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Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-14-077

June 13, 2014

10 CFR 50.4

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 2
Construction Permit No. CPPR-92
NRC Docket No. 50-391

Watts Bar Nuclear Plant, Unit 1
Facility Operating License No. NPF-90
NRC Docket No. 50-390

Subject: Responses to Degraded Voltage Issue Requests for Additional Information

References:

1. Letter from TVA to NRC, "Watts Bar Nuclear Plant (WBN) Unit 2 - Safety Evaluation Report Supplement 22 (SSER22) - Response to NRC Required Action Item, dated August 12, 2011 [ML11229A020]

2. Letter from TVA to NRC, "Watts Bar Nuclear Plant, Unit 2 - NUREG-0847 Supplemental Safety Evaluation Report (SSER) Related to the Operation of Watts Bar Nuclear Plant, Unit 2, Appendix HH Open Item 30 - Power System Degraded Voltage," dated June 7, 2012 [ML12160A350]

3. NRC Regulatory Issue Summary (RIS) 2011-12, Revision 1, "Adequacy of station Electrical Distribution System Voltages," dated December 29, 2011 [ML113050583]

4. NRC Electronic Mail (email) from Siva Lingam to Gordon Arent, on Watts Bar 2 - Open Phase and Open Item 30 RAIs, dated February 27, 2014

5. NRC Public Meeting Announcement with Tennessee Valley Authority (TVA) regarding Safety Evaluation Report electrical open items related to Watts Bar Nuclear Plant, Unit 2, April 24, 2014 [ML14100A313]

6. Letter from NRC to TVA, "Watts Bar Nuclear Plant - NRC Integrated Inspection Report 05000390/2010005," dated January 28, 2011 [ML110280456]

By letter dated August 12, 2011 (Reference 1), Tennessee Valley Authority (TVA) provided a response to NUREG-0847, Supplement 22, "Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Unit 2," Appendix HH, Open Item 30.

By letter dated June 7, 2012 (Reference 2), TVA submitted updated information related to the offsite and onsite power system degraded voltage studies for safety-related electrical equipment. This submittal included excerpts from STUDY-EEB-WBN-12-001, "Sensitivity Study of Degraded Voltage Relay (DVR) Protection During Motor Starting," Revision 1. The information provided in Reference 2 demonstrated the impact of using a methodology meeting the intent of the guidance provided in Nuclear Regulatory Commission (NRC) Regulatory Issue Summary (RIS) 2011-12, "Adequacy of station Electrical Distribution System Voltages," Revision 1 (Reference 3).

On February 27, 2014, TVA received additional requests for information related to open phase and NUREG-0847, Open Item 30 (Reference 4), including questions associated with Watts Bar Nuclear Plant (WBN), Unit 2 Final Safety Analysis Report (FSAR) Section 8.3. The responses to these requests for additional information (RAIs) are included in this transmittal as Enclosure 1.

On April 24, 2014, the NRC conducted a public meeting with members of TVA (Reference 5). The purpose of the meeting was to discuss the status of electrical open items resulting from the NRC review of the FSAR for WBN Unit 2.

TVA addressed a non-cited violation (NCV) identified in Reference 6 by performing a motor starting analysis in the calculation of record at the DVR dropout analytical limit as opposed to the DVR reset. The analysis is provided in Appendix H of Enclosure 2.

Enclosure 1 to this letter also provides the TVA response to the information requested at the April 24, 2014 public meeting, including responses to the RAIs received in Reference 4. Enclosure 2 provides a copy of the Sensitivity Study of Degraded Voltage Relay (DVR) Protection During Motor Starting, Revision 2, performed by TVA to address the additional concerns with the DVR protection scheme at WBN.

Please address any questions regarding this submittal to Gordon Arent at (423) 365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 13th day of June 2014.

Respectfully,

J. W. Shea
Vice President, Nuclear Licensing

Enclosures
cc: See Page 2

ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION FOR FSAR SECTION 8.3
ELECTRICAL OPEN ITEMS (TAC NO. ME2731)

1.0 DESCRIPTION

This enclosure provides information related to degraded voltage protection at Watts Bar Nuclear Plant (WBN). The enclosure provides an overview of the licensing correspondence regarding degraded voltage as it applies to WBN Unit 2 licensing, findings, and remedial actions taken as a result of Nuclear Regulatory Commission (NRC) inspections of degraded voltage relays (DVRs).

2.0 BACKGROUND

TVA has performed calculations to evaluate and document the adequacy of the WBN auxiliary power system for two unit operation. Calculation WBN-EEB-EDQ000-999-2007-0002, “AC Auxiliary Power System Analysis,” (Reference 1) verifies that adequate voltage is available for starting safety-related motors (individually) under degraded voltage conditions. Calculation WBN-EEB-MS-TI06-0029, “Degraded Voltage Analysis,” (Reference 2) demonstrates that the WBN auxiliary power system complies with NRC Branch Technical Position PSB-1, establishes the basis for the degraded and loss of voltage relay setpoints and their associated time delays, ensures that the voltage level is adequate to allow required safety-related electrical equipment and devices to successfully complete their safety function, and ensures that the duration of the degraded voltage at a given voltage level does not result in thermal degradation or damage of the equipment. TVA Calculation EDQ00299920080003, “Class 1E MCC Control Circuit Voltage Analysis and Transformer Sizing,” (Reference 3) and Calculation WBNEEBMSTI020020, “120V AC Class 1E Distribution Panel and Transformer Sizing and Voltage Drop Calculation,” (Reference 4) evaluate the control circuits of the Class 1E loads to determine if the circuits will operate adequately, as intended under worst-case voltage drop conditions. In addition, TVA has performed STUDY-EEB-WBN-12-001, “Degraded Voltage Relay (DVR) Protection During Motor Starting,” (Reference 5) to evaluate whether the existing DVR setpoint provides the minimum required voltages at the terminals of the Class 1E loads during motor starting (automatic start during a design basis event or individually) while still connected to the preferred offsite power source. A copy of STUDY-EEB-WBN-12-001, Revision 2 is provided in Enclosure 2.

In 2010, two independent but related events resulted in DVR settings at WBN requiring additional evaluation. First, NRC inspections (References 6 and 7) conducted at WBN identified conditions where the DVR setpoint value in the calculation of record was non-conservative with respect to the voltage specified in Technical Specifications (TS). Secondly, TVA submitted WBN Unit 2 Final Safety Analysis Report (FSAR) amendments addressing Section 8, “Electric Power.”

On January 28, 2011, TVA received a non-cited violation (NCV) of low safety significance regarding the failure to use the DVR setpoint values specified in TS and configured in the 6.9 kV bus based on the electrical design calculation (Reference 6). The NRC concluded that the availability, reliability and operability of the 6.9 kV safety buses was impacted due to a non-conservative degraded voltage input being used in the safety related motor start and running calculations.

On January 31, 2011, the NRC issued NUREG-0847, Supplement 22, "Safety Evaluation Report, Related to the Operation of Watts Bar Nuclear Plant, Unit 2," Supplement 22, Appendix HH. Appendix HH contained Open Item 30, stating:

TVA should confirm that all safety-related equipment (in addition to the Class 1E motors) will have adequate starting and running voltage at the most limiting safety-related components (such as motor-operated valves (MOVs), contactors, solenoid valves or relays) at the DVR setpoint dropout setting. TVA should also confirm that (1) the motor starting transient studies are based on the dropout voltage value of DVR and time delay, (2) the steady-state voltage drop studies are carried out by maximizing running loads on the Class 1E distribution system (bounding combination of safety systems loads), with the voltage at 6.9 kV Class 1E buses (monitored by the DVRs) at or just above the DVR dropout setting, and (3) the DVR settings do not credit any equipment operation (such as LTC transformers) upstream of the 6.9-kV Class 1E buses. TVA should also confirm that the final technical specifications (TSs) are properly derived from these analytical values for the degraded voltage settings.

By letter dated August 12, 2011 (Reference 8), TVA provided a response to NUREG-0847, Supplement 22, Appendix HH, Open Item 30. In the enclosure to the letter, and in response to Open Item 30, TVA informed the NRC that it had performed a motor-starting transient study assuming the 6.9 kV Shutdown Boards were maintained at the DVR dropout setting and applied the worst-case accident block-start loading (bounding combination of safety system loads). Additionally, the response indicated that the analysis did not credit any non-Class 1E equipment upstream of the 6.9 kV Class 1E buses (such as automatic load tap changers (LTCs) or administratively controlled grid capacity). TVA confirmed that the Class 1E motors required to start and mitigate an accident would have adequate voltage.

On June 7, 2012, TVA submitted updated information related to the offsite and onsite power system degraded voltage studies for safety-related electrical equipment (Reference 9). In Reference 9, TVA submitted excerpts from the Reference 5 sensitivity study of motor starting relative to the existing DVR setpoint. The purpose of the study was to address issues concerning DVR protection at WBN as documented in 1) NRC NCV 05000390/2010005-003, “Failure to use Worst Case 6900 VAC Bus Voltage in design calculations,” 2) NUREG-0847, Supplement 22, “Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Unit 2,” Appendix HH, Open Item 30, and 3) recent regulatory developments in the industry with respect to DVR protection and analysis including RIS 2011-12. The study was performed for both WBN Unit 1 and Unit 2.

Subsequently, on February 27, 2014, TVA received a request for additional information (RAI) via NRC Electronic Mail (Reference 10) related to certain aspects of the degraded voltage methodology used at WBN. Responses to these RAIs are provided in Section 3.0 of this enclosure.

On April 24, 2014, the NRC staff conducted a public meeting with members of TVA (Reference 11). The purpose of the meeting was to discuss the status of electrical open items resulting from the NRC review of the FSAR for WBN Unit 2 including the previous correspondence and the February 27, 2014 RAIs. The meeting allowed TVA to present the history of the regulatory guidance/industry events/actions implemented at WBN with regards to degraded voltage, highlights of the analysis performed by TVA on loss of voltage (LOV) and DVR settings, aspects of the TVA conformance with

Branch Technical Position PSB-1, and highlights of the TVA response to SSER Open Item 30.

3.0 RESPONSES TO REQUESTS FOR ADDITIONAL INFORMATION

By email dated February 27, 2014, the NRC forwarded a request for additional information. The NRC stated questions and TVA's responses are presented below.

NRC Request for Additional Information

The staff of the Electrical Engineering Branch (EEEB) of the Division of Engineering has previously requested information on open items associated with NUREG-0847, "Supplemental Safety Evaluation Report (SSER) Related to the Operation of Watts Bar Nuclear Plant, Unit 2." In order to complete the review and close these items, the staff requests additional information from the licensee, as described below:

BACKGROUND

In letter dated June 7, 2012, the Tennessee Valley Authority (TVA) provided a response to Open Item 30 (power system degraded voltage) with respect to SSER, Appendix HH.

The response states that the methodology used in the study was developed to meet the intent of Regulatory Issue Summary (RIS) 2011-12, "Adequacy of Station Electrical Distribution System Voltages".

The RIS states, "The licensee's voltage calculations should provide the basis for proper operation of the plant safety-related electrical distribution system***, when supplied from the offsite circuit(s) (from the transmission network). (emphasis added)*** These calculations should demonstrate that the voltage requirements (both starting and running voltages) of all plant safety-related systems and components are satisfied based on operation of the transmission system (including the bounding transmission system single contingency in terms of voltage drop) and the plant onsite electric power system during all operating configurations of transmission network and plant systems."

The TVA response states that to perform the analysis, the 6.9 kV shutdown boards were disconnected from all offsite power source(s) and a dedicated fixed voltage source was added to each 6.9 kV shutdown board (6.9 kV shutdown board was used as a swing bus). The source voltage was set to the degraded voltage relay (DVR) analytical dropout limit of 6555 V.

RAI QUESTION 1

Based on the above statements:

a) Please explain how disconnecting the shutdown boards from offsite power source(s) meets the intent of guidance provided in the RIS section cited above.

b) Please explain how the voltage drop through station services transformers (CSST A, B, C and D) is accounted for during block starting or sequential starting of emergency loads in the analyses provided.

c) If the shutdown bus is considered a 'dedicated fixed voltage source' or a swing bus, then please confirm that the calculation process assumes the swing bus to be an infinite source of real and reactive power. If not, provide basis for the assumption used.

d) From bus voltage perspective, discuss how this simulation depicts the dynamic response capabilities of the shutdown boards compared to the real and reactive power demand of motor starts postulated during accident conditions with offsite source(s) supplying power through CSST A, B, C and D including all worst-case operating and loading configurations.

TVA Response

During discussions between the NRC and TVA at the April 24, 2014 public meeting, the NRC accepted the study case information presented by TVA and clarified that a response to Question 1 was no longer required. Enclosure 2, Appendix H includes the study cases presented and discussed during the April 24, 2014 public meeting.

RAI QUESTION 2

The analyses states that for contactors, relays and solenoid valves, adequacy of pickup voltage was performed as part of the Control Circuit Voltage Drop (CCVD) analysis. This analysis was performed considering a steady state minimum voltage of 432V at the motor control center (MCC) bus. Please confirm that 432V is the minimum voltage required for operability of all equipment (minimum voltage required at component terminal) with nominal operating voltage of 480V and lower (230/120V) voltage systems supplied from the 480V system.

TVA Response

432 V at the 480V AC Shutdown Boards and MCCs, ensures that the safety-related equipment connected to the Class 1E system is capable of performing their intended function. TVA's analysis of this is contained in Calculations EDQ00299920080003, "Class 1E MCC Control Circuit Voltage Analysis and Transformer Sizing," (Reference 3) and WBNEEBMSTI020020, "120V AC Class 1E Distribution Panel and Transformer Sizing and Voltage Drop Calculation," (Reference 4).

RAI QUESTION 3

The analyses states that the MCC transient bus voltage under degraded voltage conditions (at DVR dropout voltage of 6555V) drops below 432V due to starting of large motors on the 480V switchgear and recovers to a value of >432V within 4 seconds. Please confirm that the duration and magnitude of voltage drop and recovery during block starting of all safety related loads and sequenced start of loads remains within the acceptable range without actuating any protective devices (accident analyses perspective) if the 6.9kV busses remain connected to the 161kV offsite power source through the CSSTs.

TVA Response

The magnitude and duration of the < 4 second dip below 432V is acceptable for all equipment as discussed in TVA Calculation WBN-EEB-EDQ000-999-2007-0002, "AC Auxiliary Power

Systems Analysis," and does not actuate any protective device, as discussed in TVA Calculation WBN-EEB-MS-TI06-0029, "Degraded Voltage Analysis."

RAI QUESTION 4

Calculation Number WBN-EEB-EDQ000-999-2007-0002 1 submitted in response to preliminary request for additional information regarding Unit 2 licensing process states the following:

> "One 161 kV transmission line and CSSTs A and D, or the other transmission line and CSSTs B and C, shall be capable of starting and running all required safety-related loads and powering all running BOP loads for a design basis accident in one unit and orderly shutdown of the other unit. The analysis for the Class 1 E power system shall evaluate all equipment that is started by a safety injection signal (SIS) as starting at the same time unless the load's control circuitry has sequential time delay, and that all continuous loads that could be operating as required by the process, whether safety-related or not, are running. The analyses in this calculation evaluate the starting of the equipment required to mitigate an accident in accordance with the above requirements for one Unit and simultaneous orderly shutdown of the other unit. The worst case bases for this evaluation is assuming a 161 kV grid pre-event voltage of 164KV and a subsequent 161 kV grid drop of 9kV at event initiation resulting in a post event 161kV grid voltage of 153kV. The analyses shows that all equipment required to start to mitigate an accident receive adequate starting voltage within the time period (5 seconds) of Reference 2.16 for the cases when both CSST C and D are available and also when only one CSST (either C or D) is available."

Enclosure 1 attached to TVA letter dated July 31, 2010, provided similar information (reference pages E1-63 and 64) regarding the capability of the electrical power system described in FSAR Section 8.1. Please clarify that the impact of the voltage drop in the 161kV system coupled with the voltage drop in CSSTs during block loading of accident loads is accounted for in the degraded voltage relay setpoint calculation performed in accordance with the recommendations of RIS 2011-12.

TVA Response

During discussions between the NRC and TVA at the April 24, 2014 public meeting, the NRC accepted the study case information presented by TVA and clarified that a response to Question 4 was no longer required. Enclosure 2, Appendix H includes the study cases presented and discussed during the April 24, 2014 public meeting.

RAI QUESTION 5

1) In response to NRC letter dated December 20, 2013, for resolving open phase condition (OPC) design vulnerability within electric system at Watts Bar 2, TVA stated that:

   Vulnerability studies of the OPC faults have been completed for WBN and additional operator meetings are being scheduled to communicate the results. For the analyzed configurations, the vulnerability studies showed existing protection automatically actuates and provides protection to the Class-1E system for grounded open phase conditions. Vulnerability to an ungrounded open phase condition has been identified for some analyzed configurations.

The TVA nuclear fleet has endorsed the generic schedule provided in the Industry OPC Initiative.

To resolve the OPC design vulnerability at Watts Bar 2, staff requests that TVA provide design features and analyses information in the Final Safety Analysis Report to automatically detect and alarm in the main control room for OPC with and without a high impedance ground condition including two open phase condition on the high voltage side of a transformer connecting a credited GDC-17 offsite power circuit to the transmission system. For OPC, automatic detection and actuation circuits will transfer loads required to mitigate postulated accidents to an alternate power source and ensure that safety functions are preserved, as required by the current licensing bases. The OPC should be sensitive enough to identify an open phase condition under all operating electrical system configurations and loading conditions for which they are required to be operable and. should minimize misoperation, maloperation, and spurious actuation. In addition, the staff requests TVA to address the limiting conditions of operation and surveillance requirements that must be added to the plant Technical Specifications to meet the provisions of 10CFR50.36 (c) (2) and c(3).

The above information is required from TVA for staff to reach the necessary safety conclusion that the electrical power system for Watts Bar Unit 2 design meets the 10 CFR Part 50, Appendix A, GDC 17, 10 CFR 50.55a(h)(2), and 10 CFR 50.36 requirements with respect to addressing electric power system design vulnerability due to OPC which could affect the safety functions of both onsite and offsite power systems.

TVA Response

As requested by the NRC staff during discussions with TVA on June 4, 2014, the response to Question 5 is being provided in a separate transmittal.

4.0 Non-cited Violation (NCV) 05000390/2010005-003

On January 28, 2011, TVA received a NCV of low safety significance (green) regarding the failure to use the DVR setpoint values specified in TS and configured in the 6.9 kV bus based on the electrical design calculation (Reference 6). The NRC concluded that the availability, reliability and operability of the 6.9 kV safety buses was impacted due to a non-conservative degraded voltage input being used in the safety related motor start and running calculations.

TVA STUDY-EEB-WBN-12-001, “Sensitivity Study of Degraded Voltage Relay (DVR) Protection During Motor Starting,” (Reference 5) evaluates whether the DVR setpoint provides the minimum required voltages at the terminals of the Class 1E loads during motor starting (automatic start during a design basis event or individually) while still connected to the preferred offsite power source. The study concludes that adequate starting voltage is available to each Class 1E load when the 6.9 kV Shutdown Boards are at the DVR dropout setpoint for the following cases: 1) during a design basis event (all Class 1E loads that are automatically actuated for a safety injection (SI) signal), and 2) when individually starting a motor (all Class 1E loads, even if not SI actuated). Therefore, the existing DVR setpoints are adequate.

A copy of the study is provided in Enclosure 2 to address issues concerning DVR protection at WBN as documented in NRC NCV 05000390/2010005-003.

References

1. TVA Calculation WBN-EEB-EDQ000-999-2007-0002, AC Auxiliary Power Systems Analysis, Revision 38, May 28, 2014

2. TVA Calculation WBN-EEB-MS-TI06-0029, Degraded Voltage Analysis, Revision 36, March 13, 2014

3. TVA Calculation EDQ00299920080003, "Class 1E MCC Control Circuit Voltage Analysis and Transformer Sizing," Revision 10, dated February 1, 2014

4. TVA Calculation WBNEEBMSTI020020, "120V AC Class 1E Distribution Panel and Transformer Sizing and Voltage Drop Calculation," Revision 15, dated August 3, 2011

5. TVA STUDY-EEB-WBN-12-001, Degraded Voltage Relay (DVR) Protection During Motor Starting, Revision 001

6. Letter from NRC to TVA, "Watts Bar Nuclear Plant - NRC Integrated Inspection Report 05000390/2010005," dated January 28, 2011

7. Letter from NRC to TVA, "Watts Bar Nuclear Plant - NRC Component Design Bases Inspection - Inspection Report 05000390/2010006," dated June 11, 2010 [ML101620543]

8. Letter from TVA to NRC, "Watts Bar Nuclear Plant (WBN) Unit 2 - Safety Evaluation Report Supplement 22 (SSER22) - Response to NRC Required Action Item," dated August 12, 2011 [ML11229A020]

9. Letter from TVA to NRC, "Watts Bar Nuclear Plant, Unit 2 - NUREG-0847 Supplemental Safety Evaluation Report (SSER) Related to the Operation of Watts Bar Nuclear Plant, Unit 2, Appendix HH Open Item 30 - Power System Degraded Voltage," dated June 7, 2012 [ML12160A350]

10. NRC Electronic Mail (email) from Siva Lingam to Gordon Arent, on Watts Bar 2 - Open Phase and Open Item 30 RAIs, dated February 27, 2014

11. Summary of April 24, 2014 Meeting with Tennessee Valley Authority Regarding Watts Bar Nuclear Plant, Unit 2, Open Item for Licensing, May 29, 2014 [ML14118A201]

ENCLOSURE 2

STUDY-EEB-WBN-12-001,
DEGRADED VOTAGE RECOVERY ANALYSIS for DBE,
Revision 2

NPG CALCULATION COVERSHEET / CTS UPDATE

REV 0 EDMS/RIMS NO.	CTS TYPE:	EDMS TYPE:	EDMS ACCESSION NO (N/A for REV. 0)
T93120417020	Calculation	CALCULATIONS (NUCLEAR)	

Calc Title:

Sensitivity Study of Degraded Voltage Relay (DVR) Protection During Motor Starting

	ORG	PLANT	BRANCH	NUMBER	CUR REV	NEW REV
CALC ID	NUC	WBN	EEB	**STUDY-EEB-WBN-12-001**	**001**	**002**

CTS UPDATE ONLY ☐
(Verifier and Approval Signatures Not Required)

NO CTS CHANGES ☒
(For calc revision, CTS has been reviewed and no CTS changes required)

UNIT (check one)	SYSTEMS	UNIDS
0 ☒, 1 ☐, 2 ☐, 3 ☐	N/A	N/A

DCN,EDC,N/A	APPLICABLE DESIGN DOCUMENT(S)	CLASSIFICATION
See Revision Log	See References	FO

QUALITY RELATED?	SAFETY RELATED? (If yes, QR = yes)	UNVERIFIED ASSUMPTION	SPECIAL REQUIREMENTS AND/OR LIMITING CONDITIONS?	DESIGN OUTPUT ATTACHMENT?	SAR/TS and/or ISFSI SAR/CoC AFFECTED
Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒

CALCULATION NUMBER REQUESTOR	PREPARING DISCIPLINE	VERIFICATION METHOD	NEW METHOD OF ANALYSIS
Name: Anil Bangalore PHONE: 423 365 1610	EEB	DESIGN REVIEW	☐ Yes ☒ No

PREPARER (PRINT NAME AND SIGN)	DATE	CHECKER (PRINT NAME AND SIGN)	DATE
Daljeet Bhatia [signature]	5/29/14	Vinu Patel [signature]	5/29/14
VERIFIER (PRINT NAME AND SIGN)	**DATE**	**APPROVAL (PRINT NAME AND SIGN)**	**DATE**
N/A ACB 5/30/14		Ronald E Cox [signature]	6/3/14

STATEMENT OF PROBLEM/ABSTRACT

DAN GCP 5/30/14

Statement of problem

Issues were raised by the NRC concerning degraded voltage relay (DVR) protection which can be summarized as the need to determine if the DVR setpoint provides the minimum required voltages at the terminals of the Class 1E loads during motor starting (automatic starting during a DBE or individually) while still connected to the preferred offsite power source.

Abstract

This study is being performed as a sensitivity study to see the impact to the DVR setpoint and/or plant response if the current methodology is changed and determine if adequate starting voltage is available to each Class 1E load when the 6.9kV Shutdown Boards are at the DVR dropout setpoint (analytical limit) for the following cases:

- During a design basis event (DBE): all Class 1E loads that are automatically actuated for a safety injection signal (SI-Phase A or SI-Phase B).
- When individually starting a motor (single motor start): all Class 1E loads, even if not SI-actuated.

This study will also show that for a degraded voltage condition, overcurrent protective devices associated with Class 1E loads will not trip during SI-actuated motor starting and subsequent start on the emergency diesel generator. This analysis is performed for both Unit 1 and Unit 2.

The study has a Compact Disk (CD) that contains Appendices C, D, E, F and G (ETAP output reports).

MICROFICHE/EFICHE Yes ☐ No ☒ FICHE NUMBER(S)

NPG CALCULATION COVERSHEET / CTS UPDATE

CALC ID	ORG	PLANT	BRANCH	NUMBER	REV
	NUC	WBN	EEB	STUDY-EEB-WBN-12-001	002

BUILDING	ROOM	ELEVATION	COORD/AZIM	FIRM
N/A	N/A	N/A	N/A	BECHTEL

CATEGORIES

KEYWORDS (A-add, D-delete)

ACTION (A/D)	KEYWORD	A/D	KEYWORD

CROSS-REFERENCES (A-add, D-delete)

ACTION (A/D)	XREF CODE	XREF PLANT	XREF TYPE	XREF NUMBER	XREF REV
A	P	WBN	CALCULATION	EDX-000-999-2004-0002	

CTS ONLY UPDATES:
Following are required only when making keyword/cross reference CTS updates and page 1 of form NEDP-2-1 is not included:

PREPARER (PRINT NAME AND SIGN)	DATE	CHECKER (PRINT NAME AND SIGN)	DATE

PREPARER PHONE NO.	EDMS ACCESSION NO.

NPG CALCULATION RECORD OF REVISION

CALCULATION IDENTIFIER STUDY-EEB-WBN-12-001	Page **2**

Title	Sensitivity Study of Degraded Voltage Relay (DVR) Protection During Motor Starting
Revision No.	**DESCRIPTION OF REVISION**
000	Initial issue. This sensitivity study also completes one of the corrective actions (298321-005) in PER 298321. Total number of pages: **127** This calculation also contains a CD which stores the ETAP output files and is stored in the calculation library for reference. Special Requirements/Limiting Conditions: None Successor Calculations: None
001	Revised to incorporate comments from Licensing, revised section 7 to add analysis for Control Circuit Voltage Drop and added Introduction to Appendix A. Pages added: 13, Appendix A (page i, ii) Pages revised & replaced: 1, 2, 3, 5 thru 9, 11, Att. 4 (pages 10, 11), Att. 5 (pages 7, 8) Pages deleted: None Total number of pages: **130** This study was prepared in accordance with procedure requirements, utilizing standard calculation format and forms. This study is a one-time sensitivity study to determine the impact, if any, to the plant if a new degraded voltage methodology is implemented. Special Requirements/Limiting Conditions: None Successor Calculations: None

NPG CALCULATION RECORD OF REVISION	
CALCULATION IDENTIFIER STUDY-EEB-WBN-12-001	Page **2A**
Title Sensitivity Study of Degraded Voltage Relay (DVR) Protection During Motor Starting	

Revision No.	DESCRIPTION OF REVISION
002	This revision involves the following: • Rerun Dynamic and Static Motor Starting analysis with the revised database incorporating all modifications performed to support U2 completion and ongoing modifications to the operating Unit 1. • Perform additional degraded voltage analysis utilizing the offsite power as a swing source. This additional analysis is being performed in Appendix H.. Pages added: 2A, 4A, App. H (5 pages), Att. 5 (pages 8A, 8B, 8C, 8D) Pages revised & replaced: 1, 1A, 3, 5, 6, 10, 13, App. A (pages 1 - 25), App. B (page 1), Att. 4 (pages 10, 11), Att. 5 (pages 7, 8) Pages deleted: Appendix A (pages 26-27) This calculation contains a CD which stores the revised ETAP Reports for Appendices C, D, E, F and G. Total number of pages for Calculation: 130 + 11 - 2 = 139 This study was prepared in accordance with procedure requirements, utilizing standard calculation format and forms. This study determines the impact, if any, to the plant if a new degraded voltage methodology is implemented. Special Requirements/Limiting Conditions: None Successor Calculations: None

NPG CALCULATION TABLE OF CONTENTS

Calculation Identifier: STUDY-EEB-WBN-12-001	Revision: 002	

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NPG COMPUTER INPUT FILE
STORAGE INFORMATION SHEET

Document STUDY-EEB-WBN-12-001	Rev. 000	Plant: WBN	

Subject:

Sensitivity Study of Degraded Voltage Relay (DVR) Protection During Motor Starting

☐ Electronic storage of the input files for this calculation is not required. Comments:

The Output files for the software ETAP are accessible in the EDMS System under Document Identifier STUDY-WBN-EEB-12-001.

☒ Input files for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. (Any retrieved file requires re-verification of its contents before use.)

File Keeper Storage / Retrieval System

Plant	WBN
Document Identifier	319518, 359519
Document Type	FILE
Initiated Date	20120404
Key Items	ELECTRICAL CALCULATION
Equipment Name	ETAP
Reference	STUDY-EEB-WBN-12-001 R0
Description	Input Files for WBN CALC 12-001 R0
Added By User	dsbhatia
Property	BSL
Data Added	04/04/2012 3.26.36 PM
Document Category	FILEKEEPER
Organization	NUCLEAR
File Name	DVR Analysis WBN (DBE Motor Starting) (319518) Single Motor Starting Analysis (319519)
Resp Org	WBNP

Calculation input files stored:

WBNDATA.MDB	*03/21/2012 @ 2:05 PM*
WBNDATA.OTI	*03/29/2012 @ 4:36 PM*
WBNDATA.PSO	*07/13/2010 @ 10:05 AM*

Note: Additional copy of the input/output files are contained on server: \\chachaapp5\etaps\wbnp\R0 STUDY-EEB-WBN-12-001

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Subject:
Sensitivity Study of Degraded Voltage Relay (DVR) Protection During Motor Starting

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1.0 Purpose

The purpose of this study is to address the issues concerning degraded voltage relay (DVR) protection at WBN as documented in:

1. WBN NCV 05000390/2010005-003 "Failure to Use Worst Case 6900 VAC Bus Voltage in Design Calculations"
2. Watts Bar (WBN) Unit 2 NUREG-0847, Supplement 22, RAI Item 30
3. Recent regulatory developments in the industry with respect to DVR protection and analysis including NRC Regulatory Issue Summary (RIS) 2011-12, "Adequacy of Station Electrical Distribution System Voltages"
4. Additional NRC comments received in public meeting

These issues can be summarized as the need to determine if the DVR setpoint provides the minimum required voltages at the terminals of the Class 1E loads during motor starting (automatic starting during a design basis event or individually) while still connected to the preferred offsite power source.

Currently, the DVR analytical limit is determined by the Degraded Voltage Analysis calculation (Ref. 2.1), using methodology consistent with industry standard IEEE Std. 741-1997 and station licensing basis. The DVR setpoint methodology has not previously considered motor starting voltage as a basis of the relay setpoint. This study is being performed as a sensitivity study to see the impact to the setpoint and/or plant response if the current methodology is changed.

1.1 Scope

This study determines if adequate starting voltage is available to each Class 1E load when the 6.9kV Shutdown Boards are at the DVR dropout setpoint (analytical limit) for the following cases:

- During a design basis event (DBE): all Class 1E loads that are automatically actuated for a safety injection signal (SI-Phase A or SI-Phase B).
- When individually starting a motor (single motor start): all Class 1E loads, even if not SI-actuated.

This study will also show that for a degraded voltage condition[1], overcurrent protective devices associated with Class 1E loads will not trip during SI-actuated motor starting and subsequent start on the emergency diesel generator.

This analysis is performed for both Unit 1 and Unit 2.

2.0 References

2.1 Calculation WBNEEBMSTI060029, Revision 33 "Degraded Voltage Analysis"

2.2 Calculation EDQ00099920070002, R37, "AC Auxiliary Power System Analysis (dual unit operation)"

2.3 Calculation WBNEEBEDQ1999010001, R75, "AC Auxiliary Power System Analysis"

2.4 NRC Regulatory Issue Summary (RIS) 2011-12, Revision 1, "Adequacy of Station Electrical Distribution System Voltages"

2.5 Watts Bar (WBN) Unit 1 NCV 05000390/2010005-03, "Failure to Use Worst Case 6900 VAC Bus Voltage in Design Calculations"

2.6 Watts Bar (WBN) Unit 2 NUREG-0847, Supplement 22, "Safety Evaluation Report Related to the operation of Watts Bar Nuclear Plant, Unit 2", RAI Item 30

2.7 Calculation WBNEEBMSTI060010, R76, "Auxiliary Power System Analysis on 1E Buses" (Historical Reference)

[1] A degraded voltage condition is when the 6.9kV Shutdown Board voltage drops below the DVR setpoint, but not below the loss of voltage (LOV) setpoint, and does not recover.

2.8 Calculation WBPE2119202001, R8, "6.9kV Shutdown Logic Boards Undervoltage Relays Requirements/Demonstrated Accuracy Calculation"

2.9 Limitorque Maintenance Update 92-2 (RIMS L33930113 803) - Extract from Design Guide DG-E2.4.6

2.10 TVA General Engineering Specification DS-E9.4.1, R1, Selection and Specifications of Motors

2.11 NEMA MG-1-1998, Motors and Generators

2.12 PER 298321

2.13 Calculation EDX-000-999-2004-0002, R3, TSS Grid Voltage Study of WBN's Offsite Power System

3.0 Bases/Assumptions

3.1 The DVR dropout analytical limit (6555V) as determined in the Degraded Voltage Analysis calculation (Ref. 2.1) will be used to determine the available starting voltage.

3.2 The ETAP model used to perform offsite power analysis for dual unit operation (Ref. 2.2) is used to perform the motor starting analysis.

3.3 All process controlled loads (random loads) are conservatively considered to start at zero seconds in a DBE.

3.4 The Phase A Start Sequence evaluates a Safety Injection Initiation without receipt of a Phase B Containment Isolation (High Containment Pressure). The Phase B Start Sequence evaluates a Safety Injection Initiation with receipt of a Phase B Containment Isolation.

The short term steady state loading at the 480V level is higher during a Phase A start sequence than during a Phase B and results in a lower voltage at the 480V busses. However, piping breaks associated with a Phase A Start Sequence are small and will result in ECCS equipment being removed from service within a short period after the event (less than an hour). This will result in a much lower overall long term loading for a Phase A event when compared to a Phase B.

This study uses short term Phase A loading for the single motor start analysis since it is the most conservative loading. If, however the starting voltage (480V) is not acceptable using the Phase A loading, then Phase B loading is used provided:

- The load is only required for a Phase B event, or
- The load is required to be manually started at a time that is at least 2 hours after the initiation of a Phase A event.

This assumption is conservative since the long term 480V loading for a Phase B event is higher than for a Phase A event.

3.5 The 89-10 MOVs for WBN utilize motor actuators which have 'hammer-blow' feature, which allows the motor to start turning prior to engaging the mechanical load of the operator (i.e. start unloaded). The actual motor current draw is typically 50% of the full locked-rotor current (Ref. 2.9). Initially all MOVs are evaluated using full locked-rotor current but if the available voltage does not meet the required voltage criteria, the available voltage is re-calculated taking credit for the 'hammer-blow' feature. These MOVs are identified in Appendix A.

4.0 Methodology/Approach

The methodology used in this study was developed to meet the intent of Regulatory Issue Summary (RIS) 2011-12, "Adequacy of Station Electrical Distribution System Voltages". The RIS states the protective function of the DVR setpoint is to ensure adequate starting voltage to all Class 1E equipment for all operating and accident conditions. Additionally, the RIS states that the DVR setpoint must be based on the starting voltage requirement at the terminal of the most limiting component and must account for the effect of all components which could affect voltage, this includes offsite power circuits, the plant distribution system, as well as all Class 1E and non-Class 1E loads.

However, the RIS does not prescribe the specific methodology to be used for the motor starting analysis, and there is no industry consensus on how to best address DVR protection for motor starting scenarios.[2] In actuality, the ability to start motors cannot be determined by monitoring voltage alone. The ability to start motors can only be determined by power system capacity, which is the ability to maintain voltage while providing the required starting current. Therefore, the very premise of using a voltage relay to protect motor starting ability requires an assumption of the power source capacity, which seems to violate the stated purpose of the DVR protective function.

An analytical approach is used in this study to determine the acceptability of the voltage during any Class 1E motor starting scenario that bounds any value of upstream capacity. This approach is based on the fact that for any Class 1E motor starting event (single motor or group of motors), the voltage at the DVR monitored bus can only respond in one of three ways:

1. The voltage decreases to the DVR setpoint, or above (i.e. DVR does not actuate)
2. The voltage decreases below the DVR setpoint and does not recover (i.e. DVR actuates and transfers loads to the DGs after the specified time)
3. The voltage decreases below the DVR setpoint and does recover (i.e. DVR actuates but does not initiate transfer since voltage remains above the LOV setpoint and recovers above the DVR reset value prior to timeout)

Analyses are performed for each of these situations as follows:

1. A starting voltage analysis is performed using a technique known as the "independent source" method. The voltage at the DVR monitored bus (i.e. 6.9kV Shutdown Board) is set at the DVR setpoint (dropout analytical limit) using an independent fixed voltage source. Since the initial DVR bus voltage prior to the event can be ignored, this simple technique produces correct voltages for downstream loads immediately after the initiation of the event. The analysis is performed for DBE motor starting (SI-actuated loads) as well as individual motor starts.
2. A protective device analysis is performed using a technique known as the "start-start" method. Since this is truly a degraded voltage situation, there is no need for a starting voltage analysis. However, an analysis should be performed to demonstrate that the Class 1E loads will be successfully transferred to the DG and started prior to their protective devices tripping. This "start-start" analysis was previously performed in the Degraded Voltage Analysis calculation (reference 2.1) and the results are reprinted in this study.
3. For DBE motor starting events, a bounding analysis is performed to demonstrate that any possible voltage transient caused by DBE motor starting, including drop to the LOV setpoint, will also result in successful recovery above DVR reset within 5 seconds (without crediting automatic load tap changers). For individual motor starting events, this situation is bounded by the starting voltage analysis from item 1 since the analysis at DVR dropout is more conservative than analysis at the DVR reset value.

These analyses bound any possible voltage outcome at the DVR monitored bus when starting any Class 1E motor required for any scenario.

[2] IEEE Power &Energy Society, Nuclear Power Engineering Committee (NPEC), Working Group 4.7 (Protection of Class 1E Power Systems and Equipment) meeting minutes of January 24, 2012, San Antonio, TX.

5.0 Design Input Data

5.1 For individual minimum motor starting voltage requirements, see Appendix A.

5.2 The degraded voltage relay setpoints are as follows (Ref. 2.1, 2.8 & Att. 2 of this study):

	Dropout (V)	Reset (V)
Nominal Setpoint	6600	6642
Allowable Value	6570	6672
Analytical Limit	6555	N/A
Operational Limit	N/A	6681

6.0 Computations and Analysis

The motor starting analysis is performed using ETAP V7.0.0N and the existing ETAP model used to perform offsite power system analysis for two unit operation (Ref. 2.2).

6.1 Starting Voltage Analysis

The 6.9kV shutdown boards were disconnected from all offsite power source(s) and a dedicated fixed voltage source was added to each 6.9kV shutdown board. The source voltage was set to the DVR dropout setting of 6555V (Section 5.2).

Using the load configuration in the existing Unit 1& 2 ETAP model, the following analyses were performed:

- Dynamic Motor Starting – Safety Injection Signal Phase A (SIA)
- Dynamic Motor Starting – Safety Injection Signal Phase B (SIB)
- Static Motor Starting (starting individual motor): This analysis is performed with SIA since this provides the worst case voltages on the 480V system. For this analysis, motor starting study case is generated to individually start each Class 1E motor. Resolutions to loads requiring additional review are annotated in Appendix A. If the starting voltage using Phase A is not acceptable, analysis is performed using Phase B loading

DBE Motor Starting:
Each study case is run for a total simulation time of 15 seconds. Since it is considered that by this time all motors have been accelerated and the APS system has come to a steady state condition. ETAP reports provide terminal voltage and current for every motor which starts at 0+ second up to 15 seconds in steps of 0.1 second.

The output reports are saved as U1 sdbds at DVDO-Complete (Study Case U1-DV-SIBms, Config. DV-LOCA-U1), U2 sdbds at DVDO-Complete (Study Case U2SIB-DV(N), Config. DV-LOCA-U2) and U12 sdbds at DVDO-Complete (Study Case U1/2SIA, Config. Deg Volt SU) in folder J:\wbnp\DVR Analysis (Static) WBN\ETAP Reports - Dynamic Motor Analysis.

Single Motor Starting:
Each study case is run using 'Study Case ID U1/2SIA and Config. Deg Volt SU'.

The output reports, in pdf format, are saved in folders J:\wbnp\DVR Analysis (Static) WBN\ETAP Reports - Shutdown Boards 1A and 1B and J:\wbnp\DVR Analysis (Static) WBN\ETAP Reports Shutdown Boards 2A and 2B\New Reports. Due to the large number of output reports, the output report names are not listed.
These analyses did not credit any non-Class 1E equipment upstream of the 6.9-kV Class 1E buses (such as LTC transformers or administratively controlled grid capacity). The available starting voltage for each motor is then documented and compared to the required starting voltage.

6.2 Protective Device Analysis (Start-Start scenario):

The scenario evaluated for the short time delay is an SI concurrent with the degraded voltage condition such that a block start attempt is made. A determination is made of the time permitted to allow voltage to return above the degraded voltage relay setpoint reset limit under block start transient conditions and still assure a subsequent start on the diesel if the voltage fails to recover, thus, making this a start-start evaluation. To evaluate the effect of the starting currents during the start-start scenario, the effect on overcurrent protective devices are considered. The board voltages at the onset of the event are, considered normal (i.e. no preheat). The degraded voltage condition presumes that the voltage does not recover but remains below the degraded voltage relay setpoint subjecting the SI initiated motors to starting currents for the time delay selected and then sequence onto the emergency diesel generators. The design calculated worst-case transient voltage dip during the accident loading sequence is used. This is conservative, because a lower voltage would produce less starting current for the motors.

The above evaluation is performed for the safety related loads required for Units 1 and 2 which would be actuated for an SI as follows:

- Motor loads fed from 6.9kV and 480V Switchgear & MCCs, MOVs & Static loads fed from the MCCs are evaluated to determine the effect of the start-start heating of the overcurrent protective devices (breakers/TOLs), such that starting on the diesel without tripping can be assured.
- Protective devices are also evaluated for the 6.6kV and 460V safety-related motors that operate during non-accident conditions. The evaluation considers that the safety bus voltage is equivalent to operation at the lower boundary of the degraded voltage relay dropout The protective devices are evaluated to ensure that operation of the safety-related loads can be sustained indefinitely at this voltage without protective device trip.
- SI actuated medium voltage (6.6kV) motor loads are evaluated to ensure that their thermal damage limits are not exceeded during the start-start event.
- 120VAC control power transformer (CPT) fuse time characteristics are evaluated to determine if the fuse could blow when carrying rated inrush current of the starter and any other normally energized devices for the safety analysis time of 11.5 seconds (upper boundary of the degraded voltage relay time delay, Attachment 2) or 12 seconds in the start-start scenario.
- MCC 120VAC distribution panel fuse time characteristics are evaluated to determine if the fuses melt during the start attempts. It is considered that circuit components required to pick-up during starting will be at inrush conditions.

6.3 <u>Voltage Recovery Analysis:</u>

See Appendix B for voltage recovery analysis for DBE for detailed purpose, approach, bases and assumptions and computations.

In addition, Appendix H demonstrates the adequacy of the DVR protection scheme if the voltage source is placed at the switchyard bus and the grid voltage and capacity is set

1. Such that the DVR monitored bus voltage is at the DVR dropout analytical limit prior to DBE initiation
2. To support successful voltage recovery following DBE motor starting

7.0 Summary of Results

7.1 Starting Voltage Analysis

See Appendix A for summary of the results. Based on a review of the results, all safety related loads have adequate starting voltage during DVR conditions and the existing setpoints for the degraded voltage relay are considered acceptable.

Note: ERCW Screen Wash Pumps are not assured to have adequate voltage as analyzed. However per N3-67-4002 this load is not required to be manually placed into service until 12 hours into a design basis event. This provides sufficient time to take corrective actions such as correcting the grid condition, adjusting the tap changers on the CSSTs or transferring the shutdown board(s) to the diesel generators.

Control Circuit Voltage Drop (CCVD) Analysis

With respect to the contactors, relays and solenoid valves, adequacy of pickup voltage for these control components (contactors, solenoid valves, relays) were performed as part of the Control Circuit Voltage Drop (CCVD) analysis. This analysis was performed considering a steady state minimum voltage of 432V at the MCC bus. All the components were determined to have adequate pickup voltage upon implementation of the issued design changes as identified in the CCVD calculation prior to Unit 2 fuel load.

The MCC transient bus voltage under degraded voltage conditions (at DVR dropout voltage of 6555V) drops below 432V due to starting of large motors on the 480V switchgear. This voltage, however, recovers to a value of >432V within 4 seconds. Since the startup of the safety related equipment may not have adequate starting voltage due to transient voltage conditions, Westinghouse evaluated the impact of additional 5 second delay for the startup of the safety injection pumps and feedwater isolation valves with offsite power available, and concluded the following: "This safety evaluation concludes that an additional five second delay for the startup of the safety injection pumps and an additional five second delay in the closure of the feedwater isolation valve does not impact the conclusions of the safety analysis that form the Watts Bar licensing basis (SECL-92-029; RIMS No. T33930330990)".

Based on the above, the analysis performed to verify adequacy of available voltage for the contactors, solenoid valves, relays is considered to be adequate and, therefore, no further analysis under the transient voltage conditions has been performed.

7.2 Protective Device Analysis

Motors Actuated by SI Signal:
As discussed in Attachment 7, there is no adverse effect of the start-start heating on the overcurrent devices on the safety related motors which would be actuated by safety injection signal and powered from safety related 6.9kV and 480V switchgears and 480V MCCs while operating at the lower boundary of the degraded voltage relay setting (6555V).

Non-Accident Safety Related Motors:
Based on the analysis, operation of safety-related loads with the 6.9kV Shutdown Board voltage operating at the lower boundary of the degraded voltage relay 6555V, will not cause tripping of protective devices. Static loads (constant impedance) are not considered, since operation at lower voltage results in less current. Therefore, operation at the lower boundary of the degraded voltage relay dropout setting would not trip the motors.

TOL Evaluation:
The generic evaluation of TOL's, in Attachment 7, showed that only motors having locked rotor current in excess of 850% are required to be evaluated further. A review of the WBN ETAP database, showed that four motors have a locked rotor current greater than 850% and start for an accident. An evaluation of those four loads shows that their TOL's are set at 115%. Therefore they would not be an issue, because it would increase their tolerance for tripping by an additional 15%.

Fuse Evaluation for MCCs 120VAC CPT Circuits and 120VAC Distribution Panel Loads:
Based on the evaluation in Attachment 7, fuses for all the 120V AC CPT Circuits and 120V AC Distribution Panel Loads are considered acceptable, the fuses will carry inrush current and will not blow or melt for at least 12 seconds during a start-start scenario.

The upper boundary limit for the time delay is 11.5 seconds, which is the maximum total time allowed for loss of voltage detection and emergency diesel generator start in the WBN safety analysis as documented in the FSAR. Based on the evaluation performed in Attachment 7, it has been determined that protective devices will not trip prior to 12 seconds for start-start operation of motors at a degraded voltage at which time period disconnection from offsite power and reconnection to the emergency diesel generators occurs.

7.3 Voltage Recovery Analysis

The voltage recovery analysis shows that in all cases the voltage on the 6.9kV shutdown boards 1A, 1B, 2A and 2B recovers above the DVR reset value (operational limit of 6681V) within 4 seconds.

8.0 Conclusions

8.1 This study determines that adequate starting voltage is available to each Class 1E load when the 6.9kV Shutdown Boards are at the DVR dropout setpoint (analytical limit) for the following cases:

- During a design basis event (DBE): all Class 1E loads that are automatically actuated for a safety injection signal (SI-Phase A or SI-Phase B).
- When individually starting a motor (single motor start): all Class 1E loads, even if not SI-actuated.

8.2 This study shows that for a degraded voltage condition, overcurrent protective devices associated with Class 1E loads will not trip during SI-actuated motor starting and subsequent start on the emergency diesel generator.

8.3 The bounding voltage recovery analysis in Appendix B demonstrates that any possible voltage transient caused by DBE motor starting, including drop to the LOV setpoint, will also result in successful recovery above DVR reset within 4 seconds.

8.4 The outcome of the analysis in Appendix H demonstrates the adequacy of the DVR protection scheme.

Therefore, using motor starting voltage as a basis for the relay setpoint shows no impact to the DVR setpoint and/or the plant response.

Appendix A

Introduction

This appendix is a summary tabulation of the results for the various motor starting scenarios described in Section 6.0. The analyses in Appendix A were developed using the methodology and applicable inputs from References 2.2, and 2.3. Voltage values were obtained from the applicable ETAP files and output reports in this study. The key information and results are determined as follows:

A. Minimum Motor Starting Voltage

Minimum motor starting voltages are based on Attachments 1, 3 and 6 of this study. The minimum motor starting voltages used are:

6600 Volt Motors - 5280 Volts (80%)***

460 Volt Motors - 391 Volts (85%)**

460 Volt Air Compressors - 368 Volts (80%)**

89-10 MOVs - Valve thrust and torque design margin calculations/evaluations based on motor terminal voltage as documented in Attachments 4 and 5 of this study.

Non 89-10 MOVs - 368 Volts (80%)**

** Percentages are based on 460 Volt rated motor voltage. For motors rated other than 480V, the same percentages are applicable. The minimum starting voltage may be different from the above voltage if it is based on manufacturer's data or test report as documented in Attachments 3 and 6 of this study.

*** 80% for all motors except for the ERCW Pump motor which requires 90% and the Auxiliary Feedwater Pump motor which requires 85%

B. Motor Starting Evaluation Results

Individual motor starting evaluation results are tabulated for all class 1E safety-related motors and motor operated valves. As summarized in Section 6.1 of this study the following steps were performed:

1. Motor terminal voltage with Phase A loading is compared against the minimum motor starting requirements above. If acceptable voltage is obtained, no further action is required.
2. Motor terminal voltage with Phase B loading is compared against the minimum motor starting requirements above. If acceptable voltage is obtained, no further action is required.
3. Single motor start terminal voltage with Phase A loading or with Phase B loading provided the Phase B criteria in section 3.4 of this study applies is compared against the minimum motor starting requirements above. If acceptable voltage is obtained, no further action is required.

4. Individual circuit operating evaluations are performed based on when the motor is in service such as the ERCW Screen Wash Pump.
5. For 89-10 MOVs, See Section C below.

C. 89-10 Motor Operated Valve Evaluation Results

For Unit 1 and Unit 2 89-10 MOVs that did not meet the required valve motor starting voltage criteria, as a first step the calculated starting voltages for these MOVs were provided to Mechanical discipline (valve group) to evaluate if the revised voltages were acceptable. Based on the new thrust and torque calculations and calculated new design margins by mechanical valve group, the new available starting voltage for some MOVs was determined to be acceptable. However, some of the MOVs still did not meet either the required voltage or the minimum design margin criteria. Available voltage for these MOVs were re-evaluated further using the hammer-blow (HB) feature (see Section 3.5) which resulted in improved starting voltage available at the motor terminals. The available voltage with HB feature was again evaluated by the mechanical valve group and determined to be acceptable.

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts									
		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)	Bases for Minimum Required Voltage	
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV /460V Base	6.6kV/460V Base	Reference	
6.9KV Shutdown Board 1A-A									
12-10 AFW	Aux Feedwater PMP 1A-A 1-MTR-3-118-A (600 HP)	99.09	Starts	99.09	Starts	99.07	85	Att. 3	
12-13 CSP	CNTMT SPRAY PMP 1A-A 1-MTR-72-27-A (700 HP)	N/A	Not Running	98.80	Starts	98.79	80	Att. 3	
12-14 RHR	RHR PUMP 1A-A 1-MTR-74-10-A (400 HP)	98.97	Starts	98.97	Starts	98.97	80	Att. 3	
12-15 SI	SAFETY INJ PMP 1A-A 1-MTR-63-10-A (400 HP)	98.94	Starts	98.94	Starts	98.94	80	Att. 3	
12-18 CCP	CNTFGL CHRG PMP 1A-A 1-MTR-62-108-A (600 HP)	98.87	Starts	98.87	Starts	98.87	80	Att. 3	
12-8 ERCW	ERCW PMP A-A 0-MTR-67-28-A (800 HP)	N/A	Starts (A-A or B-A start, but not both, other is not running)	N/A	Starts (A-A or B-A start, but not both, other is not running)	96.46	90	Att. 3	
12-9 ERCW	ERCW PMP B-A 0-MTR-67-32-A (800 HP)	93.26	Starts (A-A or B-A start, but not both, other is not running)	93.26	Starts (A-A or B-A start, but not both, other is not running)	93.12	90	Same as ERCW Pmp A-A (Att. 3)	R2
480V Shutdown Board 1A1-A									
125-3B	Comp Cooling Sys Pump 1A-A 1-MTR-70-46-A (350hp)	83.52 (8s)	Starts	84.13 (8s)	Starts	83.56	70	Att. 3	
126-10C	Containment Air Rtn Fan 1A-A 1-MTR-30-38-A (100hp)	N/A	Not Running Starts @ 9 Min)	N/A	Not Running Starts @ 9 Min)	80.97 (SIB)	80	Att. 6	
126-7C	Reac Lwr Compt Clr Fan 1A-A 1-MTR-30-74-A (60hp)	N/A	Running	N/A	Trips	81.73	80	Att. 3	
126-9C	Elec Bd Rm AHU A-A 0-MTR-31-30B-A (50hp)	N/A	Running	N/A	Running	83.82	80	Att. 6	
126-7A	Spent Fuel Pit Pump C-S 0-MTR-78-35-S (100hp)	N/A	Running	N/A	Running	80.77	80	Att. 6	
480V Shutdown Board 1A2-A									
127-2C	Control Rm A/C A-A Compressor 0-MTR-31-80/2-A (250hp)	N/A	Running	N/A	Running	90.08	80	Att. 1	
127-3B	Comp Cooling Sys Pump C-S 0-MTR-70-51-S (350hp)	81.61 (8s)	Starts	82.07 (8s)	Starts	80.61	70	Att. 3	
128-7D	Reac Lwr Compt Clr Fan 1C-A 1-MTR-30-77-A (60hp)	N/A	Running	N/A	Trips	81.25	80	Att. 3	
128-9D	480V SD Bd Rm AHU A-A 0-MTR-31-45-A (75hp)	N/A	Running	N/A	Running	87.36	85	Att. 1	
480V C&A Vent Board 1A1-A									
203-12B	Cont Bldg Emerg Press Fan A-A 0-MTR-31-6-A (1hp)	85.89	Starts	87.23	Starts	87.60	85	Att. 1	
203-13D	ERCW Scrn Wash Pump 1A-A 1-MTR-67-431-A (40hp)	N/A	N/A	N/A	N/A	73.63	75	Att. 3 See Sec. 7.1 for Justification	

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Appendix A
1A Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV /460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV/460V Base	Bases for Minimum Required Voltage Reference
203-2A	Cont Bldg Emerg Air CU Fan A-A 0-MTR-31-8-A (10hp)	86.39	Starts	87.73	Starts	89.23	85	Att. 1
203-3C	Cntmt Spray Pump 1A-A Clr Fan 1-MTR-30-177-A (7.5hp)	N/A	Running	81.87	Starts	83.18	80	Att. 3
203-4D	Emerg Gas Trtmt Sys Fan A-A 0-MTR-65-23-A (20hp)	87.24	Starts	88.59	Starts	90.95	75	Att. 3
203-6B	ERCW Str 1A-A 1-MTR-67-9-A (3hp)	N/A	Running	N/A	Running	76.43	75	Att. 3
203-10A	Cntfg Chrg Pmp 1A-A Rm Clr Fan, 1-MTR-30-183-A, (5 HP)	84.47	Starts	85.79	Starts	86.76	80	Att. 3
203-10B	PEN RM EL 713 CLR FAN 1A-A, 1-MTR-30-196-A, (3HP)	86.68	Starts	88.03	Starts	90.30	80	Att. 3
203-10C	Pipe Chase Clr Fan 1A-A, 1-MTR-30-201-A, (3 HP)	85.43	Starts	86.76	Starts	88.55	80	Att. 3
203-11A	480V BD RM 1B PR SUP FAN 1B1-A 1-MTR-31-478-A, (3HP)	N/A	N/A	N/A	N/A	92.18	85	Att. 1
203-11C	480V Bd Rm 1A A/C Ahu 1A-A 1-MTR-31-461-A (15 HP)	N/A	N/A	N/A	N/A	90.06	85	Att. 1
203-11D	Cont Rm Ahu A-A 0-MTR-31-12-A (60 HP)	N/A	N/A	N/A	N/A	88.19	85	Att. 1 R2
203-12A	125V Vtl Bat Rm II ExFan 1B1-A 1-MTR-31-285-A (0.33 HP)	N/A	N/A	N/A	N/A	91.18	85	Att. 1
203-12C	480V Bd Rm 1A A/C Cond 1A-A 1-MTR-31-290-A, (15 HP)	N/A	N/A	N/A	N/A	90.76	85	Att. 1
203-12F1	Cntmt Purge Air Radn Exh Mon 1-RE-90-130-A, (0.75 HP)	N/A	N/A	N/A	N/A	92.73	85	Att. 1
203-2C	PEN RM EL 692 CLR FAN 1A-A 1-MTR-30-186-A, (3HP)	86.13	Starts	87.47	Starts	90.42	80	Att. 3
203-4A	Btry Rm El 692 Exh Fan A-A 0-MTR-31-28-A (1.5HP)	N/A	N/A	N/A	N/A	88.45	85	Att. 1
203-4B	5TH VITL BATT.RM.EX. FAN 1B1-A 0-MTR-31-493B-A (0.25 HP)	N/A	N/A	N/A	N/A	94.40	85	Att. 1
203-5A	SFP Pmp A-A&TB Bst Pm SpClrFan 0-MTR-30-192-A (7.5HP)	86.00	Starts	87.34	Starts	89.67	80	Att. 3
203-5E	CCS & AFW PMPS SP CLR FAN A-A 1-MTR-30-190-A (20HP)	87.31	Starts	88.66	Starts	90.70	80	Att. 3
203-6A	Shutdown Bd Rm A Press Fan A-A 0-MTR-31-64-A (3HP)	N/A	N/A	N/A	N/A	92.71	85	Att. 1
203-6C	Traveling Scrn 1A-A 1-MTR-67-434-A (5HP)	N/A	N/A	N/A	N/A	80.36	80	Att. 3
203-6F1	Cntmt Bldg Lwr Compt Air Mon 1-RE-90-106-A (3HP)	N/A	N/A	N/A	N/A	92.68	85	Att. 1
203-7B	125V Vtl Bat Rm I ExhFan 1A1-A 1-MTR-31-287-A (0.33HP)	N/A	N/A	N/A	N/A	91.40	85	Att. 1
203-8A	Safety Inj Pmp 1A-A Rm Clr Fan 1-MTR-30-180-A (5HP)	83.34	Starts	84.63	Starts	85.19	80	Att. 3
203-8B	Pen Rm El 737 Clr Fan 1A-A 1-MTR-30-194-A (3HP)	88.04	Starts	89.41	Starts	92.28	80	Att. 3
203-8C	480V Xfmr Rm 1A Exh Fan 1A2-A 1-MTR-30-244G-A (3HP)	N/A	N/A	N/A	N/A	89.57	80	Att. 3

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Appendix A
1A Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV /460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV/460V Base	Bases for Minimum Required Voltage Reference	
203-8D	480V Xfmr Rm 1A Exh Fan 1A3-A 1-MTR-30-244H-A (3HP)	N/A	N/A	N/A	N/A	91.34	80	Att. 3	
203-8F1	CONT RM A/C A-A CONTROL/O.PMP 0-MTR-31-80/3-A (3.11 HP)	N/A	N/A	N/A	N/A	92.86	85	Att. 1	
203-9A	RHR Pmp 1A-A Rm Clr Fan 1-MTR-30-175-A (5HP)	82.51	Starts	83.79	Starts	84.25	80	Att. 3	
203-9B	Cont Rm A/C Circ Pmp A-A 0-MTR-31-80/1-A (15HP)	N/A	N/A	N/A	N/A	89.07	85	Att. 1	
203-9C	480V Bd Rm 1A Pr Sup Fan 1A1-A 1-MTR-31-462-A (3HP)	N/A	N/A	N/A	N/A	92.92	85	Att. 1	
203-9D	480V Xfmr Rm 1A Exh Fan 1A1-A 1-MTR-30-244F-A (3HP)	N/A	N/A	N/A	N/A	89.49	80	Att. 3	
203-9F1	Cont Rm Intake Mon 0-RE-90-205-A (0.75HP)	N/A	N/A	N/A	N/A	93.17	85	Att. 1	
203-4E	ERCW Str 1A-A Backwash Vlv 1-FCV-67-9A-A (0.33HP)	N/A	N/A	N/A	N/A	82.02	80	Att. 1	
203-6E	ERCW Str 1A-A Flush Vlv 1-FCV-67-9B-A (0.33HP)	N/A	N/A	N/A	N/A	82.70	80	Att. 1	
203-7D	RHR PMP 1A-A INLET FCV 1-FCV-74-3-A (5.2HP)	N/A	N/A	N/A	N/A	91.31	Pass	Att. 4 / Acceptable Margin	R2
203-7E	RWST TO SPRAY HDR 1A FCV 1-FCV-72-22-A (3.2HP)	N/A	N/A	N/A	N/A	86.27	Pass	Att. 4 / Acceptable Margin	
480V C&A Vent Board 1A2-A									
None									
480V Diesel Aux Board 1A1-A									
217-2B	DG 1A-A Rm Exh Fan 1-A 1-MTR-30-447-A (15hp)	91.83	Starts	92.48	Starts	92.64	85	Att. 1	
217-3D	DG 1A-A Day Tk FO XFR PMP 1 1-MTR-18-55/1-A (1hp)	91.77	Random	92.43	Random	94.74	85	Att. 1	
217-4B	DG 1A-A AUX LUBEOIL CIRC PMP A 1-MTR-82-AOPA1A (0.75hp)	92.10	Random	92.75	Random	94.57	85	Att. 1	
217-4D	Dg Rm 1A-A Pnl Vent Fan 1-MTR-30-491-A (15HP)	N/A	N/A	N/A	N/A	92.14	85	Att. 1	
217-4E	Dg 1A-A 480V Elec Bd Rm Ex Fan 1-MTR-30-459-A (2HP)	91.95	N/A	92.60	N/A	94.29	85	Att. 1	
217-3A	EM DG HX 1A1 & 1A2 SPLY VLV 1-FCV-67-66-A (0.13HP)	82.50	N/A	83.08	N/A	85.85	Pass	Att. 5	
217-6A	DG 1A-A Muffler Rm Exh Fan 1-MTR-30-463 (0.5hp)	91.88	Starts	92.54	Running	95.01	85	Att. 1	
480V Diesel Aux Board 1A2-A									
218-2B	DG 1A-A Rm Exh Fan 2-A 1-MTR-30-451-A (15hp)	92.40	Starts	92.86	Running/ Starts	92.94	85	Att. 1	
218-3D	DG 1A-A DAY TNK FO XFR PMP 2 1-MTR-18-54/1-A (1hp)	91.63	Random	92.08	Random	93.94	85	Att. 1	
218-2A	DG 1A-A AUX LUBEOIL CIRC PMP B 1-MTR-82-AOPB1A (0.75HP)	N/A	N/A	N/A	N/A	93.76	85	Att. 1	
218-2D	Dg 1A-A Lube Oil Circ Pmp 2 1-MTR-82-A2-A (1HP)	N/A	N/A	N/A	N/A	93.46	85	Att. 1	
218-5F1	Dg Bldg Co2 Refrigeration Unit 0-PKG-39-37 (2HP)	N/A	N/A	N/A	N/A	94.53	85	Att. 1	

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Appendix A
1A Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV /460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV/460V Base	Bases for Minimum Required Voltage Reference
480V RMOV Board 1A1-A								
235-5C	Lower CNTMT 1B CLRS ISLN VLV 1-FCV-67-97-A (0.13hp)	N/A	Not Running	81.71	Starts	85.11	Pass	Att. 4
235-7A	Seal Flow Ret Isln Vlv 1-FCV-62-63-A (1.9hp)	78.93	Closes on Ph A (Starts)	80.15	Closes on Ph B (Starts)	83.38	Pass	Att. 4
235-7B	CHARGING FLOW ISLN VLV 1-FCV-62-90-A (1.9hp)	85.86	Closes on SI (Starts)	87.20	Closes on SI (Starts)	90.69	Pass	Att. 4
235-8B	Vol Cont Tank Outlet Isln Vlv 1-LCV-62-132-A (1.9hp)	80.54	Closes on SI (Starts)	81.79	Closes on SI (Starts)	85.08	Pass	Att. 4
235-9A	RWST To Charging Pmp Vlv Cont 1-LCV-62-135-A (1.9hp)	83.79	Opens on SI (Starts)	85.09	Opens on SI (Starts)	88.51	Pass	Att. 4
235-9D	RCP Oil Lir Cntmt Iso Vlv 1-FCV-70-100 (0.13hp)	N/A	Not Running	81.60	Closes (Starts)	84.97	Pass	Att. 4
235-11A	SIS Pmp Inlet to CVCS Chrg Pmp 1-FCV-63-7 (1.9hp)	N/A	Not Running	N/A	Not Running	88.21*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
235-11D	SIS Boron Inj Tank Shutoff Vlv 1-FCV-63-26 (1.9hp)	86.95	Opens on SI (Starts)	88.30	Opens on SI (Starts)	91.83	Pass	Att. 4
235-12B	Cntmt Sump To RHR Pmp A-A 1-FCV-63-72-A (13hp)	N/A	Operate about 20 minutes after SI	N/A	Opperate about 20 minutes after SI	86.95	Pass	Att. 4 / Acceptable Margin
235-13E	Cntmt Spray Hdr 1A Isln Vlv 1-FCV-72-39-A (3.2hp)	N/A	Not Running	89.45 (5s)	Opens on Ph B (Starts)	91.80*	Pass	Att. 4 (5 sec after SI) - Time Delay added per DCN 52834
235-14D	RHR Pmp 1A-A Min Flow Vlv 1-FCV-74-12-A (0.13hp)	80.60	Random	81.86	Random	85.24	Pass	Att. 4
235-15D	LWR CNTMT 1D CLRS ISLN VLV 1-FCV-67-89-A (0.13hp)	N/A	Not Running	81.83	Closes (Starts)	85.21	Pass	Att. 4
235-17B	Cntmt Standpipe Isln Vlv 1-FCV-26-240-A (0.67hp)	82.41	Close (Start)	83.69	Close (Start)	87.08	Pass	Att. 4
235-18E	RCP Spray Isln Vlv 1-FCV-26-243-A (0.67hp)	83.68	Close (Start)	84.98	Close (Start)	88.42	Pass	Att. 4
235-2E1	RWST To RHR Pmp Flow Cont Vlv 1-FCV-63-1-A (5.2HP)	N/A	N/A	N/A	N/A	92.09*	Pass	Att. 4
235-5B	RHR Sys Isln Vlv 1-FCV-74-1-A (2.6HP)	N/A	N/A	N/A	N/A	90.74*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
235-6D	RCS Press Relief FCV 1-FCV-68-333-A (1.9HP)	N/A	N/A	N/A	N/A	89.2*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
235-10B	SIS Pmp Recirc To RWST 1-FCV-63-3-A (0.7HP)	N/A	N/A	N/A	N/A	90.70*	Pass	Att. 4

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EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV /460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV/460V Base	Bases for Minimum Required Voltage Reference
235-10F	Cont Spray Pmp 1A-A Recirc FCV 1-FCV-72-34-A (0.13HP)	N/A	N/A	N/A	N/A	89.39*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
235-11B	RHR Hx A To CVCS Chrgr Pmp 1-FCV-63-8-A (1.9HP)	N/A	N/A	N/A	N/A	87.56	Pass	Att. 4 / Acceptable Margin
235-12A	SIS Pmp 1A-A Inlet Vlv 1-FCV-63-47-A (1.9HP)	N/A	N/A	N/A	N/A	88.18*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
235-12D	SIS To RCS Loops 2&3 FCV 1-FCV-63-93-A (1.6 HP)	N/A	N/A	N/A	N/A	90.73	Pass	Att. 4 / Acceptable Margin
235-12E	SIS Pmp 1A-A Outlet FCV 1-FCV-63-152-A (1.9HP)	N/A	N/A	N/A	N/A	88.48*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
235-13A	SIS Pmp Out RCS Lp 1&3 Hot Leg 1-FCV-63-156-A (1.9HP)	N/A	N/A	N/A	N/A	89.28*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
235-13B	Cntmt Sump To Spray Hdr 1A FCV 1-FCV-72-44-A (3.2HP)	N/A	N/A	N/A	N/A	90.33*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature * R2
235-14A	RHR Spray Hdr 1A Isln Vlv 1-FCV-72-40-A (1.9HP)	N/A	N/A	N/A	N/A	87.74	Pass	Att. 4 / Acceptable Margin
235-14E	RHR Hx 1A Bypass Vlv 1-FCV-74-33-A (2HP)	N/A	N/A	N/A	N/A	85.35	Pass	Att. 4 / Acceptable Margin
235-4E	AFW Pmp A-A Lube Oil Pmp A-A 1-MTR-3-118D-A (0.25HP)	N/A	Manual	N/A	Manual	89.80	85	Att. 1
480V RMOV Board 1A2-A								
236-17E	480V Bd Rm 1A A/C Compressor 1A-1 1-MTR-31-465-A (50hp)	N/A	Running	N/A	Running	91.94	85	Att. 1
236-2A	ERCW Hdr A Isln Vlv 1-FCV-3-116 (0.25hp)	N/A	Random	N/A	Random	84.14	Pass	Att. 4
236-3A	ERCW Hdr A Isln Vlv 1-FCV-3-136 (0.33hp)	N/A	Random	N/A	Random	84.72	Pass	Att. 4
236-3D	St Gen No 1 FW Isln Vlv 1-FCV-3-33-A (39.4hp).	81.97	Use 89-10 starts	82.77	Use 89-10 starts	82.79	Pass	Att. 4
236-4D	St Gen No 3 FW Isln Vlv 1-FCV-3-87 (39.4hp)	79.85	Use 89-10 starts	80.63	Use 89-10 starts	80.80	Pass	Att. 4
236-7D	Lwr Cntmt Clr 1A Disch Iso Vlv 1-FCV-67-87-A (0.13hp)	N/A	Not Running	84.74	Closes (Starts)	86.85	Pass	Att. 4
236-7F	Upr Cntm Vt Clr 1A Sup Iso Vlv 1-FCV-67-130-A (0.13hp)	N/A	Not Running	82.36	Closes (Starts)	84.42	Pass	Att. 1
236-8B	Lwr Cntmt 1A Clr Sply Isln Vlv 1-FCV-67-107-A (0.33hp)	N/A	Not Running	85.38	Closes (Starts)	87.49	Pass	Att. 4

