CONTRACTOR SUBMITTAL FORM

Project Name: Navajo Gallup Water Supply Project Reach 26.1 & 2	☒ **M** (Materials) ☐ **T** (Testing) ☐ **A** (Administrative)	**Submittal No.** **M039A**
SMA Project No: 6921307		
Date: 01-03-2019		
Contractor: Navajo Engineering and Construction Authority	**No. of Copies**: 1	

Supplier: Core & Main	**Manufacturer:** Pipestone
Specification No.: 33 12 17 – 2.2 A	**Drawing No.:** DT-13,14,15
Bid Item No(s).: 41	
Submittal Checklist No(s).: 353-367, 369-371, 373-375, 378, 381	
Product Description: RESUBMITTAL #1: Prefabricated Vault w/ Engineers comments addressed. Also, please see attached email correspondence from Kira Witwer requesting approval of long lead items and note concerning power load summary.	
Are there any deviations from the Contract Documents? ☒ **No** ☐ **Yes** **Explain**:	
Contractor's certification that product meets requirements of Contract Documents: ☒ Certified ☐ Certified with variations as noted on shop drawings and/or attached sheets.	
Signed: Aaron L. Barton	**Date**: 01-03-2019

Engineer's Comments:

☐ No Exception Taken
☐ Approved as Corrected
☐ Exceptions as Noted
☐ Submittal Rejected
☒ Revise and Resubmit to Engineer
☐ Contractor to Submit Specified Information

- Please provide Cla-Val control valves Flow meters, Orifice plates, limit switches & other appurtances per specifications
- Please provide Red Hat solenoids, if cannot be provided explain why.

Review is limited to check for compliance with design concept. No changes from provisions of Contract Documents are intended and Contractor remains responsible for compliance with revisions therein.

The Contractor is solely responsible for quantities; correctness of dimensions; verification of physical interrelation of elements of the work as required by the drawings and specifications and by field determination; fabrication procedures, construction methods, techniques and sequences. This review does not relieve the Contractor from these responsibilities.

Non-conformities and errors detected have been noted but such markings, or lack thereof, shall not relieve the Contractor from compliance with all requirements of the contract drawings and specifications.

Signed: Tony F. Dane

Date: 2/20/19

NGWSP Reach 26.1 & 2

Engineer Comments on Submittal M039 – Prefabricated Vault

General comments:

- Please submit a summary of power usage and battery life for all electrical components. Will finish this upon approval of submitted equipment.
- Note that each of the items listed in the product description are labeled with an Item No. for reference to the comments below. Thank you!
- Provide an explanation of why the inside length of the control vault was increased from 19-feet to 20-feet as shown in Sheet 3 of 7 of Drawing No. PE-17-0380-DWB. This is a standard size increment for the manufacturer, if it's not a problem for the site location, we suggest having a little extra room and saving some money.

Please refer to the of the original submittal PDF for page number references for items 1 through 3:

- Page 2 (Product Description page)
    - Take out reference to 3.8" orifice plate bore. With Singer valves, the bore will be specified by manufacturer for a differential pressure of 5 psi at 690 GPM. Removed.
    - Correct the quantity of Romac DJ 400 to correspond w/ the quantity shown on page 5 (General Arrangement drawing) of the submittal and DT-12 of SMA's Final 26.1/2 plans Corrected.
- Page 3 (Product Description cont'd)
    - Correct the quantities of the following items to correspond w/ the quantities shown on page 5 (General Arrangement drawing) of the submittal and DT-13 of SMA's Final 26.1/2 plans: Corrected.
        - 2" ValMatic VB
        - 1" ValMatic ARV
        - 2" Apollo BV
        - ½" Apollo BV
        - 1" Apollo BV
        - ¾" Apollo hose connection (page 2 says 3, page 5 says 2 – which should it be?) Both. There are a total of five. Revised.
            - Change page 5 accordingly if needed.
        - ½" Ametek pressure transducer
        - ¼" pressure gauge
        - Pen Seal for 6" Carbon Steel Pipe (there are 7 wall penetrations in the vault – 1x inlet, 3x pipe outlet, 2x air line, 1x drainline on floor of vault)

- Section 2.9 A.1 of spec 33 12 17 specifies that the model # of the 2" ValMatic VB includes "XF" in it – should this be included in the description here on page 3? For this product, the part number doesn't need to have the XF (X=special, F=Fusion Bonded Epoxy) if it has the SV (Super Valve= Fusion Bonded Epoxy and Stainless Fasteners).
- Section 2.3 P of spec 33 12 17 specify that the Pressure Gauges shall have ranges of 0-300psi and 0-200 psi. Should the range of the ¼" pressure gauge (currently shown as 0-30 psi) given on Page 3 of the submittal be changed accordingly? Typo. Corrected.
- Section 2.20 B.2.j of spec 33 12 17 specify that the ½" Ametek pressure transducer shall have a range of 0-300psi. Should the range (currently shown as 0-30 psi) given on Page 3 of the submittal be changed accordingly? Corrected.

- Page 5 (General Arrangement Drawing)
  - **Remove** the orifice plate w/ 1.87" bore that is located downstream of the relief valve from the design – we no longer need it since Singer custom-drills their anti-cav cages (we put this in to limit flowrate back when we originally changed from Singer to ClaVal since ClaVal doesn't custom-drill their AC cages). Removed.
    - **Take out references to this orifice plate from all design drawings.**
- Page 65 (SINGER MODEL 106/206-RF-PR-SC-NO)
  - The PRV's model # on page 2 does not include the "NO" notation that the model # on page 65 includes- should it? Sure. Added.
- Page 70 (Material Specifications & Dimensions)
  - Section 2.3 J of spec 33 12 17 specifies that the Main Valve internal and external fasteners shall be supplied as 304 Stainless Steel. Do Items #10, 12, 51, & 52 come in SS 304? . 18-8 Stainless Steel is the same as 304SST. The Stem Nut and Guide Bushing are Brass to prevent galling with the SST stem.
- Page 83 (ASCO Red-Hat solenoids)
  - Section 2.3 U.3 of spec 33 12 17 specifies Solenoid shall draw no more than 2 watts of power. Resubmit solenoids that meet this spec. The solenoid we suggest requires 11.6 watts of power.
  - Section 2.3 U.4 of spec 33 12 17 specifies Power Requirements: 24 Volts DC. Please indicate on submittal that the submitted solenoid meets this specification. Added.
- Page 91 (SPR-MV)
  - Submit to SMA the length that the SPI-MV extends out of the valve. SMA to determine orientation of SPI-MV – same or different side of valve as pilot system? For a 6" Singer Valve, the SPI Probe will extend out 7.25" from the body, and they recommend having 8" clearance from the nut for removal.
- Page 99 (SPR-MV)
  - Section 2.3 T.7 of spec 33 12 17 specifies the Insertion Flow Meter shall use 0.7 Watts to operate. Resubmit an Insertion Flow Meter that meet this spec. Singer's flowmeter requires 21 watts.

    - Section 2.3 T.6 of spec 33 12 17 specifies the Insertion Flow Meter Power Requirements: 24 Volts DC. Please indicate on submittal that the submitted flow meter meets this specification. See page 90.
- Page 110 (SPI Converter Overview)
    - Section 2.3 T.7 of spec 33 12 17 specifies the Insertion Flow Meter shall have local display. Please indicate on page 110 of the Submittal that the local configuration shall be used. The converter in the vault has a display screen. See page 90.
- Page 158 (Orifice Plate)
    - Submit in writing that the orifice plate bore hole for the RF control on the PRVs will be manufacturer-specified for a differential pressure of 5 psi at 690 GPM. This is instead of the 3.8" borehole that SMA originally specified based on ClaVal's orifice sizing charts. This is true. Singer will determine the orifice diameter based on 5psid at 690gpm.
- Page 163 (Material Specifications & Dimensions)
    - Section 2.4 J of spec 33 12 17 specifies that the Main Valve internal and external fasteners shall be supplied as 304 Stainless Steel. Do Items #10 & 12 come in SS 304? The Stem Nut and Guide Bushing are Brass to prevent galling with the SST stem.
- Page 164 (Limit Switch / Position Indicator Assembly)
    - Section 2.4 N.5 of spec 33 12 17 specifies to provide stainless steel cap on Limit Switch Indicator. Please indicate on page 164 that the submittal conforms to this. The note return submittal is point to the stem cap for the main valve, that will be fusion bonded epoxy coated ductile iron like the rest of the valve body. The Stem Hat (item 61) can be made stainless steel. Noted.
    - Confirm that this is going to be a fully closed position limit switch for the relief valve. Yes.
- Page 165 (AC Trim)
    - Design anticav trim on Relief Valve for: Yes.
        - Min Flow: 371 GPM
        - Max Flow: 769 GPM
        - Min Inlet Pressure: 162 PSI
        - Max Inlet Pressure (DYNAMIC): 184 PSI
        - Max Inlet Pressure (STATIC): 245 PSI
        - Min Outlet Pressure: 0 PSI
        - Max Outlet Pressure: 0 PSI
- Page 180 (MARS Z Strainer)
    - Resubmit with a ClaVal X43H strainer – this is the only one SMA will approve. See pages 179-180.
        - Remove all references to the MARS Z strainer on pages 3-5

Make all changes per comments below for items 4 through 23:

- Item #4
    - Per Section 33 12 17 – 2.8.A.2, the ball valve is to be Leaked tested to 300 psi and Shell tested to 600 psi. Resubmit with technical documents indicating this information. ValMatic Specifications confirm the valves are designed, manufactured, and tested in accordance with AWWA C507 which calls for leakage test at 100% of the design pressure and hydrostatic testing at twice the design pressure.
    - Highlight/select that Class 250 Flanges are to be used in attached technical documents. Class 300# Ball Valves will have ANSI B16.1 Class 250 Flanges.
- Item #5
    - Highlight and indicate that NBR Gaskets and 316 Stainless Steel fasteners are to be used, per Section 33 12 17 – 2.16. See page 183.
- Item #8
    - Per section 33 12 17 – 2.9, vacuum breaker valve shall be 2" ValMatic **1852VB.3XFSVH** Vacuum Breaker Valve. Submit technical documents indicating this model type. The XF is not needed in the part number.
    - Attach Fusion Bonded Epoxy Coating specification documents with this item. Page added.
- Item #15
    - Indicate that pressure range shall be from 0-300 psi. Yes.
- Item #22
    - Incandescent lighting shall not be used. Resubmit with LED lighting, per Section 33 12 17 – 2.20.A. Still working on this, if you have a preference, please advise.

*** Please see comments on next page from Kira Witwer.

Aaron Barton

From: Merrick, Joseph <Joseph.Merrick@coreandmain.com>
Sent: Thursday, January 3, 2019 12:16 PM
To: Aaron Barton; Quentin Benally
Subject: FW: FW: Reach 26.1/2 - Comments for Prefab Vault Submittal M39
Attachments: Prefab-Vault-M39-1 PE Revised Submittal Comments 20190103.pdf; NG 26_1 26_2 Revised Submittal DT12 20190103.pdf

Aaron, Quentin,

Please see attached and comments below.

Please confirm receipt.

Thanks,

Joe

Joe Merrick
Contractor Sales
Core & Main
Branch 117
6135 2nd Street NW
Albuquerque NM 87107
Ph: 505-344-0223
Fx: 505-836-6033

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From: Kira Witwer [mailto:kwitwer@pipestoneeq.com]
Sent: Thursday, January 3, 2019 9:35 AM
To: Merrick, Joseph <Joseph.Merrick@coreandmain.com>
Cc: Mathews, Cynthia <Cynthia.Mathews@coreandmain.com>
Subject: Re: FW: Reach 26.1/2 - Comments for Prefab Vault Submittal M39

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hey Joe,

Here's the revised submittal for the pre-fab vault.
Please request approval of the long lead items so we can move forward.
I will work on the power load summary when we get the okay to release.

