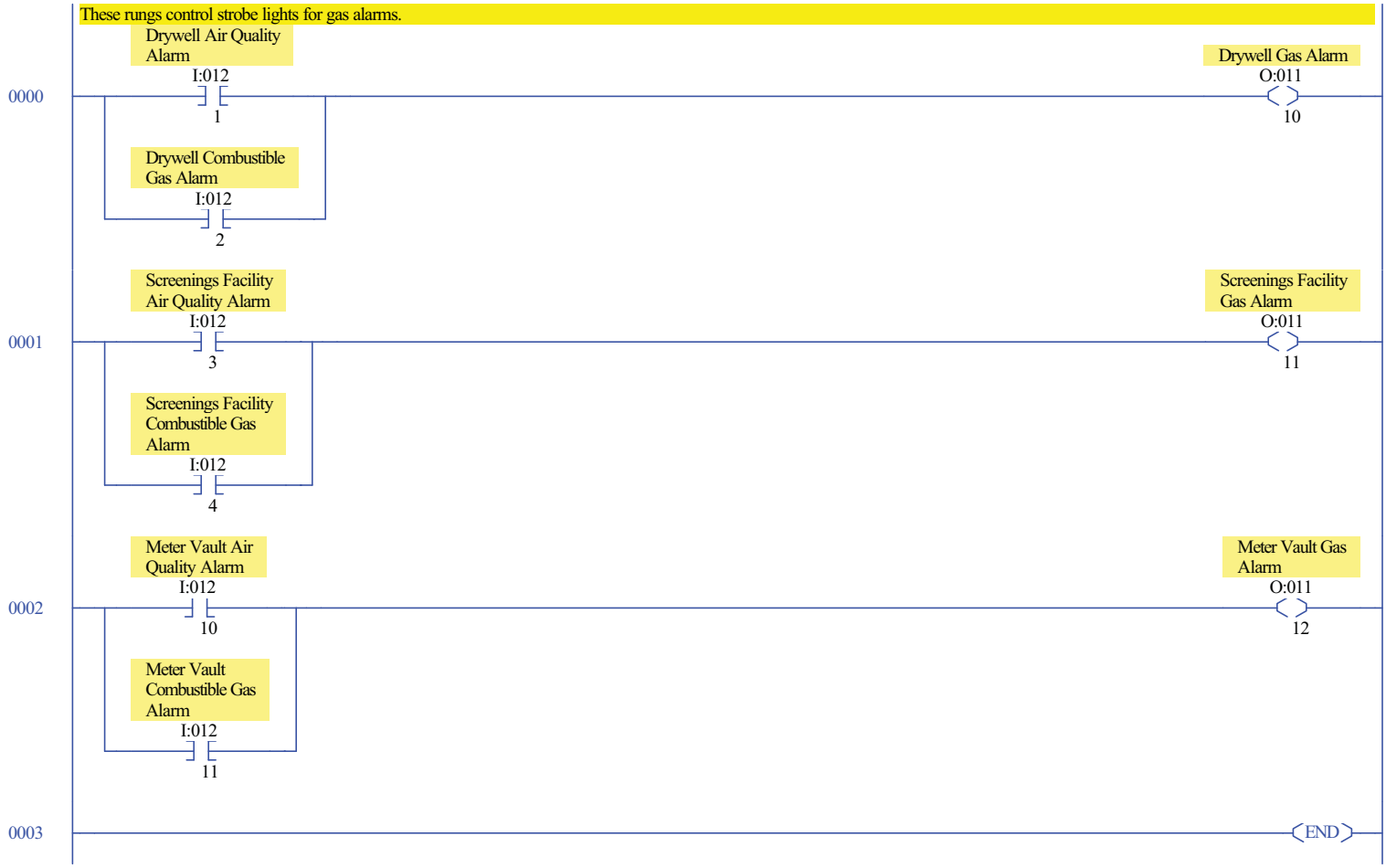

These rungs control Sluice Gate G-232.
0021
Sluice Gate G-232 Remote
I:013
16
Sluice Gate G-232 Fail To Open
B3:7
11
Sluice Gate G-232 Fail To Close
B3:7
12
Sluice Gate G-232 Available
B3:7
4
0022
Open Sluice Gate G-232
I65HS232A
N33:2
4
Open Sluice Gate G-232 One-Shot Storage
B3:7
ONS
5
Open Sluice Gate G-232 One-Shot
B3:7
6
0023
Close Sluice Gate G-232
I65HS232C
N33:2
6
Close Sluice Gate G-232 One-Shot Storage
B3:7
ONS
7
Close Sluice Gate G-232 One-Shot
B3:7
8
0024
Stop Sluice Gate G-232
I65HS232B
N33:2
5
Stop Sluice Gate G-232 One-Shot Storage
B3:7
ONS
9
Stop Sluice Gate G-232 One-Shot
B3:7
10
0025
Stop Sluice Gate G-232 One-Shot
B3:7
10
Sluice Gate G-232 Stop Timer
TOF
Timer Off Delay
Timer T4:71
Time Base 0.01
Preset 50<
Accum 50<
EN
DN
0026
Stop Sluice Gate G-232
T4:71
DN
Stop Sluice Gate G-232
O:027
3
0027
Sluice Gate G-232 Available
B3:7
4
Stop Sluice Gate G-232 One-Shot
B3:7
10
Sluice Gate G-232 Open
I:015
2
Open Sluice Gate G-232 One-Shot
B3:7
6
Sluice Gate G-232 Open Call
O:027
4
Sluice Gate G-232 Open Call
O:027
4
Sluice Gate G-232 Closed
I:015
3
Close Sluice Gate G-232 One-Shot
B3:7
8
Sluice Gate G-232 Close Call
O:027
5
Sluice Gate G-232 Close Call
O:027
5
0028
Sluice Gate G-232 Open Call
O:027
4
Sluice Gate G-232 Close Call
O:027
5
Sluice Gate G-232 Response Timer
TON
Timer On Delay
Timer T4:68
Time Base 1.0
Preset 390<
Accum 0<
EN
DN


These rungs control Plug Valve V-141.
0029
Slide Gate G-212 Close Timer Done
T4:68
DN
Sluice Gate G-232 Open Call
O:027
4
Sluice Gate G-232 Fail To Open
B3:7
11
Sluice Gate G-232 Reset
I65HS232D
N33:2
7
Sluice Gate G-232 Fail To Open
B3:7
11
0030
Slide Gate G-212 Close Timer Done
T4:68
DN
Sluice Gate G-232 Close Call
O:027
5
Sluice Gate G-232 Fail To Close
B3:7
12
Sluice Gate G-232 Reset
I65HS232D
N33:2
7
Sluice Gate G-232 Fail To Close
B3:7
12
0031
Plug Valve V-141 Remote
I:020
1
Plug Valve V-141 Fail To Open
B3:8
2
Plug Valve V-141 Fail To Close
B3:8
3
Plug Valve V-141 Available
B3:7
13
0032
Open Plug Valve V-141
I65HS141A
N33:1
8
Open Plug Valve V-141 One-Shot Storage
B3:7
ONS
14
Open Plug Valve V-141 One-Shot
B3:7
15
0033
Close Plug Valve V-141
I65HS141B
N33:1
9
Close Plug Valve V-141 One-Shot Storage
B3:8
ONS
0
Close Plug Valve V-141 One-Shot
B3:8
1
0034
Plug Valve V-141 Available
B3:7
13
Plug Valve V-141 Open
I:015
17
Open Plug Valve V-141 One-Shot
B3:7
15
Plug Valve V-141 Open Call
O:027
14
Plug Valve V-141 Open Call
O:027
14
Plug Valve V-141 Closed
I:010
17
Close Plug Valve V-141 One-Shot
B3:8
1
Plug Valve V-141 Close Call
O:027
15
Plug Valve V-141 Close Call
O:027
15
0035
Plug Valve V-141 Open Call
O:027
14
Plug Valve V-141 Close Call
O:027
15
Plug Valve V-141 Response Timer
TON
Timer On Delay
Timer T4:69
Time Base 1.0
Preset 390<
Accum 0<
EN
DN


0036
Plug Valve V-141
Response Reqd
T4:69
DN
Plug Valve V-141
Open Call
O:027
14
Plug Valve V-141
Fail To Open
B3:8
2
Plug Valve V-141
Reset
I65HS141C
N33:1
10
Plug Valve V-141
Fail To Open
B3:8
2
0037
Plug Valve V-141
Response Reqd
T4:69
DN
Plug Valve V-141
Close Call
O:027
15
Plug Valve V-141
Fail To Close
B3:8
3
Plug Valve V-141
Reset
I65HS141C
N33:1
10
Plug Valve V-141
Fail To Close
B3:8
3
0038
END

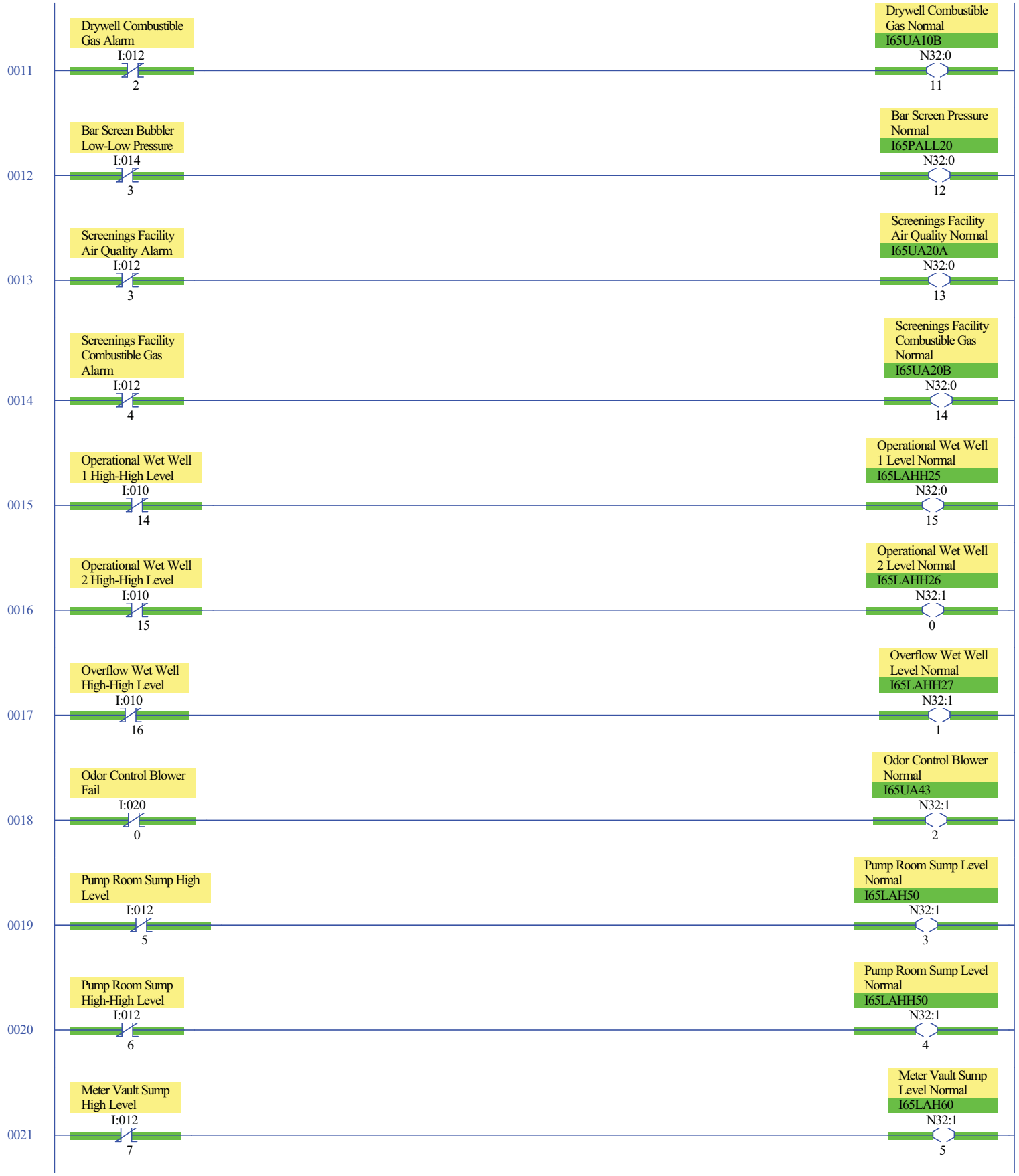
LAD 21 - CLOCK --- Total Rungs in File = 2



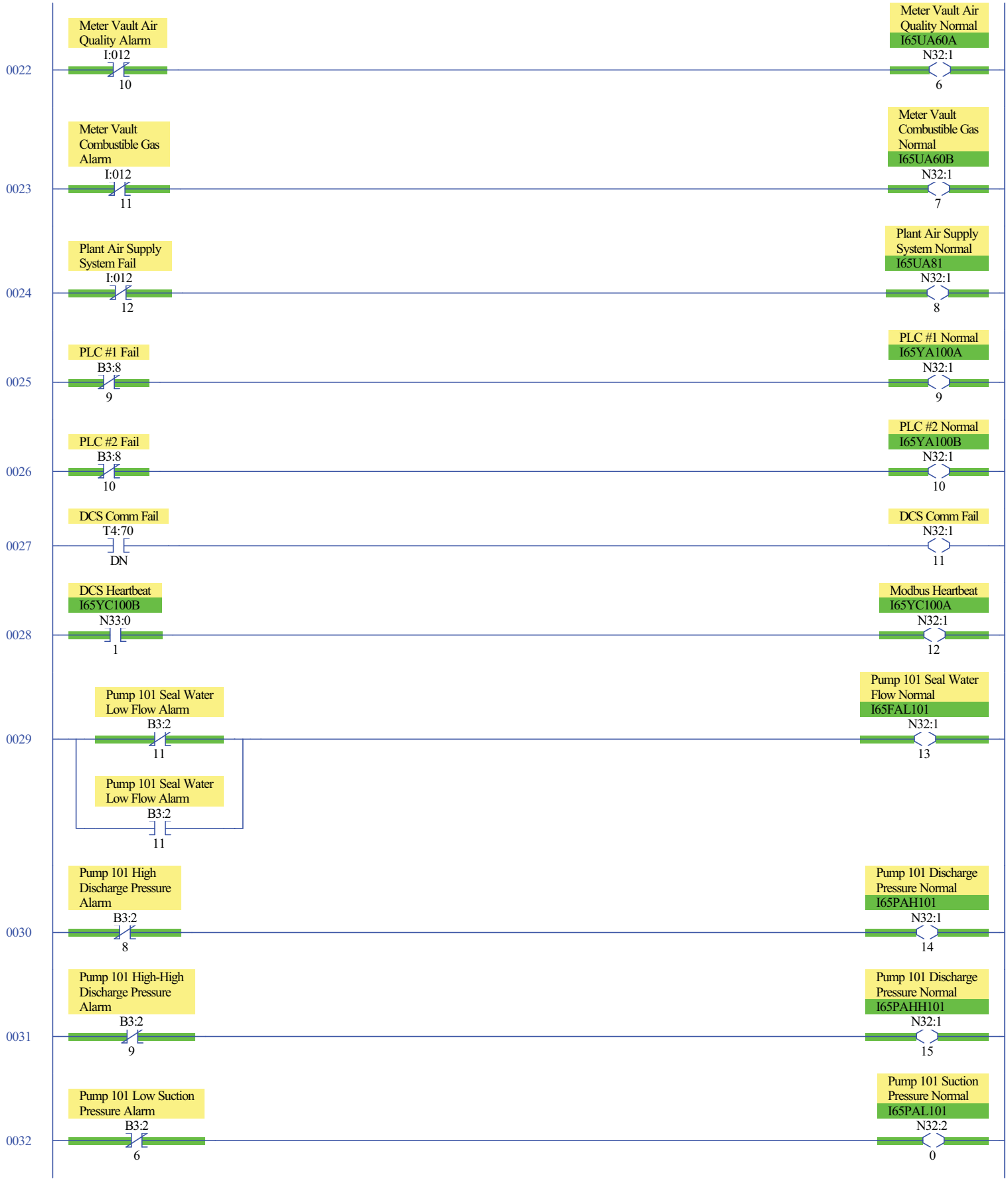

These rungs control strobe lights for gas alarms.
Drywell Air Quality Alarm
I:012
1
Drywell Combustible Gas Alarm
I:012
2
Drywell Gas Alarm
O:011
10
0000
Screenings Facility Air Quality Alarm
I:012
3
Screenings Facility Combustible Gas Alarm
I:012
4
Screenings Facility Gas Alarm
O:011
11
0001
Meter Vault Air Quality Alarm
I:012
10
Meter Vault Combustible Gas Alarm
I:012
11
Meter Vault Gas Alarm
O:011
12
0002
0003
END

These rungs map DCS data points into contiguous memory for reading by the DCS. BIts are inverted as necessary to correspond to the DCS database.

LAD 23 - DCS COMM --- Total Rungs in File = 274



LAD 23 - DCS COMM --- Total Rungs in File = 274



LAD 23 - DCS COMM --- Total Rungs in File = 274

LAD 23 - DCS COMM --- Total Rungs in File = 274

LAD 23 - DCS COMM --- Total Rungs in File = 274


0066
Pump 101 Lead 150 HP
I65HS101A
N33:0
2
Pump 102 Lead
I65YL102B
N32:4
2
0067
Pump 102 Out Of Service
I65HS102C
N33:0
10
Pump 102 Out Of Service
I65YL102C
N32:4
3
0068
Pump 102 PLC Control
I65HS102A
N33:0
8
Pump 102 PLC Control
I65YL102D
N32:4
4
0069
Pump 102 Available
B3:0
8
Pump 102 Available
I65YL102E
N32:4
5
0070
Pump 102 Hand
I:020
4
Pump 102 Hand
I65ZL102A
N32:4
6
0071
Pump 102 Auto
I:020
5
Pump 102 Auto
I65ZL102B
N32:4
7
0072
Pump 102 Discharge Check Valve Closed
I:013
2
Pump 102 Discharge Valve Open
I65ZLC102
N32:4
8
0073
Pump 103 Seal Water Low Flow Alarm
B3:4
7
Pump 103 Seal Water Flow Normal
I65FAL103
N32:4
9
Pump 103 Seal Water Low Flow Alarm
B3:4
7
0074
Pump 103 High Discharge Pressure Alarm
B3:4
4
Pump 103 Discharge Pressure Normal
I65PAH103
N32:4
10
0075
Pump 103 High-High Discharge Pressure Alarm
B3:4
5
Pump 103 Discharge Pressure Normal
I65PAHH103
N32:4
11
0076
Pump 103 Low Suction Pressure Alarm
B3:4
2
Pump 103 Suction Pressure Normal
I65PAL103
N32:4
12

LAD 23 - DCS COMM --- Total Rungs in File = 274


0088
Pump 103 Lead 400 HP
I65HS103A
N33:0
13
Pump 103 Lead
I65YL103B
N32:5
8
0089
Pump 103 Out Of Service
I65HS103D
N33:1
0
Pump 103 Out Of Service
I65YL103C
N32:5
9
0090
Pump 103 PLC Control
I65HS103B
N33:0
14
Pump 103 PLC Control
I65YL103D
N32:5
10
0091
Pump 103 Available
B3:0
9
Pump 103 Available
I65YL103E
N32:5
11
0092
Pump 103 Hand
I:020
6
Pump 103 Hand
I65ZL103A
N32:5
12
0093
Pump 103 Auto
I:020
7
Pump 103 Auto
I65ZL103B
N32:5
13
0094
Pump 103 Discharge Check Valve Closed
I:013
7
Pump 103 Discharge Check Valve Open
I65ZLC103
N32:5
14
0095
Pump 104 Seal Water Low Flow Alarm
B3:5
5
Pump 104 Seal Water Flow Normal
I65FAL104
N32:5
15
Pump 104 Seal Water Low Flow Alarm
B3:5
5
0096
Pump 104 High Discharge Pressure Alarm
B3:5
2
Pump 104 Discharge Pressure Normal
I65PAH104
N32:6
0
0097
Pump 104 High-High Discharge Pressure Alarm
B3:5
3
Pump 104 Discharge Pressure Normal
I65PAHH104
N32:6
1
0098
Pump 104 Low Suction Pressure Alarm
B3:5
0
Pump 104 Suction Pressure Normal
I65PAL104
N32:6
2

LAD 23 - DCS COMM --- Total Rungs in File = 274

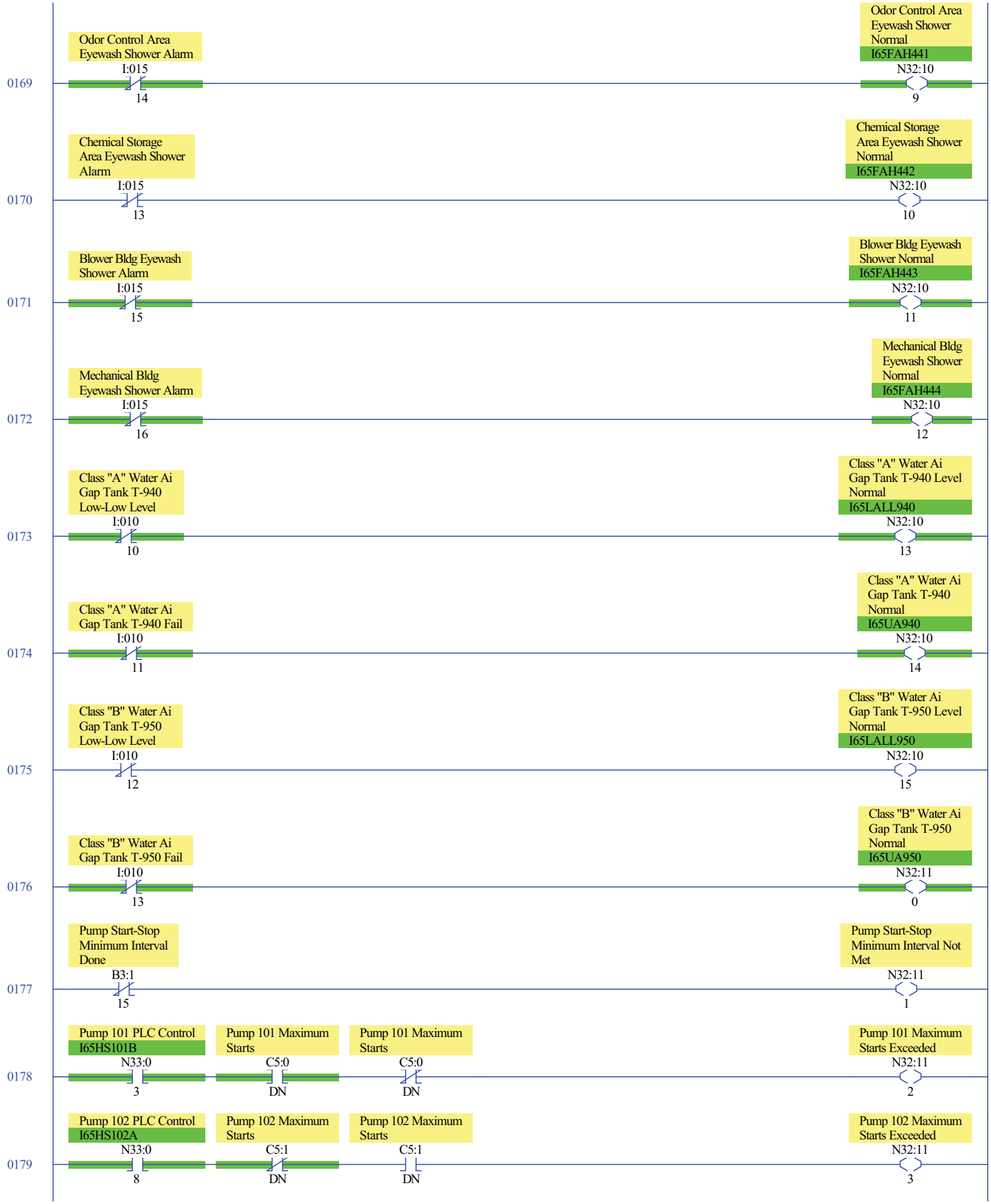

0110
Pump 103 Lead 400 HP
I65HS103A
N33:0
13
Pump 104 Lead
I65YL104B
N32:6
14
0111
Pump 104 Out Of Service
I65HS104C
N33:1
5
Pump 104 Out Of Service
I65YL104C
N32:6
15
0112
Pump 104 PLC Control
I65HS104A
N33:1
3
Pump 104 PLC Control
I65YL104D
N32:7
0
0113
Pump 104 Available
B3:0
10
Pump 104 Available
I65YL104E
N32:7
1
0114
Pump 104 Hand
I:020
10
Pump 104 Hand
I65ZL104A
N32:7
2
0115
Pump 104 Auto
I:020
11
Pump 104 Auto
I65ZL104B
N32:7
3
0116
Pump 104 Discharge Check Valve Closed
I:013
14
Pump 104 Discharge Check Valve Open
I65ZLC104
N32:7
4
0117
Sluice Gate G-111 Closed
I:014
0
Sluice Gate G-111 Closed
I65ZLC111
N32:7
5
0118
Sluice Gate G-111 Open
I:013
17
Sluice Gate G-111 Open
I65ZLO111
N32:7
6
0119
Sluice Gate G-121 Closed
I:014
2
Sluice Gate G-121 Closed
I65ZLC121
N32:7
7
0120
Sluice Gate G-121 Open
I:014
1
Sluice Gate G-121 Open
I65ZLO121
N32:7
8
0121
Plug Valve V-141 Fail To Open
B3:8
2
Plug Valve V-141 Fail To Open
I65YA141A
N32:7
9

LAD 23 - DCS COMM --- Total Rungs in File = 274

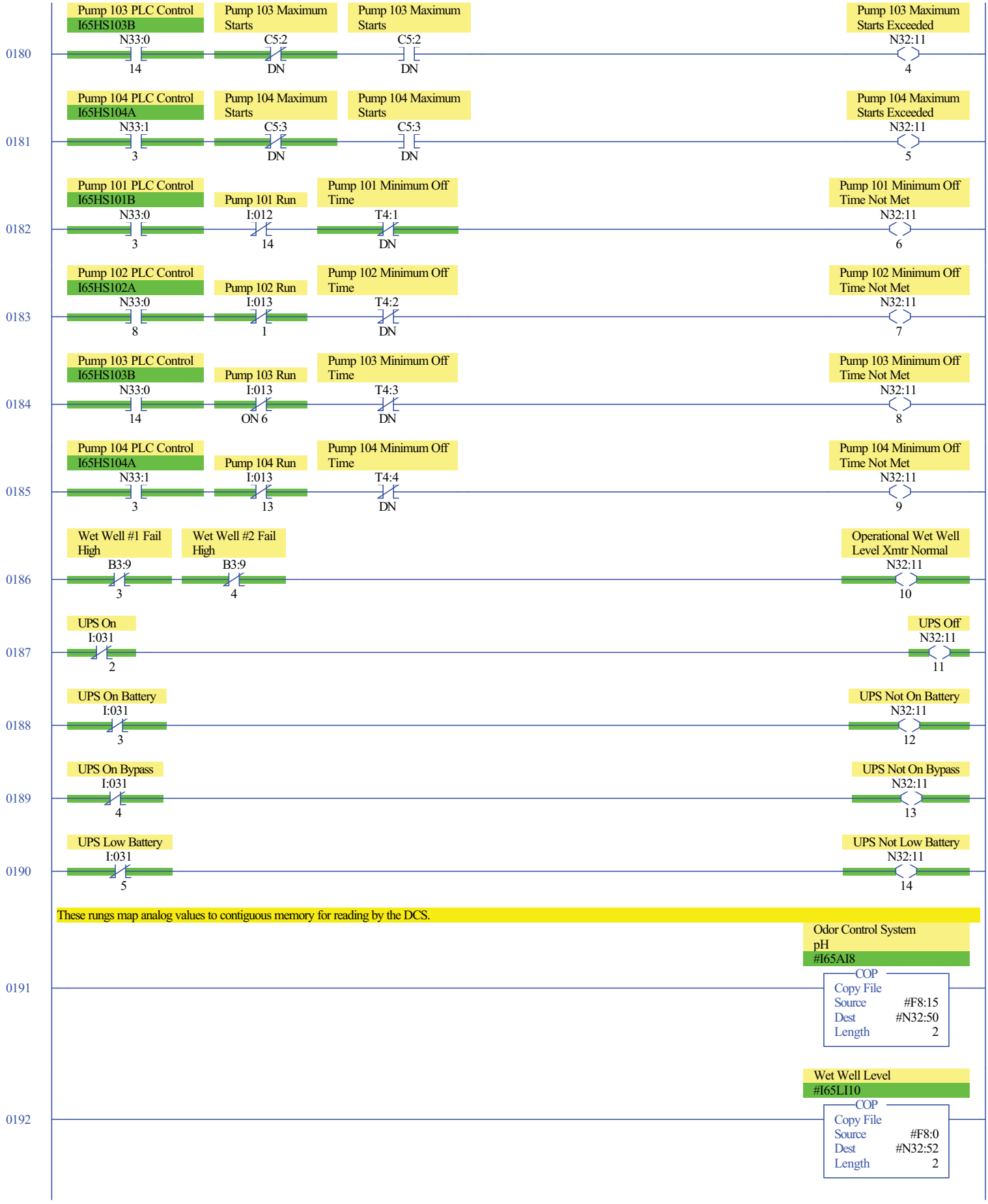

0134
Slide Gate G-211 Closed
I:014
5
Slide Gate G-211 Closed
I65ZLC211
N32:8
6
0135
Slide Gate G-211 Open
I:014
4
Slide Gate G-211 Open
I65ZLO211
N32:8
7
0136
Slide Gate G-212 Fail To Open
B3:6
11
Slide Gate G-212 Fail To Open
I65YA212A
N32:8
8
0137
Slide Gate G-212 Fail To Close
B3:6
12
Slide Gate G-212 Fail To Close
I65YA212B
N32:8
9
0138
Slide Gate G-212 Available
B3:6
6
Slide Gate G-212 Available
I65YL212
N32:8
10
0139
Slide Gate G-212 Remote
I:013
4
Slide Gate G-212 Remote Control
I65ZL212
N32:8
11
0140
Slide Gate G-212 Closed
I:014
7
Slide Gate G-212 Closed
I65ZLC212
N32:8
12
0141
Slide Gate G-212 Open
I:014
6
Slide Gate G-212 Open
I65ZLO212
N32:8
13
0142
Slide Gate G-213 Fail To Open
B3:7
2
Slide Gate G-213 Fail To Open
I65YA213A
N32:8
14
0143
Slide Gate G-213 Fail To Close
B3:7
3
Slide Gate G-213 Fail To Close
I65YA213B
N32:8
15
0144
Slide Gate G-213 Available
B3:6
13
Slide Gate G-213 Available
I65YL213
N32:9
0
0145
Slide Gate G-213 Remote
I:013
11
Slide Gate G-213 Remote Control
I65ZL213
N32:9
1


0146
Slide Gate G-213 Closed
I:014
11
Slide Gate G-213 Closed
I65ZLC213
N32:9
2
0147
Slide Gate G-213 Open
I:014
10
Slide Gate G-213 Open
I65ZLO213
N32:9
3
0148
Slide Gate G-221 Closed
I:014
13
Slide Gate G-221 Closed
I65ZLC221
N32:9
4
0149
Slide Gate G-221 Open
I:014
12
Slide Gate G-221 Open
I65ZLO221
N32:9
5
0150
Slide Gate G-222 Closed
I:014
15
Slide Gate G-222 Closed
I65ZLC222
N32:9
6
0151
Slide Gate G-222 Open
I:014
14
Slide Gate G-222 Open
I65ZLO222
N32:9
7
0152
Slide Gate G-223 Closed
I:014
17
Slide Gate G-223 Closed
I65ZLC223
N32:9
8
0153
Slide Gate G-223 Open
I:014
16
Slide Gate G-223 Open
I65ZLO223
N32:9
9
0154
Slide Gate G-231 Closed
I:015
1
Slide Gate G-231 Closed
I65ZLC231
N32:9
10
0155
Slide Gate G-231 Open
I:015
0
Slide Gate G-231 Open
I65ZLO231
N32:9
11
0156
Sluice Gate G-232 Fail To Open
B3:7
11
Sluice Gate G-232 Fail To Open
I65YA232A
N32:9
12
0157
Sluice Gate G-232 Fail To Close
B3:7
12
Sluice Gate G-232 Fail To Close
I65YA232B
N32:9
13


0158
Sluice Gate G-232 Available
B3:7
4
Sluice Gate G-232 Available
I65YL232
N32:9
14
0159
Sluice Gate G-232 Remote
I:013
16
Sluice Gate G-232 Remote Control
I65ZL232
N32:9
15
0160
Sluice Gate G-232 Closed
I:015
3
Sluice Gate G-232 Closed
I65ZLC232
N32:10
0
0161
Sluice Gate G-232 Open
I:015
2
Sluice Gate G-232 Open
I65ZLO232
N32:10
1
0162
Slide Gate G-233 Closed
I:015
5
Slide Gate G-233 Closed
I65ZLC233
N32:10
2
0163
Slide Gate G-233 Open
I:015
4
Slide Gate G-233 Open
I65ZLO233
N32:10
3
0164
Air Gap Tank T-300 Low Low Level
I:015
6
Air Gap Tank T-300 Level Normal
I65LALL300
N32:10
4
0165
Hydropneumatic Tank T-301 High Pressure
I:015
7
Hydropneumatic Tank T-301 Pressure Normal
I65PAH301
N32:10
5
0166
Hydropneumatic Tank T-301 Low Pressure
I:015
10
Hydropneumatic Tank T-301 Pressure Normal
I65PAL301
N32:10
6
0167
Hypo Bulk Storage Tank T-410 Low Level
I:015
11
Hypo Bulk Storage Tank T-410 Level Normal
I65LAL410B
N32:10
7
0168
Caustic Bulk Storage Tank T-420 Low Level
I:015
12
Caustic Bulk Storage Tank T-420 Level Normal
I65LAL420B
N32:10
8


0169
Odor Control Area Eyewash Shower Alarm
I:015
14
Odor Control Area Eyewash Shower Normal
I65FAH441
N32:10
9
0170
Chemical Storage Area Eyewash Shower Alarm
I:015
13
Chemical Storage Area Eyewash Shower Normal
I65FAH442
N32:10
10
0171
Blower Bldg Eyewash Shower Alarm
I:015
15
Blower Bldg Eyewash Shower Normal
I65FAH443
N32:10
11
0172
Mechanical Bldg Eyewash Shower Alarm
I:015
16
Mechanical Bldg Eyewash Shower Normal
I65FAH444
N32:10
12
0173
Class "A" Water Ai Gap Tank T-940 Low-Low Level
I:010
10
Class "A" Water Ai Gap Tank T-940 Level Normal
I65LALL940
N32:10
13
0174
Class "A" Water Ai Gap Tank T-940 Fail
I:010
11
Class "A" Water Ai Gap Tank T-940 Normal
I65UA940
N32:10
14
0175
Class "B" Water Ai Gap Tank T-950 Low-Low Level
I:010
12
Class "B" Water Ai Gap Tank T-950 Level Normal
I65LALL950
N32:10
15
0176
Class "B" Water Ai Gap Tank T-950 Fail
I:010
13
Class "B" Water Ai Gap Tank T-950 Normal
I65UA950
N32:11
0
0177
Pump Start-Stop Minimum Interval Done
B3:1
15
Pump Start-Stop Minimum Interval Not Met
N32:11
1
0178
Pump 101 PLC Control
I65HS101B
N33:0
3
Pump 101 Maximum Starts
C5:0
DN
Pump 101 Maximum Starts
C5:0
DN
Pump 101 Maximum Starts Exceeded
N32:11
2
0179
Pump 102 PLC Control
I65HS102A
N33:0
8
Pump 102 Maximum Starts
C5:1
DN
Pump 102 Maximum Starts
C5:1
DN
Pump 102 Maximum Starts Exceeded
N32:11
3

LAD 23 - DCS COMM --- Total Rungs in File = 274



LAD 23 - DCS COMM --- Total Rungs in File = 274

LAD 23 - DCS COMM --- Total Rungs in File = 274

LAD 23 - DCS COMM --- Total Rungs in File = 274


0217
Pump 102 Discharge Pressure
#I65PI102B
COP
Copy File
Source #F8:3
Dest #N32:102
Length 2
0218
Pump 102 Motor Winding Temp A
#I65TI102A
COP
Copy File
Source #F8:24
Dest #N32:104
Length 2
0219
Pump 102 Motor Winding Temp B
#I65TI102B
COP
Copy File
Source #F8:25
Dest #N32:106
Length 2
0220
Pump 102 Motor Winding Temp C
#I65TI102C
COP
Copy File
Source #F8:26
Dest #N32:108
Length 2
0221
Pump 102 Motor Winding Temp D
#I65TI102D
COP
Copy File
Source #F8:27
Dest #N32:110
Length 2
0222
Pump 102 Motor Winding Temp E
#I65TI102E
COP
Copy File
Source #F8:28
Dest #N32:112
Length 2
0223
Pump 102 Motor Winding Temp F
#I65TI102F
COP
Copy File
Source #F8:29
Dest #N32:114
Length 2
0224
Pump 102 Bearing Temp G
#I65TI102G
COP
Copy File
Source #F8:30
Dest #N32:116
Length 2

LAD 23 - DCS COMM --- Total Rungs in File = 274

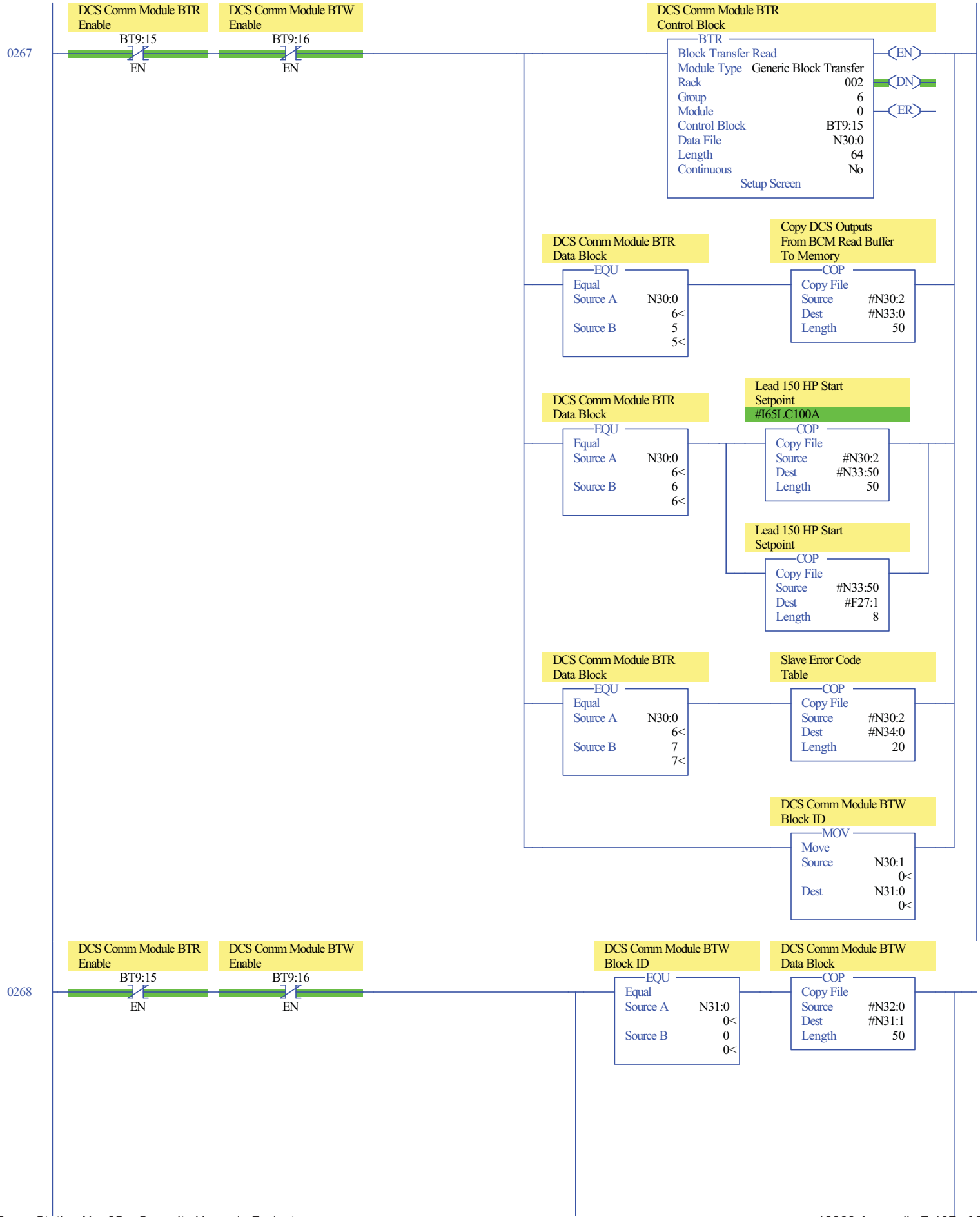

0233
Pump 103 Motor Winding Temp C
#I65TI103C
COP
Copy File
Source #F8:34
Dest #N32:134
Length 2
0234
Pump 103 Motor Winding Temp D
#I65TI103D
COP
Copy File
Source #F8:35
Dest #N32:136
Length 2
0235
Pump 103 Motor Winding Temp E
#I65TI103E
COP
Copy File
Source #F8:36
Dest #N32:138
Length 2
0236
Pump 103 Motor Winding Temp F
#I65TI103F
COP
Copy File
Source #F8:37
Dest #N32:140
Length 2
0237
Pump 103 Bearing Temp G
#I65TI103G
COP
Copy File
Source #F8:38
Dest #N32:142
Length 2
0238
Pump 103 Bearing Temp H
#I65TI103H
COP
Copy File
Source #F8:39
Dest #N32:144
Length 2
0239
Pump 103 Upper Bearing Vibration
#I65VI103A
COP
Copy File
Source #F8:52
Dest #N32:146
Length 2
0240
Pump 103 Lower Bearing Vibration
#I65VI103B
COP
Copy File
Source #F8:53
Dest #N32:148
Length 2

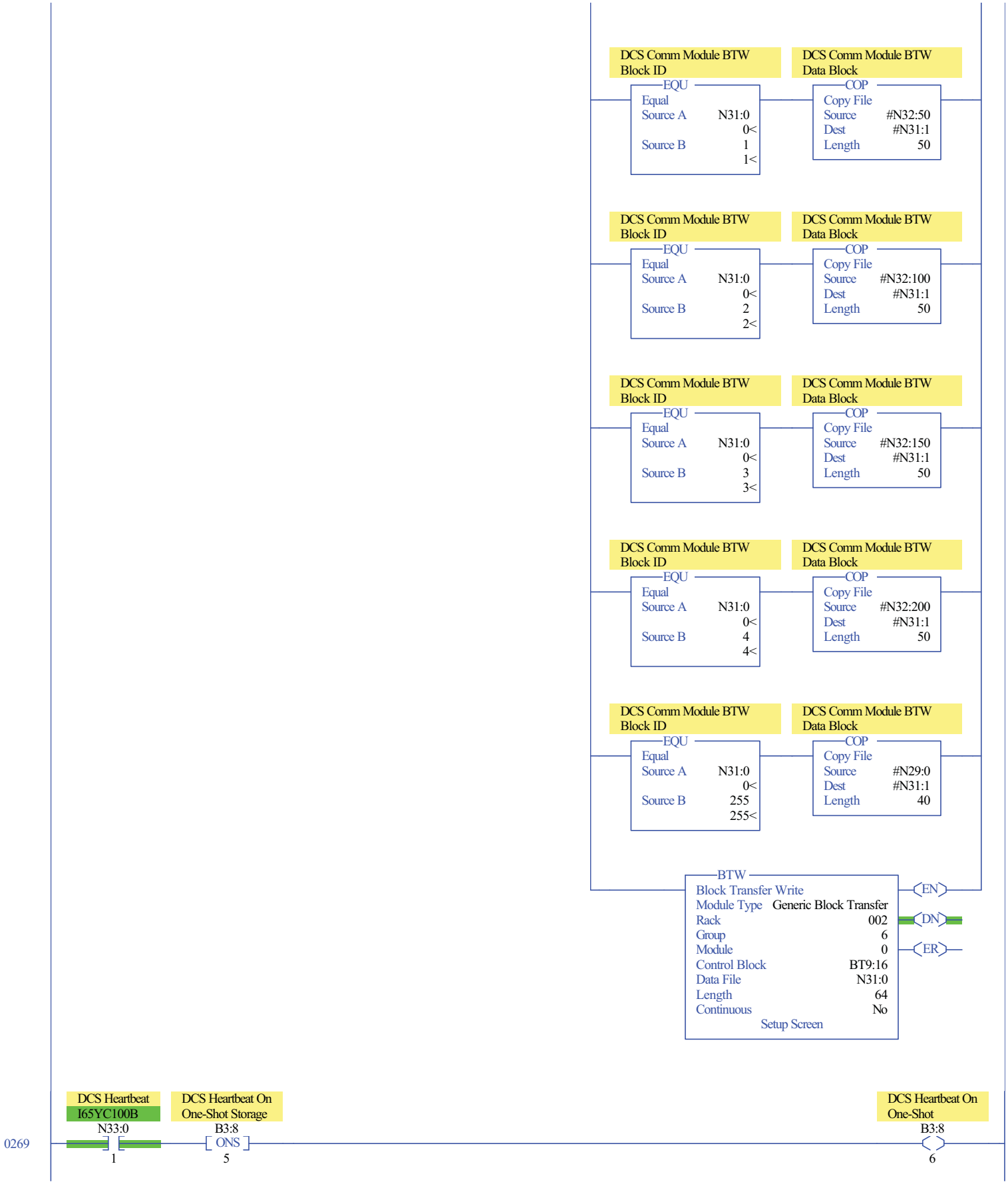

0241
Pump 104 Run Time
#I65KI104
COP
Copy File
Source #F8:59
Dest #N32:150
Length 2
0242
Pump 104 Suction Pressure
#I65PI104A
COP
Copy File
Source #F8:8
Dest #N32:152
Length 2
0243
Pump 104 Discharge Pressure
#I65PI104B
COP
Copy File
Source #F8:7
Dest #N32:154
Length 2
0244
Pump 104 Motor Winding Temp A
#I65TI104A
COP
Copy File
Source #F8:40
Dest #N32:156
Length 2
0245
Pump 104 Motor Winding Temp B
#I65TI104B
COP
Copy File
Source #F8:41
Dest #N32:158
Length 2
0246
Pump 104 Motor Winding Temp C
#I65TI104C
COP
Copy File
Source #F8:42
Dest #N32:160
Length 2
0247
Pump 104 Motor Winding Temp D
#I65TI104D
COP
Copy File
Source #F8:43
Dest #N32:162
Length 2
0248
Pump 104 Motor Winding Temp E
#I65TI104E
COP
Copy File
Source #F8:44
Dest #N32:164
Length 2


0249
Pump 104 Motor Winding Temp F
#I65TI104F
COP
Copy File
Source #F8:45
Dest #N32:166
Length 2
0250
Pump 104 Bearing Temp G
#I65TI104G
COP
Copy File
Source #F8:46
Dest #N32:168
Length 2
0251
Pump 104 Bearing Temp H
#I65TI104H
COP
Copy File
Source #F8:47
Dest #N32:170
Length 2
0252
Pump 104 Upper Bearing Vibration
#I65VI104A
COP
Copy File
Source #F8:54
Dest #N32:172
Length 2
0253
Pump 104 Lower Bearing Vibration
#I65VI104B
COP
Copy File
Source #F8:55
Dest #N32:174
Length 2
0254
Force Main Discharge Pressure
#I65PI401
COP
Copy File
Source #F8:11
Dest #N32:176
Length 2
0255
Hypo Caustic Flow To Vessel #1
#I65FI402
COP
Copy File
Source #F8:13
Dest #N32:178
Length 2
0256
Hypo Caustic Flow To Vessel #2
#I65FI403
COP
Copy File
Source #F8:14
Dest #N32:180
Length 2

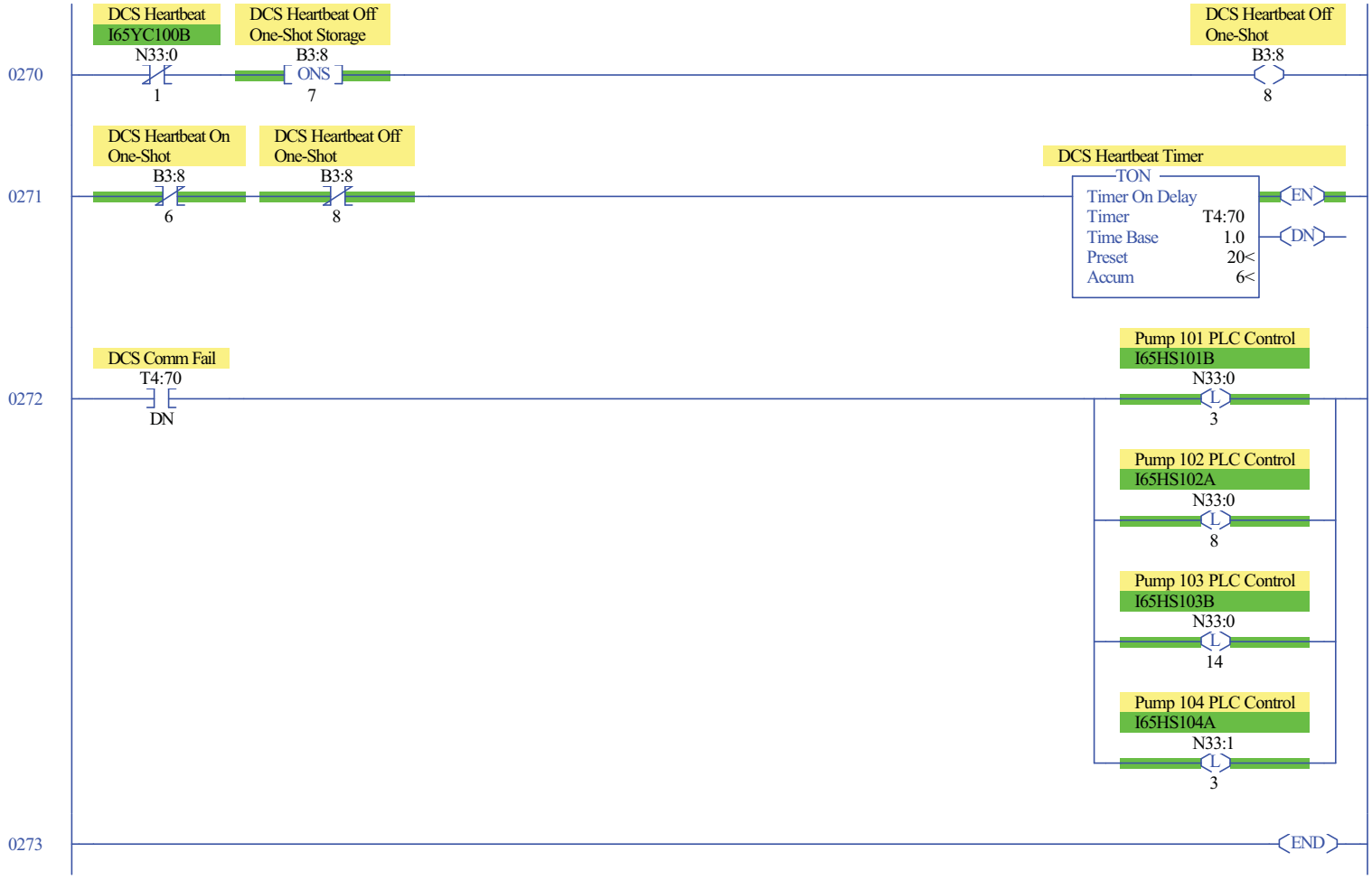

Force Main Discharge Flow Rate
#I65FI601
0257
COP
Copy File
Source #F8:10
Dest #N32:182
Length 2
Current Force Main Totalized Flow
#I65FQI601A
0258
COP
Copy File
Source #F8:61
Dest #N32:184
Length 2
Previous Force Main Totalized Flow
#I65FQI601B
0259
COP
Copy File
Source #F8:62
Dest #N32:186
Length 2
This rung reads data from the Prosoft module and copies it into the appropriate data file. Refer to the Prosoft manual for a complete description of operation.
0260
COP
Copy File
Source #F8:63
Dest #N32:188
Length 2
This rung writes data to the Prosoft module for transfer to the DCS.
0261
COP
Copy File
Source #F8:64
Dest #N32:190
Length 2
These rungs check for DCS communications failure.
0262
COP
Copy File
Source #F8:65
Dest #N32:192
Length 2
0263
COP
Copy File
Source #F8:66
Dest #N32:194
Length 2
0264
COP
Copy File
Source #F8:67
Dest #N32:196
Length 2
Bleach Level 0-8ft
0265
COP
Copy File
Source #F8:69
Dest #N32:200
Length 2
If DCS communication fails, all pumps are placed into PLC automatic control mode.
0266
COP
Copy File
Source #F8:68
Dest #N32:198
Length 2

LAD 23 - DCS COMM --- Total Rungs in File = 274

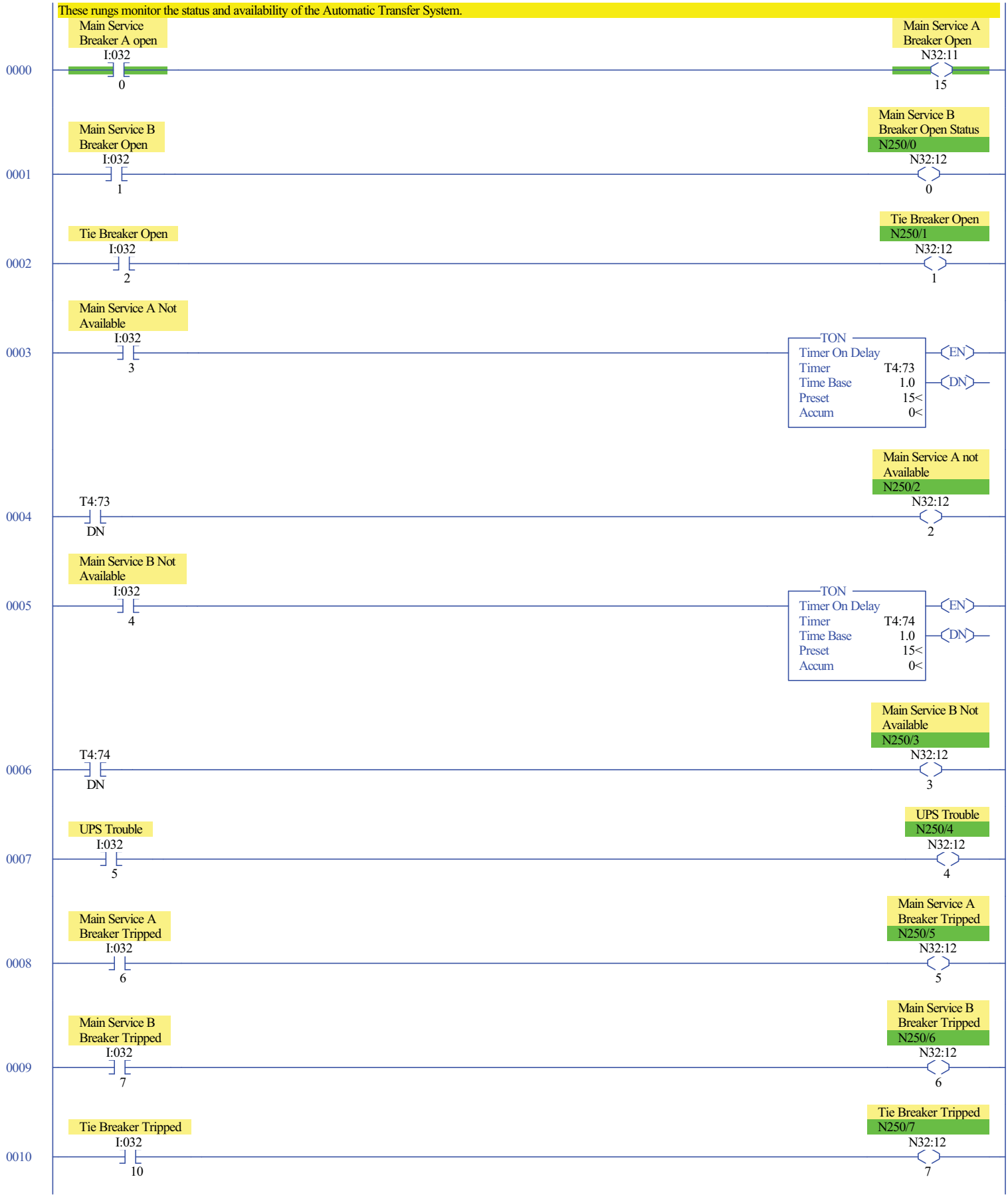



DCS Comm Module BTW Block ID
EQU
Equal
Source A N31:0 0<
Source B 1 1<
DCS Comm Module BTW Data Block
COP
Copy File
Source #N32:50
Dest #N31:1
Length 50
DCS Comm Module BTW Block ID
EQU
Equal
Source A N31:0 0<
Source B 2 2<
DCS Comm Module BTW Data Block
COP
Copy File
Source #N32:100
Dest #N31:1
Length 50
DCS Comm Module BTW Block ID
EQU
Equal
Source A N31:0 0<
Source B 3 3<
DCS Comm Module BTW Data Block
COP
Copy File
Source #N32:150
Dest #N31:1
Length 50
DCS Comm Module BTW Block ID
EQU
Equal
Source A N31:0 0<
Source B 4 4<
DCS Comm Module BTW Data Block
COP
Copy File
Source #N32:200
Dest #N31:1
Length 50
DCS Comm Module BTW Block ID
EQU
Equal
Source A N31:0 0<
Source B 255 255<
DCS Comm Module BTW Data Block
COP
Copy File
Source #N29:0
Dest #N31:1
Length 40
BTW
Block Transfer Write
Module Type Generic Block Transfer
Rack 002
Group 6
Module 0
Control Block BT9:16
Data File N31:0
Length 64
Continuous No
Setup Screen
EN
DN
ER
0269
DCS Heartbeat I65YC100B N33:0 1
DCS Heartbeat On One-Shot Storage B3:8 ONS 5
DCS Heartbeat On One-Shot B3:8 6

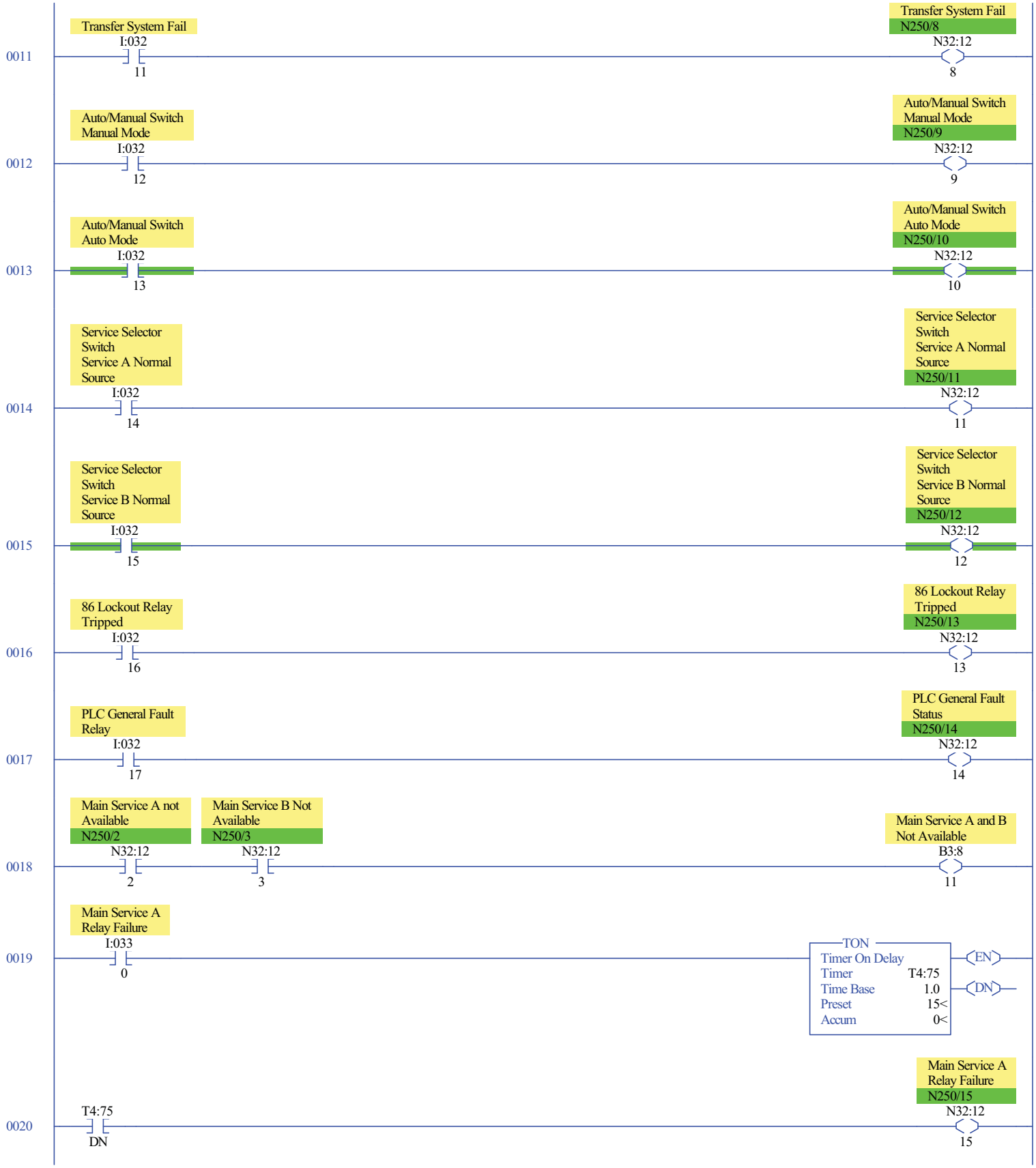
LAD 23 - DCS COMM --- Total Rungs in File = 274



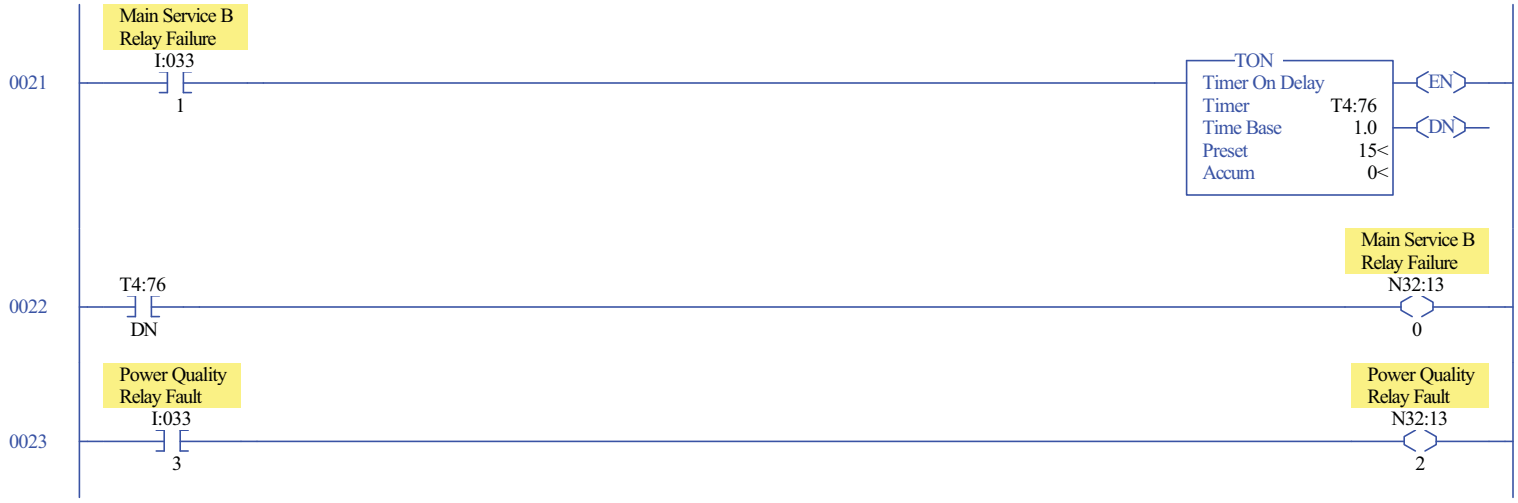
LAD 24 - ATS - Automatic Transfer System --- Total Rungs in File = 30



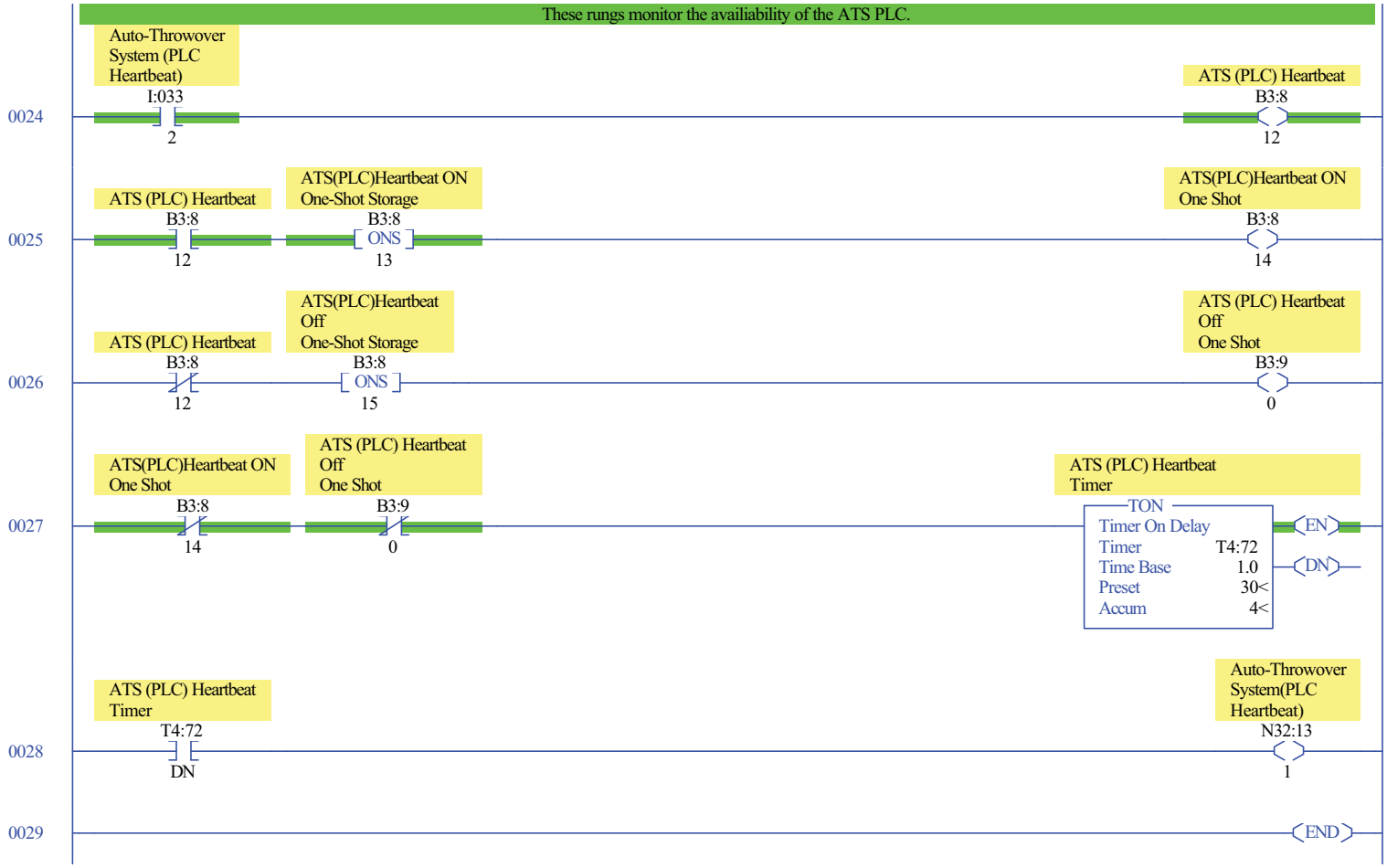
LAD 24 - ATS - Automatic Transfer System --- Total Rungs in File = 30



LAD 24 - ATS - Automatic Transfer System --- Total Rungs in File = 30



LAD 24 - ATS - Automatic Transfer System --- Total Rungs in File = 30



File O0 (bin) -- OUTPUT

Offset	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0	(Symbol) Description
O:000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Copy Outputs From BCM Read Buffer To Memory
O:011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
O:012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:063	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:071	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:074	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Offset	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0	(Symbol) Description
O:106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:164	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:167	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:172	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:173	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:174	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:176	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O:177	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

File I1 (bin) -- INPUT

Offset	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0	(Symbol) Description
I:000	0	0	1	0	1	1	1	0	0	0	1	0	0	0	0	1	
I:001	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	
I:002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:003	1	1	0	1	0	1	1	0	1	0	0	1	0	0	1	0	
I:004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:005	1	0	0	0	1	1	1	0	0	1	1	0	0	1	0	1	
I:006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:007	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
I:010	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
I:011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:012	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
I:013	1	1	0	1	0	0	1	0	1	0	0	1	0	1	0	0	
I:014	0	1	0	1	1	0	0	1	0	1	0	0	0	1	0	0	
I:015	1	0	0	0	1	1	0	0	0	1	1	0	0	1	0	1	
I:016	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
I:017	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
I:020	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	0	
I:021	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	
I:022	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	
I:023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:025	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
I:026	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	
I:027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:032	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	
I:033	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
I:034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:063	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:071	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:074	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

File I1 (bin) -- INPUT

Offset	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0	(Symbol) Description
I:106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:164	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:167	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:172	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:173	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:174	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:176	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I:177	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Main

```
First Pass S:1/15 = No                                  MM / DD / YYYY
Index Register S:24 = 0                  Date S:20-18 = 9 / 20 / 1
IO Status S:16 = 36
VME Status File S:15 = 0                                HH : MM : SS
IO Adapter Image S:25 = 0                Time S:21-23 = 12 : 45 : 5
Processor Checksum S:57 = 64FBh
Checksum Computed S:1/13 = Yes
Max Overall Scan time [ms] S:9 = 27
Last Overall Scan Time [ms] S:8 = 11
```

MCP

MCP	Program File	Disable S:79	Skip I/O Update S:78	MCP	Program File	Disable S:79	Skip I/O Update S:78
A	S:80 = 2	/8 = 0	/8 = 0	I	S:104 = 0	/0 = 0	/0 = 0
B	S:83 = 0	/9 = 0	/9 = 0	J	S:107 = 0	/1 = 0	/1 = 0
C	S:86 = 0	/10 = 0	/10 = 0	K	S:110 = 0	/2 = 0	/2 = 0
D	S:89 = 0	/11 = 0	/11 = 0	L	S:113 = 0	/3 = 0	/3 = 0
E	S:92 = 0	/12 = 0	/12 = 0	M	S:116 = 0	/4 = 0	/4 = 0
F	S:95 = 0	/13 = 0	/13 = 0	N	S:119 = 0	/5 = 0	/5 = 0
G	S:98 = 0	/14 = 0	/14 = 0	O	S:122 = 0	/6 = 0	/6 = 0
H	S:101 = 0	/15 = 0	/15 = 0	P	S:125 = 0	/7 = 0	/7 = 0

Scan Times

		Max Scan - Last Scan[ms]				Max Scan - Last Scan[ms]	
Overall	S:9-8 =	27	11				
MCP				MCP			
A	S:82-81 =	27	11	I	S:106-105 =	0	0
B	S:85-84 =	0	0	J	S:109-108 =	0	0
C	S:88-87 -	0	0	K	S:112-111 =	0	0
D	S:91-90 =	0	0	L	S:115-114 =	0	0
E	S:94-93 =	0	0	M	S:118-117 =	0	0
F	S:97-96 =	0	0	N	S:121-120 =	0	0
G	S:100 -99 =	0	0	O	S:124-123 =	0	0
H	S:103-102 =	0	0	P	S:127-126 =	0	0

Math

```
Carry S:0/0 = 0          Arithmetic Overflow S:10/14 = False
Overflow S:0/1 = 0
Zero Bit S:0/2 = 0
Sign Bit S:0/3 = 0
```

Switches

```
DH+ Station Number S:2/0 - S:2/5 = 00
Resident Chassis S:2/7 = Adapter
Addressing Mode S:2/11 - S:2/12 = 1/2 Slot
EEPROM S:2/13 - S:2/14 = Transfer On Bad Ram
Memory Protected S:2/15 = No
```

Errors

```
Rung Number Where Fault Occured S:14 = 0          Major Error Flags S:11 0000-0000-0000-0000
File Number Where Fault Occured S:13 = 0
Watchdog Setpoint [x1 ms] S:28 = 500              Major Error Code Description S:12
Proc Warninge S:29 = 0
Major Error Code S:12 = 0
EEPROM Burn
Transferred S:10/3 = False
Too Small, Failed S:10/8 = False

Battery Low or Missing
Main S:10/0 = False
Memory Cartridge S:10/6 = False
```

Prog Warning

```
MCP                                     Execution
Not Allowed S:10/10 = False             ASCII Instruction error S:17/8 = False
Not Configured S:10/9 = False           Arithmetic Overflow S:10/14 = False

SFC                                     STI
Action Overlap S:10/15 = False          STI Overlap S10/2 = False
Edits Prevent Continuing S:10/4 = False
                                        Block Transfer
PII                                     No More Command Blocks exist S:10/7 = False
Word not in Local rack S:10/11 = False
No Command Blocks S:10/13  = False
User Routine Overlap S:10/12 = False
```

Channel Warn

```
Channels                                        IO
                                                Invalid I/O Status File S:10/5 = False
No Serial Modem Present S:17/5 = False          Local/Remote IO S:17/0 = False
DF1 Master Control List Error S:17/10 = False   RIO rack is in local rack table S:17/6  = False
1A Queue Full S:17/1 = False
1B Queue Full S:17/2 = False                    DH+
2A Queue Full S:17/3 = False                    Duplicate Node Address S:17/9 = True
2B Queue Full S:17/4 = False                    DH+ Table Changed S:10/1 = True
```

STI

```
Setpoint [ms] S:30 = 1000          Warning
File Number S:31 = 17              STI Overlap S10/2 = False
Last Scan Time S:53 = 1
Macimum Scan Time S:54 = 2
```

PII

```
Preset S:50 = 0                          Word not in Local rack S:10/11 = False
Events Since Last Interrupt S:52 = 0     No Command Blocks S:10/13  = False
File Number S:46 = 0                     User Routine Overlap S:10/12 = False
Module Group S:47 = 00
Bit Mask S:48 = 0
Compare Value S:49 = 0
PII Changed Bits S:51 = 0000-0000-0000-0000
Last Scan Time [x 1ms] S:55 = 0
```

Forces

```
Forces Enabled S:1/8 = No
Forces Installed S:1/9 = Yes
```

Rack

```
Rack #              17     10               7      0

Queue Full     S:32H=00000000           S:7H=00000000
Fault          S:32L=00000000           S:7L=00000000
Reset          S:33H=00000000           S:27H=00000000
Inhibit        S:33L=00000000           S:27L=00000000
```

Comms

```
Communications Time Slice [ms] S:77= 0
Active Nodes (Octal): S:3 - S:6

0        10       20      30
10000000 00000000 00000000 00000000
40       50       60      70
00000000 00000000 00000000 00000001
```

Control

```
Rack to start at S:26/2= 0
Complimentary I/O S:26/3= Disabled
Block Transfer S:26/4= Normal
Adapter Mode S:26/5= Normal
Diagnostic S:26/7= Normal
SFC Restart/Continue S:26/0 = False
Start-up protection after power loss S:26/1 = False
Run Mode Memory Protection S:26/6 = False
```

File B3 (bin) -- BINARY

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol) Description
B3:0	0	0	0	1	1	1	1	1	1	0	0	0	1	0	0	0	Copy Storage Bits From BCM Read Buffer To Memory
B3:1	1	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	
B3:2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B3:3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B3:4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B3:5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B3:6	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	
B3:7	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	
B3:8	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	
B3:9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Offset	EN	TT	DN	BASE	PRE	ACC	(Symbol) Description
T4:0	1	0	1	.01 sec	50	50	BCM Initial Start-Up Delay Timer
T4:1	0	0	0	1.0 sec	60	0	Pump 101 Off Timer
T4:2	1	0	1	1.0 sec	60	60	Pump 102 Off Timer
T4:3	1	0	1	1.0 sec	60	60	Pump 103 Off Timer
T4:4	1	0	1	1.0 sec	60	60	Pump 104 Off Timer
T4:5	1	1	0	1.0 sec	60	19	60 Second Timer
T4:6	1	0	1	1.0 sec	15	15	Pump Start Minimum Interval Timer
T4:7	1	0	1	1.0 sec	15	15	Pump Stop Minimum Interval Timer
T4:8	1	0	1	1.0 sec	5	5	Pump 101 Start Response Timer
T4:9	0	0	0	1.0 sec	5	0	Pump 101 Stop Response Timer
T4:10	0	0	0	1.0 sec	10	0	Pump 101 Upper Bearing High Vibration Timer
T4:11	0	0	0	1.0 sec	10	0	Pump 101 Upper Bearing High-High Vibration Timer
T4:12	0	0	0	1.0 sec	10	0	Pump 101 Lower Bearing High Vibration Timer
T4:13	0	0	0	1.0 sec	10	0	Pump 101 Lower Bearing High-High Vibration Timer
T4:14	0	0	0	1.0 sec	10	0	Pump 101 Low Suction Pressure Timer
T4:15	0	0	0	1.0 sec	10	0	Pump 101 Low-Low Suction Pressure Timer
T4:16	0	0	0	1.0 sec	10	0	Pump 101 High Discharge Pressure Timer
T4:17	0	0	0	1.0 sec	10	0	Pump 101 High-High Discharge Pressure Timer
T4:18	0	0	0	1.0 sec	30	0	Pump 101 Discharge Valve Fail To Open Timer
T4:19	0	0	0	1.0 sec	30	0	Pump 101 Discharge Valve Fail To Close Timer
T4:20	0	0	0	1.0 sec	20	0	Pump 101 Seal Water Low Flow Timer
T4:21	1	1	0	1.0 sec	3600	2591	Pump 101 Hour Run Timer
T4:22	0	0	0	1.0 sec	5	0	Pump 102 Start Response Timer
T4:23	1	0	1	1.0 sec	5	5	Pump 102 Stop Response Timer
T4:24	0	0	0	1.0 sec	10	0	Pump 102 Upper Bearing High Vibration Timer
T4:25	0	0	0	1.0 sec	10	0	Pump 102 Upper Bearing High-High Vibration Timer
T4:26	0	0	0	1.0 sec	10	0	Pump 102 Lower Bearing High Vibration Timer
T4:27	0	0	0	1.0 sec	10	0	Pump 102 Lower Bearing High-High Vibration Timer
T4:28	0	0	0	1.0 sec	10	0	Pump 102 Low Suction Pressure Timer
T4:29	0	0	0	1.0 sec	10	0	Pump 102 Low-Low Suction Pressure Timer
T4:30	0	0	0	1.0 sec	10	0	Pump 102 High Discharge Pressure Timer
T4:31	0	0	0	1.0 sec	10	0	Pump 102 High-High Discharge Pressure Timer
T4:32	0	0	0	1.0 sec	30	0	Pump 102 Discharge Valve Fail To Open Timer
T4:33	0	0	0	1.0 sec	30	0	Pump 102 Discharge Valve Fail To Close Timer
T4:34	0	0	0	1.0 sec	20	0	Pump 102 Seal Water Low Flow Timer
T4:35	0	0	0	1.0 sec	3600	2577	Pump 102 Hour Run Timer
T4:36	0	0	0	1.0 sec	5	0	Pump 103 Start Response Timer
T4:37	1	0	1	1.0 sec	5	5	Pump 103 Stop Response Timer
T4:38	0	0	0	1.0 sec	10	0	Pump 103 Upper Bearing High Vibration Timer
T4:39	0	0	0	1.0 sec	10	0	Pump 103 Upper Bearing High-High Vibration Timer
T4:40	0	0	0	1.0 sec	10	0	Pump 103 Lower Bearing High Vibration Timer
T4:41	0	0	0	1.0 sec	10	0	Pump 103 Lower Bearing High-High Vibration Timer
T4:42	0	0	0	1.0 sec	10	0	Pump 103 Low Suction Pressure Timer
T4:43	0	0	0	1.0 sec	10	0	Pump 103 Low-Low Suction Pressure Timer
T4:44	0	0	0	1.0 sec	10	0	Pump 103 High Discharge Pressure Timer
T4:45	0	0	0	1.0 sec	10	0	Pump 103 High-High Discharge Pressure Timer
T4:46	0	0	0	1.0 sec	30	0	Pump 103 Discharge Valve Fail To Open Timer
T4:47	0	0	0	1.0 sec	30	0	Pump 103 Discharge Valve Fail To Close Timer
T4:48	0	0	0	1.0 sec	20	0	Pump 103 Seal Water Low Flow Timer
T4:49	0	0	0	1.0 sec	3600	2339	Pump 103 Hour Run Timer
T4:50	0	0	0	1.0 sec	5	0	Pump 104 Start Response Timer
T4:51	1	0	1	1.0 sec	5	5	Pump 104 Stop Response Timer
T4:52	0	0	0	1.0 sec	10	0	Pump 104 Upper Bearing High Vibration Timer
T4:53	0	0	0	1.0 sec	10	0	Pump 104 Upper Bearing High-High Vibration Timer
T4:54	0	0	0	1.0 sec	10	0	Pump 104 Lower Bearing High Vibration Timer
T4:55	0	0	0	1.0 sec	10	0	Pump 104 Lower Bearing High-High Vibration Timer
T4:56	0	0	0	1.0 sec	10	0	Pump 104 Low Suction Pressure Timer
T4:57	0	0	0	1.0 sec	10	0	Pump 104 Low-Low Suction Pressure Timer
T4:58	0	0	0	1.0 sec	10	0	Pump 104 High Discharge Pressure Timer
T4:59	0	0	0	1.0 sec	10	0	Pump 104 High-High Discharge Pressure Timer
T4:60	0	0	0	1.0 sec	30	0	Pump 104 Discharge Valve Fail To Open Timer
T4:61	0	0	0	1.0 sec	30	0	Pump 104 Discharge Valve Fail To Close Timer
T4:62	0	0	0	1.0 sec	20	0	Pump 104 Seal Water Low Flow Timer
T4:63	0	0	0	1.0 sec	3600	3151	Pump 104 Hour Run Timer
T4:64	0	0	0	1.0 sec	1200	0	Hydropneumatic Tank T-301 Low Pressure Timer
T4:65	0	0	0	1.0 sec	390	0	Slide Gate G-211 Response Timer
T4:66	0	0	0	1.0 sec	390	0	Slide Gate G-212 Response Timer
T4:67	0	0	0	1.0 sec	390	0	Slide Gate G-213 Response Timer
T4:68	0	0	0	1.0 sec	390	0	Sluice Gate G-232 Response Timer
T4:69	0	0	0	1.0 sec	390	0	Plug Valve V-141 Response Timer

Offset	EN	TT	DN	BASE	PRE	ACC	(Symbol) Description
T4:70	1	1	0	1.0 sec	20	6	DCS Heartbeat Timer
T4:71	0	0	0	.01 sec	50	50	Sluice Gate G-232 Stop Timer
T4:72	1	1	0	1.0 sec	30	4	ATS (PLC) Heartbeat Timer
T4:73	0	0	0	1.0 sec	15	0	
T4:74	0	0	0	1.0 sec	15	0	
T4:75	0	0	0	1.0 sec	15	0	
T4:76	0	0	0	1.0 sec	15	0	
T4:77	0	0	0	.01 sec	0	0	
T4:78	0	0	1	.01 sec	7	34	
T4:79	0	0	0	.01 sec	7	3	
T4:80	0	0	0	.01 sec	5	1	
T4:81	0	0	0	.01 sec	5	1	
T4:82	0	0	0	.01 sec	1	0	
T4:83	0	0	0	.01 sec	-1025	877	
T4:84	0	0	0	1.0 sec	2542	1342	
T4:85	0	0	0	.01 sec	2080	271	
T4:86	0	0	0	.01 sec	0	0	
T4:87	0	0	0	.01 sec	18	0	
T4:88	0	0	0	.01 sec	1158	-1024	
T4:89	0	0	0	1.0 sec	1024	-1023	
T4:90	0	0	0	.01 sec	2255	2383	
T4:91	0	0	0	.01 sec	0	0	
T4:92	0	0	0	.01 sec	56	56	
T4:93	0	0	0	.01 sec	55	55	
T4:94	0	0	0	.01 sec	41	33	
T4:95	0	0	0	.01 sec	33	32	
T4:96	0	0	0	.01 sec	32	25	
T4:97	0	0	0	.01 sec	28	27	
T4:98	0	0	0	.01 sec	27	27	
T4:99	0	0	0	.01 sec	24	27	
T4:100	0	0	0	.01 sec	23	22	
T4:101	0	0	0	.01 sec	21	22	
T4:102	0	0	0	.01 sec	21	0	
T4:103	0	0	0	.01 sec	0	0	
T4:104	0	0	0	.01 sec	0	0	
T4:105	0	0	0	.01 sec	-4	0	
T4:106	0	0	0	.01 sec	0	0	
T4:107	0	0	0	.01 sec	0	0	
T4:108	0	0	0	.01 sec	0	0	
T4:109	0	0	0	.01 sec	0	0	
T4:110	0	0	0	.01 sec	0	0	
T4:111	0	0	0	.01 sec	0	0	
T4:112	1	1	1	1.0 sec	17229	14157	
T4:113	0	0	1	1.0 sec	12336	13104	
T4:114	0	0	1	1.0 sec	14130	12592	
T4:115	1	1	1	.01 sec	14929	-20617	
T4:116	1	1	1	.01 sec	1692	0	
T4:117	0	0	0	.01 sec	0	0	
T4:118	0	0	0	.01 sec	0	0	
T4:119	0	0	0	.01 sec	0	-20385	
T4:120	1	0	1	.01 sec	-20407	0	
T4:121	0	0	0	.01 sec	2	2	
T4:122	0	0	0	.01 sec	-1	-1	
T4:123	0	0	0	.01 sec	0	0	
T4:124	0	0	0	.01 sec	0	0	
T4:125	0	0	0	.01 sec	16384	0	
T4:126	0	0	0	.01 sec	22	24651	
T4:127	0	0	1	.01 sec	-32768	1208	
T4:128	0	0	0	.01 sec	1182	4	
T4:129	0	0	0	.01 sec	4	4	
T4:130	1	0	0	.01 sec	-32768	1160	
T4:131	0	0	0	.01 sec	2177	2248	
T4:132	0	1	1	.01 sec	8	768	
T4:133	0	0	0	.01 sec	0	0	
T4:134	0	0	0	.01 sec	0	0	
T4:135	0	0	0	.01 sec	0	0	
T4:136	0	0	0	.01 sec	0	0	
T4:137	0	0	0	.01 sec	0	0	
T4:138	0	0	0	.01 sec	0	0	
T4:139	0	0	0	.01 sec	0	0	

Offset	EN	TT	DN	BASE	PRE	ACC	(Symbol) Description
T4:140	0	0	0	.01 sec	0	0	
T4:141	0	0	0	.01 sec	0	0	
T4:142	0	0	0	.01 sec	0	0	
T4:143	0	0	0	.01 sec	0	0	
T4:144	0	0	0	.01 sec	0	0	
T4:145	0	0	0	.01 sec	0	0	
T4:146	0	0	0	.01 sec	0	0	
T4:147	0	0	0	.01 sec	0	0	
T4:148	0	0	0	.01 sec	0	16601	
T4:149	1	0	0	.01 sec	16409	-26214	
T4:150	0	1	0	.01 sec	-13107	16448	
T4:151	0	0	0	.01 sec	16633	-26214	
T4:152	0	1	0	.01 sec	-26214	16646	
T4:153	0	1	1	1.0 sec	16435	13107	
T4:154	0	0	0	.01 sec	0	0	
T4:155	0	0	0	.01 sec	0	0	
T4:156	0	0	0	.01 sec	0	0	
T4:157	0	0	0	.01 sec	0	0	
T4:158	0	0	0	.01 sec	0	0	
T4:159	0	0	0	.01 sec	0	0	
T4:160	0	0	0	.01 sec	0	0	
T4:161	0	0	0	.01 sec	0	0	
T4:162	0	0	0	.01 sec	0	0	
T4:163	0	0	0	.01 sec	0	0	
T4:164	0	0	0	.01 sec	0	0	
T4:165	0	0	0	.01 sec	0	1280	
T4:166	0	0	0	.01 sec	0	4095	
T4:167	0	0	0	.01 sec	4095	0	
T4:168	0	0	0	1.0 sec	0	4095	
T4:169	0	0	0	.01 sec	4095	0	
T4:170	0	0	0	1.0 sec	0	4095	
T4:171	0	0	0	.01 sec	4095	0	
T4:172	0	0	0	.01 sec	224	0	
T4:173	0	0	0	.01 sec	1	122	
T4:174	0	0	0	.01 sec	1460	3680	
T4:175	1	1	1	.01 sec	-1024	-1024	
T4:176	0	0	0	.01 sec	0	0	
T4:177	0	0	0	.01 sec	0	0	
T4:178	0	0	0	.01 sec	0	0	
T4:179	0	0	0	.01 sec	0	0	
T4:180	0	0	0	.01 sec	0	0	
T4:181	0	0	0	.01 sec	0	0	
T4:182	0	0	0	.01 sec	0	0	
T4:183	0	0	0	.01 sec	0	0	
T4:184	0	0	0	.01 sec	0	0	
T4:185	0	0	0	.01 sec	0	0	
T4:186	0	0	0	.01 sec	0	0	
T4:187	0	0	0	.01 sec	0	0	
T4:188	0	0	0	.01 sec	0	0	
T4:189	0	0	0	.01 sec	0	0	
T4:190	0	0	0	.01 sec	0	0	
T4:191	0	0	0	.01 sec	0	0	
T4:192	0	0	0	.01 sec	0	0	
T4:193	0	0	0	.01 sec	0	0	
T4:194	0	0	0	.01 sec	0	0	
T4:195	0	0	0	.01 sec	0	0	
T4:196	0	0	0	.01 sec	0	0	
T4:197	0	0	0	.01 sec	0	0	
T4:198	0	0	0	.01 sec	0	0	
T4:199	0	0	0	.01 sec	0	0	
T4:200	0	0	0	.01 sec	0	0	
T4:201	0	0	0	.01 sec	0	0	
T4:202	0	0	0	.01 sec	0	0	
T4:203	0	0	0	.01 sec	0	0	
T4:204	0	0	0	.01 sec	0	0	
T4:205	0	0	0	.01 sec	0	0	
T4:206	0	0	0	.01 sec	0	0	
T4:207	0	0	0	.01 sec	0	0	
T4:208	0	0	0	.01 sec	0	0	
T4:209	0	0	0	.01 sec	0	0	

Offset	EN	TT	DN	BASE	PRE	ACC	(Symbol) Description
T4:210	0	0	0	.01 sec	0	0	
T4:211	0	0	0	.01 sec	0	0	
T4:212	0	0	0	.01 sec	0	0	
T4:213	0	0	0	.01 sec	0	0	
T4:214	0	0	0	.01 sec	0	0	
T4:215	0	0	0	.01 sec	0	0	
T4:216	0	0	0	.01 sec	0	0	
T4:217	0	0	0	.01 sec	0	0	
T4:218	0	0	0	.01 sec	0	0	
T4:219	0	0	0	.01 sec	0	0	
T4:220	0	0	0	.01 sec	0	0	
T4:221	0	0	0	.01 sec	0	0	
T4:222	0	0	0	.01 sec	0	0	
T4:223	0	0	0	.01 sec	0	0	
T4:224	0	0	0	.01 sec	0	0	
T4:225	0	0	0	.01 sec	0	0	
T4:226	0	0	0	.01 sec	0	0	
T4:227	0	0	0	.01 sec	0	0	
T4:228	0	0	0	.01 sec	0	0	
T4:229	0	0	0	.01 sec	0	0	
T4:230	0	0	0	.01 sec	0	0	
T4:231	0	0	0	.01 sec	0	0	

File C5 -- COUNTER

Offset	CU	CD	DN	OV	UN	PRE	ACC	(Symbol) Description
C5:0	0	0	1	0	0	7	49	Pump 101 Start Counter
C5:1	0	0	0	0	0	7	5	Pump 102 Start Counter
C5:2	0	0	0	0	0	5	2	Pump 103 Start Counter
C5:3	0	0	0	0	0	5	2	Pump 104 Start Counter
C5:4	0	0	0	0	0	1	0	
C5:5	0	0	0	0	0	-1025	877	
C5:6	0	0	0	0	0	2542	1342	
C5:7	0	0	0	0	0	2080	271	
C5:8	0	0	0	0	0	0	0	
C5:9	0	0	0	0	0	18	0	
C5:10	0	0	0	0	0	1158	-1024	
C5:11	0	0	0	0	0	1024	-1023	

Offset	EN	EU	DN	EM	ER	UL	IN	FD	LEN	POS	(Symbol) Description
R6:0	1	0	0	0	0	0	0	0	32	0	Multilin Temp Conversion Control Block
R6:1	0	0	0	0	0	0	0	0	61	0	Pump 101 Maximum Start Shift Register Control Block
R6:2	0	0	0	0	0	0	0	0	61	0	Pump 102 Maximum Start Shift Register Control Block
R6:3	0	0	0	0	0	0	0	0	61	0	Pump 103 Maximum Start Shift Register Control Block
R6:4	0	0	0	0	0	0	0	0	61	0	Pump 104 Maximum Start Shift Register Control Block

File N7 (dec) -- INTEGER

Offset	0	1	2	3	4	5	6	7	8	9
N7:0	11	0	0	6	372					

File F8 -- FLOAT

Offset	0	1	2	3	4
F8:0	6.206349	32.71795	2.575092	13.17216	5.582417
F8:5	3.428571	7.483517	3.897436	5.179487	-2.500611
F8:10	5738.706	21.5873	0	0.4981685	0.557265
F8:15	8.294018	136.4	138.2	136.4	141.8
F8:20	134.6	134.6	82.39999	87.8	87.8
F8:25	87.8	89.6	87.8	87.8	87.8
F8:30	69.8	71.6	66.2	64.39999	66.2
F8:35	69.8	68	68	64.39999	64.39999
F8:40	69.8	69.8	69.8	71.6	69.8
F8:45	69.8	69.8	68	0.02	0.068
F8:50	0.006	0.002	0.002	0.002	0
F8:55	0	16433	21225	736	780
F8:60	8956.314	2.909998	6.010043	0.02442003	-0.5372406
F8:65	6.206349	5.944811	6.388278	-0.5372406	6.384371

File BT9 -- BLK XFER

Offset	EN	ST	DN	ER	CO	EW	NR	TO	RW	RLEN	DLEN	FILE	ELEM	R G S	(Symbol) Description
BT9:0	1	1	1	0	0	1	0	0	1	0	2	10	1	00 0 0	
BT9:1	0	1	1	0	0	1	1	0	0	0	64	11	1	00 0 0	
BT9:2	0	0	1	0	0	0	0	0	0	37	37	15	0	01 6 0	Analog Input 160 Block Transfer Write Control
BT9:3	1	1	0	0	0	1	0	0	1	15	15	16	0	01 6 0	Analog Input 160 Block Transfer Read Control B
BT9:4	0	0	1	0	0	0	0	0	0	37	37	17	0	01 7 0	Analog Input 170 Block Transfer Write Control
BT9:5	1	1	0	0	0	1	0	0	1	15	15	18	0	01 7 0	Analog Input 170 Block Transfer Read Control B
BT9:6	0	0	0	0	0	0	0	0	0	0	0	0	0	00 0 0	
BT9:7	0	0	0	0	0	0	0	0	0	0	0	0	0	00 0 0	
BT9:8	0	0	0	0	0	0	0	0	0	0	0	0	0	00 0 0	
BT9:9	0	0	0	0	0	0	0	0	0	0	0	0	0	00 0 0	
BT9:10	0	0	1	0	0	0	0	0	1	64	64	19	0	02 1 0	Multilin Comm Module Block Transfer Read Contr
BT9:11	1	1	0	0	0	1	0	0	0	64	64	22	0	02 1 0	Multilin Comm Module Block Transfer Write Cont
BT9:12	1	1	0	0	0	1	0	0	1	20	20	24	0	02 2 0	Bently Nevada BTR Control Block
BT9:13	0	0	1	0	0	0	0	0	0	29	29	25	0	02 2 0	Bently Nevada Monitor 1 BTW Control Block
BT9:14	0	0	1	0	0	0	0	0	0	29	29	26	0	02 2 0	Bently Nevada Monitor 2 BTW Control Block
BT9:15	0	0	1	0	0	0	0	0	1	64	64	30	0	02 6 0	DCS Comm Module BTR Control Block
BT9:16	0	0	1	0	0	0	0	0	0	64	64	31	0	02 6 0	
BT9:17	0	0	1	0	0	0	0	0	0	37	37	37	0	02 5 0	
BT9:18	1	1	0	0	0	1	0	0	1	15	15	38	0	02 5 0	

File N10 (dec) -- BCM READ

Offset	0	1	2	3	4	5	6	7	8	9
N10:0	1	-32704	10	1	0	0	-1025	877	729	2542
N10:10	1341	310	2080	271	0	0	0	2	18	0
N10:20	0	1158	-1024	1678	1024	-1023	2507	2251	2383	0
N10:30	0	0	55	56	56	59	55	55	31	41
N10:40	33	33	33	32	32	32	25	27	28	27
N10:50	28	27	27	28	24	27	22	23	22	23
N10:60	21	22	21	21	0					

File N11 (dec) -- BCM WRITE

Offset	0	1	2	3	4	5	6	7	8	9
N11:0	11	11	11	0	0	1280	0	0	4095	0
N11:10	4095	0	4095	0	4095	0	4095	0	4095	0
N11:20	4095	0	4095	0	2	226	0	0	0	-22
N11:30	1495	1432	3270	-1024	-1024	-1024	0	0	0	0
N11:40	0	0	0	0	0	0	0	0	0	0
N11:50	0	0	0	0	0	0	0	0	0	0
N11:60	0	0	0	0	0					

Offset	0	1	2	3	4	5	6	7	8	9
N12:0	11809	-2560	0	0	0	0	0	0	1024	0
N12:10	-24568	-10604	22884	-29083	33	33	2730	37	33	0
N12:20	0	33	37	0	0	0	10241	0	0	0
N12:30	0	0	1	0	8072	-24312	0	0	0	-32768
N12:40	8256	8208	12416	0	8192	0	0	0	0	0
N12:50	0	0	0	0	0	0	0	0	0	0
N12:60	0	0	0	0	0	0	2	0	0	0
N12:70	0	0	0	0	0	0	0	0	0	0
N12:80	0	0	0	0	0	0	0	0	0	0
N12:90	0	0	0	0	0	0	0	0	0	0
N12:100	0	0	0	0	0	0	0	0	0	0
N12:110	0	0	0	0	0	0	0	0	0	0
N12:120	0	0	0	0	0	0	0	0	685	60
N12:130	0	-23859	60	60	-23859	60	60	-23859	60	60
N12:140	-15694	60	20	-23859	15	15	-23859	15	15	-23859
N12:150	5	5	672	5	0	639	10	0	624	10
N12:160	0	695	10	0	537	10	0	598	10	0
N12:170	753	10	0	563	10	0	576	10	0	574
N12:180	30	0	679	30	0	525	20	0	-15742	3600
N12:190	2591	642	5	0	-23859	5	5	570	10	0
N12:200	627	10	0	731	10	0	635	10	0	767
N12:210	10	0	767	10	0	592	10	0	592	10
N12:220	0	732	30	0	635	30	0	726	20	0
N12:230	618	3600	2577	533	5	0	-23859	5	5	610
N12:240	10	0	744	10	0	743	10	0	567	10
N12:250	0	668	10	0	621	10	0	539	10	0
N12:260	701	10	0	629	30	0	580	30	0	546
N12:270	20	0	581	3600	2339	765	5	0	-23859	5
N12:280	5	628	10	0	635	10	0	673	10	0
N12:290	604	10	0	523	10	0	523	10	0	728
N12:300	10	0	609	10	0	747	30	0	692	30
N12:310	0	523	20	0	734	3600	3151	701	1200	0
N12:320	737	390	0	522	390	0	726	390	0	674
N12:330	390	0	571	390	0	-15655	20	0	245	50
N12:340	50	-15648	30	0	530	15	0	664	15	0
N12:350	530	15	0	659	15	0	0	0	0	8192
N12:360	7	49	0	7	5	0	5	2	0	5
N12:370	2	2	1	0	0	-1025	2232	702	899	1524
N12:380	235	2044	266	0	0	0	2	18	0	0
N12:390	1414	-1024	1177	883	-1023	2025	2293	2426	0	0
N12:400	0	58	59	58	61	57	57	28	31	31
N12:410	31	32	31	31	31	21	22	19	18	19
N12:420	21	20	20	18	18	21	21	21	22	21
N12:430	21	21	20	0	0	0	0	0	0	0
N12:440	0	-4	0	0	0	0	0	0	0	0
N12:450	0	0	0	0	0	0	0	0	0	0
N12:460	0	1541	17229	14157	11825	12336	13104	12848	14130	12592
N12:470	-20134	423	-20557	-20134	15532	0	0	0	0	0
N12:480	0	0	0	0	24191	24191	24169	0	0	2
N12:490	0	0	-1	-1	0	0	0	0	0	0
N12:500	0	0	0	0	10	32	3	1	1213	1163
N12:510	1163	1167	0	1	2	-32768	-32768	1158	1218	2109
N12:520	2246	16670	8	768	0	0	0	0	0	0
N12:530	0	0	0	0	0	0	0	0	0	0
N12:540	0	0	0	0	0	0	0	0	0	0
N12:550	0	0	0	0	0	0	0	0	0	0
N12:560	0	0	0	0	0	0	0	0	0	0
N12:570	0	16601	-26214	16409	-26214	16620	-13107	16448	0	16633
N12:580	-26214	16409	-26214	16646	26214	16435	13107	0	0	0
N12:590	0	0	0	0	0	0	0	0	0	0
N12:600	0	0	0	0	0	0	0	0	0	0
N12:610	0	0	0	0	0	0	0	0	0	0
N12:620	0	0	1280	0	0	4095	0	4095	0	4095
N12:630	0	4095	0	4095	0	4095	0	4095	0	4095
N12:640	0	2	226	0	0	0	-22	1495	1432	3270
N12:650	-1024	-1024	-1024	0	0	0	0	0	0	0
N12:660	0	0	0	0	0	0	0	0	0	0
N12:670	0	0	0	0	0	0	0	0	0	0
N12:680	0	0	0	0	0	0	0	0	0	0

File N13 (dec) -- BCM STORE

Offset	0	1	2	3	4	5	6	7	8	9
N13:0	11809	-2560	0	0	0	0	0	0	1024	0
N13:10	-24568	-10604	22884	-29083	33	33	2730	37	33	0
N13:20	0	33	37	0	0	0	10241	0	0	0
N13:30	0	0	0	0	4216	-24318	0	256	0	-32768
N13:40	8256	8208	-32640	0	0	0	0	16	0	0
N13:50	0	0	0	0	0	0	0	0	0	0
N13:60	0	0	0	0	0	0	0	128	0	0
N13:70	0	0	0	0	0	0	0	0	0	0
N13:80	0	0	0	0	0	0	0	0	0	0
N13:90	0	0	0	0	0	0	0	0	0	0
N13:100	0	0	0	0	0	0	0	0	0	0
N13:110	0	0	0	0	0	0	0	0	0	0
N13:120	0	0	0	0	0	0	0	0	643	60
N13:130	0	522	60	0	-24026	60	60	-24026	60	60
N13:140	-15638	60	42	-24026	15	15	-24026	15	15	668
N13:150	5	0	610	5	0	639	10	0	624	10
N13:160	0	695	10	0	537	10	0	598	10	0
N13:170	753	10	0	563	10	0	576	10	0	633
N13:180	30	0	671	30	0	525	20	0	-15631	3600
N13:190	3523	684	5	0	559	5	0	570	10	0
N13:200	627	10	0	731	10	0	635	10	0	767
N13:210	10	0	767	10	0	592	10	0	592	10
N13:220	0	691	30	0	720	30	0	726	20	0
N13:230	-15872	3600	1340	526	5	0	529	5	0	610
N13:240	10	0	744	10	0	743	10	0	567	10
N13:250	0	668	10	0	621	10	0	767	10	0
N13:260	701	10	0	519	30	0	557	30	0	724
N13:270	20	0	704	3600	1593	558	5	0	726	5
N13:280	0	628	10	0	635	10	0	673	10	0
N13:290	604	10	0	571	10	0	563	10	0	629
N13:300	10	0	609	10	0	715	30	0	648	30
N13:310	0	571	20	0	528	3600	3090	701	1200	0
N13:320	749	390	0	657	390	0	756	390	0	750
N13:330	390	0	571	390	0	-15666	20	1	38	50
N13:340	50	-15641	30	4	582	15	0	600	15	0
N13:350	582	15	0	661	15	0	0	0	0	8192
N13:360	7	34	0	7	3	0	5	1	0	5
N13:370	1	2	1	0	0	-1025	877	729	2542	1341
N13:380	310	2080	271	0	0	0	2	18	0	0
N13:390	1158	-1024	1678	1024	-1023	2507	2251	2383	0	0
N13:400	0	55	56	56	59	55	55	31	41	33
N13:410	33	33	32	32	32	25	27	28	27	28
N13:420	27	27	28	24	27	22	23	22	23	21
N13:430	22	21	21	0	0	0	0	0	0	0
N13:440	0	-4	0	0	0	0	0	0	0	0
N13:450	0	0	0	0	0	0	0	0	0	0
N13:460	0	-6227	17229	14157	11825	12336	13104	12848	14130	12592
N13:470	-5688	14929	-20617	-5688	1692	0	0	0	0	0
N13:480	0	0	0	0	-20385	-20385	-20407	0	0	2
N13:490	2	2	-1	-1	0	0	0	0	0	0
N13:500	0	16384	0	0	22	24651	8259	-32768	1208	1158
N13:510	1182	4	0	4	4	-32768	-32768	1160	1217	2177
N13:520	2248	24840	8	768	0	0	0	0	0	0
N13:530	0	0	0	0	0	0	0	0	0	0
N13:540	0	0	0	0	0	0	0	0	0	0
N13:550	0	0	0	0	0	0	0	0	0	0
N13:560	0	0	0	0	0	0	0	0	0	0
N13:570	0	16601	-26214	16409	-26214	16620	-13107	16448	0	16633
N13:580	-26214	16409	-26214	16646	26214	16435	13107	0	0	0
N13:590	0	0	0	0	0	0	0	0	0	0
N13:600	0	0	0	0	0	0	0	0	0	0
N13:610	0	0	0	0	0	0	0	0	0	0
N13:620	0	0	1280	0	0	4095	0	4095	0	4095
N13:630	0	4095	0	4095	0	4095	0	4095	0	4095
N13:640	0	2	224	0	0	1	122	1440	1460	3680
N13:650	-1024	-1024	-1024	0	0	0	0	0	0	0
N13:660	0	0	0	0	0	0	0	0	0	0
N13:670	0	0	0	0	0	0	0	0	0	0
N13:680	0	0	0	0	0	0	0	0	0	0
N13:690	0	0	0	0	0	0	0	0	0	0

File N13 (dec) -- BCM STORE

Offset	0	1	2	3	4	5	6	7	8	9
N13:700	0	0	0	0	0	0	0	0	0	0
N13:710	0	0	0	0	0	0	0	0	0	0
N13:720	0	0	0	0	0	0	0	0	0	0
N13:730	0	0	0	0	0	0	0	0	0	0
N13:740	0	0	0	0	0	0	0	0	0	0
N13:750	0	0	0	0	0	0	0	0	0	0
N13:760	0	0	0	0	0	0	0	0	0	0
N13:770	0	0	0	0	0	0	0	0	0	0
N13:780	0	0	0	0	0	0	0	0	0	0
N13:790	0	0	0	0	0	0	0	0	0	0
N13:800	0	0	0	0	0	0	0	0	0	0
N13:810	0	0	0	0	0	0	0	0	0	0
N13:820	0									

Offset	CU	CD	DN	OV	UN	PRE	ACC	(Symbol) Description
C14:0	0	0	0	0	0	999	258	BCM BTR ERROR COUNTER
C14:1	0	0	0	0	0	999	257	BCM BTW ERROR COUNTER
C14:2	0	0	0	0	0	999	406	LOCAL SERIAL COMM ERROR COUNTER
C14:3	0	0	0	0	0	999	0	LOCAL BACKPLANE ERROR COUNTER
C14:4	0	0	1	0	0	999	20443	LOCAL BUFFER FULL ERROR COUNTER
C14:5	0	0	0	0	0	999	50	LOCAL PROGRAM ERROR COUNTER

File N15 (dec) -- AI160 WRIT

Offset	0	1	2	3	4	5	6	7	8	9
N15:0	0	1280	0	0	4095	0	4095	0	4095	0
N15:10	4095	0	4095	0	4095	0	4095	0	4095	0
N15:20	0	0	0	0	0	0	0	0	0	0
N15:30	0	0	0	0	0	0	0			

File N16 (dec) -- AI160 READ

Offset	0	1	2	3	4	5	6	7	8	9
N16:0	2	1	0	0	-1025	2232	702	899	1524	235
N16:10	2043	266	0	0	0					

File N17 (dec) -- AI170 WRIT

Offset	0	1	2	3	4	5	6	7	8	9
N17:0	0	1280	0	0	4095	0	4095	0	4095	0
N17:10	4095	0	4095	0	4095	0	4095	0	4095	0
N17:20	0	0	0	0	0	0	0	0	0	0
N17:30	0	0	0	0	0	0	0			

File N18 (dec) -- AI170 READ

Offset	0	1	2	3	4	5	6	7	8	9
N18:0	2	18	0	0	1414	-1024	1179	884	-1023	2096
N18:10	2301	2426	0	0	0					

File N19 (dec) -- M-LIN READ -- Multilin Comm Module Read Data Block

Offset	0	1	2	3	4	5	6	7	8	9
N19:0	2	4	31	31	32	31	31	31	23	23
N19:10	0	0	0	0	0	0	0	0	0	0
N19:20	0	0	0	0	0	0	0	0	0	0
N19:30	0	0	0	0	0	0	0	0	0	0
N19:40	0	0	0	0	0	0	0	0	0	0
N19:50	0	0	0	0	0	0	0	0	0	0
N19:60	0	0	0	0						

File N20 (dec) -- M-LIN CNFG

Offset	0	1	2	3	4	5	6	7	8	9
N20:0	1000	240	0	240	0	2400	1	0	0	0
N20:10	0	0	2400	0	8	1	0	0	0	0
N20:20	1	0	0	0	0	4	0	-1	0	0
N20:30	0	0	0	0	0	0	0	9600	0	8
N20:40	1	0	0	0	0	0	0	0	0	0
N20:50	0	0	0	0	0	0	0	0	0	0

File N21 (dec) -- M-LIN CMND -- Mulltilin Comm Module Commands

Offset	0	1	2	3	4	5	6	7	8	9
N21:0	1	0	5	8	0	1	3	542	0	0
N21:10	1	60	5	8	0	2	3	542	0	0
N21:20	1	120	5	8	0	3	3	542	0	0
N21:30	1	180	5	8	0	4	3	542	0	0
N21:40	0	0	0	0	0	0	0	0	0	0

File N22 (dec) -- M-LIN WRIT -- Multilin Comm Module Write Data Block

Offset	0	1	2	3	4	5	6	7	8	9
N22:0	4	1	0	5	8	0	1	3	542	0
N22:10	0	1	60	5	8	0	2	3	542	0
N22:20	0	1	120	5	8	0	3	3	542	0
N22:30	0	1	180	5	8	0	4	3	542	0
N22:40	0	0	0	0	0	0	0	0	0	0
N22:50	0	0	0	0	0	0	0	0	0	0
N22:60	0	0	0	0						

File N23 (dec) -- M-LIN DATA -- Multilin Read Data Table

Offset	0	1	2	3	4	5	6	7	8	9
N23:0	58	59	58	61	57	57	28	31	31	31
N23:10	32	31	31	31	23	23	19	18	19	21
N23:20	20	20	18	18	21	21	21	22	21	21
N23:30	21	20	0	0	0	0	0	0	0	0
N23:40	-4	0	0	0	0	0	0	0	0	0
N23:50	0	0	0	0	0	0	0	0	0	0
N23:60	1541	17229	14157	11825	12336	13104	12848	14130	12592	-20134
N23:70	423	-20557	-20134	15532	0	0	0	0	0	0
N23:80	0	0	0	24191	24191	24169	0	0	2	0
N23:90	0	-1	-1	0	0	0	0	0	0	0

File N24 (dec) -- BN DATA

Offset	0	1	2	3	4	5	6	7	8	9
N24:0	16384	0	0	11	35	3	2	1213	1163	1163
N24:10	1167	0	1	2	-32768	-32768	1158	1218	2109	2246

Offset	0	1	2	3	4	5	6	7	8	9
N25:0	0	16962	16962	8481	8481	0	0	0	0	1600
N25:10	3174	-24767	-32556	1600	3174	-24767	-32556	1600	3174	-24767
N25:20	-32556	1600	3174	-24767	-32556	0	0	0	0	

Offset	0	1	2	3	4	5	6	7	8	9
N26:0	1	16962	16962	8481	8481	0	0	0	0	1600
N26:10	3174	-24767	-32556	1600	3174	-24767	-32556	1600	3174	-24767
N26:20	-32556	1600	3174	-24767	-32556	0	0	0	0	

Offset	0	1	2	3	4
F27:0	0.7	6.8	2.4	7.4	3
F27:5	7.8	2.4	8.4	2.8	1.5
F27:10	2.5	1.5	2.5	0.5	0.25
F27:15	56	58	0	0	0
F27:20	0	0	0	0	0
F27:25	0	0	0	0	0
F27:30	0	0	0	0	0.5
F27:35	-100	0.5	0.5		

File B28 (bin) -- PUMP START

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol) Description
B28:0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
B28:23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B28:33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

File N29 (dec) -- MDBUS CNFG

Offset	0	1	2	3	4	5	6	7	8	9
N29:0	1	1	6	0	0	0	0	0	0	0
N29:10	0	0	0	0	0	0	0	0	0	0
N29:20	3	5	0	350	0	0	0	5	0	0
N29:30	0	0	0	0	0	0	0	0	0	0

File N30 (dec) -- DCS READ

Offset	0	1	2	3	4	5	6	7	8	9
N30:0	6	0	16601	-26214	16409	-26214	16620	-13107	16448	0
N30:10	16633	-26214	16409	-26214	16646	26214	16435	13107	0	0
N30:20	0	0	0	0	0	0	0	0	0	0
N30:30	0	0	0	0	0	0	0	0	0	0
N30:40	0	0	0	0	0	0	0	0	0	0
N30:50	0	0	0	0	0	0	0	0	0	0
N30:60	0	0	0	0						

File N31 (dec) -- DCS WRITE

Offset	0	1	2	3	4	5	6	7	8	9
N31:0	0	-1	-2049	-8385	-12290	-335	-21389	23807	-10037	11315
N31:10	-13669	31462	-1023	5120	0	0	0	0	0	0
N31:20	0	0	0	0	0	0	0	0	0	0
N31:30	0	0	0	0	0	0	0	0	0	0
N31:40	0	0	0	0	0	0	0	0	0	0
N31:50	0	0	0	0	0	0	0	0	0	0
N31:60	0	0	0	0						

Offset	0	1	2	3	4	5	6	7	8	9
N32:0	-1	-2049	-8385	-12290	-335	-21389	23807	-10037	11315	-13669
N32:10	31462	-1023	5120	0	0	0	0	0	0	0
N32:20	0	0	0	0	0	0	0	0	0	0
N32:30	0	0	0	0	0	0	0	0	0	0
N32:40	0	0	0	0	0	0	0	0	0	0
N32:50	16644	-19380	16582	-26006	-16352	2561	16601	-26214	16409	-26214
N32:60	16620	-13107	16448	0	16633	-26214	16409	-26214	16646	26214
N32:70	16435	13107	18048	25088	16420	-28087	16899	-31687	17160	26214
N32:80	17162	13107	17160	26214	17165	-13108	17158	-26214	17158	-26214
N32:90	17060	-13108	17071	-26214	15540	14681	15755	17302	18085	-11776
N32:100	16562	-31447	16722	-16084	17071	-26214	17071	-26214	17075	13107
N32:110	17071	-26214	17071	-26214	17071	-26214	17042	-13108	17042	-13108
N32:120	15300	-25690	15235	4719	17464	0	16623	30968	16475	28087
N32:130	17028	26214	17024	-13108	17028	26214	17035	-26214	17032	0
N32:140	17032	0	17024	-13108	17024	-13108	15107	4719	15235	4719
N32:150	17475	0	16549	-16804	16505	28568	17035	-26214	17035	-26214
N32:160	17035	-26214	17039	13107	17035	-26214	17035	-26214	17035	-26214
N32:170	17032	0	0	0	0	0	16812	-19765	16126	-28695
N32:180	16143	-14083	17844	16405	16442	15719	16576	21061	15560	3202
N32:190	-16631	-30567	16582	-26006	16574	15332	16588	27847	-16631	-30567
N32:200	16588	19653	0	0	0	0	0	0	0	0
N32:210	0	0	0	0	0	0	0	0	0	0
N32:220	0	0	0	0	0	0	0	0	0	0
N32:230	0	0	0	0	0	0	0	0	0	0
N32:240	0	0	0	0	0	0	0	0	0	0

File N33 (dec) -- FROM DCS

Offset	0	1	2	3	4	5	6	7	8	9
N33:0	16670	8	768	0	0	0	0	0	0	0
N33:10	0	0	0	0	0	0	0	0	0	0
N33:20	0	0	0	0	0	0	0	0	0	0
N33:30	0	0	0	0	0	0	0	0	0	0
N33:40	0	0	0	0	0	0	0	0	0	0
N33:50	16601	-26214	16409	-26214	16620	-13107	16448	0	16633	-26214
N33:60	16409	-26214	16646	26214	16435	13107	0	0	0	0
N33:70	0	0	0	0	0	0	0	0	0	0
N33:80	0	0	0	0	0	0	0	0	0	0
N33:90	0	0	0	0	0	0	0	0	0	0

File N34 (dec) -- MODBUS ERR

Offset	0	1	2	3	4	5	6	7	8	9
N34:0	0	0	-22041	-22041	-22041	0	0	0	0	0
N34:10	19779	19744	12846	12593	12594	13369	0	0	0	0

File N35 (dec) -- CONFIG -- Channel Configuration/Status File

Offset	0	1	2	3	4	5	6	7	8	9
N35:0	-29308	-29111	1	0	0	49	49	0	0	0
N35:10	0	0	0	0	0	0	0	0	0	0
N35:20	0	0	0	0	0	0	0	0	0	0
N35:30	0	0	0	0	0	0	0	0	0	0

File N36 (dec) -- IOSTAT -- I/O Status File

Offset	0	1	2	3	4	5	6	7	8	9
N36:0	0	0	256	0	256	0	256	0	0	0
N36:10	0	0	0	0	0	0	0	0	0	0
N36:20	0	0	0	0	0	0	0	0	0	0
N36:30	0	0	0	0	0	0	0	0	0	0
N36:40	0	0	0	0	0	0	0	0		

File N37 (dec) -- IOCONFIG -- I/O Module variable data file

Offset	0	1	2	3	4	5	6	7	8	9
N37:0	0	1280	0	0	4095	0	4095	0	4095	0
N37:10	4095	0	4095	0	4095	0	4095	0	4095	0
N37:20	0	0	0	0	0	0	0	0	0	0
N37:30	0	0	0	0	0	0	0			

File N38 (dec) -- IOCONFIG -- I/O Module variable data file

Offset	0	1	2	3	4	5	6	7	8	9
N38:0	2	226	0	0	1	-22	1495	1432	3270	-1024
N38:10	-1024	-1023	0	0	0					

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol) Description
B40:0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
B40:9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Copy Outputs From BCM Read Buffer To Memory
B40:10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B40:23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol) Description
B41:0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:10	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
B41:11	0	1	1	1	0	0	1	1	1	0	0	1	1	1	0	0	
B41:12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:13	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
B41:14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B41:16	0	0	0	0	0	0	1	0	1	0	1	0	1	0	1	0	

Address (Symbol) = Value [Description]

```
O:011        - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - 0
FILE O:011 LEN:1 - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - - 0
O:011/0      - Pump 101 Call
               OTE - File #13 PUMP 101 - 0
FILE O:011/0 LEN:1 - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - - 0
O:011/1      - Pump 102 Call
               OTE - File #14 PUMP 102 - 0
FILE O:011/1 LEN:1 - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - - 0
O:011/2      - Pump 103 Call
               OTE - File #15 PUMP 103 - 0
FILE O:011/2 LEN:1 - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - - 0
O:011/3      - Pump 104 Call
               OTE - File #16 PUMP 104 - 0
FILE O:011/3 LEN:1 - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - - 0
O:011/10     - Drywell Gas Alarm
               OTE - File #22 MISC - 0
FILE O:011/10 LEN:1 - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - - 0
O:011/11     - Screenings Facility Gas Alarm
               OTE - File #22 MISC - 1
FILE O:011/11 LEN:1 - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - - 0
O:011/12     - Meter Vault Gas Alarm
               OTE - File #22 MISC - 2
FILE O:011/12 LEN:1 - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - - 0
O:011/13     - Seal Water Pump 305 Call
               OTE - File #19 SEAL WATER - 5
FILE O:011/13 LEN:1 - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - - 0
O:011/14     - Seal Water Pump 306 Call
               OTE - File #19 SEAL WATER - 6
FILE O:011/14 LEN:1 - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - - 0
O:011/17     - Wet Well Low-Low Level
               OTE - File #12 SEQUENCE - 0
               XIO - File #23 DCS COMM - 8
FILE O:011/17 LEN:1 - COP - File #7 BCM LOAD - 0
                     File #8 BCM STORE - - 0
O:027        - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - 1
FILE O:027 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
O:027/3      - Stop Sluice Gate G-232
               OTE - File #20 GATES - 26
FILE O:027/3 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
O:027/4      - Sluice Gate G-232 Open Call
               OTE - File #20 GATES - 27
               XIC - File #20 GATES - 27, 28, 29
FILE O:027/4 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
O:027/5      - Sluice Gate G-232 Close Call
               OTE - File #20 GATES - 27
               XIC - File #20 GATES - 27, 28, 30
FILE O:027/5 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
O:027/6      - Slide Gate G-211 Open Call
               OTE - File #20 GATES - 3
               XIC - File #20 GATES - 3, 4, 5
FILE O:027/6 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
O:027/7      - Slide Gate G-211 Close Call
               OTE - File #20 GATES - 3
               XIC - File #20 GATES - 3, 4, 6
FILE O:027/7 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
```

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O:027/10     - Slide Gate G-212 Open Call
               OTE - File #20 GATES - 10
               XIC - File #20 GATES - 10, 11, 12
FILE O:027/10 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
O:027/11     - Slide Gate G-212 Close Call
               OTE - File #20 GATES - 10
               XIC - File #20 GATES - 10, 11, 13
FILE O:027/11 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
O:027/12     - Slide Gate G-213 Open Call
               OTE - File #20 GATES - 17
               XIC - File #20 GATES - 17, 18, 19
FILE O:027/12 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
O:027/13     - Slide Gate G-213 Close Call
               OTE - File #20 GATES - 17
               XIC - File #20 GATES - 17, 18, 20
FILE O:027/13 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
O:027/14     - Plug Valve V-141 Open Call
               OTE - File #20 GATES - 34
               XIC - File #20 GATES - 34, 35, 36
FILE O:027/14 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
O:027/15     - Plug Valve V-141 Close Call
               OTE - File #20 GATES - 34
               XIC - File #20 GATES - 34, 35, 37
FILE O:027/15 LEN:1 - COP - File #7 BCM LOAD - 1
                     File #8 BCM STORE - - 1
I:000/12     - BCM ID
               XIC - File #3 BCM MAIN - 4
               XIO - File #3 BCM MAIN - 4
I:010/0      - Pump Room Supply Fan SF-1 Fail
               XIO - File #23 DCS COMM - 0
I:010/1      - Meter Vault Supply Fan SF-3 Fail
               XIO - File #23 DCS COMM - 3
I:010/2      - Screening Room Supply Fan SF-4 Fail
               XIO - File #23 DCS COMM - 5
I:010/3      - Screening Room Supply Fan SF-5 Fail
               XIO - File #23 DCS COMM - 6
I:010/4      - MCP Room Exhaust Fan EF-1 Fail
               XIO - File #23 DCS COMM - 1
I:010/5      - MCP Room Exhaust Fan EF-2 Fail
               XIO - File #23 DCS COMM - 2
I:010/6      - Meter Vault Exhaust Fan EF-3 Fail
               XIO - File #23 DCS COMM - 4
I:010/7      - Odor Control System Exhaust Fan EF-8 Fail
               XIO - File #23 DCS COMM - 7
I:010/10     - Class "A" Water Ai Gap Tank T-940 Low-Low Level
               XIO - File #23 DCS COMM - 173
I:010/11     - Class "A" Water Ai Gap Tank T-940 Fail
               XIO - File #23 DCS COMM - 174
I:010/12     - Class "B" Water Ai Gap Tank T-950 Low-Low Level
               XIO - File #23 DCS COMM - 175
I:010/13     - Class "B" Water Ai Gap Tank T-950 Fail
               XIO - File #23 DCS COMM - 176
I:010/14     - Operational Wet Well 1 High-High Level
               XIO - File #23 DCS COMM - 15
I:010/15     - Operational Wet Well 2 High-High Level
               XIO - File #23 DCS COMM - 16
I:010/16     - Overflow Wet Well High-High Level
               XIO - File #23 DCS COMM - 17
I:010/17     - Plug Valve V-141 Closed
               XIC - File #23 DCS COMM - 125
               XIO - File #20 GATES - 34
I:012/0      - Wet Well Bubbler Low-Low Pressure
               XIO - File #23 DCS COMM - 9
I:012/1      - Drywell Air Quality Alarm
               XIC - File #22 MISC - 0
               XIO - File #23 DCS COMM - 10
I:012/2      - Drywell Combustible Gas Alarm
               XIC - File #22 MISC - 0
```

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                XIO - File #23 DCS COMM - 11
I:012/3       - Screenings Facility Air Quality Alarm
                XIC - File #22 MISC - 1
                XIO - File #23 DCS COMM - 13
I:012/4       - Screenings Facility Combustible Gas Alarm
                XIC - File #22 MISC - 1
                XIO - File #23 DCS COMM - 14
I:012/5       - Pump Room Sump High Level
                XIO - File #23 DCS COMM - 19
I:012/6       - Pump Room Sump High-High Level
                XIO - File #23 DCS COMM - 20
I:012/7       - Meter Vault Sump High Level
                XIO - File #23 DCS COMM - 21
I:012/10      - Meter Vault Air Quality Alarm
                XIC - File #22 MISC - 2
                XIO - File #23 DCS COMM - 22
I:012/11      - Meter Vault Combustible Gas Alarm
                XIC - File #22 MISC - 2
                XIO - File #23 DCS COMM - 23
I:012/12      - Plant Air Supply System Fail
                XIO - File #23 DCS COMM - 24
I:012/13      - Pump 101 Multilin Common Alarm
                XIC - File #13 PUMP 101 - 23
I:012/14      - Pump 101 Run
                XIC - File #12 SEQUENCE - 19, 28
                      File #13 PUMP 101 - 3, 12, 14, 20, 26
                      File #23 DCS COMM - 43
                XIO - File #12 SEQUENCE - 5, 29
                      File #13 PUMP 101 - 1, 21
                      File #23 DCS COMM - 182
I:012/15      - Pump 101 Discharge Check Valve Closed
                XIC - File #12 SEQUENCE - 19
                      File #13 PUMP 101 - 20
                XIO - File #13 PUMP 101 - 21
                      File #23 DCS COMM - 50
I:012/17      - Slide Gate G-211 Remote
                XIC - File #20 GATES - 0
                      File #23 DCS COMM - 133
I:013/0       - Pump 102 Multilin Common Alarm
                XIC - File #14 PUMP 102 - 23
I:013/1       - Pump 102 Run
                XIC - File #12 SEQUENCE - 20, 31
                      File #14 PUMP 102 - 3, 12, 14, 20, 26
                      File #23 DCS COMM - 65
                XIO - File #12 SEQUENCE - 6, 32
                      File #14 PUMP 102 - 1, 21
                      File #23 DCS COMM - 183
I:013/2       - Pump 102 Discharge Check Valve Closed
                XIC - File #12 SEQUENCE - 20
                      File #14 PUMP 102 - 20
                XIO - File #14 PUMP 102 - 21
                      File #23 DCS COMM - 72
I:013/4       - Slide Gate G-212 Remote
                XIC - File #20 GATES - 7
                      File #23 DCS COMM - 139
I:013/5       - Pump 103 Multilin Common Alarm
                XIC - File #15 PUMP 103 - 25
I:013/6       - Pump 103 Run
                XIC - File #12 SEQUENCE - 21, 34
                      File #15 PUMP 103 - 3, 12, 14, 20, 23, 28
                      File #23 DCS COMM - 87
                XIO - File #12 SEQUENCE - 7, 35
                      File #15 PUMP 103 - 1, 21
                      File #23 DCS COMM - 184
I:013/7       - Pump 103 Discharge Check Valve Closed
                XIC - File #12 SEQUENCE - 21
                      File #15 PUMP 103 - 20
                XIO - File #15 PUMP 103 - 21
                      File #23 DCS COMM - 94
I:013/11      - Slide Gate G-213 Remote
                XIC - File #20 GATES - 14
                      File #23 DCS COMM - 145
I:013/12      - Pump 104 Multilin Common Alarm
```

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                XIC - File #16 PUMP 104 - 25
I:013/13      - Pump 104 Run
                XIC - File #12 SEQUENCE - 22, 37
                      File #16 PUMP 104 - 3, 12, 14, 20, 23, 28
                      File #23 DCS COMM - 109
                XIO - File #12 SEQUENCE - 8, 38
                      File #16 PUMP 104 - 1, 21
                      File #23 DCS COMM - 185
I:013/14      - Pump 104 Discharge Check Valve Closed
                XIC - File #12 SEQUENCE - 22
                      File #16 PUMP 104 - 20
                XIO - File #16 PUMP 104 - 21
                      File #23 DCS COMM - 116
I:013/16      - Sluice Gate G-232 Remote
                XIC - File #20 GATES - 21
                      File #23 DCS COMM - 159
I:013/17      - Sluice Gate G-111 Open
                XIC - File #23 DCS COMM - 118
I:014/0       - Sluice Gate G-111 Closed
                XIC - File #23 DCS COMM - 117
I:014/1       - Sluice Gate G-121 Open
                XIC - File #23 DCS COMM - 120
I:014/2       - Sluice Gate G-121 Closed
                XIC - File #23 DCS COMM - 119
I:014/3       - Bar Screen Bubbler Low-Low Pressure
                XIO - File #23 DCS COMM - 12
I:014/4       - Slide Gate G-211 Open
                XIC - File #23 DCS COMM - 135
                XIO - File #20 GATES - 3
I:014/5       - Slide Gate G-211 Closed
                XIC - File #23 DCS COMM - 134
                XIO - File #20 GATES - 3
I:014/6       - Slide Gate G-212 Open
                XIC - File #23 DCS COMM - 141
                XIO - File #20 GATES - 10
I:014/7       - Slide Gate G-212 Closed
                XIC - File #23 DCS COMM - 140
                XIO - File #20 GATES - 10
I:014/10      - Slide Gate G-213 Open
                XIC - File #23 DCS COMM - 147
                XIO - File #20 GATES - 17
I:014/11      - Slide Gate G-213 Closed
                XIC - File #23 DCS COMM - 146
                XIO - File #20 GATES - 17
I:014/12      - Slide Gate G-221 Open
                XIC - File #23 DCS COMM - 149
I:014/13      - Slide Gate G-221 Closed
                XIC - File #23 DCS COMM - 148
I:014/14      - Slide Gate G-222 Open
                XIC - File #23 DCS COMM - 151
I:014/15      - Slide Gate G-222 Closed
                XIC - File #23 DCS COMM - 150
I:014/16      - Slide Gate G-223 Open
                XIC - File #23 DCS COMM - 153
I:014/17      - Slide Gate G-223 Closed
                XIC - File #23 DCS COMM - 152
I:015/0       - Slide Gate G-231 Open
                XIC - File #23 DCS COMM - 155
I:015/1       - Slide Gate G-231 Closed
                XIC - File #23 DCS COMM - 154
I:015/2       - Sluice Gate G-232 Open
                XIC - File #23 DCS COMM - 161
                XIO - File #20 GATES - 27
I:015/3       - Sluice Gate G-232 Closed
                XIC - File #23 DCS COMM - 160
                XIO - File #20 GATES - 27
I:015/4       - Slide Gate G-233 Open
                XIC - File #23 DCS COMM - 163
I:015/5       - Slide Gate G-233 Closed
                XIC - File #23 DCS COMM - 162
I:015/6       - Air Gap Tank T-300 Low Low Level
                XIO - File #19 SEAL WATER - 5, 6
                      File #23 DCS COMM - 164
```

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I:015/7      - Hydropneumatic Tank T-301 High Pressure
                 XIC - File #19 SEAL WATER - 1
                 XIO - File #19 SEAL WATER - 0
                       File #23 DCS COMM - 165
I:015/10     - Hydropneumatic Tank T-301 Low Pressure
                 XIC - File #19 SEAL WATER - 0
                 XIO - File #23 DCS COMM - 166
I:015/11     - Hypo Bulk Storage Tank T-410 Low Level
                 XIO - File #23 DCS COMM - 167
I:015/12     - Caustic Bulk Storage Tank T-420 Low Level
                 XIO - File #23 DCS COMM - 168
I:015/13     - Chemical Storage Area Eyewash Shower Alarm
                 XIO - File #23 DCS COMM - 170
I:015/14     - Odor Control Area Eyewash Shower Alarm
                 XIO - File #23 DCS COMM - 169
I:015/15     - Blower Bldg Eyewash Shower Alarm
                 XIO - File #23 DCS COMM - 171
I:015/16     - Mechanical Bldg Eyewash Shower Alarm
                 XIO - File #23 DCS COMM - 172
I:015/17     - Plug Valve V-141 Open
                 XIC - File #23 DCS COMM - 126
                 XIO - File #20 GATES - 34
I:020/0      - Odor Control Blower Fail
                 XIO - File #23 DCS COMM - 18
I:020/1      - Plug Valve V-141 Remote
                 XIC - File #20 GATES - 31
                       File #23 DCS COMM - 124
I:020/2      - Pump 101 Hand
                 XIC - File #23 DCS COMM - 48
I:020/3      - Pump 101 Auto
                 XIC - File #12 SEQUENCE - 19
                       File #13 PUMP 101 - 2
                       File #23 DCS COMM - 49
I:020/4      - Pump 102 Hand
                 XIC - File #23 DCS COMM - 70
I:020/5      - Pump 102 Auto
                 XIC - File #12 SEQUENCE - 20
                       File #14 PUMP 102 - 2
                       File #23 DCS COMM - 71
I:020/6      - Pump 103 Hand
                 XIC - File #23 DCS COMM - 92
I:020/7      - Pump 103 Auto
                 XIC - File #12 SEQUENCE - 21
                       File #15 PUMP 103 - 2
                       File #23 DCS COMM - 93
I:020/10     - Pump 104 Hand
                 XIC - File #23 DCS COMM - 114
I:020/11     - Pump 104 Auto
                 XIC - File #12 SEQUENCE - 22
                       File #16 PUMP 104 - 2
                       File #23 DCS COMM - 115
I:020/12     - Spare Input
                 XIO - File #23 DCS COMM - 128
I:020/13     - Spare Input
                 XIC - File #23 DCS COMM - 129
I:020/14     - Spare Input
                 XIO - File #23 DCS COMM - 127
I:031/2      - UPS On
                 XIO - File #23 DCS COMM - 187
I:031/3      - UPS On Battery
                 XIO - File #23 DCS COMM - 188
I:031/4      - UPS On Bypass
                 XIO - File #23 DCS COMM - 189
I:031/5      - UPS Low Battery
                 XIO - File #23 DCS COMM - 190
I:032/0      - Main Service Breaker A open
                 XIC - File #24 ATS - 0
I:032/1      - Main Service B Breaker Open
                 XIC - File #24 ATS - 1
I:032/2      - Tie Breaker Open
                 XIC - File #24 ATS - 2
I:032/3      - Main Service A Not Available
                 XIC - File #24 ATS - 3
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I:032/4      - Main Service B Not Available
               XIC - File #24 ATS - 5
I:032/5      - UPS Trouble
               XIC - File #24 ATS - 7
I:032/6      - Main Service A Breaker Tripped
               XIC - File #24 ATS - 8
I:032/7      - Main Service B Breaker Tripped
               XIC - File #24 ATS - 9
I:032/10     - Tie Breaker Tripped
               XIC - File #24 ATS - 10
I:032/11     - Transfer System Fail
               XIC - File #24 ATS - 11
I:032/12     - Auto/Manual Switch Manual Mode
               XIC - File #24 ATS - 12
I:032/13     - Auto/Manual Switch Auto Mode
               XIC - File #24 ATS - 13
I:032/14     - Service Selector Switch Service A Normal Source
               XIC - File #24 ATS - 14
I:032/15     - Service Selector Switch Service B Normal Source
               XIC - File #24 ATS - 15
I:032/16     - 86 Lockout Relay Tripped
               XIC - File #24 ATS - 16
I:032/17     - PLC General Fault Relay
               XIC - File #24 ATS - 17
I:033/0      - Main Service A Relay Failure
               XIC - File #24 ATS - 19
I:033/1      - Main Service B Relay Failure
               XIC - File #24 ATS - 21
I:033/2      - Auto-Throwover System (PLC Heartbeat)
               XIC - File #24 ATS - 24
I:033/3      - Power Quality Relay Fault
               XIC - File #24 ATS - 23
S:1/15       - First scan of ladder or SFC step
               XIC - File #9 ANALOG IN - 0, 2, 4
S:21         - Real time clock HOUR
               MOV - File #21 CLOCK - 0
               EQU - File #18 FLOW TOTAL - 1
S:22         - Real time  clock MINUTE
               MOV - File #21 CLOCK - 0
S:23         - Real time  clock SECOND
               MOV - File #21 CLOCK - 0
B3:0         - Copy Storage Bits From BCM Read Buffer To Memory
               COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - 2
FILE B3:0 LEN:10 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:0/0       - Configure Bently Nevada
               XIC - File #11 BENTLY - 1
FILE B3:0/0 LEN:10 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:0/2       - Multilin Download Configuration
               XIC - File #10 MULTILIN - 0
FILE B3:0/2 LEN:10 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:0/3       - Wet Well Level Lead 150 HP Reqd
               OTE - File #12 SEQUENCE - 1
               XIC - File #12 SEQUENCE - 1, 27, 30
FILE B3:0/3 LEN:10 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:0/4       - Wet Well Level Lag 150 HP Reqd
               OTE - File #12 SEQUENCE - 2
               XIC - File #12 SEQUENCE - 2, 27, 30
FILE B3:0/4 LEN:10 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:0/5       - Wet Well Level Lead 400 HP Reqd
               OTE - File #12 SEQUENCE - 3
               XIC - File #12 SEQUENCE - 3, 33, 36
               XIO - File #12 SEQUENCE - 27, 30
FILE B3:0/5 LEN:10 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:0/6       - Wet Well Level Lag 400 HP Reqd
               OTE - File #12 SEQUENCE - 4
               XIC - File #12 SEQUENCE - 4, 33, 36
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                XIO - File #12 SEQUENCE - 27, 30
FILE B3:0/6 LEN:10 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:0/7       - Pump 101 Available
                OTE - File #12 SEQUENCE - 19
                XIC - File #12 SEQUENCE - 27
                      File #23 DCS COMM - 47
FILE B3:0/7 LEN:10 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:0/8       - Pump 102 Available
                OTE - File #12 SEQUENCE - 20
                XIC - File #12 SEQUENCE - 30
                      File #23 DCS COMM - 69
FILE B3:0/8 LEN:10 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:0/9       - Pump 103 Available
                OTE - File #12 SEQUENCE - 21
                XIC - File #12 SEQUENCE - 33
                      File #23 DCS COMM - 91
                XIO - File #12 SEQUENCE - 27, 30
FILE B3:0/9 LEN:10 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:0/10      - Pump 104 Available
                OTE - File #12 SEQUENCE - 22
                XIC - File #12 SEQUENCE - 36
                      File #23 DCS COMM - 113
                XIO - File #12 SEQUENCE - 27, 30
FILE B3:0/10 LEN:10 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:0/11      - Pump 101 Reqd
                OTE - File #12 SEQUENCE - 27
                XIC - File #12 SEQUENCE - 27
                      File #13 PUMP 101 - 0
                XIO - File #12 SEQUENCE - 33, 36
                      File #13 PUMP 101 - 2
FILE B3:0/11 LEN:10 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:0/12      - Pump 101 Start One-Shot Storage
                ONS - File #12 SEQUENCE - 28
FILE B3:0/12 LEN:10 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:0/13      - Pump 101 Start One-Shot
                OTE - File #12 SEQUENCE - 28
                XIC - File #12 SEQUENCE - 9, 30, 33, 36
                XIO - File #12 SEQUENCE - 30, 33, 36, 39
FILE B3:0/13 LEN:10 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:0/14      - Pump 101 Stop One-Shot Storage
                ONS - File #12 SEQUENCE - 29
FILE B3:0/14 LEN:10 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:0/15      - Pump 101 Stop One-Shot
                OTE - File #12 SEQUENCE - 29
                XIC - File #12 SEQUENCE - 30, 33, 36
                XIO - File #12 SEQUENCE - 30, 33, 36, 40
FILE B3:0/15 LEN:10 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/0       - Pump 102 Reqd
                OTE - File #12 SEQUENCE - 30
                XIC - File #12 SEQUENCE - 30
                      File #14 PUMP 102 - 0
                XIO - File #12 SEQUENCE - 33, 36
                      File #14 PUMP 102 - 2
FILE B3:1/0 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/1       - Pump 102 Start One-Shot Storage
                ONS - File #12 SEQUENCE - 31
FILE B3:1/1 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/2       - Pump 102 Start One-Shot
                OTE - File #12 SEQUENCE - 31
                XIC - File #12 SEQUENCE - 10, 33, 36
                XIO - File #12 SEQUENCE - 33, 36, 39
```