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts								
		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)	Bases for Minimum Required Voltage
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV /460V Base	6.6kV/460V Base	Reference
236-8D	Lwr Cntmt 1C Clr Disch Iso Vlv 1-FCV-67-95-A (0.13hp)	N/A	Not Running	84.49	Closes (Starts)	86.59	Pass	Att. 4
236-8F	Upr Cntm Vt Clr 1C Sup Iso Vlv 1-FCV-67-133-A (0.13hp)	N/A	Not Running	81.29	Closes (Starts)	83.32	Pass	Att. 1
236-9A	Lwr Cntmt 1C Clr Sply Isln Vlv 1-FCV-67-99-A (0.33hp)	N/A	Not Running	85.07	Closes (Starts)	87.17	Pass	Att. 4
236-9B	Lwr CNTMT 1B CLR DISCH ISO VLV 1-FCV-67-104-A (0.33hp)	N/A	Not Running	85.41	Closes (Starts)	87.53	Pass	Att. 4
236-9D	Up Cntmt VT Clr 1A Disc Iso Vlv 1-FCV-67-295 (0.13hp)	N/A	Not Running	79.88	Closes (Starts)	81.87	Pass	Att. 4 / Acceptable Margin
236-9F	Upr Cntm Vt Clr 1B Sup Iso Vlv 1-FCV-67-139-A (0.13hp)	N/A	Not Running	81.29	Closes (Starts)	83.32	Pass	Att. 1
236-10A	Lwr Cntmt 1D Clr Disch Iso Vlv 1-FCV-67-112-A (0.33hp)	N/A	Not Running	85.46	Closes (Starts)	87.58	Pass	Att. 4
236-10D	UP CNTM VT CLR 1C DISH ISO VLV 1-FCV-67-296-A (0.13hp)	N/A	Not Running	81.33	Closes (Starts)	83.36	Pass	Att. 1
236-10F	UP CNTM VT CLR 1D DISH ISO VLV 1-FCV-67-142-A (0.13hp)	N/A	Not Running	82.36	Closes (Starts)	84.42	Pass	Att. 1
236-11D	RCP Thrm Barr Rtn Cntm Iso Vlv 1-FCV-70-90-A (0.7hp)	N/A	Not Running	86.05	Closes (Starts)	88.16	Pass	Att. 4
236-11E	RCP Thrm Barr Cntmt Isln Vlv 1-FCV-70-133-A (0.13hp)	N/A	Not Running	83.85	Closes (Starts)	85.94	Pass	Att. 4 R2
236-12D	RCP Oil Clr Rtn Cntmt Isln Vlv 1-FCV-70-92-A (0.13hp)	N/A	Not Running	85.13	Closes (Starts)	87.25	Pass	Att. 4
236-16D	Excs Ltdn Hx Cont Inlt Iso Vlv 1-FCV-70-143-A (0.33hp)	83.86	Closes on Phase A	84.68	Closes on Phase A	86.78	Pass	Att. 4
236-2B	ERCW Hdr A Isln Vlv 1-FCV-3-116B-A (0.25HP)	N/A	N/A	N/A	N/A	84.13	Pass	Att. 4
236-2D	AFWP Turb Stm Sup Fm Stm Gen 1 1-FCV-1-15-A (1HP)	N/A	N/A	N/A	N/A	92.47*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
236-2E	St Flow To AFWP Turb Isln Vlv 1-FCV-1-17-A (1HP)	N/A	N/A	N/A	N/A	89.46	Pass	Att. 4
236-3B	ERCW Hdr A Isln Vlv 1-FCV-3-136B-A (0.33HP)	N/A	N/A	N/A	N/A	84.72	Pass	Att. 4
236-5A	Sample Hx Isln Vlv 1-FCV-70-215-A (0.13HP)	N/A	N/A	N/A	N/A	86.73	Pass	Att. 1
236-5E	Cntmt Spray Hx 1A Sup Cont Vlv 1-FCV-67-125-A (0.33HP)	N/A	N/A	N/A	N/A	92.51*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
236-5F	Cntmt Spray Hx 1A Disch Vlv 1-FCV-67-126-A (0.33HP)	N/A	N/A	N/A	N/A	92.19*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *

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1A Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts									
		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)	Bases for Minimum Required Voltage	
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV /460V Base	6.6kV/460V Base	Reference	
236-6A	AFWP Turb St Sply Frm St gen 4 1-FCV-1-16-A (1HP)	N/A	N/A	N/A	N/A	92.52*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *	
236-6D	RHR Sys Isln Bypass Vlv 1-FCV-74-8-A (1.6HP)	N/A	N/A	N/A	N/A	90.99*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *	
236-11A	Cmpnt Clg Hx A Disch Cont Vlv 1-FCV-67-146-A (0.3HP)	N/A	N/A	N/A	N/A	88.07	Pass	Att. 4 / Acceptable Margin	
236-12B	SS&Con AirCpsr Sup Hdr A Iso V 0-FCV-67-205-A (0.33HP)	N/A	N/A	N/A	N/A	87.86	Pass	Att. 4 / Acceptable Margin	
236-15A	CCS HX A ERCW BYPASS FCV 1-FCV-67-143-A (0.13HP)	N/A	N/A	N/A	N/A	84.62	Pass	Att.4	R2
236-16E	RHR Hx A-A Outlet Vlv 1-FCV-70-156-A (0.33HP)	N/A	N/A	N/A	N/A	88.86	Pass	Att. 4 / Acceptable Margin	
236-17A	Sample Hx Hdr Outlet Vlv 1-FCV-70-183-A (0.13HP)	N/A	N/A	N/A	N/A	86.09	Pass	Att. 4	
236-17B	SFPCS Hx Sply Hdr Isln Vlv 0-FCV-70-197-A (0.3HP)	N/A	N/A	N/A	N/A	89.74	Pass	Att. 4 / Acceptable Margin	
480V Reac Vent Board 1A-A									
None									

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Appendix A
1B Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)

Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference	
6.9kV Shutdown Board 1B-B									
13-10 AFW	Aux Feedwater PMP 1B-B 1-MTR-3-128-B (600 HP)	99.01	Starts	99.01	Starts	98.98	85	Att. 3	
13-13 CSP	CNTMT SPRAY PMP 1B-B 1-MTR-72-10-B (700 HP)	N/A	Not Running	98.70	Start	98.69	80	Att. 3	
13-14 RHR	RHR PUMP 1B-B 1-MTR-74-20-B (400 HP)	99.12	Starts	99.12	Starts	99.12	80	Att. 3	
13-15 SI	SAFETY INJ PMP 1B-B 1-MTR-63-15-B (400 HP)	98.85	Starts	98.85	Starts	98.84	80	Att. 3	
13-18 CCP	CNTFGL CHRG PMP 1B-B 1-MTR-62-104-B (600 HP)	98.78	Starts	98.78	Starts	98.78	80	Att. 3	
13-8 ERCW	ERCW PMP F-B 0-MTR-67-51-B (800 HP)	N/A	Starts (F-B or E-B start, but not both, other is not running)	N/A	Starts (F-B or E-B start, but not both, other is not running)	96.20	90	Att. 3	
13-9 ERCW	ERCW PMP E-B 0-MTR-67-47-B (800 HP)	95.10	Starts (E-B or F-Bstart, but not both, other is not running)	95.10	Starts (E-B or F-Bstart, but not both, other is not running)	95.01	90	Same as ERCW Pmp F-B (Att. 3)	R2
480V Shutdown Board 1B1-B									
129-3C	Comp Cooling Sys Pump 1B-B 1-MTR-70-38-B (350hp)	80.89 (8s)	Starts	81.53 (8s)	Starts	80.63	70	Att. 3	
130-7A	Elec Bd Rm AHU C-B 0-MTR-31-31B-B (50hp)	N/A	Running	N/A	Running	90.28	80	Att. 6	
130-7D	Reac Lwr Compt Clr Fan 1B-B 1-MTR-30-75-B (60hp)	N/A	Running	N/A	Trips	82.24	80	Att. 3	
480V Shutdown Board 1B2-B									
131-2B	Control Rm A/C B-B Compressor 0-MTR-31-96/2-B (250hp)	N/A	Running	N/A	Running	83.25	80	Att. 1	
131-3C	SHDN BD RM CHLR PKG B-B Compressor 0-MTR-31-49/2-B (240hp)	N/A	Running	N/A	Running	87.92	85	Att. 1	
132-7D	Reac Lwr Compt Clr Fan 1D-B 1-MTR-30-78-B (60hp)	N/A	Running	N/A	Trips	82.33	80	Att. 3	
132-9A	Spent Fuel Pit Pmp B-B 0-MTR-78-9-B (100hp)	N/A	Running	N/A	Running	83.47	80	Att. 6	
132-9C	Cntmt Air Rtn Fan 1B-B 1-MTR-30-39-B (100hp)	N/A	Not Running Starts @ 9 Min)	N/A	Not Running Starts @ 9 Min)	80.27 (SIB)	80	Att. 6	
132-9D	480V SD Bd Rm AHU C-B 0-MTR-31-55-B (75hp)	N/A	Running	N/A	Running	86.74	85	Att. 1	
480V C&A Vent Board 1B1-B									
205-11A	Cont Bldg Emerg Press Fan B-B, 0-MTR-31-5-B (1hp)	89.06	Starts	90.34	Starts	91.38	85	Att. 1	
205-13D	ERCW Scrn Wash Pump 1B-B 1-MTR-67-440-B (40hp)	N/A	N/A	N/A	N/A	73.47 (SIB)	75	Att. 3 See Sec. 7.1 for Justification	

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1B Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)

Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage

Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference	
205-2A	Cont Bldg Em Air Clnup Fan B-B 0-MTR-31-7-B (10hp)	87.77	Starts	89.03	Starts	89.81	85	Att. 1	
205-3C	Cntmt Spray Pump 1B-B Rm Clr Fan 1-MTR-30-178-B (7.5hp)	N/A	Random	87.96	Starts	89.52	80	Att. 3	
205-4D	Emerg Gas Trtmt Sys Fan B-B 0-MTR-65-42-B (20hp)	86.53	Starts	87.78	Starts	88.81	80	Att. 3	
205-6B	ERCW Str 1B-B 1-MTR-67-10-B (3hp)	N/A	Running	N/A	Running	76.88	75	Att. 3	
205-7E	RWST to Spray Hdr 1A Vlv 1-FCV-72-22 (3.2hp)	N/A	Stopped (No auto Start)	N/A	Stopped (No auto Start)	88.14 (SIB)	Pass	Att. 4 / Acceptable Margin	
205-4E	ERCW Str 1B-B Backwash Vlv 1-FCV-67-10A-B (0.33HP)	N/A	N/A	N/A	N/A	82.31	80	Att. 1	
205-6E	ERCW Str 1B-B Flush Vlv 1-FCV-67-10B-B (0.33HP)	N/A	N/A	N/A	N/A	82.32	80	Att. 1	
205-7D	RHR PMP 1B-B INLET FCV 1-FCV-74-21-B (5.2HP)	N/A	N/A	N/A	N/A	91.09	Pass	Att. 4 / Acceptable Margin	
205-2C	Pen Rm El 713 Clr Fan 1B-B 1-MTR-30-197-B (3HP)	87.64	Starts	88.90	Starts	90.90	80	Att. 3	
205-3A	Shdn Bd Rm Chlr CW Cir Pmp B-B 0-MTR-31-49/1-B (25HP)	N/A	N/A	N/A	N/A	90.61	85	Att. 1	
205-3B	Pipe Chase Clr Fan 1B-B 1-MTR-30-202-B (3HP)	86.47	Starts	87.72	Starts	89.20	80	Att. 3	R2
205-3F1	Cntmt Bldg Upper Compt Air Mon 1-RE-90-112-B (3HP)	N/A	N/A	N/A	N/A	89.78	85	Att. 1	
205-4A	Battery Rm El 692 Exh Fan B-B 0-MTR-31-29-B (1.5HP)	N/A	N/A	N/A	N/A	87.82	85	Att. 1	
205-4F1	CNTMT PURGE AIR EXH MON 1-RE-90-131-B (0.75HP)	N/A	N/A	N/A	N/A	92.86	85	Att. 1	
205-5A	SFP PmpB-B&TB Bst Pmp SpClrFan 0-MTR-30-193-B (7.5HP)	86.27	Starts	87.51	Starts	88.78	80	Att. 3	
205-5E	CCS & AFW Pumps Sp Clr Fan B-B 1-MTR-30-191-B (20HP)	86.59	Starts	87.83	Starts	88.44	80	Att. 3	
205-6A	SHUTDOWN BD RM A PRESS FAN C-B 0-MTR-31-67-B (3HP)	N/A	N/A	N/A	N/A	91.61	85	Att. 1	
205-6C	Traveling Scrn 1B-B 1-MTR-67-445-B (5HP)	N/A	N/A	N/A	N/A	80.61 (SIB)	80	Att.3	
205-7B	125V Vtl Bat Rm I Ex Fan 1A2-B 1-MTR-31-288-B (0.33HP)	N/A	N/A	N/A	N/A	91.17	85	Att. 1	
205-7C	High Press Fire Pmp Str B-B 0-MTR-26-14-B (0.75HP)	N/A	N/A	N/A	N/A	86.83	85	Att. 1	
205-8A	Safety Inj Pmp 1B-B Rm Clr Fan 1-MTR-30-179-B (5HP)	N/A	N/A	N/A	N/A	86.06	80	Att.3	
205-8B	Pen Rm El 692 Clr Fan 1B-B 1-MTR-30-187-B (3HP)	N/A	N/A	N/A	N/A	89.52	80	Att.3	
205-8C	Shtdn Xfmr Rm 1B Exh Fan 1B2-B 1-MTR-30-248F-B (3HP)	N/A	N/A	N/A	N/A	89.94	80	Att.3	
205-8D	Shtdn Xfmr Rm 1B Exh Fan 1B3- 1-MTR-30-248G-B (3HP)	N/A	N/A	N/A	N/A	89.89	80	Att.3	

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EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)

Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage

Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference	
205-8E	Cont Rm A/C Clr Pmp B-B 0-MTR-31-96/1-B (15HP)	N/A	N/A	N/A	N/A	85.40	85	Att. 1	
205-8F1	CONT RM A/C B-B CONTROL/O.PMP 0-MTR-31-96/3-B (3HP)	N/A	N/A	N/A	N/A	91.69	85	Att. 1	
205-9A	RHR Pmp 1B-B Rm Clr Fan 1-MTR-30-176-B (5HP)	83.13	Starts	84.33	Starts	83.45	80	Att.3	
205-9B	5th Vtl Batt Rm Exh Fan 1B2-B 0-MTR-31-496B-B (0.25HP)	N/A	N/A	N/A	N/A	93.69	85	Att. 1	
205-9C	480V Bd Rm 1A Pr Sup Fan 1A2-B 1-MTR-31-463-B (3HP)	N/A	N/A	N/A	N/A	92.36	85	Att. 1	
205-9D	Shtdn Xfmr Rm 1B Exh Fan 1B1-B 1-MTR-30-248E-B (3HP)	N/A	N/A	N/A	N/A	87.59	80	Att.3	
205-9E	Pen Rm El 737 Clr Fan 1B-B 1-MTR-30-195-B (3HP)	87.45	Starts	88.71	Starts	89.63	80	Att.3	
205-10A	Cntfg Chrg Pmp 1B-B Rm Clr Fan 1-MTR-30-182-B (5HP)	84.65	Starts	85.87	Starts	85.42	80	Att.3	
205-10B	480V Bd Rm 1B Pr Sup Fan 1B2-B 1-MTR-31-477-B (3HP)	N/A	N/A	N/A	N/A	92.22	85	Att. 1	
205-10C	125V VTL BAT RM II EXFAN 1B2-B 1-MTR-31-286-B (0.33HP)	N/A	N/A	N/A	N/A	91.01	85	Att. 1	
205-10F1	Cont Rm Intake Mon 0-RE-90-206-B (0.75HP)	N/A	N/A	N/A	N/A	89.58	85	Att. 1	
205-11B	480V Bd Rm 1B A/C Ahu 1B-B 1-MTR-31-475-B (20HP)	N/A	N/A	N/A	N/A	89.39	85	Att. 1	
205-11C	480V Bd Rm 1B A/C Cond 1B-B 1-MTR-31-289-B (20HP)	N/A	N/A	N/A	N/A	91.40	85	Att. 1	
205-11D	Cont Rm Ahu B-B 0-MTR-31-11-B (60HP)	N/A	N/A	N/A	N/A	87.63	85	Att. 1	R2
480V C&A Vent Board 1B2-B									
None									
480V Diesel Aux Board 1B1-B									
219-2B	DG 1B-B RM EXH FAN 1-B 1-MTR-30-449-B (15hp)	90.80	Starts	91.41	Start	91.42	85	Att. 1	
219-3D	DG 1B-B DAY TNK FO XFR PMP 1 1-MTR-18-55/2-B (1hp)	90.85	Random	91.46	Random	93.65	85	Att. 1	
219-4B	Dg 1B-B Aux LubeOil Circ Pmp A 1-MTR-82-AOPA2B (0.75hp)	91.49	Starts	92.11	Starts	93.89	85	Att. 1	
219-6A	DG 1B-B Muffler Rm Exh Fan 1-MTR-30-465 (0.5hp)	91.27	Starts	91.88	Starts	94.31	85	Att. 1	
219-2D	Dg 1B-B Lube Oil Circ Pmp 1 1-MTR-82-B1-B (1HP)	N/A	N/A	N/A	N/A	93.79	85	Att. 1	
219-4E	DG 1B-B 480V ELEC BD RM EX FAN 1-MTR-30-461-B (2HP)	N/A	N/A	N/A	N/A	93.52	85	Att. 1	
480V Diesel Aux Board 1B2-B									
220-2B	DG 1B-B Rm Exh Fan 2-B 1-MTR-30-453-B (15hp)	91.32	Starts	91.79	Starts	92.60	85	Att. 1	
220-3D	DG 1B-B DAY TNK FO XFR PMP 2 1-MTR-18-54/2-B (1HP)	91.14	Starts	91.60	Starts	94.85	85	Att. 1	
220-2A	Dg 1B-B Aux LubeOil Circ Pmp B 1-MTR-82-AOPB2B (0.75HP)	N/A	N/A	N/A	N/A	94.33	85	Att. 1	

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EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)

Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference	
220-2D	Dg 1B-B Lube Oil Circ Pmp 2 1-MTR-82-B2-B (1HP)	N/A	N/A	N/A	N/A	94.71	85	Att. 1	
480V RMOV Board 1B1-B									
237-3F2	SIS ACCUM TANK FLOW ISOL VLV 1-FCV-63-98-B (6.6hp)	91.28	Opens on SI (Starts)	92.56	Opens on SI (Starts)	94.86	Pass	Att. 1	
237-6D	Seal Flow Ret Isln Vlv 1-FCV-62-61-B (1.9hp)	81.68	Closes on Ph A (Starts)	82.82	Closes on Ph B (Starts)	85.18	Pass	Att. 4	
237-7A	CHRG FLOW ISLN VLV 1-FCV-62-91-B (1.9hp)	86.42	Closes on SI (Starts)	87.63	Closes on SI (Starts)	90.11	Pass	Att. 4	
237-8A	Vol Cont Tank Outlet Isln Vlv 1-LCV-62-133-B (1.9hp)	81.82	Closes on SI (Starts)	82.97	Closes on SI (Starts)	85.33	Pass	Att. 4	
237-8B	RWST To Charging Pmp Vlv Cont 1-LCV-62-136-B (1.9hp)	79.51	Opens on SI (Starts)	80.63	Opens on SI (Starts)	82.92	Pass	Att. 4	
237-10A	SIS 1A-A DSH TO RWST SHTFF VLV 1-FCV-63-4-B (0.7hp)	N/A	Not Running or Starting	N/A	Not Running or Starting	84.83	Pass	Att. 4/ Acceptable Margin	
237-10B	RWST To SIS Pump Flow Cont Vlv 1-FCV-63-5-B (1.9hp)	N/A	Not Running or Starting	N/A	Not Running or Starting	88.02*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *	
237-11A	SIS PMP INLT TO CVCS CHRG PMP 1-FCV-63-6-B (1.9hp)	N/A	Not Running or Starting	N/A	Not Running or Starting	88.21*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *	
237-11E	SIS Boron Inj Tank Shutoff Vlv 1-FCV-63-25-B (1.9hp)	82.98	Opens on SI (Starts)	84.14	Opens on SI (Starts)	86.53	Pass	Att. 4	R2
237-12B	SIS Pmp 1B-B Inlet Vlv 1-FCV-63-48-B (1.9hp)	N/A	Not Running or Starting	N/A	Not Running or Starting	90.23*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *	
237-12D	CNTMT SUMP TO RHR PMP B-B 1-FCV-63-73-B (13hp)	N/A	Opens at approx. 20 min	N/A	Opens at approx. 20 min	88.20	Pass	Att. 4/ Acceptable Margin	
237-14A	Cntmt Spray Hdr 1B Isln Vlv 1-FCV-72-2-B (3.2hp)	N/A	Closed, Not Running	92.98* (5s)	Opens, Starting.	92.86*	Pass	Att. 4 (5 sec after SI) - Time Delay added per DCN 52834	
237-15B	RHR Pmp 1B-B Min Flow Vlv 1-FCV-74-24-B (0.13hp)	79.61	Opens, Starting.	80.73	Opens, Starting.	83.12	Pass	Att. 4	
237-17D	AFW Pmp B-B Lube Oil Pmp B-B 1-MTR-3-128D-B (0.25HP)	N/A	N/A	N/A	N/A	89.64	85	Att. 1	
237-5E	RCS Press Relief Flow Cont Vlv 1-FCV-68-332-B (1.9HP)	N/A	N/A	N/A	N/A	88.06*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *	
237-9B	RHR To RCS H.L. 1&3 Flow Iso V 1-FCV-63-172-B (2.6HP)	N/A	N/A	N/A	N/A	86.20	Pass	Att. 4 / Acceptable Margin	

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Appendix A
1B Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)

Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage

Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference
237-9F	Cont Spray Pmp 1B-B Recirc FCV 1-FCV-72-13-B (0.13HP)	N/A	N/A	N/A	N/A	90.08*	Pass	Att. 4 (10 sec after SI) - Time Delay added per DCN 52834
237-11B	RHR Hx B To SIS Pmp 1-FCV-63-11-B (2HP)	N/A	N/A	N/A	N/A	85.98	Pass	Att. 4 / Acceptable Margin
237-12E	SIS To RCS Loops 1&4 FCV 1-FCV-63-94-B (1.6HP)	N/A	N/A	N/A	N/A	90.80	Pass	Att. 4
237-13A	SIS Pmp 1B-B Outlet FCV 1-FCV-63-153-B (1.9HP)	N/A	N/A	N/A	N/A	88.75*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
237-13B	SIS PMP OUT RCS LP 2&4 H. LEG 1-FCV-63-157-B (1.9HP)	N/A	N/A	N/A	N/A	91.36*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
237-13D	SIS 1B-B Dsh To RWST Shtff Vlv 1-FCV-63-175-B (0.7HP)	N/A	N/A	N/A	N/A	84.86	Pass	Att. 4 / Acceptable Margin
237-14D	RHR Spray Hdr 1B Isln Vlv 1-FCV-72-41-B (1.9HP)	N/A	N/A	N/A	N/A	85.82	Pass	Att. 4 / Acceptable Margin
237-14E	Cntmt Sump To Spray Hdr 1B FCV 1-FCV-72-45-B (3.2HP)	N/A	N/A	N/A	N/A	89.68*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
237-15D	RHR Hx 1B Bypass Vlv 1-FCV-74-35-B (1.9HP)	N/A	N/A	N/A	N/A	83.17	Pass	Att. 4 / Acceptable Margin
480V RMOV Board 1B2-B								
238-2A	ERCW Hdr B Isln Vlv 1-FCV-3-126A-B (0.25hp)	N/A	Random	N/A	Random	83.60	Pass	Att. 4
238-3A	ERCW Hdr B Isln Vlv 1-FCV-3-179A-B (0.33hp)	N/A	Random	N/A	Random	83.71	Pass	Att. 4/ Acceptable Margin R2
238-3D	ST GEN NO 2 FW ISLN VLV 1-FCV-3-47-B (39.4hp)	80.64	Starts	81.41	Starts	82.74	Pass	Att. 4
238-4D	St Gen No 4 FW Isln Vlv 1-FCV-3-100-B (39.4hp)	80.64	Use 89-10 start	81.41	Use 89-10 start	82.74	Pass	Att. 4
238-5C	LWR CNTMT 1A CLRS ISLN VLV 1-FCV-67-113-B (0.13hp)	N/A	Not Running	82.01	Closes (Starts)	85.62	Pass	Att. 4
238-6D	RCP Thrm Bar Rtn Cntmt Iso Vlv 1-FCV-70-87-B (0.7hp)	N/A	Not Running	84.16	Closes (Starts)	87.83	Pass	Att. 4
238-6E	RCP THRM BAR CNTMT ISO VLV 1-FCV-70-134-B (0.13hp)	N/A	Not Running	82.33	Closes (Starts)	85.96	Pass	Att. 4
238-7D	Lwr Cntmt 1B Clr Dish Iso Vlv 1-FCV-67-103-B (0.13hp)	N/A	Not Running	82.80	Closes (Starts)	86.22	Pass	Att. 4
238-7F	Up Cntm Vt Clr 1A Dish Iso Vlv 1-FCV-67-131-B (0.13hp)	N/A	Not Running	80.64	Closes (Starts)	83.98	Pass	Att. 1
238-8D	Lwr Cntmt 1D Clr Dish Iso Vlv 1-FCV-67-111-B (0.13hp)	N/A	Not Running	83.11	Closes (Starts)	86.55	Pass	Att. 4

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Appendix A
1B Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)

Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference
238-8F	Up Cntm Vt Clr 1C Dish Iso Vlv 1-FCV-67-134-B (0.13hp)	N/A	Not Running	80.60	Closes (Starts)	83.93	Pass	Att. 1
238-9A	Lwr Cntmt 1A Clr Dish Iso Vlv 1-FCV-67-88-B (0.33hp)	N/A	Not Running	83.71	Closes (Starts)	87.16	Pass	Att. 4
238-9B	Lwr Cntmt 1C Clr Dish Iso Vlv 1-FCV-67-96-B (0.33hp)	N/A	Not Running	83.83	Closes (Starts)	87.28	Pass	Att. 4
238-9D	Up Cntm Vt Clr 1B Dish Iso Vlv 1-FCV-67-297-B (0.13hp)	N/A	Not Running	81.49	Closes (Starts)	84.87	Pass	Att. 1
238-9F	Up Cntm Vt Clr 1B Sup Iso Vlv 1-FCV-67-138-B (0.13hp)	N/A	Not Running	80.55	Closes (Starts)	83.88	Pass	Att. 1
238-10A	Lwr Cntmt 1B Clr Sply Isln Vlv 1-FCV-67-91-B (0.33hp)	N/A	Not Running	83.74	Closes (Starts)	87.21	Pass	Att. 4
238-10B	Lwr Cntmt 1D Clr Sply Isln Vlv 1-FCV-67-83-B (0.33hp)	N/A	Not Running	84.33	Closes (Starts)	87.82	Pass	Att. 4
238-10D	UP CNTM VT CLR 1D DIS ISO VLV 1-FCV-67-298-B (0.13hp)	N/A	Not Running	80.13	Closes (Starts)	83.46	Pass	Att. 1
238-10F	Up Cntm Vt Clr 1D Sup Iso Vlv 1-FCV-67-141-B (0.13hp)	N/A	Not Running	80.92	Closes (Starts)	84.29	Pass	Att. 1
238-11D	LWR CNTMT 1C CLRS ISLN VLV 1-FCV-67-105-B (0.13hp)	N/A	Not Running	81.77	Closes (Starts)	85.16	Pass	Att. 4
238-13D	RCP Oil Clr Rtn Cntnt Isln Vlv 1-FCV-70-89-B (0.13hp)	N/A	Not Running	83.44	Closes (Starts)	86.91	Pass	Att. 4 R2
238-13F	RCP Oil Clr Hdr Cntmt Isln Vlv 1-FCV-70-140-B (0.33hp)	N/A	Not Running	83.64	Closes (Starts)	87.10	Pass	Att. 4
238-18D	480V Bd Rm 1B A/C Cprsr 1B-B 1-MTR-31-447-B (75HP)	N/A	N/A	N/A	N/A	89.30	85	Att. 1
238-2B	ERCW Hdr B Isln Vlv 1-FCV-3-126B-B (0.25HP)	N/A	N/A	N/A	N/A	83.62	Pass	Att. 4
238-2E	St Flow To AFWP Turb Isln Vlv 1-FCV-1-18-B (1HP)	N/A	N/A	N/A	N/A	92.50*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
238-3B	ERCW Hdr B Isln Vlv 1-FCV-3-179B-B (0.33HP)	N/A	N/A	N/A	N/A	83.72	Pass	Att. 4
238-5E	Cntmt Spray Hx 1B Sup Cont Vlv 1-FCV-67-123-B (0.33HP)	N/A	N/A	N/A	N/A	92.08*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
238-5F	Cntmt Spray Hx 1B Disch Vlv 1-FCV-67-124-B (0.33HP)	N/A	N/A	N/A	N/A	91.73*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
238-11B	STA S & C AC SUP HDR B ISO VLV 0-FCV-67-208-B (0.33HP)	N/A	N/A	N/A	N/A	91.28*	Pass	Att. 4
238-17D	CCS HX B ERCW BYPASS FCV 0-FCV-67-144-B (0.13HP)	N/A	N/A	N/A	N/A	84.33	Pass	Att. 4 / Acceptable Margin
480V Reac Vent Board 1B-B								
None								

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Appendix A

1B Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)

Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage

Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)	Bases for Minimum Required Voltage
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base	Reference

* This MOV terminal voltage is calculated taking credit for the hammer blow feature.

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Appendix A
2A Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference	
6.9KV Shutdown Board 2A-A									
14-10 AFW	AUX FEEDWTR PMP 2A-A 2-MTR-3-118-A (600hp)	98.98	Starts	98.98	Starts	98.94	85	Att. 3	
14-13 CSP	CNTMT SPRAY PMP 2A-A 2-MTR-72-27-A (700hp)	N/A	Not Running	N/A	Starts	98.60	80	Based on Unit 1 motor data (Att. 3)	
14-14 RHR	RHR PMP 2A-A 2-MTR-74-10-A (400hp)	99.08	Starts	99.08	Starts	99.08	80	Based on Unit 1 motor data (Att. 3)	
14-15 SI	SAFETY INJ PMP 2A-A 2-MTR-63-10-A (400hp)	98.83	Starts	98.83	Starts	98.83	80	Based on Unit 1 motor data (Att. 3)	
14-18 CCP	CNTFGL CHRG PMP 2A-A 2-MTR-62-108-A (600hp)	98.98	Starts	98.98	Starts	98.97	80	Att. 3	
14-8 ERCW	ERCW PMP D-A 0-MTR-67-40-A (800hp)	N/A	Starts (D-A or C-A start, but not both, other is not running)	N/A	Starts (D-A or C-A start, but not both, other is not running)	96.59	90	Att. 3	
14-9 ERCW	ERCW PMP C-A 0-MTR-67-36-A (800hp)	96.67	Starts (D-A or C-A start, but not both, other is not running)	96.67	Starts (D-A or C-A start, but not both, other is not running)	96.61	90	Same as ERCW Pmp D-A (Att. 3)	R2
480V Shutdown Board 2A1-A									
133-3B	Cmpnt Clg Sys Pmp 2A-A 2-MTR-70-59-A (350hp)	81.38 (8s)	Starts	81.78 (8s)	Starts	81.26	70	Att. 3	
134-10C	Cntmt Air Rtn Fan 2A-A 2-MTR-30-38-A (100hp)	N/A	Not Running Starts @ 9 Min)	N/A	Not Running Starts @ 9 Min)	82.41 (SIB)	80	Att. 6	
134-7C	Reac Lwr Compt Clr Fan 2A-A 2-MTR-30-74-A (60hp)	N/A	Running	N/A	Trips	83.31	80	Based on Unit 1 motor data (Att. 3)	
134-9C	Elec Bd Rm AHU B-A 0-MTR-31-30D-A (50hp)	N/A	Running	N/A	Running	83.48	80	Att. 6	
480V Shutdown Board 2A2-A									
135-2C	Elec Bd Rm A/C A-A Cprsr 0MTR-31-128/2-A (250hp)	N/A	Running	N/A	Running	86.06	85	Att. 1	
135-3C	SHDN BD RM CHLR PKG A-A CPRSR 0-MTR-31-36/2-A (240hp)	N/A	Running	N/A	Running	91.51	85	Att. 1	
136-7D	REAC LWR COMPT CLR FAN 2C-A 2-MTR-30-77-A (60hp)	N/A	Running	N/A	Trips	81.11	80	Based on Unit 1 motor data (Att. 3)	
136-8D	480V SHUTDOWN BD RM AHU B-A 0-MTR-31-44-A (75hp)	N/A	Running	N/A	Running	86.84	85	Att. 1	
136-9D	Spent Fuel Pit Pmp A-A 0-MTR-78-12-A (100hp)	N/A	Running	N/A	Running	82.29	80	Att. 6	
480V Reactor Vent Board 2A-A									
None									
480V C&A Vent Board 2A1-A									
207-10A	Cntfg Chrg Pmp 2A-A Rm Clr Fan 2-MTR-30-183-A (5HP)	83.44	Starts on SI	84.19	Starts on SI	86.10	80	Based on Unit 1 motor data (Att. 3)	

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2A Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts									
		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)	Bases for Minimum Required Voltage	
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base	Reference	
207-10B	Pen Rm El 713 Clr Fan 2A-A 2-MTR-30-196-A (3HP)	87.11	Starts on SI	87.89	Starts on SI	90.89	80	Based on Unit 1 motor data (Att. 3)	
207-10C	Pipe Chase Clr Fan 2A-A 2-MTR-30-201-A (3HP)	84.55	Starts on SI	85.31	Starts on SI	86.93	80	Based on Unit 1 motor data (Att. 3)	
207-10D	ABGTS HUM HTR A-A 0-HTR-30-147-A (50.008kW)	N/A	Starts on ABI (from SI)	N/A	Starts on ABI (from SI)	N/A	Static Load	N/A	
207-11A	480V Bd Rm 2B Pr Sup Fan 2B1-A 2-MTR-31-478-A (3HP)	N/A	Running	N/A	Running	92.41	85	Att. 1	
207-11C	480V Bd Rm 2A A/C Ahu 2A-A 2-MTR-31-461-A (10HP)	N/A	Running	N/A	Running	88.57	85	Att. 1	
207-12A	125V Vital Bat Rm III Ex Fan 2B1-A 2-MTR-31-285-A (0.33HP)	N/A	Running	N/A	Running	91.84	85	Att. 1	
207-12C	480V Bd Rm 2A A/C Cond 2A-A 2-MTR-31-290-A (15HP)	N/A	Running	N/A	Running	91.02	85	Att. 1	
207-12F1	Cntmt Purge Air Radn Exh Mon 2-RE-90-130-A (0.75HP)	N/A	Running	N/A	Running	93.49	85	Att. 1	
207-13D	ERCW SCREEN WASH PUMP 2A-A 2-MTR-67-437-A (40HP)	N/A	Running	N/A	Running	76.53	75	Att. 3 Also See Sec. 7.1	
207-2A	AUX CONTROL AIR COMPRESSOR A-A 0-MTR-32-60-A (20hp)	N/A	Not Running	N/A	Not Running	84.61	80	Att. 1	
207-2C	Pen Rm El 692 Clr Fan 2A-A 2-MTR-30-186-A (3HP)	84.16	Starts on SI	84.92	Starts on SI	86.97	80	Based on Unit 1 motor data (Att. 3)	
207-3A	Shdn Bd Rm Chlr CW Cir Pmp A-A 0-MTR-31-36/1-A (25HP)	N/A	Running	N/A	Running	86.75	85	Att. 1	
207-3C	Cntm Spray Pmp 2A-A Rm Clr Fan 2-MTR-30-177-A (7.5HP)	N/A	Running	84.21	Starts on Phase B	87.19	80	Based on Unit 1 motor data (Att. 3)	
207-3D	Aux BlDG Gas Trtmt Sys Fan A-A 2-MTR-30-146-A (50hp)	83.76	Starts On ABI (from SI)	84.51	Starts On ABI	89.53	80	Att. 3	R2
207-4A	EG Trtmt Sys A-A Rm Clr Fan 2-MTR-30-200-A (3HP)	86.11	Starts on ABI (from SI)	86.89	Starts on ABI (from SI)	91.20	80	Att. 3	
207-4E	ERCW Str 2A-A Backwash Vlv 2-FCV-67-9A-A (0.33HP)	N/A	N/A	N/A	N/A	83.90	80	Att. 1	
207-5E	AFW & BA XFR SPACE CLR FAN A-A 2-MTR-30-184-A (15HP)	87.08	Starts on ABI (from SI)	87.87	Starts on ABI (from SI)	90.96	80	Based on Unit 1 motor data (Att. 3)	
207-6B	ERCW Str 2A-A 2-MTR-67-9-A (3HP)	N/A	Running	N/A	Running	82.53	75	Att. 3	
207-6C	Traveling Scrn 2A-A 2-MTR-67-439-A (5HP)	N/A	N/A	N/A	N/A	81.49	80	Att. 3	
207-7B	125V VIT BAT RM IV EXFAN 2A1-A 2-MTR-31-287-A (0.33HP)	N/A	Running	N/A	Running	92.12	85	Att. 1	
207-8A	Safety Inj Pmp 2A-A Rm Clr Fan 2-MTR-30-180-A (5HP)	84.46 (2s)	Starts on Pump Start	80.70	Starts on Pump Start	81.70	80	Based on Unit 1 motor data (Att. 3)	
207-8B	Pen Rm El 737 Clr Fan 2A-A 2-MTR-30-194-A (3HP)	87.66	Starts on ABI (from SI)	88.45	Starts on ABI (from SI)	92.45	80	Att. 3	
207-8C	480V Xfmr Rm 2A Exh Fan 2A2-A 2-MTR-30-250F-A (3HP)	N/A	Running	N/A	Running	91.94	80	Att. 3	
207-8D	480V Xfmr Rm 2A Exh Fan 2A3-A 2-MTR-30-250G-A (3HP)	N/A	Running	N/A	Running	91.94	80	Att. 3	
207-8F1	EL BD RM A/C A-A CONTROL/O.PMP 0-MTR-31-128/3-A (3.11HP)	N/A	Running	N/A	Running	91.13	85	Att. 1	

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EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)

Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage

Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)	Bases for Minimum Required Voltage	
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base	Reference	
207-9A	RHR Pmp 2A-A Rm Clr Fan 2-MTR-30-175-A (5HP)	84.23 (2s)	Starts on SI	80.47	Starts on SI	81.35	80	Based on Unit 1 motor data (Att. 3)	
207-9B	C.BIDG Ele BdRm AC Cir Pmp A-A 0-MTR-31-128/1-A (20HP)	N/A	Running	N/A	Running	88.10	85	Att. 1	
207-9C	480V Bd Rm 2A Pr Sup Fan 2A1-A 2-MTR-31-462-A (3HP)	N/A	Running	N/A	Running	92.31	85	Att. 1	
207-9D	480V Xfmr Rm 2A Exh Fan 2A1-A 2-MTR-30-250E-A (3HP)	N/A	Running	N/A	Running	91.49	85	Att. 1	
207-9F1	Cont Rm Intake Mon 0-RE-90-125-A (0.75HP)	N/A	Running	N/A	Running	93.16	85	Att. 1	
207-7E	RWST To Spray Hdr 2A FCV 2-FCV-72-22-A (3.2HP)	N/A	N/A	N/A	N/A	86.30	Pass	Att. 5 / Acceptable Margin	
480V C&A Vent Board 2A2-A									
None									
480V Diesel Aux Board 2A1-A									
221-2B	DG 2A-A RM EXH FAN 1-A 2-MTR-30-448-A (15hp)	92.28	Starts	92.66	Starts	93.44	85	Att. 3	
221-2D	DG 2A-A Lube Oil Circ Pmp 1 2-MTR-82-A1-A (1hp)	N/A	Running	N/A	Running	94.72	85	Att. 1	
221-3A	EM DG ENG HX 2A1 & 2A2 SUP VLV 2-FCV-67-66-A (0.13hp)	82.55	Starts	82.90	Starts	85.97	Pass	Att. 5	
221-3D	DG 2A-A DAY TNK FO XFR PMP 1 2-MTR-18-55/3-A (1hp)	91.55	Random	91.94	Random	94.78	85	Att. 1	
221-4B	DG 2A-A Aux LubeOil Circ Pmp A 2-MTR-82-AOPA1A (0.75hp)	N/A	Running	N/A	Running	94.97	85	Att. 1	
221-6A	DG 2A-A Muffler Rm Exh Fan 2-MTR-30-464 (0.5hp)	91.99	Starts on Diesel Start from SI	92.37	Starts on Diesel Start from SI	94.90	85	Att. 3	
221-4D	DG Rm 2A-A Pnl Vent Fan 2-MTR-30-492-A (15HP)	N/A	N/A	N/A	N/A	92.29	85	Att. 3	
221-4E	2A-A 480V ELEC BD RM EX FAN 2-MTR-30-460-A (2HP)	N/A	N/A	N/A	N/A	95.16	85	Att. 1	R2
480V Diesel Aux Board 2A2-A									
222-2A	DG 2A-A Aux LubeOil Circ Pmp B 2-MTR-82-AOPB1A (0.75hp)	N/A	Running	N/A	Running	94.93	85	Att. 1	
222-2B	DG 2A-A RM EXH FAN 2-A 2-MTR-30-452-A (15hp)	92.59	Starts	92.85	Starts	93.29	85	Att. 3	
222-2D	DG 2A-A Lube Oil Circ Pmp 2 2-MTR-82-A2-A (1hp)	N/A	Running	N/A	Running	94.98	85	Att. 1	
222-3D	DG 2A-A DAY TNK FO XFR PMP 2 2-MTR-18-54/3-A (1hp)	92.18	Random	92.44	Random	94.94	85	Att. 1	
480V RMOV Board 2A1-A									
239-10F	Cntm Spray Pmp 2A-A Recirc FCV 2-FCV-72-34-A (0.13hp)	N/A	Not Running	N/A	Closes 10s after Phase B	89.37	Pass	Att. 5	
239-11D	SIS Boron Inj Tank Shutoff Vlv 2-FCV-63-26-A (1.9hp)	86.11	Opens on SI (Starts)	86.83	Opens on SI (Starts)	92.06	Pass	Att. 5/ Acceptable Margin	
239-12B	Cntmt Sump To RHR Pmp A-A 2-FCV-63-72-A (13hp)	N/A	Operate about 20 minutes after SI	N/A	Opperate about 20 minutes after SI	91.21	Pass	Att. 5/ Acceptable Margin	

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Appendix A
2A Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference
239-13E	Cntmt Spray Hdr 2A Isln Vlv 2-FCV-72-39-A (3.2hp)	N/A	Not Running	83.13	Opens on Ph B (Starts)	87.97	Pass	Att. 5/ Acceptable Margin
239-14D	RHR Pmp 2A-A Min Flow Vlv 2-FCV-74-12-A (0.13hp)	83.91	Random	84.61	Random	89.71	Pass	Att. 5
239-15D	LWR CNTMT 2A CLRS SUP ISLN VLV 2-FCV-67-89-A (0.33hp)	N/A	Not Running	87.91	Closes (Starts)	93.22	Pass	Att. 5
239-17B	Cntmt Standpipe Isln Vlv 2-FCV-26-240-A (0.67hp)	82.10	Close (Starts)	82.78	Close (Starts)	87.74	Pass	Att. 5
239-18E	RCP Spray Isln Vlv 2-FCV-26-243-A (0.67hp)	81.17	Close (Starts)	81.85	Close (Starts)	86.47	Pass	Att. 5
239-7A	Seal Flow Ret Isln Vlv 2-FCV-62-63-A (1.9hp)	77.85	Closes on Ph A (Starts)	78.50	Closes on Ph A (Starts)	83.16	Pass	Att. 5 / Acceptable Margin
239-7B	CHRG FLOW ISLN VLV 2-FCV-62-90-A (1.9hp)	85.16	Closes on SI	85.86	Closes on SI	90.94	Pass	Att. 5 / Acceptable Margin
239-8B	Vol Cont Tank Outlet Isln Vlv 2-LCV-62-132-A (1.9hp)	80.78	Closes on SI	81.45	Closes on SI	86.28	Pass	Att. 5
239-5C	LWR CNTMT 2C CLRS SUP ISLN VLV 2-FCV-67-97-A (0.33hp)	N/A	Not Running	87.71	Closes (Starts)	93.00	Pass	Att. 5
239-9A	RWST TO CHARGING PMPS CONT 2-LCV-62-135-A (1.9hp)	84.82	Opens on SI (Starts)	85.52	Opens on SI (Starts)	90.58	Pass	Att. 5 / Acceptable Margin
239-9D	2-FCV-70-100A (0.33hp)	N/A	Not Running	87.19	Closes on Phase B	92.46	Pass	Att. 5
239-10B	SIS PMPS RECIRC TO RWST 2-FCV-63-3-A (0.7HP)	N/A	N/A	N/A	N/A	89.43	Pass	Att. 5 / Acceptable Margin
239-2B	Boric Acid Transfer Pmp 2A-A 2-MTR-62-230-A (15HP)	N/A	N/A	N/A	N/A	92.42	85	Att. 1
239-11A	SIS Pmp Inlet To CVCS Chrg Pmp 2-FCV-63-7-A (1.9HP)	N/A	N/A	N/A	N/A	81.98	Pass	Att. 5 / Acceptable Margin
239-14E	RHR Hx 2A Bypass Vlv 2-FCV-74-33-A (1.9HP)	N/A	N/A	N/A	N/A	84.67	Pass	Att. 5 / Acceptable Margin
239-2C	THERM BAR SYS BSTR PMP 2A-A 2-MTR-70-131-A (10HP)	N/A	N/A	N/A	N/A	86.94	85	Att. 1 R2
239-11B	RHR Hx A To CVCS Chrgr Pmp 2-FCV-63-8-A (1.9HP)	N/A	N/A	N/A	N/A	89.05	Pass	Att. 5 / Acceptable Margin
239-2E1	RWST To RHR Pmp Flow Cont Vlv 2-FCV-63-1-A (5.2HP)	N/A	N/A	N/A	N/A	91.80	Pass	Att. 5/ Acceptable Margin
239-3E	Cntfgl Chrg Pmp 2A-A AOP 2-MTR-62-AOP-A (2HP)	N/A	N/A	N/A	N/A	86.44	85	Att. 1
239-12A	SIS Pmp 2A-A Inlet Vlv 2-FCV-63-47-A (1.9HP)	N/A	N/A	N/A	N/A	79.72	Pass	Att. 5 / Acceptable Margin
239-4E	AFW Pmp A-A Lube Oil Pmp A-A 2-MTR-3-118D-A (0.25HP)	N/A	N/A	N/A	N/A	88.24	85	Att. 1
239-12D	SIS To RCS Loops 2&3 FCV 2-FCV-63-93-A (1.6HP)	N/A	N/A	N/A	N/A	93.00	Pass	Att. 5 / Acceptable Margin
239-12E	SIS Pmp 2A-A Outlet FCV 2-FCV-63-152-A (1.9HP)	N/A	N/A	N/A	N/A	85.61	Pass	Att. 5 / Acceptable Margin
239-13A	SIS Pmp Out RCS Lp 1&3 Hot Leg 2-FCV-63-156-A (1.9HP)	N/A	N/A	N/A	N/A	85.58	Pass	Att. 5 / Acceptable Margin

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EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference
239-6D	RCS Press Relief FCV 2-FCV-68-333-A (1.9HP)	N/A	N/A	N/A	N/A	86.46	Pass	Att. 5 / Acceptable Margin
239-13B	Cntmt Sump To Spray Hdr 2A FCV 2-FCV-72-44-A (3.2HP)	N/A	N/A	N/A	N/A	80.63	Pass	Att. 5 / Acceptable Margin
239-14A	RHR Spray Hdr 2A Isln Vlv 2-FCV-72-40-A (1.9HP)	N/A	N/A	N/A	N/A	88.31	Pass	Att. 5 / Acceptable Margin
480V RMOV Board 2A2-A								
240-10A	Lwr Cntm 2D Clr Dish Iso Vlv 2-FCV-67-112-A (0.33hp)	N/A	Not Running	89.57	Closes (Starts)	92.14	Pass	Att. 5
240-10D	Up Cntm Vt Clr 2C Dish Iso Vlv 2-FCV-67-296-A (0.13hp)	N/A	Not Running	88.24	Closes (Starts)	90.77	Pass	Att. 5
240-10F	Up Cntm Vt Clr 2D Dish Iso Vlv 2-FCV-67-142-A (0.13hp)	N/A	Not Running	89.61	Closes (Starts)	92.18	Pass	Att. 5
240-11D	RCP Thrm Barr Rtn Cntm Iso Vlv 2-FCV-70-90-A (0.7hp)	N/A	Not Running	87.25	Closes (Starts)	89.73	Pass	Att. 5
240-11E	RCP Thrm Barr Cntmt Isln Vlv 2-FCV-70-133-A (0.13hp)	N/A	Not Running	87.62	Closes (Starts)	90.14	Pass	Att. 5
240-12D	RCP Oil Clr Rtn Cntmt Isln Vlv 2-FCV-70-92-A (0.13hp)	N/A	Not Running	88.59	Closes (Starts)	91.77	Pass	Att. 5
240-16D	Excs Ltdn Hx Cont Inlt Iso Vlv 2-FCV-70-143-A (0.33hp)	88.49	Closes on Phase A	88.93	Closes on Phase A	91.48	Pass	Att. 5
240-3D	St Gen No 1 FW Isln Vlv 2-FCV-3-33-A (39.4hp)	85.33	Use 89-10 start	85.75	Use 89-10 start	86.38	Pass	Att. 5
240-4D	St Gen No 3 FW Isln Vlv 2-FCV-3-87-A (39.4hp)	87.00	Use 89-10 start	87.43	Use 89-10 start	88.05	Pass	Att. 5
240-7D	Lwr Cntm 2A Clr Dish Iso Vlv 2-FCV-67-87-A (0.13hp)	N/A	Not Running	89.73	Closes (Starts)	92.31	Pass	Att. 5
240-7F	Up Cntm Vt Clr 2A Sup Iso Vlv 2-FCV-67-130-A (0.13hp)	N/A	Not Running	89.63	Closes (Starts)	92.20	Pass	Att. 5
240-8B	Lwr Cntmt 2A Clr Sply Isln Vlv 2-FCV-67-107-A (0.33hp)	N/A	Not Running	89.57	Closes (Starts)	92.14	Pass	Att. 5
240-8D	Lwr Cntm 2C Clr Dish Iso Vlv 2-FCV-67-95-A (0.13hp)	N/A	Not Running	89.45	Closes (Starts)	92.02	Pass	Att. 5 R2
240-8F	Up Cntm Vt Clr 2C Sup Iso Vlv 2-FCV-67-133-A (0.13hp)	N/A	Not Running	89.59	Closes (Starts)	92.16	Pass	Att. 5
240-9A	Lwr Cntmt 2C Clr Sply Isln Vlv 2-FCV-67-99-A (0.33hp)	N/A	Not Running	89.40	Closes (Starts)	91.97	Pass	Att. 5
240-9B	Lwr Cntm 2B Clr Dish Iso Vlv 2-FCV-67-104-A (0.33hp)	N/A	Not Running	89.40	Closes (Starts)	91.97	Pass	Att. 5
240-9D	Up Cntm Vt Clr 2A Dish Iso Vlv 2-FCV-67-295-A (0.13hp)	N/A	Not Running	88.06	Closes (Starts)	90.59	Pass	Att. 5
240-9F	Up Cntm Vt Clr 2B Dish Iso Vlv 2-FCV-67-139-A (0.13hp)	N/A	Not Running	89.61	Closes (Starts)	92.18	Pass	Att. 5
240-11A	Cmpnt Clg Hx A Disch Cont Vlv 2-FCV-67-146-A (0.3HP)	N/A	N/A	N/A	N/A	89.64	Pass	Att. 5 / Acceptable Margin
240-15A	CCS HX B ERCW BYPASS FCV 2-FCV-67-143-A (0.13HP)	N/A	N/A	N/A	N/A	92.44	Pass	Att. 5 / Acceptable Margin
240-16E	RHR Hx A-A Outlet Vlv 2-FCV-70-156-A (0.33HP)	N/A	N/A	N/A	N/A	89.63	Pass	Att. 5 / Acceptable Margin

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EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts								
		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)	Bases for Minimum Required Voltage
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base	Reference
240-17A	Sample Hx Hdr Outlet Vlv 2-FCV-70-183-A (0.13HP)	N/A	N/A	N/A	N/A	90.15	Pass	Att. 5 / Acceptable Margin
240-17E	480V BD RM 2A A/C CPRSR 2A-A 2-MTR-31-465-A (50HP)	N/A	N/A	N/A	N/A	91.53	85	Att. 1
240-2A	ERCW Hdr A Isln Vlv 2-FCV-3-116A-A (0.25HP)	N/A	N/A	N/A	N/A	91.06	Pass	Att. 5 / Acceptable Margin
240-2B	ERCW Hdr A Isln Vlv 2-FCV-3-116B-A (0.25HP)	N/A	N/A	N/A	N/A	90.94	Pass	Att. 5 / Acceptable Margin
240-2D	AFWP Turb Stm Sup Fm Stm Gen 1 2-FCV-1-15-A (1HP)	N/A	N/A	N/A	N/A	91.38	Pass	Att. 5 / Acceptable Margin
240-3A	ERCW Hdr A Isln Vlv 2-FCV-3-136A-A (0.33HP)	N/A	N/A	N/A	N/A	90.06	Pass	Att. 5 / Acceptable Margin
240-3B	ERCW Hdr A Isln Vlv 2-FCV-3-136B-A (0.33HP)	N/A	N/A	N/A	N/A	90.07	Pass	Att. 5 / Acceptable Margin
240-5A	Sample Hx Isln Vlv 2-FCV-70-215-A (0.13HP)	N/A	N/A	N/A	N/A	90.31	Pass	Att. 5 / Acceptable Margin
240-5E	Cntmt Spray Hx 2A Sup Cont Vlv 2-FCV-67-125-A (0.33HP)	N/A	N/A	N/A	N/A	91.49	Pass	Att. 5 / Acceptable Margin
240-5F	Cntmt Spray Hx 2A Disch Vlv 2-FCV-67-126-A (0.33HP)	N/A	N/A	N/A	N/A	91.49	Pass	Att. 5 / Acceptable Margin
240-6A	AFWP Turb Stm Sup Fm Stm Gen 4 2-FCV-1-16-A (1HP)	N/A	N/A	N/A	N/A	91.37	Pass	Att. 5 / Acceptable Margin

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* This MOV terminal voltage is calculated taking credit for the hammer blow feature.

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Appendix A
2B Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference	
6.9kV Shutdown Board 2B-B									
15-10 AFW	Aux Feedwater PMP 2B-B 2-MTR-3-128-B (600 HP)	99.11	Starts	99.11	Starts	99.09	85	Att. 3	
15-13 CSP	CNTMT SPRAY PMP 2B-B 2-MTR-72-10-B (700 HP)	N/A	Not Running	98.93	Starts	98.93	80	Based on Unit 1 motor data (Att. 3)	
15-14 RHR	RHR PUMP 2B-B 2-MTR-74-20-B (400 HP)	99.03	Starts	99.03	Starts	99.03	80	Based on Unit 1 motor data (Att. 3)	
15-15 SI	SAFETY INJ PMP 2B-B 2-MTR-63-15-B (400 HP)	99.05	Starts	99.05	Starts	99.05	80	Based on Unit 1 motor data (Att. 3)	
15-18 CCP	CNTFGL CHRG PMP 2B-B 2-MTR-62-104-B (600 HP)	99.00	Starts	99.00	Starts	98.99	80	Based on Unit 1 motor data (Att. 3)	
15-8 ERCW	ERCW PMP H-B 0-MTR-67-59-B (800 HP)	N/A	Starts (H-B or G-B start, but not both, other is not running)	N/A	Starts (H-B or G-B start, but not both, other is not running)	96.05	90	Att. 3	
15-9 ERCW	ERCW PMP G-B 0-MTR-67-55-B (800 HP)	96.72	Starts (H-B or G-B start, but not both, other is not running)	96.72	Starts (H-B or G-B start, but not both, other is not running)	6.66	90	Same as ERCW Pmp H-B (Att. 3)	
480V Shutdown Board 2B1-B									
137-3C	Cmpnt Clg Sys Pmp 2B-B 2-MTR-70-33-B (350 hp)	81.40 (8s)	Starts	81.79 (8s)	Starts	81.19	70	Att. 3	R2
138-7A	Elec Bd Rm AHU D-B 0-MTR-31-31D-B (50 hp)	N/A	Running	N/A	Running	85.53	80	Att. 6	
138-7B	Spent Fuel Pit Pmp C-S ALT FDR 0-MTR-78-35-S (100 hp)	N/A	Running	N/A	Running	85.82	80	Att. 6	
138-7D	Reac Lwr Compt Clr Fan 2B-B 2-MTR-30-75-B (60 hp)	N/A	Running	N/A	Trips	83.93	80	Based on Unit 1 motor data (Att. 3)	
480V Shutdown Board 2B2-A									
139-2B	Elect Bd rm A/C B-B Cprsr 0-MTR-31-129/2-B (250 hp)	N/A	Running	N/A	Running	86.53	85	Att. 1	
139-2D	Cmpnt Clg Sys Pmp C-S 0-MTR-70-51-S (350 hp)	N/A	Running	N/A	Running	69.99 (SIB)	70	Att. 3	
140-7D	Reac Lwr Compt Clr Fan 2D-B 2-MTR-30-78-B (60 hp)	N/A	Running	N/A	Trips	86.42	80	Based on Unit 1 motor data (Att. 3)	
140-9C	Cntmt Air Rtn Fan 2B-B 2-MTR-30-39-B (100 hp)	N/A	Not Running Starts @ 9 Min	N/A	Not Running Starts @ 9 Min	84.87	80	Att. 6	
140-9D	480V Shutdown Bd Rm AHU D-B 0-MTR-31-61-B (75 hp)	N/A	Running	N/A	Running	88.06	85	Att. 1	
480V CA Vent Board 2B1-B									
209-2A	Aux Cont Air Cprsr B-B 0-MTR-32-86-B (20 hp)	N/A	Not Running	N/A	Not Running	84.56	80	Att. 1	
209-2C	Pen Rm El713 Clr Fan 2B-B 2-MTR-30-197-B (3 hp)	87.20	Starts on ABI	88.00	Starts on ABI	91.06	80	Based on Unit 1 motor data (Att. 3)	
209-3B	Pipe Chase Clr Fan 2B-B 2-MTR-30-202-B (3 hp)	87.25	Starts on ABI	88.06	Starts on ABI	91.11	80	Based on Unit 1 motor data (Att. 3)	
209-3C	Cntm Spray Pmp 2B-B Rm Clr Fan 2-MTR-30-178-B (7.5 hp)	83.48	Random	84.25	Starts on Pump Start	86.17	80	Based on Unit 1 motor data (Att. 3)	

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EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference	
209-3D	Aux Bldg Gas Trtmt Sys Fan B-B 2-MTR-30-157-B (50 hp)	82.90	Starts on ABI	83.66	Starts on ABI	88.68	80	Same as Fan A-A (207-3D), Att 3	
209-4A	BATTERY RM EL 692 EXH FAN C-B 0-MTR-31-27-B (2 hp)	N/A	Running	N/A	Running	89.95	85	Att. 1	
209-5E	AFWP&BA XFR PMP SP CLR FAN B-B 2-MTR-30-185-B (15 hp)	87.24	Starts on ABI	88.05	Starts on ABI	88.81	80	Based on Unit 1 motor data (Att. 3)	
209-6B	ERCW Str 2B-B 2-MTR-67-10-B (3 hp)	N/A	Running	N/A	Running	77.30	75	Att. 3	
209-6C	Traveling Scrn 2B-B 2-MTR-67-10-B (5 hp)	N/A	Running	N/A	Running	81.68	80	Att. 3	
209-7B	125V Vit Bat Rm IV ExFan 2A2-B 2-MTR-31-288-B (0.33 hp)	N/A	Running	N/A	Running	92.11	85	Att. 1	
209-7D	RHR Pmp 2B-B Inlet FCV 2-FCV-74-21-B (5.2 hp)	N/A	Not Running	N/A	Not Running	93.70	Pass	Att. 5	
209-8A	Safety Inj Pmp 2B-B Rm Clr Fan 2-MTR-30-179-B (5 hp)	84.79	Starts on Pump Start	85.58	Starts on Pump Start	87.41	80	Based on Unit 1 motor data (Att. 3)	
209-8B	Pen Rm El 692 Clr Fan 2B-B 2-MTR-30-187-B (3 hp)	86.61	Starts on ABI	87.41	Starts on ABI	89.49	80	Based on Unit 1 motor data (Att. 3)	
209-8C	Shtdn Xfmr Rm 2B Exh Fan 2B2-B 2-MTR-30-246G-B (3 hp)	N/A	Running	N/A	Running	91.83	80	Att. 3	
209-8D	Shtdn Xfmr Rm 2B Exh Fan 2B3-B 2-MTR-30-246H-B (3 hp)	N/A	Running	N/A	Running	92.14	80	Att. 3	
209-8E	C.Bldg Ele BdRm AC Clr Pmp B-B 0-MTR-31-129/1-B (20 hp)	N/A	Running	N/A	Running	88.44	85	Att. 1	
209-8F1	EL BD RM A/C B-B CONTROL/O.PMP 0-MTR-31-129/3-B (3 hp)	N/A	Running	N/A	Running	92.33	85	Att. 1	
209-9A	RHR Pmp 2B-B Rm Clr Fan 2-MTR-30-176-B (5 hp)	81.19	Starts on Pump Start	81.94	Starts on Pump Start	82.53	80	Based on Unit 1 motor data (Att. 3)	R2
209-9C	480V Bd Rm 2A Pr Sup Fan 2A2-B 2-MTR-31-463-B (3 hp)	N/A	Running	N/A	Running	92.84	85	Att. 1	
209-9D	Shtdn Xfrm Rm 2B Exh Fan 2B1-B 2-MTR-30-246F-B (3 hp)	N/A	Running	N/A	Running	92.45	80	Att. 3	
209-9E	Pen Rm El 737 Clr Fan 2B-B 2-MTR-30-195-B (3 hp)	87.63	Starts on ABI	88.43	Starts on ABI	91.70	80	Att. 3	
209-10A	Cntfg Chrg Pmp 2B-B Rm Clr Fan 2-MTR-30-182-B (5 hp)	86.12	Starts on Pump Start	86.91	Starts on Pump Start	89.04	80	Based on Unit 1 motor data (Att. 3)	
209-10B	480V Bd Rm 2B Pr Sup Fan 2B2-B 2-MTR-31-477-B (3 hp)	N/A	Running	N/A	Running	93.15	85	Att. 1	
209-10C	125V Vit BatRm III ExFan 2B2-B 2-MTR-31-286-B (0.33 hp)	N/A	Running	N/A	Running	91.90	85	Att. 1	
209-10F1	Cont Rm Intake Mon 0-RE-90-126-B (0.75 hp)	N/A	Running	N/A	Running	93.11	85	Att. 1	
209-11B	480V Bb Rm 2B A/C Ahu 2B-B 2-MTR-31-475-B (20 hp)	N/A	Running	N/A	Running	90.81	85	Att. 1	
209-11C	480V Bd Rm 2B A/C cond 2B-B 2-MTR-31-289-B (20 hp)	N/A	Running	N/A	Running	90.23	85	Att. 1	
209-12B	EG Trtmt Sys B-B Rm Clr Fan 2-MTR-30-207-B (3 hp)	87.39	Starts on ABI	88.20	Starts on ABI	91.70	80	Att. 3	
209-13D	ERCW Scrn Wash Pmp 2B-B 2-MTR-67-447-B (40 hp)	N/A	N/A	N/A	N/A	74.69	75	Att. 3 Also See Sec. 7.1	
209-7E	RWST To Spray Hdr 2B FCV 2-FCV-72-21-B (3.3 hp)	N/A	Not Running	N/A	Not Running	87.70	Pass	Att. 5 / Acceptable Margin	
209-6E	ERCW Str 2B-B Flush Vlv 2-FCV-67-10B-B (0.33HP)	N/A	N/A	N/A	N/A	83.36	80	Att. 1	
209-4E	ERCW Str 2B-B Backwash Vlv 2-FCV-67-10A-B (0.33HP)	N/A	N/A	N/A	N/A	83.62	80	Att. 1	

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ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference	
480V CA Vent Board 2B2-B									
None									
480V Diesel Aux Board 2B1-B									
223-2B	DG 2B-B RM EXH FAN 1B 2-MTR-30-450-B (15 hp)	92.48	Starts	92.88	Start	94.64	85	Att. 3	
223-2D	DG 2B-B Lube Oil Circ Pmp 1 2-MTR-82-B1-B (1 hp)	N/A	Running	N/A	Running	95.14	85	Att. 1	
223-3A	EM DG ENG SUP VLV FROM HDR 1B 2-FCV-67-67-B (0.13hp)	82.55	Open on Diesel Start	82.90	Open on Diesel Start	86.33	Pass	Att. 5	
223-3D	DG 2B-B DAY TNK FO XFR PMP 1 2-MTR-18-55/4-B (1 hp)	92.31	Random	92..71	Random	95.03	85	Att. 1	
223-4D	DG Rm 2B-B Pnl Vent Fan 2-MTR-30-494-B (15 hp)	N/A	Running	N/A	Running	92.52	85	Att. 3	
223-4E	DG 2B-B 480V Elec Bd Rm Ex Fan 2-MTR-30-462-B (2 hp)	N/A	Running	N/A	Running	94.63	85	Att. 1	
223-6A	Dg 2B-B Muffler Rm Exh Fan 2-MTR-30-466 (0.5HP)	92.72	Starts	93.11	Starts	95.56	85	Att. 3	
480V Diesel Aux Board 2B2-B									
224-2A	DG 2B-B Aux LubeOil Circ Pmp B 2-MTR-82-AOPB2B (0.75 hp)	N/A	Running	N/A	Running	94.71	85	Att. 1	
224-2B	DG 2B-B RM EXH FAN 2-B 2-MTR-30-454-B (15 hp)	92.76	Starts	92.99	Starts	93.13	85	Att. 3	
224-2D	DG 2B-B Lube Oil circ Pmp 2 2-MTR-82-B2-B (1 hp)	N/A	Running	N/A	Running	94.83	85	Att. 1	
224-3D	DG 2B-B DAY TNK FO XFR PMP 2 2-MTR-18-54/4-B (1 hp)	92.53	Random	92.76	Random	94.80	85	Att. 1	
480V RMOV Board 2B1-B									
241-17D	AFW Pmp B-B Lube Oil Pmp B-B 2-MTR-3-128D-B (0.25 hp)	N/A	Running	N/A	Running	88.48	85	Att. 1	R2
241-3F2	SIS Accum Tank Flow Isol Vlv 2-FCV-63-98-B (19.5 hp)	N/A	Not Running	N/A	Not Running	86.66	Pass	Att. 5 / Acceptable Margin	
241-5A	HPFP Sys Low Level Intake Vlv 0-FCV-26-8-B (0.13 hp)	N/A	Not Running	N/A	Not Running	80.91	80	Att. 1	
241-5E	RCS Press Relief FCV 2-FCV-68-332-B (2 hp)	N/A	Not Running	N/A	Not Running	84.25	Pass	Att. 5 / Acceptable Margin	
241-6D	Seal Flow Ret Isln Vlv 2-FCV-62-61-B (1.9 hp)	82.53	Closes on Ph A (Starts)	83.24	Not Running	87.63	Pass	Att. 5 / Acceptable Margin	
241-7A	CHRG FLOW ISLN VLV 2-FCV-62-91-B (1.9 hp)	86.71	Closes on SI	87.45	Closes on SI	92.06	Pass	Att. 5 / Acceptable Margin	
241-8A	Vol Cont Tank Outlet Isln Vlv 2-LCV-62-133-B (1.9 hp)	81.30	Closes on SI	82.00	Closes on SI	86.25	Pass	Att. 5 / Acceptable Margin	
241-8B	RWST TO CHRG PMP VALVE CONT 2-LCV-62-136-B (1.9 hp)	80.20	Opens on SI	80.89	Opens on SI	85.08	Pass	Att. 5 / Acceptable Margin	
241-9B	RHR To RCS H.L. 1&3 Flow Iso V 2-FCV-63-172-B (2.6 hp)	N/A	Not Running	N/A	Not Running	80.97	Pass	Att. 5 / Acceptable Margin	
241-9F	Cntm spray Pmp 2B-B Recirc FCV 2-FCV-72-13-B (0.1 hp)	N/A	Not Running	N/A	Starts 10s after Phase B	89.77	Pass	Att. 5	
241-10A	SIS 2B-B Dsh To RWST Shtff Vlv 2-FCV-63-4-B (0.66 hp)	N/A	Not Running	N/A	Not Running	89.02	Pass	Att. 5 / Acceptable Margin	
241-10B	RWST To SIS Pump FCV 2-FCV-63-5-B (2 hp)	N/A	Not Running	N/A	Not Running	83.31	Pass	Att. 5 / Acceptable Margin	
241-11A	SIS Pmp Inlet To CVCS Chrg Pmp 2-FCV-63-6-B (2 hp)	N/A	Not Running	N/A	Not Running	81.72	Pass	Att. 5 / Acceptable Margin	

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Appendix A
2B Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference	
241-11B	RHR Hx B to SIS Pmp 2-FCV-63-11-B (2 hp)	N/A	Not Running	N/A	Not Running	87.60	Pass	Att. 5 / Acceptable Margin	
241-11E	SIS Boron Inj Tank Shutoff Vlv 2-FCV-63-25-B (1.9 hp)	86.65	Closes on SI	87.40	Closes on SI	91.98	Pass	Att. 5 / Acceptable Margin	
241-12B	SIS Pmp 2B-B Inlet Vlv 2-FCV-63-48-B (2 hp)	N/A	Not Running	N/A	Not Running	84.14	Pass	Att. 5 / Acceptable Margin	
241-12D	Cntmt Sump To RHR Pmp B-B 2-FCV-63-73-B (13.2 hp)	N/A	Open at 20 Min after SI	N/A	Open at 20 Min after SI	91.40	Pass	Att. 5 / Acceptable Margin	
241-12E	SIS To RCS Loops 1 & 4 FCV 2-FCV-63-94-B (1.6 hp)	N/A	Not Running	N/A	Not Running	92.80	Pass	Att. 5 / Acceptable Margin	
241-13A	SIS Pmp 2B-B Outlet FCV 2-FCV-63-153-B (2 hp)	N/A	Not Running	N/A	Not Running	85.71	Pass	Att. 5 / Acceptable Margin	
241-13B	SIS pmp Out RCS Lp 2&4 Hot Leg 2-FCV-63-157-B (2 hp)	N/A	Not Running	N/A	Not Running	88.35	Pass	Att. 5 / Acceptable Margin	
241-13D	SIS 2B-B Dsh to RWST Shtff Vlv 2-FCV-63-175-B (0.66 hp)	N/A	Not Running	N/A	Not Running	89.50	Pass	Att. 5 / Acceptable Margin	
241-14A	Cntmt Spray Hdr 2B Isln Vlv 2-FCV-72-2-B (3.2 hp)	N/A	Not Running	85.96	Open on Phase B	90.37	Pass	Att. 5 / Acceptable Margin	
241-14D	RHR SPRAY HDR 2B ISOL VLV 2-FCV-72-41-B (2 hp)	N/A	Not Running	N/A	Not Running	88.15	Pass	Att. 5 / Acceptable Margin	
241-14E	Cntm Sump To Spray Hdr 2B FCV 2-FCV-72-45-B (3.3 hp)	N/A	Not Running	N/A	Not Running	82.22	Pass	Att. 5 / Acceptable Margin	
241-15B	RHR Pmp 2B-B Min Flow Vlv 2-FCV-74-24-B (0.1 hp)	85.18	Start on RHR pump start on SI	85.91	Start on RHR pump start on SI	90.53	Pass	Att. 5 / Acceptable Margin	
241-15D	RHR Hx 2B Bypass Vlv 2-FCV-74-35-B (2 hp)	N/A	Not Running	N/A	Not Running	79.68	Pass	Att. 5 / Acceptable Margin	
480V RMOV Board 2B2-B									
242-18D	480V Bd Rm 2B A/C Cprsr 2B-B 2-MTR-31-447-B (75 hp)	N/A	Running	N/A	Running	90.83	85	Att. 1	R2
242-2A	ERCW Hdr B Isln Vlv 2-FCV-3-126A-B (0.67 hp)	N/A	Not Running	N/A	Not Running	89.82	Pass	Att. 5 / Acceptable Margin	
242-2B	ERCW Hdr B Isln Vlv 2-FCV-3-126B-B (0.67 hp)	N/A	Not Running	N/A	Not Running	89.81	Pass	Att. 5 / Acceptable Margin	
242-2E	St Flow To AFWP Turb Isln Vlv 2-FCV-1-18-B (1 hp)	N/A	Running	N/A	Running	91.06	Pass	Att. 5 / Acceptable Margin	
242-3A	ERCW Hdr B Isln Vlv 2-FCV-3-179A-B (0.33 hp)	N/A	Random	N/A	Random	90.39	Pass	Att. 5 / Acceptable Margin	
242-3B	ERCW Hdr B Isln Vlv 2-FCV-3-179B-B (0.33 hp)	N/A	Random	N/A	Random	90.20	Pass	Att. 5 / Acceptable Margin	
242-3D	St Gen No 2 FW Isln Vlv 2-FCV-3-47-B (39.4 hp)	85.16	Use 89-10 start	85.41	Use 89-10 start	87.81	Pass	Att. 5	
242-4D	St Gen No 4 FW Isln Vlv 2-FCV-3-100-B (39.4 hp)	86.16	Use 89-10 start	86.41	Use 89-10 start	88.83	Pass	Att. 5	
242-5C	LWR CNTMT 2A CLRS SUP ISLN VLV 2-FCV-67-113B (0.3 hp)	N/A	Not Running	88.43	Closes (Starts)	91.99	Pass	Att. 5	
242-5E	Cntmt Spray Hx 2B Sup Cont Vlv 2-FCV-67-123-B (0.33 hp)	N/A	Not Running	N/A	Not Running	91.41	Pass	Att. 5 / Acceptable Margin	
242-5F	Cntmt Spray Hx 2B Sup Disch Vlv 2-FCV-67-124-B (0.33 hp)	N/A	Not Running	N/A	Not Running	91.00	Pass	Att. 5 / Acceptable Margin	
242-6D	RCP Thrm Barr Rtn Cntm Iso Vlv 2-FCV-70-87-B (0.7 hp)	N/A	Not Running	87.62	Closes (Starts)	91.14	Pass	Att. 5	

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EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base	Bases for Minimum Required Voltage Reference
242-6E	RCP Thrm Barr Cntmt Isln Vlv 2-FCV-70-134-B (0.1 hp)	N/A	Not Running	87.60	Closes (Starts)	91.14	Pass	Att. 5
242-7D	Lwr Cntmt 2B Clr Dish Isln Vlv 2-FCV-67-103-B (0.1 hp)	N/A	Not Running	87.51	Closes (Starts)	91.04	Pass	Att. 5
242-7F	Up Cntm Vt Clr 2A Dish Iso Vlv 2-FCV-67-131-B (0.1 hp)	N/A	Not Running	87.18	Closes (Starts)	90.69	Pass	Att. 5
242-8D	Lwr Cntm 2D Clr Dish Iso Vlv 2-FCV-67-111-B (0.1 hp)	N/A	Not Running	87.93	Closes (Starts)	91.48	Pass	Att. 5
242-8F	Up Cntm Vt Clr 2C dish Iso Vlv 2-FCV-67-134-B (0.1 hp)	N/A	Not Running	87.18	Closes (Starts)	85.63	Pass	Att. 5
242-9A	Lwr Cntm 2A Clr Dish Iso Vlv 2-FCV-67-88-B (0.3 hp)	N/A	Not Running	86.92	Closes (Starts)	90.43	Pass	Att. 5
242-9B	Lwr Cntm 2C Clr Dish Iso Vlv 2-FCV-67-96-B (0.3 hp)	N/A	Not Running	87.02	Closes (Starts)	90.53	Pass	Att. 5
242-9D	Up Cntm Vt Clr 2B Dish Iso Vlv 2-FCV-67-297-B (0.1 hp)	N/A	Not Running	86.19	Closes (Starts)	89.66	Pass	Att. 5
242-9F	Up Cntm Vt Clr 2B Sup Isln Vlv 2-FCV-67-138-B (0.1 hp)	N/A	Not Running	87.18	Closes (Starts)	90.69	Pass	Att. 5
242-10A	Lwr Cntmt 2B Clr Sply Isln Vlv 2-FCV-67-91-B (0.3 hp)	N/A	Not Running	86.93	Closes (Starts)	90.43	Pass	Att. 5
242-10B	Lwr Cntmt 2D Clr Sply Isln Vlv 2-FCV-67-83-B (0.3 hp)	N/A	Not Running	87.23	Closes (Starts)	90.75	Pass	Att. 5
242-10D	Up Cntm Vt Clr 2D Dish Iso Vlv 2-FCV-67-298-B (0.1 hp)	N/A	Not Running	86.87	Closes (Starts)	90.37	Pass	Att. 5 R2
242-10F	Up Cntm Vt Clr 2D Sup Isln Vlv 2-FCV-67-141-B (0.1 hp)	N/A	Not Running	87.18	Closes (Starts)	90.69	Pass	Att. 5
242-11B	LWR CNTMT 2B CLRS SUP ISLN VLV 2-FCV-67-105-B (0.3 hp)	N/A	Not Running	88.09	Closes (Starts)	91.65	Pass	Att. 5
242-12B	CCS Hx C Disch Vlv To Hdr B 0-FCV-67-152-B (0.7 hp)	N/A	Running	N/A	Running	89.74	Pass	Att. 4
242-13D	RCP OIL CLR RTN CNTMT ISLN VLV 2-FCV-70-89-B (0.3 hp)	N/A	Not Running	88.11	Closes (Starts)	91.67	Pass	Att. 5
242-13F	RCP Oil Clr Hdr Cntmt Isln Vlv 2-FCV-70-140-B (0.3 hp)	N/A	Not Running	86.94	Closes (Starts)	90.45	Pass	Att. 5
242-17A	SFPCS Hx Sply Hdr Isln Vlv 0-FCV-70-194-B (0.33 hp)	N/A	Not Running	N/A	Not Running	92.18*	Pass	Att. 4 / Acceptable Margin with voltage based on Hammer Blow feature *
242-15E	RHR Hx B-B Outlet Vlv 2-FCV-70-153-B (0.33 hp)	N/A	Not Running	N/A	Not Running	91.47	Pass	Att 5
480V Reactor Vent Board 2B-B								
None								

* This MOV terminal voltage is calculated taking credit for the hammer blow feature.