Thanks!
Kira

676 Moss Street, Unit A
Golden, CO 80401
Phone: 303-579-9658
Fax: 303-567-2861

Navajo Gallup Reaches 26.1 and 26.2

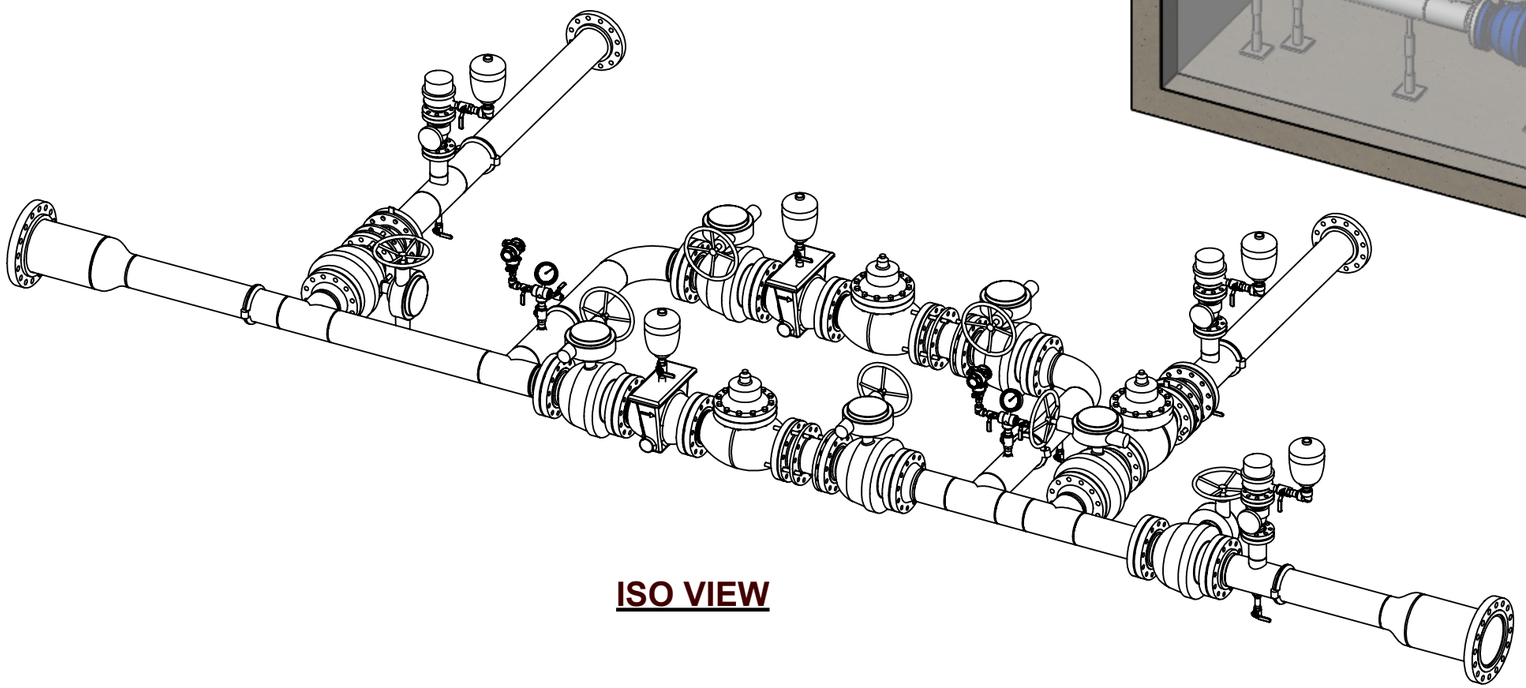
Ojo Encino to Pueblo Pintado

DT12 Vault

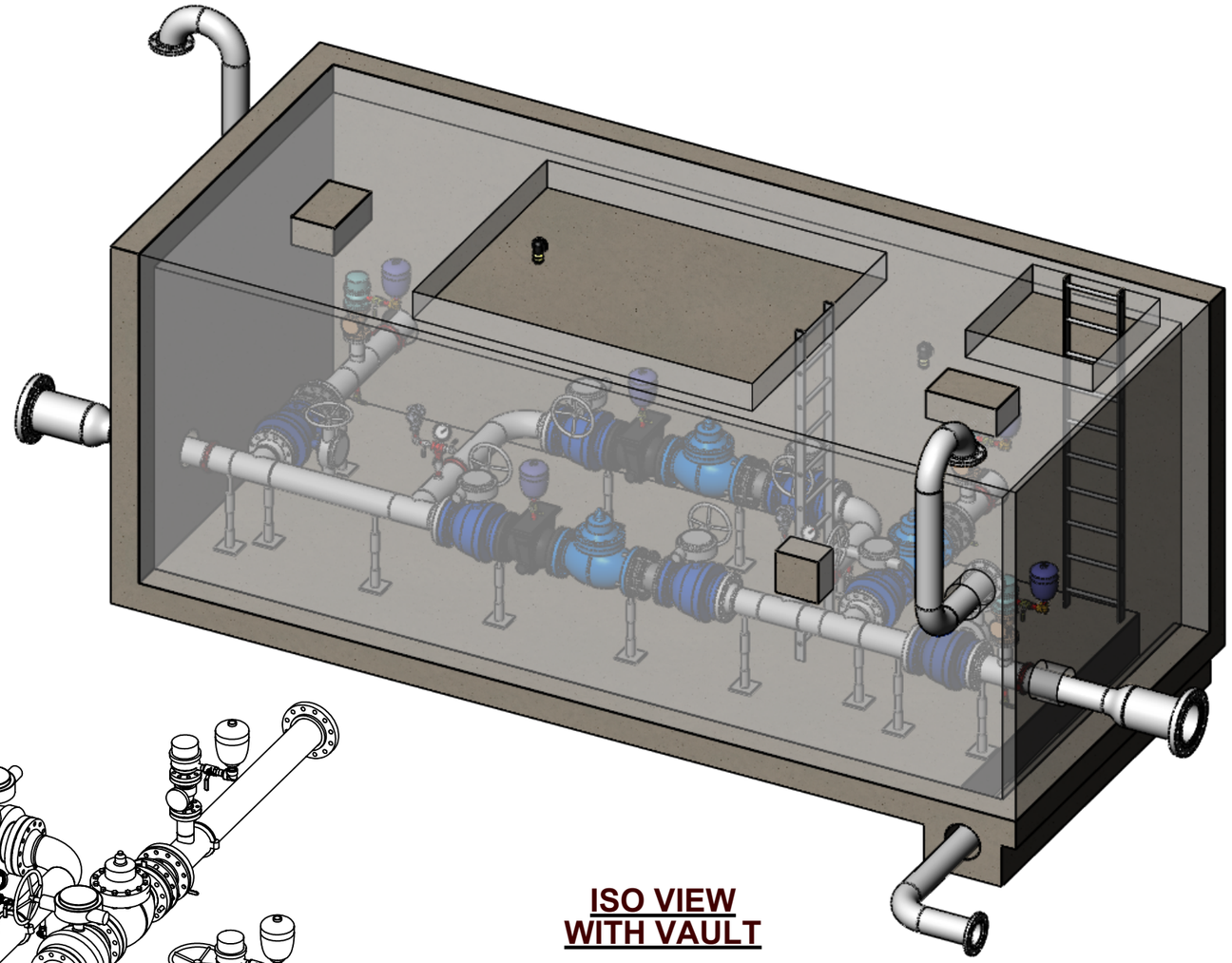
Qty	Product Description
2	6" Singer S106-RF-PR-SC-NO-SPI-MV-SSX107-2G Rate of Flow, Pressure Reducing Valve with Solenoid Override, Insertion Flowmeter, and SST Visual Position Indicator. Globe Style, Straight Pattern, Fusion Bonded Epoxy Coated, Ductile Iron Main Valve with Class 300 Flanged Ends, 316SST Stem, EPDM Elastomers, SST Fasteners, and SST Visual Position Indicator. All Stainless Steel Pilot System consisting of: Isolation Ball Valves, Strainer with Manual Blowdown (rated for 400psi), Fixed Restriction, Opening Speed Control (Locking), Constant Flow Orifice (180 Seconds or Greater Main Valve Operation), Model 160 Reducing Pilot (20-200psi, Set at 60psi), Model 160RF Rate of Flow Pilot (SST 30-480"), Normally Open Solenoid (24vdc, Manual Operation, Energize Solenoid to Close Main Valve), Upstream (0-300psi) and Downstream (0-200psi) Pressure Gauges with Bleed, Single Point Insertion Magnetic Flowmeter (24vdc), Local Display (IP65), PTFE Lined SST Braided Hose with SST Ends and Fittings. Orifice Housing, Orifice Plate (Bore Specified by Singer for 5psid at 690gpm), and (2) 316SST Grounding Rings
1	6" Singer S106-RPS-AC-X137-G Pressure Relief Valve, Globe Style, Straight Pattern, Fusion Bonded Epoxy Coated, Ductile Iron Main Valve with Class 300 Flanged Ends, 316SST Stem, EPDM Elastomers, SST Fasteners, (1) SPDT Limit Switch and SST Positioning Indicator with Bleed, and Cavitation Control Cage. All Stainless Steel Pilot System consisting of: Isolation Ball Valves, Strainer with Manual Blowdown (rated for 400psi), Fixed Restriction, Closing Speed Control (Locking), Model 81-RP Pilot (20-200psi, set at 60psi), Upstream (0-200psi) Pressure Gauge with Bleed, PTFE Lined SST Braided Hose with SST Ends and Fittings.
2	6" Cla-Val X43H Style Strainer, Ductile Iron Body and Cover, 316SST Strainer, 400psi Rated, 300# RF Flanges, Fusion Bonded Epoxy Coating, Air Bleed and Drain Blowoff
2	6" ValMatic Series 4000 Ball Valves, AWWA C507 NSF61, Rated to 300psi Full Differential Working Pressure, Ductile Iron Body, Shell Test at 600psi, ANSI B16.1 Class 250 Flanges, 17-4 Stainless Steel Stem, Double Resilient Seats, Fusion Bonded Epoxy Coating, SS Body Fasteners, Gear Operator with Both a Handwheel and 2" Operating Nut Orientation - Handwheel Perpendicular to Pipe
5	6" ValMatic Series 4000 Ball Valves, AWWA C507 NSF61, Rated to 300psi Full Differential Working Pressure, Ductile Iron Body, Shell Test at 600psi, ANSI B16.1 Class 250 Flanges, 17-4 Stainless Steel Stem, Double Resilient Seats, Fusion Bonded Epoxy Coating, SS Body Fasteners, Gear Operator with Handwheel Orientation - Handwheel Perpendicular to Pipe
4	6" ROMAC DJ 400 Dismantling Joint with Class F Flanges, Ductile Iron End Ring and Body, Fusion Bonded Epoxy Coating, Stainless Bolts and Tie Rods, Rated for 300psi