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FILE B3:1/2 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/3       - Pump 102 Stop One-Shot Storage
               ONS - File #12 SEQUENCE - 32
FILE B3:1/3 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/4       - Pump 102 Stop One-Shot
               OTE - File #12 SEQUENCE - 32
               XIC - File #12 SEQUENCE - 33, 36
               XIO - File #12 SEQUENCE - 33, 36, 40
FILE B3:1/4 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/5       - Pump 103 Reqd
               OTE - File #12 SEQUENCE - 33
               XIC - File #12 SEQUENCE - 33
                      File #15 PUMP 103 - 0
               XIO - File #12 SEQUENCE - 27, 30
                      File #15 PUMP 103 - 2
FILE B3:1/5 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/6       - Pump 103 Start One-Shot Storage
               ONS - File #12 SEQUENCE - 34
FILE B3:1/6 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/7       - Pump 103 Start One-Shot
               OTE - File #12 SEQUENCE - 34
               XIC - File #12 SEQUENCE - 11, 36
               XIO - File #12 SEQUENCE - 36, 39
FILE B3:1/7 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/8       - Pump 103 Stop One-Shot Storage
               ONS - File #12 SEQUENCE - 35
FILE B3:1/8 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/9       - Pump 103 Stop One-Shot
               OTE - File #12 SEQUENCE - 35
               XIC - File #12 SEQUENCE - 36
               XIO - File #12 SEQUENCE - 36, 40
FILE B3:1/9 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/10      - Pump 104 Reqd
               OTE - File #12 SEQUENCE - 36
               XIC - File #12 SEQUENCE - 36
                      File #16 PUMP 104 - 0
               XIO - File #12 SEQUENCE - 27, 30
                      File #16 PUMP 104 - 2
FILE B3:1/10 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/11      - Pump 104 Start One-Shot Storage
               ONS - File #12 SEQUENCE - 37
FILE B3:1/11 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/12      - Pump 104 Start One-Shot
               OTE - File #12 SEQUENCE - 37
               XIC - File #12 SEQUENCE - 12
               XIO - File #12 SEQUENCE - 39
FILE B3:1/12 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/13      - Pump 104 Stop One-Shot Storage
               ONS - File #12 SEQUENCE - 38
FILE B3:1/13 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/14      - Pump 104 Stop One-Shot
               OTE - File #12 SEQUENCE - 38
               XIO - File #12 SEQUENCE - 40
FILE B3:1/14 LEN:9 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:1/15      - Pump Start-Stop Minimum Interval Done
               OTE - File #12 SEQUENCE - 41
               XIC - File #12 SEQUENCE - 27, 30, 33, 36
               XIO - File #12 SEQUENCE - 27, 30, 33, 36
                      File #23 DCS COMM - 177
FILE B3:1/15 LEN:9 - COP - File #7 BCM LOAD - 2
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                        File #8 BCM STORE - - 2
B3:2/0       - Pump 101 Fail To Start
                 OTE - File #13 PUMP 101 - 1
                 XIC - File #13 PUMP 101 - 1, 24
                        File #23 DCS COMM - 38
FILE B3:2/0 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/1       - Pump 101 Fail To Stop
                 OTE - File #13 PUMP 101 - 3
                 XIC - File #13 PUMP 101 - 3, 24
                        File #23 DCS COMM - 39
FILE B3:2/1 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/2       - Pump 101 Upper Bearing High Vibration Alarm
                 OTE - File #13 PUMP 101 - 5
                 XIC - File #13 PUMP 101 - 5
                 XIO - File #23 DCS COMM - 34
FILE B3:2/2 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/3       - Pump 101 Upper Bearing High-High Vibration Alarm
                 OTE - File #13 PUMP 101 - 7
                 XIC - File #13 PUMP 101 - 7, 24
                 XIO - File #23 DCS COMM - 36
FILE B3:2/3 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/4       - Pump 101 Lower Bearing High Vibration Alarm
                 OTE - File #13 PUMP 101 - 9
                 XIC - File #13 PUMP 101 - 9
                 XIO - File #23 DCS COMM - 35
FILE B3:2/4 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/5       - Pump 101 Lower Bearing High-High Vibration Alarm
                 OTE - File #13 PUMP 101 - 11
                 XIC - File #13 PUMP 101 - 11, 24
                 XIO - File #23 DCS COMM - 37
FILE B3:2/5 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/6       - Pump 101 Low Suction Pressure Alarm
                 OTE - File #13 PUMP 101 - 13
                 XIC - File #13 PUMP 101 - 13
                 XIO - File #23 DCS COMM - 32
FILE B3:2/6 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/7       - Pump 101 Low-Low Suction Pressure Alarm
                 OTE - File #13 PUMP 101 - 15
                 XIC - File #13 PUMP 101 - 15, 24
                 XIO - File #23 DCS COMM - 33
FILE B3:2/7 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/8       - Pump 101 High Discharge Pressure Alarm
                 OTE - File #13 PUMP 101 - 17
                 XIC - File #13 PUMP 101 - 17
                 XIO - File #23 DCS COMM - 30
FILE B3:2/8 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/9       - Pump 101 High-High Discharge Pressure Alarm
                 OTE - File #13 PUMP 101 - 19
                 XIC - File #13 PUMP 101 - 19, 24
                 XIO - File #23 DCS COMM - 31
FILE B3:2/9 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/10      - Pump 101 Discharge Valve Fail
                 OTE - File #13 PUMP 101 - 22
                 XIC - File #13 PUMP 101 - 22
                 XIO - File #23 DCS COMM - 40
FILE B3:2/10 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/11      - Pump 101 Seal Water Low Flow Alarm
                 XIC - File #23 DCS COMM - 29
                 XIO - File #23 DCS COMM - 29
FILE B3:2/11 LEN:8 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:2/12      - Pump 101 Multilin Common Alarm
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                OTE - File #13 PUMP 101 - 23
                XIC - File #13 PUMP 101 - 24
                XIO - File #23 DCS COMM - 41
    FILE B3:2/12 LEN:8 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
    B3:2/13      - Pump 101 Fail
                OTE - File #13 PUMP 101 - 24
                XIC - File #12 SEQUENCE - 23
                      File #13 PUMP 101 - 25
                XIO - File #12 SEQUENCE - 19
                      File #23 DCS COMM - 42
    FILE B3:2/13 LEN:8 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
    B3:2/14      - Pump 102 Fail To Start
                OTE - File #14 PUMP 102 - 1
                XIC - File #14 PUMP 102 - 1, 24
                      File #23 DCS COMM - 60
    FILE B3:2/14 LEN:8 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
    B3:2/15      - Pump 102 Fail To Stop
                OTE - File #14 PUMP 102 - 3
                XIC - File #14 PUMP 102 - 3, 24
                      File #23 DCS COMM - 61
    FILE B3:2/15 LEN:8 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
    B3:3/0       - Pump 102 Upper Bearing High Vibration Alarm
                OTE - File #14 PUMP 102 - 5
                XIC - File #14 PUMP 102 - 5
                XIO - File #23 DCS COMM - 56
    FILE B3:3/0 LEN:7 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
    B3:3/1       - Pump 102 Upper Bearing High-High Vibration Alarm
                OTE - File #14 PUMP 102 - 7
                XIC - File #14 PUMP 102 - 7, 24
                XIO - File #23 DCS COMM - 58
    FILE B3:3/1 LEN:7 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
    B3:3/2       - Pump 102 Lower Bearing High Vibration Alarm
                OTE - File #14 PUMP 102 - 9
                XIC - File #14 PUMP 102 - 9
                XIO - File #23 DCS COMM - 57
    FILE B3:3/2 LEN:7 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
    B3:3/3       - Pump 102 Lower Bearing High-High Vibration Alarm
                OTE - File #14 PUMP 102 - 11
                XIC - File #14 PUMP 102 - 11, 24
                XIO - File #23 DCS COMM - 59
    FILE B3:3/3 LEN:7 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
    B3:3/4       - Pump 102 Low Suction Pressure Alarm
                OTE - File #14 PUMP 102 - 13
                XIC - File #14 PUMP 102 - 13
                XIO - File #23 DCS COMM - 54
    FILE B3:3/4 LEN:7 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
    B3:3/5       - Pump 102 Low-Low Suction Pressure Alarm
                OTE - File #14 PUMP 102 - 15
                XIC - File #14 PUMP 102 - 15, 24
                XIO - File #23 DCS COMM - 55
    FILE B3:3/5 LEN:7 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
    B3:3/6       - Pump 102 High Discharge Pressure Alarm
                OTE - File #14 PUMP 102 - 17
                XIC - File #14 PUMP 102 - 17
                XIO - File #23 DCS COMM - 52
    FILE B3:3/6 LEN:7 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
    B3:3/7       - Pump 102 High-High Discharge Pressure Alarm
                OTE - File #14 PUMP 102 - 19
                XIC - File #14 PUMP 102 - 19, 24
                XIO - File #23 DCS COMM - 53
    FILE B3:3/7 LEN:7 - COP - File #7 BCM LOAD - 2
                         File #8 BCM STORE - - 2
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B3:3/8       - Pump 102 Discharge Valve Fail
               OTE - File #14 PUMP 102 - 22
               XIC - File #14 PUMP 102 - 22
               XIO - File #23 DCS COMM - 62
FILE B3:3/8 LEN:7 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:3/9       - Pump 102 Seal Water Low Flow Alarm
               XIC - File #23 DCS COMM - 51
               XIO - File #23 DCS COMM - 51
FILE B3:3/9 LEN:7 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:3/10      - Pump 102 Multilin Common Alarm
               OTE - File #14 PUMP 102 - 23
               XIC - File #14 PUMP 102 - 24
               XIO - File #23 DCS COMM - 63
FILE B3:3/10 LEN:7 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:3/11      - Pump 102 Fail
               OTE - File #14 PUMP 102 - 24
               XIC - File #12 SEQUENCE - 24
                     File #14 PUMP 102 - 25
               XIO - File #12 SEQUENCE - 20
                     File #23 DCS COMM - 64
FILE B3:3/11 LEN:7 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:3/12      - Pump 103 Fail To Start
               OTE - File #15 PUMP 103 - 1
               XIC - File #15 PUMP 103 - 1, 26
                     File #23 DCS COMM - 82
FILE B3:3/12 LEN:7 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:3/13      - Pump 103 Fail To Stop
               OTE - File #15 PUMP 103 - 3
               XIC - File #15 PUMP 103 - 3, 26
                     File #23 DCS COMM - 83
FILE B3:3/13 LEN:7 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:3/14      - Pump 103 Upper Bearing High Vibration Alarm
               OTE - File #15 PUMP 103 - 5
               XIC - File #15 PUMP 103 - 5
               XIO - File #23 DCS COMM - 78
FILE B3:3/14 LEN:7 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:3/15      - Pump 103 Upper Bearing High-High Vibration Alarm
               OTE - File #15 PUMP 103 - 7
               XIC - File #15 PUMP 103 - 7, 26
               XIO - File #23 DCS COMM - 80
FILE B3:3/15 LEN:7 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:4/0       - Pump 103 Lower Bearing High Vibration Alarm
               OTE - File #15 PUMP 103 - 9
               XIC - File #15 PUMP 103 - 9
               XIO - File #23 DCS COMM - 79
FILE B3:4/0 LEN:6 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:4/1       - Pump 103 Lower Bearing High-High Vibration Alarm
               OTE - File #15 PUMP 103 - 11
               XIC - File #15 PUMP 103 - 11, 26
               XIO - File #23 DCS COMM - 81
FILE B3:4/1 LEN:6 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:4/2       - Pump 103 Low Suction Pressure Alarm
               OTE - File #15 PUMP 103 - 13
               XIC - File #15 PUMP 103 - 13
               XIO - File #23 DCS COMM - 76
FILE B3:4/2 LEN:6 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:4/3       - Pump 103 Low-Low Suction Pressure Alarm
               OTE - File #15 PUMP 103 - 15
               XIC - File #15 PUMP 103 - 15, 26
               XIO - File #23 DCS COMM - 77
FILE B3:4/3 LEN:6 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
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B3:4/4       - Pump 103 High Discharge Pressure Alarm
               OTE - File #15 PUMP 103 - 17
               XIC - File #15 PUMP 103 - 17
               XIO - File #23 DCS COMM - 74
FILE B3:4/4 LEN:6 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:4/5       - Pump 103 High-High Discharge Pressure Alarm
               OTE - File #15 PUMP 103 - 19
               XIC - File #15 PUMP 103 - 19, 26
               XIO - File #23 DCS COMM - 75
FILE B3:4/5 LEN:6 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:4/6       - Pump 103 Discharge Valve Fail
               OTE - File #15 PUMP 103 - 22
               XIC - File #15 PUMP 103 - 22
               XIO - File #23 DCS COMM - 84
FILE B3:4/6 LEN:6 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:4/7       - Pump 103 Seal Water Low Flow Alarm
               OTE - File #15 PUMP 103 - 24
               XIC - File #15 PUMP 103 - 24, 26
                     File #23 DCS COMM - 73
               XIO - File #15 PUMP 103 - 24, 26
                     File #23 DCS COMM - 73
FILE B3:4/7 LEN:6 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:4/8       - Pump 103 Multilin Common Alarm
               OTE - File #15 PUMP 103 - 25
               XIC - File #15 PUMP 103 - 25, 26
               XIO - File #23 DCS COMM - 85
FILE B3:4/8 LEN:6 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:4/9       - Pump 103 Fail
               OTE - File #15 PUMP 103 - 26
               XIC - File #12 SEQUENCE - 25
                     File #15 PUMP 103 - 27
               XIO - File #12 SEQUENCE - 21
                     File #23 DCS COMM - 86
FILE B3:4/9 LEN:6 - COP - File #7 BCM LOAD - 2
                    File #8 BCM STORE - - 2
B3:4/10      - Pump 104 Fail To Start
               OTE - File #16 PUMP 104 - 1
               XIC - File #16 PUMP 104 - 1, 26
                     File #23 DCS COMM - 104
FILE B3:4/10 LEN:6 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:4/11      - Pump 104 Fail To Stop
               OTE - File #16 PUMP 104 - 3
               XIC - File #16 PUMP 104 - 3, 26
                     File #23 DCS COMM - 105
FILE B3:4/11 LEN:6 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:4/12      - Pump 104 Upper Bearing High Vibration Alarm
               OTE - File #16 PUMP 104 - 5
               XIC - File #16 PUMP 104 - 5
               XIO - File #23 DCS COMM - 100
FILE B3:4/12 LEN:6 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:4/13      - Pump 104 Upper Bearing High-High Vibration Alarm
               OTE - File #16 PUMP 104 - 7
               XIC - File #16 PUMP 104 - 7, 26
               XIO - File #23 DCS COMM - 102
FILE B3:4/13 LEN:6 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:4/14      - Pump 104 Lower Bearing High Vibration Alarm
               OTE - File #16 PUMP 104 - 9
               XIC - File #16 PUMP 104 - 9
               XIO - File #23 DCS COMM - 101
FILE B3:4/14 LEN:6 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:4/15      - Pump 104 Lower Bearing High-High Vibration Alarm
               OTE - File #16 PUMP 104 - 11
               XIC - File #16 PUMP 104 - 11, 26
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                XIO - File #23 DCS COMM - 103
FILE B3:4/15 LEN:6 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/0       - Pump 104 Low Suction Pressure Alarm
                OTE - File #16 PUMP 104 - 13
                XIC - File #16 PUMP 104 - 13
                XIO - File #23 DCS COMM - 98
FILE B3:5/0 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/1       - Pump 104 Low-Low Suction Pressure Alarm
                OTE - File #16 PUMP 104 - 15
                XIC - File #16 PUMP 104 - 15, 26
                XIO - File #23 DCS COMM - 99
FILE B3:5/1 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/2       - Pump 104 High Discharge Pressure Alarm
                OTE - File #16 PUMP 104 - 17
                XIC - File #16 PUMP 104 - 17
                XIO - File #23 DCS COMM - 96
FILE B3:5/2 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/3       - Pump 104 High-High Discharge Pressure Alarm
                OTE - File #16 PUMP 104 - 19
                XIC - File #16 PUMP 104 - 19, 26
                XIO - File #23 DCS COMM - 97
FILE B3:5/3 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/4       - Pump 104 Discharge Valve Fail
                OTE - File #16 PUMP 104 - 22
                XIC - File #16 PUMP 104 - 22
                XIO - File #23 DCS COMM - 106
FILE B3:5/4 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/5       - Pump 104 Seal Water Low Flow Alarm
                OTE - File #16 PUMP 104 - 24
                XIC - File #16 PUMP 104 - 24, 26
                      File #23 DCS COMM - 95
                XIO - File #16 PUMP 104 - 24, 26
                      File #23 DCS COMM - 95
FILE B3:5/5 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/6       - Pump 104 Multilin Common Alarm
                OTE - File #16 PUMP 104 - 25
                XIC - File #16 PUMP 104 - 26
                XIO - File #23 DCS COMM - 107
FILE B3:5/6 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/7       - Pump 104 Fail
                OTE - File #16 PUMP 104 - 26
                XIC - File #12 SEQUENCE - 26
                      File #16 PUMP 104 - 27
                XIO - File #12 SEQUENCE - 22
                      File #23 DCS COMM - 108
FILE B3:5/7 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/8       - Midnight One-Shot Storage Bit
                ONS - File #18 FLOW TOTAL - 1
FILE B3:5/8 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/9       - Lead Seal Water Pump Reqd
                OTE - File #19 SEAL WATER - 0
                XIC - File #19 SEAL WATER - 0, 5, 6
FILE B3:5/9 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/10      - Hydropneumatic Tank T-301 High Pressure One-Shot Storage
                ONS - File #19 SEAL WATER - 1
FILE B3:5/10 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:5/11      - Hydropneumatic Tank T-301 High Pressure One-Shot
                OTE - File #19 SEAL WATER - 1
                XIC - File #19 SEAL WATER - 2, 4
FILE B3:5/11 LEN:5 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
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B3:5/12      - Seal Water Pump 305 Lead
               OTL - File #19 SEAL WATER - 2
               OTU - File #19 SEAL WATER - 4
               XIC - File #19 SEAL WATER - 3, 4, 5
               XIO - File #19 SEAL WATER - 2, 6
FILE B3:5/12 LEN:5 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:5/13      - Seal Water Pump 305 Lead One-Shot Storage
               ONS - File #19 SEAL WATER - 3
FILE B3:5/13 LEN:5 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:5/14      - Seal Water Pump 305 Lead One-Shot
               OTE - File #19 SEAL WATER - 3
               XIO - File #19 SEAL WATER - 4
FILE B3:5/14 LEN:5 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:5/15      - Slide Gate G-211 Available
               OTE - File #20 GATES - 0
               XIC - File #20 GATES - 3
                     File #23 DCS COMM - 132
FILE B3:5/15 LEN:5 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/0       - Open Slide Gate G-211 One-Shot Storage
               ONS - File #20 GATES - 1
FILE B3:6/0 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/1       - Open Slide Gate G-211 One-Shot
               OTE - File #20 GATES - 1
               XIC - File #20 GATES - 3
FILE B3:6/1 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/2       - Close Slide Gate G-211 One-Shot Storage
               ONS - File #20 GATES - 2
FILE B3:6/2 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/3       - Close Slide Gate G-211 One-Shot
               OTE - File #20 GATES - 2
               XIC - File #20 GATES - 3
FILE B3:6/3 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/4       - Slide Gate G-211 Fail To Open
               OTE - File #20 GATES - 5
               XIC - File #20 GATES - 5
                     File #23 DCS COMM - 130
               XIO - File #20 GATES - 0
FILE B3:6/4 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/5       - Slide Gate G-211 Fail To Close
               OTE - File #20 GATES - 6
               XIC - File #20 GATES - 6
                     File #23 DCS COMM - 131
               XIO - File #20 GATES - 0
FILE B3:6/5 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/6       - Slide Gate G-212 Available
               OTE - File #20 GATES - 7
               XIC - File #20 GATES - 10
                     File #23 DCS COMM - 138
FILE B3:6/6 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/7       - Open Slide Gate G-212 One-Shot Storage
               ONS - File #20 GATES - 8
FILE B3:6/7 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/8       - Open Slide Gate G-212 One-Shot
               OTE - File #20 GATES - 8
               XIC - File #20 GATES - 10
FILE B3:6/8 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/9       - Close Slide Gate G-212 One-Shot Storage
               ONS - File #20 GATES - 9
FILE B3:6/9 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
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B3:6/10      - Close Slide Gate G-212 One-Shot
               OTE - File #20 GATES - 9
               XIC - File #20 GATES - 10
FILE B3:6/10 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/11      - Slide Gate G-212 Fail To Open
               OTE - File #20 GATES - 12
               XIC - File #20 GATES - 12
                     File #23 DCS COMM - 136
               XIO - File #20 GATES - 7
FILE B3:6/11 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/12      - Slide Gate G-212 Fail To Close
               OTE - File #20 GATES - 13
               XIC - File #20 GATES - 13
                     File #23 DCS COMM - 137
               XIO - File #20 GATES - 7
FILE B3:6/12 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/13      - Slide Gate G-213 Available
               OTE - File #20 GATES - 14
               XIC - File #20 GATES - 17
                     File #23 DCS COMM - 144
FILE B3:6/13 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/14      - Open Slide Gate G-213 One-Shot Storage
               ONS - File #20 GATES - 15
FILE B3:6/14 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:6/15      - Open Slide Gate G-213 One-Shot
               OTE - File #20 GATES - 15
               XIC - File #20 GATES - 17
FILE B3:6/15 LEN:4 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:7/0       - Close Slide Gate G-213 One-Shot Storage
               ONS - File #20 GATES - 16
FILE B3:7/0 LEN:3 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:7/1       - Close Slide Gate G-213 One-Shot
               OTE - File #20 GATES - 16
               XIC - File #20 GATES - 17
FILE B3:7/1 LEN:3 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:7/2       - Slide Gate G-213 Fail To Open
               OTE - File #20 GATES - 19
               XIC - File #20 GATES - 19
                     File #23 DCS COMM - 142
               XIO - File #20 GATES - 14
FILE B3:7/2 LEN:3 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:7/3       - Slide Gate G-213 Fail To Close
               OTE - File #20 GATES - 20
               XIC - File #20 GATES - 20
                     File #23 DCS COMM - 143
               XIO - File #20 GATES - 14
FILE B3:7/3 LEN:3 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:7/4       - Sluice Gate G-232 Available
               OTE - File #20 GATES - 21
               XIC - File #20 GATES - 27
                     File #23 DCS COMM - 158
FILE B3:7/4 LEN:3 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:7/5       - Open Sluice Gate G-232 One-Shot Storage
               ONS - File #20 GATES - 22
FILE B3:7/5 LEN:3 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:7/6       - Open Sluice Gate G-232 One-Shot
               OTE - File #20 GATES - 22
               XIC - File #20 GATES - 27
FILE B3:7/6 LEN:3 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:7/7       - Close Sluice Gate G-232 One-Shot Storage
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                ONS - File #20 GATES - 23
FILE B3:7/7 LEN:3 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:7/8       - Close Sluice Gate G-232 One-Shot
                OTE - File #20 GATES - 23
                XIC - File #20 GATES - 27
FILE B3:7/8 LEN:3 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:7/9       - Stop Sluice Gate G-232 One-Shot Storage
                ONS - File #20 GATES - 24
FILE B3:7/9 LEN:3 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:7/10      - Stop Sluice Gate G-232 One-Shot
                OTE - File #20 GATES - 24
                XIC - File #20 GATES - 25
                XIO - File #20 GATES - 27
FILE B3:7/10 LEN:3 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:7/11      - Sluice Gate G-232 Fail To Open
                OTE - File #20 GATES - 29
                XIC - File #20 GATES - 29
                      File #23 DCS COMM - 156
                XIO - File #20 GATES - 21
FILE B3:7/11 LEN:3 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:7/12      - Sluice Gate G-232 Fail To Close
                OTE - File #20 GATES - 30
                XIC - File #20 GATES - 30
                      File #23 DCS COMM - 157
                XIO - File #20 GATES - 21
FILE B3:7/12 LEN:3 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:7/13      - Plug Valve V-141 Available
                OTE - File #20 GATES - 31
                XIC - File #20 GATES - 34
                      File #23 DCS COMM - 123
FILE B3:7/13 LEN:3 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:7/14      - Open Plug Valve V-141 One-Shot Storage
                ONS - File #20 GATES - 32
FILE B3:7/14 LEN:3 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:7/15      - Open Plug Valve V-141 One-Shot
                OTE - File #20 GATES - 32
                XIC - File #20 GATES - 34
FILE B3:7/15 LEN:3 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:8/0       - Close Plug Valve V-141 One-Shot Storage
                ONS - File #20 GATES - 33
FILE B3:8/0 LEN:2 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:8/1       - Close Plug Valve V-141 One-Shot
                OTE - File #20 GATES - 33
                XIC - File #20 GATES - 34
FILE B3:8/1 LEN:2 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:8/2       - Plug Valve V-141 Fail To Open
                OTE - File #20 GATES - 36
                XIC - File #20 GATES - 36
                      File #23 DCS COMM - 121
                XIO - File #20 GATES - 31
FILE B3:8/2 LEN:2 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:8/3       - Plug Valve V-141 Fail To Close
                OTE - File #20 GATES - 37
                XIC - File #20 GATES - 37
                      File #23 DCS COMM - 122
                XIO - File #20 GATES - 31
FILE B3:8/3 LEN:2 - COP - File #7 BCM LOAD - 2
                      File #8 BCM STORE - - 2
B3:8/4       - Reset PLC Clock One-Shot Storage
                ONS - File #21 CLOCK - 0
FILE B3:8/4 LEN:2 - COP - File #7 BCM LOAD - 2
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                        File #8 BCM STORE - - 2
B3:8/5       - DCS Heartbeat On One-Shot Storage
               ONS - File #23 DCS COMM - 269
FILE B3:8/5 LEN:2 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:8/6       - DCS Heartbeat On One-Shot
               OTE - File #23 DCS COMM - 269
               XIO - File #23 DCS COMM - 271
FILE B3:8/6 LEN:2 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:8/7       - DCS Heartbeat Off One-Shot Storage
               ONS - File #23 DCS COMM - 270
FILE B3:8/7 LEN:2 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:8/8       - DCS Heartbeat Off One-Shot
               OTE - File #23 DCS COMM - 270
               XIO - File #23 DCS COMM - 271
FILE B3:8/8 LEN:2 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:8/9       - PLC #1 Fail
               OTE - File #3 BCM MAIN - 4
               XIO - File #23 DCS COMM - 25
FILE B3:8/9 LEN:2 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:8/10      - PLC #2 Fail
               OTE - File #3 BCM MAIN - 4
               XIO - File #23 DCS COMM - 26
FILE B3:8/10 LEN:2 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:8/11      - Main Service A and B Not Available
               OTE - File #24 ATS - 18
               XIO - File #12 SEQUENCE - 19, 20, 21, 22
FILE B3:8/11 LEN:2 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:8/12      - ATS (PLC) Heartbeat
               OTE - File #24 ATS - 24
               XIC - File #24 ATS - 25
               XIO - File #24 ATS - 26
FILE B3:8/12 LEN:2 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:8/13      - ATS(PLC)Heartbeat ON One-Shot Storage
               ONS - File #24 ATS - 25
FILE B3:8/13 LEN:2 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:8/14      - ATS(PLC)Heartbeat ON One Shot
               OTE - File #24 ATS - 25
               XIO - File #24 ATS - 27
FILE B3:8/14 LEN:2 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:8/15      - ATS(PLC)Heartbeat Off One-Shot Storage
               ONS - File #24 ATS - 26
FILE B3:8/15 LEN:2 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:9/0       - ATS (PLC) Heartbeat Off One Shot
               OTE - File #24 ATS - 26
               XIO - File #24 ATS - 27
FILE B3:9/0 LEN:1 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:9/1       - OTU - File #10 MULTILIN - 1
               XIC - File #10 MULTILIN - 1
FILE B3:9/1 LEN:1 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:9/2       - OTU - File #10 MULTILIN - 1
               XIC - File #10 MULTILIN - 1
FILE B3:9/2 LEN:1 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
B3:9/3       - Wet Well #1 Fail High
               OTE - File #9 ANALOG IN - 8
               XIC - File #9 ANALOG IN - 10
               XIO - File #9 ANALOG IN - 7
                        File #23 DCS COMM - 186
FILE B3:9/3 LEN:1 - COP - File #7 BCM LOAD - 2
                        File #8 BCM STORE - - 2
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B3:9/4       - Wet Well #2 Fail High
               OTE - File #9 ANALOG IN - 11
               XIC - File #9 ANALOG IN - 7
               XIO - File #9 ANALOG IN - 10
                     File #23 DCS COMM - 186
FILE B3:9/4 LEN:1 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:9/5       - Wet Well #1 Fail Low
               OTE - File #9 ANALOG IN - 9
               XIC - File #9 ANALOG IN - 10
               XIO - File #9 ANALOG IN - 7
FILE B3:9/5 LEN:1 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
B3:9/6       - Wet Well #2 Fail Low
               OTE - File #9 ANALOG IN - 12
               XIC - File #9 ANALOG IN - 7
               XIO - File #9 ANALOG IN - 10
FILE B3:9/6 LEN:1 - COP - File #7 BCM LOAD - 2
                     File #8 BCM STORE - - 2
T4:0         - BCM Initial Start-Up Delay Timer
               TON - File #3 BCM MAIN - 9
T4:0/DN      - Initial Start-up Delay Done
               XIC - File #3 BCM MAIN - 2, 3, 5, 6
                     File #4 BCM PRI - 1, 2
T4:1         - Pump 101 Off Timer
               TON - File #12 SEQUENCE - 5
               COP - File #7 BCM LOAD - 4
                     File #8 BCM STORE - 4
FILE T4:1 LEN:231 - COP - File #7 BCM LOAD - 4
                     File #8 BCM STORE - - 4
T4:1/DN      - Pump 101 Minimum Off Time
               XIC - File #12 SEQUENCE - 19
               XIO - File #23 DCS COMM - 182
FILE T4:1/DN LEN:231 - COP - File #7 BCM LOAD - 4
                     File #8 BCM STORE - - 4
T4:2         - Pump 102 Off Timer
               TON - File #12 SEQUENCE - 6
FILE T4:2 LEN:230 - COP - File #7 BCM LOAD - 4
                     File #8 BCM STORE - - 4
T4:2/DN      - Pump 102 Minimum Off Time
               XIC - File #12 SEQUENCE - 20
               XIO - File #23 DCS COMM - 183
FILE T4:2/DN LEN:230 - COP - File #7 BCM LOAD - 4
                     File #8 BCM STORE - - 4
T4:3         - Pump 103 Off Timer
               TON - File #12 SEQUENCE - 7
FILE T4:3 LEN:229 - COP - File #7 BCM LOAD - 4
                     File #8 BCM STORE - - 4
T4:3/DN      - Pump 103 Minimum Off Time
               XIC - File #12 SEQUENCE - 21
               XIO - File #23 DCS COMM - 184
FILE T4:3/DN LEN:229 - COP - File #7 BCM LOAD - 4
                     File #8 BCM STORE - - 4
T4:4         - Pump 104 Off Timer
               TON - File #12 SEQUENCE - 8
FILE T4:4 LEN:228 - COP - File #7 BCM LOAD - 4
                     File #8 BCM STORE - - 4
T4:4/DN      - Pump 104 Minimum Off Time
               XIC - File #12 SEQUENCE - 22
               XIO - File #23 DCS COMM - 185
FILE T4:4/DN LEN:228 - COP - File #7 BCM LOAD - 4
                     File #8 BCM STORE - - 4
T4:5         - 60 Second Timer
               TON - File #12 SEQUENCE - 13
FILE T4:5 LEN:227 - COP - File #7 BCM LOAD - 4
                     File #8 BCM STORE - - 4
T4:5/DN      - One Minute Elapsed
               XIC - File #12 SEQUENCE - 14
               XIO - File #12 SEQUENCE - 13
FILE T4:5/DN LEN:227 - COP - File #7 BCM LOAD - 4
                     File #8 BCM STORE - - 4
T4:6         - Pump Start Minimum Interval Timer
               TON - File #12 SEQUENCE - 39
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FILE T4:6 LEN:226 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:6/DN      - Pump Start Minimum Interval Done
               XIC - File #12 SEQUENCE - 41
FILE T4:6/DN LEN:226 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:7         - Pump Stop Minimum Interval Timer
               TON - File #12 SEQUENCE - 40
FILE T4:7 LEN:225 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:7/DN      - Pump Stop Minimum Interval Done
               XIC - File #12 SEQUENCE - 41
FILE T4:7/DN LEN:225 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:8         - Pump 101 Start Response Timer
               TON - File #13 PUMP 101 - 0
FILE T4:8 LEN:224 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:8/DN      - Pump 101 Start Response Reqd
               XIC - File #13 PUMP 101 - 1
FILE T4:8/DN LEN:224 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:9         - Pump 101 Stop Response Timer
               TON - File #13 PUMP 101 - 2
FILE T4:9 LEN:223 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:9/DN      - Pump 101 Stop Response Reqd
               XIC - File #13 PUMP 101 - 3
FILE T4:9/DN LEN:223 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:10        - Pump 101 Upper Bearing High Vibration Timer
               TON - File #13 PUMP 101 - 4
FILE T4:10 LEN:222 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:10/DN     - Pump 101 Upper Bearing High Vibration
               XIC - File #13 PUMP 101 - 5
FILE T4:10/DN LEN:222 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:11        - Pump 101 Upper Bearing High-High Vibration Timer
               TON - File #13 PUMP 101 - 6
FILE T4:11 LEN:221 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:11/DN     - Pump 101 Upper Bearing High-High Vibration
               XIC - File #13 PUMP 101 - 7
FILE T4:11/DN LEN:221 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:12        - Pump 101 Lower Bearing High Vibration Timer
               TON - File #13 PUMP 101 - 8
FILE T4:12 LEN:220 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:12/DN     - Pump 101 Lower Bearing High Vibration
               XIC - File #13 PUMP 101 - 9
FILE T4:12/DN LEN:220 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:13        - Pump 101 Lower Bearing High-High Vibration Timer
               TON - File #13 PUMP 101 - 10
FILE T4:13 LEN:219 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:13/DN     - Pump 101 Lower Bearing High-High Vibration
               XIC - File #13 PUMP 101 - 11
FILE T4:13/DN LEN:219 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:14        - Pump 101 Low Suction Pressure Timer
               TON - File #13 PUMP 101 - 12
FILE T4:14 LEN:218 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:14/DN     - Pump 101 Low Suction Pressure
               XIC - File #13 PUMP 101 - 13
FILE T4:14/DN LEN:218 - COP - File #7 BCM LOAD - 4
                    File #8 BCM STORE - - 4
T4:15        - Pump 101 Low-Low Suction Pressure Timer
               TON - File #13 PUMP 101 - 14
FILE T4:15 LEN:217 - COP - File #7 BCM LOAD - 4
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                        File #8 BCM STORE - - 4
T4:15/DN      - Pump 101 Low-Low Suction Pressure
                XIC - File #13 PUMP 101 - 15
FILE T4:15/DN LEN:217 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:16         - Pump 101 High Discharge Pressure Timer
                TON - File #13 PUMP 101 - 16
FILE T4:16 LEN:216 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:16/DN      - Pump 101 High Discharge Pressure
                XIC - File #13 PUMP 101 - 17
FILE T4:16/DN LEN:216 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:17         - Pump 101 High-High Discharge Pressure Timer
                TON - File #13 PUMP 101 - 18
FILE T4:17 LEN:215 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:17/DN      - Pump 101 High-High Discharge Pressure
                XIC - File #13 PUMP 101 - 19
FILE T4:17/DN LEN:215 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:18         - Pump 101 Discharge Valve Fail To Open Timer
                TON - File #13 PUMP 101 - 20
FILE T4:18 LEN:214 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:18/DN      - Pump 101 Discharge Valve Fail To Open
                XIC - File #13 PUMP 101 - 22
FILE T4:18/DN LEN:214 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:19         - Pump 101 Discharge Valve Fail To Close Timer
                TON - File #13 PUMP 101 - 21
FILE T4:19 LEN:213 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:19/DN      - Pump 101 Discharge Valve Fail To Close
                XIC - File #13 PUMP 101 - 22
FILE T4:19/DN LEN:213 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:21         - Pump 101 Hour Run Timer
                RTO - File #13 PUMP 101 - 26
                RES - File #13 PUMP 101 - 27
FILE T4:21 LEN:211 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:21/DN      - Pump 101 Increment Run Time Meter
                XIC - File #13 PUMP 101 - 27
FILE T4:21/DN LEN:211 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:22         - Pump 102 Start Response Timer
                TON - File #14 PUMP 102 - 0
FILE T4:22 LEN:210 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:22/DN      - Pump 102 Start Response Reqd
                XIC - File #14 PUMP 102 - 1
FILE T4:22/DN LEN:210 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:23         - Pump 102 Stop Response Timer
                TON - File #14 PUMP 102 - 2
FILE T4:23 LEN:209 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:23/DN      - Pump 102 Stop Response Reqd
                XIC - File #14 PUMP 102 - 3
FILE T4:23/DN LEN:209 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:24         - Pump 102 Upper Bearing High Vibration Timer
                TON - File #14 PUMP 102 - 4
FILE T4:24 LEN:208 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:24/DN      - Pump 102 Upper Bearing High Vibration
                XIC - File #14 PUMP 102 - 5
FILE T4:24/DN LEN:208 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:25         - Pump 102 Upper Bearing High-High Vibration Timer
                TON - File #14 PUMP 102 - 6
FILE T4:25 LEN:207 - COP - File #7 BCM LOAD - 4
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                        File #8 BCM STORE - - 4
T4:25/DN      - Pump 102 Upper Bearing High-High Vibration
                XIC - File #14 PUMP 102 - 7
FILE T4:25/DN LEN:207 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:26         - Pump 102 Lower Bearing High Vibration Timer
                TON - File #14 PUMP 102 - 8
FILE T4:26 LEN:206 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:26/DN      - Pump 102 Lower Bearing High Vibration
                XIC - File #14 PUMP 102 - 9
FILE T4:26/DN LEN:206 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:27         - Pump 102 Lower Bearing High-High Vibration Timer
                TON - File #14 PUMP 102 - 10
FILE T4:27 LEN:205 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:27/DN      - Pump 102 Lower Bearing High-High Vibration
                XIC - File #14 PUMP 102 - 11
FILE T4:27/DN LEN:205 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:28         - Pump 102 Low Suction Pressure Timer
                TON - File #14 PUMP 102 - 12
FILE T4:28 LEN:204 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:28/DN      - Pump 102 Low Suction Pressure
                XIC - File #14 PUMP 102 - 13
FILE T4:28/DN LEN:204 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:29         - Pump 102 Low-Low Suction Pressure Timer
                TON - File #14 PUMP 102 - 14
FILE T4:29 LEN:203 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:29/DN      - Pump 102 Low-Low Suction Pressure
                XIC - File #14 PUMP 102 - 15
FILE T4:29/DN LEN:203 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:30         - Pump 102 High Discharge Pressure Timer
                TON - File #14 PUMP 102 - 16
FILE T4:30 LEN:202 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:30/DN      - Pump 102 High Discharge Pressure
                XIC - File #14 PUMP 102 - 17
FILE T4:30/DN LEN:202 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:31         - Pump 102 High-High Discharge Pressure Timer
                TON - File #14 PUMP 102 - 18
FILE T4:31 LEN:201 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:31/DN      - Pump 102 High-High Discharge Pressure
                XIC - File #14 PUMP 102 - 19
FILE T4:31/DN LEN:201 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:32         - Pump 102 Discharge Valve Fail To Open Timer
                TON - File #14 PUMP 102 - 20
FILE T4:32 LEN:200 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:32/DN      - Pump 102 Discharge Valve Fail To Open
                XIC - File #14 PUMP 102 - 22
FILE T4:32/DN LEN:200 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:33         - Pump 102 Discharge Valve Fail To Close Timer
                TON - File #14 PUMP 102 - 21
FILE T4:33 LEN:199 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:33/DN      - Pump 102 Discharge Valve Fail To Close
                XIC - File #14 PUMP 102 - 22
FILE T4:33/DN LEN:199 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:35         - Pump 102 Hour Run Timer
                RTO - File #14 PUMP 102 - 26
                RES - File #14 PUMP 102 - 27
FILE T4:35 LEN:197 - COP - File #7 BCM LOAD - 4
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                        File #8 BCM STORE - - 4
T4:35/DN      - Pump 102 Increment Run Time Meter
                XIC - File #14 PUMP 102 - 27
FILE T4:35/DN LEN:197 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:36         - Pump 103 Start Response Timer
                TON - File #15 PUMP 103 - 0
FILE T4:36 LEN:196 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:36/DN      - Pump 103 Start Response Reqd
                XIC - File #15 PUMP 103 - 1
FILE T4:36/DN LEN:196 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:37         - Pump 103 Stop Response Timer
                TON - File #15 PUMP 103 - 2
FILE T4:37 LEN:195 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:37/DN      - Pump 103 Stop Response Reqd
                XIC - File #15 PUMP 103 - 3
FILE T4:37/DN LEN:195 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:38         - Pump 103 Upper Bearing High Vibration Timer
                TON - File #15 PUMP 103 - 4
FILE T4:38 LEN:194 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:38/DN      - Pump 103 Upper Bearing High Vibration
                XIC - File #15 PUMP 103 - 5
FILE T4:38/DN LEN:194 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:39         - Pump 103 Upper Bearing High-High Vibration Timer
                TON - File #15 PUMP 103 - 6
FILE T4:39 LEN:193 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:39/DN      - Pump 103 Upper Bearing High-High Vibration
                XIC - File #15 PUMP 103 - 7
FILE T4:39/DN LEN:193 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:40         - Pump 103 Lower Bearing High Vibration Timer
                TON - File #15 PUMP 103 - 8
FILE T4:40 LEN:192 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:40/DN      - Pump 103 Lower Bearing High Vibration
                XIC - File #15 PUMP 103 - 9
FILE T4:40/DN LEN:192 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:41         - Pump 103 Lower Bearing High-High Vibration Timer
                TON - File #15 PUMP 103 - 10
FILE T4:41 LEN:191 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:41/DN      - Pump 103 Lower Bearing High-High Vibration
                XIC - File #15 PUMP 103 - 11
FILE T4:41/DN LEN:191 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:42         - Pump 103 Low Suction Pressure Timer
                TON - File #15 PUMP 103 - 12
FILE T4:42 LEN:190 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:42/DN      - Pump 103 Low Suction Pressure
                XIC - File #15 PUMP 103 - 13
FILE T4:42/DN LEN:190 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:43         - Pump 103 Low-Low Suction Pressure Timer
                TON - File #15 PUMP 103 - 14
FILE T4:43 LEN:189 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:43/DN      - Pump 103 Low-Low Suction Pressure
                XIC - File #15 PUMP 103 - 15
FILE T4:43/DN LEN:189 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:44         - Pump 103 High Discharge Pressure Timer
                TON - File #15 PUMP 103 - 16
FILE T4:44 LEN:188 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
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T4:44/DN     - Pump 103 High Discharge Pressure
               XIC - File #15 PUMP 103 - 17
FILE T4:44/DN LEN:188 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:45        - Pump 103 High-High Discharge Pressure Timer
               TON - File #15 PUMP 103 - 18
FILE T4:45 LEN:187 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:45/DN     - Pump 103 High-High Discharge Pressure
               XIC - File #15 PUMP 103 - 19
FILE T4:45/DN LEN:187 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:46        - Pump 103 Discharge Valve Fail To Open Timer
               TON - File #15 PUMP 103 - 20
FILE T4:46 LEN:186 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:46/DN     - Pump 103 Discharge Valve Fail To Open
               XIC - File #15 PUMP 103 - 22
FILE T4:46/DN LEN:186 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:47        - Pump 103 Discharge Valve Fail To Close Timer
               TON - File #15 PUMP 103 - 21
FILE T4:47 LEN:185 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:47/DN     - Pump 103 Discharge Valve Fail To Close
               XIC - File #15 PUMP 103 - 22
FILE T4:47/DN LEN:185 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:48        - Pump 103 Seal Water Low Flow Timer
               TON - File #15 PUMP 103 - 23
FILE T4:48 LEN:184 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:48/DN     - Pump 103 Seal Water Low Flow
               XIC - File #15 PUMP 103 - 24
FILE T4:48/DN LEN:184 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:49        - Pump 103 Hour Run Timer
               RTO - File #15 PUMP 103 - 28
               RES - File #15 PUMP 103 - 29
FILE T4:49 LEN:183 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:49/DN     - Pump 103 Increment Run Time Meter
               XIC - File #15 PUMP 103 - 29
FILE T4:49/DN LEN:183 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:50        - Pump 104 Start Response Timer
               TON - File #16 PUMP 104 - 0
FILE T4:50 LEN:182 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:50/DN     - Pump 104 Start Response Reqd
               XIC - File #16 PUMP 104 - 1
FILE T4:50/DN LEN:182 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:51        - Pump 104 Stop Response Timer
               TON - File #16 PUMP 104 - 2
FILE T4:51 LEN:181 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:51/DN     - Pump 104 Stop Response Reqd
               XIC - File #16 PUMP 104 - 3
FILE T4:51/DN LEN:181 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:52        - Pump 104 Upper Bearing High Vibration Timer
               TON - File #16 PUMP 104 - 4
FILE T4:52 LEN:180 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:52/DN     - Pump 104 Upper Bearing High Vibration
               XIC - File #16 PUMP 104 - 5
FILE T4:52/DN LEN:180 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
T4:53        - Pump 104 Upper Bearing High-High Vibration Timer
               TON - File #16 PUMP 104 - 6
FILE T4:53 LEN:179 - COP - File #7 BCM LOAD - 4
                        File #8 BCM STORE - - 4
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T4:53/DN     - Pump 104 Upper Bearing High-High Vibration
               XIC - File #16 PUMP 104 - 7
FILE T4:53/DN LEN:179 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:54        - Pump 104 Lower Bearing High Vibration Timer
               TON - File #16 PUMP 104 - 8
FILE T4:54 LEN:178 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:54/DN     - Pump 104 Lower Bearing High Vibration
               XIC - File #16 PUMP 104 - 9
FILE T4:54/DN LEN:178 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:55        - Pump 104 Lower Bearing High-High Vibration Timer
               TON - File #16 PUMP 104 - 10
FILE T4:55 LEN:177 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:55/DN     - Pump 104 Lower Bearing High-High Vibration
               XIC - File #16 PUMP 104 - 11
FILE T4:55/DN LEN:177 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:56        - Pump 104 Low Suction Pressure Timer
               TON - File #16 PUMP 104 - 12
FILE T4:56 LEN:176 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:56/DN     - Pump 104 Low Suction Pressure
               XIC - File #16 PUMP 104 - 13
FILE T4:56/DN LEN:176 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:57        - Pump 104 Low-Low Suction Pressure Timer
               TON - File #16 PUMP 104 - 14
FILE T4:57 LEN:175 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:57/DN     - Pump 104 Low-Low Suction Pressure
               XIC - File #16 PUMP 104 - 15
FILE T4:57/DN LEN:175 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:58        - Pump 104 High Discharge Pressure Timer
               TON - File #16 PUMP 104 - 16
FILE T4:58 LEN:174 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:58/DN     - Pump 104 High Discharge Pressure
               XIC - File #16 PUMP 104 - 17
FILE T4:58/DN LEN:174 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:59        - Pump 104 High-High Discharge Pressure Timer
               TON - File #16 PUMP 104 - 18
FILE T4:59 LEN:173 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:59/DN     - Pump 104 High-High Discharge Pressure
               XIC - File #16 PUMP 104 - 19
FILE T4:59/DN LEN:173 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:60        - Pump 104 Discharge Valve Fail To Open Timer
               TON - File #16 PUMP 104 - 20
FILE T4:60 LEN:172 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:60/DN     - Pump 104 Discharge Valve Fail To Open
               XIC - File #16 PUMP 104 - 22
FILE T4:60/DN LEN:172 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:61        - Pump 104 Discharge Valve Fail To Close Timer
               TON - File #16 PUMP 104 - 21
FILE T4:61 LEN:171 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:61/DN     - Pump 104 Discharge Valve Fail To Close
               XIC - File #16 PUMP 104 - 22
FILE T4:61/DN LEN:171 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:62        - Pump 104 Seal Water Low Flow Timer
               TON - File #16 PUMP 104 - 23
FILE T4:62 LEN:170 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:62/DN     - Pump 104 Seal Water Low Flow
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                XIC - File #16 PUMP 104 - 24
FILE T4:62/DN LEN:170 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:63         - Pump 104 Hour Run Timer
                RTO - File #16 PUMP 104 - 28
                RES - File #16 PUMP 104 - 29
FILE T4:63 LEN:169 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:63/DN      - Pump 104 Increment Run Time Meter
                XIC - File #16 PUMP 104 - 29
FILE T4:63/DN LEN:169 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:64         - Hydropneumatic Tank T-301 Low Pressure Timer
                TON - File #19 SEAL WATER - 0
FILE T4:64 LEN:168 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:64/DN      - Lag Seal Water Pump Reqd
                XIC - File #19 SEAL WATER - 5, 6
FILE T4:64/DN LEN:168 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:65         - Slide Gate G-211 Response Timer
                TON - File #20 GATES - 4
FILE T4:65 LEN:167 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:65/DN      - Slide Gate G-211 Response Reqd
                XIC - File #20 GATES - 5, 6
FILE T4:65/DN LEN:167 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:66         - Slide Gate G-212 Response Timer
                TON - File #20 GATES - 11
FILE T4:66 LEN:166 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:66/DN      - Slide Gate G-212 Response Reqd
                XIC - File #20 GATES - 12, 13
FILE T4:66/DN LEN:166 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:67         - Slide Gate G-213 Response Timer
                TON - File #20 GATES - 18
FILE T4:67 LEN:165 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:67/DN      - Slide Gate G-213 Response Reqd
                XIC - File #20 GATES - 19, 20
FILE T4:67/DN LEN:165 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:68         - Sluice Gate G-232 Response Timer
                TON - File #20 GATES - 28
FILE T4:68 LEN:164 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:68/DN      - Slide Gate G-212 Close Timer Done
                XIC - File #20 GATES - 29, 30
FILE T4:68/DN LEN:164 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:69         - Plug Valve V-141 Response Timer
                TON - File #20 GATES - 35
FILE T4:69 LEN:163 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:69/DN      - Plug Valve V-141 Response Reqd
                XIC - File #20 GATES - 36, 37
FILE T4:69/DN LEN:163 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:70         - DCS Heartbeat Timer
                TON - File #23 DCS COMM - 271
FILE T4:70 LEN:162 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:70/DN      - DCS Comm Fail
                XIC - File #23 DCS COMM - 27, 272
FILE T4:70/DN LEN:162 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:71         - Sluice Gate G-232 Stop Timer
                TOF - File #20 GATES - 25
FILE T4:71 LEN:161 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:71/DN      - Stop Sluice Gate G-232
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                XIC - File #20 GATES - 26
FILE T4:71/DN LEN:161 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:72         - ATS (PLC) Heartbeat Timer
                TON - File #24 ATS - 27
FILE T4:72 LEN:160 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:72/DN      - XIC - File #24 ATS - 28
FILE T4:72/DN LEN:160 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:73         - TON - File #24 ATS - 3
FILE T4:73 LEN:159 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:73/DN      - XIC - File #24 ATS - 4
FILE T4:73/DN LEN:159 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:74         - TON - File #24 ATS - 5
FILE T4:74 LEN:158 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:74/DN      - XIC - File #24 ATS - 6
FILE T4:74/DN LEN:158 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:75         - TON - File #24 ATS - 19
FILE T4:75 LEN:157 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:75/DN      - XIC - File #24 ATS - 20
FILE T4:75/DN LEN:157 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:76         - TON - File #24 ATS - 21
FILE T4:76 LEN:156 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
T4:76/DN      - XIC - File #24 ATS - 22
FILE T4:76/DN LEN:156 - COP - File #7 BCM LOAD - 4
                      File #8 BCM STORE - - 4
C5:0          - Pump 101 Start Counter
                CTU - File #12 SEQUENCE - 9
                CTD - File #12 SEQUENCE - 15
                COP - File #7 BCM LOAD - 5
                      File #8 BCM STORE - 5
FILE C5:0 LEN:12 - COP - File #7 BCM LOAD - 5
                      File #8 BCM STORE - - 5
C5:0/DN       - Pump 101 Maximum Starts
                XIC - File #23 DCS COMM - 178
                XIO - File #23 DCS COMM - 178
FILE C5:0/DN LEN:12 - COP - File #7 BCM LOAD - 5
                      File #8 BCM STORE - - 5
C5:0.ACC      - Pump 101 Number Of Starts In Last Hour
                GRT - File #12 SEQUENCE - 15
FILE C5:0.ACC LEN:12 - COP - File #7 BCM LOAD - 5
                      File #8 BCM STORE - - 5
C5:1          - Pump 102 Start Counter
                CTU - File #12 SEQUENCE - 10
                CTD - File #12 SEQUENCE - 16
FILE C5:1 LEN:11 - COP - File #7 BCM LOAD - 5
                      File #8 BCM STORE - - 5
C5:1/DN       - Pump 102 Maximum Starts
                XIC - File #23 DCS COMM - 179
                XIO - File #23 DCS COMM - 179
FILE C5:1/DN LEN:11 - COP - File #7 BCM LOAD - 5
                      File #8 BCM STORE - - 5
C5:1.ACC      - Pump 102 Number Of Starts In Last Hour
                GRT - File #12 SEQUENCE - 16
FILE C5:1.ACC LEN:11 - COP - File #7 BCM LOAD - 5
                      File #8 BCM STORE - - 5
C5:2          - Pump 103 Start Counter
                CTU - File #12 SEQUENCE - 11
                CTD - File #12 SEQUENCE - 17
FILE C5:2 LEN:10 - COP - File #7 BCM LOAD - 5
                      File #8 BCM STORE - - 5
C5:2/DN       - Pump 103 Maximum Starts
                XIC - File #23 DCS COMM - 180
                XIO - File #23 DCS COMM - 180
FILE C5:2/DN LEN:10 - COP - File #7 BCM LOAD - 5
```

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                        File #8 BCM STORE - - 5
C5:2.ACC      - Pump 103 Number Of Starts In Last Hour
                GRT - File #12 SEQUENCE - 17
FILE C5:2.ACC LEN:10 - COP - File #7 BCM LOAD - 5
                        File #8 BCM STORE - - 5
C5:3          - Pump 104 Start Counter
                CTU - File #12 SEQUENCE - 12
                CTD - File #12 SEQUENCE - 18
FILE C5:3 LEN:9 - COP - File #7 BCM LOAD - 5
                        File #8 BCM STORE - - 5
C5:3/DN       - Pump 104 Maximum Starts
                XIC - File #23 DCS COMM - 181
                XIO - File #23 DCS COMM - 181
FILE C5:3/DN LEN:9 - COP - File #7 BCM LOAD - 5
                        File #8 BCM STORE - - 5
C5:3.ACC      - Pump 104 Number Of Starts In Last Hour
                GRT - File #12 SEQUENCE - 18
FILE C5:3.ACC LEN:9 - COP - File #7 BCM LOAD - 5
                        File #8 BCM STORE - - 5
R6:0          - Multilin Temp Conversion Control Block
                FAL - File #10 MULTILIN - 2
R6:0/DN       - FAL Done
                XIO - File #10 MULTILIN - 2
R6:1          - Pump 101 Maximum Start Shift Register Control Block
                BSL - File #12 SEQUENCE - 14
R6:1/UL       - Pump 101 Start Shift Register Unload Bit
                XIC - File #12 SEQUENCE - 15
R6:2          - Pump 102 Maximum Start Shift Register Control Block
                BSL - File #12 SEQUENCE - 14
R6:2/UL       - Pump 102 Start Shift Register Unload Bit
                XIC - File #12 SEQUENCE - 16
R6:3          - Pump 103 Maximum Start Shift Register Control Block
                BSL - File #12 SEQUENCE - 14
R6:3/UL       - Pump 103 Start Shift Register Unload Bit
                XIC - File #12 SEQUENCE - 17
R6:4          - Pump 104 Maximum Start Shift Register Control Block
                BSL - File #12 SEQUENCE - 14
R6:4/UL       - Pump 104 Start Shift Register Unload Bit
                XIC - File #12 SEQUENCE - 18
N7:0          - BCM Packet Length
                MOV - File #3 BCM MAIN - 0, 7
                EQU - File #5 BCM SEC - 1
N7:1          - Primary Buffer Packet ID
                SUB - File #4 BCM PRI - 1
                MUL - File #4 BCM PRI - 2
N7:2          - Address Offset Into Primary Buffer
                COP - File #4 BCM PRI - 2
                MUL - File #4 BCM PRI - 2
                GEQ - File #4 BCM PRI - 2
N7:3          - BCM Secondary Buffer Packet ID
                SUB - File #5 BCM SEC - 0
                MUL - File #5 BCM SEC - 0
N7:4          - Address Offset Into BCM Secondary Buffer
                COP - File #5 BCM SEC - 0
                MUL - File #5 BCM SEC - 0
                GEQ - File #5 BCM SEC - 0
F8:0          - Wet Well Level (0-17 ft)
                COP - File #23 DCS COMM - 192
                MOV - File #9 ANALOG IN - 6, 7, 10
                GRT - File #12 SEQUENCE - 1, 2, 3, 4
                LEQ - File #12 SEQUENCE - 0
                GEQ - File #12 SEQUENCE - 1, 2, 3, 4
FILE F8:0 LEN:1 - COP - File #23 DCS COMM - 192
F8:1          - Pump 101 Discharge Pressure (0-75 psig)
                CPT - File #9 ANALOG IN - 13
                COP - File #23 DCS COMM - 204
                GEQ - File #13 PUMP 101 - 16, 18
FILE F8:1 LEN:1 - COP - File #23 DCS COMM - 204
F8:2          - Pump 101 Suction Pressure (0-15 psig)
                CPT - File #9 ANALOG IN - 14
                COP - File #23 DCS COMM - 203
                LEQ - File #13 PUMP 101 - 12, 14
FILE F8:2 LEN:1 - COP - File #23 DCS COMM - 203
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F8:3         - Pump 102 Discharge Pressure (0-75 psig)
               CPT - File #9 ANALOG IN - 15
               COP - File #23 DCS COMM - 217
               GEQ - File #14 PUMP 102 - 16, 18
FILE F8:3 LEN:1 - COP - File #23 DCS COMM - 217
F8:4         - Pump 102 Suction Pressure (0-15 psig)
               CPT - File #9 ANALOG IN - 16
               COP - File #23 DCS COMM - 216
               LEQ - File #14 PUMP 102 - 12, 14
FILE F8:4 LEN:1 - COP - File #23 DCS COMM - 216
F8:5         - Pump 103 Discharge Pressure (0-75 psig)
               CPT - File #9 ANALOG IN - 17
               COP - File #23 DCS COMM - 230
               GEQ - File #15 PUMP 103 - 16, 18
FILE F8:5 LEN:1 - COP - File #23 DCS COMM - 230
F8:6         - Pump 103 Suction Pressure (0-15 psig)
               CPT - File #9 ANALOG IN - 18
               COP - File #23 DCS COMM - 229
               LEQ - File #15 PUMP 103 - 12, 14
FILE F8:6 LEN:1 - COP - File #23 DCS COMM - 229
F8:7         - Pump 104 Discharge Pressure (0-75 psig)
               CPT - File #9 ANALOG IN - 19
               COP - File #23 DCS COMM - 243
               GEQ - File #16 PUMP 104 - 16, 18
FILE F8:7 LEN:1 - COP - File #23 DCS COMM - 243
F8:8         - Pump 104 Suction Pressure (0-15 psig)
               CPT - File #9 ANALOG IN - 20
               COP - File #23 DCS COMM - 242
               LEQ - File #16 PUMP 104 - 12, 14
FILE F8:8 LEN:1 - COP - File #23 DCS COMM - 242
F8:9         - Bar Screen Channel Differential Level (0-10 ft)
               CPT - File #9 ANALOG IN - 21
               COP - File #23 DCS COMM - 193
FILE F8:9 LEN:1 - COP - File #23 DCS COMM - 193
F8:10        - Force Main Discharge Flow Rate (0-20000 gpm)
               CPT - File #9 ANALOG IN - 22
                     File #17 STI - 0
               COP - File #23 DCS COMM - 257
FILE F8:10 LEN:1 - COP - File #23 DCS COMM - 257
F8:11        - Force Main Discharge Pressure (0-100 psig)
               CPT - File #9 ANALOG IN - 23
               COP - File #23 DCS COMM - 254
FILE F8:11 LEN:1 - COP - File #23 DCS COMM - 254
F8:13        - Hypo Caustic Flow To Vessel #1 (0-1 gpm)
               CPT - File #9 ANALOG IN - 24
               COP - File #23 DCS COMM - 255
FILE F8:13 LEN:1 - COP - File #23 DCS COMM - 255
F8:14        - Hypo Caustic Flow To Vessel #2 (0-1 gpm)
               CPT - File #9 ANALOG IN - 25
               COP - File #23 DCS COMM - 256
FILE F8:14 LEN:1 - COP - File #23 DCS COMM - 256
F8:15        - Odor Control System pH (0-14 pH)
               CPT - File #9 ANALOG IN - 26
               COP - File #23 DCS COMM - 191
FILE F8:15 LEN:1 - COP - File #23 DCS COMM - 191
F8:16        - Pump 101 Motor Winding Temp A (Deg F)
               FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 205
FILE F8:16 LEN:32 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 205
F8:17        - Pump 101 Motor Winding Temp B (Deg F)
               COP - File #23 DCS COMM - 206
FILE F8:17 LEN:31 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 206
F8:18        - Pump 101 Motor Winding Temp C (Deg F)
               COP - File #23 DCS COMM - 207
FILE F8:18 LEN:30 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 207
F8:19        - Pump 101 Motor Winding Temp D (Deg F)
               COP - File #23 DCS COMM - 208
FILE F8:19 LEN:29 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 208
F8:20        - Pump 101 Motor Winding Temp E (Deg F)
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                COP - File #23 DCS COMM - 209
FILE F8:20 LEN:28 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 209
F8:21         - Pump 101 Motor Winding Temp F (Deg F)
                COP - File #23 DCS COMM - 210
FILE F8:21 LEN:27 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 210
F8:22         - Pump 101 Bearing Temp G (Deg F)
                COP - File #23 DCS COMM - 211
FILE F8:22 LEN:26 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 211
F8:23         - Pump 101 Bearing Temp H (Deg F)
                COP - File #23 DCS COMM - 212
FILE F8:23 LEN:25 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 212
F8:24         - Pump 102 Motor Winding Temp A (Deg F)
                COP - File #23 DCS COMM - 218
FILE F8:24 LEN:24 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 218
F8:25         - Pump 102 Motor Winding Temp B (Deg F)
                COP - File #23 DCS COMM - 219
FILE F8:25 LEN:23 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 219
F8:26         - Pump 102 Motor Winding Temp C (Deg F)
                COP - File #23 DCS COMM - 220
FILE F8:26 LEN:22 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 220
F8:27         - Pump 102 Motor Winding Temp D (Deg F)
                COP - File #23 DCS COMM - 221
FILE F8:27 LEN:21 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 221
F8:28         - Pump 102 Motor Winding Temp E (Deg F)
                COP - File #23 DCS COMM - 222
FILE F8:28 LEN:20 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 222
F8:29         - Pump 102 Motor Winding Temp F (Deg F)
                COP - File #23 DCS COMM - 223
FILE F8:29 LEN:19 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 223
F8:30         - Pump 102 Bearing Temp G (Deg F)
                COP - File #23 DCS COMM - 224
FILE F8:30 LEN:18 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 224
F8:31         - Pump 102 Bearing Temp H (Deg F)
                COP - File #23 DCS COMM - 225
FILE F8:31 LEN:17 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 225
F8:32         - Pump 103 Motor Winding Temp A (Deg F)
                COP - File #23 DCS COMM - 231
FILE F8:32 LEN:16 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 231
F8:33         - Pump 103 Motor Winding Temp B (Deg F)
                COP - File #23 DCS COMM - 232
FILE F8:33 LEN:15 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 232
F8:34         - Pump 103 Motor Winding Temp C (Deg F)
                COP - File #23 DCS COMM - 233
FILE F8:34 LEN:14 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 233
F8:35         - Pump 103 Motor Winding Temp D (Deg F)
                COP - File #23 DCS COMM - 234
FILE F8:35 LEN:13 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 234
F8:36         - Pump 103 Motor Winding Temp E (Deg F)
                COP - File #23 DCS COMM - 235
FILE F8:36 LEN:12 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 235
F8:37         - Pump 103 Motor Winding Temp F (Deg F)
                COP - File #23 DCS COMM - 236
FILE F8:37 LEN:11 - FAL - File #10 MULTILIN - 2
                COP - File #23 DCS COMM - 236
F8:38         - Pump 103 Bearing Temp G (Deg F)
                COP - File #23 DCS COMM - 237
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FILE F8:38 LEN:10 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 237
F8:39        - Pump 103 Bearing Temp H (Deg F)
               COP - File #23 DCS COMM - 238
FILE F8:39 LEN:9 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 238
F8:40        - Pump 104 Motor Winding Temp A (Deg F)
               COP - File #23 DCS COMM - 244
FILE F8:40 LEN:8 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 244
F8:41        - Pump 104 Motor Winding Temp B (Deg F)
               COP - File #23 DCS COMM - 245
FILE F8:41 LEN:7 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 245
F8:42        - Pump 104 Motor Winding Temp C (Deg F)
               COP - File #23 DCS COMM - 246
FILE F8:42 LEN:6 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 246
F8:43        - Pump 104 Motor Winding Temp D (Deg F)
               COP - File #23 DCS COMM - 247
FILE F8:43 LEN:5 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 247
F8:44        - Pump 104 Motor Winding Temp E (Deg F)
               COP - File #23 DCS COMM - 248
FILE F8:44 LEN:4 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 248
F8:45        - Pump 104 Motor Winding Temp F (Deg F)
               COP - File #23 DCS COMM - 249
FILE F8:45 LEN:3 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 249
F8:46        - Pump 104 Bearing Temp G (Deg F)
               COP - File #23 DCS COMM - 250
FILE F8:46 LEN:2 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 250
F8:47        - Pump 104 Bearing Temp H (Deg F)
               COP - File #23 DCS COMM - 251
FILE F8:47 LEN:1 - FAL - File #10 MULTILIN - 2
               COP - File #23 DCS COMM - 251
F8:48        - Pump 101 Upper Bearing Vibration (In/Sec Peak)
               CPT - File #11 BENTLY - 2
               COP - File #23 DCS COMM - 213
               GEQ - File #13 PUMP 101 - 4, 6
FILE F8:48 LEN:1 - COP - File #23 DCS COMM - 213
F8:49        - Pump 101 Lower Bearing Vibration (In/Sec Peak)
               CPT - File #11 BENTLY - 3
               COP - File #23 DCS COMM - 214
               GEQ - File #13 PUMP 101 - 8, 10
FILE F8:49 LEN:1 - COP - File #23 DCS COMM - 214
F8:50        - Pump 102 Upper Bearing Vibration (In/Sec Peak)
               CPT - File #11 BENTLY - 4
               COP - File #23 DCS COMM - 226
               GEQ - File #14 PUMP 102 - 4, 6
FILE F8:50 LEN:1 - COP - File #23 DCS COMM - 226
F8:51        - Pump 102 Lower Bearing Vibration (In/Sec Peak)
               CPT - File #11 BENTLY - 5
               COP - File #23 DCS COMM - 227
               GEQ - File #14 PUMP 102 - 8, 10
FILE F8:51 LEN:1 - COP - File #23 DCS COMM - 227
F8:52        - Pump 103 Upper Bearing Vibration (In/Sec Peak)
               CPT - File #11 BENTLY - 6
               COP - File #23 DCS COMM - 239
               GEQ - File #15 PUMP 103 - 4, 6
FILE F8:52 LEN:1 - COP - File #23 DCS COMM - 239
F8:53        - Pump 103 Lower Bearing Vibration (In/Sec Peak)
               CPT - File #11 BENTLY - 7
               COP - File #23 DCS COMM - 240
               GEQ - File #15 PUMP 103 - 8, 10
FILE F8:53 LEN:1 - COP - File #23 DCS COMM - 240
F8:54        - Pump 104 Upper Bearing Vibration (In/Sec Peak)
               CPT - File #11 BENTLY - 8
               COP - File #23 DCS COMM - 252
               GEQ - File #16 PUMP 104 - 4, 6
FILE F8:54 LEN:1 - COP - File #23 DCS COMM - 252
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F8:55        - Pump 104 Lower Bearing Vibration (In/Sec Peak)
               CPT - File #11 BENTLY - 9
               COP - File #23 DCS COMM - 253
               GEQ - File #16 PUMP 104 - 8, 10
FILE F8:55 LEN:1 - COP - File #23 DCS COMM - 253
F8:56        - Pump 101 Run Time (Hours)
               COP - File #23 DCS COMM - 202
               ADD - File #13 PUMP 101 - 27
               CLR - File #13 PUMP 101 - 28
               GRT - File #13 PUMP 101 - 28
FILE F8:56 LEN:1 - COP - File #23 DCS COMM - 202
F8:57        - Pump 102 Run Time (Hours)
               COP - File #23 DCS COMM - 215
               ADD - File #14 PUMP 102 - 27
               CLR - File #14 PUMP 102 - 28
               GRT - File #14 PUMP 102 - 28
FILE F8:57 LEN:1 - COP - File #23 DCS COMM - 215
F8:58        - Pump 103 Run Time (Hours)
               COP - File #23 DCS COMM - 228
               ADD - File #15 PUMP 103 - 29
               CLR - File #15 PUMP 103 - 30
               GRT - File #15 PUMP 103 - 30
FILE F8:58 LEN:1 - COP - File #23 DCS COMM - 228
F8:59        - Pump 104 Run Time (Hours)
               COP - File #23 DCS COMM - 241
               ADD - File #16 PUMP 104 - 29
               CLR - File #16 PUMP 104 - 30
               GRT - File #16 PUMP 104 - 30
FILE F8:59 LEN:1 - COP - File #23 DCS COMM - 241
F8:60        - Force Main Flow Totalizer Accumulator
               CPT - File #17 STI - 0
               SUB - File #18 FLOW TOTAL - 0
               GRT - File #18 FLOW TOTAL - 0
F8:61        - Current Force Main Totalized Flow (MG)
               COP - File #23 DCS COMM - 258
               ADD - File #18 FLOW TOTAL - 0
               CLR - File #18 FLOW TOTAL - 1
               MOV - File #18 FLOW TOTAL - 1
FILE F8:61 LEN:1 - COP - File #23 DCS COMM - 258
F8:62        - Previous Force Main Totalized Flow (MG)
               COP - File #23 DCS COMM - 259
               MOV - File #18 FLOW TOTAL - 1
FILE F8:62 LEN:1 - COP - File #23 DCS COMM - 259
F8:63        - H2S stack
               CPT - File #9 ANALOG IN - 27
               COP - File #23 DCS COMM - 260
FILE F8:63 LEN:1 - COP - File #23 DCS COMM - 260
F8:64        - H2S barscreen Room
               CPT - File #9 ANALOG IN - 28
               COP - File #23 DCS COMM - 261
FILE F8:64 LEN:1 - COP - File #23 DCS COMM - 261
F8:65        - Wet well #1 Pumps 1-3, 0-17FT.
               CPT - File #9 ANALOG IN - 29
               COP - File #23 DCS COMM - 262
               MOV - File #9 ANALOG IN - 6, 7
               GRT - File #9 ANALOG IN - 7, 10
               LEQ - File #9 ANALOG IN - 9
               GEQ - File #9 ANALOG IN - 8
FILE F8:65 LEN:1 - COP - File #23 DCS COMM - 262
F8:66        - Wet well #2 Pumps 1-4, 0-17FT.
               CPT - File #9 ANALOG IN - 30
               COP - File #23 DCS COMM - 263
               MOV - File #9 ANALOG IN - 6, 10
               GRT - File #9 ANALOG IN - 7, 10
               LEQ - File #9 ANALOG IN - 12
               GEQ - File #9 ANALOG IN - 11
FILE F8:66 LEN:1 - COP - File #23 DCS COMM - 263
F8:67        - Bleach Level
               CPT - File #9 ANALOG IN - 31
               COP - File #23 DCS COMM - 264
               LEQ - File #15 PUMP 103 - 23
FILE F8:67 LEN:1 - COP - File #23 DCS COMM - 264
F8:68        - Barscreen H2S
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                CPT - File #9 ANALOG IN - 32
                COP - File #23 DCS COMM - 266
                LEQ - File #16 PUMP 104 - 23
FILE F8:68 LEN:1 - COP - File #23 DCS COMM - 266
F8:69        - Bleach Level 0-8ft
                COP - File #23 DCS COMM - 265
FILE F8:69 LEN:1 - COP - File #23 DCS COMM - 265
BT9:0        - BTR - File #3 BCM MAIN - 1
BT9:0/ER     - BCM BTR ER
                XIC - File #6 BCM DIAG - 0
BT9:0/DN     - BCM BTR DN
                XIC - File #3 BCM MAIN - 2, 3
                      File #4 BCM PRI - 1
                      File #5 BCM SEC - 0, 1
                      File #6 BCM DIAG - 2, 3, 4
                      File #8 BCM STORE - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
                        12
BT9:0/EN     - BCM BTR EN
                XIO - File #3 BCM MAIN - 1, 7
BT9:1        - BTW - File #3 BCM MAIN - 7
BT9:1/ER     - BCM BTW ER
                XIC - File #6 BCM DIAG - 1
BT9:1/DN     - BCM BTW DN
                XIC - File #4 BCM PRI - 0, 2
                      File #7 BCM LOAD - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
BT9:1/EN     - BCM BTW EN
                XIO - File #3 BCM MAIN - 1, 7
BT9:2        - Analog Input 160 Block Transfer Write Control Block
                BTW - File #9 ANALOG IN - 0
BT9:2/EN     - Analog Input 160 BTW Enable
                XIO - File #9 ANALOG IN - 0, 1
BT9:3        - Analog Input 160 Block Transfer Read Control Block
                BTR - File #9 ANALOG IN - 1
BT9:3/EN     - Analog Input 160 BTR Enable
                XIO - File #9 ANALOG IN - 1
BT9:4        - Analog Input 170 Block Transfer Write Control Block
                BTW - File #9 ANALOG IN - 2
BT9:4/EN     - Analog Input 170 BTW Enable
                XIO - File #9 ANALOG IN - 2, 3
BT9:5        - Analog Input 170 Block Transfer Read Control Block
                BTR - File #9 ANALOG IN - 3
BT9:5/EN     - Analog Input 170 BTR Enable
                XIO - File #9 ANALOG IN - 3
BT9:10       - Multilin Comm Module Block Transfer Read Control Block
                BTR - File #10 MULTILIN - 0
BT9:10/EN    - Multilin Comm Module BTR Enable
                XIO - File #10 MULTILIN - 0, 1
BT9:11       - Multilin Comm Module Block Transfer Write Control Block
                BTW - File #10 MULTILIN - 1
BT9:11/EN    - Multilin Comm Module BTW Enable
                XIO - File #10 MULTILIN - 0, 1
BT9:12       - Bently Nevada BTR Control Block
                BTR - File #11 BENTLY - 0
BT9:12/DN    - Bently Nevada BTR Done
                XIC - File #11 BENTLY - 2, 3, 4, 5, 6, 7, 8, 9
BT9:12/EN    - Bently Nevada BTR Enable
                XIO - File #11 BENTLY - 0, 1
BT9:13       - Bently Nevada Monitor 1 BTW Control Block
                BTW - File #11 BENTLY - 1
BT9:13/EN    - Bently Nevada Monitor 1 BTW Enable
                XIO - File #11 BENTLY - 0, 1
BT9:14       - Bently Nevada Monitor 2 BTW Control Block
                BTW - File #11 BENTLY - 1
BT9:14/EN    - Bently Nevada Monitor 2 BTW Enable
                XIO - File #11 BENTLY - 0, 1
BT9:15       - DCS Comm Module BTR Control Block
                BTR - File #23 DCS COMM - 267
BT9:15/EN    - DCS Comm Module BTR Enable
                XIO - File #23 DCS COMM - 267, 268
BT9:16       - BTW - File #23 DCS COMM - 268
BT9:16/EN    - DCS Comm Module BTW Enable
                XIO - File #23 DCS COMM - 267, 268
BT9:17       - BTW - File #9 ANALOG IN - 4
```

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BT9:17/EN     - XIO - File #9 ANALOG IN - 4, 5
BT9:18        - BTR - File #9 ANALOG IN - 5
BT9:18/EN     - XIO - File #9 ANALOG IN - 5
N10:0/0       - Local CPU Is Primary
                OTL - File #3 BCM MAIN - 2
                OTU - File #3 BCM MAIN - 2
                XIC - File #3 BCM MAIN - 3, 5
N10:0/2       - Remote Processor Failure
                OTL - File #3 BCM MAIN - 3
                OTU - File #3 BCM MAIN - 3
                XIC - File #3 BCM MAIN - 4
N10:0/4       - LOCAL ERROR FAULT STORE
                OTE - File #6 BCM DIAG - 3
N10:0/7       - ERROR COUNT RESET BIT
                XIC - File #6 BCM DIAG - 5
N10:0/8       - Remote CPU Is Primary
                OTL - File #3 BCM MAIN - 2
                OTU - File #3 BCM MAIN - 2
                XIC - File #3 BCM MAIN - 6
N10:0/12      - REMOTE ERROR FAULT STORE
                OTE - File #6 BCM DIAG - 4
N10:1         - BTR - File #3 BCM MAIN - 1
FILE N10:1 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/0       - LOCAL SERIAL COMM FAULT
                XIC - File #3 BCM MAIN - 3
                      File #6 BCM DIAG - 2, 3
                XIO - File #3 BCM MAIN - 3
FILE N10:1/0 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/1       - LOCAL BACKPLANE FAULT
                XIC - File #6 BCM DIAG - 2, 3
FILE N10:1/1 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/2       - LOCAL BUFFER FULL FAULT
                XIC - File #6 BCM DIAG - 2, 3
FILE N10:1/2 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/3       - LOCAL PROGRAM ERROR FAULT
                XIC - File #6 BCM DIAG - 2, 3
FILE N10:1/3 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/6       - BCM Status - Local CPU Is Primary
                XIC - File #3 BCM MAIN - 2
                XIO - File #3 BCM MAIN - 2
FILE N10:1/6 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/7       - BCM Status - Local Data Valid
                XIC - File #5 BCM SEC - 0, 1
FILE N10:1/7 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/8       - REMOTE SERIAL COMM FAULT
                XIC - File #3 BCM MAIN - 3
                      File #6 BCM DIAG - 4
                XIO - File #3 BCM MAIN - 3
FILE N10:1/8 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/9       - REMOTE BACKPLANE FAULT
                XIC - File #3 BCM MAIN - 3
                      File #6 BCM DIAG - 4
                XIO - File #3 BCM MAIN - 3
FILE N10:1/9 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/10      - REMOTE BUFFER FULL FAULT
                XIC - File #6 BCM DIAG - 4
FILE N10:1/10 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/11      - REMOTE PROGRAM ERROR FAULT
                XIC - File #6 BCM DIAG - 4
FILE N10:1/11 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/13      - Remote Processor Fault
                XIC - File #3 BCM MAIN - 3
                XIO - File #3 BCM MAIN - 3
FILE N10:1/13 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:1/14      - BCM Status - Remote CPU Is Primary
                XIC - File #3 BCM MAIN - 2
                XIO - File #3 BCM MAIN - 2
FILE N10:1/14 LEN:64 - BTR - File #3 BCM MAIN - 1
N10:2         - CURRENT BLOCK ID
                SUB - File #4 BCM PRI - 1
                      File #5 BCM SEC - 0
                MOV - File #4 BCM PRI - 1
                EQU - File #5 BCM SEC - 1
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                LEQ - File #4 BCM PRI - 0
FILE N10:2 LEN:63 - BTR - File #3 BCM MAIN - 1
N10:3         - COP - File #5 BCM SEC - 0
FILE N10:3 LEN:62 - BTR - File #3 BCM MAIN - 1
                COP - File #5 BCM SEC - 0
N11:0         - BCM BTR Current Packet ID
                MOV - File #4 BCM PRI - 1, 2
N11:1         - Packet Length
                BTW - File #3 BCM MAIN - 7
                MOV - File #3 BCM MAIN - 7
FILE N11:1 LEN:64 - BTW - File #3 BCM MAIN - 7
N11:2         - BCM BTW Packet ID
                MOV - File #4 BCM PRI - 2
FILE N11:2 LEN:63 - BTW - File #3 BCM MAIN - 7
N11:3         - BCM BTW DATA
                COP - File #4 BCM PRI - 2
FILE N11:3 LEN:62 - BTW - File #3 BCM MAIN - 7
                COP - File #4 BCM PRI - 2
N12:32        - COP - File #7 BCM LOAD - 0
FILE N12:32 LEN:1 - COP - File #7 BCM LOAD - 0
N12:33        - COP - File #7 BCM LOAD - 1
FILE N12:33 LEN:1 - COP - File #7 BCM LOAD - 1
N12:34        - COP - File #7 BCM LOAD - 2
FILE N12:34 LEN:10 - COP - File #7 BCM LOAD - 2
N12:44        - COP - File #7 BCM LOAD - 3
FILE N12:44 LEN:34 - COP - File #7 BCM LOAD - 3
N12:128       - COP - File #7 BCM LOAD - 4
FILE N12:128 LEN:231 - COP - File #7 BCM LOAD - 4
N12:359       - COP - File #7 BCM LOAD - 5
FILE N12:359 LEN:12 - COP - File #7 BCM LOAD - 5
N12:371       - COP - File #7 BCM LOAD - 6
FILE N12:371 LEN:15 - COP - File #7 BCM LOAD - 6
N12:386       - COP - File #7 BCM LOAD - 7
FILE N12:386 LEN:15 - COP - File #7 BCM LOAD - 7
N12:401       - COP - File #7 BCM LOAD - 8
FILE N12:401 LEN:100 - COP - File #7 BCM LOAD - 8
N12:501       - COP - File #7 BCM LOAD - 9
FILE N12:501 LEN:20 - COP - File #7 BCM LOAD - 9
N12:521       - COP - File #7 BCM LOAD - 10
FILE N12:521 LEN:100 - COP - File #7 BCM LOAD - 10
N12:621       - COP - File #7 BCM LOAD - 11
FILE N12:621 LEN:20 - COP - File #7 BCM LOAD - 11
N12:641       - COP - File #7 BCM LOAD - 12
FILE N12:641 LEN:15 - COP - File #7 BCM LOAD - 12
N12:[N7:2]    - COP - File #4 BCM PRI - 2
N13:32        - COP - File #8 BCM STORE - 0
FILE N13:32 LEN:1 - COP - File #8 BCM STORE - 0
N13:33        - COP - File #8 BCM STORE - 1
FILE N13:33 LEN:1 - COP - File #8 BCM STORE - 1
N13:34        - COP - File #8 BCM STORE - 2
FILE N13:34 LEN:10 - COP - File #8 BCM STORE - 2
N13:44        - COP - File #8 BCM STORE - 3
FILE N13:44 LEN:34 - COP - File #8 BCM STORE - 3
N13:128       - COP - File #8 BCM STORE - 4
FILE N13:128 LEN:693 - COP - File #8 BCM STORE - 4
N13:359       - COP - File #8 BCM STORE - 5
FILE N13:359 LEN:462 - COP - File #8 BCM STORE - 4, 5
N13:371       - COP - File #8 BCM STORE - 6
FILE N13:371 LEN:450 - COP - File #8 BCM STORE - 4, 5, 6
N13:386       - COP - File #8 BCM STORE - 7
FILE N13:386 LEN:435 - COP - File #8 BCM STORE - 4, 5, 7
N13:401       - COP - File #8 BCM STORE - 8
FILE N13:401 LEN:420 - COP - File #8 BCM STORE - 4, 8
N13:501       - COP - File #8 BCM STORE - 9
FILE N13:501 LEN:320 - COP - File #8 BCM STORE - 4, 9
N13:521       - COP - File #8 BCM STORE - 10
FILE N13:521 LEN:300 - COP - File #8 BCM STORE - 4, 10
N13:621       - COP - File #8 BCM STORE - 11
FILE N13:621 LEN:200 - COP - File #8 BCM STORE - 4, 11
N13:641       - COP - File #8 BCM STORE - 12
FILE N13:641 LEN:180 - COP - File #8 BCM STORE - 4, 12
N13:[N7:4]    - COP - File #5 BCM SEC - 0
C14:0         - BCM BTR ERROR COUNTER
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                CTU - File #6 BCM DIAG - 0
                RES - File #6 BCM DIAG - 5
C14:1         - BCM BTW ERROR COUNTER
                CTU - File #6 BCM DIAG - 1
                RES - File #6 BCM DIAG - 5
C14:2         - LOCAL SERIAL COMM ERROR COUNTER
                CTU - File #6 BCM DIAG - 2
                RES - File #6 BCM DIAG - 5
C14:3         - LOCAL BACKPLANE ERROR COUNTER
                CTU - File #6 BCM DIAG - 2
                RES - File #6 BCM DIAG - 5
C14:4         - LOCAL BUFFER FULL ERROR COUNTER
                CTU - File #6 BCM DIAG - 2
                RES - File #6 BCM DIAG - 5
C14:5         - LOCAL PROGRAM ERROR COUNTER
                CTU - File #6 BCM DIAG - 2
                RES - File #6 BCM DIAG - 5
N15:0         - Write data block
                BTW - File #9 ANALOG IN - 0
FILE N15:0 LEN:37 - BTW - File #9 ANALOG IN - 0
N16:0         - Read data block
                COP - File #7 BCM LOAD - 6
                      File #8 BCM STORE - 6
                BTR - File #9 ANALOG IN - 1
FILE N16:0 LEN:15 - COP - File #7 BCM LOAD - 6
                      File #8 BCM STORE - - 6
                BTR - File #9 ANALOG IN - 1
N16:0/0       - Analog Input 160 Power Up Bit
                XIC - File #9 ANALOG IN - 0
FILE N16:0/0 LEN:15 - COP - File #7 BCM LOAD - 6
                      File #8 BCM STORE - - 6
                BTR - File #9 ANALOG IN - 1
N16:5         - {PI_101B} Pump 101 Discharge Pressure
                CPT - File #9 ANALOG IN - 13
FILE N16:5 LEN:10 - COP - File #7 BCM LOAD - 6
                      File #8 BCM STORE - - 6
                BTR - File #9 ANALOG IN - 1
N16:6         - {PI_101A} Pump 101 Suction Pressure
                CPT - File #9 ANALOG IN - 14
FILE N16:6 LEN:9 - COP - File #7 BCM LOAD - 6
                      File #8 BCM STORE - - 6
                BTR - File #9 ANALOG IN - 1
N16:7         - {PI_102B} Pump 102 Discharge Pressure
                CPT - File #9 ANALOG IN - 15
FILE N16:7 LEN:8 - COP - File #7 BCM LOAD - 6
                      File #8 BCM STORE - - 6
                BTR - File #9 ANALOG IN - 1
N16:8         - {PI_102A} Pump 102 Suction Pressure
                CPT - File #9 ANALOG IN - 16
FILE N16:8 LEN:7 - COP - File #7 BCM LOAD - 6
                      File #8 BCM STORE - - 6
                BTR - File #9 ANALOG IN - 1
N16:9         - {PI_103B} Pump 103 Discharge Pressure
                CPT - File #9 ANALOG IN - 17
FILE N16:9 LEN:6 - COP - File #7 BCM LOAD - 6
                      File #8 BCM STORE - - 6
                BTR - File #9 ANALOG IN - 1
N16:10        - {PI_103A} Pump 103 Suction Pressure
                CPT - File #9 ANALOG IN - 18
FILE N16:10 LEN:5 - COP - File #7 BCM LOAD - 6
                      File #8 BCM STORE - - 6
                BTR - File #9 ANALOG IN - 1
N16:11        - {PI_104B} Pump 104 Discharge Pressure
                CPT - File #9 ANALOG IN - 19
FILE N16:11 LEN:4 - COP - File #7 BCM LOAD - 6
                      File #8 BCM STORE - - 6
                BTR - File #9 ANALOG IN - 1
N17:0         - Write data block
                BTW - File #9 ANALOG IN - 2
FILE N17:0 LEN:37 - BTW - File #9 ANALOG IN - 2
N18:0         - Read data block
                COP - File #7 BCM LOAD - 7
                      File #8 BCM STORE - 7
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```
                BTR - File #9 ANALOG IN - 3
FILE N18:0 LEN:15 - COP - File #7 BCM LOAD - 7
                      File #8 BCM STORE - - 7
                BTR - File #9 ANALOG IN - 3
N18:0/0       - Analog Input 170 Power Up Bit
                XIC - File #9 ANALOG IN - 2
FILE N18:0/0 LEN:15 - COP - File #7 BCM LOAD - 7
                      File #8 BCM STORE - - 7
                BTR - File #9 ANALOG IN - 3
N18:4         - {PI_104A} Pump 104 Suction Pre ssure
                CPT - File #9 ANALOG IN - 20
FILE N18:4 LEN:11 - COP - File #7 BCM LOAD - 7
                      File #8 BCM STORE - - 7
                BTR - File #9 ANALOG IN - 3
N18:5         - {LI_20} Bar Screen Channel D ifferential Level
                CPT - File #9 ANALOG IN - 21
FILE N18:5 LEN:10 - COP - File #7 BCM LOAD - 7
                      File #8 BCM STORE - - 7
                BTR - File #9 ANALOG IN - 3
N18:6         - {FI_601} Force Main Discharge   Flow Rate
                CPT - File #9 ANALOG IN - 22
FILE N18:6 LEN:9 - COP - File #7 BCM LOAD - 7
                      File #8 BCM STORE - - 7
                BTR - File #9 ANALOG IN - 3
N18:7         - {PI_401} Force Main Discharge  Pressure
                CPT - File #9 ANALOG IN - 23
FILE N18:7 LEN:8 - COP - File #7 BCM LOAD - 7
                      File #8 BCM STORE - - 7
                BTR - File #9 ANALOG IN - 3
N18:9         - CPT - File #9 ANALOG IN - 24
FILE N18:9 LEN:6 - COP - File #7 BCM LOAD - 7
                      File #8 BCM STORE - - 7
                BTR - File #9 ANALOG IN - 3
N18:10        - CPT - File #9 ANALOG IN - 25
FILE N18:10 LEN:5 - COP - File #7 BCM LOAD - 7
                      File #8 BCM STORE - - 7
                BTR - File #9 ANALOG IN - 3
N18:11        - {AI_8} Odor Control System pH
                CPT - File #9 ANALOG IN - 26
FILE N18:11 LEN:4 - COP - File #7 BCM LOAD - 7
                      File #8 BCM STORE - - 7
                BTR - File #9 ANALOG IN - 3
N19:0         - Multilin Comm Module Read Block ID
                BTR - File #10 MULTILIN - 0
                EQU - File #10 MULTILIN - 0
FILE N19:0 LEN:64 - BTR - File #10 MULTILIN - 0
N19:1         - Multilin Comm Module Write Block ID
                MOV - File #10 MULTILIN - 0
FILE N19:1 LEN:63 - BTR - File #10 MULTILIN - 0
N19:2         - COP - File #10 MULTILIN - 0
FILE N19:2 LEN:62 - BTR - File #10 MULTILIN - 0
                COP - File #10 MULTILIN - 0
N20:0         - Multilin Comm Module Port 1 Configuration Word
                COP - File #10 MULTILIN - 1
FILE N20:0 LEN:60 - COP - File #10 MULTILIN - 1
N21:0         - Multilin Comm Module Command 1 Port/Mode Select
                COP - File #10 MULTILIN - 1
FILE N21:0 LEN:50 - COP - File #10 MULTILIN - 1
N22:0         - Multilin Comm Module Block Transfer Write Block ID
                BTW - File #10 MULTILIN - 1
                MOV - File #10 MULTILIN - 0, 1
                LIM - File #10 MULTILIN - 1
                EQU - File #10 MULTILIN - 1
FILE N22:0 LEN:64 - BTW - File #10 MULTILIN - 1
N22:1         - Multilin Comm Module Block Transfer Write Data Block
                COP - File #10 MULTILIN - 1
FILE N22:1 LEN:63 - BTW - File #10 MULTILIN - 1
                COP - File #10 MULTILIN - 1
N23:0         - Pump 101 Motor Winding Temp A (Deg C)
                FAL - File #10 MULTILIN - 2
                COP - File #7 BCM LOAD - 8
                      File #8 BCM STORE - 8
                      File #10 MULTILIN - 0
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FILE N23:0 LEN:100 - FAL - File #10 MULTILIN - 2
               COP - File #7 BCM LOAD - 8
                     File #8 BCM STORE - - 8
                     File #10 MULTILIN - - 0
N23:8        - Pump 102 Motor Winding Temp A (Deg C)
               COP - File #10 MULTILIN - 0
FILE N23:8 LEN:92 - FAL - File #10 MULTILIN - 2
               COP - File #7 BCM LOAD - 8
                     File #8 BCM STORE - - 8
                     File #10 MULTILIN - - 0
N23:16       - Pump 103 Motor Winding Temp A (Deg C)
               COP - File #10 MULTILIN - 0
FILE N23:16 LEN:84 - FAL - File #10 MULTILIN - 2
               COP - File #7 BCM LOAD - 8
                     File #8 BCM STORE - - 8
                     File #10 MULTILIN - - 0
N23:24       - Pump 104 Motor Winding Temp A (Deg C)
               COP - File #10 MULTILIN - 0
FILE N23:24 LEN:76 - FAL - File #10 MULTILIN - 2
               COP - File #7 BCM LOAD - 8
                     File #8 BCM STORE - - 8
                     File #10 MULTILIN - - 0
N23:60       - COP - File #10 MULTILIN - 0
FILE N23:60 LEN:40 - COP - File #7 BCM LOAD - 8
                     File #8 BCM STORE - - 8
                     File #10 MULTILIN - - 0
N24:0        - COP - File #7 BCM LOAD - 9
                     File #8 BCM STORE - 9
               BTR - File #11 BENTLY - 0
FILE N24:0 LEN:20 - COP - File #7 BCM LOAD - 9
                     File #8 BCM STORE - - 9
               BTR - File #11 BENTLY - 0
N24:0/15     - Bently Nevada Power Up
               XIC - File #11 BENTLY - 1
FILE N24:0/15 LEN:20 - COP - File #7 BCM LOAD - 9
                     File #8 BCM STORE - - 9
               BTR - File #11 BENTLY - 0
N24:3        - Bently Nevada Monitor 1 Channel 1 Data
               CPT - File #11 BENTLY - 2
FILE N24:3 LEN:17 - COP - File #7 BCM LOAD - 9
                     File #8 BCM STORE - - 9
               BTR - File #11 BENTLY - 0
N24:3/15     - Bently Nevada Monitor 1 Channel 1 Not OK
               XIO - File #11 BENTLY - 2
FILE N24:3/15 LEN:17 - COP - File #7 BCM LOAD - 9
                     File #8 BCM STORE - - 9
               BTR - File #11 BENTLY - 0
N24:4        - Bently Nevada Monitor 1 Channel 2 Data
               CPT - File #11 BENTLY - 3
FILE N24:4 LEN:16 - COP - File #7 BCM LOAD - 9
                     File #8 BCM STORE - - 9
               BTR - File #11 BENTLY - 0
N24:4/15     - Bently Nevada Monitor 1 Channel 2 Not OK
               XIO - File #11 BENTLY - 3
FILE N24:4/15 LEN:16 - COP - File #7 BCM LOAD - 9
                     File #8 BCM STORE - - 9
               BTR - File #11 BENTLY - 0
N24:5        - Bently Nevada Monitor 1 Channel 3 Data
               CPT - File #11 BENTLY - 4
FILE N24:5 LEN:15 - COP - File #7 BCM LOAD - 9
                     File #8 BCM STORE - - 9
               BTR - File #11 BENTLY - 0
N24:5/15     - Bently Nevada Monitor 1 Channel 3 Not OK
               XIO - File #11 BENTLY - 4
FILE N24:5/15 LEN:15 - COP - File #7 BCM LOAD - 9
                     File #8 BCM STORE - - 9
               BTR - File #11 BENTLY - 0
N24:6        - Bently Nevada Monitor 1 Channel 4 Data
               CPT - File #11 BENTLY - 5
FILE N24:6 LEN:14 - COP - File #7 BCM LOAD - 9
                     File #8 BCM STORE - - 9
               BTR - File #11 BENTLY - 0
N24:6/15     - Bently Nevada Monitor 1 Channel 4 Not OK
```

```
                XIO - File #11 BENTLY - 5
FILE N24:6/15 LEN:14 - COP - File #7 BCM LOAD - 9
                       File #8 BCM STORE - - 9
                BTR - File #11 BENTLY - 0
N24:12       - Bently Nevada Monitor 2 Channel 1 Data
                CPT - File #11 BENTLY - 6
FILE N24:12 LEN:8 - COP - File #7 BCM LOAD - 9
                       File #8 BCM STORE - - 9
                BTR - File #11 BENTLY - 0
N24:12/15    - Bently Nevada Monitor 2 Channel 1 Not OK
                XIO - File #11 BENTLY - 6
FILE N24:12/15 LEN:8 - COP - File #7 BCM LOAD - 9
                       File #8 BCM STORE - - 9
                BTR - File #11 BENTLY - 0
N24:13       - Bently Nevada Monitor 2 Channel 2 Data
                CPT - File #11 BENTLY - 7
FILE N24:13 LEN:7 - COP - File #7 BCM LOAD - 9
                       File #8 BCM STORE - - 9
                BTR - File #11 BENTLY - 0
N24:13/15    - Bently Nevada Monitor 2 Channel 2 Not OK
                XIO - File #11 BENTLY - 7, 8
FILE N24:13/15 LEN:7 - COP - File #7 BCM LOAD - 9
                       File #8 BCM STORE - - 9
                BTR - File #11 BENTLY - 0
N24:14       - Bently Nevada Monitor 2 Channel 3 Data
                CPT - File #11 BENTLY - 8
FILE N24:14 LEN:6 - COP - File #7 BCM LOAD - 9
                       File #8 BCM STORE - - 9
                BTR - File #11 BENTLY - 0
N24:14/15    - Bently Nevada Monitor 2 Channel 3 Not OK
                XIO - File #11 BENTLY - 9
FILE N24:14/15 LEN:6 - COP - File #7 BCM LOAD - 9
                       File #8 BCM STORE - - 9
                BTR - File #11 BENTLY - 0
N24:15       - Bently Nevada Monitor 2 Channel 4 Data
                CPT - File #11 BENTLY - 9
FILE N24:15 LEN:5 - COP - File #7 BCM LOAD - 9
                       File #8 BCM STORE - - 9
                BTR - File #11 BENTLY - 0
N25:0        - BTW - File #11 BENTLY - 1
FILE N25:0 LEN:29 - BTW - File #11 BENTLY - 1
N26:0        - BTW - File #11 BENTLY - 1
FILE N26:0 LEN:29 - BTW - File #11 BENTLY - 1
F27:0        - Wet Well Low-Low Level Setpoint
                LEQ - File #12 SEQUENCE - 0
F27:1        - Lead 150 HP Start Setpoint
                COP - File #23 DCS COMM - 194, 267
                GEQ - File #12 SEQUENCE - 1
FILE F27:1 LEN:8 - COP - File #23 DCS COMM - 194, 267
F27:2        - Lead 150 HP Stop Setpoint
                COP - File #23 DCS COMM - 195
                GRT - File #12 SEQUENCE - 1
FILE F27:2 LEN:7 - COP - File #23 DCS COMM - 267, 195
F27:3        - Lag 150 HP Start Setpoint
                COP - File #23 DCS COMM - 196
                GEQ - File #12 SEQUENCE - 2
FILE F27:3 LEN:6 - COP - File #23 DCS COMM - 267, 196
F27:4        - Lag 150 HP Stop Setpoint
                COP - File #23 DCS COMM - 197
                GRT - File #12 SEQUENCE - 2
FILE F27:4 LEN:5 - COP - File #23 DCS COMM - 267, 197
F27:5        - Lead 400 HP Start Setpoint
                COP - File #23 DCS COMM - 198
                GEQ - File #12 SEQUENCE - 3
FILE F27:5 LEN:4 - COP - File #23 DCS COMM - 267, 198
F27:6        - Lead 400 HP Stop Setpoint
                COP - File #23 DCS COMM - 199
                GRT - File #12 SEQUENCE - 3
FILE F27:6 LEN:3 - COP - File #23 DCS COMM - 267, 199
F27:7        - Lag 400 HP Start Setpoint
                COP - File #23 DCS COMM - 200
                GEQ - File #12 SEQUENCE - 4
FILE F27:7 LEN:2 - COP - File #23 DCS COMM - 267, 200
```

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F27:8        - Lag 400 HP Stop Setpoint
               COP - File #23 DCS COMM - 201
               GRT - File #12 SEQUENCE - 4
FILE F27:8 LEN:1 - COP - File #23 DCS COMM - 267, 201
F27:9        - Pump Upper Bearing High Vibration Alarm Setpoint
               GEQ - File #13 PUMP 101 - 4
                     File #14 PUMP 102 - 4
                     File #15 PUMP 103 - 4
                     File #16 PUMP 104 - 4
F27:10       - Pump Upper Bearing High-High Vibration Alarm Setpoint
               GEQ - File #13 PUMP 101 - 6
                     File #14 PUMP 102 - 6
                     File #15 PUMP 103 - 6
                     File #16 PUMP 104 - 6
F27:11       - Pump Lower Bearing High Vibration Alarm Setpoint
               GEQ - File #13 PUMP 101 - 8
                     File #14 PUMP 102 - 8
                     File #15 PUMP 103 - 8
                     File #16 PUMP 104 - 8
F27:12       - Pump Lower Bearing High-High Vibration Alarm Setpoint
               GEQ - File #13 PUMP 101 - 10
                     File #14 PUMP 102 - 10
                     File #15 PUMP 103 - 10
                     File #16 PUMP 104 - 10
F27:13       - Pump Low Suction Pressure Alarm Setpoint
               LEQ - File #13 PUMP 101 - 12
                     File #14 PUMP 102 - 12
                     File #15 PUMP 103 - 12
                     File #16 PUMP 104 - 12
F27:14       - Pump Low-Low Suction Pressure Alarm Setpoint
               LEQ - File #13 PUMP 101 - 14
                     File #14 PUMP 102 - 14
                     File #15 PUMP 103 - 14
                     File #16 PUMP 104 - 14
F27:15       - Pump High Discharge Pressure Alarm Setpoint
               GEQ - File #13 PUMP 101 - 16
                     File #14 PUMP 102 - 16
                     File #15 PUMP 103 - 16
                     File #16 PUMP 104 - 16
F27:16       - Pump High-High Discharge Pressure Alarm Setpoint
               GEQ - File #13 PUMP 101 - 18
                     File #14 PUMP 102 - 18
                     File #15 PUMP 103 - 18
                     File #16 PUMP 104 - 18
F27:36       - LEQ - File #15 PUMP 103 - 23
F27:37       - LEQ - File #16 PUMP 104 - 23
B28:0        - COP - File #7 BCM LOAD - 3
                     File #8 BCM STORE - 3
               BSL - File #12 SEQUENCE - 14
FILE B28:0 LEN:34 - COP - File #7 BCM LOAD - 3
                     File #8 BCM STORE - - 3
               BSL - File #12 SEQUENCE - 14
B28:0/0      - Pump 101 Maximum Start Shift Register
               OTL - File #12 SEQUENCE - 9
               OTU - File #12 SEQUENCE - 14
               BSL - File #12 SEQUENCE - 14
FILE B28:0/0 LEN:34 - COP - File #7 BCM LOAD - 3
                     File #8 BCM STORE - - 3
               BSL - File #12 SEQUENCE - 14
B28:10       - BSL - File #12 SEQUENCE - 14
FILE B28:10 LEN:24 - COP - File #7 BCM LOAD - 3
                     File #8 BCM STORE - - 3
               BSL - File #12 SEQUENCE - 14
B28:10/0     - Pump 102 Maximum Start Shift Register
               OTL - File #12 SEQUENCE - 10
               OTU - File #12 SEQUENCE - 14
               BSL - File #12 SEQUENCE - 14
FILE B28:10/0 LEN:24 - COP - File #7 BCM LOAD - 3
                     File #8 BCM STORE - - 3
               BSL - File #12 SEQUENCE - 14
B28:20       - BSL - File #12 SEQUENCE - 14
FILE B28:20 LEN:14 - COP - File #7 BCM LOAD - 3
                     File #8 BCM STORE - - 3
```

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                BSL - File #12 SEQUENCE - 14
B28:20/0      - Pump 103 Maximum Start Shift Register
                OTL - File #12 SEQUENCE - 11
                OTU - File #12 SEQUENCE - 14
                BSL - File #12 SEQUENCE - 14
FILE B28:20/0 LEN:14 - COP - File #7 BCM LOAD - 3
                       File #8 BCM STORE - - 3
                BSL - File #12 SEQUENCE - 14
B28:30        - BSL - File #12 SEQUENCE - 14
FILE B28:30 LEN:4 - COP - File #7 BCM LOAD - 3
                       File #8 BCM STORE - - 3
                BSL - File #12 SEQUENCE - 14
B28:30/0      - Pump 104 Maximum Start Shift Register
                OTL - File #12 SEQUENCE - 12
                OTU - File #12 SEQUENCE - 14
                BSL - File #12 SEQUENCE - 14
FILE B28:30/0 LEN:4 - COP - File #7 BCM LOAD - 3
                       File #8 BCM STORE - - 3
                BSL - File #12 SEQUENCE - 14
N29:0         - DCS Comm Module Port 1 Configuration Word
                COP - File #23 DCS COMM - 268
FILE N29:0 LEN:40 - COP - File #23 DCS COMM - 268
N30:0         - DCS Comm Module BTR Data Block
                BTR - File #23 DCS COMM - 267
                EQU - File #23 DCS COMM - 267
FILE N30:0 LEN:64 - BTR - File #23 DCS COMM - 267
N30:1         - DCS Comm Module BTW Block ID
                MOV - File #23 DCS COMM - 267
FILE N30:1 LEN:63 - BTR - File #23 DCS COMM - 267
N30:2         - COP - File #23 DCS COMM - 267
FILE N30:2 LEN:62 - BTR - File #23 DCS COMM - 267
                COP - File #23 DCS COMM - 267
N31:0         - DCS Comm Module BTW Block ID
                BTW - File #23 DCS COMM - 268
                MOV - File #23 DCS COMM - 267
                EQU - File #23 DCS COMM - 268
FILE N31:0 LEN:64 - BTW - File #23 DCS COMM - 268
N31:1         - DCS Comm Module BTW Data Block
                COP - File #23 DCS COMM - 268
FILE N31:1 LEN:63 - BTW - File #23 DCS COMM - 268
                COP - File #23 DCS COMM - 268
N32:0         - COP - File #23 DCS COMM - 268
FILE N32:0 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/0       - {I65FAL1A} Pump Room Supply Fan SF-1 Normal
                OTE - File #23 DCS COMM - 0
FILE N32:0/0 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/1       - {I65FAL1B} MCP Room Exhaust Fan EF-1 Normal
                OTE - File #23 DCS COMM - 1
FILE N32:0/1 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/2       - {I65FAL2B} MCP Room Exhaust Fan EF-2 Normal
                OTE - File #23 DCS COMM - 2
FILE N32:0/2 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/3       - {I65FAL3A} Meter Vault Supply Fan SF-3 Normal
                OTE - File #23 DCS COMM - 3
FILE N32:0/3 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/4       - {I65FAL3B} Meter Vault Exhaust Fan EF-3 Normal
                OTE - File #23 DCS COMM - 4
FILE N32:0/4 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/5       - {I65FAL4} Screening Room Supply Fan SF-4 Normal
                OTE - File #23 DCS COMM - 5
FILE N32:0/5 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/6       - {I65FAL5} Screening Room Supply Fan SF-5 Normal
                OTE - File #23 DCS COMM - 6
FILE N32:0/6 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/7       - {I65FAL8} Odor Control System Exhaust Fan EF-8 Normal
                OTE - File #23 DCS COMM - 7
FILE N32:0/7 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/8       - {I65LALL10} Wet Well Level Normal
                OTE - File #23 DCS COMM - 8
FILE N32:0/8 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/9       - {I65PALL10B} Wet Well Bubbler Normal Pressure
                OTE - File #23 DCS COMM - 9
FILE N32:0/9 LEN:50 - COP - File #23 DCS COMM - 268
```

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N32:0/10     - {I65UA10A} Drywell Air Quality Normal
               OTE - File #23 DCS COMM - 10
FILE N32:0/10 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/11     - {I65UA10B} Drywell Combustible Gas Normal
               OTE - File #23 DCS COMM - 11
FILE N32:0/11 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/12     - {I65PALL20} Bar Screen Pressure Normal
               OTE - File #23 DCS COMM - 12
FILE N32:0/12 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/13     - {I65UA20A} Screenings Facility Air Quality Normal
               OTE - File #23 DCS COMM - 13
FILE N32:0/13 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/14     - {I65UA20B} Screenings Facility Combustible Gas Normal
               OTE - File #23 DCS COMM - 14
FILE N32:0/14 LEN:50 - COP - File #23 DCS COMM - 268
N32:0/15     - {I65LAHH25} Operational Wet Well 1 Level Normal
               OTE - File #23 DCS COMM - 15
FILE N32:0/15 LEN:50 - COP - File #23 DCS COMM - 268
N32:1/0      - {I65LAHH26} Operational Wet Well 2 Level Normal
               OTE - File #23 DCS COMM - 16
FILE N32:1/0 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/1      - {I65LAHH27} Overflow Wet Well Level Normal
               OTE - File #23 DCS COMM - 17
FILE N32:1/1 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/2      - {I65UA43} Odor Control Blower Normal
               OTE - File #23 DCS COMM - 18
FILE N32:1/2 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/3      - {I65LAH50} Pump Room Sump Level Normal
               OTE - File #23 DCS COMM - 19
FILE N32:1/3 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/4      - {I65LAHH50} Pump Room Sump Level Normal
               OTE - File #23 DCS COMM - 20
FILE N32:1/4 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/5      - {I65LAH60} Meter Vault Sump Level Normal
               OTE - File #23 DCS COMM - 21
FILE N32:1/5 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/6      - {I65UA60A} Meter Vault Air Quality Normal
               OTE - File #23 DCS COMM - 22
FILE N32:1/6 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/7      - {I65UA60B} Meter Vault Combustible Gas Normal
               OTE - File #23 DCS COMM - 23
FILE N32:1/7 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/8      - {I65UA81} Plant Air Supply System Normal
               OTE - File #23 DCS COMM - 24
FILE N32:1/8 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/9      - {I65YA100A} PLC #1 Normal
               OTE - File #23 DCS COMM - 25
FILE N32:1/9 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/10     - {I65YA100B} PLC #2 Normal
               OTE - File #23 DCS COMM - 26
FILE N32:1/10 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/11     - DCS Comm Fail
               OTE - File #23 DCS COMM - 27
               XIC - File #9 ANALOG IN - 7, 8, 9, 10, 11, 12
FILE N32:1/11 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/12     - {I65YC100A} Modbus Heartbeat
               OTE - File #23 DCS COMM - 28
FILE N32:1/12 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/13     - {I65FAL101} Pump 101 Seal Water Flow Normal
               OTE - File #23 DCS COMM - 29
FILE N32:1/13 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/14     - {I65PAH101} Pump 101 Discharge Pressure Normal
               OTE - File #23 DCS COMM - 30
FILE N32:1/14 LEN:49 - COP - File #23 DCS COMM - 268
N32:1/15     - {I65PAHH101} Pump 101 Discharge Pressure Normal
               OTE - File #23 DCS COMM - 31
FILE N32:1/15 LEN:49 - COP - File #23 DCS COMM - 268
N32:2/0      - {I65PAL101} Pump 101 Suction Pressure Normal
               OTE - File #23 DCS COMM - 32
FILE N32:2/0 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/1      - {I65PALL101} Pump 101 Suction Pressure Normal
               OTE - File #23 DCS COMM - 33
FILE N32:2/1 LEN:48 - COP - File #23 DCS COMM - 268
```