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Voltage Recovery Analysis for DBE

Purpose
The purpose of the attachment is to demonstrate that any possible voltage transient caused by motor starting during a DBE (SI with Phase A or Phase B isolation), including drop to the LOV setpoint, will also result in successful recovery above DVR reset within 5 seconds.

Approach
This transient voltage dip and recovery analysis is similar to that analyzed by the offsite power analysis (reference 2.2) which shows that the voltage recovers above the DVR reset within 5 seconds. However, the offsite power analysis credits the use of automatic load tap changers (LTC) for voltage recovery and also assumes minimum operable grid capacity. The offsite power analysis accounts for minimum operable grid capacity by using an extremely conservative technique of forcing the switchyard voltage to the minimum allowable post-event voltage. This technique ignores the voltage recovery that would occur once the larger motors accelerate.

In this analysis, the offsite power source has been modeled using a classical Thevenin equivalent impedance technique (fixed voltage source behind impedance). The impedance chosen is equivalent to that grid capacity that would result in the voltage at the 6.9kV Shutdown Boards dropping all the way to the loss of voltage (LOV) relay setpoint during initial DBE motor starting (block-start of ECCS loads).

Bases/Assumptions
- The offsite power LTCs (CSST C & D) are not allowed to correct the voltage during the motor starting event. However, they are allowed to adjust the voltage prior to the event. This is conservative because it will result in the worst-case voltage transient with no voltage recovery from the LTCs.
- The auxiliary power system is assumed to be in normal alignment prior to the event (Unit Boards and RCP Boards on USSTs, Common Boards on CSSTs A/B, Shutdown Boards on CSSTs C/D). This is conservative, because it puts the least amount of load on the offsite power source prior to the event and thereby results in a "stiffer" offsite power source impedance (i.e. less recovery). In addition, aligning the Shutdown Boards to CSSTs A/B would result in even greater recovery due to the Unit Board load shed feature.
- The 161kV Switchyard voltage is assumed to be at the minimum operable voltage prior to the event. This is conservative, because it will also result in a "stiffer" offsite power source impedance (i.e. less recovery).

Computations
Using the existing ETAP model used to perform offsite power analysis for two unit operation (Ref. 2.2), a dynamic motor starting analysis was performed for both SI-Phase A and SI-Phase B events on each unit. Using a trial and error technique, the switchyard source capacity (MVA_{sc}) was adjusted until the applicable 6.9kV Shutdown Board voltages just equaled the LOV setpoint (80% nominal) at t=0+ in the event being studied.

Each dynamic motor starting study case (SIA and SIB) was run for at least 5 seconds. The associated ETAP reports provide the voltage during the event in 0.1 second intervals for each 6.9kV Shutdown Board.

Results
A plot of the worst-case voltage recovery is shown for both U1 SIB and U2 SIB. The results show that in all cases the 6.9kV Shutdown Board voltage recovers above the DVR reset value (operational limit of 6681V) within 4 seconds.

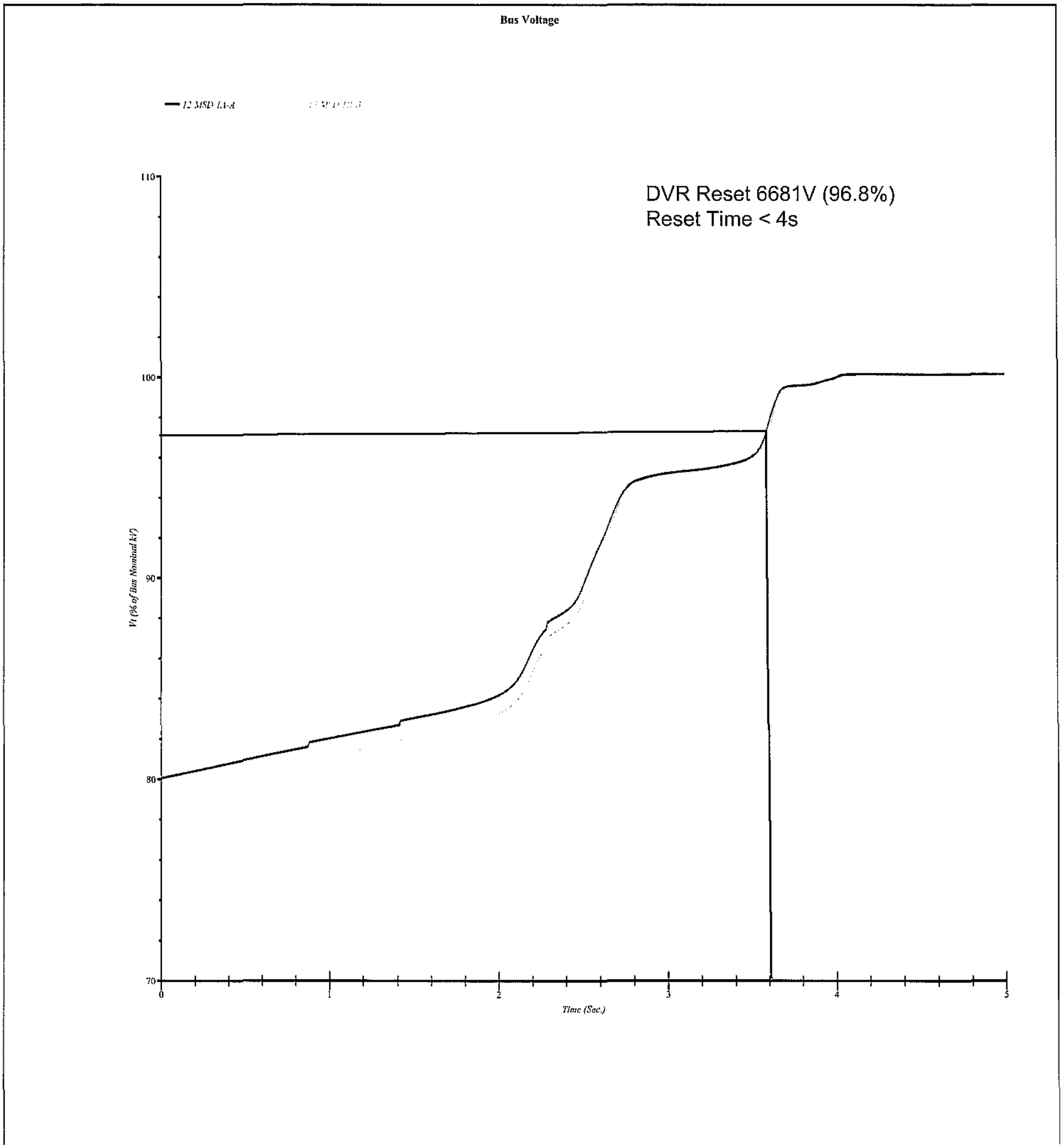
Conclusions
This bounding analysis demonstrates that any possible voltage transient caused by DBE motor starting, including drop to the LOV setpoint, will also result in successful recovery above DVR reset within 5 seconds.

Project:	Watts Bar Nuclear Plant	ETAP 7.0.0N	Date:	03-21-2012
Location:	//chachaapp5/etaps/wbnp/		SN:	90TVA12DC2
Contract:			Revision:	Unit 1&2
Engineer:		Study Case: U1 SIB-U2	Config.:	N 4 CSST-U2

WBN-EEB-MS-TI06-0029
Unit 1 SI Phase B. Plant in normal alignment (4CSSTs) at lowest operable grid (161kV). No LTC during the event.

Project File: J:\wbnp\R0 EDQ00099920120004 (DVR Analysis)\DVR Analysis WBN\DVR LOV Recovery Analysis\WBNDATA
Output Report: U1SIB-152MVA

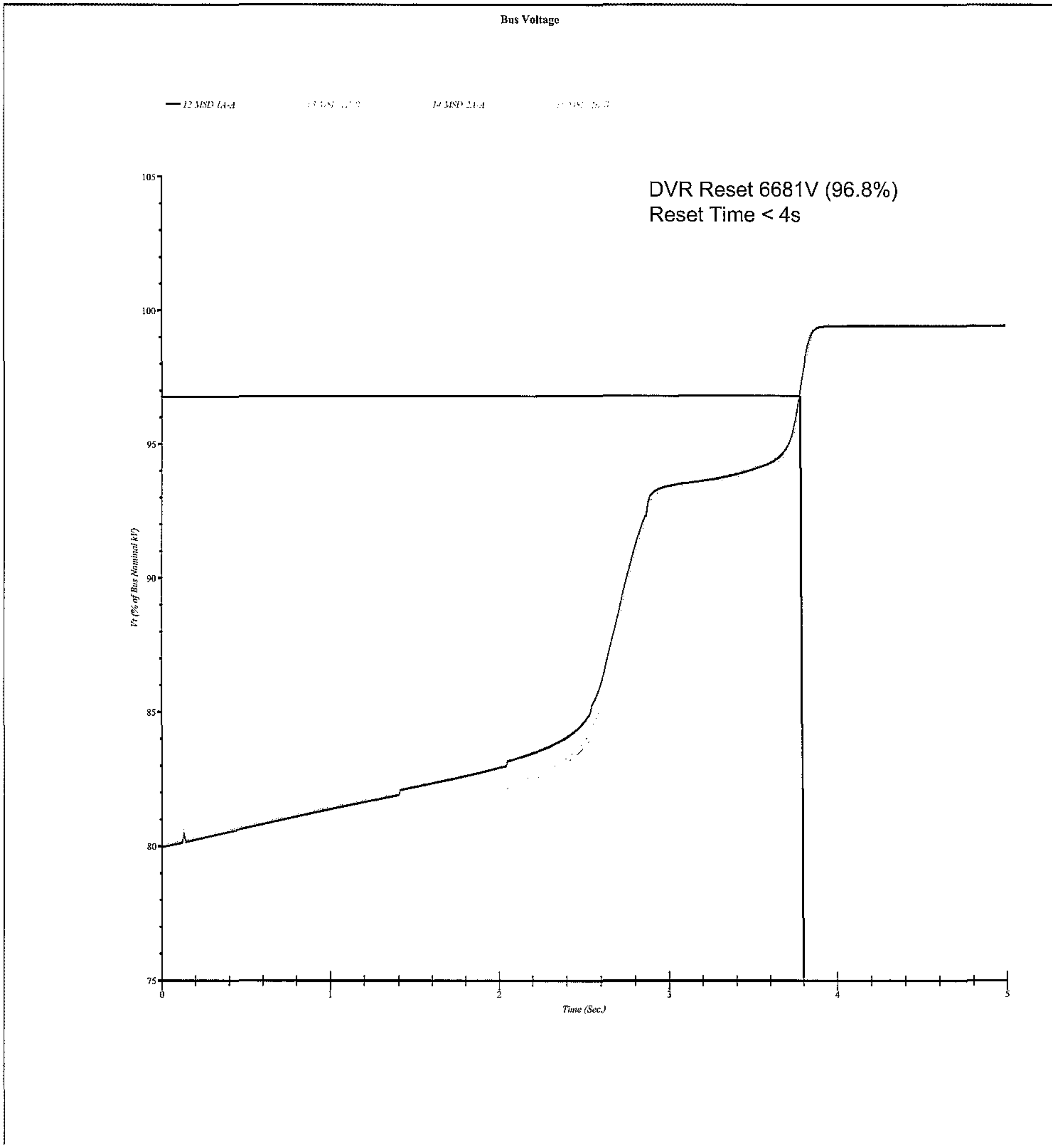
MOTOR STARTING ANALYSIS



WBN-EEB-MS-TI06-0029
Unit 1/2 SI Phase A. Plant in normal alignment (4CSSTs) at lowest operable grid (161kV). No LTC during the event.

Project File: J:\wbnp\R0 EDQ00099920120004 (DVR Analysis)\DVR Analysis WBN\DVR LOV Recovery Analysis\WBNDATA
Output Report: U12-SIA

MOTOR STARTING ANALYSIS

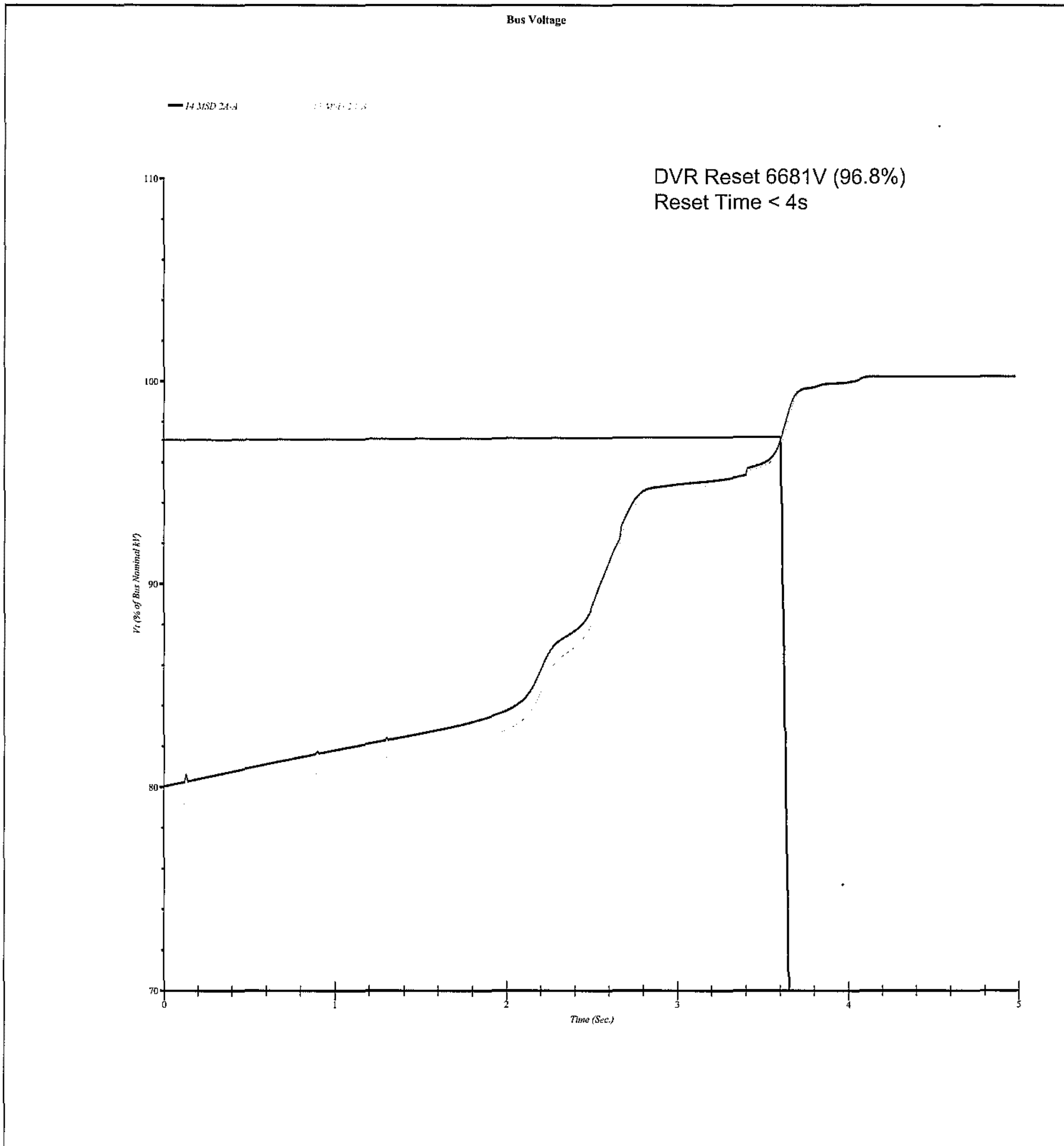


Project:	Watts Bar Nuclear Plant	ETAP 7.0.0N	Date:	03-21-2012
Location:	//chachaapp5/etaps/wbnp/		SN:	90TVA12DC2
Contract:			Revision:	Unit 1&2
Engineer:		Study Case: U2 SIB-U2	Config.:	N 4 CSST-U2

WBN-EEB-MS-TI06-0029
Unit 2 SI Phase B. Plant in normal alignment (4CSSTs) at lowest operable grid (161kV). No LTC during the event.

Project File: J:\wbnp\R0 EDQ00099920120004 (DVR Analysis)\DVR Analysis WBN\DVR LOV Recovery Analysis\WBNDATA
Output Report: U2SIB-152MVA

MOTOR STARTING ANALYSIS



Degraded Voltage Recovery Analysis for DBE

Purpose

The purpose of this appendix is to address NRC comments concerning the adequacy of the analytical methodology for the motor starting cases previously analyzed in this study to support DBE. The nature of the comments concerned the initial voltage used in the analysis at the DVR monitored bus and fell into two general areas:

1. Demonstrate the adequacy of the DVR protection scheme if the voltage source is placed at the switchyard bus and the grid voltage is set such that the DVR monitored bus voltage is at the DVR dropout analytical limit prior to the DBE initiation.

2. Demonstrate the adequacy of the DVR protection scheme if the voltage source is placed at the switchyard bus and both grid voltage and capacity are adjusted to any value that will support successful voltage recovery following DBE motor starting (i.e. Class 1E loads remain on offsite power).

Approach

This appendix follows a similar analytical technique as described in Appendix B. Additional study cases were set up to address the NRC comments as follows:

Study Case 1: The grid is set to strongest capacity (maximum short-circuit strength) and grid voltage is lowered until the DVR monitored bus voltage reaches the DVR analytical limit prior to DBE initiation. The outcome of this evaluation should demonstrate that the Class 1E bus voltage will not be able to successfully recover (i.e. reset the DVR) following the DBE initiation.

Study Case 2: Grid voltage and capacity are adjusted until the lowest possible initial voltage is found (at the DVR monitored bus) that allows successful recovery following DBE motor starting (i.e. the resulting voltage dip recovers from the Loss of Voltage relay (LOV) and also resets the DVR in a bounding fashion). The outcome of this evaluation should demonstrate that any combination of initial grid voltage and capacity that results in successful recovery of the Class 1E bus voltage does so because of the proper acceleration of the accident initiated motors on the 6.9kV 1E buses.

Analysis is performed for each study case using normal offsite power alignment via CSSTs C & D as well as alignment via CSSTs A & B (Shutdown Boards aligned to Start Buses via Unit Boards).

Bases/Assumptions

All the bases and assumptions listed in Appendix B of this study are applicable to this appendix. (Ref. Attachment 2 for relay setpoints)

Computations

The existing ETAP model from offsite power analysis for two unit operation (Ref. 2.2) was used to perform dynamic motor starting analyses similar to Appendix B. The analysis was performed considering a DBE for Unit 1 (SI with Phase B isolation). Detailed evaluation was performed for 6.9kV Shutdown Board 1A-A only (aligned to CSSTs A, B, C, or D) as the results are considered to be representative of the other Shutdown Boards for the purposes of these analyses.

Study Case 1:

1) The utility source model was placed on the 161kV switchyard bus.
2) The applicable CSST automatic load tap changers (LTC) were placed in manual (i.e. not working).

3) Using normal plant operation loading, the source voltage was lowered until the voltage at the DVR monitored bus (6.9kV Shutdown Board) was exactly at 6555V (DVR dropout analytical limit).
4) The source capacity was set to the maximum short-circuit strength (Ref PSO Study), which allows the greatest ability of the grid to recover the Class 1E bus voltage above the DVR reset value following DBE motor starting.

Study Case 2:

1) The utility source model was placed on the 161kV switchyard bus.
2) The applicable CSST automatic load tap changers (LTC) were placed in manual (i.e. not working).
3) Normal plant operation loading was used prior to the DBE initiation.
4) The source voltage and capacity were adjusted as required to achieve all of the following criteria:
   a) voltage at the 6.9kV Shutdown Board is not lower than 6555V (DVR dropout analytical limit) prior to DBE initiation.
   b) if the voltage dip produced by DBE initiation (at the 6.9kV Shutdown Board) drops below the LOV relay setpoint, it also recovers above the setpoint within the relay timeout (nominal settings used for convenience)
   c) the voltage at the 6.9kV Shutdown Board recovers to (exactly) the DVR reset point following the initial "block start" transient (nominal setting used for convenience).

Each dynamic motor starting study case was run for 5 seconds. The associated ETAP results provide the voltage profile in percent in 0.01 second intervals at the 6.9kV Shutdown Board. These values were plotted to evaluate the results. The existing offsite power analysis voltage profile for the same DBE (minimum grid capability) were also added on the same plots for general comparison (see Figures 1 and 2 of this appendix).

The following study cases have been run:

Study Case	ETAP Configuration	ETAP MS Case	ETAP Report Name
1	NCSSTABD-U2	U1SIB-U2	DVR DO AB
1	N4 CSST-U2	U1SIB-U2	DVR DO CD
2	NCSSTABD-U2	U1SIB-U2	WC Grid AB
2	N4 CSST-U2	U1SIB-U2	WC Grid CD

Results

Based on the study cases the results are summarized below:

Study Case 1 -
Voltage at the DVR monitored bus is at DVR dropout with a strong grid capacity. The evaluation shows (Ref. Figure 1) without the load tap changer, the DVR will not reset and Class 1E buses will disconnect from offsite power and transfer to the DGs as designed. Transfer to DG is acceptable because previous protective device analysis shows the successful transfer to the onsite power supply with all required Class 1E loads achieving adequate voltage for starting and running within required time limits.

Study Case 2 -
Voltage at the DVR monitored bus is at the lowest possible initial voltage that allows successful recovery. This case, while not representative of any actual postulated grid, results in the worst conceivable grid that allows Class 1E buses to remain on offsite power. The evaluation shows (Ref Figure 2) the DVR recovery time is not significantly different than that shown for offsite power analysis (minimum qualified grid). This case demonstrates that any conceivable voltage transient caused by motor starting, even at the threshold of LOV timeout and DVR timeout, will result in recovery of voltage (DVR reset or above) within 4 seconds.

Conclusions

The outcomes of these additional requested analysis demonstrate the adequacy of the DVR protection scheme based on:

1) If the LOV relay times out
    a. Class 1E buses disconnect from offsite power and transfer to the DGs
    b. Based on previous analysis, Class 1E components have adequate voltage for starting and running within analyzed time limits
2) If the LOV relay does not time out, then either:
    a. The DVR times out
        i. Class 1E buses disconnect from off site power and transfer to the DGs
        ii. Based on previous analyses, Class 1E components have adequate voltage for starting and running within analyzed time limits

        OR

    b. The DVR does not time out
        i. Class 1E buses remain connected to off site power
        ii. Based on previous analyses, Class 1E components have adequate voltage for starting and running within analyzed time limits

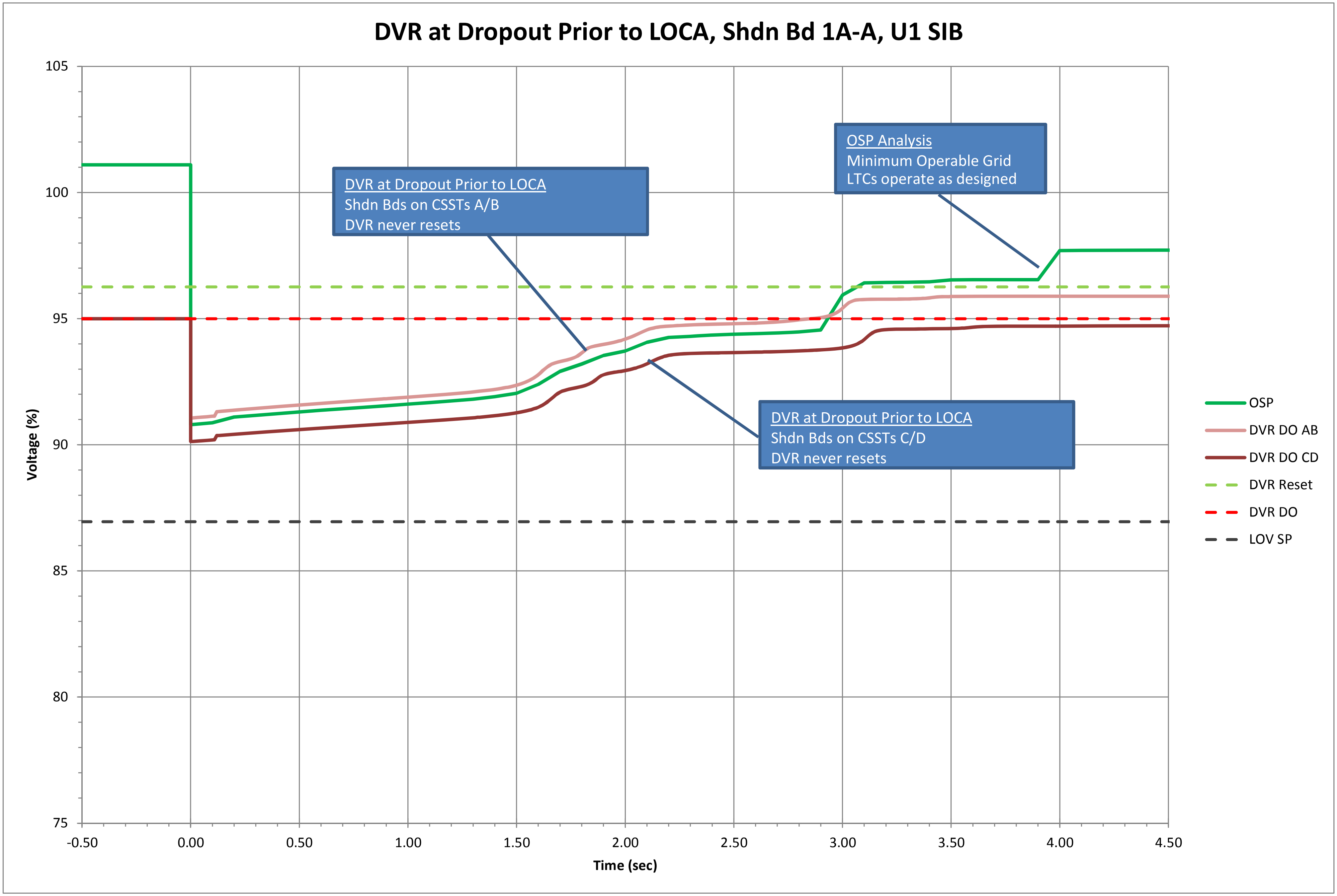


FIGURE 1
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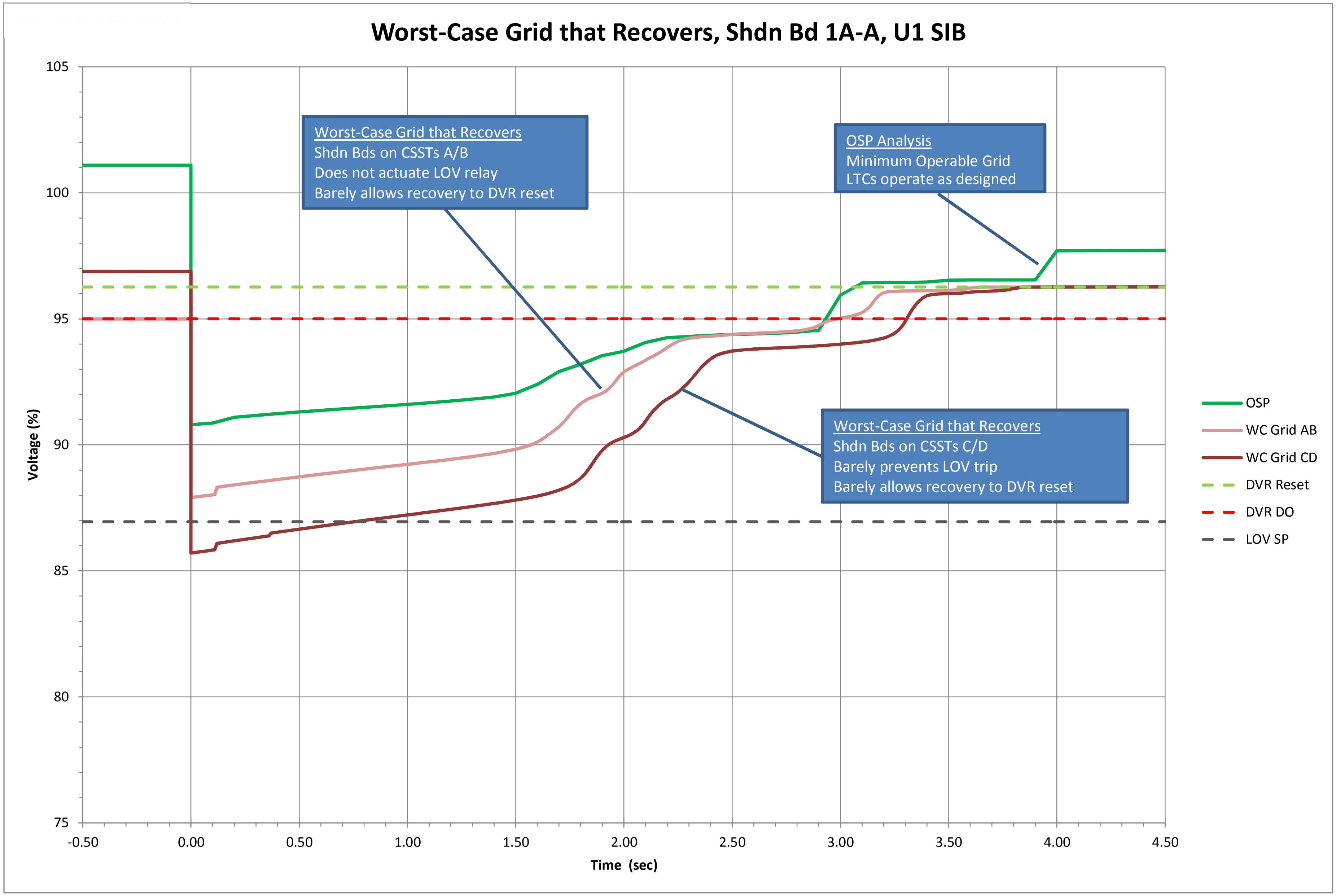

FIGURE 2
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CALCULATION SHEET

3.0 DESIGN INPUT DATA & REQUIREMENTS

The evaluation documented in this calculation was previously performed and documented in the following calculations:

WBN EEB-MS-TI05-0001, Auxiliary Power System Database (TELAS)
WBN EEB-MS-TI06-0002, Auxiliary Power System Analysis (ELMS-NON1E),
WBN EEB-MS-TI06-0010, Auxiliary Power System Analysis on 1E Buses (ELMS-1E).

The design input data identified in these calculations are still valid and will not be repeated here. Only new and significant design input data will be identified here.

3.1 "WBN ETAP CONVERSION, Phase 1 - database Conversion", RIMS B43 990303 001

3.2 Not used

3.3 Acceptable Voltage Ranges

3.3.1 Steady State Board Voltages

	6.9kV Switchgear	480V Switchgear/MCCs
Max:	7260V (2)	508V (2)
Min:	6681V (1)	440V (2)

(1) This is the reset operational limit for the degraded voltage relay (Sec. 3.12).
(2) Per Table 1 of ANSI C84.1 (Ref. 2.23), Utilization Voltage Range B.

3.3.2 Minimum Operating Voltages

Running Motors

	6.6kV**	460V*
Max:	7260V	506V
Min:	5940V	414V

480V Static Loads

Max: 528V
Min: 432V (this voltage is conservative compared to the Range B utilization voltage of 424V in Ref. 2.23)

* NEMA MG1 Section 12.45 requires that motors shall operate with variation in voltage up to plus or minus 10% of rated voltage (Reference 2.24).
** Ref. 2.23, Utilization Voltage Range B.

3.3.3 Minimum Motor Starting Voltages

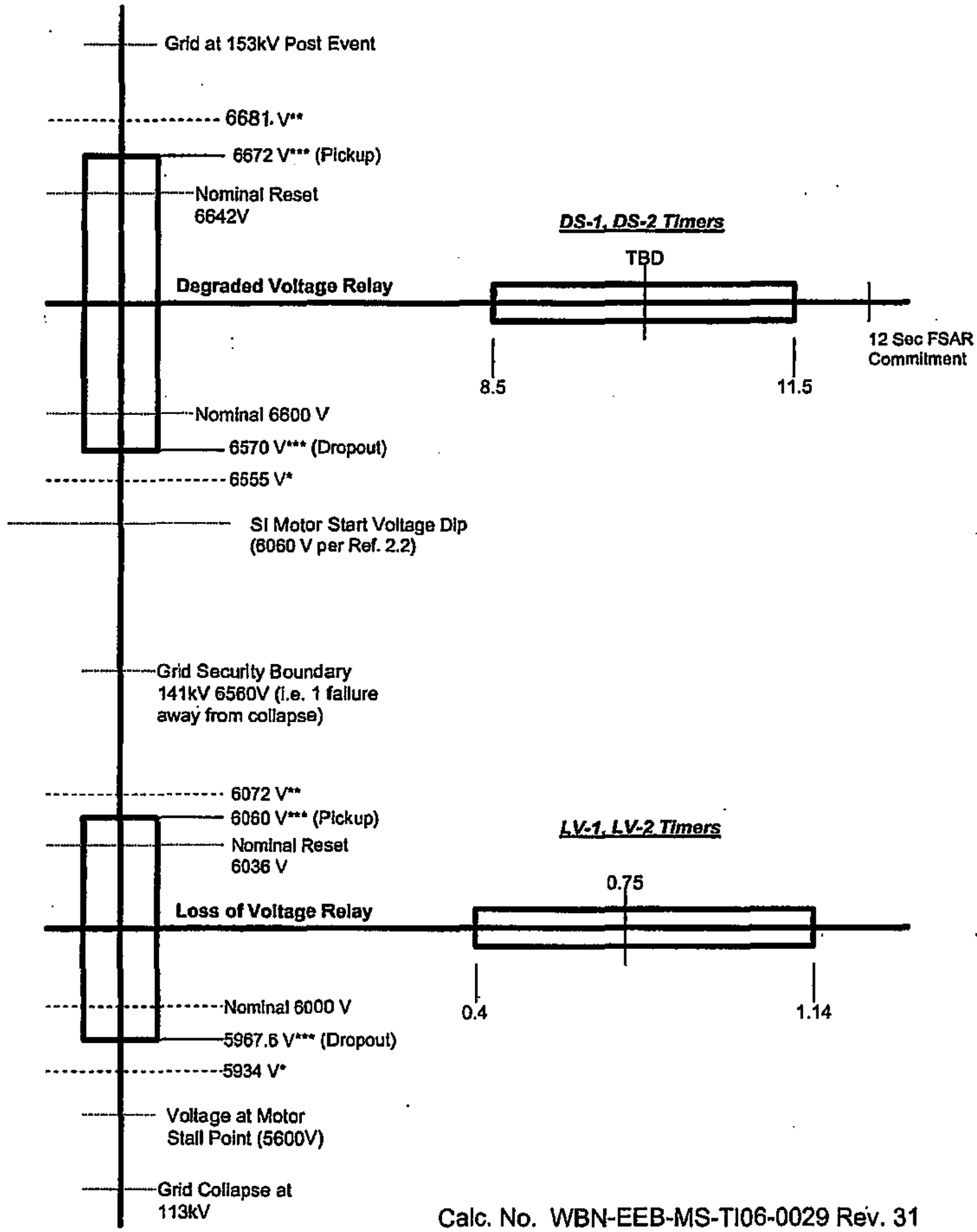
6.6kV Motors	460V Motors	460V Air Comp	89-10 MOVs	Non 89-10 MOVs
5280 (80%)***	391V (85%)**	368V (80%)**	Att. 11.5	368V (80%)**

** Percentages are based on 460V rated motor voltage. For motors rated other than 460V the same percentages are applicable. The minimum starting voltage for these motors may be different from the above voltage if it is based on manufacturer's data or test reports per Att. 11.4.
*** 80% for all motors except the for ERCW Pump motor which requires 90% and Aux Feedwater Pump motor which requires 85%. See Attachment 11.4 for motor starting voltage.

The minimum motor voltages for LV motors are based on the following:

Class 1E motors up to 30HP, NEMA Type B, provide 150 percent starting torque at full voltage which corresponds to close to 100 percent torque at 80 percent voltage (Ref. 2.24). For loads, such as fans, as the speed increases, so does the torque requirement. Other loads such as positive-displacement compressors start unloaded and do not require a

Figure 8.3



Calc. No. WBN-EEB-MS-TI06-0029 Rev. 31
This Sheet revised by Revision 31 .

Figure 8.3 - Degraded Voltage and Loss-of-Voltage Relay Setpoint

* Analytical Limit (Ref. 2.20)
** Operational Limit (Ref. 2.20)
*** Allowable Value (Excludes PT accuracy - Ref. 2.16)

18-Feb-92

~~WBN-EEB-MS-TI06-0010~~

Attachment 10.5

Block Motor Start Data

17-Sep-92

WBN-EEB-MS-TI06-0010 R0
ATTACHMENT 10.5 - BLOCK MOTOR START DATA

MOTOR NO.	BOARD NAME	COMP	MOTOR NAME	HP	FLI	LRA	LRPF	MOTOR Zm	MOTOR Rm	MOTOR jXm	CABLE NO.	CABLE SIZE	CABLE LENGTH	CABLE R	CABLE jX	TOL NO.	TOL R	TOTAL R	TOTAL jX	MIN START VOLT (%)	ACCEL TIME SEC	VOLTAGE REQ	REV
* 2	6.9KV SHTDN BD 1A-A	13	CNTMT SPRAY PMP 1A-A	700.00	52.58	294.0	0.33	12.9609	4.2771	12.2349	1PP625A	3-1C #2/0	630	0.1085	0.0780			0.0684	0.0491	80	3.30	5308.1	
* 3	6.9KV SHTDN BD 1A-A	14	RHR PUMP 1A-A	400.00	30.00	187.5	0.33	20.3227	6.6252	19.2125	1PP575A	3-1C #2/0	663	0.1085	0.0780			0.0719	0.0517	80	3.60	5298.8	
* 4	6.9KV SHTDN BD 1A-A	15	SAFETY INJ PMP 1A-A	400.00	31.00	219.0	0.30	17.3996	5.2199	16.5982	1PP600A	3-1C #2/0	618	0.1085	0.0780			0.0671	0.0482	80	4.00	5300.1	
6	6.9KV SHTDN BD 1A-A	8	ERCW PMP A-A	800.00	63.00	344.0	0.19	11.0771	2.1046	10.8753	1PP675A	3-1C #2/0	3338	0.1085	0.0780			0.3622	0.2604	90	3.60	6116.2	
* 7	6.9KV SHTDN BD 1A-A	10	AUX FEEDWTR PMP 1A-A	600.00	49.50	300.0	0.20	12.7017	2.5403	12.4451	1PP650A	3-1C #2/0	330	0.1085	0.0780			0.0358	0.0257	85	6.60	5624.3	
9	6.9KV SHTDN BD 1A-A	18	CNTFGL CHRG PMP 1A-A	600.00	45.00	269.7	0.35	14.1287	4.9450	13.2351	1PP550A	3-1C #2/0	531	0.1085	0.0780			0.0576	0.0414	80	4.55	5302.1	
* 11	6.9KV SHTDN BD 1B-B	14	RHR PUMP 1B-B	400.00	30.00	187.5	0.33	20.3227	6.6252	19.2125	1PP587B	3-1C #2/0	376	0.1085	0.0780			0.0408	0.0293	80	3.60	5290.7	
* 12	6.9KV SHTDN BD 1B-B	15	SAFETY INJ PMP 1B-B	400.00	31.00	219.0	0.30	17.3996	5.2199	16.5982	1PP612B	3-1C #2/0	780	0.1085	0.0780			0.0846	0.0608	80	4.00	5305.4	
* 13	6.9KV SHTDN BD 1B-B	18	CNTFGL CHRG PMP 1B-B	600.00	45.00	269.7	0.35	14.1287	4.9450	13.2351	1PP562B	3-1C #2/0	698	0.1085	0.0780			0.0757	0.0544	80	4.65	5309.0	
* 15	6.9KV SHTDN BD 1B-B	8	ERCW PMP F-B	800.00	63.00	344.0	0.19	11.0771	2.1046	10.8753	1PP700B	3-1C #2/0	3639	0.1085	0.0780			0.3948	0.2838	90	3.60	6132.3	
* 16	6.9KV SHTDN BD 1B-B	10	AUX FEEDWTR PMP 1B-B	600.00	49.50	300.0	0.20	12.7017	2.5403	12.4451	1PP662B	3-1C #2/0	446	0.1085	0.0780			0.0484	0.0348	85	6.60	5629.4	
* 17	6.9KV SHTDN BD 1B-B	8	CNTMT SPRAY PMP 1B-B	700.00	52.58	294.0	0.33	12.9609	4.2771	12.2349	1PP637B	3-1C #2/0	756	0.1085	0.0780			0.0820	0.0590	80	3.30	5313.8	
* 20	480V SDBD 1A1-A 3200	3B	CMPNT CLG SYS PMP 1A-A	350.00	389.00	2084.0	0.30	0.1274	0.0382	0.1216	1PL4725A	3-1C #500	675	0.0314	0.0540			0.0106	0.0182	70	3.10	374.1	
											1PL4726A	3-1C #500	675	0.0314	0.0540								
44	480V RX MOV BD 1A1-A	18E	RCP SPRAY ISLN VLV	0.67	2.10	10.5	0.60	25.2934	15.1761	20.2348	1V9165A	1-3C #12	486	2.1500	0.0765	T21	1.0700	2.1149	0.0372	85		411.9	
48	480V RX MOV BD 1A1-A	3E	CNTFGL CHRG PMP 1A-A AOP	2.00	3.10	22.6	0.62	11.7670	7.2955	9.2324	1PL6145A	1-3C #12	600	2.1500	0.0765	T31	0.1410	1.4310	0.0459	85		423.2	
49	480V RX MOV BD 1A1-A	8B	VOL CONT TANK OUTLET ISLN VLV	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	1V2760A	1-3C #12	500	2.1500	0.0765	T29	0.2370	1.3120	0.0383	85		424.1	
* 51	480V RX MOV BD 1A1-A	7B	CHARGING FLOW ISLN VLV	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	1V2247A	1-3C #12	684	2.1500	0.0765	T29	0.2370	1.7076	0.0523	80		409.3	
52	480V RX MOV BD 1A1-A	7A	SEAL FLOW RET ISOL VLV	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	1V2800A	1-3C #12	616	2.1500	0.0765	T29	0.2370	1.5614	0.0471	80		405.5	
53	480V RX MOV BD 1A1-A	9A	RWST TO CHARGING PMP VLV CONT	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	1V2070A	1-3C #12	434	2.1500	0.0765	T29	0.2370	1.1701	0.0332	80		395.6	
57	480V RX MOV BD 1A1-A	11D	SIS BORON INJ TANK SHUTOFF VLV	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	1V2680A	1-3C #12	528	2.1500	0.0765	T29	0.2370	1.3722	0.0404	80		400.7	
64	480V RX MOV BD 1A1-A	11E	SIS BIT INLET SHUTOFF VLV	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	1V2695A	1-3C #10	532	1.3500	0.0705	T29	0.2370	0.9552	0.0375	85		415.1	
75	480V RX MOV BD 1A1-A	17C	ANNULUS STANDPIPE ISOL VLV	0.67	2.10	10.5	0.60	25.2934	15.1761	20.2348	1V9360A	1-3C #12	532	2.1500	0.0765	T21	1.0700	2.2138	0.0407	85		412.9	
* 78	480V RX MOV BD 1A1-A	13E	CNTMT SPRAY HDR 1A ISLN VLV	3.20	5.20	35.0	0.60	7.3773	4.4264	5.9018	1V2820A	1-3C #10	352	1.3500	0.0705	T32	0.1000	0.5752	0.0248	80		386.8	
81	480V RX MOV BD 1A1-A	14D	RHR PMP 1A-A MIN FLOW VLV	0.13	0.45	2.6	0.60	102.1466	61.2880	81.7173	1V1935A	1-3C #12	670	2.1500	0.0765	T9	11.7200	13.1605	0.0513	80		398.4	
* 85	480V RX MOV BD 1A1-A	17B	CNTMT STANDPIPE ISLN VLV	0.67	2.10	10.5	0.60	25.2934	15.1761	20.2348	1V9147A	1-3C #12	696	2.1500	0.0765	T21	1.0700	2.5664	0.0532	85		416.6	
* 89	480V DSL AUX BD 1A1A	5A	DG 1A-A AIR CPRSR 2	5.00	7.10	44.5	0.62	5.9681	3.7002	4.6826	PL2195	1-3C #12	100	2.1500	0.0765	T39	0.0288	0.2438	0.0077	85		401.5	
* 91	480V DSL AUX BD 1A1A	3A	EM DG HX 1A1 & 1A2 SPLY VLV	0.13	0.39	2.6	0.60	102.1466	61.2880	81.7173	PL2146A	1-3C #12	155	2.1500	0.0765	T8	13.9500	14.2832	0.0119	85		426.1	
* 93	480V DSL. AUX BD 1A1A	6A	DG 1A-A MUFFLER RM EXH FAN	1.50	2.65	20.0	0.62	13.2791	8.2330	10.4188	PL2235	1-3C #12	62	2.1500	0.0765	T28	0.2950	0.4283	0.0047	85		399.0	
95	480V DSL AUX BD 1A1A	2B	DG 1A-A RM EXH FAN 1-A	15.00	19.50	118.4	0.49	2.2427	1.0989	1.9550	PL2620A	1-3C #8	105	0.8490	0.0705	T49	0.0057	0.0949	0.0074	85		400.5	
*101	480V DSL AUX BD 1A1A	4D	DG RM 1A-A PNL VENT FAN	15.00	20.00	118.4	0.49	2.2427	1.0989	1.9550	PL3444A	1-3C #8	130	0.8490	0.0705	T48	0.0083	0.1186	0.0092	85		402.9	
*104	480V C&A VT BD 1A1-A	10C	PIPE CHASE CLR FAN 1A-A	3.00	4.00	25.2	0.66	10.5389	6.9979	7.8803	1PL3071A	1-3C #10	600	1.3500	0.0705	T32	0.1000	0.9100	0.0423	80	2.80	390.9	
105	480V C&A VT BD 1A1-A	9A	RHR PMP 1A-A RM CLR FAN	5.00	6.10	45.0	0.62	5.9018	3.6591	4.6306	1PL3031A	1-3C #10	624	1.3500	0.0705	T37	0.0430	0.8854	0.0440	80	2.10	406.5	
*106	480V C&A VT BD 1A1-A	3C	CNTM SPRAY PMP 1A-A RM CLR FAN	7.50	9.00	62.0	0.57	4.2836	2.4416	3.5196	1PL3051A	1-3C #10	630	1.3500	0.0705	T40	0.0229	0.8734	0.0444	80	0.70	418.2	
*107	480V C&A VT BD 1A1-A	8A	SAFETY INJ PMP 1A-A RM CLR FAN	5.00	6.10	45.0	0.62	5.9018	3.6591	4.6306	1PL2981A	1-3C #10	632	1.3500	0.0705	T37	0.0430	0.8962	0.0446	80	2.10	407.0	
108	480V C&A VT BD 1A1-A	10A	CNTFG CHRG PMP 1A-A RM CLR FAN	5.00	6.10	45.0	0.62	5.9018	3.6591	4.6306	1PL3001A	1-3C #10	447	1.3500	0.0705	T37	0.0430	0.6465	0.0315	80	2.10	395.7	
109	480V C&A VT BD 1A1-A	5A	SFP PMP A-A&TB BST PM SPCLRFAN	7.50	9.00	62.0	0.57	4.2836	2.4416	3.5196	1PL3151A	1-3C #10	240	1.3500	0.0705	T40	0.0229	0.3469	0.0169	80	0.70	386.9	
*110	480V C&A VT BD 1A1-A	5E	CCS & AFW PMPS SP CLR FAN A-A	20.00	24.50	139.9	0.38	1.8984	0.7138	1.7591	1PL3191A	1-3C #8	400	0.8490	0.0705	T50	0.0036	0.3432	0.0282	80	0.48	402.5	
111	480V C&A VT BD 1A1-A	6B	PEN RM EL 737 CLR FAN 1A-A	3.00	4.00	25.3	0.65	10.4973	6.8127	7.9862	1PL3091A	1-3C #10	172	1.3500	0.0705	T32	0.1000	0.3322	0.0121	80	2.40	376.0	
112	480V C&A VT BD 1A1-A	2C	PEN RM EL 692 CLR FAN 1A-A	3.00	4.00	25.0	0.62	10.6232	6.5864	8.3350	1PL3131A	1-3C #10	486	1.3500	0.0705	T32	0.1000	0.7561	0.0343	80	2.40	385.7	
113	480V C&A VT BD 1A1-A	10B	PEN RM EL 713 CLR FAN 1A-A	3.00	4.00	26.0	0.62	10.2147	6.3331	8.0144	1PL3111A	1-3C #10	396	1.3500	0.0705	T32	0.1000	0.6346	0.0279	80	0.90	383.4	
*117	480V C&A VT BD 1A1-A	2A	CONT BLDG EMERG AIR CU FAN A-A	10.00	12.20	110.0	0.53	2.4144	1.2796	2.0474	1PL3301A	1-3C #8	240	0.8490	0.0705	T43	0.0139	0.2176	0.0169	85		413.0	
*118	480V C&A VT BD 1A1-A	12B	CONT BLDG EMERG PRESS FAN A-A	1.00	1.70	15.0	0.62	17.7054	10.9774	13.8917	1PL3787A	1-3C #12	682	2.1500	0.0765	T25	0.4950	1.9613	0.0522	85		420.1	
119	480V C&A VT BD 1A1-A	4D	EMERG GAS TRTMT SYS A-A	20.00	25.00	132.0	0.46	2.0120	0.9255	1.7865	1PL3520A	1-3C #8	368	0.8490	0.0705	T50	0.0036	0.3160	0.0259	75	9.70	376.7	
208	480V RX MOV BD 1A2-A	3D	ST GEN NO.1 FW ISOL VLV	39.40	48.10	494.0	0.45	0.5376	0.2419	0.4801	1V2980A	3-1C #300	850	0.0500	0.0585	T53	0.0023	0.0448	0.0497	70		360.8	
			ST GEN NO.1 FW ISOL VLV BRAKE		0.30	2.6	1.00	176.9231	176.9231	0.0000	1V2980A	3-1C #4	530	0.3363	0.0630		0.4317	0.7881	0.0668	80		369.6	
*211	480V RX MOV BD 1A2-A	4D	ST GEN NO.3 FW ISOL VLV	39.40	48.10	494.0	0.45	0.5376	0.2419	0.4801	1V2990A	3-1C #300	850	0.0500	0.0585	T53	0.0023	0.0448	0.0497	70		360.8	
			ST GEN NO.3 FW ISOL VLV BRAKE		0.30	2.6	1.00	176.9231	176.9231	0.0008	1V2990A	3-1C #4	508	0.3363	0.0630		0.4317	0.7733	0.7734	80		369.6	
216	480V RX MOV BD 1A2-A	9D	UPR CNT VT CLR 1A DIS ISOL VLV	0.13	0.45	3.1	0.60	84.5800	50.7480	67.6640	1V3086A	1-3C #12	492	2.1500	0.0765	T9	11.7200	12.7778	0.0376	85		431.6	
											1V3087A	3-1C #12	340	2.1500	0.0765			0.7310	0.0260				

THIS SHEET ADDED BY REV. 4

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Attachment 3
Required Motor Starting Voltage
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ATTACHMENT 10.5 - BLOCK MOTOR START DATA

MOTOR NO.	BOARD NAME	COMP	MOTOR NAME	HP	FLI	LRA	LRPF	MOTOR Zm	MOTOR Rm	MOTOR jXm	CABLE NO.	CABLE SIZE	CABLE LENGTH	CABLE R	CABLE jX	TOL NO.	TOL R	TOTAL R	TOTAL jX	MIN START VOLT (%)	ACCEL TIME SEC	VOLTAGE REQ	REV
221	480V RX MOV BD 1A2-A	7D	LWR CNTMT CLR 1A DISCH ISO VLV	0.13	0.60	3.5	0.60	75.8803	45.5282	60.7043	1V2261A	1-3C #12	375	2.1500	0.0765	T12	7.5300	8.3363	0.0287	85		418.6	
											1V2262A	1-3C #12	35	2.1500	0.0765			0.0753	0.0027				
222	480V RX MOV BD 1A2-A	7F	UPR CNTM VT CLR 1A SUP ISO VLV	0.13	0.45	3.2	0.60	84.3115	50.5869	67.4492	1V3020A	1-3C #12	250	2.1500	0.0765	T9	11.7200	12.2575	0.0191	85		427.6	
223	480V RX MOV BD 1A2-A	8F	UPR CNTM VT CLR 1C SUP ISO VLV	0.13	0.45	3.2	0.60	84.3115	50.5869	67.4492	1V3035A	1-3C #12	250	2.1500	0.0765	T9	11.7200	12.2575	0.0191	85		427.6	
224	480V RX MOV BD 1A2-A	8B	LWR CNTMT 1A CLR SPLY ISOL VLV	0.33	0.95	5.7	0.60	46.5932	27.9559	37.2745	1V1990A	1-3C #12	441	2.1500	0.0765	T15	3.7900	4.7382	0.0337	85		416.3	
225	480V RX MOV BD 1A2-A	9A	LWR CNTMT 1C CLR SPLY ISOL VLV	0.33	0.95	5.7	0.60	46.5932	27.9559	37.2745	1V2020A	1-3C #12	535	2.1500	0.0765	T15	3.7900	4.9403	0.0409	85		417.5	
226	480V RX MOV BD 1A2-A	10D	UP CNTM VT CLR 1C DISH ISO VLV	0.13	0.45	3.1	0.60	84.5800	50.7480	67.6640	1V3096A	1-3C #12	472	2.1500	0.0765	T9	11.7200	12.7348	0.0361	85		430.5	
											1V3097A	3-1C #12	200	2.1500	0.0765			0.4300	0.0153				
229	480V RX MOV BD 1A2-A	9F	UP CNTM VT CLR 1B DISH ISO VLV	0.13	0.45	3.2	0.60	84.3115	50.5869	67.4492	1V3060A	1-3C #12	250	2.1500	0.0765	T9	11.7200	12.2575	0.0191	85		427.6	
230	480V RX MOV BD 1A2-A	9B	LWR CNTMT 1B CLR DISCH ISO VLV	0.33	0.95	5.7	0.60	46.5932	27.9559	37.2745	1V2030A	1-3C #12	510	2.1500	0.0765	T15	3.7900	4.8865	0.0390	85		417.1	
231	480V RX MOV BD 1A2-A	8D	LWR CNTMT 1C CLR DISCH ISO VLV	0.13	0.60	3.5	0.60	75.8803	45.5282	60.7043	1V3210A	1-3C #12	494	2.1500	0.0765	T12	7.5300	8.5921	0.0378	85		419.5	
											1V3211A	3-1C #12	40	2.1500	0.0765			0.0860	0.0031				
233	480V RX MOV BD 1A2-A	10F	UP CNTM VT CLR 1D DISH ISO VLV	0.13	0.45	3.2	0.60	84.3115	50.5869	67.4492	1V3078A	1-3C #12	250	2.1500	0.0765	T9	11.7200	12.2575	0.0191	85		427.6	
234	480V RX MOV BD 1A2-A	10A	LWR CNTMT 1D CLR DISCH ISO VLV	0.33	0.95	5.7	0.60	46.5932	27.9559	37.2745	1V2090A	1-3C #12	416	2.1500	0.0765	T15	3.7900	4.6844	0.0318	85		416.0	
*237	480V RX MOV BD 1A2-A	11D	RCP THRM BARR RTN CNTM ISO VLV	0.70	2.30	12.0	0.60	22.1318	13.2791	17.7054	1V2650A	1-3C #12	650	2.1500	0.0765	T24	0.6320	2.0295	0.0497	85		414.2	
*238	480V RX MOV BD 1A2-A	11E	RCP THRM BARR CNTMT ISOL VLV	0.13	0.45	2.6	0.60	102.1466	61.2880	81.7173	1V2660A	1-3C #12	650	2.1500	0.0765	T9	11.7200	13.1175	0.0497	85		423.2	
241	480V RX MOV BD 1A2-A	12D	RCP OIL CLR RTN CNTMT ISLN VLV	0.13	0.60	3.2	0.60	84.3115	50.5869	67.4492	1V2867A	1-3C #12	625	2.1500	0.0765	T12	7.5300	8.8738	0.0478	85		417.2	
242	480V RX MOV BD 1A2-A	12F	RCP OIL CLR HDR CNTMT ISLN VLV	0.33	0.95	5.7	0.60	46.5932	27.9559	37.2745	1V2878A	1-3C #12	650	2.1500	0.0765	T14	4.7200	6.1175	0.0497	85		424.1	
*251	480V RX MOV BD 1A2-A	16D	EXCS LTDN HX CONT INLT ISO VLV	0.33	0.95	5.7	0.60	46.5932	27.9559	37.2745	1V2292A	1-3C #12	650	2.1500	0.0765	T15	3.7900	5.1875	0.0497	85		418.9	
255	480V RX MOV BD 1A2-A	13E	ANNULUS SPR ISLN VLV	1.00	2.10	5.0	0.60	53.1162	31.8697	42.4930	1V9157A	1-3C #12	600	2.1500	0.0765	T19	1.6600	2.9500	0.0459	85		404.7	
*287	480V DSL AUX BD 1A2A	5A	DG 1A-A AIR CPRSR 1	5.00	7.10	44.5	0.62	5.9695	3.7011	4.6836	PL2200	1-3C #12	74	2.1500	0.0765	T39	0.0288	0.1879	0.0057	85		399.0	
*289	480V DSL AUX BD 1A2A	2B	DG 1A-A RM EXH FAN 2-A	15.00	19.50	118.4	0.49	2.2430	1.0991	1.9551	PL2629A	1-3C #8	66	0.8490	0.0705	T49	0.0057	0.0618	0.0047	85		397.1	
*301	480V SDBD 1B1-B 3200	3C	CMPNT CLG SYS PMP 1B-B	350.00	383.00	2094.0	0.30	0.1274	0.0382	0.1216	1PL4743B	3-1C #300	575	0.0500	0.0585			0.0144	0.0168	70		374.1	
											1PL4742B	3-1C #300	575	0.0500	0.0585								
*327	480V RX MOV BD 1B1-B	4D	CNTFGL CHRG PMP 1B-B AOP	2.00	3.10	22.6	0.62	11.7670	7.2955	9.2324	1PL6152B	1-3C #12	648	2.1500	0.0765	T31	0.1410	1.5342	0.0496	85		425.7	
328	480V RX MOV BD 1B1-B	8A	VOL CONT TANK OUTLET ISLN VLV	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	1V2770B	1-3C #12	485	2.1500	0.0765	T29	0.2370	1.2798	0.0371	85		423.3	
330	480V RX MOV BD 1B1-B	7A	CHRG FLOW ISLN VLV	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	1V2255B	1-3C #12	670	2.1500	0.0765	T29	0.2370	1.6775	0.0513	80		408.5	
333	480V RX MOV BD 1B1-B	6D	SEAL FLOW RET ISLN VLV	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	1V2808B	1-3C #12	282	2.1500	0.0765	T29	0.2370	0.8433	0.0216	80		398.8	
											1V2809B	3-1C #14	135	3.4130	0.0825			0.4608	0.0111	80			
334	480V RX MOV BD 1B1-B	6B	RWST TO CHARGING PMP VLV CONT	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	1V2100B	1-3C #12	612	2.1500	0.0765	T29	0.2370	1.5528	0.0468	80		405.3	
*336	480V RX MOV BD 1B1-B	17B	ANNULUS STANDPIPE ISLN VLV	0.67	2.10	5.0	0.60	53.1162	31.8697	42.4930	1V9155B	1-3C #12	850	2.1500	0.0765	T19	1.6600	3.4875	0.0650	85		407.3	
*340	480V RX MOV BD 1B1-B	11E	SIS BORON INJ TANK SHUTOFF VLV	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	1V2687B	1-3C #10	642	1.3500	0.0705	T29	0.2370	1.1037	0.0453	85		419.0	
*360	480V RX MOV BD 1B1-B	14A	CNTMT SPRAY HDR 1B ISLN VLV	3.20	5.20	36.0	0.60	7.3773	4.4264	5.9018	1V2830B	1-3C #10	430	1.3500	0.0705	T32	0.1000	0.6805	0.0303	80		390.5	
*364	480V RX MOV BD 1B1-B	15B	RHR PMP 1B-B MIN FLOW VLV	0.13	0.45	3.2	0.60	84.3115	50.5869	67.4492	1V1915B	1-3C #12	826	2.1500	0.0765	T9	11.7200	13.4959	0.0632	80		406.3	
*369	480V DSL AUX BD 1B1B	5A	DG 1B-B AIR CPRSR 2	5.00	7.10	44.5	0.62	5.9681	3.7002	4.6826	PL2215	1-3C #12	120	2.1500	0.0765	T39	0.0288	0.2868	0.0092	85		403.4	
*371	480V DSL AUX BD 1B1B	3A	EM DG ENG HX SUP VLV FM HDR 1B	0.13	0.39	2.6	0.60	102.1466	61.2880	81.7173	PL2167B	1-3C #12	158	2.1500	0.0765	T8	13.9500	14.2897	0.0121	85		426.1	
*373	480V DSL AUX BD 1B1B	6A	DG 1B-B MUFFLER RM EXH FAN	1.50	2.65	20.0	0.62	13.2791	8.2330	10.4188	PL2249	1-3C #12	65	2.1500	0.0765	T28	0.2950	0.4347	0.0050	85		399.2	
376	480V DSL AUX BD 1B1B	2B	DG 1B-B RM EXH FAN 1-B	15.00	19.50	118.4	0.49	2.2431	1.0991	1.9553	PL2656B	1-3C #8	132	0.8490	0.0705	T49	0.0057	0.1178	0.0093	85		402.8	
*381	480V DSL AUX BD 1B1B	4D	DG RM 1B-B PNL VENT FAN	15.00	20.00	118.4	0.49	2.2431	1.0991	1.9553	PL3452B	1-3C #8	150	0.8490	0.0705	T48	0.0083	0.1357	0.0106	85		404.7	
*383	480V C&A VT BD 1B1-B	3B	PIPE CHASE CLR FAN 1B-B	3.00	4.00	25.2	0.66	10.5389	6.9979	7.8803	1PL3081B	1-3C #10	597	1.3500	0.0705	T32	0.1000	0.8992	0.0417	80	2.80	390.6	
*384	480V C&A VT BD 1B1-B	9A	RHR PMP 1B-B RM CLR FAN	5.00	6.10	45.0	0.62	5.9018	3.6591	4.6306	1PL3041B	1-3C #10	756	1.3500	0.0705	T37	0.0430	1.0636	0.0533	80	2.10	414.7	
*385	480V C&A VT BD 1B1-B	3C	CNTM SPRAY PMP 1B-B RM CLR FAN	7.50	9.00	62.0	0.57	4.2836	2.4416	3.5196	1PL3061B	1-3C #10	594	1.3500	0.0705	T40	0.0229	0.8248	0.0419	80	0.70	415.2	
386	480V C&A VT BD 1B1-B	5A	SFP PMPB-B&TB BST PMP SPCLRFAN	7.50	9.00	62.0	0.57	4.2836	2.4416	3.5196	1PL3161B	1-3C #10	520	1.3500	0.0705	T40	0.0229	0.7249	0.0367	80	0.70	409.1	
387	480V C&A VT BD 1B1-B	5E	CCS &AFW PUMPS SP CLR FAN B-B	20.00	24.50	139.9	0.38	1.8384	0.7138	1.7591	1PL3201B	1-3C #8	370	0.8490	0.0705	T50	0.0036	0.3177	0.0261	80	0.48	399.7	
388	480V C&A VT BD 1B1-B	8A	SAFETY INJ PMP 1B-B RM CLR FAN	5.00	6.10	50.1	0.62	5.2969	3.2840	4.1559	1PL2991B	1-3C #10	756	1.3500	0.0705	T37	0.0430	1.0636	0.0533	80	2.10	420.4	
389	480V C&A VT BD 1B1-B	10A	CNTFG CHRG PMP 1B-B RM CLR FAN	5.00	6.10	45.0	0.62	5.9018	3.6591	4.6306	1PL3011B	1-3C #10	596	1.3500	0.0705	T37	0.0430	0.8476	0.0420	80	2.10	404.8	
390	480V C&A VT BD 1B1-B	8B	PEN RM EL 692 CLR FAN 1B-B	3.00	4.00	25.0	0.62	10.6232	6.5864	8.3350	1PL3141B	1-3C #10	540	1.3500	0.0705	T32	0.1000	0.8290	0.0381	80	2.40	387.4	
391	480V C&A VT BD 1B1-B	2C	PEN RM EL 713 CLR FAN 1B-B	3.00	4.00	26.0	0.62	10.2147	6.3331	8.0144	1PL3121B	1-3C #10	404	1.3500	0.0705	T32	0.1000	0.6454	0.0285	80	0.90	383.6	
392	480V C&A VT BD 1B1-B	9E	PEN RM EL 737 CLR FAN 1B-B	3.00	4.00	25.3	0.65	10.4973	6.8127	7.9862	1PL3101B	1-3C #10	410	1.3500	0.0705	T32	0.1000	0.6525	0.0289	80	2.40	384.0	
*397	480V C&A VT BD 1B1-B	11A	CONT BLDG EMERG PRESS FAN B-B	1.00	1.70	15.0	0.62	17.7054	10.9774	13.8917	1PL3795B	1-3C #12	150	2.1500	0.0765	T25	0.4950	0.8175	0.0115	85		402.6	