6	6" Victualic Zero-Flex Rigid Coupling, Style 07, Enamel Coated Ductile Iron Housing, EPDM Gasket
3	2" ValMatic 1852VB.3SVH Vacuum Breaker Valve, ANSI Class 250 Flanged Inlet, Cast Iron Body, SST Trim, Fusion Bonded Epoxy Coating, SS Fasteners, Screened Hood, Rated 400psi
7	1" ValMatic 38HPDISVH Water Air Release Valve, Ductile Iron Body, 316SST Trim, EPDM Seating, Fusion Bonded Epoxy Coating, SST Bolts and Pipe Plugs, Screened Hood, Rated 500psi
3	2" Apollo 87A90801 Stainless Steel, Full Port, 300 Flanged Ball Valve
4	1/2" Apollo 76F10301A Stainless Steel, Full Port, NPT, Ball Valve
7	1" Apollo 76F10501A Stainless Steel, Full Port, NPT, Ball Valve
5	3/4" Apollo HBV2 38-314-AS Hose Connection Vacuum Breaker, Satin Brass, Manual Drain Feature
2	1/2" Ametek 88C-003-A-2 Electronic Pressure Transducer, 0-300psi Range, 316L Stainless Steel Base, Diaphragm, Silicone Fill, NPT Process Connector, 4-20mA Output
2	1/4" NPT Wika 233.34 Pressure Gauge, Plastic Case, SST Wetted Parts, 4.5" Safety Glass, Glycerine Filled, 0-300psi
2	6" ValMatic 1506 FrostSafe Two Way Air Damper, Corrosion Resistant Body with Stainless Steel Bolts
2	6" ValMatic 1606 VentSafe Vent Pipe Security Cage, PVC Body with Stainless Steel Screen and Cage
7	PS-475 Pen Seal for 6" Carbon Steel Pipe in 10" ID Core Drilled Hole, 10 links
4	PS-200 Pen Seal for 1.5" Ridig Steel Conduit in 3.5" ID Core Drilled Hole, 5 links
2	10" ROMAC Alpha Restrained Flanged Coupling, Standard for PVC Pipe, Fusion Bonded Epoxy Coated Ductile Iron, SBR Gasket, SST Fasteners
3	6" ROMAC Alpha Restrained Flanged Coupling, Standard for PVC Pipe, Fusion Bonded Epoxy Coated Ductile Iron, SBR Gasket, SST Fasteners
2	Light Fixture for Hazardous Locations
2	McMaster-Carr 7628K77 Intrusion Switch, Low-Profile, Washdown, Roller Lever Limit Switch

NAVAJO GALLUP WATER SUPPLY
GENERAL ARRANGEMENT



ISO VIEW



ISO VIEW WITH VAULT

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DWG. NO.	TITLE

REVISIONS

REV.	DESCRIPTION	BY DATE	CHK DATE	APPR DATE
-	-			

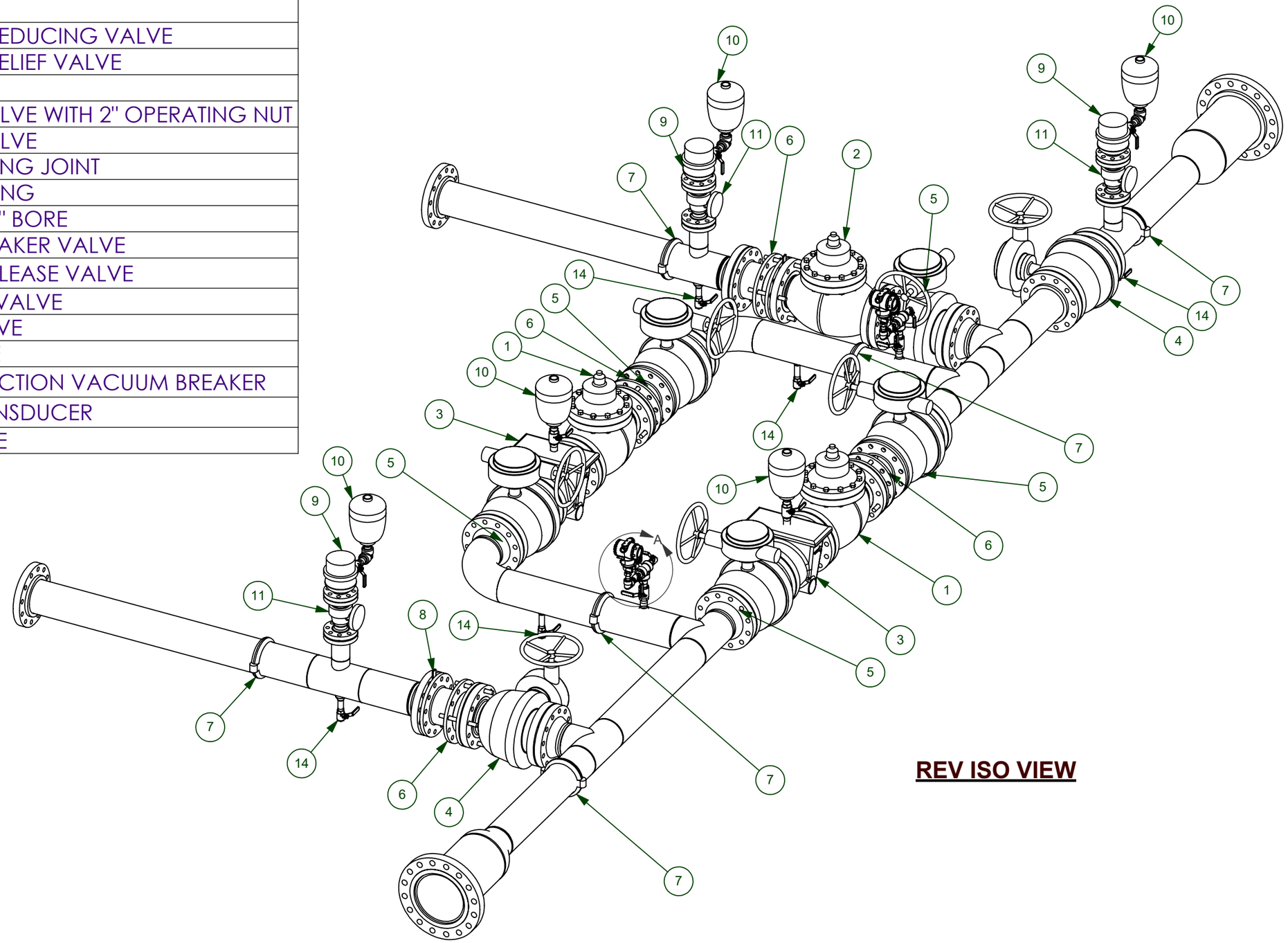
DRAWN BY: CAL	CHECKED BY: KCW
DATE DRAWN: 9/27/2018	DATE CHECKED: -

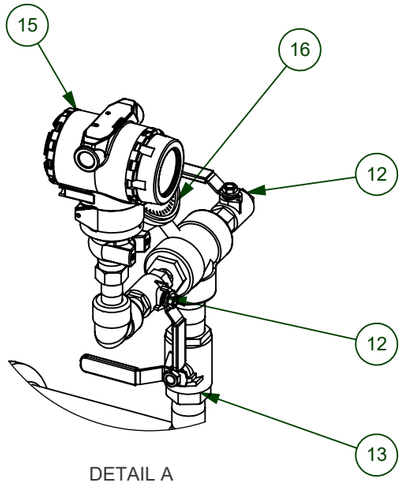
PIPESTONE EQUIPMENT

NAVAJO GALLUP WATER SUPPLY
GENERAL ARRANGEMENT DRAWING

SCALE:	PROJECT NO:	DWG NO:	REV.
1:36		PE-17-0380-DWB SHEET 1 OF 7	0

ITEM#	QTY.	DESCRIPTION
1	2	6" 300# SINGER PRESSURE REDUCING VALVE
2	1	6" 300# SINGER PRESSURE RELIEF VALVE
3	2	6" 300# CLA-VAL STRAINER
4	2	6" 300# VALMATIC BALL VALVE WITH 2" OPERATING NUT
5	5	6" 300# VALMATIC BALL VALVE
6	4	6" 300# ROMAC DISMANTLING JOINT
7	6	6" VICTUALIC RIGID COUPLING
8	1	6" ORIFICE PLATE, WITH 1.73" BORE
9	3	2" VALMATIC VACUUM BREAKER VALVE
10	5	1" VALMATIC WATER AIR RELEASE VALVE
11	3	2" APOLLO FLANGED BALL VALVE
12	4	1/2" APOLLO NPT BALL VALVE
13	7	1" APOLLO NPT BALL VALVE
14	5	3/4" APOLLO HOSE CONNECTION VACUUM BREAKER
15	2	1/2" AMETEK PRESSURE TRANSDUCER
16	2	1/4" WIKA PRESSURE GAUGE





DETAIL A
SCALE 1 : 6

REV ISO VIEW

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REV.	DESCRIPTION	BY DATE	CHK DATE	APPR DATE
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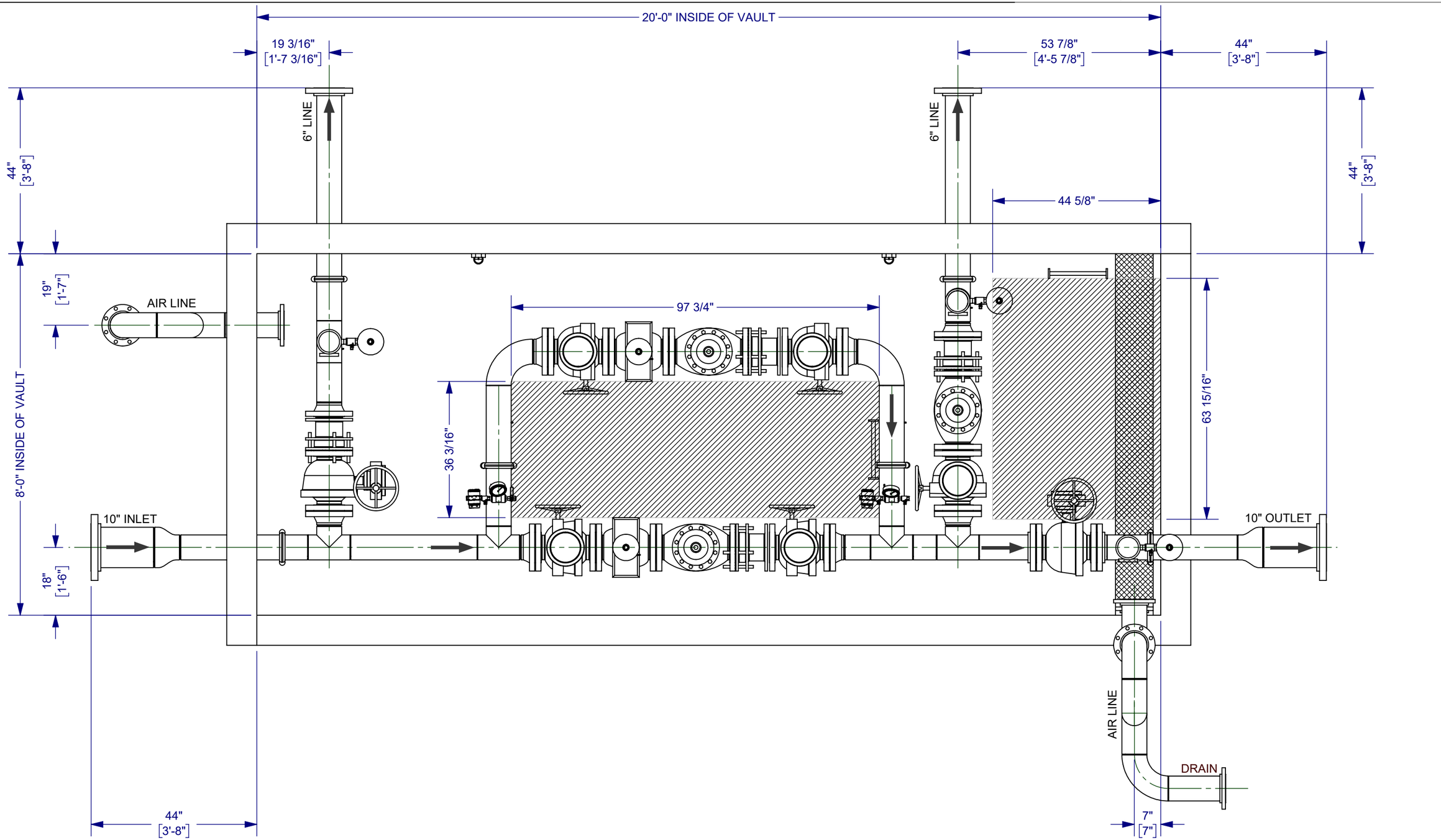
PIPESTONE EQUIPMENT