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N32:2/2      - {I65VAH101A} Pump 101 Upper Bearing Vibration Normal
               OTE - File #23 DCS COMM - 34
FILE N32:2/2 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/3      - {I65VAH101B} Pump 101 Lower Bearing Vibration Normal
               OTE - File #23 DCS COMM - 35
FILE N32:2/3 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/4      - {I65VAHH101A} Pump 101 Upper Bearing Vibration Normal
               OTE - File #23 DCS COMM - 36
FILE N32:2/4 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/5      - {I65VAHH101B} Pump 101 Lower Bearing Vibration Normal
               OTE - File #23 DCS COMM - 37
FILE N32:2/5 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/6      - {I65YA101A} Pump 101 Fail To Start
               OTE - File #23 DCS COMM - 38
FILE N32:2/6 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/7      - {I65YA101B} Pump 101 Fail To Stop
               OTE - File #23 DCS COMM - 39
FILE N32:2/7 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/8      - {I65YA101C} Pump 101 Discharge Valve Normal
               OTE - File #23 DCS COMM - 40
FILE N32:2/8 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/9      - {I65YA101D} Pump 101 Multilin Normal
               OTE - File #23 DCS COMM - 41
FILE N32:2/9 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/10     - {I65YA101E} Pump 101 Normal
               OTE - File #23 DCS COMM - 42
FILE N32:2/10 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/11     - {I65YL101A} Pump 101 Run
               OTE - File #23 DCS COMM - 43
FILE N32:2/11 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/12     - {I65YL101B} Pump 101 Lead
               OTE - File #23 DCS COMM - 44
FILE N32:2/12 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/13     - {I65YL101C} Pump 101 Out Of Service
               OTE - File #23 DCS COMM - 45
FILE N32:2/13 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/14     - {I65YL101D} Pump 101 PLC Control
               OTE - File #23 DCS COMM - 46
FILE N32:2/14 LEN:48 - COP - File #23 DCS COMM - 268
N32:2/15     - {I65YL101E} Pump 101 Available
               OTE - File #23 DCS COMM - 47
FILE N32:2/15 LEN:48 - COP - File #23 DCS COMM - 268
N32:3/0      - {I65ZL101A} Pump 101 Hand
               OTE - File #23 DCS COMM - 48
FILE N32:3/0 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/1      - {I65ZL101B} Pump 101 Auto
               OTE - File #23 DCS COMM - 49
FILE N32:3/1 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/2      - {I65ZLC101} Pump 101 Discharge Check Valve Open
               OTE - File #23 DCS COMM - 50
FILE N32:3/2 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/3      - {I65FAL102} Pump 102 Seal Water Flow Normal
               OTE - File #23 DCS COMM - 51
FILE N32:3/3 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/4      - {I65PAH102} Pump 102 Discharge Pressure Normal
               OTE - File #23 DCS COMM - 52
FILE N32:3/4 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/5      - {I65PAHH102} Pump 102 Discharge Pressure Normal
               OTE - File #23 DCS COMM - 53
FILE N32:3/5 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/6      - {I65PAL102} Pump 102 Suction Pressure Normal
               OTE - File #23 DCS COMM - 54
FILE N32:3/6 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/7      - {I65PALL102} Pump 102 Suction Pressure Normal
               OTE - File #23 DCS COMM - 55
FILE N32:3/7 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/8      - {I65VAH102A} Pump 102 Upper Bearing Vibration Normal
               OTE - File #23 DCS COMM - 56
FILE N32:3/8 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/9      - {I65VAH102B} Pump 102 Lower Bearing Vibration Normal
               OTE - File #23 DCS COMM - 57
FILE N32:3/9 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/10     - {I65VAHH102A} Pump 102 Upper Bearing Vibration Normal
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                OTE - File #23 DCS COMM - 58
FILE N32:3/10 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/11      - {I65VAHH102B} Pum 102 Lower Bearing Vibration Normal
                OTE - File #23 DCS COMM - 59
FILE N32:3/11 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/12      - {I65YA102A} Pump 102 Fail To Start
                OTE - File #23 DCS COMM - 60
FILE N32:3/12 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/13      - {I65YA102B} Pump 102 Fail To Stop
                OTE - File #23 DCS COMM - 61
FILE N32:3/13 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/14      - {I65YA102C} Pump 102 Discharge Valve Normal
                OTE - File #23 DCS COMM - 62
FILE N32:3/14 LEN:47 - COP - File #23 DCS COMM - 268
N32:3/15      - {I65YA102D} Pump 102 Multilin Normal
                OTE - File #23 DCS COMM - 63
FILE N32:3/15 LEN:47 - COP - File #23 DCS COMM - 268
N32:4/0       - {I65YA102E} Pump 102 Normal
                OTE - File #23 DCS COMM - 64
FILE N32:4/0 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/1       - {I65YL102A} Pump 102 Run
                OTE - File #23 DCS COMM - 65
FILE N32:4/1 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/2       - {I65YL102B} Pump 102 Lead
                OTE - File #23 DCS COMM - 66
FILE N32:4/2 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/3       - {I65YL102C} Pump 102 Out Of Service
                OTE - File #23 DCS COMM - 67
FILE N32:4/3 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/4       - {I65YL102D} Pump 102 PLC Control
                OTE - File #23 DCS COMM - 68
FILE N32:4/4 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/5       - {I65YL102E} Pump 102 Available
                OTE - File #23 DCS COMM - 69
FILE N32:4/5 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/6       - {I65ZL102A} Pump 102 Hand
                OTE - File #23 DCS COMM - 70
FILE N32:4/6 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/7       - {I65ZL102B} Pump 102 Auto
                OTE - File #23 DCS COMM - 71
FILE N32:4/7 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/8       - {I65ZLC102} Pump 102 Discharge Valve Open
                OTE - File #23 DCS COMM - 72
FILE N32:4/8 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/9       - {I65FAL103} Pump 103 Seal Water Flow Normal
                OTE - File #23 DCS COMM - 73
FILE N32:4/9 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/10      - {I65PAH103} Pump 103 Discharge Pressure Normal
                OTE - File #23 DCS COMM - 74
FILE N32:4/10 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/11      - {I65PAHH103} Pump 103 Discharge Pressure Normal
                OTE - File #23 DCS COMM - 75
FILE N32:4/11 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/12      - {I65PAL103} Pump 103 Suction Pressure Normal
                OTE - File #23 DCS COMM - 76
FILE N32:4/12 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/13      - {I65PALL103} Pump 103 Suction Pressure Normal
                OTE - File #23 DCS COMM - 77
FILE N32:4/13 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/14      - {I65VAH103A} Pump 103 Upper Bearing Vibration Normal
                OTE - File #23 DCS COMM - 78
FILE N32:4/14 LEN:46 - COP - File #23 DCS COMM - 268
N32:4/15      - {I65VAH103B} Pump 103 Lower Bearing Vibration Normal
                OTE - File #23 DCS COMM - 79
FILE N32:4/15 LEN:46 - COP - File #23 DCS COMM - 268
N32:5/0       - {I65VAHH103A} Pump 103 Upper Bearing Vibration Normal
                OTE - File #23 DCS COMM - 80
FILE N32:5/0 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/1       - {I65VAHH103B} Pump 103 Lower Bearing Vibration Normal
                OTE - File #23 DCS COMM - 81
FILE N32:5/1 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/2       - {I65YA103A} Pump 103 Fail To Start
                OTE - File #23 DCS COMM - 82
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FILE N32:5/2 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/3      - {I65YA103B} Pump 103 Fail To Stop
               OTE - File #23 DCS COMM - 83
FILE N32:5/3 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/4      - {I65YA103C} Pump 103 Discharge Valve Normal
               OTE - File #23 DCS COMM - 84
FILE N32:5/4 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/5      - {I65YA103D} Pump 103 Multilin Normal
               OTE - File #23 DCS COMM - 85
FILE N32:5/5 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/6      - {I65YA103E} Pump 103 Normal
               OTE - File #23 DCS COMM - 86
FILE N32:5/6 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/7      - {I65YL103A} Pump 103 Run
               OTE - File #23 DCS COMM - 87
FILE N32:5/7 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/8      - {I65YL103B} Pump 103 Lead
               OTE - File #23 DCS COMM - 88
FILE N32:5/8 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/9      - {I65YL103C} Pump 103 Out Of Service
               OTE - File #23 DCS COMM - 89
FILE N32:5/9 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/10     - {I65YL103D} Pump 103 PLC Control
               OTE - File #23 DCS COMM - 90
FILE N32:5/10 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/11     - {I65YL103E} Pump 103 Available
               OTE - File #23 DCS COMM - 91
FILE N32:5/11 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/12     - {I65ZL103A} Pump 103 Hand
               OTE - File #23 DCS COMM - 92
FILE N32:5/12 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/13     - {I65ZL103B} Pump 103 Auto
               OTE - File #23 DCS COMM - 93
FILE N32:5/13 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/14     - {I65ZLC103} Pump 103 Discharge Check Valve Open
               OTE - File #23 DCS COMM - 94
FILE N32:5/14 LEN:45 - COP - File #23 DCS COMM - 268
N32:5/15     - {I65FAL104} Pump 104 Seal Water Flow Normal
               OTE - File #23 DCS COMM - 95
FILE N32:5/15 LEN:45 - COP - File #23 DCS COMM - 268
N32:6/0      - {I65PAH104} Pump 104 Discharge Pressure Normal
               OTE - File #23 DCS COMM - 96
FILE N32:6/0 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/1      - {I65PAHH104} Pump 104 Discharge Pressure Normal
               OTE - File #23 DCS COMM - 97
FILE N32:6/1 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/2      - {I65PAL104} Pump 104 Suction Pressure Normal
               OTE - File #23 DCS COMM - 98
FILE N32:6/2 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/3      - {I65PALL104} Pump 104 Suction Pressure Normal
               OTE - File #23 DCS COMM - 99
FILE N32:6/3 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/4      - {I65VAH104A} Pump 104 Upper Bearing Vibration Normal
               OTE - File #23 DCS COMM - 100
FILE N32:6/4 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/5      - {I65VAH104B} Pump 104 Lower Bearing Vibration Normal
               OTE - File #23 DCS COMM - 101
FILE N32:6/5 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/6      - {I65VAHH104A} Pump104 Upper Bearing Vibration Normal
               OTE - File #23 DCS COMM - 102
FILE N32:6/6 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/7      - {I65VAHH104B} Pump 104 Lower Bearing Vibration Normal
               OTE - File #23 DCS COMM - 103
FILE N32:6/7 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/8      - {I65YA104A} Pump 104 Fail To Start
               OTE - File #23 DCS COMM - 104
FILE N32:6/8 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/9      - {I65YA104B} Pump 104 Fail To Stop
               OTE - File #23 DCS COMM - 105
FILE N32:6/9 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/10     - {I65YA104C} Pump 104 Discharge Valve Normal
               OTE - File #23 DCS COMM - 106
FILE N32:6/10 LEN:44 - COP - File #23 DCS COMM - 268
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N32:6/11     - {I65YA104D} Pump 104 Multilin Normal
               OTE - File #23 DCS COMM - 107
FILE N32:6/11 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/12     - {I65YA104E} Pump 104 Normal
               OTE - File #23 DCS COMM - 108
FILE N32:6/12 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/13     - {I65YL104A} Pump 104 Run
               OTE - File #23 DCS COMM - 109
FILE N32:6/13 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/14     - {I65YL104B} Pump 104 Lead
               OTE - File #23 DCS COMM - 110
FILE N32:6/14 LEN:44 - COP - File #23 DCS COMM - 268
N32:6/15     - {I65YL104C} Pump 104 Out Of Service
               OTE - File #23 DCS COMM - 111
FILE N32:6/15 LEN:44 - COP - File #23 DCS COMM - 268
N32:7/0      - {I65YL104D} Pump 104 PLC Control
               OTE - File #23 DCS COMM - 112
FILE N32:7/0 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/1      - {I65YL104E} Pump 104 Available
               OTE - File #23 DCS COMM - 113
FILE N32:7/1 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/2      - {I65ZL104A} Pump 104 Hand
               OTE - File #23 DCS COMM - 114
FILE N32:7/2 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/3      - {I65ZL104B} Pump 104 Auto
               OTE - File #23 DCS COMM - 115
FILE N32:7/3 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/4      - {I65ZLC104} Pump 104 Discharge Check Valve Open
               OTE - File #23 DCS COMM - 116
FILE N32:7/4 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/5      - {I65ZLC111} Sluice Gate G-111 Closed
               OTE - File #23 DCS COMM - 117
FILE N32:7/5 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/6      - {I65ZLO111} Sluice Gate G-111 Open
               OTE - File #23 DCS COMM - 118
FILE N32:7/6 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/7      - {I65ZLC121} Sluice Gate G-121 Closed
               OTE - File #23 DCS COMM - 119
FILE N32:7/7 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/8      - {I65ZLO121} Sluice Gate G-121 Open
               OTE - File #23 DCS COMM - 120
FILE N32:7/8 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/9      - {I65YA141A} Plug Valve V-141 Fail To Open
               OTE - File #23 DCS COMM - 121
FILE N32:7/9 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/10     - {I65YA141B} Plug Valve V-141 Fail To Close
               OTE - File #23 DCS COMM - 122
FILE N32:7/10 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/11     - {I65YL141} Plug Valve V-141 Available
               OTE - File #23 DCS COMM - 123
FILE N32:7/11 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/12     - {I65ZL141} Plug Valve V-141 Remote Control
               OTE - File #23 DCS COMM - 124
FILE N32:7/12 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/13     - {I65ZLC141} Plug Valve V-141 Closed
               OTE - File #23 DCS COMM - 125
FILE N32:7/13 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/14     - {I65ZLO141} Plug Valve V-141 Open
               OTE - File #23 DCS COMM - 126
FILE N32:7/14 LEN:43 - COP - File #23 DCS COMM - 268
N32:7/15     - {I65LAHH151} Surge Tank T-151 Level Normal
               OTE - File #23 DCS COMM - 127
FILE N32:7/15 LEN:43 - COP - File #23 DCS COMM - 268
N32:8/0      - {I65LALL151} Surge Tank T-151 Level Normal
               OTE - File #23 DCS COMM - 128
FILE N32:8/0 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/1      - {I65ZLO151} Surge Tank T-151 Valve Open
               OTE - File #23 DCS COMM - 129
FILE N32:8/1 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/2      - {I65YA211A} Slide Gate G-211 Fail To Open
               OTE - File #23 DCS COMM - 130
FILE N32:8/2 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/3      - {I65YA211B} Slide Gate G-211 Fail To Close
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                OTE - File #23 DCS COMM - 131
FILE N32:8/3 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/4       - {I65YL211} Slide Gate G-211 Available
                OTE - File #23 DCS COMM - 132
FILE N32:8/4 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/5       - {I65ZL211} Slide Gate G-211 Remote Control
                OTE - File #23 DCS COMM - 133
FILE N32:8/5 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/6       - {I65ZLC211} Slide Gate G-211 Closed
                OTE - File #23 DCS COMM - 134
FILE N32:8/6 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/7       - {I65ZLO211} Slide Gate G-211 Open
                OTE - File #23 DCS COMM - 135
FILE N32:8/7 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/8       - {I65YA212A} Slide Gate G-212 Fail To Open
                OTE - File #23 DCS COMM - 136
FILE N32:8/8 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/9       - {I65YA212B} Slide Gate G-212 Fail To Close
                OTE - File #23 DCS COMM - 137
FILE N32:8/9 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/10      - {I65YL212} Slide Gate G-212 Available
                OTE - File #23 DCS COMM - 138
FILE N32:8/10 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/11      - {I65ZL212} Slide Gate G-212 Remote Control
                OTE - File #23 DCS COMM - 139
FILE N32:8/11 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/12      - {I65ZLC212} Slide Gate G-212 Closed
                OTE - File #23 DCS COMM - 140
FILE N32:8/12 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/13      - {I65ZLO212} Slide Gate G-212 Open
                OTE - File #23 DCS COMM - 141
FILE N32:8/13 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/14      - {I65YA213A} Slide Gate G-213 Fail To Open
                OTE - File #23 DCS COMM - 142
FILE N32:8/14 LEN:42 - COP - File #23 DCS COMM - 268
N32:8/15      - {I65YA213B} Slide Gate G-213 Fail To Close
                OTE - File #23 DCS COMM - 143
FILE N32:8/15 LEN:42 - COP - File #23 DCS COMM - 268
N32:9/0       - {I65YL213} Slide Gate G-213 Available
                OTE - File #23 DCS COMM - 144
FILE N32:9/0 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/1       - {I65ZL213} Slide Gate G-213 Remote Control
                OTE - File #23 DCS COMM - 145
FILE N32:9/1 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/2       - {I65ZLC213} Slide Gate G-213 Closed
                OTE - File #23 DCS COMM - 146
FILE N32:9/2 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/3       - {I65ZLO213} Slide Gate G-213 Open
                OTE - File #23 DCS COMM - 147
FILE N32:9/3 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/4       - {I65ZLC221} Slide Gate G-221 Closed
                OTE - File #23 DCS COMM - 148
FILE N32:9/4 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/5       - {I65ZLO221} Slide Gate G-221 Open
                OTE - File #23 DCS COMM - 149
FILE N32:9/5 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/6       - {I65ZLC222} Slide Gate G-222 Closed
                OTE - File #23 DCS COMM - 150
FILE N32:9/6 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/7       - {I65ZLO222} Slide Gate G-222 Open
                OTE - File #23 DCS COMM - 151
FILE N32:9/7 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/8       - {I65ZLC223} Slide Gate G-223 Closed
                OTE - File #23 DCS COMM - 152
FILE N32:9/8 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/9       - {I65ZLO223} Slide Gate G-223 Open
                OTE - File #23 DCS COMM - 153
FILE N32:9/9 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/10      - {I65ZLC231} Slide Gate G-231 Closed
                OTE - File #23 DCS COMM - 154
FILE N32:9/10 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/11      - {I65ZLO231} Slide Gate G-231 Open
                OTE - File #23 DCS COMM - 155
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FILE N32:9/11 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/12     - {I65YA232A} Sluice Gate G-232 Fail To Open
               OTE - File #23 DCS COMM - 156
FILE N32:9/12 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/13     - {I65YA232B} Sluice Gate G-232 Fail To Close
               OTE - File #23 DCS COMM - 157
FILE N32:9/13 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/14     - {I65YL232} Sluice Gate G-232 Available
               OTE - File #23 DCS COMM - 158
FILE N32:9/14 LEN:41 - COP - File #23 DCS COMM - 268
N32:9/15     - {I65ZL232} Sluice Gate G-232 Remote Control
               OTE - File #23 DCS COMM - 159
FILE N32:9/15 LEN:41 - COP - File #23 DCS COMM - 268
N32:10/0     - {I65ZLC232} Sluice Gate G-232 Closed
               OTE - File #23 DCS COMM - 160
FILE N32:10/0 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/1     - {I65ZLO232} Sluice Gate G-232 Open
               OTE - File #23 DCS COMM - 161
FILE N32:10/1 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/2     - {I65ZLC233} Slide Gate G-233 Closed
               OTE - File #23 DCS COMM - 162
FILE N32:10/2 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/3     - {I65ZLO233} Slide Gate G-233 Open
               OTE - File #23 DCS COMM - 163
FILE N32:10/3 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/4     - {I65LALL300} Air Gap Tank T-300 Level Normal
               OTE - File #23 DCS COMM - 164
FILE N32:10/4 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/5     - {I65PAH301} Hydropneumatic Tank T-301 Pressure Normal
               OTE - File #23 DCS COMM - 165
FILE N32:10/5 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/6     - {I65PAL301} Hydropneumatic Tank T-301 Pressure Normal
               OTE - File #23 DCS COMM - 166
FILE N32:10/6 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/7     - {I65LAL410B} Hypo Bulk Storage Tank T-410 Level Normal
               OTE - File #23 DCS COMM - 167
FILE N32:10/7 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/8     - {I65LAL420B} Caustic Bulk Storage Tank T-420 Level Normal
               OTE - File #23 DCS COMM - 168
FILE N32:10/8 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/9     - {I65FAH441} Odor Control Area Eyewash Shower Normal
               OTE - File #23 DCS COMM - 169
FILE N32:10/9 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/10    - {I65FAH442} Chemical Storage Area Eyewash Shower Normal
               OTE - File #23 DCS COMM - 170
FILE N32:10/10 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/11    - {I65FAH443} Blower Bldg Eyewash Shower Normal
               OTE - File #23 DCS COMM - 171
FILE N32:10/11 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/12    - {I65FAH444} Mechanical Bldg Eyewash Shower Normal
               OTE - File #23 DCS COMM - 172
FILE N32:10/12 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/13    - {I65LALL940} Class "A" Water Ai Gap Tank T-940 Level Normal
               OTE - File #23 DCS COMM - 173
FILE N32:10/13 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/14    - {I65UA940} Class "A" Water Ai Gap Tank T-940 Normal
               OTE - File #23 DCS COMM - 174
FILE N32:10/14 LEN:40 - COP - File #23 DCS COMM - 268
N32:10/15    - {I65LALL950} Class "B" Water Ai Gap Tank T-950 Level Normal
               OTE - File #23 DCS COMM - 175
FILE N32:10/15 LEN:40 - COP - File #23 DCS COMM - 268
N32:11/0     - {I65UA950} Class "B" Water Ai Gap Tank T-950 Normal
               OTE - File #23 DCS COMM - 176
FILE N32:11/0 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/1     - Pump Start-Stop Minimum Interval Not Met
               OTE - File #23 DCS COMM - 177
FILE N32:11/1 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/2     - Pump 101 Maximum Starts Exceeded
               OTE - File #23 DCS COMM - 178
FILE N32:11/2 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/3     - Pump 102 Maximum Starts Exceeded
               OTE - File #23 DCS COMM - 179
FILE N32:11/3 LEN:39 - COP - File #23 DCS COMM - 268
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N32:11/4     - Pump 103 Maximum Starts Exceeded
               OTE - File #23 DCS COMM - 180
FILE N32:11/4 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/5     - Pump 104 Maximum Starts Exceeded
               OTE - File #23 DCS COMM - 181
FILE N32:11/5 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/6     - Pump 101 Minimum Off Time Not Met
               OTE - File #23 DCS COMM - 182
FILE N32:11/6 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/7     - Pump 102 Minimum Off Time Not Met
               OTE - File #23 DCS COMM - 183
FILE N32:11/7 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/8     - Pump 103 Minimum Off Time Not Met
               OTE - File #23 DCS COMM - 184
FILE N32:11/8 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/9     - Pump 104 Minimum Off Time Not Met
               OTE - File #23 DCS COMM - 185
FILE N32:11/9 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/10    - Operational Wet Well Level Xmtr Normal
               OTE - File #23 DCS COMM - 186
FILE N32:11/10 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/11    - UPS Off
               OTE - File #23 DCS COMM - 187
FILE N32:11/11 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/12    - UPS Not On Battery
               OTE - File #23 DCS COMM - 188
FILE N32:11/12 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/13    - UPS Not On Bypass
               OTE - File #23 DCS COMM - 189
FILE N32:11/13 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/14    - UPS Not Low Battery
               OTE - File #23 DCS COMM - 190
FILE N32:11/14 LEN:39 - COP - File #23 DCS COMM - 268
N32:11/15    - Main Service A Breaker Open
               OTE - File #24 ATS - 0
FILE N32:11/15 LEN:39 - COP - File #23 DCS COMM - 268
N32:12/0     - Main Service B Breaker Open Status
               OTE - File #24 ATS - 1
FILE N32:12/0 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/1     - Tie Breaker Open
               OTE - File #24 ATS - 2
FILE N32:12/1 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/2     - Main Service A not Available
               OTE - File #24 ATS - 4
               XIC - File #24 ATS - 18
FILE N32:12/2 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/3     - Main Service B Not Available
               OTE - File #24 ATS - 6
               XIC - File #24 ATS - 18
FILE N32:12/3 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/4     - UPS Trouble
               OTE - File #24 ATS - 7
FILE N32:12/4 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/5     - Main Service A Breaker Tripped
               OTE - File #24 ATS - 8
FILE N32:12/5 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/6     - Main Service B Breaker Tripped
               OTE - File #24 ATS - 9
FILE N32:12/6 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/7     - Tie Breaker Tripped
               OTE - File #24 ATS - 10
FILE N32:12/7 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/8     - Transfer System Fail
               OTE - File #24 ATS - 11
FILE N32:12/8 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/9     - Auto/Manual Switch Manual Mode
               OTE - File #24 ATS - 12
FILE N32:12/9 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/10    - Auto/Manual Switch Auto Mode
               OTE - File #24 ATS - 13
FILE N32:12/10 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/11    - Service Selector Switch Service A Normal Source
               OTE - File #24 ATS - 14
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FILE N32:12/11 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/12    - Service Selector Switch Service B Normal Source
               OTE - File #24 ATS - 15
FILE N32:12/12 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/13    - 86 Lockout Relay Tripped
               OTE - File #24 ATS - 16
FILE N32:12/13 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/14    - PLC General Fault Status
               OTE - File #24 ATS - 17
FILE N32:12/14 LEN:38 - COP - File #23 DCS COMM - 268
N32:12/15    - Main Service A Relay Failure
               OTE - File #24 ATS - 20
FILE N32:12/15 LEN:38 - COP - File #23 DCS COMM - 268
N32:13/0     - Main Service B Relay Failure
               OTE - File #24 ATS - 22
FILE N32:13/0 LEN:37 - COP - File #23 DCS COMM - 268
N32:13/1     - Auto-Throwover System(PLC Heartbeat)
               OTE - File #24 ATS - 28
FILE N32:13/1 LEN:37 - COP - File #23 DCS COMM - 268
N32:13/2     - Power Quality Relay Fault
               OTE - File #24 ATS - 23
FILE N32:13/2 LEN:37 - COP - File #23 DCS COMM - 268
N32:50       - {I65AI8} Odor Control System pH
               COP - File #23 DCS COMM - 191, 268
FILE N32:50 LEN:50 - COP - File #23 DCS COMM - 191, 268
N32:52       - {I65LI10} Wet Well Level
               COP - File #23 DCS COMM - 192
FILE N32:52 LEN:48 - COP - File #23 DCS COMM - 268, 192
N32:54       - {I65LI20} Bar Screen Channel Differential Level
               COP - File #23 DCS COMM - 193
FILE N32:54 LEN:46 - COP - File #23 DCS COMM - 268, 193
N32:56       - {I65LY100A} Lead 150 HP Pump Start Setpoint
               COP - File #23 DCS COMM - 194
FILE N32:56 LEN:44 - COP - File #23 DCS COMM - 268, 194
N32:58       - {I65LY100B} Lead 150 HP Pump Stop Setpoint
               COP - File #23 DCS COMM - 195
FILE N32:58 LEN:42 - COP - File #23 DCS COMM - 268, 195
N32:60       - {I65LY100C} Lag 150 HP Pump Start Setpoint
               COP - File #23 DCS COMM - 196
FILE N32:60 LEN:40 - COP - File #23 DCS COMM - 268, 196
N32:62       - {I65LY100D} Lag 150 HP Pump Stop Setpoint
               COP - File #23 DCS COMM - 197
FILE N32:62 LEN:38 - COP - File #23 DCS COMM - 268, 197
N32:64       - {I65LY100E} Lead 400 HP Pump Start Setpoint
               COP - File #23 DCS COMM - 198
FILE N32:64 LEN:36 - COP - File #23 DCS COMM - 268, 198
N32:66       - {I65LY100F} Lead 400 HP Pump Stop Setpoint
               COP - File #23 DCS COMM - 199
FILE N32:66 LEN:34 - COP - File #23 DCS COMM - 268, 199
N32:68       - {I65LY100G} Lag 400 HP Pump Start Setpoint
               COP - File #23 DCS COMM - 200
FILE N32:68 LEN:32 - COP - File #23 DCS COMM - 268, 200
N32:70       - {I65LY100H} Lag 400 HP Pump Stop Setpoint
               COP - File #23 DCS COMM - 201
FILE N32:70 LEN:30 - COP - File #23 DCS COMM - 268, 201
N32:72       - {I65KI101} Pump 101 Run Time
               COP - File #23 DCS COMM - 202
FILE N32:72 LEN:28 - COP - File #23 DCS COMM - 268, 202
N32:74       - {I65PI101A} Pump 101 Suction Pressure
               COP - File #23 DCS COMM - 203
FILE N32:74 LEN:26 - COP - File #23 DCS COMM - 268, 203
N32:76       - {I65PI101B} Pump 101 Discharge Pressure
               COP - File #23 DCS COMM - 204
FILE N32:76 LEN:24 - COP - File #23 DCS COMM - 268, 204
N32:78       - {I65TI101A} Pump 101 Motor Winding Temp A
               COP - File #23 DCS COMM - 205
FILE N32:78 LEN:22 - COP - File #23 DCS COMM - 268, 205
N32:80       - {I65TI101B} Pump 101 Motor Winding Temp B
               COP - File #23 DCS COMM - 206
FILE N32:80 LEN:20 - COP - File #23 DCS COMM - 268, 206
N32:82       - {I65TI101C} Pump 101 Motor Winding Temp C
               COP - File #23 DCS COMM - 207
FILE N32:82 LEN:18 - COP - File #23 DCS COMM - 268, 207
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N32:84       - {I65TI101D} Pump 101 Motor Winding Temp D
               COP - File #23 DCS COMM - 208
FILE N32:84 LEN:16 - COP - File #23 DCS COMM - 268, 208
N32:86       - {I65TI101E} Pump 101 Motor Winding Temp E
               COP - File #23 DCS COMM - 209
FILE N32:86 LEN:14 - COP - File #23 DCS COMM - 268, 209
N32:88       - {I65TI101F} Pump 101 Motor Winding Temp F
               COP - File #23 DCS COMM - 210
FILE N32:88 LEN:12 - COP - File #23 DCS COMM - 268, 210
N32:90       - {I65TI101G} Pump 101 Bearing Temp G
               COP - File #23 DCS COMM - 211
FILE N32:90 LEN:10 - COP - File #23 DCS COMM - 268, 211
N32:92       - {I65TI101H} Pump 101 Bearing Temp H
               COP - File #23 DCS COMM - 212
FILE N32:92 LEN:8 - COP - File #23 DCS COMM - 268, 212
N32:94       - {I65VI101A} Pump 101 Upper Bearing Vibration
               COP - File #23 DCS COMM - 213
FILE N32:94 LEN:6 - COP - File #23 DCS COMM - 268, 213
N32:96       - {I65VI101B} Pump 101 Lower Bearing Vibration
               COP - File #23 DCS COMM - 214
FILE N32:96 LEN:4 - COP - File #23 DCS COMM - 268, 214
N32:98       - {I65KI102} Pump 102 Run Time
               COP - File #23 DCS COMM - 215
FILE N32:98 LEN:2 - COP - File #23 DCS COMM - 268, 215
N32:100      - {I65PI102A} Pump 102 Suction Pressure
               COP - File #23 DCS COMM - 216, 268
FILE N32:100 LEN:50 - COP - File #23 DCS COMM - 216, 268
N32:102      - {I65PI102B} Pump 102 Discharge Pressure
               COP - File #23 DCS COMM - 217
FILE N32:102 LEN:48 - COP - File #23 DCS COMM - 268, 217
N32:104      - {I65TI102A} Pump 102 Motor Winding Temp A
               COP - File #23 DCS COMM - 218
FILE N32:104 LEN:46 - COP - File #23 DCS COMM - 268, 218
N32:106      - {I65TI102B} Pump 102 Motor Winding Temp B
               COP - File #23 DCS COMM - 219
FILE N32:106 LEN:44 - COP - File #23 DCS COMM - 268, 219
N32:108      - {I65TI102C} Pump 102 Motor Winding Temp C
               COP - File #23 DCS COMM - 220
FILE N32:108 LEN:42 - COP - File #23 DCS COMM - 268, 220
N32:110      - {I65TI102D} Pump 102 Motor Winding Temp D
               COP - File #23 DCS COMM - 221
FILE N32:110 LEN:40 - COP - File #23 DCS COMM - 268, 221
N32:112      - {I65TI102E} Pump 102 Motor Winding Temp E
               COP - File #23 DCS COMM - 222
FILE N32:112 LEN:38 - COP - File #23 DCS COMM - 268, 222
N32:114      - {I65TI102F} Pump 102 Motor Winding Temp F
               COP - File #23 DCS COMM - 223
FILE N32:114 LEN:36 - COP - File #23 DCS COMM - 268, 223
N32:116      - {I65TI102G} Pump 102 Bearing Temp G
               COP - File #23 DCS COMM - 224
FILE N32:116 LEN:34 - COP - File #23 DCS COMM - 268, 224
N32:118      - {I65TI102H} Pump 102 Bearing Temp H
               COP - File #23 DCS COMM - 225
FILE N32:118 LEN:32 - COP - File #23 DCS COMM - 268, 225
N32:120      - {I65VI102A} Pump 102 Upper Bearing Vibration
               COP - File #23 DCS COMM - 226
FILE N32:120 LEN:30 - COP - File #23 DCS COMM - 268, 226
N32:122      - {I65VI102B} Pump 102 Lower Bearing Vibration
               COP - File #23 DCS COMM - 227
FILE N32:122 LEN:28 - COP - File #23 DCS COMM - 268, 227
N32:124      - {I65KI103} Pump 103 Run Time
               COP - File #23 DCS COMM - 228
FILE N32:124 LEN:26 - COP - File #23 DCS COMM - 268, 228
N32:126      - {I65PI103A} Pump 103 Suction Pressure
               COP - File #23 DCS COMM - 229
FILE N32:126 LEN:24 - COP - File #23 DCS COMM - 268, 229
N32:128      - {I65PI103B} Pump 103 Discharge Pressure
               COP - File #23 DCS COMM - 230
FILE N32:128 LEN:22 - COP - File #23 DCS COMM - 268, 230
N32:130      - {I65TI103A} Pump 103 Motor Winding Temp A
               COP - File #23 DCS COMM - 231
FILE N32:130 LEN:20 - COP - File #23 DCS COMM - 268, 231
N32:132      - {I65TI103B} Pump 103 Motor Winding Temp B
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                COP - File #23 DCS COMM - 232
FILE N32:132 LEN:18 - COP - File #23 DCS COMM - 268, 232
N32:134      - {I65TI103C} Pump 103 Motor Winding Temp C
                COP - File #23 DCS COMM - 233
FILE N32:134 LEN:16 - COP - File #23 DCS COMM - 268, 233
N32:136      - {I65TI103D} Pump 103 Motor Winding Temp D
                COP - File #23 DCS COMM - 234
FILE N32:136 LEN:14 - COP - File #23 DCS COMM - 268, 234
N32:138      - {I65TI103E} Pump 103 Motor Winding Temp E
                COP - File #23 DCS COMM - 235
FILE N32:138 LEN:12 - COP - File #23 DCS COMM - 268, 235
N32:140      - {I65TI103F} Pump 103 Motor Winding Temp F
                COP - File #23 DCS COMM - 236
FILE N32:140 LEN:10 - COP - File #23 DCS COMM - 268, 236
N32:142      - {I65TI103G} Pump 103 Bearing Temp G
                COP - File #23 DCS COMM - 237
FILE N32:142 LEN:8 - COP - File #23 DCS COMM - 268, 237
N32:144      - {I65TI103H} Pump 103 Bearing Temp H
                COP - File #23 DCS COMM - 238
FILE N32:144 LEN:6 - COP - File #23 DCS COMM - 268, 238
N32:146      - {I65VI103A} Pump 103 Upper Bearing Vibration
                COP - File #23 DCS COMM - 239
FILE N32:146 LEN:4 - COP - File #23 DCS COMM - 268, 239
N32:148      - {I65VI103B} Pump 103 Lower Bearing Vibration
                COP - File #23 DCS COMM - 240
FILE N32:148 LEN:2 - COP - File #23 DCS COMM - 268, 240
N32:150      - {I65KI104} Pump 104 Run Time
                COP - File #23 DCS COMM - 241, 268
FILE N32:150 LEN:50 - COP - File #23 DCS COMM - 241, 268
N32:152      - {I65PI104A} Pump 104 Suction Pressure
                COP - File #23 DCS COMM - 242
FILE N32:152 LEN:48 - COP - File #23 DCS COMM - 268, 242
N32:154      - {I65PI104B} Pump 104 Discharge Pressure
                COP - File #23 DCS COMM - 243
FILE N32:154 LEN:46 - COP - File #23 DCS COMM - 268, 243
N32:156      - {I65TI104A} Pump 104 Motor Winding Temp A
                COP - File #23 DCS COMM - 244
FILE N32:156 LEN:44 - COP - File #23 DCS COMM - 268, 244
N32:158      - {I65TI104B} Pump 104 Motor Winding Temp B
                COP - File #23 DCS COMM - 245
FILE N32:158 LEN:42 - COP - File #23 DCS COMM - 268, 245
N32:160      - {I65TI104C} Pump 104 Motor Winding Temp C
                COP - File #23 DCS COMM - 246
FILE N32:160 LEN:40 - COP - File #23 DCS COMM - 268, 246
N32:162      - {I65TI104D} Pump 104 Motor Winding Temp D
                COP - File #23 DCS COMM - 247
FILE N32:162 LEN:38 - COP - File #23 DCS COMM - 268, 247
N32:164      - {I65TI104E} Pump 104 Motor Winding Temp E
                COP - File #23 DCS COMM - 248
FILE N32:164 LEN:36 - COP - File #23 DCS COMM - 268, 248
N32:166      - {I65TI104F} Pump 104 Motor Winding Temp F
                COP - File #23 DCS COMM - 249
FILE N32:166 LEN:34 - COP - File #23 DCS COMM - 268, 249
N32:168      - {I65TI104G} Pump 104 Bearing Temp G
                COP - File #23 DCS COMM - 250
FILE N32:168 LEN:32 - COP - File #23 DCS COMM - 268, 250
N32:170      - {I65TI104H} Pump 104 Bearing Temp H
                COP - File #23 DCS COMM - 251
FILE N32:170 LEN:30 - COP - File #23 DCS COMM - 268, 251
N32:172      - {I65VI104A} Pump 104 Upper Bearing Vibration
                COP - File #23 DCS COMM - 252
FILE N32:172 LEN:28 - COP - File #23 DCS COMM - 268, 252
N32:174      - {I65VI104B} Pump 104 Lower Bearing Vibration
                COP - File #23 DCS COMM - 253
FILE N32:174 LEN:26 - COP - File #23 DCS COMM - 268, 253
N32:176      - {I65PI401} Force Main Discharge Pressure
                COP - File #23 DCS COMM - 254
FILE N32:176 LEN:24 - COP - File #23 DCS COMM - 268, 254
N32:178      - {I65FI402} Hypo Caustic Flow To Vessel #1
                COP - File #23 DCS COMM - 255
FILE N32:178 LEN:22 - COP - File #23 DCS COMM - 268, 255
N32:180      - {I65FI403} Hypo Caustic Flow To Vessel #2
                COP - File #23 DCS COMM - 256
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FILE N32:180 LEN:20 - COP - File #23 DCS COMM - 268, 256
N32:182      - {I65FI601} Force Main Discharge Flow Rate
               COP - File #23 DCS COMM - 257
FILE N32:182 LEN:18 - COP - File #23 DCS COMM - 268, 257
N32:184      - {I65FQI601A} Current Force Main Totalized Flow
               COP - File #23 DCS COMM - 258
FILE N32:184 LEN:16 - COP - File #23 DCS COMM - 268, 258
N32:186      - {I65FQI601B} Previous Force Main Totalized Flow
               COP - File #23 DCS COMM - 259
FILE N32:186 LEN:14 - COP - File #23 DCS COMM - 268, 259
N32:188      - COP - File #23 DCS COMM - 260
FILE N32:188 LEN:12 - COP - File #23 DCS COMM - 268, 260
N32:190      - COP - File #23 DCS COMM - 261
FILE N32:190 LEN:10 - COP - File #23 DCS COMM - 268, 261
N32:192      - COP - File #23 DCS COMM - 262
FILE N32:192 LEN:8 - COP - File #23 DCS COMM - 268, 262
N32:194      - COP - File #23 DCS COMM - 263
FILE N32:194 LEN:6 - COP - File #23 DCS COMM - 268, 263
N32:196      - COP - File #23 DCS COMM - 264
FILE N32:196 LEN:4 - COP - File #23 DCS COMM - 268, 264
N32:198      - COP - File #23 DCS COMM - 266
FILE N32:198 LEN:2 - COP - File #23 DCS COMM - 268, 266
N32:200      - Bleach Level 0-8ft
               COP - File #23 DCS COMM - 265, 268
FILE N32:200 LEN:50 - COP - File #23 DCS COMM - 265, 268
N33:0        - Command Outputs From DCS
               COP - File #7 BCM LOAD - 10
                     File #8 BCM STORE - 10
                     File #23 DCS COMM - 267
FILE N33:0 LEN:100 - COP - File #7 BCM LOAD - 10
                     File #8 BCM STORE - - 10
                     File #23 DCS COMM - - 267
N33:0/0      - {I65KC100} Reset Plc Clock
               XIC - File #21 CLOCK - 0
FILE N33:0/0 LEN:100 - COP - File #7 BCM LOAD - 10
                     File #8 BCM STORE - - 10
                     File #23 DCS COMM - - 267
N33:0/1      - {I65YC100B} DCS Heartbeat
               XIC - File #23 DCS COMM - 28, 269
               XIO - File #23 DCS COMM - 270
FILE N33:0/1 LEN:100 - COP - File #7 BCM LOAD - 10
                     File #8 BCM STORE - - 10
                     File #23 DCS COMM - - 267
N33:0/2      - {I65HS101A} Pump 101 Lead 150 HP
               OTL - File #12 SEQUENCE - 24
                     File #14 PUMP 102 - 25
               OTU - File #12 SEQUENCE - 23
                     File #13 PUMP 101 - 25
               XIC - File #12 SEQUENCE - 23, 27, 30
                     File #13 PUMP 101 - 25
                     File #23 DCS COMM - 44
               XIO - File #12 SEQUENCE - 24, 27, 30
                     File #14 PUMP 102 - 25
                     File #23 DCS COMM - 66
FILE N33:0/2 LEN:100 - COP - File #7 BCM LOAD - 10
                     File #8 BCM STORE - - 10
                     File #23 DCS COMM - - 267
N33:0/3      - {I65HS101B} Pump 101 PLC Control
               OTL - File #23 DCS COMM - 272
               XIC - File #12 SEQUENCE - 27
                     File #13 PUMP 101 - 24
                     File #23 DCS COMM - 46, 178, 182
               XIO - File #12 SEQUENCE - 19, 27, 33, 36
FILE N33:0/3 LEN:100 - COP - File #7 BCM LOAD - 10
                     File #8 BCM STORE - - 10
                     File #23 DCS COMM - - 267
N33:0/4      - {I65HS101C} Pump 101 DCS Manual Start
               XIC - File #12 SEQUENCE - 27
FILE N33:0/4 LEN:100 - COP - File #7 BCM LOAD - 10
                     File #8 BCM STORE - - 10
                     File #23 DCS COMM - - 267
N33:0/5      - {I65HS101D} Pump 101 Out Of Service
               XIC - File #12 SEQUENCE - 23
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                        File #13 PUMP 101 - 25
                        File #23 DCS COMM - 45
                  XIO - File #12 SEQUENCE - 19
FILE N33:0/5 LEN:100 - COP - File #7 BCM LOAD - 10
                        File #8 BCM STORE - - 10
                        File #23 DCS COMM - - 267
N33:0/6       - {I65HS101E} Pump 101 Reset
                  XIO - File #13 PUMP 101 - 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 22
FILE N33:0/6 LEN:100 - COP - File #7 BCM LOAD - 10
                        File #8 BCM STORE - - 10
                        File #23 DCS COMM - - 267
N33:0/7       - {I65HS101F} Pump 101 Reset Run Time Meter
                  XIC - File #13 PUMP 101 - 28
FILE N33:0/7 LEN:100 - COP - File #7 BCM LOAD - 10
                        File #8 BCM STORE - - 10
                        File #23 DCS COMM - - 267
N33:0/8       - {I65HS102A} Pump 102 PLC Control
                  OTL - File #23 DCS COMM - 272
                  XIC - File #12 SEQUENCE - 30
                        File #14 PUMP 102 - 24
                        File #23 DCS COMM - 68, 179, 183
                  XIO - File #12 SEQUENCE - 20, 30, 33, 36
FILE N33:0/8 LEN:100 - COP - File #7 BCM LOAD - 10
                        File #8 BCM STORE - - 10
                        File #23 DCS COMM - - 267
N33:0/9       - {I65HS102B} Pump 102 DCS Manual Start
                  XIC - File #12 SEQUENCE - 30
FILE N33:0/9 LEN:100 - COP - File #7 BCM LOAD - 10
                        File #8 BCM STORE - - 10
                        File #23 DCS COMM - - 267
N33:0/10      - {I65HS102C} Pump 102 Out Of Service
                  XIC - File #12 SEQUENCE - 24
                        File #14 PUMP 102 - 25
                        File #23 DCS COMM - 67
                  XIO - File #12 SEQUENCE - 20
FILE N33:0/10 LEN:100 - COP - File #7 BCM LOAD - 10
                        File #8 BCM STORE - - 10
                        File #23 DCS COMM - - 267
N33:0/11      - {I65HS102D} Pump 102 Reset
                  XIO - File #14 PUMP 102 - 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 22
FILE N33:0/11 LEN:100 - COP - File #7 BCM LOAD - 10
                        File #8 BCM STORE - - 10
                        File #23 DCS COMM - - 267
N33:0/12      - {I65HS102E} Pump 102 Reset Run Time Meter
                  XIC - File #14 PUMP 102 - 28
FILE N33:0/12 LEN:100 - COP - File #7 BCM LOAD - 10
                        File #8 BCM STORE - - 10
                        File #23 DCS COMM - - 267
N33:0/13      - {I65HS103A} Pump 103 Lead 400 HP
                  OTL - File #12 SEQUENCE - 26
                        File #16 PUMP 104 - 27
                  OTU - File #12 SEQUENCE - 25
                        File #15 PUMP 103 - 27
                  XIC - File #12 SEQUENCE - 25, 33, 36
                        File #15 PUMP 103 - 27
                        File #23 DCS COMM - 88
                  XIO - File #12 SEQUENCE - 26, 33, 36
                        File #16 PUMP 104 - 27
                        File #23 DCS COMM - 110
FILE N33:0/13 LEN:100 - COP - File #7 BCM LOAD - 10
                        File #8 BCM STORE - - 10
                        File #23 DCS COMM - - 267
N33:0/14      - {I65HS103B} Pump 103 PLC Control
                  OTL - File #23 DCS COMM - 272
                  XIC - File #12 SEQUENCE - 33
                        File #15 PUMP 103 - 26
                        File #23 DCS COMM - 90, 180, 184
                  XIO - File #12 SEQUENCE - 21, 27, 30, 33
FILE N33:0/14 LEN:100 - COP - File #7 BCM LOAD - 10
                        File #8 BCM STORE - - 10
                        File #23 DCS COMM - - 267
N33:0/15      - {I65HS103C} Pump 103 DCS Manual Start
                  XIC - File #12 SEQUENCE - 33
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                XIO - File #12 SEQUENCE - 27, 30
FILE N33:0/15 LEN:100 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/0       - {I65HS103D} Pump 103 Out Of Service
                XIC - File #12 SEQUENCE - 25
                      File #15 PUMP 103 - 27
                      File #23 DCS COMM - 89
                XIO - File #12 SEQUENCE - 21
FILE N33:1/0 LEN:99 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/1       - {I65HS103E} Pump 103 Reset
                XIO - File #15 PUMP 103 - 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 22
                        24, 25
FILE N33:1/1 LEN:99 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/2       - {I65HS103F} Pump 103 Reset Run Time Meter
                XIC - File #15 PUMP 103 - 30
FILE N33:1/2 LEN:99 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/3       - {I65HS104A} Pump 104 PLC Control
                OTL - File #23 DCS COMM - 272
                XIC - File #12 SEQUENCE - 36
                      File #16 PUMP 104 - 26
                      File #23 DCS COMM - 112, 181, 185
                XIO - File #12 SEQUENCE - 22, 27, 30, 36
FILE N33:1/3 LEN:99 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/4       - {I65HS104B} Pump 104 DCS Manual Start
                XIC - File #12 SEQUENCE - 36
                XIO - File #12 SEQUENCE - 27, 30
FILE N33:1/4 LEN:99 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/5       - {I65HS104C} Pump 104 Out Of Service
                XIC - File #12 SEQUENCE - 26
                      File #16 PUMP 104 - 27
                      File #23 DCS COMM - 111
                XIO - File #12 SEQUENCE - 22
FILE N33:1/5 LEN:99 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/6       - {I65HS104D} Pump 104 Reset
                XIO - File #16 PUMP 104 - 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 22
                        24
FILE N33:1/6 LEN:99 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/7       - {I65HS104E} Pump 104 Reset Run Time Meter
                XIC - File #16 PUMP 104 - 30
FILE N33:1/7 LEN:99 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/8       - {I65HS141A} Open Plug Valve V-141
                XIC - File #20 GATES - 32
FILE N33:1/8 LEN:99 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/9       - {I65HS141B} Close Plug Valve V-141
                XIC - File #20 GATES - 33
FILE N33:1/9 LEN:99 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/10      - {I65HS141C} Plug Valve V-141 Reset
                XIO - File #20 GATES - 36, 37
FILE N33:1/10 LEN:99 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:1/11      - {I65HS211A} Open Slide Gate G-211
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                XIC - File #20 GATES - 1
FILE N33:1/11 LEN:99 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:1/12      - {I65HS211B} Close Slide Gate G-211
                XIC - File #20 GATES - 2
FILE N33:1/12 LEN:99 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:1/13      - {I65HS211C} Slide Gate G-211 Reset
                XIO - File #20 GATES - 5, 6
FILE N33:1/13 LEN:99 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:1/14      - {I65HS212A} Open Slide Gate G-212
                XIC - File #20 GATES - 8
FILE N33:1/14 LEN:99 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:1/15      - {I65HS212B} Close Slide Gate G-212
                XIC - File #20 GATES - 9
FILE N33:1/15 LEN:99 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:2/0       - {I65HS212C} Slide Gate G-212 Reset
                XIO - File #20 GATES - 12, 13
FILE N33:2/0 LEN:98 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:2/1       - {I65HS213A} Open Slide Gate G-213
                XIC - File #20 GATES - 15
FILE N33:2/1 LEN:98 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:2/2       - {I65HS213B} Close Slide Gate G-213
                XIC - File #20 GATES - 16
FILE N33:2/2 LEN:98 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:2/3       - {I65HS213C} Slide Gate G-213 Reset
                XIO - File #20 GATES - 19, 20
FILE N33:2/3 LEN:98 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:2/4       - {I65HS232A} Open Sluice Gate G-232
                XIC - File #20 GATES - 22
FILE N33:2/4 LEN:98 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:2/5       - {I65HS232B} Stop Sluice Gate G-232
                XIC - File #20 GATES - 24
FILE N33:2/5 LEN:98 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:2/6       - {I65HS232C} Close Sluice Gate G-232
                XIC - File #20 GATES - 23
FILE N33:2/6 LEN:98 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:2/7       - {I65HS232D} Sluice Gate G-232 Reset
                XIO - File #20 GATES - 29, 30
FILE N33:2/7 LEN:98 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:2/8       - Wet Well #1 Select, NOT #1 = Wet Well #2 Select
                XIC - File #9 ANALOG IN - 6
                XIO - File #9 ANALOG IN - 6
FILE N33:2/8 LEN:98 - COP - File #7 BCM LOAD - 10
                       File #8 BCM STORE - - 10
                       File #23 DCS COMM - - 267
N33:2/9       - Wet Well in DCS mode
                XIC - File #9 ANALOG IN - 6
                XIO - File #9 ANALOG IN - 7, 8, 9, 10, 11, 12
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FILE N33:2/9 LEN:98 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N33:50       - {I65LC100A} Lead 150 HP Start Setpoint
               COP - File #23 DCS COMM - 267
FILE N33:50 LEN:50 - COP - File #7 BCM LOAD - 10
                      File #8 BCM STORE - - 10
                      File #23 DCS COMM - - 267
N34:0        - Slave Error Code Table
               COP - File #23 DCS COMM - 267
FILE N34:0 LEN:20 - COP - File #23 DCS COMM - 267
N35:0        -     - Channel Configuration - Channel 1B:Diagnostic File
FILE N35:0 LEN:40 -     - Channel Configuration - Channel 1B:Diagnostic File
N36:0        -     - Data File - S:16
FILE N36:0 LEN:48 -     - Data File - S:16
N37:0        - Wet Well #1
               COP - File #7 BCM LOAD - 11
                     File #8 BCM STORE - 11
               BTW - File #9 ANALOG IN - 4
FILE N37:0 LEN:37 - COP - File #7 BCM LOAD - 11
                      File #8 BCM STORE - - 11
               BTW - File #9 ANALOG IN - 4
N38:0        - Read data block
               COP - File #7 BCM LOAD - 12
                     File #8 BCM STORE - 12
               BTR - File #9 ANALOG IN - 5
FILE N38:0 LEN:15 - COP - File #7 BCM LOAD - 12
                      File #8 BCM STORE - - 12
               BTR - File #9 ANALOG IN - 5
N38:0/0      - XIC - File #9 ANALOG IN - 4
FILE N38:0/0 LEN:15 - COP - File #7 BCM LOAD - 12
                      File #8 BCM STORE - - 12
               BTR - File #9 ANALOG IN - 5
N38:4        - H2S stack
               CPT - File #9 ANALOG IN - 27
FILE N38:4 LEN:11 - COP - File #7 BCM LOAD - 12
                      File #8 BCM STORE - - 12
               BTR - File #9 ANALOG IN - 5
N38:5        - H2S barscreen room
               CPT - File #9 ANALOG IN - 28, 32
FILE N38:5 LEN:10 - COP - File #7 BCM LOAD - 12
                      File #8 BCM STORE - - 12
               BTR - File #9 ANALOG IN - 5
N38:6        - Wet Well #1 Level
               CPT - File #9 ANALOG IN - 29
FILE N38:6 LEN:9 - COP - File #7 BCM LOAD - 12
                     File #8 BCM STORE - - 12
               BTR - File #9 ANALOG IN - 5
N38:7        - Wet Well #2 Level
               CPT - File #9 ANALOG IN - 30
FILE N38:7 LEN:8 - COP - File #7 BCM LOAD - 12
                     File #8 BCM STORE - - 12
               BTR - File #9 ANALOG IN - 5
N38:8        - Bleach Level
               CPT - File #9 ANALOG IN - 31
FILE N38:8 LEN:7 - COP - File #7 BCM LOAD - 12
                     File #8 BCM STORE - - 12
               BTR - File #9 ANALOG IN - 5
U:3          - BCM Main Subroutine
               JSR - File #2 MAIN - 0
U:4          - JSR - File #3 BCM MAIN - 5
U:5          - JSR - File #3 BCM MAIN - 6
U:6          - BCM Diagnostic Counters
               JSR - File #3 BCM MAIN - 8
U:7          - Copy Memory To Primary Buffer
               JSR - File #4 BCM PRI - 0
U:8          - Copy Secondary Buffer To Memory
               JSR - File #5 BCM SEC - 1
U:9          - Read Analog Inputs
               JSR - File #2 MAIN - 1
U:10         - Read Multilin
               JSR - File #2 MAIN - 2
U:11         - Read Bently Nevada
```

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                JSR - File #2 MAIN - 3
U:12          - Pump Sequencing
                JSR - File #2 MAIN - 4
U:13          - Pump 101
                JSR - File #2 MAIN - 5
U:14          - Pump 102
                JSR - File #2 MAIN - 6
U:15          - Pump 103
                JSR - File #2 MAIN - 7
U:16          - Pump 104
                JSR - File #2 MAIN - 8
U:18          - Flow Totalizer
                JSR - File #2 MAIN - 9
U:19          - Seal Water Pumps
                JSR - File #2 MAIN - 10
U:20          - Gate Control
                JSR - File #2 MAIN - 11
U:21          - Set Clock
                JSR - File #2 MAIN - 12
U:22          - Misc
                JSR - File #2 MAIN - 13
U:23          - DCS Communication
                JSR - File #2 MAIN - 14
U:24          - JSR - File #2 MAIN - 15
```

File O0 -- OUTPUT Usage

Offset	FW	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0	(Symbol) Description
O:000		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
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O:010		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Copy Outputs From BCM Read Buffer To Memory
O:011	FW	X	.	.	X	X	X	X	X	.	.	.	.	X	X	X	X	
O:012		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
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O:027	FW	.	.	X	X	X	X	X	X	X	X	X	X	X	.	.	.	
O:030		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
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Offset	FW	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0	(Symbol) Description
O:106		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
O:107		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
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O:177		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

File I1 -- INPUT Usage

Offset	FW	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0	(Symbol) Description
I:000		.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	
I:001		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:002		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:003		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:004		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:005		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:006		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:007		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:010		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
I:011		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:012		X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
I:013		X	X	.	X	X	X	X	.	X	X	X	X	.	X	X	X	
I:014		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
I:015		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
I:016		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:017		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:020		.	.	.	X	X	X	X	X	X	X	X	X	X	X	X	X	
I:021		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:022		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
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I:030		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:031		.	.	.	.	.	.	.	.	.	.	X	X	X	X	.	.	
I:032		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
I:033		.	.	.	.	.	.	.	.	.	.	.	.	X	X	X	X	
I:034		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:035		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:036		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
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I:040		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:041		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:042		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:043		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:044		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
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I:065		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:066		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:067		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:070		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:071		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:072		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:073		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:074		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:075		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:076		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:077		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:100		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:101		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:102		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:103		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:104		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:105		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

File I1 -- INPUT Usage

Offset	FW	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0	(Symbol) Description
I:106		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:107		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:110		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:111		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:112		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:113		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:114		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:115		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:116		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:117		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:120		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:121		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:122		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:123		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:124		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:125		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:126		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:127		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:130		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:131		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:132		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:133		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:134		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:135		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:136		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:137		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:140		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:141		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:142		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:143		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
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I:146		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:147		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:150		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:151		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:152		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:153		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
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I:160		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
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I:162		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:163		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:164		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:165		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:166		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:167		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:170		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:171		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:172		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:173		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:174		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:175		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:176		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
I:177		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

File S2 -- STATUS Usage

Offset	0	1	2	3	4	5	6	7	8	9
S:0	.	X	.	.	.	.	.	.	.	.
S:10	.	.	.	.	.	.	.	.	.	.
S:20	.	X	X	X	.	.	.	.	.	.
S:30	.	.	.	.	.	.	.	.	.	.
S:40	.	.	.	.	.	.	.	.	.	.
S:50	.	.	.	.	.	.	.	.	.	.
S:60	.	.	.	.	.	.	.	.	.	.
S:70	.	.	.	.	.	.	.	.	.	.
S:80	.	.	.	.	.	.	.	.	.	.
S:90	.	.	.	.	.	.	.	.	.	.
S:100	.	.	.	.	.	.	.	.	.	.
S:110	.	.	.	.	.	.	.	.	.	.
S:120	.	.	.	.	.	.	.	.		

File B3 -- BINARY Usage

Offset	FW	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol) Description
B3:0	FW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	Copy Storage Bits From BCM Read Buffer To Memory
B3:1	F	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
B3:2	F	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
B3:3	F	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
B3:4	F	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
B3:5	F	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
B3:6	F	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
B3:7	F	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
B3:8	F	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
B3:9	F	.	.	.	.	.	.	.	.	.	X	X	X	X	X	X	X	

File T4 -- TIMER Usage

Offset	FW	EN	TT	DN	BASE	PRE	ACC	(Symbol) Description
T4:0	W	.	.	X	.	.	.	BCM Initial Start-Up Delay Timer
T4:1	FW	.	.	X	.	.	.	Pump 101 Off Timer
T4:2	FW	.	.	X	.	.	.	Pump 102 Off Timer
T4:3	FW	.	.	X	.	.	.	Pump 103 Off Timer
T4:4	FW	.	.	X	.	.	.	Pump 104 Off Timer
T4:5	FW	.	.	X	.	.	.	60 Second Timer
T4:6	FW	.	.	X	.	.	.	Pump Start Minimum Interval Timer
T4:7	FW	.	.	X	.	.	.	Pump Stop Minimum Interval Timer
T4:8	FW	.	.	X	.	.	.	Pump 101 Start Response Timer
T4:9	FW	.	.	X	.	.	.	Pump 101 Stop Response Timer
T4:10	FW	.	.	X	.	.	.	Pump 101 Upper Bearing High Vibration Timer
T4:11	FW	.	.	X	.	.	.	Pump 101 Upper Bearing High-High Vibration Timer
T4:12	FW	.	.	X	.	.	.	Pump 101 Lower Bearing High Vibration Timer
T4:13	FW	.	.	X	.	.	.	Pump 101 Lower Bearing High-High Vibration Timer
T4:14	FW	.	.	X	.	.	.	Pump 101 Low Suction Pressure Timer
T4:15	FW	.	.	X	.	.	.	Pump 101 Low-Low Suction Pressure Timer
T4:16	FW	.	.	X	.	.	.	Pump 101 High Discharge Pressure Timer
T4:17	FW	.	.	X	.	.	.	Pump 101 High-High Discharge Pressure Timer
T4:18	FW	.	.	X	.	.	.	Pump 101 Discharge Valve Fail To Open Timer
T4:19	FW	.	.	X	.	.	.	Pump 101 Discharge Valve Fail To Close Timer
T4:20	F	.	.	.	.	.	.	Pump 101 Seal Water Low Flow Timer
T4:21	FW	.	.	X	.	.	.	Pump 101 Hour Run Timer
T4:22	FW	.	.	X	.	.	.	Pump 102 Start Response Timer
T4:23	FW	.	.	X	.	.	.	Pump 102 Stop Response Timer
T4:24	FW	.	.	X	.	.	.	Pump 102 Upper Bearing High Vibration Timer
T4:25	FW	.	.	X	.	.	.	Pump 102 Upper Bearing High-High Vibration Timer
T4:26	FW	.	.	X	.	.	.	Pump 102 Lower Bearing High Vibration Timer
T4:27	FW	.	.	X	.	.	.	Pump 102 Lower Bearing High-High Vibration Timer
T4:28	FW	.	.	X	.	.	.	Pump 102 Low Suction Pressure Timer
T4:29	FW	.	.	X	.	.	.	Pump 102 Low-Low Suction Pressure Timer
T4:30	FW	.	.	X	.	.	.	Pump 102 High Discharge Pressure Timer
T4:31	FW	.	.	X	.	.	.	Pump 102 High-High Discharge Pressure Timer
T4:32	FW	.	.	X	.	.	.	Pump 102 Discharge Valve Fail To Open Timer
T4:33	FW	.	.	X	.	.	.	Pump 102 Discharge Valve Fail To Close Timer
T4:34	F	.	.	.	.	.	.	Pump 102 Seal Water Low Flow Timer
T4:35	FW	.	.	X	.	.	.	Pump 102 Hour Run Timer
T4:36	FW	.	.	X	.	.	.	Pump 103 Start Response Timer
T4:37	FW	.	.	X	.	.	.	Pump 103 Stop Response Timer
T4:38	FW	.	.	X	.	.	.	Pump 103 Upper Bearing High Vibration Timer
T4:39	FW	.	.	X	.	.	.	Pump 103 Upper Bearing High-High Vibration Timer
T4:40	FW	.	.	X	.	.	.	Pump 103 Lower Bearing High Vibration Timer
T4:41	FW	.	.	X	.	.	.	Pump 103 Lower Bearing High-High Vibration Timer
T4:42	FW	.	.	X	.	.	.	Pump 103 Low Suction Pressure Timer
T4:43	FW	.	.	X	.	.	.	Pump 103 Low-Low Suction Pressure Timer
T4:44	FW	.	.	X	.	.	.	Pump 103 High Discharge Pressure Timer
T4:45	FW	.	.	X	.	.	.	Pump 103 High-High Discharge Pressure Timer
T4:46	FW	.	.	X	.	.	.	Pump 103 Discharge Valve Fail To Open Timer
T4:47	FW	.	.	X	.	.	.	Pump 103 Discharge Valve Fail To Close Timer
T4:48	FW	.	.	X	.	.	.	Pump 103 Seal Water Low Flow Timer
T4:49	FW	.	.	X	.	.	.	Pump 103 Hour Run Timer
T4:50	FW	.	.	X	.	.	.	Pump 104 Start Response Timer
T4:51	FW	.	.	X	.	.	.	Pump 104 Stop Response Timer
T4:52	FW	.	.	X	.	.	.	Pump 104 Upper Bearing High Vibration Timer
T4:53	FW	.	.	X	.	.	.	Pump 104 Upper Bearing High-High Vibration Timer
T4:54	FW	.	.	X	.	.	.	Pump 104 Lower Bearing High Vibration Timer
T4:55	FW	.	.	X	.	.	.	Pump 104 Lower Bearing High-High Vibration Timer
T4:56	FW	.	.	X	.	.	.	Pump 104 Low Suction Pressure Timer
T4:57	FW	.	.	X	.	.	.	Pump 104 Low-Low Suction Pressure Timer
T4:58	FW	.	.	X	.	.	.	Pump 104 High Discharge Pressure Timer
T4:59	FW	.	.	X	.	.	.	Pump 104 High-High Discharge Pressure Timer
T4:60	FW	.	.	X	.	.	.	Pump 104 Discharge Valve Fail To Open Timer
T4:61	FW	.	.	X	.	.	.	Pump 104 Discharge Valve Fail To Close Timer
T4:62	FW	.	.	X	.	.	.	Pump 104 Seal Water Low Flow Timer
T4:63	FW	.	.	X	.	.	.	Pump 104 Hour Run Timer
T4:64	FW	.	.	X	.	.	.	Hydropneumatic Tank T-301 Low Pressure Timer
T4:65	FW	.	.	X	.	.	.	Slide Gate G-211 Response Timer
T4:66	FW	.	.	X	.	.	.	Slide Gate G-212 Response Timer
T4:67	FW	.	.	X	.	.	.	Slide Gate G-213 Response Timer
T4:68	FW	.	.	X	.	.	.	Sluice Gate G-232 Response Timer
T4:69	FW	.	.	X	.	.	.	Plug Valve V-141 Response Timer

File T4 -- TIMER Usage

Offset	FW	EN	TT	DN	BASE	PRE	ACC	(Symbol) Description
T4:70	FW	.	.	X	.	.	.	DCS Heartbeat Timer
T4:71	FW	.	.	X	.	.	.	Sluice Gate G-232 Stop Timer
T4:72	FW	.	.	X	.	.	.	ATS (PLC) Heartbeat Timer
T4:73	FW	.	.	X	.	.	.	
T4:74	FW	.	.	X	.	.	.	
T4:75	FW	.	.	X	.	.	.	
T4:76	FW	.	.	X	.	.	.	
T4:77	F	.	.	.	.	.	.	
T4:78	F	.	.	.	.	.	.	
T4:79	F	.	.	.	.	.	.	
T4:80	F	.	.	.	.	.	.	
T4:81	F	.	.	.	.	.	.	
T4:82	F	.	.	.	.	.	.	
T4:83	F	.	.	.	.	.	.	
T4:84	F	.	.	.	.	.	.	
T4:85	F	.	.	.	.	.	.	
T4:86	F	.	.	.	.	.	.	
T4:87	F	.	.	.	.	.	.	
T4:88	F	.	.	.	.	.	.	
T4:89	F	.	.	.	.	.	.	
T4:90	F	.	.	.	.	.	.	
T4:91	F	.	.	.	.	.	.	
T4:92	F	.	.	.	.	.	.	
T4:93	F	.	.	.	.	.	.	
T4:94	F	.	.	.	.	.	.	
T4:95	F	.	.	.	.	.	.	
T4:96	F	.	.	.	.	.	.	
T4:97	F	.	.	.	.	.	.	
T4:98	F	.	.	.	.	.	.	
T4:99	F	.	.	.	.	.	.	
T4:100	F	.	.	.	.	.	.	
T4:101	F	.	.	.	.	.	.	
T4:102	F	.	.	.	.	.	.	
T4:103	F	.	.	.	.	.	.	
T4:104	F	.	.	.	.	.	.	
T4:105	F	.	.	.	.	.	.	
T4:106	F	.	.	.	.	.	.	
T4:107	F	.	.	.	.	.	.	
T4:108	F	.	.	.	.	.	.	
T4:109	F	.	.	.	.	.	.	
T4:110	F	.	.	.	.	.	.	
T4:111	F	.	.	.	.	.	.	
T4:112	F	.	.	.	.	.	.	
T4:113	F	.	.	.	.	.	.	
T4:114	F	.	.	.	.	.	.	
T4:115	F	.	.	.	.	.	.	
T4:116	F	.	.	.	.	.	.	
T4:117	F	.	.	.	.	.	.	
T4:118	F	.	.	.	.	.	.	
T4:119	F	.	.	.	.	.	.	
T4:120	F	.	.	.	.	.	.	
T4:121	F	.	.	.	.	.	.	
T4:122	F	.	.	.	.	.	.	
T4:123	F	.	.	.	.	.	.	
T4:124	F	.	.	.	.	.	.	
T4:125	F	.	.	.	.	.	.	
T4:126	F	.	.	.	.	.	.	
T4:127	F	.	.	.	.	.	.	
T4:128	F	.	.	.	.	.	.	
T4:129	F	.	.	.	.	.	.	
T4:130	F	.	.	.	.	.	.	
T4:131	F	.	.	.	.	.	.	
T4:132	F	.	.	.	.	.	.	
T4:133	F	.	.	.	.	.	.	
T4:134	F	.	.	.	.	.	.	
T4:135	F	.	.	.	.	.	.	
T4:136	F	.	.	.	.	.	.	
T4:137	F	.	.	.	.	.	.	
T4:138	F	.	.	.	.	.	.	
T4:139	F	.	.	.	.	.	.	

Offset	FW	EN	TT	DN	BASE	PRE	ACC	(Symbol) Description
T4:140	F	.	.	.	.	.	.	
T4:141	F	.	.	.	.	.	.	
T4:142	F	.	.	.	.	.	.	
T4:143	F	.	.	.	.	.	.	
T4:144	F	.	.	.	.	.	.	
T4:145	F	.	.	.	.	.	.	
T4:146	F	.	.	.	.	.	.	
T4:147	F	.	.	.	.	.	.	
T4:148	F	.	.	.	.	.	.	
T4:149	F	.	.	.	.	.	.	
T4:150	F	.	.	.	.	.	.	
T4:151	F	.	.	.	.	.	.	
T4:152	F	.	.	.	.	.	.	
T4:153	F	.	.	.	.	.	.	
T4:154	F	.	.	.	.	.	.	
T4:155	F	.	.	.	.	.	.	
T4:156	F	.	.	.	.	.	.	
T4:157	F	.	.	.	.	.	.	
T4:158	F	.	.	.	.	.	.	
T4:159	F	.	.	.	.	.	.	
T4:160	F	.	.	.	.	.	.	
T4:161	F	.	.	.	.	.	.	
T4:162	F	.	.	.	.	.	.	
T4:163	F	.	.	.	.	.	.	
T4:164	F	.	.	.	.	.	.	
T4:165	F	.	.	.	.	.	.	
T4:166	F	.	.	.	.	.	.	
T4:167	F	.	.	.	.	.	.	
T4:168	F	.	.	.	.	.	.	
T4:169	F	.	.	.	.	.	.	
T4:170	F	.	.	.	.	.	.	
T4:171	F	.	.	.	.	.	.	
T4:172	F	.	.	.	.	.	.	
T4:173	F	.	.	.	.	.	.	
T4:174	F	.	.	.	.	.	.	
T4:175	F	.	.	.	.	.	.	
T4:176	F	.	.	.	.	.	.	
T4:177	F	.	.	.	.	.	.	
T4:178	F	.	.	.	.	.	.	
T4:179	F	.	.	.	.	.	.	
T4:180	F	.	.	.	.	.	.	
T4:181	F	.	.	.	.	.	.	
T4:182	F	.	.	.	.	.	.	
T4:183	F	.	.	.	.	.	.	
T4:184	F	.	.	.	.	.	.	
T4:185	F	.	.	.	.	.	.	
T4:186	F	.	.	.	.	.	.	
T4:187	F	.	.	.	.	.	.	
T4:188	F	.	.	.	.	.	.	
T4:189	F	.	.	.	.	.	.	
T4:190	F	.	.	.	.	.	.	
T4:191	F	.	.	.	.	.	.	
T4:192	F	.	.	.	.	.	.	
T4:193	F	.	.	.	.	.	.	
T4:194	F	.	.	.	.	.	.	
T4:195	F	.	.	.	.	.	.	
T4:196	F	.	.	.	.	.	.	
T4:197	F	.	.	.	.	.	.	
T4:198	F	.	.	.	.	.	.	
T4:199	F	.	.	.	.	.	.	
T4:200	F	.	.	.	.	.	.	
T4:201	F	.	.	.	.	.	.	
T4:202	F	.	.	.	.	.	.	
T4:203	F	.	.	.	.	.	.	
T4:204	F	.	.	.	.	.	.	
T4:205	F	.	.	.	.	.	.	
T4:206	F	.	.	.	.	.	.	
T4:207	F	.	.	.	.	.	.	
T4:208	F	.	.	.	.	.	.	
T4:209	F	.	.	.	.	.	.	

File T4 -- TIMER Usage

Offset	FW	EN	TT	DN	BASE	PRE	ACC	(Symbol) Description
T4:210	F	.	.	.	.	.	.	
T4:211	F	.	.	.	.	.	.	
T4:212	F	.	.	.	.	.	.	
T4:213	F	.	.	.	.	.	.	
T4:214	F	.	.	.	.	.	.	
T4:215	F	.	.	.	.	.	.	
T4:216	F	.	.	.	.	.	.	
T4:217	F	.	.	.	.	.	.	
T4:218	F	.	.	.	.	.	.	
T4:219	F	.	.	.	.	.	.	
T4:220	F	.	.	.	.	.	.	
T4:221	F	.	.	.	.	.	.	
T4:222	F	.	.	.	.	.	.	
T4:223	F	.	.	.	.	.	.	
T4:224	F	.	.	.	.	.	.	
T4:225	F	.	.	.	.	.	.	
T4:226	F	.	.	.	.	.	.	
T4:227	F	.	.	.	.	.	.	
T4:228	F	.	.	.	.	.	.	
T4:229	F	.	.	.	.	.	.	
T4:230	F	.	.	.	.	.	.	
T4:231	F	.	.	.	.	.	.	

File C5 -- COUNTER Usage

Offset	FW	CU	CD	DN	OV	UN	PRE	ACC	(Symbol) Description
C5:0	FW	.	.	X	.	.	.	X	Pump 101 Start Counter
C5:1	FW	.	.	X	.	.	.	X	Pump 102 Start Counter
C5:2	FW	.	.	X	.	.	.	X	Pump 103 Start Counter
C5:3	FW	.	.	X	.	.	.	X	Pump 104 Start Counter
C5:4	F	.	.	.	.	.	.	.	
C5:5	F	.	.	.	.	.	.	.	
C5:6	F	.	.	.	.	.	.	.	
C5:7	F	.	.	.	.	.	.	.	
C5:8	F	.	.	.	.	.	.	.	
C5:9	F	.	.	.	.	.	.	.	
C5:10	F	.	.	.	.	.	.	.	
C5:11	F	.	.	.	.	.	.	.	

File R6 -- CONTROL Usage

Offset	FW	EN	EU	DN	EM	ER	UL	IN	FD	LEN	POS	(Symbol) Description
R6:0	W	.	.	X	.	.	.	.	.	.	.	Multilin Temp Conversion Control Block
R6:1	W	.	.	.	.	.	X	.	.	.	.	Pump 101 Maximum Start Shift Register Control Block
R6:2	W	.	.	.	.	.	X	.	.	.	.	Pump 102 Maximum Start Shift Register Control Block
R6:3	W	.	.	.	.	.	X	.	.	.	.	Pump 103 Maximum Start Shift Register Control Block
R6:4	W	.	.	.	.	.	X	.	.	.	.	Pump 104 Maximum Start Shift Register Control Block

Offset	0	1	2	3	4	5	6	7	8	9
N7:0	X	X	X	X	X					

File F8 -- FLOAT Usage

Offset	0	1	2	3	4
F8:0	X	X	X	X	X
F8:5	X	X	X	X	X
F8:10	X	X	.	X	X
F8:15	X	X	X	X	X
F8:20	X	X	X	X	X
F8:25	X	X	X	X	X
F8:30	X	X	X	X	X
F8:35	X	X	X	X	X
F8:40	X	X	X	X	X
F8:45	X	X	X	X	X
F8:50	X	X	X	X	X
F8:55	X	X	X	X	X
F8:60	X	X	X	X	X
F8:65	X	X	X	X	X

File BT9 -- BLK XFER Usage

Offset	FW	EN	ST	DN	ER	CO	EW	NR	TO	RW	RLEN	DLEN	FILE	ELEM	R	G	S	(Symbol) Description
BT9:0	W	X	.	X	X	.	.	.	.	.	.	.	.	.	.			
BT9:1	W	X	.	X	X	.	.	.	.	.	.	.	.	.	.			
BT9:2	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			Analog Input 160 Block Transfer Write Cont
BT9:3	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			Analog Input 160 Block Transfer Read Contr
BT9:4	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			Analog Input 170 Block Transfer Write Cont
BT9:5	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			Analog Input 170 Block Transfer Read Contr
BT9:6		.	.	.	.	.	.	.	.	.	.	.	.	.	.			
BT9:7		.	.	.	.	.	.	.	.	.	.	.	.	.	.			
BT9:8		.	.	.	.	.	.	.	.	.	.	.	.	.	.			
BT9:9		.	.	.	.	.	.	.	.	.	.	.	.	.	.			
BT9:10	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			Multilin Comm Module Block Transfer Read C
BT9:11	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			Multilin Comm Module Block Transfer Write
BT9:12	W	X	.	X	.	.	.	.	.	.	.	.	.	.	.			Bently Nevada BTR Control Block
BT9:13	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			Bently Nevada Monitor 1 BTW Control Block
BT9:14	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			Bently Nevada Monitor 2 BTW Control Block
BT9:15	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			DCS Comm Module BTR Control Block
BT9:16	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			
BT9:17	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			
BT9:18	W	X	.	.	.	.	.	.	.	.	.	.	.	.	.			

Offset	0	1	2	3	4	5	6	7	8	9
N10:0	X	X	X	X	X	X	X	X	X	X
N10:10	X	X	X	X	X	X	X	X	X	X
N10:20	X	X	X	X	X	X	X	X	X	X
N10:30	X	X	X	X	X	X	X	X	X	X
N10:40	X	X	X	X	X	X	X	X	X	X
N10:50	X	X	X	X	X	X	X	X	X	X
N10:60	X	X	X	X	X					

File N11 -- BCM WRITE Usage

Offset	0	1	2	3	4	5	6	7	8	9
N11:0	X	X	X	X	X	X	X	X	X	X
N11:10	X	X	X	X	X	X	X	X	X	X
N11:20	X	X	X	X	X	X	X	X	X	X
N11:30	X	X	X	X	X	X	X	X	X	X
N11:40	X	X	X	X	X	X	X	X	X	X
N11:50	X	X	X	X	X	X	X	X	X	X
N11:60	X	X	X	X	X					

Offset	0	1	2	3	4	5	6	7	8	9
N12:0	.	.	.	.	.	.	.	.	.	.
N12:10	.	.	.	.	.	.	.	.	.	.
N12:20	.	.	.	.	.	.	.	.	.	.
N12:30	.	.	X	X	X	X	X	X	X	X
N12:40	X	X	X	X	X	X	X	X	X	X
N12:50	X	X	X	X	X	X	X	X	X	X
N12:60	X	X	X	X	X	X	X	X	X	X
N12:70	X	X	X	X	X	X	X	X	.	.
N12:80	.	.	.	.	.	.	.	.	.	.
N12:90	.	.	.	.	.	.	.	.	.	.
N12:100	.	.	.	.	.	.	.	.	.	.
N12:110	.	.	.	.	.	.	.	.	.	.
N12:120	.	.	.	.	.	.	.	.	X	X
N12:130	X	X	X	X	X	X	X	X	X	X
N12:140	X	X	X	X	X	X	X	X	X	X
N12:150	X	X	X	X	X	X	X	X	X	X
N12:160	X	X	X	X	X	X	X	X	X	X
N12:170	X	X	X	X	X	X	X	X	X	X
N12:180	X	X	X	X	X	X	X	X	X	X
N12:190	X	X	X	X	X	X	X	X	X	X
N12:200	X	X	X	X	X	X	X	X	X	X
N12:210	X	X	X	X	X	X	X	X	X	X
N12:220	X	X	X	X	X	X	X	X	X	X
N12:230	X	X	X	X	X	X	X	X	X	X
N12:240	X	X	X	X	X	X	X	X	X	X
N12:250	X	X	X	X	X	X	X	X	X	X
N12:260	X	X	X	X	X	X	X	X	X	X
N12:270	X	X	X	X	X	X	X	X	X	X
N12:280	X	X	X	X	X	X	X	X	X	X
N12:290	X	X	X	X	X	X	X	X	X	X
N12:300	X	X	X	X	X	X	X	X	X	X
N12:310	X	X	X	X	X	X	X	X	X	X
N12:320	X	X	X	X	X	X	X	X	X	X
N12:330	X	X	X	X	X	X	X	X	X	X
N12:340	X	X	X	X	X	X	X	X	X	X
N12:350	X	X	X	X	X	X	X	X	X	X
N12:360	X	X	X	X	X	X	X	X	X	X
N12:370	X	X	X	X	X	X	X	X	X	X
N12:380	X	X	X	X	X	X	X	X	X	X
N12:390	X	X	X	X	X	X	X	X	X	X
N12:400	X	X	X	X	X	X	X	X	X	X
N12:410	X	X	X	X	X	X	X	X	X	X
N12:420	X	X	X	X	X	X	X	X	X	X
N12:430	X	X	X	X	X	X	X	X	X	X
N12:440	X	X	X	X	X	X	X	X	X	X
N12:450	X	X	X	X	X	X	X	X	X	X
N12:460	X	X	X	X	X	X	X	X	X	X
N12:470	X	X	X	X	X	X	X	X	X	X
N12:480	X	X	X	X	X	X	X	X	X	X
N12:490	X	X	X	X	X	X	X	X	X	X
N12:500	X	X	X	X	X	X	X	X	X	X
N12:510	X	X	X	X	X	X	X	X	X	X
N12:520	X	X	X	X	X	X	X	X	X	X
N12:530	X	X	X	X	X	X	X	X	X	X
N12:540	X	X	X	X	X	X	X	X	X	X
N12:550	X	X	X	X	X	X	X	X	X	X
N12:560	X	X	X	X	X	X	X	X	X	X
N12:570	X	X	X	X	X	X	X	X	X	X
N12:580	X	X	X	X	X	X	X	X	X	X
N12:590	X	X	X	X	X	X	X	X	X	X
N12:600	X	X	X	X	X	X	X	X	X	X
N12:610	X	X	X	X	X	X	X	X	X	X
N12:620	X	X	X	X	X	X	X	X	X	X
N12:630	X	X	X	X	X	X	X	X	X	X
N12:640	X	X	X	X	X	X	X	X	X	X
N12:650	X	X	X	X	X	X	.	.	.	.
N12:660	.	.	.	.	.	.	.	.	.	.
N12:670	.	.	.	.	.	.	.	.	.	.
N12:680	.	.	.	.	.	.	.	.	.	.

File N13 -- BCM STORE Usage

Offset	0	1	2	3	4	5	6	7	8	9
N13:0	.	.	.	.	.	.	.	.	.	.
N13:10	.	.	.	.	.	.	.	.	.	.
N13:20	.	.	.	.	.	.	.	.	.	.
N13:30	.	.	X	X	X	X	X	X	X	X
N13:40	X	X	X	X	X	X	X	X	X	X
N13:50	X	X	X	X	X	X	X	X	X	X
N13:60	X	X	X	X	X	X	X	X	X	X
N13:70	X	X	X	X	X	X	X	X	.	.
N13:80	.	.	.	.	.	.	.	.	.	.
N13:90	.	.	.	.	.	.	.	.	.	.
N13:100	.	.	.	.	.	.	.	.	.	.
N13:110	.	.	.	.	.	.	.	.	.	.
N13:120	.	.	.	.	.	.	.	.	X	X
N13:130	X	X	X	X	X	X	X	X	X	X
N13:140	X	X	X	X	X	X	X	X	X	X
N13:150	X	X	X	X	X	X	X	X	X	X
N13:160	X	X	X	X	X	X	X	X	X	X
N13:170	X	X	X	X	X	X	X	X	X	X
N13:180	X	X	X	X	X	X	X	X	X	X
N13:190	X	X	X	X	X	X	X	X	X	X
N13:200	X	X	X	X	X	X	X	X	X	X
N13:210	X	X	X	X	X	X	X	X	X	X
N13:220	X	X	X	X	X	X	X	X	X	X
N13:230	X	X	X	X	X	X	X	X	X	X
N13:240	X	X	X	X	X	X	X	X	X	X
N13:250	X	X	X	X	X	X	X	X	X	X
N13:260	X	X	X	X	X	X	X	X	X	X
N13:270	X	X	X	X	X	X	X	X	X	X
N13:280	X	X	X	X	X	X	X	X	X	X
N13:290	X	X	X	X	X	X	X	X	X	X
N13:300	X	X	X	X	X	X	X	X	X	X
N13:310	X	X	X	X	X	X	X	X	X	X
N13:320	X	X	X	X	X	X	X	X	X	X
N13:330	X	X	X	X	X	X	X	X	X	X
N13:340	X	X	X	X	X	X	X	X	X	X
N13:350	X	X	X	X	X	X	X	X	X	X
N13:360	X	X	X	X	X	X	X	X	X	X
N13:370	X	X	X	X	X	X	X	X	X	X
N13:380	X	X	X	X	X	X	X	X	X	X
N13:390	X	X	X	X	X	X	X	X	X	X
N13:400	X	X	X	X	X	X	X	X	X	X
N13:410	X	X	X	X	X	X	X	X	X	X
N13:420	X	X	X	X	X	X	X	X	X	X
N13:430	X	X	X	X	X	X	X	X	X	X
N13:440	X	X	X	X	X	X	X	X	X	X
N13:450	X	X	X	X	X	X	X	X	X	X
N13:460	X	X	X	X	X	X	X	X	X	X
N13:470	X	X	X	X	X	X	X	X	X	X
N13:480	X	X	X	X	X	X	X	X	X	X
N13:490	X	X	X	X	X	X	X	X	X	X
N13:500	X	X	X	X	X	X	X	X	X	X
N13:510	X	X	X	X	X	X	X	X	X	X
N13:520	X	X	X	X	X	X	X	X	X	X
N13:530	X	X	X	X	X	X	X	X	X	X
N13:540	X	X	X	X	X	X	X	X	X	X
N13:550	X	X	X	X	X	X	X	X	X	X
N13:560	X	X	X	X	X	X	X	X	X	X
N13:570	X	X	X	X	X	X	X	X	X	X
N13:580	X	X	X	X	X	X	X	X	X	X
N13:590	X	X	X	X	X	X	X	X	X	X
N13:600	X	X	X	X	X	X	X	X	X	X
N13:610	X	X	X	X	X	X	X	X	X	X
N13:620	X	X	X	X	X	X	X	X	X	X
N13:630	X	X	X	X	X	X	X	X	X	X
N13:640	X	X	X	X	X	X	X	X	X	X
N13:650	X	X	X	X	X	X	X	X	X	X
N13:660	X	X	X	X	X	X	X	X	X	X
N13:670	X	X	X	X	X	X	X	X	X	X
N13:680	X	X	X	X	X	X	X	X	X	X
N13:690	X	X	X	X	X	X	X	X	X	X

File N13 -- BCM STORE Usage

Offset	0	1	2	3	4	5	6	7	8	9
N13:700	X	X	X	X	X	X	X	X	X	X
N13:710	X	X	X	X	X	X	X	X	X	X
N13:720	X	X	X	X	X	X	X	X	X	X
N13:730	X	X	X	X	X	X	X	X	X	X
N13:740	X	X	X	X	X	X	X	X	X	X
N13:750	X	X	X	X	X	X	X	X	X	X
N13:760	X	X	X	X	X	X	X	X	X	X
N13:770	X	X	X	X	X	X	X	X	X	X
N13:780	X	X	X	X	X	X	X	X	X	X
N13:790	X	X	X	X	X	X	X	X	X	X
N13:800	X	X	X	X	X	X	X	X	X	X
N13:810	X	X	X	X	X	X	X	X	X	X
N13:820	X									

File C14 -- BCM DIAG Usage

Offset	FW	CU	CD	DN	OV	UN	PRE	ACC	(Symbol) Description
C14:0	W	.	.	.	.	.	.	.	BCM BTR ERROR COUNTER
C14:1	W	.	.	.	.	.	.	.	BCM BTW ERROR COUNTER
C14:2	W	.	.	.	.	.	.	.	LOCAL SERIAL COMM ERROR COUNTER
C14:3	W	.	.	.	.	.	.	.	LOCAL BACKPLANE ERROR COUNTER
C14:4	W	.	.	.	.	.	.	.	LOCAL BUFFER FULL ERROR COUNTER
C14:5	W	.	.	.	.	.	.	.	LOCAL PROGRAM ERROR COUNTER

File N15 -- AI160 WRIT Usage

Offset	0	1	2	3	4	5	6	7	8	9
N15:0	X	X	X	X	X	X	X	X	X	X
N15:10	X	X	X	X	X	X	X	X	X	X
N15:20	X	X	X	X	X	X	X	X	X	X
N15:30	X	X	X	X	X	X	X			

Offset	0	1	2	3	4	5	6	7	8	9
N16:0	X	X	X	X	X	X	X	X	X	X
N16:10	X	X	X	X	X					

File N17 -- AI170 WRIT Usage

Offset	0	1	2	3	4	5	6	7	8	9
N17:0	X	X	X	X	X	X	X	X	X	X
N17:10	X	X	X	X	X	X	X	X	X	X
N17:20	X	X	X	X	X	X	X	X	X	X
N17:30	X	X	X	X	X	X	X			

Offset	0	1	2	3	4	5	6	7	8	9
N18:0	X	X	X	X	X	X	X	X	X	X
N18:10	X	X	X	X	X					

File N19 -- M-LIN READ Usage

Offset	0	1	2	3	4	5	6	7	8	9
N19:0	X	X	X	X	X	X	X	X	X	X
N19:10	X	X	X	X	X	X	X	X	X	X
N19:20	X	X	X	X	X	X	X	X	X	X
N19:30	X	X	X	X	X	X	X	X	X	X
N19:40	X	X	X	X	X	X	X	X	X	X
N19:50	X	X	X	X	X	X	X	X	X	X
N19:60	X	X	X	X						

Offset	0	1	2	3	4	5	6	7	8	9
N20:0	X	X	X	X	X	X	X	X	X	X
N20:10	X	X	X	X	X	X	X	X	X	X
N20:20	X	X	X	X	X	X	X	X	X	X
N20:30	X	X	X	X	X	X	X	X	X	X
N20:40	X	X	X	X	X	X	X	X	X	X
N20:50	X	X	X	X	X	X	X	X	X	X

Offset	0	1	2	3	4	5	6	7	8	9
N21:0	X	X	X	X	X	X	X	X	X	X
N21:10	X	X	X	X	X	X	X	X	X	X
N21:20	X	X	X	X	X	X	X	X	X	X
N21:30	X	X	X	X	X	X	X	X	X	X
N21:40	X	X	X	X	X	X	X	X	X	X

File N22 -- M-LIN WRIT Usage

Offset	0	1	2	3	4	5	6	7	8	9
N22:0	X	X	X	X	X	X	X	X	X	X
N22:10	X	X	X	X	X	X	X	X	X	X
N22:20	X	X	X	X	X	X	X	X	X	X
N22:30	X	X	X	X	X	X	X	X	X	X
N22:40	X	X	X	X	X	X	X	X	X	X
N22:50	X	X	X	X	X	X	X	X	X	X
N22:60	X	X	X	X						

File N23 -- M-LIN DATA Usage

Offset	0	1	2	3	4	5	6	7	8	9
N23:0	X	X	X	X	X	X	X	X	X	X
N23:10	X	X	X	X	X	X	X	X	X	X
N23:20	X	X	X	X	X	X	X	X	X	X
N23:30	X	X	X	X	X	X	X	X	X	X
N23:40	X	X	X	X	X	X	X	X	X	X
N23:50	X	X	X	X	X	X	X	X	X	X
N23:60	X	X	X	X	X	X	X	X	X	X
N23:70	X	X	X	X	X	X	X	X	X	X
N23:80	X	X	X	X	X	X	X	X	X	X
N23:90	X	X	X	X	X	X	X	X	X	X

Offset	0	1	2	3	4	5	6	7	8	9
N24:0	X	X	X	X	X	X	X	X	X	X
N24:10	X	X	X	X	X	X	X	X	X	X

Offset	0	1	2	3	4	5	6	7	8	9
N25:0	X	X	X	X	X	X	X	X	X	X
N25:10	X	X	X	X	X	X	X	X	X	X
N25:20	X	X	X	X	X	X	X	X	X	

Offset	0	1	2	3	4	5	6	7	8	9
N26:0	X	X	X	X	X	X	X	X	X	X
N26:10	X	X	X	X	X	X	X	X	X	X
N26:20	X	X	X	X	X	X	X	X	X	

Offset	0	1	2	3	4
F27:0	X	X	X	X	X
F27:5	X	X	X	X	X
F27:10	X	X	X	X	X
F27:15	X	X	.	.	.
F27:20	.	.	.	.	.
F27:25	.	.	.	.	.
F27:30	.	.	.	.	.
F27:35	.	X	X		

File B28 -- PUMP START Usage

Offset	FW	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol) Description
B28:0	FW	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	
B28:1	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:2	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:3	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:4	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:5	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:6	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:7	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:8	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:9	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:10	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	
B28:11	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:12	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:13	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:14	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:15	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:16	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:17	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:18	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:19	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:20	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	
B28:21	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:22	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:23	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:24	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:25	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:26	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:27	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:28	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:29	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:30	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	
B28:31	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:32	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B28:33	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

File N29 -- MDBUS CNFG Usage

Offset	0	1	2	3	4	5	6	7	8	9
N29:0	X	X	X	X	X	X	X	X	X	X
N29:10	X	X	X	X	X	X	X	X	X	X
N29:20	X	X	X	X	X	X	X	X	X	X
N29:30	X	X	X	X	X	X	X	X	X	X

File N30 -- DCS READ Usage

Offset	0	1	2	3	4	5	6	7	8	9
N30:0	X	X	X	X	X	X	X	X	X	X
N30:10	X	X	X	X	X	X	X	X	X	X
N30:20	X	X	X	X	X	X	X	X	X	X
N30:30	X	X	X	X	X	X	X	X	X	X
N30:40	X	X	X	X	X	X	X	X	X	X
N30:50	X	X	X	X	X	X	X	X	X	X
N30:60	X	X	X	X						

File N31 -- DCS WRITE Usage

Offset	0	1	2	3	4	5	6	7	8	9
N31:0	X	X	X	X	X	X	X	X	X	X
N31:10	X	X	X	X	X	X	X	X	X	X
N31:20	X	X	X	X	X	X	X	X	X	X
N31:30	X	X	X	X	X	X	X	X	X	X
N31:40	X	X	X	X	X	X	X	X	X	X
N31:50	X	X	X	X	X	X	X	X	X	X
N31:60	X	X	X	X						

Offset	0	1	2	3	4	5	6	7	8	9
N32:0	X	X	X	X	X	X	X	X	X	X
N32:10	X	X	X	X	X	X	X	X	X	X
N32:20	X	X	X	X	X	X	X	X	X	X
N32:30	X	X	X	X	X	X	X	X	X	X
N32:40	X	X	X	X	X	X	X	X	X	X
N32:50	X	X	X	X	X	X	X	X	X	X
N32:60	X	X	X	X	X	X	X	X	X	X
N32:70	X	X	X	X	X	X	X	X	X	X
N32:80	X	X	X	X	X	X	X	X	X	X
N32:90	X	X	X	X	X	X	X	X	X	X
N32:100	X	X	X	X	X	X	X	X	X	X
N32:110	X	X	X	X	X	X	X	X	X	X
N32:120	X	X	X	X	X	X	X	X	X	X
N32:130	X	X	X	X	X	X	X	X	X	X
N32:140	X	X	X	X	X	X	X	X	X	X
N32:150	X	X	X	X	X	X	X	X	X	X
N32:160	X	X	X	X	X	X	X	X	X	X
N32:170	X	X	X	X	X	X	X	X	X	X
N32:180	X	X	X	X	X	X	X	X	X	X
N32:190	X	X	X	X	X	X	X	X	X	X
N32:200	X	X	X	X	X	X	X	X	X	X
N32:210	X	X	X	X	X	X	X	X	X	X
N32:220	X	X	X	X	X	X	X	X	X	X
N32:230	X	X	X	X	X	X	X	X	X	X
N32:240	X	X	X	X	X	X	X	X	X	X

Offset	0	1	2	3	4	5	6	7	8	9
N33:0	X	X	X	X	X	X	X	X	X	X
N33:10	X	X	X	X	X	X	X	X	X	X
N33:20	X	X	X	X	X	X	X	X	X	X
N33:30	X	X	X	X	X	X	X	X	X	X
N33:40	X	X	X	X	X	X	X	X	X	X
N33:50	X	X	X	X	X	X	X	X	X	X
N33:60	X	X	X	X	X	X	X	X	X	X
N33:70	X	X	X	X	X	X	X	X	X	X
N33:80	X	X	X	X	X	X	X	X	X	X
N33:90	X	X	X	X	X	X	X	X	X	X

File N34 -- MODBUS ERR Usage

Offset	0	1	2	3	4	5	6	7	8	9
N34:0	X	X	X	X	X	X	X	X	X	X
N34:10	X	X	X	X	X	X	X	X	X	X

Offset	0	1	2	3	4	5	6	7	8	9
N35:0	X	X	X	X	X	X	X	X	X	X
N35:10	X	X	X	X	X	X	X	X	X	X
N35:20	X	X	X	X	X	X	X	X	X	X
N35:30	X	X	X	X	X	X	X	X	X	X

Offset	0	1	2	3	4	5	6	7	8	9
N36:0	X	X	X	X	X	X	X	X	X	X
N36:10	X	X	X	X	X	X	X	X	X	X
N36:20	X	X	X	X	X	X	X	X	X	X
N36:30	X	X	X	X	X	X	X	X	X	X
N36:40	X	X	X	X	X	X	X	X		

Offset	0	1	2	3	4	5	6	7	8	9
N37:0	X	X	X	X	X	X	X	X	X	X
N37:10	X	X	X	X	X	X	X	X	X	X
N37:20	X	X	X	X	X	X	X	X	X	X
N37:30	X	X	X	X	X	X	X			

Offset	0	1	2	3	4	5	6	7	8	9
N38:0	X	X	X	X	X	X	X	X	X	X
N38:10	X	X	X	X	X					

Offset	FW	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol) Description
B40:0		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:1		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:2		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:3		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:4		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:5		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:6		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:7		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:8		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:9		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Copy Outputs From BCM Read Buffer To Memory
B40:10		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:11		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:12		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:13		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:14		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:15		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:16		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:17		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:18		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:19		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:20		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:21		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:22		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B40:23		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

File B41 Usage

Offset	FW	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol) Description
B41:0		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:1		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:2		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:3		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:4		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:5		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:6		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:7		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:8		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:9		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:10		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:11		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:12		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:13		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:14		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:15		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B41:16		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
	TIE_BREAKER_OPEN	Global	N32:12/1				
B3:0			Copy Storage Bits From BCM Read Buffer To Memory				
B3:0/0			Configure Bently Nevada				
B3:0/1			Multilin Command List End Of Poll Port 2 Off One-Shot Storage Bit				
B3:0/2			Multilin Download Configuration				
B3:0/3			Wet Well Level Lead 150 HP Reqd				
B3:0/4			Wet Well Level Lag 150 HP Reqd				
B3:0/5			Wet Well Level Lead 400 HP Reqd				
B3:0/6			Wet Well Level Lag 400 HP Reqd				
B3:0/7			Pump 101 Available				
B3:0/8			Pump 102 Available				
B3:0/9			Pump 103 Available				
B3:0/10			Pump 104 Available				
B3:0/11			Pump 101 Reqd				
B3:0/12			Pump 101 Start One-Shot Storage				
B3:0/13			Pump 101 Start One-Shot				
B3:0/14			Pump 101 Stop One-Shot Storage				
B3:0/15			Pump 101 Stop One-Shot				
B3:1/0			Pump 102 Reqd				
B3:1/1			Pump 102 Start One-Shot Storage				
B3:1/2			Pump 102 Start One-Shot				
B3:1/3			Pump 102 Stop One-Shot Storage				
B3:1/4			Pump 102 Stop One-Shot				
B3:1/5			Pump 103 Reqd				
B3:1/6			Pump 103 Start One-Shot Storage				
B3:1/7			Pump 103 Start One-Shot				
B3:1/8			Pump 103 Stop One-Shot Storage				
B3:1/9			Pump 103 Stop One-Shot				
B3:1/10			Pump 104 Reqd				
B3:1/11			Pump 104 Start One-Shot Storage				
B3:1/12			Pump 104 Start One-Shot				
B3:1/13			Pump 104 Stop One-Shot Storage				
B3:1/14			Pump 104 Stop One-Shot				
B3:1/15			Pump Start-Stop Minimum Interval Done				
B3:2/0			Pump 101 Fail To Start				
B3:2/1			Pump 101 Fail To Stop				
B3:2/2			Pump 101 Upper Bearing High Vibration Alarm				
B3:2/3			Pump 101 Upper Bearing High-High Vibration Alarm				
B3:2/4			Pump 101 Lower Bearing High Vibration Alarm				
B3:2/5			Pump 101 Lower Bearing High-High Vibration Alarm				
B3:2/6			Pump 101 Low Suction Pressure Alarm				
B3:2/7			Pump 101 Low-Low Suction Pressure Alarm				
B3:2/8			Pump 101 High Discharge Pressure Alarm				
B3:2/9			Pump 101 High-High Discharge Pressure Alarm				
B3:2/10			Pump 101 Discharge Valve Fail				
B3:2/11			Pump 101 Seal Water Low Flow Alarm				
B3:2/12			Pump 101 Multilin Common Alarm				
B3:2/13			Pump 101 Fail				
B3:2/14			Pump 102 Fail To Start				
B3:2/15			Pump 102 Fail To Stop				
B3:3/0			Pump 102 Upper Bearing High Vibration Alarm				
B3:3/1			Pump 102 Upper Bearing High-High Vibration Alarm				
B3:3/2			Pump 102 Lower Bearing High Vibration Alarm				
B3:3/3			Pump 102 Lower Bearing High-High Vibration Alarm				
B3:3/4			Pump 102 Low Suction Pressure Alarm				
B3:3/5			Pump 102 Low-Low Suction Pressure Alarm				
B3:3/6			Pump 102 High Discharge Pressure Alarm				
B3:3/7			Pump 102 High-High Discharge Pressure Alarm				
B3:3/8			Pump 102 Discharge Valve Fail				
B3:3/9			Pump 102 Seal Water Low Flow Alarm				
B3:3/10			Pump 102 Multilin Common Alarm				
B3:3/11			Pump 102 Fail				
B3:3/12			Pump 103 Fail To Start				
B3:3/13			Pump 103 Fail To Stop				
B3:3/14			Pump 103 Upper Bearing High Vibration Alarm				
B3:3/15			Pump 103 Upper Bearing High-High Vibration Alarm				
B3:4/0			Pump 103 Lower Bearing High Vibration Alarm				
B3:4/1			Pump 103 Lower Bearing High-High Vibration Alarm				
B3:4/2			Pump 103 Low Suction Pressure Alarm				
B3:4/3			Pump 103 Low-Low Suction Pressure Alarm				
B3:4/4			Pump 103 High Discharge Pressure Alarm				
B3:4/5			Pump 103 High-High Discharge Pressure Alarm				
B3:4/6			Pump 103 Discharge Valve Fail				
B3:4/7			Pump 103 Seal Water Low Flow Alarm				
B3:4/8			Pump 103 Multilin Common Alarm				
B3:4/9			Pump 103 Fail				
B3:4/10			Pump 104 Fail To Start				
B3:4/11			Pump 104 Fail To Stop				
B3:4/12			Pump 104 Upper Bearing High Vibration Alarm				
B3:4/13			Pump 104 Upper Bearing High-High Vibration Alarm				
B3:4/14			Pump 104 Lower Bearing High Vibration Alarm				
B3:4/15			Pump 104 Lower Bearing High-High Vibration Alarm				
B3:5/0			Pump 104 Low Suction Pressure Alarm				
B3:5/1			Pump 104 Low-Low Suction Pressure Alarm				
B3:5/2			Pump 104 High Discharge Pressure Alarm				
B3:5/3			Pump 104 High-High Discharge Pressure Alarm				
B3:5/4			Pump 104 Discharge Valve Fail				
B3:5/5			Pump 104 Seal Water Low Flow Alarm				
B3:5/6			Pump 104 Multilin Common Alarm				
B3:5/7			Pump 104 Fail				
B3:5/8			Midnight One-Shot Storage Bit				
B3:5/9			Lead Seal Water Pump Reqd				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
B3:5/10			Hydropneumatic Tank T-301 High Pressure One-Shot Storage				
B3:5/11			Hydropneumatic Tank T-301 High Pressure One-Shot				
B3:5/12			Seal Water Pump 305 Lead				
B3:5/13			Seal Water Pump 305 Lead One-Shot Storage				
B3:5/14			Seal Water Pump 305 Lead One-Shot				
B3:5/15			Slide Gate G-211 Available				
B3:6/0			Open Slide Gate G-211 One-Shot Storage				
B3:6/1			Open Slide Gate G-211 One-Shot				
B3:6/2			Close Slide Gate G-211 One-Shot Storage				
B3:6/3			Close Slide Gate G-211 One-Shot				
B3:6/4			Slide Gate G-211 Fail To Open				
B3:6/5			Slide Gate G-211 Fail To Close				
B3:6/6			Slide Gate G-212 Available				
B3:6/7			Open Slide Gate G-212 One-Shot Storage				
B3:6/8			Open Slide Gate G-212 One-Shot				
B3:6/9			Close Slide Gate G-212 One-Shot Storage				
B3:6/10			Close Slide Gate G-212 One-Shot				
B3:6/11			Slide Gate G-212 Fail To Open				
B3:6/12			Slide Gate G-212 Fail To Close				
B3:6/13			Slide Gate G-213 Available				
B3:6/14			Open Slide Gate G-213 One-Shot Storage				
B3:6/15			Open Slide Gate G-213 One-Shot				
B3:7/0			Close Slide Gate G-213 One-Shot Storage				
B3:7/1			Close Slide Gate G-213 One-Shot				
B3:7/2			Slide Gate G-213 Fail To Open				
B3:7/3			Slide Gate G-213 Fail To Close				
B3:7/4			Sluice Gate G-232 Available				
B3:7/5			Open Sluice Gate G-232 One-Shot Storage				
B3:7/6			Open Sluice Gate G-232 One-Shot				
B3:7/7			Close Sluice Gate G-232 One-Shot Storage				
B3:7/8			Close Sluice Gate G-232 One-Shot				
B3:7/9			Stop Sluice Gate G-232 One-Shot Storage				
B3:7/10			Stop Sluice Gate G-232 One-Shot				
B3:7/11			Sluice Gate G-232 Fail To Open				
B3:7/12			Sluice Gate G-232 Fail To Close				
B3:7/13			Plug Valve V-141 Available				
B3:7/14			Open Plug Valve V-141 One-Shot Storage				
B3:7/15			Open Plug Valve V-141 One-Shot				
B3:8/0			Close Plug Valve V-141 One-Shot Storage				
B3:8/1			Close Plug Valve V-141 One-Shot				
B3:8/2			Plug Valve V-141 Fail To Open				
B3:8/3			Plug Valve V-141 Fail To Close				
B3:8/4			Reset PLC Clock One-Shot Storage				
B3:8/5			DCS Heartbeat On One-Shot Storage				
B3:8/6			DCS Heartbeat On One-Shot				
B3:8/7			DCS Heartbeat Off One-Shot Storage				
B3:8/8			DCS Heartbeat Off One-Shot				
B3:8/9			PLC #1 Fail				
B3:8/10			PLC #2 Fail				
B3:8/11			Main Service A and B Not Available				
B3:8/12			ATS (PLC) Heartbeat				
B3:8/13			ATS(PLC)Heartbeat ON One-Shot Storage				
B3:8/14			ATS(PLC)Heartbeat ON One Shot				
B3:8/15			ATS(PLC)Heartbeat Off One-Shot Storage				
B3:9/0			ATS (PLC) Heartbeat Off One Shot				
B3:9/3			Wet Well #1 Fail High				
B3:9/4			Wet Well #2 Fail High				
B3:9/5			Wet Well #1 Fail Low				
B3:9/6			Wet Well #2 Fail Low				
B3:9/7			Pump 101 Reqd One-Shot				
B3:9/8			Pump 102 Reqd One-Shot				
B3:9/9			Pump 103 Reqd One-Shot				
B3:9/10			Pump 104 Reqd One-Shot				
B28:0							
B28:0/0			Pump 101 Maximum Start Shift Register				
B28:10/0			Pump 102 Maximum Start Shift Register				
B28:20/0			Pump 103 Maximum Start Shift Register				
B28:30/0			Pump 104 Maximum Start Shift Register				
B29:0/0			Reset Plc Clock				
B29:0/1			DCS Heartbeat				
B29:0/2			Pump 101 Lead 150 HP				
B29:0/3			Pump 101 PLC Control				
B29:0/4			Pump 101 DCS Manual Start				
B29:0/5			Pump 101 Out Of Service				
B29:0/6			Pump 101 Reset				
B29:0/7			Pump 101 Reset Run Time Meter				
B29:0/8			Pump 102 PLC Control				
B29:0/9			Pump 102 DCS Manual Start				
B29:0/10			Pump 102 Out Of Service				
B29:0/11			Pump 102 Reset				
B29:0/12			Pump 102 Reset Run Time Meter				
B29:0/13			Pump 103 Lead 400 HP				
B29:0/14			Pump 103 PLC Control				
B29:0/15			Pump 103 DCS Manual Start				
B29:1/0			Pump 103 Out Of Service				
B29:1/1			Pump 103 Reset				
B29:1/2			Pump 103 Reset Run Time Meter				
B29:1/3			Pump 104 PLC Control				
B29:1/4			Pump 104 DCS Manual Start				
B29:1/5			Pump 104 Out Of Service				
B29:1/6			Pump 104 Reset				
B29:1/7			Pump 104 Reset Run Time Meter				
B29:1/8			Open Plug Valve V-141				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
B29:1/9			Close Plug Valve V-141				
B29:1/10			Plug Valve V-141 Reset				
B29:1/11			Open Slide Gate G-211				
B29:1/12			Close Slide Gate G-211				
B29:1/13			Slide Gate G-211 Reset				
B29:1/14			Open Slide Gate G-212				
B29:1/15			Close Slide Gate G-212				
B29:2/0			Slide Gate G-212 Reset				
B29:2/1			Open Slide Gate G-213				
B29:2/2			Close Slide Gate G-213				
B29:2/3			Slide Gate G-213 Reset				
B29:2/4			Open Sluice Gate G-232				
B29:2/5			Stop Sluice Gate G-232				
B29:2/6			Close Sluice Gate G-232				
B29:2/7			Sluice Gate G-232 Reset				
B40:8/0			Pump 101 Call				
B40:8/1			Pump 102 Call				
B40:8/2			Pump 103 Call				
B40:8/3			Pump 104 Call				
B40:9			Copy Outputs From BCM Read Buffer To Memory				
B40:9/0			Pump 101 Call				
B40:9/1			Pump 102 Call				
B40:9/2			Pump 103 Call				
B40:9/3			Pump 104 Call				
B40:9/8			Drywell Gas Alarm				
B40:9/9			Screenings Facility Gas Alarm				
B40:9/10			Meter Vault Gas Alarm				
B40:9/11			Seal Water Pump 305 Call				
B40:9/12			Seal Water Pump 306 Call				
B40:9/15			Wet Well Low-Low Level				
B40:23/4			Sluice Gate G-232 Open Call				
B40:23/5			Sluice Gate G-232 Close Call				
B40:23/6			Slide Gate G-211 Open Call				
B40:23/7			Slide Gate G-211 Close Call				
B40:23/8			Slide Gate G-212 Open Call				
B40:23/9			Slide Gate G-212 Close Call				
B40:23/10			Slide Gate G-213 Open Call				
B40:23/11			Slide Gate G-213 Close Call				
B40:23/12			Plug Valve V-141 Open Call				
B40:23/13			Plug Valve V-141 Close Call				
B40:23/14			PLC Normal				
B41:8/0			Pump Room Supply Fan SF-1 Fail				
B41:8/1			Meter Vault Supply Fan SF-3 Fail				
B41:8/2			Screening Room Supply Fan SF-4 Fail				
B41:8/3			Screening Room Supply Fan SF-5 Fail				
B41:8/4			MCP Room Exhaust Fan EF-1 Fail				
B41:8/5			MCP Room Exhaust Fan EF-2 Fail				
B41:8/6			Meter Vault Exhaust Fan EF-3 Fail				
B41:8/7			Odor Control System Exhaust Fan EF-8 Fail				
B41:8/12			Operational Wet Well 1 High-High Level				
B41:8/13			Operational Wet Well 2 High-High Level				
B41:8/14			Overflow Wet Well High-High Level				
B41:8/15			Plug Valve V-141 Closed				
B41:10/0			Wet Well Bubbler Low-Low Pressure				
B41:10/1			Drywell Air Quality Alarm				
B41:10/2			Drywell Combustible Gas Alarm				
B41:10/3			Screenings Facility Air Quality Alarm				
B41:10/4			Screenings Facility Combustible Gas Alarm				
B41:10/5			Pump Room Sump High Level				
B41:10/6			Pump Room Sump High-High Level				
B41:10/7			Meter Vault Sump High Level				
B41:10/8			Meter Vault Air Quality Alarm				
B41:10/9			Meter Vault Combustible Gas Alarm				
B41:10/10			Plant Air Supply System Fail				
B41:10/11			Pump 101 Multilin Common Alarm				
B41:10/12			Pump 101 Run				
B41:10/13			Pump 101 Discharge Check Valve Closed				
B41:10/14			Pump 101 Seal Water Low Flow				
B41:10/15			Slide Gate G-211 Remote				
B41:11/0			Pump 102 Multilin Common Alarm				
B41:11/1			Pump 102 Run				
B41:11/2			Pump 102 Discharge Check Valve Closed				
B41:11/3			Pump 102 Seal Water Low Flow				
B41:11/4			Slide Gate G-212 Remote				
B41:11/5			Pump 103 Multilin Common Alarm				
B41:11/6			Pump 103 Run				
B41:11/7			Pump 103 Discharge Check Valve Closed				
B41:11/8			Pump 103 Seal Water Low Flow				
B41:11/9			Slide Gate G-213 Remote				
B41:11/10			Pump 104 Multilin Common Alarm				
B41:11/11			Pump 104 Run				
B41:11/12			Pump 104 Discharge Check Valve Closed				
B41:11/13			Pump 104 Seal Water Low Flow				
B41:11/14			Sluice Gate G-232 Remote				
B41:11/15			Sluice Gate G-111 Open				
B41:12/0			Sluice Gate G-111 Closed				
B41:12/1			Sluice Gate G-121 Open				
B41:12/2			Sluice Gate G-121 Closed				
B41:12/3			Bar Screen Bubbler Low-Low Pressure				
B41:12/4			Slide Gate G-211 Open				
B41:12/5			Slide Gate G-211 Closed				
B41:12/6			Slide Gate G-212 Open				
B41:12/7			Slide Gate G-212 Closed				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
B41:12/8			Slide Gate G-213 Open				
B41:12/9			Slide Gate G-213 Closed				
B41:12/10			Slide Gate G-221 Open				
B41:12/11			Slide Gate G-221 Closed				
B41:12/12			Slide Gate G-222 Open				
B41:12/13			Slide Gate G-222 Closed				
B41:12/14			Slide Gate G-223 Open				
B41:12/15			Slide Gate G-223 Closed				
B41:13/0			Slide Gate G-231 Open				
B41:13/1			Slide Gate G-231 Closed				
B41:13/2			Sluice Gate G-232 Open				
B41:13/3			Sluice Gate G-232 Closed				
B41:13/4			Slide Gate G-233 Open				
B41:13/5			Slide Gate G-233 Closed				
B41:13/6			Air Gap Tank T-300 Low Low Level				
B41:13/7			Hydropneumatic Tank T-301 High Pressure				
B41:13/8			Hydropneumatic Tank T-301 Low Pressure				
B41:13/9			Hypo Bulk Storage Tank T-410 Low Level				
B41:13/10			Caustic Bulk Storage Tank T-420 Low Level				
B41:13/11			Chemical Storage Area Eyewash Shower Alarm				
B41:13/12			Odor Control Area Eyewash Shower Alarm				
B41:13/13			Blower Bldg Eyewash Shower Alarm				
B41:13/14			Mechanical Bldg Eyewash Shower Alarm				
B41:13/15			Plug Valve V-141 Open				
B41:15/10			Surge Tank T-151 Low-Low Level				
B41:15/11			Surge Tank T-151 Valve Open				
B41:15/12			Surge Tank T-151 High High Level				
B41:16/0			Odor Control Blower Fail				
B41:16/1			Plug Valve V-141 Remote				
B41:16/2			Pump 101 Hand				
B41:16/3			Pump 101 Auto				
B41:16/4			Pump 102 Hand				
B41:16/5			Pump 102 Auto				
B41:16/6			Pump 103 Hand				
B41:16/7			Pump 103 Auto				
B41:16/8			Pump 104 Hand				
B41:16/9			Pump 104 Auto				
BT9:0							
BT9:0/ER			BCM BTR ER				
BT9:0/DN			BCM BTR DN				
BT9:0/EN			BCM BTR EN				
BT9:1							
BT9:1/ER			BCM BTW ER				
BT9:1/DN			BCM BTW DN				
BT9:1/EN			BCM BTW EN				
BT9:2			Analog Input 160 Block Transfer Write Control Block				
BT9:2/0			Block Transfer Write configure bit				
BT9:2/EN			Analog Input 160 BTW Enable				
BT9:3			Analog Input 160 Block Transfer Read Control Block				
BT9:3/EN			Analog Input 160 BTR Enable				
BT9:4			Analog Input 170 Block Transfer Write Control Block				
BT9:4/EN			Analog Input 170 BTW Enable				
BT9:5			Analog Input 170 Block Transfer Read Control Block				
BT9:5/EN			Analog Input 170 BTR Enable				
BT9:10			Multilin Comm Module Block Transfer Read Control Block				
BT9:10/DN			Multilin Comm Module BTR Done				
BT9:10/EN			Multilin Comm Module BTR Enable				
BT9:11			Multilin Comm Module Block Transfer Write Control Block				
BT9:11/EN			Multilin Comm Module BTW Enable				
BT9:12			Bently Nevada BTR Control Block				
BT9:12/DN			Bently Nevada BTR Done				
BT9:12/EN			Bently Nevada BTR Enable				
BT9:13			Bently Nevada Monitor 1 BTW Control Block				
BT9:13/EN			Bently Nevada Monitor 1 BTW Enable				
BT9:14			Bently Nevada Monitor 2 BTW Control Block				
BT9:14/EN			Bently Nevada Monitor 2 BTW Enable				
BT9:15			DCS Comm Module BTR Control Block				
BT9:15/EN			DCS Comm Module BTR Enable				
BT9:16							
BT9:16/EN			DCS Comm Module BTW Enable				
BT9:17							
BT9:18							
BT37:0			Block Transfer Read control block				
BT37:1			Block Transfer Write control block				
BT37:2			Block Transfer Read control block				
BT37:3			Block Transfer Write control block				
C5:0			Pump 101 Start Counter				
C5:0.ACC			Pump 101 Number Of Starts In Last Hour				
C5:0/DN			Pump 101 Maximum Starts				
C5:1			Pump 102 Start Counter				
C5:1.ACC			Pump 102 Number Of Starts In Last Hour				
C5:1/DN			Pump 102 Maximum Starts				
C5:2			Pump 103 Start Counter				
C5:2.ACC			Pump 103 Number Of Starts In Last Hour				
C5:2/DN			Pump 103 Maximum Starts				
C5:3			Pump 104 Start Counter				
C5:3.ACC			Pump 104 Number Of Starts In Last Hour				
C5:3/DN			Pump 104 Maximum Starts				
C14:0			BCM BTR ERROR COUNTER				
C14:1			BCM BTW ERROR COUNTER				
C14:2			LOCAL SERIAL COMM ERROR COUNTER				
C14:3			LOCAL BACKPLANE ERROR COUNTER				
C14:4			LOCAL BUFFER FULL ERROR COUNTER				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
C14:5			LOCAL PROGRAM ERROR COUNTER				
F8:0			Wet Well Level (0-17 ft)				
F8:1			Pump 101 Discharge Pressure (0-75 psig)				
F8:2			Pump 101 Suction Pressure (0-15 psig)				
F8:3			Pump 102 Discharge Pressure (0-75 psig)				
F8:4			Pump 102 Suction Pressure (0-15 psig)				
F8:5			Pump 103 Discharge Pressure (0-75 psig)				
F8:6			Pump 103 Suction Pressure (0-15 psig)				
F8:7			Pump 104 Discharge Pressure (0-75 psig)				
F8:8			Pump 104 Suction Pressure (0-15 psig)				
F8:9			Bar Screen Channel Differential Level (0-10 ft)				
F8:10			Force Main Discharge Flow Rate (0-20000 gpm)				
F8:11			Force Main Discharge Pressure (0-100 psig)				
F8:13			Hypo Caustic Flow To Vessel #1 (0-1 gpm)				
F8:14			Hypo Caustic Flow To Vessel #2 (0-1 gpm)				
F8:15			Odor Control System pH (0-14 pH)				
F8:16			Pump 101 Motor Winding Temp A (Deg F)				
F8:17			Pump 101 Motor Winding Temp B (Deg F)				
F8:18			Pump 101 Motor Winding Temp C (Deg F)				
F8:19			Pump 101 Motor Winding Temp D (Deg F)				
F8:20			Pump 101 Motor Winding Temp E (Deg F)				
F8:21			Pump 101 Motor Winding Temp F (Deg F)				
F8:22			Pump 101 Bearing Temp G (Deg F)				
F8:23			Pump 101 Bearing Temp H (Deg F)				
F8:24			Pump 102 Motor Winding Temp A (Deg F)				
F8:25			Pump 102 Motor Winding Temp B (Deg F)				
F8:26			Pump 102 Motor Winding Temp C (Deg F)				
F8:27			Pump 102 Motor Winding Temp D (Deg F)				
F8:28			Pump 102 Motor Winding Temp E (Deg F)				
F8:29			Pump 102 Motor Winding Temp F (Deg F)				
F8:30			Pump 102 Bearing Temp G (Deg F)				
F8:31			Pump 102 Bearing Temp H (Deg F)				
F8:32			Pump 103 Motor Winding Temp A (Deg F)				
F8:33			Pump 103 Motor Winding Temp B (Deg F)				
F8:34			Pump 103 Motor Winding Temp C (Deg F)				
F8:35			Pump 103 Motor Winding Temp D (Deg F)				
F8:36			Pump 103 Motor Winding Temp E (Deg F)				
F8:37			Pump 103 Motor Winding Temp F (Deg F)				
F8:38			Pump 103 Bearing Temp G (Deg F)				
F8:39			Pump 103 Bearing Temp H (Deg F)				
F8:40			Pump 104 Motor Winding Temp A (Deg F)				
F8:41			Pump 104 Motor Winding Temp B (Deg F)				
F8:42			Pump 104 Motor Winding Temp C (Deg F)				
F8:43			Pump 104 Motor Winding Temp D (Deg F)				
F8:44			Pump 104 Motor Winding Temp E (Deg F)				
F8:45			Pump 104 Motor Winding Temp F (Deg F)				
F8:46			Pump 104 Bearing Temp G (Deg F)				
F8:47			Pump 104 Bearing Temp H (Deg F)				
F8:48			Pump 101 Upper Bearing Vibration (In/Sec Peak)				
F8:49			Pump 101 Lower Bearing Vibration (In/Sec Peak)				
F8:50			Pump 102 Upper Bearing Vibration (In/Sec Peak)				
F8:51			Pump 102 Lower Bearing Vibration (In/Sec Peak)				
F8:52			Pump 103 Upper Bearing Vibration (In/Sec Peak)				
F8:53			Pump 103 Lower Bearing Vibration (In/Sec Peak)				
F8:54			Pump 104 Upper Bearing Vibration (In/Sec Peak)				
F8:55			Pump 104 Lower Bearing Vibration (In/Sec Peak)				
F8:56			Pump 101 Run Time (Hours)				
F8:57			Pump 102 Run Time (Hours)				
F8:58			Pump 103 Run Time (Hours)				
F8:59			Pump 104 Run Time (Hours)				
F8:60			Force Main Flow Totalizer Accumulator				
F8:61			Current Force Main Totalized Flow (MG)				
F8:62			Previous Force Main Totalized Flow (MG)				
F8:63			H2S stack				
F8:64			H2S barscreen Room				
F8:65			Wet well #1 Pumps 1-3, 0-17FT.				
F8:66			Wet well #2 Pumps 1-4, 0-17FT.				
F8:67			Bleach Level				
F8:68			Barscreen H2S				
F8:69			Bleach Level 0-8ft				
F27:0			Wet Well Low-Low Level Setpoint				
F27:1			Lead 150 HP Start Setpoint				
F27:2			Lead 150 HP Stop Setpoint				
F27:3			Lag 150 HP Start Setpoint				
F27:4			Lag 150 HP Stop Setpoint				
F27:5			Lead 400 HP Start Setpoint				
F27:6			Lead 400 HP Stop Setpoint				
F27:7			Lag 400 HP Start Setpoint				
F27:8			Lag 400 HP Stop Setpoint				
F27:9			Pump Upper Bearing High Vibration Alarm Setpoint				
F27:10			Pump Upper Bearing High-High Vibration Alarm Setpoint				
F27:11			Pump Lower Bearing High Vibration Alarm Setpoint				
F27:12			Pump Lower Bearing High-High Vibration Alarm Setpoint				
F27:13			Pump Low Suction Pressure Alarm Setpoint				
F27:14			Pump Low-Low Suction Pressure Alarm Setpoint				
F27:15			Pump High Discharge Pressure Alarm Setpoint				
F27:16			Pump High-High Discharge Pressure Alarm Setpoint				
I:000/0			Main Service A Breaker Open				
I:000/12			BCM ID				
I:010/0			Pump Room Supply Fan SF-1 Fail				
I:010/1			Meter Vault Supply Fan SF-3 Fail				
I:010/2			Screening Room Supply Fan SF-4 Fail				
I:010/3			Screening Room Supply Fan SF-5 Fail				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
I:010/4			MCP Room Exhaust Fan EF-1 Fail				
I:010/5			MCP Room Exhaust Fan EF-2 Fail				
I:010/6			Meter Vault Exhaust Fan EF-3 Fail				
I:010/7			Odor Control System Exhaust Fan EF-8 Fail				
I:010/10			Class "A" Water Ai Gap Tank T-940 Low-Low Level				
I:010/11			Class "A" Water Ai Gap Tank T-940 Fail				
I:010/12			Class "B" Water Ai Gap Tank T-950 Low-Low Level				
I:010/13			Class "B" Water Ai Gap Tank T-950 Fail				
I:010/14			Operational Wet Well 1 High-High Level				
I:010/15			Operational Wet Well 2 High-High Level				
I:010/16			Overflow Wet Well High-High Level				
I:010/17			Plug Valve V-141 Closed				
I:012/0			Wet Well Bubbler Low-Low Pressure				
I:012/1			Drywell Air Quality Alarm				
I:012/2			Drywell Combustible Gas Alarm				
I:012/3			Screenings Facility Air Quality Alarm				
I:012/4			Screenings Facility Combustible Gas Alarm				
I:012/5			Pump Room Sump High Level				
I:012/6			Pump Room Sump High-High Level				
I:012/7			Meter Vault Sump High Level				
I:012/10			Meter Vault Air Quality Alarm				
I:012/11			Meter Vault Combustible Gas Alarm				
I:012/12			Plant Air Supply System Fail				
I:012/13			Pump 101 Multilin Common Alarm				
I:012/14			Pump 101 Run				
I:012/15			Pump 101 Discharge Check Valve Closed				
I:012/16			Pump 101 Seal Water Low Flow				
I:012/17			Slide Gate G-211 Remote				
I:013/0			Pump 102 Multilin Common Alarm				
I:013/1			Pump 102 Run				
I:013/2			Pump 102 Discharge Check Valve Closed				
I:013/3			Pump 102 Seal Water Low Flow				
I:013/4			Slide Gate G-212 Remote				
I:013/5			Pump 103 Multilin Common Alarm				
I:013/6			Pump 103 Run				
I:013/7			Pump 103 Discharge Check Valve Closed				
I:013/10			Pump 103 Seal Water Low Flow				
I:013/11			Slide Gate G-213 Remote				
I:013/12			Pump 104 Multilin Common Alarm				
I:013/13			Pump 104 Run				
I:013/14			Pump 104 Discharge Check Valve Closed				
I:013/15			Pump 104 Seal Water Low Flow				
I:013/16			Sluice Gate G-232 Remote				
I:013/17			Sluice Gate G-111 Open				
I:014/0			Sluice Gate G-111 Closed				
I:014/1			Sluice Gate G-121 Open				
I:014/2			Sluice Gate G-121 Closed				
I:014/3			Bar Screen Bubbler Low-Low Pressure				
I:014/4			Slide Gate G-211 Open				
I:014/5			Slide Gate G-211 Closed				
I:014/6			Slide Gate G-212 Open				
I:014/7			Slide Gate G-212 Closed				
I:014/10			Slide Gate G-213 Open				
I:014/11			Slide Gate G-213 Closed				
I:014/12			Slide Gate G-221 Open				
I:014/13			Slide Gate G-221 Closed				
I:014/14			Slide Gate G-222 Open				
I:014/15			Slide Gate G-222 Closed				
I:014/16			Slide Gate G-223 Open				
I:014/17			Slide Gate G-223 Closed				
I:015/0			Slide Gate G-231 Open				
I:015/1			Slide Gate G-231 Closed				
I:015/2			Sluice Gate G-232 Open				
I:015/3			Sluice Gate G-232 Closed				
I:015/4			Slide Gate G-233 Open				
I:015/5			Slide Gate G-233 Closed				
I:015/6			Air Gap Tank T-300 Low Low Level				
I:015/7			Hydropneumatic Tank T-301 High Pressure				
I:015/10			Hydropneumatic Tank T-301 Low Pressure				
I:015/11			Hypo Bulk Storage Tank T-410 Low Level				
I:015/12			Caustic Bulk Storage Tank T-420 Low Level				
I:015/13			Chemical Storage Area Eyewash Shower Alarm				
I:015/14			Odor Control Area Eyewash Shower Alarm				
I:015/15			Blower Bldg Eyewash Shower Alarm				
I:015/16			Mechanical Bldg Eyewash Shower Alarm				
I:015/17			Plug Valve V-141 Open				
I:017/0			Spare Input				
I:017/1			Spare Input				
I:017/2			Spare Input				
I:017/3			Spare Input				
I:017/4			Spare Input				
I:017/5			Spare Input				
I:017/6			Spare Input				
I:017/7			Spare Input				
I:017/10			Spare Input				
I:017/11			Spare Input				
I:017/12			Surge Tank T-151 Low-Low Level				
I:017/13			Surge Tank T-151 Valve Open				
I:017/14			Surge Tank T-151 High High Level				
I:017/15			Surge Tank T-151 High High Level				
I:017/16			Surge Tank T-151 High High Level				
I:017/17			Surge Tank T-151 High High Level				
I:020/0			Odor Control Blower Fail				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
I:020/1			Plug Valve V-141 Remote				
I:020/2			Pump 101 Hand				
I:020/3			Pump 101 Auto				
I:020/4			Pump 102 Hand				
I:020/5			Pump 102 Auto				
I:020/6			Pump 103 Hand				
I:020/7			Pump 103 Auto				
I:020/10			Pump 104 Hand				
I:020/11			Pump 104 Auto				
I:020/12			Spare Input				
I:020/13			Spare Input				
I:020/14			Spare Input				
I:020/15			Spare Input				
I:020/16			Spare Input				
I:020/17			Spare Input				
I:022/0			NEW POINT				
I:031/2			UPS On				
I:031/3			UPS On Battery				
I:031/4			UPS On Bypass				
I:031/5			UPS Low Battery				
I:032/0			Main Service Breaker A open				
I:032/1			Main Service B Breaker Open				
I:032/2			Tie Breaker Open				
I:032/3			Main Service A Not Available				
I:032/4			Main Service B Not Available				
I:032/5			UPS Trouble				
I:032/6			Main Service A Breaker Tripped				
I:032/7			Main Service B Breaker Tripped				
I:032/10			Tie Breaker Tripped				
I:032/11			Transfer System Fail				
I:032/12			Auto/Manual Switch Manual Mode				
I:032/13			Auto/Manual Switch Auto Mode				
I:032/14			Service Selector Switch Service A Normal Source				
I:032/15			Service Selector Switch Service B Normal Source				
I:032/16			86 Lockout Relay Tripped				
I:032/17			PLC General Fault Relay				
I:033/0			Main Service A Relay Failure				
I:033/1			Main Service B Relay Failure				
I:033/2			Auto-Throwover System (PLC Heartbeat)				
I:033/3			Power Quality Relay Fault				
N7:0			BCM Packet Length				
N7:1			Primary Buffer Packet ID				
N7:2			Address Offset Into Primary Buffer				
N7:3			BCM Secondary Buffer Packet ID				
N7:4			Address Offset Into BCM Secondary Buffer				
N10:0/0			Local CPU Is Primary				
N10:0/2			Remote Processor Failure				
N10:0/4			LOCAL ERROR FAULT STORE				
N10:0/7			ERROR COUNT RESET BIT				
N10:0/8			Remote CPU Is Primary				
N10:0/12			REMOTE ERROR FAULT STORE				
N10:1/0			LOCAL SERIAL COMM FAULT				
N10:1/1			LOCAL BACKPLANE FAULT				
N10:1/2			LOCAL BUFFER FULL FAULT				
N10:1/3			LOCAL PROGRAM ERROR FAULT				
N10:1/6			BCM Status - Local CPU Is Primary				
N10:1/7			BCM Status - Local Data Valid				
N10:1/8			REMOTE SERIAL COMM FAULT				
N10:1/9			REMOTE BACKPLANE FAULT				
N10:1/10			REMOTE BUFFER FULL FAULT				
N10:1/11			REMOTE PROGRAM ERROR FAULT				
N10:1/13			Remote Processor Fault				
N10:1/14			BCM Status - Remote CPU Is Primary				
N10:2			CURRENT BLOCK ID				
N11:0			BCM BTR Current Packet ID				
N11:1			Packet Length				
N11:2			BCM BTW Packet ID				
N11:3			BCM BTW DATA				
N12:0			Copy Outputs From Memory To BCM Write Buffer				
N12:1			Copy Output From Memory To BCM Write Buffer				
N12:2							
N12:10							
N12:11							
N12:14							
N12:23							
N12:221							
N12:233							
N12:245							
N12:266							
N12:278							
N12:300							
N12:312							
N12:400							
N12:406							
N12:412							
N12:418							
N13:23							
N13:233							
N13:245							
N15:0			Write data block				
N16:0			Read data block				
N16:0/0			Analog Input 160 Power Up Bit				
N16:1/0			Operational Wet Well Level Xmtr Underrange				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
N16:2/0			Operational Wet Well Level Xmtr Overrange				
N16:4	LI_10	Global	Operational Wet Well Level				
N16:5	PI_101B	Global	Pump 101 Discharge Pressure				
N16:6	PI_101A	Global	Pump 101 Suction Pressure				
N16:7	PI_102B	Global	Pump 102 Discharge Pressure				
N16:8	PI_102A	Global	Pump 102 Suction Pressure				
N16:9	PI_103B	Global	Pump 103 Discharge Pressure				
N16:10	PI_103A	Global	Pump 103 Suction Pressure				
N16:11	PI_104B	Global	Pump 104 Discharge Pressure				
N17:0			Write data block				
N18:0			Read data block				
N18:0/0			Analog Input 170 Power Up Bit				
N18:4	PI_104A	Global	Pump 104 Suction Pre ssure				
N18:5	LI_20	Global	Bar Screen Channel D ifferential Level				
N18:6	FI_601	Global	Force Main Discharge Flow Rate				
N18:7	PI_401	Global	Force Main Discharge Pressure				
N18:11	AI_8	Global	Odor Control System pH				
N19:0			Multilin Comm Module Read Block ID				
N19:1			Multilin Comm Module Write Block ID				
N20:0			Multilin Comm Module Port 1 Configuration Word				
N20:1			Multilin Comm Module Port 1 Slave Address				
N20:2			Multilin Comm Module Port 1 Baud Rate				
N20:3			Multilin Comm Module Port 1 RTS To TxD Delay				
N20:4			Multilin Comm Module Port 1 RTS Off Delay				
N20:5			Multilin Comm Module Port 1 Message Response Timeout				
N20:6			Multilin Comm Module Port 1 Inter-Character Timing				
N20:10			Multilin Comm Module Port 2 Configuration Word				
N20:11			Multilin Comm Module Port 2 Slave Address				
N20:12			Multilin Comm Module Port 2 Baud Rate				
N20:13			Multilin Comm Module Port 2 RTS To TxD Delay				
N20:14			Multilin Comm Module Port 2 RTS Off Delay				
N20:15			Multilin Comm Module Port 2 Message Response Timeout				
N20:16			Multilin Comm Module Port 2 Inter-Character Timing				
N20:20			Multilin Comm Module Read Data Block Count				
N20:21			Multilin Comm Module Write Data Block Count				
N20:22			Multilin Comm Module Command Block Count				
N20:23			Multilin Comm Module Slave Error Block Pointer				
N20:24			Multilin Comm Module Master Error Block Pointer				
N21:0			Multilin Comm Module Command 1 Port/Mode Select				
N21:1			Multilin Comm Module Command 1 Slave Address				
N21:2			Multilin Comm Module Command 1 Function Code				
N21:3			Multilin Comm Module Command 1 Source Address				
N21:4			Multilin Comm Module Command 1 Count				
N21:5			Multilin Comm Module Command 1 Dest Address				
N21:10			Multilin Comm Module Command 2 Port/Mode Select				
N21:11			Multilin Comm Module Command 2 Slave Address				
N21:12			Multilin Comm Module Command 2 Function Code				
N21:13			Multilin Comm Module Command 2 Source Address				
N21:14			Multilin Comm Module Command 2 Count				
N21:15			Multilin Comm Module Command 2 Dest Address				
N21:20			Multilin Comm Module Command 3 Port/Mode Select				
N21:21			Multilin Comm Module Command 3 Slave Address				
N21:22			Multilin Comm Module Command 3 Function Code				
N21:23			Multilin Comm Module Command 3 Source Address				
N21:24			Multilin Comm Module Command 3 Count				
N21:25			Multilin Comm Module Command 3 Dest Address				
N21:30			Multilin Comm Module Command 4 Port/Mode Select				
N21:31			Multilin Comm Module Command 4 Slave Address				
N21:32			Multilin Comm Module Command 4 Function Code				
N21:33			Multilin Comm Module Command 4 Source Address				
N21:34			Multilin Comm Module Command 4 Count				
N21:35			Multilin Comm Module Command 4 Dest Address				
N22:0			Multilin Comm Module Block Transfer Write Block ID				
N22:1			Multilin Comm Module Block Transfer Write Data Block				
N23:0			Pump 101 Motor Winding Temp A (Deg C)				
N23:1			Pump 101 Motor Winding Temp B (Deg C)				
N23:2			Pump 101 Motor Winding Temp C (Deg C)				
N23:3			Pump 101 Motor Winding Temp D (Deg C)				
N23:4			Pump 101 Motor Winding Temp E (Deg C)				
N23:5			Pump 101 Motor Winding Temp F (Deg C)				
N23:6			Pump 101 Bearing Temp G (Deg C)				
N23:7			Pump 101 Bearing Temp H (Deg C)				
N23:8			Pump 102 Motor Winding Temp A (Deg C)				
N23:9			Pump 102 Motor Winding Temp B (Deg C)				
N23:10			Pump 102 Motor Winding Temp C (Deg C)				
N23:11			Pump 102 Motor Winding Temp D (Deg C)				
N23:12			Pump 102 Motor Winding Temp E (Deg C)				
N23:13			Pump 102 Motor Winding Temp F (Deg C)				
N23:14			Pump 102 Bearing Temp G (Deg C)				
N23:15			Pump 102 Bearing Temp H (Deg C)				
N23:16			Pump 103 Motor Winding Temp A (Deg C)				
N23:17			Pump 103 Motor Winding Temp B (Deg C)				
N23:18			Pump 103 Motor Winding Temp C (Deg C)				
N23:19			Pump 103 Motor Winding Temp D (Deg C)				
N23:20			Pump 103 Motor Winding Temp E (Deg C)				
N23:21			Pump 103 Motor Winding Temp F (Deg C)				
N23:22			Pump 103 Bearing Temp G (Deg C)				
N23:23			Pump 103 Bearing Temp H (Deg C)				
N23:24			Pump 104 Motor Winding Temp A (Deg C)				
N23:25			Pump 104 Motor Winding Temp B (Deg C)				
N23:26			Pump 104 Motor Winding Temp C (Deg C)				
N23:27			Pump 104 Motor Winding Temp D (Deg C)				
N23:28			Pump 104 Motor Winding Temp E (Deg C)				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
N23:29			Pump 104 Motor Winding Temp F (Deg C)				
N23:30			Pump 104 Bearing Temp G (Deg C)				
N23:31			Pump 104 Bearing Temp H (Deg C)				
N23:40			Wet well #1 Pumps 1-3, 0-17FT.				
N23:50/1			Multilin Command List End Of Poll Port 2				
N24:0/15			Bently Nevada Power Up				
N24:3			Bently Nevada Monitor 1 Channel 1 Data				
N24:3/15			Bently Nevada Monitor 1 Channel 1 Not OK				
N24:4			Bently Nevada Monitor 1 Channel 2 Data				
N24:4/15			Bently Nevada Monitor 1 Channel 2 Not OK				
N24:5			Bently Nevada Monitor 1 Channel 3 Data				
N24:5/15			Bently Nevada Monitor 1 Channel 3 Not OK				
N24:6			Bently Nevada Monitor 1 Channel 4 Data				
N24:6/15			Bently Nevada Monitor 1 Channel 4 Not OK				
N24:12			Bently Nevada Monitor 2 Channel 1 Data				
N24:12/15			Bently Nevada Monitor 2 Channel 1 Not OK				
N24:13			Bently Nevada Monitor 2 Channel 2 Data				
N24:13/15			Bently Nevada Monitor 2 Channel 2 Not OK				
N24:14			Bently Nevada Monitor 2 Channel 3 Data				
N24:14/15			Bently Nevada Monitor 2 Channel 3 Not OK				
N24:15			Bently Nevada Monitor 2 Channel 4 Data				
N24:15/15			Bently Nevada Monitor 2 Channel 4 Not OK				
N29:0			DCS Comm Module Port 1 Configuration Word				
N29:1			DCS Comm Module Port 1 Slave Address				
N29:2			DCS Comm Module Port 1 Baud Rate				
N29:3			DCS Comm Module Port 1 RTS To TxD Delay				
N29:4			DCS Comm Module Port 1 RTS Off Delay				
N29:5			DCS Comm Module Port 1 Message Response Timeout				
N29:6			DCS Comm Module Port 1 Inter-Character Timing				
N29:10			DCS Comm Module Port 2 Configuration Word				
N29:11			DCS Comm Module Port 2 Slave Address				
N29:12			DCS Comm Module Port 2 Baud Rate				
N29:13			DCS Comm Module Port 2 RTS To TxD Delay				
N29:14			DCS Comm Module Port 2 RTS Off Delay				
N29:15			DCS Comm Module Port 2 Message Response Timeout				
N29:16			DCS Comm Module Port 2 Inter-Character Timing				
N29:20			DCS Comm Module Read Data Block Count				
N29:21			DCS Comm Module Write Data Block Count				
N29:22			DCS Comm Module Command Block Count				
N29:23			DCS Comm Module Slave Error Block Pointer				
N29:24			DCS Comm Module Master Error Block Pointer				
N29:25			DCS Comm Module BT Delay Counter				
N29:26			DCS Comm Module Floating Point Offset				
N29:27			DCS Comm Module Read Block ID Start				
N29:28			DCS Comm Module Write Block ID Start				
N30:0			DCS Comm Module BTR Data Block				
N30:1			DCS Comm Module BTW Block ID				
N31:0			DCS Comm Module BTW Block ID				
N31:1			DCS Comm Module BTW Data Block				
N32:0/0	I65FAL1A	Global	Pump Room Supply Fan SF-1 Normal				
N32:0/1	I65FAL1B	Global	MCP Room Exhaust Fan EF-1 Normal				
N32:0/2	I65FAL2B	Global	MCP Room Exhaust Fan EF-2 Normal				
N32:0/3	I65FAL3A	Global	Meter Vault Supply Fan SF-3 Normal				
N32:0/4	I65FAL3B	Global	Meter Vault Exhaust Fan EF-3 Normal				
N32:0/5	I65FAL4	Global	Screening Room Supply Fan SF-4 Normal				
N32:0/6	I65FAL5	Global	Screening Room Supply Fan SF-5 Normal				
N32:0/7	I65FAL8	Global	Odor Control System Exhaust Fan EF-8 Normal				
N32:0/8	I65LALL10	Global	Wet Well Level Normal				
N32:0/9	I65PALL10B	Global	Wet Well Bubbler Normal Pressure				
N32:0/10	I65UA10A	Global	Drywell Air Quality Normal				
N32:0/11	I65UA10B	Global	Drywell Combustible Gas Normal				
N32:0/12	I65PALL20	Global	Bar Screen Pressure Normal				
N32:0/13	I65UA20A	Global	Screenings Facility Air Quality Normal				
N32:0/14	I65UA20B	Global	Screenings Facility Combustible Gas Normal				
N32:0/15	I65LAHH25	Global	Operational Wet Well 1 Level Normal				
N32:1/0	I65LAHH26	Global	Operational Wet Well 2 Level Normal				
N32:1/1	I65LAHH27	Global	Overflow Wet Well Level Normal				
N32:1/2	I65UA43	Global	Odor Control Blower Normal				
N32:1/3	I65LAH50	Global	Pump Room Sump Level Normal				
N32:1/4	I65LAHH50	Global	Pump Room Sump Level Normal				
N32:1/5	I65LAH60	Global	Meter Vault Sump Level Normal				
N32:1/6	I65UA60A	Global	Meter Vault Air Quality Normal				
N32:1/7	I65UA60B	Global	Meter Vault Combustible Gas Normal				
N32:1/8	I65UA81	Global	Plant Air Supply System Normal				
N32:1/9	I65YA100A	Global	PLC #1 Normal				
N32:1/10	I65YA100B	Global	PLC #2 Normal				
N32:1/11			DCS Comm Fail				
N32:1/12	I65YC100A	Global	Modbus Heartbeat				
N32:1/13	I65FAL101	Global	Pump 101 Seal Water Flow Normal				
N32:1/14	I65PAH101	Global	Pump 101 Discharge Pressure Normal				
N32:1/15	I65PAHH101	Global	Pump 101 Discharge Pressure Normal				
N32:2/0	I65PAL101	Global	Pump 101 Suction Pressure Normal				
N32:2/1	I65PALL101	Global	Pump 101 Suction Pressure Normal				
N32:2/2	I65VAH101A	Global	Pump 101 Upper Bearing Vibration Normal				
N32:2/3	I65VAH101B	Global	Pump 101 Lower Bearing Vibration Normal				
N32:2/4	I65VAHH101A	Global	Pump 101 Upper Bearing Vibration Normal				
N32:2/5	I65VAHH101B	Global	Pump 101 Lower Bearing Vibration Normal				
N32:2/6	I65YA101A	Global	Pump 101 Fail To Start				
N32:2/7	I65YA101B	Global	Pump 101 Fail To Stop				
N32:2/8	I65YA101C	Global	Pump 101 Discharge Valve Normal				
N32:2/9	I65YA101D	Global	Pump 101 Multilin Normal				
N32:2/10	I65YA101E	Global	Pump 101 Normal				
N32:2/11	I65YL101A	Global	Pump 101 Run				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
N32:2/12	I65YL101B	Global	Pump 101 Lead				
N32:2/13	I65YL101C	Global	Pump 101 Out Of Service				
N32:2/14	I65YL101D	Global	Pump 101 PLC Control				
N32:2/15	I65YL101E	Global	Pump 101 Available				
N32:3/0	I65ZL101A	Global	Pump 101 Hand				
N32:3/1	I65ZL101B	Global	Pump 101 Auto				
N32:3/2	I65ZLC101	Global	Pump 101 Discharge Check Valve Open				
N32:3/3	I65FAL102	Global	Pump 102 Seal Water Flow Normal				
N32:3/4	I65PAH102	Global	Pump 102 Discharge Pressure Normal				
N32:3/5	I65PAHH102	Global	Pump 102 Discharge Pressure Normal				
N32:3/6	I65PAL102	Global	Pump 102 Suction Pressure Normal				
N32:3/7	I65PALL102	Global	Pump 102 Suction Pressure Normal				
N32:3/8	I65VAH102A	Global	Pump 102 Upper Bearing Vibration Normal				
N32:3/9	I65VAH102B	Global	Pump 102 Lower Bearing Vibration Normal				
N32:3/10	I65VAHH102A	Global	Pump 102 Upper Bearing Vibration Normal				
N32:3/11	I65VAHH102B	Global	Pum 102 Lower Bearing Vibration Normal				
N32:3/12	I65YA102A	Global	Pump 102 Fail To Start				
N32:3/13	I65YA102B	Global	Pump 102 Fail To Stop				
N32:3/14	I65YA102C	Global	Pump 102 Discharge Valve Normal				
N32:3/15	I65YA102D	Global	Pump 102 Multilin Normal				
N32:4/0	I65YA102E	Global	Pump 102 Normal				
N32:4/1	I65YL102A	Global	Pump 102 Run				
N32:4/2	I65YL102B	Global	Pump 102 Lead				
N32:4/3	I65YL102C	Global	Pump 102 Out Of Service				
N32:4/4	I65YL102D	Global	Pump 102 PLC Control				
N32:4/5	I65YL102E	Global	Pump 102 Available				
N32:4/6	I65ZL102A	Global	Pump 102 Hand				
N32:4/7	I65ZL102B	Global	Pump 102 Auto				
N32:4/8	I65ZLC102	Global	Pump 102 Discharge Valve Open				
N32:4/9	I65FAL103	Global	Pump 103 Seal Water Flow Normal				
N32:4/10	I65PAH103	Global	Pump 103 Discharge Pressure Normal				
N32:4/11	I65PAHH103	Global	Pump 103 Discharge Pressure Normal				
N32:4/12	I65PAL103	Global	Pump 103 Suction Pressure Normal				
N32:4/13	I65PALL103	Global	Pump 103 Suction Pressure Normal				
N32:4/14	I65VAH103A	Global	Pump 103 Upper Bearing Vibration Normal				
N32:4/15	I65VAH103B	Global	Pump 103 Lower Bearing Vibration Normal				
N32:5/0	I65VAHH103A	Global	Pump 103 Upper Bearing Vibration Normal				
N32:5/1	I65VAHH103B	Global	Pump 103 Lower Bearing Vibration Normal				
N32:5/2	I65YA103A	Global	Pump 103 Fail To Start				
N32:5/3	I65YA103B	Global	Pump 103 Fail To Stop				
N32:5/4	I65YA103C	Global	Pump 103 Discharge Valve Normal				
N32:5/5	I65YA103D	Global	Pump 103 Multilin Normal				
N32:5/6	I65YA103E	Global	Pump 103 Normal				
N32:5/7	I65YL103A	Global	Pump 103 Run				
N32:5/8	I65YL103B	Global	Pump 103 Lead				
N32:5/9	I65YL103C	Global	Pump 103 Out Of Service				
N32:5/10	I65YL103D	Global	Pump 103 PLC Control				
N32:5/11	I65YL103E	Global	Pump 103 Available				
N32:5/12	I65ZL103A	Global	Pump 103 Hand				
N32:5/13	I65ZL103B	Global	Pump 103 Auto				
N32:5/14	I65ZLC103	Global	Pump 103 Discharge Check Valve Open				
N32:5/15	I65FAL104	Global	Pump 104 Seal Water Flow Normal				
N32:6/0	I65PAH104	Global	Pump 104 Discharge Pressure Normal				
N32:6/1	I65PAHH104	Global	Pump 104 Discharge Pressure Normal				
N32:6/2	I65PAL104	Global	Pump 104 Suction Pressure Normal				
N32:6/3	I65PALL104	Global	Pump 104 Suction Pressure Normal				
N32:6/4	I65VAH104A	Global	Pump 104 Upper Bearing Vibration Normal				
N32:6/5	I65VAH104B	Global	Pump 104 Lower Bearing Vibration Normal				
N32:6/6	I65VAHH104A	Global	Pump104 Upper Bearing Vibration Normal				
N32:6/7	I65VAHH104B	Global	Pump 104 Lower Bearing Vibration Normal				
N32:6/8	I65YA104A	Global	Pump 104 Fail To Start				
N32:6/9	I65YA104B	Global	Pump 104 Fail To Stop				
N32:6/10	I65YA104C	Global	Pump 104 Discharge Valve Normal				
N32:6/11	I65YA104D	Global	Pump 104 Multilin Normal				
N32:6/12	I65YA104E	Global	Pump 104 Normal				
N32:6/13	I65YL104A	Global	Pump 104 Run				
N32:6/14	I65YL104B	Global	Pump 104 Lead				
N32:6/15	I65YL104C	Global	Pump 104 Out Of Service				
N32:7/0	I65YL104D	Global	Pump 104 PLC Control				
N32:7/1	I65YL104E	Global	Pump 104 Available				
N32:7/2	I65ZL104A	Global	Pump 104 Hand				
N32:7/3	I65ZL104B	Global	Pump 104 Auto				
N32:7/4	I65ZLC104	Global	Pump 104 Discharge Check Valve Open				
N32:7/5	I65ZLC111	Global	Sluice Gate G-111 Closed				
N32:7/6	I65ZLO111	Global	Sluice Gate G-111 Open				
N32:7/7	I65ZLC121	Global	Sluice Gate G-121 Closed				
N32:7/8	I65ZLO121	Global	Sluice Gate G-121 Open				
N32:7/9	I65YA141A	Global	Plug Valve V-141 Fail To Open				
N32:7/10	I65YA141B	Global	Plug Valve V-141 Fail To Close				
N32:7/11	I65YL141	Global	Plug Valve V-141 Available				
N32:7/12	I65ZL141	Global	Plug Valve V-141 Remote Control				
N32:7/13	I65ZLC141	Global	Plug Valve V-141 Closed				
N32:7/14	I65ZLO141	Global	Plug Valve V-141 Open				
N32:7/15	I65LAHH151	Global	Surge Tank T-151 Level Normal				
N32:8/0	I65LALL151	Global	Surge Tank T-151 Level Normal				
N32:8/1	I65ZLO151	Global	Surge Tank T-151 Valve Open				
N32:8/2	I65YA211A	Global	Slide Gate G-211 Fail To Open				
N32:8/3	I65YA211B	Global	Slide Gate G-211 Fail To Close				
N32:8/4	I65YL211	Global	Slide Gate G-211 Available				
N32:8/5	I65ZL211	Global	Slide Gate G-211 Remote Control				
N32:8/6	I65ZLC211	Global	Slide Gate G-211 Closed				
N32:8/7	I65ZLO211	Global	Slide Gate G-211 Open				
N32:8/8	I65YA212A	Global	Slide Gate G-212 Fail To Open				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
N32:8/9	I65YA212B	Global	Slide Gate G-212 Fail To Close				
N32:8/10	I65YL212	Global	Slide Gate G-212 Available				
N32:8/11	I65ZL212	Global	Slide Gate G-212 Remote Control				
N32:8/12	I65ZLC212	Global	Slide Gate G-212 Closed				
N32:8/13	I65ZLO212	Global	Slide Gate G-212 Open				
N32:8/14	I65YA213A	Global	Slide Gate G-213 Fail To Open				
N32:8/15	I65YA213B	Global	Slide Gate G-213 Fail To Close				
N32:9/0	I65YL213	Global	Slide Gate G-213 Available				
N32:9/1	I65ZL213	Global	Slide Gate G-213 Remote Control				
N32:9/2	I65ZLC213	Global	Slide Gate G-213 Closed				
N32:9/3	I65ZLO213	Global	Slide Gate G-213 Open				
N32:9/4	I65ZLC221	Global	Slide Gate G-221 Closed				
N32:9/5	I65ZLO221	Global	Slide Gate G-221 Open				
N32:9/6	I65ZLC222	Global	Slide Gate G-222 Closed				
N32:9/7	I65ZLO222	Global	Slide Gate G-222 Open				
N32:9/8	I65ZLC223	Global	Slide Gate G-223 Closed				
N32:9/9	I65ZLO223	Global	Slide Gate G-223 Open				
N32:9/10	I65ZLC231	Global	Slide Gate G-231 Closed				
N32:9/11	I65ZLO231	Global	Slide Gate G-231 Open				
N32:9/12	I65YA232A	Global	Sluice Gate G-232 Fail To Open				
N32:9/13	I65YA232B	Global	Sluice Gate G-232 Fail To Close				
N32:9/14	I65YL232	Global	Sluice Gate G-232 Available				
N32:9/15	I65ZL232	Global	Sluice Gate G-232 Remote Control				
N32:10/0	I65ZLC232	Global	Sluice Gate G-232 Closed				
N32:10/1	I65ZLO232	Global	Sluice Gate G-232 Open				
N32:10/2	I65ZLC233	Global	Slide Gate G-233 Closed				
N32:10/3	I65ZLO233	Global	Slide Gate G-233 Open				
N32:10/4	I65LALL300	Global	Air Gap Tank T-300 Level Normal				
N32:10/5	I65PAH301	Global	Hydropneumatic Tank T-301 Pressure Normal				
N32:10/6	I65PAL301	Global	Hydropneumatic Tank T-301 Pressure Normal				
N32:10/7	I65LAL410B	Global	Hypo Bulk Storage Tank T-410 Level Normal				
N32:10/8	I65LAL420B	Global	Caustic Bulk Storage Tank T-420 Level Normal				
N32:10/9	I65FAH441	Global	Odor Control Area Eyewash Shower Normal				
N32:10/10	I65FAH442	Global	Chemical Storage Area Eyewash Shower Normal				
N32:10/11	I65FAH443	Global	Blower Bldg Eyewash Shower Normal				
N32:10/12	I65FAH444	Global	Mechanical Bldg Eyewash Shower Normal				
N32:10/13	I65LALL940	Global	Class "A" Water Ai Gap Tank T-940 Level Normal				
N32:10/14	I65UA940	Global	Class "A" Water Ai Gap Tank T-940 Normal				
N32:10/15	I65LALL950	Global	Class "B" Water Ai Gap Tank T-950 Level Normal				
N32:11/0	I65UA950	Global	Class "B" Water Ai Gap Tank T-950 Normal				
N32:11/1			Pump Start-Stop Minimum Interval Not Met				
N32:11/2			Pump 101 Maximum Starts Exceeded				
N32:11/3			Pump 102 Maximum Starts Exceeded				
N32:11/4			Pump 103 Maximum Starts Exceeded				
N32:11/5			Pump 104 Maximum Starts Exceeded				
N32:11/6			Pump 101 Minimum Off Time Not Met				
N32:11/7			Pump 102 Minimum Off Time Not Met				
N32:11/8			Pump 103 Minimum Off Time Not Met				
N32:11/9			Pump 104 Minimum Off Time Not Met				
N32:11/10			Operational Wet Well Level Xmtr Normal				
N32:11/11			UPS Off				
N32:11/12			UPS Not On Battery				
N32:11/13			UPS Not On Bypass				
N32:11/14			UPS Not Low Battery				
N32:11/15			Main Service A Breaker Open				
N32:12	N250	Global					
N32:12/0			Main Service B Breaker Open Status				
N32:12/1			Tie Breaker Open				
N32:12/2			Main Service A not Available				
N32:12/3			Main Service B Not Available				
N32:12/4			UPS Trouble				
N32:12/5			Main Service A Breaker Tripped				
N32:12/6			Main Service B Breaker Tripped				
N32:12/7			Tie Breaker Tripped				
N32:12/8			Transfer System Fail				
N32:12/9			Auto/Manual Switch Manual Mode				
N32:12/10			Auto/Manual Switch Auto Mode				
N32:12/11			Service Selector Switch Service A Normal Source				
N32:12/12			Service Selector Switch Service B Normal Source				
N32:12/13			86 Lockout Relay Tripped				
N32:12/14			PLC General Fault Status				
N32:12/15			Main Service A Relay Failure				
N32:13							
N32:13/0			Main Service B Relay Failure				
N32:13/1			Auto-Throwover System(PLC Heartbeat)				
N32:13/2			Power Quality Relay Fault				
N32:13/3			Power Monitor				
N32:32/1							
N32:50	I65AI8	Global	Odor Control System pH				
N32:52	I65LI10	Global	Wet Well Level				
N32:54	I65LI20	Global	Bar Screen Channel Differential Level				
N32:56	I65LY100A	Global	Lead 150 HP Pump Start Setpoint				
N32:58	I65LY100B	Global	Lead 150 HP Pump Stop Setpoint				
N32:60	I65LY100C	Global	Lag 150 HP Pump Start Setpoint				
N32:62	I65LY100D	Global	Lag 150 HP Pump Stop Setpoint				
N32:64	I65LY100E	Global	Lead 400 HP Pump Start Setpoint				
N32:66	I65LY100F	Global	Lead 400 HP Pump Stop Setpoint				
N32:68	I65LY100G	Global	Lag 400 HP Pump Start Setpoint				
N32:70	I65LY100H	Global	Lag 400 HP Pump Stop Setpoint				
N32:72	I65KI101	Global	Pump 101 Run Time				
N32:74	I65PI101A	Global	Pump 101 Suction Pressure				
N32:76	I65PI101B	Global	Pump 101 Discharge Pressure				
N32:78	I65TI101A	Global	Pump 101 Motor Winding Temp A				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
N32:80	I65TI101B	Global	Pump 101 Motor Winding Temp B				
N32:82	I65TI101C	Global	Pump 101 Motor Winding Temp C				
N32:84	I65TI101D	Global	Pump 101 Motor Winding Temp D				
N32:86	I65TI101E	Global	Pump 101 Motor Winding Temp E				
N32:88	I65TI101F	Global	Pump 101 Motor Winding Temp F				
N32:90	I65TI101G	Global	Pump 101 Bearing Temp G				
N32:92	I65TI101H	Global	Pump 101 Bearing Temp H				
N32:94	I65VI101A	Global	Pump 101 Upper Bearing Vibration				
N32:96	I65VI101B	Global	Pump 101 Lower Bearing Vibration				
N32:98	I65KI102	Global	Pump 102 Run Time				
N32:100	I65PI102A	Global	Pump 102 Suction Pressure				
N32:102	I65PI102B	Global	Pump 102 Discharge Pressure				
N32:104	I65TI102A	Global	Pump 102 Motor Winding Temp A				
N32:106	I65TI102B	Global	Pump 102 Motor Winding Temp B				
N32:108	I65TI102C	Global	Pump 102 Motor Winding Temp C				
N32:110	I65TI102D	Global	Pump 102 Motor Winding Temp D				
N32:112	I65TI102E	Global	Pump 102 Motor Winding Temp E				
N32:114	I65TI102F	Global	Pump 102 Motor Winding Temp F				
N32:116	I65TI102G	Global	Pump 102 Bearing Temp G				
N32:118	I65TI102H	Global	Pump 102 Bearing Temp H				
N32:120	I65VI102A	Global	Pump 102 Upper Bearing Vibration				
N32:122	I65VI102B	Global	Pump 102 Lower Bearing Vibration				
N32:124	I65KI103	Global	Pump 103 Run Time				
N32:126	I65PI103A	Global	Pump 103 Suction Pressure				
N32:128	I65PI103B	Global	Pump 103 Discharge Pressure				
N32:130	I65TI103A	Global	Pump 103 Motor Winding Temp A				
N32:132	I65TI103B	Global	Pump 103 Motor Winding Temp B				
N32:134	I65TI103C	Global	Pump 103 Motor Winding Temp C				
N32:136	I65TI103D	Global	Pump 103 Motor Winding Temp D				
N32:138	I65TI103E	Global	Pump 103 Motor Winding Temp E				
N32:140	I65TI103F	Global	Pump 103 Motor Winding Temp F				
N32:142	I65TI103G	Global	Pump 103 Bearing Temp G				
N32:144	I65TI103H	Global	Pump 103 Bearing Temp H				
N32:146	I65VI103A	Global	Pump 103 Upper Bearing Vibration				
N32:148	I65VI103B	Global	Pump 103 Lower Bearing Vibration				
N32:150	I65KI104	Global	Pump 104 Run Time				
N32:152	I65PI104A	Global	Pump 104 Suction Pressure				
N32:154	I65PI104B	Global	Pump 104 Discharge Pressure				
N32:156	I65TI104A	Global	Pump 104 Motor Winding Temp A				
N32:158	I65TI104B	Global	Pump 104 Motor Winding Temp B				
N32:160	I65TI104C	Global	Pump 104 Motor Winding Temp C				
N32:162	I65TI104D	Global	Pump 104 Motor Winding Temp D				
N32:164	I65TI104E	Global	Pump 104 Motor Winding Temp E				
N32:166	I65TI104F	Global	Pump 104 Motor Winding Temp F				
N32:168	I65TI104G	Global	Pump 104 Bearing Temp G				
N32:170	I65TI104H	Global	Pump 104 Bearing Temp H				
N32:172	I65VI104A	Global	Pump 104 Upper Bearing Vibration				
N32:174	I65VI104B	Global	Pump 104 Lower Bearing Vibration				
N32:176	I65PI401	Global	Force Main Discharge Pressure				
N32:178	I65FI402	Global	Hypo Caustic Flow To Vessel #1				
N32:180	I65FI403	Global	Hypo Caustic Flow To Vessel #2				
N32:182	I65FI601	Global	Force Main Discharge Flow Rate				
N32:184	I65FQI601A	Global	Current Force Main Totalized Flow				
N32:186	I65FQI601B	Global	Previous Force Main Totalized Flow				
N32:192							
N32:200			Bleach Level 0-8ft				
N33:0			Command Outputs From DCS				
N33:0/0	I65KC100	Global	Reset Plc Clock				
N33:0/1	I65YC100B	Global	DCS Heartbeat				
N33:0/2	I65HS101A	Global	Pump 101 Lead 150 HP				
N33:0/3	I65HS101B	Global	Pump 101 PLC Control				
N33:0/4	I65HS101C	Global	Pump 101 DCS Manual Start				
N33:0/5	I65HS101D	Global	Pump 101 Out Of Service				
N33:0/6	I65HS101E	Global	Pump 101 Reset				
N33:0/7	I65HS101F	Global	Pump 101 Reset Run Time Meter				
N33:0/8	I65HS102A	Global	Pump 102 PLC Control				
N33:0/9	I65HS102B	Global	Pump 102 DCS Manual Start				
N33:0/10	I65HS102C	Global	Pump 102 Out Of Service				
N33:0/11	I65HS102D	Global	Pump 102 Reset				
N33:0/12	I65HS102E	Global	Pump 102 Reset Run Time Meter				
N33:0/13	I65HS103A	Global	Pump 103 Lead 400 HP				
N33:0/14	I65HS103B	Global	Pump 103 PLC Control				
N33:0/15	I65HS103C	Global	Pump 103 DCS Manual Start				
N33:1/0	I65HS103D	Global	Pump 103 Out Of Service				
N33:1/1	I65HS103E	Global	Pump 103 Reset				
N33:1/2	I65HS103F	Global	Pump 103 Reset Run Time Meter				
N33:1/3	I65HS104A	Global	Pump 104 PLC Control				
N33:1/4	I65HS104B	Global	Pump 104 DCS Manual Start				
N33:1/5	I65HS104C	Global	Pump 104 Out Of Service				
N33:1/6	I65HS104D	Global	Pump 104 Reset				
N33:1/7	I65HS104E	Global	Pump 104 Reset Run Time Meter				
N33:1/8	I65HS141A	Global	Open Plug Valve V-141				
N33:1/9	I65HS141B	Global	Close Plug Valve V-141				
N33:1/10	I65HS141C	Global	Plug Valve V-141 Reset				
N33:1/11	I65HS211A	Global	Open Slide Gate G-211				
N33:1/12	I65HS211B	Global	Close Slide Gate G-211				
N33:1/13	I65HS211C	Global	Slide Gate G-211 Reset				
N33:1/14	I65HS212A	Global	Open Slide Gate G-212				
N33:1/15	I65HS212B	Global	Close Slide Gate G-212				
N33:2/0	I65HS212C	Global	Slide Gate G-212 Reset				
N33:2/1	I65HS213A	Global	Open Slide Gate G-213				
N33:2/2	I65HS213B	Global	Close Slide Gate G-213				
N33:2/3	I65HS213C	Global	Slide Gate G-213 Reset				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
N33:2/4	I65HS232A	Global	Open Sluice Gate G-232				
N33:2/5	I65HS232B	Global	Stop Sluice Gate G-232				
N33:2/6	I65HS232C	Global	Close Sluice Gate G-232				
N33:2/7	I65HS232D	Global	Sluice Gate G-232 Reset				
N33:2/8			Wet Well #1 Select, NOT #1 = Wet Well #2 Select				
N33:2/9			Wet Well in DCS mode				
N33:50	I65LC100A	Global	Lead 150 HP Start Setpoint				
N33:52	I65LC100B	Global	Lead 150 HP Stop Setpoint				
N33:54	I65LC100C	Global	Lag 150 HP Start Setpoint				
N33:56	I65LC100D	Global	Lag 150 HP Stop Setpoint				
N33:58	I65LC100E	Global	Lead 400 HP Start Setpoint				
N33:60	I65LC100F	Global	Lead 400 HP Stop Setpoint				
N33:62	I65LC100G	Global	Lag 400 HP Start Setpoint				
N33:64	I65LC100H	Global	Lag 400 HP Stop Setpoint				
N34:0			Slave Error Code Table				
N37:0			Wet Well #1				
N38:0			Read data block				
N38:4			H2S stack				
N38:5			H2S barscreen room				
N38:6			Wet Well #1 Level				
N38:7			Wet Well #2 Level				
N38:8			Bleach Level				
N38:64			Write data block				
N38:128			Read data block				
N38:192			Write data block				
O0000:0010			Copy Outputs From BCM Read Buffer To Memory				
O:010/0			Pump 101 Call				
O:010/1			Pump 102 Call				
O:010/2			Pump 103 Call				
O:010/3			Pump 104 Call				
O:010/4			Spare Output				
O:010/5			Spare Output				
O:010/6			Spare Output				
O:010/7			Spare Output				
O:010/10			Spare Output				
O:010/11			Spare Output				
O:010/12			Spare Output				
O:010/13			Spare Output				
O:010/14			Spare Output				
O:010/15			Spare Output				
O:010/16			Spare Output				
O:010/17			Spare Output				
O:011/0			Pump 101 Call				
O:011/1			Pump 102 Call				
O:011/2			Pump 103 Call				
O:011/3			Pump 104 Call				
O:011/4			Spare Output				
O:011/5			Spare Output				
O:011/6			Spare Output				
O:011/7			Spare Output				
O:011/10			Drywell Gas Alarm				
O:011/11			Screenings Facility Gas Alarm				
O:011/12			Meter Vault Gas Alarm				
O:011/13			Seal Water Pump 305 Call				
O:011/14			Seal Water Pump 306 Call				
O:011/15			Spare Output				
O:011/16			Spare Output				
O:011/17			Wet Well Low-Low Level				
O:027/0			Spare Output				
O:027/1			Spare Output				
O:027/2			Spare Output				
O:027/3			Stop Sluice Gate G-232				
O:027/4			Sluice Gate G-232 Open Call				
O:027/5			Sluice Gate G-232 Close Call				
O:027/6			Slide Gate G-211 Open Call				
O:027/7			Slide Gate G-211 Close Call				
O:027/10			Slide Gate G-212 Open Call				
O:027/11			Slide Gate G-212 Close Call				
O:027/12			Slide Gate G-213 Open Call				
O:027/13			Slide Gate G-213 Close Call				
O:027/14			Plug Valve V-141 Open Call				
O:027/15			Plug Valve V-141 Close Call				
O:027/16			PLC Normal				
O:027/17			Spare Output				
R6:0			Multilin Temp Conversion Control Block				
R6:0/DN			FAL Done				
R6:1			Pump 101 Maximum Start Shift Register Control Block				
R6:1/UL			Pump 101 Start Shift Register Unload Bit				
R6:2			Pump 102 Maximum Start Shift Register Control Block				
R6:2/UL			Pump 102 Start Shift Register Unload Bit				
R6:3			Pump 103 Maximum Start Shift Register Control Block				
R6:3/UL			Pump 103 Start Shift Register Unload Bit				
R6:4			Pump 104 Maximum Start Shift Register Control Block				
R6:4/UL			Pump 104 Start Shift Register Unload Bit				
S:0/0			Processor arithmetic carry flag				
S:0/1			Processor arithmetic underflow/ overflow flag				
S:0/2			Processor arithmetic zero flag				
S:0/3			Processor arithmetic sign flag				
S:1/0			Bad RAM CHECKSUM at power up				
S:1/1			PLC-5 in RUN mode				
S:1/2			PLC-5 in TEST mode				
S:1/3			PLC-5 in PROG mode				
S:1/4			PLC-5 is burning an EEPROM				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
S:1/5			Download- ing in progress				
S:1/6			Test edits enabled				
S:1/7			Mode switch in REMOTE				
S:1/8			Forces enabled				
S:1/9			Forces present				
S:1/10			EEPROM success- fully Burned				
S:1/11			Perform- ing online program- ming				
S:1/12			Processor is in DEBUG mode				
S:1/13			User program CHECKSUM done				
S:1/14			Last scan of ladder or SFC step				
S:1/15			First scan of ladder or SFC step				
S:7/0			Rack 0 Faulted				
S:7/1			Rack 1 Faulted				
S:7/2			Rack 2 Faulted				
S:7/3			Rack 3 Faulted				
S:7/4			Rack 4 Faulted				
S:7/5			Rack 5 Faulted				
S:7/6			Rack 6 Faulted				
S:7/7			Rack 7 Faulted				
S:7/8			Block Xfer queue to rack 0 is full				
S:7/9			Block Xfer queue to rack 1 is full				
S:7/10			Block Xfer queue to rack 2 is full				
S:7/11			Block Xfer queue to rack 3 is full				
S:7/12			Block Xfer queue to rack 4 is full				
S:7/13			Block Xfer queue to rack 5 is full				
S:7/14			Block Xfer queue to rack 6 is full				
S:7/15			Block Xfer queue to rack 7 is full				
S:8			Last program scan time ladder & SFC				
S:9			Maximum program scan time ladder & SFC				
S:10/0			Battery is bad or missing				
S:10/1			DH+ active node table changed				
S:10/2			STI overlap				
S:10/3			EEPROM trans- ferred				
S:10/4			Edits prevent SFC continuing				
S:10/5			Invalid I/O status file				
S:10/6			Memory cartridge battery low				
S:10/7			No more command blocks exist				
S:10/9			No MCP was configured to run				
S:10/10			MCP not allowed				
S:10/11			PII word number isn't in local rack				
S:10/12			User PII routine overlap				
S:10/13			No command block exists to get PII				
S:10/14			Arithmetic overflow occurred				
S:10/15			SFC lingering action overlap				
S:11/0			Bad program file				
S:11/1			Bad address in ladder program				
S:11/2			Programmer error				
S:11/3			SFC Fault				
S:11/4			Program assembly error				
S:11/5			Powerup protection fault				
S:11/6			Error not defined				
S:11/7			User generated fault				
S:11/8			Watchdog timer fault				
S:11/9			Bad system config- uration				
S:11/10			Hardware Error				
S:11/11			MCP file does not exist or is not ladder				
S:11/12			PII file does not exist or is not ladder				
S:11/13			STI file does not exist or is not ladder				
S:11/14			Fault file does not exist or is not ladder				
S:11/15			Non ladder file				
S:12			Fault Code				
S:13			Program file where fault occurred				
S:14			Rung number where fault occurred				
S:16			I/O status file				
S:17/0			Queue full between local and remote I/O				
S:17/1			Queue full servicing channel 1A				
S:17/2			Queue full servicing channel 1B				
S:17/3			Queue full servicing channel 2A				
S:17/4			Queue full servicing channel 2B				
S:17/5			No modem on serial port				
S:17/6			Remote I/O is greater than image size				
S:17/8			ASCII instruct- ion error				
S:17/9			Duplicate node address				
S:18			Real time clock YEAR				
S:19			Real time clock MONTH				
S:20			Real time clock DAY				
S:21			Real time clock HOUR				
S:22			Real time clock MINUTE				
S:23			Real time clock SECOND				
S:24			Indexed Addressing Offset				
S:25			Adapter Image File				
S:26/0			SFC Restart/ Continue				
S:26/1			Start-up protect- ion after power loss				
S:26/2			Local rack is 1 if set or 0 if bit = 0				
S:26/3			Complement Rack Mode				
S:27/0			Rack 0 Inhibit				
S:27/1			Rack 1 Inhibit				
S:27/2			Rack 2 Inhibit				
S:27/3			Rack 3 Inhibit				
S:27/4			Rack 4 Inhibit				
S:27/5			Rack 5 Inhibit				
S:27/6			Rack 6 Inhibit				
S:27/7			Rack 7 Inhibit				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
S:27/8			Rack 0 Reset				
S:27/9			Rack 1 Reset				
S:27/10			Rack 2 Reset				
S:27/11			Rack 3 Reset				
S:27/12			Rack 4 Reset				
S:27/13			Rack 5 Reset				
S:27/14			Rack 6 Reset				
S:27/15			Rack 7 Reset				
S:28			Watchdog Timer Setpoint				
S:29			Fault routine file number				
S:30			STI setpoint (interval)				
S:31			STI file number				
S:32/0			Rack 10 Faulted				
S:32/1			Rack 11 Faulted				
S:32/2			Rack 12 Faulted				
S:32/3			Rack 13 Faulted				
S:32/4			Rack 14 Faulted				
S:32/5			Rack 15 Faulted				
S:32/6			Rack 16 Faulted				
S:32/7			Rack 17 Faulted				
S:32/8			Block Xfer queue to rack 10 is full				
S:32/9			Block Xfer queue to rack 11 is full				
S:32/10			Block Xfer queue to rack 12 is full				
S:32/11			Block Xfer queue to rack 13 is full				
S:32/12			Block Xfer queue to rack 14 is full				
S:32/13			Block Xfer queue to rack 15 is full				
S:32/14			Block Xfer queue to rack 16 is full				
S:32/15			Block Xfer queue to rack 17 is full				
S:33/0			Rack 10 Inhibit				
S:33/1			Rack 11 Inhibit				
S:33/2			Rack 12 Inhibit				
S:33/3			Rack 13 Inhibit				
S:33/4			Rack 14 Inhibit				
S:33/5			Rack 15 Inhibit				
S:33/6			Rack 16 Inhibit				
S:33/7			Rack 17 Inhibit				
S:33/8			Rack 10 Reset				
S:33/9			Rack 11 Reset				
S:33/10			Rack 12 Reset				
S:33/11			Rack 13 Reset				
S:33/12			Rack 14 Reset				
S:33/13			Rack 15 Reset				
S:33/14			Rack 16 Reset				
S:33/15			Rack 17 Reset				
S:34/0			Rack 20 Faulted				
S:34/1			Rack 21 Faulted				
S:34/2			Rack 22 Faulted				
S:34/3			Rack 23 Faulted				
S:34/4			Rack 24 Faulted				
S:34/5			Rack 25 Faulted				
S:34/6			Rack 26 Faulted				
S:34/7			Rack 27 Faulted				
S:34/8			Block Xfer queue to rack 20 is full				
S:34/9			Block Xfer queue to rack 21 is full				
S:34/10			Block Xfer queue to rack 22 is full				
S:34/11			Block Xfer queue to rack 23 is full				
S:34/12			Block Xfer queue to rack 24 is full				
S:34/13			Block Xfer queue to rack 25 is full				
S:34/14			Block Xfer queue to rack 26 is full				
S:34/15			Block Xfer queue to rack 27 is full				
S:35/0			Rack 20 Inhibit				
S:35/1			Rack 21 Inhibit				
S:35/2			Rack 22 Inhibit				
S:35/3			Rack 23 Inhibit				
S:35/4			Rack 24 Inhibit				
S:35/5			Rack 25 Inhibit				
S:35/6			Rack 26 Inhibit				
S:35/7			Rack 27 Inhibit				
S:35/8			Rack 20 Reset				
S:35/9			Rack 21 Reset				
S:35/10			Rack 22 Reset				
S:35/11			Rack 23 Reset				
S:35/12			Rack 24 Reset				
S:35/13			Rack 25 Reset				
S:35/14			Rack 26 Reset				
S:35/15			Rack 27 Reset				
S:46			PII file number				
S:47			PII module group to examine				
S:48			PII bit mask				
S:48/0			PII Module Bit 1=Monitor 0=Ignore				
S:49			PII compare value				
S:49/0			PII Bit 1=false to true, 0= true to FALSE				
S:50			PII down count				
S:51			PII return mask				
S:52			PII accum- ulator				
S:53			STI last scan time				
S:54			STI max scan time				
S:55			PII last scan time				
S:56			PII max scan time				
S:79/0			Main control program A disable bit				
S:79/1			Main control program B disable bit				
S:79/2			Main control program C disable bit				
S:79/3			Main control program D disable bit				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
S:79/4			Main control program E disable bit				
S:79/5			Main control program F disable bit				
S:79/6			Main control program G disable bit				
S:79/7			Main control program H disable bit				
S:79/8			Main control program I disable bit				
S:79/9			Main control program J disable bit				
S:79/10			Main control program K disable bit				
S:79/11			Main control program L disable bit				
S:79/12			Main control program M disable bit				
S:79/13			Main control program N disable bit				
S:79/14			Main control program O disable bit				
S:79/15			Main control program P disable bit				
S:80			Main control program A file number				
S:81			Program A scan time				
S:82			Program A maximum scan time				
S:83			Main control program B file number				
S:84			Program B scan time				
S:85			Program B maximum scan time				
S:86			Main control program C file number				
S:87			Program C scan time				
S:88			Program C maximum scan time				
S:89			Main control program D file number				
S:90			Program D scan time				
S:91			Program D maximum scan time				
S:92			Main control program E file number				
S:93			Program E scan time				
S:94			Program E maximum scan time				
S:95			Main control program F file number				
S:96			Program F scan time				
S:97			Program F maximum scan time				
S:98			Main control program G file number				
S:99			Program G scan time				
S:100			Program G maximum scan time				
S:101			Main control program H file number				
S:102			Program H scan time				
S:103			Program H maximum scan time				
S:104			Main control program I file number				
S:105			Program I scan time				
S:106			Program I maximum scan time				
S:107			Main control program J file number				
S:108			Program J scan time				
S:109			Program J maximum scan time				
S:110			Main control program K file number				
S:111			Program K scan time				
S:112			Program K maximum scan time				
S:113			Main control program L file number				
S:114			Program L scan time				
S:115			Program L maximum scan time				
S:116			Main control program M file number				
S:117			Program M scan time				
S:118			Program M maximum scan time				
S:119			Main control program N file number				
S:120			Program N scan time				
S:121			Program N maximum scan time				
S:122			Main control program O file number				
S:123			Program O scan time				
S:124			Program O maximum scan time				
S:125			Main control program P file number				
S:126			Program P scan time				
S:127			Program P maximum scan time				
T4:0			BCM Initial Start-Up Delay Timer				
T4:0/DN			Initial Start-up Delay Done				
T4:1			Pump 101 Off Timer				
T4:1/DN			Pump 101 Minimum Off Time				
T4:2			Pump 102 Off Timer				
T4:2/DN			Pump 102 Minimum Off Time				
T4:3			Pump 103 Off Timer				
T4:3/DN			Pump 103 Minimum Off Time				
T4:4			Pump 104 Off Timer				
T4:4/DN			Pump 104 Minimum Off Time				
T4:5			60 Second Timer				
T4:5/DN			One Minute Elapsed				
T4:6			Pump Start Minimum Interval Timer				
T4:6/DN			Pump Start Minimum Interval Done				
T4:7			Pump Stop Minimum Interval Timer				
T4:7/DN			Pump Stop Minimum Interval Done				
T4:8			Pump 101 Start Response Timer				
T4:8/DN			Pump 101 Start Response Reqd				
T4:9			Pump 101 Stop Response Timer				
T4:9/DN			Pump 101 Stop Response Reqd				
T4:10			Pump 101 Upper Bearing High Vibration Timer				
T4:10/DN			Pump 101 Upper Bearing High Vibration				
T4:11			Pump 101 Upper Bearing High-High Vibration Timer				
T4:11/DN			Pump 101 Upper Bearing High-High Vibration				
T4:12			Pump 101 Lower Bearing High Vibration Timer				
T4:12/DN			Pump 101 Lower Bearing High Vibration				
T4:13			Pump 101 Lower Bearing High-High Vibration Timer				
T4:13/DN			Pump 101 Lower Bearing High-High Vibration				
T4:14			Pump 101 Low Suction Pressure Timer				
T4:14/DN			Pump 101 Low Suction Pressure				
T4:15			Pump 101 Low-Low Suction Pressure Timer				
T4:15/DN			Pump 101 Low-Low Suction Pressure				
T4:16			Pump 101 High Discharge Pressure Timer				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
T4:16/DN			Pump 101 High Discharge Pressure				
T4:17			Pump 101 High-High Discharge Pressure Timer				
T4:17/DN			Pump 101 High-High Discharge Pressure				
T4:18			Pump 101 Discharge Valve Fail To Open Timer				
T4:18/DN			Pump 101 Discharge Valve Fail To Open				
T4:19			Pump 101 Discharge Valve Fail To Close Timer				
T4:19/DN			Pump 101 Discharge Valve Fail To Close				
T4:20			Pump 101 Seal Water Low Flow Timer				
T4:20/DN			Pump 101 Seal Water Low Flow				
T4:21			Pump 101 Hour Run Timer				
T4:21/DN			Pump 101 Increment Run Time Meter				
T4:22			Pump 102 Start Response Timer				
T4:22/DN			Pump 102 Start Response Reqd				
T4:23			Pump 102 Stop Response Timer				
T4:23/DN			Pump 102 Stop Response Reqd				
T4:24			Pump 102 Upper Bearing High Vibration Timer				
T4:24/DN			Pump 102 Upper Bearing High Vibration				
T4:25			Pump 102 Upper Bearing High-High Vibration Timer				
T4:25/DN			Pump 102 Upper Bearing High-High Vibration				
T4:26			Pump 102 Lower Bearing High Vibration Timer				
T4:26/DN			Pump 102 Lower Bearing High Vibration				
T4:27			Pump 102 Lower Bearing High-High Vibration Timer				
T4:27/DN			Pump 102 Lower Bearing High-High Vibration				
T4:28			Pump 102 Low Suction Pressure Timer				
T4:28/DN			Pump 102 Low Suction Pressure				
T4:29			Pump 102 Low-Low Suction Pressure Timer				
T4:29/DN			Pump 102 Low-Low Suction Pressure				
T4:30			Pump 102 High Discharge Pressure Timer				
T4:30/DN			Pump 102 High Discharge Pressure				
T4:31			Pump 102 High-High Discharge Pressure Timer				
T4:31/DN			Pump 102 High-High Discharge Pressure				
T4:32			Pump 102 Discharge Valve Fail To Open Timer				
T4:32/DN			Pump 102 Discharge Valve Fail To Open				
T4:33			Pump 102 Discharge Valve Fail To Close Timer				
T4:33/DN			Pump 102 Discharge Valve Fail To Close				
T4:34			Pump 102 Seal Water Low Flow Timer				
T4:34/DN			Pump 102 Seal Water Low Flow				
T4:35			Pump 102 Hour Run Timer				
T4:35/DN			Pump 102 Increment Run Time Meter				
T4:36			Pump 103 Start Response Timer				
T4:36/DN			Pump 103 Start Response Reqd				
T4:37			Pump 103 Stop Response Timer				
T4:37/DN			Pump 103 Stop Response Reqd				
T4:38			Pump 103 Upper Bearing High Vibration Timer				
T4:38/DN			Pump 103 Upper Bearing High Vibration				
T4:39			Pump 103 Upper Bearing High-High Vibration Timer				
T4:39/DN			Pump 103 Upper Bearing High-High Vibration				
T4:40			Pump 103 Lower Bearing High Vibration Timer				
T4:40/DN			Pump 103 Lower Bearing High Vibration				
T4:41			Pump 103 Lower Bearing High-High Vibration Timer				
T4:41/DN			Pump 103 Lower Bearing High-High Vibration				
T4:42			Pump 103 Low Suction Pressure Timer				
T4:42/DN			Pump 103 Low Suction Pressure				
T4:43			Pump 103 Low-Low Suction Pressure Timer				
T4:43/DN			Pump 103 Low-Low Suction Pressure				
T4:44			Pump 103 High Discharge Pressure Timer				
T4:44/DN			Pump 103 High Discharge Pressure				
T4:45			Pump 103 High-High Discharge Pressure Timer				
T4:45/DN			Pump 103 High-High Discharge Pressure				
T4:46			Pump 103 Discharge Valve Fail To Open Timer				
T4:46/DN			Pump 103 Discharge Valve Fail To Open				
T4:47			Pump 103 Discharge Valve Fail To Close Timer				
T4:47/DN			Pump 103 Discharge Valve Fail To Close				
T4:48			Pump 103 Seal Water Low Flow Timer				
T4:48/DN			Pump 103 Seal Water Low Flow				
T4:49			Pump 103 Hour Run Timer				
T4:49/DN			Pump 103 Increment Run Time Meter				
T4:50			Pump 104 Start Response Timer				
T4:50/DN			Pump 104 Start Response Reqd				
T4:51			Pump 104 Stop Response Timer				
T4:51/DN			Pump 104 Stop Response Reqd				
T4:52			Pump 104 Upper Bearing High Vibration Timer				
T4:52/DN			Pump 104 Upper Bearing High Vibration				
T4:53			Pump 104 Upper Bearing High-High Vibration Timer				
T4:53/DN			Pump 104 Upper Bearing High-High Vibration				
T4:54			Pump 104 Lower Bearing High Vibration Timer				
T4:54/DN			Pump 104 Lower Bearing High Vibration				
T4:55			Pump 104 Lower Bearing High-High Vibration Timer				
T4:55/DN			Pump 104 Lower Bearing High-High Vibration				
T4:56			Pump 104 Low Suction Pressure Timer				
T4:56/DN			Pump 104 Low Suction Pressure				
T4:57			Pump 104 Low-Low Suction Pressure Timer				
T4:57/DN			Pump 104 Low-Low Suction Pressure				
T4:58			Pump 104 High Discharge Pressure Timer				
T4:58/DN			Pump 104 High Discharge Pressure				
T4:59			Pump 104 High-High Discharge Pressure Timer				
T4:59/DN			Pump 104 High-High Discharge Pressure				
T4:60			Pump 104 Discharge Valve Fail To Open Timer				
T4:60/DN			Pump 104 Discharge Valve Fail To Open				
T4:61			Pump 104 Discharge Valve Fail To Close Timer				
T4:61/DN			Pump 104 Discharge Valve Fail To Close				
T4:62			Pump 104 Seal Water Low Flow Timer				
T4:62/DN			Pump 104 Seal Water Low Flow				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Group	Dev. Code	ABV	BLW
T4:63			Pump 104 Hour Run Timer				
T4:63/DN			Pump 104 Increment Run Time Meter				
T4:64			Hydropneumatic Tank T-301 Low Pressure Timer				
T4:64/DN			Lag Seal Water Pump Reqd				
T4:65			Slide Gate G-211 Response Timer				
T4:65/DN			Slide Gate G-211 Response Reqd				
T4:66			Slide Gate G-212 Response Timer				
T4:66/DN			Slide Gate G-212 Response Reqd				
T4:67			Slide Gate G-213 Response Timer				
T4:67/DN			Slide Gate G-213 Response Reqd				
T4:68			Sluice Gate G-232 Response Timer				
T4:68/DN			Slide Gate G-212 Close Timer Done				
T4:69			Plug Valve V-141 Response Timer				
T4:69/DN			Plug Valve V-141 Response Reqd				
T4:70			DCS Heartbeat Timer				
T4:70/DN			DCS Comm Fail				
T4:71			Sluice Gate G-232 Stop Timer				
T4:71/DN			Stop Sluice Gate G-232				
T4:72			ATS (PLC) Heartbeat Timer				
T4:72/1			ATS (PLC) Heartbeat Timer				
U:3			BCM Main Subroutine				
U:6			BCM Diagnostic Counters				
U:7			Copy Memory To Primary Buffer				
U:8			Copy Secondary Buffer To Memory				
U:9			Read Analog Inputs				
U:10			Read Multilin				
U:11			Read Bently Nevada				
U:12			Pump Sequencing				
U:13			Pump 101				
U:14			Pump 102				
U:15			Pump 103				
U:16			Pump 104				
U:18			Flow Totalizer				
U:19			Seal Water Pumps				
U:20			Gate Control				
U:21			Set Clock				
U:22			Misc				
U:23			DCS Communication				