THIS SHEET ADDED BY REV. 4

ATTACHMENT 10.5 - BLOCK MOTOR START DATA

MOTOR NO.	BOARD NAME	COMP	MOTOR NAME	HP	FLI	LRA	LRPF	MOTOR Zm	MOTOR Rm	MOTOR jXm	CABLE NO.	CABLE SIZE	CABLE LENGTH	CABLE R	CABLE jX	TDL NO.	TDL R	TOTAL R	TOTAL jX	MIN START VOLT (%)	ACCEL TIME SEC	VOLTAGE REQ	REV
*398	480V C&A VT BD 1B1-B	2A	CONT BLDG EM AIR CLNUP FAN B-B	10.00	12.20	110.0	0.53	2.4144	1.2796	2.0474	1PL3308B	1-3C #8	210	0.8490	0.0705	T43	0.0139	0.1922	0.0148	85		410.3	
*399	480V C&A VT BD 1B1-B	4D	EMERG GAS TRTMT SYS FAN B-B	20.00	25.00	132.0	0.46	2.0120	0.9255	1.7865	1PL3530B	1-3C #8	560	0.8490	0.0705	T50	0.0036	0.4790	0.0395	75	9.70	395.0	
498	480V RX MOV BD 1B2-B	3D	ST GEN NO 2 FW ISLN VLV	39.40	48.10	494.0	0.45	0.6792	0.3057	0.6066	1V3000B	3-1C #300	850	0.0500	0.0585	T53	0.0023	0.0873	0.0497	70		362.7	
			ST GEN NO 2 FW ISLN VLV BRAKE		0.30	2.6	1.00	176.9231	176.9231	0.0000	1V3000B	3-1C #4	824	0.3363	0.0630		0.4393	0.9935	0.1038	80		370.1	
*500	480V RX MOV BD 1B2-B	4D	ST GEN NO 4 FW ISLN VLV	39.40	48.10	494.0	0.45	0.6792	0.3057	0.6066	1V3010B	3-1C #300	850	0.0500	0.0585	T53	0.0023	0.0873	0.0497	70		362.7	
			ST GEN NO 4 FW ISLN VLV BRAKE		0.30	2.6	1.00	176.9231	176.9231	0.0000	1V3010B	3-1C #4	724	0.3363	0.0630		0.4393	0.9263	0.0912	80		369.9	
505	480V RX MOV BD 1B2-B	6D	RCP THRM BAR RTN CNTMT ISO VLV	0.70	2.30	12.0	0.60	22.1318	13.2791	17.7054	1V2640B	1-3C #12	618	2.1500	0.0765	T24	0.6320	1.9607	0.0473	85		415.9	
											1V2647B	1-3C #12	100	2.1500	0.0765			0.2150	0.0077				
506	480V RX MOV BD 1B2-B	6E	RCP THRM BAR CNTMT ISO VLV	0.13	0.45	2.6	0.60	102.1466	61.2880	81.7173	1V2670B	1-3C #12	522	2.1500	0.0765	T9	11.7200	12.8423	0.0399	85		422.4	
507	480V RX MOV BD 1B2-B	9D	UP CNTM VT CLR 1B DISH ISO VLV	0.13	0.45	2.6	0.60	102.1466	61.2880	81.7173	1V3106B	1-3C #12	463	2.1500	0.0765	T9	11.7200	12.7155	0.0354	85		424.6	
											1V3107B	1-3C #12	440	2.1500	0.0765			0.9460	0.0337				
*510	480V RX MOV BD 1B2-B	7D	LWR CNTMT 1B CLR DISH ISO VLV	0.13	0.60	3.5	0.60	75.8803	45.5282	60.7043	1V2275B	1-3C #12	649	2.1500	0.0765	T12	7.5300	8.9254	0.0496	85		420.7	
											1V2276B	1-3C #12	40	2.1500	0.0765			0.0860	0.0031				
511	480V RX MOV BD 1B2-B	9F	UP CNTM VT CLR 1B SUP ISO VLV	0.13	0.45	3.1	0.60	84.5800	50.7480	67.6640	1V3051B	1-3C #12	545	2.1500	0.0765	T9	11.7200	12.8918	0.0417	85		429.6	
512	480V RX MOV BD 1B2-B	10F	UP CNTM VT CLR 1D SUP ISO VLV	0.13	0.45	3.2	0.60	84.3115	50.5869	67.4492	1V3096B	1-3C #12	304	2.1500	0.0765	T9	11.7200	12.3736	0.0233	85		428.0	
513	480V RX MOV BD 1B2-B	10A	LWR CNTMT 1B CLR SPLY ISLN VLV	0.33	0.95	5.7	0.60	46.5932	27.9559	37.2745	1V2050B	1-3C #12	513	2.1500	0.0765	T15	3.7900	4.8930	0.0392	85		417.2	
514	480V RX MOV BD 1B2-B	10B	LWR CNTMT 1D CLR SPLY ISLN VLV	0.33	0.95	5.7	0.60	46.5932	27.9559	37.2745	1V2060B	1-3C #12	337	2.1500	0.0765	T15	3.7900	4.5146	0.0258	85		415.0	
515	480V RX MOV BD 1B2-B	10D	UP CNTM VT CLR 1D DIS ISO VLV	0.13	0.45	3.14	0.60	84.5800	50.7480	67.6640	1V3120B	1-3C #12	255	2.1500	0.0765	T9	11.7200	12.2683	0.0195	85		429.9	
											1V3121B	1-3C #12	340	2.1500	0.0765			0.7310	0.0260				
518	480V RX MOV BD 1B2-B	7F	UP CNTM VT CIR 1A DISH ISO VLV	0.13	0.45	3.2	0.60	84.3115	50.5869	67.4492	1V3028B	1-3C #12	472	2.1500	0.0765	T9	11.7200	12.7348	0.0361	85		429.2	
519	480V RX MOV BD 1B2-B	9A	LWR CNTMT 1A CIR DISH ISO VLV	0.33	0.95	5.7	0.60	46.5932	27.9559	37.2745	1V2010B	1-3C #12	525	2.1500	0.0765	T15	3.7900	4.9188	0.0402	85		417.3	
520	480V RX MOV BD 1B2-B	8D	LWR CNTMT 1D CIR DISH ISO VLV	0.13	0.60	3.5	0.60	75.8803	45.5282	60.7043	1V2283B	1-3C #12	463	2.1500	0.0765	T12	7.5300	8.5255	0.0354	85		419.5	
											1V2284B	1-3C #12	67	2.1500	0.0765			0.1440	0.0051				
522	480V RX MOV BD 1B2-B	8F	UP CNTM VT CIR 1C DISH ISO VLV	0.13	0.45	3.2	0.60	84.3115	50.5869	67.4492	1V3043B	1-3C #12	495	2.1500	0.0765	T9	11.7200	12.7843	0.0379	85		429.3	
523	480V RX MOV BD 1B2-B	9B	LWR CNTMT 1C CIR DISH ISO VLV	0.33	0.95	5.7	0.60	46.5932	27.9559	37.2745	1V2040B	1-3C #12	488	2.1500	0.0765	T15	3.7900	4.8392	0.0373	85		416.9	
*528	480V RX MOV BD 1B2-B	12F	ANNULUS SPR ISLN VLV	0.67	2.10	5.0	0.60	53.1162	31.8697	42.4930	1V2170B	1-3C #12	720	2.1500	0.0765	T19	1.6600	3.2080	0.0551	85		405.9	
*534	480V RX MOV BD 1B2-B	13F	RCP OIL CLR HDR CNTMT ISLN VLV	0.33	0.95	5.7	0.60	46.5932	27.9559	37.2745	1V2888B	1-3C #12	546	2.1500	0.0765	T15	3.7900	4.9639	0.0418	85		417.6	
540	480V RX MOV BD 1B2-B	13D	RCP OIL CLR RTN CNTMT ISLN VLV	0.13	0.60	3.5	0.60	75.8803	45.5282	60.7043	1V2854B	1-3C #12	265	2.1500	0.0765	T12	7.5300	8.0998	0.0203	85		418.2	
											1V2855B	1-3C #12	100	2.1500	0.0765			0.2150	0.0077				
*570	480V DSL AUX BD 1B2B	5A	DG 1B-B AIR CPRSR 1	5.00	7.10	44.5	0.62	5.9681	3.7002	4.6826	PL2220	1-3C #12	100	2.1500	0.0765	T39	0.0288	0.2438	0.0077	85		401.5	
*572	480V DSL AUX BD 1B2B	2B	DG 1B-B RM EXH FAN 2-B	15.00	19.50	118.4	0.49	2.2427	1.0991	1.9553	PL2665B	1-3C #8	110	0.8490	0.0705	T49	0.0057	0.0991	0.0078	85		401.0	
*585	6.9KV SHTDN BD 2A-A	1B	CNTFGL CHRG PMP 2A-A	600.00	45.00	269.7	0.35	14.1287	4.9450	13.2351	2PP550A	3-1C #2/0	673	0.1085	0.0780			0.0730	0.0525	80	4.65	5308.0	
587	6.9KV SHTDN BD 2A-A	8	ERCW PMP D-A	800.00	63.00	344.0	0.19	11.0771	2.1046	10.8753	2PP687A	3-1C #2/0	3186	0.1085	0.0780			0.3457	0.2485	80	3.60	5429.4	
*588	6.9KV SHTDN BD 2A-A	10	AUX FEEDWTR PMP 2A-A	600.00	49.50	300.0	0.20	12.7017	2.5403	12.4451	2PP575A	3-1C #2/0	470	0.1085	0.0780			0.0510	0.0367	85	6.60	5630.4	
*596	6.9KV SHTDN BD 2B-B	8	ERCW PMP H-B	800.00	63.00	344.0	0.19	11.0771	2.1046	10.8753	2PP712B	3-1C #2/0	3822	0.1085	0.0780			0.4147	0.2981	90	3.60	6142.1	
*597	6.9KV SHTDN BD 2B-B	10	AUX FEEDWTR PMP 2B-B	600.00	49.50	300.0	0.20	12.7017	2.5403	12.4451	2PP587B	3-1C #2/0	300	0.1085	0.0780			0.0326	0.0234	85	6.60	5623.0	
*660	480V DSL AUX BD 2A1A	5A	DG 2A-A AIR CPRSR 2	5.00	7.10	44.5	0.62	5.9681	3.7002	4.6826	PL2205	1-3C #12	100	2.1500	0.0765	T39	0.0288	0.2438	0.0077	85		401.5	
*662	480V DSL AUX BD 2A1A	3A	EM DG ENG HX 2A1 & 2A2 SUP VLV	0.13	0.39	2.6	0.60	102.1466	61.2880	81.7173	PL2160A	1-3C #12	160	2.1500	0.0765	T8	13.9500	14.2940	0.0122	85		426.1	
*664	480V DSL AUX BD 2A1A	6A	DG 2A-A MUFFLER RM EXH FAN	1.50	2.65	20.0	0.62	13.2791	8.2330	10.4188	PL2242	1-3C #12	52	2.1500	0.0765	T28	0.2950	0.4068	0.0040	85		398.6	
667	480V DSL AUX BD 2A1A	2B	DG 2A-A RM EXH FAN 1-A	15.00	19.50	118.4	0.49	2.2427	1.0989	1.9550	PL2638A	1-3C #8	70	0.8490	0.0705	T49	0.0057	0.0652	0.0049	85		397.4	
*672	480V DSL AUX BD 2A1A	4D	DG RM 2A-A PNL VENT FAN	15.00	20.00	118.4	0.49	2.2427	1.0989	1.9550	PL3448A	1-3C #8	130	0.8490	0.0705	T48	0.0083	0.1186	0.0092	85		402.9	
674	480V C&A VT BD 2A1-A	10C	PIPE CHASE CLR FAN 2A-A	3.00	4.30	25.2	0.66	10.5389	6.9979	7.8803	2PL3071A	1-3C #10	700	1.3500	0.0705	T32	0.1000	1.0450	0.0494	85		419.0	
*679	480V C&A VT BD 2A1-A	5E	AFW &HA XFR SPACE CLR FAN A-A	15.00	20.20	105.2	0.49	2.5236	1.2366	2.1999	2PL3151A	1-3C #8	210	0.8490	0.0705	T48	0.0083	0.1866	0.0148	85		407.9	
680	480V C&A VT BD 2A1-A	8B	PEN RM EL 737 CLR FAN 2A-A	3.00	4.00	25.5	0.66	10.4027	6.8658	7.8152	2PL3091A	1-3C #10	262	1.3500	0.0705	T32	0.1000	0.4537	0.0185	80	2.40	379.3	
*681	480V C&A VT BD 2A1-A	2C	PEN RM EL 692 CLR FAN 2A-A	3.00	4.30	26.7	0.62	9.9506	6.1694	7.8072	2PL3131A	1-3C #10	776	1.3500	0.0705	T32	0.1000	1.1476	0.0547	85		422.0	
682	480V C&A VT BD 2A1-A	10B	PEN RM EL 713 CLR FAN 2A-A	3.00	4.00	26.7	0.62	9.9506	6.1694	7.8072	2PL3111A	1-3C #10	350	1.3500	0.0705	T32	0.1000	0.5725	0.0247	85		406.1	
689	480V C&A VT BD 2A1-A	4A	EG TRTMT SYS A-A RM CLR FAN	3.00	4.10	27.0	0.53	9.8363	5.2133	8.3412	2PL3774A	1-3C #10	500	1.3500	0.0705	T32	0.1000	0.7750	0.0353	80	1.05	385.2	
*690	480V C&A VT BD 2A1-A	3D	AUX BLDG GAS TRTMT SYS FAN A-A	50.00	62.00	304.0	0.37	0.8736	0.3232	0.8116	2PL2748A	1-3C #2	550	0.2134	0.0615	T56	0.0012	0.1186	0.0338	75	9.10	376.7	
*843	480V DSL AUX BD 2A2A	5A	DG 2A-A AIR CPRSR 1	5.00	7.25	46.0	0.62	5.7735	3.5796	4.5299	PL2210	1-3C #12	82	2.1500	0.0765	T38	0.0348	0.2111	0.0063	85		400.3	
*845	480V DSL AUX BD 2A2A	2B	DG 2A-A RM EXH FAN 2-A	15.00	19.50	118.4	0.49	2.2427	1.0989	1.9550	PL2647A	1-3C #8	100	0.8490	0.0705	T49	0.0057	0.0906	0.0070	85		400.0	

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ATTACHMENT 10.5 - BLOCK MOTOR START DATA

MOTOR NO.	BOARD NAME	COMP	MOTOR NAME	HP	FLI	LRA	LRPF	MOTOR Zm	MOTOR Rm	MOTOR jXm	CABLE NO.	CABLE SIZE	CABLE LENGTH	CABLE R	CABLE jX	TOL NO.	TOL R	TOTAL R	TOTAL jX	MIN START VOLT (%)	ACCEL TIME SEC	VOLTAGE REQ	REV
*301	480V SDBD 2B1-B 3200	3C	CMPNT CLG SYS PMP 2B-B	350.00	389.00	2084.0	0.30	0.1274	0.0382	0.1216	2PL4742B	3-1C #500	675	0.0314	0.0540			0.0106	0.0182	70	3.10	374.1	
											2PL4743B	3-1C #500	675	0.0314	0.0540								
*914	480V DSL AUX BD 2B1B	5A	DG 2B-B AIR CPRSR 2	5.00	7.10	44.5	0.62	5.9681	3.7002	4.6826	PL2225	1-3C #12	122	2.1500	0.0765	T39	0.0288	0.2911	0.0093	85		403.6	
*916	480V DSL AUX BD 2B1B	3A	EM DG ENG SUP VLV FROM HDR 1B	0.13	0.39	2.6	0.62	102.1466	63.3309	80.1444	PL2180B	1-3C #12	162	2.1500	0.0765	T8	13.9500	14.2983	0.0124	85		427.1	
*918	480V DSL AUX BD 2B1B	6A	DG 2B-B MUFFLER RM EXH FAN	1.50	2.65	20.0	0.62	13.2791	8.2330	10.4188	PL2255	1-3C #12	80	2.1500	0.0765	T29	0.2370	0.4090	0.0061	85		398.7	
921	480V DSL AUX BD 2B1B	2B	DG 2B-B RM EXH FAN FAN 1B	15.00	19.50	118.4	0.49	2.2427	1.0989	1.9550	PL2674B	1-3C #8	120	0.8490	0.0705	T49	0.0057	0.1076	0.0085	85		401.8	
*927	480V DSL AUX BD 2B1B	4D	DG RM 2B-B PNL VENT FAN	15.00	20.00	118.4	0.49	2.2427	1.0989	1.9550	PL3456B	1-3C #8	150	0.8490	0.0705	T48	0.0083	0.1357	0.0106	85		404.7	
928	480V C&A VT BD 2B1-B	3B	PIPE CHASE CLR FAN 2B-B	3.00	4.00	25.2	0.66	10.5389	5.9979	7.8803	2PL3081B	1-3C #10	460	1.3500	0.0705	T32	0.1000	0.7210	0.0324	85		410.1	
*931	480V C&A VT BD 2B1-B	5E	AFWP&BA XFR PMP SP CLR FAN B-B	15.00	19.00	133.5	0.49	1.9897	0.9749	1.7344	2PL3161B	1-3C #8	250	0.8490	0.0705	T49	0.0057	0.2180	0.0175	85		416.5	
*934	480V C&A VT BD 2B1-B	8B	PEN RM EL 692 CLR FAN 2B-B	3.00	4.30	26.7	0.62	9.9506	6.1694	7.8072	2PL3141B	1-3C #10	458	1.3500	0.0705	T32	0.1000	0.7183	0.0323	85		410.1	
935	480V C&A VT BD 2B1-B	2C	PEN RM EL 713 CLR FAN 2B-B	3.00	4.30	26.7	0.62	9.9506	6.1694	7.8072	2PL3121B	1-3C #10	306	1.3500	0.0705	T32	0.1000	0.5131	0.0216	85		404.5	
936	480V C&A VT BD 2B1-B	9E	PEN RM EL 737 CLR FAN 2B-B	3.00	4.00	24.6	0.66	10.7960	7.1361	8.1012	2PL3101B	1-3C #10	340	1.3500	0.0705	T32	0.1000	0.5590	0.0240	80	2.40	381.5	
942	480V C&A VT BD 2B1-B	12B	EG TRTMT SYS B-B RM CLR FAN	3.00	4.10	27.0	0.53	9.8363	5.2133	8.3412	2PL3201B	1-3C #10	367	1.3500	0.0705	T32	0.1000	0.5955	0.0259	80	1.05	381.1	
*943	480V C&A VT BD 2B1-B	3D	AUX BLDG GAS TRTMT SYS FAN B-B	50.00	62.00	304.0	0.37	0.8736	0.3232	0.8116	2PL3760B	1-3C #2	350	0.2134	0.0615	T56	0.0012	0.0759	0.0215	75	9.10	364.8	
*1057	480V RX MOV BD 2B2-B	12B	CCS HX C DISCH VLV TO HDR B	0.67	1.90	7.6	0.60	35.1298	21.0779	28.1038	2V2791B	1-3C #12	342	2.1500	0.0765	T24	0.6320	1.3673	0.0262	85		400.5	
*1102	480V DSL AUX BD 2B2B	5A	DG 2B-B AIR CPRSR 1	5.00	7.25	44.5	0.62	5.9681	3.7002	4.6826	PL2230	1-3C #12	115	2.1500	0.0765	T39	0.0288	0.2760	0.0088	85		402.9	
*1104	480V DSL AUX BD 2B2B	2B	DG 2B-B RM EX FAN 2-B	15.00	19.50	118.4	0.49	2.2427	1.0989	1.9550	PL2683B	1-3C #8	114	0.8490	0.0705	T49	0.0057	0.1025	0.0080	85		401.3	
1119	480V RX MOV BD 1B2-B	5C	RCP OIL CLR SUP CNTMT ISOL VLV	0.13	0.60	3.5	0.60	75.8803	45.5282	60.7043	1V800B	1-3C #10	408	1.3500	0.0705	T11	9.2500	9.8953	0.0337	85		423.7	R4
											1V801B	1-3C #10	70	1.3500	0.0705								
1120	480V RX MOV BD 1A1-A	9D	RCP OIL CLR SUP CNTMT ISOL VLV	0.13	0.60	3.5	0.60	75.8803	45.5282	60.7043	1V816A	1-3C #12	425	2.1500	0.0765	T11	9.2500	10.5400	0.0459	85		426.0	R4
											1V817A	1-3C #12	175	2.1500	0.0765								

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Attachment 10.6

480V Switchgear and Motor Control Center Motor Starting Voltages

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ATTACHMENT 10.6 - LOW VOLTAGE SWITCHGEAR MOTOR STARTING VOLTAGES

LVSG VOLTAGE =446.4V UNLESS NOTED OTHERWISE

ENG_TITLE	BOARD	COMP NO.	EQUIPID_NO	LOAD	SF	FLI	LRA	LRPF	Zm	Rm	jXm	CABLE NO.	CABLE SIZE	CABLE LENG	Rc	jXc	MOTOR START VOLT	MIN START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
Aux Bldg Gen Sply Fan 1A	480V SHDN BD 1A1-A	2C	1-MTR-30-103	100.0	1.15	120.0	622	0.31	0.42698	0.13236	0.40594	1PL5140	4/0	105	0.00723	0.00646	437.8				
COMPONENT COOL SYS PUMP 1A-A	480V SHDN BD 1A1-A	3B	1-MTR-70-46-A	350.0	1.15	389.0	2084	0.30	0.12744	0.03823	0.12157	1PL4725A	500MCM	509	0.00799	0.01374	397.9	70%	3.1	PARALLEL COND	
	480V SHDN BD 1A1-A	3B										1PL4726A	500MCM	509							
CRDM Clr Fan 1A-A Mtr 1	480V SHDN BD 1A1-A	7B	1-MTR-30-83/1-A	75.0	1.15	97.0	413	0.33	0.64305	0.21221	0.60703	1PL4800A	1/0	460	0.06219	0.02760	408.1			AMP FAIL	
	480V SHDN BD 1A1-A	7B										1PL4801A	1/0	110	0.01487	0.00660					
Reac Lwr Compt Clr Fan 1A-A	480V SHDN BD 1A1-A	7C	1-MTR-30-74-A	60.0	1.00	73.8	583	0.29	0.45554	0.13302	0.43569	1PL4750A	#2	650	0.13871	0.03998	368.0	80%	12.0	ECN 110014R0	DCN F-11816-A
	480V SHDN BD 1A1-A	7C										1PL4751A	#2	30	0.00640	0.00185					DCN F-11816-A
CRDM Clr Fan 1A-A Mtr 2	480V SHDN BD 1A1-A	7D	1-MTR-30-83/2-A	75.0	1.15	97.0	413	0.33	0.64305	0.21221	0.60703	1PL4816A	1/0	477	0.06449	0.02862	407.0			AMP FAIL	
	480V SHDN BD 1A1-A	7D										1PL4817A	1/0	110	0.01487	0.00660					
Elec Bd Rm AHU A-A	480V SHDN BD 1A1-A	9C	0-MTR-31-308-A	50.0	1.15	56.5	395	0.37	0.67236	0.24877	0.62464	1PL4500A	4/0	500	0.03445	0.03075	420.4				
Cntmt Air Rtn Fan 1A-A	480V SHDN BD 1A1-A	10C	1-MTR-30-38-A	100.0	1.00	115.0	869	0.31	0.30562	0.09474	0.29056	1PL4875A	4/0	490	0.03376	0.03014	386.5			AMP FAIL	
	480V SHDN BD 1A1-A	10C										1PL4876A	1/0	70	0.00946	0.00420					
CONT RM A/C A-A CPRSR	480V SHDN BD 1A2-A	2C	0-MTR-31-80/2-A	250.0	1.15	275.0	1825	0.24	0.14552	0.03493	0.14127	1PL4522A	4/0	141	0.00486	0.00434	430.4			PARALLEL COND	
	480V SHDN BD 1A2-A	2C										1PL4520A	4/0	141							
COMPONENT COOL SYS PUMP C-S	480V SHDN BD 1A2-A	3B	0-MTR-70-51-S	350.0	1.15	389.0	2084	0.30	0.12744	0.03823	0.12157	1PL4733A	300MCM	575	0.01438	0.01682	384.3	70%	3.1	PARALLEL COND	
	480V SHDN BD 1A2-A	3B										1PL4734A	300MCM							300 MCM IMPEDANCE	
	480V SHDN BD 1A2-A	3B										1PL4735S	500MCM							USED FOR ENTIRE	
	480V SHDN BD 1A2-A	3B										1PL4736S	500MCM							LENGTH	
AUX CONT & SERV AIR CPRSR A	480V SHDN BD 1A2-A	3D	0-MTR-32-25	125.0	1.15	162.0	770	0.28	0.34491	0.09657	0.33111	1PL5033	4/0	517	0.03562	0.03180	398.6	80%			
Station Fire Pmp 1A-A	480V SHDN BD 1A2-A	4D	1-MTR-26-1-A	200.0	1.00	230.0	1179	0.27	0.22515	0.06079	0.21678	1PL5003A	500MCM	3220	0.05855	0.08694	316.3	68%		PARALLEL COND	LVSG VOLT=454.4
												1PL5004A	500MCM	3220							
Spent Fuel Pit Pmp C-S (SPARE)	480V SHDN BD 1A2-A		0-MTR-78-35-S	100.0	1.15	115.0	647	0.42	0.41067	0.17248	0.37269	1PL4540A	4/0	539	0.03714	0.03315	396.6			AMP FAIL	
												1PL4541S	1/0	47	0.00635	0.00282					
CRD Mech Clr Fan 1C-A Mtr 1	480V SHDN BD 1A2-A	7A	1-MTR-30-88/1-A.	75.0	1.15	97.0	413	0.33	0.64305	0.21221	0.60703	1PL4820A	1/0	543	0.07341	0.03258	403.9			AMP FAIL	
	480V SHDN BD 1A2-A	7A										1PL4821A	1/0	93	0.01257	0.00558					
Aux Bldg Gen Exhaust Fan 1A	480V SHDN BD 1A2-A	7B	1-MTR-30-159	125.0	1.15	147.0	987	0.29	0.26913	0.07805	0.25757	1PL5150	4/0	320	0.02205	0.01968	407.5				
Reac Lwr Compt Clr Fan 1C-A	480V SHDN BD 1A2-A	7D	1-MTR-30-77-A	60.0	1.00	73.8	583	0.29	0.45554	0.13302	0.43569	1PL4775A	#2	660	0.14084	0.04059	368.0	80%	12.0	ECN 11001480	DCN F-11816-A
	480V SHDN BD 1A2-A	7D										1PL4776A	#2	20	0.00427	0.00123					DCN F-11816-A
CRD Mech Clr Fan 1C-A Mtr 2	480V SHDN BD 1A2-A	8A	1-MTR-30-88/2-A	75.0	1.15	97.0	416	0.33	0.63888	0.21083	0.60309	1PL4836A	1/0	530	0.07166	0.03180	404.4			AMP FAIL	
	480V SHDN BD 1A2-A	8A										1PL4837A	1/0	93	0.01257	0.00558					
480V Shutdown Bd Rm AHU A-A	480V SHDN BD 1A2-A	9D	0-MTR-31-45-A	75.0	1.15	92.0	592	0.33	0.44854	0.14802	0.42341	1PL5180A	#2	130	0.02774	0.00800	429.8				
Aux Bldg Gen Sply Fan 1B	480V SHDN BD 1B1-B	2B	1-MTR-30-102	100.0	1.15	120.0	624	0.31	0.42561	0.13194	0.40464	1PL5160	4/0	122	0.00841	0.00750	436.4				
COMPONENT COOL SYS PUMP 1B-B	480V SHDN BD 1B1-B	3C	1-MTR-70-38-B	350.0	1.15	389.0	2084	0.30	0.12744	0.03823	0.12157	1PL4742B	300MCM	575	0.01438	0.01682	384.3	70%	3.1	PARALLEL COND	
	480V SHDN BD 1B1-B	3C										1PL4743B	300MCM	575							
RECIPROCATING CHARGING PUMP	480V SHDN BD 1B1-B	3B	1-MTR-62-101	200.0	1.15	221.0	1579	0.25	0.16820	0.04205	0.16285	1PL5025	400MCM	391	0.00747	0.01056	416.3				
AUX CONT & SERV AIR CPRSR B	480V SHDN BD 1B1-B	3D	0-MTR-32-26	125.0	1.15	162.0	770	0.28	0.34491	0.09657	0.33111	1PL5089	4/0	795	0.05478	0.04889	376.4	80%			
Elec Bd Rm AHU C-B	480V SHDN BD 1B1-B	7A	0-MTR-31-31B-B	50.0	1.15	62.5	360	0.37	0.73773	0.27296	0.68537	1PL4460B	#2	650	0.13871	0.03998	394.9			AMP FAIL	
CRD Mech Clr Fan 1B-B Mtr 1	480V SHDN BD 1B1-B	7C	1-MTR-30-92/1-B	75.0	1.15	97.0	413	0.33	0.64305	0.21221	0.60703	1PL4839B	1/0	588	0.07950	0.03528	400.4			AMP FAIL	
	480V SHDN BD 1B1-B	7C										1PL4840B	1/0	103	0.01393	0.00618					
Reac Lwr Compt Clr Fan 1B-B	480V SHDN BD 1B1-B	7D	1-MTR-30-75-B	60.0	1.00	73.8	583	0.29	0.45554	0.13302	0.43569	1PL4764B	#2	650	0.13871	0.03998	368.0	80%	12.0	ECN 11001480	DCN F-12119-A
	480V SHDN BD 1B1-B	7D										1PL4765B	#2	30	0.00640	0.00185					DCN F-12119-A
CRD Mech Clr Fan 1B-B Mtr 2	480V SHDN BD 1B1-B	10D	1-MTR-30-92/2-B	75.0	1.15	97.0	413	0.33	0.64305	0.21221	0.60703	1PL4853B	1/0	578	0.07815	0.03468	401.0			AMP FAIL	
	480V SHDN BD 1B1-B	10D										1PL4854B	1/0	103	0.01393	0.00618					
CONT RM A/C B-B CPRSR	480V SHDN BD 1B2-B	2B	0-MTR-31-96/2-B	250.0	1.15	275.0	1825	0.24	0.14552	0.03493	0.14127	1PL4429B	400MCM	600	0.01146	0.01620	392.0			PARALLEL COND	DCN M-11886-A
	480V SHDN BD 1B2-B	2B										1PL4430B	400MCM	600							
	480V SHDN BD 1B2-B	2B											4/0	20	0.00138	0.00123					
480V Shdn Bd Rm Chler B-B	480V SHDN BD 1B2-B	3C	0-MTR-31-49/2-B	240.0		247.0	1209	0.24	0.21967	0.05272	0.21325	1PL5200B	350MCM	282	0.01410	0.01650	409.8				
Station Fire Pmp 1B-B	480V SHDN BD 1B2-B	4D	1-MTR-26-4-B	200.0	1.00	230.0	1179	0.27	0.22515	0.06079	0.21678	1PL5017B	500MCM	3333	0.05233	0.08999	312.9	68%		PARALLEL COND	LVSG VOLT=454.4
												1PL5018B	500MCM	3333							

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ATTACHMENT 10.6 – LOW VOLTAGE SWITCHGEAR MOTOR STARTING VOLTAGES

LVSG VOLTAGE =446.4V UNLESS NOTED OTHERWISE

ENG_TITLE	BOARD	COMP NO.	EQUIPID_NO	LOAD	SF	FLI	LRA	LRPF	Zm	Rm	jXm	CABLE NO.	CABLE SIZE	CABLE LENG	Rc	jXc	MOTOR START VOLT	MIN START VOLT (%)	ACCEL TIME SEC (%%)	REMARKS		REV
Aux Bldg Gen Exhaust Fan 1B	480V SHDN BD 1B2-B	7A	1-MTR-30-162	125.0	1.00	147.0	854	0.29	0.31098	0.09019	0.29762	1PL5170	4/0	320	0.02205	0.01968	412.5					
CRD Mech Clr Fan 10-B Mtr 1	480V SHDN BD 1B2-B	7B	1-MTR-30-80/1-B	75.0	1.15	97.0	413	0.33	0.64305	0.21221	0.60703	1PL4856B	1/0	437	0.05908	0.02622	409.4			AMP FAIL		
		7B										1PL4857B	1/0	113	0.01528	0.00678						
Reac Lwr Compt Clr Fan 10-B	480V SHDN BD 1B2-B	7D	1-MTR-30-78-B	60.0	1.00	73.8	583	0.29	0.45554	0.13302	0.43569	1PL4789B	#2	640	0.13658	0.03936	368.0	80%	12.0	ECN 11001R0	DCN F-12119-A	
	480V SHDN BD 1B2-B	7D										1PL4790B	#2	40	0.00854	0.00246					DCN F-12119-A	
Cntmt Air Rtn Fan 1B-B	480V SHDN BD 1B2-B	9C	1-MTR-30-39-B	100.0	1.00	115.0	828	0.31	0.32075	0.09943	0.30495	1PL4885B	4/0	428	0.02949	0.02632	391.8			M-09638-A		
	480V SHDN BD 1B2-B	9C										1PL4886B	250MCM	120	0.00714	0.00684				M-09638-A	F-12813-A	
	480V SHDN BD 1B2-B	9C											2/0	10	0.00109	0.00060					F-12813-A	
Spent Fuel Pit Pmp B-B	480V SHDN BD 1B2-B	9A	0-MTR-78-9-B	100.0	1.15	115.0	647	0.42	0.41067	0.17248	0.37269	1PL4895B	400MCM	582	0.02223	0.03143	403.7			M-15092-A		R4
													4/0	65	0.00448	0.00400				M-15092-A		R4
480V Shutdown Bd Rm AHU C-B	480V SHDN BD 1B2-B	9D	0-MTR-31-55-B	75.0	1.15	92.0	592	0.33	0.44862	0.14804	0.42349	1PL5520B	4/0	240	0.01654	0.01476	421.7					
													#2	50	0.01067	0.00308						
CRD Mech Clr Fan 10-B Mtr 2	480V SHDN BD 1B2-B	10C	1-MTR-30-80/2-B	75.0	1.15	97.0	413	0.33	0.64305	0.21221	0.60703	1PL4873B	1/0	418	0.05651	0.02508	410.6			AMP FAIL		
	480V SHDN BD 1B2-B	10C										1PL4874B	1/0	113	0.01528	0.00678						
Aux Bldg Gen Sply Fan 2A	480V SHDN BD 2A1-A	2C	2-MTR-30-104	100.0	1.15	120.0	630	0.31	0.42156	0.13068	0.40079	2PL5140	4/0	84	0.00579	0.00517	439.4					
COMPONENT COOL SYS PUMP 2A-A	480V SHDN BD 2A1-A	3B	2-MTR-70-59-A	350.0	1.15	389.0	2084	0.30	0.12744	0.03823	0.12157	2PL4725A	500MCM	675	0.01060	0.01823	384.2	70%	3.1	PARALLEL COND		
	480V SHDN BD 2A1-A	3B										2PL4726A	500MCM	675								
CRD Mech Clr Fan 2A-A Mtr 1	480V SHDN BD 2A1-A	7B	2-MTR-30-83/1-A	75.0		97.0																
Reac Lwr Compt Clr Fan 2A-A	480V SHDN BD 2A1-A	7C	2-MTR-30-74-A	40.0		47.0																
CRD Mech Clr Fan 2A-A Mtr 2	480V SHDN BD 2A1-A	7D	2-MTR-30-83/2-A	75.0		97.0																
Elec Bd Rm AHU B-A	480V SHDN BD 2A1-A	9C	0-MTR-31-300-A	50.0	1.15	56.5	395	0.37	0.67236	0.24877	0.62464	2PL4500A	#2	620	0.13231	0.03813	392.6			AMP FAIL		
Cntmt Air Rtn Fan 2A-A	480V SHDN BD 2A1-A	10C	2-MTR-30-38-A	100.0		115.0																
Elec Bd Rm A/C A-A Cprsr	480V SHDN BD 2A2-A	2C	0MTR-31-128/2-A	250.0	1.15	275.0	1825	0.24	0.14552	0.03493	0.14127	2PL4520A	4/0	350	0.01206	0.01076	408.2			PARALLEL COND		
	480V SHDN BD 2A2-A	2C										2PL4522A	4/0	350								
480V Shdn Bd Rm Chlr A-A	480V SHDN BD 2A2-A	3C	0-MTR-31-36/2-A	240.0		247.0	1209	0.24	0.21967	0.05272	0.21325	2PL5120A	300MCM	192	0.00960	0.01123	420.9			AMP FAIL		
Aux Bldg Gen Exhaust Fan 2A	480V SHDN BD 2A2-A	7B	2-MTR-30-274	125.0	1.00	147.0	866	0.29	0.30668	0.08894	0.29350	2PL5150	4/0	369	0.02542	0.02269	407.2					
Fuel Handling Exhaust Fan A	480V SHDN BD 2A2-A	7C	0-MTR-30-136	100.0	1.15	120.0	624	0.31	0.42561	0.13194	0.40464	2PL5111	4/0	229	0.01578	0.01408	427.9					
480V SHUTDOWN BD RM AHU B-A	480V SHDN BD 2A2-A	8D	0-MTR-31-44-A	75.0	1.15	92.0	592	0.33	0.44862	0.14804	0.42349	2PL5180A	#2	306	0.06530	0.01882	407.8			AMP FAIL		
Station Fire Pmp 2A-A	480V SHDN BD 2A2-A	4D	2-MTR-26-9-A	200.0	1.00	230.0	1179	0.27	0.22515	0.06079	0.21678	2PL5003A	500MCM	2802	0.04399	0.07565	329.3	68%		PARALLEL COND	LVSG VOLT=454.4	
												2PL5004A	500MCM	2802								
Spent Fuel Pit Pmp A-A	480V SHDN BD 2A2-A	9D	0-MTR-78-12-A	100.0		113.8	647	0.42	0.41067	0.17248	0.37269	2PL4895A	4/0	743	0.05119	0.04569	386.4			AMP FAIL		
CRD Mech Clr Fan 2C-A Mtr 2	480V SHDN BD 2A2-A	8A	2-MTR-30-88/2-A	75.0		97.0																
REAC LWR COMPT CLR FAN 2C-A	480V SHDN BD 2A2-A	7D	2-MTR-30-77-A	40.0		54.0																
CRD MECH CLR FAN C-A MTR 1	480V SHDN BD 2A2-A	7A	2-MTR-30-88/1-A	75.0		97.0																
Aux Bldg Gen Sply Fan 2B	480V SHDN BD 2B1-B	2B	2-MTR-30-105	100.0	1.15	120.0	626	0.31	0.42425	0.13152	0.40335	2PL5160	4/0	76	0.00524	0.00467	440.1					
COMPONENT COOL SYS PUMP 2B-B	480V SHDN BD 2B1-B	3C	2-MTR-70-33-B	350.0	1.15	389.0	2084	0.30	0.12744	0.03823	0.12157	2PL4742B	500MCM	675	0.01060	0.01823	384.2	70%	3.1	PARALLEL COND		
	480V SHDN BD 2B1-B	3C										2PL4743B	500MCM	675								
Elec Bd Rm AHU D-B	480V SHDN BD 2B1-B	7A	0-MTR-31-310-B	50.0	1.15	62.5	360	0.37	0.73773	0.27296	0.68537	2PL4460B	#2	538	0.11481	0.03309	403.4					
Reciprocating Charging Pmp	480V SHDN BD 2B1-B	3B	2-MTR-62-101	200.0		221.0																
Spent Fuel Pit Pmp C-S ALT FDR	480V SHDN BD 2B1-B	7B	0-MTR-78-35-S	100.0	1.15	115.0	647	0.42	0.41067	0.17248	0.37269	2PL4540B	1/0	268	0.03623	0.01606	410.3			AMP FAIL		
												1PL4541S	1/0	47	0.00635	0.00282				AMP FAIL		
Reac Lwr Compt Clr Fan 2B-B	480V SHDN BD 2B1-B	7D	2-MTR-30-75-B	40.0		54.0																
CRD MECH CLR FAN 2B-B MTR 2	480V SHDN BD 2B1-B	10D	2-MTR-30-92/2	75.0		97.0																
CRD Mech Clr Fan 2B-B Mtr 1	480V SHDN BD 2B1-B	7C	2-MTR-30-92/1-B	75.0		97.0																
Elec Bd Rm A/C B-B Cprsr	480V SHDN BD 2B2-B	2B	0MTR-31-129/2-B	250.0	1.15	275.0	1825	0.24	0.14552	0.03493	0.14127	2PL4440B	4/0	315	0.01085	0.00969	411.8			PARALLEL COND		
	480V SHDN BD 2B2-B	2B										2PL4443B	4/0	315								
COMPONENT COOL SYS PUMP C-S	480V SHDN BD 2B2-B	2D	0-MTR-70-51-S	350.0	1.15	389.0	2084	0.30	0.12744	0.03823	0.12157	2PL4733B	500MCM	1500	0.02355	0.04050	328.0	70%	3.1	PARALLEL COND		R3
	480V SHDN BD 2B2-B	2D										2PL4734B	500MCM	1500						PARALLEL COND		
	480V SHDN BD 2B2-B	2D										1PL4735S	500MCM									
	480V SHDN BD 2B2-B	2D										1PL4736S	500MCM									

GCP 9-23-92 ~~9-24-92~~

THIS SHEET ADDED BY REV 4

WBN-EEB-ED-Q000-999-2007-0002, R0

ATTACHMENT 11.4, Page 8 of 26

Calc. STUDY-EEB-WBN-12-001
Attachment 3
Required Motor Starting Voltage
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24-Sep-92

WBN-EEB-MS-TI06-0010 R0

ATTACHMENT 10.6 - LOW VOLTAGE SWITCHGEAR MOTOR STARTING VOLTAGES

ENE_TITLE	BOARD	COMP NO.	EQUIPID_NO	LOAD	SF	FLI	LRA	LRPF	Zm	Rm	jXm	CABLE NO.	CABLE SIZE	CABLE LENG	Rc	jXc	MOTOR START VOLT	MIN START VOLT (%)	ACCEL TIME SEC (ss)	REMARKS	REV
LVSG VOLTAGE =446.4V UNLESS NOTED OTHERWISE																					
Aux Bldg Gen Exhaust Fan 2B	480V SHDN BD 282-B	7A	2-MTR-30-278	125.0	1.00	147.0	850	0.29	0.31245	0.09061	0.29902	2PL5170	4/0	444	0.03059	0.02731	400.7				
Fuel Handling Exhaust Fan B	480V SHDN BD 282-B	7C	0-MTR-30-139	100.0	1.15	120.0	624	0.31	0.42561	0.13194	0.40464	2PL5100	4/0	248	0.01709	0.01525	426.4				
480V Shutdown Bd Rm AHU D-B	480V SHDN BD 282-B	9D	0-MTR-31-61-B	75.0	1.15	92.0	592	0.33	0.44862	0.14804	0.42349	2PL5520B	4/0	170	0.01171	0.01046	426.9			AMP FAIL	
													#2	50	0.01067	0.00308					
Station Fire Pmp 2B-B	480V SHDN BD 282-B	4D	2-MTR-26-11-B	200.0	1.00	230.0	1179	0.27	0.22515	0.06079	0.21678	2PL5017B	500MCM	2989	0.04693	0.08070	323.4	68%		PARALLEL COND LVSG VOLT=454.4	
												2PL5018B	500MCM	2989							

THIS SHEET ADDED BY REV 4

Revision 5
Prepared by GCP/RS Date 10-31-92
Checked by [signature] 10-31-92

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(ADDED BY REV5)

30-Oct-92

WBN-EEB-MS-TI06-0010 R0 "ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES
(TABLE 42 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R10)

EQ_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLA	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtel	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
Cont Bldg Emerg Air CU Fan A-A	203	C&A VENT BD 1A1-A	2A	0-MTR-31-8-A	10.00	12.20	110.0	0.53	2.4144	1.2756	2.0274	T43	0.01387	1PL3301A	#8	240	0.2038	0.0169	416.6	401.0				
5th Vit Batt Rm Intk Fan 1A1-A	203	C&A VENT BD 1A1-A	2B	0-MTR-31-4931-A	1.50	2.50	15.0	0.62	17.6583	10.0482	13.8547	T28	0.29500	1PL6640L	#12	*146	0.3139	0.0112	430.4					
PZR RM EL 692 CLR FAN 1A-A	203	C&A VENT BD 1A1-A	2C	1-MTR-30-186-A	3.00	4.00	25.0	0.62	10.6232	6.5964	8.3350	T32	0.10000	1PL3131A	#10	476	0.6551	0.0343	419.8	412.2	80%	2.4		
Pri Makeup Wtr Pmp 1A	203	C&A VENT BD 1A1-A	2D	1-MTR-81-3	30.00	36.10	236.1	0.42	1.1215	0.4710	1.0178	T52	1.00252	1PL3223	#6	353	0.1911	0.0247	399.1					
Cntm Spray Pmp 1A-A Rm Clr Fan	203	C&A VENT BD 1A1-A	3C	1-MTR-30-177-A	7.50	9.00	62.0	0.57	4.2836	2.4166	3.5196	T46	0.02763	1PL3052A	#2C	630	0.8565	0.0444	387.2	386.7	80%	0.7	AMP FAIL	
Cond Vac Pmp Air Exh Mon	203	C&A VENT BD 1A1-A	3F1	1-RE-90-119	1.40	1.80	5.4	0.65	49.1817	31.5681	37.3748			1PL3589	#10	512	0.6912	0.0361	435.0					
FLR AND STR RM SUMP A PMP 1A	203	C&A VENT BD 1A1-A	3F2	1-MTR-40-32	2.50	2.65	20.0	0.62	13.2791	8.2330	10.4188			1PL3720	#10	2776	3.7476	0.1957	365.0				FAILED MOT-ST	
Btry Rm El 692 Exh Fan A-A	203	C&A VENT BD 1A1-A	4A	0-MTR-31-28-A	1.00	2.20	19.5	0.62	13.6195	8.4441	10.6859	T27	0.36200	1PL2885A	#12	560	1.2040	0.0128	408.4					
5TH VITL BATT.RM.EX. FAN 1B1-A	203	C&A VENT BD 1A1-A	4B	0-MTR-31-4938-A	1.50	2.50	16.5	0.62	18.3151	11.3559	14.3707	T28	0.29500	1PL6445A	#12	146	0.3139	0.0112	430.8					
Emerg Gas Trtmt Sys Fan A-A	203	C&A VENT BD 1A1-A	4D	0-MTR-65-23-A	20.00	25.00	132.0	0.46	2.0120	0.9255	1.7865	T50	0.00357	1PL3520A	#8	368	0.3174	0.0259	403.4	395.6	80%	7.8	AMP FAIL	
ERCW Str 1A-A Backwash Vlv	203	C&A VENT BD 1A1-A	4E	1-FCV-67-9A-A	0.33	0.75	5.79	0.60	45.8689	27.5714	36.6951	T14	4.72400	1V1005A	#8	3690	2.6734	0.2178	397.5					
SFP Pmp A-A&TR Rst Pm SpClrFan	203	C&A VENT BD 1A1-A	5A	0-MTR-30-192-A	7.50	9.00	62.0	0.57	4.2836	2.6416	3.5196	T46	0.02289	1PL3151A	#10	740	0.3240	0.0169	418.5	410.9	80%	0.7		
CCS & AFW PMPS SP CLR FAN A-A	203	C&A VENT BD 1A1-A	5E	1-MTR-30-190-A	20.00	24.50	139.9	0.38	1.8984	0.7138	1.7591	T50	0.00357	1PL3191A	#6	600	0.3396	0.0282	402.3	395.0	80%	0.48	AMP FAIL	
Serv Bldg Vt Mon	203	C&A VENT BD 1A1-A	5F1	0-RE-90-132	4.50	6.00	18.0	0.65	14.7545	9.5904	11.2125			1PL3599	#10	386	1.3311	0.0695	413.4					
Shutdown Bd Rm A Press Fan A-A	203	C&A VENT BD 1A1-A	6A	0-MTR-31-64-A	3.00	4.50	28.0	0.62	9.4850	5.8807	7.4420	T34	0.07300	1PL3601A	#12	86	0.1849	0.0066	432.4					
ERCW STRAINER 1A-A	203	C&A VENT BD 1A1-A	6B	1-MTR-67-9A-A	3.00	6.00	30.1	0.62	8.8292	5.4829	6.9204	T36	0.05500	1PL3513A	#4	2100	0.7062	0.1323	356.2		75%			
	203	C&A VENT BD 1A1-A	6B												#10	1477	1.9872	0.1038						
TRAVELLING SCREEN 1A-A	203	C&A VENT BD 1A1-A	6C	1-MTR-67-438-A	5.00	6.80	41.0	0.62	6.4776	3.9663	5.1229	T38	0.03403	1PL3810A	#2	450	0.1034	0.0523	372.0		60%			
	203	C&A VENT BD 1A1-A	6C												#10	450	0.6075	0.0317						
	203	C&A VENT BD 1A1-A	6C												#4	2100	0.7062	0.1323						
ERCW Str 1A-A Flush Vlv	203	C&A VENT BD 1A1-A	6E	1-FCV-67-9B-A	0.33	0.75	5.79	0.60	45.8689	27.5214	36.6951	T14	4.72000	1V3501L	#8	3186	2.6455	0.2197	397.4					
Cntmt Bldg Lwr Cmpt Air Mon	203	C&A VENT BD 1A1-A	6F1	1-RE-90-106-A	4.50	6.36	18.0	0.65	24.7545	9.5904	11.2125			1PL3584A	#10	122	0.2533	0.0083	436.7					
125V Vtl Bat Rm I ExhFan 1A1-A	203	C&A VENT BD 1A1-A	7B	1-MTR-31-287-A	0.33	0.36	5.2	0.62	51.3733	31.6854	40.0722	T17	2.20500	1PL3560A	#12	220	0.4730	0.0168	425.7				P-04468-A	
High Press Fire Pmp Str A-A	203	C&A VENT BD 1A1-A	7C	0-MTR-26-7-A	4.75	2.05	8.5	0.62	31.3976	19.4634	24.6307	T25	0.42100	1PL3800A	#10	1128	1.5228	0.0795	406.3					
	203	C&A VENT BD 1A1-A	7C												#8	2108	1.7929	0.1481						
RHR Pmp 1A-A Inlet FCV	203	C&A VENT BD 1A1-A	7D	1-FCV-74-3-A	5.20	10.60	60.0	0.60	4.4254	2.6558	3.5401	T40	0.02283	1V1920A	#2	1170	0.2497	0.0720	417.2				M-13725-A,P-14470-A	**125
	203	C&A VENT BD 1A1-A	7D												#8	30	0.0755	0.0021					P-14670-A,P-01667-C	125
RWST To Spray Hdr 1A FCV	203	C&A VENT BD 1A1-A	7E	1-FCV-72-22-A	3.20	5.20	36.0	0.60	7.3773	4.4266	5.9018	T37	0.18600	1V1870A	#8	725	0.6155	0.0511	410.2				M-13725-A	
	203	C&A VENT BD 1A1-A	7E												#10	50	0.0675	0.0035					M-13725-A	
Safety Inj Pmp 1A-A Rm Clr Fan	203	C&A VENT BD 1A1-A	8A	1-MTR-30-180-A	5.00	6.10	45.0	0.62	5.9018	3.6591	4.6306	T37	0.04300	1PL2918A	#10	632	0.8532	0.0446	397.8	390.6	80%	2.1		
Pen Rm El 737 Clr Fan 1A-A	203	C&A VENT BD 1A1-A	8B	1-MTR-30-194-A	3.00	4.00	25.3	0.65	10.4373	6.8227	7.9862	T32	0.10000	1PL3093A	#10	172	0.2322	0.0121	430.7	422.8	80%	2.4		
480V Xfmr Rm 1A Exh Fan 1A2-A	203	C&A VENT BD 1A1-A	8C	1-MTR-30-2460-A	3.00	4.40	27.4	0.67	9.6927	6.4457	7.2390	T34	0.07100	1PL2154A	#12	302	0.6493	0.0231	424.0		80%		M-13273-A	
480V Xfmr Rm 1A Exh Fan 1A3-A	203	C&A VENT BD 1A1-A	8D	1-MTR-30-2448-A	3.00	4.40	27.4	0.67	9.6927	6.4457	7.2390	T34	0.07100	1PL2837A	#12	174	0.3741	0.0133	426.3		80%		M-13273-A	
Cont Rm A/C Sys Oil Pmp	203	C&A VENT BD 1A1-A	8F1	0-MTR-31-80/3-A	3.11	3.90	31.0	0.62	6.5671	5.3816	6.7210			1PL3810A	#8	216	0.1834	0.0152	433.6					
RHR Pmp 1A-A Rm Clr Fan	203	C&A VENT BD 1A1-A	9A	1-MTR-30-175-A	5.00	6.10	45.0	0.62	5.9018	3.5591	4.6306	T37	0.04300	1PL3031A	#10	624	0.8424	0.0440	398.3	391.1	80%	2.1		
Cont Rm A/C Circ Pmp A-A	203	C&A VENT BD 1A1-A	9B	0-MTR-31-80/1-A	15.00	20.00	118.4	0.49	2.2431	1.0991	1.9553	T49	0.04572	1PL3825A	#6	180	0.1528	0.0127	427.6	418.9			AMP FAIL	
480V Bd Rm 1A Pr Sup Fan 1A1-A	203	C&A VENT BD 1A1-A	9C	1-MTR-31-462-A	3.00	4.60	28.0	0.62	9.4850	5.8807	7.4420	T34	0.07100	1PL3478A	#10	90	0.1215	0.0063	434.3					
480V Xfmr Rm 1A Exh Fan 1A1-A	203	C&A VENT BD 1A1-A	9D	1-MTR-30-2447-A	3.00	4.40	27.4	0.67	9.6922	6.4457	7.2390	T34	0.07100	1PL2846A	#12	300	0.6450	0.0230	418.1		80%		M-13273-A	
Cont Rm Intake Mon	203	C&A VENT BD 1A1-A	9F1	0-RE-90-205-A	1.40	1.80	5.4	0.65	49.1817	31.5681	37.3748			1PL3260A	#10	258	0.3483	0.0182	437.3					
Cntg Chrg Pmp 1A-A Rm Clr Fan	203	C&A VENT BD 1A1-A	10A	1-MTR-30-183-A	5.00	6.10	45.0	0.62	5.9018	3.6591	4.6306	T37	0.04300	1PL3001A	#10	447	0.6035	0.0315	405.2	401.8	80%	2.1		

\UINCC70\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1200 FEET

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(ADDED BY REV 5)

Revision 5
Prepared By GCP/BJ Date 10-31-92
Checked By [signature] Date 10-31-92

30-Oct-92

WBN-EEB-MS-TI06-0010 R0 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOTAGES
(TABLE L7 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R28)

ENG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLA	LRA	LRPF	Xm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
PEF RM EL 713 CLR FAN 1A-A	203	C&A VENT BD 1A1-A	10B	1-MTR-30-196-A	3.00	4.00	26.0	0.62	10.2147	6.3338	8.0144	T32	0.10000	1PL3111A	#10	396	0.5346	0.0279	422.6	414.7	80%	0.9		
Pipe Chase Clr Fan 1A-A	203	C&A VENT BD 1A1-A	10C	1-MTR-30-201-A	3.00	4.00	25.2	0.66	10.5389	6.9979	7.8803	T32	0.10000	1PL3071A	#10	600	0.8100	0.0423	414.3	406.7	80%	2.8		
Aux Bldg Vent Mon	203	C&A VENT BD 1A1-A	10F1	0-RE-90-101	4.50	6.00	38.0	0.65	14.7565	9.5904	11.2125			1PL3598	#10	480	0.6480	0.0338	426.9					
480V BD RM 1B PR SUP FAN 1B1-A	203	C&A VENT BD 1A1-A	11A	1-MTR-31-478-A	3.00	4.60	28.0	0.62	9.4050	5.8107	7.4424	T34	0.07100	1PL3480A	#10	160	0.2160	0.0113	431.4					
480V Bd Rm 1A A/C Ahu 1A-A	203	C&A VENT BD 1A1-A	11C	1-MTR-31-461-A	10.00	12.00	78.9	0.53	3.3660	1.7840	2.8544	T44	0.01218	1PL4060A	#6	277	0.0932	0.0175	428.8				P-12656-A	*
	203	C&A VENT BD 1A1-A	11C												#10	29	0.0270	0.0016					P-12656-A	
Cont Rm Ahu A-A	203	C&A VENT BD 1A1-A	11D	0-MTR-31-12-A	50.00	72.00	413.6	0.30	0.6631	0.3215	0.5569	T59	0.00087	1PL4020A	#2	134	0.0414	0.0119	419.8				AMP FAIL	
125V Vit Bat Rm II ExFan 1B1-A	203	C&A VENT BD 1A1-A	12A	1-MTR-31-285-A	0.33	0.80	5.2	0.62	51.0333	31.6654	40.0722	T17	2.20500	1PL3570A	#12	196	0.4121	0.0148	426.0				P-04668-A	
Cont Bldg Emerg Press Fan A-A	203	C&A VENT BD 1A1-A	12B	0-MTR-31-6-A	1.00	1.70	15.0	0.62	17.7054	10.9774	13.8917	T25	0.49500	1PL3747A	#12	682	1.4663	0.0522	409.5	402.1				
480V Bd Rm 1A A/C Cond 1A-A	203	C&A VENT BD 1A1-A	12C	1-MTR-31-290-A	15.00	21.00	111.0	0.49	2.3936	1.1724	2.0857	T49	0.00532	1PL4010A	#8	196	0.1664	0.0138	422.3				AMP FAIL	
Cont Bldg Press Fan A-A	203	C&A VENT BD 1A1-A	12D	0-MTR-31-1-A	2.00	3.65	27.0	0.62	9.8363	6.0985	7.7136	T31	0.14100	1PL3241A	#8	230	0.1953	0.0162	430.2	422.4				
Gaseous Eff Radn Mon	203	C&A VENT BD 1A1-A	12E1	1-PNL-90-L338	5.00	7.25	46.0																	
Cntmt Purge Air Radn Exh Mon	203	C&A VENT BD 1A1-A	12F1	1-RE-90-130-A	1.40	1.80	5.4	0.65	49.1817	31.9681	37.3748			1PL3780A	#10	354	0.4779	0.0250	437.1					
Aux Chgrg Pmp 1A	203	C&A VENT BD 1A1-A	13A	1-MTR-84-15	1.00	1.80	12.5	0.62	21.1787	13.1309	16.6165	T25	0.49500	1PL2940	#12	266	0.5719	0.0203	426.1					
Aux Chgrg Bstr Pmp	203	C&A VENT BD 1A1-A	13B	0-MTR-84-6	1.00	1.80	11.3	0.62	23.5444	14.5975	18.4730	T25	0.49500	1PL3460	#12	214	0.4601	0.0164	428.8					
Cntmt Annulus Vac Fan 1A	203	C&A VENT BD 1A1-A	13C	1-MTR-65-77	5.00	7.25	46.0	0.62	5.1735	3.5795	4.5299	T38	0.03483	1PL3645	#12	380	0.8170	0.0291	399.6					
ERCW Scrn Wash Pmp 1A-A	203	C&A VENT BD 1A1-A	13D	1-MTR-67-431-A	40.00	49.80	290.0	0.38	0.9158	0.3480	0.8472	T54	0.00202	1PL3960A	2-1/0	2180	0.1420	0.0630	356.7		75%			
	203	C&A VENT BD 1A1-A	13D												4/0	1050	0.0751	0.0670						
Hot Instr Shop Hstr Pmp	204	C&A VENT BD 1A2-A	2A	0-MTR-31-339	0.75	1.20	12.5	0.62	21.2465	13.1728	16.6700	T20	1.33000	1PL2830	#12	135	0.3363	0.0134	418.7					
North Main St Vlt Exh Fan	204	C&A VENT BD 1A2-A	3A	1-MTR-30-25	3.00	4.50	32.0	0.62	8.2996	5.1456	6.5117	T34	0.07100	1PL2506	#12	1146	2.4639	0.0877	388.6				FAILED NON-1E	
Smplg Rm Hood Exh Fan 1A	204	C&A VENT BD 1A2-A	4A	1-MTR-30-283	1.00	1.70	15.0	0.62	17.7458	10.9734	13.8917	T25	0.63200	1PL3671	#12	480	1.0320	0.0367	411.2					
Smoke Removal Fan	204	C&A VENT BD 1A2-A	4D	0MTR-31-203/204	7.50	9.70	63.5	0.37	4.1124	2.3840	3.4364	T41	0.01801	V1328	#10	250	0.3375	0.0176	437.4					
N. Main St Vlt Backup Exh Fan	204	C&A VENT BD 1A2-A	5A	1-MTR-30-303	3.00	4.60	32.0	0.62	8.2994	5.1458	6.5117	T34	0.07100	1PL3435	#12	550	1.1825	0.0421	398.7					
Cont Rod Dr Eqpt Rm A/C 1A	204	C&A VENT BD 1A2-A	8A	1-MTR-30-CRD	47.50	71.40	378.5	0.37	0.7017	0.2596	0.6519			1PL3692	2/0	238	0.0258	0.0183	426.0					
Cont Bldg Em Air Clnup Fan B-B	205	C&A VENT BD 1B1-B	2A	0-MTR-31-7-B	10.00	12.20	130.0	0.53	2.4844	1.2796	2.0474	T43	0.01387	1PL3308B	#8	216	0.1783	0.0148	419.3	411.7				
Pen Rm El 713 Clr Fan 1B-B	205	C&A VENT BD 1B1-B	2C	1-MTR-30-197-B	3.00	4.00	26.0	0.62	10.2142	6.3331	8.0144	T32	0.10000	1PL3121B	#10	404	0.5454	0.0285	422.1	414.4	80%	0.9		
Pri Makeup Wtr Pmp 1B	205	C&A VENT BD 1B1-B	2D	1-MTR-81-7	30.00	36.00	236.8	0.42	1.1215	0.4710	1.0178	T57	0.00252	1PL3228	#6	494	0.2637	0.0341	384.2				FAILED NON-1E	
VLV & STRAIN RM SUMP B PUMP 1B	205	C&A VENT BD 1B1-B	2F2	1-MTR-40-66A	1.50	2.65	20.0	0.62	13.2791	8.2330	10.4188			1PL3730	#14	2036	3.9636	0.2070	361.2				FAILED NON-1E	
Shdn Bd Rm Chlr CW Cir Pmp B-B	205	C&A VENT BD 1B1-B	3A	0-MTR-31-49/1-B	25.00	31.00	197.1	0.43	1.3458	0.5785	1.2147	T53	0.00226	1PL4010B	#8	346	0.2938	0.0244	390.3				AMP FAIL	
Pipe Chase Clr Fan 1B-B	205	C&A VENT BD 1B1-B	3B	1-MTR-30-202-B	3.00	4.00	25.2	0.66	10.5389	6.9979	7.8803	T32	0.10000	1PL3081B	#10	592	0.7992	0.0417	414.6	407.0	80%	2.8		
Cntm Spray Pmp 1B-B Rm Clr Fan	205	C&A VENT BD 1B1-B	3C	1-MTR-30-178-B	7.50	9.00	62.0	0.57	4.2836	2.4416	3.5196	T40	0.02789	1PL3061B	#10	596	0.8019	0.0419	396.0	387.9	80%	0.7	AMP FAIL	
Cntmt Bldg Upper Compt Air Mon	205	C&A VENT BD 1B1-B	3F1	1-RE-90-112-B	4.50	6.00	38.0	0.65	14.7565	9.5904	11.2125			1PL3507B	#10	482	0.6507	0.0340	426.8					
Battery Rm El 692 Exh Fan B-B	205	C&A VENT BD 1B1-B	4A	0-MTR-31-25-B	1.00	2.20	19.5	0.62	13.6195	8.4441	10.6853	T27	0.36200	1PL2895B	#12	628	1.3330	0.0474	405.9					
Emerg Gas Trtmt Sys Fan B-B	205	C&A VENT BD 1B1-B	4B	0-MTR-65-42-B	20.00	25.00	137.0	0.46	2.0128	0.9255	1.7865	T50	0.00357	1PL3530B	#8	560	0.4754	0.0395	384.3	377.3	80%	7.1	AMP FAIL	
ERCW Str 1B-B Backwash Vlv	205	C&A VENT BD 1B1-B	4E	1-FCV-67-188-B	0.33	0.75	5.79	0.60	45.8435	27.5214	36.6951	T14	6.72000	1V3956B	#8	3430	2.9123	0.2418	355.1					
CNTMT PURGE AIR EXH MON	205	C&A VENT BD 1B1-B	4F1	1-RE-90-131-B	1.40	1.80	5.4	0.65	49.1817	31.9681	37.3748			1PL3077B	#10	424	0.5724	0.0299	436.5					
SFP PmpB-BSTB Rst Pmp SpClrFan	205	C&A VENT BD 1B1-B	5A	0-MTR-30-193-B	7.50	9.00	62.0	0.57	4.2836	2.4416	3.5196	T40	0.02789	1PL3161B	#10	520	0.7020	0.0367	395.8	388.6	80%	0.7	AMP FAIL	
CCS & AFW Pumps Sp Clr Fan B-B	205	C&A VENT BD 1B1-B	5E	1-MTR-30-191-B	20.00	24.50	139.5	0.38	1.8984	0.7138	1.7591	T58	0.00357	1PL3201B	#8	370	0.3141	0.0261	405.1	397.8	80%	0.48	AMP FAIL	

\UIMCCTD\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1200 FEET

Rev. 5

Prepared By GCP/RS Date 10-31-92

Checked By [signature] Date 10-31-92

30-Oct-92

WBN-EEB-MS-TI06-0010 R0 ATTACHMENT 10.4 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOTAGES
(TABLE L2 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI05-0002 R10)

EAC_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLA	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND-MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	KEY
SHUTDOWN BD RM A PRESS FAN C-B	205	C&A VENT BD 1B1-B	6A	0-MTR-31-67-B	3.00	4.60	28.0	0.62	9.4850	5.8807	7.4420	T34	0.07100	1PL3611B	#12	160	0.3440	0.0122	427.7					
ERCW STRAINER 1B-B	205	C&A VENT BD 1B1-B	6B	1-MTR-67-108-B	3.00	6.00	30.1	0.62	8.8252	5.4741	6.9274	T36	0.05500	1PL3970B	#4	2200	0.7062	0.1323	358.7		75%			
	205	C&A VENT BD 1B1-B	6B												#10	1400	1.8900	0.0987						
Traveling Scrn 1B-B	205	C&A VENT BD 1B1-B	6C	1-MTR-67-445-B	5.00	6.80	41.1	0.61	6.4618	3.9546	5.1104	T38	0.03483	1PL3940B	#2	2200	0.4491	0.3292	368.8		80%			
	205	C&A VENT BD 1B1-B	6C												#8	1330	1.1252	0.0938						
ERCW Str 1B-B Flush Vlv	205	C&A VENT BD 1B1-B	6E	1-FCV-67-108-B	0.33	0.75	5.79	0.60	45.8683	27.5214	36.6953	T14	4.72000	1V3988B	#8	3425	2.9078	0.2615	395.8					
5th Vtl Batt Rm Exh Fan 1A2-B	205	C&A VENT BD 1B1-B	7A	0-MTR-31-456A-B	1.50	2.50	14.5	0.62	18.3159	11.3559	14.3707	T28	0.23500	1PL6450B	#12	237	0.5096	0.0181	427.8					
125V Vtl Bat Rm I Ex Fan 1A2-B	205	C&A VENT BD 1B1-B	7B	1-MTR-31-288-B	0.33	0.80	5.2	0.62	51.6733	31.6654	40.0722	T17	2.20500	1PL3565B	#12	274	0.5891	0.0210	425.1				P-04468-A	
High Press Fire Pmp Str B-B	205	C&A VENT BD 1B1-B	7C	0-MTR-26-14-B	0.75	2.05	8.3	0.61	31.3926	19.4634	24.6307	T26	0.42100	1PL3418B	#10	1246	1.6822	0.0878	404.9					
	205	C&A VENT BD 1B1-B	7C												#8	2100	1.7823	0.1481						
RHR Pmp 1B-B Inlet FCV	205	C&A VENT BD 1B1-B	7D	1-FCV-74-21-B	5.20	10.60	60.0	0.50	4.4254	2.6553	3.5411	T48	0.02283	1V1500B	#2	1170	0.2457	0.0720	417.2				N-13725-A,P-14471-A	**;R5
	205	C&A VENT BD 1B1-B	7D												#8	30	0.3255	0.0021					P-14471-A,P-01567-C	;R5
RHSI To Spray Hdr 1B FCV	205	C&A VENT BD 1B1-B	7E	1-FCV-72-21-B	3.20	5.20	36.0	0.60	7.3773	4.4264	5.9018	T32	0.18000	1V1850B	#8	675	0.5731	0.0476	411.8				N-13725-A	*
	205	C&A VENT BD 1B1-B	7E												#10	50	0.0675	0.0035					N-13725-A	
Safety Inj Pmp 1B-B Rm Clr Fan	205	C&A VENT BD 1B1-B	8A	1-MTR-30-179-B	5.00	6.10	50.1	0.62	5.2958	3.2840	4.1559	T37	0.04300	1PL2991B	#10	756	1.0206	0.0533	385.1	378.1	80%	2.1	AMP FAIL	
Pen Rm El 692 Clr Fan 1B-B	205	C&A VENT BD 1B1-B	8B	1-MTR-30-187-B	3.00	4.00	25.0	0.62	10.6232	6.5864	8.3358	T32	0.10000	1PL3141B	#10	540	0.7290	0.0381	417.9	410.1	80%	2.4		
Shtdn Xfmr Rm 1B Exh Fan 1B2-B	205	C&A VENT BD 1B1-B	8C	1-MTR-30-248F-B	3.00	4.40	27.4	0.67	9.6927	6.4457	7.2390	T34	0.07100	1PL2870B	#12	232	0.5848	0.0208	419.9		80%		N-13273-A	
Shtdn Xfmr Rm 1B Exh Fan 1B3-B	205	C&A VENT BD 1B1-B	8D	1-MTR-30-248G-B	3.00	4.40	27.4	0.67	9.6927	6.4457	7.2390	T34	0.07100	1PL2862B	#12	276	0.5934	0.0211	419.7		80%		N-13273-A	
Cont Rm A/C Clr Pmp B-B	205	C&A VENT BD 1B1-B	8E	0-MTR-31-96/1-B	15.00	20.00	111.4	0.49	2.3431	1.0991	1.9553	T49	0.00572	1PL3435B	#6	337	0.2819	0.0234	408.5				AMP FAIL	
Cont Rm A/C Sys Oil Pmp	205	C&A VENT BD 1B1-B	8F1	0-MTR-31-96/3-B	3.00	4.60	32.6	0.62	8.2994	5.1455	6.5117			1PL3838B	#8	374	0.3175	0.0264	428.6					
RHR Pmp 1B-B Rm Clr Fan	205	C&A VENT BD 1B1-B	9A	1-MTR-30-176-B	5.00	6.10	45.0	0.62	5.9018	3.6591	4.6306	T37	0.04300	1PL3041B	#10	756	1.0206	0.0533	380.4	341.3	80%	2.1	AMP FAIL	
5th Vtil Batt Rm Exh Fan 1B2-B	205	C&A VENT BD 1B1-B	9B	0-MTR-31-456B-B	1.50	2.50	14.5	0.62	18.3159	11.3559	14.3707	T28	0.23500	1PL6455B	#12	237	0.5096	0.0181	427.8					
480V Bd Rm 1A Pr Sup Fan 1A2-B	205	C&A VENT BD 1B1-B	9C	1-MTR-31-463-B	3.00	4.60	28.0	0.62	9.4850	5.8807	7.4420	T34	0.07100	1PL3487B	#10	150	0.2025	0.0106	431.8					
Shtdn Xfmr Rm 1B Exh Fan 1B1-B	205	C&A VENT BD 1B1-B	9D	1-MTR-30-248E-B	3.00	4.40	27.4	0.67	9.6927	6.4457	7.2390	T34	0.07100	1PL2870B	#12	418	0.9617	0.0335	409.4		80%		N-13273-A	
Pen Rm El 737 Clr Fan 1B-B	205	C&A VENT BD 1B1-B	9E	1-MTR-30-195-B	3.00	4.00	25.3	0.65	10.4973	6.8227	7.9862	T32	0.10000	1PL3161B	#10	410	0.5535	0.0289	421.7	414.0	80%	2.4		
Cntfg Chrg Pmp 1B-B Rm Clr Fan	205	C&A VENT BD 1B1-B	10A	1-MTR-30-182-B	5.00	6.10	45.0	0.62	5.9018	3.6591	4.6306	T37	0.04300	1PL3081B	#10	596	0.8046	0.0420	400.0	392.7	80%	2.1		
480V Bd Rm 1B Pr Sup Fan 1B2-B	205	C&A VENT BD 1B1-B	10B	1-MTR-31-477-B	3.00	4.60	28.0	0.62	9.4850	5.8807	7.4420	T34	0.07100	1PL3495B	#10	158	0.2133	0.0111	431.5					
125V VTL BAT RM II EXFAN 1B2-B	205	C&A VENT BD 1B1-B	10C	1-MTR-31-296-B	0.33	0.80	5.2	0.62	51.0733	31.6654	40.0722	T17	2.20500	1PL3575B	#12	264	0.5676	0.0202	425.2				P-04468-A	
Cont Rm Intake Mon	205	C&A VENT BD 1B1-B	10F1	0-RE-90-205-B	1.40	1.00	5.6	0.65	49.1817	31.9641	37.3748			1PL3263B	#10	164	0.2214	0.0116	430.6					
Cont Bldg Emerg Press Fan B-B	205	C&A VENT BD 1B1-B	11A	0-MTR-31-5-B	1.00	1.70	15.0	0.62	17.7054	10.9774	13.8912	T25	0.45500	1PL3255B	#12	150	0.3225	0.0115	427.3	419.5				
480V Bd Rm 1B A/C Ahu 1B-B	205	C&A VENT BD 1B1-B	11B	1-MTR-31-475-B	20.00	25.80	142.0	0.46	1.8703	0.8603	1.6607	T51	0.00318	1PL4070B	#1	210	0.1781	0.0149	437.1				AMP FAIL	
480V Bd Rm 1B A/C Cond 1B-B	205	C&A VENT BD 1B1-B	11C	1-MTR-31-203-B	20.00	25.00	142.0	0.46	1.8703	0.8603	1.6607	T51	0.00318	1PL4090B	#1	164	0.1392	0.0116	422.1				AMP FAIL	
Cont Rm Ahu B-B	205	C&A VENT BD 1B1-B	11D	0-MTR-31-11-B	60.00	72.00	413.0	0.50	0.6431	0.3215	0.5569	T58	0.00124	1PL4040B	#2	136	0.0286	0.0082	425.2				AMP FAIL	
Recip Chgrg Pmp Rm Clr Fan	205	C&A VENT BD 1B1-B	12A	1-MTR-30-181	3.00	4.30	26.7	0.62	8.9669	6.1671	7.8043	T33	0.08000	1PL3021	#10	400	0.5400	0.0282	422.3					
Cont Bldg Press Fan B-B	205	C&A VENT BD 1B1-B	12B	0-MTR-31-2-B	2.00	3.65	27.0	0.62	9.8363	6.0985	7.7176	T31	0.14100	1PL3249B	#8	174	0.1877	0.0123	431.6					
GASEOUS EFL RADN MON	205	C&A VENT BD 1B1-B	12C1	0-PNL-90-133	5.00	7.10	44.5																	
Cond Vac Pmp Air Exh Mon	205	C&A VENT BD 1B1-B	12F1	1-RE-90-99	1.40	1.80	5.4	0.65	49.1817	31.9641	37.3748			1PL3730	#10	924	1.2474	0.0651	432.4					
Aux Chgrg Pmp 1B	205	C&A VENT BD 1B1-B	13A	1-MTR-84-21	1.00	1.80	12.5	0.62	21.1556	13.1433	16.6301	T25	0.45500	1PL2948	#12	266	0.5719	0.0203	426.1					
Aux Chgrg Batr Pmp	205	C&A VENT BD 1B1-B	13B	0-MTR-84-11	1.00	1.80	11.3	0.62	23.5444	14.5975	18.4730	T25	0.45500	1PL3165	#12	356	0.7656	0.0272	425.2					
Cntmt Annulus Vac Fan 1B	205	C&A VENT BD 1B1-B	13C	1-MTR-65-74	5.00	6.80	50.1	0.62	5.2958	3.2840	4.1559	T38	0.03483	1PL3610	#12	782	1.6813	0.0598	356.4				FAILED NON-1E	