NAVAJO GALLUP WATER SUPPLY
GENERAL ARRANGEMENT DRAWING

SCALE: 1:20
PROJECT NO:
DWG NO: PE-17-0380-DWB
REV. 0



PLAN VIEW

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REFERENCE DRAWINGS

DWG. NO.	TITLE

REVISIONS

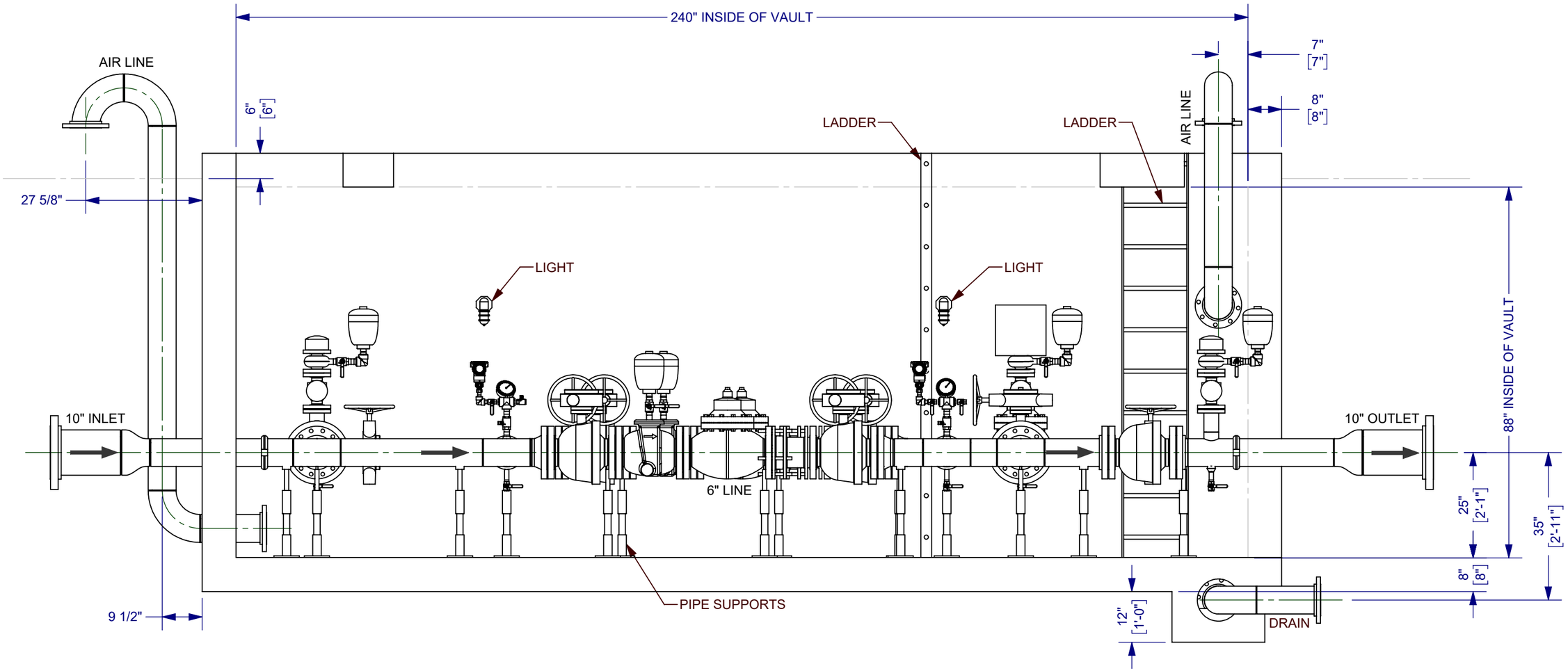
REV.	DESCRIPTION	BY DATE	CHK DATE	APPR DATE
-	-			

DRAWN BY: CAL
DATE DRAWN: 9/27/2018
CHECKED BY: KCW
DATE CHECKED: -

PIPESTONE EQUIPMENT

NAVAJO GALLUP WATER SUPPLY
GENERAL ARRANGEMENT DRAWING

SCALE: 1:25
PROJECT NO:
DWG NO: PE-17-0380-DWB
SHEET 3 OF 7
REV. **0**



ELEVATION VIEW

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2 PLACE ±.06
3 PLACE ±.031
BREAK ALL SHARP EDGES

CUSTOMER CONN TOLERANCE
UNLESS OTHERWISE SPECIFIED
FRACTIONAL: DECIMAL:
FRACTION ±1" 1 PLACE ±.1
2 PLACE ±.06
3 PLACE ±.031
BREAK ALL SHARP EDGES

REFERENCE DRAWINGS

DWG. NO.	TITLE

REVISIONS

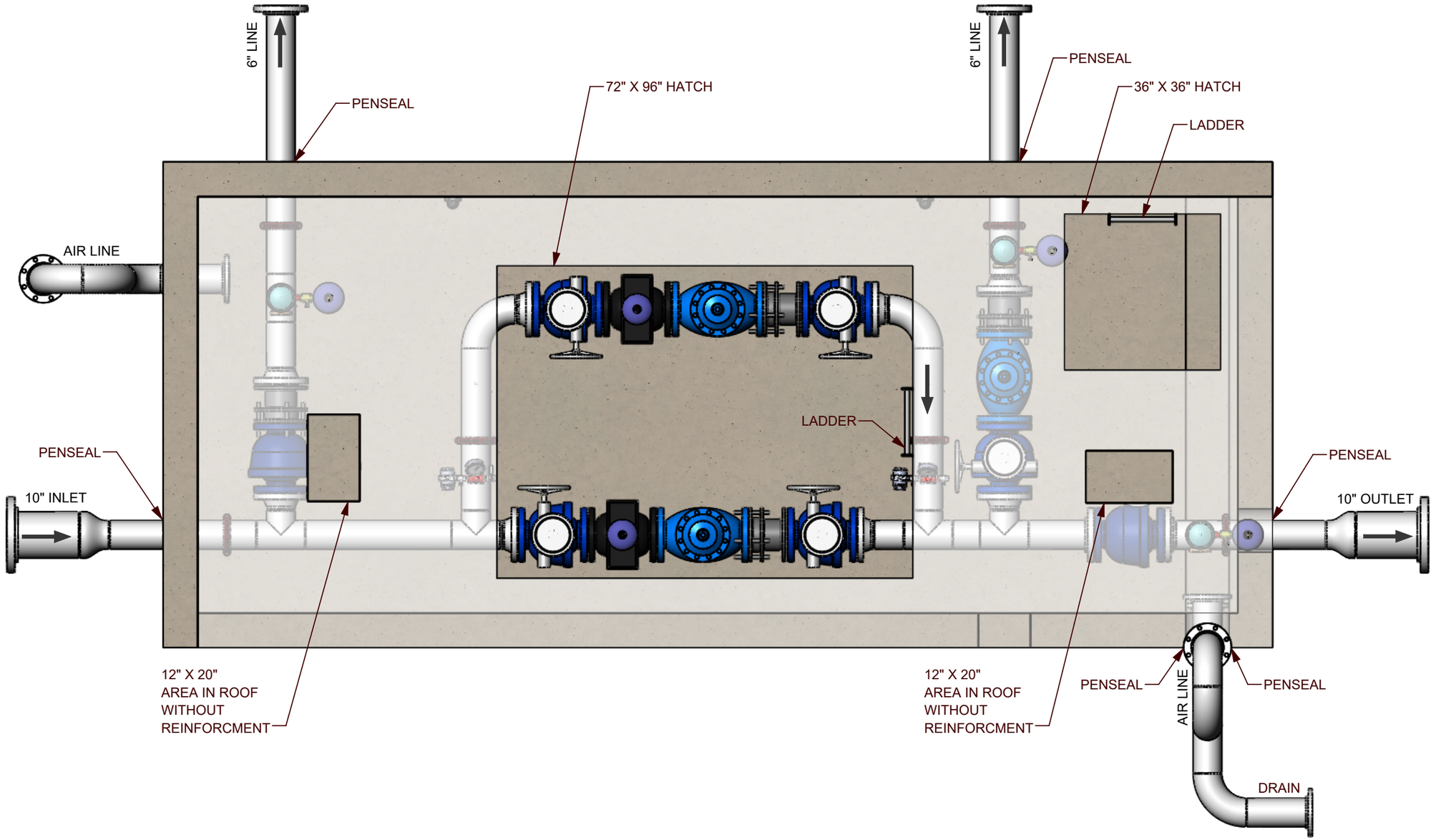
REV.	DESCRIPTION	BY DATE	CHK DATE	APPR DATE
-	-			

DRAWN BY: CAL
CHECKED BY: KCW
DATE DRAWN: 9/27/2018
DATE CHECKED: -

PIPESTONE EQUIPMENT

NAVAJO GALLUP WATER SUPPLY
GENERAL ARRANGEMENT DRAWING

SCALE: 1:25
PROJECT NO:
DWG NO: PE-17-0380-DWB
SHEET 4 OF 7
REV. **0**



COLOR PLAN VIEW

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CUSTOMER CONN TOLERANCE
UNLESS OTHERWISE SPECIFIED
FRACTIONAL: DECIMAL:
FRACTION ±1" 1 PLACE ±.1
2 PLACE ±.06
3 PLACE ±.031
BREAK ALL SHARP EDGES

REFERENCE DRAWINGS

DWG. NO.	TITLE

REVISIONS

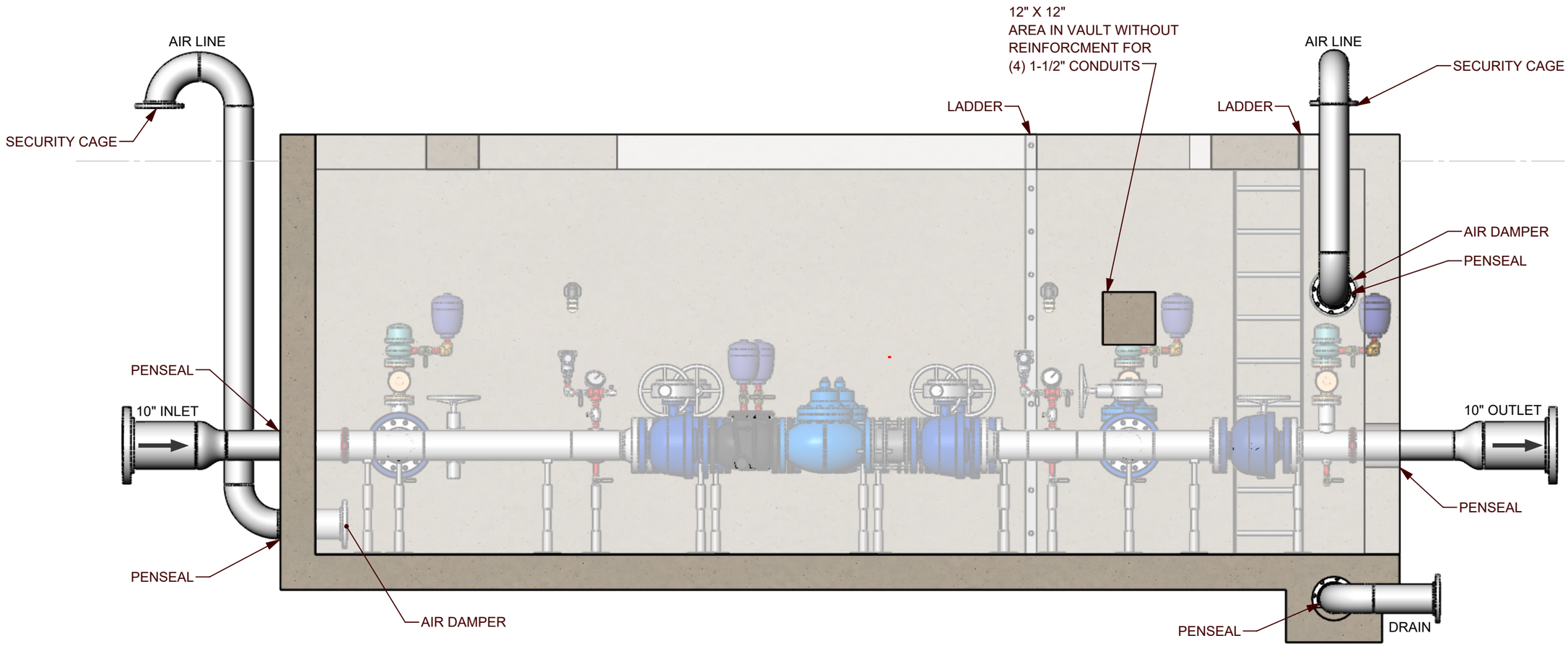
REV.	DESCRIPTION	BY DATE	CHK DATE	APPR DATE
-	-			