Instruction Comment Database

Address	Instruction	Description
B28:0	COP	Copy Pump Start Shift Registers From BCM Read Buffer To Memory
C5:0	COP	Copy Counters From BCM Read Buffer To Memory
F8:60	COP	Copy Flow Totals From BCM Read Buffer To Memory
F27:0	COP	Copy Setpoints From BCM Read Buffer To Memory
N12:2	COP	Copy Storage Bits From Memory To BCM Write Buffer
N12:11	COP	Copy Timers From Memory To BCM Write Buffer
N12:221	COP	Copy Counters From Memory To BCM Write Buffer
N12:233	COP	Copy Pump Start Shift Registers From Memory To BCM Write Buffer
N12:266	COP	Copy Setpoints From Memory To BCM Write Buffer
N12:300	COP	Copy DCS Outputs From Memory To BCM Write Buffer
N12:400	COP	Copy Flow Totals From Memory To BCM Write Buffer
N12:406	COP	Copy PLC Real Time Clock From Memory To BCM Write Buffer
N33:0	COP	Copy DCS Outputs From BCM Read Buffer To Memory
S:18	COP	Copy PLC Real Time Clock From BCM Read Buffer To Memory
T4:1	COP	Copy Timers From BCM Read Buffer To Memory

Group_Name Description

SECTION 13400 - DISTRIBUTED CONTROL SYSTEM (DCS)

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall furnish all equipment and provide all needed engineering to accomplish the functional and technical requirements of these Contract Documents including, but not limited to, project management, design assistance, coordination with Operations staff, detailed system design and integration, conducting graphic development meetings, equipment supply, shipment, storage, job site delivery, programming and configuration, installation oversight, training, calibration, testing, startup, and maintenance. The DISTRIBUTED CONTROL SYSTEM (DCS) shall be provided by Emerson Process Management Power and Water solutions (Emerson) to match existing.

B. It is the intent of these specifications to have the Contractor singularly responsible for the procurement, supply, delivery, implementation and future support of all DCS equipment (i.e., hardware and software). In order to preserve this focused responsibility, the Contractor shall procure the services of Emerson to ensure the following:

1. Be the manufacturer of the DCS hardware being proposed for this project or offer the hardware in their standard product line.
2. Be the originator of all data acquisition and control software.
3. Be the integrator of all Workstation (WS) and communication software.
4. Be the programmer and integrator of all DCS functions.
5. Be the source of all DCS documentation.

For Emerson Scope of Work, please contact the following people:

Robert Eberle, Manager North America Water Pursuits
Water Automation Solutions
Emerson Process Management Power & Water Solutions, Inc.
200 Beta Drive | Pittsburgh, PA 15238
T (412)-963-4839 | F (412)-963-4447
Robert.Eberle@Emerson.com

Or

Mike Rinaldi, Proposal Engineer
Water Automation Solutions
Emerson Process Management Power & Water Solutions, Inc.
200 Beta Drive | Pittsburgh, PA 15238
T (412)-963-3613 | F (412)-963-4447
Michael.Rinaldi@Emerson.com

C. The Contractor shall be responsible for providing all equipment, labor, engineering, and services associated with integrating all of the instrumentation and Control devices, and special systems (Fire Detection, Energy Management, and control valve data links), into the DCS in a transparent and seamless manner.

D. The Contractor shall perform all project management, hardware integration, submittal preparation, configuration, training, testing, training, maintenance and warranty work at the Kearny Mesa facility close to the Metropolitan Operations Center (MOC).

E. As a minimum, the Contractor shall assume full responsibility for the following:

1. Implementation of the DCS:
    a. Provide all engineering, resources, equipment, and labor required to:
        1) Design and submit DCS hardware, software, and spare part submittals.
        2) RESERVED

3) Conduct user meetings at the Department Headquarters and at the Project site dedicated to the development of graphic criteria and design of graphic screens.

4) Submit all required graphic criteria and graphic design submittals.

5) Procure all hardware and software required to conform to these specifications.

6) Program, configure, and integrate all software into hardware platforms as required to conform to these specifications.

7) RESERVED

8) Perform an Operational Readiness Test (ORT) near the Department Headquarters or the project site to verify conformance of the DCS to these specifications.

2. Integration of the DCS with the facility:

a. Provide all engineering, resources, equipment and labor required to:

1) Reserved

2) Review all loop drawings generated for all control and instrumentation devices associated with each facility and verify system compatibilities.

3) Install DCS equipment, data communications devices, fiber optic and other communications cables and other equipment as specified in these Contract Documents.

4) Coordinate with suppliers for data link information and configure DCS data links to communicate equipment furnished by others.

5) Oversee the performance of on-site loop and commissioning tests by others.

6) RESERVED

7) Update and submit all documentation and previous submittals to reflect "as-built" or record conditions.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 13300 Instrumentation and Control

2. Section 09800 Protective Coating

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Fire Code

2. National Electrical Code

3. Underwriters Laboratory (UL) (or third-party certification that work meets UL requirements)

B. Where the requirements set forth in the Contract Documents are greater or more rigid than the mandatory requirements referenced herein the applicable portions of the Contract Documents shall govern.

C. In the case of conflict between any mandatory requirements and the Contract Documents, the mandatory requirement shall be followed in each case, but only after submitting such proposed changes to the CONSTRUCTION MANAGER for approval.

D. Nothing contained in the Contract Documents shall be so construed to conflict with any national state, municipal, or local laws or regulations governing the installation of Work specified herein, and all such acts, ordinance, and regulations, including the National Electrical Code, are hereby incorporated and made a part of the Contract Documents. All such requirements shall be satisfied by the CONTRACTOR at no additional expense to the OWNER.

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1.	ISA-S5.1	Instrument Symbols and Identification
2.	ISA-S5.4	Instrument Loop Diagrams
3.	ISA-S12.4	Instrument Purging for Reduction of Hazardous Area Classification
4.	ISO 9001	Quality systems - Model for Quality Assurance in Design/Development, Production, Installation and Servicing
5.	SAMA	Scientific Apparatus Makers Association (SAMA) SAMA-PMC-33.1
6.	IEEE 812	Standard Definitions of Terms Relating to Fiber Optics
7.	EIA/TIA-568	Commercial Building Telecommunications Wiring Standard

1.5 ELECTRONIC DOCUMENT SUBMITTALS

A. All final submittals are required in both paper and electronic format. One copy of each final submittal shall be provided on DVD.

B. Where preliminary submittals are required in electronic format, one copy of the preliminary submittal shall be provided on DVD for the City's review.

C. File Requirements:

1. Documents shall be in Adobe Acrobat PDF format, version as specified by the Contract Manager. Vendor and CONTRACTOR shop drawings developed under the Contract shall be in Bentley Microstation (.DGN) format. Documents in electronic format (, Microsoft Word, Excel, etc.) shall be converted to standard PDF format using the Acrobat printer driver.

2. Deviation from this standard will be accepted only if advance approval is given by the Project Manager.

3. Documents not available in electronic format shall be scanned at 300 dpi, bitonal (black and white) and converted into Adobe Acrobat (PDF). Scanned image enhancement software shall be used. PDF sub-format shall be full Image + Hidden Text PDF file format.

4. All PDF documents shall be reviewed, and corrected if necessary, for orientation and legibility.

5. Individual document files shall not exceed 3 megabytes in size.

D. Document Organization and Indexing:

1. Submittals shall be logically organized. File names shall be in UPPERCASE only, a maximum of 64 characters, contain no spaces, and clearly indicate the file contents.

2. Supplier's submittals that include O&M documentation for more than one equipment item shall be divided into separate documents for each equipment item.

3. Each document's Table of Contents shall be bookmarked to the referenced sections within the document.

4. A master PDF index file shall be generated, with a master Table of Contents, and links to individual document files. External PDF link file names shall be in uppercase only.

5. A table shall be provided and submitted in spreadsheet format which includes the information about each document file. The contents of the table shall be submitted and approved by the Project Manager. An example of information to be provided is as follows: (This is an example only)

a. Document file name

b. Document title and description

c. Hard Copy Catalog No. (used by facility document coordinator)

d. Document Type:

1) Design

a) Design Specifications

b) Design Drawings

2) Operations

a) Facility design O&M manuals

b) Facility manufacturer O&M manuals

c) Standard Operations Procedures

d) Record Drawings

3) Maintenance

a) Maintenance Management System

b) Facility Loop and Wiring Diagrams

4) Training

5) Student study guide

6) User guides

7) User manuals

e. Environmental

f. Engineering

g. Research & Development

h. Division Processes and Procedures

i. Facility Name

j. Specification Number

k. Process Name

l. Unit Process Number

m. Manufacturer's Name (if applicable)

n. Supplier's Name (if applicable)

o. EMPAC asset number (if applicable)

p. Asset Description (if applicable)

1) Keyword

2) Qualifier

1.6 SHOP DRAWINGS AND SAMPLES

A. The CONTRACTOR shall prepare and submit complete and organized shop drawings, as specified herein. Incomplete or partial submittals are not acceptable. All shop drawings and record drawings shall be submitted in hard and electronic copy. All drawing shall be developed in Bentley Systems MICROSTATION CAD software.

B. The CONTRACTOR shall provide a project loop drawing submittal (PLDS) to verify the DCS interfaces with all instrumentation and devices being provided. For each DCS input/output, the DBC shall note on the PLDS the following information:

1. PCM number and physical location.

2. Type of input.

3. Tag number

4. I/O card location and address.

5. All DCS-dependent displayed functions using ISA symbology.

6. Drawing reference for DCS software content.

C. In these Contract Documents all systems, all meters, all instruments, and all other elements are represented schematically, and are designated by symbology as derived from Instrument Society of America Standard ISA S5.1 (latest revision). The nomenclature and numbers designated herein and on the Drawings shall be employed exclusively throughout shop drawings, and similar materials. Any other symbols, designations, and nomenclature unique to any manufacturer's standard methods shall not replace those prescribed above, used herein, and on the Drawings.

D. All shop drawings shall include the letter head and/or title block of the CONTRACTOR. The title block shall include, as a minimum, the CONTRACTOR's registered business name and address, project name, drawing name, revision level, and personnel responsible for the content of the drawing. The quantity of submittal sets required shall be as specified in Section 2.5.3.3, "Contractor Submittals".

E. The DCS hardware submittal (DCSHS) shall be a singular all inclusive submittal which shall include, but not be limited to:

1. A complete set of system diagrams which depict:

    a. All Process Control Modules (PCMs), communication devices, network equipment and communication links.

    b. All conduit and wire required to support the power, ground, Input/Output, and communication requirements of the system. A separate diagram shall be submitted for each DCS component fully annotated with conduit size, number, associated with the power source. All conduit and wire numbers shall be consistent with the numbering system shown in these Contract Documents.

    c. All separation requirements between signal, power and communication conductors shall be clearly shown.

2. Comprehensive power diagrams which shall show and identify each component of each system and shall show which components require a nominal 110 volt, 60 Hz power source. Where a voltage regulator is required, it shall be included.

3. Technical data sheets for each component together with a technical projects brochure or bulletin which show:

    a. The component name as used on project drawings and in these specifications.

    b. Manufacturer's model number or other identifying product designation.

    c. The project tag number.

    d. The project system of which it is a part of.

    e. The project site to which it applies.

    f. Input and output characteristics.

    g. Requirements for electric power.

    h. Specifications for ambient operating condition.

    i. Details on materials of construction for those components to be field mounted.

4. Site-specific arrangement and construction drawings for all DCS equipment cabinets, including dimensions, identification of all components, preparation and finish data, nameplates, and the like. All drawings shall be accurately scaled and show the position of the equipment in its intended installation location. All drawings must show a scaled representation of the placement of all DCS equipment being provided under this contract and its spatial relationship to all other equipment (both new and existing) located in the abutting and adjoining areas. All acquired access and clearances associated with the DCS equipment and other equipment must be shown with a statement of compliance to manufacturer’s recommendation, NEC and other applicable codes. All drawings must be drawn to a 1/2-inch = 1 foot scale.

5. Installation, mounting and anchoring details for all components and assemblies to be field mounted, including access requirements, conduit connections or entry details. All details must be site specific.

6. Calibration, adjustment and test details for all components and systems.

7. Complete and detailed bill of material.

8. Calculations shall be submitted to verify each network=s optical power budget. Calculations shall include the PMD being used, transmitter output power level (dbm), receiver input power level (dbm), losses generated by splices, connectors, and repeaters. The resulting calculations shall represent the allowable end-to-end optical link budgets for use in designing the network.

9. The hardware submittal copies shall be numbered, with controlled distribution. Updates for the DCS Hardware submittal shall be issued whenever the hardware configuration or equipment supplied changes as a result of change orders, requests for substitution or any other procedure. Updates shall be clearly marked as to the pages to be removed and replaced. Updates shall be issued to all holders of controlled distribution copies.

F. The DCS Software Submittal (DCSSS) shall be included in a singular all inclusive submittal which shall include but not be limited to:

1. A complete set of all available software algorithms.

2. A complete set of control strategies which depict all monitoring and control functions on a loop by loop basis, in a modified SAMA-type format.

3. An English narrative of each data acquisition or control loop mission and anticipated action. Narratives shall enumerate the signal point name, signal descriptor, associated PCM number, associated system template displays, system functions activated by signal (i.e., interlocks, alarms, logs, etc.).

4. A complete set of annotated module configuration sheets depicting each loop linkage.

5. A complete listing of the DCS data base listing for each data points relevant parameters such as range, contact orientation, limits, incremental limits, I/O card type, I/O hardware address and assignment.

6. Detailed descriptions of procedures used to implement and modify control strategies and data base construction.

7. The software submittal copies shall be numbered, with controlled distribution. Updates for the DCS Software submittal shall be issued periodically or upon major software configuration changes occur as a result of change orders, requests for substitution or any other procedure. Updates shall be clearly marked as to the pages to be removed and replaced. Updates shall be issued to all holders of controlled distribution copies.

G. The DCS Graphic Submittal (DCSGS) shall reflect the results of process graphics meetings held for the facility. These meetings shall be chaired by the CONTRACTOR and attended by a user group participants and the CONSTRUCTION MANAGER. The CONTRACTOR shall allocate 0.5 hours of meeting time per custom graphic display defined in Table A-1. The DCSGS copies shall be numbered, with controlled distribution. Updates for the DCSGS shall be issued after each meeting or upon major graphics configuration changes. Updates shall be clearly marked as to the pages to be removed and replaced. Updates shall be issued to all holders of controlled distribution copies. Subsequent to the successful review of the DCSGS, the CONTRACTOR shall submit for each facility:

1. One complete set of all WS accessible displays which are unique to this project (i.e., process global, system global, process regional, systems regional, process group, process loop, process component, integrated tutorials, integrated process tutorials, integrated documentation, user assistance). These displays shall be in full size color graphic format and replicate the proposed screen contents. All background colors shall be identical to that of the screen content. All displays shall be arranged in a hierarchical order with references to associated WSs.

2. A system display linkage diagram which defines the hierarchical order and the linkages via page, down, left, right commands.

3. A definition of each displays data fields by tag numbers.

4. A definition of each displays dynamic elements which shall blink, change color, rotate or change shape in response to process changes.

5. A listing of all "help" text associated with each display screen.

6. The software submittal copies shall be numbered, with controlled distribution. Updates for the DCS Software submittal shall be issued periodically or upon major software configuration changes occur as a result of change orders, requests for substitution or any other procedure. Updates shall be clearly marked as to the pages to be removed and replaced. Updates shall be issued to all holders of controlled distribution copies.

H. The CONTRACTOR shall submit the procedures proposed to be followed during the tests required under this project. Procedures shall include statement indicating test objectives, test descriptions, forms, and checklists to be used to control and document the required tests. Prior to the preparation of the detailed test procedures, the CONTRACTOR shall submit outlines of the specific proposed tests. Submittal shall include examples of the proposed forms and checklists. Once the Preliminary Test Procedure Submittal have been reviewed by the CONSTRUCTION MANAGER and returned stamped either "no exceptions noted" or "make corrections noted", the CONTRACTOR shall submit the proposed detailed test procedures, forms, and checklists. Once the detailed Test Procedures Submittal have been reviewed by the CONSTRUCTION MANAGER and returned stamped either "no exceptions noted" or "make corrections noted", the tests may be scheduled. Upon completion of each required test, document the test by submitting a copy of the signed-off test procedures shall be submitted as test documentation. These requirements shall apply to the factory testing of all panels, and all on-site tests. The CONTACTOR shall submit a detailed ORT

specification to the CONSTRUCTION MANAGER at least 6 weeks in advance of commencement of the ORT.

I. RESERVE

1. RESERVE

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3. RESERVE

1.7 OWNERS MANUAL

A. The organization of the preceding shop drawing submittal shall be compatible to eventual inclusion with the Operations & Maintenance Manual submittals for this facility and shall include final alterations reflecting "record" conditions. Submittal not organized as described herein and incomplete submittals for a given Loop shall not be accepted. Accordingly, the initial multiple-copy shop drawing submittal shall be separately bound in a standard size, 3-ring, loose-leaf, vinyl plastic, hard cover, binder suitable for bookshelf storage. Binder ring size shall not exceed 3-inches. Five (5) final sets of technical manuals shall be supplied for the OWNER in accordance with Section 2.5.3.5, "Contractor Submittal", and one final set shall be supplied for the CONSTRUCTION MANAGER, as a condition of acceptance of the project.

1. Initially, 2 sets of these manuals shall be submitted to the CONSTRUCTION MANAGER for review after return of favorably reviewed shop drawings and data required herein. Following the CONSTRUCTION MANAGER's review, one set will be returned to the CONTRACTOR with comments. The sets shall be revised and/or amended as required and the requisite final sets shall be submitted to the CONSTRUCTION MANAGER 15 days prior to start-up of systems. The CONSTRUCTION MANAGER will distribute the copies.

2. In addition to updated shop drawing information reflecting actual existing conditions, each set of technical manuals shall include installation, connection, operation, troubleshooting, maintenance and overhaul instructions in complete detail. This shall provide the OWNER with comprehensive information on all systems and all components to enable operation, service, maintenance and repair. Exploded or other detailed views of instruments, assemblies and accessory components shall be included together with complete parts lists and ordering instructions.

3. Repair parts list for each item (as applicable); such lists shall contain the name of each item, purchase order number, model/serial number, and the recommended repair parts to stock, along with the catalog, part, or piece number of each such repair part.

4. Outline dimensional drawings and assembly drawings and the names of the parts.

5. Copies of maintenance specifications, schedules, and instructions.

6. Copies of operation and adjustment instructions for all equipment and components.

7. Processor, peripheral, and data communications equipment instruction, reference, wiring, and option manuals.

8. Software manuals and program source and object listings, annotated in clear English, technically correct flow charts, narrative descriptions, diagnostics, and user's guides. Permanent copies of all programs on magnetic tape/CD shall be provided for the OWNER's use. Software documentation shall include full instructions on how a program is used, including execution procedures and system software dependency.

9. System test plans and procedures.

10. Simple, English language instructions on how to operate the system through the Workstation (WS).

11. All Operations and Maintenance materials, including shop drawings and standard DCS manuals and documentation, shall also be submitted in an electronic format. All text files shall be in Microsoft Word for Windows. Electronic data shall be submitted on DVD medium.

1.8 AS-BUILT DRAWINGS

A. As-built drawings shall be prepared in accordance with Section 2.5.3.5 with the following exceptions and changes:

1. The CONTRACTOR shall keep current an approved set of complete DCS loop drawings, PIDs, control descriptions, Input/Output termination lists, control schematics, DCS installation drawings, UPS installation drawings, network conduit and cable routing drawings, and test reports. These drawings shall include all devices furnished under this specification and interfaces with all other devices furnished under this specification and interfaces with all other devices which communicate with the DCS.

2. One set of original drawings and two copies of each as-built drawing under this Section shall be submitted to the CONSTRUCTION MANAGER after completion of field checkout, but before placing the systems in service for the OWNER'S use.

1.9 SERVICES OF MANUFACTURER

A. The CONTRACTOR shall provide job site visits and services of manufacturer's technical field representatives for all equipment which is furnished by others. Job site visits shall occur during the calibration, testing and start-up phase of the project.

1. The CONTRACTOR shall provide the services of competent field technicians to oversee the installation, testing, calibration, start-up, operation and maintenance of the equipment provided under this Section.

2. Provide all necessary assistance to instruct the OWNER's representative in regard to the operation of the equipment supplied. This assistance shall be provided during the start-up phase of the project and the first year of the facility operation following project completion and OWNER acceptance.

1.10 GUARANTEE

A. The CONTRACTOR shall guarantee the WORK of this section.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

A. After the successful completion the Operational Readiness Testing, and subsequent to the site construction progressing to a point where the intended locations for DCS equipment are complete and free from exposure to on-going construction, all equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weight shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site. Special instructions for proper field handling, storage, and installation required by the manufacturer for proper protection, shall be securely attached to each piece of equipment prior to packaging and shipment.

B. Each component shall be tagged to identify its location, tag number, and function in the system. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment under this Section. Identification shall be prominently displayed on the outside of the package.

1. Equipment shall not be stored outdoors. Equipment shall be stored in dry permanent shelters, including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the CONTRACTOR at their own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such test such as directed by the CONSTRUCTION MANAGER. This shall be at the cost and expense of the CONTRACTOR, or the apparatus shall be replaced by the CONTRACTOR at their own expense.

1.12 QUALITY ASSURANCE

A. The CONTRACTOR shall have instituted a quality assurance program which utilizes organized methodologies and industry standards. All manufacturing, design, development, production, installation, and field service resources of the CONTRACTOR shall be certified as conforming with all of the requirements of international quality standard ISO 9001. The certification shall be submitted to the CONSTRUCTION MANAGER. This certification shall be a "Certification of Quality", from an internationally recognized certification agency. The program shall include the following aspects at a minimum:

1. System of traceability of manufactured unit and system software throughout development, production and testing.

2. System of "burn-in" for all components and available supportive documents.

3. Demonstrated record of prompt positive response to field failures.

4. Record of prompt shipments in accordance with contract obligations.

5. Documented program of failure analysis.

6. Quality assurance organization which complies with ISO 9001 guidelines.

7. Documented product safety policy relevant to all products intended to be furnished under this Contract.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Current Technology:** All hardware and software shall be the most recent field-proven models and revision levels marketed by their manufacturers at the time of proposal submission. It is the intent of the Department to obtain a DCS which utilizes state-of-the-art products in the DCS manufacturer's product line. Products within the DCS manufacturer's product line which have been superseded by newer, more advanced devices shall be acceptable. Successful operation and calculation shall be demonstrated during startup and testing.

B. **Hardware and Software Commonality:** Where there is more than one item of similar equipment, being furnished under this contract, all such equipment shall be the product of a single manufacturer and feature the interchangeability of parts. Minor deviations from this requirement are acceptable when specific technical requirements impose a deviation in the specifications. In case of a discontinued or upgraded product, or other cases where changing technology requires changes in equipment, the CONTRACTOR shall submit a Substitute Item Request Form. All equipment shall be of modular design to facilitate interchangeability of parts and to assure ease of servicing. This interchangeability shall apply to the following components, as a minimum, of the DCS.

1. Processor Modules

2. Bulk Memory Modules

3. Communication Interface Modules

4. Analog and Discrete Signal Modules

5. Power Supply Modules

C. **Fault Tolerant:** Where a system processor is indicated to be redundant, that unit shall function as a fault tolerant device. Fault tolerant processing shall consist of two parallel-operation processors (electronics) with separate connections to the system communication network. Both processors shall receive and process information simultaneously, with faults detected by the processors themselves. A fault tolerant configuration shall provide synchronous read/execute/compare capabilities with no database transfer. Upon detection of a fault, self-diagnostics shall be run by both processors to determine which processor is defective. The non-defective processor shall then assume communication without affecting normal system operation. Upon replacement of the defective processor, the operator shall initiate the processor and

initiate a command from the workstation to download the database and control logic from the active processor. The operator shall then choose to initiate a transfer to the replaced processor. Alternatively, the download may occur automatically on processor replacement. The use of backup, "hot standby", or "automatic switch over" configurations are acceptable if the transition from failed device to backup device does not degrade the process monitoring and control system or the system's availability.

D. Environmental Suitability: All DCS devices provided under this contract shall be provided with enclosures which are suitable for use in a treatment facility environment where there are typically high energy AC fields, DC control pulses, and varying ground potentials between the transducers or process instrument locations and those occupied by DCS components. The system design shall be adequate to provide proper protection against interferences from all such possible situations. As a minimum, all DCS equipment shall be resistive to airborne contaminants commonly found in wastewater treatment facilities, and be suitable for installation in an environment which conforms to a G2 classification as defined by ISA-S71.04.

1. **Field-Situated Equipment**: DCS equipment being furnished under this contract shall be suitable for use in wastewater treatment facilities, some of which are in an environment of salt-sea laden air with traces of methane and hydrogen sulfide. The system design shall be adequate to provide proper protection against such an environment. All field-situated equipment including PCMs shall be UL-listed or certified by a qualified third-party as meeting UL requirements. All DCS devices shall be housed in an enclosure suitable for its intended service and installation location. All DCS devices to be installed in MCC or other protected areas shall be furnished in NEMA 1 rated enclosures. All DCS devices to be installed in indoor unprotected areas shall be furnished in NEMA 12 rated enclosures. All DCS devices to be installed in indoor areas subject to hose-down conditions, or outdoor areas, shall be furnished in NEMA 4X rated stainless steel enclosures. All DCS devices to be installed in areas where corrosive agents are present in quantities which exceed the warranty limits of the equipment (Headworks, Digesters, Solids Handling, etc) shall be furnished in purged, refrigerated/ air scrubbed NEMA 4X rated stainless steel enclosures. As a minimum, the DCS shall be designed and constructed for satisfactory, long, and low maintenance operation under the following environmental conditions;

   a. Temperature Range: 0 through 50 degrees C (32 through 122 degrees F)

   b. Thermal Shock: 0.55 degrees C (1 degree F per minute maximum)

   c. Relative Humidity: 5 through 95 percent (non-condensing)

2. **Control Room-Situated Equipment**: Each Area control room or central control room will be normally air conditioned to maintain environmental conditions defined herein. No positive control of relative humidity is provided or contemplated. DCS equipment shall meet the following environmental requirements:

   a. PCMs:

1) Temperature Range: Storage: -40 to 70 degrees C; Operating: 0 to 50 degrees C.

2) Thermal Shock: 6 degrees C maximum rate of change in 30 minutes.

3) Relative Humidity: Storage: 0 to 100% non-condensing

4) Operating: 5 to 95% non-condensing

b. WS

1) Temperature Range: Storage: -40 to 70 degrees C

2) Operating: 0 to 40 degrees C.

3) Thermal Shock: 6 degrees C maximum rate of change in 30 minutes.

4) Relative Humidity: Storage: 5 to 95% non-condensing

5) Operating: 5 to 95% non-condensing

3. **Noise Tolerance:** The CONTRACTOR shall furnish and install sound adsorption materials within/over (i.e., printer covers) DCS equipment enclosures to be installed in those area control centers where DCS devices share work space with personnel to ensure that, with only the DCS equipment operating, the ambient dB level is 55 dB or less when monitored three (3) feet from the operating DCS equipment.

4. **Environmental Operating Range:** All indoor and outdoor enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Control Documents. Heating, cooling, and dehumidifying devices shall be incorporated in order to maintain all devices 20% below their rated environmental operating ranges. The CONTRACTOR shall furnish all internal power wiring for these devices (i.e., heaters, fans, etc.). Enclosures suitable for the environment shall be furnished. All instrumentation in hazardous areas shall be suitable for use in the particular hazardous/classified location in which it is to be installed, and be in conformance with the National Electrical Code (NEC).

5. **Surge and Radio Interference:** All DCS devices shall be IEEE surge withstand qualified. Radio Frequency Protection (RFI) shall conform to SAMA-PMC-33.1.

6. Each PCM shall be provided with an RTD which reports the control room temperature excursions associated with PCM enclosures. For those PCM enclosures which utilize purging, sensors shall be provided which report to the control room to high temperature, low pressure, and "door ajar" conditions. All I/O and sensors associated with enclosure monitoring are to be furnished by the CONTRACTOR.

E. **Equipment Locations:** The DCS configurations indicated are diagrammatic. The locations of equipment are approximate. The exact locations and routing of wiring and cables shall be governed by structural conditions and physical interferences and by the

location of electrical terminations on equipment. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. Where job conditions require reasonable changes in approximated locations and arrangements, or when the OWNER exercises the right to require changes in location of equipment which do not impact material quantities or cause material rework, the CONTRACTOR shall make such changes without extra cost to the OWNER.

F. **Alternative Equipment and Methods:** Equipment or methods requiring redesign of any project details are not acceptable without prior written approval of the CONSTRUCTION MANAGER. Any changes inherent to a proposed alternative, including design modifications, shall be at no additional cost to the OWNER or CONSTRUCTION MANAGER. The required approval shall be obtained by the CONTRACTOR prior to submittal of shop drawings and data. Any proposal for approval of alternative equipment or methods shall include evidence of improved performance, operational advantage and maintenance enhancement over the equipment or method specified, or shall include evidence that a specified component is not available.

G. **RESERVED**

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J. **PRIMARY SYSTEM COMPONENTS:** The DCS shall consist of the following primary components;

1. Process Control Modules (PCMs): PCMs shall be directly hardwired to process I/O, intelligent transmitters, and Programmable Logic Controllers (PLCs). All PCMs shall be fault tolerant. PCMs shall receive power from dedicated UPS or, in the event of a failure to the UPS, from the supply power to the UPS. Each PCM shall contain all of the required data acquisition, alarming and control strategies required to monitor and control its associated process. PCMs shall be configured by operator interface devices called Workstations (WS) which utilize object-oriented interactive editors to download database and control configurations over the Process Information Network (PIN). The failure of any other DCS device shall not affect the monitoring and control capabilities of the PCMs. PCMs shall dual ported to communicate with other DCS devices over the Process Information Network (PIN). For additional PCM requirements, see paragraph 2.2.

2. Process Inputs/ Outputs (I/O): All process I/O shall be terminated in an enclosure which is proximal or integral with the PCM that is associated with the I/O. All I/O modules shall be IEEE surge withstand qualified with individual A/D and D/A converters on a per-point basis.

   a. If the DCS manufacturer's analog input/analog output I/O boards do not provide A/D and D/A conversion on a per-point basis, or adequate signal isolation, the CONTRACTOR shall:

      1) Furnish spare analog input/analog output or AD/DA boards to conform to the per-point requirement (i.e. if a board has 8 inputs which share an A/D, seven spare analog input boards or seven spare A/D converter boards shall be furnished.

      2) Partition I/O so that the failure of an I/O board will not disable a control strategy. If the implementation of this partitioning results in the need to provide additional analog input/analog output boards, they shall be furnished by the CONTRACTOR at no additional cost to the Owner.

      3) Furnish and install signal isolators on the field side termination assembly of the PCM on a per-point basis.

   b. For additional requirements, see paragraph 2.3.

   c. All I/O shall be optically isolated. Process I/O shall accept the following variations:

      1) Analog Inputs To DCS

         a) Four (4) wire transmitters shall provide an isolated 4 to 20 mA signal.

         b) Two (2) wire transmitters shall provide an isolated 4 to 20 mA signal powered from dc power supplies internal to the DCS.

         c) The DCS shall have a fixed 4-20 ma analog input load of 250 ohms. Provision shall be made to ensure continuity of the loop independent of the DCS equipment status.

      2) Analog Outputs From DCS

         a) Outputs shall be isolated 4 to 20 mA dc signals powered from the DCS

         b) Signal shall be capable of driving a loop impedance of 0 to six hundred (600) ohms or greater.

      3) Discrete Inputs To DCS

         a) Inputs shall be unpowered, isolated contact closures rated at 1A at 24 V dc. Contacts shall be of nobel metal or hermetically sealed.

b) The DCS shall monitor the inputs using internal 24V dc power supplies.

c) Field contacts for alarms will be wired to discrete inputs in a "fail-safe" mode; i.e. an open wire will result in an alarm.

4) Discrete Outputs From DCS

a) Outputs shall be unpowered, isolated contacts rated at 5 amps, 120V ac.

b) 120V ac power for sensing all discrete outputs shall be provided external to the DCS.

5) Intelligent Transmitter Interface To DCS

a) Intelligent transmitters shall communicate with the DCS using a bi-directional communication interface.

b) The DCS interface shall enable remote transmitter configuration and simultaneous DCS database updating from a DCS workstation (WS).

d. Programmable Logic Controller (PLC) Interface With DCS

1) The instrumentation panels to be provided under Section 13300 shall be provided with PLC controllers and membrane LED displays in lieu of the specified relays and window-box annunciators.

2) PLCs shall communicate with the DCS using serial communication cables furnished and installed by others. Protocol shall be one of the following:

a) Modbus RTU, with the PLC acting as the slave.

b) Ethernet

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a. RESERVED

b. RESERVED.

4. **Process Information Network (PIN)**: The PIN shall consist of communications processors and fiber optic cables all of shall be dual ported into all connected DCS devices. The PIN, in its installed configuration shall be fault tolerant. The PIN provides connectivity between the WSs, PCMs, and the Historian System (HS) to enable the timely update and archiving of process information and timely control response. For additional PIN requirements, see paragraph 2.4.

5. **RESERVED**

6. **Facility Information Network (FIN):** The FIN shall provide connectivity between the DCS and plant facility management systems. The FIN shall specifically have connectivity to WS and HS devices using X-Window facilities. For additional FIN requirements, see paragraph 2.4.

7. **Department Information Network (DIN):** The DIN shall provide connectivity between the all Department facilities and resources by virtue of a network which incorporates high-speed fiber, and telephone data links and radio technology. For additional DIN requirements, see paragraph 2.4.

2.2 PROCESS CONTROL MODULES

A. **General**: The PCM shall be a 32 bit microprocessor with on-board random access memory (RAM) for read/write functions. The PCM, in conjunction with field Input/Output (I/O) modules shall perform all system data acquisition, alarm detection, regulatory, logic, timing and sequential process control. PCMs shall perform continuous control, sequential control, and data acquisition concurrently in the same microprocessor. PCMs shall communicate with the Historian System (HS), Workstations (WS) over the Process Information Network (PIN). All PCMs shall be fault tolerant and be provided with the implemented built-in capability to provide continued correct execution in the presence of the failure of a common logic board or software faults. Failover from one processor to another shall occur within 1000 ms**.** Each PCM shall be supplied to provide complete redundancy (excluding I/O) configured for fault tolerant processing via standard system configuration procedures. Fault tolerant features shall each include, but not be limited to, control processors, power supplies, wiring and buses. PCM's shall be remotely configurable from WSs over the PIN. Each PCM shall have the capacity to accommodate a minimum of 2000 field-originated I/O points, without requiring additional memory or processors, assuming a mix of 25% analog I/O and 75% discrete, with 50% of memory reserved for control logic

B. **Communications:** PCM's shall communicate with each other directly in a peer-to-peer manner using peer protocol or logical link protocol in which the sequence of message exchanges between two entities in the same layer is facilitated by utilizing the services of underlying layers to effect the successful transfer of data/control information from one location to another location.

C. **PCM Functionality:** Independent of the operation or failure of any other DCS device, the PCM shall perform the following core or essential functions;

1. Real-time data acquisition at scan rates specified at the WSs.

2. Perform input signal smoothing, averaging, or totalization, as required.

3. Alarm limit checking for absolute limits, deviation rates, or warning limits on designated variables.

4. Real-time process control based on logic and control strategies downloaded from the WSs to the PCM's over the PIN.

5. Communicate variable data information (i.e., current value, alarm status, set point, output control constants, etc.) to the HS and WSs.

6. Communicate with all other system processors regardless of their function without the need for hardware or software gateways. Respond to interrogations for data and receive downloaded operating system, processing records, point data base information and updated parameters for application programs operating in the PCM.

7. Perform regulatory, logic and sequential control based on configuration data written in a high level process oriented control language, compiled, and downloaded to the PCM.

8. Have an extensive array of self-diagnostics which test and report on the integrity of each printed circuit board in the common logic file in addition to I/O failures. Errors and/or failures shall be indicated locally by Light Emitting Diode (LED) and reported at the WSs.

9. The PCM shall function as a stand-alone unit which performs all of the functions described herein completely independent from the functioning of the HS device, WSs, the PIN, bridges, routers or other PCMs, i.e., a failure. Any device furnished under this section or other PCM(s) shall not impact data acquisition, control, scaling, alarm checking, or communication functions of a given PCM.

D. **PCM Hardware Component Platform**: Each PCMs hardware platform shall use fully redundant Intel or Intel-compatible microprocessors, each with its own bus connection. No hard disks or other moving parts shall be used. The PCM shall consist of the following components:

1. **Microprocessor Unit**: The microprocessor CPU shall be a CISC- complex Instruction Set Computer or a RISC-Reduced Instruction Set Computer. The CPU shall conform to the following:

   a. Intel-compatible 32 BIT processor, 400 MHz or faster

   b. Floating point processor.

   c. Crystal controlled real time clock.

   d. Power fail/auto restart.

   e. Watch dog timer protection (hardware or API).

   f. Redundant isolated power supplies (may be shared with I/O)

   g. Serial interface to process I/O.

   h. Priority interrupt driven.

2. **Memory**: CPU memory shall be on-board and shall conform to the following:

   a. CMOS shared RAM memory with battery backup. After the configuration of all database and control strategies which incorporate the current I/O quantities plus the 20 percent growth required under 2.1 G, each PCM shall have 25

percent of its memory which is dedicated to (1) the storage of database and control strategies and (2) field I/O termination points unused with both resources available for future expansion. Requirements for spare memory capacity may be, on approval by the Engineer, applied on a Facility basis.

b. Cache memory which is positioned between the CPU and the bus which maintains a copy of referenced data from the shared memory.

c. CMOS-ROM or EPROM in which firmware and the operating system resides.

3. An itemization of PCMs required for the Facility is located in the Appendix and defines the current I/O allocations associated with each device. These totals do not include spare I/O points and spare resources as defined in paragraph 2.1 of this section.

2.3 PROCESS INPUTS/OUTPUTS (I/O)

A. General: Process I/O modules shall be rack mounted or DIN rail-mounted in an enclosure which is proximal or integral to/with the associated PCM. All process I/O boards shall be slot independent i.e. any I/O card can occupy any card slot. The backplane of the I/O nest shall permit the removal of I/O cards without the need to remove power from the I/O card being removed. All process I/O channels shall be electrically isolated (input isolated, output isolated, and power isolated) from field terminations and adjacent channels as defined in ISA-S50.1.

B. All I/O boards shall conform to ANSI/IEEE C37.90-1989 for surge withstand capability and EN50082-2 for electromagnetic compatibility immunity.

C. Analog input boards shall provide 120 dB at 50 or 60 Hz and 60 dB common mode and normal mode noise rejection respectively. Analog Input boards shall have an on-board isolation of 500 DCV pr peak ac between channels or channel to ground.

D. Analog input boards or modules shall be provided to interface with process I/O and intelligent transmitters as follows;

1. Analog input boards shall be provided to accept 4-20 mA, pulse frequency, and thermocouple (Type K,T,J,R,S) inputs. Through board level jumper selection on a point-by-point basis, the analog input channel can act as either source for two wire transmitters) or sink (four wire transmitters). Each analog input shall have a minimum of 12-bit resolution, minimum accuracy of plus or minus 0.1 percent, maximum long-term drift of 0.02 percent, and a dedicated A/D converter.

2. Intelligent transmitter modules (ITMs) which allow receiving continuous self-diagnostic data shall be provided. The reading of transmitter data or value shall not disturb or interfere with the reading of the measurement signal.

a. Intelligent process instrumentation shall be directly connected to the DCS through a bi-directional digital communication interface at the PCM. Analog transmission of variables from intelligent transmitters shall not be acceptable.

b. Each ITM shall contain a minimum of six (6) individual channels, each of which provides isolated power and communication to the intelligent device. All digital communication with the intelligent process instrumentation from the DCS WS shall be in engineering units and shall be received a minimum of ten (10) times per second. Each message shall contain the following;

   1) Primary measurement information such as flow, pressure, level, etc.

   2) Transmitter temperature readings in a 32 bit floating point format which complies with IEEE.

   3) Data security information

   4) Diagnostic information

   5) Message checking

c. Information (when available from the field instrument), which shall be displayable at any DCS WS, shall include:

   1) The assignment of configurable parameters such as tag number, location, address, tag name, designation of digital or 4 to 20 mA output, upper and lower range values, zero elevation or suppression, linear or square root output for d/p cells, and damping time.

   2) Perform a loop integrity check.

   3) Rearrange without using calibrating input pressure.

   4) Display the 4 to 20 mA signal in terms of percent of span, or engineering units.

   5) Last calibration date.

   6) Fail-safe direction.

   7) Read process variables in user selected engineering units.

   8) Diagnose problems and determine fault between processor or transmitter.

d. All ITMs shall be slot independent. ITM operation shall not be impacted in the event that one of a pair of fault tolerant PCM processor fails.

e. The transmitter bus provided shall where indicated provide ISA SP50, or ISP (InterOperable Systems Project) connectivity.

f. In addition to ISA SP 50 and ISP conformity, all ITM devices shall be furnished to communicate with devices which use the HART protocol.

E. Analog output boards shall be provided to output 4-20 mA commands. Each analog output shall have a minimum of 12-bit resolution, accuracy of 0.1 percent of full scale, and a dedicated D/A converter.

F. Discrete input boards shall be of the voltage monitoring type and shall be powered by the PCM. The discrete input board shall accept 24 V dc.

G. Discrete output boards shall be unpowered isolated contacts rated for 5 amps at 120 V ac.

H. PLCs shall interface to the DCS through a foreign processor interface (FPI) which is defined as follows;

1. The DCS shall be provided with an integrated foreign processor interface (FPI) in the PCM which supports monitoring and control of the PLC. The FPI shall support the following protocols: MODBUS (master), Allen-Bradley DF1. The FPI shall be fault-tolerant and redundant where indicated.

2. The DCS shall have an open architecture which shall enable the FPI to provide a means of integration of with multiple vendors in a manner which is transparent to the user at the WS level. All of the data associated with the FPI shall appear at the WS as being identical in format and presentation to data derived from PCMs. All WS interaction functions that the operator uses to monitor and control inputs/outputs associated with the PLC(s) shall be identical as those used by the operator to interact with inputs / outputs associated with the PCM(s).

3. The FPI shall be provided to interface with all PLCs which provide inputs/outputs to the DCS.

4. The FPI shall support the following functions;

a. PLC-derived data shall appear identical to PCM-derived data in the process I/O data base for PCM-to PCM communications.

b. The ability to have closely-coupled continuous and sequential control strategies which involve PCM and PLC coordination.

2.4 COMMUNICATION SYSTEMS

A. **General:** Data communication subsystems shall be comprised of industrial grade redundant communication buses that provide high speed data transmission between all distributed processors and I/O modules. Each communication network shall be designed around the International Standards Organization's Open System Interconnection (OSI) model, IEEE 802 or ANSI X3T12 industry standards and support a hierarchical communications network. Communications shall be masterless with communications residing in each distributed processor. All communication cables shall be installed in conduits. The CONTRACTOR shall review the contract drawings to review the current communications system design. The CONTRACTOR shall furnish all cable required to accommodate the communications system being provided. The PIN and the FIN may be integrated into a single network, provided that the PIN real-time data uses synchronous mode transmission.

B. **Low-Level Protocols**: Physical and data link layer protocols shall support local area networks (LANs), metropolitan area networks or wide area networks (WANs). Information shall be conveyed in packets with a sustained signaling rate of at least 2 million bits per second.

C. **Mid-Level Protocols**: Network and transport layer protocols shall provide addressing and routing facilities to enable a host on one network to send a block of information to host located on another network thereby expanding a host's communication environment from a single network to a network of networks, or an ethernet, joining addressable hosts. Mid-level protocols shall support the implementation of half-gateways i.e., LAN - backbone coupling and full gateways i.e., LAN-LAN couplings. Node-node gateways shall perform protocol translation and if necessary implement virtual circuits where required. For those applications which access the network layer directly, a programming interface shall be implemented in the packet network to facilitate the use of datagrams i.e., blocks of information embedded within single packets which can be sent to individual hosts without using additional protocol software.

D. **High-Level Protocols**: The Session, Presentation, and Application Layers shall use the transport mechanism provided by the Mid-Level Protocols to implement a distributed computational environment. Session Layer services shall augment the virtual circuit facilities present at the Transport Layer. The Presentation Layer shall regulate the representation of data items conveyed across the network. Support for the ONC (Open Network Computing) product suite (i.e. XDR, RPC, NIS, NIS+), BSD sockets, SYS V streams shall be provided.

E. **Process Information Network (PIN)**: The CONTRACTOR shall furnish and oversee the installation of a Process Information Network (PIN) which shall connect all DCS and information system devices in a manner which creates an environment in which applications on distinct devices shall accomplish work cooperatively by sharing information as well as synchronizing the operation of the two applications of a common task. The PIN shall be the DCS manufacturer's standard and most secure offering for a process control network, and shall use a physical star and/or and ring topology. The PIN shall conform to the following;

1. Each DCS and information system device shall be furnished with a PIN communication device, complete with detailed device command algorithms encoded as processor instructions, to manage the device/controller interface.

2. The PIN shall be able to support the system response times stated in paragraph 2.5 with a database sized in conformance with 2.1 H (i.e. 220% of the current database).

3. The PIN shall utilize redundant fiber optic cables between structures. Within structures, Category 5 unshielded twisted pair cable (UTP) may be used, provided that levels of induced electrical noise do not interfere with data transmission. The cables shall be furnished and installed by the CONTRACTOR.

4. The CONTRACTOR shall review the Contract Documents to determine if the conduit system meets the DCS manufacturer's requirements, determine the exact length requirements and to compare the tensile strength associated with the cable to be provided with the hand hole/pull box spacing indicated in the contract documents. If additional hand holes/pull boxes are needed to accommodate the characteristics of the CONTRACTOR'S cable, they shall be furnished by the CONTRACTOR at no expense to the OWNER. The PIN shall utilize a medium which as a minimum conforms to the following:

a. Industrial grade, water resistant optic fiber, coated with a suitable material to preserve the intrinsic strength of the glass, suitable for installation in conduits which are encased/directly buried/ cable trays.

b. Cable of all dielectric construction.

c. Multi-mode, graded index, solid glass waveguides with the following characteristics:

- Nominal core diameter 62.5 microns
- Minimum ellipicity 2.0 percent
- Outside clad diameter 125.0 microns
- Maximum Numerical Aperture (NA) 0.275
- Maximum attenuation (850) 3.75 dB/Km
- Maximum attenuation (1,300) 1.5 dB/Km

d. Each fiber continuous with no factory splices.

e. Tight buffer.

f. RESERVED

g. Drop cables shall be of variable lengths of flexible fiber optic cable, typically not to exceed 400 feet so that loss in the drop cable is less than 1 dB. This length of drop cable shall permit relative freedom in routing the trunk cable and locating the station.

F. **Facility Information Network (FIN)**: The intent of these Contract Documents is to conceptually describe the desired level of functionality and key criteria associated with the FIN.

1. **FIN CONCEPTS:** The FIN shall connect all WSs associated with the facility with multiple file servers which will run various future applications. The FIN shall provide connectivity between the DCS and plant facility management systems. The FIN shall specifically have connectivity to WS and HS devices. Each WS shall interact with (i.e. monitor and manipulate data) resources associated with the FIN. The HS shall provide a DCS historical resource for the FIN connected devices to support FIN applications. All FIN resources and applications, including those implemented under this contract and future applications, shall all be accessible and manipulatable from the WS in a manner that is identical to any terminal directly connected to the FIN while the WS is using X-WINDOW utilities. The FIN shall have access to the current DCS database, all WS display graphics, and the DCS historical database. Any PCWS device connected to the FIN shall have monitoring and display capabilities equivalent to that of the WSs.

2. **FIN Design Criteria:** The FIN shall enable plant staff to select different third-party applications which run on varying hardware and software platforms. The FIN shall comply with IEEE 802.3 for 10 BASE-T Ethernet, or IEEE 802.3u Fast Ethernet (100BASE-T). Within a building, the FIN configuration shall provide a dedicated 10 Mbps Ethernet 10BaseT port to each device on the FIN, using switched Ethernet. Switching shall use the fragment-free or store-and-forward

method. Stackable switching hubs, provided with UPS power, shall provide support for SNMP management, and for multiple MAC addresses. External to a building, backbone connections to the switching hubs shall be 100 Mbps or Fast Ethernet. All FIN WSs and PCWSs shall be provided with 10/100 network interface cards. The FIN to be designed and furnished by the CONTRACTOR shall conform to the following;

a. Machine Independent

b. Operating system independent

c. Network independent

d. Transport protocol independent

e. Accommodate multiple servers

f. Accommodate 75 nodes

3. **FIN Cable Installation:** The CONTRACTOR shall furnish all FIN cable. FIN cable shall conform to the cable specified for the PIN, and when routed through the process areas, shall be installed in the same conduits as the PIN. In the operations building, the FIN cable shall be routed to a patch panel which shall be provided under this contract. The patch panel shall be located as shown on the contract drawings. From the patch panel, the FIN shall be extended to the various office sites as indicated on the electrical drawings. From the patch panel, the FIN shall be extended to the various office sites (as shown on the contract electrical drawings of the Reference Documents) using **two** 4-pair solid conductor #24 AWG cable wired in conformance with the EIA/TIA-568a cabling specifications and recommendations. The untwisted pair (UTP) cable shall not be run in conduits that carry electrical cable and shall not be run near fluorescent lights or large electromagnetic machinery. Teflon sheaths shall be used for plenum installations. All closet connections and wall plates shall be clearly labeled for easy identification of origin and end node. UTP shall be AT&T DIW 24/4 EIA/TIA 568 Category 5, or equal.

4. For connections between buildings, multi-mode fiber shall be used. The PIN and FIN may be different strands within the same bundle of fiber. The CONTRACTOR shall allocate one spare strand for every strand used for PIN and FIN application.

5. Fiber optic cable terminations: All fiber optic cables shall be terminated in a fiber optic patch panel, Siecor model WCC or equal, with epoxy- type ST connectors. One fiber optic jumper cable shall be provided for each fiber.

6. **FIN Testing**: The capability of FIN devices to extract data from the PIN and compile this data into Excel spreadsheets shall be tested. The capability of WSs and other FIN devices to use the Microsoft Office and Microsoft Windows resources shall be tested.

G. **Department Information Network (DIN):** The intent of these Contract Documents is to conceptually describe the desired level of functionality and key criteria associated with the DIN.

1. **DIN CONCEPTS:** The DIN shall interconnect with the FINs and PINs associated with North City Water Reclamation Plant (NCWRP), Fiesta Island Replacement Project/Northern Sludge Processing facility (MBC/NSPF) and the Point Loma Wastewater Treatment Plant (PLWTP). This interconnection shall utilize a multistranded single-mode fiber optic data communication link between all facilities.

2. A WS at any facility shall be identical to and have the same access to all process displays and FIN data via a remote X-windows session. Serial data transport within the DIN to the existing Ovation system at COMC shall be configured for selected real-time and calculated process data to be placed onto the COMC PIN for display and control.

3. **DIN Design Criteria:** The DIN shall provide a service backbone network for the Department. At the COMC control room at MOC 2, the WSs located in the Department Headquarters shall have the capability of the following;

   a. Dynamically view any WS process display screen associated with the selected facility connected to the DIN.

   b. View all displays associated every facilities' FIN resources. This shall include dynamically linking into MMS, MIS, LIMS, etc data associated with the selected facility.

   c. View current and historical associated with both the PIN and FIN resources at any facility.

   d. Receive, in a dynamic manner, all high priority alarms associated with any facility.

   e. Generate overview process reports based on data extracted from each plants historical database. The CONTRACTOR shall provide for the quantity of reports listed in the Appendix. Reports shall be generated on a daily, weekly, monthly and annual basis.

   f. Generate overview reports based on data extracted from each plant's FIN database, such as management / maintenance / laboratory / process data. The CONTRACTOR shall provide for the quantity of reports listed in the Appendix. Reports shall be generated on a daily, weekly, monthly and annual basis.

   g. Receive a selected set of real-time process data at COMC and alarms for display on an inter-facility overview graphic. A total of 100 digital I/O and 50 analog points shall be implemented.

2.5 RESERVED

A. **RESERVED**

B. **RESERVED**

C. **RESERVED**

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3. RESERVED

4. RESERVED

D. **RESERVED**

E. **RESERVE**

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9. RESERVE

10. RESERVE

F. **WS Operating System (OS) Software**: The OS shall comply with the requirements of paragraph 2.14.

G. **WS database Management System (DBMS)**: Each WS shall have its own Real-Time Data Base (RTDB) that reflects the current state of all process variables. All real time process data shall be available to any WS connected to the PIN.

H. **WS Tools Platforms (TP)**: The TP shall extend the functionality of the multitasking OS by providing application tools or extensions of the OSS platform. The TP shall provide, through a procedural call interface, software to support:

1. User-operating system interface (shells) to allow the user to manipulate files and run application programs in a concurrent manner.

2. Database management systems (DBMS) which employ Structured Query Language (SQL) interface to a relational database. Shell environment variables to support SQL shall be configured for Oracle.

3. Multimedia input/output to mass storage and image input/output i.e., optical disks using mapped files and special storage device drivers incorporated into the OS platform.

I. **WS Standards Compliance**: The following standards shall apply to maximize the interoperability and connectivity of the system and to provide object code compatibility between all hardware platforms used on this project:

1. Floating point processor shall comply with IEEE-754.

2. Network communications shall comply with IEEE-802.3/802.4.

3. Peripheral interface shall comply with Ultra-SCSI

4. Compatible with network protocols TCP/IP.

5. User interface based on X Windows, X11.

2.6 RESERVE

A. **RESERVE**

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C. RESERVE

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2.7 RESERVED

A. **RESERVED**

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f. RESERVED

g. RESERVED

5. RESERVED

a. RESERVED

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B. **RESERVE**

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D. **RESERVED**

E. **RESERVED**

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e. RESERVED

4. RESERVED

F. **RESERVED**

G. **RESERVED**

2.8 RESERVED

A. **RESERVED**

B. **RESERVED**

C. **RESERVED**

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7. RESERVED

D. **RESERVED**

E. **RESERVED**

2.9 RESERVED

A. RESERVED

2.10 EQUIPMENT ENCLOSURES AND CONSOLES

A. **General:** The DCS equipment furnished under this contract shall be housed in enclosures designed to provide physical and environmental protection for the interior modules, busses and terminations. All PCM enclosures shall be provided with dual feed, fully redundant power modules utilizing power auctioning to provide intermediate power to all enclosure components. Input power source shall be 120 Vac 60 Hz and 125 or 24 V dc. Enclosures shall contain racks which allow easy removal of all modules, i.e., processors, I/O boards, power supplies, etc. without removal of wiring or power. All modules shall be restrained to prevent accidental disconnection. Each enclosure shall be designed to pass through a 36 x 90 inch doorway opening. All equipment enclosures shall be UL-listed or certified by a qualified third party as meeting UL requirements.

B. **Field Enclosures:** Field enclosures shall provide moisture and contaminant protection and meet the electrical classification specified. Enclosures shall as a minimum provide NEMA 1 protection. Internal air circulation fans to aid in convection cooling or other means of temperature conditioning shall be provided as needed. Power and signal wiring shall enter the enclosures from its top or bottom section and terminate at termination assemblies residing in the bottom or side sections of the enclosure. Terminal connections shall support a single 12 AWG or two 14 AWG wires. A terminal shall be provided for each conductor of external circuits plus one ground for each internally powered analog signal shield. Each analog loop shall be individually fused with all fuses or circuit

breakers clearly labeled and located for each maintenance if individual isolation is not provided at the board level.

C. **RESERVED**

2.11 NITROGEN GAS PURGE SYSTEMS FOR PCMs

A. Where required, the CONTRACTOR shall furnish a nitrogen gas purge system which continuously purges PCM enclosures with nitrogen gas at the rate of one (1) complete volume change per day.

1. The nitrogen gas system shall consist of nitrogen cylinders piped to a common manifold with individual branch circuits extending to each enclosure to be purged.

2. The manifold system shall include;

3. A discharge pressure regulator on the manifold

4. An isolation valve for each cylinder

5. A check valve for each cylinder

6. An isolation valve on each branch circuit

7. A check valve on each circuit

8. All ancillary piping, fittings, and accessories

B. Suitable couplings and flexible pipe sections shall be provided on each branch to permit the quick removal and installation of cylinders on a routine basis.

1. All valves, fittings, and accessories shall be 316 stainless steel.

2. All components, including but not limited to, piping, enclosures, liquid nitrogen cylinders, gauges, fittings and other accessories shall be purchased. Temporary rental or leasing arrangements shall be acceptable.

C. A minimum of two (2) liquid nitrogen cylinders, each containing the equivalent of three thousand six hundred (3600) cubic feet of nitrogen gas at atmospheric pressure will be provided for each system.

D. Each cylinder shall deliver gas reliably and continuously without pressure fall-off. The pressure building regulator shall maintain minimum operating pressure while the economizer regulator shall reduce excess pressure during non-use periods.

E. Each liquid nitrogen storage cylinder shall have the following features;

1. Allow direct gas flow without auxiliary equipment.

2. Sustain discharge at required pressures.

3. Be capable of providing gas at a maximum continuous rate of twenty five (25) cubic feet per hour

4. Be capable of providing gas at a maximum intermittent rate of one hundred (100) cubic feet per hour

5. Both of the flow rates noted in preceding items 3 and 4 shall be delivered with only regulator and piping attachments required. An external heat exchanger shall not be utilized.

6. Have a built-in shock absorbing system to resist rough handling during transport.

7. Have self-contained controls and piping which is protected by a stainless steel ring which is welded to the top of the cylinder.

8. All valve handles shall have a low thermal conductivity to permit comfortable operation without the need for gloves.

9. A strong internal support system to provide added stability and added protection under all working conditions.

10. Fully insulated cylinder walls to reduce evaporative losses through the pressure relief valve.

11. A built-in automatic pressure building system to allow immediate operation after filling or pressure transfer.

12. A built-in evaporizer to provide direct gas flow without auxiliary equipment. A built-in economizer circuit shall be provided to reduce evaporative pressure build up during idle time and provide virtual no-loss operation. Evaporative losses during periods of non-use (zero-gas withdrawal) shall not exceed two and one-half (2.5) percent of the stored volume per day

13. Designed for unattended service or operation subsequent to initial set up without the need to make repetitive pressure adjustments.

14. The following devices shall be provided for each cylinder in conformance with the technical requirements which regulate the quality of such devices as defined in the contract documents;

    a. gas pressure gauges

    b. Container bursting disc

    c. safety relief valve

    d. manual gas vent valve

    e. economizer regulator

    f. pressure building regulator

g. manual pressure building valve

h. liquid level gauge

i. casting bursting disc

j. manual liquid fill and withdrawal valve

k. pressure building coil

l. vaporizer

m. . gas withdrawal check valve.

F. Each cylinder safety relief valve shall be set at 235 psig with a normal container gas operating pressure of one hundred twenty five (125) psig. A single pressure regulator, adjustable between 0 and 3.0 psig shall be provided on the manifold gas line to maintain a desired positive pressure in each enclosure being purged.

G. Unless otherwise specified or shown, all piping, fittings, valves, and other accessories shall be 1/4 inch diameter.

H. All cylinders shall be secured by retainers to prevent tipping over.

I. All PCMs which are purged shall be provided with sensors which detect and transmit to the DCS the following conditions:

a. A low pressure condition internal to the enclosure.

b. A high temperature condition internal to the enclosure.

c. An enclosure-door-open condition.

J. The complete nitrogen purge system shall be checked-out and in operation prior to the installation of related PCMs. All costs associated with nitrogen deliveries and refills prior to system acceptance shall be the responsibility of the CONTRACTOR.

K. All cylinders, valves, piping, enclosures, and other equipment comprising the nitrogen gas purge system shall become the property of the Department upon system acceptance.

2.12 OPERATING SYSTEM SOFTWARE

A. **Operating System Software (OSS)**: The OSS shall be a multiprogramming network operating system in that it shall support multiple processes by sharing computer resources with processes intercommunicating with various forms of resource sharing occurring via a network. The OSS shall be a multitasking (i.e., supports multiple processes per user). A process shall be defined as units of activity characterized by a single sequential thread of execution, a current state, and an associated set of resources. The OSS shall be open (i.e., have a publicly specified interface, be non-proprietary, and be based on a public domain specification). The OSS shall be a UNIX variant (SVID) with an IEEE P1003.1 POSIX compliant interface or equal. The OSS shall be certified Year-2000 compliant. The OSS shall provide the following functionality:

1. Multi-tasking to provide task suspension and priority scheduling of task execution.

2. Hardware interrupt priority handling.

3. Network communications to accommodate program downloading from the host and to respond with data transfers as required by the host or interactive shared display system.

4. Support for multiple processors.

5. TCP/IP shall be implemented on this project. All OSS's shall be UNIX and be provided with SMP. OSS's which feature SMP and TCP/IP but which do not implement it are not acceptable.

2.13 SYSTEM CONFIGURATOR

A. **General:** The following software components shall be furnished to structure and customize process operations and information management tasks. The ability to modify the structure at a later date shall also be provided.

1. **Display Building, Configuring and Editing Tools:** Software tools shall be provided for developing, editing, using and managing displays. Sophisticated display structures shall be configured as defined by the CONTRACTOR subsequent to the finalization of user meetings and graphic submittals. Displays shall be constructed from a combination of pre-defined graphic objects that shall be developed, maintained, and manipulated. The Display Builder shall contain libraries of grouped objects and separate libraries of user- and system suppliers-defined marker tables. Addition to the libraries shall be provided by incorporating user-defined objects named and created with the Display Builder. Addition to the marker tables shall be provided by using the Marker Editor in the Graphics Utilities.

2. **Display Builder:** The Display Builder shall use pull-down menus and a high resolution pointing/input device, such as a mouse or trackball, for function selection. It shall also create overlays as unique files. It shall be possible to configure any number of overlays to exist on the screen at any one time. Overlays or "windows" shall contain any information that must be invoked quickly from a "base" display (typically for gaining more detail). The builder shall be a general purpose, object-oriented editor for the construction and editing of detailed, interactive displays. It shall produce an object-oriented data base that is used during the building process. The software shall enable the operator to build displays representing any type of application.

a. The following types of objects shall be furnished as a minimum:

1) Geometric Shapes -- Lines, rectangles, polygons, arcs, and ellipses.

2) Text -- Alphanumeric characters in a variety of fonts and sizes.

3) Markers -- Small, single-color shapes such as pumps, valves, and icons that are used repeatedly.

4) Groups -- Object(s) composed of other objects.

5) Library Group -- Standard and user-defined objects for inclusion in user-built displays.

b. There shall be no inherent limit on the complexity of objects or the number of objects contained in another object. Display objects shall be connected to control algorithm parameters and system variables. Configured displays shall remain editable by the Display Builder. Display objects shall have the following editing features as a minimum:

1) Move -- Change the location of an object within a display.

2) Stretch/Shrink -- Alter the dimensions of an object.

3) Cut/Copy/Paste -- Delete, duplicate, and add objects.

c. Drawing functions shall be organized as a set of tools and resources, selectable from the menu bar, that are used to construct and edit objects. Resources shall be used to aid in the construction. These major functions shall include as a minimum:

1) Filing

2) Library functions

3) Drawing

4) Editing

5) Resources

6) Grid

3. **Display Configurator:** A Display Configurator shall be furnished to convert static displays into dynamic displays that interact with the process, and provide a logical hierarchy of control capability. Connection of display objects, trend objects, or X/Y plot objects to shared system variables to reflect the current value of the variable, or to connect to control variables to allow the operator to view and change the value of the variable shall be provided.

a. Selectability configuration of a given display object shall be provided to perform one or more of the following functions when the operator picks that display object:

1) Run/execute a program

2) Call up a display or overlay

3) Close the current display or overlay

4) Write text to a file

5) Set a relative pick

6) Ramp

7) Momentary contact (Hold-down Pulse or Timed-Pulse)

8) Trends, X/Y profile plots

4. **User Interface:** Associated variables (process or shared) with display objects shall use both graphical and hierarchical methods to move about and within the display object data base. Pull-down menus accessible from the display field shall select objects in the display hierarchy and specify connection attributes.

   a. **Display Object Data Base:** The Display Object data base shall be composed of all the display objects that are all part of the hierarchy of object groups. The root group shall contain all display object groups. At each level in the hierarchy, the associated display menu shall indicate the position of the currently selected object in the hierarchy as well as of the connectable attributes of that object.

   b. **System Data Base**: The System data base shall be any system variable or value in the system that is accessible through the Object Manager. This shall include all shared program variables and all control variables. The system data base shall be accessed by typing the qualified path name of the system variable to be read or written in the appropriate connection dialogue box.

5. **Display File Manipulation:** The Display Configurator shall accept Display Builder files to configure as well as installed files to re-configure. Direct access to Display Builder software for necessary object changes shall be furnished. Once a display is configured, it shall be installed automatically for use by Display Manager in an interactive mode.

6. **Connection Types:** Any connection between an external variable and a display attribute shall be active or passive, and continuous or discrete. Active connections shall alter process or system variables in response to operator manipulation of the display. Passive connections shall alter attributes of display objects in response to changes in process or system variables. Also, attributes shall be active and passive and the system shall be able to configure both an active and a passive connection for them. The active connection shall determine the behavior of the object (position, shape, text contents, etc.) as long as the object is selected for user manipulation. The passive connection shall determine the behavior at all other times. Continuous connections shall vary continuously over a given range, such as flow. Discrete connections shall exhibit a finite number of states, such as pump status or steps in a sequence.

7. **Connection Configuration:** Selecting an object and the desired object attribute for connection shall present an appropriate configuration dialogue box. The dialogue box shall allow the operator to enter a connectable variable and related configuration information (e.g., state table, type of pulse, change delta). If the object selectability attribute is to be configured, the function menu shall become selectable. Selecting the desired function accesses the appropriate dialogue box for

configuration. Selecting a trend or plot shall provide access to configuration dialogue boxes specific to trends or plots. Changes to or deletion of configured connections shall be by the connect menu.

8. **Display Conventions Configurator:** The configuration shall be a menu driven subsystem that allows the operator to build and edit named conventions used to connect display object attributes, such as color and text contents, to individual bits in control strategy: algorithm parameters and global variables. Bit assignments for algorithm parameters, connections to any data type: long integer, floating point, byte, and character shall be possible. Objects shall be bitmapped: rectangle, polygon, arc, text, and marker. Their attributes include visibility, color, fill color, line style, marker number, text contents, and background color. Display Builder and Display Configurator shall be used in conjunction with Display Conventions Configurator. Conventions shall be stored in a file that is read by the Display Configurator.

9. **Graphics Status Attributes Configurator:** This software shall be furnished to edit a configuration file used by the Display Manager to show out-of-service (OOS) and bad input/out (BADIO) status of control algorithms in Detail displays, faceplates, and user displays. Display objects that are connected to a point that reports one of these states shall change the graphic attributes of the object. Display actions for BADIO and OOS shall be separately configurable. The configuration file shall be global and shall govern the graphic behavior of all workstations. The configurator shall provide a brief description of the command options, show the selected configuration, and prompt for any changes. Also, a file with default values shall be supplied for the system. Display objects to display the connection status are: Rectangle, Normal Text, Overstrike Text, Polygon, Circle, Arc, Line, Polyline, Mark. As a minimum, their attributes shall include visibility, color, fill color, line style, marker number, foreground and background color.

10. **Graphics Utilities:** A collection of general purpose graphics editors and utility files for the construction of new fonts and markers, or for editing system supplied fonts and markers shall be furnished. In addition, a color palette shall be available with both the system supplied colors and colors that are customizable.

    a. The editors shall be used to modify both the standard system graphic utility files which store system markers, fonts and colors, and user graphic utility files for user markers. These files shall be referenced by all displays upon display call up.

    b. The fonts, markers, and colors shall be accessible in the Display Builder and Display Configurator software for use in building and configuring displays.

    c. Font Editor software shall allow the operator to edit a font set or create a variety of fonts for use on displays. When accessed within the Display Builder, the selected character font set shall be made available in one of four sizes: single-width, single-height; single-width, double-height; double width, single-height; double-width, double-height.

d. Marker Editor software shall allow the operator to create graphics symbols that are used repeatedly. Symbols shall appear as industry-standard shapes, and shall be included in a marker table.

e. The Color Palette Editor shall allow the operator to edit colors in the system palette file or create palette work files. The user shall be able to change the foreground and background colors available from the color palette to create more than 16 million colors. At least 233 colors shall be available for use in process diagrams. The first sixteen background colors are standard colors related to system displays. Blink colors shall also be settable.

11. **Workstation/Mode Configuration:** The User's view of the system and the process to which it is connected shall be provided. A specific mode shall be associated with a user, a group of users, or fixed for a given workstation.

a. This shall be the first level of security for accessing and manipulating system information. The second level of security shall be provided by restricting the selection of individual fields within displays. Different modes shall have different groups of selectable fields for the utmost security. Workstation configuration shall be enabled by the Password Mode Configurator. It shall allow the flexibility to set up security schemes to match plant operation setup.

b. The configurator shall be a collection of mode editing functions and tools that maintain a set of configuration data files that allow the following functions:

1) Provide access security for the different operation modes of the system.

2) Allow an authorized user to modify mode menus (menu bar entries), and to associate specific displays with the invocation of any given mode.

3) The configurator shall be able to run in any workstation as a transient application task, and shall operate primarily with simple menu selections and dialogue box prompts. An alphanumeric keyboard and a high resolution input device, such as a mouse or trackball, shall be required for configurator operation. Any input device can be used to access menus subsequently built.

c. There shall be six default modes, in order of increasing capabilities and access:

1) View Only

2) Senior Operator

3) Operator

4) I & C

5) Programmer

6) Administration

d. The content of all modes and menu bars shall be able to be configured to suit the user. Additional modes shall be assigned by using the configurator.

2.14 WORKSTATION (WS) APPLICATIONS

A. **General:** Window systems shall manage the user-OSS interface that deals with multiple processes and the display of those processes from virtual displays via space multiplexed physical displays. Each WS shall employ a base window system designed for use in a networked, bitmapped workstation mode. The operations for placing information on the screen include graphic oriented and character oriented commands for monochrome and color displays. The windowed implementation shall divide an implementation into a client and a server with a specialized interface between them. The protocol between the client and server shall be of a sufficiently high level (and general) that the client and server can be implemented on distinct machines interconnected by the network although the usual workstation configuration is to implement the two parts on a single machine. The user interface shall provide the fundamental facilities required to support a desktop management implementation which explicitly addresses space multiplexing for representing virtual terminals-across multiple physical screens that operate with a single physical keyboard and mouse, each with its own application process.

B. The display software furnished shall enable any WS to interact with any and all of the real-time plant, field and process data that is provided in the system. Areas of operational access or "modes" for the workstation shall be changeable on-line and shall be pre-configured by using a Password Mode Configurator.

C. All screen selections shall be based on intuitive "picking" of display objects and menus on the screen. A common menu bar structure with pull-down menus shall be presented at the top of all displays to enable fast access amongst available workstation functions. Multiple windows with icons shall also be available. Content of the menus shall form the display hierarchy.

D. The Real-Time Display Software shall support either single-screen or dual-screen operation. Single-screen operation shall allow workstations to operate independently of one another; e.g., duplicate workstations can have duplicate or independent responsibilities. As a minimum, dual-screen real-time software shall provide the following:

1. Ability to direct input devices such as a mouse, trackball, or keyboard, to multiple screens.

2. Ability to enable/disable keyboard and cursor device on-line.

3. Ability to redirect displays from one screen to another and to support up to four process diagram windows on each screen.

4. Ability to call up multiple displays simultaneously with a single request.

5. All process diagrams shall be available for dual-screen use.

E. Windows and menus shall be used by the OPEN LOOK Graphical User Interface to provide an intuitive windows mode. Windowing shall take advantage of the multi-tasking operating system capability. It shall allow beginning a task in one window while

continuing work in another. It shall also allow a single CRT interface within the system using X Window for interfaces with the DIN and FIN (information networks). As a minimum, the following applications that concurrently appear in its own window shall be:

1. Network Manager
2. Display Manager
3. Data Acquisition and Control Configurator
4. Report Configurator
5. Historian Configurator
6. Operator Message Interface
7. Spreadsheet
8. Virtual Terminal Mode
9. Electronic Documentation Print Routine
10. Loadable Documentation
11. Help Functions
12. X Window from FIN and DIN

2.15 NETWORK MANAGEMENT SOFTWARE (NMS)

A. **General:** Each network connected device shall be provided with NMS which provides an operator with a means to:

1. Define users, groups, and their access privileges. The NMS shall be able to define the domains to which the users and groups belong. Domains shall define a set of servers and resources to which users and groups have automatic and transparent access.
2. Analyze the server performance and resource statistics to determine potential bottlenecks.
3. Monitor the network traffic, to identify problems after they occur, and more importantly, to spot potential trouble before it happens.

B. **Intelligent Facilities**: The intelligent facility operators' information and object domain shall be managed by NMS. NMS shall regulate all aspects of heterogeneity, resource management, performance monitoring and tuning, and other administrative tasks. The end result shall consist of the organization and management of facility and Department objects not files and directories. Facility and Department objects may physically consist of files and directories, but the emphasis shall be on managing the object as a whole by

the NMS. The NMS shall support both Version 1 and Version 2 Simple Network Management Protocol (SNMP).

C. **Information and Object Domains**: The NMS shall provide users access to resources in an efficient and easy-to-use way. An intelligent facility worker's information and object domain will be managed by the NMS which shall be responsible for of all aspects of heterogeneity, resource management, performance monitoring and tuning, and other administrative tasks. Note that this is an organization and management of facility objects not files and directories. Facility objects may physically consist of files and directories, but the emphasis is on managing the object as a whole by the NMS. The NMS shall employ a global naming service in that the NMS shall support, on all WS and external systems and network components with support for SNMP, an intelligent facility mode which concentrates on the administration and management of intelligent facility objects, such as the following;

1. Processes
2. Process Area
3. Facility Plans and Fire Detection
4. Maintenance Management
5. Laboratory Information Management
6. Operation and Maintenance Data
7. Plant Security and Communications
8. Training Network
9. Energy Management
10. Peripherals and devices
11. Policies and procedures
12. Plant/Department Staff

D. **Global Naming Service:** The NMS shall provide users access to resources in an efficient and easy-to-use way. The NMS shall employ a global naming service in that everything on the network shall be assigned an item name, a group name, and an organization name. Using this approach, if a user wishes to get run-time related maintenance management data from the MBC locale, the item is called "run time"; the group is called "maintenance management" and the organization "MBC". The name "RUN TIME @ MAINTENANCE MANAGEMENT@ MBC would precisely define the location of the data in a straightforward manner.

E. **Standard Protocol**: The NMS shall conform to a standardized protocol that makes it possible to maintain complex internetworks and reconfigure resources as patterns change. The NMS shall be designed for the purpose of monitoring network performance,

detecting and troubleshooting network faults, and configuring or reconfiguring network resources. The standard protocol shall include SNMP.

F. **NMS Organization**: The NMS shall be based on three major components; the NMS protocol, the management information base (MIB), and the structure of management information (SMI). The NMS shall be an application-layer protocol stack that defines a common method of communications among network devices. The MIB shall define a common set of information variables and statistics that must be kept. In addition, the MIB shall define an OSI-compliant registration hierarchy that groups logically related information into tables. For example, information relating to the error rates and addresses of communication interfaces would be placed in the interface table. The NMS shall also consist of agent software, which resides at the location of each resource being managed. The other element of the NMS is the network management station, which contains the master database of resources being managed.

G. **NMS Components**: NMS shall consist of a bundle of software that resides and runs somewhere on a network device, usually imbedded in a network interface card. It communicates closely with the network chipset, monitoring the activity of the chips and the network/ring and making any necessary modifications. The responsibilities of NMS shall be divided into two basic categories; state machines and frame services. The state machines shall provide the network reliability component of NMS by monitoring the 802.xx chipset and adapting to changing network conditions. The frame services shall provide the network management component by responding to in-band requests from the network manager. The following modules shall comprise the state machines and the frame services. The NMS shall consist of the following object components;

1. Ring Management (RMT) which shall;

    a. Initialize MAC (medium access control layer) for data transmission

    b. Detect and resolve duplicate address conditions

    c. Detect stuck beaconing conditions and restricted dialog on the network

    d. Transmit directed beacon frames.

2. Connection Management (CMT) shall manage the connection of the physical network. CMT shall consist of;

    a. Entity Coordination Management (ECM) which shall;

        1) Control the optical bypass

        2) Implement the hold policy

        3) Propagate trace to detect ring fault domains

        4) Starts and stops other NMS232 state machines

    b. Physical Connection Management (PCM)which shall;

1) Initialize port-to-port connections.

2) Monitor bit error rates on links.

3) Enforces connection policies.

4) Controls PHY (physical layer) and PMD (physical medium dependent layer).

c. Configuration Element Management (CEM) which shall;

1) Clear ring of frame fragments.

2) Reconfigure station resources.

3) Enforces configuration rules.

4) Controls the CCE.

3. NMS Agent which shall receive, parse, and respond to frame-based requests from the network.

4. Neighbor Notification Transmitter (NNT) which shall monitor the identity of the MAC's upstream and downstream neighbors.

5. Status Report Frame (SRF) which shall implement a protocol used to notify the network of changes in station status.

6. Management Information Base (MIB) which shall provide access to NMS variables in a generic manner. The following types of data shall be in the MIB;

a. SMT- Items about SMT in general

b. MAC- Items specific to a MAC

c. Path class- Items relating to paths in general

d. Path- Items relating to a specific nonlocal (primary or secondary) path.

e. Port- Items relating to a specific port

f. Attachment-Items relating to a specific attachment.

H. **Network Security**: The NMS shall defines the access rights of the users on the networks and determines what resources a user has access to and what operations that user may perform on those resources. Security and authorization shall be based on the concepts of users and passwords. The network administrator shall be able to define every new user for the system, gives the user an account, and assigns that user to the rights to various network objects. To gain access to the system, users must log on to the system, specifying both their user names and their passwords. Passwords shall be unique and shall be specified to be of minimum acceptable length. All passwords shall be encrypted and are

sent across the network only in encrypted form. The NMS shall facilitate the periodic changing of passwords on a routine basis.

I. **Network Authorization:** Files, directories and devices shall be protected by a number of access rights. The user shall be given privileges (such as read, write, update, delete, modify attributes, perform directory search, execute, create, and supervisory) at the file or directory level. Files themselves shall be further protected by attributes such as read-only, which shall prevent the file from being modified. The NMS shall feature a security database which shall be responsible for assigning and tracking the privileges of all objects on the network. All objects, such as users and files must be registered in the security database. This database then determines who is allowed access to what object.

J. **NMS Displays**: NMS shall run on any workstation in any mode with the capability of NMS menus and displays appearing on any number of workstations simultaneously. There shall be multiple copies of this software concurrently resident within the system. Operator actions shall be performed through a number of menus and displays that are initially accessed by pull-down menus. NMS shall determine which conditions exist and shall put up the appropriate NMS health display. The NMS shall display shall show all stations/ connections on the network. Selection of the NMS display feature shall give the stations and their logical names showing the all domain and station status. Pointing/input devices used for displays shall be mouse, trackball, or touchscreen. Using NMS, the operator shall be able to have access to the following features;

1. Viewing hierarchical system and network displays indicating the health of system equipment and network communications. Access to information from the system network down to the intelligent sensor level shall be available both in a graphical and tabular format.

2. Network statistics for analyzing network performance.

3. Display system monitor domain information and complete information about stations and peripherals within the domain.

4. Allow an operator to perform equipment change actions, such as rebooting a station or putting a peripheral off-line.

5. Running On-Line and Off-Line diagnostics.

K. Network Configuration: NMS shall utilize a system configurator which consists of a series of editors used to create a network by linking all network hardware and software modules. Each editor shall list all available hardware and software resources. The NWS shall be used to define all logical and physical connections associated with the network. This network configuration function shall be accomplished by selecting items from logically organized pull down menus, selecting appropriate software modules, and assigning network identification tags and descriptors. The NWS shall have self-checking utilities that verify the existence of all necessary logical connections. If the network has logical gaps, the NMS shall identify the concern and display the missing linkages or modules.

2.16 DISPLAY MANAGER

A. The Display Manager window, shall present the initial control systems display and shall always be present on the screen (as window or icon) and shall be used to view process displays. It shall also provide consistent access to other application windows via the top menu bar and pull-down menus. Workstations shall be directly connected to applications running on other platforms to allow single operator interface to multiple systems and multi-media capability.

The contents of the selected application shall be displayed in a base window on the background screen area (workspace). Control of the workspace shall be handled by using the mouse/trackball buttons, touchscreen (to emulate left button), and function keys to perform the following actions as a minimum:

1. Access function menus, window, and icons - stack a window in front or back of another window.

2. Make selections from menus.

3. Manipulate the size and location of windows - toggle between two window sizes, and change window dimensions.

4. Iconize a window - change the window to an icon representing it in compressed form or open an icon to its full size window.

B. The types of menus as a minimum shall be:

1. A window menu for performing functions related to the window, such as re-sizing, moving, re-stacking, opening/closing.

2. A Workspace menu for accessing a function or sub-menu of functions, such as, programs, utilities, properties.

3. Scroll bar menu, for scrolling specified text in the application pane to new locations within the pane or back to the previous position.

4. Pop-up windows for filling in information or making choices. These menus shall be available under menu buttons in the control area or as pop-up menus at the pointer location. Menus shall be accessible on a temporary basis, available until dismissed, or push pinned to the workspace for ready access.

2.17 DATABASE CONFIGURATOR

A. **General:** Each WS shall provide a comprehensive, distributed interactive database system for creating, storing, editing and monitoring all process inputs, outputs, manually entered data, and internally calculated values. Process data point creation shall utilize conversational fill-in-the-blanks techniques for ease of use by the process engineer. The Database Configurator shall provide a file-oriented structure for the purposes of data acquisition, data conversion, digital filtering, scaling, and alarm checking. All of the parameters and features noted shall be individually selectable and modifiable in an on-line fashion at the CRT console. As a minimum, the configuration software shall provide/perform the following functions:

1. Each input or calculated value shall have a unique tag and descriptor. The configurator shall accept a tag of up to 16 characters and a descriptor length of up to 30 characters. All data shall be tag accessible and not require an imbedded hardware address.

2. Process inputs shall be capable of being processed for alarm detection and control processing at a user adjustable rate between 0.1 and 1.0 seconds.

3. All process outputs shall be capable of being updated at an adjustable rate between 1 and 3600 seconds. Sequence of events (SOE) points shall be adjustable to be updated at least once per 0.1 second.

4. Filter, scale and linearize raw input signals into engineering units based on a scale of 0 to 65,000 counts. Point resolution shall be at least 13 bits.

5. Check input signals for instrument limit conditions.

6. Assign alarm limits for high, low, and rate-of-change limits.

7. Assign alarm priority levels. At least 4 levels of alarms shall be definable.

8. Each data point shall have the capability of assuming various grades of quality status. The state shall provide the operator with an indication of the quality of the hardware and software. As a minimum, the following states shall be provided:

   - GOOD: This state shall indicate hardware and software are functioning properly.
   - ENTERED VALUE: In this state, the data point shall not be processed. Data values may be inserted by the operator.
   - POOR: This state shall indicate a software malfunction. The data point shall be returned to ON only by operator or technical intervention.
   - BAD: This state shall indicate hardware malfunctions such a multiplexer failure, transmitter failure, open thermocouple detection, etc. In this state, the last reasonable data value shall be maintained in memory. When the hardware malfunction clears, the data point shall be automatically returned.

B. **Data Validation:** The data point state shall be combined with the process alarm conditions to indicate data point status in a concise manner. Hardware and software malfunction shall precede process alarms. If the data point state is BAD, its status shall also be BAD, irrespective of previous process alarm condition. However, if the data point is being monitored with a high alarm present, its status shall be HIGH.

2.18 DATA ACQUISITION AND CONTROL CONFIGURATOR

A. **General:** The Data Acquisition and Control Configurator shall enable the development and modification of control strategies using a menu driven fill-in-the-blanks conversational technique. The DCS manufacturer shall furnish a standard library of data acquisition and control algorithms to monitor process variables, detect errors between desired set points and measured variables, and issue corrective commands to manipulated variables such as final control elements. Control algorithms shall also be provided to perform sequential and ladder logic control. As a minimum, the library of control

algorithm algorithms shall provide the following functions or algorithms that provide equivalent functionality:

1. Process Inputs and Outputs: Analog Input, Contact Input, Analog Output, Contact Output, Boolean Alarm, Pattern Alarm, Event, Flow Calc.

2. Process Control: PID with Options, Ratio, Bias, Differential Gap, Pulse Duration, Self-Tuning Adaptive, High, Low, Switch Position, Universal Ramp, Timer, Status.

3. Calculations: Impulse, Lead-Lag, Dead-Time, Add/Subtract, Multiply/Divide, Square Root, k Exponentiation, Characterizer, Pulse Counter, Accumulator, High/Low Clamp, Rate of Change Clamp, Packed Boolean.

4. Logic: AND, OR, NAND, NOR, XOR, NXOR, Logic Switch, Compare, Bi-Directional Delay, On-Off with Feedback, NO Contact, NC Contact, Energized Coil, Latch Coil, Unlatch Coil, Retentive Timer On-Delay, Retentive Timer Reset, Up-Counter, Down-Counter, Counter Reset, Compare, Program Flow Control, Immediate Input, Immediate Output.

5. Sequential Control: High Level Batch Language (HLBL).

B. Configuring a data acquisition and control scheme shall be performed by linking, from a pre-defined standard list of control algorithms. Operation shall be in an off-line and on-line fashion and shall in no way disrupt the normal operation of independent loops. Pull down menus shall be employed so as to maintain a consistent human interaction with the system.

C. A backup image of the data acquisition and control configuration shall be available at each WS, or in a central server with RDBMS maintenance tools, for reloading of the controller when required. The storage medium shall be an "on-line" bulk storage device - tape or cartridges are not acceptable.

D. Automated system security measures shall preclude the possibility of dissimilar database structures, data acquisition strategies, or control strategies from being resident in the set of fault tolerant processors associated with each PCM. All database structures, data acquisition strategies, and control strategies shall be either downloaded to both PCM processors simultaneously or sent to the "backup" processor which automatically reflects or mirrors the image to the "on-line" processor.

E. The control configurator shall be self-documenting. The present operating control schemes shall be accessible from at least two WS in the central control room, and one additional WS. All additions or modifications shall be automatically recorded and shall require no additional operator action. Remote control configuration shall be available from the COMC using remote X-windows.

F. **Data Acquisition Software Algorithms**: The following data acquisition algorithms are being defined to indicate the level of functionality and inter-algorithm interaction associated with fundamental data acquisition functions required for this project. This listing is not all inclusive of project requirements in that additional algorithms may be required to configure a complete and operable system. In all cases, each PCM shall scan

analog and discrete inputs at a uniform rate. Existing data samples and status information stored in the PCM current data base memory shall be updated by data and status entries obtained during each new data channel scan.

1. **Analog Processing Algorithms**: All analog inputs shall be sampled at a fixed rate and normalized to eliminate zero drift errors and gain errors. Normalization shall be provided for by applying at least two calibration signals (zero and a positive calibrated reference signal) to a dedicated analog-to-digital converter assembly and then applying a normalization equation. Signal conditioning shall be applied where applicable including digital filtering, linearization, etc. Digital filtering requirements will be determined by the CONTRACTOR during the construction period. All transducer signals which bear a nonlinear relationship to the associated measured variable shall be linearized. Signal linearization may be accomplished using table look-up linear interpolation techniques, straight line segment conversion multi-techniques, or by using conversion equations. All analog inputs shall be validated prior to signal conversion and subsequent entry into the current database.

   a. Fifth-Order-Polynomial

$$Y = K_1 + K_2 X + K_3 X^2 + K_4 X^3 + K_5 X^4$$

   b. Power

$$Y = K_1 + K^2 (X)^{K}3$$

   c. Exponential

$$Y = K_1 + K_2 e^{K} 3^{X}$$

   d. Logarithmic

$$Y = K_1 + K_2 (\ln X)$$

Where:

Y = Linearized variable

X = Measured variable

e = Base of the natural system of logarithms (e = 2.7182818...)

ln = Natural logarithm

K = Constant whose value and polarity shall be selectable at the WS for each individual measurement channel.

   e. Scaling: All 4-20 MA analog inputs shall be scaled to a common span. Scaling operations shall not reduce the accuracy of the data. Analog data shall be converted to engineering units by means of the following algorithm:

$$Y = (H-L)^{(X)} + L (Z)$$

Where:

Y = value in engineering units

H = high value of span, expressed in engineering units

L = low value of span, expressed in engineering units

X = digital value of normalized and linearized data sample

Z = full scale digital data value

f. Filtering

A digital filtering algorithm of the exponential smoothing type shall be provided to smooth time-varying analog input data in accordance with the equation given below. The filter time "constant" shall be a function of the sampling period and the digital filtering constant, both of which shall be user adjustable.

$V_F = V_{F-1} + K (V_u - V_{F-1})$

Where:

V_F = new filtered value

V_{F-1} = last filtered value

K = digital filtering constant which is given by t/T where t = sampling period and

T = required time constant.

V_u = new unfiltered value

2. **Discrete Processing Algorithms**: Discrete inputs include both alarm and status inputs. At each scan interval, all discrete inputs shall be checked to determine status changes or alarm conditions. If an input changes status, the new status and time of occurrence shall be recorded in the current data base. Discrete inputs must be processed by suitable time delay/logic algorithms before alarms are noted.

3. **Manual Inputs**: Numerical engineering unit data may be entered manually in a "fill-in-the-blanks" mode at the WS. This data shall consist of additional values for the current data base (e.g., laboratory analyses result); substitution data for measured variables normally scanned, substituted output data for failed algorithms; and new or modified fixed data values (e.g., tank volumes). Variable identification symbols for non-scanned data such as laboratory analyses shall be compatible in format to those symbols used for scanned analog input variables. Replacement data entered manually to control programs shall be treated as out-of-scan analog or discrete input data. All inputs shall be subjected to validation checks to verify reasonableness of data. The system shall be configured to accept a minimum of [500] lab-oriented manual inputs which will be defined by the CONSTRUCTION MANAGER during the system construction period.

G. **Calculation Algorithms**: Calculated variables, such as summed variables, mass flow variables, tank volumes, etc., shall be derived from manually inputted constants and analog inputs which have been normalized, conditioned, and converted into engineering

units. Calculated variables shall be computed with the same frequency as their associated analog inputs and shall be stored in the current data base. Suspect data flags shall be set for calculated variables when any of the analog input variables used in their computation have exceeded any signal amplitude or rate-of-change high/low limit. Calculated variables associated with discontinuous processes shall be activated and deactivated by either a software interlock or a process input to avoid the accumulation of erroneous measurements.

1. **Square Root Extractor Algorithm**: A square root algorithm shall extract the square root of an input signal and also have the capability of applying a gain factor and bias to the output signal. A typical square root extractor equation shall be of the form:

   Output = K_1 */Y + K_2

   Where Y is the input signal, K_1 and K_2 are adjustable parameters.

2. **Summer Algorithm:** A summer algorithm shall have the capability of summing or subtracting at least two input signals. The summer shall have the capability of applying a gain factor and bias to each of the inputs, and applying an additional gain factor and bias to the output or the equivalent. A typical summer equation shall be of the form:

   Output = K_1 * X + K_2 * Y + K_3

   Where X and Y are inputs, K_1, K_2, and K_3 are adjustable parameters.

   Note: * indicates multiplication

3. **Multiplier Algorithm:** A multiplier algorithm shall have the capability of computing the product of two input signals. The multiplier shall have the capability of applying a gain factor to the product and bias to the output, or the equivalent. A typical multiplier equation shall be of the form:

   Output = K_1 * X * Y + K_2

   Where X and Y are input signals, K_1 and K_2 are adjustable parameters.

4. **Divider Algorithm:** A divider algorithm shall have the capability of dividing one input signal by another input signal. The divider shall have the capability of applying a gain factor to the quotient and bias to the output signal, or the equivalent. A typical divider equation shall be of the form:

   Output = K_1 * (Y/X) + K_2

   Where X and Y are input signals

   K_1 and K_2 are adjustable parameters.

5. **Real-Time Data Averaging Algorithm**: Real-time data averaging algorithms shall be provided to calculate running averages of measured and virtual variables. The

software shall not require the PCM to store all of the discrete data samples being averaged. Real-time modules shall be provided to time integrate measured and calculated variable rate data.

6. **Max/Min Algorithms**: Max/Min algorithms shall be provided which record the maximum and minimum data value generated by measured and calculated variables during a designated time interval. Two maximum/minimum identification detection modes shall be provided. The first shall consist of monitoring discrete data values which are sequentially compared against the previously detected discrete maximum and minimum values. The second mode shall consist of averaging the three most current data values and then comparing the average against both existing and maximum and minimum averaged values. The second mode is provided to reduce the effects of random values. For both modes, previously detected maximum and minimum values shall be replaced whenever exceeded by current high and low data values, respectively.

7. **Logged Variables**: Input data shall be sorted, compressed, totalized, averaged, filed and then transferred to the WS/HISTORIAN in response to an Operators request to support functions associated with the WS/HISTORIAN.

H. **Control Algorithms:** The following control algorithms are being defined to indicate the level of functionality and inter-algorithm interaction associated with fundamental control applications associated with. This listing is not all inclusive of project requirements in that additional control algorithms may be required to configure a complete and operable system. In all cases of regulatory (modulating) control algorithm configuration, the algorithm shall be configured to track the manipulated variable or manual setpoint to avoid process excursions.

1. **PID Control Algorithms**: Continuous digital control (PID) shall be implemented in the PCM using a high level process control language. Control calculations for PID shall be performed after each scan of the associated controlled variable(s) and new controller set points or final control element operating values generated and issued as required. Control loop states shall be changeable from automatic to manual and vice versa via Process Control Module Logic (PCML) and under Operator control at the WSs. Manually entered control strategy data shall be validity and quality tested in the same manner as scanned input variables or calculated variables.

    a. Position and incremental outputs to final control elements shall be constrained using a PID algorithm with both high, low and rate limits.

    b. Set points shall be constrained to lie between adjustable high and low limits. In addition, if a PID algorithm is employed with an error-based derivative term, an adjustable set point ramping rate limit shall be provided to minimize process variable excursions when set point changes are introduced.

    c. Manually entered analog data values shall be buffered so that the affected parameter is ramped to its new value at a specified maximum rate.

    d. Provision shall be made to prevent windup in the PCML control algorithms.

e. If a control strategy failure has occurred, i.e., the control strategy output exceeds second level high/low amplitude limits, an analog input failure has occurred, i.e., the input value exceeds second level high/low amplitude limits or a control strategy linkage has been broken by the Operator, all attached PID algorithms shall revert from auto control to manual.

f. When a PID algorithm incorporating feedback, feed forward or cascaded control loops is in the "auto" state, the output of the control algorithm shall be automatically fed to the associated final control elements or to the set point of a secondary control algorithm. In addition, all other loops within the PID algorithm shall be in the "auto" state.

g. When a PID algorithm incorporating feedback, feed forward or cascaded control loops is in the "manual" state, the control algorithm output shall be disabled and the output to the associated final control elements shall be under the manual control from the WS.

h. If one or more of the feedback control loops has failed with the outputs of all failed feedback loops being deactivated and placed under manual control one or more of the feedback loops is in a "manual" state because of a control loop failure where all failed inputs and outputs have been replaced with manually entered data; or because one more loops is in a "manual" state because the Operator has replaced valid sampled or derived data with manually entered data, then the PID algorithms incorporating feedback from the attached control loop shall revert to a manual state.

2. **Sequential Digital Control (SDC)**: Control calculations for SDC shall be performed as necessary after each scan of discrete and analog inputs associated with a particular SDC algorithm. SDC control states shall be changeable from automatic to manual and vice versa via PCML. SDC algorithms shall be linked to PID algorithms where appropriate. A SDC loop status shall be changed from automatic to manual and a change-of-status alarm generated if an associated analog input exceeds a second level high/low amplitude limit or if there are irrational combinations of associated discrete inputs. Two SDC control loop output states shall be possible as described below.

   a. When a loop is in the "automatic" state, the output of the control algorithm is fed directly to the associated final control element(s).

   b. When a loop is in the "manual" state, the control algorithm output is disabled and the output to the associated final control element(S) is under the manual control.

3. **Lead/Lag Algorithms**: Lead/Lag algorithms shall have the capability of providing dynamic lead/lag compensation to an input signal. The lead/lag element shall represent the transfer function:

   Output = K (T1 * s + 1)

   (T2 * s + 1) *X

Where X is the input signal.

T1 is an adjustable lead time constant.

T2 is an adjustable lag time constant.

s is the LaPlacian operator.

K is a gain factor.

4. **High/Low Selector Algorithms:** High/Low selector algorithms shall have the capability of selection of the highest or lowest of at least two input signals. A high selector shall have an output equal to the highest of the input signals. A low selector shall have an output equal to the lowest of the input signals.

5. **High/Low Override Selector Algorithm**: High/Low override selector algorithms shall have the capability of selecting one of eight control loops to manipulate a final control element. The override selector shall select either the highest or lowest of the input signals to manipulate the final control element. Additionally, the override selector shall provide a feedback signal to non-selected controllers to prevent them from "winding-up" in the low or high direction. The operator shall be able to specify a limit for the difference between the selected and non-selected controller outputs.

6. **Auto/Manual Station Algorithm**: Auto/manual station algorithms shall have the capability of an auto/manual station which shall allow the operator to place an external bias on the input signal when in auto mode. When in manual mode, the operator shall be able to manipulate the station's output. The auto/manual station shall be self-balancing to enable bumpless transfer from manual to auto and auto to manual without any manual balancing.

7. **In-service/Out of Service Algorithm:** In-service (IS)/out-of-service (OOS) algorithms shall have the capability of masking or blocking out all or selected alarms associated with the OOS device i.e., if a wetwell is declared OSS, low level alarms shall be inhibited. OOS algorithms shall be implementing using analog and digital ladder logic. If a device has been designated OSS, all control routines shall declare the equipment or a train of equipment as being unavailable for service. This will also apply to valves. Further requirements for display of Out of Service status are in Section 2.20.

    a. The OOS algorithm shall be implemented for any plant equipment monitored by the DCS and greater than 5 HP.

    b. Functions for future implementation with the MMS: The MMS EMPAC modules shall dynamically receive out-of-service status from the DCS. A "tag out status" for a piece of equipment entered on the MMS system shall automatically result in the assignment of an "out of service" status on the DCS.

2.19 ALARM CONFIGURATOR

A. Alarm Algorithms: A WS configurable alarm subsystem which manages the initialization, configuration, display, and actions of alarm messages and alarm associated keys within a workstation shall be provided. It shall provide as a minimum:

1. List of unacknowledged alarms.

2. Current alarm list.

3. Alarm history list.

4. Control of Current Alarm Display (CAD) and actions associated with process alarm messages.

B. **System Alarms:** Alarms related to the health of the network and of the stations and peripherals on the network shall be provided.

C. **Plant/Process Alarms:** Alarms related to the process control compounds and algorithms shall be provided. Information available for this type of alarm shall include the control strategy/algorithm/point name, date and time of alarm, alarm type, value at time of alarm, alarm quality, type of alarm, units, and value of alarm limit exceeded.

D. **Voice Alarm Annunciation:** The alarm subsystem shall support voice alarms using digitally recorded audio files on the WS hard disk. An audio signal output on the WS shall provide a standard audio pre-amp signal to external speakers which have built-in amplifiers. The notification of alarming at a workstation shall be suppressed by assigning an alarm the lowest priority via the Integrated Control Configurator. The sounding of a voice alarm at the workstation shall be configured based on a priority of 1 for system alarms and a priority of 2-4 for the incoming process alarms. The priority threshold for the alarm shall be user-defined. Alarm Panel and Alarm Table configurators and a user changeable file for alarm default configuration shall be provided for defining and setting up alarms.

E. **Current and Historical Alarms:** The Alarm Subsystem shall support both an Alarm History and Current Alarm Queue. The Alarm History display shall show up to 5000 occurrences (plant/process alarms and return from normal events) in chronological order. Acknowledged alarms shall be indicated by a change in color of the alarm entry, or by re-sorting or removing alarms to an Acknowledged Alarm list. Alarm entries shall clear from the CAD based on the acknowledgement and return to normal states. A field associated with each alarmable point shall be able to be preconfigured with a process diagram index, which can then be activated by selecting the point and using the cursor control device button.