\UIMCCWD\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1300 FEET

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30-Oct-92

WBN-EEB-MS-TI06-0010 R0 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES
(TABLE 62 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R18)

ENG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLA	LRA	LRPF	Rm	Xm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
ERCW SCREEN WASH PUMP 1B-B	205	C&A VENT BD 1B1-B	13D	1-MTR-67-440-B	40.00	49.80	290.0	0.38	0.5158	4.3480	0.8471	T54	0.00202	1PL3905B	1-1/0	2100	0.1420	0.0630	348.6		75%			
	205	C&A VENT BD 1B1-B	130												4/0	1386	0.0355	0.0852						
Shdn Bd Rm Chlr Pkg B-B O. Pmp	205	C&A VENT BD 1B1-B	13F2	0-MTR-31-49/3-B	2.00	4.18	12.5	0.62	21.2465	13.1728	16.6700			1PL3760B	#10	370	0.4995	0.0261	433.2				4.75hp	
Toilet And Locker Rm Exh Fan	206	C&A VENT BD 1B2-B	2B	0-MTR-31-418	0.33	1.00	10.0	0.62	26.5581	16.4660	20.8375	T18	1.87500	1PL3654	#12	210	0.4515	0.0161	416.3					
Smply Rm Hood Exh Fan 1B	206	C&A VENT BD 1B2-B	3B	1-MTR-30-284	1.00	1.70	15.0	0.62	17.7054	10.9774	13.8917	T24	0.63200	1PL3626	#12	540	1.1610	0.0413	412.2					
Smply Rm Hood Exh Fan 1C	206	C&A VENT BD 1B2-B	3C	1-MTR-30-66	1.00	1.70	15.0	0.62	17.7054	10.9774	13.8917	T24	0.63200	1PL3631	#12	540	1.1610	0.0413	412.2					
South Main St Vlt Stup Exh Fan	206	C&A VENT BD 1B2-B	4B	1-MTR-30-302	3.00	4.60	32.0	0.62	8.2994	5.1456	6.5117	T33	0.08080	1PL3435	#12	568	1.2212	0.0435	397.2					
South Main St Vlt Exh Fan	206	C&A VENT BD 1B2-B	5B	1-MTR-30-25	3.00	4.60	32.0	0.62	8.2994	5.1456	6.5137	T33	0.08080	1PL2913	#12	568	1.2212	0.0435	397.2					
Cont Rod Dr Eqpt Rm A/C 1B	206	C&A VENT BD 1B2-B	9A	1-MTR-30-CRB	47.50	78.40	370.5	0.40	0.7017	0.2807	0.6431			1PL3671	2/0	501	0.0544	0.0301	410.6					
Dg 1A-A Btry Hood Exh Fan	217	DSL AUX BD 1A1-A	2A	1-MTR-30-455-A	0.33	1.00	10.0	0.62	26.5581	16.4660	20.8375	T19	1.66080	PL2580A	#12	85	0.1828	0.0065	421.2					
DG 1A-A RM EXH FAN 1-A	217	DSL AUX BD 1A1-A	2B	1-MTR-30-447-A	15.00	19.50	118.4	0.49	2.2431	1.0991	1.9553	T49	0.00572	PL2620A	#8	105	0.0891	0.0074	429.6	421.8				
Dg 1A-A Lube Oil Circ Pmp 1	217	DSL AUX BD 1A1-A	2D	1-MTR-82-A1-A	1.00	1.55	8.3	0.62	32.1917	19.9588	25.2576	T26	0.42100	PL2735A	#12	92	0.1978	0.0070	434.7					
EM DG HX 1A1 & 1A2 SPLY VLV	217	DSL AUX BD 1A1-A	3A	1-FCV-67-66-A	0.13	0.39	2.60	0.60	102.1466	61.2880	81.7173	T8	13.95000	PL2146A	#12	155	0.3333	0.0119	403.8	396.4	80%			
Dg 1A-A Day Tk FO Xfr Pmp 1-A	217	DSL AUX BD 1A1-A	3D	1-MTR-18-55-A	1.00	1.85	11.3	0.62	23.5444	14.5975	18.4730	T26	0.42100	PL2714A	#12	96	0.2064	0.0073	432.7					
DG 1A-A AUX LUBEOIL CIRC PMP A	217	DSL AUX BD 1A1-A	4B	1-MTR-82-AOPA-A	0.75	1.27	11.5	0.75	23.0940	17.3205	15.2753	T23	0.80000	PL3320A	#12	60	0.1290	0.0046	426.9				0-05146-A	
Dg Rm 1A-A Pnl Vent Fan	217	DSL AUX BD 1A1-A	4D	1-MTR-30-491-A	15.00	20.00	118.4	0.49	2.2431	1.0991	1.9553	T48	0.00825	PL3444A	#8	130	0.1104	0.0092	427.0	419.2				
Dg 1A-A 480V Elec Bd Rm Ex Fan	217	DSL AUX BD 1A1-A	4E	1-MTR-30-459-A	2.00	2.70	22.6	0.62	11.7514	7.2859	9.2202	T29	0.23700	PL2520A	#10	95	0.1283	0.0067	431.4					
Dg 1A-A Air Cprsr 2	217	DSL AUX BD 1A1-A	5A	1-MTR-82-181	5.00	7.10	44.5	0.62	5.9695	3.7011	4.6836	T39	0.02878	PL2195	#12	109	0.2150	0.0077	428.5	420.7				
Dg 1A-A Muffler Rm Exh Fan	217	DSL AUX BD 1A1-A	6A	1-MTR-30-463	1.50	2.65	20.0	0.62	13.2791	8.2330	10.4188	T28	0.29500	PL2235	#12	62	0.1333	0.0047	431.1	423.3				
DG 1A-A AUX LUBEOIL CIRC PMP B	218	DSL AUX BD 1A2-A	2A	1-MTR-82-AOPB-A	0.75	1.27	11.5	0.75	23.0940	17.3205	15.2753	T23	0.80000	PL3321A	#12	176	0.3784	0.0135	423.4				0-05146-A	
DG 1A-A RM EXH FAN 2-A	218	DSL AUX BD 1A2-A	2B	1-MTR-30-452-A	15.00	19.50	118.4	0.49	2.2431	1.0991	1.9553	T49	0.00572	PL2629A	#8	66	0.0560	0.0047	433.3	425.4				
Dg 1A-A Lube Oil Circ Pmp 2	218	DSL AUX BD 1A2-A	2D	1-MTR-82-A2-A	1.00	1.70	15.0	0.62	17.7054	10.9774	13.8917	T24	0.63200	PL2736A	#12	170	0.3655	0.0130	424.5					
EMDG ENG 1A1 & 1A2 SUP VLV	218	DSL AUX BD 1A2-A	3A	1-FCV-67-68-A	0.13	0.39	2.60	0.60	102.1466	61.2880	81.7173	T8	13.95000	PL2140A	#12	110	0.2365	0.0084	404.0					
Dg 1A-A Day Tnk FO Xfr Pmp 2-A	218	DSL AUX BD 1A2-A	3D	1-MTR-18-54-A	1.00	1.85	11.3	0.62	23.5444	14.5975	18.4730	T26	0.42100	PL2737A	#12	172	0.3698	0.0132	430.7					
DG 1A-A AIR CPRSR 1	218	DSL AUX BD 1A2-A	5A	1-MTR-82-180	5.00	7.10	44.5	0.62	5.9695	3.7011	4.6836	T39	0.02878	PL2200	#12	74	0.1591	0.0057	431.1	423.3				
Dg Bldg Co2 Refrigeration Unit	218	DSL AUX BD 1A2-A	5F1	0-PKG-39-37	2.00	3.10	25.0	0.62	10.6732	6.5864	8.3350			PL2765	#10	150	0.2025	0.0106	434.5					
Lube Oil & Co2 Stor Rm Exh Fan	218	DSL AUX BD 1A2-A	6A	0-MTR-30-470	0.75	1.40	12.5	0.62	21.2465	13.1728	16.6700	T22	0.65900	PL2572	#12	140	0.3010	0.0107	424.9					
Dg 1B-B Battery Hood Exh Fan	219	DSL AUX BD 1B1-B	2A	1-MTR-30-457-B	0.33	1.00	10.0	0.62	26.5581	16.4660	20.8375	T18	1.87500	PL2590B	#12	100	0.2150	0.0077	428.7					
DG 1B-B RM EXH FAN 1-B	219	DSL AUX BD 1B1-B	2B	1-MTR-30-449-B	15.00	19.50	118.4	0.49	2.2431	1.0991	1.9553	T49	0.00572	PL2656B	#8	132	0.1121	0.0093	427.1	419.3				
Dg 1B-B Lube Oil Circ Pmp 1	219	DSL AUX BD 1B1-B	2D	1-MTR-82-B1-B	1.00	2.05	11.3	0.62	23.5444	14.5975	18.4730	T26	0.42100	PL2740B	#12	152	0.3268	0.0116	431.2					
EM DG ENG HX SUP VLV FM HDR 1B	219	DSL AUX BD 1B1-B	3A	1-FCV-67-67-B	0.13	0.39	2.60	0.60	102.1466	61.2880	81.7173	T8	13.95000	PL2147B	#12	158	0.3397	0.0121	403.7	396.4	80%			
Dg 1B-B Day Tnk FO Xfr Pmp 1-B	219	DSL AUX BD 1B1-B	3D	1-MTR-18-55-B	1.00	1.85	11.3	0.62	23.5444	14.5975	18.4730	T26	0.42100	PL2725B	#12	168	0.3612	0.0129	430.8					
Dg 1B-B Aux LubeOil Circ Pmp A	219	DSL AUX BD 1B1-B	4B	1-MTR-82-AOPA-B	0.75	1.27	11.5	0.75	23.0940	17.3205	15.2753	T23	0.80000	PL3322B	#12	60	0.1290	0.0046	426.9				0-05146-A	
Dg Rm 1B-B Pnl Vent Fan	219	DSL AUX BD 1B1-B	4D	1-MTR-30-493-B	15.00	20.00	118.4	0.49	2.2431	1.0991	1.9553	T48	0.00825	PL3452B	#8	150	0.1274	0.0106	425.1	417.4				
DG 1B-B 480V ELEC BD RM EX FAN	219	DSL AUX BD 1B1-B	4E	1-MTR-30-461-B	2.00	2.75	22.6	0.62	11.7514	7.2859	9.2202	T29	0.23700	PL2530B	#10	91	0.1323	0.0065	431.3					
Dg 1B-B Air Cprsr 2	219	DSL AUX BD 1B1-B	5A	1-MTR-82-211	5.00	7.10	44.5	0.62	5.9681	3.7002	4.6826	T39	0.02878	PL2215	#12	120	0.2580	0.0092	426.5	418.7				

\U1MCCVD\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1200 FEET

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(ADDED BY REV 5)

30-Oct-97

Revision 5
Prepared By GCP/RS Date 10-31-97
Checked By [signature] Date 10-31-97

WBN-EEB-MS-TI06-0010 R0 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES
(TABLE 12 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R18)

ENG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPIN_NO	LOAD	FL1	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
Dg 1B-B Muffler Rm Exh Fan	219	DSL AUX BD 1B1-B	6A	1-MTR-30-465	1.50	2.65	20.0	0.62	13.2791	8.2330	10.4188	T28	0.29500	PL2243	#12	65	0.1398	0.0050	431.0	423.2				
Dg 1B-B Aux LubeOil Circ Pmp B	220	DSL AUX BD 1B2-B	2A	1-MTR-82-AOPB-B	0.75	1.27	11.5	0.75	23.0940	17.3205	15.2753	T23	0.80000	PL3323B	#12	176	0.3784	0.0135	423.4				Q-05146-A	
Dg 1B-B Rm Exh Fan 2-B	220	DSL AUX BD 1B2-B	2B	1-MTR-30-453-B	15.00	19.50	118.4	0.49	2.2431	1.0991	1.9553	T49	0.00572	PL2665B	#8	116	0.0934	0.0078	429.1	421.3				
Dg 1B-B Lube Oil Circ Pmp 2	220	DSL AUX BD 1B2-B	2D	1-MTR-82-B2-B	1.00	2.05	11.3	0.62	23.5444	14.5975	18.4730	T26	0.42100	PL2741B	#12	186	0.3999	0.0142	430.3					
Emer Dg Hx Sup Vlv From Hdr 2A	220	DSL AUX BD 1B2-B	3A	1-FCV-67-65-B	0.13	0.39	2.60	0.60	102.1466	61.2880	81.7173	T8	13.95000	PL2173B	#12	130	0.2795	0.0099	403.9					
Dg 1B-B Day Tnk FO Xfr Pmp 2-B	220	DSL AUX BD 1B2-B	3D	1-MTR-18-54-B	1.00	1.85	11.3	0.62	23.5444	14.5975	18.4730	T26	0.42100	PL2727B	#12	160	0.3440	0.0122	431.0					
Dg 1B-B Air Cprsr 1	220	DSL AUX BD 1B2-B	5A	1-MTR-82-220	5.00	7.10	44.5	0.62	5.9681	3.7002	4.6826	T39	0.02878	PL2220	#12	100	0.2150	0.0077	428.5	420.7				
D.G RM EXH FAN 2	225	DSL AUX BD C1-S	BM	0-MTR-30-332-S	15.00	18.00	105.2	0.49	2.5236	1.2366	2.1999	C228	0.00570	PL3376S	#8	110	0.0934	0.0078	430.3					
D.C. RM. EXH FAN 1	225	DSL AUX BD C1-S	BS	0-MTR-30-334-S	15.00	18.00	105.2	0.49	2.5236	1.2366	2.1999	C228	0.00570	PL3370S	#8	126	0.1070	0.0089	429.0					
480V AUX BD RM EXH FAN	225	DSL AUX BD C1-S	CA	0-MTR-30-331-S	1.50	1.95	13.4	0.62	19.8937	12.3341	15.6086	C263	0.42800	PL3395S	#10	120	0.1620	0.0085	431.1					
6.9KV BD. RM	225	DSL AUX BD C1-S	CE	0-MTR-30-330-S	10.00	12.08	78.9	0.53	3.3660	1.7840	2.8544	C16.	0.01050	PL3385S	#8	100	0.0849	0.0071	432.6					
ERCW TO DSL GEN OC-S HTX VLV	225	DSL AUX BD C1-S	DA	2-FCV-67-73-S	0.13	0.45	3.26	0.60	81.4666	48.8800	65.1733	C054	10.70000	PL3303S	#12	140	0.3010	0.0107	405.0					
ERCW TO DSL GEN OC-S HTX VLV	225	DSL AUX BD C1-S	DE	1-FCV-67-72-S	0.13	0.45	3.26	0.60	81.4666	48.8800	65.1733	C054	10.70000	PL3362S	#12	130	0.2795	0.0099	405.0					R4
D.G. DAY TANK FUEL TRANS PMP 1	225	DSL AUX BD C1-S	EA	0-MTR-18-108A-S	1.00	2.00	10.8	0.62	26.4787	16.4168	20.7752	C268	0.42800	PL3251S	#12	76	0.1634	0.0058	433.9					
D.G. DAY TANK FUEL TRANS PMP 2	225	DSL AUX BD C1-S	EB	0-MTR-18-108B-S	1.00	2.00	10.8	0.62	26.4787	16.4168	20.7752	C268	0.42800	PL3261S	#12	200	0.4300	0.0153	431.0					
DSL GEN ENG A LUBE OIL PMP 1	226	DSL AUX BD C2-S	BA	0-MTR-82-C1-S	2.00	3.50	22.6	0.62	11.7670	7.2955	9.2324	C419	0.09800	PL3257S	#12	150	0.3225	0.0115	430.0					
DSL GEN ENG B LUBE OIL PMP 2	226	DSL AUX BD C2-S	BE	0-MTR-82-C2-S	2.00	3.50	22.6	0.62	11.7670	7.2955	9.2324	C419	0.09800	PL3260S	#12	200	0.4300	0.0153	427.4					
FUEL OIL TRANSFER RM EXH FAN	226	DSL AUX BD C2-S	CA	0-MTR-30-329	0.50	1.00	10.0	0.62	26.5581	16.4660	20.8375	C118	1.97000	PL3308	#12	150	0.3225	0.0115	436.7					
DG BLDG FUEL TRANS. PMP	226	DSL AUX BD C2-S	DM	0-MTR-18-110	10.00	13.00	100.3	0.53	2.6484	1.4036	2.2458	C163	0.01050	PL3350	#8	232	0.1970	0.0164	419.6					
DG AIR COMP 1	226	DSL AUX BD C2-S	BR	0-MTR-82-320	5.00	7.10	44.5	0.62	5.9695	3.7011	4.6836	C955	0.42300	PL3265	#12	90	0.1935	0.0069	429.8					
DG AIR COMP 2	226	DSL AUX BD C2-S	DD	0-MTR-82-321	5.00	7.10	44.5	0.62	5.9695	3.7011	4.6836	C955	0.42300	PL3260	#12	120	0.2580	0.0092	426.8					
DG MUFFLER RM EXH FAN	226	DSL AUX BD C2-S	EA	0-MTR-30-327	1.50	1.95	12.5	0.62	21.2465	13.1728	16.6700	C268	0.42800	PL3316	#12	55	0.1183	0.0042	432.9					
Boric Acid Transfer Pmp 1A-A	235	RMOV BD 1A1-A	2B	1-MTR-62-230-A	7.50	13.00	105.2	0.49	2.5236	1.2366	2.1999	T43	0.01387	1PL6104A	#8	434	0.3685	0.0306	402.9				AMP FAIL	
Boric Acid Transfer Pmp 1A-1	235	RMOV BD 1A1-A	2B	1-MTR-62-230-A	15.00	18.00	105.2	0.49	2.5236	1.2366	2.1999	T44	0.00825	1PL6108A	#8	434	0.3685	0.0306	403.4				AMP FAIL	
THERM BAR SYS BSTR PMP 1A-A	235	RMOV BD 1A1-A	2C	1-MTR-70-131-A	10.00	14.00	70.20	0.53	3.7832	2.0051	3.2082	T44	0.01214	1PL6120A	#8	428	0.3634	0.0302	414.2					
FDR BKR TO COMP 10A	235	RMOV BD 1A1-A	2E1																					
FDR BKR TO COMP 9A	235	RMOV BD 1A1-A	2F2																					
CNTMGL CHARG PMP 1A-A AOP	235	RMOV BD 1A1-A	3E	1-MTR-62-AOP-A	2.00	3.10	22.6	0.62	11.7670	7.2955	9.2324	T31	0.14700	1PL6145A	#12	600	1.2900	0.0459	406.5					
FDR BKR TO COMP 8D	235	RMOV BD 1A1-A	3F2																					
AFW Pmp A-A Lube Oil Pmp A-A	235	RMOV BD 1A1-A	4E	1-MTR-3-118B-A	0.25	0.56	3.5	0.62	75.6541	46.9118	59.3662	T33	6.15800	1PL6310A	#12	425	0.9138	0.0325	414.8					
HPFP Sys Low Level Intake Vlv	235	RMOV BD 1A1-A	5A	0-FCV-26-3-A	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T5	11.72800	1V1026A	#10	1128	1.5228	0.0395	393.6		80%			
	235	RMOV BD 1A1-A	5A												#8	2100	1.7829	0.1481						
FDR BKR TO COMP 10D	235	RMOV BD 1A1-A	5B																					
Lwr Cntmt 1B Clr SUP Vlv [1B]	235	RMOV BD 1A1-A	5C	1-FCV-67-97-A	0.13	0.60	3.58	0.60	75.8303	45.5242	60.7043	T31	9.25000	1V712A	#10	453	0.6116	0.0319	405.9	398.5			M-11413-A	
	235	RMOV BD 1A1-A	5C											1V713A	#10	60	0.0810	0.0042					M-11413-A	
HPFP TK A MDR FCV TO YARD	235	RMOV BD 1A1-A	5E	0-FCV-26-6-A	0.13	0.75	5.7	0.60	46.5932	27.9559	37.2745	T14	4.72800	1V2224A	#12	1045	2.2468	0.0799	385.2		80%			

\UIMCCVD\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1200 FEET

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Revision 5
Prepared By [signature] Date 11-1-92
Checked By [signature] Date 11-1-92

PAGE 181 (Added Per Rev 5)

10-Oct-92

WBN-EEB-MS-TI06-0010 R0 ATTACHMENT 10.5 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES
(TABLE 62 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R10)

ENG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLI	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
	235	RMOV BD 1A1-A	5E												#10	2100	2.1350	0.1481						
POSIT DISPLMNT PMP RECIRC VLV	235	RMOV BD 1A1-A	5F	1-FCV-62-275-A	0.70	2.30	16.0	0.60	15.5988	9.3593	12.4791	T26	0.42180	1V3300A	#12	596	1.2814	0.0456	412.5				M-12409-A	
RCS Press Relief FCV	235	RMOV BD 1A1-A	6D	1-FCV-68-333-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2451A	#12	476	1.0234	0.0364	401.5					
	235	RMOV BD 1A1-A	6E											1V2452A	#12	100	0.2150	0.0077						
HPFP AUX BLDG TR 1 HDR VLV	235	RMOV BD 1A1-A	6F	0-FCV-26-126-A	4.33	0.75	5.7	0.60	46.5932	27.9559	37.2745	T13	6.15000	1V3340A	#12	286	0.6149	0.0219	402.3					
Seal Flow Ret Isln Vlv	235	RMOV BD 1A1-A	7A	1-FCV-62-63-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2280A	#12	616	1.3244	0.0471	399.3	392.0	80%			
CHARGING FLOW ISLN VLV	235	RMOV BD 1A1-A	7C	1-FCV-62-90-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2247A	#12	684	1.4706	0.0523	395.6	388.5	80%			
SIS Accum Tank 3 Flow Isol Vlv	235	RMOV BD 1A1-A	7D	1-FCV-63-80-A	6.60	10.00	84.0	0.60	3.1617	1.8970	2.5293	T39	0.02878	1V2720A	#6	406	0.2167	0.0280	411.7		80%		P-01667-C	|R5
	235	RMOV BD 1A1-A	7D											1V2733A	#2	100	0.0213	0.0062						
CHARG PMP 1A-A MIN FLOW	235	RMOV BD 1A1-A	8A	1-FCV-62-91-A	0.66	2.30	12.0	0.60	22.1318	13.2791	17.7054	T22	0.16900	1V2237A	#12	694	1.4921	0.0531	411.5					
Vol Cont Tank Outlet Isln Vlv	235	RMOV BD 1A1-A	8B	1-LCV-62-132-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2260A	#12	500	1.0750	0.0383	405.6	398.3	80%			
SIS Accum Tank 1 Flow Isol Vlv	235	RMOV BD 1A1-A	8D	1-FCV-63-118-A	6.60	10.00	84.0	0.60	3.1617	1.8970	2.5293	T39	0.02878	1V2710A	#6	400	0.2135	0.0276	415.0		80%		P-01667-C	|R5
	235	RMOV BD 1A1-A	8D											1V2711A	#2	100	0.0213	0.0062						
RWST To Charging Pmp Vlv Cont	235	RMOV BD 1A1-A	9A	1-LCV-62-135-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2070A	#12	434	0.9331	0.0332	409.3	401.8	80%			
SIS PMP INLET TO CVCS CHG PMP	235	RMOV BD 1A1-A	9B	1-FCV-63-173-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2112A	#8	1200	1.0088	0.0846	405.7				M-10473-A	**|R5
RCP OIL CLR SUP CNTMT ISOL VLV	235	RMOV BD 1A1-A	9D	1-FCV-70-100-A	0.13	0.60	3.5	0.60	75.8803	45.5282	60.7043	T11	5.25000	1V816A	#10	425	0.5738	0.0380	405.5	398.1				|R5
	235	RMOV BD 1A1-A	9E											1V817A	#10	175	0.2363	0.0123						
RWST To RHR Pmp Flow Cont Vlv	235	RMOV BD 1A1-A	10A	1-FCV-63-1-A	5.20	10.50	60.0	0.60	4.4264	2.6558	3.5411	T40	0.02789	1V2320A	#2	1200	0.2561	0.0738	416.7				A-06555-A,P-01667-C	**|R5
															#8	30	0.0255	0.0021					M-10473-A	|R5
SIS Pmp Recirc To RWST	235	RMOV BD 1A1-A	10B	1-FCV-63-3-A	0.70	2.30	12.0	0.60	22.1318	13.2791	17.7054	T22	0.16900	1V2900A	#12	702	1.5093	0.0537	411.3					
RHR Sys Isln Vlv	235	RMOV BD 1A1-A	10D	1-FCV-74-1-A	2.60	4.73	38.0	0.60	6.9890	4.1934	5.5912	T33	0.08000	1V2780A	#8	550	0.4670	0.0380	405.2				M-12070A	*
	235	RMOV BD 1A1-A	10E											1V2781A	#8	350	0.2972	0.0242					M-12078A	*
Cont Spray Pmp 1A-A Recirc FCV	235	RMOV BD 1A1-A	10F	1-FCV-72-34-A	0.13	0.45	2.6	0.50	102.1466	61.2880	81.7173	T5	11.32000	1V3160A	#12	642	1.3803	0.0491	406.6					
SIS Pmp Inlet To CVCS Chrg Pmp	235	RMOV BD 1A1-A	11A	1-FCV-63-7-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2326A	#12	698	1.5007	0.0534	394.9					
RHR Hx A To CVCS Chrgr Pmp	235	RMOV BD 1A1-A	11B	1-FCV-63-8-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V3170A	#10	534	0.7209	0.0376	414.4					
SIS Boron Inj Tank Shutoff Vlv	235	RMOV BD 1A1-A	11D	1-FCV-63-25-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2680A	#12	528	1.1352	0.0404	404.1	396.7	80%			
SIS BIT Inlet Shutoff Valve	235	RMOV BD 1A1-A	11E	1-FCV-63-39-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2695A	#10	532	0.7182	0.0375	414.5	407.8	80%			
SIS Pmp 1A-A Inlet Vlv	235	RMOV BD 1A1-A	12A	1-FCV-63-47-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2338A	#12	702	1.5093	0.0537	394.7					
Cntmt Sump To RHR Pmp A-A	235	RMOV BD 1A1-A	12B	1-FCV-63-72-A	13.00	38.40	137.0	0.50	1.9385	0.9693	1.6788	T46	0.01080	1V3130A	#2	50	0.0107	0.0031	425.0				M-10473-A,P-01667-C	**|R5
															#1/0	1120	0.1524	0.0672						|R5
															#8	30	0.0255	0.0021						|R5
SIS To RCS Loops 2&3 FCV	235	RMOV BD 1A1-A	12D	1-FCV-63-93-A	1.60	4.00	25.0	0.60	10.6232	6.3739	8.4986	T30	0.17900	1V2314A	#6	682	0.3534	0.0457	425.5				P-01667-C	|R5
SIS Pmp 1A-A Outlet FCV	235	RMOV BD 1A1-A	12E	1-FCV-63-152-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2362A	#12	664	1.4276	0.0508	396.7					
SIS Pmp Out RCS Lp 1&3 Hot Leg	235	RMOV BD 1A1-A	13A	1-FCV-63-156-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2346A	#12	566	1.2169	0.0433	402.4					
Cntmt Sump To Spray Hdr 1A FCV	235	RMOV BD 1A1-A	13B	1-FCV-72-44-A	3.20	5.20	36.0	0.60	7.3773	4.4264	5.9018	T32	0.10000	1V1110A	#10	550	0.7425	0.0388	408.8					
Cntmt Spray Hdr 1A Isln Vlv	235	RMOV BD 1A1-A	13E	1-FCV-72-39-A	3.20	5.20	36.0	0.60	7.3773	4.4264	5.9018	T32	0.10000	1V2470A	#10	352	0.4752	0.0248	418.6	411.0	80%			
RHR Spray Hdr 1A Isln Vlv	235	RMOV BD 1A1-A	14A	1-FCV-72-40-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2743A	#10	516	0.6966	0.0364	415.1					
RHR Pmp 1A-A Min Flow Vlv	235	RMOV BD 1A1-A	14D	1-FCV-74-12-A	0.13	0.45	2.6	0.50	102.1466	61.2880	81.7173	T5	11.32000	1V1935A	#12	670	1.4405	0.0513	405.4	399.0	80%			
RHR Hx 1A Bypass Vlv	235	RMOV BD 1A1-A	14E	1-FCV-74-33-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T25	0.23700	1V2446A	#12	482	1.0363	0.0369	405.6					
Lwr Cntmt 1D Clr SUP Vlv (IB)	235	RMOV BD 1A1-A	15D	1-FCV-67-89-A	0.13	0.60	3.50	0.60	75.8803	45.5282	60.7043	T11	5.25000	1V704A	#10	366	0.4941	0.0258	406.3	399.2			M-11413-A	

\UIMCCTD\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. & CABLE LENGTH [illegible]

EN-EEB-MS-TI06-0010 R0 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES
TABLE L2 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R19)

NG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLI	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
	235	RMOV BD 1A1-A	15D											1V705A	#10	50	0.0675	0.0035					M-11413-A	
ncore Inst Rm Clr Fan 1A	235	RMOV BD 1A1-A	16A	1-MTR-31-265	3.00	4.30	26.7	0.62	9.9469	6.1671	7.8043	T33	0.08000	1PL6300	#10	456	0.6156	0.0321	420.2					
eac Cntmt Pit Sump Eject Pmp	235	RMOV BD 1A1-A	16B	1-MTR-77-129	1.50	2.40	16.9	0.62	15.6870	9.7259	12.3081	T27	0.36200	1PL6268	#10	435	0.5873	0.0307	423.0					
ERFP Hdr Str A-A Backwash Vlv	235	RMOV BD 1A1-A	16D	0-FCV-26-141-A	0.26	0.55	5.7	0.60	46.5932	27.9559	37.2745	T12	7.53000	V1960A	#12	1016	2.3844	0.0777	382.2		80%			
	235	RMOV BD 1A1-A	16D												#4	2100	0.7062	0.1323						
ERFP Hdr Str A-A Backflush Vlv	235	RMOV BD 1A1-A	16E	0-FCV-26-7-A	0.26	0.55	5.7	0.60	46.5932	27.9559	37.2745	T12	7.53000	V1987A	#12	1030	2.2145	0.0788	382.0		80%			
	235	RMOV BD 1A1-A	16E												#4	2100	0.7062	0.1323						
ncore Inst Rm Ch Wtr Cprsr 1A	235	RMOV BD 1A1-A	16F2	1-MTR-31-303/2	3.00	4.60	32.0	0.62	8.2994	5.1456	6.5117			1PL6289	#10	630	0.8505	0.0444	411.0					
ntmt Standpipe Isln Vlv	235	RMOV BD 1A1-A	17B	1-FCV-26-240-A	0.67	2.10	10.5	0.60	25.2934	15.1761	20.2348	T21	1.07000	1V9147A	#12	696	1.4964	0.0532	412.9	405.4				
nnulus Standpipe Isln Vlv	235	RMOV BD 1A1-A	17C	1-FCV-26-242-A	0.67	2.10	10.5	0.60	25.2934	15.1761	20.2348	T21	1.07000	1V9360A	#12	532	1.1436	0.0407	416.6	409.1				
DR BKR TO COMP 7D	235	RMOV BD 1A1-A	17F2																					
efueling Wtr Prfcn Pmp A-A	235	RMOV BD 1A1-A	18A	0-MTR-78-19-A	20.00	26.00	145.0	0.46	1.6316	0.8425	1.6263	T51	0.00318	1PL6385A	#2	818	0.1746	0.0503	409.4				DCN M-15092-A *	R4
															#6	12	0.0102	0.0008						R4
ncore Inst Rm Circ Pump 1A	235	RMOV BD 1A1-A	18C	1-MTR-31-303/1	3.00	4.20	30.1	0.62	8.8292	5.4741	6.9274	T33	0.08000	1PL6281	#12	584	1.2556	0.0447	398.8					
oric Acid Batch Tank Agitator	235	RMOV BD 1A1-A	18D	0-MTR-62-226	1.00	2.05	12.5	0.62	21.1787	13.1308	16.6169	T26	0.42100	1PL6265	#12	500	1.0750	0.0383	420.4					
CP Spray Isln Vlv	235	RMOV BD 1A1-A	18E	1-FCV-26-243-A	0.67	2.10	10.5	0.60	25.2934	15.1761	20.2348	T21	1.07000	1V9165A	#12	486	1.0445	0.0372	417.7	410.1				
ERCW Hdr A Isln Vlv	236	RMOV BD 1A2-A	2A	1-FCV-3-116A-A	0.25	0.55	4.3	0.60	61.7631	37.0578	49.4104	T11	9.25000	1V2930A	#12	318	0.6837	0.0243	392.4				M-21246-A	R6
ERCW Hdr A Isln Vlv	236	RMOV BD 1A2-A	2B	1-FCV-3-116B-A	0.25	0.55	4.3	0.60	61.7631	37.0578	49.4104	T11	9.25000	1V2950A	#12	320	0.6880	0.0245	398.4				M-21246-A	R6
AFWP Turb Stm Sup Fm Stm Gen 1	236	RMOV BD 1A2-A	2D	1-FCV-1-15-A	1.00	2.80	17.8	0.60	14.9203	8.9522	11.9362	T24	0.63200	1V1830A	#10	1200	1.6200	0.0846	399.5				M-15529-A	** R5
St Flow To AFWP Turb Isln Vlv	236	RMOV BD 1A2-A	2E	1-FCV-1-17-A	1.00	2.80	17.8	0.60	14.9203	8.9522	11.9362	T24	0.63200	1V2620A	#10	1200	1.6200	0.0846	399.5				M-15529-A	** R5
ERCW Hdr A Isln Vlv	236	RMOV BD 1A2-A	3A	1-FCV-3-136A-A	0.33	0.75	5.7	0.60	46.5932	27.9559	37.2745	T13	6.15000	1V1950A	#12	436	0.9374	0.0334	400.5					
ERCW Hdr A Isln Vlv	236	RMOV BD 1A2-A	3B	1-FCV-3-136B-A	0.33	0.75	5.7	0.60	46.5932	27.9559	37.2745	T13	6.15000	1V1960A	#12	436	0.9374	0.0334	400.5					R4
St Gen No 1 FW Isln Vlv	236	RMOV BD 1A2-A	3D	1-FCV-3-33-A	35.40	48.10	494.0	0.45	0.5376	0.2419	0.4801	T53	0.00226	1V2980A	300	800	0.0400	0.0468	390.5	383.4	70%		M-12553-A,M-10473-A	R5
															#1/0	20	0.0027	0.0012						R5
															#2	30	0.0064	0.0018						R5
Loop 1 Deaeration Line Vlv	236	RMOV BD 1A2-A	4A	1-FCV-3-191	1.60	4.00	25.0	0.60	10.6232	6.3739	8.4986	T28	0.29500	1V3360	#12	320	0.6880	0.0245	415.2					
Loop 2 Deaeration Line Vlv	236	RMOV BD 1A2-A	4B	1-FCV-3-192	1.60	4.00	25.0	0.60	10.6232	6.3739	8.4986	T28	0.29500	1V3230	#12	750	1.6125	0.0574	392.5					
St Gen No 3 FW Isln Vlv	236	RMOV BD 1A2-A	4D	1-FCV-3-87-A	35.40	48.10	494.0	0.45	0.5376	0.2415	0.4801	T53	0.00226	1V2990A	300	100	0.0400	0.0468	390.5	383.4	70%		M-12553-A,M-10473-A	R5
															#1/0	20	0.0027	0.0012						R5
															#2	30	0.0064	0.0018						R5
Sample Hx Isln Vlv	236	RMOV BD 1A2-A	5A	1-FCV-70-215-A	0.13	0.80	3.35	0.60	84.3115	50.5869	67.4492	T11	9.25000	1V2566A	#12	550	1.1825	0.0421	401.7					R4
Sply Hdr 1A To Hdr 2B Isln Vlv	236	RMOV BD 1A2-A	5B	1-FCV-67-147-A	0.70	2.30	12.00	0.60	22.1318	13.2791	17.7054	T26	0.42100	1V2428A	#12	234	0.5031	0.0179	426.3					
Hydrogen Det Sys	236	RMOV BD 1A2-A	5D1	1-H2AN-43-200	4.16	5.22																		
Cntmt Spray Hx 1A Sup Cont Vlv	236	RMOV BD 1A2-A	5E	1-FCV-67-125-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2200A	#12	304	0.6536	0.0233	419.6					
Cntmt Spray Hx 1A Disch Vlv	236	RMOV BD 1A2-A	5F	1-FCV-67-126-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2208A	#12	472	1.0148	0.0361	411.5					
AFWP Turb St Sply Frm St gen 4	236	RMOV BD 1A2-A	6A	1-FCV-1-16-A	1.00	2.80	17.8	0.60	14.9203	8.9522	11.9362	T24	0.63200	1V1820A	#10	1200	1.6200	0.0846	399.5				M-15529-A	** R5
ESE Sys Isln Bypass Vlv	236	RMOV BD 1A2-A	6D	1-FCV-74-8-A	1.60	4.00	25.0	0.60	10.6232	6.3739	8.4986	T31	0.14100	1V2140A	#12	381	0.8192	0.0291	409.7					
	236	RMOV BD 1A2-A	6D											1V2141A	#12	110	0.2365	0.0084						
ERCW Hdr 1A Iso Vlv Before Str	236	RMOV BD 1A2-A	7B	1-FCV-67-22-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T17	2.20500	1V2398A	#6	2300	1.7825	0.1481	404.2		80%			

\DINCCVD\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1200 FEET

THIS SHEET ADDED BY REV 6

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(ADDED BY RWG)

Revision 5
Prepared By GCP/RS Date 10-31-92
Checked By [signature] Date 10-31-92

30-Oct-92

WBN-EEB-MS-TI06-0030 R0 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES
(TABLE 12 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R18)

ENG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLA	LRA	LRPF	Xm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
	236	RMOV BD 1A2-A	7B												#12	1030	2.2145	0.0788						
Lwr Cntmt Clr 1A Disch Iso Vlv	236	RMOV BD 1A2-A	7D	1-FCV-67-87-A	0.13	0.60	3.50	0.60	75.8803	45.5282	60.7043	T12	7.53000	1V2261A	#12	375	0.8063	0.0287	411.0	403.5				
	236	RMOV BD 1A2-A	7D											1V2262A	#12	35	0.0753	0.0027						
Upr Cntm Vt Clr 1A Sup Iso Vlv	236	RMOV BD 1A2-A	7F	1-FCV-67-130-A	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T9	11.72000	1V3020A	#12	250	0.5375	0.0191	402.3	395.0				
A.Bldg ERCW Sup Hdr 1A Iso Vlv	236	RMOV BD 1A2-A	8A	1-FCV-67-83-A	0.67	2.30	12.00	0.60	22.1318	13.2791	17.7054	T26	0.42100	1V1980A	#12	500	1.0750	0.0383	421.7				X-12825-A	
Lwr Cntmt 1A Clr Sply Isln Vlv	236	RMOV BD 1A2-A	8B	1-FCV-67-107-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V1990A	#12	441	0.9482	0.0337	413.3	405.8			X-11413-A	
Lwr Cntmt 1C Clr Disch Iso Vlv	236	RMOV BD 1A2-A	8D	1-FCV-67-95-A	0.13	0.60	3.50	0.60	75.8803	45.5282	60.7043	T12	7.53000	1V3210A	#12	494	1.0621	0.0378	410.1	402.9				
	236	RMOV BD 1A2-A	8D											1V3211A	#12	40	0.0860	0.0031						
Upr Cntm Vt Clr 1C Sup Iso Vlv	236	RMOV BD 1A2-A	8F	1-FCV-67-133-A	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T9	11.72000	1V3035A	#12	250	0.5375	0.0191	402.3	395.0				
Lwr Cntmt 1C Clr Sply Isln Vlv	236	RMOV BD 1A2-A	9A	1-FCV-67-99-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V2020A	#12	535	1.1503	0.0409	412.1	404.6			X-11413-A	
LWR CNTMT 1A CLR DISCH ISO VLV	236	RMOV BD 1A2-A	9B	1-FCV-67-104-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V2030A	#12	510	1.0965	0.0390	412.4	404.9				
Upr Cnt Vt Clr 1A Dis Isln Vlv	236	RMOV BD 1A2-A	9D	1-FCV-67-295-A	0.13	0.45	3.14	0.60	84.5800	50.7480	67.6640	T9	11.72000	1V3086A	#12	492	1.0578	0.0376	398.6	391.4				
	236	RMOV BD 1A2-A	9D											1V3087A	#12	340	0.7310	0.0260						
UP CNTM VT CLR 1B DISH ISO VLV	236	RMOV BD 1A2-A	9F	1-FCV-67-139-A	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T9	11.72000	1V3060A	#12	250	0.5375	0.0191	402.3	395.0				
Lwr Cntmt 1B Clr Disch Iso Vlv	236	RMOV BD 1A2-A	10A	1-FCV-67-112-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V2090A	#12	416	0.8944	0.0318	413.6	406.1				
A.Bldg AirClr Sup Hdr 1A Iso V	236	RMOV BD 1A2-A	10B	1-FCV-67-127-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T14	4.72000	1V2410A	#12	344	0.7396	0.0263	409.4					
UP CNTM VT CLR 1C DISH ISO VLV	236	RMOV BD 1A2-A	10D	1-FCV-67-296-A	0.13	0.45	3.14	0.60	84.5800	50.7480	67.6640	T9	11.72000	1V3096A	#12	472	1.0148	0.0361	399.7	392.4				
	236	RMOV BD 1A2-A	10D											1V3097A	#12	200	0.4300	0.0153						
UP CNTM VT CLR 1D DISH ISO VLV	236	RMOV BD 1A2-A	10F	1-FCV-67-142-A	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T9	11.72000	1V3070A	#12	250	0.5375	0.0191	400.1	395.0				
Cmpnt Clg Hx A Disch Cont Vlv	236	RMOV BD 1A2-A	11A	1-FCV-67-146-A	0.33	0.83	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V2422A	#12	338	0.7267	0.0259	414.5					
FDR BKR TO COMP 5B	236	RMOV BD 1A2-A	11B	TO COMPT 5B	0.33	0.83	5.00	0.60	53.1167	31.8697	42.4930													
RCP Thrm Barr Rtn Cntm Iso Vlv	236	RMOV BD 1A2-A	11D	1-FCV-70-90-A	0.70	2.30	12.00	0.60	22.1318	13.2791	17.7054	T24	0.63200	1V2650A	#12	650	1.3975	0.0497	415.4	407.8				
	236	RMOV BD 1A2-A	11E	TO COMPT 16B	0.13	0.45	2.60	0.60	102.1466	61.2880	81.7173													
Cmpt Clg Hx C Dish Vl To Hdr A	236	RMOV BD 1A2-A	12A	0-FCV-67-152-A	0.67	1.90	7.56	0.60	35.1258	21.0775	28.1031	T24	0.63200	1V2751A	#12	320	0.6880	0.0245	429.9					
SS&Con AirCpsr Sup Hdr A Iso V	236	RMOV BD 1A2-A	12B	0-FCV-67-205-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V2434A	#12	400	0.8600	0.0306	413.8					
RCP Oil Clr Rtn Cntmt Isln Vlv	236	RMOV BD 1A2-A	12D	1-FCV-70-92-A	0.13	0.60	3.15	0.60	84.3115	50.5869	67.4492	T12	7.53000	1V2867A	#12	625	1.3438	0.0478	412.4	404.9				
Aux Waste Evap Pkg Outlet Vlv	236	RMOV BD 1A2-A	12E	0-FCV-70-211-A	0.13	0.60	3.15	0.60	84.3115	50.5869	67.4492	T12	7.53000	1V2236A	#12	800	1.7200	0.0612	411.2					
RCP Oil Clr Hdr Cntmt Isln Vlv	236	RMOV BD 1A2-A	12F	1-FCV-70-139-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T14	4.72000	1V2878A	#12	650	1.3975	0.0497	405.7	398.3				
FDR BKR TO COMP 6F	236	RMOV BD 1A2-A	13A	1-FCV-67-223-A	0.66	2.30	12.00	0.60	22.1318	13.2791	17.7054	T26	0.42100	1V2961A	#12	250	0.5375	0.0191	428.3					
BR & Gas Strip Evap Pkg 1A FCV	236	RMOV BD 1A2-A	13D	1-FCV-70-168-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V1940A	#12	552	1.1868	0.0422	411.9					
ANNULUS SPR ISLN VLV	236	RMOV BD 1A2-A	13E	1-FCV-26-245-A	1.00	2.10	5.0	0.60	53.1162	31.8697	42.4930	T15	1.66000	1V9175A	#12	600	1.2900	0.0459	425.1	417.4				
RHR Hx A Hdr Inlet Vlv	236	RMOV BD 1A2-A	14A	1-FCV-70-2-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2460A	#12	282	0.6063	0.0216	419.9					
Misc Eqpt Hdr Inlet Vlv	236	RMOV BD 1A2-A	14B	1-FCV-70-4-A	0.33	0.75	5.80	0.60	45.7898	27.4739	36.6319	T14	4.72000	1V2472A	#12	284	0.6106	0.0217	409.6					
CCS Hx A Outlet Vlv	236	RMOV BD 1A2-A	14D	1-FCV-70-8-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2478A	#12	284	0.6106	0.0217	419.9					
CCS Hx A & C Outlet Isln Vlv	236	RMOV BD 1A2-A	14E	1-FCV-70-10-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2490A	#12	286	0.6149	0.0219	419.8					
CCS HX A Disch Bypass Cont Vlv	236	RMOV BD 1A2-A	15A	1-FCV-67-143-A	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T9	11.72000	1V1876A	#10	403	0.5441	0.0284	400.2				F-01136-B *	
CCS Hx A & C Inlet Isln Vlv	236	RMOV BD 1A2-A	15B	1-FCV-70-23-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2520A	#12	318	0.6837	0.0243	419.4					
CCS Hx A Inlet Vlv	236	RMOV BD 1A2-A	15D	1-FCV-70-25-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2526A	#12	311	0.6687	0.0238	419.5					
ERCW To Cmpnt Clg Hx A	236	RMOV BD 1A2-A	15E	1-FCV-67-458-A	0.67	1.90	7.56	0.60	35.1258	21.0779	28.1038	T24	0.63200	1V2580A	#12	224	0.4816	0.0171	431.5					
FDR BKR TO COMP 13D	236	RMOV BD 1A2-A	16A																					

\DIMCCVD\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1200 FEET

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(ADDED BY RCW5)

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Prepared By GCP/RS Date 10-31-92
Checked By [signature] Date 10-31-92

30-Oct-92

WBN-EEB-MS-TI06-0010 R0 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOTAGES
(TABLE 12 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R18)

ENG_TITLE	NODE_NO	BOARD	COMPT ID	EQUIPID_NO	LOAD	FLI	LRA	CRPF	Za	Ra	jXa	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	LOCK ROTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	KEY
RCP THRM BAR CNTMT ISO VLV	236	RMOV BD 1A2-A	16B	1-FCV-70-133-A	0.13	0.45	2.60	0.60	102.1466	61.2880	81.7173	T9	11.72000	1V2660A	#12	650	1.3975	0.0497	406.5	399.2				
Excs Ltdn Hx Cont Inlt Iso Vlv	236	RMOV BD 1A2-A	16D	1-FCV-70-143-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V2292A	#12	650	1.3975	0.0497	410.7	403.2				
RHR Hx A-A Outlet Vlv	236	RMOV BD 1A2-A	16E	1-FCV-70-156-A	0.33	0.83	5.00	0.60	53.1152	31.8697	42.4930	T15	3.79000	1V2562A	#12	374	0.8041	0.0286	417.2					
Sample Hx Hdr Outlet Vlv	236	RMOV BD 1A2-A	17A	1-FCV-70-183-A	0.13	0.45	2.60	0.60	102.1466	61.2880	81.7173	T9	11.72000	1V2568A	#12	466	1.0019	0.0356	407.6					
SFPCS Rx Sply Hdr Isln Vlv	236	RMOV BD 1A2-A	17B	0-FCV-70-197-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2574A	#12	252	0.5418	0.0193	420.2					
480V Ad Rm 1A A/C Cprsr 1A-1	236	RMOV BD 1A2-A	17E	1-MTR-31-465-A	50.00	57.00	350.0	0.37	0.7571	0.2801	0.7033			1PL2955A	#2	80	0.0171	0.0043	433.7					
Boric Acid Transfer Pmp 1B-B	237	RMOV BD 1B1-B	2B	1-MTR-62-232-B	15.40	18.00	105.2	0.49	2.5236	1.2366	2.1999	T48	0.00825	1PL6114B	#10	600	0.8100	0.0423	365.1				AMP FAIL	
Boric Acid Transfer Pmp 1B-B	237	RMOV BD 1B1-B	2B	1-MTR-62-232-B	7.50	13.00	105.2	0.49	2.5236	1.2366	2.1999	T43	0.01387	1PL6114B	#10	600	0.8100	0.0423	364.6				AMP FAIL	
COMPT CLR BOOSTER PUMP 1B-B	237	RMOV BD 1B1-B	2C	1-MTR-70-130-B	10.00	13.00	70.2	0.53	3.7854	2.0062	3.2100	T44	0.01214	1PL6131B	#8	686	0.5824	0.0484	399.5				AMP FAIL	
FDR BKR TO COMP 2B	237	RMOV BD 1B1-B	2F2																					
CDWE Bldg Supply Valve	237	RMOV BD 1B1-B	3E	1-FCV-70-207-B	0.13	0.45	3.14	0.60	84.5800	50.7480	67.6640	T9	11.72000	1V4050B	#12	579	1.2449	0.0443	400.3					
FDR BKR TO COMP 3D	237	RMOV BD 1B1-B	3F2																					
Cntfgl Chgrg Pmp 1B-B AOP	237	RMOV BD 1B1-B	4D	1-MTR-62-AOP-B	2.00	3.10	22.6	0.62	11.7670	7.2955	9.2324	T31	0.14100	1PL6157B	#12	648	1.3932	0.0496	404.1	396.8				
HPFP Aux Bldg To B Hdr Vlv	237	RMOV BD 1B1-B	4F	0-FCV-26-121-B	0.33	0.75	5.7	0.60	46.5932	27.9559	37.2745	T13	6.15000	1V3320B	#12	508	1.0922	0.0389	399.7					
RHR Sys Isln Vlv	237	RMOV BD 1B1-B	5B	1-FCV-74-2-B	2.60	4.73	38.0	0.60	6.9890	4.1934	5.5912	T33	0.08000	1V2840B	#12	232	0.4988	0.0177	417.3					
	237	RMOV BD 1B1-B	5B											1V2841B	#12	90	0.1935	0.0069						
RHR Sys Isln Bypass Vlv	237	RMOV BD 1B1-B	5C	1-FCV-74-9-B	1.60	4.00	25.0	0.60	10.6232	6.3739	8.4986	T31	0.14100	1V2150B	#8	1200	1.0188	0.0846	409.3				M-12070A	**
	237	RMOV BD 1B1-B	5C											1V2151B	#8		0.0000	0.0000					M-12070A	
RCS Press Relief Flow Cont Vlv	237	RMOV BD 1B1-B	5E	1-FCV-68-332-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2445B	#12	630	1.3545	0.0482	392.1					
	237	RMOV BD 1B1-B	5E											1V2446B	#12	120	0.2580	0.0092						
Seal Flow Ret Isln Vlv	237	RMOV BD 1B1-B	6D	1-FCV-62-61-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2808B	#12	282	0.6063	0.0216	406.0	398.6	80%			
	237	RMOV BD 1B1-B	6D											1V2809B	#14	135	0.4608	0.0111						
CHRG FLOW ISLN VLV	237	RMOV BD 1B1-B	7A	1-FCV-62-91-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2255B	#12	670	1.4405	0.0513	396.4	385.2	80%			
CHRG PMP 1A-A MIN FLOW	237	RMOV BD 1B1-B	7B	1-FCV-62-99-B	0.66	2.30	12.0	0.60	22.1318	13.2791	17.7054	T28	1.33000	1V2240B	#12	600	1.2900	0.0459	408.6					
SIS ACCUM TANK FLOW ISOL VLV	237	RMOV BD 1B1-B	7D	1-FCV-63-67-B	6.60	10.00	84.0	0.60	3.1617	1.8970	2.5293	T39	0.02878	1V3200B	#6	485	0.2589	0.0335	402.4		80%		F-01667-C,M-10511-A	#R5
														1V3201B	#10	95	0.1283	0.0057						#R5
Vol Cont Tank Outlet Isln Vlv	237	RMOV BD 1B1-B	8A	1-LCV-62-133-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2770B	#12	485	1.0428	0.0371	406.5	399.3	80%			
RWST To Charging Pmp Vlv Cont	237	RMOV BD 1B1-B	8B	1-LCV-62-136-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2108B	#12	622	1.3158	0.0468	399.5	392.3	80%			
SIS ACCUM TANK FLOW ISOL VLV	237	RMOV BD 1B1-B	8D	1-FCV-63-98-B	6.60	10.00	84.0	0.60	3.1617	1.8970	2.5293	T39	0.02878	1V2720B	#6	671	0.3582	0.0463	394.2		80%		F-01667-C,M-10511-A	#R5
	237	RMOV BD 1B1-B	8D											1V2725B	#10	90	0.1215	0.0043						#R5
Emer Boration Flow Cont Vlv	237	RMOV BD 1B1-B	9A	1-FCV-62-138-B	1.30	2.40	16.0	0.60	16.5388	9.9593	13.2791	T24	0.63200	1V2975B	#12	640	1.3760	0.0490	407.7					
RHR To RCS H.L. 1&3 Flow Iso V	237	RMOV BD 1B1-B	9B	1-FCV-63-172-B	2.60	4.73	38.0	0.60	6.9890	4.1934	5.5912	T33	0.08000	1V2343B	#8	1200	1.0188	0.0846	395.3				M-10511-A	**#R5
Cont Spray Pmp 1B-B Recirc FCV	237	RMOV BD 1B1-B	9F	1-FCV-72-13-B	0.13	0.45	2.6	0.60	102.1466	61.2880	81.7173	T9	11.72000	1V3150B	#12	810	1.7415	0.0620	405.7					
SIS 1B-B DSH TO RWST SHTFF VLV	237	RMOV BD 1B1-B	10A	1-FCV-63-4-B	0.70	2.80	16.0	0.60	16.5388	9.9593	13.2791	T24	0.63200	1V2900B	#12	780	1.6770	0.0597	403.0					
RWST To SIS Pump Flow Cont Vlv	237	RMOV BD 1B1-B	10B	1-FCV-63-5-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2332B	#12	756	1.6254	0.0578	391.8					
FDR BKR TO COMP 5B	237	RMOV BD 1B1-B	10D																					
SIS PMP INLT TO CVCS CHRG PMP	237	RMOV BD 1B1-B	11A	1-FCV-63-6-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2520B	#12	732	1.5738	0.0560	393.1					
RHR Hx B To SIS Pmp	237	RMOV BD 1B1-B	11B	1-FCV-63-11-B	1.90	3.50	23.3	0.60	11.3983	6.8390	9.1187	T29	0.23700	1V3185B	#10	1200	1.6200	0.0846	396.1				M-35529-B	**#R5
SIS Pmp Cold Leg Inj	237	RMOV BD 1B1-B	11D	1-FCV-63-22-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2356B	#12	680	1.4620	0.0520	395.9					

\U1MCCVD\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1200 FEET

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WB-EEB-MS-TI06-0010 R0 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOTAGES
TABLE 12 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R18)

JG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLI	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	INE MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT [$]	ACCEL TIME SEC ($$)	REMARKS	REV
IS Boron Inj Tank Shutoff Vlv	237	RMOV BD 1B1-B	11E	1-FCV-63-25-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V26878	#10	642	0.8667	0.0453	410.6	403.1				
IS Brn Inj Tnk Inlt Shtff Vlv	237	RMOV BD 1B1-B	12A	1-FCV-63-40-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2703B	#10	746	1.0071	0.0526	406.9					
IS Pmp 1B-B Inlet Vlv	237	RMOV BD 1B1-B	12E	1-FCV-63-48-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2350E	#8	1200	1.0188	0.0846	405.7				M-10511-A	**
ntmt Sump To RHR Pmp B-B	237	RMOV BD 1B1-B	12D	1-FCV-63-73-B	13.00	18.40	137.0	0.50	1.9385	0.9693	1.6788	T46	0.01080	1V3140B	#10	30	0.0405	0.0021	415.2				M-10511-A,P-01667-C	**R5
															#1/0	1170	0.1582	0.0702					M-10511-A	R5
IS To RCS Loops 1&4 FCV	237	RMOV BD 1B1-B	12E	1-FCV-63-94-B	1.60	4.00	25.0	0.60	10.6232	6.3735	8.4986	T30	0.17900	1V2380E	#6	744	0.3971	0.0523	424.2				P-01667-C	R5
IS Pmp 1B-B Outlet FCV	237	RMOV BD 1B1-B	13A	1-FCV-63-153-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2368E	#12	664	1.4276	0.0508	396.7					
IS PMP OUT RCS LP 2&4 H. LEG	237	RMOV BD 1B1-B	13B	1-FCV-63-157-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2392E	#10	551	0.7439	0.0388	413.8					
IS 1B-B Dsh To RWST Shtff Vlv	237	RMOV BD 1B1-B	13D	1-FCV-63-175-B	0.70	2.30	16.0	0.60	16.5988	9.9593	13.2791	T24	0.63200	1V2920B	#12	764	1.6426	0.0584	403.5					
ntmt Spray Hdr 1B Isln Vlv	237	RMOV BD 1B1-B	14A	1-FCV-72-2-B	3.20	5.20	36.0	0.60	7.3773	4.4264	5.9018	T32	0.10000	1V2630E	#10	*430	0.5805	0.0303	414.7	407.2	80%			
HE Spray Hdr 1B Isln Vlv	237	RMOV BD 1B1-B	14D	1-FCV-72-41-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2752B	#10	732	0.9882	0.0516	407.4					
ntmt Sump To Spray Hdr 1B FCV	237	RMOV BD 1B1-B	14E	1-FCV-72-45-B	3.20	5.20	36.0	0.60	7.3773	4.4264	5.9018	T32	0.10000	1V1800E	#10	678	0.9153	0.0478	402.6					
HE Pmp 1B-B Min Flow Vlv	237	RMOV BD 1B1-B	15E	1-FCV-74-24-B	0.12	0.45	3.2	0.60	84.3115	50.5865	67.4492	T9	11.72000	1V1915E	#12	826	1.7759	0.0632	398.5	391.3	80%			
HE Hx 1B Bypass Vlv	237	RMOV BD 1B1-B	15D	1-FCV-74-35-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	1V2612B	#12	654	1.4061	0.0500	397.3					
ncore Inst Rm Clr Fan 1B	237	RMOV BD 1B1-B	16A	1-MTR-31-266	3.00	4.30	25.7	0.62	9.9469	6.1671	7.8043	T33	0.08000	1PL6310	#10	*430	0.5805	0.0303	421.1					
DE BKR TO COMP 7D	237	RMOV BD 1B1-B	16F2																					
nnulus Standpipe Isln Vlv	237	RMOV BD 1B1-B	17B	1-FCV-26-241-B	0.67	2.10	5.0	0.60	53.1162	31.8697	42.4930	T19	1.66000	1V9155E	#12	650	1.8275	0.0650	421.4	414.7				
FW Pmp B-B Lube Oil Pmp B-B	237	RMOV BD 1B1-B	17D	1-MTR-3-1260-B	0.25	0.56	3.5	0.62	75.8603	47.0458	59.5356	T13	6.15000	1PL6330B	#12	500	1.0750	0.0383	414.3					
ncore Inst Rm Ch Wtr Cprsr 1B	237	RMOV BD 1B1-B	17F2	1-MTR-31-324/2	3.00	4.60	95.5	0.62	2.7956	1.7333	2.1934			1PL6291	#10	430	0.5805	0.0303	383.3				FAILED NON-1E	
efueling Wtr Prifn Pmp B-B	237	RMOV BD 1B1-B	18A	0-MTR-78-20-B	20.00	26.00	145.0	0.16	1.8316	0.8425	1.6263	T51	0.00318	1PL6380E	#2	878	0.1874	0.0540	407.3				DCN M-15092-A *	
															#8	12	0.0182	0.0008						
ncore Inst Rm Circ Pump 1B	237	RMOV BD 1B1-B	18C	1-MTR-31-324/1	3.00	4.20	30.1	0.62	8.8292	5.4741	6.9274	T33	0.05000	1PL6285	#10	824	1.1124	0.0581	402.3					
nx Boration Tank Agitator	237	RMOV BD 1B1-B	18D	0-MTR-84-2	1.00	2.20	12.5	0.61	21.1956	13.1433	16.6301	T26	0.42100	1PL6273	#12	544	1.1696	0.0416	419.2					
FPP Hdr Strnr B-B Bkflush Vlv	237	RMOV BD 1B1-B	18E	0-FCV-26-142-B	0.26	0.55	5.7	0.60	46.5932	27.9559	37.2745	T12	7.53000	V1995E	#12	1282	2.7563	0.0981	375.2		40%			
	237	RMOV BD 1B1-B	18E												#4	2100	0.7067	0.1323						
FPP Hdr Strnr B-B Bkflush Vlv	237	RMOV BD 1B1-B	18F	0-FCV-26-14-B	0.26	0.55	5.7	0.60	46.5932	27.9559	37.2745	T12	7.53000	V2005S	#12	1392	2.9928	0.1065	377.5		80%			
	237	RMOV BD 1B1-B	18F												#4	2100	0.7067	0.1323						
RCW Hdr B Isln Vlv	238	RMOV BD 1B2-B	2A	1-FCV-3-1261-B	0.25	0.55	4.3	0.60	61.7631	37.0578	49.4104	T11	9.25000	1V2940E	#12	472	1.0148	0.0361	397.1				M-21246-A	R5
~~RCW Hdr B Isln Vlv~~	~~238~~	~~RMOV BD 1B2-B~~	2B	1-FCV-3-1262-B	0.25	0.55	4.3	0.60	61.7631	37.0578	49.4104	T11	9.25000	1V2960E	#12	466	1.0019	0.0356	397.1				~~M-21246-A~~	~~R5~~
: Flow To AFWP Turb Isln Vlv	238	RMOV BD 1B2-B	2E	1-FCV-1-18-B	1.00	2.80	17.5	0.60	14.9203	8.9522	11.9362	T24	0.63200	1V2630E	#10	1200	1.6200	0.0846	399.5				M-15529-A	**R5
RCW Hdr B Isln Vlv	238	RMOV BD 1B2-B	3A	1-FCV-3-179A-B	0.33	0.75	5.7	0.60	46.5932	27.9559	37.2745	T13	6.15000	1V2080E	#12	558	1.1997	0.0427	399.1					
RCW Hdr B Isln Vlv	238	RMOV BD 1B2-B	3B	1-FCV-3-179B-B	0.33	0.75	5.7	0.60	46.5932	27.9559	37.2745	T13	6.15000	1V2130B	#12	556	1.1954	0.0425	399.1					
: GEN NO 2 FW ISLN VLV	238	RMOV BD 1B2-B	3D	1-FCV-3-47-B	39.40	48.10	494.0	0.45	0.5376	0.2419	0.4801	T53	0.00226	1V3000B	300	800	0.0400	0.0468	390.5	383.4	70%		M-12553-A,M-10511-A	R5
															#1/0	20	0.0027	0.0012						R5
															#2	30	0.0054	0.0018						R5
oop 3 Deaeration Line Vlv	238	RMOV BD 1B2-B	4A	1-FCV-3-193	1.60	4.00	25.0	0.60	10.6232	6.3739	8.4986	T28	0.29500	1V3250	#12	800	1.7200	0.0612	390.0				FAILED NON-1E	
oop 4 Deaeration Line Vlv	238	RMOV BD 1B2-B	4E	1-FCV-3-194	1.60	4.00	25.0	0.60	10.6232	6.3739	8.4986	T28	0.29500	1V3270	#12	650	1.3975	0.0497	397.7					
: Gen No 4 FW Isln Vlv	238	RMOV BD 1B2-B	4D	1-FCV-3-190-B	39.40	48.10	494.0	0.45	0.5376	0.2419	0.4801	T53	0.00226	1V3010E	300	800	0.0400	0.0468	390.5	383.4	70%		M-12553-A,M-10511-A	R5
															#1/0	20	0.0027	0.0012						R5

RD 11-6-92
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Calc. STUDY-EEB-WBN-12-001
Attachment 3
Required Motor Starting Voltage
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UIKCCVD\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1200 FEET

THIS SHEET ADDED BY REV 6

30-Oct-92

Revision 5
Prepared By GCP/RS Date 10-31-92
Checked By [signature] 10-31-92

WBN-EEB-MS-TI06-0010 R0 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES
(TABLE L2 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R18)

EQ_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLC	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
															#2	30	0.0064	0.0013						#R5
HPFP Com Hdr To Yd FCV	238	RMOV BD 1B2-B	5A	0-FCV-26-17-B	0.33	0.75	5.7	0.60	46.5932	27.9559	37.2745	T14	4.72000	1V3330B	#10	1234	1.6659	0.0870	393.7		40%			
	238	RMOV BD 1B2-B	5A												#8	2100	1.7829	0.1481						
COND Building Return Valve	238	RMOV BD 1B2-B	5B	0-FCV-70-206-B	0.13	0.45	2.60	0.60	102.1466	61.2880	81.7173	T9	11.72000	1V4029B	#12	698	1.5007	0.0534	406.3					
Lwr Cntmt 1A Clr SUP Vlv (IE)	238	RMOV BD 1B2-B	5C	1-FCV-67-113-B	0.13	0.60	3.50	0.60	75.8803	45.5282	60.7043	T11	5.25000	1V800B	#10	408	0.5508	0.0288	406.1	396.6			N-11413-A	
	238	RMOV BD 1B2-B	5C											1V801B	#10	70	0.0945	0.0049					N-11413-A	
Cntmt Spray Hx 1B Sup Cont Vlv	238	RMOV BD 1B2-B	5E	1-FCV-67-123-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2160B	#12	412	0.8858	0.0315	418.3					
Cntmt Spray Hx 1B Disch Vlv	238	RMOV BD 1B2-B	5F	1-FCV-67-124-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2170B	#12	600	1.2900	0.0459	415.9					
RCP THRM BAR RTN CNTMT ISO VLV	238	RMOV BD 1B2-B	6D	1-FCV-70-87-B	0.70	2.30	12.00	0.60	22.1318	13.2791	17.7054	T24	0.63200	1V2640B	#12	618	1.3287	0.0473	415.2	408.6				
RCP THRM BAR CNTMT ISO VLV	238	RMOV BD 1B2-B	6E	1-FCV-70-134-B	0.13	0.45	2.60	0.60	102.1466	61.2880	81.7173	T9	11.72000	1V2670B	#12	522	1.1223	0.0399	407.3	399.8				
Lwr Cntmt 1B Clr Dish Iso Vlv	238	RMOV BD 1B2-B	7D	1-FCV-67-103-B	0.13	0.60	3.50	0.60	75.8803	45.5282	60.7043	T12	7.53000	1V2275B	#12	649	1.3954	0.0496	408.9	401.5				
	238	RMOV BD 1B2-B	7D											1V2276B	#12	40	0.0860	0.0031						
Up Cntm Vt Clr 1A Dish Iso Vlv	238	RMOV BD 1B2-B	7F	1-FCV-67-331-B	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T9	11.72000	1V3021B	#12	472	1.0148	0.0361	400.9	393.6				
ERCW Hdr 1B Iso Vlv Before Str	238	RMOV BD 1B2-B	8A	1-FCV-67-24-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2404B	#8	2100	1.7829	0.1481	397.6		40%			
	238	RMOV BD 1B2-B	8A												#12	1247	2.6811	0.0954						
A.Bldg ERCW Sup Hdr 1B Iso Vlv	238	RMOV BD 1B2-B	8B	1-FCV-67-82-B	0.67	1.90	7.56	0.60	35.1298	21.0775	28.1038	T24	0.63200	1V2060B	#12	630	1.3545	0.0482	424.7					
Lwr Cntmt 1D Clr Dish Iso Vlv	238	RMOV BD 1B2-B	8D	1-FCV-67-111-B	0.13	0.60	3.50	0.60	75.8803	45.5282	60.7043	T12	7.53000	1V2283B	#12	463	0.9955	0.0354	410.1	402.7				
	238	RMOV BD 1B2-B	8D											1V2284B	#12	67	0.1441	0.0051						
Up Cntm Vt Clr 1C Dish Iso Vlv	238	RMOV BD 1B2-B	8F	1-FCV-67-134-B	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T9	11.72000	1V3043B	#12	495	1.0643	0.0379	400.7	393.4				
Lwr Cntmt 1A Clr Dish Iso Vlv	238	RMOV BD 1B2-B	9A	1-FCV-67-88-B	0.13	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V2810B	#12	525	1.1288	0.0402	412.2	404.7				
Lwr Cntmt 1C Clr Dish Iso Vlv	238	RMOV BD 1B2-B	9B	1-FCV-67-96-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V2040B	#12	488	1.0492	0.0373	412.7	405.2				
Up Cntm Vt Clr 1B Dish Iso Vlv	238	RMOV BD 1B2-B	9D	1-FCV-67-297-B	0.13	0.45	2.60	0.60	102.1466	61.2880	81.7173	T9	11.72000	1V3106B	#12	463	0.9955	0.0354	405.1	400.1				
	238	RMOV BD 1B2-B	9D											1V3107B	#12	440	0.9460	0.0337						
Up Cntm Vt Clr 1B Sup Iso Vlv	238	RMOV BD 1B2-B	9F	1-FCV-67-138-B	0.13	0.45	3.14	0.60	84.5800	50.7480	67.6640	T9	11.72000	1V3051B	#12	545	1.1718	0.0417	400.5	393.2				
Lwr Cntmt 1B Clr Sply Isln Vlv	238	RMOV BD 1B2-B	10A	1-FCV-67-91-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V2050B	#12	513	1.1030	0.0392	412.4	404.9			N-11413-A	
Lwr Cntmt 1D Clr Sply Isln Vlv	238	RMOV BD 1B2-B	10B	1-FCV-67-83-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V2060B	#12	337	0.7246	0.0258	414.6	407.0			N-11413-A	
UP CNTM VT CLR 1D DIS ISO VLV	238	RMOV BD 1B2-B	10D	1-FCV-67-298-B	0.13	0.45	3.14	0.60	84.5800	50.7480	67.6640	T9	11.72000	1V3120B	#12	255	0.5483	0.0195	400.2	392.9				
	238	RMOV BD 1B2-B	10D											1V3121B	#12	340	0.7310	0.0260						
Up Cntm Vt Clr 1D Sup Iso Vlv	238	RMOV BD 1B2-B	10F	1-FCV-67-141-B	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T9	11.72000	1V3063B	#12	304	0.6536	0.0233	402.0	394.7				
A.Bldg AirClr Sup Hdr 1B Iso V	238	RMOV BD 1B2-B	11A	1-FCV-67-128-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T14	4.72000	1V2416B	#12	373	0.8020	0.0285	409.0					
STA S & C AC SUP HDR B ISO VLV	238	RMOV BD 1B2-B	11B	0-FCV-67-208-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	1V2440B	#12	458	0.9847	0.0350	413.1					
Lwr Cntmt 1C Clr SUP Vlv (IE)	238	RMOV BD 1B2-B	11B	1-FCV-67-105-B	0.13	0.60	3.50	0.60	75.8803	45.5282	60.7043	T11	5.25000	1V802B	#10	612	0.8262	0.0431	405.1	397.7			N-11413-A	
	238	RMOV BD 1B2-B	11D											1V803B	#10	65	0.0878	0.0046					N-11413-A	
Hydrogen Det Sys	238	RMOV BD 1B2-B	11F1	1-H2AN-43-210	4.16	5.22																		
Yd Hdr B Disch Vlv To Clg Twr	238	RMOV BD 1B2-B	12A	0-FCV-67-362	1.00	2.80	16.00	0.60	16.5988	9.9593	13.2791	T29	0.23700	1V3230	#12	1554	3.3411	0.1189	383.5		40%			
ERCW To Cmpnt Clg Hx A	238	RMOV BD 1B2-B	12B	1-FCV-67-478-B	0.70	2.30	12.00	0.60	22.1318	13.2791	17.7054	T26	0.42100	1V3350B	#12	500	1.0750	0.0383	421.7					
FDR HDR TO COMP 5D	238	RMOV BD 1B2-B	12D	1-FCV-70-87-B	0.70	2.30	12.00	0.60	22.1318	13.2791	17.7054	T24	0.63200	1V2640B	#12	518	1.1137	0.0396	416.2					
	238	RMOV BD 1B2-B	12D											1V2647B	#12	100	0.2150	0.0077						
ANNULUS SPR ISLN VLV	238	RMOV BD 1B2-B	12F	1-FCV-26-244-B	0.67	2.10	5.00	0.60	53.1162	31.8697	42.4930	T19	1.66000	1V3170B	#12	720	1.5480	0.0551	423.8					
CCS Hx A & C Inlet Isln Vlv	238	RMOV BD 1B2-B	13B	1-FCV-70-13-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2500B	#12	416	0.8944	0.0318	418.2					