DRAWN BY:	CHECKED BY:
CAL	KCW
DATE DRAWN: 9/27/2018	DATE CHECKED: -

PIPESTONE EQUIPMENT

NAVAJO GALLUP WATER SUPPLY
GENERAL ARRANGEMENT DRAWING

SCALE:	PROJECT NO:	DWG NO:	REV.
1:25		PE-17-0380-DWB SHEET 5 OF 7	0



COLOR ELEVATION VIEW

PROPRIETARY AND CONFIDENTIAL
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STANDARD TOLERANCE
UNLESS OTHERWISE SPECIFIED
FRACTIONAL: DECIMAL:
FRACTION ±3/8" 1 PLACE ±.1
2 PLACE ±.06
3 PLACE ±.031
BREAK ALL SHARP EDGES

CUSTOMER CONN TOLERANCE
UNLESS OTHERWISE SPECIFIED
FRACTIONAL: DECIMAL:
FRACTION ±1" 1 PLACE ±.1
2 PLACE ±.06
3 PLACE ±.031
BREAK ALL SHARP EDGES

REFERENCE DRAWINGS

DWG. NO.	TITLE

REVISIONS

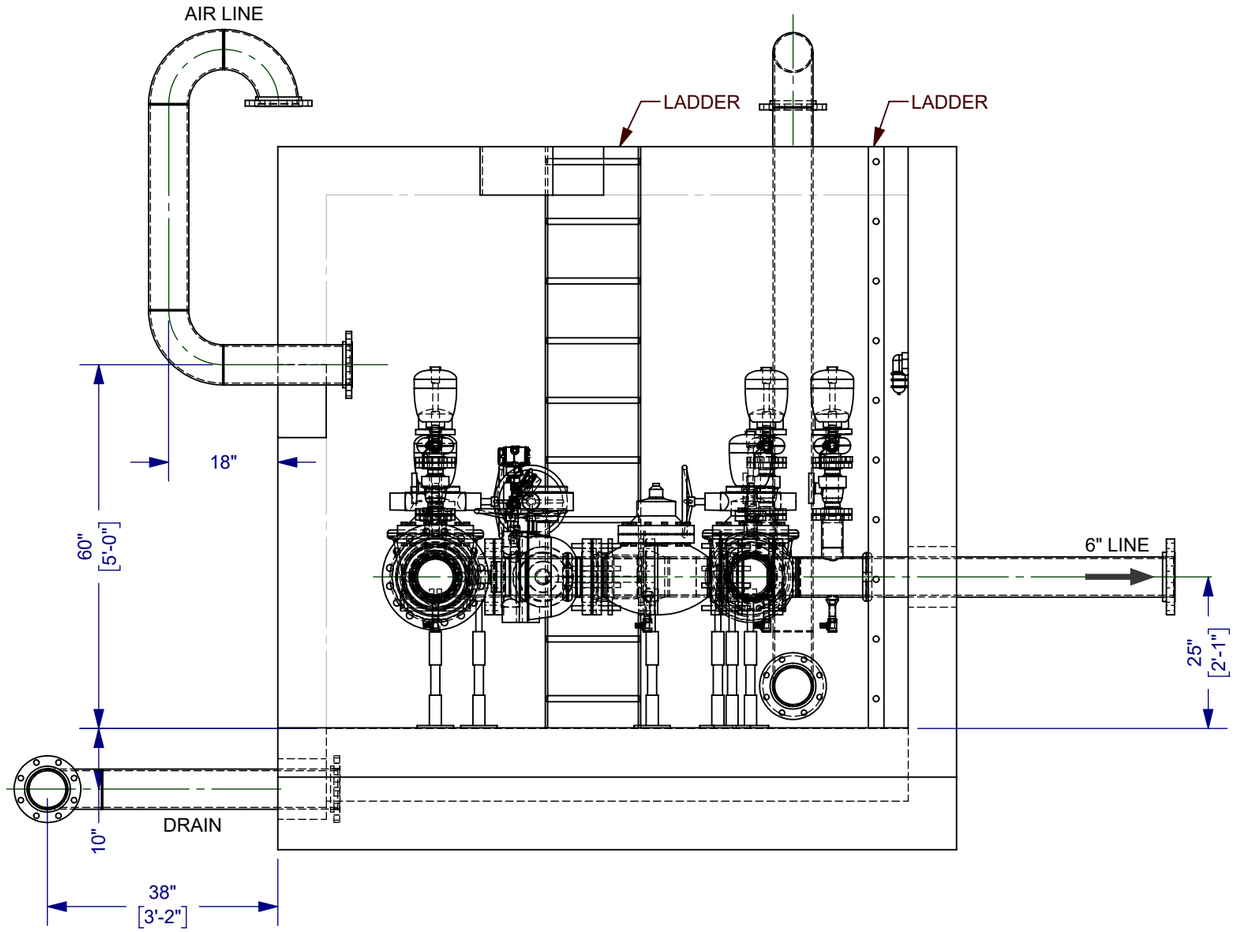
REV.	DESCRIPTION	BY DATE	CHK DATE	APPR DATE
-	-			

DRAWN BY: CAL	CHECKED BY: KCW
DATE DRAWN: 9/27/2018	DATE CHECKED: -

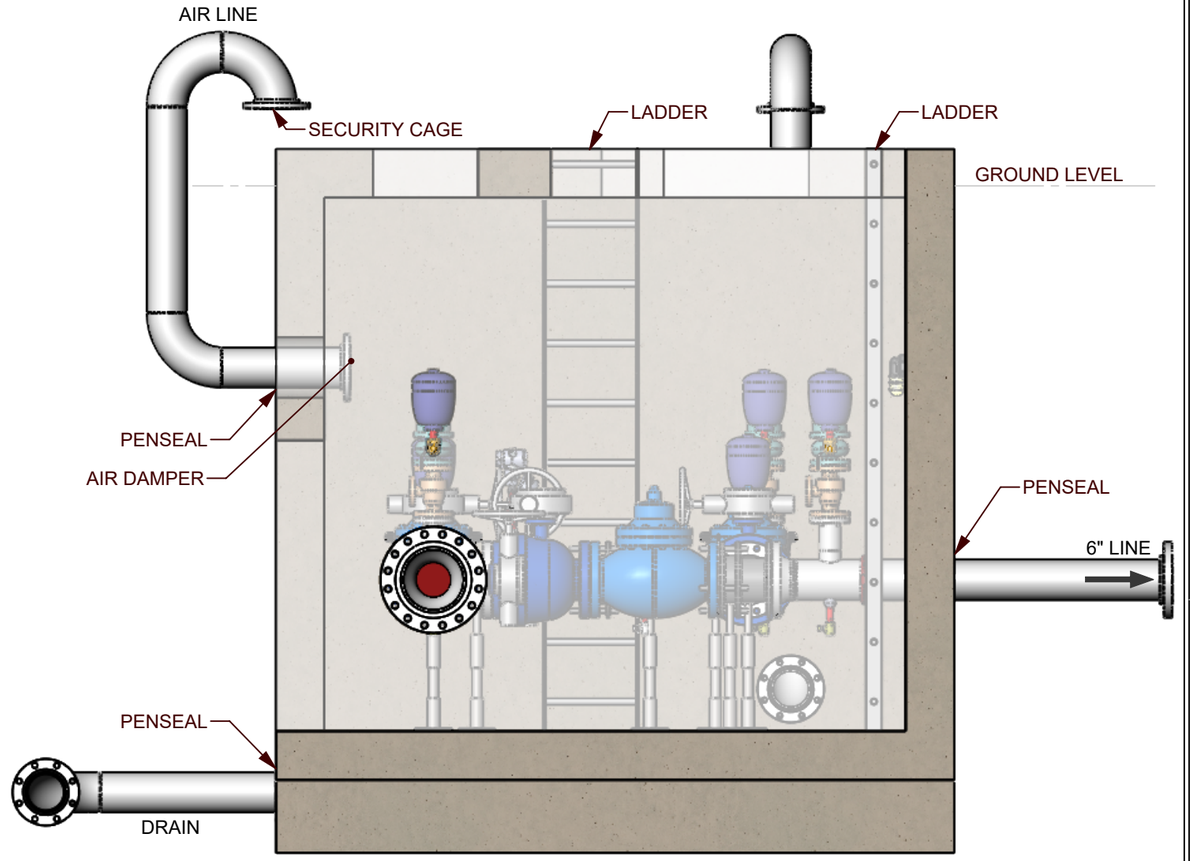
PIPESTONE EQUIPMENT

NAVAJO GALLUP WATER SUPPLY
GENERAL ARRANGEMENT DRAWING

SCALE:	PROJECT NO:	DWG NO:	REV.
1:25		PE-17-0380-DWB SHEET 6 OF 7	0



SIDE ELEVATION VIEW



COLOR SIDE ELEVATION VIEW

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STANDARD TOLERANCE
UNLESS OTHERWISE SPECIFIED
FRACTIONAL: FRACTION ±3/8"
DECIMAL: 1 PLACE ±.1; 2 PLACE ±.06; 3 PLACE ±.031
BREAK ALL SHARP EDGES

CUSTOMER CONN TOLERANCE
UNLESS OTHERWISE SPECIFIED
FRACTIONAL: FRACTION ±1"
DECIMAL: 1 PLACE ±.1; 2 PLACE ±.06; 3 PLACE ±.031
BREAK ALL SHARP EDGES

REFERENCE DRAWINGS

DWG. NO.	TITLE

REVISIONS

REV.	DESCRIPTION	BY DATE	CHK DATE	APPR DATE
-	-			

DRAWN BY: CAL
CHECKED BY: KCW
DATE DRAWN: 9/27/2018
DATE CHECKED: -

PIPESTONE EQUIPMENT

NAVAJO GALLUP WATER SUPPLY
GENERAL ARRANGEMENT DRAWING

SCALE: 1:25
PROJECT NO:
DWG NO: PE-17-0380-DWB
SHEET 7 OF 7
REV. 0

vaughn concrete products, inc.
12650 Tucson Street Henderson, Colorado 80640-9443 (303) 659-3747 Fax (303) 659-1333
2671 S. Greeley Hwy Cheyenne, Wyoming 82007-3681 (307) 634-0695 Fax (307) 634-0694
10021 Amarillo Blvd E. Amarillo, Texas 79108-7542 (806) 374-3747 Fax (806) 335-3717
Toll Free Phone (877) 827-8255 Toll Free Fax (877) 827-7363
www.vaughnconcreteproducts.com

ENGINEER'S CERTIFICATE

I, being a Registered Professional Engineer under the laws of New Mexico, hereby certify that this document was prepared by me or under my direct supervision, and is correct to the best of my knowledge and belief.

Our submittal packet was prepared for our standard size products that utilize industry standard precast production procedures and manufacturing techniques. The precast concrete products being submitted on herein may differ from that specified for this project but it is our belief they are suitable for this application.