F. Alarm Processing Modules: On each scan, the PCM shall test for the occurrence of such events. Upon recognition of an alarm or "return-to-normal" condition, the PCM shall retransmit the data for annunciation, display, and recording purposes. Alarm messages shall generate upon the occurrence of an alarm condition or when alarm summaries are requested. Alarm sources shall be as specified below:

1. **Alarm Processing:**

a. All hardwired alarm inputs shall be transmitted to the associated PCM.

b. All analog inputs and associated calculated variables configured for alarms shall be tested for high/low limit violations by the associated PCM.

c. All analog inputs and associated calculated variables so configured shall be tested on each scan for high/low rate-of-change limit violations by the associated PCM.

d. A discrepancy alarm shall be configurable in control logic for any final control element if an irrational combination of associated discrete inputs and outputs occurs. If a discrepancy exists between a PCM command and the device status, e.g., the PCM commands a drive to start after establishing that the device is in the "ready-to-run" condition, and the drive fails to start, then a discrepancy alarm shall be generated. Likewise, involuntary changes in device status shall be noted, e.g., pump starts when not commanded to do so or pump runs and then shuts down even though it still has a command to run. All discrepancy alarms shall be listed in the software submittal.

e. Because many discrete final control elements have a cycle time in excess of the scan interval, each output shall have an associated delay period selected to be longer than the operating period of the final control element. Delay periods for each final control element shall be configurable in control logic. All time delays shall be listed by the CONTRACTOR in the software submittal.

f. Alarm/Event Logging: A program shall be included to log the following: Record all hardware and software generated alarms and Record "return-to-normal" for all alarms.

g. Although many of the analog data points shown in the Contract Documents were not represented with high and low alarms, the CONTRACTOR shall configure alarm points for all inputs, outputs, and calculated data points.

2. **Limit Checking**: Dual level limit checking modules shall be provided which shall identify a limit violation when every time a measured or virtual variable goes out-of-limits and returns back into limits. The software shall determine the time at which each limit excursion occurred. An alarm limit deadband shall be provided to prevent a point which is hovering around an alarm limit for becoming an eventual nuisance. The deadband shall be expressed as a percentage of span or in engineering units and shall be adjustable from the WS. All high/low limits shall be set independently for each analog data channel. An unreasonable data alarm shall be generated whenever a signal amplitude or rate-of-change value exceeds or becomes less than a first level high/low value. Whenever a second level high/low amplitude limit value is exceeded, the operational status of associated, software-based control strategies shall be unconditionally changed from automatic to either provisional or manual control and a change of status alarm shall be generated. Whenever a signal amplitude value becomes less than a second high/low limit value a change of status alarm shall be generated but the associated control strategies shall remain in provisional or manual until placed under automatic control by the Operator. All limit check alarms shall be displayed at the WSs. The

value of all high/low limits shall be established by the CONSTRUCTION MANAGER during system construction.

3. **Erroneous Alarm Suppression:** Due to the discontinuous nature of many of the sub processes associated with a treatment plant, certain discrete and analog input alarms must be processed via logic modules such as AND, OR, Exclusive OR, NOT etc. to produce conditional inputs. Typically, if a pump is directed to be in the "OFF" state, low discharge pressure alarms shall be suppressed. Additionally, if a flow meter is indicating zero flow but its associated pump is confirmed as being in the OFF condition, the non-zero value shall be set to zero to preserve system logging and trending integrity. The CONTRACTOR shall submit a complete listing of data and status points which must be suppressed/manipulated in the software submittal.

4. **Rate Checking**: Rate checking modules shall be provided which shall identify a rate limit violation every time the time-rate-of-change of a measured or virtual variable exceeds or becomes less than rate limit selected at the WS. The software shall determine the time at which each rate limit excursion occurs. A rate-limit-out/rate-limit-in deadband shall be provided (expressed as a percent of the rate limit value or in engineering units) whose width may be altered at the WS.

5. **Inferential Alarming**: The PCM shall be capable of receiving down loaded process scenarios in the form of logic associations between process I/O, manual inputs and calculated invariables and use these scenarios to generate inferential alarms with an associated priority level. Process scenarios shall be developed by the CONSTRUCTION MANAGER and will consist of the implementation of AND, OR NOR, NAND GATES, signal characterization, look-up tables, signal monitors and timers. Typically, inferential alarming shall have the functionality to compare parameters associated with process equipment (amp draw, speed,), extrapolate a theoretical output from the equipment curves, and compare this calculation to measured parameter such as flow, level or pressure. If a deviation or an incongruity exists between the monitored and calculated values, an inferential or an advisory alarm will occur. A typical example of inferential alarming shall be the monitoring of the variable speed primary sludge pumps. In this instance, the DCS shall store the pumps speed versus flow parameter (either as a look-up table or as a mathematical relationship and shall also monitor pump discharge flow with a dedicated flow meter. If the pump is active and a discrepancy of "X" percent exists between the extrapolated flow and the measured slow, an inferential alarm would be generated. A total of twenty five (25) inferential alarming schemes shall be implemented by the CONTRACTOR. Subsequent to the initial development, the CONTRACTOR shall incorporate this work into the software submittal and implement. Inferential alarms shall have display capabilities identical to all other DCS alarms.

G. Alarm Display and Processing: All alarm detection shall occur at the PCM level. Once detected, alarms shall be announced at the WS in the following manner:

1. Conditional text shall appear on the CRT graphic in a colored consistent with the alarms dedicated priority. Text shall describe the alarm condition and indicate present value.

2. Shapes associated with the alarm condition shall blink.

3. An alphanumeric message announcing the alarm condition shall appear in a CRT screen area exclusively reserved for alarm posting. This alarm scratch pad area shall always be present on each CRT independent of operator function. Messages shall contain time of occurrence, tag number, alarm description, current value alarm limits.

4. NOTE: Each of the preceding alarming features shall be capable of being utilized or silenced based on the priority assigned to an alarm. The alarm subsystem shall accept a minimum of 5 distinct priorities.

5. Operator acknowledgment of an alarm shall cause text/horn to change state/silence.

H. **Alarm Actions**: There shall be four (4) priorities available for alarming. The alarms shall appear on the alarm list in reverse video indicating that they are "unacknowledged". Once acknowledged they shall return to normal text. The priority should be 0(white), 1(yellow), 2(magenta), and 3(red) - lowest to highest. As a minimum, the alarming package shall perform as follows:

1. Detection of a priority No. 1 alarm (indicative of process excursions).

2. Shapes or text associated with alarm point display in a white color on the monitor.

3. Operator console annunciator announces the alarm with a Priority No. 1 intensity and pitch.

4. Detection of a Priority No. 2 alarm (indicative of impending hazard to equipment or process).

5. Shapes or text associated with alarm point display in a yellow color on the CRT.

6. Operator console annunciator announces the alarm with a Priority No. 2 intensity and pitch.

7. Annunciator horn located on process floor announces the alarm with a Priority No. 2 intensity and pitch.

8. Detection of a Priority No. 3 alarm (indicative of impending hazard to personnel safety).

9. Shapes or text associated with alarm point display in a red color on the CRT.

10. Operator console annunciators announce alarm with a Priority No. 3 intensity and pitch.

11. Annunciator horns associated with the Page/Party system and located on the process floor and external to the process building which contains the alarm point announce the alarm with a Priority No. 3 intensity and pitch. The CONTRACTOR shall provide the required interface cables and signals to the page/party amplifier.

2.20 REPORT CONFIGURATOR

A. **General:** The report Configurator shall consist of all resources needed to generate process, facility, department and system reports. All software algorithms shall be object oriented and linked to facilitate revisions and modifications and to minimize redundant coding of identical tasks. All software shall be structured so that an expansion in digital system hardware and/or the addition of new process inputs and outputs can be accomplished without having to reengineer report software.

B. The report configurator shall allow the operator to generate printed reports listing the status of a set of control strategies and algorithms that are in an exception condition; e.g., in alarm, in manual, not on control. The operator shall be able print or to write the report to a file, to be copied to diskette for long-term storage of report data.

1. The configurator shall be able to be accessed concurrently by several WS Processors. The configurator shall contain an easy-to-use operator interface.

2. The configurator shall let the operator select configured report files that already exist, or define new report files. Files that contain reporting selections shall include a list of available printers; control strategy and algorithm names; specifications for the control strategies/algorithms and their associated exception states and report types; alarm conditions.

3. The report configurator shall have the computational capabilities to perform the following operations;

4. Summation, subtraction.

5. Multiplication, division.

6. Integration.

7. Differentiation.

8. High/low select.

9. Average Value; hourly, shift, daily, weekly, monthly, yearly average.

10. The report configurator shall interact with resources that collects current values of specified variables from on line data storage areas, statistically manipulates data, and creates and maintains a data base of values collected. Statistical manipulation shall include linear averaging, filtered averaging, and noting of "bad" or suspect values.

C. The configurator shall enable the operator to select configured report files that already exist, or define new report files. Files that contain reporting selections shall include a list of available printers; tags and algorithm names; specifications for the tags/algorithms and their associated exception states and report types; alarm conditions.

D. The report configurator shall support the generation of 4 distinct types of report generation. Each of these types of reports shall be capable of having any or all of

reporting frequencies based on hourly, shift, daily, weekly, monthly, or yearly. Process reports shall consist of a total of seventy five (75) pages with twenty (20) variables per page; management reports shall consist of a total of one hundred (100) pages with twenty (20) variables per page; Department Management reports shall be as defined under 2.4 herein; and control system reports shall consist of minimum of ten (10) pages. Report types are as follows;

1. Facility Process Reports: Contain data derived from on-line process a measurement and lab data which has been manually inputted with an associated time and date.

2. Facility Management Reports: Contains data derived from the resources associated with FIN. Reports shall include MIS, MMS, and LIMS data.

3. Department Management Reports: Contains data derived from resources associated with DIN, FIN, and PIN.

4. Facility Control Systems Reports: Contains data relating to component availabilities (uptime); diagnostic results; network diagnostic results; listing of all alarms associated with a tag, algorithm, or hardware device; time stamps of when automatic system backup occurred; listing of all points not in scan, etc.

2.21 HISTORIAN CONFIGURATOR

A. **General:** The Historian System (HS) shall be a real-time software supported system which shall provide process management capabilities. The system shall:

1. Communicate with the Lab and Office terminals over the FIN, WSs, DIN devices, and all process control modules (PCM's).

2. Maintain a process information data base to support historical data storage, retrieval operations, report/log generation, trending, and event reconstruction.

B. All software shall be provided to enable historical data base generation to be accomplished by a conversational fill-in-the-blanks technique on WS display formats in which operational characteristics (i.e., name, scan class, alarm limits, etc.) are inserted into linkable prewritten software modules which perform scanning, computational, and collection functions. Once the information is transcribed into system algorithms, the data base software shall:

1. Read and interpret the information.

2. Generate report files.

3. Perform self documenting functions such as producing hard copies of listings, main and disc memories, and data sorts by analog input, analog output, contact input and contact output.

C. The software system shall incorporate a disk memory resident data base which shall store all software elements necessary to implement all data acquisition, calculation, logging and reporting functions. The system data base shall be comprised of the following elements:

1. Current data base; includes process status information.

2. Historical data base; includes non-current process status information.

D. The HS shall extract data from the communications networks at specifiable rates as defined at the WS. In addition to defining the historical database contents and the data associated collection rate, the operator at the WS shall also be able to define floating point formats, and calculation requirements. All data shall be stored in a system data base. Typical input signals to be scanned include:

1. Limit, status, or position information from open/close valves, motors and process monitoring devices such as flow, temperature and pressure switches.

2. Measured variables such as flows, pressures, etc.

3. Measurements, set points and outputs from PCM-resident controllers.

4. Computed values such as inferential measurements.

5. Operational commands from WSs.

6. Manually Inputted data.

7. Password Activity (sign on/sign off times, WS activities during interval between sign on and sign off by password, etc)

E. HS computational algorithms, which are configurable at the WS shall be provided to perform:

1. Average

2. Maximum and minimum

3. Time of min/max.

4. Integration.

5. Toggle.

6. Toggle reset.

7. Time reset.

F. The HS shall be provided complete with all programming that collects current values of specified variables from on line data storage areas, statistically manipulates data, and creates and maintains an historical data base of values collected. Statistical manipulation shall include linear averaging, filtered averaging, and noting of "bad" values. Statistically manipulated data shall then be stored in an historical data base.

1. The frequency of historical collection shall be selectable from 0.1 to 1 second. The type and quantity of historical data shall be selectable by addition and deletion to/from the historical data base. The HS software shall support point collection on

an exception basis with adjustable dead bands, or on a time basis. The HS software shall be capable of supporting up to 10000 individual tags at varying collection intervals.

2. All required software shall also be provided to enable delta-band data storage techniques.

3. The HS shall be furnished complete with all utility and application software required to enable interaction with all subsystem specified.

4. The CONTRACTOR shall provide fully paid up licenses for all software packages provided.

5. The CONTRACTOR shall provide any necessary licenses, media or documents normally provided to support the operating Historian System.

G. Historian software shall be the EMERSON WDPF II Historian.

H. RESERVED

2.22 STATION (WS) CUSTOM GRAPHIC SCREENS

A. **General:** All process graphic displays shall reside in non-volatile or battery-backed RAM/DRAM memory resident in each workstation (WS) and be updated in accordance with the display response time requirements specified herein. All process graphics shall utilize advanced graphic features such as isometric representation of process equipment, tanks, and flow lines; line-fills which use the dynamic movement of color and patterns to indicate the current process flow routing in pipelines or channels; permissive dialog boxes which itemize all of the permissives, and their current state, associated with control strategies related to the currently displayed process graphic. The number of unique process graphics required under this contract is listed in the APPENDIX. All graphics shall be stored in non-volatile memory and shall be updated in conformance with display response times stated herein. The CONTRACTOR shall furnish a minimum number of process graphics as listed in the APPENDIX, with each graphic containing a minimum of (a) five (5) analog or calculated variables, (b) fifteen (15) discrete status information points used to annotate equipment status coloration, (c) five (5) fields of conditional text which are generated by discrete alarms and high/low current trips associated with analog values discrete and current trips, (d) seven (7) process equipment/tank shapes, drawn in an isometric format, which are color annotated by associated status and alarm conditions, (e) three (3) instrument shapes, (f) ten (10) main process lines, drawn in an isometric format, which are dynamically filled by the detection of an associated device's active status, (g) five (5) poke points which are used to invoke displays associated with control stations for process equipment, displays which list the status of all permissives associated with a particular control routine or process equipment device, or preformatted trend displays. These custom graphics which do not include template graphics (such as trends, manual/auto (M/A) stations or other generic graphics required for this project), shall typically incorporate a total of thirty (30) variables for each process graphic. Graphics shall be built in accordance with the existing COMNET Graphics Criteria, and further defined in a series of Graphics User group meetings to be held.

B. **Display Hierarchy**: Each WS shall be configured with displays arranged in a hierarchical manner which enable rapid movement between various levels via paging or other logic oriented functions. The hierarchy shall apply to both process and system oriented displays. Each WS shall, as a minimum, be configured in conformance with a hierarchy consisting of the following displays levels:

1. Global level
2. Regional level
3. Group level
4. Loop level
5. Component level

C. **Process Global Display Layer**: The process global display layer shall be a level of display which presents a department-wide overview. Process Global Displays shall consist of a series of pages which:

1. Depict system, date, time and status on all displays.
2. Graphically depict, in an algorithm diagram format, each on-site and offsite regional plant process area and the logical association between each area.
3. Indicate the current and historical operational level based on percent of capacity.
4. Indicate the current and historical energy efficiency based on connected load. An X-Y plot of operational versus energy efficiency shall be displayed.
5. Itemize each process area which currently exhibits alarms of a given priority (E.G., separate listings of priority No. 1,2,3 alarms associated with each area).
6. Presents a main menu which lists all process regions or areas. The operator shall be able to use this menu to page or link down to the Process Regional Display Layer.

D. **System Global Display Layer**: The system global display layer shall be a level of display which shall depict the current status and "health" of all on-site and off-site DCS components. System Global Displays shall consist of a series of pages which:

1. Depict system date, time and status on all displays.
2. Graphically depict the on-line, off-line, backup and failure status of all devices.
3. Indicates the accumulate run time for each device. For those devices which have backup controllers, the accumulated run time for on-line mode operation shall be indicated for each controller.
4. Indicate the availability of each device or component for which a run time is being accumulated. This display shall also indicate the availability for the entire system. All calculations to support the availability calculations shall be in conformance

with these specifications. These calculations shall be distributed throughout the system to preserve the calculations integrity.

5. Indicate all system diagnostic results including time-out response, allocated time to transmit and actual time to transmit.

6. Indicate all system alarms, and their associated priority, which have occurred in the previous twenty-four (24) hours.

E. **Process Regional Display Layer**: The process regional display layer shall be a level of display which presents a detailed view of a prescribed process area. Process Regional Displays shall consist of a series of pages which:

1. Depict system date, time and status on all displays.

2. Present a deviation overview which displays, in bar graph form, the deviation of this area's key process variables from their corresponding set points. All loops which have exceeded a prescribed deviation shall have their respective bar graph change color.

3. Presents a bar graph depiction of all process variables engineering values with their associated alarm limits being indicated. If a variable has exceeded in rate or absolute alarm limit, the bar graph shall change color.

4. Presents a display, in an isometric PID ID format, which illustrates all of the process equipment and instrumentation associated with this area. All process graphics shall be drawn in an isometric format and shall depict critical engineering values, all equipment status indicated by conditional text and color, and all process lines shall be dynamically filled with the appropriate color when flow is detected or equipment is active. All operator actions shall be pokable. These displays shall also incorporate the windowing of trend and X-Y plots.

5. Presents an alarm and event history of all area alarms or operator interface events. All data shall be annotated by tag names, descriptors, event, occurrence, type of alar, priority, current value, alarm limits, and alarm status. All unacknowledged alarms shall be annotated in a reverse video format.

F. **System Regional Display Layer**: The system regional display layer shall be a level of display which shall depict the current status and health of each DCS component within a prescribed process area. System Regional Displays shall consist of a series of pages which:

1. Depict system date, time and status on all system displays.

2. Graphically depict the on-line, off-line, backup and failure status of all devices.

3. Indicates the accumulated run time for each device. For those devices which have backup controllers, the accumulated run time for on-line mode operation shall be indicated for each controller.

4. Indicates the availability of each device or component for which a run time is being accumulated. This display shall also indicate the availability for the entire system. All calculations to support the availability calculations shall be in conformance with these specifications. These calculations shall be distributed throughout the system to preserve the calculations' integrity.

5. Indicate all system diagnostic results, including time out response, allocated time to transmit, and actual time to transmit.

6. Indicate all system alarms, and their associated priority, which have occurred in the previous twenty-four (24) hours.

7. Present a graphic depiction of all of the printed circuit boards associated with a particular device. All boards which have failed diagnostics shall be alarmed and be annotated by a change in color.

8. Present a board-level diagnostic fault display analysis which itemizes the specific cause for fault assignment. All descriptions shall be English language devoid of computer terminology.

9. Present a graphical input/output display which enables the detection of a problem or failure down to the point level. This display shall also indicate A/D and D/A performance, accumulated run times per board and availability per board.

G. **Process Group Display Layer**: The process group display layer shall be a level of display which presents the operator with information on and a means to control key variables and equipment within the prescribed area from which this display was accessed. Process Group Displays shall consist of a series of pages which:

1. Depict system date, time and status on all displays.

2. Depict bar graphs showing values of set points, alarm limits, control outputs and process variables. All alarms shall be annotated by color change. All values shall be in engineering units.

3. Depict manual, automatic and cascade mode status.

4. Depict, in a graphical format, logic stations which enable the operator to perform logical operations such as opening and closing valves, starting and stopping motors and starting and stopping control sequences. Every control output shall have a dedicated logic station.

5. Depict trend displays which are windowed into displays with associated data.

6. Depict, in an isometric P & ID format, a detailed view of each sub process.

7. Depict In/Out of Service Status for each device.

    a. The OOS assignment shall be made from a button on the pop-up control window for each device.

b. The Out of Service Status shall be indicated by "graying-out" the device symbol on the control graphic.

H. **Process Loop Display Layer**: The process loop display layer shall be a level of display which presents an interface for the operator to interact with the process on a loop level. Process Loop Displays shall consist of a series of pages which:

1. Depict system date, time, and status on all displays.

2. Depicts, in a graphical format, M/A control stations for each analog output in the area. This display shall display process variables in engineering units, display controller output in percent, display the mode that the control system is in, display alarm limits in engineering units and in percent output. The display shall enable an operator with proper security clearance to perform any one or all of the following:

   a. Change control modes

   b. Ramp set point

   c. Enter finite value for set point

   d. Delete variable from scan

   e. Change alarm limits

   f. Delete alarm actions

3. Depicts, in a graphical format, a high speed X-Y plot or trend which can be windowed into displays with control status.

4. Depicts control loop tuning displays which are designed to be used by operators, process engineers and instrument engineers. Plant personnel shall be able to use these displays to make step changes, activate/deactivate loops, trend process variable versus output versus response time and perform on-line tuning adjustments. All of these tasks shall require proper security clearance. These displays shall be generated for each loop and shall contain:

   a. A control station displayed in graphical format.

   b. A windowed fast trend X-Y plot.

   c. A listing of all the tuning parameters associated with the loop, (e.g., proportional band, reset rate, derivative rate, etc.)

I. **Process Component Display Layer**: The process component display layer shall be a level of display which presents a highly detailed historical accounting of all major process equipment, all DCS components and all field analog devices. Process component displays shall consist of a series of pages which:

1. Depict system date, time and status on all displays.

2. Graphically depict the current status of each process equipment device which utilizes over five (5) HP or more on a dedicated P&ID isometric formatted graphic. Each graphic shall display current status, values in engineering units which are associated with the device, alarms, accumulated run time, a history of all past alarms, indication of manufacturer, model number and date of installation of all associated components.

3. Graphically depict the manufacturer, model number, date of installation, accumulated run times, alarm history and availability of each DCS component.

4. Graphically depict the manufacturer, model number, date of installation, drawing reference and calibration data associated with each analog device being installed under this project. Displays shall also have an imbedded alarm history based on process and validity of alarms.

2.23 WORKSTATION (WS)-TREND SUBSYSTEM

A. **General:** A collection of pre-built (preformatted) display fields that show lines (trends) representing changing data values from the real-time database and from the historical database shall be furnished. The Trend Subsystem shall be able to trend any variable in the data base, both analog and discrete.

B. The maximum number of trends shall be limited only by the display storage media capacity. Each trend line shall be capable of at least 600 samples of the process variable. Any CRT shall be able to display any historized variable from any historian in the system. Historical trend data shall be capable of being archived to streaming tape and/or floppy disk to be able to be displayed at any future date.

C. Trends shall represent changing data values from the real-time database, and from the historical database. Trends shall be configured on-line with the Display Configurator, and shall be laid out using the Group Display Configurator. The on-line trend configurator shall be selectable from a Detail display, to allow change of trend area attributes and trend line attributes without disrupting the process.

D. A library of standard trend areas, X/Y plot areas, and profile plot areas which can be copies into any display shall be furnished. The trend areas shall vary in size (resolution) and shall be of two types: real-time and historical. The X/Y and profile plot areas shall also vary in size. The Display Builder and Display Configurator software shall include these areas in user-defined displays, and the Display Configurator shall be used to assign the desired configurable options. Trend areas to include as a minimum:

1. Up to eight trend lines per trend area representing variable data types (Boolean, signed integer, real, and signed long integer)

2. Tick marks indicating division of the axis

3. Time axis length shall be chosen freely

4. Y-axis scaling shall be independent of its length

5. Off-normal limits shall be available in different colors

6. Background color of a trend area shall be changeable

7. Trend line color shall be changeable per trend line

8. Solid trend shall be drawn instead of a line trend

9. X-Y trend objects (one variable versus another)

10. Reassignment to any process variable in the system

E. Text fields shall be defined and configured:

1. Loop Tag

2. Loop Descriptor

3. Any parameter engineering unit

4. Engineering Unit Descriptor

5. Scroll frequency for an entire trend area (limited to real-time trend objects)

6. Per-trend variable:

a. High range value

b. Low range value

c. Value at ruler (for direct readout)

d. Off-normal limits

F. **Real-Time Trending:** Real-time trend areas shall scroll dynamically as data changes occur according to the selected scroll frequency (e.g., 1, 2, 5, 10, 30, 60 seconds). Scrolling and updating of real-time trends start immediately after calling up the display. Real time trends shall be capable of collecting and displaying all 1 second samples without averaging or compression.

G. **Historical Trending:** Historical trend areas shall provide purely historized data from the historical database files, which shall include sample data and reduction group data; archived sample group data and archive reduction group data; restored archive sample group and archive reduction group data from floppy disk or streaming tape. Historical trend variables shall incorporate any data reduction and archiving functions thereof. On-line Historical Trend Area interactions shall include:

1. Selection of parameters to be viewed from the Historian data base.

2. Specification of the high and low scale of the Y-axis for each variable for more or less detail.

3. User definition of the time window (base time and/or time span) specified by the time axis in order to view another portion of the history or to view a portion in more or less detail.

4. Use of a moveable ruler to position and numerically read out historical variables within a displayed time window.

5. Specification of off-normal limits.

6. Zero axis readings.

2.24 WORKSTATION (WS)-X/Y PLOTS AND PROFILE PLOTS

A. **General:** The X/Y plots shall contain two variables which are plotted against each other. These variables shall be real-time data taken from object manager-connectable variables within the system or a file of X/Y pairs. The data points shall be collected at a configured scan rate and displayed as a series of points or markers that can be connected. Color shall be used to designate the latest X/Y pair and previously plotted points. Via the use of colors, file data shall be visually compared to recent real-time data. Plots shall include as a minimum:

1. Background color of X/Y plot shall be changeable.

2. Objects shall be capable of being added to the background area.

3. Style selection of real-time and file plot data

4. Standard grid

5. Multiple colors for representing the most recent data point, real data, and file data.

B. The X/Y plot line attributes for each variable shall include: high scale value, low scale value, and delta change value (for real-time data). Default values for these attributes shall be accessed directly.

C. The profile plot area shall display data accessed from a data array of the following type of data: float, long, integer, or byte. The plot shall display each data point along the X-axis with the value of each point associated with the Y-axis. The profile line shall include: high and low scale values, high and low alarm values, the start and end offset for the data array, and the location to which a selected point value is to be sent. The profile style shall be either line profile or bar profile and updates occur simultaneously or by exception. Plot shall include as a minimum:

1. Up to four lines of bar lines per plot area.

2. A reference line representing the median value for each line

3. Line color specified per lot line under normal conditions

4. Off-normal limits specified in a different color

5. Reference line color

6. Lines or bar lines shall be mirrored along the Y-axis

2.25 AUTOMATICALLY GENERATED DISPLAYS

A. Automatically generated displays shall be fully operational displays, which are presented in three levels of control hierarchy:

1. Station display

2. Control strategy and Algorithm Overview display

3. Detail display

B. A Station Algorithm shall convey information about the system capacity parameters for a Process Control Module type station. This algorithm shall be installed automatically when the database is downloaded, and provides global data storage for system functions. Information displayed includes: percent of CPU time used for processing input/output, all algorithms and continuous control algorithms; free memory available; Object Manager scanner data; cumulative algorithm processor overruns; total inter-station IPC connections; and peer-to-peer point connection status.

C. To access a control scheme without configuring displays, the operator shall be able to request the Control strategy and Algorithm Overview display. The current level of criticality (the highest priority alarm that exists in any algorithm within the control strategy) and relevant data shall be displayed for each control strategy and algorithm. All alarm information displayed or set by Default Displays shall be received from or sent to Processors. This includes the acknowledged and/or unacknowledged status of the alarms.

D. Displays for individual control strategies shall be accessed from the Compound and Algorithm Overview display. Control strategy displays shall be live displays that allow interaction with all algorithms within a single control strategy. Control strategies from several processors shall be grouped and turned on or off as a group.

E. Detail displays for individual algorithms shall be accessible from the Control strategy and Algorithm Overview, Alarm History and Current Alarm displays. Detail displays shall allow operator manipulation of all valid algorithm parameters. They shall show all connectable algorithm parameters, a faceplate area and a real-time trend area (for continuous control algorithms). In graphic format and in a small area, faceplates shall provide information as to algorithm type and description; measurement, setpoint, output values; algorithm state and status; alarm condition; auto/manual and remote/local designation. There shall be three categories of algorithm types/domains as a minimum:

1. Continuous Control

2. Sequence Control

3. Ladder Logic (Programmable Logic Algorithms)

2.26 PREFORMATTED GROUP DISPLAYS

A. **General:** Preformatted displays provided shall be modified or new ones created through a menu-driven configuration and editing process. Link preformatted displays shall be linked to each other and to graphics to form a user-defined display hierarchy.

B. The group display shall present information for up to eight control algorithms in a four-over-four screen layout. It shall show each algorithm as a faceplate with a unique layout available for each algorithm type. The display shall contain faceplates, trends, or X/Y plots or a combination of all three. Display Builder and Display Configurator shall be used to edit displays.

C. Sequence algorithms shall be intermingled with Continuous algorithms and PLB algorithms in the group display when required. All control algorithm types/domains shall be supported. Group display interactions shall be performed with screen functions keys. Interactions to include as a minimum:

1. Control and alarm monitoring of algorithms

2. Ramping or numeric entry of set points, ratios, targets, outputs, etc.

3. Toggling discrete values and controller states

4. Requesting the Detail display for a selected algorithm

5. Direct access to the previous display

2.27 INVOKING DEFAULT DISPLAYS

A. Default displays, preformatted displays, and user-defined displays must all be invoked in an identical manner. Any specific pre-defined display shall be assigned to and called from any menu, attached to a hard annunciator key or soft (screen) key, called via an application program, or attached to an active display object with a display.

2.28 ELECTRONIC DOCUMENTATION

A. **General:** Systems documentation shall be provided on the system itself in electronic format. It shall be available as DVDs to be run as a separate entity, and as on-line help that is associated with the software functions themselves. DVDs shall be used as they are needed or be loaded onto the hard drive for easy access.

B. Documentation shall be broken down by function and user. Information required by process operators shall be included in a Process Operator's Guide; information required to configure process control algorithms shall be included in Integrated Control documents and shall be geared toward the process engineer.

1. **Loadable Documentation:** Loadable documentation shall provide comprehensive information about hardware and software. It shall consist of text and graphics displayed on the workstation screen. Documentation shall be able to run in its own window concurrently with other applications. Documents shall be accessed via the menu bar pick, with further selections made from another menu and table of

contents. Documents shall be picked from an alphabetical list or from functionally organized subgroups. Once a document is selected, choice of reading the entire document, a specific area of interest or list of figures, or an index that shows the document selections that discuss the subject area desired will be made available. Various screen control functions shall be provided as selectable icons displayed at the bottom right of each screen of text. These shall include Next Screen, Previous Screen, Next Section, Table of Contents, Exit, and Return. A distinction shall be made between active and inactive selections using different icons.

2. **Printing Loadable Documentation:** Loadable documentation shall be printed by a special utility that prints all text sections in the document. Each printed page shall contain up to two screens of text.

3. **Embedded Help:** Embedded help shall provide information and assistance for software program/functions. The information shall relate to the current display, current program operation or selection. It shall change as the operator proceeds through the program to provide appropriate information. Help shall be requested by selecting HELP from the menu bar. A menu of topics relating to the current display or selection shall appear on the screen. Selection of a topic from a menu displays the Help text in a partial screen overlay. Screen control functions shall be displayed as selectable icons below each help overlay. They shall be Return, Next Screen, Previous Screen, and Exit Help. For operator guidance, embedded help shall also be user-created to be associated with operational displays.

PART 3 -- EXECUTION

3.1 EQUIPMENT, MATERIALS AND WORKMANSHIP

A. **General:** It is the intent of these Contract Documents to secure high quality in all equipment and materials, and to require first-class workmanship, in order to assure long, trouble-free operation and minimum maintenance of the DCS.

B. Equipment and materials shall be the products of reputable, experienced manufacturers with a verifiable history of manufacturing similar equipment. Similar items in the project shall be the products of the same manufacturer. All equipment shall be of industrial grade and standard construction, shall be of sturdy design and manufacture, and shall be capable of long, reliable, trouble-free service.

C. All work, including calibration, testing, adjustment, start-up and maintenance, shall be done by qualified experienced personnel who are technically skilled in their trade, are thoroughly instructed, and are competently supervised. The resulting completed installation shall reflect professional quality work, employing the highest industrial standards and methods.

3.2 OPERATIONAL READINESS TESTING (ORT)

A. **General:** The complete system, including all, DCS equipment, peripheral devices and interconnecting cables shall be assembled on the DCS manufacturer's test floor, and all programs shall be completely tested under simulated operating conditions. Further tests shall be performed in the field at time of start-up with external sensors and field wiring connected to determine final specification compliance.

B. All hardware test procedures shall strictly conform to the following sections of ISA-RP55.1 - 1975 (R 1983):

1. Section 3: in its entirety
2. Section 4: applicable portions
3. Section 5: in its entirety
4. Section 6: in its entirety
5. Section 7: in its entirety
6. Section 8: in its entirety
7. Glossary - CMR test configuration
8. Glossary - NMR test configuration
9. Glossary - Noise measurement configuration
10. Appendix A - Analog Input Subsystem Accuracy

C. Four certified copies of all test data and results shall be submitted to the CONSTRUCTION MANAGER. All test documentation and results shall comply with ISA-RP55.1-1975 (R1983) Type 2 and type 3 documentation as described in section 10.2 of the referenced standard.

D. The equipment shall be operationally tested for compliance with the conditions of these Specifications. ORT operational readiness test set-up shall include simulated inputs. On line configuration of the monitoring and control loops using simulated inputs shall be demonstrated without error or malfunction. Logs and report generation capability shall be demonstrated by simulating process inputs and manually entering data.

E. The CONTRACTOR shall submit a detailed ORT specification to the CONSTRUCTION MANAGER at least 6 weeks in advance of commencement of the ORT. The CONSTRUCTION MANAGER shall be notified at least 30 days in advance of the ORT and reserves the right to have his representatives in attendance.

F. Each item of equipment shall be fully inspected, calibrated and tested for function, operation and continuity of circuits as applicable. Exceptions shall be approved in writing from the CONSTRUCTION MANAGER.

G. System performance shall be tested using a complete integrated system including all peripheral devices and interconnecting cables assembled on the test floor, complete operational programs loaded, and simulated inputs applied. The CONTRACTOR shall carry out a 100-hour full system test during which the entire system shall operate continuously without failure, all in accordance with the requirements of the specifications and drawings. If a system component fails during the test, the 100-hour test period shall be restarted after its operation is restored.

H. After successful completion of the factory test, 4 certified copies of all test results shall be furnished to the CONSTRUCTION MANAGER together with a clear and unequivocal statement that all ORT requirements have been met. The CONSTRUCTION MANAGER will give written notice of the acceptability of the ORT within 30 days of receipt of the ORT results.

I. Three CONSTRUCTION MANAGER/OWNER Representatives shall witness the ORT and at least 30 working days written notice shall be given prior to date of starting tests. One copy of each acceptance test procedure shall be submitted to the OWNER 30 days prior to the start of the acceptance test.

J. In the event that the system does not function as specified, it shall be modified at the factory to meet the specification requirements, and shall be retested as specified herein. Costs for all such retesting and witnessing shall also be borne by the CONTRACTOR.

All of the CONSTRUCTION MANAGERS/OWNER's travel and per diem costs associated with all ORT testing and retesting shall be borne by the CONTRACTOR.

K. Prior to installation, all PIN, FIN, and DIN cable shall be ORT by the CONTRACTOR to verify that the attenuation does not exceed prescribed limits and to ensure that concealed or internal discontinuities which could cause reflections do not exist. In conformance with the submittal requirements of these specifications, the CONTRACTOR shall submit certified test reports which contain the following data:

1. Dielectric constant

2. Outside diameter of inner conductor

3. Inside diameter of outer conductor

4. Attenuation constant

5. Plot of each cable attenuation-frequency response per 100 feet of cable.

6. All datalinks, which shall be the final hardware, application software, and Modbus addresses installed in the field shall be tested during the operational readiness test.

3.3 INSTALLATION SUPERVISION

A. General: The CONTRACTOR shall provide personnel to properly oversee the installation of all DCS equipment performed by others. Subsequent to the installation of all DCS equipment, the CONTRACTOR shall certify to the OWNER that the DCS has been properly installed.

B. The CONTRACTOR shall furnish the services of trained engineer(s) to check the completed installation and to make all necessary adjustments for satisfactory operation of the DCS. There shall also be furnished complete installation drawings and instructions in accordance with these Specifications.

3.4 CALIBRATION

A. **General:** The CONTRACTOR shall calibrate the complete system after installation. This shall ensure that those components having adjustable features are set carefully for the specific conditions and applications of this installation and that the components and systems are within the specified limits of accuracy. Defective elements which cannot achieve proper calibration or accuracy, either individually or within the system, or subsystem, shall be replaced.

1. Analog input channels shall be verified at 25 percent, 50 percent and 75 percent of span by applying simulated analog test signals. Applied test data shall be processed by the associated PCM using programs assigned to the particular data channels being simulated with the resulting engineering unit data presented on a CRT display. At least one simulated analog signal shall be routed through each analog-to-digital converter. The accuracy of the analog-to-digital converters and data processing activities shall be verified at each calibration step for each channel being simulated by comparing the known input against the Root Mean Square Summation tolerances calculated for each engineering unit data value noted.

2. The accuracy of all digital-to-analog converters shall be verified by manually entering engineering unit data values at the WS and then reading and recording the resulting analog output data. All analog output data shall be compared against calculated Root Mean Square Summation tolerance requirements.

3.5 TESTING OF FIBER OPTIC CABLE INSTALLATION

A. **Acceptance Testing**: The CONTRACTOR shall perform pre-installation and post-installation fiber optic cable acceptance tests of cable installed by others. The CONSTRUCTION MANAGER shall be notified a minimum of 5 days in advance so they may have the opportunity to witness the tests. Each of these tests is described as follows;

1. **Pre-installation tests:** Prior to the installation of cable, the CONTRACTOR shall perform the following test;

a. The purposes of these tests is to perform acceptance tests on the shipped cable prior to installation in order to validate that the cable conforms to the manufacturers specifications, and is free of defects, breaks, and damages caused by transportation and manufacturing processes. The CONTRACTOR shall perform all tests on all reels of cable. These tests shall be documented and submitted to the CONSTRUCTION MANAGER for review. Subsequent to the receipt of the CONSTRUCTION MANAGERS approval, the cable shall be available for installation.

b. The tests shall measure a total attenuation or loss for each fiber on each cable reel and document results of physical inspections to identify any cable and reel damage conditions, less or more than the specified fibers in the cable, and any deviations from the manufacturer’s specifications.

2. Post-Installation Tests: The CONTRACTOR, upon completion by others of the fiber optic cable installation and splicing, shall perform the following tests;

a. Double-ended loss test per EIA/TIA 568 Appendix H: OFSTP-14 (Optical Fiber Test Procedure 14.) Method B

b. Measurements for each fiber shall be documented and provided to the CONSTRUCTION MANAGER

c. Any fiber, connectors or other components which do not meet the requirements of EIA/TIA 568 B3 (including standards incorporated by reference) shall be removed and replaced at the expense of the CONTRACTOR. Fusion splices shall not have a loss of more than 0.3 dB. Multimode splices must have a return loss of better than 20 dB. Single mode splices must be better than 26 dB ORL. Requirements for loss are:

Fiber Type	Wavelength (nm)	Max Attenuation Coefficient (dB/km)	Bandwidth (MHz-km with overfilled launch)
50/125	850	3.5	500
	1300	1.5	500
62.5/125	850	3.5	160
	1300	1.5	500
Single mode$_{(Premises)}$	1310	1.0	NA
	1550	1.0	NA
Single mode$_{(Outside Plant)}$	1310	0.5	NA
	1550	0.5	NA

d. Upon completion of the previous tests, all fiber optic cable coils shall be secured with ends capped to prevent intrusion of dirt and water.

3.6 INSTALLATION TEST

A. **General:** The CONTRACTOR shall be responsible for the oversight of installation of all DCS equipment being furnished under this project. If a DCS device (including network cables) has been installed in a faulty manner, the CONTRACTOR shall notify the CONSTRUCTION MANAGER. Systems shall be exercised through operational tests in the presence of the CONSTRUCTION MANAGER in order to demonstrate achievement of the specified performance.

B. A complete integrated distributed control system test shall be performed. All modes of operation and man/machine interactions shall be exercised. Compliance to specified system failure detection and failover requirements shall be verified by selectively disabling individual CRT's, common logic files, data communication equipment and data links. Compliance to signal failure detection and response requirements shall be verified by employing analog test equipment to apply excessive signal amplitude and rate-of-change values. All data communication equipment shall be thoroughly tested for function and accuracy.

C. The results of all distributed control system installation test activities shall be documented. All analog-to-digital converter and digital-to-analog converter accuracy tests shall be documented on test forms, approved by the CONSTRUCTION MANAGER, which include calculated Root Mean Square tolerance limits for each calibration step.

D. Upon the satisfactory completion of all distributed control system installation tests, a certified report, including all test documentation, shall be furnished to the CONSTRUCTION MANAGER together with a clear and unequivocal statement that the installed system has been successfully calibrated, inspected and tested. The CONSTRUCTION MANAGER will give his acceptance of the installation tests within 10 days of his personal receipt of the test report if the results of the computer installation tests are acceptable.

3.7 SYSTEM COMMISSIONING AND PERFORMANCE TESTING

A. **General:** System commissioning and performance testing shall comply with the provisions specified herein and the contract drawings and specifications. Further, system commissioning and performance testing shall commence after all installation tests and inspections have been conducted and accepted in accordance with the following B, C, D, and E, and shall demonstrate that all components of the control system can meet all contract requirements with the equipment operating over full operating ranges under actual operating conditions.

B. All commissioning and test activities shall follow detailed test procedures, and check lists, previously reviewed by the CONSTRUCTION MANAGER. All tests data shall be acquired using equipment as specified and recorded on test forms, previously reviewed by the CONSTRUCTION MANAGER, which includes calculated tolerance limits for each calibration step. Completion of all system commissioning and test activities shall be documented by a certified report, including all test forms with tests data entered, delivered to the CONSTRUCTION MANAGER with a clear and unequivocal statement that all system commissioning and test requirements have been satisfied. The CONSTRUCTION MANAGER will give his acceptance of the system commissioning and test activities within ten days of his personal receipt of the report if the report is accepted.

C. The proper control of all final control elements and control panels shall be verified by tests conducted in accordance with the requirements specified herein. Where feasible system commissioning activities shall include the use of water to establish service conditions that simulate, to the greatest extent practicable, normal final control element operating ranges and environmental conditions. Final control elements, control panels, and ancillary equipment shall be tested under start-up and steady-state operating conditions to verify that proper and stable control is achieved using the distributed control system and local field mounted control circuits. All hardwired control circuit interlocks and alarms shall be operational. The control of final control elements and ancillary equipment shall be tested using both manual and automatic (where provided) control modes. The stable steady-state operation of final control elements running under the control of field mounted automatic analog controllers shall be assured by adjusting the controllers, as required, to eliminate oscillatory final control element operation. The transient stability of final control elements operating under the control field mounted automatic analog controllers shall be verified by applying control signal disturbances,

monitoring the amplitude and decay rate of control parameter oscillations (if any) and making necessary controller adjustments, as required, to eliminate excessive oscillatory amplitudes and decay rates.

D. All control stations incorporating proportional, integral and/or differential control circuits shall be tuned experimentally, by applying control signal disturbances and adjusting the gain, reset and/or rate setting(s) as required to achieve a proper response. Measured final control element variable position/speed set-point settings shall be compared to measured final control element position/speed values at 25 percent, 50 percent and 75 percent of span and the results checked against specified accuracy tolerances. Specified accuracy tolerances are defined as the root-mean-square-summation of individual component accuracy requirements. Individual component accuracy requirements shall be as specified in the contract or as specified by published manufacturer accuracy specifications whenever contract accuracy requirements are not specified.

E. Subsequent to the performance testing of process/process equipment furnished by others, the CONTRACTOR shall conduct a successful 90 day performance test for the distributed control systems furnished under this contract. In the test, the entire DCS shall be continuously operated and maintained (i.e., 7 days per week, 24 hours per day) during the test period with zero downtime resulting from system failures. If a system failure occurs, the 90 day test shall be considered a failure and not acceptable. The CONTRACTOR shall reinitiate the 90 day test. The DCS shall be acceptable only after all equipment has satisfied the performance test requirements and demonstrated a system availability of 99.98 percent.

F. The system availability shall be calculated based on the following equation:

$$A = (MTBF \times 100\%) / (MTBF + MTTR)$$

where, A = system availability in percent

MTBF = average time interval between consecutive system failures

MTTR = average time required to repair system failure

G. Downtime resulting from the following shall be considered system failures:

1. Downtime of any system component which is automatically "backed-up" and the back-up unit fails to automatically assume control within the specified time or if a component failure cannot be repaired/replaced within 2 hours.

2. Downtime of any component (exclusive of I/O) whose failure results in the inability of the Operator to monitor and manipulate control loops from the associated EC/OC using standard man-machine interface procedures.

3. Downtime resulting from the concurrent failure of any two (2) workstations, or any two (2) operator workstation input devices associated with the same workstation.

4. Downtime in excess of 2 hours resulting from any I/O component failure.

5. Downtime resulting from concurrent failure of two or more I/O components in a single PCM.

6. Downtime of any component/peripheral associated with the Historian if the failed component (1) results in a disabling of the historical functions and (2) the failed component is not repaired or replaced within 8 hours.

H. The CONTRACTOR shall submit a performance test completion report which shall state that all contract requirements have been met and which shall include (1) a listing of all DCS equipment maintenance/repair activities conducted during testing and (2) a listing of all components which were unable to operate successfully. Final acceptance, in writing, of the DCS will be provided by the CONSTRUCTION MANAGER if the results of all of the performance tests are acceptable.

I. The CONTRACTOR shall guarantee the required availability of the entire distributed control system for a period of one (1) year after acceptance of all required performance tests. The CONTRACTOR shall be responsible for furnishing and maintaining the spare parts/tools on-site at an inventory level it determines is sufficient to achieve the system availability requirements specified herein. All spare parts/tools stored on-site shall become the property of the OWNER upon completion of the guarantee period. If the DCS does not comply with the availability requirements stated herein within the first year of system operation, the CONTRACTOR shall forfeit that amount of the performance bond equal to the replacement cost of the entire DCS bid under this contract. The CONTRACTOR shall guarantee the following:

1. The completed system shall perform all of the data acquisition, control, and reporting functions as shown and specified.

2. The availability of the entire distributed control system shall not be less than 99.98 percent with a mean time to repair (MTTR) of 2.0 hours for any consecutive period of 6 months during the guarantee period. Availability, MTTR and other supporting terminology shall be as defined in SAMA Standard PMC 32.1-1976.

3.8 RESERVED

A. **RESERVED**

B. RESERVED

C. RESERVED

D. RESERVED

E. RESERVED

1. RESERVED

a. RESERVED

b. RESERVED

c. RESERVED

d. RESERVED

1) RESERVED

2) RESERVED

3) RESERVED

4) RESERVED

5) RESERVED

6) RESERVED

7) RESERVED

8) RESERVED

e. RESERVED

2. RESERVED

a. RESERVED

b. RESERVED

c. RESERVED

1) RESERVED

2) RESERVED

3) RESERVED

4) RESERVED

5) RESERVED

6) RESERVED

F. RESERVED

3.9 RESERVED

A. **RESERVED**

B. RESERVED

C. RESERVED

D. RESERVED

E. RESERVED

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G. RESERVED

1. RESERVED

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3.10 RESERVED

A. **RESRVED**

B. RESERVED

C. RESERVED

1. RESERVED

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3. RESERVED

4. RESERVED

3.11 SOFTWARE DOCUMENTATION

A. Software documentation shall be delivered to the OWNER prior to the final acceptance at which time all programs shall have been tested, delivered, and fully operational. The Owner retains all rights to programming and software configurations developed, performed, and implemented under this project. The CONTRACTOR must obtain the Owner's consent prior to reuse of project software. Each set of documentation shall include, but not be limited to, the following:

1. General description of the overall purpose of each program with any assumptions or restrictions fully explained. Format for any input and/or output messages shall be included.

2. Abstracts describing the operational objectives of each major program section together with an explanation of its relationship to other major program sections.

3. A complete listing all of hardware devices which comprise the DCS. The listing shall include manufacturer, model number, physical location and hardware address.

4. A complete listing of all of the tag numbers in the DCS along with associated description information and hardware addresses.

5. A complete listing of all specialized interface functions that are associated with each system function, tag, or operator function.

6. Complete documentation on all system and process displays including a graphical depiction of the hierarchy with linkages shown, definition of security levels associated with each display, a listing and hard copy of all displays and formats.

7. Complete copy of system data base organized by PCM.

8. Complete set of all software configurations implemented for data acquisition, control, and alarming purposes. Data shall include both text and graphic depictions. All software listings shall be fully annotated with as-built data.

** END OF SECTION **

SECTION 15000 - PIPING COMPONENTS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing fittings, hangers, supports, anchors, expansion joints, flexible connectors, insulation, lining and coating, testing, disinfection, and accessories.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 05500 Miscellaneous Metalwork
2. Section 09800 Protective Coating
3. Section 11000 Equipment General Provisions
4. Section 15010 Mill Piping - Exposed and Buried
5. Section 15020 Pipe Supports
6. Section 15025 Cathodic Protection

1.3 CODES

A. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:

1. Uniform Mechanical Code
2. Uniform Plumbing Code
3. Uniform Fire Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following applies to the WORK of this Section:

ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch)
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys
ANSI/ASME B31.1	Power Piping
ANSI/AWWA C111	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
ANSI/AWWA C150	Thickness Design for Ductile Iron Pipe
ANSI/AWWA C153	Ductile Iron Compact Fittings, 3 In through 24 In and 54 In Through 64 In for Water Service
ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in. Through 144 in.

ANSI/AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
ANSI/AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 In Through 12 In for Water Distribution
ANSI/AWWA C905	Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In through 36 In
ANSI/AWS D10.9	Specifications for Qualifications of Welding Procedures and Welders for Piping and Tubing
ASTM A 123	Specification for Zinc Coatings on Iron and Steel Products
ASTM A 536	Ductile Iron Castings
ASTM D 792	Test Methods for Specific Gravity and Density of Plastics by Displacement
ASTM D 2000	Classification System for Rubber Products in Automotive Applications

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Shop drawings showing dimensions and details of pipe joints, fittings, fitting specials, valves and appurtenances.

2. Detailed layout, spool, or fabrication drawings showing pipe spools, spacers, adapters, connectors, fittings, and pipe supports.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. Manufacturer's product data.
2. Manufacturer's installation instructions.
3. Manufacturer's certification of compliance.
4. Statement from the pipe fabricator certifying that all pipe will be fabricated subject to a Quality Control Program.
5. Outline of Quality Control Program.

1.7 INSPECTION, TESTING AND WELDING

A. **Inspection:** Products shall be inspected at the manufacturer's plant.

B. **Tests:** Materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards.

C. **Welding Requirements:** Welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D10.9. Welding procedures shall be required for longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

D. **Welder Qualifications:** Welding shall be performed by skilled operators who have had adequate experience in the methods and materials to be used and have been qualified under the provisions of ANSI/AWS D10.9 by an independent approved testing agency not more than 6 months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the WORK shall be used in qualification tests.

1.8 FACTORY TESTING

A. **Product Testing:** Products shall be tested at the factory for compliance with the indicated requirements.

B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness factory tests.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials:** Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Miscellaneous Small Pipes:** Miscellaneous small pipes and fittings shall comply with Section 15010.

B. **Pipe Supports:** Pipes shall be properly supported in accordance with Section 15020.

C. **Coating:** Pipes above ground or in structures shall be field-painted in accordance with Section 09800.

D. **Pressure Rating:** Except as otherwise indicated, piping systems shall be designed for 150 percent of the maximum indicated pressure.

E. **Grooved Piping Systems:** Grooved couplings on buried piping must be bonded. Grooved fittings, couplings, and valves shall be from the same manufacturer.

2.2 PIPE FLANGES

A. **Flanges:** Where the design pressure is 150 psi or less, flanges shall conform to either ANSI/AWWA C207 Class D or ANSI B16.5 150-lb class. Where the design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to either ANSI/AWWA C207 Class E, Class F, or ANSI B16.5 150-lb class. Where the design pressure is greater than 275 psi up to a maximum of 700 psi, flanges shall conform to ANSI B16.5 300-lb class. Flanges shall be attached to the pipe in accordance with ANSI/AWWA C207.

B. **Blind Flanges:** Blind flanges shall comply with ANSI/AWWA C207. Blind flanges for pipe sizes 12 inches and larger shall include lifting eyes in form of welded or screwed eye bolts.

C. **Flange Coating:** Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

D. **Flange Bolts:** Bolts and nuts shall comply with Section 05500. Studs and bolts shall extend through the nuts a minimum of 1/4-inch. All-thread studs may be used only on valve flange connections where space restrictions preclude the use of regular bolts.

E. **Insulating Flanges:** Insulated flanges shall have bolt holes 1/4-inch diameter greater than the bolt diameter. Existing flanges where new insulating gaskets are required for the project may require boring the holes greater or replacement of the flanges at no additional cost to the CITY.

F. **Insulating Flange Sets:** Insulating flange sets shall be provided where indicated and shall consist of insulating gaskets (retainer), insulating bolt sleeves, and double insulating washers. All insulating components shall be NEMA G-10 epoxy glass. Insulating gaskets (retainers) shall be full face, Type E and shall have a Buna-N (nitrile) O-ring type sealing element such as PSI Linebacker or equal.

Insulating flange kits shall be tested and inspected by the City's Corrosion Engineer. The City's Corrosion Engineer shall be contacted at (858) 614-5560 a minimum of 48 hours prior to the assembly of any insulating flange kits. Insulating flange kits shall be installed and tested in accordance with NACE SP0286-07. Insulating flange kits shall be tested using a minimum of two test methods. The first test method shall utilize a Gas Electronics Model 601 Insulator Checker specifically designed for testing insulating flanges. Additionally, insulating flanges shall be tested by measuring pipe-to-soil potentials on either side of the insulating joint as described in SP02186-07 Paragraph 9.2.2.

The installation of the insulating flange kit shall be considered complete when the testing above indicates that no shorts or partial shorts are present. Any insulating flange kit that is determined to be ineffective shall be repaired or replaced at the CONTRACTOR'S expense.

G. **Flange Gaskets:** Gaskets for flanged joints shall be full-face, 1/16-inch thick sheets of virgin graded Teflon, suitable for temperatures to 550 degrees F, a pH of 0 to 14, and pressures to 1400 psig. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets shall not be permitted.

2.3 THREADED INSULATING CONNECTIONS

A. **General:** Threaded insulating bushings, unions, and couplings shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are indicated.

B. **Materials:** Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties suitable for the service and loading conditions indicated.

2.4 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

A. **General:** Cast mechanical-type couplings shall be provided where shown. Bolts and nuts shall conform to Section 05500. Gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized in accordance with the coupling manufacturer's recommendations. The wall thickness of all grooved piping shall conform with the coupling manufacturer's recommendations suitable for the highest pressure indicated.

2.5 SLEEVE-TYPE COUPLINGS

A. **Construction:** Sleeve-type couplings shall be installed where indicated and shall include steel bolts, without pipe stop, and shall be sized to fit the pipe and fittings indicated. The middle ring shall be not less than 1/4-inch in thickness and shall be either 5 or 7 inches long for standard steel couplings, and 16 inches long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Bolts and nuts shall conform to Section 05500. Buried sleeve-type couplings shall be epoxy-coated at the factory.

B. **Pipe Preparation:** The ends of the pipe, where indicated, shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

C. **Gaskets:** Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," grade 60, or equivalent suitable elastomer. The rubber in the gasket shall comply with the following:

1. Color - Jet Black
2. Surface - Non-blooming
3. Durometer Hardness - 74 ∀ 5
4. Tensile Strength - 1000 psi Minimum
5. Elongation - 175 percent Minimum

The gaskets shall resist deterioration caused by impurities normally found in water or wastewater. Gaskets shall comply with ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as otherwise indicated. Gaskets shall be compatible with the piping service and fluid utilized.

D. **Insulating Couplings:** Where insulating couplings are indicated, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an insulating compound in order to insulate coupling metal parts from the pipe.

E. **Restrained Joints:**

1. Harnesses for flexible sleeve type couplings shall be in accordance with the requirements of the appropriate reference standards and standard practices.

2. Mechanical and Push-On Joints: Restraints shall be provided where shown and may be provided in lieu of concrete thrust blocks.

   a. Mechanical joint restraint mechanisms shall consist of individually activated multiple gripping devices which incorporate breakoff actuating units and permanent nuts for future disassembly. Pressure ratings shall be:

      (1) Ductile Iron Pipe
         (a) 3 to 6 inch diameter: 350 psi (2:1 safety factor)
         (b) 18 to 48 inch diameter: 250 psi (2:1 safety factor)

      (2) PVC Pipe

         (a) 3 to 36 inch diameter: full pressure rating or pressure class of pipe (2.5:1 safety factor)

   b. Push-on joints for steel pipes shall be in accordance with the appropriate reference standards and standard practice.

   c. Restrained push-on joints for all other pipe materials shall be comprised of two rings with connecting rods. The restraint ring shall be on the spigot, and a plain or slit bell ring shall be on the bell. Pressure ratings shall be:

      (1) Ductile Iron Pipe

         (a) 3 to 16 inch diameter: 350 psi (2:1 safety factor)
         (b) 18 to 48 inch diameter: 250 psi (2:1 safety factor)

      (2) PVC Pipe

         (a) 3 to 10 inch diameter: 200 psi (4:1 safety factor)
         (b) 12 inch diameter: 150 psi (4:1 safety factor)
         (c) 14 to 16 inch diameter: 235 psi (2:1 safety factor)
         (d) 18 to 30 inch diameter: 165 psi (2:1 safety factor)
         (e) 36 inch diameter: 125 psi (2:1 safety factor)

      (3) Dimensions of push-on bell restraints shall be compatible with ANSI/AWWA C150 and C900 or C905 for ductile iron or PVC pipe, respectively.

   d. Restraint glands shall be of ductile iron conforming to ASTM A 536. Dimensions of the glands shall be compatible with standard mechanical joint bell and tee head bolts conforming to ANSI/AWWA C111 and C153, respectively.

   e. Bolts and nuts shall conform to Section 05500.

2.6 FLEXIBLE CONNECTORS

A. Flexible connectors shall be provided in all piping connections to engines, blowers, compressors, vibrating equipment, and where indicated. Flexible connectors for service temperatures up to 180 degrees F shall be flanged reinforced neoprene or butyl rubber spools, rated for working pressures of 40 to 150 psi or reinforced flanged rubberized duck, as best suited for the application. For temperatures above 180 degrees F, flexible connectors shall be flanged braided Type 316 stainless steel spools with inner corrugated stainless steel hose rated for minimum 150 psi working pressure unless indicated otherwise. Connectors shall be minimum of 9 inches face to face between flanges. Material selection shall be proposed by the manufacturer based on the application.

2.7 EXPANSION JOINTS

A. **Linear Expansion Only**: Use expansion loops, bellows-type expansion joints, or sliding type expansion joints of ductile iron, stainless steel, monel, or rubber.

B. **Linear, Angular, and Lateral Movement:** Use flexible expansion joints consisting of expansion sleeve and ball-and-socket joints in a single unit. Each unit shall be capable of minimum 15 degrees angular motion in any direction, and the expansion sleeve shall be capable of minimum 4 inches of linear travel. Joints shall be suitable for the pressure and temperature application and be ductile iron conforming to ANSI/AWWA C153. All surfaces containing pressure and sealing surfaces shall be coated with minimum 15 mils of fusion bonded epoxy conforming to ANSI/AWWA C213.

2.8 PIPE THREADS

A. Pipe threads shall comply with ANSI/ASME B1.20.

2.9 PIPE INSULATION (NOT USED)

2.10 AIR AND GAS TRAPS (NOT USED)

2.11 STEAM TRAPS (NOT USED)

2.12 GLASS LINING (NOT USED)

2.13 MANUFACTURERS

A. **Manufacturers**: Products of the type or model (if any) indicated shall be manufactured by one of the following (or equal):

1. **Insulating Flanges:**

JM Red Devil, Type E
Maloney Pipeline Products Co.
PSI Products, Inc.

2. **Flange Gaskets:**

   John Crane, Style 2160
   Garlock, BLUE-GARD® Style 3000

3. **Steel Pipe Couplings:**

   Gustin-Bacon (banded or grooved)
   Victaulic Vic-Ring® Style 41 or 44 (banded)
   Victaulic Style 77 or Zero-Flex® Style 07 (grooved)

4. **Ductile Iron Pipe Couplings**:

   Gustin-Bacon
   Victaulic Style 31

5. **Couplings for PVC Pipe:**

   Gustin-Bacon
   Victaulic Style 775

6. **Sleeve-Type Couplings:**

   Dresser, style 38
   Ford Meter Box Co., Inc., Style FC1 or FC3
   Smith-Blair, Style 411

7. **Dismantling Joints:**

   Romac Industries, Inc DJ400
   Smith-Blair, Inc 970 Series

PART 3 -- EXECUTION

3.1 GENERAL

A. Pipes, fittings, and appurtenances shall be installed in accordance with the manufacturer's installation instructions.

** END OF SECTION **

SECTION 15010 - MILL PIPING - EXPOSED AND BURIED

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing small steel pipe, stainless steel pipe and tubing, copper pipe, solvent-welded PVC pipe, cast iron soil pipe, and corrosion-resistant cast iron pipe with fittings, gaskets, bolts, insulating connections, pipe insulation, and other specialties required for an operable piping system.

1.2 RELATED SECTIONS

A. The WORK of the following Section applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 15000 Piping Components

1.3 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ANSI/ASME B16.3	Malleable Iron Threaded Fittings, Classes 150 and 300
ANSI/ASME B16.4	Cast Iron Threaded Fittings, Class 125 and 250
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys
ANSI B16.11	Forged Steel Fittings, Socket-Welding and Threaded
ANSI B16.12	Cast-Iron Threaded Drainage Fittings
ANSI/ASME B16.15	Cast Bronze Threaded Fittings, Classes 125 and 250
ANSI B16.21	Nonmetallic Flat Gaskets for Pipe Flanges
ANSI B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ANSI/ASME B16.24	Cast Copper Alloy Pipe Flanges and Flanged Fittings
ASTM A 53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 74	Specification for Cast Iron Soil Pipe and Fittings
ASTM A 105	Specification for Forgings for Piping Components
ASTM A 106	Specification for Seamless Carbon Steel Pipe for High Temperature Service
ASTM A 269	Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service
ASTM A 312	Specification for Seamless and Welded Austenitic Stainless Steel Pipe
ASTM A 518	Specification for Corrosion-Resistant High-Silicon Iron Castings
ASTM B 42	Specification for Seamless Copper Pipe, Standard Sizes
ASTM B 43	Specification for Seamless Red Brass Pipe, Standard Sizes

ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings
ASTM B 88	Specifications for Seamless Copper Water Tube
ASTM C 599	Specification for Process Glass Pipe and Fittings
ASTM D 1785	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2996	Specification for Filament-Wound Reinforced Thermosetting Resin Pipe
ASTM D 4101	Specification for Propylene Plastic Injection and Extrusion Materials
ASTM F 441	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Manufacturer's product specifications and performance information.

PART 2 -- PRODUCTS

2.1 SMALL STEEL PIPE

A. Unless otherwise indicated, galvanized steel pipe and black steel pipe in sizes 6 inches in diameter and smaller shall conform to the requirements of ASTM A 53 and ASTM A 106 and shall be Schedule 40 or 80 as indicated. Fittings for galvanized steel pipe shall be of galvanized malleable iron, with NPT or grooved ends as indicated. Black pipe may have welded joints, with standard or extra strong welded fittings unless otherwise indicated in the Piping Schedule.

2.2 STAINLESS STEEL PIPE

A. Unless otherwise indicated, stainless steel pipe shall be Type 316 Schedule 40 threaded pipe conforming to ASTM A 312 with stainless steel threaded fittings, or with stainless steel welded fittings, where indicated. Lightweight stainless steel pipe shall be Type 316 Schedule 10 pipe conforming to ASTM A 312, with stainless steel welding fittings.

2.3 STAINLESS STEEL TUBING

A. Stainless steel tubing shall be made of Type 316 L stainless steel to the requirements of ASTM A 269, of minimum 1/4-inch inside diameter, or as indicated, for the test pressure required. The fittings shall be swage ferrule design of Type 316 L stainless steel, of the double acting ferrule design, providing both a primary seal and a secondary bearing force. Flare bite or compression type fittings are not acceptable.

2.4 RED BRASS PIPE (NOT USED)

2.5 COPPER PIPE

A. Copper pipe shall be hard drawn, to the requirements of ASTM B 42, with regular or extra strong wall thickness, as required for the test pressure. Copper pipe shall have screwed ends for NPT fittings, or brazed joints. The fittings shall be threaded cast bronze fittings to the requirements of ANSI/ASME B16.15, class 125 or 250, as required, or flanged cast copper alloy fittings to the requirements of ANSI/ASME B16.24, with 150 lbs rating, or as required.

2.6 COPPER TUBING

A. Copper tubing shall conform to the requirements of ASTM B 88 and shall be Type K, soft temper for buried tubing and hard drawn for above-ground application. Fittings shall be soldered or sweated on and shall be of wrought copper conforming to ANSI B16.22. Soldered joints shall contain 95-percent tin and 5-percent antimony. For oxygen service, joints shall be made with silver solder. No solders or fluxes containing more than 0.2 percent of lead shall be used.

2.7 POLYVINYL CHLORIDE PRESSURE PIPE, SOLVENT-WELDED

A. Polyvinyl chloride pressure pipe shall be made from all new rigid unplasticized polyvinyl chloride and shall be Normal Impact Class 12454-B, Schedule 80, conforming to ASTM D 1785, unless otherwise indicated. Elbows and tees shall be of the same material as the pipe. Joint design shall be for solvent-welded construction.

2.8 CHLORINATED POLYVINYL CHLORIDE PRESSURE PIPE, SOLVENT-WELDED NOT USED)

2.9 POLYPROPYLENE PIPE (NOT USED)

2.10 PROCESS GLASS PIPE (NOT USED)

2.11 FIBERGLASS REINFORCED PLASTIC PIPE (NOT USED)

2.12 CAST IRON SOIL PIPE (NOT USED)

2.13 CORROSION-RESISTANT CAST IRON SOIL PIPE (NOT USED)

PART 3 -- EXECUTION

3.1 INSTALLATION

A. **General:** Mill piping shall be installed in accordance with the manufacturer's installation instructions.

B. **Small Steel Pipe:** Buried galvanized or black steel pipe shall be coated in accordance with Section 09800 or with an extruded high density polyethylene coating with minimum thickness of 35 mils.

C. **Plastic Pipe:** PVC pipe joints shall be solvent-welded in accordance with the manufacturer's instructions. Expansion joints or pipe bends shall be installed to absorb pipe expansion over a temperature range of 100 degrees F, unless otherwise indicated. Care shall be taken to provide sufficient supports, anchors, and guides, to eliminate stress on the piping.

3.2 CONTINUITY BONDS

A. Where indicated, metallic pipe joints, except field-welded joints and insulating joints, shall be continuity bonded in accordance with Section 15025 or as indicated on the drawings.

** END OF SECTION**

SECTION 15020 - PIPE SUPPORTS

PART 1-- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing pipe supports, hangers, guides, and anchors.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 05500 Miscellaneous Metalwork
2. Section 15000 Piping Components

1.3 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ANSI/ASME B31.1	Power Piping
ANSI/MSS SP-58	Standard Pipe Support Components

1.4 SHOP DRAWINGS AND SAMPLES

A. Submittals shall comply with Section 15000 and shall include:

1. Shop drawings of pipe supports including details of concrete inserts.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. **General:** Piping systems including connections to equipment shall be properly supported to prevent deflection and stresses. Supports shall comply with ANSI/ASME B31.1, except as otherwise indicated.

B. **ANSI/MSS Types**: Except as otherwise indicated, pipe support components shall comply with the types in ANSI/MSS SP-58.

C. **Support Spacing:** Supports for horizontal piping shall be properly spaced. Except as otherwise indicated, pipe support spacing shall comply with the following:

1. **Support Spacing for Schedule 40 & 80 Steel Pipe:**

Pipe Size (inches)	Max. Span (feet)
1/2	6
3/4 & 1	8
1-1/4 to 2	10
3	12
4	14
6	17
8 & 10	19
12 & 14	23
16 & 18	25
20 & Above	30

2. **Support Spacing for Copper Tubing:**

Tube Size (inches)	Max. Span (feet)
1/2 to 1-1/2	6
2 to 4	10
6 & Above	12

3. **Support Spacing for Schedule 80 PVC Pipe:**

Pipe size (inches)	Max Span (@100 degrees F) (feet)
1/2	4
3/4	4
1	5
1-1/4	5
1-1/2	5
2	6
3	7
4	8
6	10
8	11
10	12
12	13

4. **Support Spacing for Welded, Fabricated Steel Pipe:**

Practical Safe Spans for Simply Supported Pipe in
120-deg Contact Saddles

Nominal Size in.	Wall Thickness-in 3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
	Span, L-ft									
24	33	37	40	43	45	47				
26	33	37	41	43	45	47				
28	33	38	41	44	46	48				
30	34	38	41	44	47	49				
32	34	38	42	45	47	50				
34	34	38	42	45	48	50				
36	34	39	42	45	48	50	54			
38	34	39	43	46	48	51	55			
40	34	39	42	46	49	51	55			
42	35	39	43	46	49	52	56			
45		39	43	47	50	52	56			
48		40	44	47	50	53	57	61		
51		40	44	47	50	53	58	61		
54		40	44	47	51	53	58	62		
57		40	44	48	51	54	58	62		
60		40	44	48	51	54	59	63	66	69
63		40	44	48	51	54	59	63	67	70
66		40	45	48	52	54	59	64	67	71
72		41	45	49	52	55	60	64	68	72
78		41	45	49	52	55	61	65	69	72
84		41	45	49	53	56	61	66	70	73
90		41	45	49	53	56	61	66	70	74
96		41	46	50	53	56	62	67	71	75

For steel pipe sizes not indicated, the support spacing shall be designed to ensure that the stress on the pipe does not exceed 5,000 psi calculated from the following formula:

$$L = \frac{7500tD}{32t+D}D$$

t = thickness, in.
= Diameter, in.
L = Safe span, ft.

Maximum deflection of pipe shall be limited to 1/360th of the span.

5. **Support Spacing for Ductile Iron Pipe:**

Pipe Size	Max. Span
All Sizes	2 Supports per length or 10 feet (One of the 2 supports located at joint)

6. **Variances:** For temperatures other than ambient temperatures and for other piping materials or wall thicknesses, the above spacings shall be modified in accordance with the pipe manufacturer's recommendations.

7. **Additional Supports:** Additional supports complying with ANSI B31.1 shall be provided at critical elbows, valves, gauges, and meters.

D. **Pipe Hangers:** Pipe hangers shall be capable of supporting the pipe, shall allow for free expansion and contraction of the piping, and shall prevent excessive stress on equipment. Hangers shall have a means of vertical adjustment after erection. Hangers shall be designed so that they cannot become disengaged by any movement of the pipe. Hangers subject to shock, seismic disturbances, or thrust imposed by the actuation of safety valves, shall include hydraulic shock suppressors. All hanger rods shall be subject to tensile loading, only.

E. **Hangers Subject to Horizontal Movements:** At hanger locations where lateral or axial movement is indicated, suitable linkage shall be provided to permit movement. Where horizontal pipe movement is greater than 1/2-inch, or where the hanger rod deflection from the vertical is greater than 4 degrees from minimum to maximum temperature, the hanger rod and structural attachment shall be offset in such a manner that the rod is vertical in the hot position.

F. **Spring-Type Hangers:** Spring-type pipe hangers shall be provided for piping where vibration or vertical expansion and contraction is indicated, (engine exhausts and similar piping). Spring-type hangers shall be sized to the manufacturer's printed recommendations and the loading conditions indicated. Variable spring supports shall be provided with means to limit misalignment, buckling, eccentric loading, or to prevent overstressing of the spring, and with means to indicate at all times the compression of the spring. Supports shall be designed for a maximum variation of 25 percent for the total travel resulting from thermal movement.

G. **Thermal Expansion:** Wherever expansion and contraction of piping is indicated, a sufficient number of expansion loops or joints shall be provided, with rolling or sliding supports, anchors, guides, pivots, and restraints. They shall permit the piping to expand and contract freely in directions away from the anchored points and shall be structurally suitable to withstand all loads imposed.

H. **Heat Transmission:** Supports, hangers, anchors, and guides shall be designed and insulated so that excessive heat shall not be transmitted to the structure or to other equipment.

I. **Riser Supports:** Risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.

J. **Freestanding Piping:** Free-standing pipe connections to equipment, including chemical feeders and pumps, shall be firmly attached to fabricated steel frames made of angles, channels, or I-beams anchored to the structure. Exterior, free-standing overhead piping shall be supported on fabricated pipe stands, consisting of pipe columns anchored to concrete footings, with horizontal, welded steel angles and U-bolts or clamps installed to secure piping.

L. **Point Loads:** Meters, valves, heavy equipment, and other point loads on PVC, and other plastic pipes, shall be supported on both sides according to manufacturer's recommendations to avoid pipe stresses. Supports on plastic piping shall be equipped with extra wide pipe saddles or galvanized steel shields.

M. **Noise Reduction:** To reduce transmission of noise in piping systems, copper tubes shall be wrapped with a 2-inch wide strip of rubber fabric at each pipe support, bracket, clip, and hanger.

N. **Structural Design:** Pipe supports, anchors, and restrainers shall be designed for static, dynamic, wind, and seismic loads. The horizontal seismic design force shall be the greater of that indicated in the project Geotechnical Report or the requirement of the CBC for Seismic Zone 4.

2.2 COATING

A. **Galvanizing:** Fabricated pipe products, except stainless steel or non-ferrous supports, shall be blast-cleaned after fabrication and hot-dip galvanized in accordance with ASTM 123.

B. **Other Coatings:** Other than stainless steel or non-ferrous supports, supports shall be coated in accordance with Section 09800.

2.3 MANUFACTURERS

A. Pipe supports shall be manufactured by one of the following (or equal):

Basic Engineers
Bergen-Paterson Corp.
ITT-Grinnell Corp.
NPS Industries, Inc.
Powerstrut
Unistrut

PART 3 -- EXECUTION

3.1 INSTALLATION

A. **General:** Pipe supports, hangers, brackets, anchors, guides, and inserts shall be installed in accordance with the manufacturer's installation instructions and ANSI/ASME B31.1.

B. **Appearance:** Supports and hangers shall be installed to produce an orderly, neat piping system. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings as possible and without interference with other work.

** END OF SECTION **

SECTION 15030 - PIPING IDENTIFICATION SYSTEMS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing identification devices for all piping and valves using color bands, lettering, flow direction arrows, and related permanent identification devices, and all appurtenant works. The WORK of this Section also includes providing identification devices for all hazardous materials storage and conveyance facilities.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 09800 Protective Coating
2. Divisions 11, 13, 15 Piping, Valves, and Appurtenances, as applicable

1.3 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ANSI A13.1	Scheme for the Identification of Piping Systems
ANSI Z535.1	Safety Color Code
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
NFPA	Guide to Hazardous Materials
NFPA 704	Hazard Identification System
UFC 79-3	Identification of the Health, Flammability and Reactivity of Hazardous Materials
29CFR 1910.106	Flammable and Combustible Liquids (OSHA)
29CFR 1910.145	Specification for Accident Prevention Signs and Tags (OSHA)
29CFR 1910.1200	Hazard Communication (OSHA)

1.4 CODES

A. The WORK of this Section shall comply with the following codes in the California Code of Regulations (CCR):

CCR, Title 8, ' 537	Piping Systems Valving and Labeling (Cal-OSHA)
CCR, Title 8, ' 3321	Identification of Piping (Cal-OSHA)
CCR, Title 8, ' 5194	Hazard Communication (Cal-OSHA)

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Samples of all types of identification devices to be used in the WORK.
2. A list of suggested wording for all valve tags.

PART 2 -- PRODUCTS

2.1 IDENTIFICATION OF EXPOSED PIPING

A. Identification of all exposed interior and exterior pipe, including pipe in accessible ceiling spaces, pipe trenches, pipe chases, vaults and valve boxes, shall be accomplished by complete color coded painting of all visible pipe and its insulation in accordance with Section 09800 and providing marker lettering and color banding as indicated. Stainless steel pipe shall be color coded utilizing bands at 20 feet intervals as specified for identification of hazardous substance conveyance facilities in CCR, Title 8, Section 3321. Certain pipe indicated in paragraph 3.5 also shall be color coded utilizing bands at 20 feet intervals as specified for identification of hazardous substance conveyance facilities in CCR, Title 8, Section 3321.

B. Each pipe identification shall consist of a printed pipe marker identifying the name of the pipe and a flow arrow to indicate direction(s) of flow in the pipe. All markers shall be preprinted. Markers shall be the mechanically attached type that are easily removable; they shall not be the adhesive applied type. Markers shall consist of pressure sensitive legends applied to plastic backing which is strapped or otherwise mechanically attached to the pipe. Fasteners shall be non-metallic. Legend and backing shall be resistant to petroleum based oils and grease and shall meet criteria for humidity, solar radiation, rain, salt, fog and leakage fungus, as specified by MIL-STD-810C. Markers shall withstand a continuous operating temperature range of minus 40 degrees F to 180 degrees F. Plastic coding markers shall not be the individual letter type, but shall be manufactured and applied in one continuous length of plastic.

C. Marker and letter sizes shall conform to ANSI A13.1 except as otherwise indicated for hazardous materials identification. Directional arrows shall be the same size as the lettering.

D. Except as otherwise indicated for hazardous materials identification, markers shall be white with black letters and directional arrows, except for pipes painted white, on which markers shall be blue with white letters.

E. Pipelines which convey hazardous materials and hazardous materials storage facilities shall be labeled in full conformance with the Cal-OSHA and Federal OSHA regulatory standards, and the guidelines provided in UFC 79-3 and NFPA 704. As a minimum, pipeline identification shall include the chemical name and an appropriate hazard warning using words, pictures, symbols, or a combination thereof to identify flammability, health and reactivity. Placards may be used for hazard warnings, if affixed to the pipes.

2.2 IDENTIFICATION OF EXPOSED VALVES AND SHORT PIPE LENGTHS

A. Identifying devices for valves, and the sections of pipe that are too short to be identified with preprinted markers, and arrows, shall be plastic tags.

B. Plastic tags shall be engraved. The minimum tag thickness shall be 1/6-inch; the minimum size of 2-1/2-inch by 2-1/2-inch with 5/32-inch diameter top holes. Color shall be white with black lettering. Minimum lettering height shall be 1/4-inch. All tags shall be designed to be firmly attached to the valves or short pipes or to the structure immediately adjacent to such valves or short pipes.

2.3 LOCATION MARKING OF BURIED PIPES

A. Identification of buried electrical conduits shall be in accordance with Section 16050 and as indicated.

2.4 EXISTING IDENTIFICATION SYSTEMS

A. In installations where existing piping identification systems have been established, the CONTRACTOR shall continue to use the existing system for pipes which convey non-hazardous materials. Where existing identification systems are incomplete, utilize the existing system as far as practical and supplement with the indicated system. The objective is to fully identify all new piping, valves, and appurtenances to the level indicated herein.

2.5 MANUFACTURERS

A. Products of the type indicated shall be manufactured by the following (or equal):

1. W.H. Brady Co.
2. Seton Nameplate Corp.

PART 3 -- EXECUTION

3.1 GENERAL

A. All markers and identification tags shall be installed in accordance with the manufacturer's printed instructions, and shall be neat and uniform in appearance. All such tags or markers shall be readily visible from all normal working locations.

3.2 VALVE TAGS

A. Valve tags shall be attached to the valve or structure by means of self-locking plastic or nylon ties.

B. Wording on the valve tags shall include both the valve number and a description of the exact function of each valve, e.g., "DHWR-BALANCING," "CLS THROTTLING", "RAS-PUMP SHUT-OFF," etc.

3.3 EXPOSED PIPE IDENTIFICATION

A. Each exposed pipe shall be identified at intervals of 20 feet, and at least one time in each room. Piping shall also be identified at a point approximately within 2 feet of all turns, ells, valves, and on the upstream side of all distribution fittings or branches. Sections of pipe that are too short to be identified with lettered markers, and directional arrows shall be tagged and identified similar to valves.

B. Pipe identification shall consist of two to four elements: color coating and/ or banding of the pipe, a lettered marker with a directional arrow; and a hazard warning for pipelines which convey hazardous materials.

3.4 EXPOSED PIPE IDENTIFICATION SCHEDULE

A. Application of the pipe identification systems shall conform to the following color codes. Marker lettering shall conform to that listed under "Function and Identification."

Fluid Abbreviation	Function and Identification	Identification Color	Remarks Suggested Tnemec Color or Equal
BD	Bottom Drain	Brown	Banyonbark AC12 (dark brown)
BP	Bypass	See Remarks	Same color corresponding to fluid being bypassed
D	Drain	Brown	Banyonbark AC12 (dark brown)
F	Fire	Red	Safety Red,
FM	Forcemain	See Remarks	Same color corresponding to fluid being carried
FPW F	Fire Protection Water Fire,	Red	Safety Red
FSW	Filter Surface Wash-Water	Purple	Reclaimed Purple R1217
LSP	Landscaping Sprinkler - Potable Water	Light Blue	Clear Sky EN17
LSR	Landscaping Sprinkler - Reclaimed Water	Purple	Reclaimed Purple R1217
OF	Overflow	See Remarks	Same color corresponding to fluid from which overflow comes
PD	Plant Drain	Brown	Banyonbark AC12 (dark brown)
PE	Primary Effluent	Grey	Grey IN05
PLI	Plant Influent	Grey	Grey IN05
POF	Plant Overflow	See Remarks	Same color corresponding to fluid from which overflow comes
PW W1	Potable Water W1 - Potable Water	White	White WH01
RS	Raw Sewage	Grey	Grey IN05

Fluid Abbreviation	Function and Identification	Identification Color	Remarks Suggested Tnemec Color or Equal
SD	Sanitary Drain	Grey	Grey IN05
SDR	Storm Drain	Grey	Grey IN05
SPD	Sump Pump Discharge	Brown	Banyonbark AC12 (dark brown)
SS	Sanitary Sewer	Grey	Grey IN05
SVT	Sanitary Vent	Grey	Grey IN05

** END OF SECTION **

SECTION 15034 - GAUGES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing pressure and vacuum gauges, including fittings, snubbers, connections, gaskets, supports, and accessories.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 11000 Equipment General Provisions
2. Section 15100 Valves, General

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Plumbing Code

PART 2 -- PRODUCTS

2.1 PRESSURE AND VACUUM GAUGES

A. **General:** Pressure gauges shall be installed on suction and discharge connections to pumps; on discharge connections from blowers and compressors; at each side of pressure reducing valves; and where otherwise indicated. Vacuum gauges and compound gauges, where indicated, shall be installed on vacuum pumps.

B. **Gauge Construction:** Gauges shall have Type 316 stainless steel movement and stainless steel or alloy case. Except as otherwise indicated, gauges shall have a 3-1/2-inch dial, 1/4-inch threaded connection, a Type 316 stainless steel snubber adapter, and a shut-off valve. Gauges shall be calibrated to read with an accuracy of ∀ 1 percent to 150 percent of the indicated pressure. Gauges shall be vibration and shock resistant. Gauges on liquid service should have cases filled with a suitable liquid.

C. **Diaphragm Seal:** Gauges attached to systems containing chemical solutions, corrosive fluids, sludge, sewage, or other liquids containing solids, shall be equipped with diaphragm seals, or equal protective pressure or vacuum sensing devices, and comply with the following:

1. For: sewage, sludge, liquids containing solids, pulsating flow — Seals shall be fabricated with Type 316 stainless steel, with stainless steel diaphragm for pressures over 15 psi, and elastomer diaphragm for pressures of 15 psi

		and below with Type 316 stainless steel nuts and bolts, fill connection and valved flush port size 1/4-inch NPT, capable of disassembly without loss of filler fluid.
	2. For: chemical solutions, low pressure sewage and chemical sludge except as otherwise indicated	Seals shall be fabricated with PVC body for removable mounting and rated at 200 psi, with Type 316 stainless steel bolts and nuts, 1/2-inch inlet, 1/4-inch outlet, liquid-filled with Teflon diaphragm for pressure service and proper elastomer diaphragm for vacuum service.

2.2 SLEEVE PRESSURE GAUGES

A. **General:** Sleeved pressure gauges shall be provided where indicated.

B. Sensors shall be in-line ring-type, bolted directly between 600 lb R.F. flanges. The sensors shall have through-holes for positive alignment with pipeline flanges. Inside diameters of the sensors shall be the same at the mating pipes. Pressure sensing rings shall measure pressure for 360 degrees around the inside circumference of the pipe. Pressure shall be transmitted to the gauge by a locked-in, sealed ethylene glycol or silicone oil. The pressure indicators shall be local to the sensors. Pressure transmitters shall be connected by capillary tubing to the sensors.

2.3 MANUFACTURERS

A. Pressure and Vacuum Gauges

1. **Pressure and vacuum gauges shall be manufactured by one of the following (or equal):**

Ashcroft Industrial Instruments (Dresser)
Foxboro/Jordan, Inc.
Marsh Instrument Company
Marshalltown Instruments, Inc.
U.S. Gauge Div. of Ametek

2. **Diaphragm seals shall be of the following manufacture and model (or equal):**

a. Stainless steel diaphragm seals and elastomer diaphragm seals for sewage, sludge and liquids containing solids.

Ashcroft®, model 101
Marshalltown, Series 225-01
U.S. Gauge (Ametek), SG

b. Teflon diaphragm and elastomer diaphragm seals for chemical solutions, low pressure sewage, and chemical sludge.

Harrington Ind. Plastics, Inc.
Plast-O-Matic Valves, Inc.
Utilities Supply

B. **Sleeve Pressure Gauges:**

1. **Sleeve pressure gauges shall be manufactured by one of the following (or equal):**

Red Valve Company, Inc.
Ronningen-Petter

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Gauges shall be installed in accordance with the manufacturer's installation instructions.

B. Gauges shall be installed with the face in the vertical position at the indicated locations. Gauges shall be installed to minimize the effect of water hammer and vibrations, and, where indicated, gauges shall be mounted independently, with flexible connectors.

** END OF SECTION **

SECTION 15100 - VALVES, GENERAL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing general requirements for valves including epoxy coating, installing, adjusting, and testing of valves and where buried valves are indicated, valve boxes to grade, with covers, stem extensions, and position indicators.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 11000 Equipment General Provisions
2. Section 15000 Piping Components
3. Section 15101 Valve Operators
4. Section 15105 Check Valves
5. Section 15106 Ball Valves
6. Section 15110 Plug Valves
7. Section 15113 Air Release and Vacuum Valves

1.3 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following standards apply to the WORK of this Section:

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys
ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inch)
ANSI/ASME B31.1	Power Piping
ASTM A 36	Specification for Structural Steel
ASTM A 48	Specification for Gray Iron Castings
ASTM A 126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A 536	Specification for Ductile Iron Castings
ASTM B 61	Specification for Steam or Valve Bronze Castings
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings
ASTM B 148	Specification for Aluminum-Bronze Castings
ASTM B 584	Specification for Copper Alloy Sand Castings for General Applications
ANSI/AWWA C500	Gate Valves for Water and Sewerage Systems
ANSI/AWWA C502	Dry-Barrel Fire Hydrants
ANSI/AWWA C503	Wet-Barrel Fire Hydrants

ANSI/AWWA C504	Rubber-Seated Butterfly Valves
ANSI/AWWA C506	Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types
ANSI/AWWA C507	Ball Valves 6 Inches Through 48 Inches
AWWA C508	Swing-Check Valves for Waterworks Service, 2 Inches Through 24 Inches NPS
ANSI/AWWA C509	Resilient-Seated Gate Valves for Water and Sewage Systems
AWWA C550	Protective Interior Coatings for Valves and Hydrants
SSPC-SP-2	Hand Tool Cleaning
SSPC-SP-5	White Metal Blast Cleaning

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Manufacturer's product data including catalogue cuts.
2. Manufacturer's installation instructions.
3. Shop drawings showing details and dimensions.
4. Manufacturer's certification that products comply with the indicated requirements.
5. Schedule of valves indicating valve identification and location.
6. Manufacturer's certification that epoxy coatings have been factory tested and comply with the indicated requirements.

1.5 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. Manufacturer's installation and operating instructions.
2. Manufacturer's maintenance procedures.
3. List of special tools.
4. Schedule of valves indicating valve identification and location.

1.6 FACTORY TESTING

A. **General**: Valves shall be tested in compliance with the AWWA Standards as indicated. Except as otherwise indicated, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

B. **Proof-of-Design Tests**: The CONTRACTOR shall furnish the CONSTRUCTION MANAGER three (3) certified copies of a report from an independent testing laboratory certifying successful completion of proof-of-design testing for all valves of sizes 10-inch and larger unless indicated otherwise in the specific valve Section. In lieu of testing the valves at an independent testing laboratory, proof-of-design testing may be performed at the valve manufacturer's laboratory, but must be witnessed by a representative of a qualified independent testing laboratory representative. Proof-of-design testing shall have been performed on not less than three valves, with all three units demonstrating full compliance with the test standards. Failure to satisfactorily complete the test shall be deemed sufficient evidence to reject all valves of the proposed make or manufacturer's model number.

1.7 FIELD TESTING

A. **Testing**: Valves shall be field-tested for compliance with the indicated requirements.

PART 2 -- PRODUCTS

2.1 VALVES

A. **General:** Shut-off valves, 6-inch and larger, shall have operators with position indicators. Where buried, these valves shall be provided with valve boxes and covers containing position indicators, and valve extensions. Valves mounted higher than 7 feet above working level shall be provided with chain operators.

B. **Valve Flanges:** The flanges of valves shall comply with Section 15000.

C. **Protective Coating:** Except where otherwise indicated, ferrous surfaces, exclusive of stainless steel surfaces, in the water passages of all valves 4-inch and larger, and exterior surfaces of submerged valves, shall be epoxy coated conforming to Section 09800. Flange faces of valves shall not be epoxy coated.

D. **Valve Operators:** Where indicated, valves shall include electric operators recommended by the manufacturer. Operators of the same type shall be furnished by the same manufacturer. Valve operators, regardless of type, shall be installed, adjusted, and tested by the valve manufacturer at the manufacturing plant. Except as otherwise indicated, electric, pneumatic, and hydraulic valve operators shall comply with Section 15101.

E. **Nuts and Bolts:** Nuts and bolts on valve flanges, bodies and supports shall comply with Section 05500.

2.2 NAMEPLATES, TOOLS AND SPARE PARTS

A. **Nameplates**: Except as otherwise indicated, a label shall be provided on all valves exclusive of hose bibbs and chlorine cylinder valves. The label shall be 1/16-inch plastic or stainless steel, minimum 2 inches by 4 inches in size, and shall be permanently attached to the valve.

B. **Spare Parts:** Two sets of packings, O-rings, gaskets, discs, seats, and bushings shall be furnished with each valve, as applicable.

PART 3 -- EXECUTION

3.1 VALVE INSTALLATION

A. **General:** Valves, operating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's installation instructions. Valves shall be independently supported to prevent stresses on the pipe.

B. **Access:** Valves shall be installed to provide easy access for operation, removal, and maintenance and to prevent interferences between valve operators and structural members or handrails.

C. **Valve Accessories:** Where combinations of valves, sensors, switches, and controls are indicated, the combinations shall be properly assembled and installed to ensure that systems are compatible and operating properly.

** END OF SECTION **

SECTION 15101 - VALVE AND GATE OPERATORS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing all shut off and throttling valves with manual and power operators as indicated. The CONTRACTOR shall provide the valve and gate operators, complete and operable, including all controls, motors, gears, enclosures and other necessary appurtenances as indicated.

B. The WORK also requires that the valve or gate manufacturer accept responsibility for furnishing the WORK in this Section but without altering or modifying the CONTRACTOR'S responsibilities under the Contract Documents.

C. The WORK additionally requires that the one manufacturer who accepts the indicated responsibilities shall manufacture the valve or gate, as a minimum.

D. The WORK also includes coordination of design, assembly, testing and installation.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 15100 Valves, General
2. Section 16040 Electric Motors
3. Section 16050 Basic Electrical Materials and Methods

1.3 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

JIC P-1	Pneumatic Standards for Industrial Equipment and General Purpose Machine Tools
NEMA ICS-2	Industrial Control Devices, Controllers and Assemblies

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with the provisions of Section 15100:

1. Electrical wiring and control diagrams.

1.5 SERVICES OF MANUFACTURER

A. **Inspection, Startup, and Field Adjustment**: An authorized representative of the manufacturer shall visit the site for not less than 3 days to furnish the indicated services.

B. **Instruction of OWNER'S Personnel**: The authorized service representative shall also furnish the indicated services for instruction of OWNER'S personnel for not less than 2 days.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **General:** Unless otherwise indicated, all shut-off and throttling valves, and externally-actuated valves and gates, shall be provided with manual or power operators. The CONTRACTOR shall furnish all operators complete and operable with mounting hardware, motors, gears, controls, wiring, solenoids, handwheels, levers, chains, and extensions, as applicable. All operators shall be capable of holding the valve in any intermediate position between fully-open and fully-closed without creeping or fluttering. All wires of motor-driven operators shall be identified by unique numbers.

B. **Manufacturers:** Where indicated, certain valves and gates may be provided with operators manufactured by the valve or gate Manufacturer. Where operators are furnished by different manufacturers, the CONTRACTOR shall coordinate selection to have the fewest number of manufacturers possible.

C. **Materials:** All operators shall be current models of the best commercial quality materials and liberally-sized for the maximum expected torque. All materials shall be suitable for the environment in which the valve or gate is to be installed.

D. **Mounting:** All operators shall be securely mounted by means of brackets or hardware specially designed and sized for this purpose and of ample strength. The word "open" shall be cast on each valve or operator with an arrow indicating the direction to open in the counter-clockwise direction. All gear and power operators shall be equipped with position indicators. Where possible, manual operators shall be located between 48 and 60 inches above the floor or a permanent work platform.

E. **Standard:** Unless otherwise indicated and where applicable, all operators shall be in accordance with ANSI/AWWA C 540 - AWWA Standard for Power-Actuating Devices for Valves and Sluice Gates.

F. **Functionality:** Electric, pneumatic, and hydraulic operators shall be coordinated with power and instrumentation equipment indicated elsewhere in the Contract Documents.

2.2 MANUAL OPERATORS

A. **General:** Unless otherwise indicated, all valves and gates shall be furnished with manual operators. Valves in sizes up to and including 3 ½ inches shall have direct acting lever or handwheel operators of the Manufacturer's best standard design. Larger valves and gates shall have gear-assisted manual operators, with an operating pull of maximum 60 pounds on the rim of the handwheel. All buried and submerged gear-assisted valves, all gates, all gear-assisted valves for pressures higher than 250 psi, all valves 30 inches in diameter and larger, and where so indicated, shall have worm-gear operators, hermetically-sealed and grease-packed, where buried or submerged. All other valves 4 inches to 24 inches in diameter may have traveling-nut operators, or worm-gear operators as indicated.

B. **Chain Operator:** Manually-operated valves with the stem located more than 7 feet 6 inches above the floor or operating level shall be furnished with chain drives consisting of sprocket-rim chain wheels, chain guides, and operating chains, and be provided by the valve Manufacturer. The wheel and guide shall be of ductile-iron or cast-iron, and the chain shall be hot-dip galvanized steel or stainless steel, extending to 5 feet 6 inches above the operating floor level. The valve stem of chain-operated valves shall be extra strong to allow for the extra weight and chain pull. For plug valves 8 inches and larger, the actuator shall be provided with a hammer blow wheel. Hooks shall be provided for chain storage where chains interfere with pedestrian traffic.

C. **Manual Worm-Gear Operator:** The operator shall consist of a single or double reduction gear unit contained in a weather-proof cast-iron or steel body with cover and minimum 12-inch diameter handwheel. The operator shall be capable of 90-degree rotation and shall be equipped with travel stops capable of limiting the valve opening and closing. The operator shall consist of spur or helical gears and worm-gearing. The spur or helical gears shall be of hardened alloy steel and the worm-gear shall be ductile iron. The worm-gear shaft and the handwheel shaft shall be of 17-4 PH or similar stainless steel. All gearing shall be accurately cut with hobbing machines. Ball or roller bearings shall be used throughout. Operator output gear changes shall be mechanically possible by simply changing the exposed or helical gearset ratio without further disassembly of the operator. All gearing shall be designed for a 100 percent overload.

2.3 ELECTRIC MOTOR OPERATORS (NOT USED)

2.4 PNEUMATIC OPERATORS (NOT USED)

2.5 FLUID POWER SYSTEMS (NOT USED)

2.6 MANUFACTURERS

A. Products shall be from the following manufacturers, or equal.

1. Manual Worm-Gear Override:

G.H. Bettis
Keystone Controls, Inc.
Neles-Jamesbury, Inc.
Auma

PART 3 -- EXECUTION

3.1 GENERAL

Installation shall be as specified herein. Valve operators shall be located so that they are readily accessible for operation and maintenance. Valve operators shall be mounted for unobstructed access, but mounting shall not obstruct walkways. Valve operators shall not be mounted where shock or vibration will impair their operation. Support systems shall not be attached to handrails, process piping, or mechanical equipment.

3.2 SERVICES OF MANUFACTURER

A. **Field Adjustments:**

1. Field representatives of manufacturers of valves or gates with pneumatic, hydraulic, or electric operators shall adjust operator controls and limit-switches in the field for the required function.

3.3 INSTALLATION

A. All valve and gate operators and accessories shall be installed in accordance with Section 15100 - Valves, General.

** END OF SECTION **

SECTION 15105 – CHECK VALVES

PART 1 – GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing check valves of the types and sizes indicated with epoxy coating, appurtenances, and accessories.

1.2 RELATED SECTIONS

A. The WORK of the following Section applies to the WORK of this Section. Other Sections of the Specifications, no referenced below, shall also apply to the extent required per proper performance of this WORK.

1. Section 15100 Valves, General

1.3 FACTORY TESTING

A. Valves shall be tested in compliance with AWWA C508, and Section 15100 – Valves, General.

B. Proof-of-design tests shall be submitted in compliance with Section 15100 – Valves, General, for all check valves sizes 10-inch and larger.

PART 2 – PRODUCTS

2.1 SWING CHECK VALVES

A. General: Except as otherwise indicated, swing check valves designed for sewage and general service shall be of resilient, flexible disc type, complying with AWWA C 508, and full port opening; valves shall be designed for a water-working pressure of 150 psi and shall have a flanged cover piece designed to provide access to the disc. Interior and exterior surfaces of valves shall be fusion bonded epoxy coated complying with Section 09800 – Protective Coating.

B. Design: The valve body shall be designed to provide full pipe size flow area. Seating surface shall be on a 45 degree angle with disc travel to full open of 35 degrees. Valve shall have non-slam closure characteristics.

C. Body: The valve body shall be fabricated with ductile iron conforming to ASTM A 536 or cast iron conforming to ASTM A 126, class B, with flanged ends conforming to ANSI B 16.1, class 125 unless otherwise indicated.

D. Disc: The valve disc shall be fabricated of Buna-N conforming to ASTM D 2000 with steel reinforcing.

E. Backflow Actuator: A stainless steel backflow actuator shall be provided to allow opening of the valve during no-flow conditions.

F. Disc Position Indicator: A mechanical stainless steel actuator shall be provided for indication of valve position.

G. Proximity Switch: A proximity switch shall be provided to indicate when the disc is closed.

H. Boss: Provide a threaded boss upstream of the disc for installation of air release assembly associated with self-priming non-clog pump installation where indicated on the drawings.

2.2 MANUFACTURERS

A. Check valves shall be manufactured by the following (or Owner pre-approved equal):

1. Swing check valves:

VAL-MATIC (Valve and Manufacturing Corporation) Surgebuster

PART 3 – EXECUTION

3.1 GENERAL

A. Valves shall be installed in accordance with Section 15100 – Valves, General.

** END OF SECTION **

SECTION 15106 - BALL VALVES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing manually-operated ball valves with epoxy coating, operators, and accessories.

1.2 RELATED SECTIONS

A. The WORK of the following Section applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 15100 Valves, General

1.3 FACTORY TESTING

A. Valves shall be tested in compliance with AWWA C507 and Section 15100.

B. Proof-of-design tests shall be submitted in compliance with Section 15100 for all ball valves size 10-inch and larger.

PART 2 -- PRODUCTS

2.1 BALL VALVES (6-INCH AND LARGER) (NOT USED)

2.2 BALL VALVES (4-INCH AND SMALLER)

A. **General Requirements:** Except as otherwise indicated, ball valves in sizes up to 4 inches shall have manual operators with lever or handwheel. Ferrous surfaces of valves where contact with water is indicated shall be epoxy-coated conforming to Section 09800.

B. **Body:** Ball valves up to 1-1/2 inches in size shall have bronze or forged brass 2- or 3-piece bodies with ends threaded and shall be designed for a pressure rating of not less than 300 psi. Valves 2-inch to 4-inch in size shall have bronze forged brass or steel 2-or 3-piece bodies with flanged ends and shall be designed for a pressure rating of 150 psi.

C. **Balls:** The balls shall be fabricated of solid brass, chrome plated bronze, or Type 316 stainless steel, with full openings.

D. **Stems:** The valve stems shall be of the blow-out proof design, and fabricated of bronze or Type 316 stainless steel and shall include reinforced Teflon seals.

E. **Seats:** The valve seats shall be of Teflon or Buna-N.

2.3 PLASTIC BALL VALVES

A. **General Requirements:** Plastic ball valves designed for use with corrosive fluids shall be fabricated of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), or polyvinylidene fluoride (PVDF), as recommended by the manufacturer for use in the service indicated. Valves shall have manual operators except as otherwise indicated.

B. **Construction:** Plastic ball valves shall have union ends or flanged ends conforming to ANSI B 16.5, class 150. Balls shall have full size ports and Teflon seats. Body seals, union O-ring seals, and stem seals shall be Viton. Valves shall be suitable for a maximum working of 150 psi at 73 degrees F for PVC.

2.4 MANUFACTURERS

A. Ball valves shall be manufactured by the following (or equal):

1. **Ball Valves (4-inch and Smaller):**

Jamesbury Corporation
Jenkins Bros.
Lunkenheimer Flow Control
Wm. Powell Company
Worcester Controls

2 **Plastic Ball Valves:**

ASAHI-America, (full port: ½ to 4 inches only)
G F Plastic Systems, Inc., (full port: ½ to 2 inches only)
NIBCO Inc., (Chemtrol), (full port: ½ to 4 inches only)
Spears, (full port: ½ to 6 inches only)

PART 3 -- EXECUTION

3.1 GENERAL

A. Valves shall be installed in accordance with Section 15100.

** END OF SECTION **

SECTION 15110 - PLUG VALVES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing plug valves with operators, protective coatings, and lubricating guns.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 15100 Valves, General

1.3 FACTORY TESTING

A. Product Testing: Products shall be tested at the factory for compliance with the indicated requirements and as follows:

1. An independent testing laboratory shall conduct proof-of-design testing on valves ranging in size from 24-inch and 42-inch diameter in accordance with AWWA C 504, Section 5, except that where the word "disc" appears in the standard, it is understood to mean "plug."

B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserve the right to witness factory tests.

C. **Results:** Proof-of-design test results shall be submitted in compliance with Section 15100.

PART 2 -- PRODUCTS

2.1 LUBRICATED PLUG VALVES (NOT USED)

2.2 ECCENTRIC PLUG VALVES

A. **Equipment Requirements:** Eccentric plug valves shall be of the non-lubricated eccentric type with cast iron bodies, resilient faced plugs, or shall include replaceable, resilient seat in the body. Except as otherwise indicated, all valves for sizes 4-inch and larger shall have worm gear operators, nickel or stainless steel seats, and ANSI 125 psi flanged or grooved ends. Valves 2-1/2 inches and smaller shall have operating levers, nickel or stainless steel seats, and threaded ends with resilient facing suitable for the intended service. Submerged and buried valves shall be equipped with worm-gear operators, lubricated and sealed to prevent entry of dirt and water into the operator. Shaft bearings shall be stainless steel furnished with permanently-lubricated bearing surfaces. Operators shall clearly indicate valve position. Valves up to and including 20 inches in size shall have an unobstructed port

area of not less than 80 percent of full pipe area, and not less than 70 percent for larger valves. Eccentric plug valves shall have a pressure rating of not less than 150 psi water, oil, or gas (WOG) service and bubble-tight shut-off.

B. **Surface Coating:** Ferrous surfaces of valves 4 inches and larger in contact with process fluid shall be epoxy-coated conforming to Section 09800.

2.3 MANUFACTURERS

A. Products of the type or model (if any) indicated shall be manufactured by one of the following (or equal):

1 **Eccentric Plug Valves:**

DeZurik Corporation
Keystone, Drum-Owens, (Homestead)
Victualic Company of America

PART 3 -- EXECUTION

3.1 INSTALLATION

A. **General:** Valves shall be installed in accordance with Section 15100.

B. **Eccentric Plug Valves:** Except as otherwise indicated, the installation of eccentric plug valves in sewage, sludge, or other liquid systems containing solids, silt, or fine sand shall comply with the following:

1. Valves shall be installed with the stem in the horizontal position.

2. In horizontal piping, the plug shall swing upwards when opening to permit flushing out of solids.

3. The flow direction through the installed valve shall be such that the valve body cannot fill up with incoming solids when the valve is closed.

4. Valves where closure for extended periods is indicated (stand-by, bypass, or drain lines), and valves where reversed flow is indicated (higher pressure on downstream side forcing the plug away from its seat) shall include worm gear operators for sizes 4 inches and larger.

** END OF SECTION **

SECTION 15113 - AIR RELEASE AND VACUUM VALVES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing air release and vacuum valves as indicated, complete and operable, including accessories and drain connections.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 15100 Valves, General

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Combination Air Valves**: Combination air valves shall combine the characteristics of air and vacuum valves and air release valves by exhausting accumulated air in systems under pressure and releasing or re-admitting sufficient quantities of air, as determined by the manufacturer's approved sizing methods, while a system is being filled or drained, respectively.

1. The Sewage Air Release & Vacuum Break Valve shall consist of a compact tubular all stainless steel fabricated body, hollow direct acting float and solid large orifice float in H.D.P.E. - stainless steel nozzle and woven dirt inhibitor screen, EPDM rubber seals and seat.

2. The valve shall have an integral "Anti-Surge" Orifice mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure to less than 1.5 x valve rated working pressure.

3. The intake orifice area shall be equal to the nominal size of the valve i.e., a 80mm (3") valve shall have a 80mm (3") intake orifice. Large orifice sealing shall be affected by the flat face of the control float seating against an EPDM rubber 'O' ring housed in a dovetail groove circumferentially surrounding the orifice.

4. Discharge of pressurized air shall be controlled by the seating & unseating of a small orifice nozzle on a natural rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seal is prevented. The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to twice the designed working pressure.

5. Connection to the valve inlet shall be facilitated by flanged ends conforming to PN10, 16 or 25 ratings of BS4504 or SABS 1123 Standards or ANSI B16.1 Class 125 & Class 250 and ANSI B16.5 Class 150 or Class 300 Standards. AS 4087 Fig. B7 - B9, AS 2129 Table E/F. Flanged ends shall be supplied with the requisite number of stainless steel screwed studs inserted for alignment to the specified standard.

B. **Stainless Steel Pipe Fittings:** As specified above, for each air valve the pipe connection to the manifold and all other piping in the assembly shall be Type 316 stainless steel. Provide an isolation plug valve on the assembly to allow maintenance and removal of each air release valve.

2.2 MANUFACTURERS

A. **Products shall be manufactured by one of the following (or equal):**

1. Vent-O-Mat with no known equal.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All valves shall be installed in accordance with the manufacturer's printed recommendations.

** END OF SECTION **

SECTION 16030 - ELECTRICAL TESTS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes testing, commissioning and demonstrating electrical WORK.

B. The WORK of this Section includes circuit activation, equipment running and installation of temporary jumpers.

C. The WORK of this Section includes correction of defects and retesting.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 13300 Instrumentation and Control
2. Section 16050 Basic Electrical Materials and Methods

1.3 CODES

A. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:

1. National Electrical Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. NETA National Electrical Testing Association, Latest Edition

1.5 SEQUENCE AND SCHEDULING

A. Electrical testing including functional testing of power and controls not tested under Section 13300 shall be completed before commencement of the 7-day test.

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Report of testing of electrical WORK.

PART 2 -- PRODUCTS

2.1 TEST EQUIPMENT AND MATERIALS

A. Test instruments shall be calibrated to references traceable to the National Bureau of Standards and shall have a current sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date recalibration is required.

PART 3 -- EXECUTION

3.1 TESTING

A. In addition to indicated testing requirements and acceptance criteria, testing shall include the following:

1. **Lighting:** N/A

2. **Power Instrumentation:** Demonstration that voltmeter and ammeter switches are functional and that meters, including kilowatt meters, are installed within catalog accuracy.

3. Demonstration of mechanical and electrical interlocking by attempting to subvert the indicated sequence.

4. Activation of ground fault tripping by operating test features provided with ground current protective systems and by injecting a known, and reasonable, current in the ground current sensor circuit. Where not otherwise indicated, ground fault tripping shall occur at a ground current equivalent to 20 percent of phase current. Current injection is not required of circuit 400 amperes or less.

5. **Cable Testing:** 480-volt circuits shall be tested for insulation resistance with a 1000-volt megohm meter. Testing shall be done after the 480-volt equipment is terminated. Phase-to-phase A-B, B-C, A-C and phase-to-ground insulation resistance tests shall be performed on each 5 kv, 15 kv, and 25 kv cable prior to termination at equipment but subsequent to stress cone makeup. Test results shall be submitted for review 30 days prior to plant operation and any system testing. Equipment which may be damaged during this test shall be disconnected. Tests shall be performed with other equipment connected to the circuit. The cable must withstand the test high voltage without breakdown, and shall exhibit steady or decreasing leakage current during the high potential test, and have satisfactory comparable megger readings in each megger test. Test results shall identify equipment used and time of test. Cable operating at more than 2,000 volts shall be tested in accordance with ICEA publications S-68-61, S-61-402, S-19-81, and S-68-516. Cable testing and reporting shall be performed by an organization recommended by the Manufacturer of the cable to be tested. The testing organization shall have a record of at least one prior successful project of comparable size and complexity. Testing shall verify the quality of cable terminations. Test results for medium and high voltage cable shall be

submitted to the CONSTRUCTION MANAGER 30 days prior to the time schedule for equipment energization.

6. Functional test and testing of electrical components shall be performed prior to subsystem testing and commissioning. Compartments and equipment shall be cleaned before commencement of functional testing. Functional testing shall include:
Visual and physical check of cables, busswork, circuit breakers, transformers, and connections associated with new and modified equipment.

Setting of protective relays in conformance with results of the Short Circuit Study and testing of relays to assure that relays will trip at the current value and time required by the Study.

Circuit breakers which are specified with adjustable time or pick-up settings for ground current, instantaneous overcurrent, short-time overcurrent, or long-time overcurrent, shall be field adjusted by a representative of the circuit breaker Manufacturer. Time and pickup setting shall correspond to the recommendations of the Short Circuit Study. Setting shall be tabulated and proven for each circuit breaker in its installed position; test results shall be certified and 7 copies shall be submitted to the CONSTRUCTION MANAGER.

7. Complete ground testing of all grounding electrodes prior to operating the equipment utilizing a three-point ground test.

B. Subsystem testing shall occur after the proper operation of alarm and status contacts has been demonstrated to the CONSTRUCTION MANAGER and after process control devices have been adjusted. The WORK of this Section includes adjusting limit switches and level switches prior to testing and setting pressure switches, flow switches, and timing relays.

C. After initial settings have been completed, each subsystem shall be operated in the manual mode. Once the manual mode of operation has been proven, automatic operation shall be demonstrated to verify proper start and stop sequence of pumps, proper operation of valves, proper speed control, and similar parameters.

D. Subsystems, in the context discussed here, mean individual and groups of pumps, conveyor systems, chemical feeders, air conditioning units, ventilation fans, air compressors, and similar equipment.

3.2 COMMISSIONING

A. Commissioning during the 7-day test shall not be attempted until all subsystems have been found to operate satisfactorily; commissioning shall only be attempted as a function of normal plant operation in which plant process flows and levels are routine and equipment operates automatically in response to flow and level parameters or computer command, as applicable. Simulation of process parameters shall be considered only upon receipt of a written request by the CONTRACTOR.

** END OF SECTION **

SECTION 16040 - ELECTRIC MOTORS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing electric motors with accessories.

1.2 RELATED SECTIONS

A. The WORK of the following Section applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 11033 Variable Frequency Drives
2. Section 16050 Basic Electrical Materials and Methods

1.3 CODES

A. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:

1. National Electrical Code, 2011

1.4 SPECIFICATIONS AND STANDARD

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1.	AFBMA 9	Load Ratings and Fatigue Life for Ball Bearings.
2.	AFBMA 11	Load Ratings and Fatigue Life for Roller Bearings.
3.	ANSI/IEEE 112	Standard Test Procedure for Polyphase Induction Motors and Generators.
4.	IEEE 841	Standard for Petroleum and Chemical Industry—Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors—Up to and Including 500 HP
5.	NEMA ICS 2	Industrial Control Devices, Controllers and Assemblies
6.	NEMA ICS 6	Enclosures for Industrial Controls and Systems.
7.	NEMA MG 1	Motors and Generators.
8.	UL 674	Motors and Generators, Electric, for Use in Hazardous Locations, Class I, Groups C and D, Class II, Groups E, F and G.
9.	UL 1004	Motors, Electric

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Machine name and submitted data on driven machine.
2. Motor manufacturer.

3. Motor type, model and dimensioned drawing.
4. Nominal horsepower.
5. NEMA design.
6. Frame size.
7. Enclosure.
8. Winding insulation class and treatment.
9. Rated ambient temperature.
10. Service factor.
11. Voltage, phase, and frequency rating.
12. Full load current at rated horsepower and indicated voltage.
13. Starting code letter, or locked rotor kVA, and current.
14. Special winding configuration.
15. Rated full load speed.
16. Power Factor at full load, ¾ load and ½ load.
17. Details of water cooling (if any) for thrust bearings.
18. Motor efficiencies.
19. Name plate drawing with data filled in.
20. Wiring diagram, internal and typical external connections.
21. Port and connection detail for vibration sensor where it is applicable.
22. Factory tests including sound level, SCT, CIT, vibration, polarization.

B. The following shall be submitted:

1. Bill of Material: Complete Bills of Material with catalog data sheets and manuals for all equipment and devices comprising the variable frequency drive system. Where catalog cuts and other brochures depicting product characteristics are supplied, annotate to show product to be used on this project.

2. List of Spare Parts: A complete list of recommended spare parts. Include item descriptions, recommended quantities, and unit costs. The recommended list should be based on a maintenance plan where the OWNER will remove and replace failed items to the lowest replaceable module/component level.

3. Operation, Maintenance and Installation Instructions: Furnish with the equipment at delivery Operation and Maintenance Manuals, installation instructions, and other documentation necessary for the installation, start-up, operation and maintenance of the system.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. **Conformance**: Electric motors driving identical machines shall be identical.

B. **Rating**: The nominal rated motor horsepower shall be adequate for the driven machine without infringing upon the indicated motor service factor, unless more restrictive motor requirements are specified for a specific equipment item.

C. **Minimum Motor hp:** The motor horsepower shall be not less than the minimum indicated for each driven machine. If the minimum horsepower is not adequate, the motor with the next larger horsepower, circuit breakers, magnetic starters, motor feeder conductors and conduit shall be provided.

2.2 DESIGN REQUIREMENTS

A. **General:** Electric motors shall comply with ANSI/NEMA MG 1.

B. **NEMA Design:** Except as otherwise indicated, electric motors shall be NEMA Design B, constant speed squirrel-cage induction motors designed for normal starting torque with low starting current. In no case shall starting torque or breakdown torque be less than the value indicated in ANSI/NEMA MG 1.

C. **Motor Voltage Ratings:** Motors shall be rated 460 volts, 3-phase, 60-HZ, 900RPM.

E. **Insulation (Heavy Duty Motors):** Motors shall include Class F insulation, rated to operate at an ambient temperature of 50 degrees C without exceeding Class B temperature rise limits at the motor's nominal rating

F. **Motor Type:** Except as otherwise indicated, all motors shall be totally enclosed, fan cooled (TEFC) with a service factor of 1.15.

G. **High Efficiency Motors:** Motors with a nameplate rating of 5 hp and above shall be "high efficiency" units with efficiencies determined by the test set forth in ANSI/IEEE 112, Method B with stray load loss adjustment as modified by NEMA MG 1-12.53(a) and (b).

H. **Efficiency Index:** Efficiency index, nominal efficiency, and minimum efficiency shall be defined in accordance with ANSI/NEMA MG 1-12.53.b. Motor nameplate data shall include the nominal efficiency value.

I. **High efficiency Motors:** High efficiency motors shall conform to the following minimum efficiency requirements for full load values:

Motor	Guaranteed Minimum Efficiency Synchronous	(Efficiency)	
hp	Speed, rpm	Open	Enclosed
500	900	95	95

J. **Motors for VFD Drives**: Motors for variable frequency drives (VFD) shall be specifically rated for inverter duty, NEMA MG 1 design A or B, high efficiency, totally enclosed fan cooled (TEFC) with Class F insulation. Winding temperature rise shall be limited to Class B rise when operating over the speed range specified in VFD Section 11033 with the specified load speed/torque characteristic. Six 100-ohm platinum resistance temperature detectors (RTDs) shall be provided in the stator windings for motors 100 Hp and larger. Motor insulation shall be designed to meet NEMA MG 1, Part 31 (1600-volt peak at a minimum of 0.1 microsecond rise time). Motors shall conform to IEEE 841. All internal surfaces shall be coated with epoxy paint.

Inverter duty motors shall be specifically certified by the motor manufacturer to be compatible with the VFD to be used with the motor. Inverter duty motors shall be designed to operate over the speed or frequency range specified. Inverter duty motors shall be provided with Type 2 thermal protection as specified in NEMA MG 1-12.53.2.

Inverter duty motors shall be equipped with ceramic coated bearings to insulate them from VFD induced current.

K. **Stator Windings and Resistance Temperature Detectors:** Stator windings shall be copper. Except as otherwise indicated, six 100-ohm platinum resistance temperature detectors (RTDs) shall be provided in the stator windings for motors greater than 250 Hp..

L. **Thrust Value:** The motor supplier shall be responsible to provide motors that comply with system thrust value from pumps. System thrust value shall be obtained from pump manufacturer.

M. **Space Heaters:** 120 volt space heaters shall be provided on all 15 Hp and larger motors.

2.3 MOTOR BEARINGS

A. **General:** Bearings shall comply with Section 11000.

B. **Bearing Life:** Except as otherwise indicated, motors shall be heavy duty and shall include bearings with a minimum L-10 life of 100,000 hours.

C. **Vertical Motors Over 2 hp:** Vertical motors larger than 2 hp shall be furnished with relubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall comply with the manufacturer's recommendations.

D. **Temperature Detectors:** Except as otherwise indicated, one 3 wire, 100 ohm platinum RTD per bearing shall be provided for motors greater than 250 Hp.

2.4 ACCESSORY REQUIREMENTS

A. **General:** Horizontal motors 3 hp and larger, and all vertical motors, shall have split-type cast metal conduit boxes. Motors other than open drip-proof shall include gaskets.

B. **Lifting Devices:** All motors weighing 50 lbs or more shall include lifting devices designed for installation and removal.

C. **Terminal Boxes:** Motors shall have extra large terminal boxes to accommodate stress cone terminations as recommended by cable manufacturers.

D. **Nameplate:** Motors shall include a permanent, non-corrosive nameplate indelibly stamped or engraved with NEMA Standard motor data, including bearing description and lubrication instructions, insulation class, ambient temperature, and power factor at full load.

2.5 MANUFACTURER

A. Inverter duty motors shall be manufactured by U.S. Motors, Inverter Grade or OWNER approved equal.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Motors shall be installed in accordance with the manufacturer's installation instructions and written requirements of the manufacturer of the driven equipment. The supplied equipment shall be fully compatible with the pump, variable frequency drive and other equipment at the job site. The motor manufacturer representative and contractor shall provide a pre-service test plan and operation of the motor in all normal modes of operation to test start, stop, acceleration, and acceleration of motor and sustained operation at full and minimum speed. OWNER will accept the installation only after functional test indicates compliance with these specifications.

3.2 WARRANTY

A. Warranty period shall cover 24 months from date of startup, not to exceed 30 months from date of shipment. During this period, repairs, including parts and labor, shall be provided at no cost to the OWNER.

** END OF SECTION **

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing the following:

1. Raceways, Fittings and Supports
2. Concrete Pads, Underground Ducts, Manholes and Pull-Boxes
3. Conductors, Wire and Cable
4. Wiring Devices
5. Disconnect Switches
6. Electrical Identification
7. Pushbuttons
8. Cabinets and Enclosures
9. Process Control Devices

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02200 Earthwork
2. Section 03300 Cast-In-Place Structural Concrete
3. Section 05500 Miscellaneous Metalwork
4. Section 09800 Protective Coating
5. Section 13300 Instrumentation and Control
6. Section 15034 Gauges
7. Section 16030 Electrical Tests
8. Section 16170 Grounding System
9. Section 16431 Short Circuit and Coordination Report

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. California Building Code - 2010
2. National Electrical Code - 2010

1.5 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. Federal Specifications:

FS W-C-596E/GEN(1)	Connector, Plug, Receptacle and Cable Outlet, Electrical Power
FS W-S-896E/GEN(1)	Switches, Toggle (Toggle and Lode), Flush Mounted (ac)
FS WW-C-581E	Conduit, Metal, Rigid, and Intermediate; And Coupling, Elbow, and Nipple, Electrical Conduit: Steel, Zinc Coated
WW-C-581E	Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit; Zinc Coated

2. Commercial Standards:

ANSI C80.1	Rigid Steel Conduit, Zinc Coated, Specification For
ANSI/IEEE 386	Separable Insulated Connector Systems for Power Distribution Systems Above 600V
ANSI C37.46	Specifications for Power Fuses and Fused Disconnecting Switches
NEMA TC2	Electrical Plastic Tubing (EPT) and Conduit (EPC 40 and EPC 80)
NEMA ICS 6	Enclosures for Industrial Controls and Systems
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NEMA WC7	Cross-Linked-Thermosetting Insulated Wire and Cable for the Transmission and Distribution of Electric Energy
ASTM B3	Soft or Annealed Copper Wire
ASTM B8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B33	Tinned Soft or Annealed Copper Wire for Electrical Purposes

ASTM B189	Lead Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes
ICEA S-68-516	Ethylene-Propylene-Rubber-Insulated Wire
IEEE 383	Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations
UL 44	Rubber-Insulated Wires and Cable
UL 83	Thermoplastic-Insulated Wires and Cable
UL 67	Underwriters Laboratories, Electric Panelboards
UL 489	Molded-Case Circuit Breakers and Circuit Breaker Enclosures
UL 50	Cabinets and Boxes

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. General

Shop drawings including the following:

Complete material list stating manufacturer and name of each item or class of material.
Front, side, and rear elevations and top views.
Location of conduit entrances and access plates.
Identification of conductors not indicated on drawings.
Identification numbers of conductors.
Manufacturers' equipment drawings.
Details of shielded power cable termination.
Component data.
Connection, terminal and internal wiring diagrams, and conductor sizes.
Layout drawings indicating arrangement, dimensions and weights.
Methods of anchoring.
Finish.
Nameplates.
Temperature limitations, as applicable.

Manufacturer's product data including the following:

Catalogue cuts, bulletins, brochures, or photocopies of applicable pages for mass produced, non-custom manufactured products stamped to indicate the project name, applicable Specification section and paragraph, model number, ratings and options.

Lists of the following:

Materials, equipment, apparatus and fixtures proposed for use; with the list including sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.

Test reports of the following:

Factory-fabricated products.
Currents resulting from DC high potential testing.

2. Lighting and Power Distribution Panelboards

Manufacturer's data as follows:

Manufacturer's certification that bus bracing is capable of withstanding the specified short circuit condition.

Quantity and rating of circuit breakers provided with each panelboard.

B. General Requirement

1. All equipment furnished by the contractor shall be listed by and shall bear the label of Underwriters' Laboratories, Incorporated (UL).

2. The construction and installation of all electrical equipment and materials shall comply with all applicable provisions of the Cal/OSHA Safety Orders (Title 8, CCR), State Building Standards, and Applicable local codes and regulations.

1.7 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. Manufacturer's installation instructions.
2. Manufacturer's maintenance procedures.

1.8 PROJECT RECORD DRAWINGS

A. The following shall be included in the PROJECT RECORD DRAWINGS:

1. Accurate location of conductors including depths and routing of concealed below-grade electrical WORK.

2. Accurate location of electrical WORK (raceway and conductors) where the location differs substantially from the locations indicated.

1.9 AREA DESIGNATIONS

A. **General:** For purposes of delineating electrical enclosure and installation requirements, certain areas are classified as defined below. Electrical installations within these areas shall conform to the indicated code requirements for the area indicated.

B. **General Purpose Locations**: WORK installed in areas which are not otherwise specifically classified shall be "General Purpose." Enclosures shall comply with the requirements of these Specifications and shall be NEMA Type 1.

C. **Outdoor Locations**: In outdoor locations, raceway shall be rigid galvanized steel conduit; entrances shall be threaded; and fittings shall have gasketed covers. Fittings and conduit shall be drained. Threaded fastening hardware shall be stainless steel. Mounting brackets shall be galvanized. Attachments or welded assemblies shall be galvanized after fabrication. Instruments and control cabinets, panels, switchboards and motor control centers shall be "Weatherproof NEMA Type 3R." Enclosures shall be mounted 1/4-inch from walls to provide an air space unless specifically shown otherwise.

D. **Damp Location**: Locations which are indoors and 2 feet below grade elevation or which are indicated as damp locations on the Drawings shall have electrical installations which conform to the requirements for outdoor locations; except, that the air space from walls may be less than 1/4-inch and enclosures shall be NEMA Type 2. "Damp locations" shall include pipe galleries, tunnels, and basements. Rooms housing liquid handling equipment are also classified as damp locations regardless of grade elevation.

E. **Splash Locations**: Areas indicated as "splash-proof" locations shall have electrical installations as described for "outdoor locations"; except, that NEMA Type 4 enclosures shall be provided for instruments and controls, panels, switchboards, and motor control centers.

F. **Corrosive Locations**: Areas indicated as "corrosive" locations shall have stainless steel threaded hardware; electrical hardware, fittings, and raceway systems shall be PVC-coated. Enclosures shall be NEMA Type 4X of fiberglass and reinforced polyester or equal. Corrosive locations include chemical feeder and chemical storage rooms, chlorination rooms, reservoir access, valve structures, and outdoor areas within 10 feet of chemical storage tanks and areas within 10 feet of inlet channels.

G. **Hazardous Locations**: NEC "Hazardous (Classified) Locations" shall be as indicated and shall comply with NFPA 820.

1.10 FACTORY TESTING

A. **Product Testing**: Products shall be tested at the factory for compliance with the indicated requirements and as follows:

1. Cabinets and Enclosures: Each motor control center shall be completed, assembled, wired, and tested at the factory. All buses and wiring shall be given a dielectric test in accordance with the latest IEEE and NEMA Standards.

B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness factory tests.

1.11 FIELD TESTING

A. **Testing:** Products shall be field-tested for compliance with the indicated requirements.

B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness field tests.

1.12 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials**: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements. Products shall not be damaged, marred, or splattered with water, foam, plaster, or paint. Moving parts shall be kept clean and dry.

C. **Replacement**: Damaged materials or equipment, including face plates of panels and switchboard sections, shall be replaced or refinished by the manufacturer at no expense to the OWNER.

1.13 REGULATORY REQUIREMENTS

A. In addition to other indicated regulatory requirements, the WORK of this Section shall comply with the requirements of SSPWC Subsection 209-1.

1.14 UTILITY REQUIREMENTS

A. The WORK of this Section includes compliance with the requirements of San Diego Gas and Electric Company and payment of related charges.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Listing:** Electrical equipment and materials shall be listed for the intended purpose by an independent testing laboratory including Underwriters Laboratories (UL) or an independent testing laboratory shall be acceptable to the inspection authority having jurisdiction.

B. **Unlisted Products:** When a product is not available with a testing laboratory listing for the intended purpose, special testing (if any) required by the authority having jurisdiction shall be included in the original contract price.

C. **Project/Site Conditions:** Unless otherwise indicated, equipment and materials shall be sized and rated for the ambient conditions in San Diego but not less than an ambient temperature of 40 degrees C at sea level without exceeding the manufacturer's stated tolerances.

D. **Product Qualifications**: Equipment and materials shall be new and shall bear the UL label, where UL requirements apply. Equipment and materials shall be the products of reputable manufacturers specializing in the products indicated in this Section. Similar items in the project shall be products of the same manufacturer. Equipment and materials shall be of industrial grade and standard of construction and shall be of sturdy design and manufacture; and shall be capable of reliable, trouble-free service.

E. **Area Classification:** Dry well area is classified as damp and corrosive area. All product and installation specified herein or plans for dry well area shall comply with damp and corrosive application.

2.2 RACEWAY, FITTINGS AND SUPPORTS

A. **Raceway**: Raceway shall comply with the following:

1. **Rigid Steel Conduit:** Raceway shall be rigid steel conduit complying with ANSI C80.1 unless otherwise indicated. Rigid steel conduit shall be full weight, mild steel, hot-dip galvanized and bichromate coated inside and outside after galvanizing.

2. **Intermediate Metal Conduit**: N/A.

3. **Fittings:** Locknuts shall be extra heavy electrogalvanized steel for sizes through 2 inches. Locknuts larger than 2 inches shall be electrogalvanized malleable iron. Bushings shall be electrogalvanized malleable iron with insulating collar. Grounding bushings shall be locking type and shall include a feed-through compression lug for securing the ground cables. Unions shall be electrogalvanized ferrous alloy type. Threadless fittings are not acceptable. Gaskets shall be made of neoprene.

   Expansion fittings in embedded runs shall be watertight and shall be provided with an internal bonding jumper. The expansion material shall be neoprene and shall allow for 3/4-inch movement in any direction.

4. **Plastic Coated Rigid Steel Conduit and Fittings:** Plastic coated conduit shall be rigid steel conduit with PVC jacket and shall conform to Federal Specification WW-C-581E, ANSI C80.1, and to Underwriter's Laboratories specifications. The zinc surfaces of the conduit shall remain intact and undisturbed on both the inside and the outside of the conduit through the preparation and application processing. A PVC coating shall be bonded to the galvanized outer surface of the conduit. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic. The thickness of the PVC coating shall be a minimum of 40 mils. A PVC jacketed coupling shall be provided with each length of conduit. A PVC sleeve equal to the OD of the conduit shall extend 1-1/2 inches from each end of coupling.

Fittings used with plastic coated conduit shall be similarly coated to the same thickness as the conduit and shall be provided with type 304 stainless steel hardware. Conduit and fittings shall be manufactured by the same company. Minimum size shall be 3/4 inch.

5. **Electrical Metallic Tubing:** N/A.

6. **Flexible Metal Conduit:** Flexible metal conduit shall be formed from spirally wound galvanized steel strip with successive convolutions securely interlocked. Minimum size shall be 1/2 inch. Fittings shall be compression type. Flexible metal conduit shall be provided with ground wire.

7. **Liquidtight Flexible Steel Conduit:** Liquidtight flexible steel conduit shall be formed from spirally wound galvanized steel strip with successive convolutions securely interlocked and jacketed with liquidtight plastic cover. Minimum size shall be 1/2 inch. Fittings for liquidtight conduit shall have cadmium-plated malleable iron body and gland nut with cast-in lug, brass grounding ferrule threaded to engage conduit spiral and O-ring seals around the conduit, box connection and insulated throat. Forty-five and 90-degree fittings shall be used where applicable.

8. **Explosion proof Flexible Conduit:** Explosionproof flexible conduit shall be suitable for use in Class I, Division 1, Groups C and D hazardous areas complying with NEC and shall be watertight.

9. **Rigid Nonmetallic Conduit:** Rigid nonmetallic conduit shall be NEMA TC2, type EPC-40-PVC, or EPC-80-PVC high impact, polyvinylchloride (PVC). Fittings used with PVC conduit shall be PVC solvent weld type. Nonmetallic conduits shall be UL listed for applications indicated. Minimum size shall be 1 inch.

10. **Wireways:** Wireways and auxiliary gutters shall be JIC EMP-1 sectional flanged oiltight type with hinged covers and shall be 8 inches by 8 inches in cross section unless otherwise indicated.

11. **Cable Trays:** N/A.

12. Metallic Insulation Bushings: Metallic insulated bushings shall have ground terminals and smooth and well-rounded surfaces to protect the conductor insulation. The conduit threads shall be deep, clean and easily attached to the conduits. The bushing shall be O-Z/Gedney, Thomas and Betts, or equal.

B. **Boxes and Fittings:** Boxes and fittings shall comply with the following:

1. **Sheet Metal Boxes:** Boxes and fittings installed in areas where electrical metallic tubing is indicated shall be standard UL approved electro-galvanized sheet steel.

2. **Cast Ferrous Alloy Boxes:** Boxes shall be hot-dip galvanized cast ferrous alloy unless otherwise indicated. Integrally cast threaded hubs or bosses shall be provided for conduit entrances and shall provide for full 5-thread contact on tightening. Drilling and threading shall be done before galvanizing. A full body neoprene gasket shall be included with the cover. Type 304 stainless steel screws shall be provided for covers. Where two or more devices are located together, outlet and device boxes shall be gang type. Cover plates shall be hot-dip galvanized cast ferrous alloy unless the particular device requires a cover that is not manufactured in this material.

3. **Floor Boxes:** Floor boxes shall be hot-dip galvanized cast boxes with an NEMA 4 rating. Boxes shall include a recessed ring neoprene gasket, hot-dip galvanized steel checker cover plates and type 304 stainless steel machine screws of not less than 1/4 inch diameter. The cover screws shall be flat head type or recessed socket head screws designed to be flush with cover plate.

4. **Welded Sheet Steel Boxes:** Large boxes shall be fabricated from welded steel and shall be hot-dip galvanized after fabrication. Before finish is applied, a grounding pad drilled for two bolted grounding lugs or a grounding stud shall be welded to the inside of the box. Hardware shall be 304 stainless steel. Boxes shall, as a minimum, meet NEMA 12 and JIC EMP-1 requirements.

5. **Explosion proof Boxes and Seal Fittings:** In areas specified as Class I, Division 1 or 2, hazardous, boxes and fittings shall be NEMA 7, Groups C and D, explosionproof. Seal fittings for conduit systems in hazardous atmosphere locations shall be hot-dip galvanized cast ferrous alloy. Sealing compound shall be hard type and UL listed for explosionproof sealing fittings.

6. **Hubs:** Threaded hubs for connection of conduit to junction, device or terminal boxes shall be made of cast ferrous alloy, electroplated with zinc and shall have insulated liner and insulating bushings. The hubs shall utilize a neoprene O-ring and shall ensure a watertight connection.

C. **Raceway Supports**: Raceway supports shall comply with the following:

1. **Conduit Supports:** Hot-dip galvanized framing channel shall be used to support groups of conduit. Individual conduit supports shall be one-hole galvanized malleable iron pipe straps used with galvanized clamp backs and nesting backs where required. Conduit supports for PVC coated rigid steel and PVC conduit systems shall be one-hole PVC coated clamps or PVC conduit wall hangers.

2. **Ceiling Hangers:** Ceiling hangers shall be adjustable galvanized carbon steel rod hangers. Straps or hangers of plumber's perforated tape are not acceptable. Unless otherwise indicated hanger rods shall be 1/2-inch full-threaded rods and shall meet ASTM A193. Hanger rods in corrosive areas and those exposed to weather or moisture shall be stainless steel.

3. **Structural Attachments (Racks):** Structural attachments shall be constructed from hot-dip galvanized framing channel as specified. Field cuts shall be treated with zinc enriched paint.

2.3 CONCRETE PADS, UNDERGROUND DUCTS, MANHOLES AND PULL-BOXES

A. **General:** The WORK of this Section includes concrete pads, manholes, pull-boxes and concrete required for encasement, installation, or construction and shall be 2500-psi concrete conforming to the requirements of Section 03300 and the following:

1. Consolidation of encasement concrete around duct banks shall be by hand puddling, and no mechanical vibration will be permitted.

2. A workability admixture consisting of a hydroxylated carboxylic acid type in liquid form shall be used in encasement concrete, admixtures containing calcium chloride shall not be used.

3. Concrete for encasement of conduit or duct banks shall contain an integral red-oxide coloring pigment in the proportion of 8 pounds per cubic yard of concrete.

B. **Concrete Pads:** Concrete housekeeping pads shall be provided for floor-standing electrical equipment. Unless noted otherwise, housekeeping pads shall be 3 inches above surrounding finished floor or grade and shall be 2 inches larger in both dimensions than the supported equipment unless otherwise indicated.

C. **Concrete-Encased Ducts:** Where an underground distribution system is indicated, it shall be constructed of multiple runs of single bore [thin-wall] non-metallic ducts, concrete encased, with steel reinforcing bars, with underground manholes and pullboxes.

D. **Manholes and Pull-Boxes** N/A.

2.4 CONDUCTORS, WIRE AND CABLE

A. **General**: The type, size and number of conductors shall comply with the indicated requirements. Number and types of communication, paging, and security cables shall be as required for the particular equipment provided.