\DIMCCVD\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1200 FEET

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Pages 1/36 (Added by Rev 5)

PAGE 186A
(ADDED BY Rev 5)

30-Oct-92

Revision 5
Prepared By GCP/RS Date 10-31-92
Checked By [signature] Date 10-31-92

WBN-EEB-MS-TI06-0010 R0 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES
(TABLE 62 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0007 R18)

ENG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLI	LRA	LRPF	Im	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REF
RCP Oil Clr Rtn Cntmt Isln Vlv	238	RMOV BD 1B2-B	13D	1-FCV-70-89-B	0.13	0.60	3.50	0.60	75.8803	45.5282	60.7043	T12	7.53000	1V2854B	#12	265	0.5698	0.0203	411.4	403.9				
	238	RMOV BD 1B2-B	13D											1V2855B	#12	180	0.2150	0.0077						
RCP Oil Clr Hdr Cntmt Isln Vlv	238	RMOV BD 1B2-B	13F	1-FCV-70-140-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.75000	1V2848B	#12	546	1.1739	0.0418	412.8	404.5				
CCS Hx C Outlet Vlv	238	RMOV BD 1B2-B	14A	0-FCV-70-12-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2502B	#12	400	0.8600	0.0305	418.4					
RHR Hx B Hdr Inlet Vlv	238	RMOV BD 1B2-B	14B	1-FCV-70-3-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2466B	#12	354	0.7611	0.0271	418.0					
CCSP 1AA&1BB To C-S Outl Iso V	238	RMOV BD 1B2-B	14D	1-FCV-70-26-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2532B	#12	462	0.9933	0.0353	417.6					
CCS Pmps 1A-A To 1B-B Isln Vlv	238	RMOV BD 1B2-B	14E	1-FCV-70-34-B	0.67	1.90	7.56	0.60	35.1298	21.0779	28.1038	T24	0.63200	1V3220B	#12	570	1.2255	0.0436	425.7					
RHR Hx B Rtn Hdr Isln Vlv	238	RMOV BD 1B2-B	15A	1-FCV-70-75-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V1970B	#12	645	1.3889	0.0494	415.4					
CCS Hx A & C Outlet Isln Vlv	238	RMOV BD 1B2-B	15B	1-FCV-70-9-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2484B	#12	346	0.7439	0.0265	419.1					
CCSP 1AA&1BB To C-S Inl Iso Vl	238	RMOV BD 1B2-B	15D	1-FCV-70-64-B	0.67	1.90	16.00	0.60	16.5988	9.9593	13.2791	T24	0.63200	1V2544B	#12	568	1.2212	0.0435	410.2					
RHR Hx B-B Outlet Vlv	238	RMOV BD 1B2-B	15E	1-FCV-70-153-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2556B	#12	512	1.1008	0.0392	417.0					
CCSP 1AA&1BB To C-S Inl Iso Vl	238	RMOV BD 1B2-B	16A	1-FCV-70-74-B	0.67	1.90	7.56	0.60	35.1298	21.0779	28.1038	T24	0.63200	1V2550B	#12	504	1.0836	0.0386	426.8					
FOR RHR TO COMP 6E	238	RMOV BD 1B2-B	16B	1-FCV-70-134-B	0.13	0.45	2.60	0.60	102.1466	61.2880	81.7173	T9	11.72000	1V2670B	#12	522	1.1223	0.0399	407.3					
CCS Hx C Inlet Vlv	238	RMOV BD 1B2-B	16E	0-FCV-70-22-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2514B	#12	502	1.0793	0.0384	417.1					
CCSP 1AA&1BB To C-S Outl Iso V	238	RMOV BD 1B2-B	17B	1-FCV-70-27-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	1V2538B	#12	502	1.0793	0.0384	417.1					
CCS HX C DISCH BYPASS CONT VLV	238	RMOV BD 1B2-B	27D	0-FCV-67-144-B	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T9	11.72000	1V1877B	#10	431	0.5819	0.0304	402.1				F-01136-B *	
480V Rd Rm 1B A/C Cprsr 1B-B	238	RMOV BD 1B2-B	18D	1-MTR-31-447-B	75.00	91.50	542.5	0.33	0.4896	0.1616	0.4621			1PL3660B	#2	107	0.0218	0.0063	428.2				AMP FAIL	
Cntmt Fl & Eqpt Dr Sump Pmp 1A	243	RX VENT BD 1A-A	2A	1-MTR-77-125A	3.00	4.60	33.9	0.62	7.8343	4.8572	6.1460	T35	0.05000	1PL653	#10	472	0.6372	0.0333	399.5					
	243	RX VENT BD 1A-A	2A											1PL654	#12	210	0.4515	0.0161						
Incore Flux Det Dr Unit 1D	243	RX VENT BD 1A-A	3A	1-MTR-94-1D	3.42	7.25	32.0	0.62	8.2994	5.1456	6.5117			1PL295	#10	493	0.6656	0.0348	405.1				Approx 3hp	
	243	RX VENT BD 1A-A	3A											1PL296	#10	270	0.3645	0.0190						
Incore Flux Det Dr Unit 1E	243	RX VENT BD 1A-A	3B	1-MTR-94-1E	3.42	7.25	32.0	0.62	8.2994	5.1456	6.5117			1PL300	#10	493	0.6656	0.0348	405.1				Approx 3hp	
	243	RX VENT BD 1A-A	3B											1PL301	#10	270	0.3645	0.0190						
Incore Flux Det Dr Unit 1F	243	RX VENT BD 1A-A	3C	1-MTR-94-1F	3.42	7.25	32.0	0.62	8.2994	5.1456	6.5117			1PL305	#10	493	0.6656	0.0348	405.1				Approx 3hp	
	243	RX VENT BD 1A-A	3C											1PL306	#10	270	0.3645	0.0190						
Ice Cond Fl Clg Pmp	243	RX VENT BD 1A-A	4D	1-MTR-61-51	22.79	27.80	222.5	0.43	1.1936	0.5133	1.0776	T51	0.00318	1PL4320	#8	371	0.3150	0.0262	380.1				FAILED NON-1E	
Spreading Rm Sply Fan	243	RX VENT BD 1A-A	5A	0-MTR-31-406	0.25	1.00	10.0	0.62	26.5581	16.4660	20.8375	T18	1.87500	1PL644	#12	680	1.4620	0.0520	406.0					
Spreading Rm Exh Fan A	243	RX VENT BD 1A-A	6A	0-MTR-31-25	3.00	4.60	32.0	0.62	8.2994	5.1456	6.5117	T34	0.07100	1PL735	#12	750	1.6125	0.0574	385.4				FAILED NON-1E	
Waste Gas Cprsr Pkg A	243	RX VENT BD 1A-A	6C	0-MTR-77-91	25.00	30.00	197.4	0.43	1.3454	0.5785	1.2147	T53	0.00226	1PL5460	#6	420	0.2242	0.0290	399.6					
Reac Cool Pmp 1 Oil Lift Pmp	243	RX VENT BD 1A-A	7D	1-MTR-68-84	10.00	13.60	81.0	0.53	3.2788	1.7378	2.7804	T45	0.01238	1PL396	#10	510	0.6885	0.0360	380.0				FAILED NON-1E	
	243	RX VENT BD 1A-A	7D											1PL397	#10	75	0.1013	0.0053						
Reac Cool Pmp 3 Oil Lift Pmp	243	RX VENT BD 1A-A	8D	1-MTR-68-86	10.00	13.60	81.0	0.53	3.2788	1.7378	2.7804	T45	0.01238	1PL400	#10	465	0.6278	0.0328	385.3				FAILED NON-1E	
	243	RX VENT BD 1A-A	8D											1PL401	#10	65	0.0878	0.0046						
Reac Upper Cmpt Clr Fan 1A	243	RX VENT BD 1A-A	9B	1-MTR-30-35	5.00	9.10	39.5	0.62	6.7236	4.1686	5.2753	T40	0.02285	1PL520	#10	485	0.6548	0.0342	374.6				FAILED NON-1E	
	243	RX VENT BD 1A-A	9B											1PL521	#12	450	0.9675	0.0344						
Reac Upper Cmpt Clr Fan 1C	243	RX VENT BD 1A-A	10B	1-MTR-30-39	5.00	9.10	39.5	0.62	6.7236	4.1686	5.2753	T40	0.02285	1PL550	#10	460	0.6210	0.0324	393.3					
	243	RX VENT BD 1A-A	10B											1PL551	#12	160	0.3440	0.0122						
COMPUTER ROOM AHU NO. 1	243	RX VENT BD 1A-A	11B	0-MTR-31-497	7.50	9.60	60.0	0.57	4.4264	2.5230	3.6369	T41	0.01808	1PL3980	#6	1180	0.6299	0.0814	394.5					
Reac Cool Dr Tk Pmp 1A	243	RX VENT BD 1A-A	11D	1-MTR-77-4	7.50	9.50	66.7	0.57	3.9817	2.2696	3.2716	T40	0.02285	1PL485	#10	465	0.6278	0.0328	377.3				FAILED NON-1E	

\UINCCTB\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1200 FEET

PAGE 186 B
(ADDED BY RWS)

30-Oct-92

Revision 5

Prepared By GCP / RS Date 10-31-92

Checked By [signature] 10-31-92

WBN-EEB-MS-TI06-0010 R0 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOTAGES
[TABLE 62 - UNIT 1 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R10]

ENG_TITLE	NODE_ID	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLI	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (432)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REF.
	243	RX VENT BD 1A-A	-11D											1PL486	#10	240	0.3240	0.0169						
ICE COND AIR HANDLING UNIT 1	243	RX VENT BD 1A-A	13D	1-AHU-61-1TO28	89.00	119.50	320.0	0.43	0.8299	0.3569	0.7493			1PL820	4/0	599	0.0423	0.0368	402.7					
	243	RX VENT BD 1A-A	13D											1PL821	2/0	120	0.0130	0.0072						
Ice Cond End Wall Door No 1	243	RX VENT BD 1A-A	14B	1-MTR-61-280A	2.00	2.90	25.0	0.62	10.6232	6.5864	8.3350	T30	0.17900	1PL587	#12	378	0.8127	0.0289	406.0					
	243	RX VENT BD 1A-A	14B											1PL588	#12	150	0.3225	0.0115						
ICE COND AIR HANDLING UNIT 1	243	RX VENT BD 1A-A	14D	1-AHU-61-3TO 27	78.00	104.50	280.0	0.35	0.9485	0.3320	0.8885			1PL861	4/0	275	0.0185	0.0169	425.2					
	243	RX VENT BD 1A-A	14D											1PL862	2/0	110	0.0119	0.0066						
Cntmt Purge Air Sply Fan 1A	243	RX VENT BD 1A-A	15D	1-MTR-30-1	50.00	62.00	350.0	0.37	0.7588	0.2808	0.7050	T56	0.00124	1PL777	#6	350	0.1868	0.0242	385.2				FAILED NON-1E	
Cntmt Purge Air Exh Fan 1A	243	RX VENT BD 1A-A	16D	1-MTR-30-1E	50.00	62.00	312.0	0.37	0.8512	0.3150	0.7908	T56	0.00124	1PL764	#2	504	0.1067	0.0308	405.3					
Cntmt FI & Eqpt Dr Sump Pmp 1B	244	RX VENT BD 1B-B	2A	1-MTR-77-125B	3.00	4.30	33.9	0.62	7.8343	4.8572	6.1468	T33	0.08000	1PL672	#12	262	0.5633	0.0200	410.0					
	244	RX VENT BD 1B-B	2A											1PL673	#10	150	0.2025	0.0106						
Incore Flux Det Dr Unit 1A	244	RX VENT BD 1B-B	3A	1-MTR-94-1A	3.42	7.25	32.0	0.62	8.2994	5.1456	6.5117			1PL280	#10	458	0.6183	0.0323	414.7				Approx 3hp	
	244	RX VENT BD 1B-B	3A											1PL281	#10	90	0.1215	0.0063						
Incore Flux Det Dr Unit 1B	244	RX VENT BD 1B-B	3B	1-MTR-94-1B	3.42	7.25	32.0	0.62	8.2994	5.1456	6.5117			1PL285	#10	458	0.6183	0.0323	414.7				Approx 3hp	
	244	RX VENT BD 1B-B	3B											1PL286	#10	90	0.1215	0.0063						
Incore Flux Det Dr Unit 1C	244	RX VENT BD 1B-B	3C	1-MTR-94-1C	3.42	7.25	32.0	0.62	8.2994	5.1456	6.5117			1PL290	#10	460	0.6210	0.0324	414.6				Approx 3hp	
	244	RX VENT BD 1B-B	3C											1PL291	#10	90	0.1215	0.0063						
Incore Instr Rm Purge Sply Fan	244	RX VENT BD 1B-B	5E	1-MTR-30-11	0.25	1.00	10.0	0.62	26.5581	16.4660	20.8375	T18	1.87500	1PL794	#12	626	1.3459	0.0479	407.1					
Spreading Rm Exh Fan B	244	RX VENT BD 1B-B	6A	0-MTR-31-26	3.00	4.60	32.0	0.62	8.2994	5.1456	6.5117	T34	0.07100	1PL752	#12	800	1.7200	0.0612	382.1				FAILED NON-1E	
Ice Cond Fl Clg Pmp	244	RX VENT BD 1B-B	6C	1-MTR-61-61	25.00	27.80	182.5	0.43	1.4552	0.6258	1.3138	T51	0.00318	1PL4325	#8	351	0.2580	0.0247	393.3					
Incore Instr Rm Purge Exh Fan	244	RX VENT BD 1B-B	6E	1-MTR-30-11E	0.33	1.00	10.0	0.62	26.5581	16.4660	20.8375	T18	1.87500	1PL760	#12	786	1.6856	0.0600	401.7					
Pmnt Bay Sump Pmp 1	244	RX VENT BD 1B-B	6F1	1-MTR-40-2	5.00	7.25	46.0	0.62	5.7735	3.5796	4.5299			1PL695	#10	584	0.7884	0.0412	401.8					
Reac Cool Pmp 2 Oil Lift Pmp	244	RX VENT BD 1B-B	7D	1-MTR-68-85	18.00	13.50	79.0	0.53	3.3618	1.7817	2.8508	T45	0.01238	1PL402	#10	460	0.6210	0.0324	384.0				FAILED NON-1E	
	244	RX VENT BD 1B-B	7D											1PL403	#10	97	0.1310	0.0068						
Reac Cool Pmp 4 Oil Lift Pmp	244	RX VENT BD 1B-B	8B	1-MTR-68-87	14.00	13.60	81.0	0.53	3.2788	1.7378	2.7804	T45	0.01238	1PL414	#10	278	0.3659	0.0191	402.5					
	244	RX VENT BD 1B-B	8B											1PL415	#10	85	0.1148	0.0060						
Reac Upper Compt Clr Fan 1B	244	RX VENT BD 1B-B	9B	1-MTR-30-97	5.00	9.10	39.5	0.62	6.7236	4.1686	5.2753	T40	0.02289	1PL531	#10	467	0.6305	0.0329	398.9					
	244	RX VENT BD 1B-B	9B											1PL532	#12	160	0.3440	0.0122						
Reac Upper Compt Clr Fan 1D	244	RX VENT BD 1B-B	10B	1-MTR-30-100	5.00	9.10	39.5	0.62	6.7236	4.1686	5.2753	T40	0.02289	1PL561	#10	280	0.3780	0.0197	409.9					
	244	RX VENT BD 1B-B	10B											1PL562	#12	150	0.3225	0.0115						
Reac Cool Dr Tk Pmp 1B	244	RX VENT BD 1B-B	11D	1-MTR-77-6	15.00	18.20	118.4	0.49	2.2431	1.0991	1.9553	T48	0.00825	1PL496	#6	536	0.2861	0.0370	388.0				FAILED NON-1E	
	244	RX VENT BD 1B-B	11D											1PL497	#8	208	0.1690	0.0141						
Ice Cond End Wall Door No 1B	244	RX VENT BD 1B-B	13B	1-MTR-61-280B	2.00	2.90	25.0	0.62	10.6232	6.5864	8.3350	T30	0.17900	1PL598	#10	536	0.7236	0.0378	416.1					
ICE COND AIR HANDLING UNIT	244	RX VENT BD 1B-B	13D	1-AHU-61-2TO30	89.00	119.50	320.0	0.43	0.8299	0.3569	0.7493			1PL897	4/0	536	0.0369	0.0330	411.2					
ICE COND AIR HANDING UNIT	244	RX VENT BD 1B-B	13D											1PL975	2/0	120	0.0130	0.0072						
ICE COND AIR HANDLING UNIT	244	RX VENT BD 1B-B	14D	1-AHU-61-5TO29	78.00	104.50	280.0	0.43	0.9485	0.4079	0.8563			1PL937	4/0	585	0.0403	0.0360	414.1					
	244	RX VENT BD 1B-B	14D											1PL938	2/0	90	0.0098	0.0054						
Cntmt Purge Air Sply Fan 1B	244	RX VENT BD 1B-B	15D	1-MTR-30-4	50.00	62.00	350.0	0.37	0.7588	0.2808	0.7050	T56	0.00124	1PL785	#2	543	0.1159	0.0334	398.1					
Cntmt Purge Air Exh Fan 1B	244	RX VENT BD 1B-B	16D	1-MTR-30-4E	50.00	67.90	312.0	0.37	0.8512	0.3150	0.7908	T56	0.00124	1PL768	#2	775	0.1654	0.0477	387.3				FAILED NON-1E	

\UINCCVB\ $ MINIMUM MOTOR STARTING VOLTAGE = 85% OF 460V, EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM CABLE LENGTH <1200 FEET

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WBN-EEB-MS-TI06-0010 R10 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES
(TABLE L3 - UNIT 2 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R18)

ENG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLI	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (415)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
AUX CONTROL AIR COMPRESSOR A-A	207	C&A VENT BD 2A1-A	2A	0-MTR-32-60-A	20.00	26.00	157.89	0.46	1.6821	0.7737	1.4935	T51	0.00318	2PL3785A	#2	1275	0.2721	0.0784	391.6					
Shdn Bd Rm Chlr CW Cir Pmp A-A	207	C&A VENT BD 2A1-A	3A	0-MTR-31-36/1-A	25.00	31.00	197.4	0.43	1.3454	0.5785	1.2147	T53	0.00226	2PL4020A	#8	364	0.3090	0.0257	387.8				AMP FAIL	
Aux Bldg Gas Trtmt Sys Fan A-A	207	C&A VENT BD 2A1-A	3D	2-MTR-30-146-A	50.00	62.00	304.0	0.37	0.8736	0.3232	0.8116	T56	0.00124	2PL3748A	#2	550	0.1174	0.0338	403.0	380.1	80%	7.4	AMP FAIL	
EG Trtmt Sys A-A Rm Clr Fan	207	C&A VENT BD 2A1-A	4A	2-MTR-30-200-A	3.00	4.10	27.0	0.53	9.8363	5.2133	8.3412	T32	0.10000	2PL3774A	#10	500	0.6750	0.0353	420.3	396.4	80%	1.05		
ERCW Str 2A-A Backwash Vlv	207	C&A VENT BD 2A1-A	4E	2-FCV-67-9A-A	0.33	0.75	5.79	0.60	45.8689	27.5214	36.6951	T14	4.72000	2V4005A	#8	2798	2.3755	0.1973	398.9					
AFW & BA XFR SPACE CLR FAN A-A	207	C&A VENT BD 2A1-A	5E	2-MTR-30-184-A	15.00	20.20	105.2	0.49	2.5236	1.2366	2.1999	T48	0.00825	2PL3151A	#8	210	0.1783	0.0148	421.8	397.8				
Shutdown Bd Rm B Press Fan B-A	207	C&A VENT BD 2A1-A	6A	0-MTR-31-62-A	3.00	4.60	28.0	0.62	9.4850	5.8807	7.4420	T33	0.08000	2PL3601A	#12	175	0.3763	0.0134	426.5					
ERCW STRAINER 2A-A	207	C&A VENT BD 2A1-A	6B	2-MTR-67-9A-A	3.00	6.00	30.1	0.62	8.8292	5.4741	6.9274	T36	0.05500	2PL3913A	#4	2100	0.7062	0.1323	380.7		75%			
	207	C&A VENT BD 2A1-A	6B												#10	798	1.0773	0.0563						
Traveling Scrn 2A-A	207	C&A VENT BD 2A1-A	6C	2-MTR-67-439-A	5.00	6.80	41.1	0.61	6.4618	3.9546	5.1104	T38	0.03483	2PL3880A	#2	2100	0.4481	0.1292	373.6		80%			
	207	C&A VENT BD 2A1-A	6C												#10	764	1.0314	0.0539						
ERCW Str 2A-A Flush Vlv	207	C&A VENT BD 2A1-A	6E	2-FCV-67-9B-A	0.33	0.75	5.79	0.60	45.8689	27.5214	36.6951	T14	4.72000	2V3980A	#8	2790	2.3687	0.1967	399.0					
125V VIT BAT RM IV EXFAN 2A1-A	207	C&A VENT BD 2A1-A	7B	2-MTR-31-287-A	0.33	0.80	5.2	0.62	51.0733	31.6654	40.0722	T17	2.20500	2PL3560A	#12	318	0.6837	0.0243	424.6				P-04468-A	
Pen Rm El 737 Clr Fan 2A-A	207	C&A VENT BD 2A1-A	8B	2-MTR-30-194-A	3.00	4.00	25.5	0.66	10.4027	6.8616	7.8188	T32	0.10000	2PL3091A	#10	262	0.3537	0.0185	426.9	402.7	80%	2.4		
480V Xfmr Rm 2A Exh Fan 2A2-A	207	C&A VENT BD 2A1-A	8C	2-MTR-30-250F-A	3.00	4.40	27.4	0.67	9.6927	6.4457	7.2390	T34	0.07100	2PL2854A	#12	200	0.4300	0.0153	424.6		80%		M-13273-A	
480V Xfmr Rm 2A Exh Fan 2A3-A	207	C&A VENT BD 2A1-A	8D	2-MTR-30-250G-A	3.00	4.40	27.4	0.67	9.6927	6.4457	7.2390	T34	0.07100	2PL2837A	#12	200	0.4300	0.0153	424.6		80%		M-13273-A	
Elec Bd Rm A/C Sys Oil Pmp	207	C&A VENT BD 2A1-A	8F1	0MTR-31-128/5-A	3.11	3.90	31.0	0.62	8.5671	5.3116	6.7218			2PL3825A	#8	650	0.5519	0.0458	421.0					
C.Bldg Ele BdRm AC Cir Pmp A-A	207	C&A VENT BD 2A1-A	9B	0MTR-31-128/1-A	20.00	25.00	157.9	0.46	1.6820	0.7737	1.4934	T51	0.00318	2PL4000A	#2	596	0.1272	0.0367	410.6				M-09701-A	
	207	C&A VENT BD 2A1-A	9B												#8	50	0.0425	0.0035					F-12766-A	
480V Bd Rm 2A Pr Sup Fan 2A1-A	207	C&A VENT BD 2A1-A	9C	2-MTR-31-462-A	3.00	4.60	28.0	0.62	9.4850	5.8807	7.4420	T34	0.07100	2PL3470A	#10	274	0.3699	0.0193	426.8					
480V Xfmr Rm 2A Exh Fan 2A1-A	207	C&A VENT BD 2A1-A	9D	2-MTR-30-250E-A	3.00	4.40	27.4	0.67	9.6927	6.4457	7.2390	T34	0.07100	2PL2846A	#12	226	0.4859	0.0173	422.9				M-13273-A	
Cont. Rm Intake Mon	207	C&A VENT BD 2A1-A	9F1	0-RE-90-125-A	1.40	1.80	5.4	0.65	49.1817	31.9681	37.3748			2PL3818A	#10	518	0.6993	0.0365	435.7					
480V Bd Rm 2B Pr Sup Fan 2B1-A	207	C&A VENT BD 2A1-A	11A	2-MTR-31-476-A	3.00	4.60	28.0	0.62	9.4850	5.8807	7.4420	T34	0.07100	2PL3480A	#10	250	0.3375	0.0176	427.7					
480V Bd Rm 2A A/C Ahu 2A-A	207	C&A VENT BD 2A1-A	11C	2-MTR-31-461-A	10.00	12.00	78.9	0.53	3.3660	1.7840	2.8544	T44	0.01214	2PL4060A	#10	500	0.6750	0.0353	389.5				AMP FAIL	
125V VitBatRm III Ex Fan 2B1-A	207	C&A VENT BD 2A1-A	12A	2-MTR-31-285-A	0.33	0.80	5.2	0.62	51.0733	31.6654	40.0722	T17	2.20500	2PL3570A	#12	322	0.6923	0.0246	424.5				P-04468-A	
480V Bd Rm 2A A/C Cond 2A-A	207	C&A VENT BD 2A1-A	12C	2-MTR-31-290-A	15.00	21.00	111.0	0.49	2.3926	1.1724	2.0857	T49	0.00572	2PL4080A	#8	286	0.2428	0.0202	414.4				AMP FAIL	
ERCW SCREEN WASH PUMP 2A-A	207	C&A VENT BD 2A1-A	13D	2-MTR-67-437-A	40.00	49.80	290.0	0.38	0.9158	0.3480	0.8471	T54	0.00202	2PL3960A	2-1/0	2100	0.1420	0.0630	366.1		75%			
	207	C&A VENT BD 2A1-A	13D												#4/0	758	0.0522	0.0466						
Shtdn BdRm Chlr Pkg A-A OilPmp	207	C&A VENT BD 2A1-A	13F1	0-MTR-31-36/3-A	2.00	4.17	12.5	0.62	21.2465	13.1728	16.6700			2PL3770A	#10	450	0.6075	0.0317	431.7				.75hp	
Smplg Rm Hood Exh Fan 2A	208	C&A VENT BD 2A2-A	4A	2-MTR-30-67	1.50	2.65	20.0	0.62	13.2791	8.2330	10.4188	T29	0.23700	2PL3621	#12	650	1.3975	0.0497	406.1					
AUX CONT AIR CPRSR B-B	209	C&A VENT BD 2B1-B	2A	0-MTR-32-86-B	20.00	27.00	157.89	0.46	1.6821	0.7737	1.4935	T51	0.00318	2PL3795B	#1/0	1750	0.2366	0.1050	391.0					
PEN RM EL 713 CLR FAN 2B-B	209	C&A VENT BD 2B1-B	2C	2-MTR-30-197-B	3.00	4.30	26.70	0.62	9.9469	6.1671	7.8043	T34	0.07100	2PL3121B	#10	436	0.5886	0.0307	421.2	397.2			F-14692-A *	
Aux Bldg Gas Trtmt Sys Fan B-B	209	C&A VENT BD 2B1-B	3D	2-MTR-30-157-B	50.00	62.00	304.0	0.37	0.8736	0.3232	0.8116	T56	0.00124	2PL3760B	#2	350	0.0747	0.0215	416.1	392.4				
BATTERY RM EL 692 EXH FAN C-B	209	C&A VENT BD 2B1-B	4A	0-MTR-31-27-B	2.00	2.70	22.0	0.60	12.0719	7.2431	9.6575	T29	0.23700	2PL2895B	#12	398	0.8557	0.0304	415.6				P-06202-B	
ERCW Str 2B-B Backwash Vlv	209	C&A VENT BD 2B1-B	4E	2-FCV-67-10A-B	0.33	0.75	5.79	0.60	45.8689	27.5214	36.6951	T14	4.72000	2V3996B	#8	3184	2.7032	0.2245	396.9				F-10614-A, TELAS R11	
	209	C&A VENT BD 2B1-B	4E	2-FCV-67-10A-B											#12	10	0.0215	0.0008					F-10614-A, TELAS R11	
ERCW STRAINER	209	C&A VENT BD 2B1-B	6B	2-MTR-67-10B-B	3.00	6.00	30.1	0.62	8.8292	5.4741	6.9274	T36	0.05500	2PL3920B	#4	2100	0.7062	0.1323	357.0		75%			
	209	C&A VENT BD 2B1-B	6B	2-MTR-67-10B-B											#10	1450	1.9575	0.1022						
Traveling Scrn 2B-B	209	C&A VENT BD 2B1-B	6C	2-MTR-67-451-B	5.00	6.80	41.1	0.61	6.4618	3.9546	5.1104	T38	0.03483	2PL3940B	#2	2100	0.4481	0.1292	377.5		80%			
	209	C&A VENT BD 2B1-B	6C	2-MTR-67-451-B											#8	1059	0.8991	0.0747						
ERCW Str 2B-B Flush Vlv	209	C&A VENT BD 2B1-B	6E	2-FCV-67-10B-B	0.33	0.75	5.70	0.60	46.5932	27.9559	37.2745	T14	4.72000	2V3988B	#8	3256	2.7643	0.2295	397.2				F-10614-A	
	209	C&A VENT BD 2B1-B	6E	2-FCV-67-10B-B											#12	10	0.0215	0.0008					F-10614-A	
125V Vit Bat Rm IV ExFan 2A2-B	209	C&A VENT BD 2B1-B	7B	2-MTR-31-288-B	0.33	0.80	5.2	0.62	51.0733	31.6654	40.0722	T17	2.20500	2PL3565B	#12	280	0.6020	0.0214	425.0				P-04468-A	
Shtdn Xfmr Rm 2B Exh Fan 2B2-B	209	C&A VENT BD 2B1-B	8C	2-MTR-30-246G-B	3.00	4.40	27.4	0.67	9.6927	6.4457	7.2390	T34	0.07100	2PL2873B	#12	200	0.4300	0.0153	424.6		80%		M-13273-A	
Shtdn Xfmr Rm 2B Exh Fan 2B3-B	209	C&A VENT BD 2B1-B	8D	2-MTR-30-246H-B	3.00	4.40	27.4	0.67	9.6927	6.4457	7.2390	T34	0.07100	2PL2862B	#12	178	0.3827	0.0136	426.1		80%		M-13273-A	
C.Bldg Ele BdRm AC Cir Pmp B-B	209	C&A VENT BD 2B1-B	8E	0MTR-31-129/1-B	20.00	25.00	157.9	0.46	1.6820	0.7737	1.4934	T51	0.00318	2PL3980B	#2	546	0.1165	0.0336	412.5				M-09700-A	
	209	C&A VENT BD 2B1-B	8E												#8	50	0.0425	0.0035					F-12463-A	

[illegible]

THIS SHEET ADDED BY REV. 4

10-Sep-92

WBN-EEB-MS-TI06-0010 R10 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES

(TABLE L3 - UNIT 2 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R18)

ENG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLI	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (415)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
Elec Bd Rm A/C Sys Oil Pmp	209	C&A VENT BD 2B1-B	8F1	0MTR-31-129/3-B	3.00	3.90	31.0	0.62	8.5671	5.3116	6.7218			2PL3830B	#8	448	0.3804	0.0316	426.8					
480V Bd Rm 2A Pr Sup Fan 2A2-B	209	C&A VENT BD 2B1-B	9C	2-MTR-31-463-B	3.00	4.60	28.0	0.62	9.4850	5.8807	7.4420	T34	0.07100	2PL3487B	#10	200	0.2700	0.0141	429.8					
Shtdn Xfmr Rm 2B Exh Fan 2B1-B	209	C&A VENT BD 2B1-B	9D	2-MTR-30-246F-B	3.00	4.40	27.4	0.67	9.6927	6.4457	7.2390	T34	0.07100	2PL2870B	#12	150	0.3225	0.0115	427.9		80%		M-13273-A	
Pen Rm El 737 Clr Fan 2B-B	209	C&A VENT BD 2B1-B	9E	2-MTR-30-195-B	3.00	4.00	24.6	0.66	10.8048	7.1311	8.1172	T32	0.10000	2PL3101B	#10	340	0.4590	0.0240	424.5	400.4	80%	2.4		
480V Bd Rm 2B Pr Sup Fan 2B2-B	209	C&A VENT BD 2B1-B	10B	2-MTR-31-477-B	3.00	4.60	28.0	0.62	9.4850	5.8807	7.4420	T34	0.07100	2PL3495B	#10	156	0.2106	0.0110	431.6					
125V Vit BatRm III ExFan 2B2-B	209	C&A VENT BD 2B1-B	10C	2-MTR-31-286-B	0.33	0.80	5.2	0.62	51.0733	31.6654	40.0722	T17	2.20500	2PL3575B	#12	266	0.5719	0.0203	425.2				P-04468-A	
Cont Rm Intake Mon	209	C&A VENT BD 2B1-B	10F1	0-RE-90-126-B	1.40	1.80	5.4	0.65	49.1817	31.9681	37.3748			2PL3819B	#10	482	0.6507	0.0340	436.0					
480V Bd Rm 2B A/C Ahu 2B-B	209	C&A VENT BD 2B1-B	11B	2-MTR-31-475-B	20.00	25.00	142.0	0.46	1.8703	0.8603	1.6607	T51	0.00318	2PL4070B	#8	280	0.2377	0.0197	409.6				AMP FAIL	
480V Bd Rm 2B A/C Cond 2B-B	209	C&A VENT BD 2B1-B	11C	2-MTR-31-289-B	20.00	25.00	142.0	0.46	1.8703	0.8603	1.6607	T51	0.00318	2PL4090B	#8	266	0.2258	0.0188	411.1				AMP FAIL	
EG Trtmt Sys B-B Rm Clr Fan	209	C&A VENT BD 2B1-B	12B	2-MTR-30-207-B	3.00	4.10	27.0	0.53	9.8363	5.2133	8.3412	T32	0.10000	2PL3201B	#10	367	0.4955	0.0259	424.9	400.8	80%	1.05		
ERCW Scrn Wash Pmp 2B-B	209	C&A VENT BD 2B1-B	13D	2-MTR-67-447-B	40.00	49.80	290.0	0.38	0.9158	0.3480	0.8471	T54	0.00202	2PL3905B	2-1/0	2100	0.1420	0.0630	358.1		75%			
	209	C&A VENT BD 2B1-B	13D	2-MTR-67-447-B											#4/0	1037	0.0714	0.0638						
Dg 2A-A Btry Hood Exh Fan	221	DSL AUX BD 2A1-A	2A	2-MTR-30-456-A	0.33	2.20	9.3	0.62	28.6495	17.7627	22.4785	T28	0.29500	PL2585A	#12	100	0.2150	0.0077	435.1					
DG 2A-A RM EXH FAN 1-A	221	DSL AUX BD 2A1-A	2B	2-MTR-30-448-A	15.00	19.50	118.4	0.49	2.2431	1.0991	1.9553	T49	0.00572	PL2638A	#8	70	0.0594	0.0049	432.9	408.3				
Dg 2A-A Lube Oil Circ Pmp 1	221	DSL AUX BD 2A1-A	2D	2-MTR-82-A1-A	1.00	1.70	15.0	0.62	17.7054	10.9774	13.8917	T24	0.63200	PL2737A	#12	170	0.3655	0.0130	424.5					
EM DG ENG HX 2A1 & 2A2 SUP VLV	221	DSL AUX BD 2A1-A	3A	2-FCV-67-66-A	0.13	0.39	2.60	0.60	102.1466	61.2880	81.7173	T8	13.95000	PL2160A	#12	160	0.3440	0.0122	403.7	380.8			VALVE	
Dg 2A-A Day Tnk FO Xfr Pmp 1-A	221	DSL AUX BD 2A1-A	3D	2-MTR-18-55-A	1.00	1.85	11.3	0.62	23.5444	14.5975	18.4730	T26	0.42100	PL2720A	#12	160	0.3440	0.0122	431.0					
Dg 2A-A Aux LubeOil Circ Pmp A	221	DSL AUX BD 2A1-A	4B	2-MTR-82-AOPA-A	0.75	1.27	11.5	0.75	23.0940	17.3205	15.2753	T23	0.80000	PL3324A	#12	60	0.1290	0.0046	426.9				0-05146-A	
Dg Rm 2A-A Pnl Vent Fan	221	DSL AUX BD 2A1-A	4D	2-MTR-30-492-A	15.00	20.00	118.4	0.49	2.2431	1.0991	1.9553	T48	0.00825	PL3448A	#8	130	0.1104	0.0092	427.0	402.7				
2A-A 480V ELEC BD RM EX FAN	221	DSL AUX BD 2A1-A	4E	2-MTR-30-460-A	2.00	2.70	22.6	0.62	11.7722	7.2988	9.2365	T29	0.23700	PL2525A	#10	90	0.1215	0.0063	431.6					
Dg 2A-A Air Cprsr 2	221	DSL AUX BD 2A1-A	5A	2-MTR-82-241	5.00	7.10	44.5	0.62	5.9695	3.7011	4.6836	T39	0.02878	PL2205	#12	100	0.2150	0.0077	428.5	404.2				
Dg 2A-A Muffler Rm Exh Fan	221	DSL AUX BD 2A1-A	6A	2-MTR-30-464	1.50	2.65	20.0	0.62	13.2791	8.2330	10.4188	T28	0.29500	PL2242	#12	52	0.1118	0.0040	431.6	407.1				
Dg 2A-A Aux LubeOil Circ Pmp B	222	DSL AUX BD 2A2-A	2A	2-MTR-82-AOPB-A	0.75	1.27	11.5	0.75	23.0940	17.3205	15.2753	T23	0.80000	PL3325A	#12	176	0.3784	0.0135	423.4				0-05146-A	
DG 2A-A RM EXH FAN 2-A	222	DSL AUX BD 2A2-A	2B	2-MTR-30-452-A	15.00	19.50	118.4	0.49	2.2431	1.0991	1.9553	T49	0.00572	PL2647A	#8	100	0.0849	0.0071	430.1	405.6				
Dg 2A-A Lube Oil Circ Pmp 2	222	DSL AUX BD 2A2-A	2D	2-MTR-82-A2-A	1.00	2.05	12.5	0.62	21.1956	13.1413	16.6301	T26	0.42100	PL2738A	#12	180	0.3870	0.0138	429.4					
EM DG ENG HX 2A1 & 2A2 SUP VLV	222	DSL AUX BD 2A2-A	3A	2-FCV-67-68-A	0.13	0.39	2.60	0.60	102.1466	61.2880	81.7173	T8	13.95000	PL2153A	#12	100	0.2150	0.0077	404.1	381.1				
Dg 2A-A Day Tnk FO Xfr Pmp 2-A	222	DSL AUX BD 2A2-A	3D	2-MTR-18-54-A	1.00	1.85	11.3	0.62	23.5444	14.5975	18.4730	T26	0.42100	PL2722A	#12	180	0.3870	0.0138	430.5					
Dg 2A-A Air Cprsr 1	222	DSL AUX BD 2A2-A	5A	2-MTR-82-240	5.00	7.25	46.0	0.62	5.7735	3.5796	4.5299	T38	0.03483	PL2210	#12	82	0.1763	0.0063	429.7	405.3				
Dg 2B-B Btry Hood Exh Fan	223	DSL AUX BD 2B1-B	2A	2-MTR-30-458-B	0.33	1.00	10.0	0.62	26.5581	16.4660	20.8375	T18	1.87500	PL2595B	#12	200	0.4300	0.0153	416.5					
DG 2B-B RM EXH FAN 1B	223	DSL AUX BD 2B1-B	2B	2-MTR-30-450-B	15.00	19.50	118.4	0.49	2.2431	1.0991	1.9553	T49	0.00572	PL2674B	#8	120	0.1019	0.0085	428.2	403.9				
Dg 2B-B Lube Oil Circ Pmp 1	223	DSL AUX BD 2B1-B	2D	2-MTR-82-B1-B	1.00	1.95	7.9	0.62	33.6605	20.8695	26.4101	T26	0.42100	PL2742B	#12	160	0.3440	0.0122	433.7					
EM DG ENG SUP VLV FROM HDR 1B	223	DSL AUX BD 2B1-B	3A	2-FCV-67-67-B	0.13	0.39	2.60	0.60	102.1466	61.2880	81.7173	T8	13.95000	PL2180B	#12	162	0.3483	0.0124	403.7	380.8			VALVE	
Dg 2B-B Day Tnk FO Xfr Pmp 1-B	223	DSL AUX BD 2B1-B	3D	2-MTR-18-55-B	1.00	1.85	11.3	0.62	23.5444	14.5975	18.4730	T26	0.42100	PL2730B	#12	174	0.3741	0.0133	430.6					
Dg 2B-B Aux LubeOil Circ Pmp A	223	DSL AUX BD 2B1-B	4B	2-MTR-82-AOPA-B	0.75	1.27	11.5	0.75	23.0940	17.3205	15.2753	T23	0.80000	PL3326B	#12	60	0.1290	0.0046	426.9				0-05146-A	
Dg Rm 2B-B Pnl Vent Fan	223	DSL AUX BD 2B1-B	4D	2-MTR-30-494-B	15.00	20.00	118.4	0.49	2.2431	1.0991	1.9553	T48	0.00825	PL3456B	#8	150	0.1274	0.0106	425.1	401.0				
Dg 2B-B 480V Elec Bd Rm Ex Fan	223	DSL AUX BD 2B1-B	4E	2-MTR-30-462-B	2.00	2.70	22.6	0.62	11.7722	7.2988	9.2365	T29	0.23700	PL2535B	#10	150	0.2025	0.0106	429.6					
Dg 2B-B Air Cprsr 2	223	DSL AUX BD 2B1-B	5A	2-MTR-82-271	5.00	7.10	44.5	0.62	5.9681	3.7002	4.6826	T39	0.02878	PL2225	#12	122	0.2623	0.0093	426.3	402.1				
Dg 2B-B Muffler Rm Exh Fan	223	DSL AUX BD 2B1-B	6A	2-MTR-30-466	1.50	2.65	20.0	0.62	13.2791	8.2330	10.4188	T29	0.23700	PL2255	#12	80	0.1720	0.0061	431.5	407.0				
Dg 2B-B Aux LubeOil Circ Pmp B	224	DSL AUX BD 2B2-B	2A	2-MTR-82-AOPB-B	0.75	1.27	11.5	0.75	23.0940	17.3205	15.2753	T23	0.80000	PL3327B	#12	176	0.3784	0.0135	423.4				0-05146-A	
DG 2B-B RM EXH FAN 2-B	224	DSL AUX BD 2B2-B	2B	2-MTR-30-454-B	15.00	19.50	118.4	0.49	2.2431	1.0991	1.9553	T49	0.00572	PL2683B	#8	114	0.0968	0.0080	428.8	404.4				
Dg 2B-B Lube Oil Circ Pmp 2	224	DSL AUX BD 2B2-B	2D	2-MTR-82-B2-B	1.00	2.05	11.3	0.62	23.5444	14.5975	18.4730	T26	0.42100	PL2743B	#12	180	0.3870	0.0138	430.5					
EMDG ENG SUP VLV FROM HDR 2A	224	DSL AUX BD 2B2-B	3A	2-FCV-67-65-B	0.13	0.39	2.60	0.60	102.1466	61.2880	81.7173	T8	13.95000	PL2187B	#12	126	0.2709	0.0096	403.9					
Dg 2B-B Day Tnk FO Xfr Pmp 2-B	224	DSL AUX BD 2B2-B	3D	2-MTR-18-54-B	1.00	1.85	11.3	0.62	23.5444	14.5975	18.4730	T26	0.42100	PL2732B	#12	180	0.3870	0.0138	430.5					
Dg Bldg Fuel Oil Xfr Pmp	224	DSL AUX BD 2B2-B	4B	0-MTR-18-98	7.50	11.00	63.5	0.57	4.1824	2.3840	3.4364	T42	0.01503	PL2460	#10	100	0.1350	0.0071	430.4					
Dg 2B-B Air Cprsr 1	224	DSL AUX BD 2B2-B	5A	2-MTR-82-270	5.00	7.25	44.5	0.62	5.9681	3.7002	4.6826	T39	0.02878	PL2230	#12	115	0.2473	0.0088	427.0	402.7				

LEGEND: $ MINIMUM MOTOR START VOLTAGE = 85% OF 460V EXCEPT NOTED $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE EXCEPT NOTED + CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET ++ MAXIMUM LENGTH CABLE < 1200 FEET

THIS SHEET ADDED BY REV. 4

WBN-EEB-ED-Q000-999-2007-0002, R0

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Calc. STUDY-EEB-WBN-12-001
Attachment 3
Required Motor Starting Voltage
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15-Sep-92

WBN-EEB-MS-TI06-0010 R10   ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES
(TABLE L3 - UNIT 2 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R18)

ENG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLI	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	END MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (415)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
Boric Acid Transfer Pmp 2A-A	239	RMOV BD 2A1-A	2B	2-MTR-62-230-A	15.00	18.00	105.2	0.49	2.5245	1.2370	2.2007	T48	0.00825	2PL6108A	#8	600	0.5094	0.0423	390.1				AMP FAIL	
Boric Acid Transfer Pmp 2A-A	239	RMOV BD 2A1-A	2B	2-MTR-62-230-A	7.50	13.00	105.2	0.49	2.5245	1.2370	2.2007	T43	0.01387	2PL6108A	#8	400	0.3396	0.0282	405.7				AMP FAIL	
Vol Cont Tank Outlet Isln Vlv	239	RMOV BD 2A1-A	8B	2-LCV-62-132-A	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	2V2760A	#12	542	1.1653	0.0415	403.3					
Cntmt Standpipe Isln Vlv	239	RMOV BD 2A1-A	17B	2-FCV-26-240-A	0.67	2.80	16.0	0.60	16.5988	9.9593	13.2791	T24	0.63200	2V9147A	#12	900	1.9350	0.0689	399.0					
Annulus Standpipe Isln Vlv	239	RMOV BD 2A1-A	17C	2-FCV-26-242-A	0.67	2.80	16.0	0.60	16.5988	9.9593	13.2791	T24	0.63200	2V9360A	#12	538	1.1567	0.0412	411.2					
RCP Spray Isln Vlv	239	RMOV BD 2A1-A	18E	2-FCV-26-243-A	0.67	2.80	16.0	0.60	16.5988	9.9593	13.2791	T24	0.63200	2V9165A	#12	532	1.1438	0.0407	411.4					
Cntmt Spray Hx 2A Sup Cont Vlv	240	RMOV BD 2A2-A	5E	2-FCV-67-125-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2200A	#12	408	0.8772	0.0312	418.3					
ERCW Hdr 2A Iso Vlv Before Str	240	RMOV BD 2A2-A	7B	2-FCV-67-22-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T17	2.20500	2V2398A	#8	2100	1.7829	0.1481	409.9					
	240	RMOV BD 2A2-A	7B												#12	553	1.1890	0.0423						
A.Bldg ERCW Sup Hdr 2A Iso Vlv	240	RMOV BD 2A2-A	8A	2-FCV-67-81-A	0.67	1.90	7.56	0.60	35.1298	21.0779	28.1038	T24	0.63200	2V1980A	#12	815	1.7523	0.0623	421.7					
A.Bldg AirClr Sup Hdr 2A Iso V	240	RMOV BD 2A2-A	10B	2-FCV-67-127-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T14	4.72000	2V2410A	#12	600	1.2900	0.0459	406.3					
Cmpt Clg Hx A Disch Cont Vlv	240	RMOV BD 2A2-A	11A	2-FCV-67-146-A	0.67	1.90	7.56	0.60	35.1298	21.0779	28.1038	T24	0.63200	2V2422A	#12	360	0.7740	0.0275	429.2				F-13942-A	
COKE BLDG SUPPLY VALVE	240	RMOV BD 2A2-A	11F	0-FCV-70-208-A	0.13	0.45	2.60	0.60	102.1466	61.2880	81.7173	T9	11.72000	2V4020A	#12	476	1.0234	0.0364	407.5					
RCP Oil Clr Rtn Cntmt Isln Vlv	240	RMOV BD 2A2-A	12D	2-FCV-70-92-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	2V2867A	#12	700	1.5050	0.0536	410.1					
SPLY HDR 2A TO HDR 1B ISLN VLV	240	RMOV BD 2A2-A	13A	2-FCV-67-223-A	0.67	1.90	12.00	0.60	22.1318	13.2791	17.7054	T24	0.63200	2V2968A	#12	470	1.0105	0.0360	420.1					
YD HDR A DIS VLV TO CLG TWR	240	RMOV BD 2A2-A	13B	0-FCV-67-360	1.00	2.80	16.00	0.60	16.5988	9.9593	13.2791	T29	0.23700	2V3230	#12	1236	2.6574	0.0946	393.7					
BA & Gas Strip Evap Pkg 2A FCV	240	RMOV BD 2A2-A	13D	2-FCV-70-168-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T15	3.79000	2V1940A	#12	630	1.3545	0.0482	411.0					
Annulus Spr Isln Vlv	240	RMOV BD 2A2-A	13E	2-FCV-26-245-A	0.67	2.80	16.0	0.60	16.5988	9.9593	13.2791	T24	0.63200	2V9175A	#12	600	1.2900	0.0459	409.1					
RHR Hx A Hdr Inlet Vlv	240	RMOV BD 2A2-A	14A	2-FCV-70-2-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2460A	#12	350	0.7525	0.0268	419.0					
Misc Eqpt Hdr Inlet Vlv	240	RMOV BD 2A2-A	14B	2-FCV-70-4-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2472A	#12	346	0.7439	0.0265	419.1					
CCS Hx B Outlet Vlv	240	RMOV BD 2A2-A	14D	2-FCV-70-15-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2478A	#12	276	0.5934	0.0211	419.9					
CCS HX B & C OUTLET ISLN VLV	240	RMOV BD 2A2-A	14E	2-FCV-70-195-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2490A	#12	294	0.6321	0.0225	419.7					
CCS HX B DISCH BYPASS CONT VLV	240	RMOV BD 2A2-A	15A	2-FCV-67-143-A	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T9	11.72000	2V1876A	#10	450	0.6075	0.0317	402.1				P-01136-B	
CCS Hx B & C Inlet Isln Vlv	240	RMOV BD 2A2-A	15B	2-FCV-70-18-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2520A	#12	650	1.3975	0.0497	415.3					
CCS HX B INLET VALVE	240	RMOV BD 2A2-A	15D	2-FCV-70-16-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2526A	#12	534	1.1481	0.0409	416.8					
RHR Hx A-A Outlet Vlv	240	RMOV BD 2A2-A	16E	2-FCV-70-156-A	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2562A	#12	558	1.1997	0.0427	416.5					
480V BD RM 2A A/C CPRSR 2A-A	240	RMOV BD 2A2-A	17E	2-MTR-31-465-A	50.00	57.00	350.8	0.37	0.7571	0.2801	0.7033			2PL2955A	#2	130	0.0277	0.0080	429.8					
Boric Acid Transfer Pmp 2B-B	241	RMOV BD 2B1-B	2B	2-MTR-62-232-B	7.50	13.00	105.2	0.49	2.5245	1.2370	2.2007	T43	0.01387	2PL6114B	#10	457	0.6170	0.0322	381.6				AMP FAIL	
Boric Acid Transfer Pmp 2B-B	241	RMOV BD 2B1-B	2B	2-MTR-62-232-B	15.00	18.00	105.2	0.49	2.5245	1.2370	2.2007	T48	0.00825	2PL6114B	#10	686	0.9261	0.0484	355.3				AMP FAIL	
COKE Bldg Supply Valve	241	RMOV BD 2B1-B	3E	2-FCV-70-207-B	0.13	0.45	2.60	0.60	102.1466	61.2880	81.7173	T9	11.72000	2V4050B	#12	446	0.9589	0.0341	407.7					
HPFP Sys Low Level Intake Vlv	241	RMOV BD 2B1-B	5A	0-FCV-26-8-B	0.13	0.45	3.15	0.60	84.3115	50.5869	67.4492	T9	11.72000	2V1626B	#12	1252	2.6918	0.0958	387.1		80%			
	241	RMOV BD 2B1-B	5A												#10	2100	2.8350	0.1481						
Vol Cont Tank Outlet Isln Vlv	241	RMOV BD 2B1-B	8A	2-LCV-62-133-B	1.90	3.50	26.0	0.60	10.2147	6.1288	8.1717	T29	0.23700	2V2770B	#12	530	1.1395	0.0405	404.0					
Annulus Standpipe Isln Vlv	241	RMOV BD 2B1-B	17B	2-FCV-26-241-B	0.67	2.80	16.0	0.60	16.5988	9.9593	13.2791	T24	0.63200	2V9155B	#12	584	1.2556	0.0447	409.6					
INCORE INSTR RM CHILLED H2O	241	RMOV BD 2B1-B	17F2	2-MTR-31-324/2	3.00	4.60	32.0																	
HPFP Com Hdr FCV	242	RMOV BD 2B2-B	5A	0-FCV-26-15	0.07	0.60	2.6	0.60	102.1466	61.2880	81.7173	T9	11.72000	2V3360	#12	748	1.6082	0.0572	406.0					
HPFP Com Hdr FCV	242	RMOV BD 2B2-B	5B	0-FCV-26-16	0.07	0.60	2.6	0.60	102.1466	61.2880	81.7173	T9	11.72000	2V3370	#12	576	1.2384	0.0441	407.0					
Cntmt Spray Hx 2B Sup Cont Vlv	242	RMOV BD 2B2-B	5E	2-FCV-67-123-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2160B	#12	350	0.7525	0.0268	419.0					
Cntmt Spray Hx 2B Disch Vlv	242	RMOV BD 2B2-B	5F	2-FCV-67-124-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2170B	#12	538	1.1567	0.0412	416.7					
ERCW Hdr 2B Iso Vlv Before Str	242	RMOV BD 2B2-B	8A	2-FCV-67-24-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T17	2.20500	2V2404B	#8	2100	1.7829	0.1481	403.4					
	242	RMOV BD 2B2-B	8A												#12	1093	2.3500	0.0836						
A.Bldg ERCW Sup Hdr 2B Iso Vlv	242	RMOV BD 2B2-B	8B	2-FCV-67-82-B	0.67	1.90	7.56	0.60	35.1298	21.0779	28.1038	T24	0.63200	2V2000B	#12	572	1.2298	0.0438	425.7					
A.Bldg AirClr Sup Hdr 2B Iso V	242	RMOV BD 2B2-B	11A	2-FCV-67-128-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T14	4.72000		#12	388	0.8342	0.0297	408.8					
HPFP To B Hdr FCV To Yard	242	RMOV BD 2B2-B	11F	0-FCV-26-13-B	0.33	0.75	5.7	0.60	46.5932	27.9559	37.2745	T14	4.72000	2V2224B	#12	1232	2.6488	0.0942	388.5				MOV OL	
	242	RMOV BD 2B2-B	11F												#8	2100	1.7829	0.1481						

\U2MOCVD\ $ MINIMUM MOTOR START VOLTAGE = 85% OF 460V.EXCEPT NOTED. $$ ACCELERATION TIME IS AT 80% STARTING VOLTAGE, EXCEPT NOTED. * CABLE LENGTH USED IS DESIGN LENGTH PLUS 100 FEET. ** MAXIMUM LENGTH CABLE (1200 FEET

THIS SHEET ADDED BY REV. 4

16-Sep-92

WBN-EEB-MS-TI06-0010 R16 ATTACHMENT 10.6 - 480V SWITCHGEAR AND MOTOR CONTROL CENTER MOTOR STARTING VOLTAGES
(TABLE L3 - UNIT 2 MCC MOTOR STARTING VOLTAGES FROM WBN-EEB-MS-TI06-0002 R16)

ENG_TITLE	NODE_NO	BOARD	COMPT NO	EQUIPID_NO	LOAD	FLI	LRA	LRPF	Zm	Rm	jXm	OVLD SIZE	Rtol	CABLE NO.	CABLE SIZE	LENG	Rc	jXc	IND MOTOR START VOLT (440)	BLOCK MOTOR START VOLT (415)	MIN MOTOR START VOLT ($)	ACCEL TIME SEC ($$)	REMARKS	REV
CCS Hx C Disch Vlv To Hdr B	242	RMOV BD 2B2-B	12B	0-FCV-67-152-B	0.67	1.90	7.56	0.60	35.1298	21.0779	28.1038	T24	0.63200	2V2791B	#12	342	0.7353	0.0262	429.5	405.1			VALVE	
Annulus Spr Isln Vlv	242	RMOV BD 2B2-B	12F	2-FCV-26-244-B	0.67	2.80	16.0	0.60	16.5988	9.9593	13.2791	T24	0.63200	2V9170B	#14	700	2.3891	0.0578	392.4					
Sply Hdr 2B To Hdr 1A Isln Vlv	242	RMOV BD 2B2-B	13A	2-FCV-67-147-B	0.70	2.30	12.00	0.60	22.1318	13.2791	17.7054	T26	0.42100	2V2428B	#12	494	1.0621	0.0378	421.9					
CCS Hx B & C Inlet Isln Vlv	242	RMOV BD 2B2-B	13B	2-FCV-70-14-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2506B	#12	572	1.2298	0.0438	416.3					
RHR Hx B Hdr Inlet Vlv	242	RMOV BD 2B2-B	14B	2-FCV-70-3-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2466B	#12	386	0.8299	0.0295	418.6					
CCSP 2AA&2BB To C-S Outl Iso V	242	RMOV BD 2B2-B	14D	2-FCV-70-28-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2532B	#12	566	1.2169	0.0433	416.4					
CCS Pmps 2A-A To 2B-B Isln Vlv	242	RMOV BD 2B2-B	14E	2-FCV-70-39-B	0.67	1.90	7.56	0.60	35.1298	21.0779	28.1038	T24	0.63200	2V3220B	#12	566	1.2169	0.0433	425.8				TELAS R11	
RHR Hx B Rtn Hdr Isln Vlv	242	RMOV BD 2B2-B	15A	2-FCV-70-75-B	0.33	0.75	5.70	0.60	46.5932	27.9559	37.2745	T14	4.72000	2V1970B	#12	704	1.5136	0.0539	405.0					
CCS Hx B & C Outlet Isln Vlv	242	RMOV BD 2B2-B	15B	2-FCV-70-196-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2484B	#12	366	0.7869	0.0280	418.8					
CCSP 2AA&2BB To C-S Inlt Iso V	242	RMOV BD 2B2-B	15D	2-FCV-70-78-B	0.67	1.90	7.56	0.60	35.1298	21.0779	28.1038	T24	0.63200	2V2544B	#12	570	1.2255	0.0436	425.7				TELAS R11	
RHR Hx B-B Outlet Vlv	242	RMOV BD 2B2-B	15E	2-FCV-70-153-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2556B	#12	470	1.0105	0.0360	417.5					
CCSP 2AA&2BB To C-S Inlt Iso V	242	RMOV BD 2B2-B	16A	2-FCV-70-76-B	0.67	1.90	7.56	0.60	35.1298	21.0779	28.1038	T24	0.63200	2V2550B	#12	560	1.2040	0.0428	425.9				TELAS R11	
SFPCS Hx Sply Hdr Isln Vlv	242	RMOV BD 2B2-B	17A	0-FCV-70-194-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2514B	#12	416	0.8944	0.0318	418.2					
CCSP 2AA&2BB To C-S Outl Iso V	242	RMOV BD 2B2-B	17B	2-FCV-70-29-B	0.33	0.95	5.70	0.60	46.5932	27.9559	37.2745	T16	2.95000	2V2538B	#12	556	1.1954	0.0425	416.5					
480V Bd Rm 2B A/C Cprsr 2B-B	242	RMOV BD 2B2-B	18D	2-MTR-31-447-B	75.00	90.00	526.2	0.33	0.5047	0.1666	0.4764			2PL3860B	#2	170	0.0363	0.0105	421.0				AMP FAIL	
Waste Gas Cprsr Pkg B	245	RX VENT BD 2A-A	6C	0-MTR-77-105	25.00	30.00	197.4	0.43	1.3454	0.5785	1.2147	T53	0.00226	2PL5460	#6	640	0.3416	0.0442	379.3				FAILED NON-1E	
Cont Bay Sump Pmp 1	246	RX VENT BD 2B-B	6E1	2-MTR-40-2	5.00	7.25	46.0	0.62	5.7735	3.5796	4.5299			2PL695	#10	976	1.3176	0.0688	378.1				FAILED NON-1E	
COMPUTER ROOM AHU NO. 2	246	RX VENT BD 2B-B	11B	0-MTR-31-498	7.50	9.60	60.0	0.57	4.4264	2.5230	3.6369	T41	0.01808	2PL3901	#6	1160	0.6299	0.0814	398.5					

THIS SHEET ADDED BY REV. 4

WBN-EEB-ED-Q000-999-2007-0002, R0

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Calc. STUDY-EEB-WBN-12-001
Attachment 3
Required Motor Starting Voltage
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Mechanical Degraded Voltage Time Requirements for GL 89-10 MOVs

VALVEID	Train	T(sec) from SI: 0, 4, 5, 10 or SS See Notes	MOV Position Change	Required Voltage	Comments (also, see Notes Section)
0-FCV-067-0144	B	SS SS	O to C C to O	C = 388.3 O = 388.3	Steady State Voltage
0-FCV-067-0152	B	0 SS	C to O O to C	O = 395.1 C = 414	Need Best avail Voltage at t=0 sec from SI
0-FCV-067-0205	A	SS SS	O to C C to O	C = 429.9 O = 429.9	Steady State Voltage
0-FCV-067-0208	B	SS SS	O to C C to O	C = 428.9 O = 428.9	Steady State Voltage
0-FCV-070-0194	B	SS SS	O to C C to O	C = 440.9 O = 440.9	Steady State Voltage
0-FCV-070-0197	A	SS SS	O to C C to O	C = 439.1 O = 439.1	Steady State Voltage
1-FCV-001-0015	A	SS SS	O to C C to O	C = 414 O = 414	Steady State Voltage
1-FCV-001-0016	A	SS SS	O to C C to O	C = 414 O = 414	Steady State Voltage
1-FCV-001-0017	A	SS SS	O to C C to O	C = 408.1 O = 408.1	Steady State Voltage
1-FCV-001-0018	B	SS SS	O to C C to O	C = 413.3 O = 413.3	Steady State Voltage
1-FCV-001-0051	S	0 SS	C to O O to C	O = 90.49 C = 90.49	125 V DC Motor, Need Best Avail Voltage at T=0 sec from SI
1-FCV-003-0033	A	0 4 SS	O to C O to C C to O	C = 322 C = 389.5 O = 414	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=4 sec forward from SI (normally open MOV). Need SS voltage for non-safety related opening stroke.
Motor Brake (1-FCV-003-0033)	A	0	energize	368	Needs 80% of 460 voltage @ T=0
1-FCV-003-0047	B	0 4 SS	O to C O to C C to O	C = 322 C = 381.5 O = 414	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=4 sec forward from SI (normally open MOV). Need SS voltage for non-safety related opening stroke.
Motor Brake (1-FCV-003-0047)	B	0	energize	368	Needs 80% of 460 voltage @ T=0

Mechanical Degraded Voltage Time Requirements for GL 89-10 MOVs

VALVEID	Train	T(sec) from SI: 0, 4, 5, 10 or SS See Notes	MOV Position Change	Required Voltage	Comments (also, see Notes Section)
1-FCV-003-0087	A	0 4 SS	O to C O to C C to O	C = 322 C = 377.0 O = 403.0	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=4 sec forward from SI (normally open MOV). Need SS voltage for non-safety related opening stroke.
Motor Brake (1-FCV-003-0087)	A	0	energize	368	Needs 80% of 460 voltage @ T=0
1-FCV-003-0100	B	0 4 SS	O to C O to C C to O	C = 322 C = 381.5 O = 414	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=4 sec forward from SI (normally open MOV). Need SS voltage for non-safety related opening stroke.
Motor Brake (1-FCV-003-0100)	B	0	energize	368	Needs 80% of 460 voltage @ T=0
1-FCV-003-0116A	A	SS SS	C to O O to C	O = 383.6 C = 383.6	Steady State Voltage
1-FCV-003-0116B	A	SS SS	C to O O to C	O = 383.6 C = 383.6	Steady State Voltage
1-FCV-003-0126A	B	SS SS	C to O O to C	O = 381.9 C = 381.9	Steady State Voltage
1-FCV-003-0126B	B	SS SS	C to O O to C	O = 382 C = 382	Steady State Voltage
1-FCV-003-0136A	A	SS SS	C to O O to C	O = 386.3 C = 386.3	Steady State Voltage
1-FCV-003-0136B	A	SS SS	C to O O to C	O = 386.3 C = 386.3	Steady State Voltage
1-FCV-003-0179A	B	SS SS	C to O O to C	O = 384.5 C = 384.5	Steady State Voltage
1-FCV-003-0179B	B	SS SS	C to O O to C	O = 384.5 C = 384.5	Steady State Voltage
1-FCV-026-0240	A	0 5 SS	O to C O to C C to O	C = 322 C = 403.5 O = 427.2	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-026-0243	A	0 5 SS	O to C O to C C to O	C = 322 C = 409.7 O = 422.4	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-062-0061	B	0 5 SS	O to C O to C C to O	C = 322 C = 386.6 O = 393.7	Need 70% Voltage at t=0 sec Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).

Mechanical Degraded Voltage Time Requirements for GL 89-10 MOVs

VALVEID	Train	T(sec) from SI: 0, 4, 5, 10 or SS See Notes	MOV Position Change	Required Voltage	Comments (also, see Notes Section)
1-FCV-062-0063	A	0 5 SS	O to C O to C C to O	C = 322 C = 381.1 O = 409.2	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-062-0090	A	0 5 SS	O to C O to C C to O	C = 322 C = 414 O = 414	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-062-0091	B	0 5 SS	O to C O to C C to O	C = 322 C = 414 O = 414	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-062-0138	B	SS SS	C to O O to C	O = 407.5 C = 407.5	Steady State Voltage
1-FCV-063-0001	A	SS SS	O to C C to O	C = 413.5 O = 413.5	Steady State Voltage
1-FCV-063-0003	A	SS SS	O to C C to O	C = 400.5 O = 400.5	Steady State Voltage
1-FCV-063-0004	B	SS SS	O to C C to O	C = 390 O = 390	Steady State Voltage
1-FCV-063-0005	B	SS SS	O to C C to O	C = 399.5 O = 399.5	Steady State Voltage
1-FCV-063-0006	B	SS SS	C to O O to C	O = 401.1 C = 401.1	Steady State Voltage
1-FCV-063-0007	A	SS SS	C to O O to C	O = 403.5 C = 403.5	Steady State Voltage
1-FCV-063-0008	A	SS SS	C to O O to C	O = 429.8 C = 429.8	Steady State Voltage
1-FCV-063-0011	B	SS SS	C to O O to C	O = 415.7 C = 415.7	Steady State Voltage
1-FCV-063-0022	B	SS SS	O to C C to O	C = 401.4 O = 401.4	Steady State Voltage
1-FCV-063-0025	B	0 SS	C to O O to C	O = 361.8 C = 414	Need Best avail Voltage at t=0 sec from SI for opening stroke, need steady state for closing stroke.

Calculation No.:
WBNEEBEDQ1999010001

ATTACHMENT 11.9
JOG Review Plan

Mechanical Degraded Voltage Time Requirements for GL 89-10 MOVs

VALVEID	Train	T(sec) from SI: 0, 4, 5, 10 or SS See Notes	MOV Position Change	Required Voltage	Comments (also, see Notes Section)
1-FCV-063-0026	A	**0** **SS**	**C to O** **O to C**	**O = 343.4** **C = 414**	**Temporary minimum requirment in support of DCN 52837 Stage 2.** Need Best avail Voltage at t=0 sec from SI for opening stroke, need steady state for closing stroke.
		0 **SS**	**C to O** **O to C**	**O = 370** **C = 414**	**Long term minimum requirment in support of DCN 52837 Stage 3.** Need Best avail Voltage at t=0 sec from SI for opening stroke, need steady state for closing stroke.
1-FCV-063-0047	A	**SS** **SS**	**O to C** **C to O**	**C = 403** **O = 403**	Steady State Voltage
1-FCV-063-0048	B	**SS** **SS**	**O to C** **C to O**	**C = 418.8** **O = 418.8**	Steady State Voltage
1-FCV-063-0072	A	**SS** **SS**	**C to O** **O to C**	**O = 404.3** **C = 404.3**	Steady State Voltage
1-FCV-063-0073	B	**SS** **SS**	**C to O** **O to C**	**O = 408.7** **C = 408.7**	Steady State Voltage
1-FCV-063-0093	A	**SS** **SS**	**C to O** **O to C**	**O = 419.6** **C = 419.6**	Steady State Voltage
1-FCV-063-0094	B	**SS** **SS**	**C to O** **O to C**	**O = 418.2** **C = 418.2**	Steady State Voltage
1-FCV-063-0152	A	**SS** **SS**	**O to C** **C to O**	**C = 405.8** **C = 405.8**	Steady State Voltage
1-FCV-063-0153	B	**SS** **SS**	**O to C** **C to O**	**C = 405.8** **O = 405.8**	Steady State Voltage
1-FCV-063-0156	A	**SS** **SS**	**C to O** **O to C**	**O = 412.7** **C = 412.7**	Steady State Voltage
1-FCV-063-0157	B	**SS** **SS**	**C to O** **O to C**	**O = 414** **C = 414**	Steady State Voltage
1-FCV-063-0172	B	**SS** **SS**	**C to O** **O to C**	**O = 396.7** **C = 396.7**	Steady State Voltage
1-FCV-063-0175	B	**SS** **SS**	**O to C** **C to O**	**C = 390.7** **O = 390.7**	Steady State Voltage
1-FCV-067-0083	B	**0** **5** **SS**	**O to C** **O to C** **C to O**	**C = 322** **C = 395.1** **O = 404.3**	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).

Mechanical Degraded Voltage Time Requirements for GL 89-10 MOVs

VALVEID	Train	T(sec) from SI: 0, 4, 5, 10 or SS See Notes	MOV Position Change	Required Voltage	Comments (also, see Notes Section)
1-FCV-067-0087	A	0 5 SS	O to C O to C C to O	C = 322 C = 392.4 O = 399.6	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0088	B	0 5 SS	O to C O to C C to O	C = 322 C = 392.2 O = 401.3	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0089	A	0 5 SS	O to C O to C C to O	C = 322 C = 386.7 O = 393.6	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0091	B	0 5 SS	O to C O to C C to O	C = 322 C = 392.4 O = 401.5	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0095	A	0 5 SS	O to C O to C C to O	C = 322 C = 391.6 O = 398.5	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0096	B	0 5 SS	O to C O to C C to O	C = 322 C = 392.8 O = 401.9	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0097	A	0 5 SS	O to C O to C C to O	C = 322 C = 385.9 O = 393	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0099	A	0 5 SS	O to C O to C C to O	C = 322 C = 393.9 O = 401.2	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0103	B	0 5 SS	O to C O to C C to O	C = 322 C = 388 O = 397	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0104	A	0 5 SS	O to C O to C C to O	C = 322 C = 394.3 O = 401.6	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0105	B	0 5 SS	O to C O to C C to O	C = 322 C = 383.1 O = 392	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0107	A	0 5 SS	O to C O to C C to O	C = 322 C = 395.3 O = 402.7	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).