9-20-18

P.E. No. 13161

vaughn
concrete products, inc.
12650 Tucson Street Henderson, Colorado 80640-9443 (303) 659-3747 Fax (303) 659-1333
2671 S. Greeley Hwy Cheyenne, Wyoming 82007-3681 (307) 634-0695 Fax (307) 634-0694
10021 Amarillo Blvd E. Amarillo, Texas 79108-7542 (806) 374-3747 Fax (806) 335-3717
Toll Free Phone (877) 827-8255 Toll Free Fax (877) 827-7363
www.vaughnconcreteproducts.com

REQUEST FOR DEVIATIONS

We request a thorough review of our submittal. The attached submittal packet includes product drawings that are for standard size products that utilize standard precast manufacturing techniques, materials and items that are industry standard that may differ from that shown on the project drawings.

We are submitting on the vault to be supplied with our alternate standard 20’ inside length. We request approval to supply the vault on this project as submitted on herein.

PRECAST CONCRETE VAULT

8'-0" WIDE X 20'-0" LONG X 7'-4" HIGH INSIDE DIMENSIONS

USED FOR CONTROL VALVE VAULT DETAILED ON SHEETS DT-12, DT-13 & DT-14

PIPESTONE EQUIPMENT

NAVAJO GALLUP WATER SUPPLY

PROJECT REACH 26.1

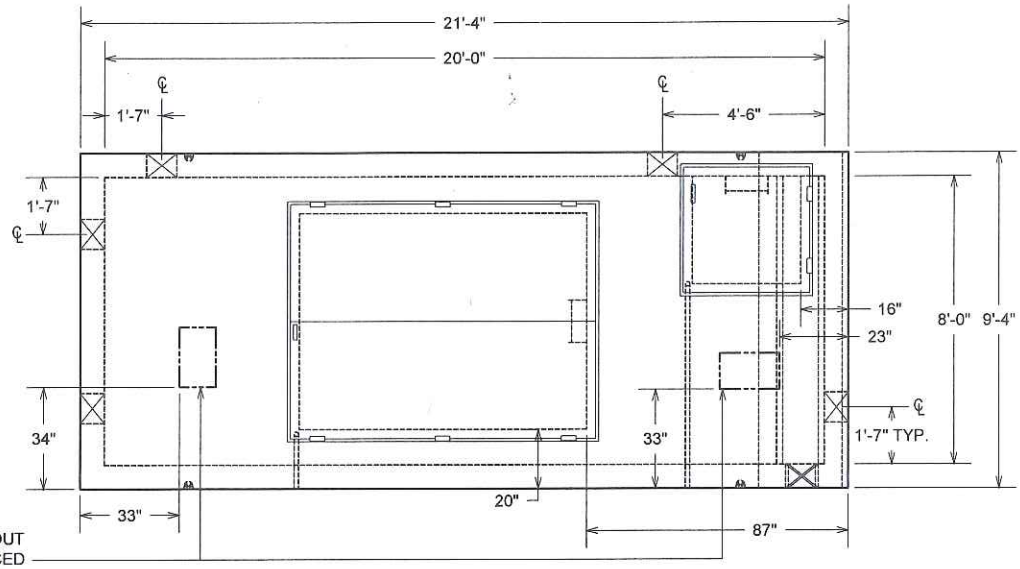
GALLUP, NM

1 REQUIRED

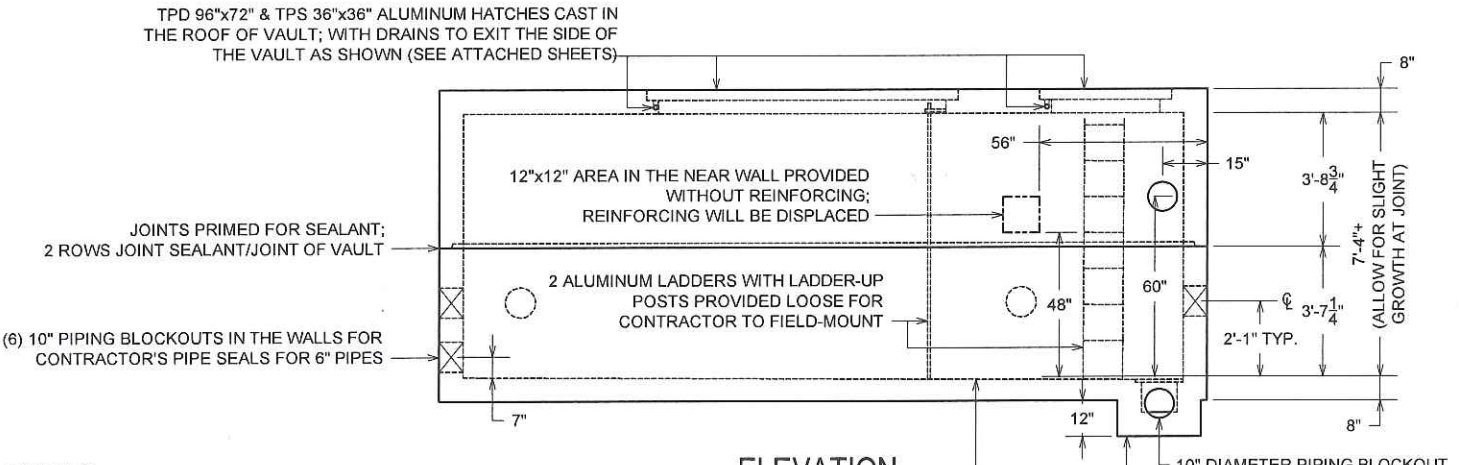
SHEET 1 OF 1

MICHAEL L. VAUGHN
NEW MEXICO
13161
PROFESSIONAL ENGINEER
9-29-18

(2) 12"x20" AREAS IN ROOF PROVIDED WITHOUT REINFORCING; REINFORCING WILL BE DISPLACED



PLAN VIEW



ELEVATION

WEIGHTS:

- BOTTOM SECTION WEIGHS APPX. 45,000 LBS.
- TOP SECTION WEIGHS APPX. 37,000 LBS.

LIFTING:

- SECTIONS TO LIFT FROM 4 RECESSED GALVANIZED LIFT BARS

NOTES:

- CONCRETE: 5000 PSI MINIMUM
- REINFORCING: GRADE 60 MINIMUM
- FLOOR, WALLS & ROOF TO BE 8" THICK
- VAULT MANUFACTURED TO SATISFY AASHTO HS-20-44 LOADINGS
- HATCHES ONLY SUITABLE FOR 300PSF PEDESTRIAN LOADINGS
- **INTERIOR WALLS & ROOF COATED WITH SHERWIN-WILLIAMS EXTERIOR WHITE PAINT PRIOR TO SHIPMENT**
- **EXTERIOR COATED WITH CS-55 DAMPPROOFING COATING PRIOR TO SHIPMENT**

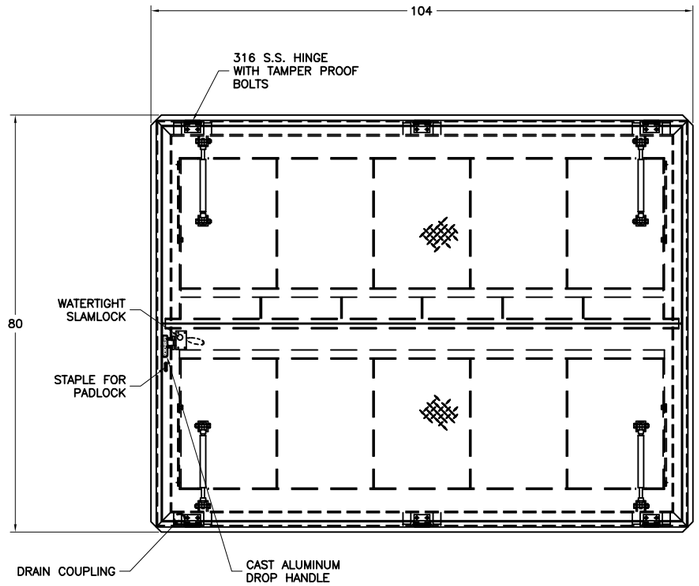
ACTUAL DIMENSIONS OF CONCRETE PRODUCTS MAY VARY SLIGHTLY

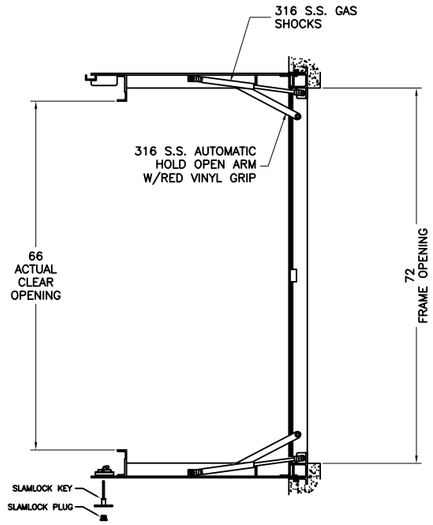
8X20 CONTROL VALVE VAULT, PIPESTONE, NAVAJO GALLUP.DWG
DATE CREATED: 9.28.18

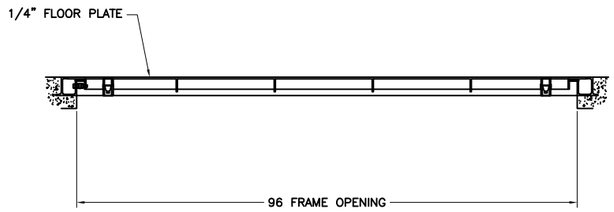
DRAWING SCALE IS 1:64

vaughn concrete products, inc.

12650 Tucson Street Henderson, Colorado 80640-9443
Toll Free (877) 827-8255 Toll Free Fax (877) 827-7363
(303) 659-3747 Fax (303) 659-1333
2671 So. Greeley Hwy Cheyenne, Wyoming 82007-3681 (307) 634-0695
10021 Amarillo Blvd. East Amarillo, Texas 79108-7542 (806) 374-3747

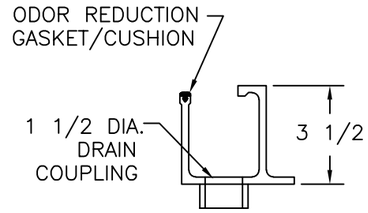






SELECTED FEATURES
1. S.S GAS SHOCKS
2. SLAMLOCK

NOTES
1. MATERIAL: ALUMINUM
2. FINISH: MILL
3. LOADING: 300 PSF
4. 316 SS NUTS & BOLTS
5. APPROX HATCH WT: 425.93 LBS



1/4" EXTRUDED TROUGH SECTION
W/INTEGRAL CONT. ANCHOR FLANGE
& GROOVE FOR GASKET/CUSHION
FRAME MAT'L: ALUMINUM 6063–T5

FRAME DETAIL

NOTE:
AS AN AUTOMATED DRAWING, THE DESIGN HAS NOT BEEN REVIEWED BY USFF ENGINEERING AND IS THEREFORE TO BE USED FOR REFERENCE ONLY. USFF RESERVES THE RIGHT TO ADJUST DIMENSIONS TO INSURE ADHERENCE TO CUSTOMER REQUIREMENTS AND PROPER OPERATION OF THE PRODUCT.