Conductors, including ground conductors, shall be copper. Insulation shall bear the manufacturer's trademark, type, voltage rating, and conductor size.

B. **Color Coding:** Color coding shall comply with the following:

1. **Control Conductors:** Control conductors color coding shall be manufacturer's standard.

2. **Power Conductors**: Single-conductor power conductors shall have the following colors for 600V or less:

	120/208V	480/277V
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Ground	Green	Green
Neutral	White	Grey

Color coding tape shall be used where colored insulation is not available. Branch circuit switch shall be yellow. Insulated ground wire shall be green, and neutral shall be gray. Color coding and phasing shall be consistent throughout the site, but bars at panelboards, switchboards, and motor control centers shall be connected Phase A-B-C, top to bottom, or left to right, facing connecting lugs.

General purpose ac control conductors shall be pink. General purpose dc control conductors shall be blue.

Cables sized No. 4 AWG and larger may be black with colored 3/4-inch vinyl plastic tape applied in 3-inch lengths around the cable at each end. The cables shall be tagged at terminations and in pull boxes, handholes and manholes.

C. **Lighting and Receptacle Branch Circuit Conductors:** Lighting conductors shall be stranded except for No. 12 AWG which shall be solid.

1. Conductors shall comply with the following characteristics:

Voltage:	600 volts.
Conductor:	Bare annealed copper; stranded in accordance with ASTM B8.
Insulation:	THWN/THHN, 90 degree C dry, 75 degree C wet, polyvinylchloride (PVC) per UL 83.
Jacket:	Nylon.
Flame resistance:	UL 83.

D. **Power and Control Conductors and Cable, 600 Volts:** Conductors and cable shall comply with the following:

1. **Single Conductors:** Single conductor cable shall be stranded and shall be installed in conduits for power and control circuits.

Conductors shall comply with the following characteristics:

Voltage:	600 volts.
Conductor:	Coated, Class B, stranded, annealed copper per ASTM B8.

Insulation:	XHHW, 90 degrees C dry, 75 degrees C wet, composite of ethylene propylene rubber (EPR) and chlorosulfonated polyethylene (CSPE) per ICEA UL 44 and NEMA WC-7.
Jacket:	Chlorosulfonated polyethylene (CSPE).
Flame resistance:	IEEE 383.

2. **Multiconductor Cable:** Multiconductor cable shall be used for power and control circuits installed in cable tray. Cables shall be UL labeled, Type TC, designed for cable tray installation in accordance with NEC 340. The type of insulation, number of conductors, and size of conductor shall comply with the indicated requirements.

   Multiconductor power cable shall contain three or four conductors, as indicated, plus an equipment grounding conductor.
   Multiconductor power cables shall comply with the following:

Voltage:	600 volts.
Conductors:	Annealed copper, stranded, per ASTM B8, coated per ASTM B33.
Insulation:	THWN/THHN, 90 degrees C dry, 75 degrees C wet, ethylene propylene rubber (EPR) or a composite of EPR and chlorosulfonated polyethylene (CSPE) per ICEA S-68-516 and UL 44.
Jacket:	Polyvinylchloride (PVC).
Flame resistance:	IEEE 383.

   Unless otherwise indicated, multiconductor control cable shall be size 14 AWG and shall comply with the following:

Voltage:	600 volts.
Conductors:	Annealed copper, stranded, per ASTM B8, coated per ASTM B33.
Insulation:	THWN/THHN, 90 degrees C dry, 75 degrees C wet, ethylene propylene rubber (EPR) or a composite of EPR and chlorosulfonated polyethylene (CSPE) per ICEA S-68-516 and UL 44.
Jacket:	Polyvinylchloride (PVC).
Flame resistance:	IEEE 383.

E. **Direct Burial:** N/A.

F. **Medium Voltage Power Conductors and Cable (5 KV-15 KV):** N/A.

G. **Signal Cables:** Signal cables shall comply with the following:

1. **General:** Signal cable shall be provided for instrument signal transmission, alarm, communication and any circuit operating at less than 100 volts. Cables shall be color coded black and white for pairs or black, white and red for triads. Circuit shielding shall be provided in addition to cable shielding.

2. **Single Circuit:** Cable shall consist of one pair or triad, No. 16 AWG conductors with 15 mils of 90 degree C polyvinylchloride (PVC) insulation, 4 mils nylon conduit or jacket, twisted on a 2-inch lay, and covered with a 100 percent 1.35 mil aluminum-Mylar tape shield with No. 18 AWG 7-strand tinned copper drain wire and a 45 mil PVC jacket overall. Cable shall be UL listed, Type TC, rated 600 volts.

3. **Multiple Circuit:** Cable shall consist of four or more pairs or triads which are made up of No. 18 AWG conductors with 15 mils of 90 degree C PVC insulation, 4 mils nylon jacket, twisted on a staggered lay 1-1/2 to 2-1/2 inches, and covered with a 100 percent 1.35 mil aluminum-Mylar tape shield with No. 22 AWG 7-strand tinned copper drain wire. Overall cable shield shall be 2.35 mil aluminum-Mylar tape with a No. 20 AWG 7-strand tinned copper drain wire. Cable shall be UL listed, Type TC, 600 volts.

4. **Thermocouple Extension:** Extension cable shall be provided for the type of thermocouple circuit indicated. Conductors shall be 16 AWG, solid alloy, with 15 mils of 90 degree C flame-retardant polyvinylchloride insulation, twisted and covered with 100 percent 2.35 mil aluminum polyester tape and a 20 AWG, 7-strand, tinned-copper drain wire and a 35 mil, flame-retardant PVC jacket overall. Cable shall be listed for cable tray installation.

5. **Communication, Paging and Security System:** Communication, paging, and security system cables shall comply with Section 13300.

6. **Modbus cable:** Modbus cable shall be fully compatible with the network system shown on plans and meet the requirements set forth at http://www.modbus.org/. The contractor shall coordinate and be responsible for all cable configurations, proof of proper resistance, impedance, shielding, and connections to the motor protection relays and VFDs communication ports.

H. **Portable Cord:** Portable cord shall be UL listed, Type SO for sizes No. 10 AWG and smaller. Cords with conductors larger than No. 10 AWG shall be UL listed, Type G. Cords shall contain an equipment grounding conductor.

1. Cables shall comply with the following:

Conductors:	Flexible rope stranded per ASTM B189 and B33. Conductors shall be coated except ground conductors may be uncoated.

Insulation:	Insulation shall be ethylenepropylene (EPR) as per ICEA S-68-516 and rated for continuous operation at 90 degrees C.
Jacket:	Heavy-duty neoprene as per ICEA S-68-516.

I. **Splicing and Terminating Materials:** Splicing and terminating materials shall comply with the following:

1. 600 Volt Conductor and Cable Connectors: Connectors shall be compression type of correct size and UL listed for the specific application. Connectors shall be tin-plated high conductivity copper. Connectors for wire sizes No. 10 AWG and smaller shall be nylon self-insulated, ring tongue or locking-spade terminals. Connectors for wire sizes No. 8 AWG and larger shall be one-hole lugs up to size No. 3/0 AWG, and two-hole or four-hole lugs for size No. 4/0 and larger. Mechanical clamp, dimple, screw-type connectors are not acceptable.
In-line splices and taps shall be used only where indicated, or shown on the shop drawings. When used, they shall be of the same construction as other connectors. Splices shall be compression type, made with a compression tool die designed for the purpose. Splice shall be covered with a heat-shrinkable sleeve or boot.

2. 5 KV and 15 KV Cable Terminators: N/A.

2.5 WIRING DEVICES

A. **General:** Wiring devices shall be UL approved for the current and voltage indicated and shall comply with NEMA WD-1. Devices shall contain provisions for back wiring and side wiring with captively held binding screws.

Devices shall be brown, except those located in finished areas shall be ivory.

Special purpose devices shall be the color indicated.

Receptacles and switches shall conform to Federal Specifications W-C-596E and W-S-896E, respectively, and the indicated standards.

B. **Receptacles and Plugs:** Receptacles and plugs shall comply with the following:

1. **General:** Receptacles shall be grounding type.

2. **120V Receptacles:** Receptacles indicated for indoor use in clean areas shall be duplex 20 amp, NEMA 5-20R, and shall accept NEMA 5-15P and 5-20P plug caps.

Receptacle indicated for use outdoors or in process or corrosive areas shall be duplex, 20 ampere, NEMA 5-20R, and shall accept NEMA 5-15P and 5-20P plug caps. Receptacle and plug caps shall be corrosion resistant, marine duty with yellow polycarbonate weatherproof lift covers.

3. **Ground Fault Interrupter Receptacles:** Receptacles shall be NEMA 5-20R configured and shall mount in a standard outlet box. Units shall trip at 5 milliamperes of ground current and shall comply with NEMA WD-1-1.10 and UL 943. GFI receptacles shall be capable of individual as well as "downstream" operation.

4. **240V Receptacles:** 240-volt duplex receptacles shall be 2-pole, 3-wire, grounding type, 240-volt, ac, 20-amperes, NEMA Configuration 6-20R. Single 30-ampere receptacles shall be 2-pole, 3-wire, grounding type, 125-volt, ac, 30-amperes, NEMA Configuration 5-30R.

5. **Plug Caps:** Male plug caps for 120 volt and 240 volt receptacles shall be of the cord grip armored type with heavy phenolic housing, of the same manufacture as the receptacle. Plug caps shall be rated 15 amps. One plug cap shall be provided for every four receptacles (minimum 2 plug caps).

6. **Three Phase Receptacles and Plugs:** Receptacles shall be suitable for 480 volt, 3-phase, 4-wire service, with ampere ratings as indicated. Receptacles and plugs shall be designed so that the grounding pole is permanently connected to the housing. The grounding pole shall make contact before the line poles are engaged when the plug is connected to the receptacle housing. The plug sleeve shall also make contact with the receptacle housing before the line and load poles make contact. Receptacles shall include cast back box, angle adapter, gaskets, and a gasketed screw-type, weathertight cap with chain fastener. Each receptacle shall be provided with one plug.

7. **Receptacles for Hazardous Areas:** Receptacles for use in hazardous areas shall be rated in accordance with NEC for the area in which they are to be located and shall be factory sealed. Receptacles shall be designed so the plug must be inserted and turned before load is energized. Receptacles shall be provided with mounting box, sealing chamber, and compatible plug.

C. **Switches:** Switches shall comply with the following:

1. **General Purpose (Indoor, Clean Areas):** General purpose switches shall be quiet AC type, specification grade, and shall comply with rated capacities as required. Switches shall match receptacles in color.

2. **Switches for Hazardous Areas:** Switches for control of lighting and small single-phase power loads in hazardous areas shall consist of a factory assembled and sealed combination general purpose type switch in an explosion-proof housing. The switch shall be rated in accordance with NEC for the area in which it is to be installed. The external operating mechanism shall consist of a wing-type handle having the "ON" and "OFF" positions visible from the front.

3. **Switches for Outdoor and Corrosive Areas:** Switches shall be heavy-duty industrial type 20-ampere presswitch type with weatherproof/corrosion resistant neoprene plate. CONTRACTOR shall provide abuse-resistant nylon handles, and switches with corrosion-resistant steel nickel plate bridge.

D. **Device Plates:** Device plates shall be provided with switches. In noncorrosive indoor areas, receptacle device plates shall be made of sheet steel, zinc electroplated with chrome finish.

Device plates in corrosive or outdoor areas shall be corrosion-resistant/marine-duty type. Device plates for explosionproof equipment shall be factory provided with the equipment.

Device plates shall include engraved laminated phenolic nameplates with 1/8-inch white characters on black background.

Nameplates for switches shall identify panel and circuit number and area served.

Nameplates for receptacles shall identify circuit and voltage if other than 120 volts, single phase.

E. **Plug Strips:** N/A.

2.6 LIGHTING AND POWER DISTRIBUTION PANELBOARDS (NOT USED)

2.7 DISCONNECT SWITCHES

A. Disconnect switches shall be externally operated with quick-make/quick-break mechanisms. The handle shall be interlocked with the switch cover by means of a defeatable interlock device. The switch shall be lockable in the "off" position. Switches shall have nameplates with manufacturer, rating, and catalog number. Heavy-duty switches shall have arc suppressors, pin hinges, and shall be horsepower rated at 600-volts. Heavy-duty switches shall be provided for all motor circuits above 3 horsepower. In smaller motor circuits switches shall be general duty. Switch enclosure shall be NEMA 4X.

2.8 ELECTRICAL IDENTIFICATION

A. **Nameplates:** Nameplates shall be fabricated from white-center, black-face laminated plastic engraving stock. Nameplates shall be fastened securely, using fasteners of brass, cadmium plated steel, or stainless steel, screwed into inserts or tapped holes, as required. Engraved characters shall be block style of adequate size to be read easily at a distance of 6 feet with no characters smaller than 1/8-inch high.

B. **Conductor and Equipment Identification**: Conductor and equipment identification devices shall be either imprinted plastic-coated cloth marking devices or shall be heat-shrink plastic tubing, imprinted split-sleeve markers cemented in place.

C. **Identification Tape (Buried)**: Identification tape for protection of buried installation shall be a 6-inch wide green polyethylene tape imprinted "CAUTION - ELECTRIC UTILITIES BELOW".

2.9 PUSHBUTTONS

A. Remote-mounted pushbuttons shall be NEMA rated heavy duty, oiltight type with synthetic rubber boots and any special gasketing required to make the completed station watertight. Provide NEMA Type 4 pushbutton for above ground indoor unit and NEMA Type 4X constructed of stainless steel or glass polyester for dry well area.

B. Install provisions for locking pushbuttons in the OFF position wherever lockout provisions are indicated. Locking provision shall be 316 stainless steel.

2.10 CABINETS AND ENCLOSURES

A. **General:** The WORK of this Section includes the following requirements for control compartments of motor control sections, for control cabinets of lighting panelboards, and for separate terminal and control cabinets:

1. **Terminal Cabinets:** Terminal cabinets located indoors shall be NEMA 12. Cabinets located outdoors and in corrosive areas shall be NEMA 4X. Cabinets shall be provided with hinged doors. Cabinets shall be provided with channel mounted terminal blocks rated 30 amperes, 600 volt AC. Terminals shall be No. 8 minimum strap-screw type, suitable for ring tongue or locking spade terminals. Sufficient terminal blocks to terminate 25 percent more conductors than are indicated shall be provided.

2. **Components:** Compartments of motor control centers containing terminal blocks and control components shall be isolated from other compartments of the control center and shall have a separate hinged door with locking handle. Internal control components shall be mounted on a removable mounting pan.

3. **Relay and Control Cabinets:** Relay and control cabinets shall comply with NEMA 12 for enclosures. Floor-standing cabinets shall have locking handles with 3-point catches. Bottom conduit entrances shall be located accurately and cut to the conduit diameter using a circle cutter (not a torch). Interiors of relay and control compartments shall be finished white. Terminal block requirements shall comply with the requirements for Terminal Cabinets.

B. **Wiring:** Wiring of terminal cabinets and control cabinets shall be accomplished with stranded copper conductor rated for 600-volts and UL listed as Type MTW. Wires for annunciator and indication circuits shall be No. 16 AWG. Other wiring shall be No. 14 AWG. Color coding shall comply with the indicated requirements. Incoming wires to terminal or relay cabinets shall be terminated on a master set of terminal blocks. All wiring from the master terminals to internal components shall be factory-installed and shall be contained in plastic raceways with removable covers. Wiring to door-mounted devices shall be extra flexible and anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals.

C. **Engraving:** Nameplates shall comply with the indicated requirements.

2.11 ELECTROLIERS (NOT USED)

2.12 PROCESS CONTROL DEVICES (NOT USED)

2.13 MANUFACTURERS

A. Products of the type or model number indicated shall be manufactured by one of the below listed manufacturers (or equal):

1. Unions:
Appleton UNF or UNY
Crouse-Hinds UNF or UNY

2. Device Boxes:
Appleton FD
Crouse-Hinds FD

3. Sealing Compound:
Chico A

4. Watertight Seals:
O.Z. Gedney Co., Type CSMC
Thunderline Corp.
Link Seal

5. Lighting and Receptacle Branch Circuit Conductors:
Okoseal-N, Series 116-67-XXXX

6. Single Power and Control Conductors and Cable, 600V:
Okonite-Okolon, Series 112-11-XXXX
Anaconda
Durasheath EP

7. Multiconductor Cables:
Okonite-Okolon, Series 202-11-3XXX
Anaconda
Durasheath EP

8. Direct Burial Cables:
Okonite
CLX

9. Medium Voltage Power Conductors and Cable (5-15 KV) Installed In Raceway:
N/A

10. Armored Cable:
Okoguard, Series 571-23-3XXX
Anaconda
Duralox Unishield EP

11. Single Circuit Signal Cable:
Okoseal-N Type P-OS

12. Multiple Circuit Signal Cable:
Okoseal-N Type SP-OS

13. Thermocouple Extension:
Okonite P-OS, Type PLTC

14. Portable Cords:
Okocord

15. Compression Tool Die For Splicing:
Thomas and Betts Corp.

16. Heat Shrinkable Moisture Seal Caps:
Raychem Corp. "Thermofit"

17. 120V Receptacles (Indoor, Clean Areas):
Hubbell IG-5362
Arrow-Hart 6766
G.E. 4107-1 (Brown)

18. 120V Receptacles (Outdoor, Process or Corrosive Areas):
Hubbell 53CM62/53CM21
General Electric GE5262-C

19. 240V Duplex Receptacles (Gray):
Hubbell 5462
General Electric G.E. 4188-9

20. 240V Single Receptacles (Black):
Hubbell 9308
General Electric G.E. 4138-3

21. Three Phase Receptacles (60 amps):
Crouse-Hinds Catalog No. AREA 6424
Hubbell Hubbellock

22. Three Phase Receptacles (30 amps):
Crouse-Hinds Catalogue No. AREA 3423
Bryant Cat. 7223FR
Russell Stoll No. JRFA6344

23. Toggle Switches:

Hubbell	**Bryant**	**Hubbell**	**Bryant**	
Single Pole	1221 (brown)	4901 (brown)	1221I (ivory)	4901I (ivory)
Three Way	1223	4903	1223I	4903I
Double Pole	1222	4902	1222I	4902I
Momentary	1556	4821	1556I	4821I

24. Switches (Hazardous Areas):
Crouse-Hinds EFSC2129
Appleton EFSC175-F1

25. Electrical Identification:
Nameplates
Formica Type ES-1

Imprinted Plastic Coated Cloth
Brady
Thomas & Betts

26. Device Plates:
Crouse-Hinds
Appleton

27. Plug Strips:
Plugmold

28. Manholes and Pullboxes:
Brooks
Quikset

29. Flexible Conduit:
American Brass
Anaconda
Electroflex

30. Cable Trays:
P-W
Cope

31. Compression Connectors:
Burndt "Hi Lug"
Thomas & Betts "Shure Stake"

32. Spring Connectors (Wire Nuts):
3M "Scotch Lok"
Ideal "Wing Nuts"

33. Insulating Tape:
Scotch No. 33
Plymouth "Slip knot"

34. High Temperature Insulating Tape (Polyvinyl):
Plymouth
3M

35. Pre-Insulated Fork Tongue Lugs:
Thomas & Betts RC Series
Burndy

36. Epoxy Resin Splicing Kits:
3M Scotchcoat 82 Series
Burndy "Hy Seal"

37. Stress Cone Material For Make-up Of Medium Voltage Shielded Cable:
G & W
3M
duPont

38. Stainless Steel Covers:
Sierra S-line
Hubbell

39. Products For Cast Boxes:
Switches at outdoor locations
Crouse-Hinds DS 128
Mackworth Rees Style 3845
Joy Flexitite

Switches at damp locations
Mackworth Rees Style 3496
Joy Flexitite

Switches at dry locations
Crouse-Hinds DS 32G
Pyle National SCT-10k

Receptacles at outdoor locations
Crouse-Hinds
Hubbell

Receptacles at damp or dry locations
Crouse-Hinds DS 23G
Pyle National N-1

Receptacles at corrosive locations
Crouse-Hinds "Ark Gard"
Appleton DTQ
Hubbell 52CM21 or 5221

40. Cast Boxes Required for Pull or Junction Boxes:
Floor boxes with checker plate covers
O-Z Type "YR",
Surface boxes
O-Z type "YH"

41. Floor Type Outlet Boxes:
Hubbell Catalog B-2530 with S-2530 cover plate
Steel City (Russell & Stoll) Catalog 78AL and 889

42. Power Outlet Boxes:
Hubbell Cat. No. SC-3098
Steel City Cat. No SFH40RG

43. Telephone Outlet Boxes:
Hubbell Cat. No. SS-309-T
Steel City Cat. No SFL10

44. Insulated Bushings:
O-Z Type A and B
Thomas & Betts
Steel City
Appleton
Efcor
Gedney

45. Insulated Grounding Bushings:
O-Z Type BL
Thomas & Betts
Steel City
Efcor
Gedney

46. Erickson Couplings:
Appleton Type EC
Thomas & Betts
Steel City
Efcor
Gedney

47. Liquid-tight Fittings:
Appleton Type ST
Thomas & Betts
Crouse-Hinds
Efcor
Gedney

48. Hubs:
Appleton Type HUB
Thomas & Betts
Myers Scrutite
Efcor

49. Sealing Fittings:
Appleton Type EYS
O-Z Type FSK

50. Expansion Couplings:
O-Z Type D
Crouse-Hinds Type

PART 3 -- EXECUTION

3.1 GENERAL

A. **Field Control of Location and Arrangement**: The Drawings diagrammatically indicate the location and arrangement of outlets, conduit runs, equipment, and other items. Exact locations shall be determined in the field based on the physical size and arrangement of equipment, finished elevations, and obstructions. Locations shown on the Drawings shall be adhered to as closely as possible. Omissions or conflicts on Drawings or between Drawings and Specifications shall be brought to the attention of the CONSTRUCTION MANAGER for clarification before proceeding with the WORK.

B. **Installation:** The CONTRACTOR shall make all necessary provisions throughout the site to receive the work as construction progresses and shall furnish and install adequate backing, supports, inserts, and anchor bolts for the hanging and support of all electrical fixtures, conduit, panelboard, and switches, and shall furnish and install sleeves through walls, floors, or foundations where electrical lines are required to penetrate.

Conduit and equipment shall be installed in such a manner as to avoid all obstructions and to preserve head room and keep openings and passageways clear. Fixtures, switches, convenience outlets, and similar items shall be located within finished rooms, as shown. Where the Drawings do not indicate exact locations, locations of concealed conductors shall be as indicated on the shop drawings.

C. **Workmanship:** Materials and equipment shall be installed in accordance with printed recommendations of the manufacturer. The installation shall be accomplished by workmen skilled in this type of work and installation shall be coordinated in the field with other trades so that interferences are avoided.

D. **Tests:** The WORK of this Section includes tests required by the authority having jurisdiction. Tests shall be performed in the presence of the CONSTRUCTION MANAGER. The WORK includes testing equipment, replacement parts and labor necessary to repair damage resulting from damaged equipment or from testing and correction of faulty installation. The following tests shall be performed:

Insulation resistance tests.
Operational testing of equipment.

E. **Field Quality Control**: Conduit shall be provided with a number tag at each end and in each manhole and pullbox. Trays shall be identified by stencils at intervals not exceeding 50 feet, at intersections, and at each end.

3.2 RACEWAY, FITTINGS AND SUPPORTS

A. **General**: Except as otherwise indicated, conduit installed in direct contact with earth and in concrete slabs on grade shall be corrosion-protected.

Conduit shall be left exposed until inspected by the CONSTRUCTION MANAGER.

Raceways shall be installed as indicated. Raceway systems shall be electrically and mechanically complete before conductors are installed. Bends and offsets shall be smooth and symmetrical, and shall be accomplished with tools designed for the purpose intended. Factory elbows shall be used for all 3/4-inch conduits. Bends in larger sizes of metallic conduit shall be accomplished by field bending or by the use of factory elbows.

Conduit may be cast integral with horizontal and vertical concrete slabs, providing one-inch clearance is maintained between conduit surface and concrete surface. If said clearance cannot be maintained, the conduit shall be installed exposed below elevated slabs; provided, that in the case of slabs on grade, conduit shall be installed below the slab and shall be encased with a minimum cover of 3 inches of concrete.

Non-metallic conduit may be cast integral with horizontal slabs with placement criteria as stated in the previous paragraph. Non-metallic conduit may be run beneath structures or slabs on grade, without concrete encasement. In these instances conduit shall be placed at least 12 inches below the bottom of the structure or slab. Non-metallic conduit may be buried 24 inches minimum below grade, with a 3-inch concrete cover, in open areas or where otherwise not protected by concrete slab or structures. Top of concrete cover shall be colored red. Non-metallic conduit shall be permitted only in concealed locations as described above. The use of direct burial thinwall duct will be permitted only as indicated for underground ducts.

Where a run of concealed PVC conduit becomes exposed, a transition to rigid steel conduit is required. Such transition shall be accomplished by means of a factory elbow or a minimum 3-foot length of rigid steel conduit, either terminating at the exposed concrete surface with a flush coupling. Piercing of concrete walls by non-metallic runs shall be accomplished by means of a short steel nipple terminating with flush couplings.

Flexible conduit may be used in lengths required for the connection of recessed lighting fixtures; otherwise the maximum length of flexible conduit shall be 18 inches.

1. Application: Galvanized rigid steel shall be installed unless noted otherwise:

Embedded or encased in non-hazardous areas	Schedule 40 PVC
Exposed in corrosive areas	Plastic coated, rigid steel
Direct buried lighting and receptacle raceways in non-hazardous areas	Schedule 80 PVC
Hazardous and corrosive areas within stud walls, above suspended ceilings, and within elevator machine rooms	Plastic coated, rigid steel
Dry well/Pump room area	Plastic coated, rigid steel
Final raceway connections to lighting fixtures, equipment and pressure switches subject to vibration-DRY AREAS	Flexible metallic

Final raceway connections to Equipment	Liquidtight, flexible metallic

2. Conduit Runs Between Boxes: The number of directional changes of the conduit shall be limited to total not more than 270 degrees in any run between pull boxes. Conduit runs shall be limited to 400 feet, less 100 feet or fraction thereof, for every 90 degrees of change in direction. Bends and offsets shall be avoided where possible but, where necessary, shall be made without flattening or kinking, or shall be factory preformed bends. Turns shall be made with cast metal fittings or conduit bends. Welding, brazing or otherwise heating of conduit is not acceptable.

3. Junction and Pull Boxes: Cast junction or pull boxes shall be installed where required for pulling cable and as necessary to meet the indicated requirements. Pull boxes used for multiple conduit runs shall not combine circuits of different motor control centers, switchboards, or switchgear.

4. Conduit Terminations: The WORK of this Section includes conductors required to interconnect incoming annunciator, control and instrumentation except as otherwise indicated.
Two- and 3-conductor shielded cables installed in conduit runs which exceed 2,000 feet may be spliced in pullboxes. These cable runs shall have only one splice per conductor.
Control conductors shall be spliced or terminated only at the locations indicated and only on terminal strips or terminal lugs of vendor furnished equipment. 120/208-volt and 480-volt branch circuit conductors may be spliced in suitable fittings at locations required. 5-kV conductors shall be spliced or terminated only at equipment terminals indicated.
Solid conductors shall be terminated at equipment terminal screws such that conductor is tightly wound around screw and does not protrude beyond screw head. Stranded conductors shall be terminated directly on equipment box lugs such that all conductor strands are confined within lug. Use forked-tongue lugs where equipment box lugs have not been provided.
Splices in 600-volt wire which are not pre-insulated shall be insulated with three layers of tape each half lapped except that splices in below grade pull boxes or in any box subject to flooding shall be made watertight using an epoxy resin splicing kit.

   Splices to motor leads in motor terminal boxes shall be taped with varnished cambric tape and with high temperature tape on the exterior.

   Shielded power cable shall be terminated with pre-assembled stress cones in a manner approved by the cable manufacturer. The CONTRACTOR shall submit the proposed termination procedure as described for shop drawings.

   Control devices, such as solenoid operated valves, that are normally supplied with conductor pigtails, shall be terminated as described for control conductors.

Conduit entering NEMA 1 type sheet steel boxes or cabinets shall be secured by locknuts on both the interior and exterior of the box or cabinet and shall have an insulating grounding or bonding bushing installed over the conduit end. Conduit entering other boxes shall be terminated with a threaded hub. Cast boxes and nonmetallic enclosures shall have threaded hubs. Joints shall be made with standard couplings or threaded unions. Metal parts of nonmetallic boxes and plastic coated boxes shall be bonded to the conduit system. Running threads shall not be used in lieu of conduit nipples, nor shall excessive thread be used on any conduit. The ends of conduit shall be cut square, reamed, and threaded with straight threads. Rigid steel conduit shall be made up tight and without thread compound. Exposed male threads on rigid steel conduit shall be coated with zinc-rich paint.

PVC conduit entering fiberglass boxes or cabinets shall be secured by threaded bushings on the interior of the box and shall be terminated with a threaded male terminal adapter having a neoprene O-ring. Joints shall be made with standard PVC couplings.

Conduit entering field equipment enclosures shall enter the bottom or side of the box. Where conduit comes from above, it shall be run down beside the enclosure and a tee conduit and drip leg installed.

5. Matching Existing Facilities: When new conduit is added to areas which are already painted, the conduit and its supports shall be painted to match the existing facilities. Where new conduit is used to replace existing conduit, the existing conduit and supports shall be removed, resulting blemishes shall be patched and repainted to match original conditions. Similarly, if existing conduits are to be reused and rerouted, resulting blemishes shall be corrected in the same manner. Coating system shall comply with Section 09800.

6. Conduit Support: Exposed rigid steel or plastic coated conduit shall be run on supports spaced not more than 10 feet apart and shall be constructed with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceiling. Exposed PVC conduit shall be run on supports spaced not more than 3 feet apart for conduits up to 1 inch, 5 feet apart for conduits 1 1/4 inches to 2 inches and 6 feet apart for conduits 2 1/2 inches and larger. No conduit shall approach closer than 6 inches to any object operating above 30 degrees C. PVC conduit shall not be provided where it will be damaged by heat.

   Conduit rack and tray supports shall be secured to concrete walls and ceilings by means of cast-in-place anchors. Individual conduit supports shall use cast-in-place anchors, die-cast, rustproof alloy or expansion shields. Wooden plugs, plastic inserts or gunpowder-driven inserts are not acceptable.

7. Conduit Penetrations: Unless otherwise indicated, conduit routed perpendicular through floors, walls or other concrete structures shall pass through cast-in-place openings wherever possible. In cases where cast-in-place openings are not possible, appropriate size holes shall be bored through the concrete to accommodate the conduit passage. The size and location of the holes shall not impair the structure's integrity. After completion, grout or calk around conduit

and finish to match existing surroundings. Unless otherwise protected, conduits that rise vertically through the floor shall be protected by a 3 1/2-inch high concrete pad with a sloping top.

Conduits entering manholes and handholes shall be horizontal. Conduits shall not enter through the concrete bottom of handholes and manholes.
Wherever conduits penetrate outdoor concrete walls or ceilings below grade, watertight seal shall be installed.

8. Conduit Separation: Signal conduits shall be separated from AC power or control conduits. The separation shall be a minimum of 12 inches for metallic conduits and 24 inches for nonmetallic conduits.

9. Conduit Seals For Hazardous or Corrosive Areas: Conduit passing from a hazardous or corrosive area into a nonhazardous or noncorrosive area shall be provided with a sealing fitting which shall be located at the boundary in accordance with NEC.

   Seal fittings for conduit systems in hazardous atmosphere locations shall be hot-dip galvanized cast ferrous alloy. Sealing compound shall be hard type and shall be UL listed for explosionproof sealing fittings. Sealing compound shall be nonhardening type for corrosive areas. Sealing compound shall not be poured in place until electrical installation has been otherwise accepted.

10. Plastic Coated Conduit: Plastic coated conduit shall be made up tight with strap wrenches. Conduit threads shall be covered by a plastic overlap which shall be coated and sealed in accordance with manufacturer's recommendations. Pipe wrenches and channel locks shall not be used for tightening plastic coated conduits. Damaged areas shall be patched, using manufacturer's recommended material. The area to be patched shall be built up to the full thickness of the coating. Painted fittings are not acceptable.

11. Liquidtight Flexible Conduit: The length of flexible liquidtight conduit shall not exceed 15 times the trade diameter of the conduit. The length of liquidtight conduit shall not exceed 36 inches.

12. Conduit Fittings: Fittings shall comply with the same requirements as the raceway with which they will be used. Fittings having a volume less than 100 cubic inches for use with rigid steel conduit, shall be cast or malleable non-ferrous metal. Fittings larger than one inch shall be "mogul size." Fittings shall be of the gland ring compression type. Covers of fittings, unless in "dry" locations, shall include gaskets. Surface-mounted cast fittings, housing wiring devices in outdoor and damp locations, shall have mounting lugs.
    Erickson couplings shall be used at all points of union between ends of rigid steel conduits which cannot be coupled. Running threads and threadless couplings shall not be used. Couplings shall be 3-piece type.
    Transition fittings to mate steel to PVC conduit, and PVC access fitting, shall be as furnished or recommended by the manufacturer of the PVC conduit.

B. **Cable Tray:** N/A.

3.3 UNDERGROUND DUCTS, MANHOLES AND PULL-BOXES (NOT USED)

3.4 CONDUCTORS, WIRE AND CABLE

A. **General:** Pulling wire and cable into conduit or trays shall be completed without damaging or putting undue stress on the cable insulation. The cable pulling compound shall be polymer-based and UL approved. It shall be non-toxic, non-flammable, non-corrosive and compatible with all cable types. The product shall dry to a thin semi-liquid film that will not clog the conduit. The cable pulling lubricant shall be AquaGel II by Ideal Industries, or equal. Raceway construction shall be complete, cleaned, and protected from the weather before cable is installed.

Whenever a cable leaves a raceway, a cable support shall be provided.

When flat bus bar connections are made with unplated bar, the contact areas shall be "scratch-brushed" before connection. Bolts shall be torqued to the bus manufacturer's recommendations.

B. **600 Volt Conductor and Cable:** Conductors in panels and electrical equipment, No. 6 AWG and smaller, shall be bundled and laced at intervals not greater than 6 inches, spread into trees and connected to their respective terminals. Lacing shall be made up with plastic cable ties. Lacing is not necessary in plastic panel wiring duct. Conductors crossing hinges shall be bundled into groups not exceeding 12 and shall be so arranged that they will be protected from chafing when the hinged member is moved.

Slack shall be provided in junction and pull boxes, handholes and manholes. Slack shall be sufficient to allow cables or conductors to be routed along the walls of the box. Amount of slack shall be equal to largest dimension of the box. Where plastic panel wiring duct is installed for wire runs, lacing is not required. Plastic panel wiring duct shall not be used in manholes and handholes.

Stranded conductors shall be terminated. Conductors shall be terminated directly on the terminal block. Compression lugs and connectors shall be installed using manufacturer's recommended tools.

Lighting and receptacle circuits may be in the same conduit in accordance with derating requirements of the NEC. However, lighting and receptacle circuits shall not be installed in conduits with power or control conductors.

Solid wire shall not be lugged nor shall electrical spring connectors be used on any except for solid wires in lighting and receptacle circuits. Lugs and connectors shall be installed with a compression tool.

Terminations at 460 volt motors shall be made by bolt-connecting the lugged connectors. Connections shall be insulated and sealed with factory-engineered kits. Motor connection kits shall consist of heat-shrinkable, polymeric insulating material over the connection area and a high dielectric strength mastic to seal the ends. Bolt connection area shall be kept free of mastics and fillers to facilitate rapid stripping and re-entry. Motor connection kits shall accommodate a range of cable sizes for both in-line and stub-type configurations.

In-line splices and tees shall be made with tubular compression connectors and insulated as for motor terminations, except that conductors No. 10 AWG and smaller may be spliced using self-insulating connectors. Splices and tees in underground handholes or pull boxes shall be insulated using Scotch-cast epoxy resin splicing kits. Terminations at devices with 120V pigtail leads, at solenoid valves, 120 volt motors, and other devices furnished with pigtail leads shall be made using self-insulating tubular compression connectors.

Conductor and cable markers shall be provided at splice points.

C. **Signal Cable:** Circuits shall be installed as individually shielded twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever 3-wire circuits are required. Terminal blocks shall be provided at instrument cable junctions, and circuits shall be identified at such junctions unless otherwise indicated. Signal circuits shall be installed without splices between instruments, terminal boxes, or panels.

Shields are not acceptable as a signal path, except for circuits operating at radio frequencies and utilizing coaxial cables.

Common ground return conductors for two or more circuits are not acceptable.

Unless otherwise indicated, shields shall be bonded to the signal ground bus at the control panel and isolated from ground and other shields at other locations. Terminals shall be installed for running signal leads and shield drain wires through junction boxes.

Spare circuits and the shield drain wire shall be terminated on terminal blocks at both ends of the cable run and be electrically continuous through terminal boxes. Shield drain wires for spare circuits shall not be grounded at either end of the cable run.

Terminal boxes shall be installed at instrument cable splices. If cable is buried or in raceway below grade at splice, an instrument stand shall be provided as specified with terminal box mounted approximately 3 feet above grade.

Cable for paging, telephone, and security systems shall be installed and terminated in compliance with the manufacturer's recommendations.

D. **5 KV and 15 KV Cable**: (NOT USED)

E. **Portable Cord**: Portable cord feeding permanent equipment, such as pendant cords, pumps, cranes, hoists, and portable items shall have a wire mesh cord grip of flexible stainless steel wire to take the tension from the cable termination. Connection of portable cords to permanent wiring shall be accomplished with the use of terminals. In-line taps and splices shall be used only where indicated.

F. **Testing:** Testing shall comply with the requirements of Section 16030 and the following:

1. Signal Cable: Each signal pair or triad shall be tested for electrical continuity. Any pair or triad exhibiting a loop resistance of less than or equal to 50 ohms shall be deemed satisfactory without further test. For pairs with greater than 50

ohm loop resistance, the expected loop resistance shall be calculated considering loop length and intrinsic safety barriers if present. Loop resistance shall not exceed the calculated value by more than 5 percent.

Each shield drain conductor shall be tested for continuity. Shield drain conductor resistance shall not exceed the loop resistance of the pair or triad. Each conductor (signal and shield drain) shall be tested for insulation resistance with all other conductors in the cable grounded.

Instruments used for continuity measurements shall have a resolution of 0.1 ohms and an accuracy of better than 0.1 percent of reading plus 0.3 ohms. A 500 volt megohmmeter shall be used for insulation resistance measurements.

2. 5-15 KV Cable: N/A.

3.5 WIRING DEVICES

A. **General**: Boxes shall be independently supported by galvanized brackets, expansion bolts, toggle bolts, or machine or wood screws as appropriate. Wooden plugs inserted in masonry or concrete shall not be used as a base to secure boxes, nor shall welding or brazing be used for attachment.

Unless otherwise indicated, receptacles and switches installed in sheet steel boxes shall be flush mounted and shall be located 18 inches above the floor unless otherwise indicated.

Switch boxes and receptacles installed in cast device boxes shall be mounted 48 inches above the floor.

B. **Application of Boxes and Covers**: Boxes and covers shall be installed as follows:

1. Outlet, switch, and junction boxes for flush-mounting in general purpose locations shall be sheet metal.
2. Outlet, switch, and junction boxes where surface mounted in exposed locations shall be cast alloy ferrous boxes with mounting lugs, zinc or cadmium plating, and enamel finish. Surface mounted boxes in concealed locations may be welded sheet steel boxes.
3. Outlet, control station, and junction boxes, including covers, for installation in corrosive locations shall be fiberglass-reinforced polyester and shall include mounting lugs.
4. Sheet metal boxes for flush-mounting in concrete shall include with cast, malleable box covers and gaskets. Covers for pressed steel boxes shall be one-piece pressed steel, cadmium plated, except that boxes for installation in plastered areas shall be stainless steel over plaster rings.
5. Outlet boxes shall be used as junction boxes wherever possible. Where separate pullboxes are indicated, they shall include screw covers. Outdoors boxes shall be galvanized and shall be provided with gasketed covers and threaded hubs. Indoor boxes shall be painted.

3.6 LIGHTING AND POWER DISTRIBUTION PANELBOARDS

A. **General:** The circuit description as indicated on the record drawings or panelboard schedule shall be typed on the circuit directory.

B. **Testing:** Panelboards shall be tested for proper operation and function.

3.7 CABINETS AND ENCLOSURES

A. The installation of cabinets and enclosures shall comply with the following:

1. Cabinets: Cabinets shall be set plumb at an elevation such that the maximum circuit breaker height shall be less than 5 ft 6 inches. Top edge of trim of adjacent panels shall be at the same height. Panels which are indicated as flush mounted shall be set so cabinet is flush and serves as a "ground" for plaster application.
2. Connections: Factory bus and wire connections shall be made at shipping splits, and all field wiring and grounding connections shall be made after the assemblies are anchored.
3. Finishes: Enclosures smaller in volume than 500 cubic inches shall be finished in accordance with the manufacturer's standard procedures. Finish color shall be No. 61 complying with ANSI Z55.1.

Enclosures larger in volume than 500 cubic inches shall comply with Section 09800.

3.8 EQUIPMENT ANCHORING

A. Freestanding or wall-hung equipment shall be anchored in place by methods that will meet seismic requirement in the area where project is located. Wall-mounted panels that weigh more than 500 pounds or which are within 18 inches of the floor shall be provided with fabricated steel support pedestal(s). Pedestals shall be of welded steel angle sections. If the supported equipment is a panel or cabinet and enclosed with removable side plates, it shall match supported equipment in physical appearance and dimensions. Transformers hung from 4-inch stud walls and weighing more than 300 pounds, shall have auxiliary floor supports.

B. Anchoring methods and leveling shall comply with the printed recommendations of the equipment manufacturers.

3.9 CONDUCTOR AND EQUIPMENT IDENTIFICATION

A. The completed electrical installation shall include adequate identification to facilitate proper control of circuits and equipment and to reduce maintenance effort.

B. Control and instrumentation wire and cable shall be assigned a unique identification number. Numbers shall be assigned to conductors having common terminals. Identification numbers shall appear within 3 inches of conductor terminals. "Control" shall be defined as any conductor used for alarm, annunciator, or signal purposes or any connect switch or relay contacts or any relay coils.

1. Multiconductor cable shall be assigned a number which shall be attached to the cable at intermediate pull boxes and at stub-up locations beneath free-standing equipment. It is expected that the cable number will form a part of the individual wire number. All individual control conductors and instrumentation cable shall be identified at pull points as described above.

2. The instrumentation cable numbers shall incorporate the loop numbers shown.

3. Refer to Section 13300.1.12 for numbering details.

C. Spare conductors shall be terminated on terminal screws and shall be identified with a unique number as well as with destination.

D. Nameplates shall be provided for panelboards, panels, starters, switches, and pushbutton stations. In addition to the name plates indicated, control devices shall be equipped with standard collar-type legend plates, as required.

E. Terminal strips shall be identified by imprinted, varnished, marker strips attached under the terminal strip.

F. Three-phase receptacles shall be consistent with respect to phase connection of receptacle terminals. Errors in phasing shall be corrected at the bus, not at the receptacle.

G. Toggle switches which control loads out of sight of switch, and all multi-switch locations of more than 2 switches, shall have suitable inscribed finish plates.

H. Empty conduits shall be tagged at both ends to indicate the destination at the far end. Where it is not possible to tag the conduit, destination shall be identified by marking an adjacent surface.

I. Identification tape shall be installed directly above buried raceway. Tape shall be installed 8 inches below grade and parallel with raceway. Identification tape shall be installed for buried raceway not under buildings or equipment pads except identification tape is not required for protection of street lighting raceway.

** END OF SECTION **

SECTION 16431 - SHORT CIRCUIT AND COORDINATION REPORT

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing a short circuit and protective device coordination study and harmonic measurement for the electrical power system.

B. The studies shall include the electrical distribution system for normal and standby power sources including the 480V distribution system.

C. The studies shall include protection studies for motors supplied with factory-installed solid state overload and overcurrent protection devices.

D. The WORK of this Section includes measurement of harmonic current and the installation of filters required for harmonic suppression.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 16050 Basic Electrical Materials and Methods

1.3 CODES

A. The WORK of the Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:

1. National Electrical Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. ANSI/IEEE 141Recommended Practice for Electrical Power Distribution for Industrial Plants
2. ANSI/IEEE 242Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
3. ANSI C 37.010 Standard Application Guide for AC High-Voltage Circuit Breakers
4. ANSI C 37.5 Calculation of Fault Currents for Application of Power Circuit Breakers
5. ANSI C 37.13 Low-Voltage AC Power Circuit Breaker (600-Volt Insulation Class)
6. IEEE 519 Recommended Practice and Requirements for Harmonic Control in Electrical Power Systems

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Studies related to distribution system protection and coordination shall be submitted to the CONSTRUCTION MANAGER prior to submittal of distribution equipment shop drawings and/or release of equipment for manufacture. A preliminary submittal shall be made with sufficient detail to review the adequacy of products and to indicate the computer program selected for use in performing the WORK of this Section.

2. Studies for harmonic current, voltage and line notching test results shall be forwarded to the CONSTRUCTION MANAGER prior to acceptance of the project and after installation of harmonic generating and harmonic sensitive equipment.

3. Submittals for solid state motor protective devices shall be forwarded to the CONSTRUCTION MANAGER prior to loading the motor.

4. Protective device and coordination evaluation studies must be approved by the CONSTRUCTION MANAGER prior to acceptance testing.

5. Submittals shall indicate proposed changes to the protection scheme and equipment selection which will result in improved system reliability and safety.

6. Documentation of at least one successful study of comparable size and complexity completed in the recent past, including contact names, addresses, and telephone numbers.

1.6 QUALIFICATIONS

A. Short circuit studies, protective device evaluation studies, and protective coordination studies shall be performed by an electrical testing service regularly engaged in short circuit and protective device coordination studies, having at least one successful study of comparable size and complexity completed in the recent past.

1.7 STUDY REPORTS

A. The results of the power system study and harmonic current, voltage and line notching measurements shall be summarized in a final report, signed by the professional electrical engineer, registered in the State of California responsible for the studies. Six bound copies of the final report shall be submitted and shall include the following:

1. Single-line diagram
2. Impedance diagram
3. Tabulation and identification of protective devices on a single-line diagram.
4. Time/current coordination curves
5. Computerized fault current calculations

6. Test instrumentation, condition and connections, as applicable, for each study
7. Harmonic measurement results
8. Specific recommendations (if any)

PART 2 – PRODUCTS

2.1 GENERAL

A. **General:** The report shall include a single-line and an impedance diagram of the power system. This diagram shall identify components included in the study and the ratings of power devices including transformers, circuit breakers, relays, fuses, busses, and cables. The resistances and reactance of cables shall be indicated in the impedance diagram. The study shall include written data regarding maximum available short circuit current, voltage, and X/R ratio of San Diego Gas and Electric Co.

2.2 SHORT CIRCUIT STUDY

A. The short circuit study shall be performed with the aid of a computer program complying with ANSI C 37.5, IEEE Standard 242, and IEEE Standard 141.

2.3 PROTECTIVE DEVICE EVALUATION STUDY

A. A protective device evaluation study shall be performed to determine the adequacy of circuit breakers, molded case switches, automatic transfer switches, and fuses. Any problem areas or inadequacies in the equipment due to prospective short-circuit currents shall be promptly brought to the CONSTRUCTION MANAGER's attention in writing but in no case more than 7 days after discovery.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

A. A protective device coordination study shall be performed including calculations required to review the selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low-voltage breaker trip characteristics and settings.

2.5 TIME/CURRENT COORDINATION CURVES

A. The time/current coordination curves for the power distribution system shall include, on 5-cycle log-log graph paper, at least the following:

1. Time/current curves for each protective relay or fuse showing graphically that the settings will provide protection and selectivity within industry standards. Each curve shall be identified, and tap and time dial settings shall be shown.
2. Time/current curves for each device shall be positioned to provide the maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, the CONSTRUCTION MANAGER shall be promptly notified of the cause in writing but in no case more than 7

days after discovery.

3. Time/current curves and points for cable and equipment damage.

4. Circuit interrupting device operating and interrupting times.

5. Maximum fault values.

6. Sketch of bus and breaker arrangement.

7. Magnetizing inrush points of transformers.

8. Compliance with Code requirements and proper coordination intervals and separation of characteristics curves.

9. Thermal limits of motors 250 hp and above.

2.6 HARMONIC MEASUREMENT

A. The report of the distribution system, at all voltage levels, shall indicate the harmonic currents anticipated at each voltage level. The report shall indicate sources of harmonic currents, voltages, and line notching of equipment. The report shall state the tolerance of sensitive equipment to harmonics.

B. The report shall include measurement of harmonics present in the output of harmonic-generating equipment at the input terminals of sensitive equipment. Filters required to prevent equipment malfunction due to harmonics shall be installed. Harmonic measurements shall be performed and documented after the filter installation.

C. Equipment which is required to conform with IEEE 519 shall be measured to determine output harmonic content. Corrective action necessary for compliance with IEEE 519, Tables 2 and 4 General System Class shall be made. Measurements and documentation shall be performed to demonstrate compliance with 5 percent voltage distortion limitation.

2.7 MOTOR PROTECTION

A. Where overload protection as phase overcurrent for medium voltage motors is specified to be solid state protective modules, modules shall be adjusted for actual installed motor torque, current and thermal characteristics. Protective settings shall be submitted, and reviewed, before motors are run under load.

PART 3 -- EXECUTION

3.1 TESTING, CALIBRATION, AND ADJUSTMENT

A. The low voltage equipment manufacturer shall provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate, and adjust the protective relays and circuit breaker trip devices as recommended in the power system study for 2 days.

** END OF SECTION **

SECTION 16485 - LOCAL CONTROL PANELS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing local control panels including enclosures, wiring and control devices.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 13300 Instrumentation and Control
2. Section 16050 Basic Electrical Materials and Methods

1.3 CODES

A. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:

1. National Electrical Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1.	JIC EGP-1	Electrical Standards for General Purpose Machine Tools
2.	NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
3.	UL	Underwriters' Laboratories

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted:

1. Manufacturer's product data including catalogue cut sheets showing classifications.
2. Arrangement drawings of the local control panel enclosure indicating the front door and rear panel equipment arrangement and dimensions.
3. List of materials and components.
4. Connection diagrams.
5. Shop drawings indicating mounting of devices, discrete inputs and outputs, and termination points.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL:

1. Manufacturer's installation instructions.
2. Manufacturer's maintenance procedures.
3. Manufacturer's certification that products comply with the indicated requirements.

1.7 FACTORY TESTING

A. **Product Testing**: Panels shall be tested at the factory for sequence of operation.

B. **Witnesses**: The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness factory tests.

1.8 FIELD TESTING

A. **Testing**: Panels shall be field-tested for functional operation after connection of external conductors and prior to equipment startup.

PART 2 -- PRODUCTS

2.1 LABELING

A. Products shall bear the UL label.

2.2 CLASSIFICATION

A. Unless otherwise indicated, enclosures installed indoors shall be NEMA 12 with gasketed doors. Enclosures installed outdoors or in corrosive areas shall be NEMA 4X. Enclosures installed in the indicated hazardous areas shall comply with the NEC requirements for that area.

2.3 SIZE

A. Unless otherwise indicated, the minimum enclosure area, height by width, shall be twice the sum of the areas of the individual components mounted on the back panel. The enclosure depth shall not be less than 6 inches.

2.4 LOCAL CONTROL PANELS (LCP)

A. The LCP shall be designed to provide the indicated sequence of operations. The LCP controls shall be 120 VAC. Control conductors shall comply with the requirements of Section 16050.

B. Each LCP shall include terminal strips identified for the connection of external conductors. The LCP shall include sufficient terminal blocks to connect 25 percent additional conductors for future use. Termination points shall be identified in accordance with shop drawings. The LCP shall be the source of power for 120 VAC solenoid valves interconnected with the LCP. Equipment associated with the LCP shall be ready for service after connection of conductors to equipment, controls, and LCP.

C. Internal wiring shall be factory-installed and shall be enclosed in plastic raceways with removable covers. Wiring to door-mounted devices shall be extra flexible and shall be anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent contact.

D. Enclosures shall be either freestanding, or designed to be mounted on pedestals or equipment skids or as indicated. Internal control components shall be mounted on a removable mounting pan. Interior of enclosure and mounting pan shall be finished white. Enclosure shall include 100-watt incandescent light (min.) designed to be controlled by a hand-operated switch and a circuit breaker and 15-amp duplex receptacle.

E. The main feeder disconnect shall be flange-mounted unless otherwise indicated.

F. Each source of voltage and motor control shall include a means for disconnecting by disconnecting or pull-apart terminal blocks or a disconnect operable from the panel front.

G. Motor starters: N/A.

H. Discrete outputs from the LCP shall be provided by electrically isolated dry contacts rated for 5 amps at 120 VAC. Analog inputs and outputs shall be isolated 4-20 mA two-wire signal with power supply complying with Section 13300.

I. Identification of panel-mounted devices, conductors, and electrical components shall comply with Section 13300.

J. LCPs shall include programmable logic controllers (PLCs) in accordance with Section 13300.

K. Indicating lights shall be "Push-to-Test" type.

2.5 COLOR CODING

A. Wiring shall be color coded complying with Section 16050.

2.6 LABELING AND NAMEPLATES

A. **Labeling**: Local control panel components shall be labeled to match the description on the elementary diagram. Internal components of the local control panel on the back side of the door shall be labeled with the same description as provided on the front side. Labeling shall be permanently marked on or near each component. Plastic embossed labels such as "Dymo" tape will not be accepted.

B. **Nameplates**: External door-mounted components and the local control panel description shall be identified with plastic nameplates.

2.7 GROUNDING

A. Neutrals of locally derived control circuits shall be grounded to the mounting plate using a copper bus or grounding lug. A grounding lug for a size No. 2 AWG bare copper conductor shall be included to ground the panel to the plant's grounding system.

2.8 MANUFACTURERS

A. Products of the type or model (if any) indicated shall be manufactured by one of the following (or equal):

Hoffmann Engineering Co., Bulletin A
E.M. Wiegman and Co., Inc.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Products, equipment, conduit, conductors and terminations shall be installed in accordance with the manufacturer’s written installation instructions and Section 16050.

B. LCP interior and exteriors shall be cleaned and coatings shall be touched up to match original finish upon completion of the WORK.

C. Alternating current control circuits shall be grounded. One terminal of each load device shall be connected to the grounded conductor. Control contracts shall be installed in the ungrounded side of the circuit.

D. Signal and control wiring shall be separated and installed in separate wireways.

E. The panel shall be grounded to the plant grounding system as indicated.

F. Local control panel centers shall be mounted at 36 inches minimum above the finished floor.

G. A copy of the wiring diagrams shall be placed on the inner panel door. Drawings shall be enclosed in a transparent, protective jacket. A metal pocket measuring not less than 10 inches wide by 8 inches high by 3/4-inch deep shall be provided on the inside of the door for the drawings.

** END OF SECTION **

APPENDIX E1

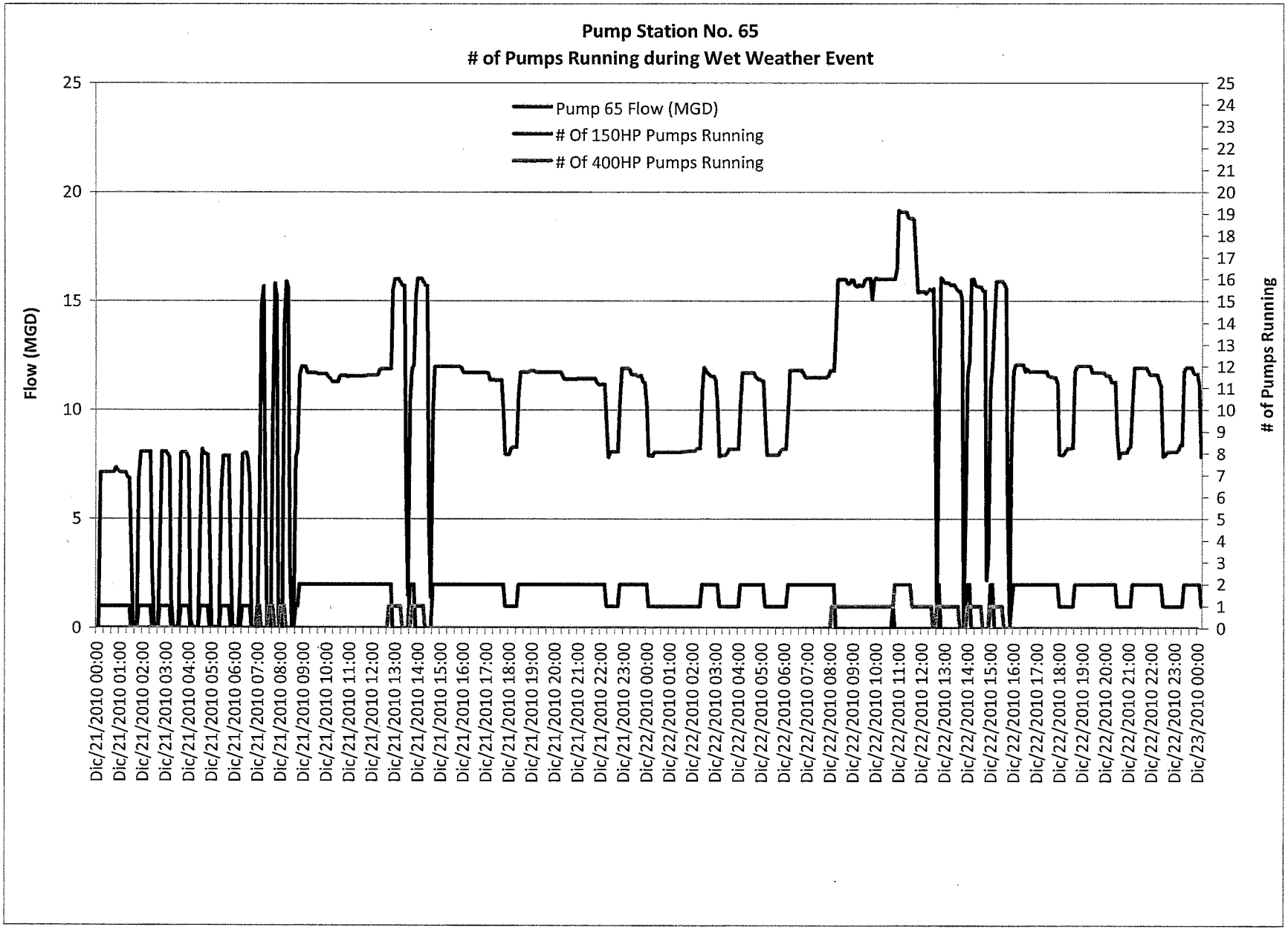
Technical Diagrams

Sewer Pump Station 65 Flow Projections

	Average Daily Flow (mgd)	Peak Dry Weather Flow (mgd)	Peak Wet Weather Flow (mgd)
2010	6.6	11.1	20.1
2015	7.7	12.3	22.2
2020	7.8	12.5	22.5
2025	7.9	12.6	22.7
2030	**8.0**	**12.8**	**23.0**
2035	8.1	12.9	23.2
2040	8.3	13.2	23.8
2045	8.5	13.5	24.3
2050	8.7	13.9	25.0

Note:
Flow projections were based on SANDAG Series 12 Forecasts. City of Del Mar's peak flows were based on contractual agreement. There was no high flow from Del Mar observed in the recent years.

Updated Feb 2011


Pump Station No. 65
# of Pumps Running during Wet Weather Event
Pump 65 Flow (MGD)
Of 150HP Pumps Running
Of 400HP Pumps Running
Flow (MGD)
# of Pumps Running
0
5
10
15
20
25
Dic/21/2010 00:00
Dic/21/2010 01:00
Dic/21/2010 02:00
Dic/21/2010 03:00
Dic/21/2010 04:00
Dic/21/2010 05:00
Dic/21/2010 06:00
Dic/21/2010 07:00
Dic/21/2010 08:00
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Dic/22/2010 12:00
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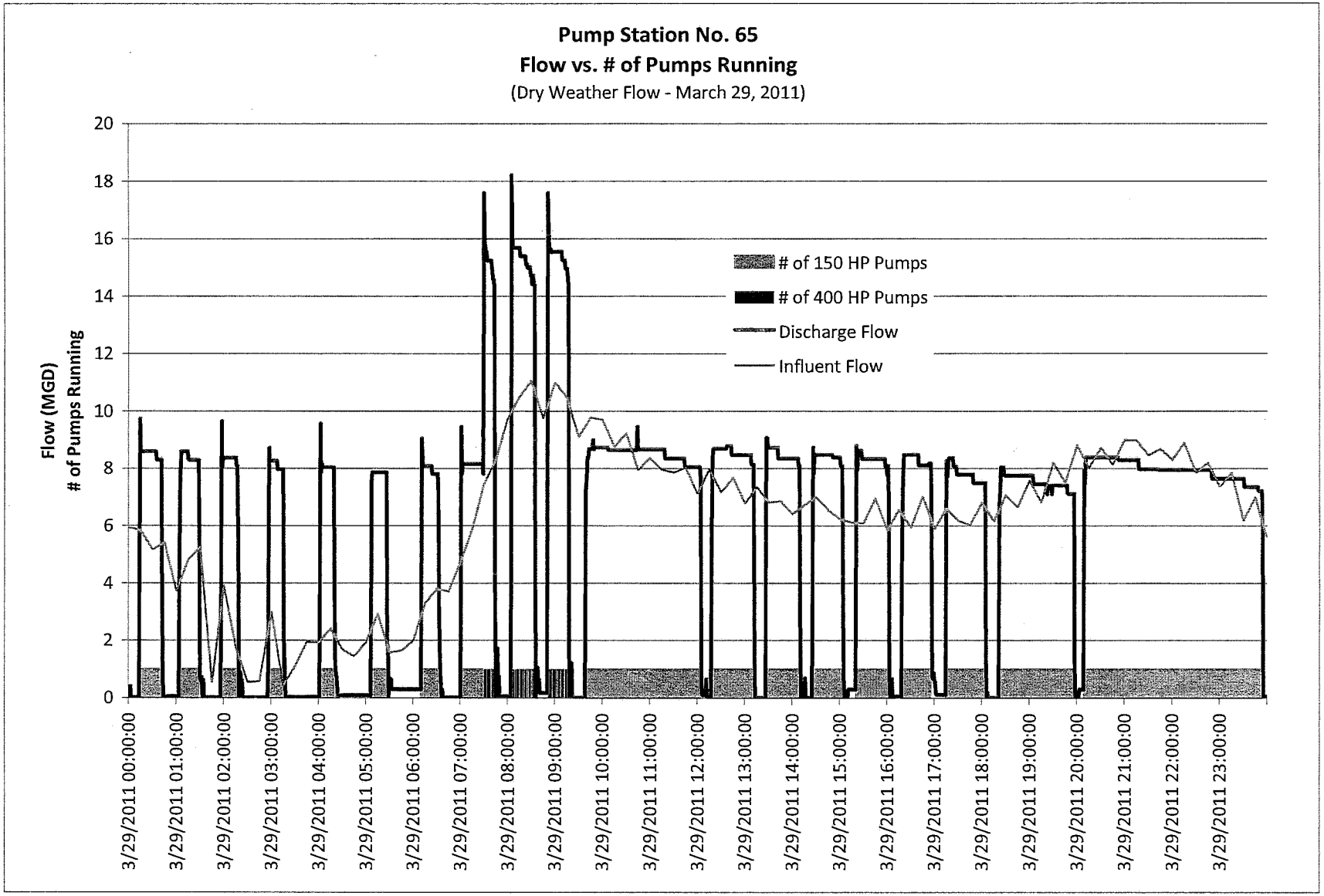
Dic/23/2010 00:00

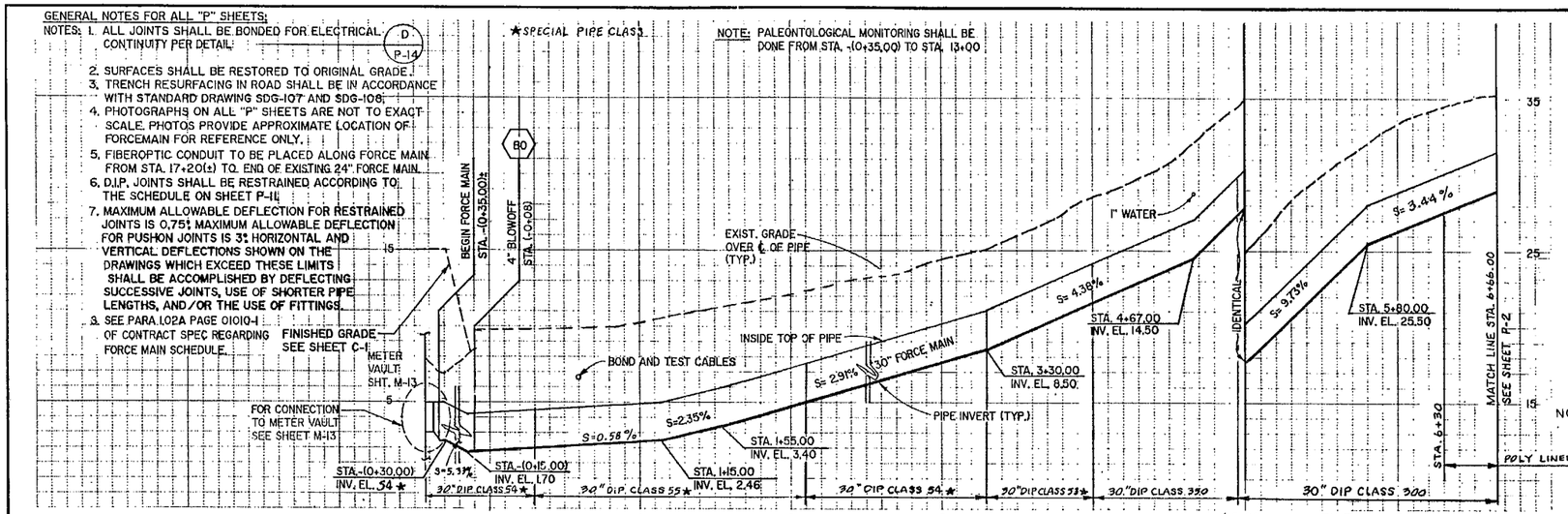

Pump Station No. 65
Flow vs. # of Pumps Running
(Dry Weather Flow - March 29, 2011)
Flow (MGD)
# of Pumps Running
20
18
16
14
12
10
8
6
4
2
0
of 150 HP Pumps
of 400 HP Pumps
Discharge Flow
Influent Flow
3/29/2011 00:00:00
3/29/2011 01:00:00
3/29/2011 02:00:00
3/29/2011 03:00:00
3/29/2011 04:00:00
3/29/2011 05:00:00
3/29/2011 06:00:00
3/29/2011 07:00:00
3/29/2011 08:00:00
3/29/2011 09:00:00
3/29/2011 10:00:00
3/29/2011 11:00:00
3/29/2011 12:00:00
3/29/2011 13:00:00
3/29/2011 14:00:00
3/29/2011 15:00:00
3/29/2011 16:00:00
3/29/2011 17:00:00
3/29/2011 18:00:00
3/29/2011 19:00:00
3/29/2011 20:00:00
3/29/2011 21:00:00
3/29/2011 22:00:00
3/29/2011 23:00:00

GENERAL NOTES FOR ALL "P" SHEETS:

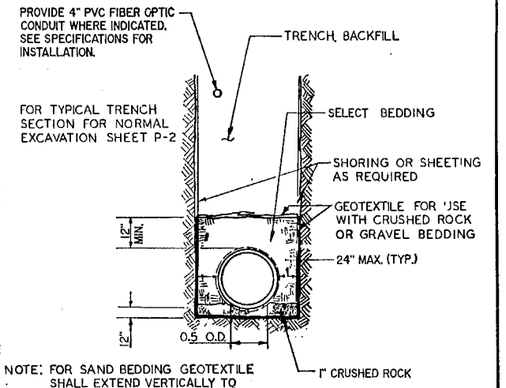
NOTES:
1. ALL JOINTS SHALL BE BONDED FOR ELECTRICAL CONTINUITY PER DETAIL (D / P-14)
2. SURFACES SHALL BE RESTORED TO ORIGINAL GRADE.
3. TRENCH RESURFACING IN ROAD SHALL BE IN ACCORDANCE WITH STANDARD DRAWING SDG-107 AND SDG-108.
4. PHOTOGRAPHS ON ALL "P" SHEETS ARE NOT TO EXACT SCALE. PHOTOS PROVIDE APPROXIMATE LOCATION OF FORCEMAIN FOR REFERENCE ONLY.
5. FIBEROPTIC CONDUIT TO BE PLACED ALONG FORCE MAIN FROM STA. 17+20(±) TO. END OF EXISTING 24". FORCE MAIN.
6. D.I.P. JOINTS SHALL BE RESTRAINED ACCORDING TO THE SCHEDULE ON SHEET P-11.
7. MAXIMUM ALLOWABLE DEFLECTION FOR RESTRAINED JOINTS IS 0.75°. MAXIMUM ALLOWABLE DEFLECTION FOR PUSHON JOINTS IS 3° HORIZONTAL AND VERTICAL. DEFLECTIONS SHOWN ON THE DRAWINGS WHICH EXCEED THESE LIMITS SHALL BE ACCOMPLISHED BY DEFLECTING SUCCESSIVE JOINTS, USE OF SHORTER PIPE LENGTHS, AND/OR THE USE OF FITTINGS.
8. SEE PARA.102A PAGE 01010-1 OF CONTRACT SPEC REGARDING FORCE MAIN SCHEDULE.

★SPECIAL PIPE CLASS

NOTE: PALEONTOLOGICAL MONITORING SHALL BE DONE FROM STA. -(0+35.00) TO STA. 13+00

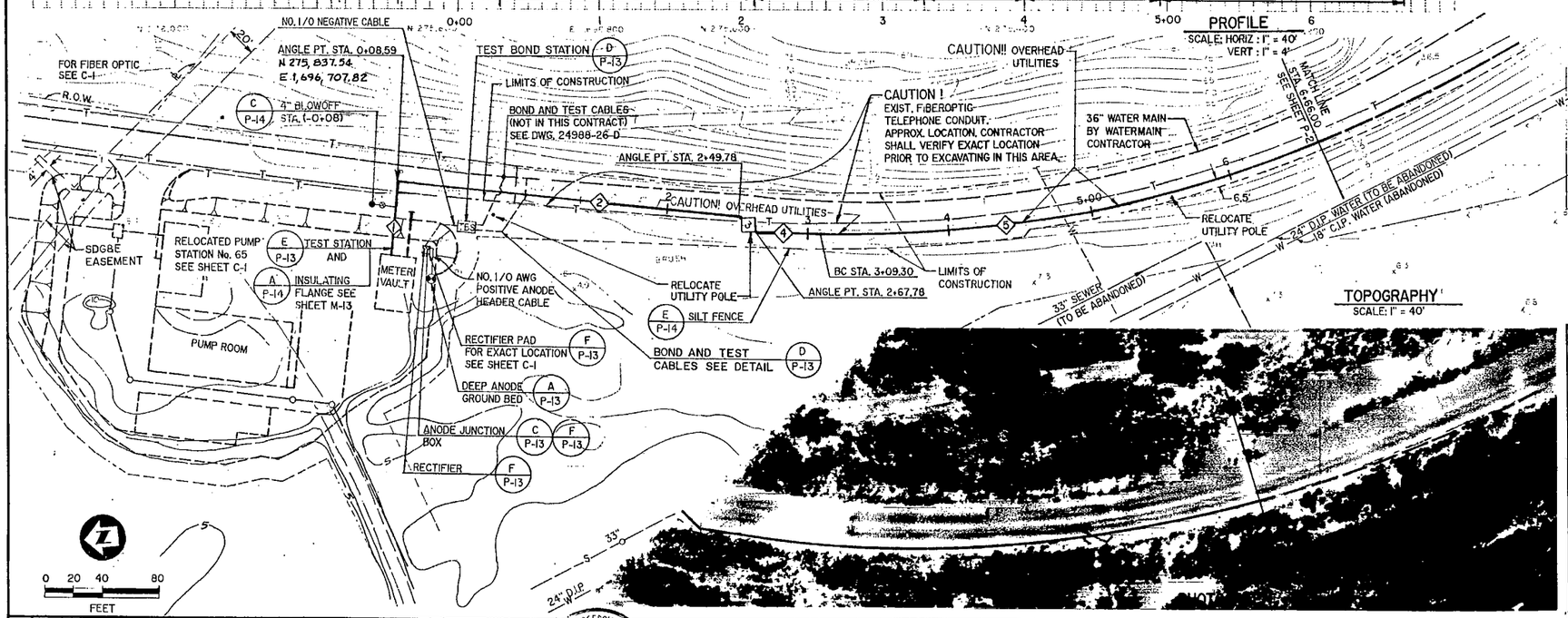


PROFILE
SCALE: HORIZ: 1" = 40'
VERT: 1" = 4'



NOTE: FOR SAND BEDDING GEOTEXTILE SHALL EXTEND VERTICALLY TO LIMIT OF CRUSHED ROCK.

TYPICAL TRENCH SECTION
FOR OVER-EXCAVATION
N.T.S.



TOPOGRAPHY
SCALE: 1" = 40'

T. KNUTSEN — Date 12/13/94

...record drawing has been prepared ... furnished by others. While this drawing is ... furnished is assumed to be reliable, the DESIGN CONSULTANT ... does not assure its accuracy. The DESIGN CONSULTANT will not be responsible for any ... which may have been incorporated into this record drawing as a result. The DESIGN CONSULTANT is responsible for errors incorporating the information furnished by others ... This record drawing should not be used ... drawing must obtain ... confirmation of its applicability before approving it for any purpose.

DESIGN CONSULTANT Craig Nuhot Date 12/13/94

CONSTRUCTION MANAGER

CONTRACTOR

FORCE MAIN DATA

NO.	DELTA / BRG.	RADIUS	LENGTH	REMARKS
1	S 78°32'48"E		51.00'	30" D.I.P.
2	S 09°28'48"W		241.19'	30" D.I.P.
3	S 41°49'48"W		18.00'	30" D.I.P.
4	S 06°13'50"W		41.52'	30" D.I.P.
5	A= 31°02'04"	840.00'	454.99'	30" D.I.P.

PLANS FOR THE CONSTRUCTION OF:
PUMP STATION No. 65 RELOCATION
30 INCH FORCE MAIN
STA. -(0+42.41) TO STA. 6+50.00

CITY OF SAN DIEGO, CALIFORNIA
WATER UTILITIES DEPARTMENT
SHEET 122 OF 146 SHEETS

E.W.O. 170511
U.W.O. 170511
46-11/0
SPEC. NO. 93-004

CLEAR WATER PROGRAM DIRECTOR — DATE 12/6/94
ENGINEERING SUPERINTENDENT
DESIGN ENGINEER — 12/13/94

CONTROL CERTIFICATION
274-1695
LAMBERT COORDINATES
24989-122-D

NO.	DATE	REVISIONS	BY
	8/98	AS-BUILT	C.W.

PROJECT NO.	SD006
DESIGNED BY	C. WHITE, S. SHUMAKER 2-93
DRAWN BY	C.P., M.H.C. 3-93
CHECKED BY	D. DUPREY 3-93
ENGINEER	Craig Nuhot
REGISTRATION NO.	C33684 DATE 3/7/93

REGISTERED PROFESSIONAL ENGINEER — CRAIG T. WHITE — No. C 33684 — Exp. 6/30/94 — CIVIL — STATE OF CALIFORNIA

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
9404 GENESSE AVENUE, SUITE 140 L.A./LA JOLLA, CALIFORNIA 92037 619 453-8650
OFFICES IN PRINCIPAL CITIES
ES

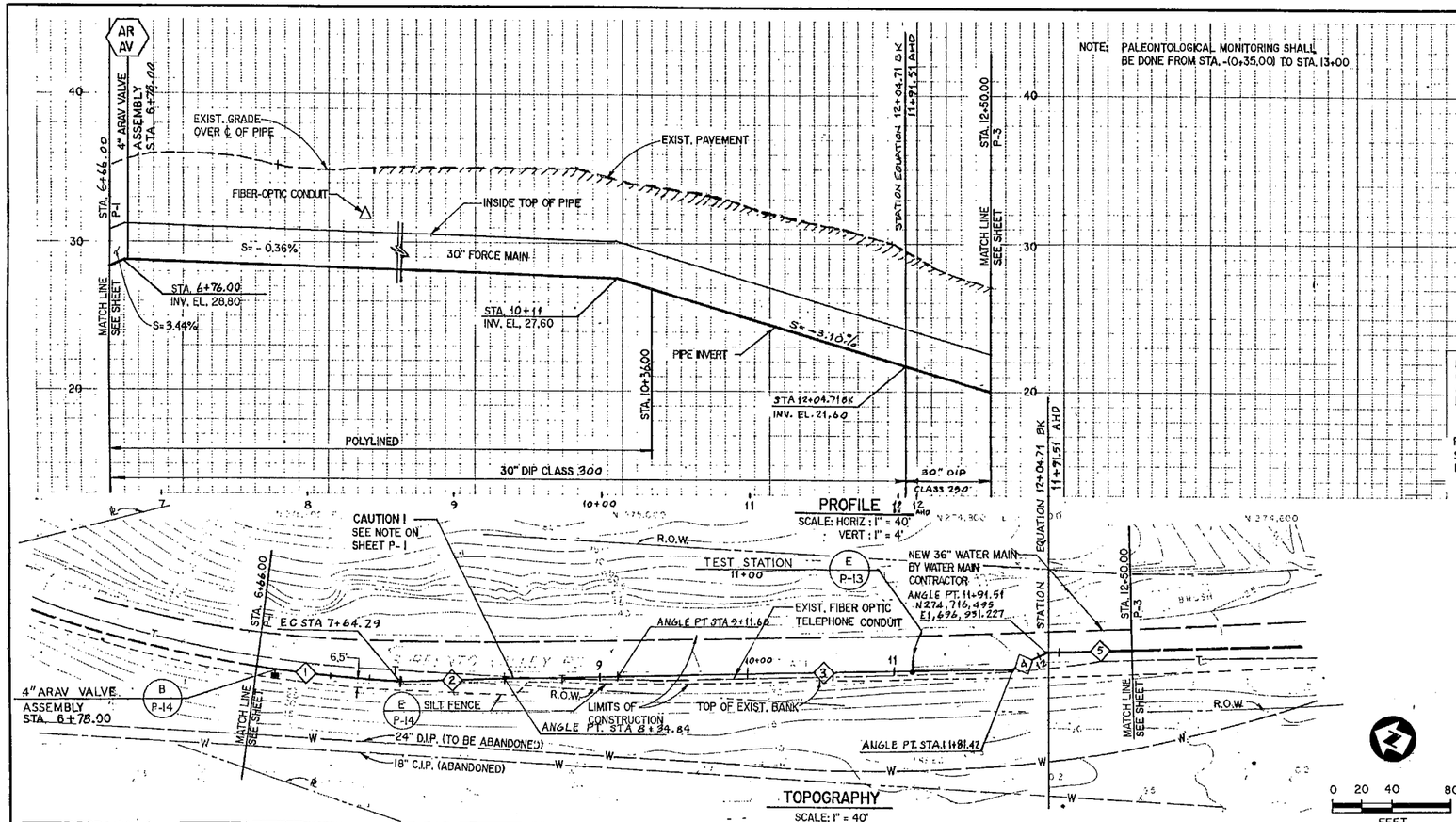
DESCRIPTION	BY	APPROVED	FILMED
As Built	C.W.	11/14/98	

CONSTRUCTION RECORD

CONTRACTOR: HINGUS CONSTRUCTION, INC. DATE STARTED 6/94
INSPECTOR: C. EVANS / D. JANICKI DATE COMPLETED 12/97
CONNECTIONS BY:

SCALE 1" = 40'
SHEET NO. P-1
FILE NO.

AS BUILT

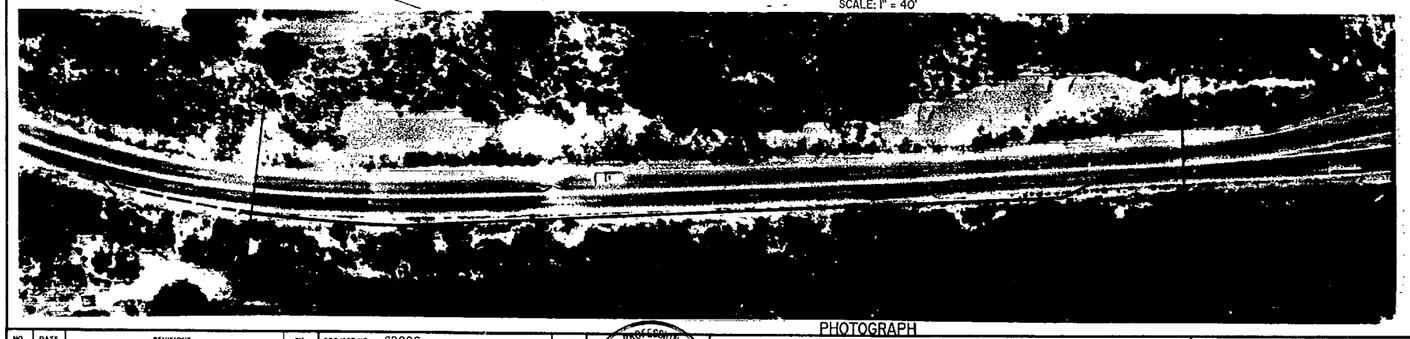


NOTE: PALEONTOLOGICAL MONITORING SHALL BE DONE FROM STA. -(0+35.00) TO STA. 13+00

PROFILE
SCALE: HORIZ : 1" = 40'
VERT : 1" = 4'

TOPOGRAPHY
SCALE: 1" = 40'

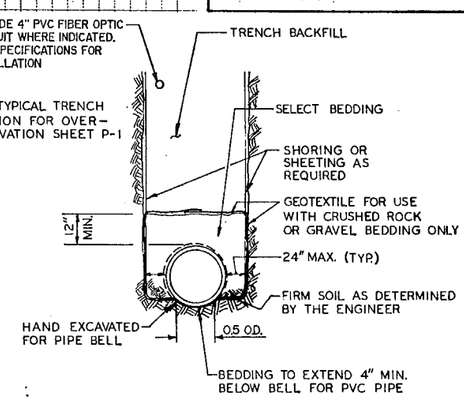
0 20 40 80
FEET



PHOTOGRAPH

PROVIDE 4" PVC FIBER OPTIC CONDUIT WHERE INDICATED. SEE SPECIFICATIONS FOR INSTALLATION

FOR TYPICAL TRENCH SECTION FOR OVER-EXCAVATION SHEET P-1



TYPICAL TRENCH SECTION
FOR NORMAL EXCAVATION
N.T.S.

CONSTRUCTION MANAGER

CONTRACTOR

FORCE MAIN DATA				
NO.	DELTA/BRG.	RADIUS	LENGTH	REMARKS
1	Δ=31°02'04"	840.00	454.99	30" D.I.P.
2	S 24°48'13" E		70.55	30" D.I.P.
3	S 27°52'32" E		269.76	30" D.I.P.
4	S51°29'14"E		23.29	30" D.I.P.
5	S 26° 34' 14" E		180.24	30" D.I.P.
6				30" D.I.P.

PLANS FOR THE CONSTRUCTION OF:
PUMP STATION No. 65 RELOCATION
30 INCH FORCE MAIN
STA. 6+50.00 TO STA. 12+50.00

CITY OF SAN DIEGO, CALIFORNIA
WATER UTILITIES DEPARTMENT
SHEET 123 OF 146 SHEETS

E.W.O. 170511
U.W.O. 170511
CIP 46-417.0
SPEC. NO. 93-004

CLEAN WATER PROGRAM DIRECTOR — DATE 11/26/97
ENGINEERING SUPERINTENDENT
DESIGN ENGINEER — DATE 12-4-97

DESCRIPTION	BY	APPROVED	FILMED
As Built	C.W.	12/24/97	MAR 18 '98

CONSTRUCTION RECORD
CONTRACTOR: MANSON CONSTRUCTION DATE STARTED 6/98
INSPECTOR: C. REYNES / D. JANSEN DATE COMPLETED 12/97
CONNECTIONS BY:

CONTROL CERTIFICATION
274-1695
LAMBERT COORDINATES
24989-123-D

NO.	DATE	REVISIONS	BY
	8/98	AS-BUILT	C.W.

PROJECT NO.	SD006	
DESIGNED BY	C. WHITE, S. SHUMAKER	2/93
DRAWN BY	B. PATIL	3/93
CHECKED BY	D. DUPREY	3/93
ENGINEER	Craig T. White	
REGISTRATION NO.	C33684	DATE 3/9/93

REGISTERED PROFESSIONAL ENGINEER — CRAIG T. WHITE — No. C 33684 — 6/30/94 — CIVIL — STATE OF CALIFORNIA

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
8404 ROBERT AVENUE, SUITE 140 • LA JOLLA, CALIFORNIA 92037 • 619/453-3650
OFFICES IN PRINCIPAL CITIES
ES

RECORD DRAWING
I hereby certify that I have prepared based on information furnished by others, T. KNUTZEN Date 12/19/97
From records known by me to be reliable, the DESIGN CONSULTANT cannot assure its accuracy. The DESIGN CONSULTANT is not responsible for any errors or omissions which may have been incorporated into the information furnished by others and that record drawing. Those relying on this record drawing must take independent verifications of its accuracy before applying it for any purpose.
Craig T. White
Date: 12/19/97

SCALE 1" = 40'
SHEET NO. P-2
FILE NO.

AS BUILT

0 1 2 3 4 IN.

CONSTRUCTION MANAGER

CONTRACTOR

NOTE: PALEONTOLOGICAL MONITORING SHALL BE DONE FROM STA. -0+35.00 TO STA. 13+00

B.O.

EXIST. GRADE OVER ℄ OF PIPE

EXIST. PAVEMENT

1" WATER

TEL.

TIE-IN POINT 1/2 RESTRAINED PRESSER COUPLINGS

4" BLOWOFF STA. 18+16

S=4.00%

STA 13+00 INV. EL.=18.00

16"ACP

30" FORCE MAIN

INSIDE TOP OF PIPE

24" D.I.P.

BEGIN STEEL CASING

36"C.M.P. STORM DRAIN

DOUBLE BOX CULVERT 2'-9" x 6'-0" MODIFIED PER RFP #66 CO #31

DETAIL B P-12

16" ACP

END STEEL CASING STA 18+10.00

24" D.I.P.

PIPE INVERT

S=-.08%

STA. 15+50.00 INV. EL 8.00

STA. 17+55 INV. EL. 6.22

S=48.50%

S=0.00%

S=-0.25%

S=5.64%

STA. 19+03.00 INV. EL. 3.30

STA. 21+25.00 INV. EL. 3.30

STA. 17+67 INV. EL. 0.40

STA. 18.48 INV. EL. 0.20

30" DIP CLASS 250

30" DIP CLASS 200

30" DIP CLASS 300

MATCH LINE SEE SHEET

STA. 12+50.00 P-2

STA. 21+25.00 P-4

MATCH LINE SHT. P-4

PROFILE

SCALE: HORIZ : 1" = 40'
VERT : 1" = 4'

NEW 36" WATER MAIN BY WATER MAIN CONTRCTOR

R.O.W.

12"ACP

8" VCP

24" D.I.P. (TO BE ABANDONED BY WATER MAIN CONTRCTOR)

18" C.I.P. (ABANDONED)

BC STA. 13+71.75
N 274,555.295
E 1,697,011.846

EC STA. 14+88.39
N 274,456.205
E 1,697,073.072

A P-15 PULL BOX STA. 18+02

STA. 17+20(±) MAKE FIBEROPTIC CONDUIT CONNECTION TO CONDUIT PLACED BY WATER MAIN CONTRACTOR. FOR CONTINUATION SEE 24988-24-D

CAUTION! SEE NOTE ON SHEET P-1

TOPOGRAPHY

SCALE: 1" = 40'

CARMEL MOUNTAIN RD.

18" RCP

24" RCP

12" VCP

16" CIP

24" D.I.P.

TEST STATION STA. 18+25.00 E P-13

TEST STATION FLUSH MOUNT E P-13

FUTURE 30" W.L.

3" H.P.

30" RCP

8" VCP

CAUTION! H.P. GAS LINE

4" BLOWOFF STA. 18+18.00 C P-13

STEEL CASING A P-12

BC STA. 20+67.84
N 273,992.537
E 1,697,420.593

DOUBLE BOX CULVERT

0 20 40 80

PHOTOGRAPH

FORCE MAIN DATA

NO.	DELTA/BRG.	RADIUS	LENGTH	REMARKS
1	S 26°34'14"E		180.24'	30" D.I.P.
2	A=10°16'52"	650.00'	116.64'	30" D.I.P.
3	S 36°51'06"E		579.45'	30" D.I.P.
4	A=18°54'39"	650.00'	214.54'	30" D.I.P.

PLANS FOR THE CONSTRUCTION OF:

PUMP STATION No. 65 RELOCATION

30 INCH FORCE MAIN

STA. 12+50.00 TO STA. 21+25.00

CITY OF SAN DIEGO, CALIFORNIA
WATER UTILITIES DEPARTMENT
SHEET 124 OF 136 SHEETS

E.W.O. 170511
U.W.O. 170511
CIP 46-117.0
SPEC. NO. 93-004

ASSISTANT WATER PROGRAM DIRECTOR — DATE 11/26/97

ENGINEERING SUPERINTENDENT — DATE

NO.	DATE	REVISIONS	BY
	8/98	AS-BUILT	C.W.

PROJECT NO.	50006
DESIGNED BY	C. WHITE, S. SHUMAKER 2-93
DRAWN BY	B. PATIL 3-93
CHECKED BY	D. DUPREY 3-93
ENGINEER	[signature]
REGISTRATION NO.	33684 DATE 3/7/97

REGISTERED PROFESSIONAL ENGINEER — CRAIG T. WHITE — No. C 33684 — Exp. 6/30/99 — STATE OF CALIFORNIA — CIVIL

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
9404 GENESEE AVENUE, SUITE 140-LA JOLLA, CALIFORNIA 92037-(619)453-9450
OFFICES IN PRINCIPAL CITIES

ES

RECORD DRAWING

This record drawing has been prepared based on information furnished by others. While this information is assumed to be reliable, the DESIGN CONSULTANT cannot assure its accuracy. The DESIGN CONSULTANT will not be responsible for any errors or omissions in which may have been incorporated herein resulting from the information furnished by others which may be discovered. Those relying on this record drawing must obtain independent verification of its accuracy prior to relying on it for any purpose.

DESIGN CONSULTANT: T. KNUTSEN Date: 12/13/98

Date: 12/13/98

DESCRIPTION	BY	APPROVED	FILMED
As-Built	C.W.	12/14/98	

CONSTRUCTION RECORD

CONTRACTOR: [illegible] INC. DATE STARTED 6/94
INSPECTOR: C. REYES/B. HANES DATE COMPLETED 12/97
CONNECTIONS BY:

DESIGN ENGINEER — 12/14/98

CONTROL CERTIFICATION

274-1696

LAMBERT COORDINATES

24989-124-D

SCALE 1" = 40'

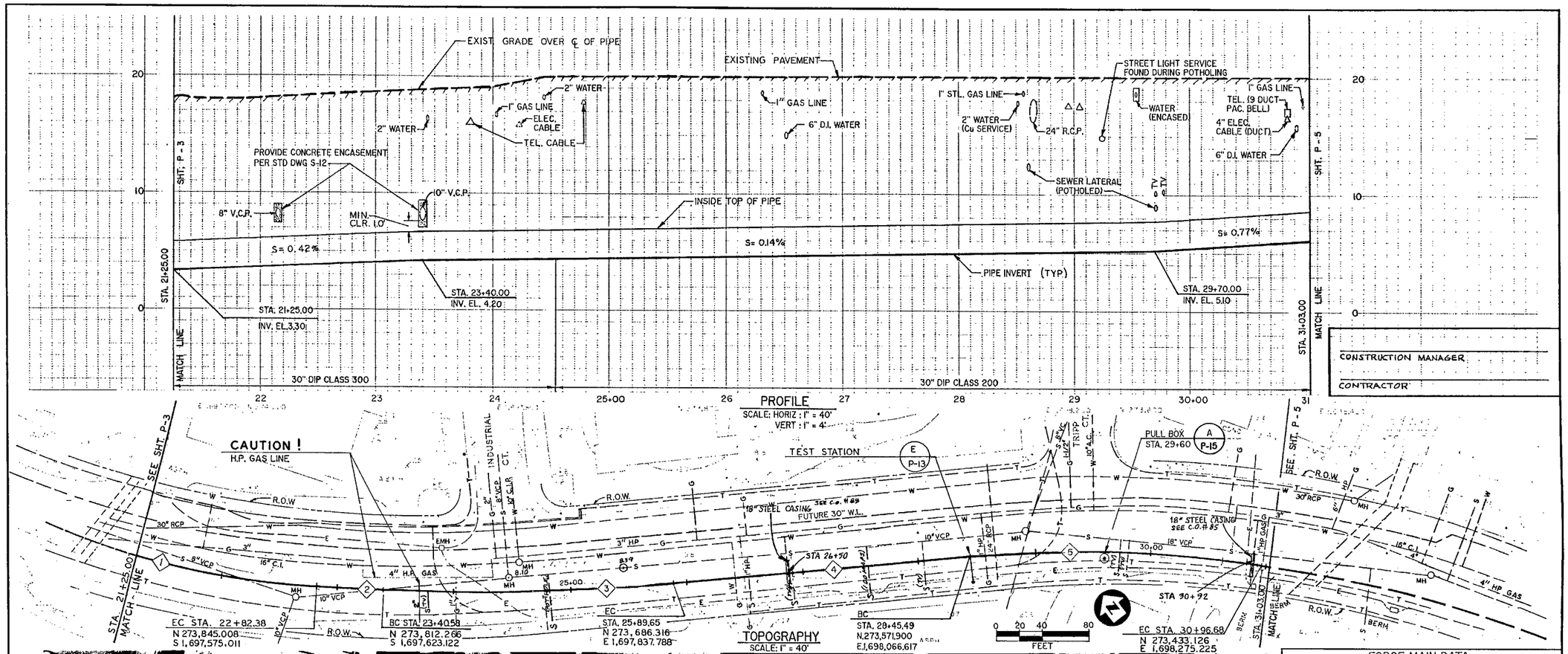
SHEET NO. P-3

FILE NO.

AS BUILT

0 1 2 3 4 IN.

FILMED FROM THE ORIGINAL
BEST QUALITY OBTAINABLE

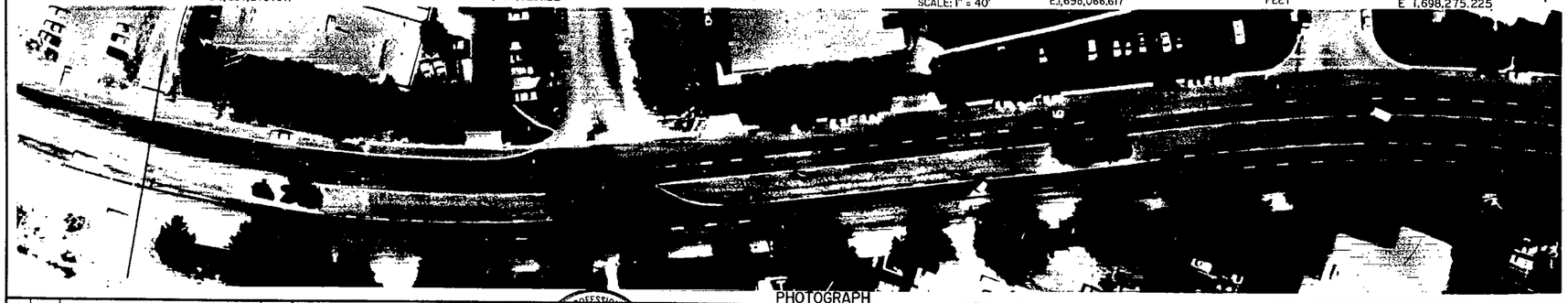


PROFILE

SCALE: HORIZ : 1" = 40'
VERT : 1" = 4'

TOPOGRAPHY

SCALE: 1" = 40'



PHOTOGRAPH

FORCE MAIN DATA				
NO.	DELTA / BRG.	RADIUS	LENGTH	REMARKS
1	Δ= 18°54'39"	650.00'	214.54'	30" D.I.P.
2	S55°45'45"E		58.20'	30" D.I.P.
3	Δ=07°40'21"	1860.00'	249.07'	30" D.I.P.
4	S63°26'06"E		255.84'	30" D.I.P.
5	Δ=14°08'15"	1018.00'	251.19'	30" D.I.P.

PLANS FOR THE CONSTRUCTION OF:

PUMP STATION No. 65 RELOCATION

30 INCH FORCE MAIN
STA. 21+25.00 TO STA. 31+03.00

CITY OF SAN DIEGO, CALIFORNIA
WATER UTILITIES DEPARTMENT
SHEET 125 OF 146 SHEETS

CLEAN WATER PROGRAM DIRECTOR — DATE 12/6/98

E.W.O. 170511
U.W.O. 170511
C.I.P. 46-117.0
SPEC NO. 93-004

ENGINEERING SUPERINTENDENT — DATE 12/6/98

DESIGN ENGINEER — DATE 12/8/98

CONTROL CERTIFICATION
270-1695
LAMBERT COORDINATES
24989-125-D

DESCRIPTION	BY	APPROVED	FILMED
As Built	C.W.	12/16/98	AS IS W MS 15 W

CONSTRUCTION RECORD
CONTRACTOR: MINGOS CONSTRUCTION — DATE STARTED 6/96
INSPECTOR: C. EYCKEL/B. IBARRA — DATE COMPLETED 12/97
CONNECTIONS BY:

CONSTRUCTION MANAGER

CONTRACTOR

NO.	DATE	REVISIONS	BY
	8/98	AS-BUILT	C.W.

PROJECT NO. SD006
DESIGNED BY C. WHITE, S. SHUMAKER — DATE 2-93
DRAWN BY B. CZARNOCKI — DATE 3-93
CHECKED BY D. DUPREY — DATE 3-93
ENGINEER Craig T. White
REGISTRATION NO. C33684 — DATE 3/7/93

REGISTERED PROFESSIONAL ENGINEER — CRAIG T. WHITE — No. C 33684 — Exp 6/30/94 — CIVIL — STATE OF CALIFORNIA

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
9404 GENESEE AVENUE, SUITE 140 • LA JOLLA, CALIFORNIA 92037 • 619/453-9620
OFFICES IN PRINCIPAL CITIES

ES

RECORD DRAWING

Revisions drawn by: T. KNUTSEN — Date 12/13/98

This record drawing has been prepared based on information furnished by others. While the information furnished is assumed to be reliable, the DESIGN CONSULTANT makes no warranty of accuracy. The DESIGN CONSULTANT will not be responsible for any errors or omissions which may have been incorporated in or omitted from the information furnished by others and relied upon in preparing this record drawing. Those relying on this record drawing must obtain independent verification of its accuracy before applying it for any purpose.

DESIGN CONSULTANT — Craig T. White — Date 12/13/98

SCALE 1" = 40'
SHEET NO. P-4
FILE NO.

AS BUILT

0 1 2 3 4 IN.

CONSTRUCTION MANAGER

CONTRACTOR:

EQUATION: STA 36+34.23 BK = STA 36+33.93 AHD

EXIST. GRADE OVER ℄ OF PIPE

EXIST. PAVEMENT

SEWER LATERAL

2" WATER (CW)

1½" WATER (CW)

ELEC. CABLE

3/4" GAS LINE

TEL. CABLE

2" WATER

GAS LINE

PAC BELL

SEWER LATERAL (POTHOLED)

1" (IRON) GAS LINE

4" FIRE MAIN (PIP)

8" FIRE MAIN (ANT) GAS LINES

2" WATER (CW)

(POLY)

ELEC. CONDUIT

FIRE HYDRANT 6" WATER

STL. CASING

CATHODIC PROTECTION

2" WATER (CW)

2 - 57" R.C.P.

TEL (9 DUCT PAC. BELL)

POTHOLED

INSIDE TOP OF PIPE

S=0.20%

S=5.83%

S=0.00%

S=0.83%

S=0.10%

S=0.00%

S=2.70%

S=0.20%

S=3.51%

S=0.77%

STA 34+00 INV EL 14.65

STA 35+10 INV EL 14.65

STA 35+60 INV EL 16.00

SEWER LATERAL (POTHOLED)

STA 37+20 INV EL 16.92

STA 37+50 INV EL 13.00

STA 38+10 INV EL 16.50

END STEEL CASING

STA 39+20 INV EL 16.50

BEGIN STEEL CASING

STA 41+00 INV EL 18.00

POTHOLED

SEWER LATERAL (POTHOLED)

ADJACENT SEWER LATERAL CONNECTION (TYPICAL)

STA 31+72.00 INV EL 6.65

30" DIP CLASS 200

STA. 31+03.00

SHT. P-4

MATCH LINE

STA. 42+54.00

SHT. P-6

MATCH LINE

30

20

10

32 33 34 35+00 36 37 38 39 40+00 41 42

PROFILE

SCALE: HORIZ : 1" = 40'
VERT : 1" = 4'

TOPOGRAPHY

SCALE: 1" = 40'.

57" R.C.P. STORM DRAINS

SEE SHT. P-4

STA. 31+03.00

R.O.W.

30" RCP SD

18" RCP

16" C.I.

4" H.P.

3/4"

MH

8" V.C.

MATCH LINE

BC STA. 31+32.90
N 273,409.505
E 1,698,302.684

TEST STATION E P-13

CAUTION! H.P. GAS LINE

BC EQN: STA. 36+34.23 BK = STA. 36+33.93 AHD
N 273,024.046
E 1,698,621.414

EC STA. 33+54.23
N 273,248.133
E 1,698,453.529

35+00

STA 35+04

PC STA. 36+90.96
N 272,976.967
E 1,698,653.561

EXIST. ELEC. VAULT

4" H.P. GAS

FIELD CLOSURE SEE C.O. # 9

STA 38+04

EC STA. 37+47.99
N 272,929.888
E 1,698,685.708

BC STA. 37+87.99
N 272,897.876
E 1,698,709.691

PC STA. 38+45.01
N 272,853.795
E 1,698,745.840

18" STEEL CASING

STEEL CASING A P-12

STA 39+03 40+00

3/4" GAS

EC STA. 39+02.04
N 272,809.714
E 1,698,781.989

TEST STATION E P-13

A P-15 PULL BOX STA. 41+60

0 20 40 80 FEET

PHOTOGRAPH

FORCE MAIN DATA

NO.	DELTA / BRG.	RADIUS	LENGTH	REMARKS
1	S 49°17'51"E		36.22'	30" D.I.P.
2	A=12°27'26"	1018.00'	221.33'	30" D.I.P.
3	S 36°50'25"E		280.00'	30" D.I.P.
4	A=05°01'36"	650.00'	57.03'	30" D.I.P.
5	S 36°50'25"E		40.00'	30" D.I.P.
6	S 36°50'25"E		1786.14'	30" D.I.P.

PLANS FOR THE CONSTRUCTION OF:

PUMP STATION No. 65 RELOCATION

30 INCH FORCE MAIN
STA. 31+03.00 TO STA. 42+54.00

CITY OF SAN DIEGO, CALIFORNIA
WATER UTILITIES DEPARTMENT
SHEET 126 OF 146 SHEETS

E.W.O. 170511
U.W.O. 170511
CIP 46-117.0
SPEC NO. 93-004

WATER PROGRAM DIRECTOR — DATE 11/24/98 — ENGINEERING SUPERINTENDENT

DESCRIPTION	BY	APPROVED	FILMED
As-Built	C.W.	8/7/98	1/6/99

DESIGN ENGINEER 1/25/94

CONTROL CERTIFICATION

CONSTRUCTION RECORD

CONTRACTOR: MINGUE CONTRACTING — DATE STARTED 6/94
INSPECTOR: C. RUFFEL / B. SANDA — DATE COMPLETED 12/97
CONNECTIONS BY:

LAMBERT COORDINATES

24989-126-D

NO.	DATE	REVISIONS	BY
	8/98	AS-BUILT	C.W.

		DATE
PROJECT NO.	SD006	
DESIGNED BY	C. WHITE, S. SHUMAKER	2-93
DRAWN BY	B. CZARNOCKI	3-93
CHECKED BY	D. DUPREY	3-93
ENGINEER	Craig White	
REGISTRATION NO.	C33684	DATE 3/9/93

CRAIG T. WHITE — No. C 33684 — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA — 6/30/94

ENGINEERING-SCIENCE
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3404 BENEDICT AVENUE, SUITE 140 • LA JOLLA, CALIFORNIA 92037 • 619/453-9400
OFFICES IN PRINCIPAL CITIES
ES

RECORD DRAWING

Record drawing by: T. KNUTSON Date: 12/3/98

This record drawing has been prepared based on information furnished by others. While this information is assumed to be reliable, the DESIGN CONSULTANT does not guarantee accuracy. The DESIGN CONSULTANT will not be responsible for any changes or omissions which may have been incorporated into the information during construction. The CONTRACTOR is responsible for accepting the information during construction and for reporting to the DESIGN CONSULTANT any discrepancies before proceeding with the construction work. The CONTRACTOR shall review and approve all shop drawings prior to submittal to the DESIGN CONSULTANT. The DESIGN CONSULTANT will review shop drawings for general conformance with the design concept of the project and general compliance with the information given in the contract documents. The CONTRACTOR is responsible for dimensions to be confirmed and correlated at the jobsite, for information that pertains solely to the fabrication processes or to techniques of assembly, and for performing his work in a safe manner. The review of shop drawings by the DESIGN CONSULTANT will not relieve the CONTRACTOR of responsibility for deviations from the requirements of the contract documents unless he has specifically informed the DESIGN CONSULTANT in writing of such deviation at the time of submittal and the DESIGN CONSULTANT has given written approval to the specific deviation. The CONTRACTOR shall not be relieved of responsibility for errors or omissions in the shop drawings by the DESIGN CONSULTANT's review of them. The review of shop drawings by the DESIGN CONSULTANT will not relieve the CONTRACTOR of responsibility for any deviations from the requirements of the contract documents unless the CONTRACTOR has informed the DESIGN CONSULTANT in writing of such deviation at the time of submittal and the DESIGN CONSULTANT has given written approval to the specific deviation. The CONTRACTOR shall not be relieved of responsibility for errors or omissions in the shop drawings by the DESIGN CONSULTANT's review of them. The review of shop drawings by the DESIGN CONSULTANT will not relieve the CONTRACTOR of responsibility for any deviations from the requirements of the contract documents unless the CONTRACTOR has informed the DESIGN CONSULTANT in writing of such deviation at the time of submittal and the DESIGN CONSULTANT has given written approval to the specific deviation. The CONTRACTOR shall not be relieved of responsibility for errors or omissions in the shop drawings by the DESIGN CONSULTANT's review of them.

DESIGN CONSULTANT: Craig White — DATE: 12/3/98

SCALE: 1" = 40'

SHEET NO. P-5

FILE NO.

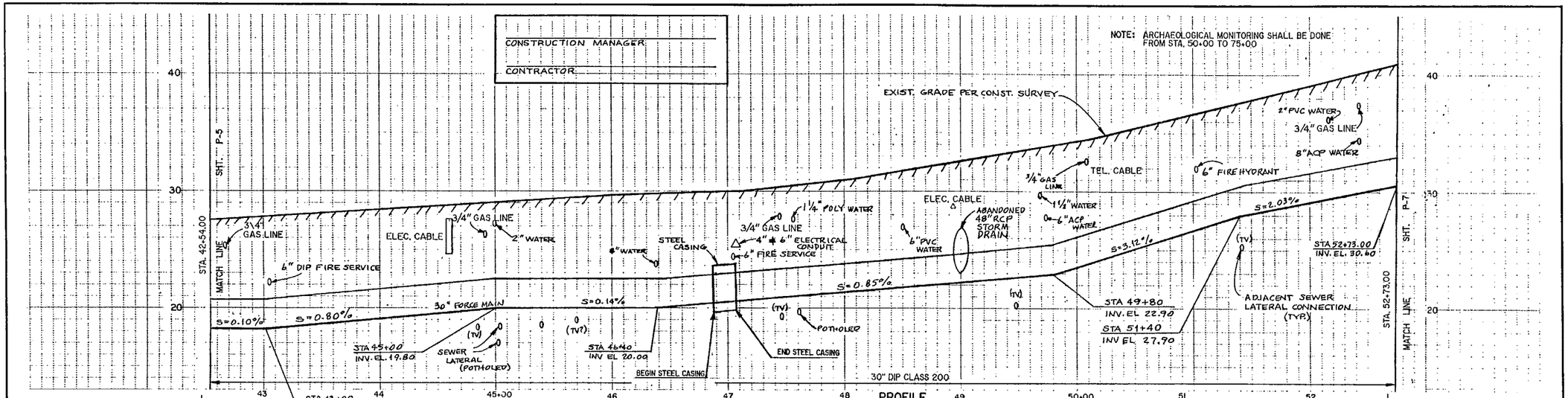
AS BUILT

0 1 2 3 4 IN.

CONSTRUCTION MANAGER

CONTRACTOR

NOTE: ARCHAEOLOGICAL MONITORING SHALL BE DONE FROM STA. 50+00 TO 75+00

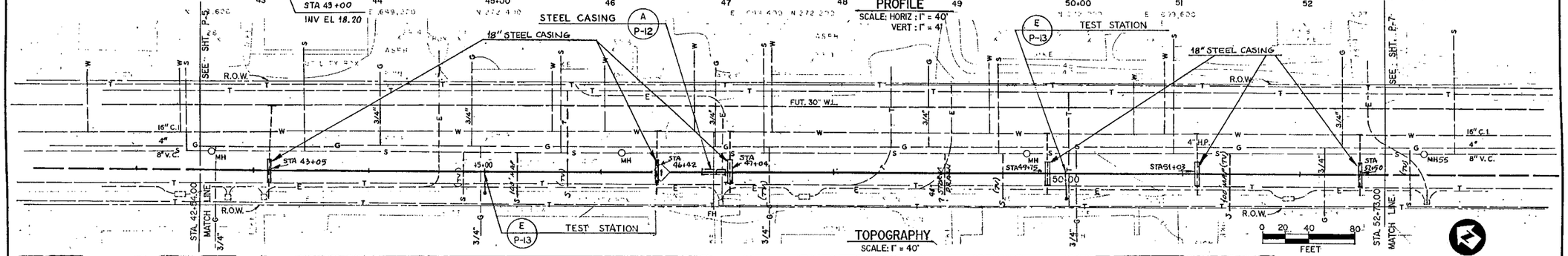


PROFILE

SCALE: HORIZ : 1" = 40'
VERT : 1" = 4'

STEEL CASING (A / P-12)

TEST STATION (E / P-13)



TOPOGRAPHY

SCALE: 1" = 40'

PHOTOGRAPH

FORCE MAIN DATA				
NO.	DELTA/BRG.	RADIUS	LENGTH	REMARKS
①	S36°50'25" E		1786.14'	30" D.I.P.

PLANS FOR THE CONSTRUCTION OF:

PUMP STATION No. 65 RELOCATION

30 INCH FORCE MAIN

STA. 42+54.00 TO STA. 52+73.00

CITY OF SAN DIEGO, CALIFORNIA
WATER UTILITIES DEPARTMENT
SHEET 127 OF 168 SHEETS

E.W.O. 170511
U.W.O. 170511
CIP 46-170
SPEC. NO. 93-004

CLEAN WATER PROGRAM DIRECTOR — DATE 11/26/98

ENGINEERING SUPERINTENDENT — DATE

DESIGN ENGINEER — DATE 1/4/94

DESCRIPTION	BY	APPROVED	FILMED
As Built	CW	12/4/98	

CONSTRUCTION RECORD

CONTRACTOR: MANIGLIA CONSTRUCTION, INC. DATE STARTED 6/94
INSPECTOR: C. RYDELL / S. RINCON DATE COMPLETED 12/97
CONNECTIONS BY:

CONTROL CERTIFICATION
270-1695
LAMBERT COORDINATES

24989-127-D

NO.	DATE	REVISIONS	BY
	8/98	AS-BUILT	C.W.

PROJECT NO.	SD006	DATE
DESIGNED BY	C. WHITE, S. SHUMAKER	2-93
DRAWN BY	B. CZARNOCKI	3-93
CHECKED BY	D. DUPREY	3-93
ENGINEER	Craig T. White	
REGISTRATION NO.	33684	DATE 3/9/93

REGISTERED PROFESSIONAL ENGINEER — CRAIG T. WHITE — No. 33684 — Ex. 6/30/94 — CIVIL — CALIFORNIA

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
9404 GENESEE AVENUE, SUITE 140 · LA JOLLA, CALIFORNIA 92037 · 619/453-9630
OFFICES IN PRINCIPAL CITIES

ES

RECORD DRAWING

Revisions drawn by T. KNUTSEN Date 12/15/98

I record drawing has been prepared based on information furnished by others. Where the information is incorrect or incomplete, the GEORGE CONSULTANT cannot assure its accuracy. The DESIGN will not be responsible for any errors or omissions which may have been incorporated

Craig T. White 12/15/98

SCALE 1" = 40'

SHEET NO. P-6

FILE NO.

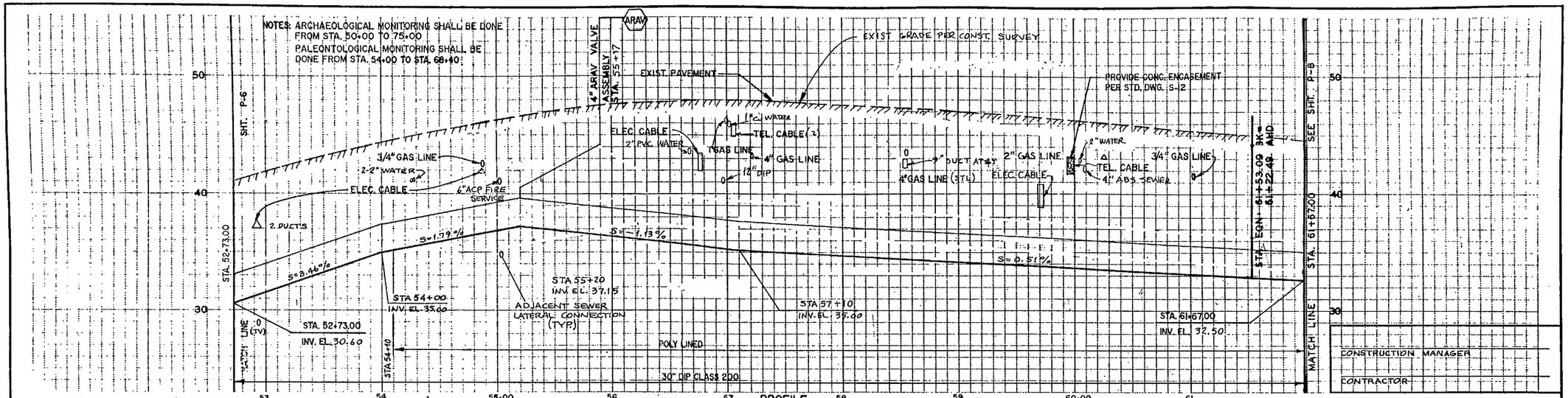
AS BUILT

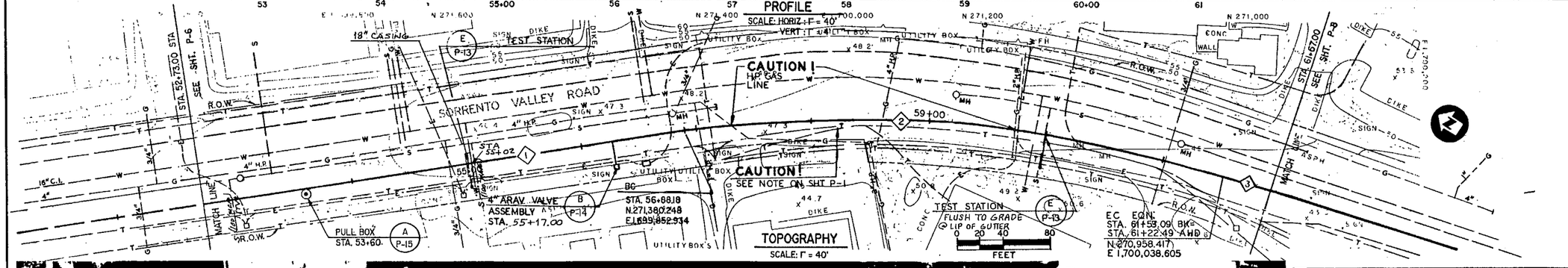
0 1 2 3 4 IN.

NOTES: ARCHAEOLOGICAL MONITORING SHALL BE DONE FROM STA. 50+00 TO 75+00
PALEONTOLOGICAL MONITORING SHALL BE DONE FROM STA. 54+00 TO STA. 68+40

PROFILE

SCALE: HORIZ: 1" = 40'
VERT: 1" = 4'





FORCE MAIN DATA

NO.	DELTA/BRG.	RADIUS	LENGTH	REMARKS
1	S36°50'25"E		1786.14'	30" D.I.P.
2	Δ=26° 10'00"	1018.00'	464.92'	30" D.I.P.
3	S10°40'25"E		396.27'	30" D.I.P.

PLANS FOR THE CONSTRUCTION OF:
PUMP STATION No. 65 RELOCATION

30 INCH FORCE MAIN
STA. 52+73.00 TO STA. 61+67.00

CITY OF SAN DIEGO, CALIFORNIA
WATER UTILITIES DEPARTMENT
SHEET 128 OF 146 SHEETS

CLEAN WATER PROGRAM DIRECTOR — DATE 1/16/98
ENGINEERING SUPERINTENDENT

E.W.O. 170511
U.W.O. 170511
C.I.P. 46-117.0
SPEC. NO. 93-004

DESCRIPTION	BY	APPROVED	FILMED
As Built	CW	11/4/98	

CONSTRUCTION RECORD
CONTRACTOR: NINGUS CONSTRUCTION, INC. DATE STARTED 6/94
INSPECTOR: C. STEPEK / D. DUPREY DATE COMPLETED 12/97
CONNECTIONS BY:

DESIGN ENGINEER — DATE

CONTROL CERTIFICATION
270 - 1695
LAMBERT COORDINATES
24989 - 128 - D

NO.	DATE	REVISIONS	BY
	8/98	AS-BUILT	C.W.

PROJECT NO. SD006 — DATE
DESIGNED BY C. WHITE, S. SHUMAKER — 2-93
DRAWN BY B. CZARNOCKI — 3-93
CHECKED BY D. DUPREY — 3-93
ENGINEER — DATE 8/13/91
REGISTRATION NO. C33089

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
9404 SCHEMET AVENUE, SUITE 140 · LA JOLLA, CALIFORNIA 92037 · 619/453-8830
OFFICES IN PRINCIPAL CITIES

RECORD DRAWING
Information drawn by: T. KNUTSEN Date: 12/3/98
This record drawing has been prepared based on information compiled by others. While this information is believed to be reliable, the DESIGN CONSULTANT cannot assure its accuracy. The DESIGN CONSULTANT shall not be responsible for the correctness or completeness which may have been incorporated into this record drawing by others. The DESIGN CONSULTANT shall not be responsible for any errors or omissions which may appear on this record drawing that were not originally prepared by the DESIGN CONSULTANT. The DESIGN CONSULTANT is not responsible for any subsequent changes made to this record drawing by others.
DESIGN CONSULTANT: Craig White — Date: 12/3/98

SCALE 1" = 40'
SHEET NO. P-7
FILE NO.

AS BUILT

CONSTRUCTION MANAGER

CONTRACTOR

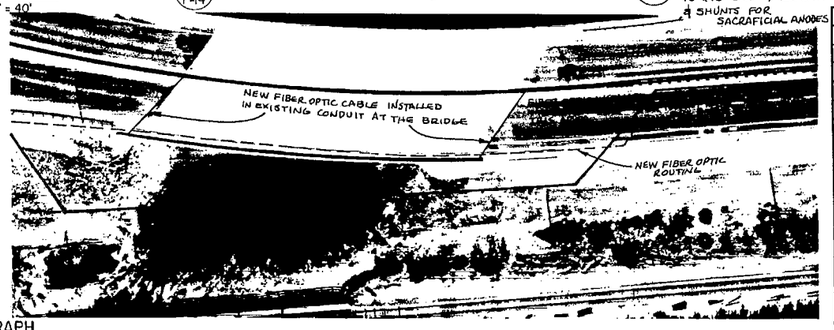
NOTES: 1. ARCHAEOLOGICAL MONITORING SHALL BE DONE FROM STA. 50+00 TO 75+00.
2. PALEONTOLOGICAL MONITORING SHALL BE DONE FROM STA. 54+00 TO STA. 68+40

EXIST. PAVEMENT
TELE CABLE
6" CLAY
4" ABS
16" RCP
EXIST. GRADE OVER ℄ OF PIPE
INSIDE TOP OF PIPE
4" RCP
PIPE INVERT
STA. 61+67.00
INV. EL. 32.50
STA. 64+37.00
INV. EL. 27.00
S=2.04%
S=5.60%
STA. 65+62.00
INV. EL. 20.00
S=12.19%
STA. 66+40.00
INV. EL. 8.00
END CASING
POLY LINED
30" DIP CLASS 200
30" DIP CLASS 350
MATCH LINE STA. 61+67.00 SEE SHT. P-7
STA. 63+60
WL VARIES
TEL. CABLE AØAN.
END STEEL CASING STA. 68+80
JACKED STEEL CASING
4" BLOWOFF ASSEMBLY STA. 68+95.00
EXIST. PAVEMENT
4" GAS LINE
S=0.31%
STA. 70+30.00
INV. EL. 24.00
S=12.31%
30" DIA. CLASS 350
MATCH LINE STA. 71+46.00 SEE SHT. P-9

PROFILE
SCALE: HORIZ: 1" = 40'
VERT: 1" = 4'

TOPOGRAPHY
SCALE: 1" = 40'

SORRENTO VALLEY RD.
S=0.00%
EL. 7.00
LIMITS OF CONSTRUCTION
FL 8.09
ROW
EDGE OF PAVEMENT
CAUTION! HIGH PRESSURE GAS LINE
16" ACP
16" WL
PULL BOX STA. 64+77
A P-15
65+00
62+00
24" RCP
18" RCP
10" VCP
16" ACP
SORRENTO VALLEY RD.
MATCH LINE STA. 61+67.00 SEE SHT. P-7
ANGLE PT. STA. 65+18.76
N 270,569.00
E 1,700,112.00
ANGLE PT. STA. 66+34.76
N 270,460,828
E 1,700,070.109
ANGLE PT. STA. 69+60.76
N 270,200.071
E 1,700,265.766
ANGLE PT. STA. 70+41.26
N 270,188.704
E 1,700,345.459
SILT FENCE E P-14
JACKED STEEL CASING A P-12
SEA. SACRIFICIAL ANODES (10 65' DEEP WELLS (ONE EA. SIDE MAIN))
EXIST. RIP-RAP
STA. 67+67.01
69+00
27.64' TO TOE
4" BLOWOFF ASSEMBLY STA. 68+95.00
CAUTION! SEE NOTE ON SHT. P-1
C.P. TEST STATION # 12"x12" BOX W/ TERMINATIONS & SHUNTS FOR SACRIFICIAL ANODES
PULL BOX STA 70+00 FIBER OPTICS MODIFIED STA #64+77 TO STA 70+00
EDGE OF PAVEMENT
MATCH LINE STA. 71+46.00 SEE SHT. P-9
0 20 40 80 FEET



PHOTOGRAPH

FORCE MAIN DATA

NO.	DELTA/BRG.	RADIUS	LENGTH	REMARKS
1	S10°40'25"E		396.27'	30" D.I.P.
2	S21°10'11"W		116.00'	30" D.I.P.
3	S36°52'57"E		326.00'	30" D.I.P.
4	S81°52'57"E		80.50'	30" D.I.P.
5	S37°05'28"E		417.09'	30" D.I.P.

PLANS FOR THE CONSTRUCTION OF:
PUMP STATION No. 65 RELOCATION

30 INCH FORCE MAIN
STA. 61+67.00 TO STA. 71+46.00

CITY OF SAN DIEGO, CALIFORNIA
WATER UTILITIES DEPARTMENT
SHEET 129 OF 141 SHEETS

CLEAN WATER PROGRAM DIRECTOR — DATE

E.W.O. 170511
W.O. 170511
CIP 46-117.0
SPEC. NO. 93-004

ENGINEERING SUPERINTENDENT

DESCRIPTION	BY	APPROVED	FILMED
As Built	C.W.	8/98	

DESIGN ENGINEER — 1/24/94

CONTROL CERTIFICATION

CONSTRUCTION RECORD
CONTRACTOR: MINGUS CONSTRUCTION, INC. DATE STARTED 6/94
INSPECTOR: C.R. CREEL/A. IANNI DATE COMPLETED 12/97
CONNECTIONS BY:

270-1695
LAMBERT COORDINATES
24989-129-D

NO.	DATE	REVISIONS	BY
	8/98	AS-BUILT	C.W.

PROJECT NO. SD006
DESIGNED BY C. WHITE, S. SHUMAKER 2-93
DRAWN BY C. PATIL 3-93
CHECKED BY D. DUPREY 3-93
ENGINEER Craig T. White DATE 3/7/93
REGISTRATION NO. C33684

REGISTERED PROFESSIONAL ENGINEER CRAIG T. WHITE No. C 33684 Exp. 6/30/94 CIVIL STATE OF CALIFORNIA

ENGINEERING-SCIENCE
DESIGN ● RESEARCH ● PLANNING
9404 GENESEE AVENUE, SUITE NO 1 LA JOLLA, CALIFORNIA 92037 - 619/453-9600
OFFICES IN PRINCIPAL CITIES
ES

RECOMMENDED: T. KNUTSEN Date 12/19/97
Craig White Date 12/19/97

SCALE 1" = 40'
SHEET NO. P-8
FILE NO.

AS BUILT

0 1 2 3 4 IN.

City of San Diego

CITY CONTACT: CLAUDIA ABARCA, CONTRACT SPECIALIST; Email: CAbarca@sandiego.gov
Phone No. 619-533-3439; Fax No. 619-533-3633

ADDENDUM "A"

FOR

PUMP STATION 65 CAPACITY UPGRADE PROJECT

BID NO.:	K-13-5522-DBB-3-A
SAP NO. (WBS/IO/CC):	B-00306
CLIENT DEPARTMENT:	2011
COUNCIL DISTRICT:	1
PROJECT TYPE:	BP

BID DUE DATE:

2:00 PM
MAY 22, 2013
CITY OF SAN DIEGO
PUBLIC WORKS DEPARTMENT
1010 SECOND AVENUE, SUITE 1400, MS 614C
SAN DIEGO, CA 92101

ENGINEER OF WORK

The engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Engineer:

Registered Engineer

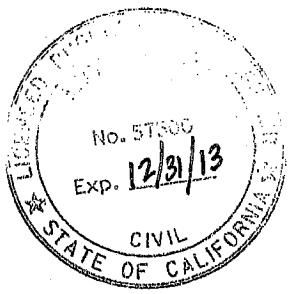
05/16/13
Date

Seal:

For City Engineer

5/16/13
Date

Seal:



A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the Contract Documents are hereby made effective as though originally issued with the bid package. Bidders are reminded that all previous requirements to this solicitation remain in full force and effect.

B. BIDDER's QUESTIONS

Q1. Drawings D-3, S-4, and M-2 indicate that the bottom elevation of the wet well is -33.55. However, Details D and E on Drawing S-7 indicate that the bottom elevation of the wet well is -35.55. It appears that elevation -33.55 is correct. Please confirm.

A1. Elevation of the wet well invert is -33.55 feet.

Q2. Specification Section 02999, page 151, paragraph 2.3 indicated that a stop log system should be installed to an elevation of -9.00 for a total height of 26.55' However, if the bottom elevation of the wet well is actually -33.55 as we believe, the required height of the stop log system to elevation -9.00 would only be 24.55 feet. Please confirm that the height of the stop log system should be 24.55' rather than 26.55'.

A2. The height of the stop log is 24.55 feet.

Q3. Please reference SSP 6-8.3 Warranty. There is no fiber optic on the project. Please clarify this.

A3. There is no fiber optic on this Project.

Q4. What is DWT and does it apply to this project?

A4. DWT is Detectable Warning Tile. It does not apply to this Project.

Q5. There is no LED signal on the project. please clarify.

A5. There is no LED signal on this Project.

Q6. Please clarify what the Private sewer pump station is.

A6. Private Sewer Pump Station does not apply to this Project.

Tony Heinrichs, Director
Public Works Department

Dated: *May 20, 2013*
San Diego, California

TH/nb/ca/egz

5/23/13 CW

City of San Diego

CONTRACTOR'S NAME: NEWEST CONSTRUCTION CO., INC.
ADDRESS: 7847 DONBROOK RD, STE. C., SAN DIEGO, CA 92126
TELEPHONE NO.: 858-537-0774 FAX NO.: 858-537-9653
CITY CONTACT: CLAUDIA ABARCA, CONTRACT SPECIALIST; Email: CAbarca@sandiego.gov
Phone No. 619-533-3439; Fax No. 619-533-3633
C.Dadachanji/N.Batta/egz

CONTRACT DOCUMENTS

FOR

PUMP STATION 65 CAPACITY UPGRADE PROJECT

VOLUME 2 OF 2

BID NO.:	K-13-5522-DBB-3-A
SAP NO. (WBS/IO/CC):	B-00306
CLIENT DEPARTMENT:	2011
COUNCIL DISTRICT:	1
PROJECT TYPE:	BP

THIS CONTRACT IS SUBJECT TO THE FOLLOWING:

- THE CITY'S SUBCONTRACTING PARTICIPATION REQUIREMENTS FOR SLBE PROGRAM.
- PREVAILING WAGE RATES: **STATE.**
- PHASED-FUNDING.
- THIS IS A PARTICIPATION AGENCY FUNDED CONTRACT.

THIS BIDDING DOCUMENT TO BE SUBMITTED IN ITS ENTIRETY
REFER TO VOLUME 1 COVER PAGE FOR TIME, DATE, AND LOCATION

TABLE OF CONTENTS

Volume 2 - Bidding Documents

The following forms must be completed in their entirety and submitted with the Bid. Include the form(s) even if the information does not apply. Where the information does not apply write in N/A. Failure to include any of the forms may cause the Bid to be deemed **non-responsive.** If you are uncertain or have any questions about any required information, contact the City no later than 14 days prior to Bid due date.

DESCRIPTION **PAGE NUMBER**

PROPOSAL

Bidder's General Information

To the City of San Diego:

Pursuant to "Invitation to Bids", specifications, and requirements on file with the City Clerk, and subject to all provisions of the Charter and Ordinances of the City of San Diego and applicable laws and regulations of the United States and the State of California, the undersigned hereby proposes to furnish to the City of San Diego, complete at the prices stated herein, the items or services hereinafter mentioned. The undersigned further warrants that this bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

The undersigned bidder(s) further warrants that bidder(s) has thoroughly examined and understands the entire Contract Documents (plans and specifications) and the Bidding Documents therefore, and that by submitting said Bidding Documents as its bid proposal, bidder(s) acknowledges and is bound by the entire Contract Documents, including any addenda issued thereto, as such Contract Documents incorporated by reference in the Bidding Documents.

IF A SOLE OWNER OR SOLE CONTRACTOR SIGN HERE:

(1) Name under which business is conducted_____

(2) Signature (Given and surname) of proprietor _____

(3) Place of Business (Street & Number) _____

(4) City and State _____ Zip Code _____

(5) Telephone No. _____ Facsimile No. _____

IF A PARTNERSHIP, SIGN HERE:

(1) Name under which business is conducted _____

(2) Name of each member of partnership [indicate character of each partner, general or special (limited):

_____

_____

(3) Signature (Note: Signature must be made by a general partner)

_____

Full Name and Character of partner

_____

_____

(4) Place of Business (Street & Number) _____

(5) City and State _____ Zip Code _____

(6) Telephone No. _____ Facsimile No. _____

IF A CORPORATION, SIGN HERE:

(1) Name under which business is conducted NEWEST CONSTRUCTION CO., INC.

(2) Signature, with official title of officer authorized to sign for the corporation:

_____
(Signature)

MARK S. JENNETTE
(Printed Name)

PRESIDENT
(Title of Officer)

(Impress Corporate Seal Here)

(3) Incorporated under the laws of the State of CA

(4) Place of Business (Street & Number) 7847 DUNBROOK RD #C

(5) City and State SAN DIEGO Zip Code CA

(6) Telephone No. 858-537-0774 Facsimile No. 858-537-9653

THE FOLLOWING SECTIONS MUST BE FILLED IN BY ALL PROPOSERS:

In accordance with the "**INVITATION TO BIDS**", the bidder holds a California State Contractor's license for the following classification(s) to perform the work described in these specifications:

LICENSE CLASSIFICATION A, B, C10

LICENSE NO. 847555 EXPIRES 9/30, 2014

This license classification must also be shown on the front of the bid envelope. Failure to show license classification on the bid envelope may cause return of the bid unopened.

TAX IDENTIFICATION NUMBER (TIN): [redacted]

E-Mail Address: MJENNETTE@NEWESTCO.COM

NON-COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID UNDER 23 USC 112 AND PCC 7106

State of California)
) ss.
County of San Diego)

Mark S Jennette, being first duly sworn, deposes and says that he or she is President of the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

Signed: _____

Title: President

Subscribed and sworn to before me this 16th day of May, 2013

Terri L Jennette
Notary Public

(SEAL)

CONTRACTORS CERTIFICATION OF PENDING ACTIONS

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of all instances within the past ten years where a complaint was filed or pending against the Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

CHECK ONE BOX ONLY.

☑ The undersigned certifies that within the past 10 years the Bidder has NOT been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers.

☐ The undersigned certifies that within the past 10 years the Bidder has been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers. A description of the status or resolution of that complaint, including any remedial action taken and the applicable dates is as follows:

DATE OF CLAIM	LOCATION	DESCRIPTION OF CLAIM	LITIGATION (Y/N)	STATUS	RESOLUTION/REMEDIAL ACTION TAKEN

Contractor Name: NEWEST CONSTRUCTION CO., INC.

Certified By MARC JENNETTE Title PRESIDENT

Name

Signature Date 5-22-13

USE ADDITIONAL FORMS AS NECESSARY

EQUAL BENEFITS ORDINANCE CERTIFICATION OF COMPLIANCE

For additional information, contact:
CITY OF SAN DIEGO
EQUAL BENEFITS PROGRAM
202 C Street, MS 9A, San Diego, CA 92101
Phone (619) 533-3948 Fax (619) 533-3220

COMPANY INFORMATION

Company Name: NEWEST CONSTRUCTION CO INC
Contact Name: MARK JENNETTE
Company Address: 7847 DUNBROOK RD
Contact Phone: 858-537-0774
SAN DIEGO, CA 92126
Contact Email: MJENNETTE@NEWESTCO.COM

CONTRACT INFORMATION

Contract Title:
Start Date:
Contract Number (if no number, state location):
End Date:

SUMMARY OF EQUAL BENEFITS ORDINANCE REQUIREMENTS

The Equal Benefits Ordinance [EBO] requires the City to enter into contracts only with contractors who certify they will provide and maintain equal benefits as defined in SDMC §22.4302 for the duration of the contract. To comply:

- Contractor shall offer equal benefits to employees with spouses and employees with domestic partners.
  - Benefits include health, dental, vision insurance; pension/401(k) plans; bereavement, family, parental leave; discounts, child care; travel/relocation expenses; employee assistance programs; credit union membership; or any other benefit.
  - Any benefit not offer an employee with a spouse, is not required to be offered to an employee with a domestic partner.
- Contractor shall post notice of firm's equal benefits policy in the workplace and notify employees at time of hire and during open enrollment periods.
- Contractor shall allow City access to records, when requested, to confirm compliance with EBO requirements.
- Contractor shall submit *EBO Certification of Compliance*, signed under penalty of perjury, prior to award of contract.

NOTE: This summary is provided for convenience. Full text of the EBO and Rules Implementing the EBO are available at *www.sandiego.gov/administration*.

CONTRACTOR EQUAL BENEFITS ORDINANCE CERTIFICATION

Please indicate your firm's compliance status with the EBO. The City may request supporting documentation.

☑ I affirm **compliance** with the EBO because my firm *(contractor must select one reason):*

- ☑ Provides equal benefits to spouses and domestic partners.
- ☐ Provides no benefits to spouses or domestic partners.
- ☐ Has no employees.
- ☐ Has collective bargaining agreement(s) in place prior to January 1, 2011, that has not been renewed or expired.

☐ I request the City's approval to pay affected employees a cash equivalent in lieu of equal benefits and verify my firm made a reasonable effort but is not able to provide equal benefits upon contract award. I agree to notify employees of the availability of a cash equivalent for benefits available to spouses but not domestic partners and to continue to make every reasonable effort to extend all available benefits to domestic partners.

It is unlawful for any contractor to knowingly submit any false information to the City regarding equal benefits or cash equivalent associated with the execution, award, amendment, or administration of any contract. [San Diego Municipal Code §22.4307(a)]

Under penalty of perjury under laws of the State of California, I certify the above information is true and correct. I further certify that my firm understands the requirements of the Equal Benefits Ordinance and will provide and maintain equal benefits for the duration of the contract or pay a cash equivalent if authorized by the City.