Mechanical Degraded Voltage Time Requirements for GL 89-10 MOVs

VALVEID	Train	T(sec) from SI: 0, 4, 5, 10 or SS See Notes	MOV Position Change	Required Voltage	Comments (also, see Notes Section)
1-FCV-067-0111	B	0 5 SS	O to C O to C C to O	C = 322 C = 389.4 O = 398.5	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0112	A	0 5 SS	O to C O to C C to O	C = 322 C = 395.7 O = 403.1	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0113	B	0 5 SS	O to C O to C C to O	C = 322 C = 384.3 O = 393.2	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-067-0123	B	SS SS	C to O O to C	O = 436.3 C = 436.3	Steady State Voltage
1-FCV-067-0124	B	SS SS	C to O O to C	O = 433.0 C = 433.0	Steady State Voltage
1-FCV-067-0125	A	SS SS	C to O O to C	O = 438.2 C = 438.2	Steady State Voltage
1-FCV-067-0126	A	SS SS	C to O O to C	O = 435.3 C = 435.3	Steady State Voltage
1-FCV-067-0143	A	SS SS	C to O O to C	O = 388.4 C = 388.4	Steady State Voltage
1-FCV-067-0146	A	SS SS	C to O O to C	O = 431 C = 431	Steady State Voltage
1-FCV-068-0332	B	SS SS	C to O O to C	O = 399.9 C = 399.9	Steady State Voltage
1-FCV-068-0333	A	SS SS	C to O O to C	O = 412 C = 412	Steady State Voltage
1-FCV-070-0087	B	0 5 SS	O to C O to C C to O	C = 322 C = 391 O = 403.6	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-070-0089	B	0 5 SS	O to C O to C C to O	C = 322 C = 391.0 O = 426.4	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).

ATTACHMENT 11.9
JOG Review Plan
Mechanical Degraded Voltage Time Requirements for GL 89-10 MOVs

VALVEID	Train	T(sec) from SI: 0, 4, 5, 10 or SS See Notes	MOV Position Change	Required Voltage	Comments (also, see Notes Section)
1-FCV-070-0090	A	0 5 SS	O to C O to C C to O	C = 322 C = 398.5 O = 405.8	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-070-0092	A	0 5 SS	O to C O to C C to O	C = 322 C = 400.6 O = 428.0	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-070-0100	A	0 5 SS	O to C O to C C to O	C = 322 C = 393.4 O = 416.6	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-070-0133	A	0 12 SS	O to C O to C C to O	C = 322 C = 414 O = 414	Need 70% Voltage at t=0 sec, Need best Avail Voltage at t=12 sec forward from SI (Normally Open MOV)
1-FCV-070-0134	B	0 12 SS	O to C O to C C to O	C = 322 C = 414 O = 414	Need 70% Voltage at t=0 sec, Need best Avail Voltage at t=12 sec forward from SI (Normally Open MOV)
1-FCV-070-0140	B	0 5 SS	O to C O to C C to O	C = 322 C = 391.9 O = 427.4	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-070-0143	A	0 5 SS	O to C O to C C to O	C = 322 C = 398.5 O = 425.7	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-FCV-070-0153	B	SS SS	C to O O to C	O = 391.0 C = 391.0	Steady State Voltage; Active safety function is to operate from close/throttle position to open position. R73
1-FCV-070-0156	A	SS SS	C to O O to C	O = 434.8 C = 434.8	Steady State Voltage
1-FCV-070-0183	A	SS SS	O to C C to O	C = 395.1 O = 395.1	Steady State Voltage
1-FCV-070-0215	A	SS SS	O to C C to O	C = 395.4 O = 395.4	Steady State Voltage
1-FCV-072-0002	B	5 SS	C to O O to C	O = 412.7 C = 415	Time Delay added per DCN 52834, need best avail Voltage at t=5 sec from SI
1-FCV-072-0013	B	10 SS	C to O O to C	O = 414 C = 414	Need Best Avail Voltage at t= 10 sec from SI (MOV will not get a signal to open until after time delay per DCN 52834)
1-FCV-072-0021	B	SS SS	O to C C to O	C = 402.2 O = 402.2	Steady State Voltage

Mechanical Degraded Voltage Time Requirements for GL 89-10 MOVs

VALVEID	Train	T(sec) from SI: 0, 4, 5, 10 or SS See Notes	MOV Position Change	Required Voltage	Comments (also, see Notes Section)
1-FCV-072-0022	A	SS SS	O to C C to O	C = 400.2 O = 400.2	Steady State Voltage
1-FCV-072-0034	A	10 SS	C to O O to C	O = 414 C = 414	Need Best Avail Voltage at t= 10 sec from SI (MOV will not get a signal to open until after time delay per DCN 52834)
1-FCV-072-0039	A	5 SS	C to O O to C	O = 411.3 C = 415	Time Delay added per DCN 52834, need best avail Voltage at t=5 sec from SI
1-FCV-072-0040	A	SS SS	C to O O to C	O = 405.7 C = 405.7	Steady State Voltage
1-FCV-072-0041	B	SS SS	C to O O to C	O = 396 C = 396	Steady State Voltage
1-FCV-072-0044	A	SS SS	C to O O to C	O = 414 C = 414	Steady State Voltage
1-FCV-072-0045	B	SS SS	C to O O to C	O = 414 C = 414	Steady State Voltage
1-FCV-074-0001	A	SS SS	O to C C to O	O = 414 C = 414	Steady State Voltage
1-FCV-074-0002	B	SS SS	C to O O to C	O = 414 C = 414	Steady State Voltage
1-FCV-074-0003	A	SS SS	O to C C to O	C = 424.2 O = 424.2	Steady State Voltage
1-FCV-074-0008	A	SS SS	O to C C to O	C = 414 O = 414	Steady State Voltage
1-FCV-074-0009	B	SS SS	O to C C to O	C = 419.4 O = 419.4	Steady State Voltage
1-FCV-074-0012	A	0 SS	C to O O to C	O = 345.4 C = 393.7	Need Best avail Voltage at t=0 sec from SI (OPEN); and SS (CLOSED)
1-FCV-074-0021	B	SS SS	O to C C to O	C = 422.3 O = 422.3	Steady State Voltage
1-FCV-074-0024	B	0 SS	C to O O to C	O = 347.2 C = 383.8	Need Best avail Voltage at t=0 sec from SI (OPEN); and SS (CLOSED)
1-FCV-074-0033	A	SS SS	O to C C to O	C = 394.6 O = 394.6	Steady State Voltage

ATTACHMENT 11.9
JOG Review Plan
Mechanical Degraded Voltage Time Requirements for GL 89-10 MOVs

VALVEID	Train	T(sec) from SI: 0, 4, 5, 10 or SS See Notes	MOV Position Change	Required Voltage	Comments (also, see Notes Section)
1-FCV-074-0035	B	SS SS	O to C C to O	C = 383 O = 383	Steady State Voltage
1-LCV-062-0132	A	0 5 SS	O to C O to C C to O	C = 322 C = 394.3 O = 414	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-LCV-062-0133	B	0 5 SS	O to C O to C C to O	C = 322 C = 401.6 O = 414	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec forward from SI (Normally open MOV).
1-LCV-062-0135	A	0 SS	C to O O to C	O = 353 C = 409.3	Need Best avail Voltage at t=0 sec from SI
1-LCV-062-0136	B	0 SS	C to O O to C	O = 343 C = 383.3	Need Best avail Voltage at t=0 sec from SI

Notes:

1) The maximum required voltage for any GL 89-10 MOV is equal to or above 90% of 460 v (414 v). Guidance given in Design Standard DS-M18.2.21 states that for voltages 90% or greater the voltage factor is 1.0 (i.e. no degradation is required at 90% or above). Therefore, there will be no impact to any Mechanical MOV calculations as long as 90% of 460 v (414 v) is met.

2) Required voltage for MOVs at T = 0, T = 4, T = 5 or T = 10 sec is the minimum available voltage from the time specified to any time forward during the SI. Example: If a 4 sec voltage was requested and voltage dropped at 5 sec, then the lower 5 sec voltage should be used to bound degraded voltage.

3) For MOVs that are open and go closed upon receiving an SI signal the required voltage at T = 0 is only 70% of 460 v (322 v) until the valve becomes loaded. MOVATs differential pressure test traces were reviewed and conservative bounding times were determined for when the MOV becomes loaded. A 70% starting voltage is based on guidance provided in Limitorque Technical Update 98-01 in Vendor Manual WBN-VTD-L200-0460.

The voltages listed in this Attachment must be met or exceeded.

R73 Prepared By: William F. Cetta Date: 11/11/11 Reviewed By: Jerry V. Mills Date: 11/11/11 | R73

1A BOARDS

ETAP Node ID	MOV	Available Voltage (New Analysis) Value from SS	Time from SI Signal (SS = steady state)	New Design Margin (using new Voltages) (open)	New Design Margin (using new Voltages) (closed)	Comments**
235-5B	RHR Sys Isln Vlv 1-FCV-74-1-A (2.6HP)	90.74*	SS	13.30%	18.80%	Acceptable Margin
235-6D	RCS Press Relief FCV 1-FCV-68-333-A (1.9HP)	89.20*	SS	19.90%	15.80%	Acceptable Margin
235-11B	RHR Hx A To CVCS Chrgr Pmp 1-FCV-63-8-A (1.9HP)	87.48	SS	13.20%	124.60%	Acceptable Margin
235-12A	SIS Pmp 1A-A Inlet Vlv 1-FCV-63-47-A (1.9HP)	88.18*	SS	19.60%	16.10%	Acceptable Margin
235-12D	SIS To RCS Loops 2&3 FCV 1-FCV-63-93-A (1.6 HP)	88.65	SS	18.60%	140.30%	Acceptable Margin
235-12E	SIS Pmp 1A-A Outlet FCV 1-FCV-63-152-A (1.9HP)	88.48*	SS	29.50%	39.40%	Acceptable Margin
235-13A	SIS Pmp Out RCS Lp 1&3 Hot Leg 1-FCV-63-156-A (1.9HP)	89.28*	SS	15.40%	15.90%	Acceptable Margin
235-13B	Cntmt Sump To Spray Hdr 1A FCV 1-FCV-72-44-A (3.2HP)	90.33*	SS	35.50%	105.93%	Acceptable Margin
235-14A	RHR Spray Hdr 1A Isln Vlv 1-FCV-72-40-A (1.9HP)	87.66	SS	75.20%	121.90%	Acceptable Margin
235-14E	RHR Hx 1A Bypass Vlv 1-FCV-74-33-A (2HP)	85.27	SS	79.30%	45.10%	Acceptable Margin
236-9D	Up Cntmt Clr 1A Disc Iso Vlv 1-FCV-67-295 (0.13HP)	81.98	Not 89-10	28.96%	28.96%	Acceptable Margin
236-2D	AFWP Turb Stm Sup Fm Stm Gen 1 1-FCV-1-15-A (1HP)	92.47*	SS	14.50%	35.40%	Acceptable Margin
236-5E	Cntmt Spray Hx 1A Sup Cont Vlv 1-FCV-67-125-A (0.33HP)	92.51*	SS	24.40%	24.40%	Acceptable Margin
236-5F	Cntmt Spray Hx 1A Disch Vlv 1-FCV-67-126-A (0.33HP)	92.19*	SS	24.40%	24.40%	Acceptable Margin
236-6A	AFWP Turb St Sply Frm St gen 4 1-FCV-1-16-A (1HP)	92.52*	SS	14.50%	35.40%	Acceptable Margin
236-6D	RHR Sys Isln Bypass Vlv 1-FCV-74-8-A (1.6HP)	90.99*	SS	17.50%	42.40%	Acceptable Margin
236-11A	Cmpnt Clg Hx A Disch Cont Vlv 1-FCV-67-146-A (0.3HP)	87.97	SS	13.50%	13.50%	Acceptable Margin
236-17B	SFPCS Hx Sply Hdr Isln Vlv 0-FCV-70-197-A (0.3HP)	89.63	SS	28.10%	28.10%	Acceptable Margin
235-11A	SIS Pmp Inlet To CVCS Chrg Pmp 1-FCV-63-7-A (1.9HP)	88.21*	SS	9.40%	105.40%	Acceptable Margin
235-12B	Cntmt Sump To RHR Pmp A-A 1-FCV-63-72-A (13HP)	85.00	SS	21.50%	1781.80%	Acceptable Margin
236-12B	SS&Con AirCpsr Sup Hdr A Iso V 0-FCV-67-205-A (0.33.9HP)	86.86	SS	78.40%	78.40%	Acceptable Margin
236-16E	RHR Hx A-A Outlet Vlv 1-FCV-70-156-A (0.33.9HP)	87.86	SS	24.40%	24.40%	Acceptable Margin R2
203-7D	RHR PMP 1A-A INLET FCV 1-FCV-74-3-A (5.2HP)	90.31	SS	125.80%	2250.80%	Acceptable Margin
203-7E	RWST TO SPRAY HDR 1A FCV 1-FCV-72-22-A (3.2HP)	85.27	SS	273.70%	266.60%	Acceptable Margin
	* Calculated voltage considering Hammer Blow feature (using 50% LRC during unseating)					
	**Calculated voltages based on the new analysis have been reviewed and are considered acceptable based on the available margin.					

1B BOARDS

ETAP Node ID	MOV	Available Voltage (New Analysis) Value from SS	Time from SI Signal (SS = steady state)	New Design Margin (using new Voltages) (open)	New Design Margin (using new Voltages) (closed)	Comments **
205-7D	RHR PMP 1B-B INLET FCV 1-FCV-74-21-B (5.2HP)	91.00	SS	107.10%	1705.70%	Acceptable Margin
237-5E	RCS Press Relief Flow Cont Vlv 1-FCV-68-332-B (1.9HP)	88.06*	SS	>21.7%	>13.5%	Acceptable Margin
237-9B	RHR To RCS H.L. 1&3 Flow Iso V 1-FCV-63-172-B (2.6HP)	85.99	SS	59.20%	87.40%	Acceptable Margin
237-11B	RHR Hx B To SIS Pmp 1-FCV-63-11-B (2HP)	85.71	SS	8.90%	124.60%	Acceptable Margin
237-13A	SIS Pmp 1B-B Outlet FCV 1-FCV-63-153-B (1.9HP)	88.75*	SS	19.90%	30.10%	Acceptable Margin
237-13B	SIS PMP OUT RCS LP 2& 4 H. LEG 1-FCV-63-157-B (1.9HP)	91.36*	SS	11.10%	11.50%	Acceptable Margin
237-13D	SIS 1B-B Dsh To RWST Shtff Vlv 1-FCV-63-175-B (0.7HP)	84.70	SS	977.40%	77.10%	Acceptable Margin
237-14D	RHR Spray Hdr 1B Isln Vlv 1-FCV-72-41-B (1.9HP)	85.82	SS	66.90%	111.40%	Acceptable Margin
237-14E	Cntmt Sump To Spray Hdr 1B FCV 1-FCV-72-45-B (3.2HP)	89.68*	SS	**3.30%**	57.00%	Acceptable Margin
238-2E	St Flow To AFWP Turb Isln Vlv 1-FCV-1-18-B (1HP)	92.50*	SS	95.80%	18.20%	Acceptable Margin
238-5F	Cntmt Spray Hx 1B Disch Vlv 1-FCV-67-124-B (0.33HP)	91.73*	SS	24.40%	24.40%	Acceptable Margin
238-5E	Cntt Spray Hx 1B Sup Cont Vlv 1-FCV-67-123-B (0.33HP)	92.08*	SS	24.40%	24.40%	Acceptable Margin
205-7E	RWST TO SPRAY HDR 1B Vlv 1-FCV-72-22-B (3.3HP)	86.79	SS	291.10%	283.70%	Acceptable Margin
237-10A	SIS 1A-A DSH TO RWST SHTFF VLV 1-FCV-63-4-B (0.7HP)	84.57	SS	943.70%	76.10%	Acceptable Margin
237-10B	RWST To SIS Pump Flow Cont Vlv 1-FCV-63-5-B (1.9HP)	88.02*	SS	17.30%	38.60%	Acceptable Margin
237-11A	SIS PMP INLT TO CVCS CHRG PMP 1-FCV-63-6-B (1.9HP)	88.21*	SS	11.30%	118.70%	Acceptable Margin
237-12B	SIS Pmp 1B-B Inlet Vlv 1-FCV-63-48-B (1.9HP)	90.23*	SS	39.00%	46.60%	Acceptable Margin
237-12D	CNTMT SUMP TO RHR PMP B-B 1-FCV-63-73-B (13HP)	88.03	SS	17.40%	2117.00%	Acceptable Margin
237-14A	Cntmt Spray Hdr 1B Isln Vlv 1-FCV-72-2-B (3.2HP)	92.86*	5s	10.40%	359.00%	Acceptable Margin
238-3A	ERCW Hdr B Isln Vlv 1-FCV-3-179A-B (0.33HP)	83.46	SS	22.10%	19.00%	Acceptable Margin
238-17D	CCS HX B ERCW BYPASS FCV 0-FCV-67-144-B (0.13HP)	82.00	SS	110.40%	112.00%	Acceptable Margin R2
237-15D	RHR Hx 1B Bypass Vlv 1-FCV-74-35-B (1.9HP)	81.00	SS	64.30%	37.80%	Acceptable Margin
	* Calculated voltage considering Hammer Blow feature (using 50% LRC during unseating)					
	**Calculated voltages based on the new analysis have been reviewed and are considered acceptable based on the available margin.					

This page revised and replaced by R2

AUXILIARY POWER SYSTEM ANALYSIS
WBN-EEB-EDQ000-999-2007-0002,
ATTACHMENT 11.5

WBN Unit 2 GL 89-10
Required Voltage Vs Time

VALVEID	T(sec) from SI: 0, 5, or SS	MOV Position Change	Comments	OLD Min. Voltage Required to Achieve Position	Stroke Time (Secs)	NEW Min. Voltage Required to Achieve Position
2-FCV-1-15	SS	either	Steady State Voltage	O= 415 C= 415	20	O= 428.3 C= 428.3
2-FCV-1-16	SS	either	Steady State Voltage	O= 415 C= 415	20	O= 428.2 C= 428.2
2-FCV-1-17	SS	O to C	Steady State Voltage	O= 415 C= 415	16	O= 428.3 C= 428.3
2-FCV-1-18	SS	O to C	Steady State Voltage	O= 415 C= 415	16	O= 423.3 C= 423.3
2-FCV-1-51	0	C to O	125 VDC Motor, Need Best Avail Voltage at T=0 sec from SI	Not evaluated	16	O= 90V C= 90V
2-FCV-3-33	4	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=4 sec from SI (5.75 sec stroke time). Based on review of dP test MOV could become dP loaded just before 5 sec.	O- 390.3 C- 415.	6.5	O= 414 C= 414
2-FCV-3-47	4	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=4 sec from SI (5.75 sec stroke time). Based on review of dP test MOV could become dP loaded just before 5 sec.	O- 390.3 C- 415.	6.5	O= 414 C= 414
2-FCV-3-87	4	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=4 sec from SI (5.75 sec stroke time). Based on review of dP test MOV could become dP loaded just before 5 sec.	O- 376.9 C- 415.	6.5	O= 414 C= 414
2-FCV-3-100	4	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=4 sec from SI (5.75 sec stroke time). Based on review of dP test MOV could become dP loaded just before 5 sec.	O- 390.3 C- 415.	6.5	O= 414 C= 414
2-FCV-3-116A	SS	C to O	Steady State Voltage	O= 415 C= 415.	10	O= 413.3 C= 413.3
2-FCV-3-116B	SS	C to O	Steady State Voltage	O= 415 C= 415.	10	O= 413.2 C= 413.2
2-FCV-3-126A	SS	C to O	Steady State Voltage	O= 408 C= 408	10	O= 406.1 C= 406.1
2-FCV-3-126B	SS	C to O	Steady State Voltage	O= 408 C= 408	10	O= 406.1 C= 406.1
2-FCV-3-136A	SS	C to O	Steady State Voltage	O= 415 C= 415.	15	O= 412.2 C= 412.2
2-FCV-3-136B	SS	C to O	Steady State Voltage	O= 415 C= 415.	15	O= 412.3 C= 412.3
2-FCV-3-179A	SS	C to O	Steady State Voltage	O= 405 C= 405.	15	O= 409 C= 409
2-FCV-3-179B	SS	C to O	Steady State Voltage	O= 405 C= 405.	15	O= 409 C= 409
2-FCV-26-240	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (8.21 sec stroke time)	O= 408.7 C= 401.3	20	O= 430.6 C= 406.9
2-FCV-26-243	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (8.21 sec stroke time)	O= 408.7 C= 401.3	20	O= 426.5 C= 403
2-FCV-62-61	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (5.25 sec stroke time)	O= 415 C= 340.	10	O= 401.2 C= 401.2
2-FCV-62-63	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (5.25 sec stroke time)	O= 405 C= 378.5.	10	O= 380.5 C= 380.5
2-FCV-62-90	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (8.80 sec stroke time)	O= 415 C= 415.	10	O= 414 C= 414
2-FCV-62-91	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (8.25 sec stroke time)	O= 415 C= 415.	10	O= 414 C= 414

WBN Unit 2 GL 89-10
Required Voltage Vs Time

VALVEID	T(sec) from SI: 0, 5, or SS	MOV Position Change	Comments	OLD Min. Voltage Required to Achieve Position	Stroke Time (Secs)	NEW Min. Voltage Required to Achieve Position
2-LCV-62-132	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (5.25 sec stroke time)	O= 390 C= 322	10	O= 417.8 C= 394.7
2-LCV-62-133	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (5.25 sec stroke time)	O= 390 C= 334	10	O= 418.7 C= 394.7
2-LCV-62-135	0	C to O	Need Best avail Voltage at t=0 sec from SI	O= 401.8 C= 409.3	15	O= 320.0 C= 396.3
2-LCV-62-136	0	C to O	Need Best avail Voltage at t=0 sec from SI	O= 376.3 C= 411.3	15	O= 342.9 C= 413.0
2-FCV-62-138	SS	C to O	Steady State Voltage	O= 384 C= 384	6	O= 421.4 C= 421.4
2-FCV-63-001	SS	O to C	Steady State Voltage	O= 413.5 C= 413.5	60	O= 364.2 C= 362.2
2-FCV-63-003	SS	O to C	Steady State Voltage	O= 401 C= 401	10	O= 426.3 C= 426.3
2-FCV-63-004	SS	O to C	Steady State Voltage	O= 390 C= 390	10	O= 416.4 C= 416.4
2-FCV-63-005	SS	O to C	Steady State Voltage	O= 395 C= 395	14	O= 404.4 C= 404.4
2-FCV-63-006	SS	C to O	Steady State Voltage	O= 395 C= 395	10	O= 396.7 C= 396.7
2-FCV-63-007	SS	C to O	Steady State Voltage	O= 399 C= 399	10	O= 396.5 C= 396.5
2-FCV-63-008	SS	C to O	Steady State Voltage	O= 415 C= 415	28	O= 430.7 C= 430.7
2-FCV-63-011	SS	C to O	Steady State Voltage	O= 415 C= 415	28	O= 429.6 C= 429.6
2-FCV-63-022	SS	O to C	Steady State Voltage	O= 407 C= 407	17	O= 408.6 C= 408.6
2-FCV-63-025	0	C to O	Need Best avail Voltage at t=0 sec from SI	O= 415 C= 415	12	O= 414 C= 414
2-FCV-63-026	0	C to O	Need Best avail Voltage at t=0 sec from SI	O= 415 C= 415	12	O= 414 C= 414
2-FCV-63-047	SS	O to C	Steady State Voltage	O= 400 C= 400.	15	O= 385.6 C= 385.6
2-FCV-63-048	SS	O to C	Steady State Voltage	O= 415 C= 415	15	O= 408.2 C= 408.2
2-FCV-63-067	SS	Open Only	Steady State Voltage		105	O = 322
2-FCV-63-072	SS	C to O	Steady State Voltage	O = 415 C = 415	60	O = 410 C = 410
2-FCV-63-073	SS	C to O	Steady State Voltage	O = 415 C = 415	60	O = 420 C = 420
2-FCV-63-080	SS	Open Only	Steady State Voltage		105	O = 322
2-FCV-63-093	SS	either	Steady State Voltage	O= 415 C= 415	40	O = 451.1 C = 451.1
2-FCV-63-094	SS	either	Steady State Voltage	O= 415 C= 415	40	O = 451.8 C = 451.8

WBN Unit 2 GL 89-10
Required Voltage Vs Time

VALVEID	T(sec) from SI: 0, 5, or SS	MOV Position Change	Comments	OLD Min. Voltage Required to Achieve Position	Stroke Time (Secs)	NEW Min. Voltage Required to Achieve Position
2-FCV-63-098	SS	Open Only	Steady State Voltage		105	O = 322
2-FCV-63-118	SS	Open Only	Steady State Voltage		105	O = 322
2-FCV-63-152	SS	O to C	Steady State Voltage	O= 415 C= 415	15	O = 414.6 C = 414.6
2-FCV-63-153	SS	O to C	Steady State Voltage	O= 415 C= 415	15	O = 415.7 C = 415.7
2-FCV-63-156	SS	C to O	Steady State Voltage	O= 415 C= 415	17	O = 414.4 C = 414.4
2-FCV-63-157	SS	C to O	Steady State Voltage	O= 415 C= 415	17	O = 428.6 C = 428.6
2-FCV-63-172	SS	either	Steady State Voltage	O= 394 C= 394	120	O = 395.2 C = 395.2
2-FCV-63-175	SS	O to C	Steady State Voltage	O= 400 C= 400	10	O = 419.5 C = 419.5
1-FCV-67-66	0	C to O	Need best voltage at T = 0 Secs from SI		66	O = 362.4 C = 362.4
1-FCV-67-67	0	C to O	Need best voltage at T = 0 Secs from SI		66	O = 361.9 C = 361.9
2-FCV-67-66	0	C to O	Need best voltage at T = 0 Secs from SI		66	O = 360.8 C = 360.8
2-FCV-67-67	0	C to O	Need best voltage at T = 0 Secs from SI		66	O = 363.8 C = 363.8
2-FCV-67-83	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 364	66	O = 434.8 C = 410.1
2-FCV-67-87	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 362	66	O = 431.5 C = 407
2-FCV-67-88	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 340	66	O = 422.5 C = 402.6
2-FCV-67-89	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 322	66	O = 322 C = 322
2-FCV-67-91	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 364	66	O = 433.9 C = 409.3
2-FCV-67-95	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 361	66	O = 430.7 C = 406.1
2-FCV-67-96	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 341	66	O = 423 C = 403.1
2-FCV-67-97	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 393.0 C=385.9	66	O = 322 C = 322
2-FCV-67-99	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 340	66	O = 422.5 C = 402.6
2-FCV-67-103	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 340	66	O = 422.4 C = 402.6
2-FCV-67-104	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 370	66	O = 441.7 C = 416.6
2-FCV-67-105	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 329	66	O = 322 C = 322

WBN Unit 2 GL 89-10
Required Voltage Vs Time

VALVEID	T(sec) from SI: 0, 5, or SS	MOV Position Change	Comments	OLD Min. Voltage Required to Achieve Position	Stroke Time (Secs)	NEW Min. Voltage Required to Achieve Position
2-FCV-67-107	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 342	66	O = 424.1 C = 404.1
2-FCV-67-111	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 342	66	O = 424.3 C = 404.4
2-FCV-67-112	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 364	66	O = 434.8 C = 410.1
2-FCV-67-113	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 393.2 C= 386.1	66	O = 322 C = 322
2-FCV-67-123	SS	C to O	Steady State Voltage	O= 415 C= 415	70	O = 436.3 C = 436.3
2-FCV-67-124	SS	C to O	Steady State Voltage	O= 415 C= 415	70	O = 433 C = 433
2-FCV-67-125	SS	C to O	Steady State Voltage	O= 415 C= 415	70	O = 441.8 C = 441.8
2-FCV-67-126	SS	C to O	Steady State Voltage	O= 415 C= 415	70	O = 439.4 C = 439.4
2-FCV-67-130	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-131	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-133	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-134	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-138	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-139	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-141	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-142	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-143	SS	either	Steady State Voltage	O= 415 C= 415	180	O= 418.8 C= 418.8
2-FCV-67-295	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-296	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-297	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-298	0	O to C	Need best voltage at T = 0 Secs from SI		66	O = 322 C = 322
2-FCV-67-146	SS	either	Steady State Voltage	O= 415 C= 415	60	O= 435.9 C= 435.9
2-FCV-68-332	SS	either	Steady State Voltage	O= 407 C= 407	20	O= 408.6 C= 408.6
2-FCV-68-333	SS	either	Steady State Voltage	O= 415 C= 415	20	O= 418.7 C= 418.7

WBN Unit 2 GL 89-10
Required Voltage Vs Time

VALVEID	T(sec) from SI: 0, 5, or SS	MOV Position Change	Comments	OLD Min. Voltage Required to Achieve Position	Stroke Time (Secs)	NEW Min. Voltage Required to Achieve Position
2-FCV-70-087	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (24.04 sec stroke time)	O= 403.6 C= 396.2	66	O= 441.6 C= 420.8
2-FCV-70-089	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 400 C= 348	66	O= 406 C= 386.9
2-FCV-70-090	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (24.04 sec stroke time)	O= 415 C= 365	66	O= 436.1 C= 411.3
2-FCV-70-092	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 376	66	O= 449.2 C= 423.7
2-FCV-70-100	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 392.5 C= 385.4	66	O= 442.7 C= 417.5
2-FCV-70-133	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (16.8 sec stroke time)	O= 395.5 C= 415	66	O= 424.6 C= 400.4
2-FCV-70-134	5	O to C	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=5 sec from SI (16.8 sec stroke time)	O= 415 C= 415	66	O= 419.8 C= 400.1
2-FCV-70-140	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Open Butterfly Valve, 62.65 sec stroke time)	O= 415 C= 327	66	O= 422.6 C= 402.7
2-FCV-70-143	5	O to C	Need 70% Voltage at t=0 & best avail at t=5 sec (Normally Closed Butterfly Valve, will close if opened, 62.65 sec stroke time. No opening accident requirement)	O= 415 C= 363	66	O= 432.7 C= 408.1
1-FCV-70-153	SS	C to O	Steady State Voltage		90	O= 416.76 C= 416.76
2-FCV-70-153	SS	C to O	Steady State Voltage		90	O= 434.2 C= 434.2
2-FCV-70-156	SS	C to O	Steady State Voltage	O= 415 C= 415	90	O= 443.3 C= 443.3
2-FCV-70-183	SS	O to C	Steady State Voltage	O= 415 C= 415	30	O= 425 C= 425
2-FCV-70-215	SS	O to C	Steady State Voltage	O= 415 C= 415	30	O= 425.7 C= 425.7
2-FCV-72-2	5	C to O	Need Best avail Voltage at t=0 sec from SI	O= 415 C= 415	28	O= 398.1 C= 398.1
2-FCV-72-13	10	C to O	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=10 sec from SI (10 sec time delay)	O= 410 C= 415	10	O= 396 C= 396
2-FCV-72-21	SS	O to C	Steady State Voltage	O= 415 C= 415	15	O= 423.7 C= 423.7
2-FCV-72-22	SS	O to C	Steady State Voltage	O= 402 C= 402	15	O= 406 C= 406
2-FCV-72-34	10	C to O	Need 70% Voltage at t=0 sec, Need Best Avail Voltage at t=10 sec from SI (10 sec time delay)	O= 404 C= 404	10	O= 390.8 C= 390.8
2-FCV-72-39	5	C to O	Need Best avail Voltage at t=0 sec from SI	O= 415 C= 415	28	O= 399 C= 399
2-FCV-72-40	SS	C to O	Steady State Voltage	O= 415 C= 415.	15	O= 427.6 C= 427.6
2-FCV-72-41	SS	C to O	Steady State Voltage	O= 415 C= 415.	15	O= 427.6 C= 427.6
2-FCV-72-44	SS	C to O	Steady State Voltage	O= 400 C= 400.	20	O= 405.4 C= 405.4
2-FCV-72-45	SS	C to O	Steady State Voltage	O= 400 C= 400.	20	O= 412.8 C= 412.8

WBN Unit 2 GL 89-10
Required Voltage Vs Time

VALVEID	T(sec) from SI: 0, 5, or SS	MOV Position Change	Comments	OLD Min. Voltage Required to Achieve Position	Stroke Time (Secs)	NEW Min. Voltage Required to Achieve Position
2-FCV-74-01	SS	O to C	Steady State Voltage	O= 415 C= 415.	120	O= 414 C= 414
2-FCV-74-02	SS	C to O	Steady State Voltage	O= 415 C= 415.	120	O= 414 C= 414
2-FCV-74-03	SS	O to C	Steady State Voltage	O= 358 C= 358	60	O= 356.7 C= 356.7
2-FCV-74-08	SS	O to C	Steady State Voltage	O= 415 C= 415.	120	O= 425.8 C= 425.8
2-FCV-74-09	SS	O to C	Steady State Voltage	O= 415 C= 415.	120	O= 423.7 C= 423.7
2-FCV-74-12	0	C to O	Need Best avail Voltage at t=0 sec from SI	O= 386.6 C= 415	15	O= 337.3 C= 394.6
2-FCV-74-21	SS	O to C	Steady State Voltage	O= 392 C= 392	60	O= 393.3 C= 393.3
2-FCV-74-24	0	C to O	Need Best avail Voltage at t=0 sec from SI	O= 376.8 C= 415	15	O= 341.1 C= 387.2
2-FCV-74-33	SS	O to C	Steady State Voltage	O= 405 C= 405	15	O= 410 C= 410
2-FCV-74-35	SS	O to C	Steady State Voltage	O= 385 C= 385	15	O= 386.6 C= 386.6

Notes:

1) The maximum required voltage for any GL 89-10 MOV is equal to or above 90% of 460 V (414 V). Guidance given in Design Standard DS-M18.2.21 states that for voltages 90% or greater the voltage factor is 1.0 (i.e. no degradation is required at 90% or above). Therefore, there will be no impact to any Mechanical MOV calculations as long as 90% of 460 V (414 V) is achieved.

2) Required voltage for MOVs at T = 0, T = 4, T = 5 or T = 10 sec is the minimum available voltage from the time specified to any time forward during the SI. Example: If a 4 sec voltage was requested and voltage dropped at 5 sec, then the lower 5 sec voltage should be used to bound degraded voltage.

3) For MOVs that are open and go closed upon receiving an SI signal, the required voltage at T = 0 is only 70% of 460 V (322 V) until the valve becomes loaded. MOVATs differential pressure test traces were reviewed and conservative bounding times were determined for when the MOV becomes loaded. A 70% starting voltage is based on guidance provided in Limitorque Technical Update 98-01 in Vendor Manual WBN-VTD-L200-0460.

The voltages listed in this Attachment must be met or exceeded.

Prepared By: [signature] FAROOQ SOFI Date: 5/11/11 Reviewed By: [signature] M. R. Johnson Date: 5/11/11

2A BOARDS

ETAP Node ID	MOV	Available Voltage (New Analysis) Value from SS	Time from SI Signal (SS = steady state)	New Design Margin (using new Voltages) (open)	New Design Margin (using new Voltages) (closed)	Comments **	
~~239-10B~~	~~SIS PMPS RECIRC TO RWST 2-FCV-63-3-A (0.7HP)~~	~~86.31~~	~~SS~~	~~975~~	~~47.8~~	~~Acceptable Margin~~	
~~239-11A~~	~~SIS Pmp Inlet To CVCS Chrg Pmp 2-FCV-63-7-A (1.9HP)~~	~~80.28~~	~~SS~~	~~20~~	~~87~~	~~Acceptable Margin~~	
~~239-14E~~	~~RHR Hx 2A Bypass Vlv 2-FCV-74-33-A (1.9HP)~~	~~82.97~~	~~SS~~	~~30~~	~~40~~	~~Acceptable Margin~~	
~~239-11B~~	~~RHR Hx A To CVCS Chrgr Pmp 2-FCV-63-8-A (1.9HP)~~	~~87.15~~	~~SS~~	~~13~~	~~135~~	~~Acceptable Margin~~	
~~239-9F~~	~~RWST To Spray Hdr 2A FCV 2-FCV-72-22-A (3.2HP)~~	~~87.21~~	~~SS~~	~~288~~	~~272~~	~~Acceptable Margin~~	
~~239-12A~~	~~SIS Pmp 2A-A Inlet Vlv 2-FCV-63-47-A (1.9HP)~~	~~78.09~~	~~SS~~	~~108~~	~~26~~	~~Acceptable Margin~~	R2
~~239-12D~~	~~SIS To RCS Loops 2&3 FCV 2-FCV-63-93-A (1.6HP)~~	~~91.22~~	~~SS~~	~~180~~	~~153~~	~~Acceptable Margin~~	
~~239-12E~~	~~SIS Pmp 2A-A Outlet FCV 2-FCV-63-152-A (1.9HP)~~	~~89.49*~~	~~SS~~	~~20~~	~~29~~	~~Acceptable Margin~~	
~~239-13A~~	~~SIS Pmp Out RCS Lp 1&3 Hot Leg 2-FCV-63-156-A (1.9HP)~~	~~83.86~~	~~SS~~	~~15~~	~~28~~	~~Acceptable Margin~~	
239-6D	RCS Press Relief FCV 2-FCV-68-333-A (1.9HP)	85.43	SS	22	19	Acceptable Margin	
~~239-13B~~	~~Cntmt Sump To Spray Hdr 2A FCV 2-FCV-72-44-A (3.2HP)~~	~~82~~	~~SS~~	~~17~~	~~43~~	~~Acceptable Margin~~	
~~239-14A~~	~~RHR Spray Hdr 2A Isln Vlv 2-FCV-72-40-A (1.9HP)~~	~~86.5~~	~~SS~~	~~103~~	~~156~~	~~Acceptable Margin~~	
239-13E	Cntmt Spray Hdr 2A Isln Vlv 2-FCV-72-39-A (3.2HP)	79.41	5 sec	18.5	162.5	Acceptable Margin	
240-15A	CCS HX B ERCW BYPASS FCV 2-FCV-67-143-A (0.13HP)	78.67	SS	222	270	Acceptable Margin	
240-16E	RHR Hx A-A Outlet Vlv 2-FCV-70-156-A (0.33HP)	89.51	SS	14	14	Butterfly Valve & Acceptable Margin	
240-17A	Sample Hx Hdr Outlet Vlv 2-FCV-70-183-A (0.13HP)	86.06	SS	134	147	Acceptable Margin	
~~240-2A~~	~~ERCW Hdr A Isln Vlv 2-FCV-3-116A-A (0.25HP)~~	~~83.72~~	~~SS~~	~~99~~	~~115~~	~~Acceptable Margin~~	
~~240-2B~~	~~ERCW Hdr A Isln Vlv 2-FCV-3-116B-A (0.25HP)~~	~~83.68~~	~~SS~~	~~86~~	~~115~~	~~Acceptable Margin~~	
~~240-2D~~	~~AFWP Turb Stm Sup Fm Stm Gen 1 2-FCV-1-15-A (1HP)~~	~~91.15*~~	~~SS~~	~~25~~	~~45~~	~~Acceptable Margin~~	R2
~~240-2E~~	~~St Flow To AFWP Turb Iso Vlv 2-FCV-1-17-A (1HP)~~	~~91.15*~~	~~SS~~	~~85~~	~~20~~	~~Acceptable Margin~~	
~~240-3A~~	~~ERCW Hdr A Isln Vlv 2-FCV-3-136A-A (0.33HP)~~	~~83.49~~	~~SS~~	~~22~~	~~42~~	~~Acceptable Margin~~	
~~240-3B~~	~~ERCW Hdr A Isln Vlv 2-FCV-3-136B-A (0.33HP)~~	~~83.5~~	~~SS~~	~~22~~	~~42~~	~~Acceptable Margin~~	
240-5A	Sample Hx Isln Vlv 2-FCV-70-215-A (0.13HP)	86.16	SS	227	231	Acceptable Margin	
240-5E	Cntmt Spray Hx 2A Sup Cont Vlv 2-FCV-67-125-A (0.33HP)	89.4	SS	14	14	Butterfly Valve & Acceptable Margin	
240-5F	Cntmt Spray Hx 2A Disch Vlv 2-FCV-67-126-A (0.33HP)	88.91	SS	14	14	Butterfly Valve & Acceptable Margin	
~~240-6A~~	~~AFWP Turb Stm Sup Fm Stm Gen 4 2-FCV-1-16-A (1HP)~~	~~91.14*~~	~~SS~~	~~25~~	~~31~~	~~Acceptable Margin~~	R2
240-11A	Cmpnt Clg Hx A Disch Cont Vlv 2-FCV-67-146-A (0.33HP)	88.48	SS	9.4	9.4	Acceptable Margin	

~~* Calculated voltage considering Hammer Blow feature (using 50% LRC during unseating)~~ R2

**Calculated voltages based on the new analysis have been reviewed and are considered acceptable based on the available margin.

This page revised and replaced by R2

2B BOARDS

ETAP Node ID	MOV	Available Voltage (New Analysis) Value from SS	Time from SI Signal (SS = steady state)	New Design Margin (using new Voltages) (open)	New Design Margin (using new Voltages) (closed)	Comments **	
~~209-7E~~	~~RWST To Spray Hdr 2B FCV 2-FCV-72-21-B (3.3 hp)~~	~~89.23~~	~~SS~~	~~311~~	~~295~~	~~Acceptable Margin~~	
241-5E	RCS Press Relief FCV 2-FCV-68-332-B (2 hp)	83.26	SS	29	17	Acceptable Margin	
~~241-9B~~	~~RHR To RCS H.L. 1&3 Flow Iso V 2-FCV-63-172-B (2.6 hp)~~	~~80.11~~	~~SS~~	~~45~~	~~69~~	~~Acceptable Margin~~	
~~241-10A~~	~~SIS 2B-B Dsh To RWST Shtff Vlv 2-FCV-63-4-B (0.66 hp)~~	~~84.47~~	~~SS~~	~~900~~	~~50~~	~~Acceptable Margin~~	
~~241-10B~~	~~RWST To SIS Pump FCV 2-FCV-63-5-B (2 hp)~~	~~81.8~~	~~SS~~	~~45~~	~~23~~	~~Acceptable Margin~~	
~~241-10F~~	~~RWST To Spray Hdr 2B FCV 2-FCV-72-21-B (3.2 hp)~~	~~85.62~~	~~SS~~	~~260~~	~~250~~	~~Acceptable Margin~~	
~~241-11A~~	~~SIS Pmp Inlet To CVCS Chrg Pmp 2-FCV-63-6-B (2 hp)~~	~~80.24~~	~~SS~~	~~16~~	~~86~~	~~Acceptable Margin~~	R2
~~241-11B~~	~~RHR Hx B to SIS Pmp 2-FCV-63-11-B (2 hp)~~	~~86.86~~	~~SS~~	~~13~~	~~134~~	~~Acceptable Margin~~	
~~241-12B~~	~~SIS Pmp 2B-B Inlet Vlv 2-FCV-63-48-B (2 hp)~~	~~82.55~~	~~SS~~	~~130~~	~~40~~	~~Acceptable Margin~~	
~~241-12D~~	~~Cntmt Sump To RHR Pmp B-B 2-FCV-63-73-B (13.2 hp)~~	~~90.37~~	~~SS~~	~~36~~	~~2000~~	~~Acceptable Margin~~	
~~241-12E~~	~~SIS To RCS Loops 1 & 4 FCV 2-FCV-63-94-B (1.6 hp)~~	~~91.33~~	~~SS~~	~~187~~	~~157~~	~~Acceptable Margin~~	
~~241-13A~~	~~SIS Pmp 2B-B Outlet FCV 2-FCV-63-153-B (2 hp)~~	~~89.61*~~	~~SS~~	~~20~~	~~29~~	~~Acceptable Margin~~	
~~241-13B~~	~~SIS pmp Out RCS Lp 2&4 Hot Leg 2-FCV-63-157-B (2 hp)~~	~~86.64~~	~~SS~~	~~13~~	~~26~~	~~Acceptable Margin~~	
~~241-13D~~	~~SIS 2B-B Dsh to RWST Shtff Vlv 2-FCV-63-175-B (0.66 hp)~~	~~84.87~~	~~SS~~	~~900~~	~~48~~	~~Acceptable Margin~~	
241-14A	Cntmt Spray Hdr 2B Isln Vlv 2-FCV-72-2-B (3.2 hp)	85.35	SS	28	185	Acceptable Margin	
~~241-14D~~	~~RHR SPRAY HDR 2B ISOL VLV 2-FCV-72-41-B (2 hp)~~	~~90.92*~~	~~SS~~	~~90~~	~~140~~	~~Acceptable Margin~~	
~~241-14E~~	~~Cntm Sump To Spray Hdr 2B FCV 2-FCV-72-45-B (3.3 hp)~~	~~89.25*~~	~~SS~~	~~37~~	~~65~~	~~Acceptable Margin~~	R2
~~241-15D~~	~~RHR Hx 2B Bypass Vlv 2-FCV-74-35-B (2 hp)~~	~~78.21~~	~~SS~~	~~20~~	~~29~~	~~Acceptable Margin~~	
~~241-11E~~	~~SIS Boron Inj Tank Shutoff Vlv 2-FCV-63-25-B (1.9 hp)~~	~~82.51~~	~~5 sec~~	~~30.2~~	~~24.7~~	~~Acceptable Margin~~	
241-15B	RHR Pmp 2B-B Min Flow Vlv 2-FCV-74-24-B (0.1 hp)	71.67	0 sec	290.2	48.5	Acceptable Margin	
~~242-2B~~	~~ERCW Hdr B Isln Vlv 2-FCV-3-126B-B (0.67 hp)~~	~~83.06~~	~~SS~~	~~86~~	~~115~~	~~Acceptable Margin~~	
~~242-2E~~	~~St Flow To AFWP Turb Isln Vlv 2-FCV-1-18-B (1 hp)~~	~~90.84*~~	~~SS~~	~~85~~	~~20~~	~~Acceptable Margin~~	R2
~~242-3A~~	~~ERCW Hdr B Isln Vlv 2-FCV-3-179A-B (0.33 hp)~~	~~83.66~~	~~SS~~	~~19~~	~~39~~	~~Acceptable Margin~~	
~~242-3B~~	~~ERCW Hdr B Isln Vlv 2-FCV-3-179B-B (0.33 hp)~~	~~83.67~~	~~SS~~	~~19~~	~~39~~	~~Acceptable Margin~~	
242-5E	Cntmt Spray Hx 2B Sup Cont Vlv 2-FCV-67-123-B (0.33 hp)	89.15	SS	14	14	Butterfly Valve & Acceptable Margin	
242-5F	Cntmt Spray Hx 2B Sup Disch Vlv 2-FCV-67-124-B (0.33 hp)	88.5	SS	14	14	Butterfly Valve & Acceptable Margin	
242-17A	SFPCS Hx Sply Hdr Isln Vlv 0-FCV-70-194-B (0.33HP)	92.18*	SS	28.10%	28.10%	Acceptable Margin	
242-15E	RHR Hx B-B Outlet Vlv 2-FCV-70-153-B (0.33HP)	85	SS			Acceptable Margin	R2

* Calculated voltage considering Hammer Blow feature (using 50% LRC during unseating)

**Calculated voltages based on the new analysis have been reviewed and are considered acceptable based on the available margin.

This page revised and replaced by R2

MOV UNIDs	Minimum Voltage Required in Mechanical Calculations
2-FCV-01-015 (T = SS)	414
2-FCV-01-016 (T = SS)	414
2-FCV-01-017 (T = SS)	414
2-FCV-01-018 (T = SS)	414
2-FCV-03-116A (T = SS)	376
2-FCV-03-116B (T = SS)	376
2-FCV-03-126A (T = SS)	373
2-FCV-03-126B (T = SS)	373
2-FCV-03-136A (T = SS)	375
2-FCV-03-136B (T = SS)	374
2-FCV-03-179A (T = SS)	376
2-FCV-03-179B (T = SS)	376

PREPARER:
N.R. Bezwada
N.R. Bezwada
04-10-14

CHECKER:
Greg Lee
4/10/14

MOV UNIDs	Minimum Voltage Required in Mechanical Calculations
2-FCV-62-061	366
2-FCV-62-063	345
2-FCV-62-090 (T = 0 secs)	322
2-FCV-62-090 (T = 5 secs)	414
2-FCV-62-091 (T = 0 secs)	322
2-FCV-62-091 (T = 5 secs)	414
2-FCV-62-138	391
2-LCV-62-132	354
2-LCV-62-133	360
2-LCV-62-135	372
2-LCV-62-136	355

PREPARER:
Mark R. Johnson
12/10/13

CHECKER:
Greg Lee
12/10/13

MOV UNIDs	Minimum Voltage Required in Mechanical Calculations
2-FCV-63-1	413
2-FCV-63-3	386
2-FCV-63-4	379
2-FCV-63-5	367
2-FCV-63-6	360
2-FCV-63-7	361
2-FCV-63-8	392
2-FCV-63-11	390
2-FCV-63-22	383
2-FCV-63-47	351
2-FCV-63-48	371
2-FCV-63-67	401
2-FCV-63-72	413
2-FCV-63-73	407
2-FCV-63-80	406
2-FCV-63-93	411
2-FCV-63-94	411
2-FCV-63-98	394
2-FCV-63-118	401
2-FCV-63-152	389
2-FCV-63-153	390
2-FCV-63-156	377
2-FCV-63-157	371
2-FCV-63-172	359
2-FCV-63-175	381
2-FCV-63-25	414 (Test Condition)
2-FCV-63-26	414 (Test Condition)
2-FCV-63-25	372 (Accident Condition)
2-FCV-63-26	365 (Accident Condition)

PREPARER:
Mark R. Johnson
MRJohnson 11/19/13

CHECKER:
Greg J. Lee
GJLee 11/19/13

MOV UNIDs	Minimum Voltage Required in Mechanical Calculations
2-FCV-72-021 (T = 5 secs)	385
2-FCV-72-022 (T = 5 secs)	392
2-FCV-72-040 (T = 5 secs)	389
2-FCV-72-041 (T = 5 secs)	401
2-FCV-72-044 (T = 5 secs)	368
2-FCV-72-045 (T = 5 secs)	384
2-FCV-74-033 (T = 5 secs)	373
2-FCV-74-035 (T = 5 secs)	351

PREPARER:
Mark R. Johnson
2/20/14

CHECKER:
Greg Lee
2/20/14

WBN-VTD-R165-0140

DRAWING TRANSMITTAL

Date: 3/23/77

NUCLEAR

JECT NO.	WESTINGHOUSE S.O. NO.	VENDOR REQUISITION NO.	CUSTOMER ORDER
	SY 41779		[illegible]

TO: GOULDS PUMPS INC
NUCLEAR DIVISION; ROUTE
SENECA FALLS, N.Y. 13148

SAME

THIS ARE:

- FOR APPROVAL — Drawings are in compliance with your specified requirements. Drawings "Approved" or "Approved with Modifications" authorize Westinghouse to proceed with manufacture. Modifications not in the contract or modifications made during or after drawing approval may result in a price change and/or shipment delay. To maintain shipping schedule, approved drawings must be received by Westinghouse no later than ______
- [X] FOR CONSTRUCTION OR INSTALLATION — The equipment shown on these drawing(s) has been released for manufacture, any modification may result in a price change and shipment delay.
- [ ] FOR REFERENCE
- [ ]

ITEM: 1 SO# 77012671

MARK: N229729

WBN REV 0
WBN PAGE 4

DESCRIPTION:

HP:	100	FLA:	115	AMBIENT:	40 C
RPM:	1770	ENCL:	DP	MOUNTING:	HORIZ.
FRAME:	404TS	TYPE:	LLT	SHAFT EXT:	FRONT-NONE REAR -STRAIGHT
MODEL:	TBDP	NEMA DESIGN:	B	DUTY:	CONTINUOUS
VOLTAGE:	460	INSUL:	B	SPACE HEATERS:	NONE
PHASE:	3	SERV. FACTOR:	1.15	THERMAL PROT:	T.S.
HERTZ:	60	ASSY:	F1		

ADDITIONAL FEATURES:

BEST AVAILABLE COPY

OUTLINE DWG: 5840700 Sub 9 + I.L. 2930-1ITD — EXCEPT- SCREENS & S.S. COND. BOX

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WBN-VTD-R165-0140

Westinghouse Electric Corporation

BUFFALO, N.Y.

Date 11/5/74

Purchaser GOULDS PUMPS D04883 Stock Order No. 73C74082

G.O. No. SY-44883 H.P. 100 Volts 230/460 Phase 3 Class B Insulation

Apparatus FR.404TS,TBDP,SQ.CAGE IND. MTR. Poles 4 R.P.M. 1770 Cycles 60

	1	2	3	COMMENTS
Amperes Per Terminal at no load 460 Volts	27.13			
Watts Input at no load	1694			
Stator Res. (T-T) at 75° C - ohms	.1323			
Starting Winding Res. at 75° C - ohms				
Rotor Res. (bet rings) at 75° C - ohms				
LOSSES IN WATTS AT FULL LOAD				
Stray Load Loss	1012			
Stator I^2R Loss	2795			
Rotor I^2R Loss	1180			
Core Loss	1080			
Friction and Windage Loss	440			
% Efficiency - Full Load	92			
- ¾ Load	93.1			
- ½ Load	93.2			
% Power Factor Full Load	89.4			
- ¾ Load	88.7			
- ½ Load	83.9			
RPM at Full Load	1772			
Amperes Per Term. at full load	113.82			
KW input at full load	81.11			
Amperes per Term-Rotor locked 460 V	646.7			
KW input - Rotor locked	215			
Max. Sec. Volts between rings	–			
Sec. Amps per ring at full load	–			
Full Load Torque (F.L.T.) in lb. ft.	296.2			
Max. Torque in % of F.L.T.	215.7			
Starting Torque in % of F.L.T.	168.6			
End Play Tested	OK			
Balance Tested	OK			
Stator Ins Tested 2100 V 60 Sec.	OK			
Rotor Ins Tested V Sec.	–			
TEMPERATURE TESTS				
Length of Test in hours	7.5			
Volts	460			
% Normal Full Load Amp.	100			
Temp. Rise in degrees C — Stator Copper by Res.	78			
Temp. Rise in degrees C — Stator Iron	48			
Temp. Rise in degrees C — Rotor Copper				
Temp. Rise in degrees C — Rotor Iron				
Room temperature in °C	26			
Curve Nos.				

The above is a true and correct record of data obtained from tests made at the works of Westinghouse Electric Corporation. 3

REPORT OF TESTS ON INDUCTION MOTORS
FORM 2958 K

Signed P. M. Sendlbeck Engineer
P. M. Sendlbeck

L.N01779
N229729

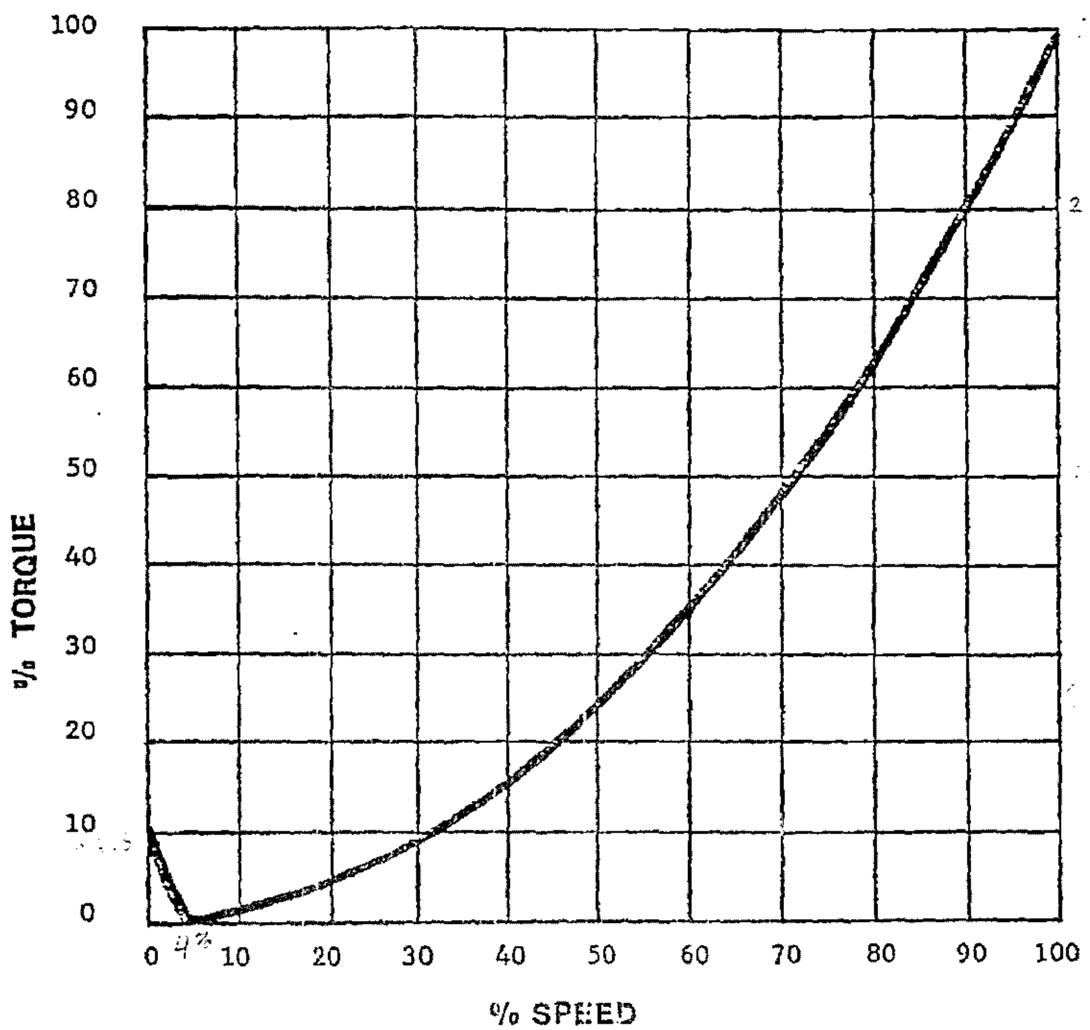
SPEED - TORQUE CURVE

AT RUNOUT of
2750 GPM @ 122 FEET

100% TORQUE = 288.8 FT. LBS.

E-2126

100% SPEED = 1750 R. P. M.



PUMP MODEL - 3405

PUMP SIZE - 8X10-12 DV

IMPELLER DWG. # - 80-45

IMPELLER PATT. # - 52895

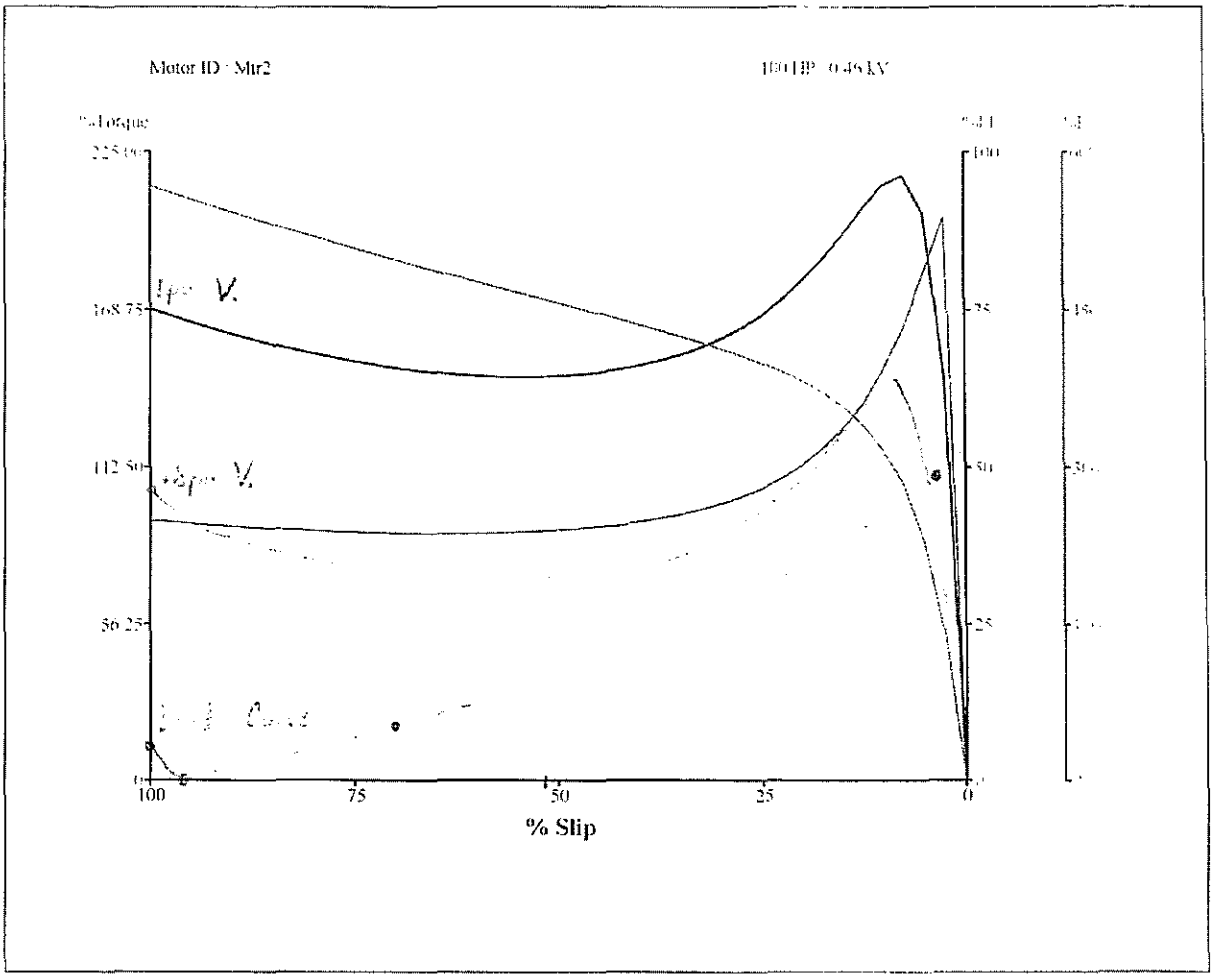
IMPELLER DIAMETER - 12"

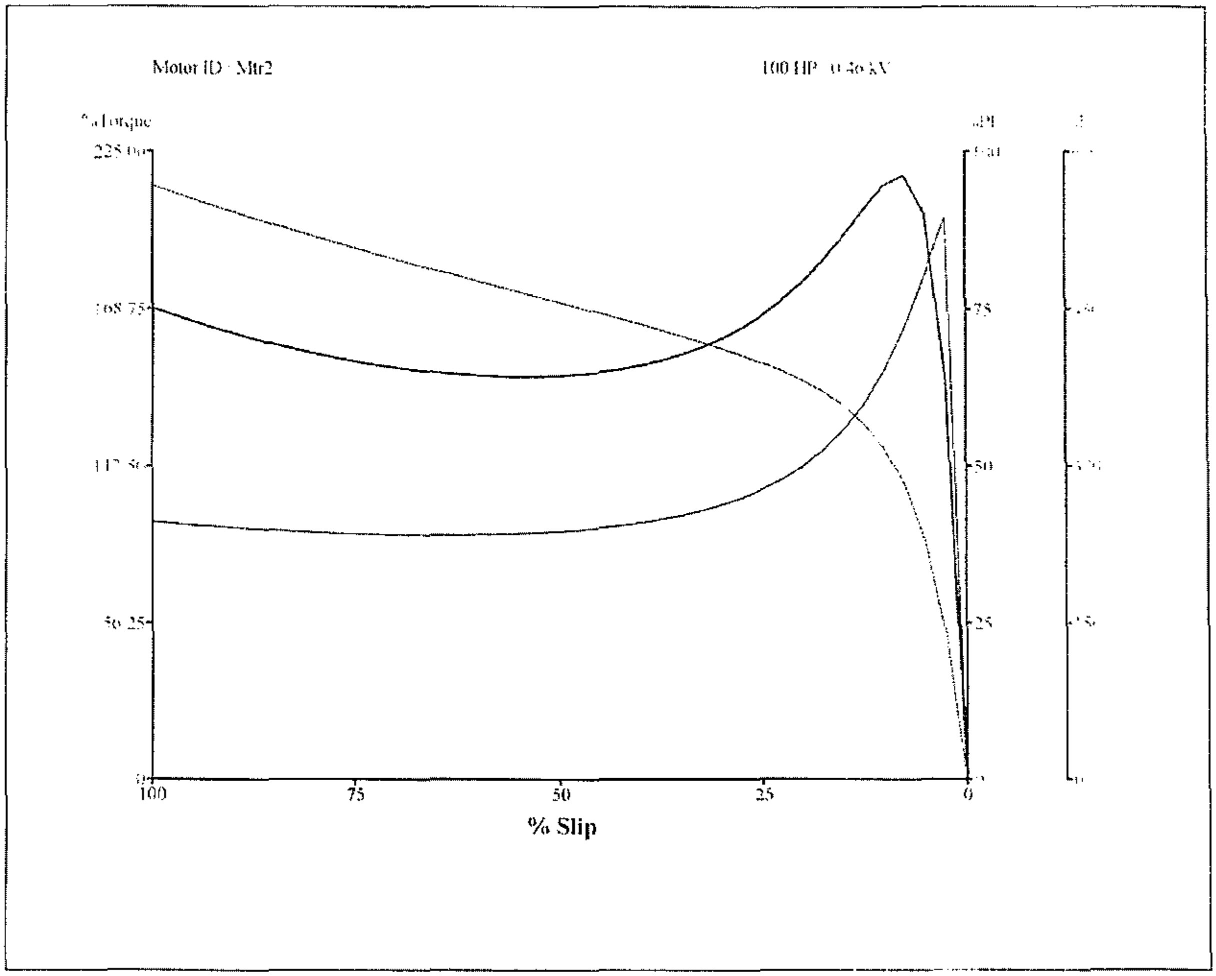
$$100\% \text{ TORQUE} = \frac{\text{H. P.} \times 5250}{\text{R. P. M.}}$$

Notes: A. H. P. is the shut-off H. P. at 100% speed with the rated impeller diameter.
B. Sleeve Bearing starting point is 15% not 10%.

PUMP WR^2 = 8.15 LB.-FT^2

WBN REV 0
WBN PAGE 8


Motor ID : Mtr2
100 HP 0.46 kV
225.00
168.75
112.50
56.25
100
75
50
25
0
% Slip


Motor ID : Mtr2
100 HP
% Torque
225.00
168.75
112.50
56.25
0
100
75
50
25
0
75
50
25
% Slip

(1) CONTAINMENT AIR RETURN FAN 1A-A
1-MTR-030-0038-A

RELIANCE ELECTRIC COMPANY

24701 Euclid Avenue, Cleveland, Ohio 44117

REPORT OF ROUTINE TESTS

Induction Motor

Purchaser Joy Manufacturing Co.
338 South Broadway
New Philadelphia, Ohio 44663

Date of Test ....

Manufacturer's Order No. 1XF-882396

Purchaser's Order No. NA2836

The air gap, condition of bearings and rotor balance were examined and found to be satisfactory.

Engineer P. Licurs, Jr.

WBN REV 2
WBN PAGE 16

NAMEPLATE DATA

Hp	Service Factor	Rpm	Phase	Hertz	Volts	Amperes
100	1.0	1786	3	60	460	115

Type	Frame	Temp Rise by Method Indicated	Ambient Temp and Insulation Class	Time Rating	Design Letter	Code Letter for Locked Kva/Hp
P	444TCZ	-	50°C/H *	Cont.	-	J

TEST CHARACTERISTICS

Serial Number	No Load					Locked Rotor (Single Phase) (Three Phase)					Wound Rotor Open Circuit Volt.	@ High-potential Test Voltage	Date of Test
	Volts	Hertz	Rpm	Amperes		Volts	Hertz	Amperes					
A-1	460	60	1799	40.5		460	60	869			-	2000	7-6-77
A-2	460	60	1799	41.5		230	60	414			-	2000	7-7-77
A-3	460	60	1799	41.1		230	60	412			-	2000	7-7-77
A-4	460	60	1799	41.4		230	60	411			-	2000	7-7-77

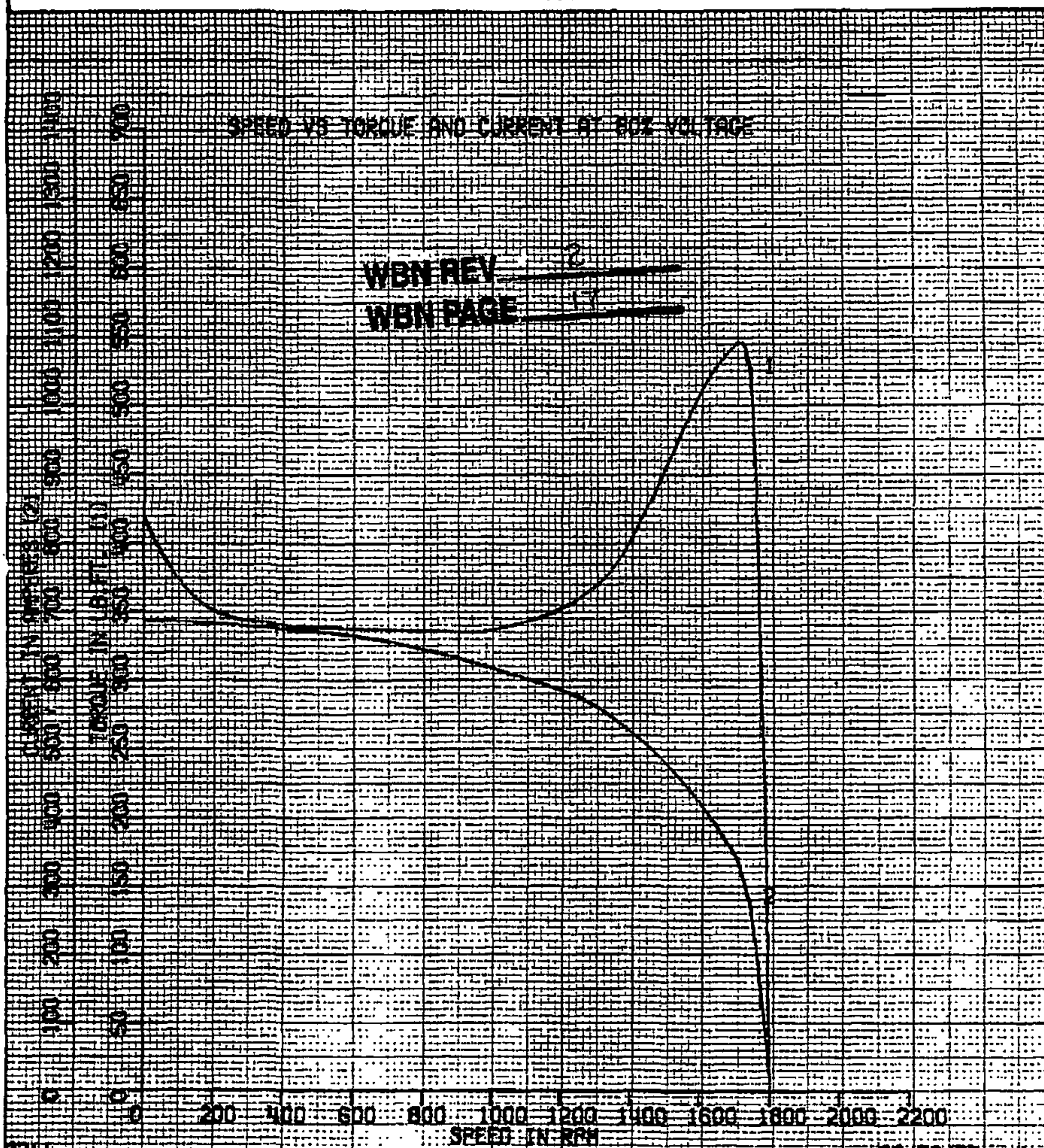
Notes: * Type RN insulation. @ For 60 seconds.

Data on test from these (this or duplicate) motors.

Approved by P. Licurs, Jr. (Engineer) Data D.J.G.

Issued: 8-12-77

REL. S.O.	1XF-882396	RPM	1786	S.F.	1.0	ROTOR	604882-1RJ
FRAME	444TCZ	VOLTS	460	NEMA DESIGN	-	TEST S.O.	1XF-882396
HP	100	AMPS	115	CODE LETTER	J	TEST DATE	7-6-77
TYPE	P	DUTY	Cont.	ENCLOSURE	TEAO	STATOR RES. @ 25°C	.06439
PHASE/HERTZ	3/60	AMB°C/INSUL	50/H *	E/S	597617		OHMS (BETWEEN LINES)



WBN REV 2
WBN PAGE 17

3711 08/20/77

AMPERES SHOWN FOR 460 Volt CONNECTION. IF OTHER VOLTAGE CONNECTIONS ARE AVAILABLE, THE AMPERES WILL VARY INVERSELY WITH THE RATED VOLTAGE. * Type RN insulation.