MARK JENNETTE/PRESIDENT
Name/Title of Signatory

Signature

FOR OFFICIAL CITY USE ONLY

Receipt Date: **EBO Analyst:** ☐ **Approved** ☐ **Not Approved – Reason:**

rev 02/15/2011

PROPOSAL (BID)

The Bidder agrees to the construction of **PUMP STATION 65 CAPACITY UPGRADE PROJECT**, for the City of San Diego, in accordance with these contract documents for the prices listed below. The Bidder guarantees the Contract Price for a period of 120 days (90 days for federally funded contracts and contracts valued at $500,000 or less) from the date of Bid opening to Award of the Contract. The duration of the Contract Price guarantee shall be extended by the number of days required for the City to obtain all items necessary to fulfill all conditions precedent e.g., bond and insurance.

Item	Quantity	Unit	NAICS	Payment Reference	Description	Unit Price	Extension
BASE BID							
1.	1	LS	237110	9-3	General Construction		$3,569,000
2.	1	LS	524126	9-3.5	Bonds (Payment and Performance)		$ 28,833
3.	1	AL	237110	9-3.6	Field Orders – Type II Allowance		$162,707.00
						ESTIMATED TOTAL BASE BID	$3,760,540

TOTAL BID PRICE FOR BID (Items 1 through 3 inclusive) amount written in words:
Three Million Seven Hundred Sixty Thousand Five Hundred Fourty dollars

The Bid shall contain an acknowledgment of receipt of all addenda, the numbers of which shall be filled in on the Bid form. If an addendum or addenda has been issued by the City and not noted as being received by the Bidder, this proposal shall be rejected as being **non-responsive**. The following addenda have been received and are acknowledged in this bid: A

The names of all persons interested in the foregoing proposal as principals are as follows:

MARK JEWNETTE - PRESIDENT, SECRETARY, TREASURER

IMPORTANT NOTICE: If Bidder or other interested person is a corporation, state secretary, treasurer, and manager thereof; if a co-partnership, state true name of firm, also names of all individual co-partners composing firm; if Bidder or other interested person is an individual, state first and last names in full.

Bidder: NEWEST CONSTRUCTION CO., INC.

Title: PRESIDENT

Business Address: 7847 DUNBROOK RD, STE C., SAN DIEGO, CA 92126

Place of Business: SAN DIEGO, CA

Place of Residence: SAN DIEGO, CA

Signature:

NOTES:

A. The City shall determine the low Bid based on the Base Bid alone.

B. Prices and notations shall be in ink or typewritten. All corrections (which have been initiated by the Bidder using erasures, strike out, line out, or "white-out") shall be typed or written in with ink adjacent thereto, and shall be initialed in ink by the person signing the bid proposal.

C. Failure to initial all corrections made in the bidding documents shall cause the Bid to be rejected as **non-responsive** and ineligible for further consideration.

D. Blank spaces must be filled in, using figures. Bidder's failure to submit a price for any Bid item that requires the Bidder to submit a price shall render the Bid **non-responsive** and shall be cause for its rejection.

E. Unit prices shall be entered for all unit price items. Unit prices shall not exceed two (2) decimal places. If the Unit prices entered exceed two (2) decimal places, the City will only use the first two digits after the decimal points without rounding up or down.

F. All extensions of the unit prices bid will be subject to verification by the City. In the case of inconsistency or conflict between the product of the Quantity x Unit Price and the Extension, the product shall govern.

G. In the case of inconsistency or conflict, between the sums of the Extensions with the estimated total Bid, the sum of the Extensions shall govern.

H. Bids shall not contain any recapitulation of the Work. Conditional Bids will be rejected as being **non-responsive.** Alternative proposals will not be considered unless called for.

LIST OF SUBCONTRACTORS

In accordance with the requirements provided in the "Subletting and Subcontracting Fair Practices Act", Division 2, Part 1, Chapter 4 of the Public Contract Code, the Bidder shall list below the name and address of each Subcontractor who will perform work, labor, render services or specially fabricates and installs a portion [type] of the work or improvement, in an amount in excess of 0.5% of the Contractor's total Bid. The Bidder shall also list below the portion of the work which will be done by each subcontractor under this Contract. The Contractor shall list only one Subcontractor for each portion of the Work. The **DOLLAR VALUE** of the total Bid to be performed shall be stated for all subcontractors listed. Failure to comply with this requirement shall result in the Bid being rejected as non-responsive and ineligible for award. The Bidder's attention is directed to the Special Provisions - General; Paragraph 2-3 Subcontracts, which stipulates the percent of the Work to be performed with the Bidders' own forces. The Bidder shall list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors that Bidders are seeking recognition towards achieving any mandatory, voluntary, or both subcontracting participation percentages.

NAME, ADDRESS AND TELEPHONE NUMBER OF SUBCONTRACTOR	CONSTRUCTOR OR DESIGNER	TYPE OF WORK	DOLLAR VALUE OF SUBCONTRACT	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB ①	WHERE CERTIFIED ②	CHECK IF JOINT VENTURE PARTNERSHIP
Name: BLAIR RASMUSSEN CONSTR Address: 11315 RANCHO BERNARDO City: SAN DIEGO State: CA Zip: 92127 Phone: 858-613-9244	CONSTRUCTOR	HOT TAP/ BYPASS	270,000	ELBE	CITY	
Name: JES ASPHALT Address: 6121 FAIRMONT AVE City: SAN DIEGO State: CA Zip: 92160 Phone: 619-528-0593	CONSTRUCTOR	ASPHALT	14,882	SLBE	CITY	
Name: NATIONAL COATING & LINING Address: 21885 2ND ST STE J City: LAKE ELSINORE State: CA Zip: 92532 Phone: 951-471-3388	CONSTRUCTOR	COATING	29,730			

① As appropriate, Bidder shall identify Subcontractor as one of the following and shall include a valid proof of certification (except for OBE, SLBE and ELBE):

Certified Minority Business Enterprise	MBE	Certified Woman Business Enterprise	WBE
Certified Disadvantaged Business Enterprise	DBE	Certified Disabled Veteran Business Enterprise	DVBE
Other Business Enterprise	OBE	Certified Emerging Local Business Enterprise	ELBE
Certified Small Local Business Enterprise	SLBE	Small Disadvantaged Business	SDB
Woman-Owned Small Business	WoSB	HUBZone Business	HUBZone
Service-Disabled Veteran Owned Small Business	SDVOSB		

② As appropriate, Bidder shall indicate if Subcontractor is certified by:

City of San Diego	CITY	State of California Department of Transportation	CALTRANS
California Public Utilities Commission	CPUC	San Diego Regional Minority Supplier Diversity Council	SRMSDC
State of California's Department of General Services	CADoGS	City of Los Angeles	LA
State of California	CA	U.S. Small Business Administration	SBA

The Bidder will not receive any subcontracting participation percentages if the Bidder fails to submit the required proof of certification.

0.0836 CW

NAMED EQUIPMENT/MATERIAL SUPPLIER LIST

The Bidder seeking the recognition of equipment, materials, or supplies obtained from Suppliers towards achieving any mandatory, voluntary, or both subcontracting participation percentages shall submit with the Bid the Named Equipment/Material Supplier List. The Named Equipment/Material Supplier List, at a minimum, shall have the name, locations (City) and the **DOLLAR VALUE** of the Suppliers. The Bidder will be credited up to 60% of the amount to be paid to the Suppliers for such materials and supplies unless vendor manufactures or substantially alters materials and supplies in which case 100% will be credited. The Bidder is to indicate (Yes/No) whether listed firm is a supplier or manufacturer. In calculating the subcontractor participation percentages, vendors/suppliers will receive 60% credit of the listed **DOLLAR VALUE**, whereas manufacturers will receive 100% credit. If no indication provided, listed firm will be credited at 60% of the listed dollar value for purposes of calculating the Subcontractor Participation Percentage, Suppliers will receive 60% credit of the listed **DOLLAR VALUE**, whereas manufacturers will receive 100% credit. If no indication provided, listed firm will be credited at 60% of the listed **DOLLAR VALUE** for purposes of calculating the subcontractor participation percentages.

NAME, ADDRESS AND TELEPHONE NUMBER OF VENDOR/SUPPLIER	MATERIALS OR SUPPLIES	DOLLAR VALUE OF MATERIAL OR SUPPLIES	SUPPLIER (Yes/No)	MANUFACTURER (Yes/No)	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB ①	WHERE CERTIFIED ②
Name:_____ Address:_____ City:_____ State:_____ Zip:_____ Phone:_____						
Name:_____ Address:_____ City:_____ State:_____ Zip:_____ Phone:_____						
Name:_____ Address:_____ City:_____ State:_____ Zip:_____ Phone:_____						

① As appropriate, Bidder shall identify Vendor/Supplier as one of the following and shall include a valid proof of certification (except for OBE, SLBE and ELBE):

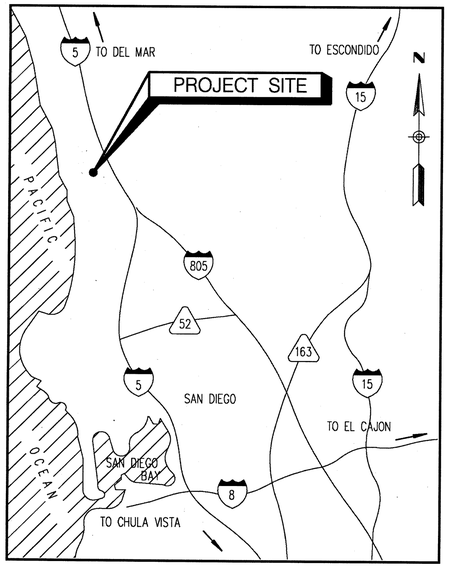
Certified Minority Business Enterprise	MBE	Certified Woman Business Enterprise	WBE
Certified Disadvantaged Business Enterprise	DBE	Certified Disabled Veteran Business Enterprise	DVBE
Other Business Enterprise	OBE	Certified Emerging Local Business Enterprise	ELBE
Certified Small Local Business Enterprise	SLBE	Small Disadvantaged Business	SDB
Woman-Owned Small Business	WoSB	HUBZone Business	HUBZone
Service-Disabled Veteran Owned Small Business	SDVOSB		

② As appropriate, Bidder shall indicate if Vendor/Supplier is certified by:

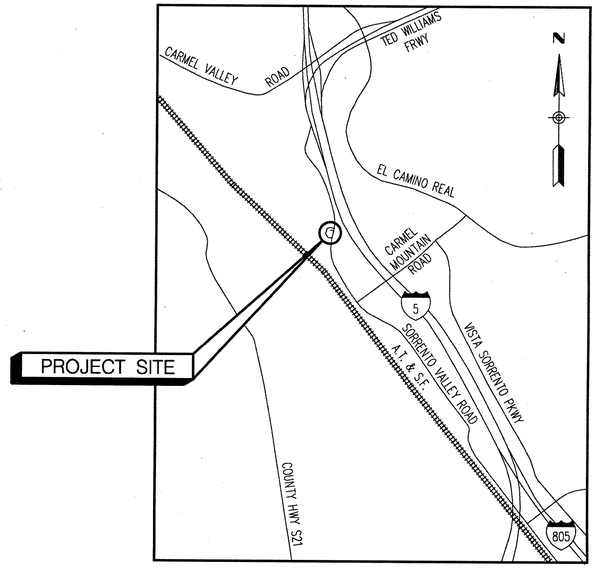
City of San Diego	CITY	State of California Department of Transportation	CALTRANS
California Public Utilities Commission	CPUC	San Diego Regional Minority Supplier Diversity Council	SRMSDC
State of California's Department of General Services	CADoGS	City of Los Angeles	LA
State of California	CA	U.S. Small Business Administration	SBA

The Bidder will not receive any subcontracting participation percentages if the Bidder fails to submit the required proof of certification.

PUMP STATION NO. 65
CAPACITY UPGRADE



VICINITY MAP
NOT TO SCALE



KEY MAP
NOT TO SCALE

* I HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS. I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE CITY OF SAN DIEGO IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

Eric R. Lovering August 20th, 2012
(ENGINEER'S NAME) DATE

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER ERIC R. LOVERING No. C70807 CIVIL STATE OF CALIFORNIA

G-1

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

COVER SHEET

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 01 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hoa G. Alan FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY Daniel Park ASSOCIATE ENGINEER
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695
LAMBERT COORDINATE
1914-6256
CCS83 COORDINATE
36349-01-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

PUMP STATION NO. 65 CAPACITY UPGRADE

n:\proj\844\design\General\G-01.dgn
8/6/2012 11:01:59 AM Daniel Park

LIMITS OF WORK

CITY OF SAN DIEGO DRAWING NO.	SHEET NO.	DESCRIPTION
		GENERAL
36349-01-D	G-1	COVER SHEET
36349-02-D	G-2	DRAWING INDEX
36349-03-D	G-3	STANDARDS, LEGENDS, GENERAL NOTES, & ABBREVIATIONS SHEET 1 OF 2
36349-04-D	G-4	STANDARDS, LEGENDS, GENERAL NOTES, & ABBREVIATIONS SHEET 2 OF 2
		CIVIL
36349-05-D	C-1	SITE & UNDERGROUND PIPING PLAN
		DEMOLITION
36349-06-D	D-1	WET WELL DEMOLITION PLAN
36349-07-D	D-2	DRY WELL DEMOLITION PLANS
36349-08-D	D-3	DEMOLITION SECTION
		STRUCTURAL
36349-09-D	S-1	STRUCTURAL NOTES SHEET 1 OF 2
36349-10-D	S-2	STRUCTURAL NOTES SHEET 2 OF 2
36349-11-D	S-3	STRUCTURAL PLAN
36349-12-D	S-4	STRUCTURAL SECTION
36349-13-D	S-5	PIPE SUPPORTS PLAN & SECTION
36349-14-D	S-6	PIPE SUPPORTS DETAILS
36349-15-D	S-7	WET WELL DETAILS
36349-16-D	S-8	MISCELLANEOUS DETAILS
		MECHANICAL
36349-17-D	M-1	MECHANICAL PLANS
36349-18-D	M-2	MECHANICAL SECTION
36349-19-D	M-3	MECHANICAL DETAILS
		ELECTRICAL
36349-20-D	E-1	ELECTRICAL LEGENDS & ABBREVIATIONS
36349-21-D	E-2	ELECTRICAL SITE PLAN
36349-22-D	E-3	ELECTRICAL DEMOLITION PLAN MOTOR/CONTROL ROOM LEVEL
36349-23-D	E-4	ELECTRICAL DEMOLITION SINGLE LINE DIAGRAM MCC-A & MCC-B
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G	GENERAL
C	CIVIL
D	DEMOLITION
S	STRUCTURAL
M	MECHANICAL
E	ELECTRICAL
I	INSTRUMENTATION

CONTRACTOR'S RESPONSIBILITIES

1. PURSUANT TO SECTION 4216 OF THE GOVERNMENT CODE, AT LEAST 2 WORKING DAYS PRIOR TO COMMENCING ANY EXCAVATION, THE CONTRACTOR SHALL CONTACT THE REGIONAL NOTIFICATION CENTER (UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA) AND OBTAIN AN INQUIRY IDENTIFICATION NUMBER.
2. THE CONTRACTOR SHALL NOTIFY SDG&E AT LEAST 10 WORKING DAYS PRIOR TO EXCAVATING WITHIN 10' OF SDG&E UNDERGROUND HIGH VOLTAGE TRANSMISSION POWER LINES. (i.e., 69 KV & HIGHER)

STORM WATER PROTECTION

1. THIS PROJECT IS SUBJECT TO MUNICIPAL STORM WATER PERMIT ORDER NO. R9-2007-0001 AND IS REQUIRED TO DEVELOP AND IMPLEMENT A "WATER POLLUTION CONTROL PLAN (WPCP)".

WATER POLLUTION CONTROL NOTES

THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS NOTED IN THE GREENBOOK 2009 CITY SUPPLEMENT SEC 801- WATER POLLUTION CONTROL.

PROJECT DATA

PROJECT NAME: PUMP STATION NO. 65 CAPACITY UPGRADE PROJECT

PROJECT ADDRESS: PUMP STATION 65
12112 SORRENTO VALLEY ROAD
SAN DIEGO, CA 92121

PROJECT MANAGER: CHISTI DADACHANJI (619) 533-4648

ZONE: OP-1-1, IL-3-1
OWNER: CITY OF SAN DIEGO

LEGAL DESCRIPTION: SEC 25-T14S-R4W

ASSESSOR'S PARCEL NUMBER: 310-020-2900

PLAN FILE NO: TBD
PERMIT NO(S): TBD

SUMMARY OF WORK

THE WORK IN THIS CONTRACT COMPRISES OF THE FOLLOWING BUT NOT LIMITED TO:

1. WET WELL MODIFICATIONS INCLUDING: DEMOLITION OF OPERATIONAL WET WELL DIVIDING WALL, DEMOLITION OF EXISTING 4' SQ. SLUICE GATES, AND CONCRETE AND RELINING WORK.
2. DEMOLITION AND REPLACEMENT OF TWO EXISTING 400-HP MOTORS WITH 500-HP MOTORS WITH VFDS FOR P-103 AND P-104.
3. REMOVAL AND REPLACEMENT OF ENTIRE LINESHAFT ASSEMBLIES FOR P-103 AND P-104.
4. REPLACEMENT OF EXISTING 23" IMPELLERS WITH 25" IMPELLERS FOR P-103 AND P-104.
5. INSTALLATION OF A NEW PUMP (P-105), COMPLETE WITH LINESHAFT AND 500-HP MOTOR WITH VFD.
6. INSTALLATON OF P-105 DISCHARGE PIPING AND CONNECTION TO EXISTING 36" DISCHARGE HEADER.
7. PROVIDE NEW ELECTRICAL, INSTRUMENTATION, AND CONTROLS TO MAKE THE SYSTEMS COMPLETE AND FUNCTIONAL.
8. REMOVAL OF PUMPS P-101 AND P-102 AND ASSOCIATED MOTORS AND ANCILLIARY EQUIPMENT.
9. PROVIDE, OPERATE, AND MAINTAIN TEMPORARY PUMPING FACILITIES DURING CONSTRUCTION.

PUMP STATION NO. 65 CAPACITY UPGRADE

G-2

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

DRAWING INDEX

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

ERIC R. LOVERIN No. C70807 REGISTERED PROFESSIONAL ENGINEER CIVIL STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 02 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hosri Accar FOR CITY ENGINEER 8-27-12 DATE

SUBMITTED BY Daniel Park ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

Abderrazik PROJECT ENGINEER

274-1695 LAMBERT COORDINATE

1914-6256 CCS83 COORDINATE

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

36349-02-D

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3/6/2012 11:02:01 AM Daniel Park

REFERENCE DRAWINGS

1. PUMP STATION NO. 65 RELOCATION PROJECT, 249890D
2. PUMP STATION NO. 65 EXPANSION PROJECT, 23334-D
3. LOS PENASQUITOS SEWERAGE SYSTEM FORCE MAIN NUMBER 1, 13644-39-D

BENCHMARK

CITY OF SAN DIEGO BRASS DISK "SORRENTO-2"
ELEV. 357.68'

WORK TYPE DESIGNATIONS

OR (D) - DEMOLITION

OR (E) - EXISTING

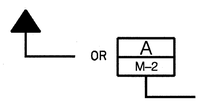
OR (N) - NEW WORK

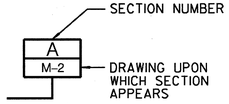
ABBREVIATIONS

AB	ANCHOR BOLT
ABAND	ABANDON
AD	AREA DRAIN
ASSY	ASSEMBLY
A/V	AIR RELEASE AND VACUUM VALVE
BFG	BELOW FINISHED GRADE
BF	BLIND FLANGE
BMP	BEST MANAGEMENT PRACTICES
BTWN	BETWEEN
C, ℄	CENTERLINE
CB	CATCH BASIN
CLR	CLEAR
CO	CLEAN OUT
CONC	CONCRETE
COND	CONDUIT
CONT	CONTINUATION
CP	CONTROL PANEL
CV	CHECK VALVE
(D)	DEMOLISH
DG	DECOMPOSED GRANITE
DI	DUCTILE IRON
DIA, ø	DIAMETER
DWG	DRAWING
EF	EACH FACE
EL, ELEV	ELEVATION
ELEC	ELECTRICAL
EMBED	EMBEDMENT
(E), EX, EXIST	EXISTING
EV	ELECTRICAL VAULT
EW	EACH WAY
FD	FLOOR DRAIN
FF	FILTER FEED, FINISHED FLOOR
FG	FINISHED GRADE
FH	FIRE HYDRANT
FL/FLG	FLOW LINE/FLANGED
FLR	FLAIR/FLOOR
FPW	FIRE PROTECTION WATER
FS	FINISHED SURFACE/FORGED STEEL
G	GATE
GR	GROOVED
GV	GATE VALVE
HP	HIGH PRESSURE/HORSE POWER
HSS	HOLLOW STRUCTURAL SECTIONS
HV	HAND VALVE
HWL	HIGH WATER LEVEL
ID	INNER DIAMETER
IE	INVERT ELEVATION
LB/LBS	POUNDS
LWL	LOW WATER LEVEL
MAX	MAXIMUM
MECH	MECHANICAL
MFR	MANUFACTURER
MIN	MINIMUM
MJ	MECHANICAL JOINT
(N)	NEW
NG	NATURAL GAS
NO	NUMBER
OC	ON CENTER
OPNG	OPENING
P	PUMP
ℙ	PLATE
PCF	POUNDS PER CUBIC FOOT
PE	PLAIN END
POC	POINT OF CONNECTION
PROP	PROPOSED
PS	PIPE SUPPORT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
PW	POTABLE WATER
RD	ROOF DRAIN
REQ'D	REQUIRED
RT	RIGHT
S	SURVEY LINE
SCH, SCHD	SCHEDULE
SD	STORM DRAIN
SDG&E	SAN DIEGO GAS AND ELECTRIC
SDMH	STORM DRAIN MANHOLE
SDR	SUMP DRAIN
SDRMH	SUMP DRAIN MANHOLE
SHC	SODIUM HYPOCHLORITE
SIM	SIMILAR
SLV	STREET LIGHT VAULT
SMH	SEWER MANHOLE
SQ	SQUARE
SST	STAINLESS STEEL
STR	STRUCTURAL
SVT	SANITARY VENT
SWR	SEWER
TBD	TO BE DETERMINED
TC	TOP OF CURB
TEL	TELEPHONE
TEMP	TEMPORARY/TEMPERATURE
TG	TOP OF GRATE
TOS	TOP OF STEEL
TP	TOP OF PIPE
TYP	TYPICAL
UMH	UTILITY MANHOLE
UNK	UNKNOWN
UV	UTILITY VAULT
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
W	WIDE
W/	WITH

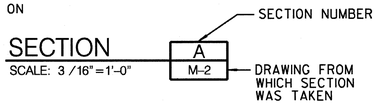
SECTION AND DETAIL IDENTIFICATION

SECTION CUT ON DRAWING G-1:

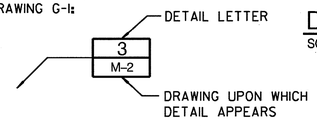




SECTION AS APPEARS ON DRAWING G-2:



PROJECT SPECIFIC DETAIL CALLED OUT ON DRAWING G-1:



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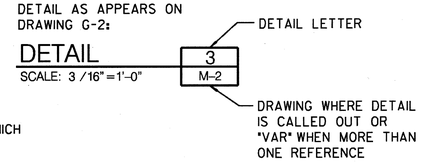
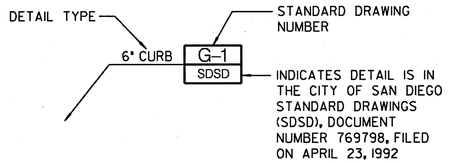


CITY OF SAN DIEGO STANDARD DETAIL IS CALLED OUT ON PLAN OR SECTION AS:



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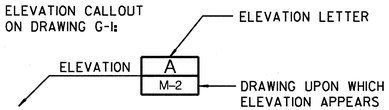

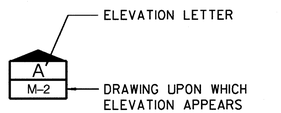

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING

0 1

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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER ERIC R. LOVERIN No. C70807 CIVIL STATE OF CALIFORNIA

PUMP STATION NO. 65 CAPACITY UPGRADE

G-3

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

STANDARDS, LEGENDS, GENERAL NOTES, & ABBREVIATIONS SHEET 1 OF 2

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 03 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hoyci Ajax FOR CITY ENGINEER 8-27-12 DATE

CHECKED BY Daniel Park ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

Mark Estrella PROJECT ENGINEER

274-1695 LAMBERT COORDINATE

1914-6256 CCS83 COORDINATE

36349-03-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

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PIPE AND FITTING SYMBOLS

DOUBLE LINE	SINGLE LINE	
		ELBOW UP
		ELBOW DOWN
		TEE UP
		TEE DOWN
		LATERAL UP
		LATERAL DOWN
		CONCENTRIC REDUCER
		ECCENTRIC REDUCER
		UNION
		CAP
		ANCHOR
		ELBOW, 90 DEGREE
		CROSS
		TEE
		ELBOW, 45 DEGREE
		LATERAL
		GATE VALVE
		BUTTERFLY VALVE
		CHARACTERIZED BALL CONTROL VALVE
		BALL VALVE
		GLOBE TYPE MIXING VALVE
		DIAPHRAGM VALVE
OR		PLUG VALVE
		CHECK VALVE

PIPE AND FITTING SYMBOLS (CONT'D)

DOUBLE LINE	SINGLE LINE	
		SLEEVE TYPE (FLEXIBLE) COUPLING
		BALL CHECK VALVE
		PRESSURE GAUGE AND VALVE
		COMBINATION AIR VALVE

GENERAL LEGEND

- CENTERLINE
- EXISTING FENCE
- 123 — CONTOUR LINE, PROPOSED FINISHED GRADE
- 123.20 — EXISTING SPOT ELEVATION
- (123.20) — FINISHED SPOT ELEVATION
- PROPOSED REDUCER, PROPOSED PIPE
- EXISTING REDUCER
  NOTE: EXISTING REDUCER TO BE SHOWN ONLY WHEN CONNECTING TO A PROPOSED PIPE.
- EXIST PVMT — EXISTING PAVEMENT
- EXIST GRADE — EXISTING GRADE
- CURB LINE
- PROPERTY LINE ALONG STREET OR ALLEY R/W
- MH — EXISTING MANHOLE - PLAN

MATERIAL SYMBOLS

- CONCRETE
- CHECKERED PLATE
- GRASS
- SPAN
- GRATING
- EARTH

PIPING DESIGNATION

EXAMPLE:

16" RAS

16" RAS

- PIPE USE IDENTIFICATION LEGEND
- NOMINAL PIPE DIAMETER

NOTES:

1. ONLY FLANGED END CONNECTIONS ARE SHOWN HERE FOR DOUBLE LINE FITTINGS. FITTINGS WITH OTHER END PATTERNS ARE SHOWN SIMILARLY ON THE CONSTRUCTION DRAWINGS.
2. SYMBOLS SHOWN HERE FOR SINGLE LINE FITTINGS ARE GENERIC ONLY.

GENERAL PIPING NOTES

1. LAY PIPE TO UNIFORM GRADE BETWEEN INDICATED ELEVATION POINTS.
2. SIZE OF FITTINGS SHOWN ON PLANS SHALL CORRESPOND TO ADJACENT STRAIGHT RUN OF PIPE, UNLESS OTHERWISE INDICATED. TYPE OF JOINT AND FITTING MATERIAL SHALL BE THE SAME AS SHOWN FOR ADJACENT STRAIGHT RUN OF PIPE.
3. LOCATION AND NUMBER OF PIPE HANGERS AND PIPE SUPPORTS SHOWN IS ONLY APPROXIMATE. THE CONTRACTOR SHALL DESIGN PIPING SUPPORT SYSTEMS IN ACCORDANCE WITH THE SPECIFICATIONS. MAXIMUM SPACING SHALL BE AS SPECIFIED.
4. ALL JOINTS SHALL BE WATERTIGHT. WALL PIPES WITH THRUST COLLARS AS SPECIFIED SHALL BE USED WHEREVER PIPING PASSES FROM A STRUCTURE TO BACKFILL.
5. ALL FLEXIBLE CONNECTORS OR FLANGED COUPLING ADAPTERS SHALL BE PROVIDED WITH THRUST TIES, BLOCKS, OR ANCHORS, UNLESS OTHERWISE NOTED. THRUST PROTECTION SHALL BE ADEQUATE FOR TEST PRESSURES SPECIFIED.
6. SYMBOLS, LEGENDS, AND PIPE USE IDENTIFICATIONS SHOWN SHALL BE FOLLOWED THROUGHOUT THE PLANS, WHEREVER APPLICABLE. NOT ALL OF THE VARIOUS PIPING COMPONENTS ARE NECESSARILY USED IN THE PROJECT.
7. NUMBER AND LOCATION OF UNIONS SHOWN ON PLANS IS ONLY APPROXIMATE. PROVIDE ALL UNIONS NECESSARY TO FACILITATE CONVENIENT REMOVAL OF VALVES AND MECHANICAL EQUIPMENT.
8. WHERE A GROOVED END COUPLING IS SHOWN, IT SHALL BE THE RIGID JOINT TYPE, UNLESS OTHERWISE SPECIFIED. WHERE A FLANGED COUPLING ADAPTER IS SHOWN, A STANDARD FLANGE SHALL BE JOINED TO THE COUPLING ADAPTER.

PIPING SCHEDULE

SIZE (INCH)	PIPING MATERIAL OPTIONS (EXPOSED PIPING)	
	PIPE	FITTINGS
6 AND SMALLER	2	6
20	3	7
30	4	7, 8
36	4	7, 8

1. FOR FIELD TEST PROCEDURES AND ADDITIONAL TEST REQUIREMENTS, SEE SPECIFICATIONS.
2. FOR PIPE LINING AND COATING, SEE SPECIFICATIONS.
3. EXPOSED PIPING SHALL BE PAINTED IN ACCORDANCE WITH SPECIFICATIONS.

PIPING MATERIAL SCHEDULE

GROUP NO.	MATERIAL
1	(NOT USED)
2	STEEL, ASTM 54, SCH 40, GALVANIZED
3	DUCTILE IRON
4	STEEL CYLINDER, SCH 80
5	(NOT USED)
6	GALVANIZED MALLEABLE IRON WITH NTP OR GROOVED ENDS
7	DUCTILE IRON, MECHANICAL JOINTS, RUBBER GASKET PUSH-ON JOINTS, FLANGED (CLASS 250), THICKNESS CLASS 50
8	STEEL SCH 80, SINGLE WELDED FIELD WEL JOINTS, MECHANICAL JOINT, FITTED FLANGES, CLASS E FLANGES 275 PSI

PUMP STATION NO. 65 CAPACITY UPGRADE

G-4

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING

0 1

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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

REGISTERED PROFESSIONAL ENGINEER — ERIC B. LOVERING — No. C70807 — CIVIL — STATE OF CALIFORNIA

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

STANDARDS, LEGENDS, GENERAL NOTES, & ABBREVIATIONS SHEET 2 OF 2

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 04 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Heidi Alan FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-04-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

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PUMP STATION NO. 65 CAPACITY UPGRADE

(E) ENTRANCE

(E) 30"ø FORCE MAIN

(E) 54"ø TRUNK SEWER

(E) JUNCTION STRUCRURE

(E) 6" FIRE

(E) SCREENING STRUCTURE

(E) ODOR CONTROL FACILITIES

(E) 36" FRP

(E) 42" FRP

(E) 24" FRP

(E) 20" FRP

(E) 24" FRP

(E) OVERFLOW WETWELL (BELOW)

9 POC (E) OVERFLOW WET WELL (BELOW)

5

(E) BLOWER BUILDING

(E) HV601

(E) METER VAULT

(N) TEMP BY-PASS PUMPING (SUCTION)

1 S-7 | 2 S-7 | 3

MAINTAIN 9' WIDE ACCESS CORRIDOR

2 (SIM) | M-3 (N) INSULATING GASKETS 10

(E) 3/4" AS

(E) 1" CL "B"

(E) OPERATIONAL WETWELL (BELOW)

(E) OPER. WETWELL (BELOW)

(E) CHEM. STORAGE (ABOVE)

(N) TEMP BY-PASS PUMPING (DISCHARGE)

1 | 2

1 | M-2

6

(E) 36"ø DISCHARGE PIPE

(E) 36" FLEXIBLE COUPLING

(E) MH NO 4

(E) 4" IRRI

(E) SURGE TANK

52.78'

(E) 36" HEADER

(E) 20" BY-PASS LINE

(E) PUMP STATION

(N) TEMP LINE STOP

4 | 8 | 7

(E) 6" DRAIN

POC (E) 20" BY-PASS

(N) TEMP BY-PASS LINE

(E) 4" DRAIN

(E) 3" WASTE

(E) $1\frac{1}{2}$" CL "B"

(E) $\frac{3}{4}$" AS

(E) 24" TRUNK SEWER

(E) 2" CL "A"

9'

25.65'

9'

MAINTAIN 9' WIDE ACCESS CORRIDOR

(E) MH NO 2

(E) MH NO 1

(E) 6" DRAIN

(E) 4" DRAIN

(E) 6" WATER SUPPLY

(E) FH

(E) 24" TRUNK SEWER

(E) CATCH BASIN

MECHANICAL BUILDING

(E) 4" CL "B"

(E) CATCH BASIN

NOTES:

1. SHADED ARE SHOWN IS FOR ILLUSTRATION PURPOSES ONLY AND THE CONTRACTOR SHALL ADOPT AND ADJUST THEIR MEANS AND METHODS AS NECESSARY, WITH PRIOR APPROVAL FROM THE CITY, TO PERFORM BY-PASS PUMPING OPERATIONS IN ACCORDANCE WITH SPECIFICATIONS 01014 AND 02999. AFTER BY-PASS OPERATIONS ARE COMPLETE ALL TEMPORARY DEVICES AND EQUIPMENT SHALL BE REMOVED TO THE EXTENT POSSIBLE.
2. CONTRACTOR SHALL PROTECT ALL EXISTING UNDERGROUND UTILITIES DURING PREPARATION OF THE SITE AND WHILE PERFORMING BY-PASS PUMPING OPERATIONS. CONTRACTOR SHALL RESTORE PAVEMENT ON BY-PASS PUMPING LAYOUT AREA AND CONCRETE CURB TO THEIR ORIGINAL CONDITION.
3. PROVIDE TEMPORARY BY-PASS PUMPING LINE IF REQUIRED FOR CONTRACTOR'S BY-PASS SCHEME PER SPEC 02999. CONTRACTOR SHALL CAP AND PLUG OVERFLOW WET WELL WALL PENETRATION AFTER PERFORMING BY-PASS PUMPING OPERATIONS.
4. (N) 36" x 30" TAPPING SADDLE. AFTER BY-PASS OPERATIONS ARE COMPLETE SADDLE MAY REMAIN BUT SHALL BE BLIND FLANGED.
5. SEE SHEET S-5 FOR NEW SLUICE GATE DETAIL. (REQUIRED REGARDLESS OF CONTRACTORS ADOPTED BY-PASS PUMPING PLAN).
6. (N) TEMP 30" RUN x 20" BRANCH CROSS.
7. (N) TEMP 20" 90 ELL.
8. (N) TEMP 20" ISOLATION VALVE.
9. CONTRACTOR TO CONSIDER USE OF SUBMERSIBLE PUMPS DUE TO HIGH SUCTION LIFT REQUIREMENTS OF THE SITE VS USING ABOVE GRADE HIGH SUCTION LIFT SELF PRIMING PUMPS. CONTRACTOR TO PROVIDE HYDRAULIC CALCULATIONS FROM LICENSED ENGINEER TO SUPPORT THEIR BY-PASS PUMPING SCHEME.
10. PROVIDE A NEW INSULATING GASKET INSIDE THE METER VAULT ON THE DOWNSTREAM SIDE OF HV601 FLANGE. CONTRACTOR TO DEVELOP THEIR OWN BYPASSING PLAN TO INSTALL THE NEW INSULATING GASKET AND SUBMIT THE PLAN TO THE CITY FOR APPROVAL. BYPASS PLAN SHALL ADDRESS KEEPING THE STATION FULLY OPERATIONAL AND PREVENT HYDRAULIC SURGE FROM DAMAGING THE FORCEMAIN DURING BYPASS OPERATIONS. THE CONTRACTOR SHALL INTEGRATE AND COORDINATE THIS WORK IN ADDITION TO THE WORK SPECIFIED IN SECTION 01014 WORK SEQUENCING. THE CONTRACTOR SHALL COMPLY WITH SECTION 02999 TEMPORARY HANDLING OF SEWAGE FLOW.

SITE PLAN

SCALE: 1"=10'

N

0 10 20 30

SCALE 1"=10'

C-1

CONSTRUCTION CHANGE / ADDENDUM			
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

REGISTERED PROFESSIONAL ENGINEER ERIC R. LOVELAND No. C70807 CIVIL STATE OF CALIFORNIA

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

SITE & UNDERGROUND PIPING PLAN

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 05 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: FOR CITY ENGINEER — DATE 8-27-12
SUBMITTED BY: ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

PROJECT ENGINEER

274-1695
LAMBERT COORDINATE

1914-6256
CCS83 COORDINATE

CONTRACTOR ____ DATE STARTED ____
INSPECTOR ____ DATE COMPLETED ____

36349-05-D

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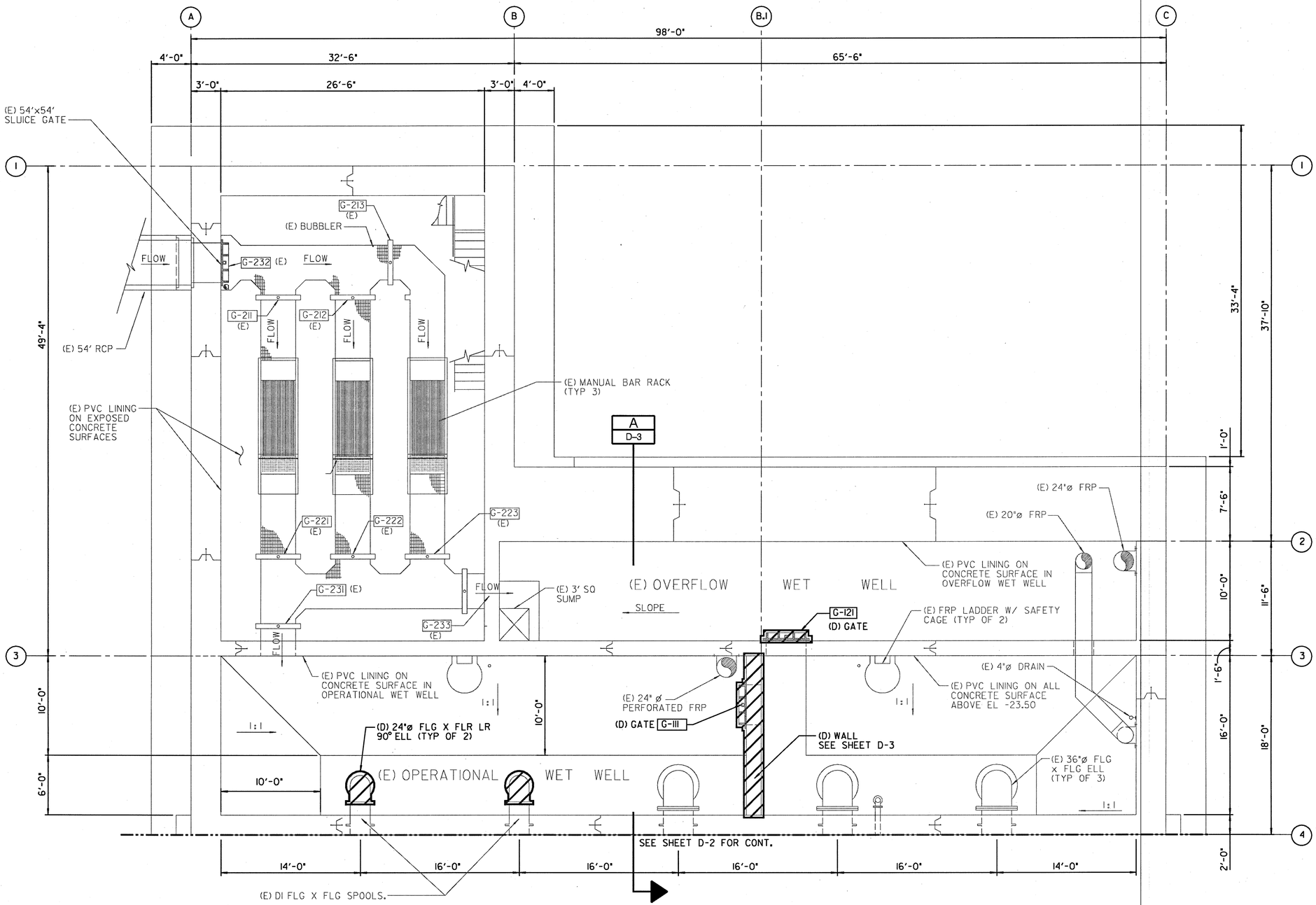

WET WELL DEMOLITION PLAN 1
SCALE: 3/16" = 1'-0"

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SCALE 3/16" = 1'-0"

D-1

PUMP STATION NO. 65 CAPACITY UPGRADE

PUMP STATION NO. 65
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WET WELL DEMOLITION PLAN

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 06 OF 40 SHEETS

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PROJECT ENGINEER
274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-06-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER ERIC R. LOVEJOY No. C 70807 CIVIL STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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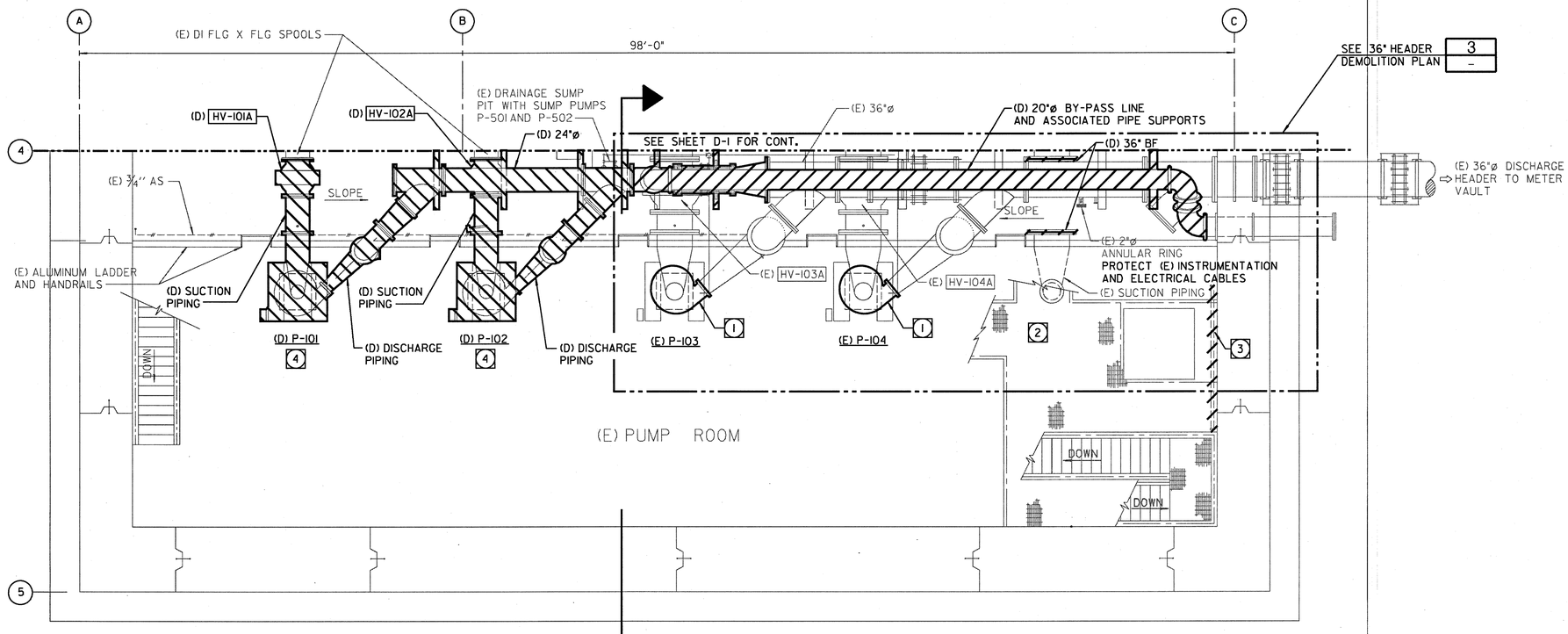

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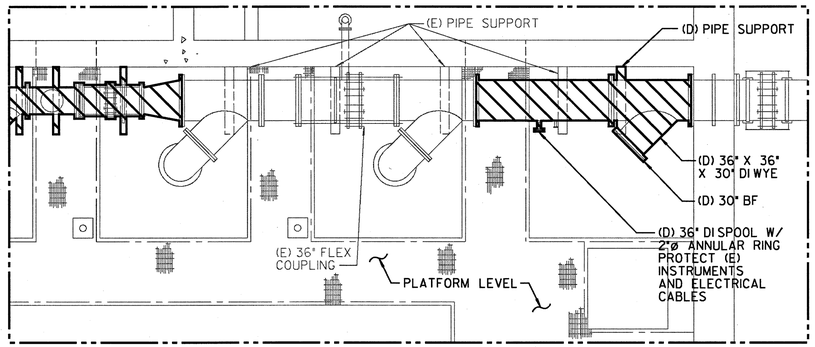
DRY WELL DEMOLITION PLAN 2 -

SCALE: 3/16"=1'-0"



36" HEADER DEMOLITION PLAN 3 -

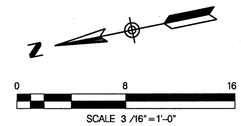
SCALE: 3/16"=1'-0"

NOTES:

1. (E) P-103 AND (E) P-104, THE PUMPS' VOLUTE AND CASING SHALL REMAIN, AND THE FOLLOWING ITEMS SHALL BE DEMOLISHED AND REPLACED PER SPECIFICATIONS: 23" DIA IMPELLERS, ENTIRE LINESHAFT ASSEMBLIES INCLUDING U-JOINTS AND BEARINGS, WEAR RINGS, CASE WEAR RINGS, PUMP BEARINGS, SEALS, GASKETS, AND ASSOCIATED ANCILLARY EQUIPMENT.
2. NOT ALL ALUMINUM GRATING SHOWN FOR CLARITY.
3. REMOVE PUMP SEAL WATER SUPPLY AND RETURN PIPING AND PIPE SUPPORTS. SEAL WATER SYSTEM IS NOT CURRENTLY OPERATIONAL AND CONSISTS OF APPROXIMATELY 200 LF OF PVC PIPE. PIPING BEGINS AT SW CORNER OF MOTOR/CONTROL ROOM, RUNS ALONG SOUTHERN WALL OF PUMP STATION, AND TERMINATES NEAR P-101, P-102, P-103, AND P-104. NOT ALL SEAL WATER PIPING IS SHOWN FOR CLARITY.
4. CONTRACTOR SHALL SALVAGE P-101 AND P-102 AND ALL ASSOCIATED EQUIPMENT. SEE TABLE BELOW FOR COMPLETE LIST OF SALVAGED ITEMS (SEE SHEET E-3 FOR ADDITIONAL ELECTRICAL DEMOLITION ITEMS):

LIST OF ITEMS TO BE SALVAGED	
ITEM	QUANTITY
24" PLUG VALVE	2
20" CHECK VALVE	2
20" PLUG VALVE	2
VIBRATION SENSORS	4
150-HP MOTOR	2
400-HP MOTOR	2
20" DI 90 GRxGR ELL	2
24"x24"x20" DI WYES	2
20" KNIFE GATE VALVE	2
20" DI FLxMJ 90 ELL	1
20" VICTAULIC COUPLING	6
24" VICTAULIC COUPLINGS	2
36" BLIND FLANGE	2
30" BLIND FALGE	1
36"x36"x30" WYE	1
24"x24"x20" DI TEE	1
24"x36" DI REDUCER	1
PRESSURE GAUGES	4
TRANSMITTERS	4
150-HP MOTOR FEEDER CABLES, CONTROL/ INSRUMENT DEVICE AND CABLES	2
400-HP MOTOR FEEDER CABLES, CONTROL/ INSTRUMENT DEVICE AND CABLES	2
150-HP MOTOR STARTER AND BREAKER	2
400-HP MOTOR STARTER AND BREAKER	2
CONTROL CABINET (CP-10 & CP-20)	2

CONTRACTOR SHALL DELIVER ALL SALVAGED EQUIPMENT TO THE CITY'S PUBLIC UTILITIES DEPARTMENT LOCATED AT: 9191 KEARNY VILLA COURT, SAN DIEGO, CA, 92123 (MOC-9). CONTRACTOR SHALL CLEAN, PALLETIZE, TAG, AND SHRINK WRAP ALL SALVAGED EQUIPMENT PRIOR TO DELIVERY. PROVIDE MANIFEST OF SALVAGED EQUIPMENT, AND COORDINATE DELIVERY WITH CITY STAFF.



D-2

PUMP STATION NO. 65 CAPACITY UPGRADE

PUMP STATION NO. 65 CAPACITY UPGRADE PROJECT (H094844)

DRY WELL DEMOLITION PLANS

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 07 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Hoc C. Ayo FOR CITY ENGINEER — DATE 8-27-12
SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
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274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-07-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

ERIC R. LOVERING No. C70007 — PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM

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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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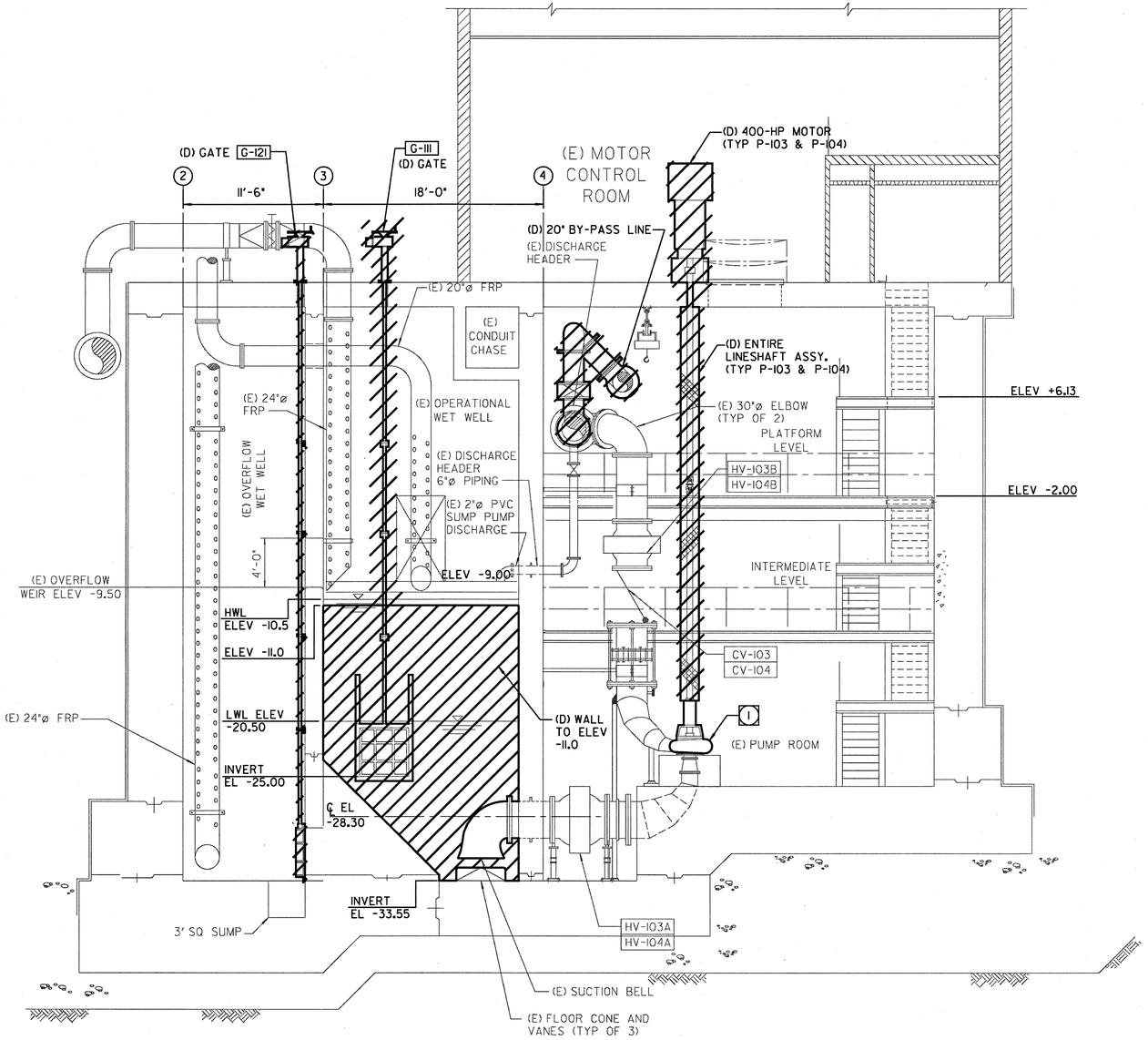
Daniel Park



DEMOLITION SECTION A

SCALE: 3/16"=1'-0"

D-1, D-2

NOTE:

1 SEE NOTE 1 ON SHEET D-2

0 8 16

SCALE 3/16"=1'-0"

PUMP STATION NO. 65 CAPACITY UPGRADE

D-3

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

DEMOLITION SECTION

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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW _X_

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ERIC R. LOVEN No. C70807 CIVIL STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 08 OF 40 SHEETS

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FOR CITY ENGINEER DATE

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WBS B-00306
WBS _____

SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER

274-1695
LAMBERT COORDINATE

1914-6256
CCS83 COORDINATE

36349-08-D

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STRUCTURAL NOTES

GENERAL

G1 THE NOTES AND TYPICAL DETAILS ARE APPLICABLE TO THE ENTIRE PROJECT EXCEPT WHERE SPECIFIED OR INDICATED OTHERWISE.

G2 ALL WORKMANSHIP AND MATERIALS SHALL CONFORM TO THE REQUIREMENTS OF THE CALIFORNIA BUILDING CODE, 2010 EDITION.

G3 THE CONTRACTOR SHALL VERIFY, PRIOR TO CONSTRUCTION, ALL DIMENSIONS CONTROLLED BY OR RELATED TO EQUIPMENT AND INSTRUMENTS SHOWN ON OTHER DRAWINGS.

G4 THE STRUCTURES HAVE BEEN DESIGNED FOR OPERATIONAL LOADS ON COMPLETED STRUCTURES. DURING CONSTRUCTION, THE STRUCTURES SHALL BE PROTECTED BY PROPER BRACING, REINFORCING AND BALANCING WHEREVER ADDITIONAL CONSTRUCTION LOADS MAY OCCUR.

G5 ALL WORK IN THIS PROJECT SHALL COMPLY WITH THE SPECIFIED SECTIONS OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, LATEST EDITION, AND SHALL BE EXECUTED IN ACCORDANCE WITH FEDERAL, STATE, COUNTY, AND CITY CODES AND REGULATIONS.

G6 ALL ASPHALT CONCRETE, CONCRETE PAVEMENT, AND OTHER EXISTING SURFACES DAMAGED BY CONSTRUCTION ACTIVITIES SHALL BE RESTORED TO THE ORIGINAL CONDITION OR BETTER AT THE CONTRACTOR'S EXPENSE.

G7 THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PERMITS AND INSPECTIONS REQUIRED BY THE DEPAERTMENT OF BUILDING AND SAFETY OF THE CITY OF SAN DIEGO AND ALL OTHERS DESCRIBED IN THE SPECIFICATIONS.

G8 UNLESS SPECIFIED OR SHOWN MORE RESTRICTIVE IN THE LATEST EDITIONS OF THE CALIFORNIA BUILDING CODE (CBC), ACI CODE, AISC MANUAL, AND AWS CODE, CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS.

G9 THE ENGINEER DOES NOT WARRANT THE ACCURACY OF THE DIMENSIONS AND ELEVATIONS OF EXISTING STRUCTURES SHOWN ON THE DRAWINGS. FIELD MEASUREMENT OF DIMENSIONS AND ELEVATIONS OF EXISTING AFFECTED ITEMS SHALL BE MADE PRIOR TO THE START OF CONSTRUCTION.

G10 SAFETY NOTES:

A) IT IS THE CONTRACTOR'S RESPONSIBILITY TO COMPLY WITH THE PERTINENT SECTIONS OF THE "CONSTRUCTION SAFETY ORDERS" ISSUED BY THE STATE OF CALIFORNIA, LATEST EDITION, AND ALL OSHA REQUIREMENTS AS THEY APPLY TO THIS PROJECT.

B) THE ENGINEER, AND THE OWNER DO NOT ACCEPT ANY RESPONSIBILITY FOR THE CONTRACTOR'S FAILURE TO COMPLY WITH THESE REQUIREMENTS.

C) THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUATE DESIGN AND CONSTRUCTION OF ALL FORMS AND SHORING REQUIRED.

G11 CONTRACTOR SHALL NOTIFY THE ENGINEER WHERE A CONFLICT OCCURS ON ANY OF THE CONTRACT DRAWINGS OR DOCUMENTS. CONTRACTOR IS NOT TO ORDER MATERIAL OR CONSTRUCT ANY PORTION OF THE BUILDING THAT IS IN CONFLICT UNTIL THE CONFLICT IS RESOLVED WITH THE AFFECTED PARTIES.

G12 ALL REQUIRED APPROVALS MUST BE OBTAINED FROM THE FIRE AND HAZARD PREVENTION SERVICES BEFORE THE BUILDING IS OCCUPIED.

G13 EXIT DOORS TO BE OPERABLE FROM THE INSIDE WITHOUT THE USE OF A KEY OR ANY SPECIAL KNOWLEDGE OR EFFORT.

G14 EPOXY DOWELS SHALL BE HILTI RE 500 SYSTEM PER ICC-ESR-2322, REDHEAD EPCON G5 SYSTEM PER ICC-ESR-1137, OR APPROVED EQUAL.

FOUNDATION / EARTHWORK

F1 FOOTINGS SHALL BEAR ON SOIL COMPACTED TO 95% RELATIVE DENSITY PER ASTM D1557.

F2 ALL FOOTINGS SHALL BE FORMED. FOUNDATIONS MAY BE PLACED IN EXCAVATIONS, PROVIDED WRITTEN PERMISSION IS OBTAINED FROM THE ENGINEER OF RECORD AND FOOTINGS ARE INCREASED THREE INCHES IN WIDTH.

F3 NOTIFY THE ENGINEER 72 HOURS IN ADVANCE OF PLACING CONCRETE.

F4 CONTRACTOR SHALL BE ENTIRELY RESPONSIBLE FOR DESIGN AND PROVISION OF ALL TEMPORARY SHORING.

STRUCTURAL STEEL

S1 FABRICATION AND ERECTION TO CONFORM TO A.I.S.C. LATEST EDITION "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL BUILDINGS" AND "CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES" EXCEPT AS OTHERWISE SHOWN OR SPECIED.

S2. A.W.S. CERTIFIED WELDERS SHALL BE USED FOR ALL WELDING. WELDING TO BE PERFORMED IN AISC CERTIFIED FABRICATOR SHOP OR EQUAL. ALL WELDING TO CONFORM TO THE LATEST EDITION OF THE AMERICAN WELDING SOCIETY STRUCTURAL WELDING CODE A.W.S. D1.1.

S3 MATERIALS:

ROLLED SHAPES	
WIDE FLANGES	ASTM A992 GRADE 50
CHANNELS, ANGLES & OTHER PLATES	ASTM A36
BEAM COVER/SIDE PLATES	ASTM A572 GRADE 50
COLUMN CONTINUITY PLATES	ASTM A572 GRADE 50
COLUMN BASE PLATES	ASTM A572 GRADE 50
OTHER UON	ASTM A36
STEEL PIPES	ASTM A53 GRADE B
STEEL TUBING	ASTM A500, GRADE B (Fy=46 KSI)
HIGH STRENGTH BOLTS	ASTM A325
MACHINE BOLTS	ASTM A307
ANCHOR BOLTS	ASTM F1554, GRADE 36 UON
THREADED AND HANGER ROD	ASTM A307
WELDED SHEAR CONNECTORS	ASTM A108 GRADE 1015 THRU 1020
GALVANIZING	ASTM A123
RUST-INHIBITING PRIMER	TT-P-645

S4 HOT-DIPPED GALVANIZE PER ASTM A123, A153, A385 AFTER FABRICATION OF ALL STRUCTURAL STEEL AND CONNECTORS EXPOSED TO WEATHER. REPAIR PER ASTM A780.

S5 CONNECTED MEMBERS SHALL BEAR ONLY UPON UNTHREADED PORTIONS OF BOLTS.

S6 BURNING OF HOLES IS NOT ALLOWED.

S7 INSPECTION OF WELDING SHALL CONFORM TO C.B.C. REQUIREMENTS (CHAPTER 17).

S8 THE STRUCTURAL STEEL FABRICATOR SHALL SUBMIT SHOP DRAWINGS TO THE ENGINEER FOR REVIEW PRIOR TO FABRICATION.

S9 BOLT HOLES SHALL BE 1/16" LARGER IN DIAMETER THAN NOMINAL SIZE OF BOLT USED, UNLESS NOTED OTHERWISE.

S10 ALL STRUCTURAL STEEL SURFACES TO RECEIVE SPRAY-APPLIED FIREPROOFING OR TO BE ENCASED IN CONCRETE OR MASONRY SHALL BE LEFT UNPAINTED.

S11 STRUCTURAL STEEL SHALL BE DELIVERED TO THE JOB SITE FREE OF EXCESSIVE RUST, MILL SCALE, GREASE, ETC.

S12 OPENING SHALL NOT BE PLACED IN STEEL MEMBERS UNLESS SPECIFICALLY DETAILED

S13 UNLESS OTHERWISE SHOWN OR SPECIFIED, STAINLESS STEEL SHALL BE TYPE 316.

WELDING

W1 ALL WELDING SHALL BE IN ACCORDANCE WITH THE PROVISIONS OF THE AMERICAN WELDING SOCIETY CODE D1.1. (LATEST EDITION). ALL WELDING SYMBOLS ARE SHOWN IN ACCORDANCE TO STEEL CONSTRUCTION MANUAL TABLE 8.2.

W2 ALL WELDING SHALL BE DONE BY CERTIFIED WELDERS.

W3 ALL WELDS SHALL HAVE A WELD CONTROLLED SEQUENCE AND TECHNIQUE IN ORDER TO MINIMIZE SHRINKAGE, STRESSES AND DISTORTION.

W4 ALL ELECTRODES FILLER MATERIAL SHALL BE A MINIMUM OF E70XX.

W5 WELDING OF REINFORCING BARS TO BE IN ACCORDANCE WITH A.W.S. D1.4. REINFORCING STEEL TO BE WELDED SHALL HAVE A CARBON EQUIVALENT (CE) OF 0.75. SPECIAL INSPECTION IS REQUIRED.

WELDING (CONT'D)

W6 WELDING OF SHEET METAL SHALL BE IN ACCORDANCE WITH A.W.S. D1.3.

W7 SPECIAL INSPECTION IS REQUIRED FOR ALL FIELD WELDING.

W8 ALL SHOP AND FIELD WELDING OF MOMENT CONNECTIONS OR MOMENT RESISTING FRAMES, AND ALL COLUMN SPLICE WELDS, SHALL BE TESTED AS PER C.B.C.

W9 ALL SHOP AND FIELD WELDING OF MOMENT CONNECTIONS OR MOMENT RESISTING FRAMES, AND ALL COLUMN SPLICE WELDS, SHALL BE TESTED AS PER CBC.

W10 PROVIDE ON PLANS A COMPREHENSIVE SCHEDULE FOR INSPECTIONS TO BE PERFORMED ON A PERIODIC BASIS. THE SPECIAL INSPECTOR MUST INSPECT THE MATERIALS AND VERIFY WELDING PROCEDURES AND QUALIFICATIONS OF WELDERS PRIOR TO THE START OF WORK; INSPECT WORK IN PROGRESS DURING PERIODS STATED AND VISUALLY INSPECT ALL WELDS PRIOR TO COMPLETION OR PRIOR TO SHIPMENT OF WELDED COMPONENTS TO THE JOBSITE.

W11 WELDS DONE IN A FABRICATOR'S SHOP APPROVED BY INSPECTION SERVICES NEED NOT TO HAVE CONTINUOUS OR PPERIODIC SPECIAL INSPECTION. AT COMPLETION OF FABRICATION, THE APPROVED FABRICATOR SHALL SUBMIT THE 'CERTIFICATE OF COMPLIANCE' FORM TO INSPECTION SERVICES.

CONCRETE

C1 ALL CONCRETE WORK SHALL CONFORM TO ALL REQUIREMENTS OF A.C.I. 318 - LATEST EDITION "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS", AND ACI 350 - LATEST EDITION "CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES", EXCEPT AS MODIFIED BY THE SUPPLEMENTAL REQUIREMENTS CONTAINED HEREIN OR SHOWN ON THE DRAWINGS.

C2 ALL CONCRETE SHALL BE 150 P.C.F. HARDROCK, MIXED PER A.S.T.M. C-94, AND SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 P.S.I. AT 28 DAYS.

C3 THE MAXIMUM SIZE AGGREGATE IN FOUNDATION AND MASS CONCRETE WORK SHALL BE 1 INCH. THE MAXIMUM SIZE AGGREGATE IN SLABS ON GRADE, WALLS, AND ALL OTHER CONCRETE SHALL BE 3/4 INCH.

C4 CEMENT SHALL CONFORM TO A.S.T.M. C-150, TYPE II, LOW ALKALI. AGGREGATES FOR NORMAL WEIGHT SHALL CONFORM TO A.S.T.M. C-33.

C5 ADMIXTURES AND COLORS (EXCEPT AS NOTED HEREIN) SHALL NOT BE USED UNLESS SUBSTANTIATING DATA IS SUBMITTED TO AND REVIEWED BY THE ENGINEER AND ARCHITECT OF RECORD.

C6 CONCRETE MIXES SHALL BE DESIGNED BY A QUALIFIED TESTING LABORATORY. THE MIX DESIGNS SHALL CONFORM TO C.B.C. SEC. 1905 UNLESS OTHERWISE NOTED.

C7 NON-STRUCTURAL STEEL EMBEDDED IN CONCRETE SHALL BE GALVANIZED OR PAINTED. ALL DAMAGED GALVANIZED AREAS SHALL BE REPAIRED PRIOR TO EMBEDMENT.

C8 PROVIDE 2- #5 DIAGONAL BARS AT CORNERS OF WALL, FLOOR, AND ROOF OPENINGS AND INSIDE CORNERS OF FLOORS.

C9 PROVIDE WATERSTOPS IN ALL BELOW GRADE FOUNDATION WALL CONSTRUCTION JOINTS.

C10 READY MIXED CONCRETE SHALL CONFORM TO (A.S.T.M. C-94).

C11 PLACEMENT OF CONCRETE SHALL CONFORM TO A.C.I. 304. CLEAN AND ROUGHEN TO 1/4" AMPLITUDE FOR ALL CONCRETE SURFACES AGAINST WHICH CONCRETE IS TO BE PLACED.

C12 ALL EXPOSED CONCRETE SHALL HAVE A SMOOTH FORM FINISH USING B-B PLYFORM, CLASS I, EXT-A.P.A. PLYWOOD.

C13 ALL SLABS SHALL HAVE A TROWELED FINISH EXCEPT AS NOTED ON THE DRAWINGS.

C14 ALL REINFORCING STEEL, ANCHOR BOLTS, DOWELS AND INSERTS SHALL BE WELL SECURED IN POSITION PRIOR TO PLACING CONCRETE.

C15 IF THE CONTRACTOR DESIRES TO MAKE ANY CONSTRUCTION JOINTS OTHER THAN THOSE SHOWN ON THESE DRAWINGS, HE SHALL SUBMIT DETAILS OF CHANGES TO THE ENGINEER OF RECORD FOR REVIEW BEFORE STARTING WORK.

C16 NO BRICK OR POROUS MATERIAL SHALL BE USED TO SUPPORT FOUNDATION STEEL OFF THE GROUND.

C17 PROVIDE 3/4 INCH CHAMFER ON ALL EXPOSED CONCRETE CORNERS, U.O.N.

CONCRETE (CONT'D)

C18 SLEEVE PLUMBING OPENINGS IN SLABS WITH NON-CORROSIVE SLEEVE BEFORE PLACING CONCRETE AND BEND REINFORCING AROUND SLEEVES.

C19 ALL REINFORCING BARS SHALL BE PROVIDED WITH THE FOLLOWING CONCRETE MINIMUM COVER:

C20 FOOTINGS CAST AGAINST EARTH	3"
FORMED CONCRETE EXPOSED TO EARTH, WEATHER OR LIQUID	2"
BEAMS AND GIRDERS	1 1/2"
WALLS	1 1/2"
COLUMN TIES	1 1/2"
SLABS (#11 AND SMALLER)	3/4"

C21 CONCRETE CURING: TYPICALLY REQUIRED A MINIMUM OF 10 DAYS.

ALUMINUM

A1 ALL ALUMINUM PLATES AND ALUMINUM STRUCTURAL MEMBERS SHALL BE ALLOY 6061-T6, UNLESS NOTED OTHERWISE. SEE SPECIFICATIONS FOR CORROSION PROTECTION.

A. ALL CONNECTION BOLTS SHALL BE 3/4 " DIAMETER TYPE 316 STAINLESS STEEL, UON.
B. COAT ALL SURFACES OF ALUMINUM WHICH COME IN CONTACT WITH CONCRETE WITH ZINC CHROMATE.
C. WELDING SHALL CONFORM TO THE LATEST EDITION OF OF AWS D1.1. WELDING SHALL BE PERFORMED BY WELDERS CERTIFIED BY AWS FOR ALUMINUM.

REINFORCEMENT

R1 ALL REINFORCING STEEL SHALL BE PLACED IN CONFORMANCE WITH THE C.B.C., AND THE "MANUAL OF STANDARD PRACTICE" BY THE C.R.S.I. OR AS MODIFIED BY THE CONSTRUCTION DOCUMENTS.

R2 REINFORCING BARS SHALL CONFORM TO A.S.T.M. A-706, DEFORMED GRADE 60.

R3 WELDING OF REINFORCEMENT SHALL BE IN ACCORDANCE WITH A.S.T.M. A-706 WITH LOW HYDROGEN ELECTRODES AND STRUCTURAL WELDING CODE REINFORCING STEEL SHALL CONFORM TO A.N.S.I. / A.W.S. D1.4. MINIMUM TENSILE STRENGTH OF WELD METAL SHALL BE 90 K.S.I. ALL WELDING SHALL BE PERFORMED BY CERTIFIED WELDERS.

R4 ALL REINFORCING BAR BENDS SHALL BE MADE COLD, UNLESS OTHERWISE PERMITTED BY THE BUILDING OFFICIAL.

R5 WELDED WIRE FABRIC SHALL CONFORM TO A.S.T.M. A-185, AND SHALL BE LAPPED 1 SPACE AND 12" MINIMUM.

R6 DOWELS BETWEEN FOOTINGS AND WALLS OR COLUMNS SHALL BE LAPPED WITH THE SAME GRADE, SIZE, SPACING AND NUMBER AS THE VERTICAL REINFORCEMENT.

R7 REINFORCING SPLICES SHALL BE MADE AS INDICATED ON THE DRAWINGS.

R8 ALL VERTICAL REINFORCING SHALL BE CONTINUOUS BETWEEN TWO LEVELS, UNLESS OTHERWISE NOTED.

R9 SLAB ON GRADE REINFORCING SHALL BE POSITIONED AT MID-DEPTH, UNLESS OTHERWISE NOTED.

R10 PROVIDE #3 SPACER TIES AT 2'-6" ON CENTER IN ALL BEAMS AND FOOTINGS TO SECURE REINFORCING BARS IN PLACE, UNLESS OTHERWISE NOTED.

R11 PIPING AND CONDUIT SHALL BE SO FABRICATED AND INSTALLED THAT CUTTING, BENDING, OR DISPLACEMENT OF REINFORCEMENT FROM ITS PROPER LOCATION WILL NOT BE REQUIRED. A.C.I. #6.3.12

R12 UNLESS SPECIFIED OTHERWISE, THE LENGTH OF LAP FOR SPLICES SHALL BE PER T-SI TO S4.

PUMP STATION NO. 65 CAPACITY UPGRADE

S-1

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STRUCTURAL NOTES
SHEET 1 OF 2

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CITY OF SAN DIEGO, CALIFORNIA
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SHEET 09 OF 40 SHEETS

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BASIS OF DESIGN

(2010 CALIFORNIA BUILDING CODE)

DESIGN LOADS:

DEAD LOADS: CONCRETE 150 pcf
WATER 63 pcf
STEEL 490 pcf

OCCUPANCY GROUP: F-2
CONSTRUCTION TYPE: II-B

LIVE LOADS: ROOF 20 psf
FLOOR 300 psf

SEISMIC CRITERIA: DESIGN PROCEDURE: EQUIVALENT LATERAL FORCE PROCEDURE
OCCUPANCY CATEGORY = III
SEISMIC DESIGN CATEGORY = D
SITE CLASS = D

F_a = 1.00 S_{DS} = 0.984
F_v = 1.50 S_{D1} = 0.553
S_S = 1.476 I_P = 1.50
S_1 = 0.553 I = 1.25

WIND CRITERIA: WIND SPEED 90mph
EXPOSURE C I_w =1.15

THE CURRENT CALIFORNIA CONSTRUCTION CODES ARE THE 2010 CALIFORNIA BUILDING CODE (BASE ON 2009 IBC), THE 2010 CALIFORNIA ELECTRICAL CODE (BASED ON THE 2007 NEC), THE 2010 CALIFORNIA PLUMBING CODE (BASED ON THE 2008 UPC BY IAPMO), THE 2010 CALIFORNIA MECHANICAL CODE (BASED ON THE 2008 UMC BY IAPMO), AND THE 2010 CALIFORNIA FIRE CODE (BASED ON THE 2008 IFC).

SPECIAL INSPECTION NOTES – APPLIES TO ALL TABLES

1. THE SPECIAL INSPECTORS MUST BE CERTIFIED BY THE CITY OF SAN DIEGO DEVELOPMENT SERVICES, IN THE CATEGORY OF WORK REQUIRED TO HAVE SPECIAL INSPECTION.
2. THE CONSTRUCTION MATERIALS TESTING LABORATORY MUST BE APPROVED BY THE CITY OF SAN DIEGO DEVELOPMENT SERVICES, FOR TESTING OF MATERIALS, SYSTEMS, COMPONENTS AND EQUIPMENTS.
3. FABRICATOR MUST BE REGISTERED AND APPROVED BY THE CITY OF SAN DIEGO, DEVELOPMENT SERVICES, FOR THE FABRICATION OF MEMBERS AND ASSEMBLIES ON THE PREMISES OF THE FABRICATOR'S SHOP.
4. FABRICATOR SHALL SUBMIT AN APPLICATION TO PERFORM OFF-SITE FABRICATION TO THE INSPECTION SERVICES DIVISION FOR APPROVAL PRIOR TO COMMENCEMENT OF FABRICATION.
5. FABRICATOR SHALL SUBMIT A CERTIFICATE OF COMPLIANCE FOR OFF-SITE FABRICATION TO THE INSPECTION SERVICES DIVISION PRIOR TO ERECTION OF FABRICATED ITEMS AND ASSEMBLIES.
6. A PROPERTY OWNER'S FINAL REPORT FORM FOR WORK REQUIRED TO HAVE SPECIAL INSPECTIONS, TESTING AND STRUCTURAL OBSERVATIONS MUST BE COMPLETED BY THE PROPERTY OWNER, PROPERTY OWNER'S AGENT OF RECORD, ARCHITECT OF RECORD, OR ENGINEER OF RECORD AND SUBMITTED TO THE INSPECTION SERVICES DIVISION.
7. THE SPECIAL INSPECTIONS IDENTIFIED ON PLANS ARE, IN ADDITION TO, AND NOT A SUBSTITUTE FOR, THESE INSPECTIONS REQUIRED TO BE PERFORMED BY A CITY'S BUILDING INSPECTOR.
8. WHERE MATERIALS OR ASSEMBLIES ARE REQUIRED BY THE BUILDING CODE TO BE LABELED, SUCH MATERIALS AND ASSEMBLIES SHALL BE LABELED BY AN AGENCY APPROVED BY THE CITY OF SAN DIEGO IN ACCORDANCE WITH SECTION 1703. PRODUCTS AND MATERIALS TO BE LABELED SHALL BE TESTED, INSPECTED AND LABELED IN ACCORDANCE WITH THE PROCEDURES SET FORTH IN SECTIONS 1703.5.1 THROUGH 1703.5.3. IDENTIFY ON PLANS, NAME AND ADDRESS OF THE TESTING/INSPECTION AGENCY.
9. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE SPECIAL INSPECTOR OR INSPECTION AGENCY AT LEAST ONE WORKING DAY PRIOR TO PERFORMING ANY WORK THAT REQUIRES SPECIAL INSPECTION.
10. ALL HIGH STRENGTH BOLTS SHALL BE INSTALLED AND INSPECTED IN ACCORDANCE WITH THE CALIBRATED WRENCH METHOD.

STATEMENT OF SPECIAL INSPECTIONS

1. SPECIAL INSPECTIONS, STRUCTURAL TESTS AND STRUCTURAL OBSERVATIONS WILL BE PERFORMED IN ACCORDANCE WITH APPROVED PLANS, SPECIFICATIONS, THIS STATEMENT AND CALIFORNIA BUILDING CODE 2010 SECTION 1704, 1705, 1707, 1708 AND 1709.
2. PROVIDE SPECIAL INSPECTION FOR CONCRETE CONSTRUCTION PER SCHEDULE OF SPECIAL INSPECTIONS IN ACCORDING WITH CBC 2010, TABLE 1704.4.
3. PROVIDE SPECIAL INSPECTION FOR SOILS PER SCHEDULE OF SPECIAL INSPECTIONS.

STRUCTURAL OBSERVATION NOTES

1. STRUCTURAL OBSERVATION SHALL BE PROVIDED BY THE ENGINEER OF RECORD RESPONSIBLE FOR THE STRUCTURAL DESIGN, OR ANOTHER ENGINEER DESIGNATED BY THE ENGINEER OF RECORD RESPONSIBLE FOR THE STRUCTURAL DESIGN, AS OUTLINED IN THE STRUCTURAL OBSERVATION PROGRAM.
2. STRUCTURAL OBSERVATION DOES NOT INCLUDE OR WAIVE THE INSPECTIONS REQUIRED BY SECTIONS 108, 1701 OR OTHER SECTIONS OF THE CODE.
3. ALL OBSERVED DEFICIENCIES SHALL BE REPORTED IN WRITING TO THE OWNER'S REPRESENTATIVE, SPECIAL INSPECTOR, CONTRACTOR AND INSPECTION SERVICES, THE STRUCTURAL OBSERVER SHALL SUBMIT A WRITTEN STATEMENT TO INSPECTION SERVICES THAT THE SITE VISITS HAVE BEEN MADE AND THE CONSTRUCTION REQUIRING STRUCTURAL OBSERVATION CONFORMS TO THE APPROVED PLANS.

SCHEDULE OF SPECIAL INSPECTION

REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION		
VERIFICATION AND INSPECTION		
1. INSPECTION OF REINFORCING STEEL, INCLUDING PRESTRESSING TENDONS, AND PLACEMENT.	-	X
2. INSPECTION OF REINFORCING STEEL WELDING IN ACCORDANCE WITH REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION TABLE, ITEM 5B.	-	X
3. INSPECT CAST-IN-PLACE ANCHOR BOLTS TO BE INSTALLED IN CONCRETE PRIOR TO AND DURING PLACEMENT OF CONCRETE WHERE ALLOWABLE LOADS HAVE BEEN INCREASED FROM TABLE 1911.2.	X	-
4. VERIFYING USE OF REQUIRED DESIGN MIX.	-	X
5. AT THE TIME FRESH CONCRETE IS SAMPLED TO FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE.	X	-
6. INSPECTION OF CONCRETE AND PLACEMENT FOR PROPER APPLICATION TECHNIQUES.	-	X
7. INSPECTION FOR MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES.	-	X
8. ERECTION OF PRECAST CONCRETE MEMBERS.	-	X
9. INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED.	-	X
10. ADHESIVE ANCHORS AND EXPANSION ANCHORS FOR MECHANICAL AND ELECTRICAL EQUIPMENTS.	X	-

SCHEDULE OF SPECIAL INSPECTION

REQUIRED VERIFICATION AND INSPECTION OF SOILS		
VERIFICATION AND INSPECTION	CONTINUOUS INSPECTION	PERIODIC INSPECTION
1. VERIFY MATERIALS BELOW FOOTINGS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY.	-	X
2. VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIALS.	-	X
3. PERFORM CLASSIFICATION AND TESTING OF CONTROLLED FILL MATERIALS.	-	X
4. VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF CONTROLLED FILL.	X	-
5. PRIOR TO PLACEMENT OF CONTROLLED FILL, OBSERVE SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY.	-	X

SCHEDULE OF SPECIAL INSPECTION

REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION		
VERIFICATION AND INSPECTION	CONTINUOUS INSPECTION	PERIODIC INSPECTION
1. MATERIAL VERIFICATION OF HIGH-STRENGTH BOLTS, NUTS AND WASHERS:		
A. IDENTIFICATION MARKINGS TO CONFORM TO ASTM STANDARDS SPECIFIED IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X
B. MANUFACTURERS CERTIFICATE OF COMPLIANCE REQUIRED.	-	X
2. INSPECTION OF HIGH-STRENGTH BOLTING: ON-SITE	-	
A. BEARING-TYPE CONNECTIONS	-	X
B. SLIP-CRITICAL CONNECTIONS	-	X
C. SNUG TIGHT CONNECTIONS	-	X
3. MATERIAL VERIFICATION OF STRUCTURAL STEEL:		
A. IDENTIFICATION MARKINGS TO CONFORM TO ASTM STANDARDS SPECIFIED IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X
B. MANUFACTURERS' CERTIFIED MILL TEST REPORTS.	-	X
4. MATERIAL VERIFICATION OF WELD FILLER MATERIALS:		
A. IDENTIFICATION MARKINGS TO CONFORM TO AWS SPECIFICATIONS IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X
B. MANUFACTURER'S CERTIFICATE OF COMPLIANCE REQUIRED.	-	X
5. INSPECTION OF WELDING: ON-SITE		
A. STRUCTURAL STEEL:		
1) COMPLETE AND PARTIAL PENETRATION GROOVE WELDS.	X	-
2) MULTIPASS FILLET WELDS.	X	-
3) SINGLE-PASS FILLET WELDS > 5/16"	X	-
4) SINGLE-PASS FILLET WELDS < 5/16"	-	X
5) FLOOR AND ROOF DECK WELDS.	-	X
B. REINFORCING STEEL:		
1) VERIFICATION OF WELDABILITY OF REINFORCING STEEL OTHER THAN ASTM A706.	-	X
2) REINFORCING STEEL-RESISTING FLEXURAL AND AXIAL FORCES IN INTERMEDIATE AND SPECIAL MOMENT FRAMES, AND BOUNDARY ELEMENTS OF SPECIAL REINFORCED CONCRETE SHEAR WALLS AND SHEAR REINFORCEMENT.	-	-
3) SHEAR REINFORCEMENT.	-	-
4) OTHER REINFORCING STEEL.	-	X
6. INSPECTION OF STEEL FRAME JOINT DETAILS FOR COMPLIANCE WITH APPROVED CONSTRUCTION DOCUMENTS:	-	X
A. DETAILS SUCH AS BRACING AND STIFFENING.		
B. MEMBER LOCATIONS.		
C. APPLICATION OF JOINT DETAILS AT EACH CONNECTION.		

DSD NOTES

"NOTICE OF THE APPLICANT/OWNER/OWNER'S AGENT/ARCHITECT OR ENGINEER OF RECORD: BY USING THIS PERMITTED CONSTRUCTION DRAWINGS FOR CONSTRUCTION/INSTALLATION OF THE WORK SPECIFIED HEREIN, YOU AGREE TO COMPLY WITH THE REQUIREMENTS OF CITY OF SAN DIEGO FOR SPECIAL INSPECTIONS, STRUCTURAL OBSERVATIONS, CONSTRUCTION MATERIAL TESTING AND OFF-SITE FABRICATION OF BUILDING COMPONENTS, CONTAINED IN THE STATEMENT OF SPECIAL INSPECTIONS AND, AS REQUIRED BY THE CALIFORNIA CONSTRUCTION CODES."

"NOTICE TO THE CONTRACTOR/BUILDER/INSTALLER/SUB-CONTRACTOR/OWNER-BUILDER: BY USING THIS PERMITTED CONSTRUCTION DRAWINGS FOR CONSTRUCTION/INSTALLATION OF THE WORK SPECIFIED HEREIN, YOU ACKNOWLEDGE AND ARE AWARE OF, THE REQUIREMENTS CONTAINED IN THE STATEMENT OF SPECIAL INSPECTIONS. YOU AGREE TO COMPLY WITH THE REQUIREMENTS OF CITY OF SAN DIEGO FOR SPECIAL INSPECTIONS, STRUCTURAL OBSERVATIONS, CONSTRUCTION MATERIAL TESTING AND OFF-SITE FABRICATION OF BUILDING COMPONENTS, CONTAINED IN THE STATEMENT OF SPECIAL INSPECTIONS AND, AS REQUIRED BY THE CALIFORNIA CONSTRUCTION CODE."

PUMP STATION NO. 65 CAPACITY UPGRADE

S-2

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

STRUCTURAL NOTES
SHEET 2 OF 2

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 10 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hazel Ajua FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY Daleng ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

PROJECT ENGINEER
274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-10-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

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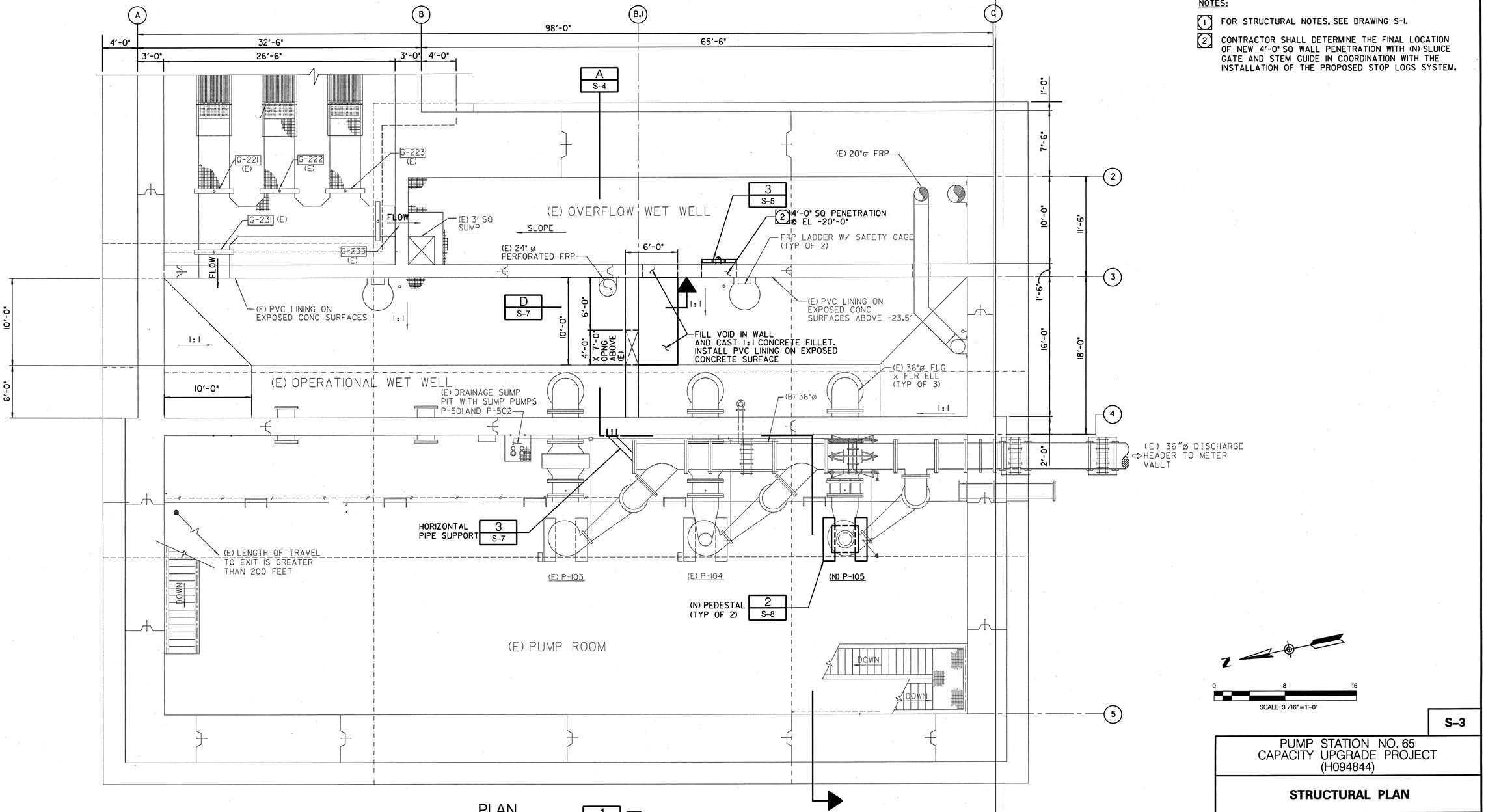
Daniel Park



PLAN 1 / – (1)
SCALE: 3/16" = 1'-0"

NOTES:

(1) FOR STRUCTURAL NOTES, SEE DRAWING S-1.

(2) CONTRACTOR SHALL DETERMINE THE FINAL LOCATION OF NEW 4'-0" SQ WALL PENETRATION WITH (N) SLUICE GATE AND STEM GUIDE IN COORDINATION WITH THE INSTALLATION OF THE PROPOSED STOP LOGS SYSTEM.

PUMP STATION NO. 65 CAPACITY UPGRADE

S-3

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

STRUCTURAL PLAN

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 11 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: 8-27-12 FOR CITY ENGINEER
8-27-17 DATE
DRAWN BY: ASSOCIATE ENGINEER
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-11-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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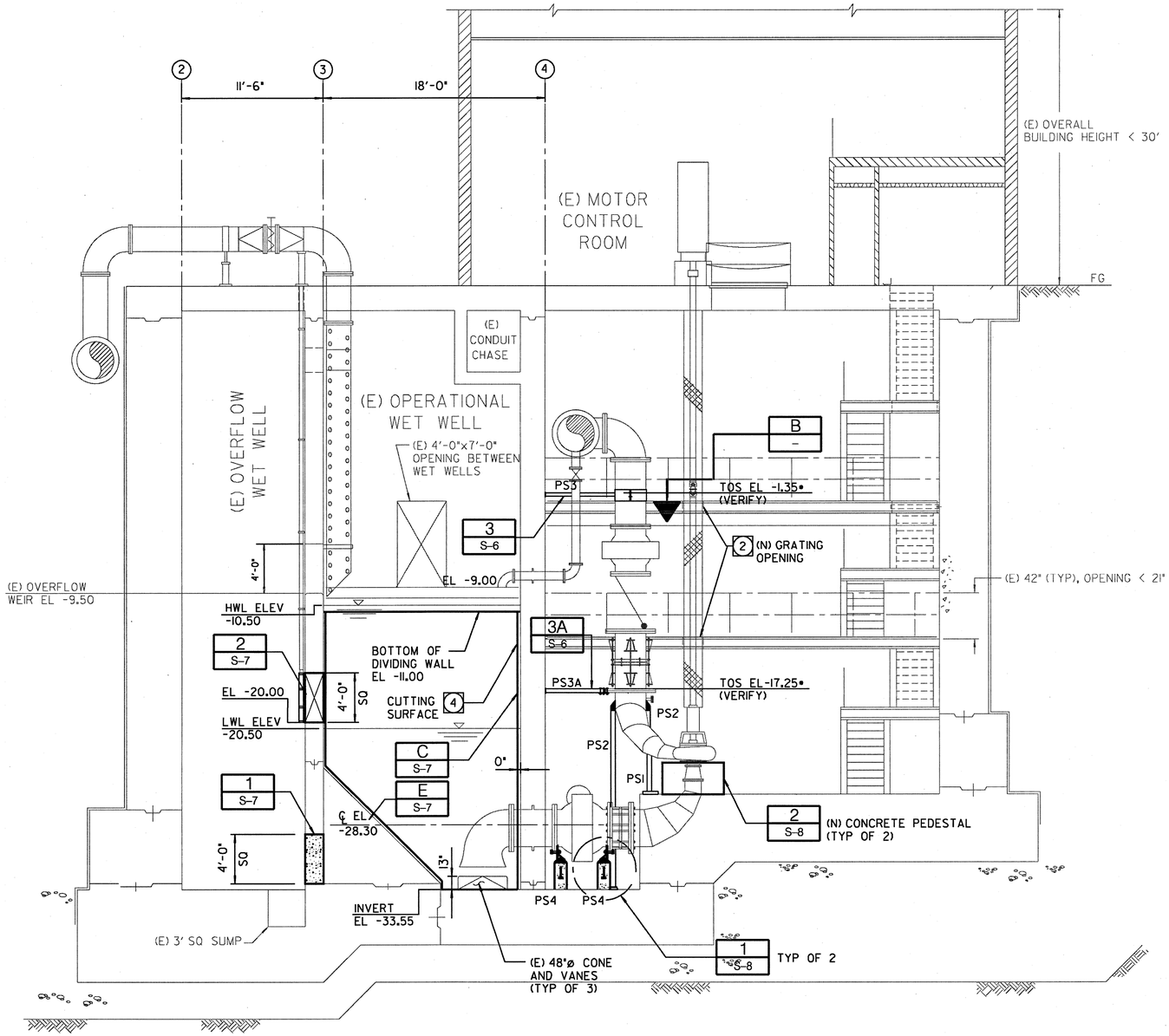
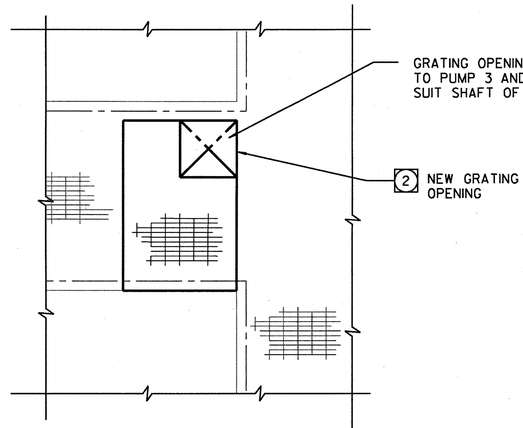
Daniel Park



SECTION A S-3 (1)(3)
SCALE: 3/16" = 1'-0"

NOTES:

1. FOR STRUCTURAL NOTES, SEE DRAWING S-1.
2. MODIFY EXISTING ALUMINUM GRATING TO ACOMMODATE THE OPENING FOR PUMP SHAFT. BAND THE EDGES OF ALL GRATING AT OPENING.
3. ADJUST DIMENSIONS AND LEVEL WITH • TO SUIT THE FINAL PIPE/EQUIPMENT SELECTION.
4. FOR ALL CUTTING SURFACE, PROVIDE WELD STRIP OVERLAPPING



SECTION B – (TYP OF 2)
SCALE: 1/2"=1'-0"

0 8 16
SCALE 3/16"=1'-0"

PUMP STATION NO. 65 CAPACITY UPGRADE

S-4

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

STRUCTURAL SECTION

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 12 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hoyle Allen FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

PROJECT ENGINEER
274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-12-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER — DANIEL S. CHERRY — No. C65511 — Exp. 06/30/13 — CIVIL — STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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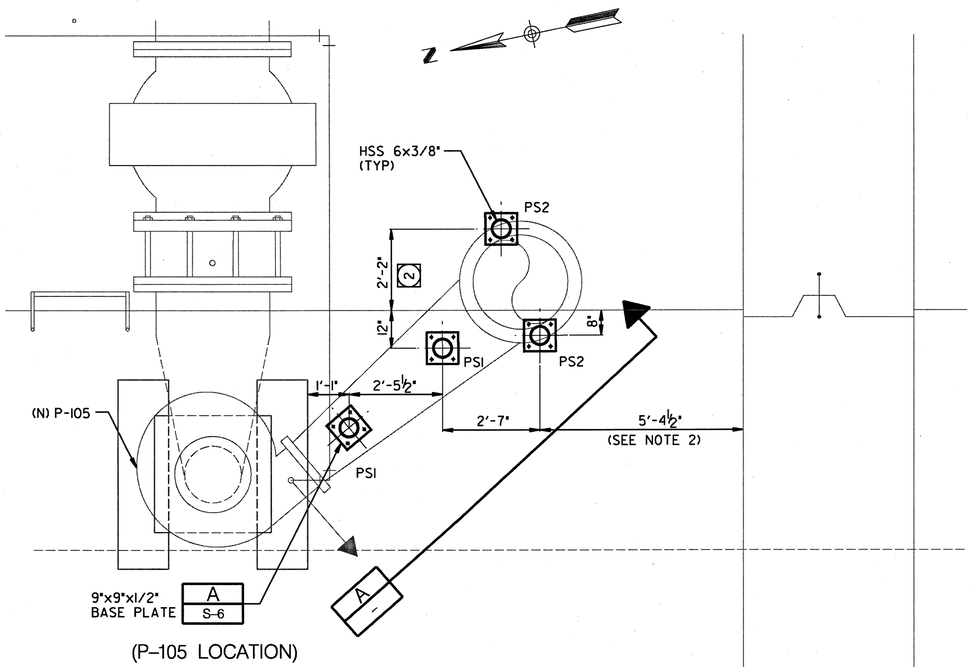
Daniel Park

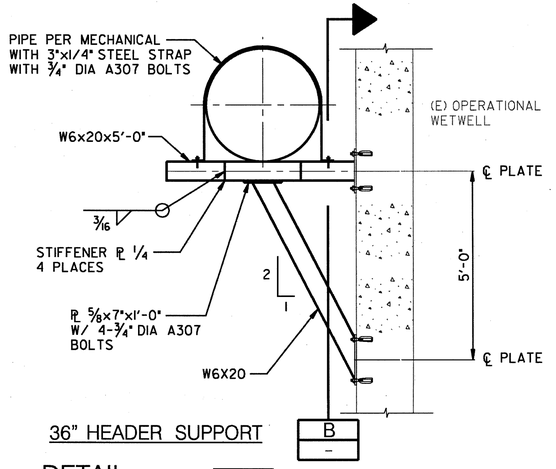


(P-105 LOCATION)

PIPE SUPPORTS

PLAN 1 –

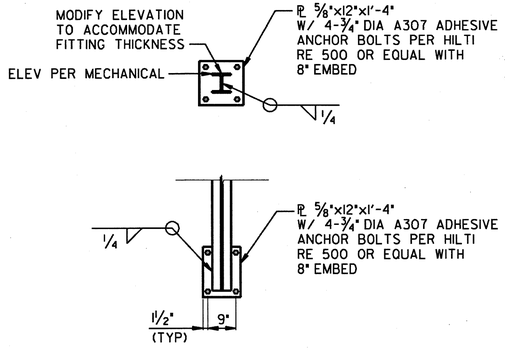
SCALE: 1/2"=1'-0"



36" HEADER SUPPORT B –

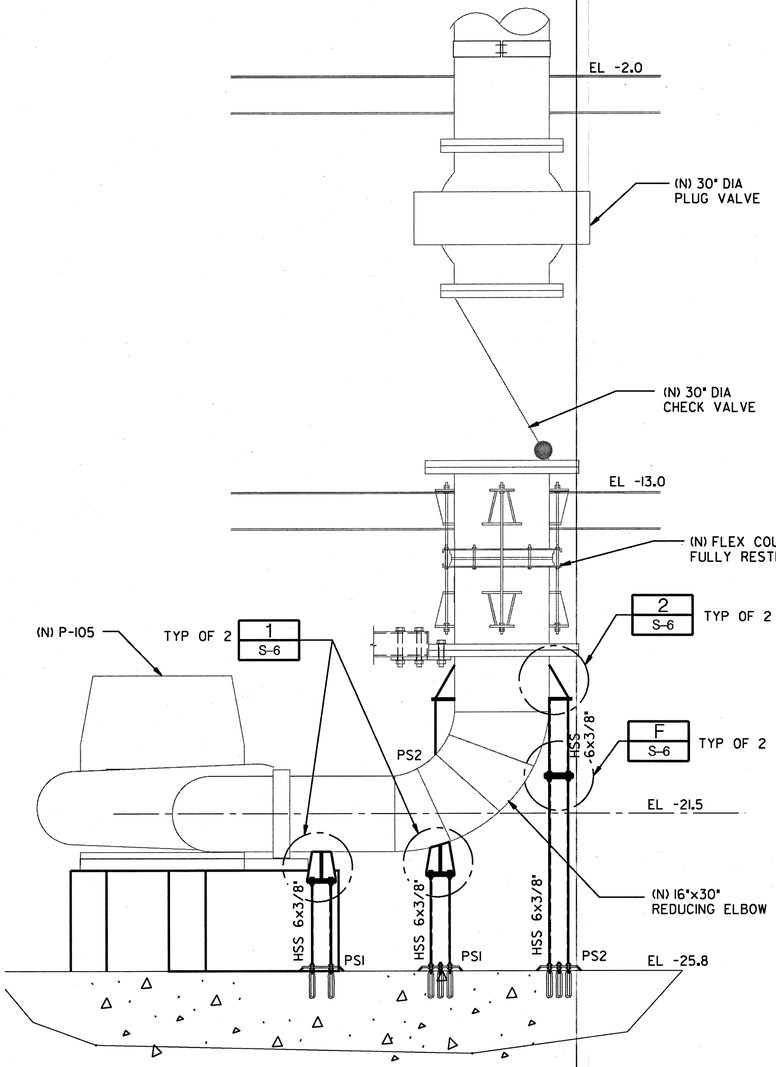
DETAIL 2 M-1

SCALE: 1/2"=1'-0"



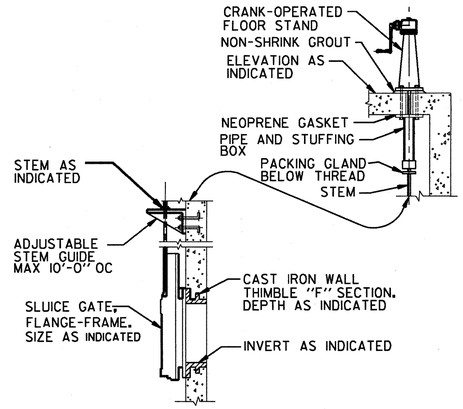
SECTION B –

SCALE: 1/2"=1'-0"



SECTION A –

SCALE: 1/2"=1'-0"



SLUICE GATE

DETAIL 3 S-3

SCALE: 1/2"=1'-0"

NOTES:

1. FOR STRUCTURAL NOTES, SEE DRAWING S-1.
2. DIMENSIONS TO SUIT MECHANICAL EQUIPMENT FINAL LOCATIONS.

0 2 4 6

SCALE 1/2"=1'-0"

PUMP STATION NO. 65 CAPACITY UPGRADE

S-5

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

PIPE SUPPORTS PLAN & SECTION

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING

0 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 13 OF 40 SHEETS

APPROVED Hoel Acuy FOR CITY ENGINEER 8-27-12 DATE

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

WBS B-00306
WBS _____

SUBMITTED BY: ASSOCIATE ENGINEER

PROJECT ENGINEER

274-1695 LAMBERT COORDINATE

1914-6256 CCS83 COORDINATE

36349-13-D

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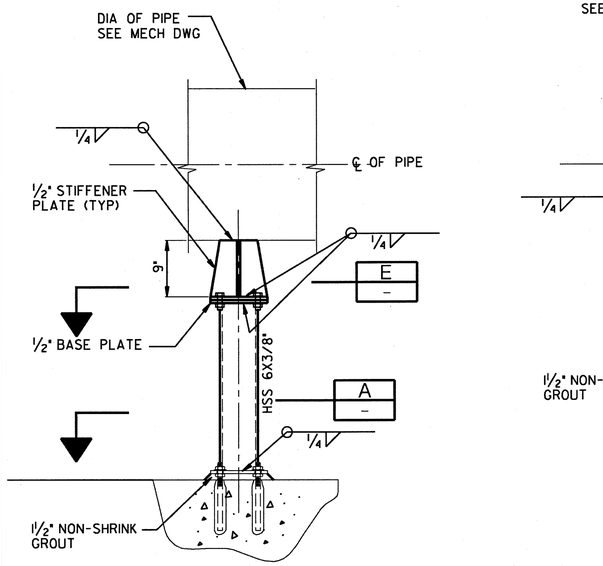
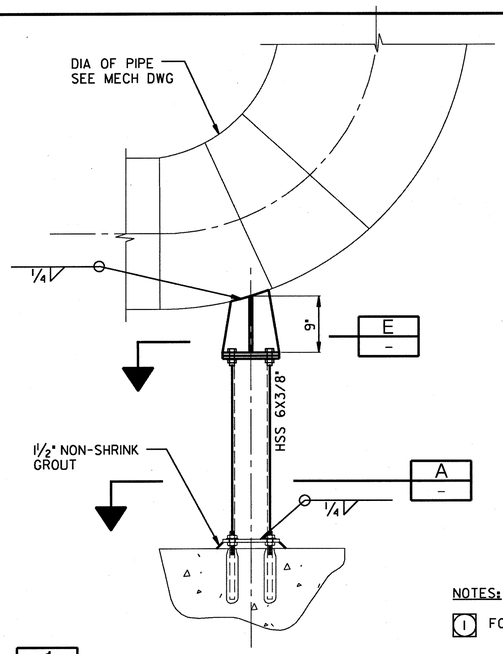
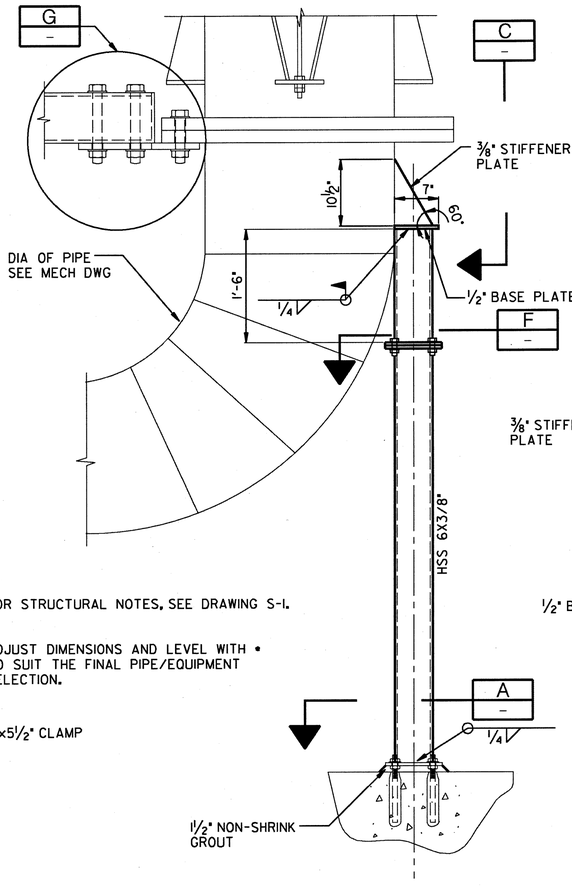


PS-1 DETAIL 1 / S-5
SCALE: 1"=1'-0"

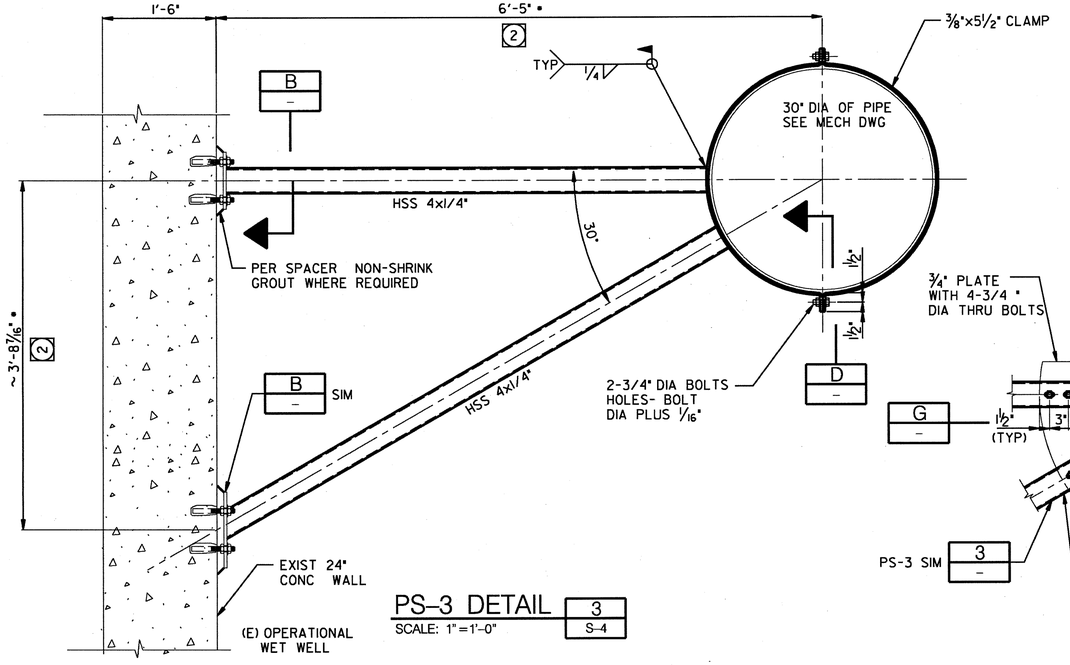




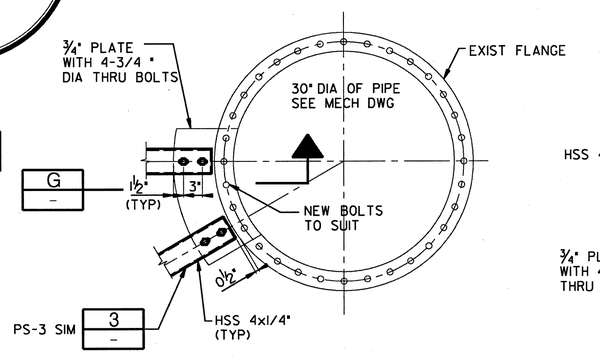
NOTES:

1. FOR STRUCTURAL NOTES, SEE DRAWING S-1.
2. ADJUST DIMENSIONS AND LEVEL WITH • TO SUIT THE FINAL PIPE/EQUIPMENT SELECTION.

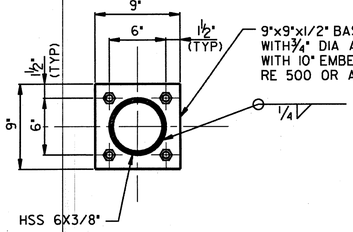
PS-2 DETAIL 2 / S-5
SCALE: 1"=1'-0"



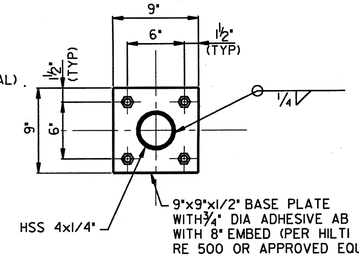
PS-3 DETAIL 3 / S-4
SCALE: 1"=1'-0"



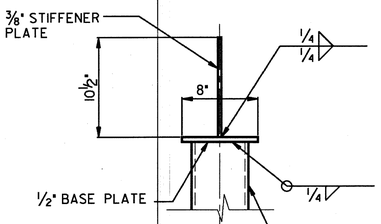
PS-3A DETAIL 4 / S-4
SCALE: 1"=1'-0"



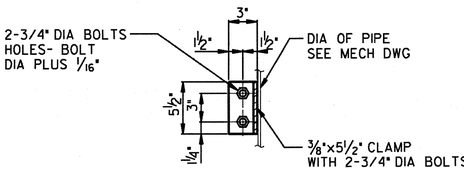
SECTION A / SCALE: 1 1/2"=1'-0"



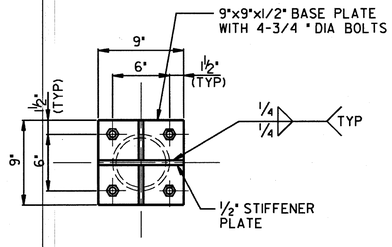
SECTION B / SCALE: 1 1/2"=1'-0"



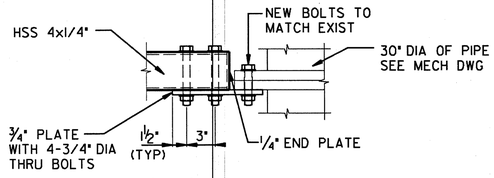
SECTION C / SCALE: 1 1/2"=1'-0"



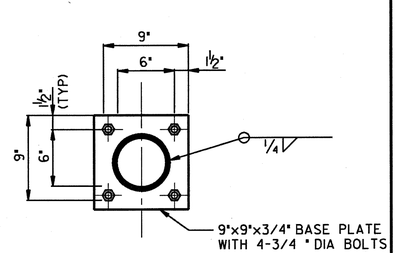
SECTION D / SCALE: 1 1/2"=1'-0"



SECTION E / SCALE: 1 1/2"=1'-0"



SECTION G / SCALE: 1 1/2"=1'-0"



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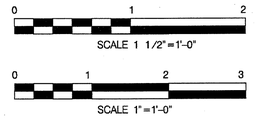

PUMP STATION NO. 65 CAPACITY UPGRADE

S-6

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

PIPE SUPPORTS DETAILS

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 14 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Hosein Asar FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-14-D

CONTRACTOR ____ DATE STARTED ____
INSPECTOR ____ DATE COMPLETED ____

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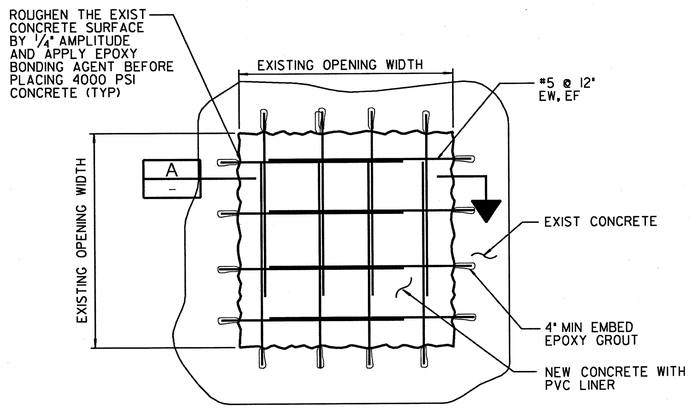
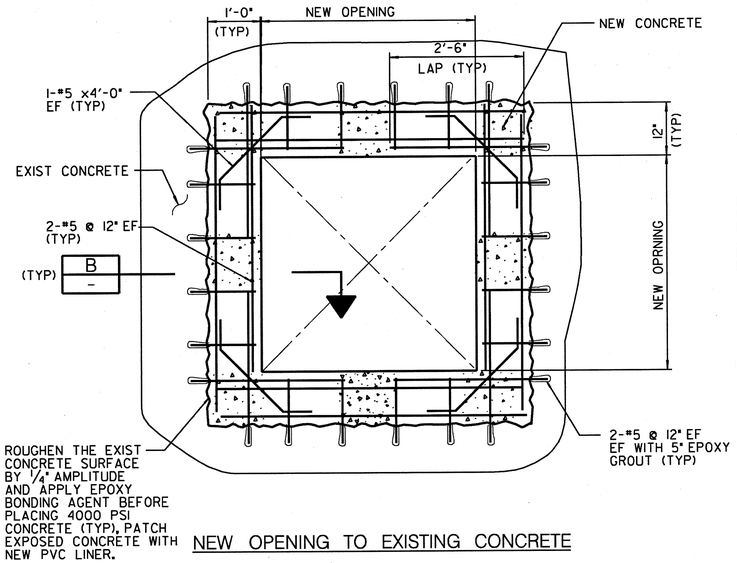
Daniel Park



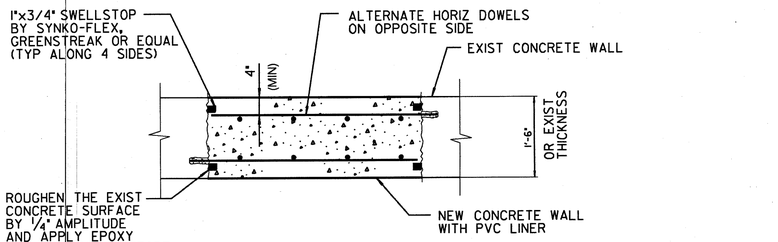
EXIST OPENING TO BE FILLED IN CONCRETE

DETAIL 1 / S-4
SCALE: 3/4"=1'-0"

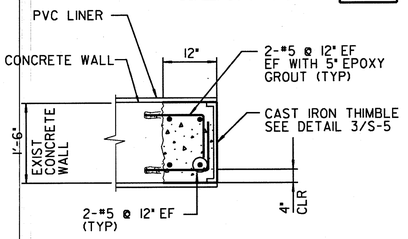


NEW OPENING TO EXISTING CONCRETE

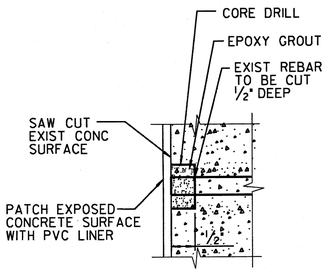
DETAIL 2 / S-4
SCALE: 3/4"=1'-0"



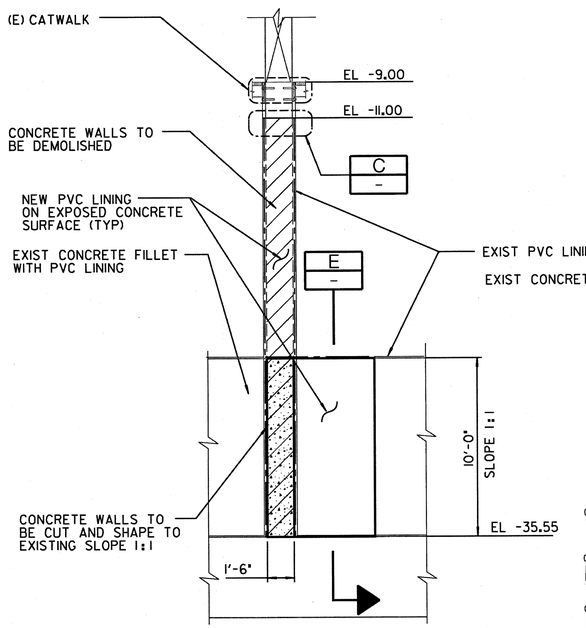
SECTION A / –
SCALE: 3/4"=1'-0"



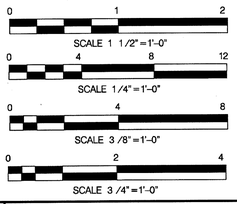
SECTION B / –
SCALE: 3/4"=1'-0"

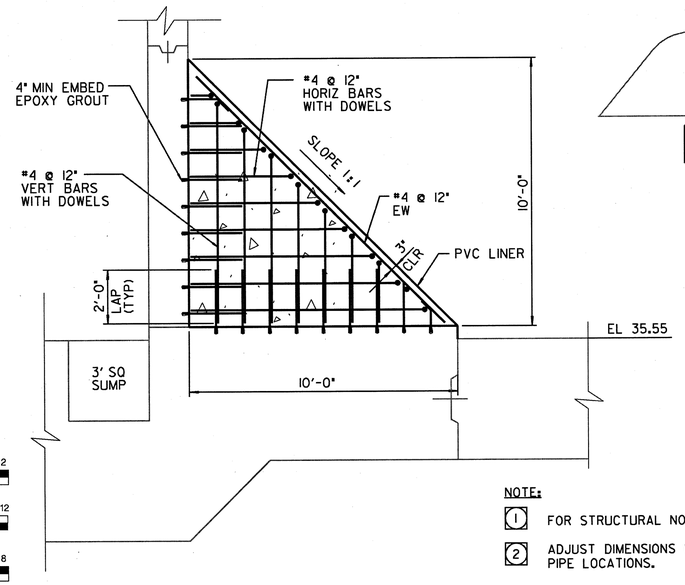


DETAIL C / S-4 S-7
NOT TO SCALE

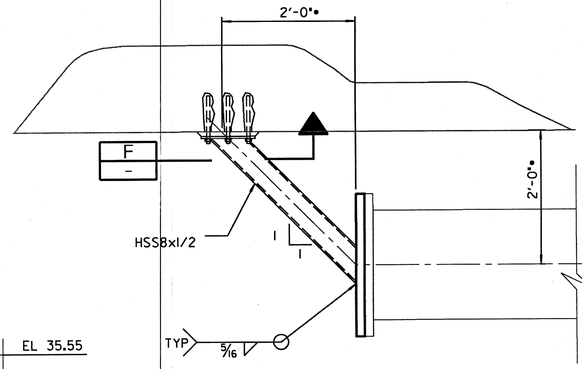


SECTION D / S-3
SCALE: 1/4"=1'-0"



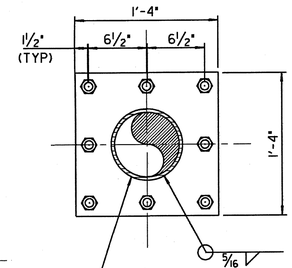


SECTION E / S-4 S-7
SCALE: 3/8"=1'-0"



HORIZONTAL FLANGE SUPPORT

DETAIL 3 / S-3
SCALE: 3/4"=1'-0"



SECTION F / –
SCALE: 1 1/2"=1'-0"

NOTE:

1. FOR STRUCTURAL NOTES, SEE DRAWING S-1.
2. ADJUST DIMENSIONS WITH • TO SUIT THE FINAL PIPE LOCATIONS.

PUMP STATION NO. 65 CAPACITY UPGRADE

S-7

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

WET WELL DETAILS

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

REGISTERED PROFESSIONAL ENGINEER — STEVEN S. CARLSON — No. C56508 — Exp. 06/30/13 — CIVIL — STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 15 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Hoa Lirau FOR CITY ENGINEER 8-27-12 DATE

SUBMITTED BY: ASSOCIATE ENGINEER

PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695
LAMBERT COORDINATE

1914-6256
CCS83 COORDINATE

CONTRACTOR ____ DATE STARTED ____
INSPECTOR ____ DATE COMPLETED ____

36349-15-D

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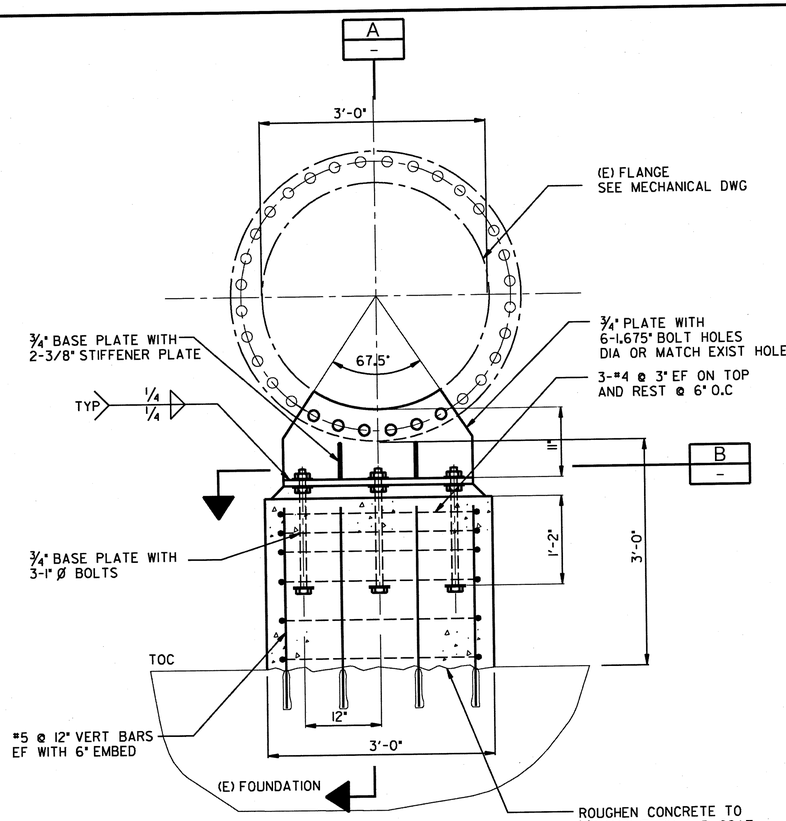
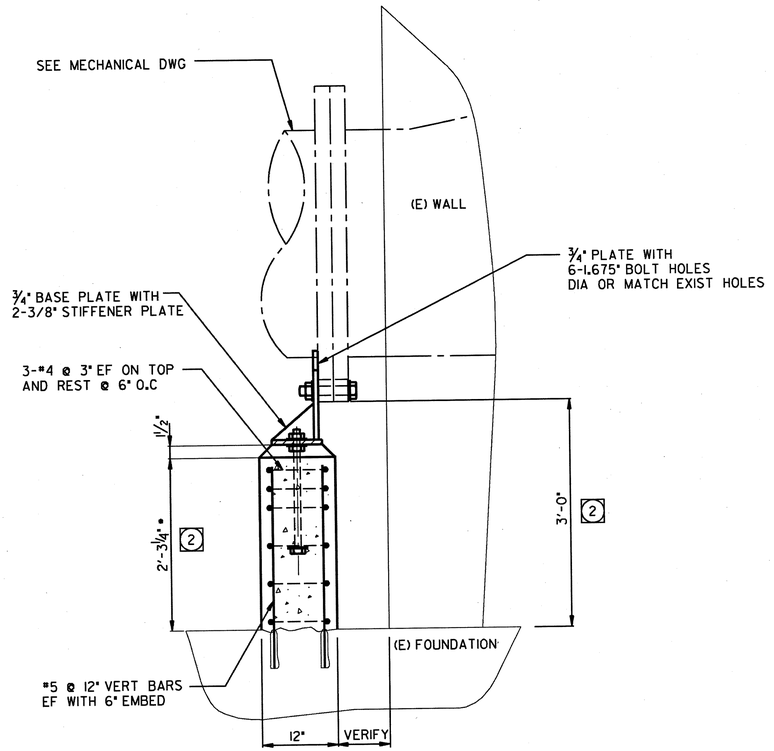
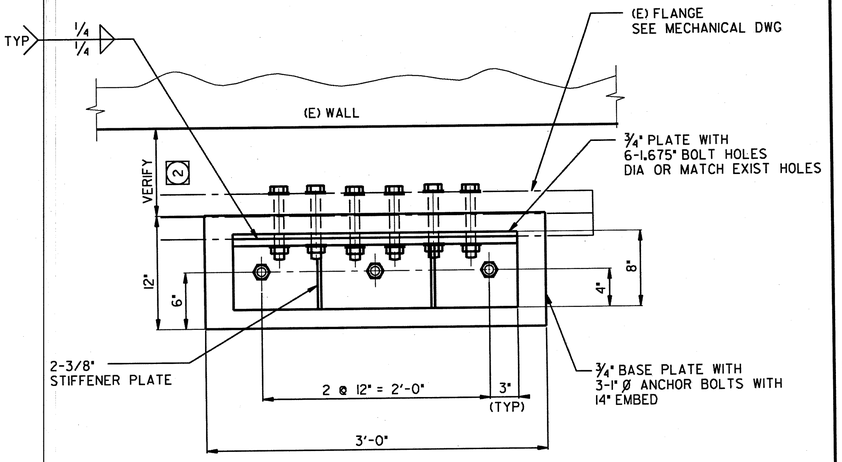
Daniel Park



PS-4 DETAIL 1 / S-4
SCALE: 1"=1'-0"

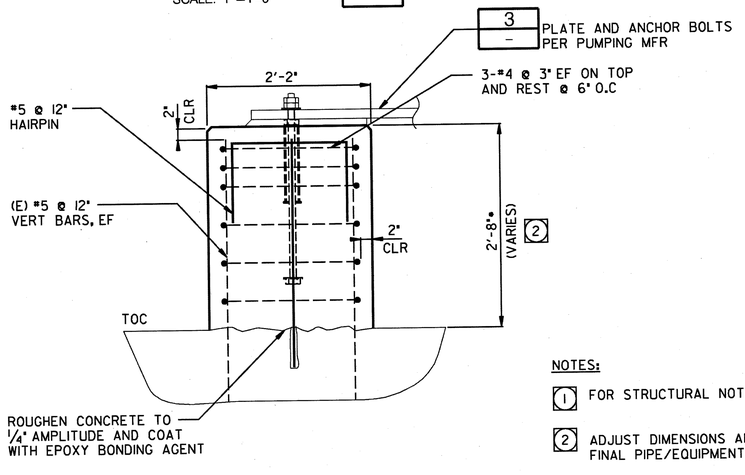


SECTION A / SCALE: 1"=1'-0"

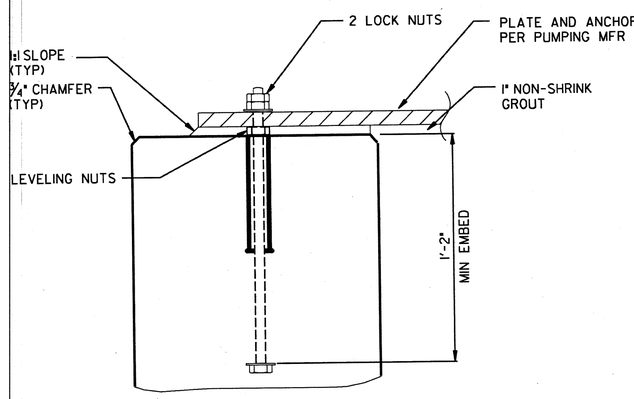


SECTION B / SCALE: 1"=1'-0"

CONCRETE SUPPORT PLAN
DETAIL 2 / S-4 S-3
SCALE: 1"=1'-0"



SECTION C / SCALE: 1"=1'-0"



EQUIPMENT AND MACHINERY PAD
SECTION 3 / NOT TO SCALE

NOTES:

1. FOR STRUCTURAL NOTES, SEE DRAWING S-1.
2. ADJUST DIMENSIONS AND LEVEL WITH • TO SUIT THE FINAL PIPE/EQUIPMENT SELECTION.

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

REGISTERED PROFESSIONAL ENGINEER
STATION S. CHEUNG
No. C65108
Exp. 06/30/13
CIVIL
STATE OF CALIFORNIA

S-8

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

MISCELLANEOUS DETAILS

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 16 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hoac i Acur FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-16-D

CONTRACTOR ____ DATE STARTED ____
INSPECTOR ____ DATE COMPLETED ____

PUMP STATION NO. 65 CAPACITY UPGRADE

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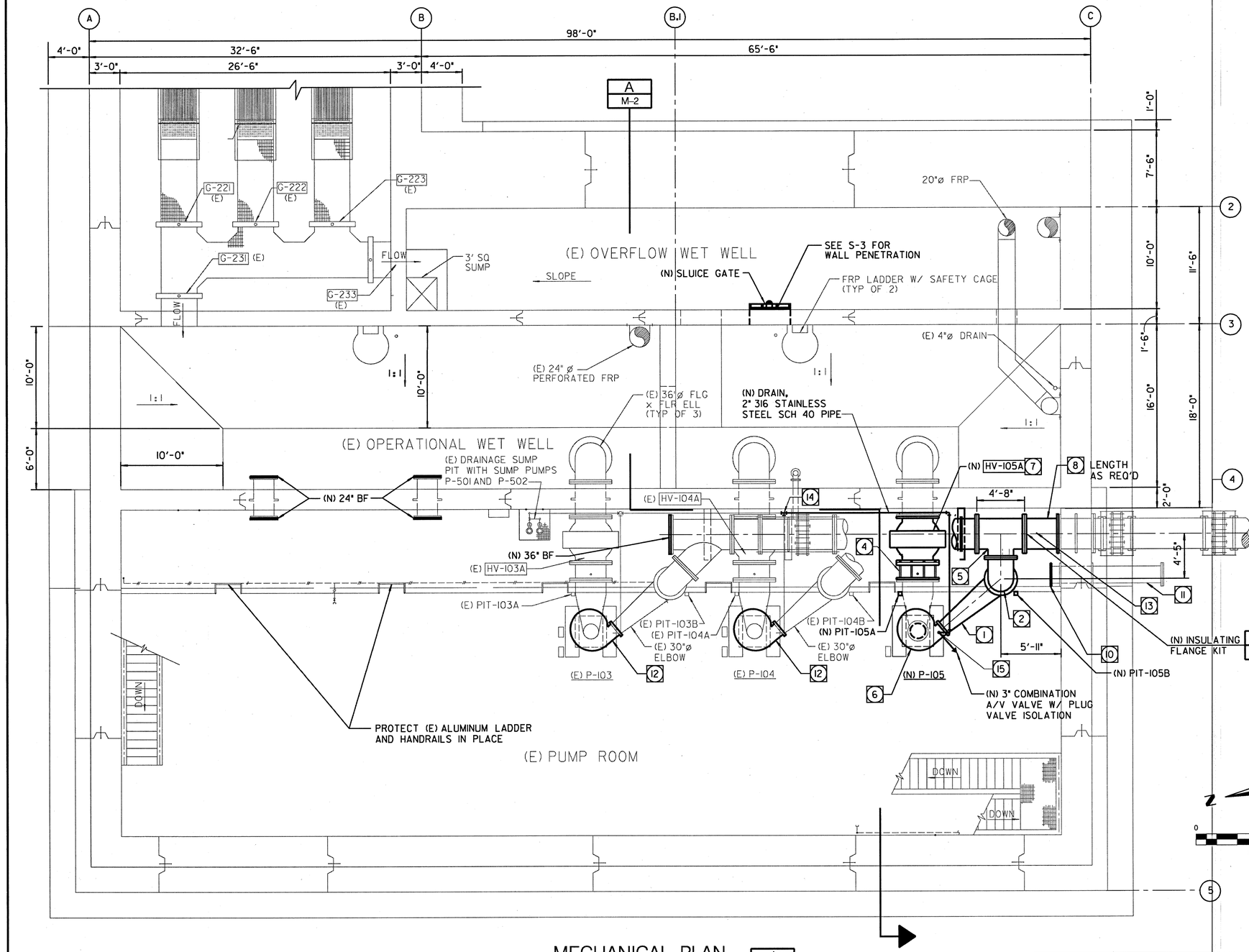
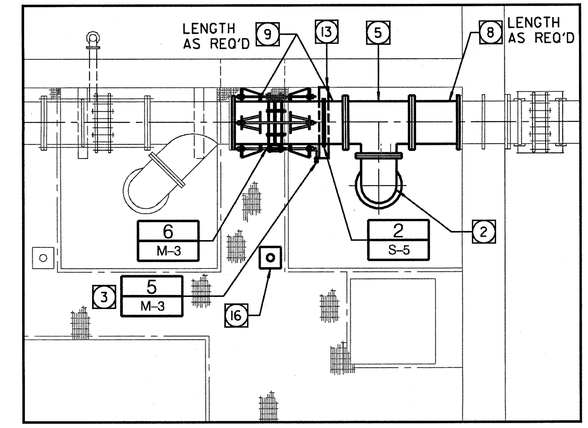
3/6/2012 11:00:52 AM Daniel Park



MECHANICAL PLAN
SCALE: 3/16" = 1'-0"
1 – 17



MECHANICAL PLAN @ PLATFORM LEVEL -2.0'
SCALE: 3/16" = 1'-0"
2 –

0 8 16
SCALE 3/16" = 1'-0"

NOTES:

1. SEE NOTE 1 ON SHEET M-2
2. (N) 30°ø ELBOW (ABOVE)
3. CONNECT (E) 2" RING TO (N) 2" TAP W/ 2" BALL VALVE ON PIPE SPOOL. RECONNECT (E) INSTRUMENTS AND ELECTRICAL CABLES.
4. (N) 36" DISMANTLING JOINT
5. (N) 36" X 36" X 30" DI TEE
6. (N) P-105
7. (N) 36" PLUG VALVE
8. (N) 36" STEEL FLG X FLG SPOOL
9. (N) 36" STEEL FLG X MJ SPOOL
10. (N) GROOVED COUPLING AND BLIND FLANGE
11. NOT USED
12. (E) P-103 AND (E) P-104, INSTALL 25" DIA IMPELLERS, LINESHAFT ASSEMBLY INCLUDING U-JOINTS AND BEARINGS, WEAR RINGS, CASE WEAR RINGS, PUMP BEARINGS, SEALS, AND ASSOCIATED ANCIALLIARY EQUIPMENT.
13. SEE DETAIL 2 ON SHEET S-5 FOR 36" HEADER SUPPORT
14. CONNECT TO (E) P-104 DRAIN TO (N) P-105 DRAIN.
15. PROVIDE 3" TEE, ONE BRANCH TO A/V VALVE. THE OTHER BRANCH TO DRAIN W/ 2" STAINLESS STEEL DRAIN COCK ISOLATION VALVE. VALVE CONNECTION TO SUITE PER MANUFACTURE.
16. SEE SHEET S-4 FOR CATWALK PENETRATION DETAIL AT INTERMEDIATE (ELEV. 13.0') AND PLATFORM (ELEV. -2.0') LEVELS.
17. SEE PROTECTIVE COATING SPECIFICATION SECTION 09800, COATING SYSTEM SCHEDULE FM-17 FOR EXISTING EQUIPMENT THAT SHALL BE RE-COATED.