RELIANCE ELECTRIC COMPANY CLEVELAND, OHIO 44117 U.S.A.	DR. BY ED CK. BY [illegible] APP. BY [illegible] DATE 8-22-77	A-C MOTOR PERFORMANCE CURVES	V29593.000 ISSUE DATE 8-22-77

RE 1572VB2 Printed in U.S.A.

· 6YF882998
CONTRACT #81K5-829093,CHG. #1
FOR: WATTS BAR NUCLEAR PLANT
HVAC EQUIPMENT
TRAVELING WATER SCREENS

(6) ERCW TRAV. SCREEN 1B-B
1-MTR-067-0445-B

SPECIAL DATA SHEET

a. Manufacturer RELIANCE ELECTRIC COMPANY

b. Application TRAVELING WATER SCREENS

c. Rated horsepower 5

d. Service factor 1.15

e. Rated voltage 460

f. Full load current per phase at the applicable rated voltage

6.8 AMPERES

g. Locked rotor current at the applicable rated voltage

41.1 AMPERES

h. Locked rotor power factor at rated voltage 61.2%

* i. Full load current per phase at 80% of motor rated voltage

8.8 AMPERES

J. Locked rotor current at 80% of motor rated voltage

30.6 AMPERES

k. Locked rotor withstand time at rated voltage starting from ambient temperature

(3-ph motors only) 20 SECONDS

l. Locked rotor withstand time at rated voltage starting from rated temperature

(3-ph motors only) 8 SECONDS

m. Efficiency at 100%, 75% and 50% of rated horsepower

82.3%, 82.9%, 82.5%

n. Power factor at 100%, 75% and 50% rated horsepower

83.9%, 79.8%, 70.6%

* MOTOR NOT SUITABLE FOR CONTINUOUS OPERATION AT 80% VOLTAGE.

WATTS BAR
81-829093
6YF882998
N/F 1 of 2

ELLIS AND WATTS
CINCINNATI, OHIO 45244

DOCUMENT NO. N0055-4 **REVISION** 0 4/28/86

ISSUE NO. ______

TITLE: NUCLEAR ENVIRONMENTAL QUALIFICATION REPORT FOR 50 HP - 1800 RPM MOTOR

PART NO. ______

PART NAME ______

PREPARED BY:	K.Z. Vanky	4/28/86
ENGINEERING APPROVAL:	M.J. Fox	4/28/86
Q.A. APPROVAL:	R. R. Schertler	4/28/86
		DATE

Tennessee Valley Authority
Watts Bar Generating Station
Contract No. 85PM8-451609

REPORT OF TEST-INDUCTION MOTOR

DATE OF TEST) 01-15-86
MANUFACTURERS ORDER NO. 6-150206
PURCHASERS ORDER NO. 76013

PURCHASER ELLIS & WATTS

RATING

TYPE	FRAME	RATED H.P.	FULL LOAD R.P.M.	VOLTS	PH	HZ.	FULL LOAD AMPERES	SERVICE FACTOR	TIME RATING
COG6B	326T	50	1770	480	3	60	56.5	1.15	CONT.

CONDITIONS OF TEST				TEMPERATURE RISE-DEG. C				
				STATOR		ROTOR		
HOURS RUN	LINE VOLTS	LINE AMPERES	COOLING AIR DEG. C	CORE BY THERMO-COUPLE METHOD	WINDINGS (CROSS OUT THREE) BY RESISTANCE METHOD BY EMBEDDED DETECTOR BY THERMOCOUPLE METHOD BY THERMOMETER METHOD	CORE BY THERMO-METER METHOD	WINDINGS (CROSS OUT ONE) BY RESISTANCE METHOD BY THERMO-METER METHOD	COLLECTOR RINGS
3.5	483	65.7	21	68	108.8	-----	-------	--------

CHARACTERISTICS

SLIP-PERCENT	AMPERES RUNNING LIGHT	RESISTANCE IN OHMS AT 25°C (BETWEEN LINES)		SECONDARY VOLTS AT STANDSTILL	SECONDARY AMPERES PER RING AT FULL LOAD
		STATOR BETWEEN TERMINALS	ROTOR BETWEEN RINGS		
1.53	17.4	.159	--------	----------------	------------------

TORQUE AND STARTING CURRENT			HIGH-POTENTIAL TESTS VOLTS A-C FOR 1 SEC.	
BREAK-DOWN TORQUE LBS. AT 1 FT. RADIUS	LOCKED ROTOR TORQUE LBS. AT 1 FT. RADIUS WITH-% VOLTS APPLIED	STARTING CURRENT AMPERES (LOCKED ROTOR) WITH-% VOLTS APPLIED	STATOR	ROTOR
341.0 LB-FT	218-99.2%	334.7-99.2%	2400	----------------

EFFICIENCIES AND POWER FACTOR

EFFICIENCY, PERCENT			POWER FACTOR, PERCENT		
FULL LOAD	3/4 LOAD	1/2 LOAD	FULL LOAD	3/4 LOAD	1/2 LOAD
93.1	93.9	94.0	83.4	81.8	75.8

NOTES: DATA FROM TEST ON THIS (THIS OR DUPLICATE) MOTOR. IN ACCORDANCE WITH IEEE 112-1984 FORM A-2.

THIS DATA FOR REFERENCE ONLY UNLESS OTHERWISE SPECIFIED

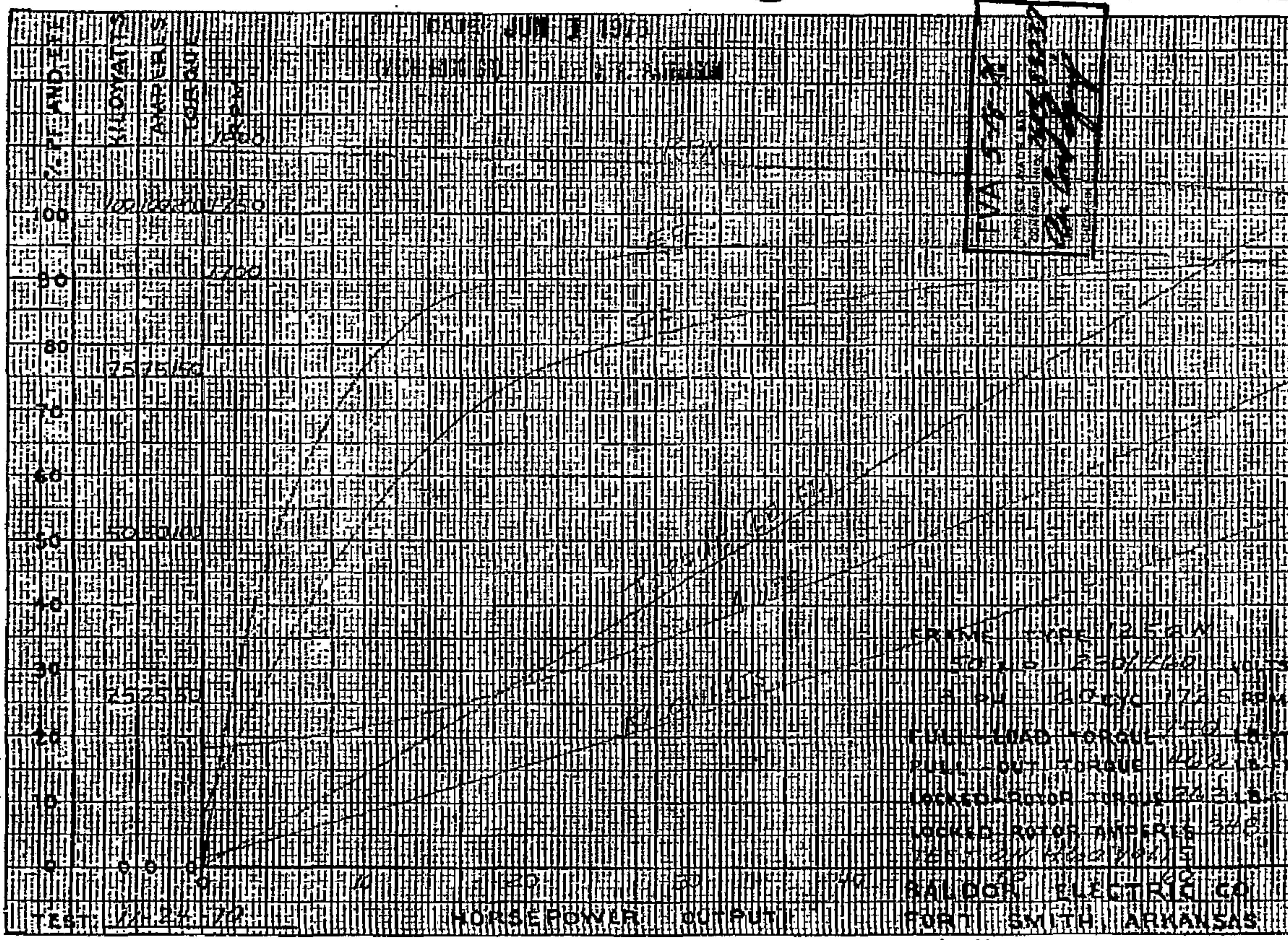
PREPARED BY C L MATTHEWS
APPROVED BY [signature]
DATE 04-02-86

LouisAllis
A Division of Mag-Tek Inc

B32E04-050-731-C0
SHEET 1 OF 1

M 3126 2/84

FOR INFORMATION ONLY (7) WINDING: 312-325



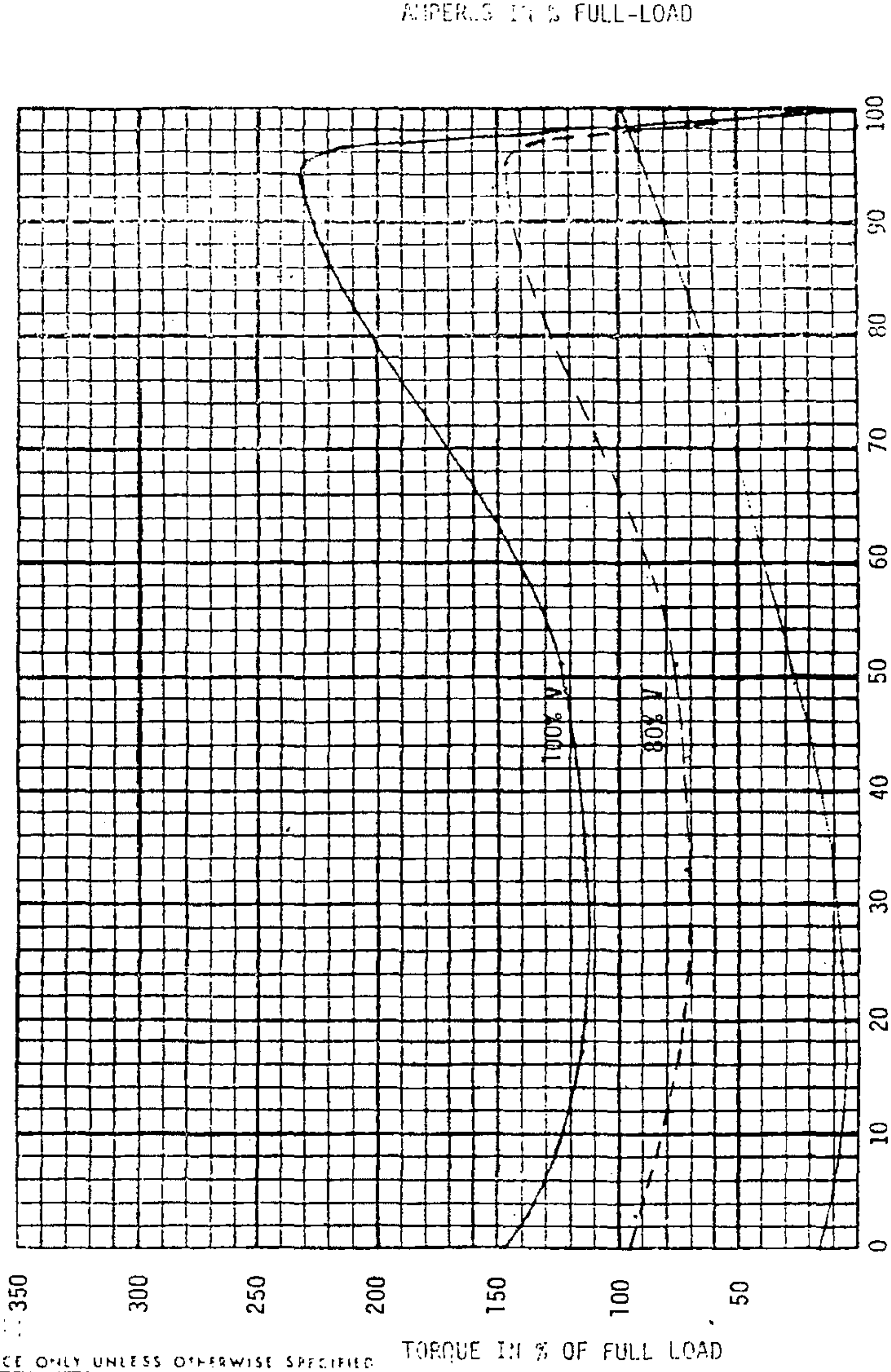
1-11-71 WB

TVA P.O. 76K 36-83237
SCHEDULE II

SPEED-TORQUE & CURRENT CURVE

DATE OF TEST 01-16-86
MANUFACTURERS ORDER NO. 6-150206
PURCHASER ELLIS & WATTS
PURCHASERS ORDER NO. 76013

TYPE COG6B FRAME 326T HP 50 F.L. RPM 1770
VOLTAGE 480 PHASE/HERTZ 3/60 AMBIENT 40 SERVICE FACTOR 1.15
F.L. AMPS 56.5 F.L. TORQUE 148.4 LBS. FT.
INSULATION CLASS H DUTY CONT. ENCLOSURE O.D.P. MOUNTING F-1



THIS DATA FOR REFERENCE ONLY UNLESS OTHERWISE SPECIFIED

PREPARED BY C. L. MATTHEWS
APPROVED BY [signature]
DATE 04-02-86

Louis Allis

B32E04-050-731-S0
SHEET 1 OF

M 3101 2/82

5.2. Second Level Undervoltage (Degraded Voltage) Relay Reset Setpoint

An upper boundary should also be established for the reset setting of the degraded voltage relay. The tightest possible tolerance should be employed between the nominal dropout and reset setpoints. The upper boundary of the reset setting should be equal to the nominal setpoint plus all tolerances from any errors in accordance with Technical Instruction TI-28 (Ref. 2.13). Margin should exist between the upper boundary of the reset setting and the safety bus voltage equivalent to having the minimum allowable switchyard voltage during anticipated worst-case system operating conditions. If operation of the auxiliary power system under normal design transient (starting) conditions, with the safety-related bus voltage equivalent to having the minimum allowable switchyard voltage determines that the bus voltage drops below the dropout setting, then it must recover above the upper boundary of the reset setting prior to the lower boundary of the time delay selected in section 5.4.

The safety bus voltages associated with the upper boundary of the reset setting are evaluated to ensure adequate operation of the auxiliary power system under steady-state (starting) conditions and recovery (running) voltage conditions. The acceptance criteria and means of evaluation is as follows:

5.2.1. Induction motor starting analyses were performed at 6672V which bounds the operational limit of the degraded voltage relay reset setting upper boundary, 6681V (Section 3.9) to ensure that motors and motor-operated valves (MOVs) have adequate starting voltage as specified in section 3.8. Using 6672V provides conservative results for motor starting. R31

5.2.2. All static loads are evaluated to ensure adequate operating voltages as specified in section 3.7

R31

5.3. Second Level Undervoltage (Degraded Voltage) - Long Time Delay

The long time delay specified in NRC Branch Technical Position PSB-1 is not used at WBN.

5.4. Second Level Undervoltage (Degraded Voltage) - Short Time Delay

5.4.1. The upper boundary of the time delay selected should be less than the safety analysis time allowed for the emergency diesel generators to come up to rated speed and voltage and be ready to accept load. The lower boundary of the time delay should be greater than the time it takes the safety bus voltage to recover above the upper boundary of the degraded voltage relay reset setting established in Section 5.2. The nominal setpoint should be selected considering all errors in accordance with Technical Instruction TI-28 (reference 2.13).

5.4.2. The scenario evaluated for the short time delay is an SI concurrent with the degraded voltage condition such that a block start attempt is made. A determination is made of the time permitted to allow voltage to return above the degraded voltage relay setpoint reset limit under block start transient conditions and still assure a subsequent start on the diesel if the voltage fails to recover, thus, making this a start-start evaluation.

5.4.3. To evaluate the effect of the starting currents during the start-start scenario, the effect on overcurrent protective devices are considered. The board voltages at the onset of the event are, considered normal and are taken from Reference 2.2. The degraded voltage condition presumes that the voltage does not recover but remains below the degraded voltage relay setpoint subjecting the SI initiated motors to starting currents for the time delay selected and then sequence onto the emergency diesel generators. The design calculated worst-case transient voltage dip during the accident loading sequence (from reference 2.2) is used. This is conservative, because a lower voltage would produce less starting current for the motors.

5.4.4. Loads evaluated for this condition are safety-related loads required for Unit 1 which would be actuated for an SI. Load types considered are motor loads, vendor package loads, 120VAC motor control circuits, and MCC 120VAC distribution panel loads. The acceptance criteria and means of evaluation is as follows:

5.4.4.1. Motor loads are evaluated to determine the effect of the start-start heating of the overcurrent protective devices, such that starting on the diesel without tripping can be assured.

5.4.4.1.1. 6.9kV Switchgear Breakers - Motors fed from 6.9kV shutdown boards do not require analysis for starting immediately after running at degraded voltage. Overcurrent relays derive their input from current transformers. When power is lost, the relays reset to their normal state.

5.4.4.1.2. 480V Switchgear Breakers - Motors supplied from the 480V Shutdown Boards do not require analysis for starting immediately after running at degraded voltage. Amptector solid state overcurrent protective devices obtain their input from the current transformers. When the power is lost, the protective devices reset to their normal state.

5.4.4.1.3. 480V MCC breakers feeding static loads - These loads are constant impedance loads and will have reduced current requirements at a degraded voltage, and therefore the reduced heating effect would not challenge their applicable protective devices.

5.4.4.1.4. 480V MCC protective devices feeding MOV's - Thermal Overload Relays (TOL's) used in accident initiated MOV circuits have their trip function bypassed during an accident. The magnetic-only circuit breakers are set above the locked-rotor current of the MOV's and would not be affected by the operation of the MOV. Therefore the protective device heating effects during a degraded voltage for MOV's are not evaluated.

5.4.4.1.5. 480V MCC protective devices feeding motor loads - Motor protective devices consist of a TOL in conjunction with a magnetic-only circuit breaker. The magnetic-only circuit breakers are set above the locked-rotor current of the motor and would not be affected and therefore not analyzed.

The TOL's were evaluated as follows: The minimum terminal voltage of the enveloping safety-related MCC motor was determined from Reference 2.2. The minimum starting voltage at motor 203-12B is calculated as follows:

$$\%V_{st} @ 432 = 83.77\% \text{ of } 480V$$

$$\%V_{st} @ 380 = 83.77\% * \frac{380}{432} = 73.69\%$$

$$V_{st} = \frac{73.69\%}{100} * 480 = 353.71V$$

This is based on worst case voltage of 380V at t=0 for 480V C&A Vent Board 1A1-A with a grid voltage drop from 164kV to 153kV, concurrent with an SI accident.

For added margin, for conservatism 320 volts was used in this evaluation. Next, ETAP PowerStation was used to model a typical low voltage MCC motor in order to determine the total starting time during a degraded voltage event. The total starting time consists of an attempted start at a degraded voltage of 320 volts plus a re-start at rated 460 volts when applied to the diesel generator. The ETAP default dynamic model for a low voltage 50 HP motor was used as the typical WBN MCC motor. The 50 HP model has a higher power factor and efficiency than the smaller motor models. This produces a higher "%Start Load" for the connected mechanical load resulting in slower acceleration. In order to determine a conservatism value for the motor inertia constant "H", the motor acceleration simulation was performed several times at 80% rated voltage until it was found that an "H" value of 0.7 produced a 5 second acceleration time. The results of this simulation are given in output file **LV-H-7** (Attachment 1). Using this typical motor data, a simple three bus system was modeled which could be used to switch the motor from degraded voltage to rated voltage at a specified time (see Attachment 2).

Two cases were analyzed using this model. In the first case, the load was conservatively tripped from degraded voltage at 6 seconds and re-started at rated voltage at 10 seconds. This was conservative in that the load is given 4 seconds to slow down before it is re-energized at 10 seconds. In the second case, the load was tripped at 11.5 seconds and immediately re-started at rated voltage. The results of these cases are given in output files **LV-ACC-1 and LV-ACC-2** (Attachment 2 and 3). Both acceleration cases show that a typical low voltage MCC motor will be fully accelerated in 12 seconds.

5.4.4.1.6. A generic review of MCC thermal overload (TOL) devices were evaluated to determine if they could trip during the 12 seconds of motor acceleration. The motor draws a reduced starting current during the degraded voltage period. For conservatism, the decay of starting current during motor acceleration has been ignored. For the ITE TOLs installed at WBN on safety-related loads, a starting current of 638% will trip the TOL in 12 seconds (see Reference 2.3). This is based on the TOL tripping in 12 seconds based on 555% of TOL 100% trip amps, which is a minimum of 115% of the motor current. The characteristic curve for size 0, 1 and 2 starters were conservatively used, since the current vs time for size 3 and 4 starters are significantly higher. Additionally, since the accident has just occurred, the equipment ambient temperatures are not elevated to 40°C, and there is an additional margin of 115% in the TOL trip time (see Reference 2.3). Therefore, at a reduced ambient temperature, the TOL would trip in 12 seconds for a starting current of 734%. Due to the reduced starting voltage available at the motors during the degraded condition, a voltage of 1% less than the minimum starting voltage of 85% will be conservatively used. This is based on reference 2.2 for the design calculated worst-case transient voltage dip during the accident loading sequence. This is conservative, because a lower voltage would produce less starting current for the motors. Therefore, this would be equivalent to a motor starting current of 851%. Therefore, the analysis will evaluate all TOL's for class 1E motors that start for an accident that have motor starting current greater than 850% of full load current.

5.4.4.1.7. Protective devices should also be evaluated for the 460V safety-related loads that operate during non-accident conditions. The evaluation should consider that the safety bus voltage is equivalent to operation at the lower boundary of the degraded voltage relay dropout The protective devices should be evaluated to ensure that operation of the safety-related loads can be sustained indefinitely at this voltage without protective device trip.

5.4.4.2. SI actuated medium voltage motor loads are evaluated to ensure that their thermal damage limits are not exceeded during the start-start event.

This was determined not to be an issue. The medium voltage motors can start with 80 percent of motor rated voltage of 6600V (i.e. 76.5% of 6900Vin ETAP). During the start-start scenario the voltage can not drop below 86% without actuating the loss-of-voltage relays, which will trip the offsite supply in no more than 1.14 seconds. Therefore the available voltages at the medium voltage motors will be adequate to ensure starting and accelerating of these loads and will not challenge the motor thermal limits during starting.

5.4.4.3. 120VAC control power transformer (CPT) fuse time characteristics are evaluated to determine if the fuse could blow when carrying rated inrush current of the starter and any other normally energized devices for the safety analysis time from 5.4.1 above. See reference 2.7.

5.4.4.4. MCC 120VAC distribution panel. Fuse time characteristics are evaluated to determine if the fuses melt during the start attempts. It is considered that circuit components required to pick-up during starting will be at inrush conditions.

5.5. Loss-of-Voltage (LOV) Relay Setpoint

The loss of voltage (LOV) relays are an integral part of the degraded voltage protection scheme, and their setting and time delay should be selected to limit the magnitude and duration of degraded voltage the safety buses will encounter. The LOV relay nominal setpoint and associated time delays should be selected considering all errors in accordance with Technical Instruction TI-28 (Ref. 2.13).

5.5.1. The LOV relay voltage setpoint upper boundary should be established to be less than, with some margin, the safety bus voltage equivalent to the design calculated worst-case transient voltage dip during the accident loading sequence. This setpoint should also be less than the TPS calculated security boundary voltage which is based on the grid voltage that is one failure away from failure (see reference 2.11).

5.5.2. The LOV relay voltage setpoint lower limit is selected by evaluating operation of the auxiliary power system under steady-state (running) conditions, with the 6.9-kV Shutdown Board voltage as low as possible while keeping all connected safety- related motor loads above their stall voltage (greater than 70.7 percent of rated motor voltage for NEMA Design "B" motors, see assumption 4.6). The lower limit must also be greater than the 6.9kV Shutdown Board voltage equivalent to having the lowest switchyard voltage that could be sustained without instability or collapse (see reference 2.11).

5.5.3. The lower boundary of the LOV voltage relay time delay should be long enough to ride through short-circuits and other short time system transients (lightning strikes, switching transients, etc.), taking into account the total sensing and clearing times for the above type of events. The time delay upper boundary should be less than the safety analysis time allowed for loss of voltage detection.

6. SUMMARY OF RESULTS

6.1. Degraded Voltage Relay Drop Out Setpoint

6.1.1. Table 1 in Section 9.0, shows the minimum calculated steady-state operating voltage for the boards when the 6.9kV Shutdown Boards are operating at the degraded voltage dropout lower boundary of 6555V. All 6.9kV switchgear and 480V switchgear voltages are equal to or greater than the ANSI C84.1 voltage range B service voltages of 6560V (5V difference is considered insignificant) and 440V, respectivlely, And 480V mccs are equal to or greater than the ANSI C84.1 voltage range B utilization voltages of 432V. R31 not need to be started during a time of voltage degradation. Therefore, the voltage is considered acceptable under those conditions.

Note 2 - Percent Required starting voltages were obtained from Att 10.7 of Ref 2.6 of Calculation WBN-EEB-EDQ1999-010001 (Ref 2.2).

6.3 Degraded Voltage Time Delays

6.3.1. Motor Protective Device Evaluation

Per section 5.4.4.1, the only issue requiring evaluation was TOL's protecting safety-related motors that start for an accident. The generic evaluation of TOL's, in section 5.4.4.1.6, showed that only motors having locked rotor current in excess of 850% would have to be evaluated further. A review of the WBN ETAP database, showed that the following motors in Table III have a locked rotor current greater than 850% and start for an accident:

Table III - Locked Rotor Current Summary

ID	Name	Percent
203-12B	Cont Bldg Emerg Press Fan A-A	882
203-2A	Cont Bldg Emerg Air CU Fan A-A	902
205-11A	Cont Bldg Emerg Press Fan B-B	882
205-2A	Cont Bldg Em Air Clnup Fan B-B	902

An evaluation of those four loads show that their TOL's are set at 115% (see reference 2.3). Therefore they would not be an issue, because it would increase their tolerance for tripping an additional 115%.

6.3.2. Fuse Evaluation for 120VAC CPT Circuits and MCC 120VAC Distribution Panel Loads

During the start-start scenario, MCC bus voltages are below the levels used in verifying adequate voltage in previous calculations. Control circuits for motors being started, or other loads being energized, may be at a sustained inrush for the duration of the start attempt (6 seconds) before going to the diesels. Consequently fuses for these circuits must be verified to not actuate for this condition.

Calculation WBNEEBMSTI020019 (Ref. 2.4) and its reference calculation WBPEVAR8909006, were reviewed to identify the typical circuit configurations, their worst case burden during inrush, and the fuse size and type presently required . The current for each circuit was calculated for the burden at rated voltage.

Calculation WBNEEBMSTI020020 (Ref. 2.5) was reviewed to identify the worst case inrush at rated voltage on each MCC 120VAC distribution panel. Each panel uses the same size and type fuse.

The inrush currents were then compared with the fuse melting time-current characteristic to determine the melt times. The results are tabulated in Tables 2, 3 and 4 in section 9.0. Use of inrush currents calculated at rated voltage is conservative for constant impedance devices as the current at degraded voltages will be less. The acceptance pass-fail criteria required for melting time is 12 seconds. From a review of Tables 2, 3, and 4 all fuses will carry inrush current for at least 12 seconds and are considered acceptable.

6.3.3. Non-Accident Degraded Voltage - Motor Protective Device Evaluation

Operation of safety-related loads with the 6.9kV Shutdown Board voltage operating at the lower boundary of the degraded voltage relay, 6555V, will not cause tripping of protective devices. Static loads are not considered, since operation at lower voltage results in less current. The evaluation was based on the following: R31

6.6kV Motors - The voltage at the boards is 6555V (95% of nominal). The increased motor current would be approximately 105% of nominal. All of the protective relays are set to alarm only for overloads above 125% of nominal. Therefore, operation at the lower boundary of the degraded voltage relay dropout setting would not trip the motors. R31

480V switchgear motors - The lowest voltage at the 480V Shutdown Boards would be 437 volts (Ref Table 1). The increased motor current would be approximately 110% of normal. All of the switchgear breakers are set above 115% of nominal, and most above 125% of nominal. Therefore, operation at the lower boundary of the degraded voltage relay dropout setting would not trip the motors. R31

480V mcc motors - The lowest voltage at the 480V mccs would be 432 volts (Ref Table 1). The increased motor current would be approximately 110% of normal. All of the TOLs are set above 115% of nominal, and most above 125% of nominal. All motor breakers are magnetic only, and are not an issue. Therefore, operation at the lower boundary of the degraded voltage relay dropout setting would not trip the motors. R31

6.3.4. The upper limit for the time delay is 11.5 seconds, which is the maximum total time allowed for loss of voltage detection and emergency diesel generator start in the WBN safety analysis as documented in the FSAR. Based on the above evaluations, it has been determined that protective devices will not trip prior to 12 seconds for operation at a degraded voltage for a period of time, disconnection from offsite power, and reconnection to the emergency diesel generators.

The bounding motor starting analysis from reference 2.2, assumes the plant being in a normal operating mode, with the grid at its expected grid schedule voltage of 165kV, followed by an accident concurrent with the grid falling to a voltage of 153kV. For this unlikely conservative drop in the grid, the degraded voltage relays can be reset in approximately 6 seconds. For conservatism and margin, the lower limit for the time delay is 8.5 seconds.

6.5 Loss of Voltage (LOV) Relay Setpoint and Time Delay

6.5.1. The LOV relay upper analytical limits were determined to be 6072 volts, which is the minimum voltage dip during any expected starting transient from reference 2.2 and 6560 volts which is the lowest 6.9kV Shutdown Board voltage when the grid is degraded down to the security boundary voltage of 141kV. See section 5.5.1. The upper boundary of the LOV relay is 6072 volts from reference 2.20. The current LOV setpoint meets the criteria in section 5.5.1. Table IV shows the 6.9kV Shutdown Board voltages when the grid is degraded down to the security boundary voltage of 141kV. R32 R32

1.0 PURPOSE

The purpose of this appendix is as follows:

- Evaluate impact of the degraded voltage on the protective devices of safety related components and devices. This includes loads fed from 6.9kV and 480V switchgear, 480V MCCs, 120V CPT circuits and MCC 120VAC distribution panels. The equipment powered from Unit 2 boards required to support Unit 1 has been already analyzed in the main body of this calculation and therefore, not reviewed in this appendix.
- Ensure the duration of the degraded voltage at a given voltage level does not result in thermal degradation or damage of any required equipment.
- Verify that the existing setting of degraded voltage and loss of voltage relays, as stated in the main body, are acceptable for Unit 2

Analysis to verify adequacy of start and running voltages under degraded voltage conditions and stall voltage analysis is performed in calculation EDQ00099920070002 (Ref. 2.1).

2.0 SOURCES OF DESIGN INPUT/REFERENCES

References listed in Section 2.0 of the main body of this calculation, except references 2.2, 2.3, and 2.4, are also applicable to this appendix. Additional references are as follows:

2.1 Calculation EDQ000-999-2007-0002, R18 - Auxiliary Power System Analysis

2.2 Calculation EDQ002-999-2008-0004, R12 - 480V Class 1E Protection, Coordination and TOL Heater Calculation – Unit 2

2.3 Calculation EDQ002-999-2008-0003, R4 - 120VAC Class 1E MCC Control Circuit Voltage Analysis and Transformer Sizing

2.4 Calculation EDQ002-999-2008-0016, R2 – 6.9kV Protection and Coordination Calculation – Unit 2

2.5 Calculation WBNEEBMSTI070018, R80 – 120VAC Protection, Coordination and Short Circuit Study

3.0 Design Input and Requirements

3.1 Thermal overload heaters data is obtained from Appendix 8 of Reference 2.2.

3.2 MCC control circuit loads data is taken from Ref. 2.3.

3.3 Degraded Voltage and Loss of Voltage relays Setpoint (Sec 3.9 and Figure 8.3 of the main body)

Degraded Voltage Relay (27DAT, 27DBT, 27DCT)

Setpoint (Nominal) 6600V

Allowable Value: Dropout – 6570V Pickup – 6672V

Analytical Limit:	Dropout – 6555V	Pickup – 6681V

Loss of Voltage Relay (27LVA, 27LVB, 27LVC)

Setpoint (Nominal)	6000V	
Allowable Value:	Dropout – 5967.6V	Pickup – 6036V
Analytical Limit:	Dropout – 5934V	Pickup – 6072V

4.0 DOCUMENTATION OF ASSUMPTIONS AND JUSTIFICATION

Assumptions and justification listed in Sections 4.1 through 4.5 in the main body of this calculation are also applicable to this appendix. These are repeated below:

4.1 The resistive loads do not require protective device analysis for degraded voltage.

Justification: For a degraded voltage condition, the current for constant impedance devices decreases. Decreased current reduces the cumulative heating effect on thermal overloads, fuses or circuit breakers.

4.2 Motor operated valves do not require protective device analysis for degraded voltage.

Justification: The operation of the valve motors is intermittent and their overload relays are bypassed during accident conditions. Therefore the heating effect has no impact on this analysis.

4.3 Motors supplied from the 480V Shutdown Boards do not require protective device analysis for starting immediately after running at degraded voltage.

Justification: Amptector solid state overcurrent protective devices obtain their input from the current transformers. When the power is lost, the protective devices reset to their normal state.

4.4 Motors fed from 6.9kV shutdown boards do not require protective device analysis for starting immediately after running at degraded voltage.

Justification: Overcurrent relays derive their input from current transformers. When power is lost, the relays reset to their normal state.

4.5 A five second acceleration time is assumed for motors with no acceleration time.

Justification: IEEE-384-1977 (Ref. 2.18 of the main body), provides a typical motor acceleration time range from 2.5 to 4 seconds. Using 5 seconds is conservative.

5.0 COMPUTATIONS AND ANALYSIS

5.1 Degraded Voltage and Loss of Voltage Relays Settings

Degraded Voltage and Loss of Voltage relay setpoints are determined in the main body of this calculation and the currently installed settings are documented in Section 3.3 & Figure 8.3. These setting are reviewed to verify their acceptability for Unit 2 as follow:

5.1.1 Degraded Voltage relay

From the auxiliary power system voltage analysis performed in Ref. 2.1, it is seen that under the worst case scenario of an accident with grid dropping from normal 164kV to the minimum of 153kV, the voltage on the 6.9kV shutdown boards will fall below the relay dropout level at t=0+ second but recovers to a level above the relay reset value in ≤ 5 seconds (Att. 11.3.b of Ref. 2.1). The minimum time to reset the degraded voltage relay so as not to isolate the shutdown boards from the offsite power is 8.5 second (Figure 8.3).

Also as per the analysis performed in Ref. 2.1, it is verified that all safety related equipment and devices will have adequate starting and running voltage under the degraded voltage reset and dropout conditions respectively, after the proposed modifications in Section 12.0 of Ref. 2.1 are implemented.

5.1.2 Loss of Voltage relay
From the auxiliary power system voltage analysis performed in Ref. 2.1, it is seen that under the worst case scenario of an accident with grid dropping from normal 164kV to the minimum of 153kV, the worst case voltage on the 6.9kV shutdown boards at t=0+ second is 88.85% of nominal voltage (Att. 11.3.b of Ref. 2.1) which is above the loss of voltage relay nominal setting of 87% (Figure 8.3).

Based on the above, the degraded voltage and loss of voltage relays existing settings, listed in Section 3.3, are acceptable for Unit 2.

5.2 Effect of the starting currents during the Start-Start scenario on the overcurrent protective devices

5.2.1 The effect of starting currents during Start-Start scenario on overcurrent protective devices for safety related loads required for Unit 1 which would be actuated for an SI are evaluated in Sections 5.4.3 and 5.4.4 in the main body of this calculation. Load types considered are motor loads, Static loads, 120VAC motor control circuits, and MCC 120VAC distribution panel loads. The evaluation performed in Sections 5.4.3 and 5.4.4 in the main body of this calculation is typical and, therefore, also applicable for Unit 2 loads except for the TOLs since the TOLs for Unit 2 loads have been replaced with new TOLs model AR supplied by Square D (Appendix 8 of Ref. 2.2). Unit 2 TOL evaluation is performed in Section 5.2.2 below.

5.2.2 Based on a worst case analysis performed for a 50 HP motor in Section 5.4.4.1.5 in the main body of this calculation, it was determined that a typical low voltage MCC motor will fully accelerate in 12 seconds during start-start scenario. This analysis is also applicable for Unit 2 based on similarity of U1 and U2 equipment.
A generic review of U2 MCC TOL devices (Square D type AR) is performed to determine if they could trip during the 12 seconds of motor acceleration. The motor draws a reduced starting current during the degraded voltage period. Since the motor starting analysis is performed with the worst case voltage dip of 320V at the bus, the reduced starting current is 70% (320/460) of the rated locked rotor current. For the replacement Square D type AR TOLs installed at WBN Unit 2 on safety-related loads, a starting current of 525% will trip the TOL in 12 seconds

(see TOL Time-Current charactiristics in Appendix 8 of Reference 2.2). The characteristic curve for size 0, 1 starters was conservatively used, since the current vs time for size 2, 3 and 4 starters are higher. Additionally, since the accident has just occurred, the equipment ambient temperatures are not elevated to 40°C, and there is an additional margin of 115% in the TOL trip time (see Reference 2.2). Therefore, at a reduced ambient temperature, the TOL would trip in 12 seconds for a starting current of 604% (525x1.15). The maximum motor starting current that would yield 604% at degraded voltage is 863% (604/0.7). Therefore, the analysis evaluates all TOL's for class 1E motors that start for an accident that have motor starting current greater than 850% of full load current.

5.2.3 Protective devices are also evaluated for the 6.6kV and 460V safety-related motors that operate during non-accident conditions. The evaluation considers that the safety bus voltage is equivalent to operation at the lower boundary of the degraded voltage relay dropout The protective devices are evaluated to ensure that operation of the safety-related loads can be sustained indefinitely at this voltage without protective device trip.

6.6kV Motors - The lowest voltage at the boards is 6555V (95% of nominal 6900V). The increased motor current would be approximately 105% of nominal. All of the protective relays are set 115% nominal and most at 125% of nominal motor current (Ref. 2.4). The protective relay (51) is set to alarm only. Therefore, operation at the lower boundary of the degraded voltage relay dropout setting would not trip the motors.

480V switchgear motors - The lowest voltage at the 480V Shutdown Boards would be 441 volts or approximately 92% (Attachment 11.3.a of Ref. 2.1). The increased motor current would be approximately 110% of normal. All of the switchgear breakers for motors are set above 125% of nominal (Ref. 2.2). Therefore, operation at the lower boundary of the degraded voltage relay dropout setting would not trip the motors.

480V mcc motors - The lowest voltage at the 480V mccs would be 437 volts or approximately 91% (Attachment 11.3.a of Ref. 2.1). The increased motor current would be approximately 110% of normal. TOLs are set above 115% of nominal for motors with SF 1.0 and above 125% of nominal for motors with SF 1.15 (Ref. 2.2). All motor breakers are magnetic only, and are not an issue. Therefore, operation at the lower boundary of the degraded voltage relay dropout setting would not trip the motors.

5.2.4 SI actuated medium voltage (6.6kV) motor loads are evaluated to ensure that their thermal damage limits are not exceeded during the start-start event.

This was determined not to be an issue. The medium voltage motors can start with 80 percent of motor rated voltage of 6600V (i.e. 76.5% of 6900V in ETAP). During the start-start scenario the 6.9kV bus voltage cannot drop below 87% (Section 3.3) without actuating the loss-of-voltage relays, which will trip the offsite supply in no more than 1.14 seconds (Figure 8.3). Therefore, the available voltages at the medium voltage motors will be adequate to ensure starting and accelerating of these loads and will not challenge the motor thermal limits during starting.

5.2.5 120VAC control power transformer (CPT) fuse time characteristics are evaluated to determine if the fuse could blow when carrying rated inrush current of the starter and any other normally energized devices for the safety analysis time of 11.5 seconds (upper boundary of the degraded voltage relay time delay, Figure 8.3) or 12 seconds in the start-start scenario.

During the start-start scenario, MCC bus voltages are below the levels used in verifying adequate voltage in control circuit voltage drop calculation. Control circuits for motors being started, or other loads being energized, may be at a sustained inrush for the duration of the start attempt (6 seconds) before going to the diesels. Consequently fuses for these circuits must be verified to not actuate for this condition.

Calculation EDQ00299920080003 (Appendices J and K of Ref. 2.3) was reviewed to identify the typical circuit configurations, their worst case burden during inrush, and the fuse size and presently installed fuses of type TRM. The current for each circuit was calculated for the burden at rated voltage.

The inrush currents were then compared with the fuse melting time-current characteristic (page 8 of this appendix) to determine the melt times. The results are tabulated in Tables B-1 and B-2. Use of inrush currents calculated at rated voltage is conservative for constant impedance devices as the current at degraded voltages will be less. The acceptance pass-fail criteria required for melting time is 12 seconds. From a review of Table B-1 all fuses will carry inrush current for at least 12 seconds and are considered acceptable.

5.2.6 MCC 120VAC distribution panel fuse time characteristics are evaluated to determine if the fuses melt during the start attempts. It is considered that circuit components required to pick-up during starting will be at inrush conditions.

Calculation WBNEEBMSTI020020 (Attachment 10.1, 10.2 of R15 of Ref. 2.5 in the main body of this calculation) was reviewed to identify the worst case inrush at rated voltage on each MCC 120VAC distribution panel. Each panel uses KTK type fuses of the 5 amps size. From a review of Table B-2 all fuses will carry inrush current for at least 12 seconds and are considered acceptable.

6.0 SUMMARY OF RESULTS

Based on Section 5.0, following is the summary of results:

6.1 Degraded Voltage Relay and Loss of Voltage relay Setpoint

Existing setpoints for the degraded voltage relay and loss of voltage relay are acceptable.

6.2 Protective Device Evaluation

6.2.1 Motors Actuated by SI Signal

As discussed in Section 5.2.1, there is no adverse effect of the start-start heating on the overcurrent devices on the safety related motors which would be actuated by safety injection signal and powered from safety related 6.9kV and 480V switchgears and 480V MCCs under the degraded voltage conditions.

6.2.2 Non-Accident Safety Related Motors

Based on te analysis in Section 5.2.3, operation of safety-related loads with the 6.9kV Shutdown Board voltage operating at the lower boundary of the degraded voltage relay, 6555V, will not cause tripping of protective devices. Static loads (constant impedance) are not considered, since operation at lower voltage results in less current.

6.2.3 TOL Evaluation

The generic evaluation of TOL's in Section 5.2.2, showed that only motors having locked rotor current in excess of 850% would have to be evaluated further. A review of the WBN ETAP database (Ref. 2.1) showed that there are **no** motors with a locked rotor current greater than 850% and start for an accident.

6.2.4 Fuse Evaluation for MCCs 120VAC CPT Circuits and 120VAC Distribution Panel Loads

Based on Sections 5.2.5 and 5.2.6, fuses for all 120VAC CPT Circuits and 120VAC Distribution Panel loads are acceptable and will not blow or melt during the 12 seconds criteria during a start-start scenario.

6.3 The upper boundary limit for the time delay is 11.5 seconds (Figure 8.3), which is the maximum total time allowed for loss of voltage detection and emergency diesel generator start. Based on the above evaluations, it has been determined that protective devices will not trip prior to 12 seconds for start-start operation of motors at a degraded voltage at which time disconnection from offsite power and reconnection to the emergency diesel generators occurs.

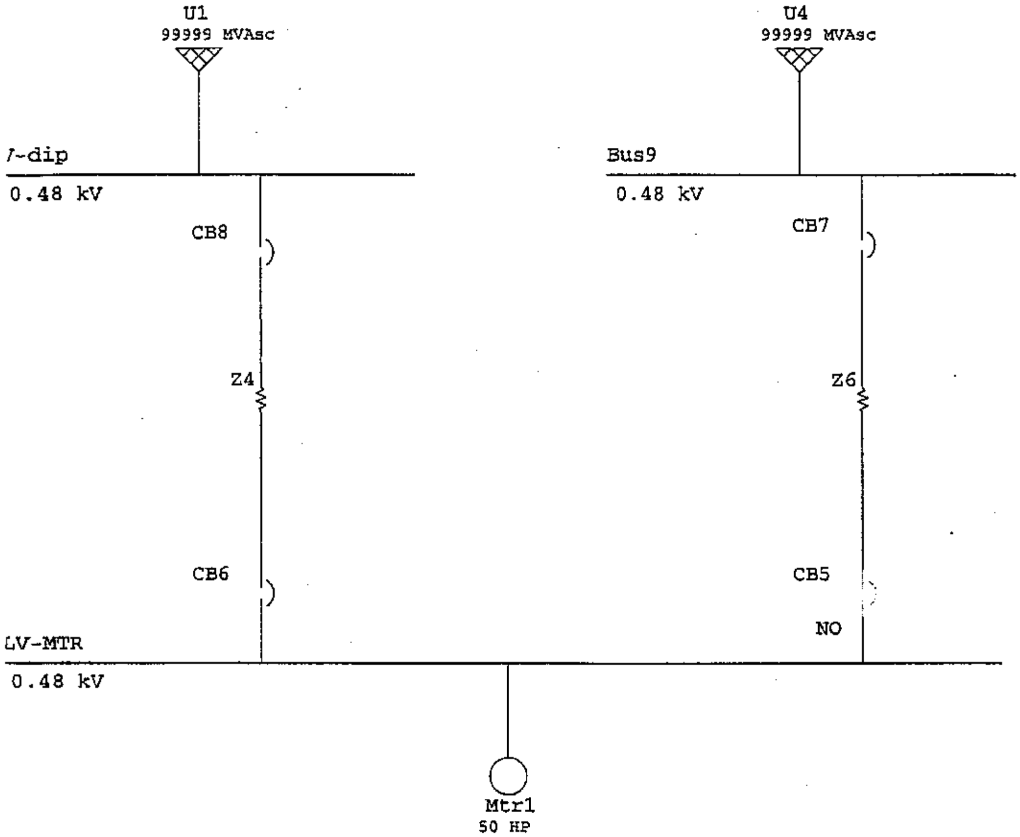
7.0 CONCLUSIONS

The above analyses have demonstrated that in the event of degraded voltage conditions, all safety related loads required for safe shutdown of the unit will be available and perform their intended safety function.

Acceleration of Typical Class 1E Motors (@ 80% MRV)

Appendix No. Attachment 1
Calc. No. WBN-EEB-MS-TI06-0029 Rev. 29
Sheet No. 1 of 16

One-Line Diagram - OLV1



Appendix No. Attachment 1
Calc. No. WBN-EEB-MS-TI06-0029 Rev. 29
Sheet No. 2 of 16

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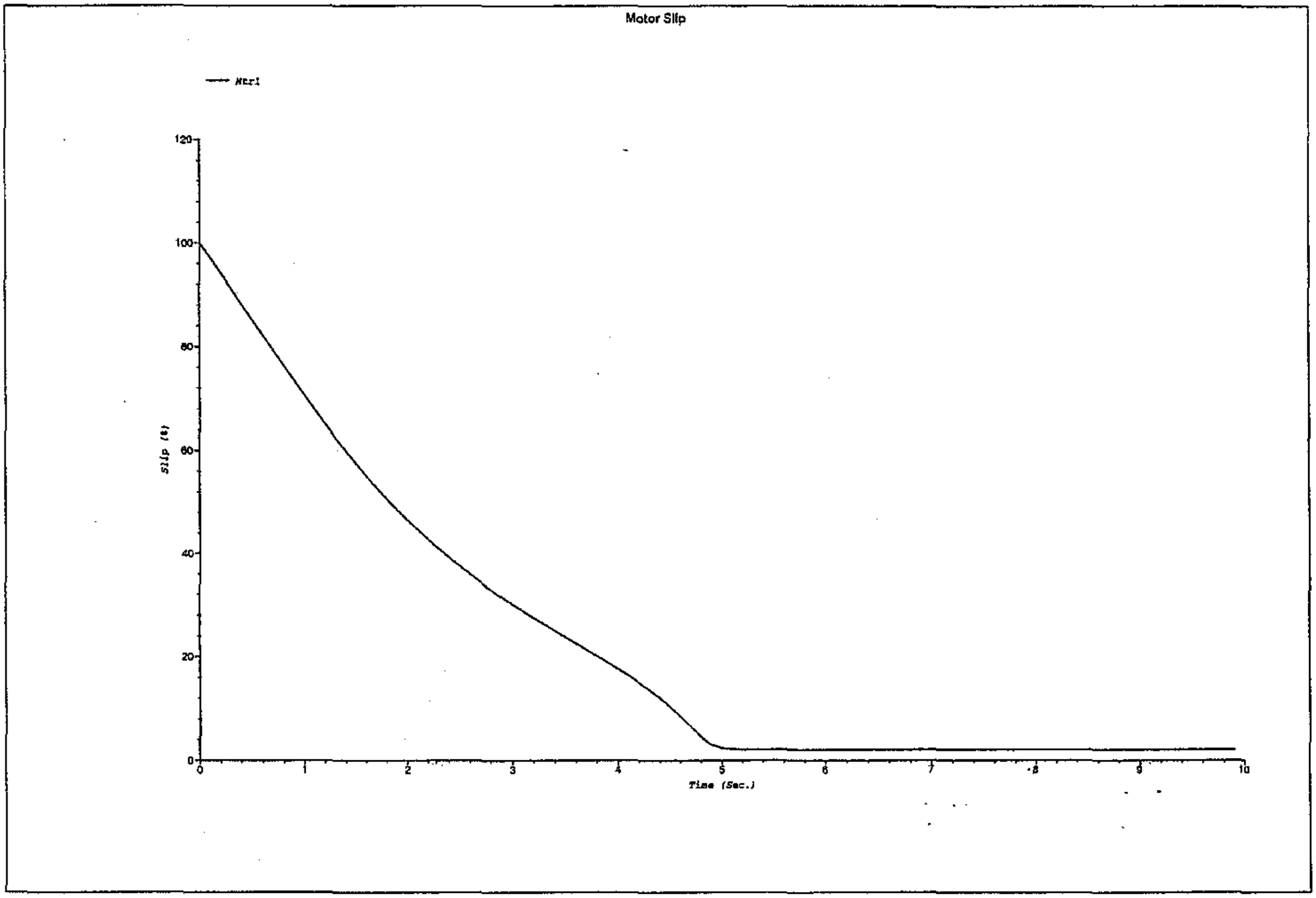
Location:
Contract:
Engineer:

May 26, 2000

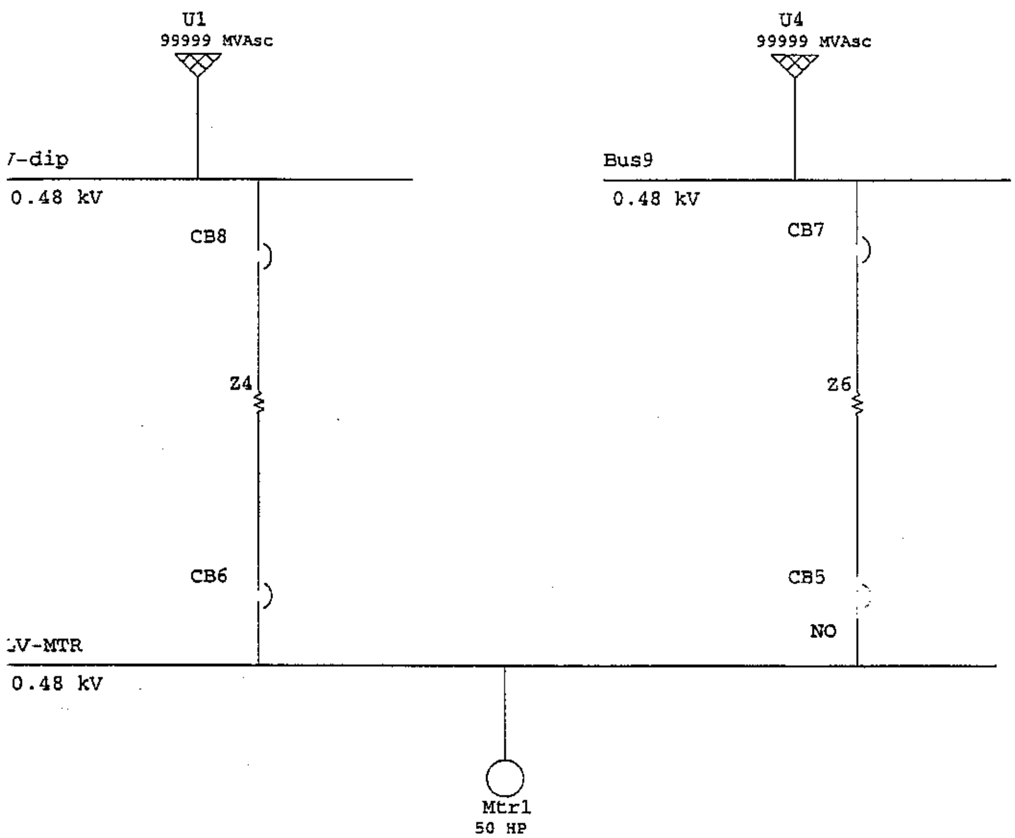


Project File: DVMotorAcc

Output Report: Mtr1@80%

Acceleration of Typical Class 1E Motors; Motor Voltage at 320 V
Diesel Generator Breaker Close @ 10 Sec.

One-Line Diagram - OLV1



Appendix No. Attachment 2
Calc. No. WBN-EEB-MS-TI06-0029 Rev. 29
Sheet No. 2 of 23

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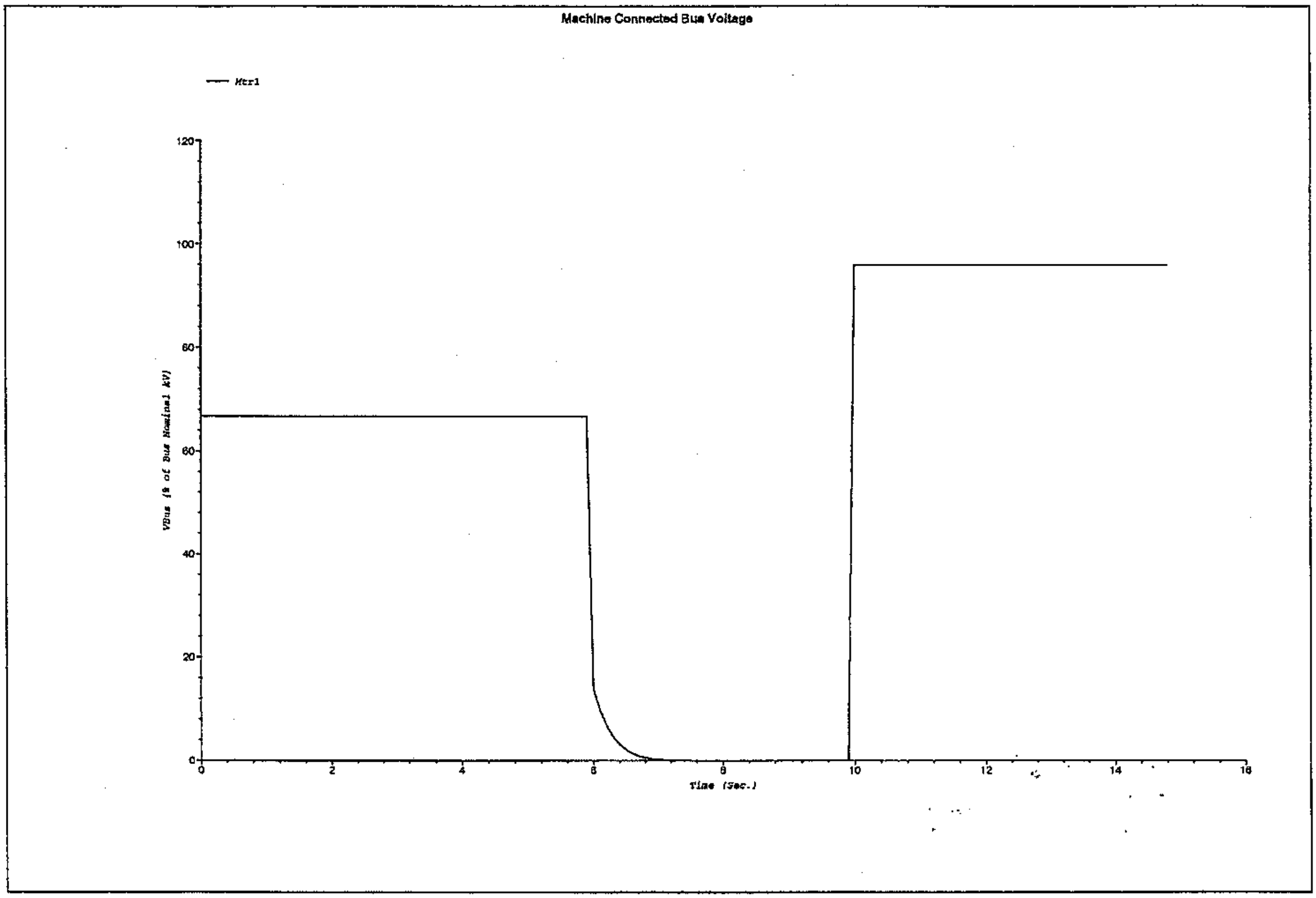
Location:
Contract:
Engineer:

May 26, 2000

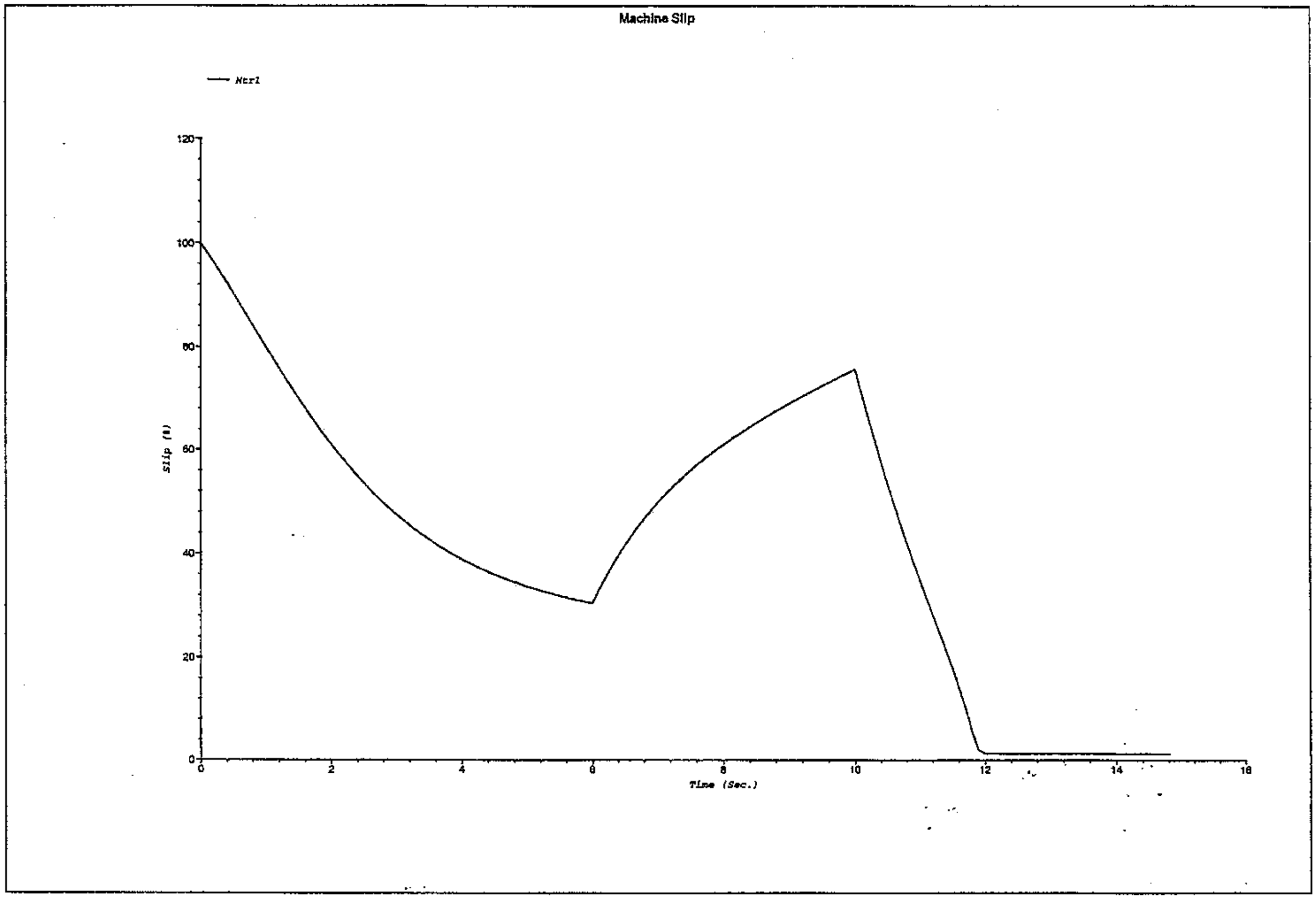


Project File: DVMotorAcc

Output Report: DV-Case1

Project:
Location:
Contract:
Engineer:

May 26, 2000

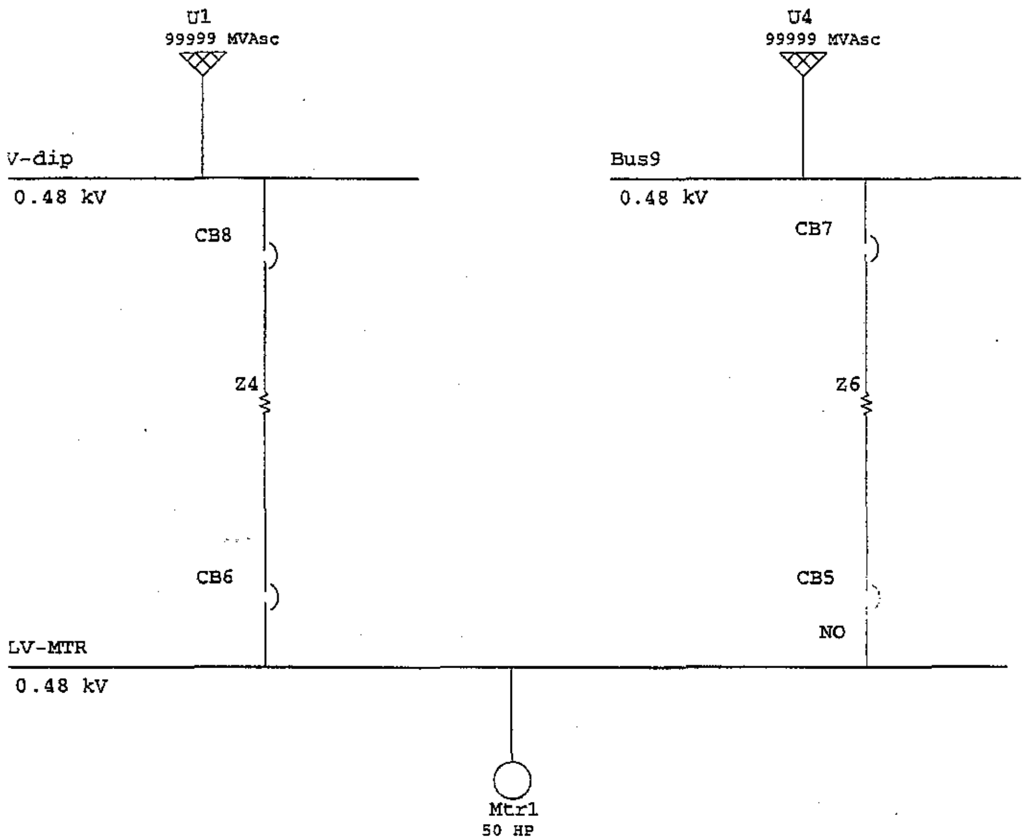


Project File: DVMotorAcc

Output Report: DV-Case1

Acceleration of Typical Class 1E Motors; Motor Voltage at 320 V
Diesel Generator Breaker Close @ 11.5 Sec.

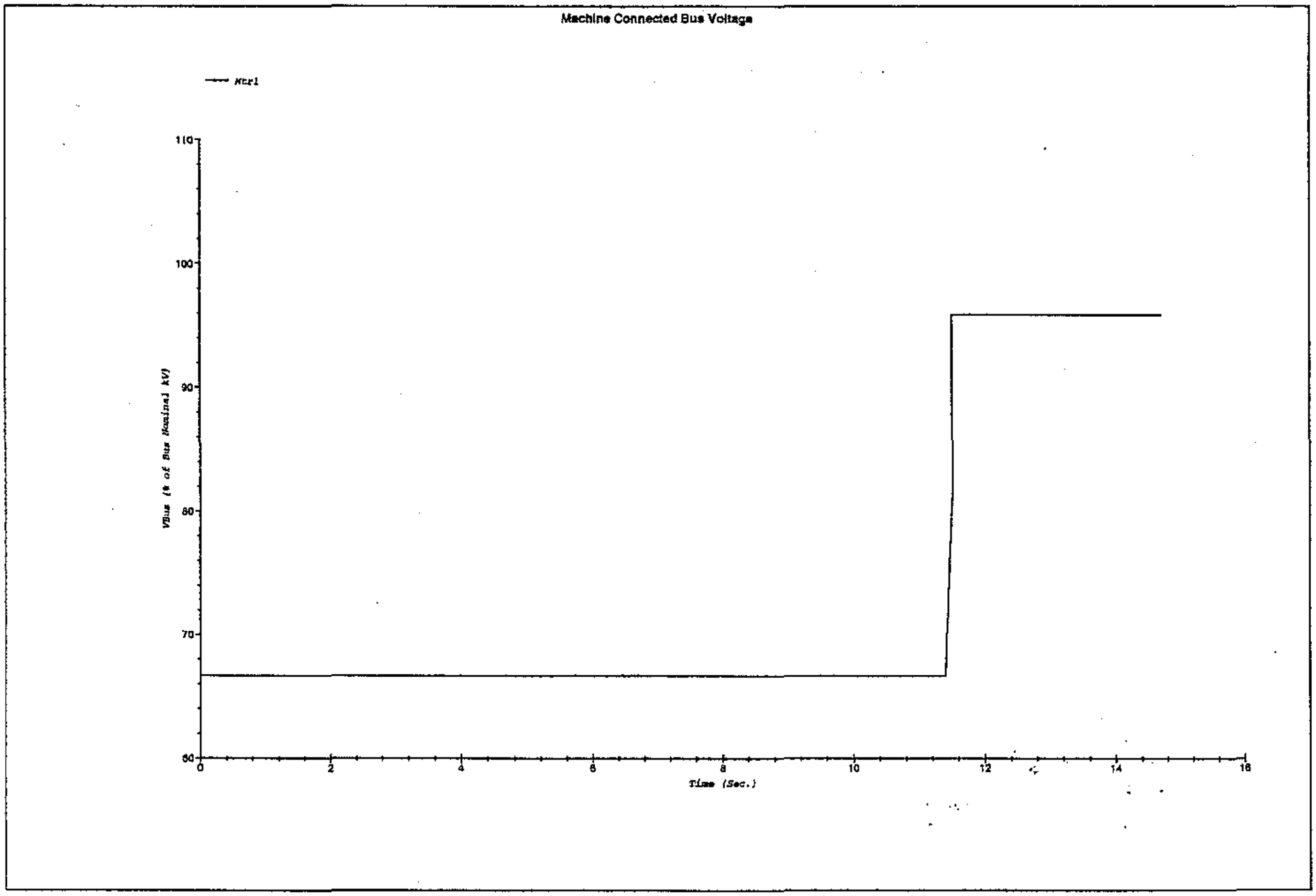
One-Line Diagram - OLV1



Appendix No. Attachment 3
Calc. No. WBN-EEB-MS-TI06-0029 Rev. 29
Sheet No. 2 of 23

Project:
Location:
Contract:
Engineer:

May 26, 2000

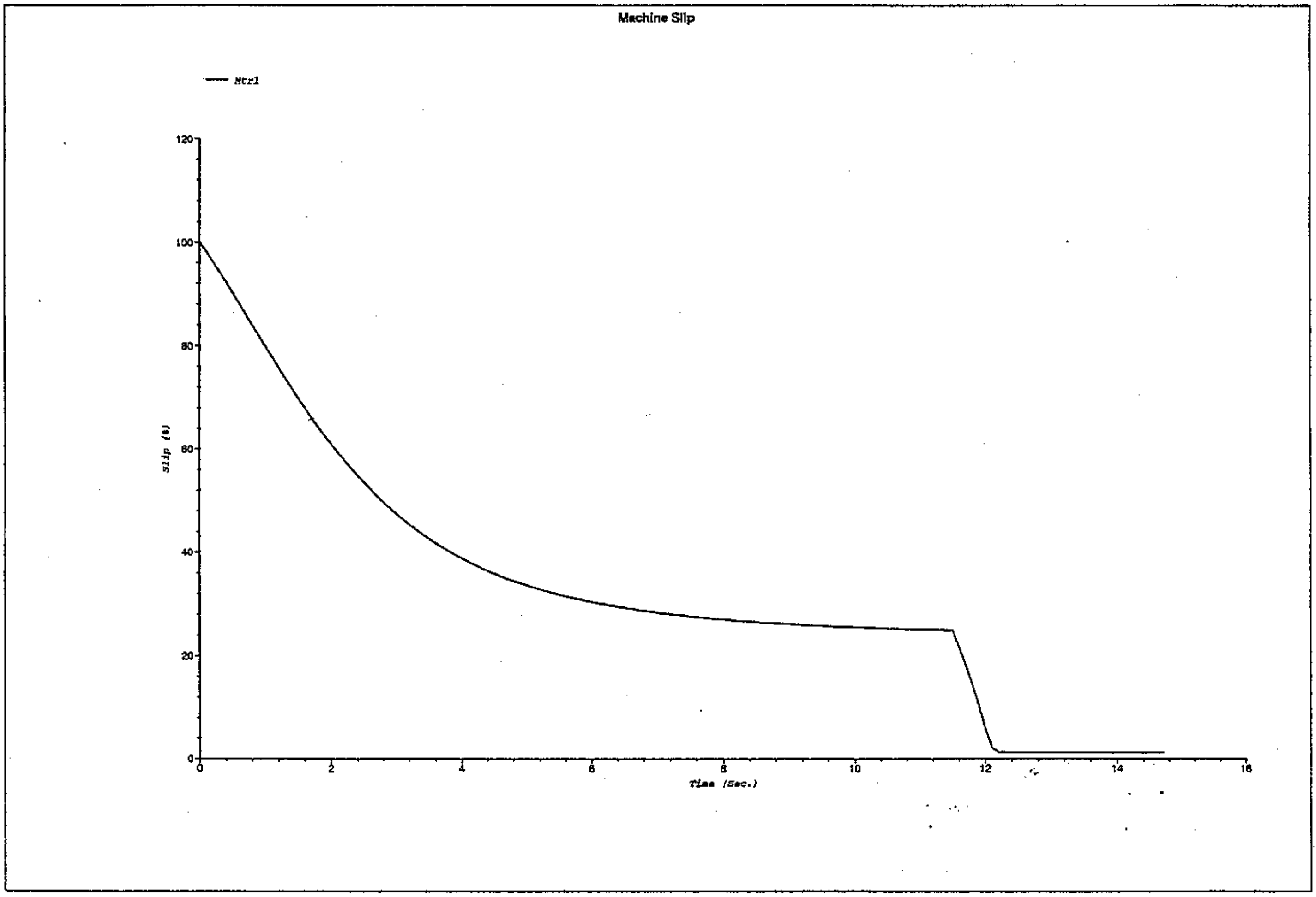


Project File: DVMotorAcc

Output Report: DV-Case2

Project:
Location:
Contract:
Engineer:

May 26, 2000



Project File: DVMotorAcc

Output Report: DV-Case2