PUMP STATION NO. 65 CAPACITY UPGRADE

M-1

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

MECHANICAL PLANS

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER ERIC R. LOVERIN No. C70807 CIVIL STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 17 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Roger Agar FOR CITY ENGINEER — DATE 8-27-12
SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695
LAMBERT COORDINATE
1914-6256
CCS83 COORDINATE
36349-17-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

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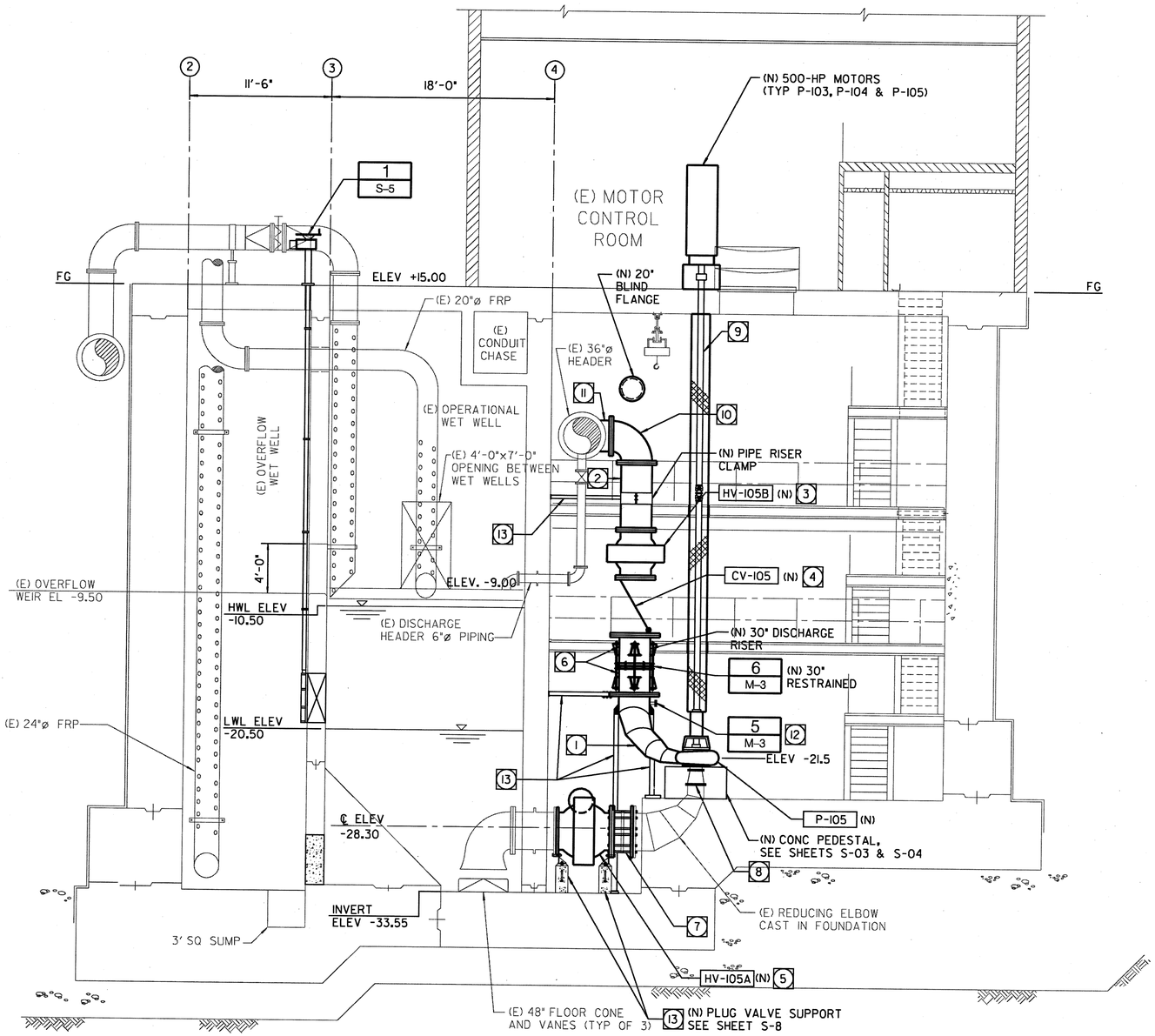
Daniel Park

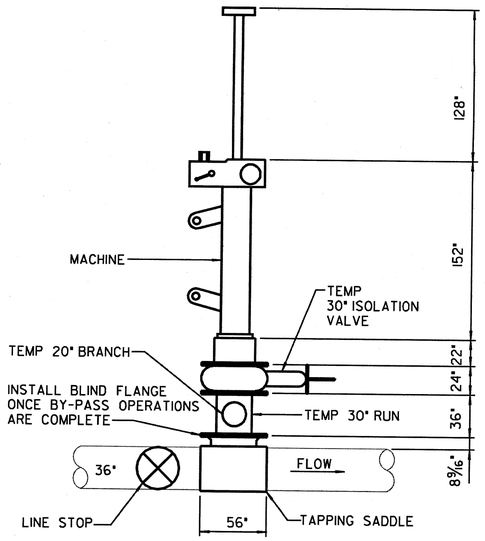


MECHANICAL SECTION A
SCALE: 3/16"=1'-0"

0 8 16
SCALE 3/16"=1'-0"

NOTES:

1. FABRICATED STL INCREASING MITERED FLG 90° ELBOW TO SUIT APPROVED PUMP DISCHARGE CONNECTION AND 30" DISCHARGE RISER. AS ALTERNATIVE PROVIDE DIP STD INCREASER FLG'D SPOOL PIECE & STD ELBOW.
2. (N) 30" STEEL FLG X FLG SPOOL
3. (N) 30" PLUG VALVE
4. (N) 30" CHECK VALVE
5. (N) 36" PLUG VALVE
6. (N) 30" STEEL FLG X PE SPOOL
7. (N) 36" DISMANTLING JOINT
8. (N) REDUCER TO MATCH (E) REDUCING MITERED ELBOW AND APPROVED (N) P-105 FLANGED SUCTION.
9. (N) 4-SECTION LINESHAFT AND GUARD ASSY. WITH U-JOINTS AND INTERMEDIATE BEARINGS (TYP P-103, P-104 & P-105)
10. (N) 30" DI ELBOW
11. (N) 36" X 36" X 30" DI TEE
12. (N) 2" ANNULAR RING W/ 2" BALL VALVE
13. SEE SHEET S-8 FOR PIPE SUPPORTS



30" HOT TAPPING MACHINE
DETAIL 1 C-1
SCALE: NTS

PUMP STATION NO. 65 CAPACITY UPGRADE

M-2

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

MECHANICAL SECTION

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 18 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hoss Hass FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-18-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER ERIC R. LOVEJOY No. C70807 CIVIL STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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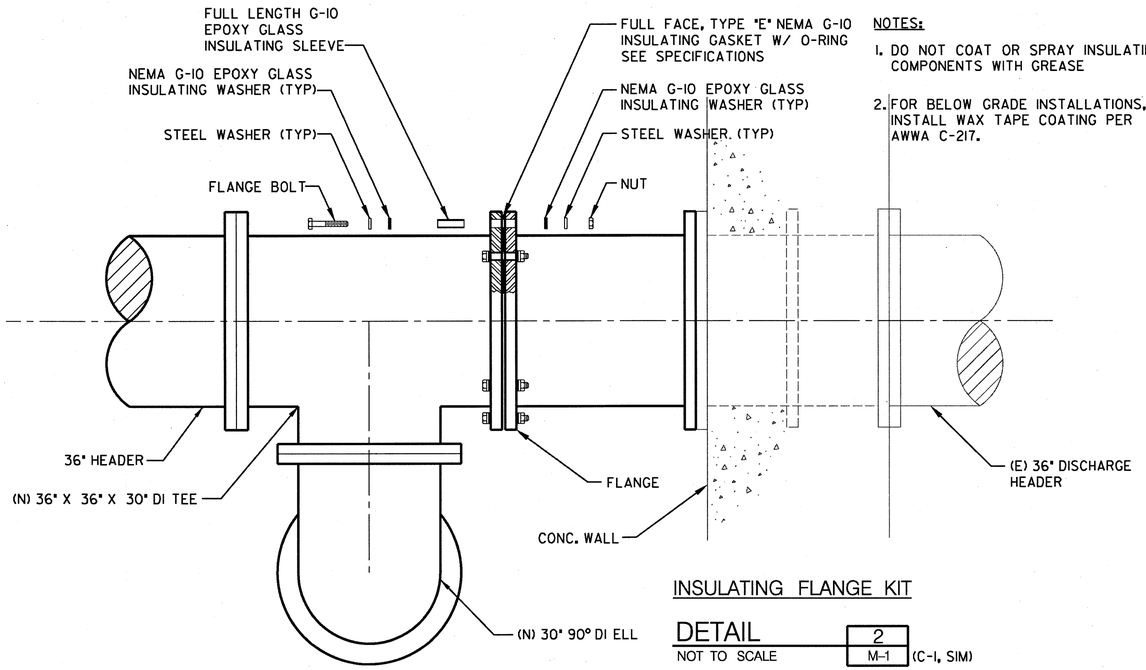
Daniel Park

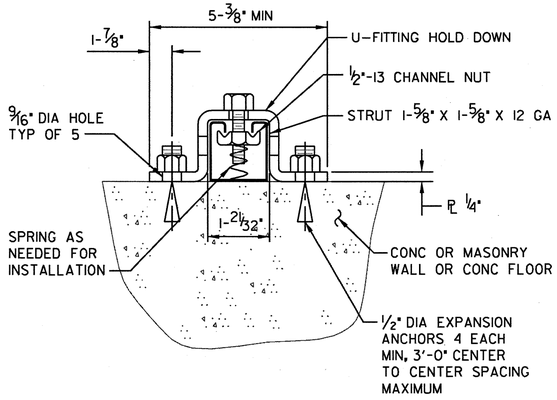


NOTES:

1. DO NOT COAT OR SPRAY INSULATING COMPONENTS WITH GREASE
2. FOR BELOW GRADE INSTALLATIONS, INSTALL WAX TAPE COATING PER AWWA C-217.

INSULATING FLANGE KIT

DETAIL — NOT TO SCALE — 2 / M-1 (C-1, SIM)



NOTE:

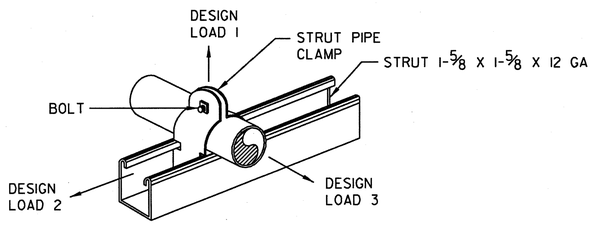
1. MAX ALLOWABLE PULL-OUT STRENGTH IS 2,000 LBS AND RESISTANCE TO SLIP 1,500 LBS PER CHANNEL NUTS.

CONNECTION TO CONCRETE DETAIL

DETAIL — NOT TO SCALE — 3 / M-2

STRUT PIPE CLAMPS SCHEDULE

PIPE SIZE	MIN BOLT SIZE	MIN BOLT SIZE	MIN BOLT SIZE	MIN BOLT SIZE	MIN BOLT SIZE
1/4"	1/4"-20	16	120	30	30
3/8"	1/4"-20	16	300	40	40
1/2" THRU 7/8"	1/4"-20	16	400	50	50
1" THRU 1-5/8"	1/4"-20	14	500	75	75
1-3/4" THRU 3-1/2"	5/16"-18	12	800	125	125
3-5/8" THRU 6"	5/16"-18	11	1000	200	150
6-1/8" THRU 12-3/4"	3/8"-16	11	1000	250	200

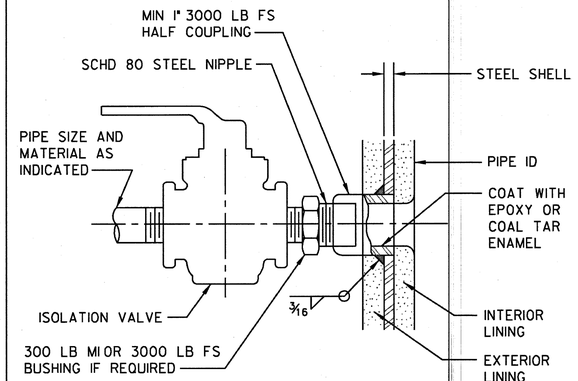


NOTES:

1. DO NOT USE FOR PIPES LARGER THAN 2" WHEN STRUT IS MOUNTED VERTICALLY.

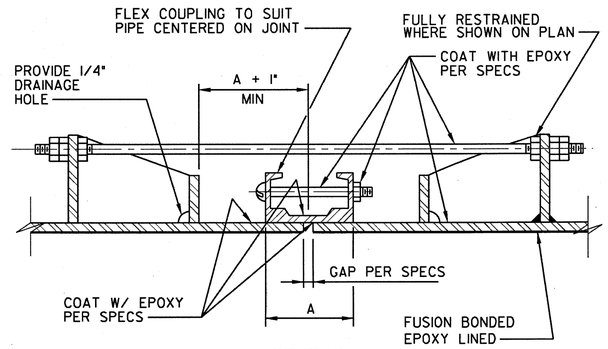
STRUT PIPE CLAMP DETAIL

DETAIL — NOT TO SCALE — 4 / M-2

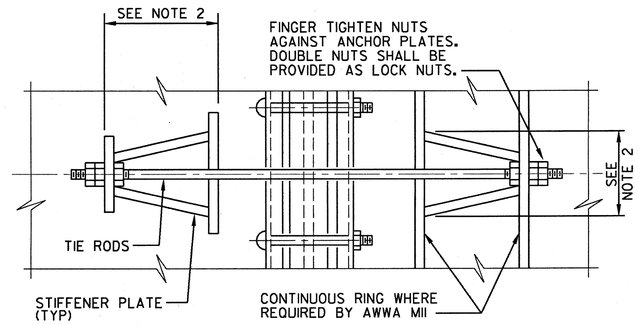


PIPE CONNECTION 2-1/2" AND SMALLER DETAIL

DETAIL — NOT TO SCALE — 5 / M-1 M-2



SECTION



PLAN

NOTE:

1. DESIGN SHALL BE BASED ON TEST PRESSURE.
2. ANCHOR LUGS AND TIE RODS FOR STEEL PIPE SHALL BE DESIGNED BY PIPE MANUFACTURER IN ACCORDANCE WITH AWWA M11 STEEL PIPE MANUAL.
3. GRIND ALL CORNERS SMOOTH.

TIE DOWN FOR STEEL PIPE FLEXIBLE COUPLING

DETAIL — NOT TO SCALE — 6 / M-1 M-2

PUMP STATION NO. 65 CAPACITY UPGRADE

M-3

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

MECHANICAL DETAILS

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING

0 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW..X..

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 19 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Hoa C. Acay FOR CITY ENGINEER — DATE 8-27-12
SUBMITTED BY: ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

PROJECT ENGINEER

274-1695
LAMBERT COORDINATE

1914-6256
CCS83 COORDINATE

36349-19-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

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ELECTRICAL DIAGRAM LEGEND

DRAWOUT TYPE CIRCUIT BREAKER 3-POLE UNLESS OTHERWISE NOTED

MOLDED CASE CIRCUIT BREAKER 3-POLE UNLESS OTHERWISE NOTED

60A — DISCONNECT SWITCH, 60A 3-POLE UNLESS OTHERWISE NOTED

60AF — FUSE, 60A

GROUND CONNECTION

CURRENT TRANSFORMER

POWER TRANSFORMER, DELTA CONNECTED PRIMARY AND SOLIDLY GROUNDED STAR CONNECT SECONDARY

1 OR 1 — MAGNETIC MOTOR STARTER FVNR, 3 POLE, UON NUMBER DENOTES NEMA SIZE

5 — INDUCTION MOTOR, 3 PHASE NUMBER DENOTES HP

RVSS — REDUCED VOLTAGE SOLID STATE STARTER WITH BY-PASS CONTACTOR

VARIABLE FREQUENCY DRIVE (ADJUSTABLE SPEED DRIVE)

NORMALLY OPEN VACUUM OR PRESSURE SWITCH, CLOSE ON RISING PRESSURE

NORMALLY CLOSED VACUUM OR PRESSURE SWITCH, OPEN ON RISING PRESSURE

NORMALLY OPEN TEMPERATURE ACTUATED SWITCH, CLOSE ON RISING TEMPERATURE

NORMALLY CLOSED TEMPERATURE ACTUATED SWITCH, OPEN ON RISING TEMPERATURE

NORMALLY CLOSED LIMIT SWITCH

NORMALLY OPEN FLOW SWITCH CLOSE ON FLOW INCREASE

NORMALLY CLOSED FLOW SWITCH OPEN ON FLOW INCREASE

NORMALLY OPEN PUSH BUTTON, MOMENTARY CLOSE

NORMALLY CLOSED PUSHBUTTON, MOMENTARY OPEN

LOS — NORMALLY CLOSED PUSH BUTTON SINGLE CIRCUIT, LOCK-OUT-STOP (LOCATED AT MOTOR UNLESS OTHERWISE NOTED)

NORMALLY OPEN TIMED CONTACT - CONTACT ACTION, IN DIRECTION OF ARROW, RETARDED ON ENERGIZATION

NORMALLY CLOSED TIMED CONTACT - CONTACT ACTION, IN DIRECTION OF ARROW, RETARDED ON ENERGIZATION

NORMALLY OPEN TIMED CONTACT- UPON INITIAL ENERGIZATION, CONTACT CHANGES STATE, CONTACT ACTION, IN DIRECTION OF ARROW, RETARDED ON DE-ENERGIZATION

NORMALLY CLOSED TIMED CONTACT- UPON INITIAL ENERGIZATION, CONTACT CHANGES STATE, CONTACT ACTION, IN DIRECTION OF ARROW, RETARDED ON DE-ENERGIZATION

ON OFF — XO OX — TWO-POSITION SELECTOR SWITCH, H=HAND, M=MANUAL, R=REMOTE, L=LOCAL, A=AUTOMATIC, O=OFF OR OPEN, C=CLOSE, X'S AND O'S INDICATE SEQUENCE OF OPERATION

H O A — XOO OXO OOX — THREE-POSITION SELECTOR SWITCH (SAME AS ABOVE)

SINGLE POLE TOGGLE SWITCH

GROUND CONNECTION

OL — NORMALLY CLOSED, AUXILIARY OVERLOAD RELAY CONTACT

OL — NORMALLY OPEN, AUXILIARY OVERLOAD RELAY CONTACT

MANUAL MOTOR STARTER WITH THERMAL OVERLOAD RELAY

FUSE

ETM — ELAPSED TIME METER

SPACE HEATER (LOCATED AT MOTOR, UNO)

RES — RESISTOR (FIXED)

POTENTIOMETER TYPE RESISTOR (CONTINUOUSLY ADJUSTABLE)

R — PUSH-TO-TEST INDICATING LIGHT R=RED, A=AMBER, Y=YELLOW, W=WHITE, G=GREEN

TERMINALS IN ELECTRICAL CONTROL EQUIPMENT

CONTACT OR DEVICE REMOTE FROM ELECTRICAL CONTROL EQUIPMENT

SOFTWARE LINK

R — INDICATING LIGHT, PUSH TO TEST TYPE LENS COLOR CODE: A=AMBER, R=RED, W=WHITE, G=GREEN

R — INDICATES CONTROL RELAY OR MOTOR STARTER COIL

- T OR TD = TIME DELAY RELAY
- R OR CR = CONTROL RELAY
- MS = MAGNETIC MOTOR STARTER
- C = MAGNETIC CONTACTOR

ELECTRICAL PLAN LEGEND

POLE MOUNTED LIGHTING FIXTURE WITH CONCRETE PULLBOX AT BASE OF POLE

SURFACE OR PENDENT MOUNTED FIXTURE

PENDENT OR CEILING MOUNTED FLUORESCENT FIXTURE

1' X 4' LIGHT FIXTURE

1' X 4' EMERGENCY LIGHT FIXTURE

WALL MOUNTED OCCUPANCY SENSOR

EMERGENCY FIXTURE WITH BATTERY PACK

WALL MOUNTED FIXTURE

STANCHION MOUNTED FIXTURE

EXIT SIGN

EXPLOSION PROOF CONDUIT SEAL

S — SINGLE POLE TOGGLE TYPE LIGHTING SWITCH

GROUNDED TYPE DUPLEX RECEPTACLE

M M — MOTOR

LOCAL CONTROL STATION (LCS)

EXPOSED ELECTRICAL CONDUIT

CONDUIT IN SLAB OR UNDERGROUND

A-1.3 — HOMERUN TO PANEL A CIRCUIT 1& 3

G — GROUND WIRE, SIZE AS NOTED

HASH MARKS DENOTE QUANTITY OF CONDUCTORS, #12AWG UON

ELECTRICAL CONDUIT RUN-UP

ELECTRICAL CONDUIT RUN-DOWN

WATER TIGHT FLEXIBLE CONDUIT

PANEL BOARD

D 2/40 X 8' — FIXTURE TYPE; FIXTURE QUANTITY; NUMBER OF LAMPS/LAMP WATTAGE PER FIXTURE; MOUNTING HEIGHT

J — JUNCTION BOX

GROUND ROD AND WELL, 3/4"ø X 10'-0" LENGTH COPPERCLAD STEEL

DISCONNECT SWITCH 3P

FIELD MOUNTED INSTRUMENT

SPEAKER/HORN

GENERATOR RECEPTACLE

PC — PHOTOCELL

TELEPHONE OUTLET

P102 — CONDUIT NUMBER (P=POWER, C=CONTROL, I=INSTRUMENTATION)

ABBREVIATIONS

A	AMPERE (AMPS), ANALOG	(N)	NEW
AC	ALTERNATING CURRENT/ AIR CONDITIONING	N	NEUTRAL
AF	AMPS-FRAME	NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION
AIC	AVAILABLE INTERRUPTING CURRENT		
AM	AMP METER	NC	NORMALLY CLOSED
AS	AMP SWITCH	NF	NON-FUSED
AT	AMPS-TRIP	NL	NIGHT LIGHT
ATS	AUTOMATIC TRANSFER SWITCH	NO	NORMALLY OPEN
AUTO	AUTOMATIC	N/P	NAMEPLATE
AWG	AMERICAN WIRE GAUGE	OC	ON CENTER
BKR	BREAKER	OC	OPEN/CLOSE (STATUS)
BPS	BOOSTER PUMP STATION		
BSC	BARE STRANDED COPPER	P	POLE
		P	POWER, PUMP
C	CONDUIT	PB	PULL BOX
C	CONTROL	PC	PHOTO CELL
CB	CIRCUIT BREAKER	PH, ø	PHASE
CID	CURRENT INDICATING TRANSMITTER	PIT	PRESSURE INDICATOR TRANSMITTER
CID	CLASS I, DIVISION I	PNL	PANEL
CKT	CIRCUIT	PM	POWER MONITOR
CO	CONDUIT ONLY		
CP	CONTROL PANEL	RECEPT	RECEPTACLE
CPT	CURRENT POTENTIAL TRANSFORMER	RGS	RIGID GALVANIZED STEEL
CR	CONTROL RELAY	RTD	RESISTANCE TEMPERATURE DEVICE
CT	CURRENT TRANSFORMER	RVAT	REDUCED VOLTAGE AUTO XFMR STARTER
CTRL	CONTROL		
CU	COPPER	RVSS	REDUCED VOLTAGE SOLID STATE STARTER
DC	DISCONNECT	S	STAINLESS STEEL
DCS	DISTRIBUTIVE CONTROL SYSTEM	SW	SWITCH
DI	DIGITAL INPUT	SWBD	SWITCHBOARD
DIV	DIVISION	SWGR	SWITCHGEAR
DO	DIGITAL OUTPUT		
ETM	ELAPSED TIME METER	TB	TERMINAL BLOCK
(E),EXST	EXISTING	TD	TIME DELAY
		TDI	TIME DELAY IMMIGRATION
FBK	FEEDER BREAKER	TEMP	TEMPERATURE
FLA	FILL LOAD AMPS	TOU	TIME OF USE
FVNR	FULL VOLTAGE NON-REVERSING	TSP	TWISTED SHIELDED PAIR
G,GND	GROUND	TST	TWISTED SHIELDED TRIAD
GFI	GROUND FAULT INTERRUPTER	TT	THERMOSTAT
GIW	GROUND FAULT INTERRUPTER, WEATHER PROOF	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
HID	HIGH INTENSITY DISCHARGE (LAMP)	TYP	TYPICAL
HMI	HUMAN MACHINE INTERFACE		
HPS	HIGH PRESSURE SODIUM (LAMP)	UG	UNDERGROUND
HTR	HEATER	UON	UNLESS OTHERWISE NOTED
HZ	HERTZ	UPS	UNINTERRUPTIBLE POWER SUPPLY
I	INSTRUMENTATION	V	VOLT
IND	INDICATION	VA	VOLTAMPERES
I/O	INPUT/OUTPUT	VAC	VOLTS AC
J	JUNCTION BOX	VDC	VOLTS DC
		VFD	VARIABLE FREQUENCY DRIVE
K	KIRK KEY INTERLOCK	VIB	VIBRATION
KCM	THOUSAND CIRCULAR MILS (OR MCM)	VS	VOLTAGE SWITCH
KV	KILOVOLT		
KVA	KILOVOLT AMPERES	W	WATTS, WIRE
		WP	WEATHERPROOF
L	LINE	XFMR	TRANSFORMER
LCP	LOCAL CONTROL PANEL		
LOS	LOCK-OUT STOP PUSH BUTTON		
LSI	LONG TIME, SHORT TIME, INSTANTANEOUS		
LTG	LIGHTING		
MA	MILLIAMPERE		
MANUF	MANUFACTURER'S		
MBK	MAIN BREAKER		
MCC	MOTOR CONTROL CENTER		
MCP	MOTOR CIRCUIT PROTECTION		
MH	MANHOLE		
MIC	MANUFACTURER'S INTERCONNECTING CABLE		
MOV	MOTOR OPERATED VALVE		
MPR	MOTOR PROTECTION RELAY		
MS	MAGNETIC STARTER		
MTR	MOTOR		
MTS	MANUAL TRANSFER SWITCH		

PUMP STATION NO. 65 CAPACITY UPGRADE

E-1

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

ELECTRICAL LEGENDS & ABBREVIATIONS

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING

0 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 20 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Hong Li Jiang FOR CITY ENGINEER — 8-27-12 DATE

SUBMITTED BY: ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

PROJECT ENGINEER

274-1695
LAMBERT COORDINATE

1914-6256
CCS83 COORDINATE

36349-20-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

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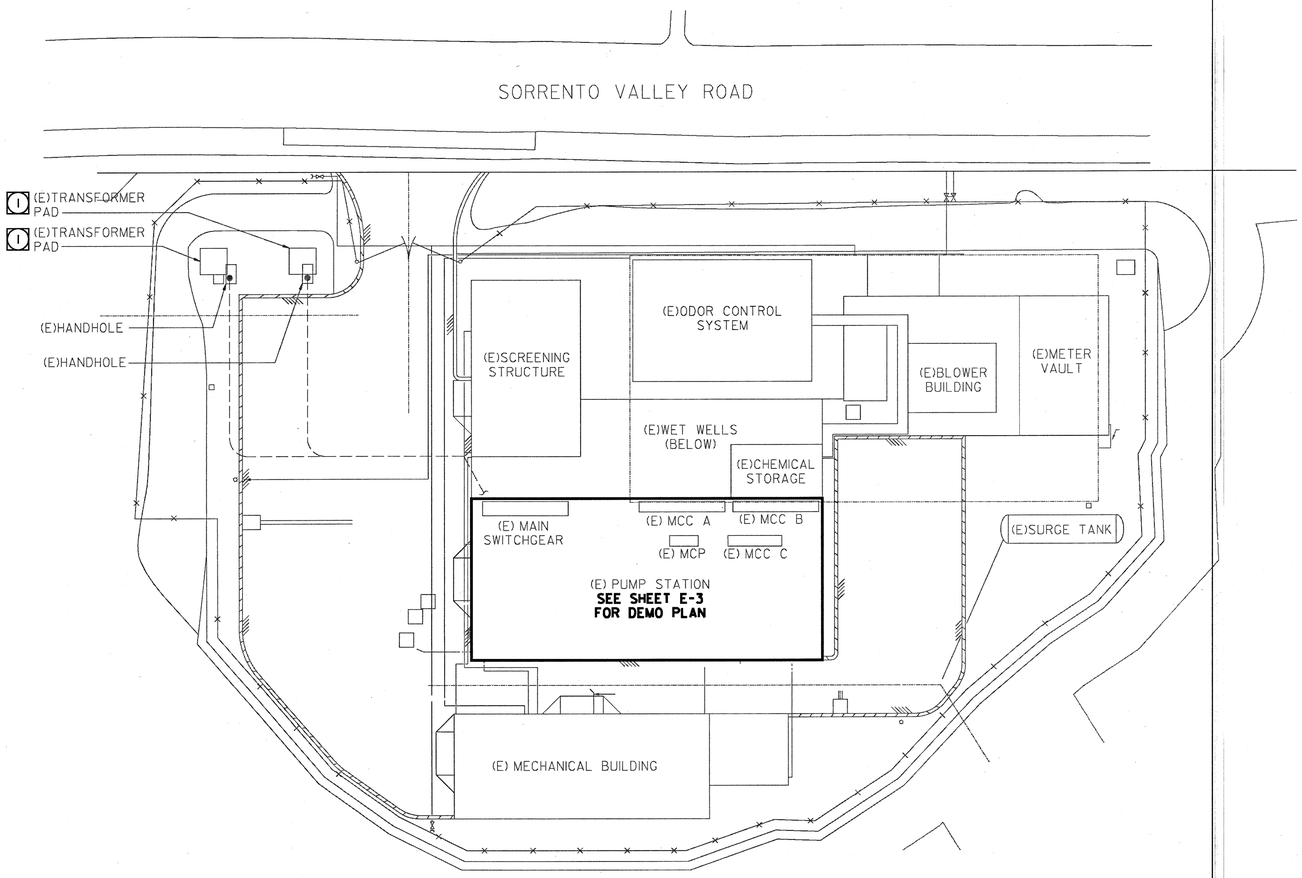

ELECTRICAL SITE PLAN 1
SCALE: 1"=20'

NOTE:

(1) FOR INFORMATION ONLY, (E)SERVICE TRANSFORMER WILL BE REPLACED WITH NEW BY SDG&E. NO WORK REQUIRED PER THIS CONTRACT.

N

0 20 40 60
SCALE 1"=20'

PUMP STATION NO. 65 CAPACITY UPGRADE

E-2

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

ELECTRICAL SITE PLAN

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 21 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hoge Tyson FOR CITY ENGINEER 8-27-12 DATE
DESIGNED BY ASSOCIATE ENGINEER
PROJECT ENGINEER
274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-21-D

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

SPEC. NO. 5522

REGISTERED PROFESSIONAL ENGINEER JEONG S. PARK No.E6792 Exp. 03-31-2013 ELECTRICAL STATE OF CALIFORNIA

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

CONSULTANT

LEE & RO, Inc.
San Diego, California

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
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PUBLIC WORKS PROJECT

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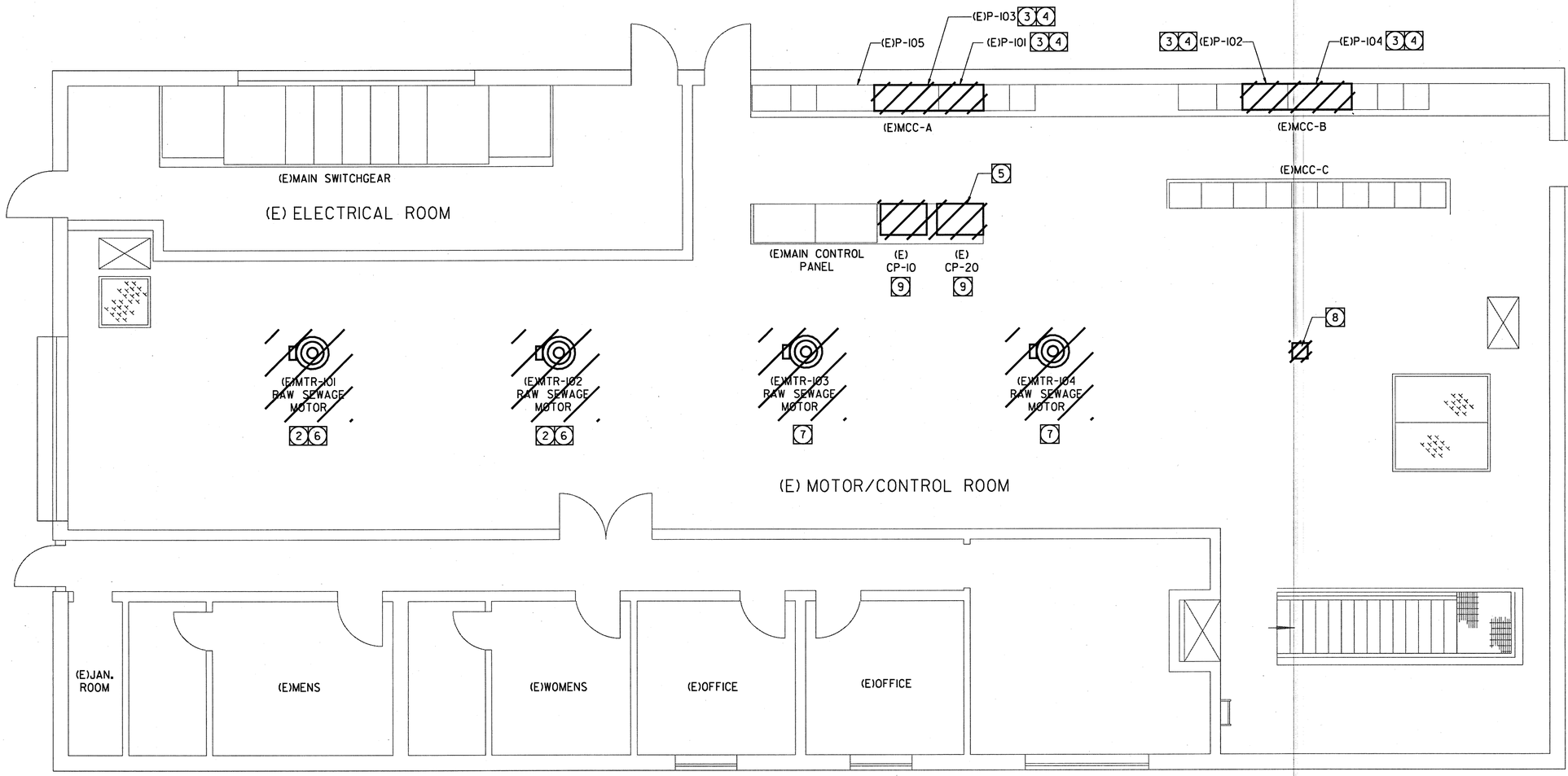

NOTES:

1. GENERAL: HASH MARKS DENOTES DEMOLITION WORK PER THIS CONTRACT. SEE SHEET D-1 THROUGH D-3 AND E-6 FOR ADDITIONAL NOTES.
2. DISCONNECT AND REMOVE EXISTING CONDUCTORS FOR RAW SEWAGE PUMPS P-101 AND P-102. DEMO ASSOCIATED EXPOSED CONDUITS.
3. REMOVE ALL INTERNAL COMPONENTS INLCUDING BREAKER, SOLID STATE MOTOR STARTER, AND CONTROL DEVICES.
4. REMOVE DOOR PANELS WITH MOTOR PROTECTION RELAY. PROTECT EXISTING MCC ENCLOSURE AND BACK PANEL IN PLACE.
5. RELOCATE (2) EXISTING LEVEL INDICATOR TO EXISTING MAIN CONTROL PANEL DOOR.
6. PROVIDE BLANK COVER AT THE OPENING OF PUMP SHAFT. MATCH COVER WITH EXISTING AT PUMP NO. 5.
7. DISCONNECT AND REMOVE EXISTING CONDUCTORS FOR RAW SEWAGE PUMPS P-103 AND P-104. PROTECT ASSOCIATED CONDUITS AND KEEP IN PLACE.
8. REMOVE EXISTING BLANK COVER.
9. REMOVE EXISTING CONTROL PANELS, CP-10 AND CP-20.

0 4 8 12

SCALE 1/4" = 1'-0"

ELECTRICAL DEMOLITION PLAN
MOTOR / CONTROL ROOM LEVEL

1 / –

SCALE: 1/4" = 1'-0"

PUMP STATION NO. 65 CAPACITY UPGRADE

E-3

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

ELECTRICAL DEMOLITION PLAN MOTOR/CONTROL ROOM LEVEL

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 22 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Hazi Ayaz FOR CITY ENGINEER — DATE 8-27-12
SUBMITTED BY: Daniel Park ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

J. Serrillo PROJECT ENGINEER

274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-22-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW _X_

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER JEONG S. PARK No. E16192 ELECTRICAL STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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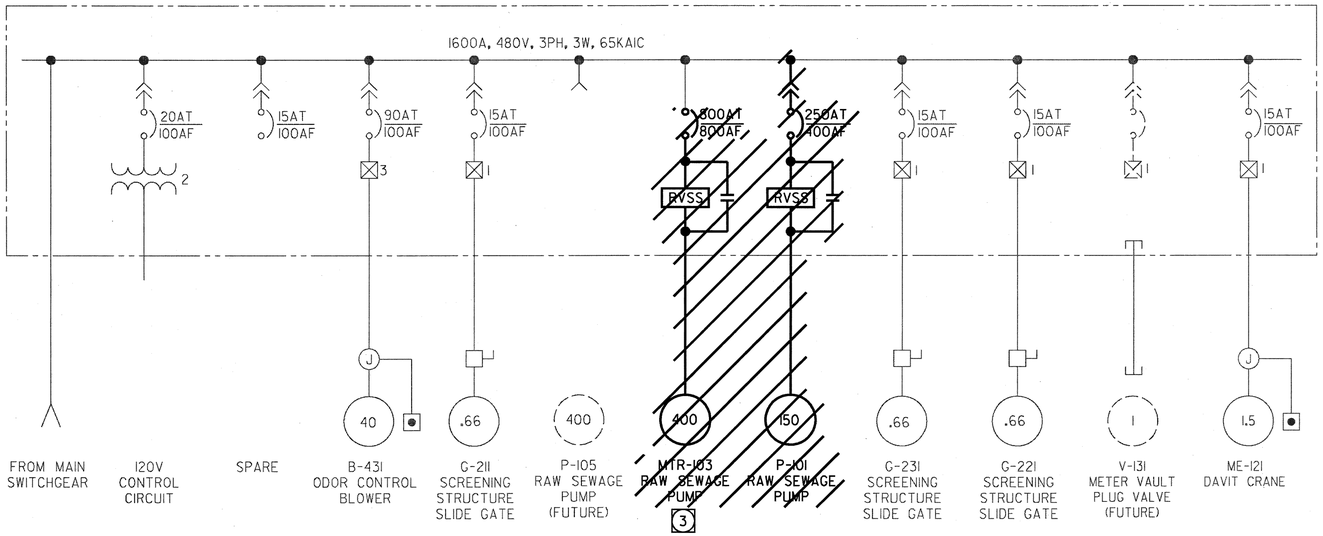
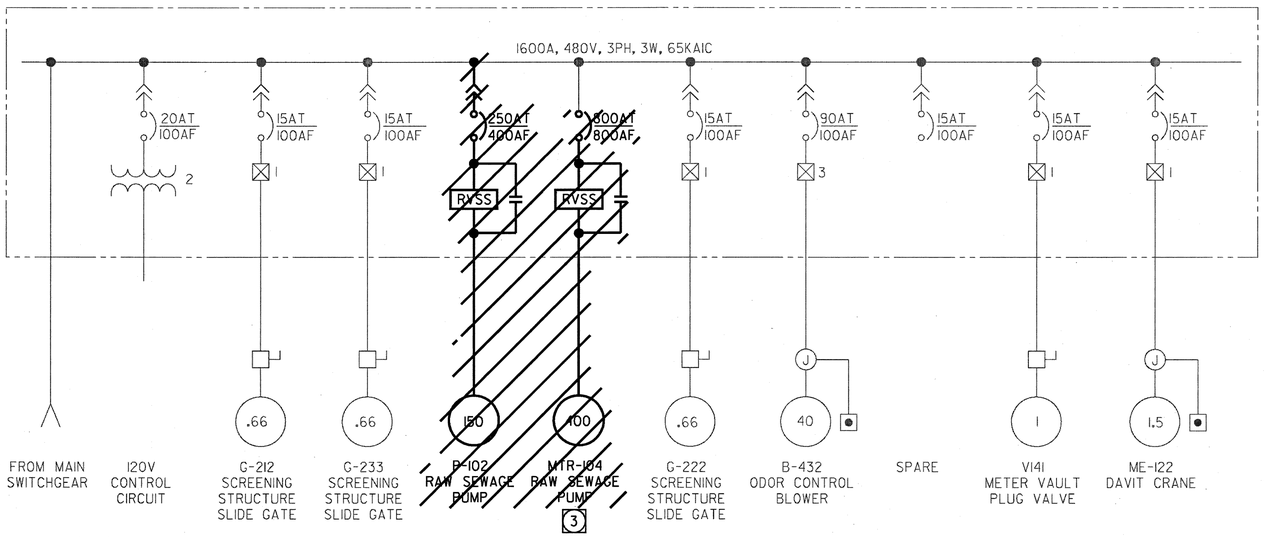
(E) MCC-A



MCC-A SINGLE LINE DIAGRAM-DEMOLITION (1)(2)

(E) MCC-B



MCC-B SINGLE LINE DIAGRAM-DEMOLITION (1)(2)

(E) MCC-A LOAD LIST		
LOAD	HP/KVA	AMPS
B-431 ODOR CONTROL BLOWER	40HP	52.0
G-211 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
MTR-103 RAW SEWAGE PUMP	400HP	477.0
MTR-101 RAW SEWAGE PUMP	150HP	188.0
G-231 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
G-221 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
ME-121 DAVIT CRANE	1.5HP	3.0
TOTAL	595.9KVA	716.8

(E) MCC-B LOAD LIST		
LOAD	HP/KVA	AMPS
G-212 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
G-233 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
MTR-102 RAW SEWAGE PUMP	150HP	180.0
MTR-104 RAW SEWAGE PUMP	400HP	477.0
G-222 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
B-432 ODOR CONTROL BLOWER	40HP	52.0
V-141 METER VAULT PLUG VALVE	1.0HP	2.1
ME-122 DAVIT CRANE	1.5HP	3.0
TOTAL	597.7KVA	718.9

NOTES:

(1) HASH MARKS DENOTES DEMOLITION WORK PER THIS CONTRACT.

(2) SEE SHEET E-6 FOR ADDITIONAL DETAILS.

(3) PROTECT EXISTING CONDUIT(S) IN PLACE.

PUMP STATION NO. 65 CAPACITY UPGRADE

E-4

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

ELECTRICAL DEMOLITION
SINGLE LINE DIAGRAM
MCC-A & MCC-B

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 23 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: FOR CITY ENGINEER — DATE 8-27-12
SUBMITTED BY: ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

PROJECT ENGINEER

274-1695
LAMBERT COORDINATE

1914-6256
CCS83 COORDINATE

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

36349-23-D

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER — JEONG S. PARK — No. E16392 — ELECTRICAL — STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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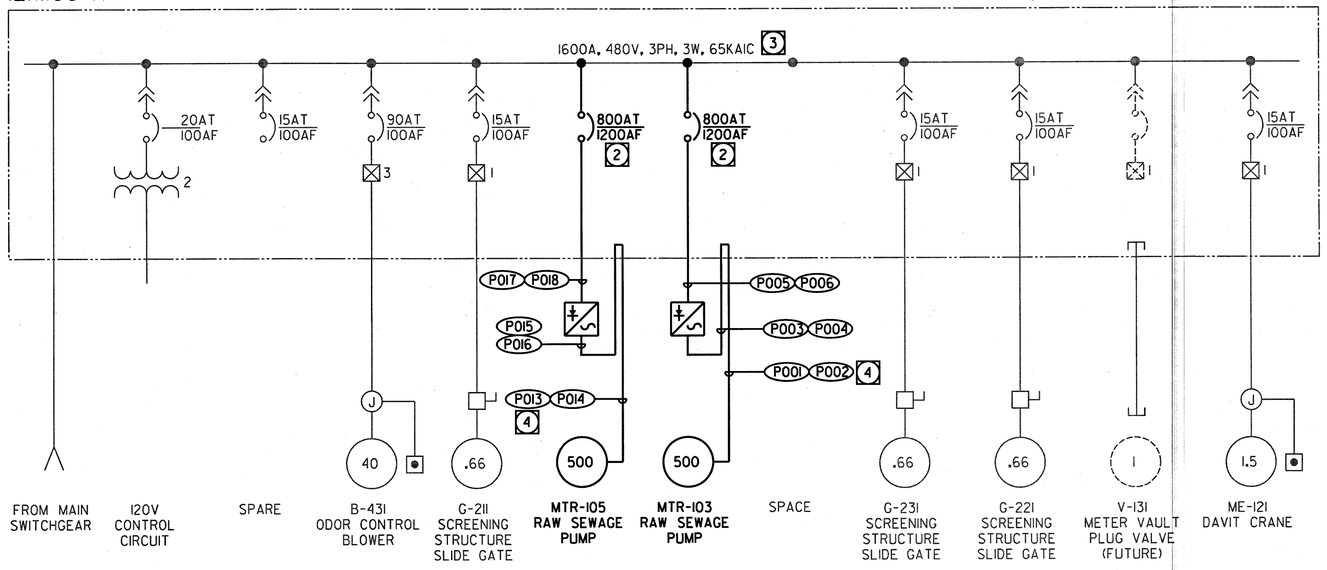
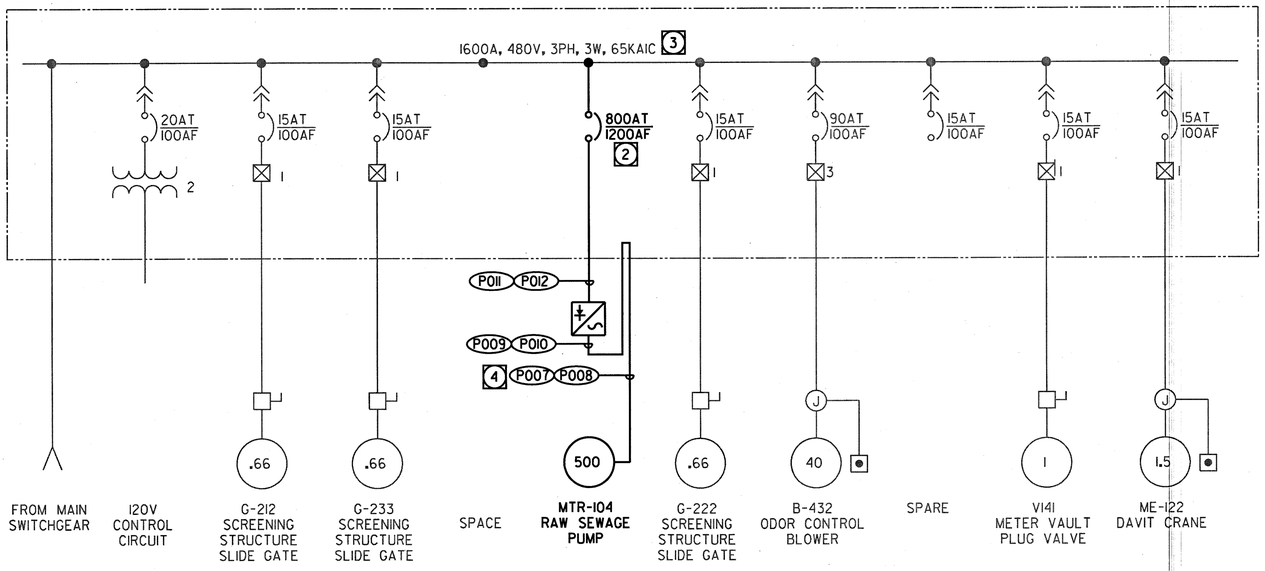
(E)MCC-A



MCC-A SINGLE LINE DIAGRAM-MODIFIED

MCC-A LOAD LIST		
LOAD	HP/KVA	AMPS
B-431 ODOR CONTROL BLOWER	40HP	52.0
G-211 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
MTR-105 RAW SEWAGE PUMP	500HP	590.0
MTR-103 RAW SEWAGE PUMP	500HP	590.0
G-231 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
G-221 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
V-131 METER VAULT PLUG VALVE	1.0HP	2.1
ME-121 DAVIT CRANE	1.5HP	3.0
TOTAL	1032.5KVA	1241.9
TOTAL KVA INCREASE	436.6KVA	

(E)MCC-B



MCC-B SINGLE LINE DIAGRAM-MODIFIED

MCC-B LOAD LIST		
LOAD	HP/KVA	AMPS
G-212 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
G-233 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
MTR-104 RAW SEWAGE PUMP	500HP	590.0
G-222 SCREENING STRUCT. SLIDE GATE	.66HP	1.6
B-432 ODOR CONTROL BLOWER	40HP	52
V-141 METER VAULT PLUG VALVE	1HP	2.1
ME-122 DAVIT CRANE	1.5HP	3.0
TOTAL	542.0KVA	651.9
TOTAL KVA INCREASE	-55.7KVA	

NOTES:

1. GENERAL: BOLD LINE DENOTES NEW EQUIPMENT.
2. BREAKER SHALL BE RATED 65KAIC OR BETTER. PROVIDE INTERCHANGEABLE SOLID STATE TRIP UNIT WITH ADJUSTABLE LSI.
3. EXISTING MCC IS A SQUARE D MODEL 5 SERIES.
4. EXISTING CONDUIT WITH NEW FEEDER CABLE.

PUMP STATION NO. 65 CAPACITY UPGRADE

E-5

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

SINGLE LINE DIAGRAM
MCC-A & MCC-B

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 24 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hector Arias FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY Dan Ladson ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

PROJECT ENGINEER
274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-24-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER JEONG S. PARK No.E16392 ELECTRICAL STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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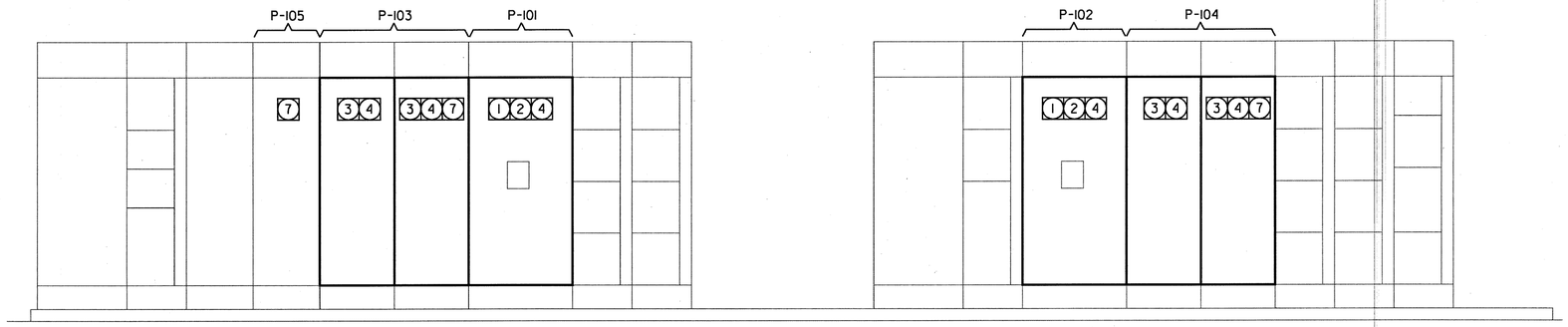
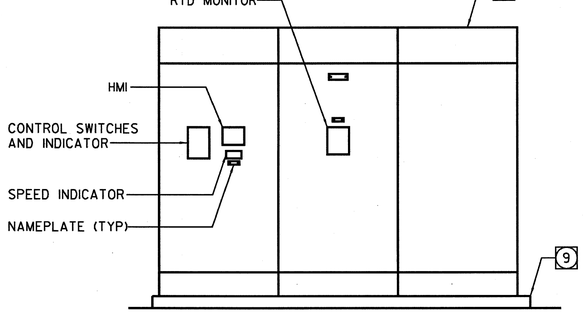


(E) MCC–A ELEVATION–MODIFICATION [6]
NOT TO SCALE

(E) MCC–B ELEVATION–MODIFICATION [6]
NOT TO SCALE



VFD ELEVATION [5]
NOT TO SCALE

NOTES:

1. DISCONNECT AND REMOVE ALL EXISTING POWER AND CONTROL/SIGNAL CABLES FROM FIELD DEVICES.
2. REMOVE EXISTING BREAKER, MOTOR STARTER AND APPURTENANCE.
3. REMOVE EXISTING BREAKER, SOLID STATE MOTOR STARTER AND APPURTENANCE.
4. REMOVE EXISTING DOOR PANEL AND INSTALL NEW.
5. TYPICAL FOR VFD-P-103, VFD-P-104 AND VFD-P-105.
6. RETURN REMOVED MULTILIN MOTOR PROTECTION RELAY WITH CT'S TO CITY, TYPICAL.
7. PROVIDE AND INSTALL FEEDER BREAKER AND DOOR MOUNT BREAKER OPERATING MECHANISM.
8. VFD ENCLOSURE. OVERALL DIMENSION OF THE VFD ENCLOSURE SHALL NOT BE OVER 120"W X 92"H X 32"D.
9. CONCRETE HOUSEKEEPING PAD. 4" ALL AROUND EXCEPT BACKSIDE. MATCH PAD HEIGHT WITH EXISTING. SEE DRAWING E-15 FOR CONCRETE HOUSEKEEPING PAD DETAIL.

PUMP STATION NO. 65 CAPACITY UPGRADE

E–6

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

MCC & VFD ELEVATIONS

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER JEONG S. PARK No. E6792 ELECTRICAL STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 25 OF 40 SHEETS

APPROVED Hoss Ayat FOR CITY ENGINEER — DATE 8-27-12

SUBMITTED BY Daniel Park ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

WBS B-00306
WBS _____

Jeong S. Park PROJECT ENGINEER

274-1695 LAMBERT COORDINATE

1914-6256 CCSD83 COORDINATE

36349-25-D

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Daniel Park

	CONDUIT		CONDUCTORS (1)				FROM	TO	REMARKS
	NO.	SIZE	POWER	CONTROL	SIGNAL	SPARES			
(2)	C001	1 1/4"		6#14		2#14	PULL BOX @ PUMP ROOM	(E)MAIN CONT PNL	LOS, (2) CHECK VLV
(2)	C002	1 1/4"		6#14		2#14	PULL BOX @ PUMP ROOM	(E)MAIN CONT PNL	LOS, (2) CHECK VLV
(3)	C003	1 1/4"		6#14		2#14	PULL BOX @ PUMP ROOM	(E)MAIN CONT PNL	LOS, (2) CHECK VLV
	C004								NOT USED
	C005	1"		16#14		2#14	VFD-P-105	J-BOX	NOTE 4
	C006	1"		16#14		2#14	VFD-P-104	J-BOX	NOTE 4
	C007	1"		32#14		4#14	J-BOX	J-BOX	
	C008	1"		16#14		2#14	VFD-P-103	J-BOX	NOTE 4
	C009	1"		20#14		2#14	J-BOX	J-BOX	NOTE 6
	C010	1"		16#14		6#14	J-BOX	CP-2	NOTE 7
	C011	1 1/4"		32#14			(E)MAIN CONTROL PANEL	J-BOX	NOTE 8
	C012	3/4"		4#14			P-105 CHECK VALVE	PULL BOX	
	C013	3/4"		2#14			P-105 LOS	PULL BOX	
	1001	1 1/2"		2#12, 1#12G	8TST		MTR-103	VFD-P-103	RTD & SPACE HEATER
	1002								NOT USED
(2)	1003	1 1/2"		2#12, 1#12G	8TST		MTR-104	(E)MCC-B	
	1004	1 1/2"		2#12, 1#12G	8TST		(E)MCC-B	VFD-P-104	RTD & SPACE HEATER
(2)	1005	1 1/2"		2#12, 1#12G	8TST		MTR-105	(E)MCC-A	
	1006								NOT USED
	1007	1 1/2"		2#12, 1#12G	8TST		(E)MCC-A	VFD-P-105	RTD & SPACE HEATER
	1008	3/4"			2TSP		VFD-P-105	J-BOX	SPEED IND. & CTRL
	1009	3/4"			2TSP		VFD-P-104	J-BOX	SPEED IND. & CTRL
	1010	1"			4TSP		J-BOX	J-BOX	
	1011	3/4"			2TSP		VFD-P-103	J-BOX	SPEED IND. & CTRL
	1012	1"			2TSP		(E)MCC-A	CP-2	P-103 VIB
	1013	1"			2TSP		(E)MCC-B	CP-2	P-104 VIB
	1014	1 1/4"			6TSP		J-BOX	CP-2	VFD-P-103, P-104, P-105 SPEED
	1015	1"			MODBUS		VFD-P-105	J-BOX	
	1016	1"			(2) MODBUS		VFD-P-104	J-BOX	
	1017	1"			MODBUS		J-BOX	J-BOX	
	1018	1"			(2) MODBUS		VFD-P-103	J-BOX	
	1019	1"			MODBUS		J-BOX	CP-2	
(2)	1020	1 1/2"			2TST, 4TSP		P-103 PULL BOX	(E)MCC-A	RTD, VIB, PIT, NOTE 5
(2)	1021	1 1/2"			2TST, 4TSP		P-104 PULL BOX	(E)MCC-B	RTD, VIB, PIT, NOTE 5
	1022								NOT USED
(3)	1023	1 1/2"			2TST, 4TSP		P-105 PULL BOX	(E)MCC-A	RTD, VIB, PIT
	1024	1 1/2"			2TST		(E)MCC-B	VFD-P-104	P-104 RTD
	1025	1 1/2"			2TST		(E)MCC-A	VFD-P-105	P-105 RTD
	1026	1 1/2"			2TST		(E)MCC-A	VFD-P-103	P-103 RTD
	1027	1 1/2"			4TSP		(E)MCC-A	CP-2	P-105 VIB, PIT
	1028	1"			2TSP		J-BOX	PULL BOX	PIT'S
	1029	1"			2TST		PULL BOX	BEARING RTD	
	1030	1"			-		VIB TRANSMITTER	VIB SENSOR	MANUF CABLE
	1031	1"			2TSP		VIB TRANSMITTER	PULL BOX	
	1032	3/4"			ITSP		PIT-105B	J-BOX	
	1033	3/4"			ITSP		PIT-105A	J-BOX	

	CONDUIT		CONDUCTORS (1)				FROM	TO	REMARKS
	NO.	SIZE	POWER	CONTROL	SIGNAL	SPARES			
(2)	P001	3"	3#500, 1#1/0G				MTR-103	(E)MCC-A	
(2)	P002	3"	3#500, 1#1/0G				MTR-103	(E)MCC-A	
	P003	3"	3#500, 1#1/0G				(E)MCC-A	VFD-P-103	
	P004	3"	3#500, 1#1/0G				(E)MCC-A	VFD-P-103	
	P005	3"	3#500, 1#1/0G				VFD-P-103	(E)MCC-A	
	P006	3"	3#500, 1#1/0G				VFD-P-103	(E)MCC-A	
(2)	P007	3"	3#500, 1#1/0G				MTR-104	(E)MCC-B	
(2)	P008	3"	3#500, 1#1/0G				MTR-104	(E)MCC-B	
	P009	3"	3#500, 1#1/0G				(E)MCC-B	VFD-P-104	
	P010	3"	3#500, 1#1/0G				(E)MCC-B	VFD-P-104	
	P011	3"	3#500, 1#1/0G				VFD-P-104	(E)MCC-B	
	P012	3"	3#500, 1#1/0G				VFD-P-104	(E)MCC-B	
(2)	P013	3"	3#500, 1#1/0G				MTR-105	(E)MCC-A	
(2)	P014	3"	3#500, 1#1/0G				MTR-105	(E)MCC-A	
	P015	3"	3#500, 1#1/0G				(E)MCC-A	VFD-P-105	
	P016	3"	3#500, 1#1/0G				(E)MCC-A	VFD-P-105	
	P017	3"	3#500, 1#1/0G				VFD-P-105	(E)MCC-A	
	P018	3"	3#500, 1#1/0G				VFD-P-105	(E)MCC-A	

NOTES:

(1) ALL CONDUCTORS SHOWN PER THIS SCHEDULE ARE NEW CONDUCTORS THAT SHALL BE PROVIDED BY THE CONTRACTOR.

(2) EXISTING CONDUIT.

(3) EXISTING CONDUIT EXTENSION, SEE DETAIL PLAN ON SHEET E-12.

(4) (2) DO, (4) DI, LOS AND CHECK VALVE STATUS.

(5) PIT SIGNAL CABLES (2TSP) SHALL BE TERMINATED AT EXISTING PLC VIA EXISTING CONDUIT. EXISTING CONDUIT IS NOT SHOWN ON PLAN.

(6) P-103 (1) DO
P-104 (1) DO, (4) DI, LOS , CHECK VALVE
P-105 LOS, CHECK VALVE

(7) P-103 (1) DO
P-104 (1) DO
P-105 (2) DO, (4) DI

(8) P-103 (1) DO, (4) DI, LOS, CHECK VALVE
P-104 (1) DO, (4) DI, LOS, CHECK VALVE
P-105 LOS, CHECK VALVE

PUMP STATION NO. 65 CAPACITY UPGRADE

E-7

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

CABLE & CONDUIT SCHEDULE

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 26 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: FOR CITY ENGINEER — DATE 8-27-12
SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER
274-1695 LAMBERT COORDINATE
1914-6256 CCSS83 COORDINATE
36349-26-D

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER — JEONG S. PARK — NO. E 15792 — ELECTRICAL — STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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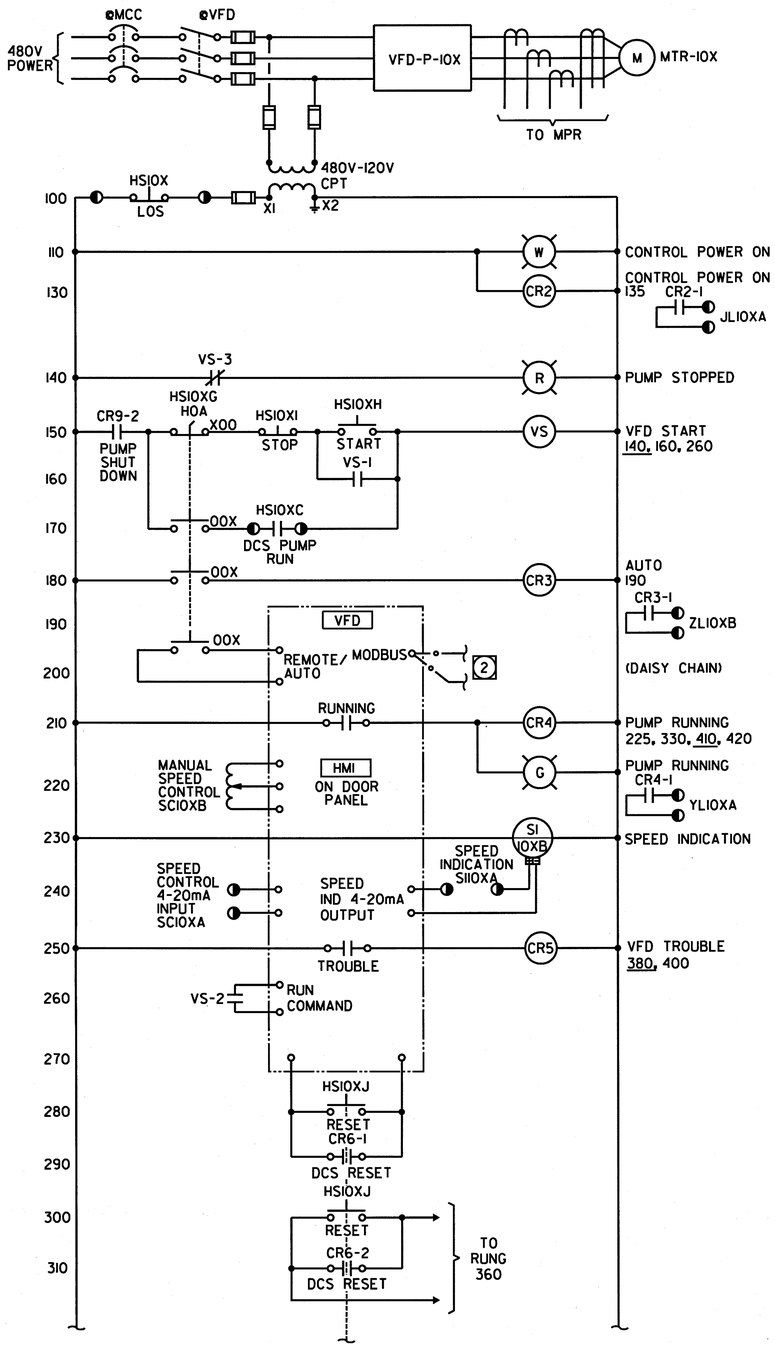
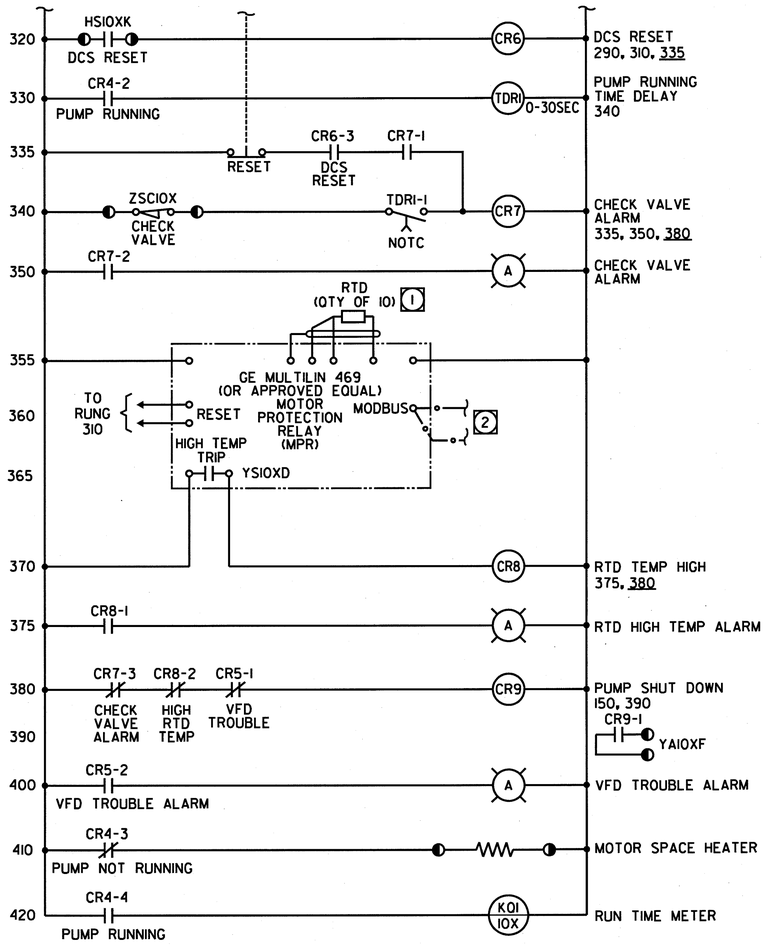
Daniel Park





PUMP CONTROL DIAGRAM 3

(PUMPS P-103, P-104 & P-105)

LEGEND	
P-103	X = 3
P-104	X = 4
P-105	X = 5

NOTES:

1. (6) MOTOR WINDING RTD (TWO PER PHASE).
   (2) MOTOR BEARING RTD
   (2) PUMP BEARING RTD.
2. SEE SHEET I-6 FOR MODBUS NETWORK.
3. VFD MANUFACTURER TO PROVIDE FORCED AIR VENTILATION SYSTEM WITH FILTER AND ENCLOSURE SPACE HEATER CONTROLLED BY THERMOSTAT(S). NOT SHOWN HEREIN FOR CLARITY.

PUMP STATION NO. 65 CAPACITY UPGRADE

E-8

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

ELECTRICAL
PUMP CONTROL SCHEMATIC

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 27 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Hoss Askar FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY: Peter Bilbit ASSOCIATE ENGINEER
Jeff Serrette PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-27-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH .... MEDIUM .... LOW. X.

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER JEONG S. PARK No.E16352 ELECTRICAL STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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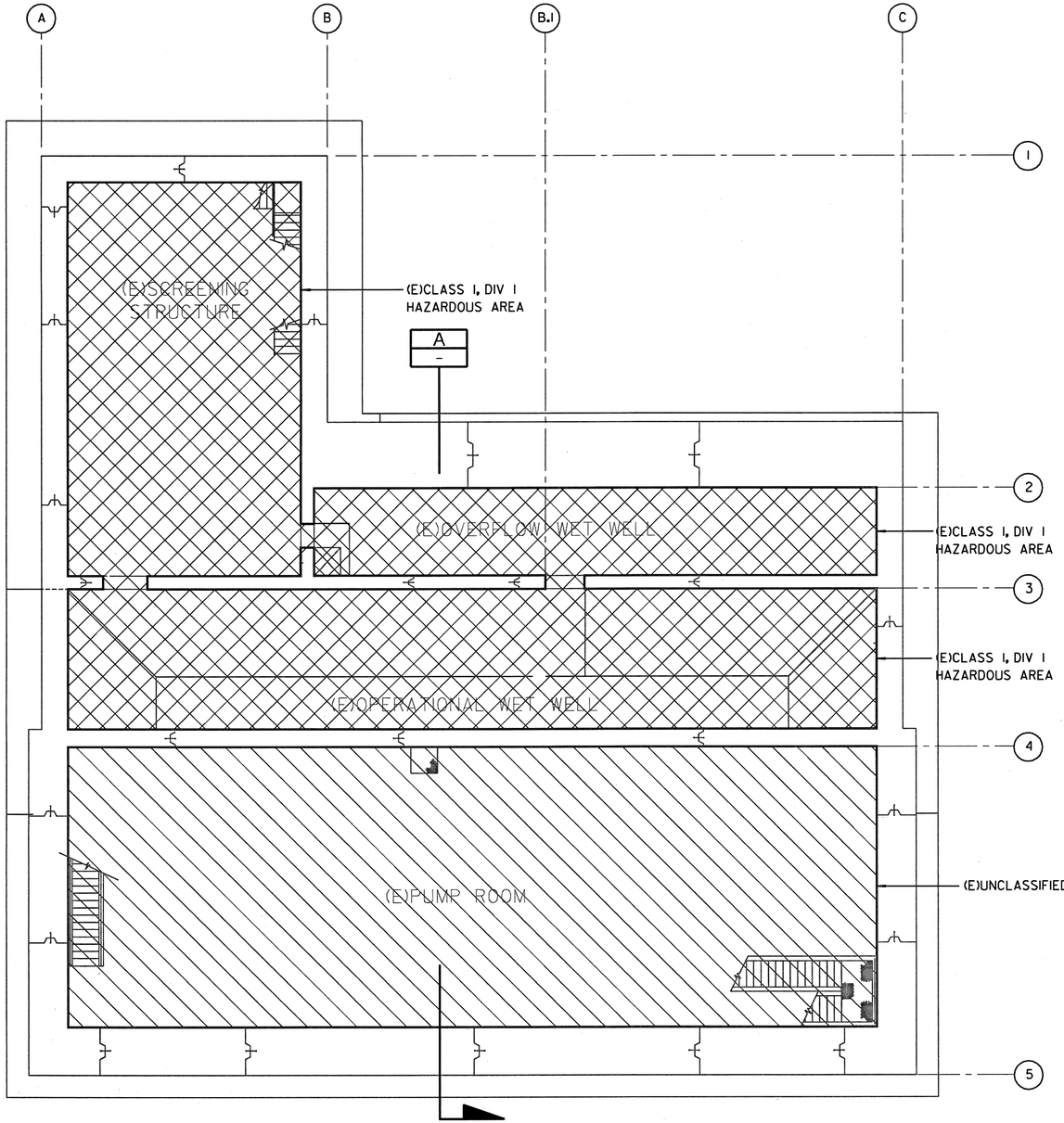
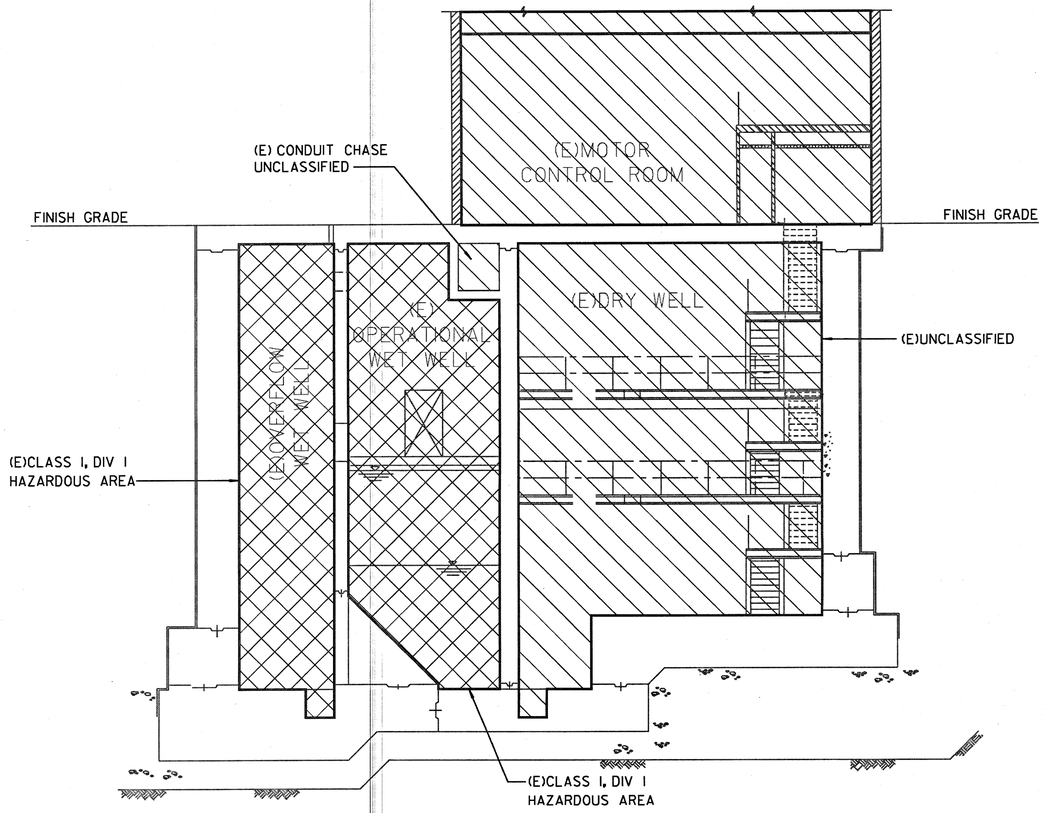
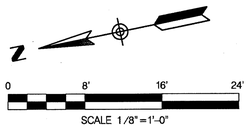


ELECTRICAL PLAN 1
SCALE: 1/8"=1'-0"



SECTION A
SCALE: 1/8"=1'-0"



SCALE 1/8"=1'-0"

PUMP STATION NO. 65 CAPACITY UPGRADE

E-9

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

ELECTRICAL AREA CLASSIFICATION PLAN & SECTION

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 28 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Hoyt Azar FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER
274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-28-D

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER JEONG S. PARK No.E16392 ELECTRICAL STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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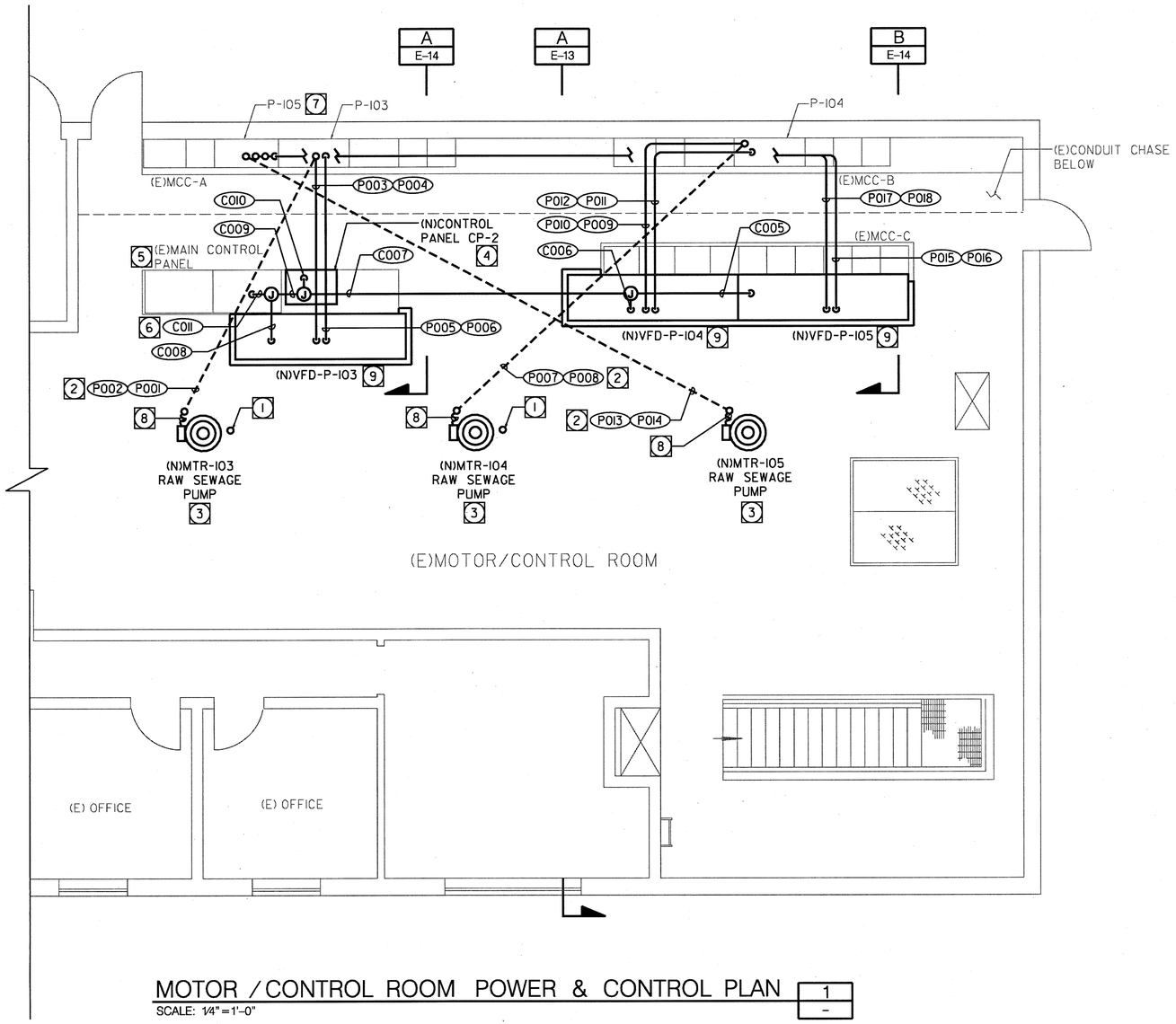
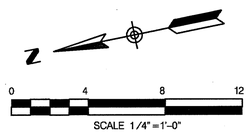


MOTOR / CONTROL ROOM POWER & CONTROL PLAN 1

SCALE: 1/4" = 1'-0"

NOTES:

1. PROTECT IN PLACE EXISTING 1"C CONDUIT STUB-UP. PROVIDE END-CAP.
2. EXISTING CONDUIT WITH NEW FEEDER CABLE.
3. THE FEEDER OF RAW SEWAGE PUMP MOTOR SHALL BE ROUTED IN FOLLOWING ORDER:
   a. FEEDER BREAKER AT MCC TO VFD INPUT TERMINALS.
   b. VFD OUTPUT TREMINALS TO MCC (NO TERMINATION).
   c. MCC TO RAW SEWAGE PUMP MORTOR VIA EXISTING CONDUIT.
4. NEMA 12 ENCLOSURE. 36"W x 24"D x 90"H MINIMUM.
5. CONTRACTOR SHALL VERIFY EXACT LOCATION OF EXISTING CONTROL CONDUIT STUB-UPS THAT COMES FROM PUMPS AT BASEMENT. (LOS AND CHECK VALVE STATUS CIRCUIT). ADJUST CONDUIT ROUTING IN FIELD AS REQUIRED AT NO ADDITIONAL COST TO OWNER.
6. LOS AND CHECK VALVE STATUS CIRCUITS FROM P-103, P-104 AND P-105, SEE NOTE 5.
7. RELOCATE MCC SUB FRAME IF IT BLOCKS EXISTING CONDUIT STUN-UPS.
8. NEW LIQUIDTITE FLEXIBLE CONDUIT CONNECTION.
9. DIMENSION OF VFD WILL VARY PER MANUFACTURER. ADJUST EXACT LOCATION IN FIELD AS NECESSARY.



SCALE 1/4" = 1'-0"

PUMP STATION NO. 65 CAPACITY UPGRADE

E-10

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

MOTOR/CONTROL ROOM POWER & CONTROL PLAN

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING

0 1

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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

REGISTERED PROFESSIONAL ENGINEER — JEONG S. PARK — No. E6392 — ELECTRICAL — STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 29 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Hoa Lin Luu FOR CITY ENGINEER — DATE 8-27-12
SUBMITTED BY: S. Delvalle ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

W. Devilla PROJECT ENGINEER

274-1695 LAMBERT COORDINATE

1914-6256 CCS83 COORDINATE

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

36349-29-D

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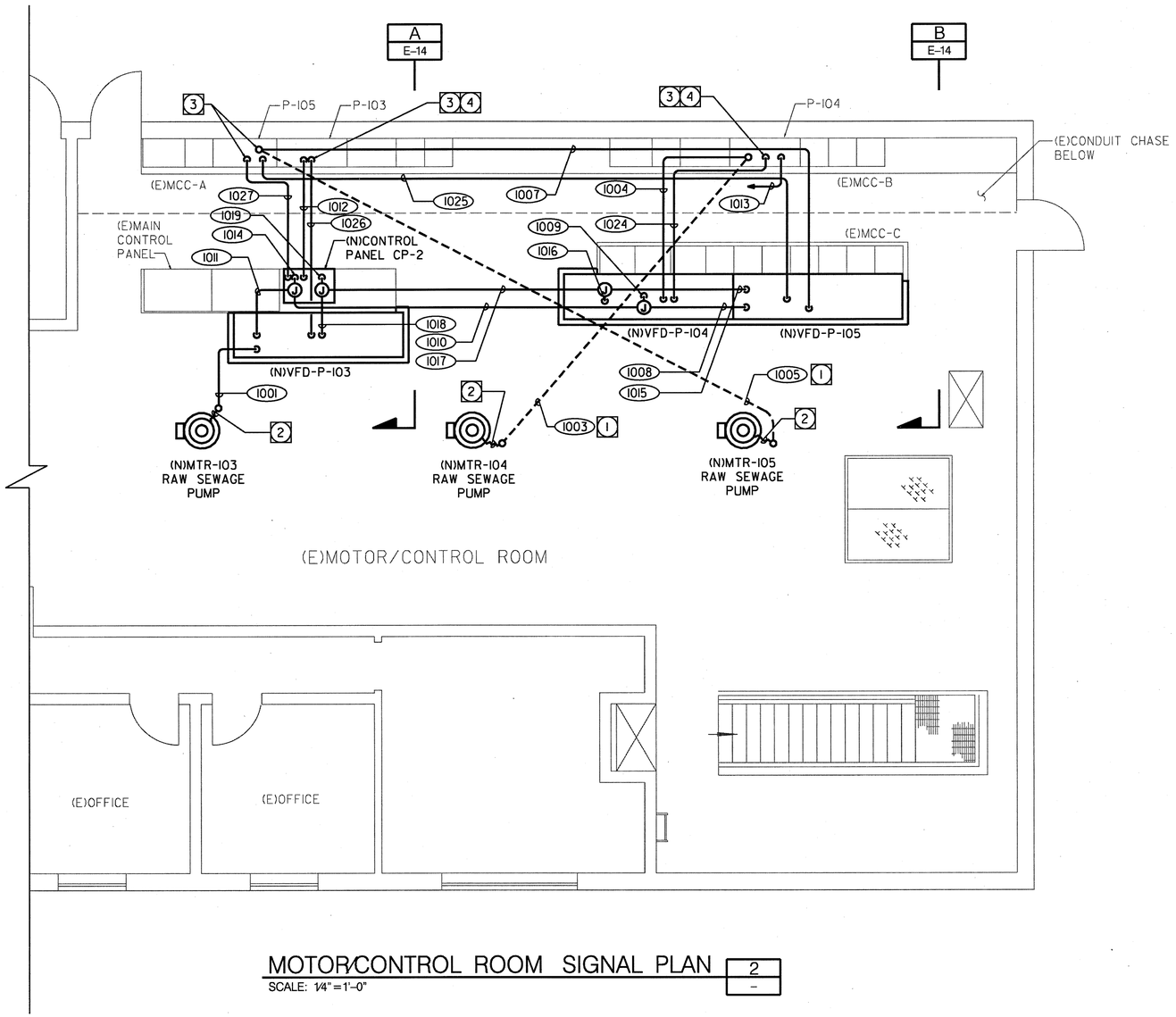
Daniel Park



MOTOR/CONTROL ROOM SIGNAL PLAN 2

SCALE: 1/4"=1'-0"

NOTES:

1. EXISTING CONDUIT WITH NEW CABLE.
2. NEW FLEXIBLE CONDUIT CONNECTION.
3. CONTRACTOR SHALL VERIFY EXACT LOCATION OF EXISTING SIGNAL CONDUIT STUB-UPS THAT COMES FROM PUMP AT BASEMENT (PIT'S, RTD'S AND VIBRATION TRANSMITTERS). ADJUST CONDUIT ROUTING IN FIELD AS REQUIRED AT NO ADDITIONAL COST TO OWNER.
4. RECONNECT NEW PIT'S SIGNAL CABLES FOR P-103 AND P-104 TO EXISTING PLC & (E)MAIN CONTROL PANEL VIA EXISTING CONDUIT. CONTRACTOR SHALL VERIFY EXACT ROUTING IN FIELD.

N

0 4 8 12

SCALE 1/4"=1'-0"

PUMP STATION NO. 65 CAPACITY UPGRADE

E-11

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

MOTOR/CONTROL ROOM SIGNAL PLAN

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 30 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hoss Ara FOR CITY ENGINEER 8-27-12 DATE

SUBMITTED BY ASSOCIATE ENGINEER

PROJECT ENGINEER

274-1695 LAMBERT COORDINATE

1914-6256 CCS83 COORDINATE

36349-30-D

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

REGISTERED PROFESSIONAL ENGINEER JEONG S. PARK No. E16392 ELECTRICAL STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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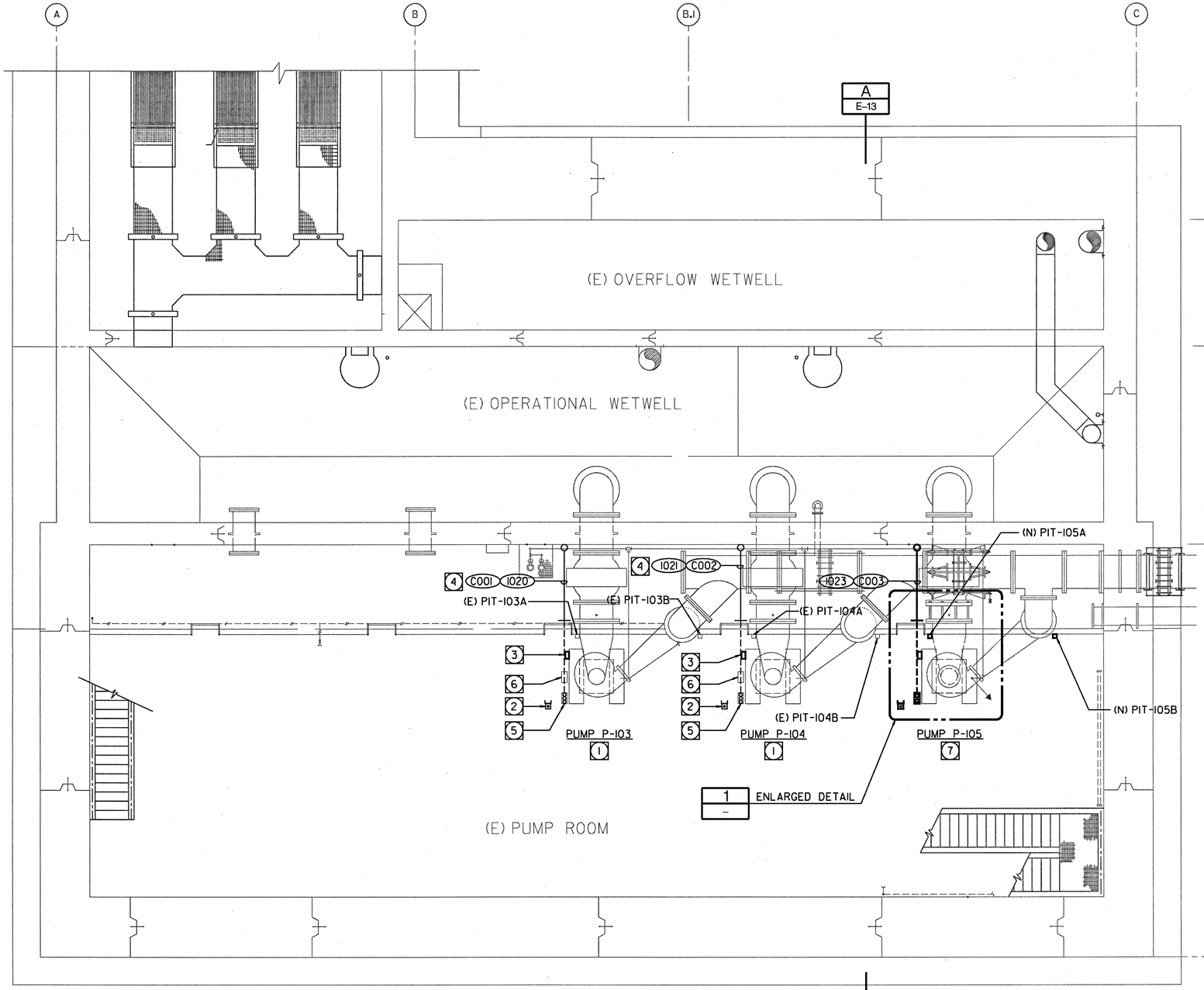
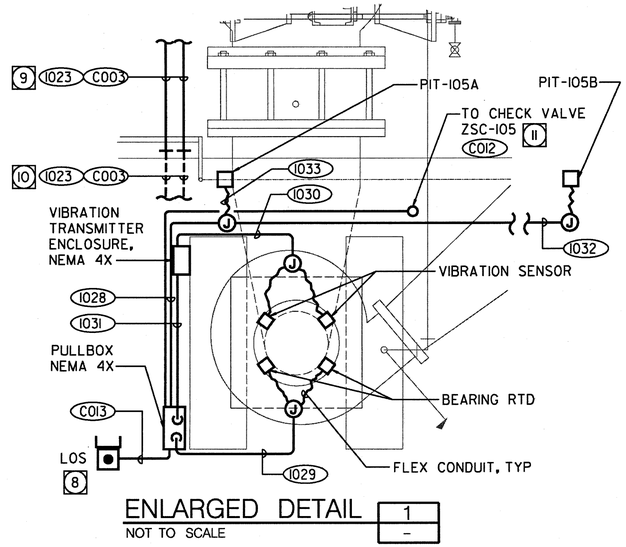
Daniel Park



ELECTRICAL PUMP ROOM PLAN 3/4
SCALE: 3/16"=1'-0"



ENLARGED DETAIL 1/-
NOT TO SCALE

NOTES:

1. EXISTING PUMP MODIFIED. RECONNECT EXISTING FIELD INSTRUMENT WIRING INCLUDING PIT'S, RTD'S, LOS AND VIBRATION SENSOR. ALL EXISTING CABLES SHALL BE REPLACED WITH NEW.
2. REPLACE EXISTING LOS WITH NEW. PROTECT IN PLACE LOS ENCLOSURE.
3. INSTALL VIBRATION TRANSMITTERS WITH NEMA 4X ENCLOSURE. REPLACE EXISTING VIBRATION SENSORS WITH NEW. INTERCEPT EXISTING CONDUIT OR PROVIDE NEW AS NECESSARY.
4. EXISTING CONDUIT WITH NEW CABLES, SEE NOTE 1 ABOVE.
5. REPLACE (E)CONTROL/INSTRUMENT PULLBOX WITH NEW NEMA 4X PULLBOX.
6. REMOVE (E)CONTROL PULLBOX. EXTEND CONDUIT TO NEW CONTROL/INSTRUMENT PULLBOX.
7. NEW PUMP WITH NEW FIELD INSTRUMENTS.
8. SEE SHEET E-15 FOR MOUNTING DETAL.
9. EXISTING CONDUIT STUB-OUT BETWEEN PUMP PAD AND SUMP PIT. SEE SECTION ON SHEET E-13.
10. EXISTING CONDUIT FROM EXISTING CONDUIT STUB-OUT AS INDICATED ON SHEET E-13.
11. PROVIDE (2) SETS OF STATUS SIGNAL: ONE FOR PLC AND ONE FOR VFD AS INDICATED ON P&ID, TYPICAL FOR P-103, P-104 AND P-105.

SCALE 3/16"=1'-0"

PUMP STATION NO. 65 CAPACITY UPGRADE

E-12

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

ELECTRICAL PUMP ROOM PLAN

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER
JEONG S. PARK
No. E6392
ELECTRICAL
STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 31 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Hoglin Arax FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-31-D

CONTRACTOR ____ DATE STARTED ____
INSPECTOR ____ DATE COMPLETED ____

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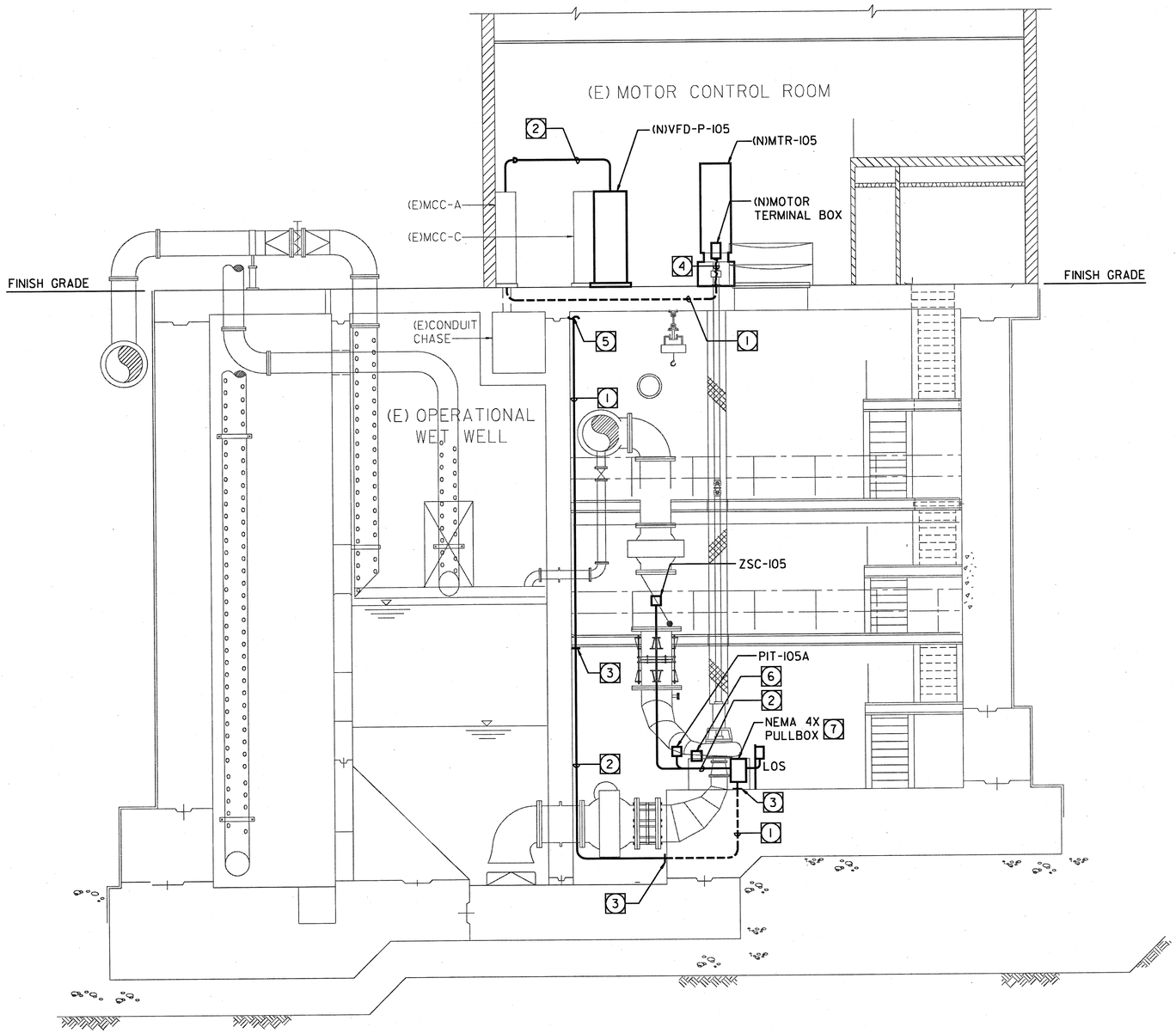

NOTES:

1. NEW FEEDER/CABLE IN EXISTING CONDUIT(S). VERIFY EXACT ROUTING OF CONDUIT IN FIELD. ADJUST CIRCUIT WIRING AS NECESSARY.
2. NEW FEEDER/CABLE IN NEW CONDUIT(S). SEE PLANS AND CABLE & CONDUIT SCHEDULE FOR DETAIL.
3. EXISTING CONDUIT STUB-OUTS. EXTEND CONDUITS AS INDICATED.
4. NEW FLEX CONDUIT(S).
5. TO MCC/CONTROL PANEL.
6. VIBRATION TRANSMITTERS ENCLOSURE, NEMA 4X.
7. 20"x16"x6" MINIMUM.

ELECTRICAL SECTION A (E-10/E-12)

SCALE: 3/16"=1'-0"

PMUP P-105 IS SHOWN. SOME FIELD DEVICES AND CONDUITS ARE NOT SHOWN FOR CLARITY.

0 8 16

SCALE 3/16"=1'-0"

PUMP STATION NO. 65 CAPACITY UPGRADE

E-13

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

ELECTRICAL SECTION – 1

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING

0 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER JONG S. PARK No. E6332 ELECTRICAL STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 32 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: Hoyt Ingram FOR CITY ENGINEER 8-27-12 DATE

SUBMITTED BY: ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

PROJECT ENGINEER

274-1695
LAMBERT COORDINATE

1914-6256
CCS83 COORDINATE

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

36349-32-D

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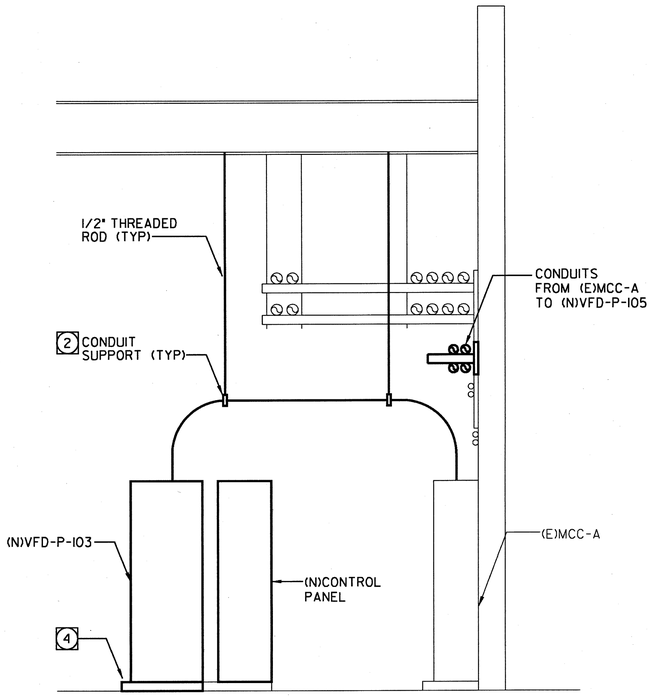
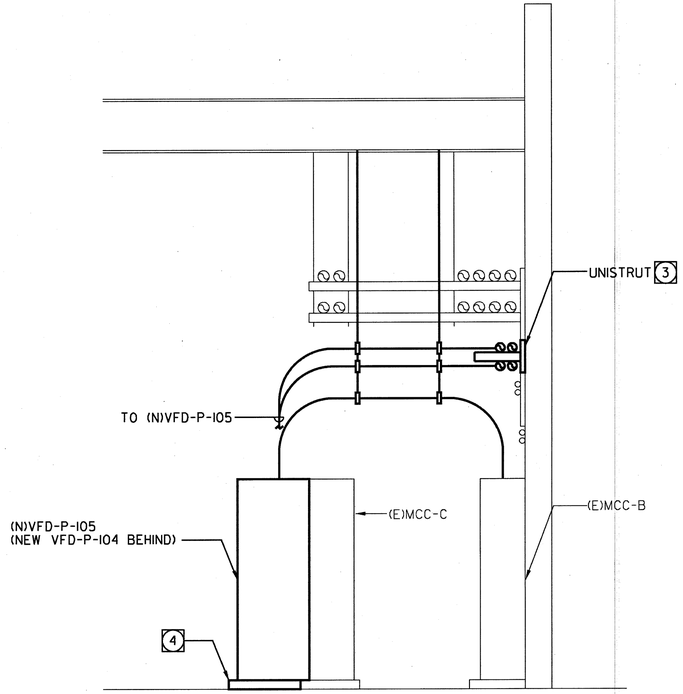


SECTION A (1)
SCALE: 3/8"=1'-0" E-11/E-12



SECTION B (1)
SCALE: 3/8"=1'-0" E-11/E-12

NOTES:

1. SECTIONS SHOWN HEREIN INDICATE DIAGRAMMATICALLY THE DESIRED LOCATION AND ARRANGEMENT OF CONDUIT RUNS AND EQUIPMENTS. FIELD DETERMINE EXACT LOCATION BASED ON ACTUAL EQUIPMENT LAYOUT AND CONSTRUCTION.
2. FIELD DETERMINE EXACT NUMBER AND LOCATION OF SUPPORTS.
3. HOT DIP GALVANIZED CONDUIT SUPPORT. UNISTRUT P1000 SERIES OR EQUAL.
4. CONCRETE HOUSEKEEPING PAD. 4" ALL AROUND EXCEPT BACKSIDE. MATCH PAD HEIGHT WITH EXISTING.

0 2' 4' 6' 8'
SCALE: 3/8" = 1'-0"

PUMP STATION NO. 65 CAPACITY UPGRADE

E-14

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

ELECTRICAL SECTION - 2

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 33 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hoon Ahn FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY ASSOCIATE ENGINEER
PROJECT ENGINEER
274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-33-D

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X.

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER JEONG S. PARK No. E6392 ELECTRICAL STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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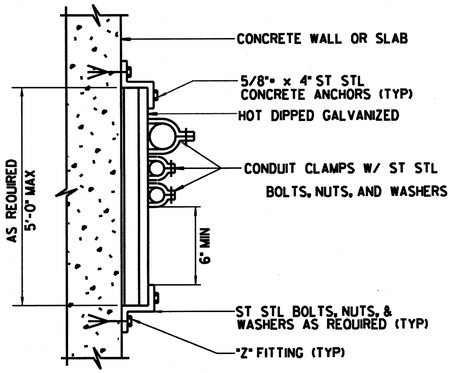
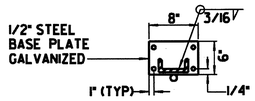


ELEVATION

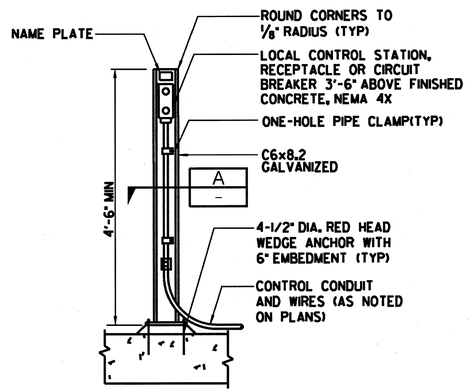
NOTES:

1. SEE SHEET G-3 FOR ABBREVIATIONS AND SHEET S-1 FOR APPLICABLE STRUCTURAL REQUIREMENTS.
2. TYPICAL FOR BOTH VERTICAL AND HORIZONTAL MOUNTING.
3. PREFORMED CHANNEL, FITTINGS AND CLAMPS SHALL BE HOT-DIP GALVANIZED STEEL. FIELD COAT ALL CUTS.
4. CHANNELS TO BE SPACED AT 5'-0" OC MAXIMUM.

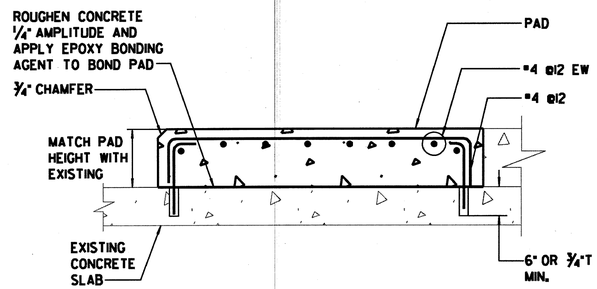
CONDUIT SUPPORT DETAIL 1 VAR — SCALE: NTS



PLAN A — SCALE: NTS



MOUNTING STAND DETAIL 2 E-12 — SCALE: NTS



HOUSEKEEPING PAD

DETAIL 3 E-6/E-15 — SCALE: NTS

PUMP STATION NO. 65 CAPACITY UPGRADE

E-15

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

ELECTRICAL DETAILS

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 34 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: FOR CITY ENGINEER — DATE 8-27-12
SUBMITTED BY: ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

PROJECT ENGINEER
274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____
36349-34-D

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

REGISTERED PROFESSIONAL ENGINEER — JEONG S. PARK — No. E 9752 — ELECTRICAL — STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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GENERAL INSTRUMENT OR FUNCTION SYMBOLS

	PRIMARY LOCATION •••NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNT	AUXILIARY LOCATION •••NORMALLY ACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS	IPI••		
SHARED DISPLAY, SHARED CONTROL			
COMPUTER FUNCTION			
PROGRAMMABLE LOGIC CONTROL			

•• ABBREVIATIONS SUCH AS IPI (INSTRUMENT PANEL #1), IC2 (INSTRUMENT CONSOLE #2), CC3 (COMPUTER CONSOLE #3), ETC, ARE USED WHEN NECESSARY TO SPECIFY INSTRUMENT OR FUNCTION LOCATION

••• NORMALLY INACCESSIBLE OR BEHIND-THE-PANEL DEVICES OR FUNCTIONS ARE DEPICTED BY USING THE SAME SYMBOLS BUT WITH DASHED HORIZONTAL BARS, IE

(XXX) SOFTWARE OR LOGIC RESIDENT IN DISTRIBUTED CONTROL SYSTEM (DCS) AT PROCESS CONTROL MODULE (PCM) XXX. SEE ASSOCIATED LOOP DESCRIPTION IN SPECIFICATIONS

(XXX) DESIGNATIONS OF CONTROL FUNCTIONS ASSOCIATED WITH INSTRUMENT OR OTHER COMPONENTS

OCA - OPEN/CLOSE/AUTO
RSL - RAISE/STOP/LOWER
HOA - HAND OFF/AUTO
AM - AUTO/MANUAL
LR - LOCAL/REMOTE
SD - SHUTDOWN
DEV - DEVIATION
RL - RAISE/LOWER
OAC - OPEN/AUTO/CLOSE
OSC - OPEN/STOP/CLOSE
SS - STOP/START
SEL - SELECT
SP - SET POINT

FY INSTRUMENT PANEL MOUNTED WITH COMPUTING OR CONVERTING FUNCTION

CONVERT %

E - VOLTAGE
I - CURRENT
P - PNEUMATIC
A - ANALOG
B - BINARY
H - HYDRAULIC
O - ELECTROMAGNETIC, SONIC
R - RESISTANCE (ELECT)
D - DIGITAL

COMPUTE •

SUMMING Σ
SUBTRACTOR -
MULTIPLYING ×
DIVIDING ÷
ROOT EXTRACTION √
PROPORTIONAL P
DERIVITIVE R
AVERAGING Σ/n
RATIO 1:1
DIFFERENCE Δ
HIGH SELECTING >
LOW SELECTING <
INTEGRAL ∫

INSTRUMENT SYMBOLS

MAGNETIC FLOWMETER
ELECTRIC SIGNAL
SOFTWARE SIGNAL
CENTRIFUGAL PUMP
BALL VALVE
PLUG VALVE
CHECK VALVE
PINCH CHECK VALVE
REDUCER
KNIFE GATE VALVE
GATE VALVE
ELECTRICAL MOTOR OPERATED VALVE
SOLENOID VALVE
DIAPHRAGM SEAL
LEVEL TRANSMITTER FLOAT TYPE

LIT INSTRUMENT OR OTHER COMPONENT TO BE MOUNTED IN THE FIELD
TSL INSTRUMENT OR OTHER COMPONENT TO BE MOUNTED INSIDE MAIN CONTROL PANEL OR OTHER PANEL AS MARKED
FIC INSTRUMENT OR OTHER COMPONENT TO BE MOUNTED ON MCP FRONT PANEL OR OTHER PANEL AS MARKED
FIC INSTRUMENT MOUNTED ON LOCAL CONTROL PANEL
PIR PSH SINGLE INSTRUMENT OR OTHER COMPONENT HAVING MULTIPLE FUNCTIONS
INSTRUMENT OR OTHER COMPONENT TO BE FURNISHED AND INSTALLED BY OTHERS IN THE FUTURE
F COMPUTER INTERFACE
I GENERALIZED FOR COMPLEX INTERLOCK LOGIC-SEE ELECTRICAL SCHEMATICS OR SPECIFICATIONS
OR INTERLOCK IF ANY ONE OR MORE INPUTS EXIST
AND INTERLOCK IF ALL INPUTS EXIST

A STATUS OR PILOT LIGHT R-RED G-GREEN A-AMBER
DIGITAL INPUT
DIGITAL OUTPUT
ANALOG INPUT
ANALOG OUTPUT

INSTRUMENT IDENTIFICATION TAG LETTERS

LETTER	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER FLAME				
C	CONDUCTIVITY ELECTRICAL			CONTROL	
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO			
G	GAGE		GLASS		
H	HAND (MANUALLY INITIATED)				HIGH (OPEN)
I	CURRENT (ELECT)		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW (CLOSE)
M	MOISTURE OR HUMIDITY				MIDDLE OR INTERMEDIATE
N	TORQUE				
O			ORIFICE		
P	PRESSURE OR VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY OR EVENT	INTEGRATE TOTALIZE			
R	RADIOACTIVITY		RECORD OR PRINT		
S	SPEED/FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER, OR LOUVER	
W	WEIGHT OR FORCE		WELL		
X					
Y	EVENT / STATE			RELAY OR COMPUTE	
Z	POSITION			DRIVER, ACTUATOR	

INSTRUMENTATION IDENTIFICATION & NUMBERING

FIRST LETTER — LIT XXXX — SUCCEEDING LETERS
INSTRUMENT LOOP NUMBER

I/O NUMBERING SYSTEM

I65 YL-7340A

I65 — PLANT AREA (NOT SHOWN)
YL — INSTRUMENT IDENTIFICATION
7340A — LOOP NUMBER

PUMP STATION NO. 65 CAPACITY UPGRADE

I-1

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

INSTRUMENTATION SYMBOLS & ABBREVIATIONS

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW..X..

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

ERIC R. LOVERIN No.E8727 REGISTERED PROFESSIONAL ENGINEER ELECTRICAL STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 35 OF 40 SHEETS

APPROVED: Hoyt Arax FOR CITY ENGINEER 8-27-12 DATE

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

WBS B-00306
WBS _____
SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER
274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-35-D

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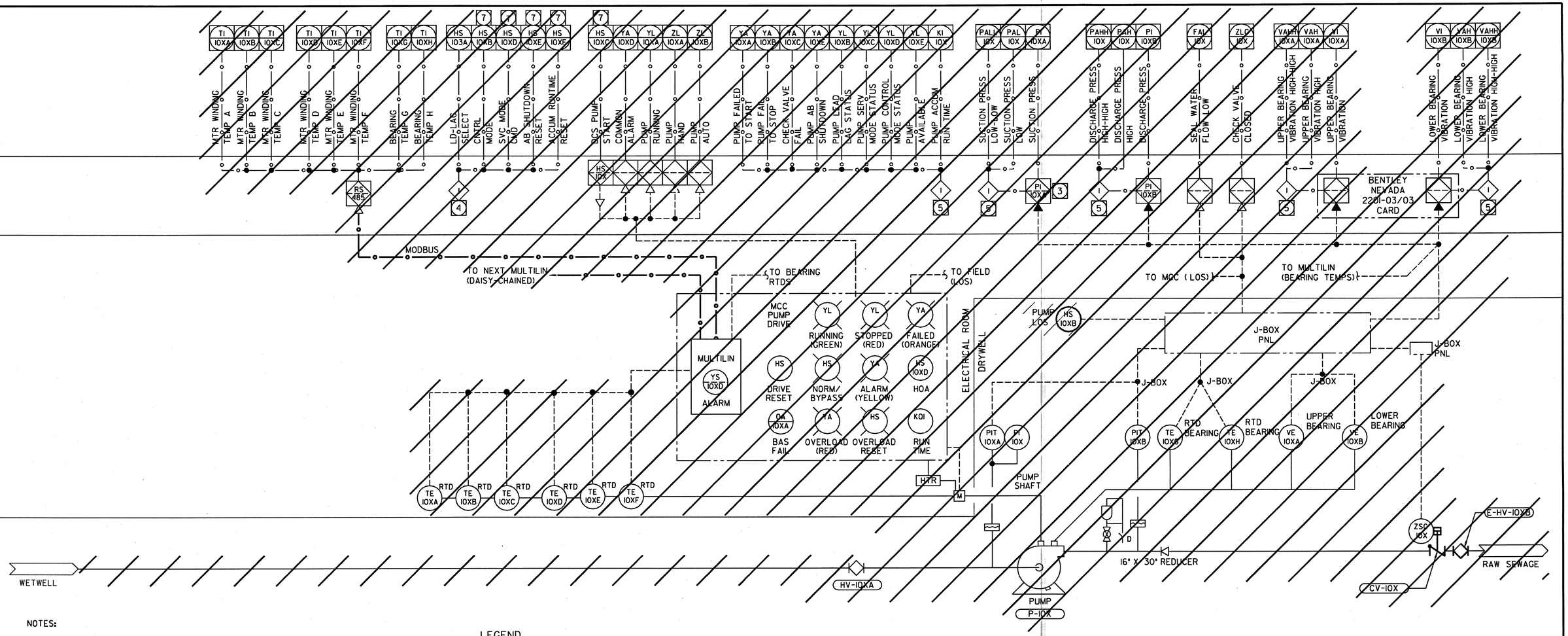

NOTES:

1. SHEET ONLY SHOWS PLC AND DCS DERIVED DATA MESSAGED BACK AND FORTH REGARDING PUMPS P-101 AND P102.
2. EVERYTHING ON THIS SHEET IS EXISTING; CONTRACTOR TO DEMOLISH CIRCUITS AND DEVICES WHERE SHOWN WITH DEMOLITION HATCHING.
3. NOT USED
4. SOURCE: DCS LOGIC
5. SOURCE: PLC LOGIC
6. ALL TAG PREFIXES ARE I65.
7. SOME PUMP SUFFIXES VARY BETWEEN PUMPS P-101 AND P-102, SEE TABLE BELOW FOR CORRECTIONS TO P-102 TAGS.

TAGS FOR P-102

HSIOXB = HSI02A
HSIOXC = HSI02B
HSIOXD = HSI02C
HSIOXE = HSI02D
HSIOXF = HSI02E

LEGEND

PIOI	X = 1
PI02	X = 2

//// DEMOLITION

PUMP STATION NO. 65 CAPACITY UPGRADE

I-2

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

PROCESS & INSTRUMENTATION DEMOLITION DIAGRAM – 1

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

REGISTERED PROFESSIONAL ENGINEER ERIC R. LOVERING No.E8727 ELECTRICAL STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 36 OF 40 SHEETS

WBS B-00306
WBS 21000

APPROVED FOR CITY ENGINEER Hoyt Ayer 8-27-12 DATE

SUBMITTED BY: ASSOCIATE ENGINEER

PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695
LAMBERT COORDINATE

1914-6256
CCS83 COORDINATE

36349-36-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

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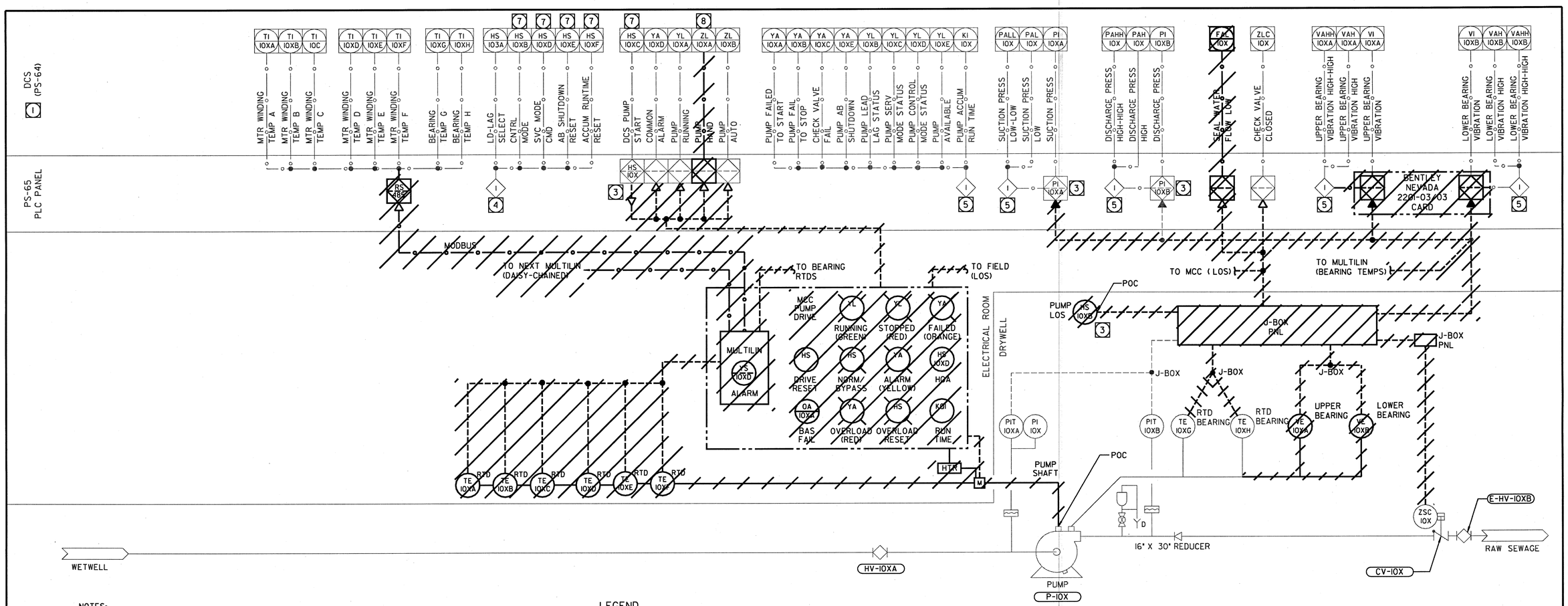

NOTES:

1. SHEET ONLY SHOWS PLC AND DCS DERIVED DATA MESSAGED BACK AND FORTH REGARDING PUMPS P-103 AND 104.
2. EVERYTHING ON THIS SHEET IS EXISTING; CONTRACTOR TO DEMOLISH CIRCUITS AND DEVICES WHERE SHOWN WITH DEMOLITION HATCHING.
3. DUPLICATE TAG NUMBER TO BE RENAMED, SEE SHEET I-3 FOR CHANGES.
4. SOURCE: DCS LOGIC
5. SOURCE: PLC LOGIC
6. ALL TAG PREFIXES ARE 165.
7. SOME PUMP SUFFIXES VARY BETWEEN PUMPS P-103 AND P-104, SEE TABLE BELOW FOR CORRECTIONS TO P-104 TAGS.

TAGS FOR P-104

HS10XB = HS104A
HS10XC = HS104B
HS10XD = HS104C
HS10XE = HS104D
HS10XF = HS104E

8. PUMP HAND SIGNAL WILL BE REPURPOSED TO PUMP CONTROL POWER ON, SEE SHEET I-4 FOR CLARITY.

LEGEND

PI03	X = 3
PI04	X = 4

DEMOLITION

PUMP STATION NO. 65 CAPACITY UPGRADE

I-3

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

PROCESS & INSTRUMENTATION DEMOLITION DIAGRAM – 2

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 37 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hoss Ajar FOR CITY ENGINEER 8-27-12 DATE
SUBMITTED BY: ASSOCIATE ENGINEER
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-37-D

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW..X..

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

REGISTERED PROFESSIONAL ENGINEER ERIC W. LOWERY No. E18727 ELECTRICAL STATE OF CALIFORNIA

CONSTRUCTION CHANGE / ADDENDUM

CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

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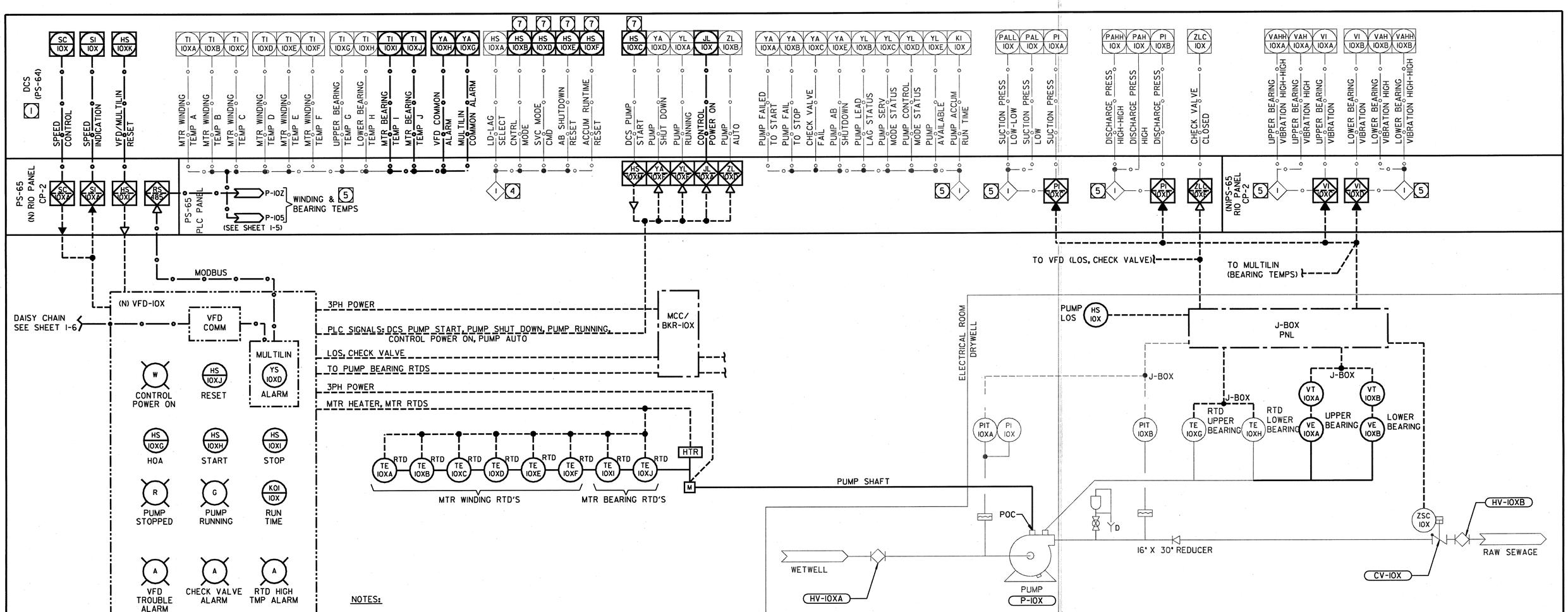

NOTES:

1. SHEET ONLY SHOWS PLC AND DCS DERIVED DATA MESSAGED BACK AND FORTH REGARDING PUMPS P-103 AND P-104.
2. NOT USED
3. NOT USED
4. SOURCE: DCS LOGIC
5. SOURCE: PLC LOGIC
6. ALL TAG PREFIXES ARE 165.
7. TAGS FOR PUMP P-104 ARE REVISED AS SHOWN

LEGEND

PI03	X = 3	Z = 4
PI04	X = 4	Z = 3

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING

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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

ERIC R. LOVERING No. E8727 REGISTERED PROFESSIONAL ENGINEER CIVIL STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 38 OF 40 SHEETS

WBS B-00306
WBS

APPROVED Hercin Agak FOR CITY ENGINEER 8-27-12 DATE

SUBMITTED BY Daniel Park ASSOCIATE ENGINEER

Daniel Park PROJECT ENGINEER

274-1695 LAMBERT COORDINATE

1914-6256 CCS83 COORDINATE

36349-38-D

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

I-4

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

PROCESS & INSTRUMENTATION DIAGRAM – 1

PUMP STATION NO. 65 CAPACITY UPGRADE

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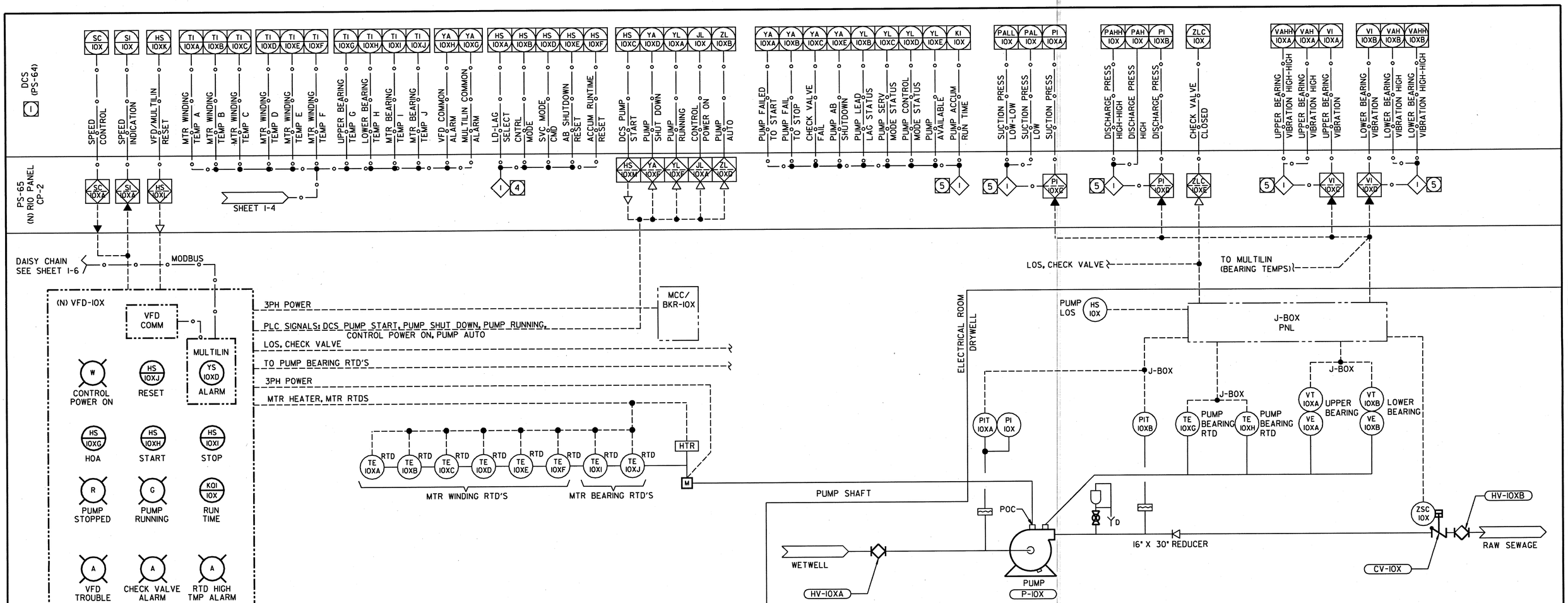

NOTES:

1. SHEET ONLY SHOWS PLC AND DCS DERIVED DATA MESSAGED BACK AND FORTH REGARDING PUMP P-105.
2. NOT USED.
3. NOT USED.
4. SOURCE: DCS LOGIC
5. SOURCE: PLC LOGIC
6. ALL TAG PREFIXES ARE I65.

LEGEND

PI05	X = 5

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING

0 1

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CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

SPEC. NO. 5522

CONSULTANT

LEE & RO, Inc.
San Diego, California

I-5

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

PROCESS & INSTRUMENTATION DIAGRAM – 2

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 39 OF 40 SHEETS

WBS B-00306
WBS

APPROVED: FOR CITY ENGINEER — DATE 8-27-12
SUBMITTED BY: ASSOCIATE ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

PROJECT ENGINEER

274-1695
LAMBERT COORDINATE

1914-6256
CCS83 COORDINATE

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

36349-39-D

PUMP STATION NO. 65 CAPACITY UPGRADE

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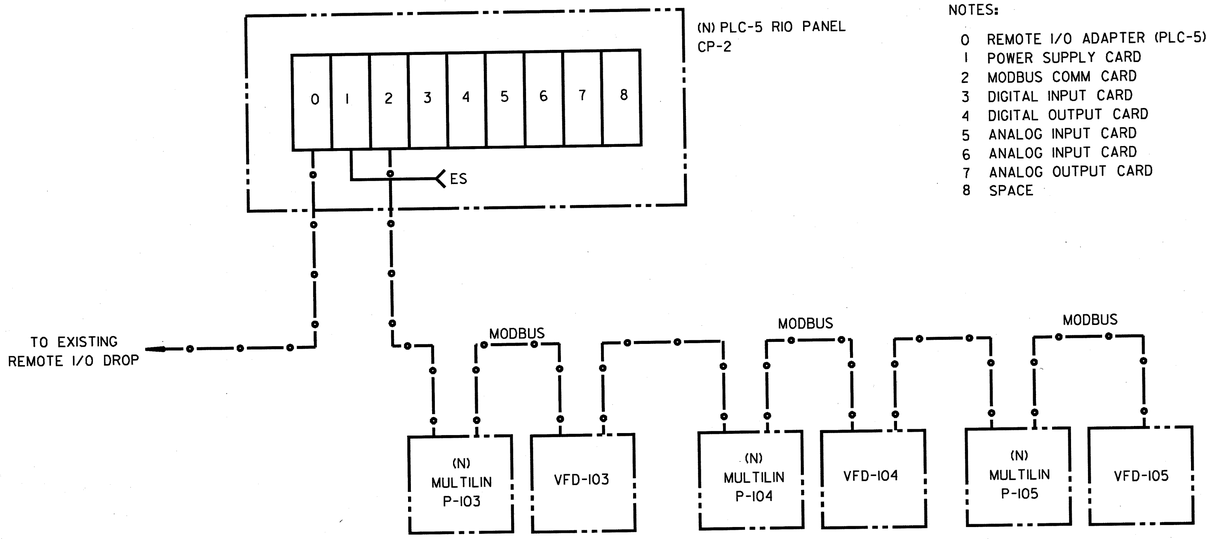
3/5/2012 11:02:33 AM Daniel Park

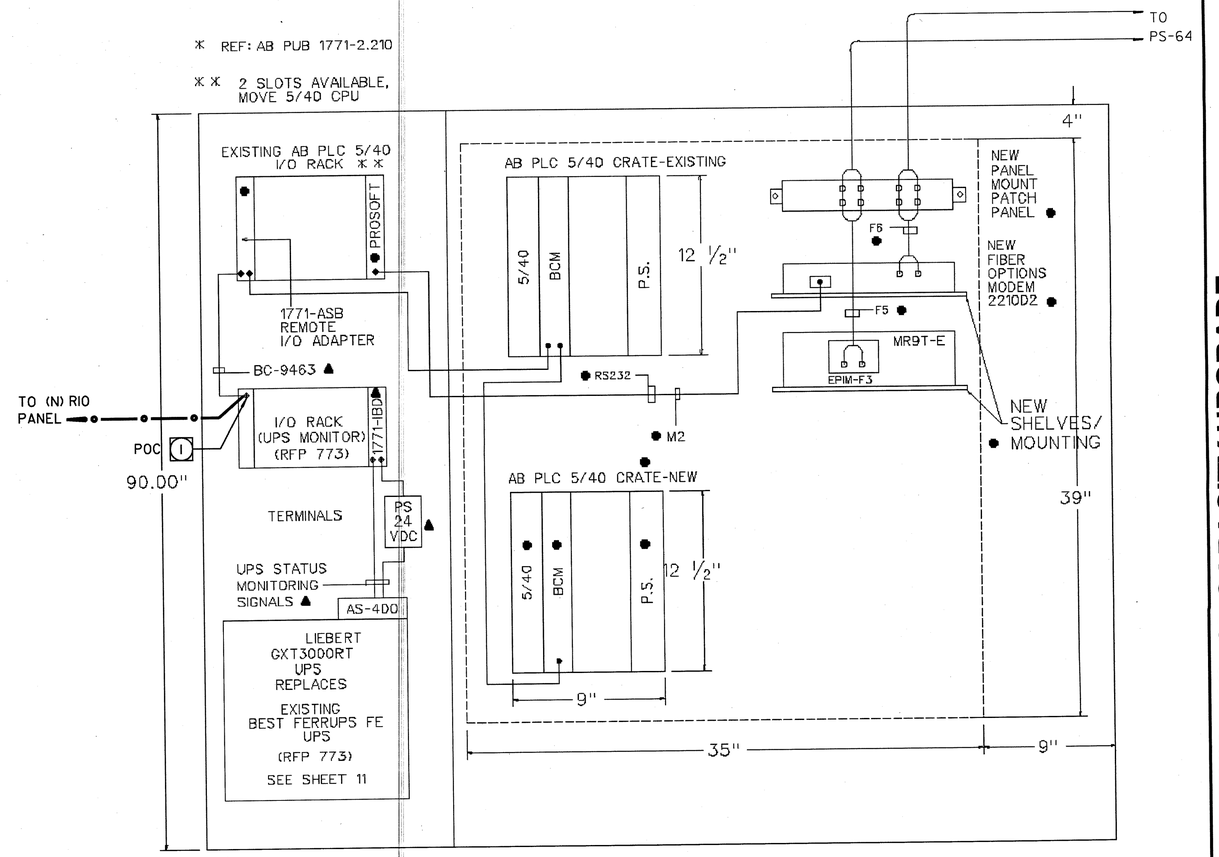


NOTES:

0 REMOTE I/O ADAPTER (PLC-5)
1 POWER SUPPLY CARD
2 MODBUS COMM CARD
3 DIGITAL INPUT CARD
4 DIGITAL OUTPUT CARD
5 ANALOG INPUT CARD
6 ANALOG INPUT CARD
7 ANALOG OUTPUT CARD
8 SPACE

NETWORK ARCHITECTURE

NOT TO SCALE



(E) MAIN CONTROL "PLC" PANEL MODIFICATION [2][3]

NOT TO SCALE

NOTES:

[1] NEW WORK IS BOLD AND SHOWN AT POINT OF CONNECTION.

[2] BACKGROUND IS WESTINGHOUSE DOCUMENT 5D9460I.

[3] SEE SECTION 13300 FOR REQUIRED MODIFICATIONS TO THE EXISTING PLC SYSTEM.

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.

WARNING
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

TEMPORARY BMP CONSTRUCTION SITE STORM WATER PRIORITY: HIGH ____ MEDIUM ____ LOW X

CONSULTANT

LEE & RO, Inc.
San Diego, California

SPEC. NO. 5522

REGISTERED PROFESSIONAL ENGINEER ERIC R. LOVERING No. E9727 ELECTRICAL STATE OF CALIFORNIA

I-6

PUMP STATION NO. 65
CAPACITY UPGRADE PROJECT
(H094844)

COMMUNICATION MODIFICATIONS

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 40 OF 40 SHEETS

APPROVED: Hoa C. Huy FOR CITY ENGINEER 8-27-12 DATE

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	LRI			

CONTRACTOR _____ DATE STARTED _____
INSPECTOR _____ DATE COMPLETED _____

WBS B-00306
WBS _____
SUBMITTED BY: Daniel Park ASSOCIATE ENGINEER
J. Hurtado PROJECT ENGINEER
274-1695 LAMBERT COORDINATE
1914-6256 CCS83 COORDINATE
36349-40-D

PUMP STATION NO. 65 CAPACITY UPGRADE

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3/5/2012 11:02:42 AM Daniel Park