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INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M

BREAK ALL SHARP CORNERS & EDGES TO 0.01

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL
INCHES = ± 1/16
1/16 = ± 1/32
1/32 = ± 1/64

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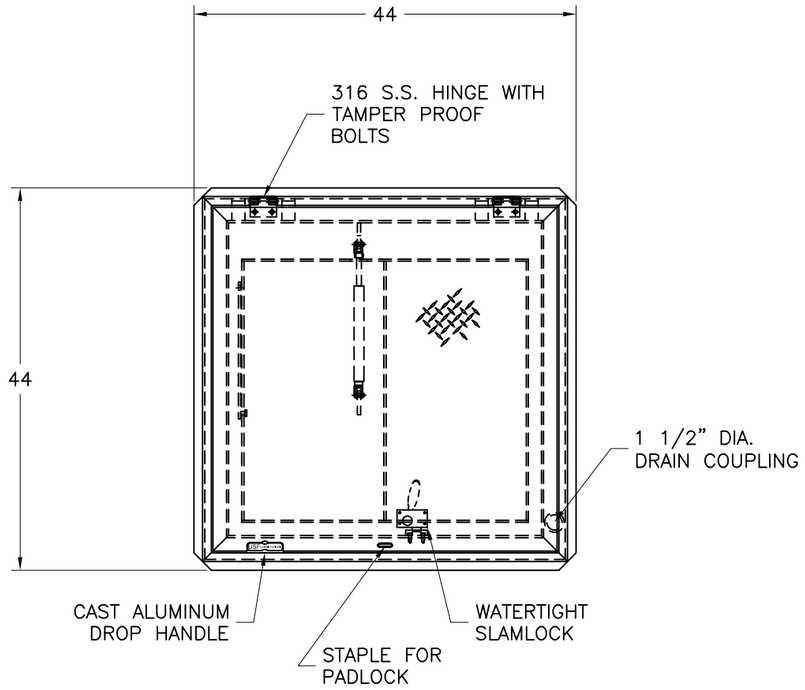
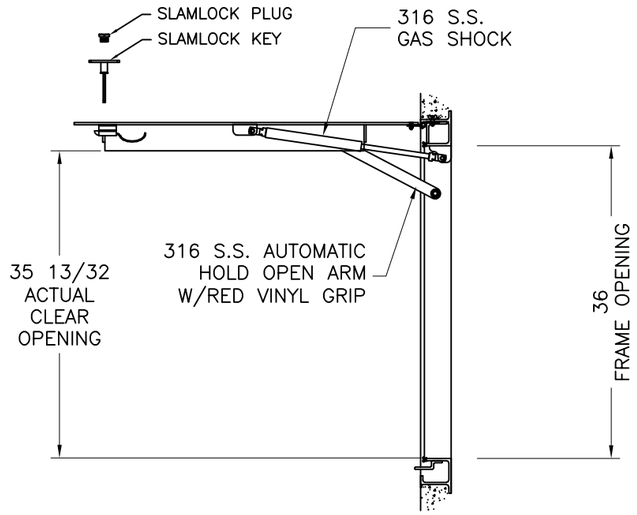
HIALEAH, FL

HATCH TPD 96 X 72 ALUM

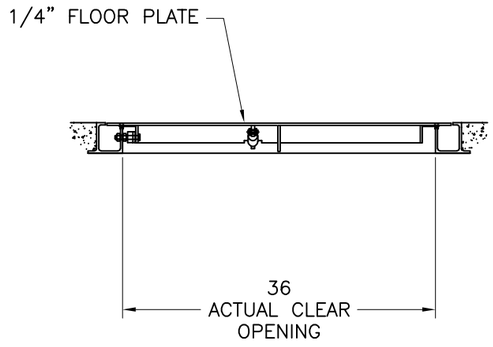
DWN. BY:	SCALE:	SHEET:	DATE:
BOB	1:40	1 OF 1	11/06/17
CHK. BY:	DWG #	SHEET SIZE:	REV:
BOB	1000086777	A	0

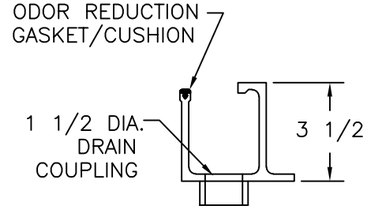




SELECTED FEATURES
1. S.S GAS SHOCKS
2. SLAMLOCK

NOTES
1. MATERIAL: ALUMINUM
2. FINISH: MILL
3. LOADING: 300 PSF
4. 316 SS NUTS & BOLTS
5. APPROX HATCH WT: 134.67 LBS





1/4" EXTRUDED TROUGH SECTION
W/INTEGRAL CONT. ANCHOR FLANGE
& GROOVE FOR GASKET/CUSHION
FRAME MAT'L: ALUMINUM 6063–T5

FRAME DETAIL

NOTE:
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INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M

BREAK ALL SHARP CORNERS & EDGES TO 0.01

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL
INCHES = ± 1/16
1/16 = ± 1/32
1/32 = ± 1/64

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HIALEAH, FL

HATCH TPS 36 X 36 ALUM

DWN. BY:	SCALE:	SHEET:	DATE:
BOB	1:24	1 OF 1	11/06/17
CHK. BY:	DWG #	SHEET SIZE:	REV:
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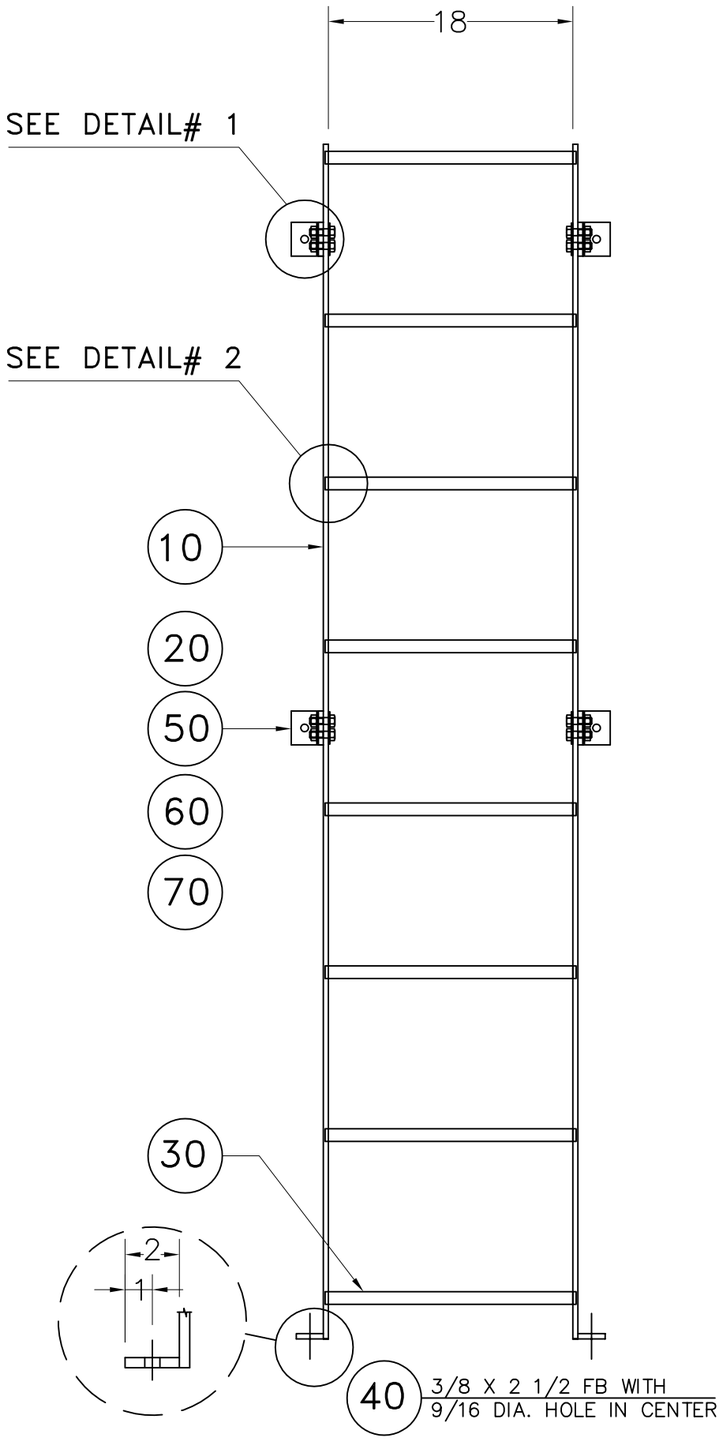
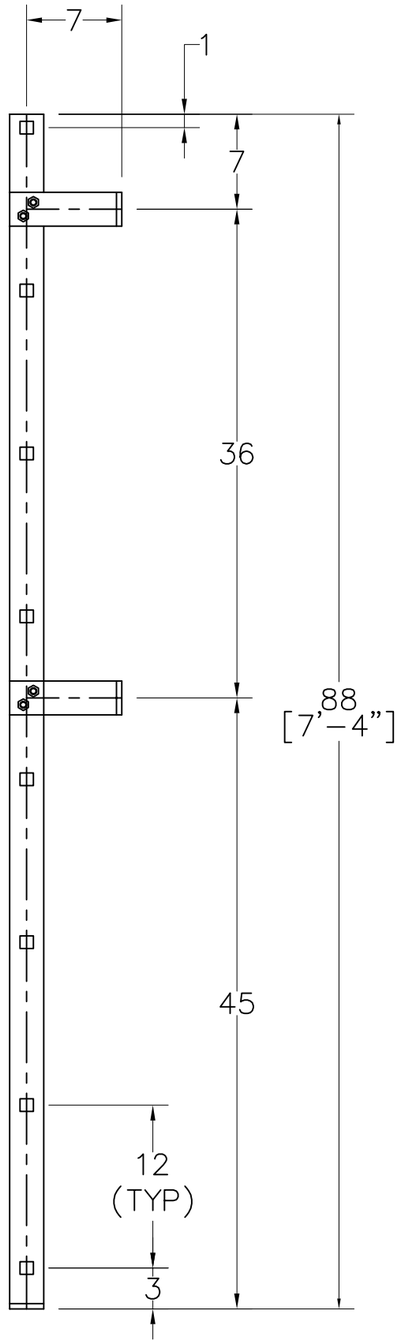
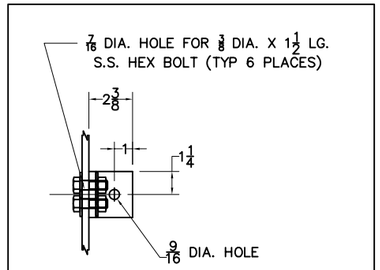
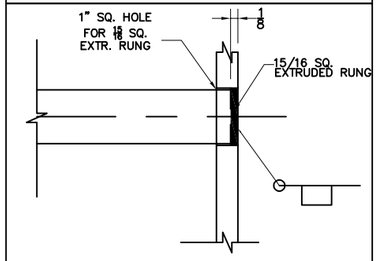


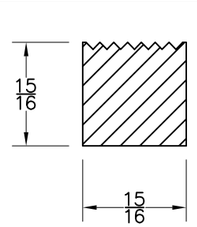




DETAIL #1



DETAIL# 2



RUNG DETAIL

NOTE:

1– MATERIAL: ALUMINUM

2– APPROX. WEIGHT: 35 LBS.

INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M

BREAK ALL SHARP CORNERS & EDGES TO 0.01

TOLERANCES UNLESS OTHERWISE SPECIFIED:

INCHES = ± 1/16
1/16 = ± 1/32
1/32 = ± 1/64

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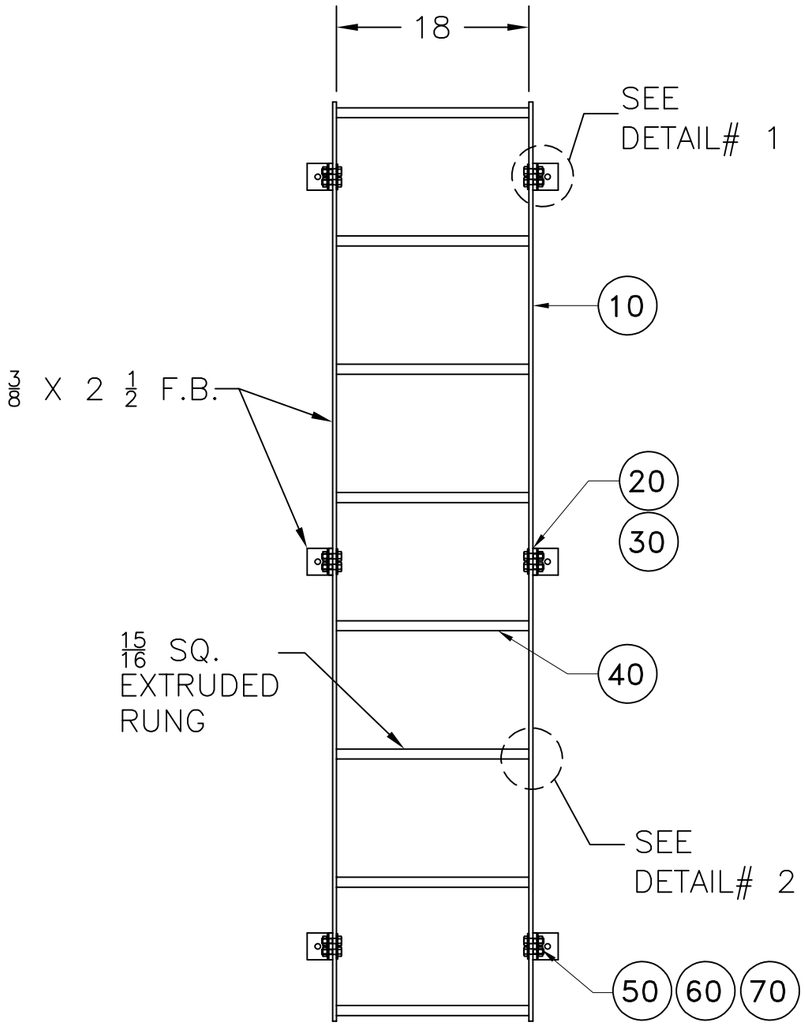
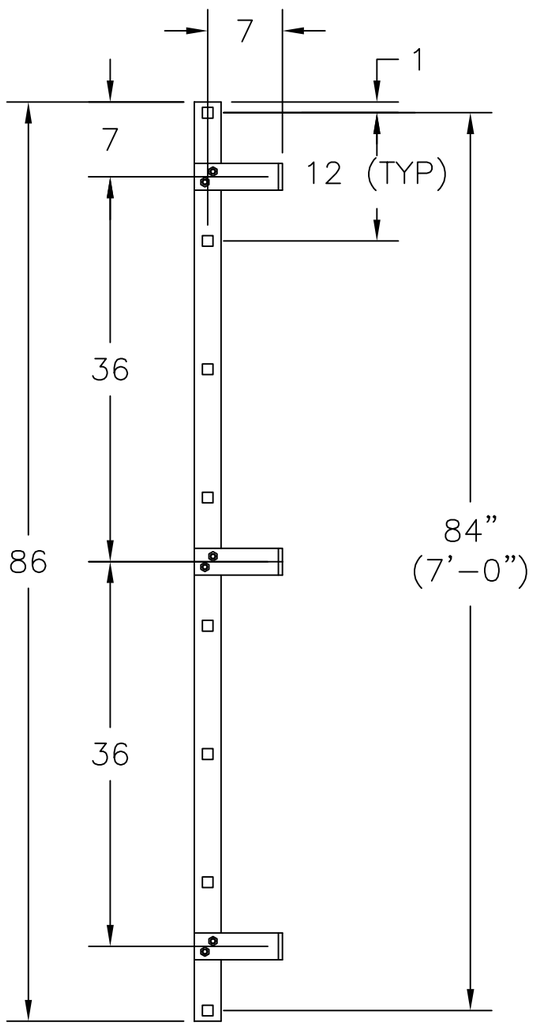
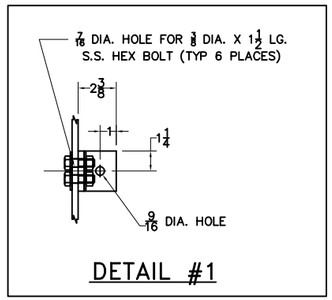
U.S.F. FABRICATION INC.
HIALEAH, FLORIDA

ALUMINUM LADDER – FLOOR MOUNTED 7'–4" LG.(OVERALL)

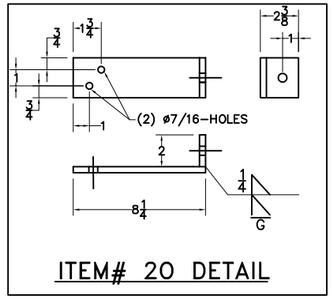
DRAWN BY:	SCALE:	SHEET:	DATE:
RT	1:16	1 OF 1	08/30/16
APP'D BY:	DWG. NO:	SHEET SIZE:	REV:
RT	1000042796	B	0



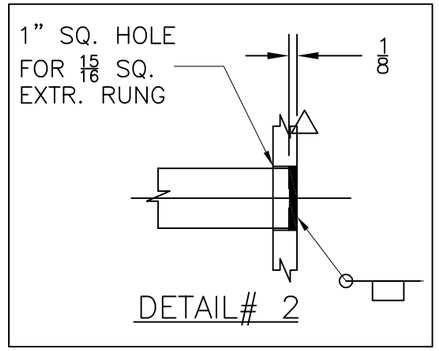




DETAIL #1



ITEM# 20 DETAIL



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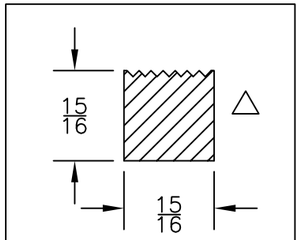

RUNG DETAIL

NOTES:
1- MATERIAL: ALUMINUM
2- APPROXIMATE WEIGHT: 37 LBS.

REV.	DATE	BY	CHK.	DESCRIPTION
3	09/26/16	A.Q.	A.Q.	ADDED B.O.M
2	05/18/16	A.Q.	A.Q.	STAND OFF NOW ARE BOLTING.

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INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M

BREAK ALL SHARP CORNERS & EDGES TO 0.01

TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONAL

INCHES = ± 1/16
1/16 = ± 1/32
1/32 = ± 1/64

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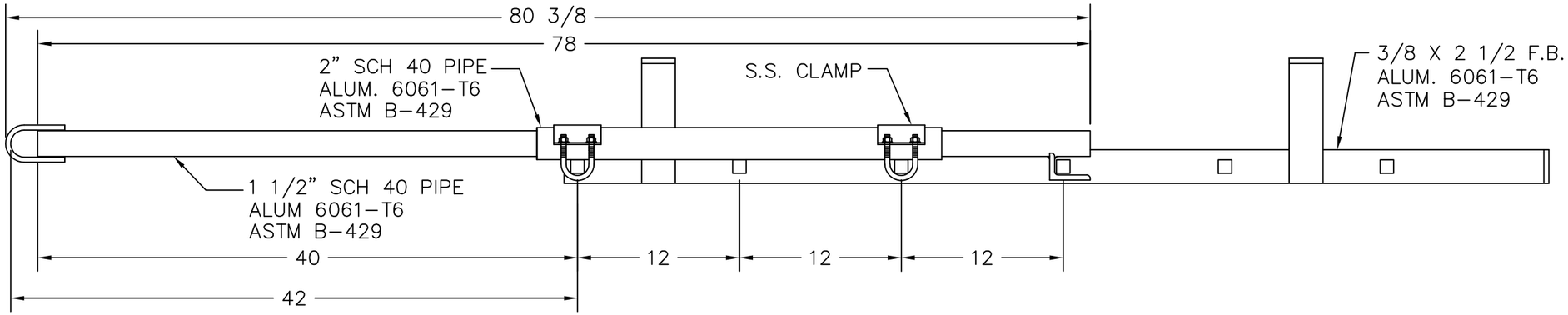
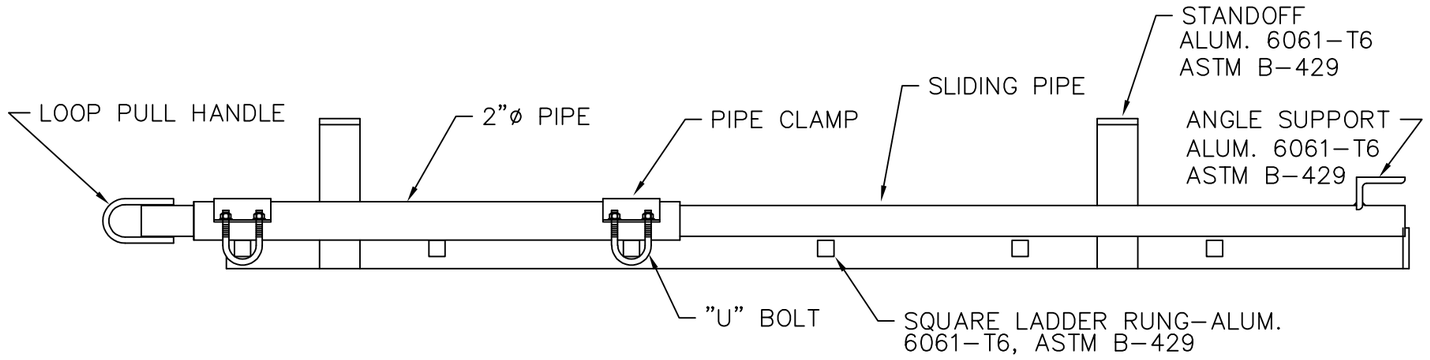
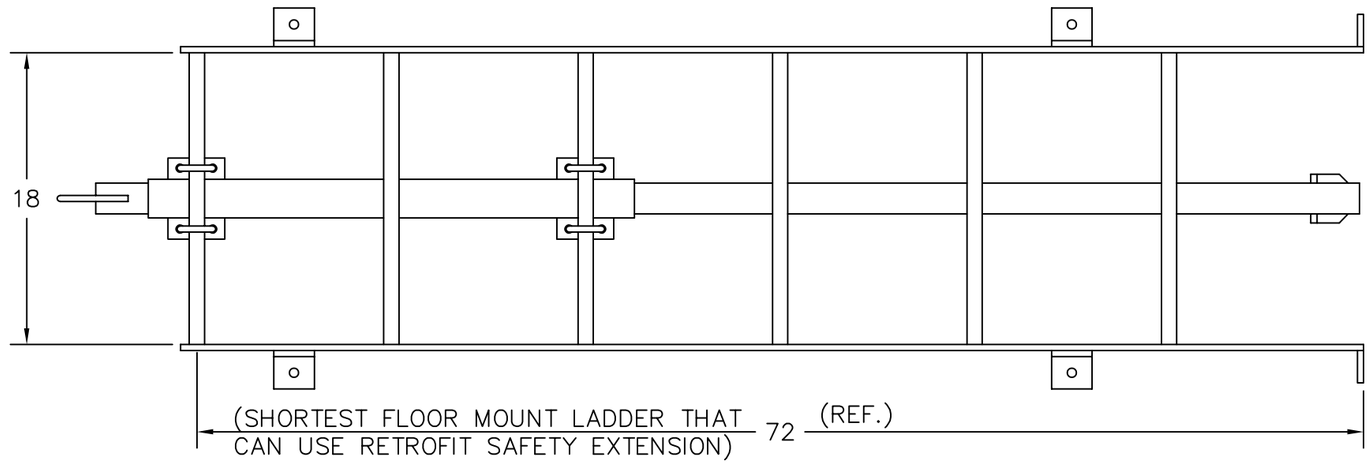
U.S.F. FABRICATION INC.
HIALEAH, FLORIDA

LADDER WALL 7'-0

DWN. BY:	SCALE:	SHEET:	DATE:
AQ/ALJ	1=16	1 OF 1	8/3/15
CHK. BY: OR/ALJ	DWG.# 1000001049	SHEET SIZE: B	REV: 3







INSTALLATION & OPERATION INSTRUCTIONS

INSTALLATION INSTRUCTIONS:

1- PLACE THE LADDER ON A FLAT SURFACE WITH THE STANDOFFS FACING UP.

2- LAY THE SLIDING PIPE ASSEMBLY IN THE CENTER OF THE SQUARE LADDER RUNGS WITH THE PULL LOOP AT THE TOP OF THE LADDER.

3- PLACE THE (2) PIPE CLAMPS OVER THE 2"ø PIPE CENTERED ON THE FIRST AND THIRD RUNGS OF THE LADDER.

4- PLACE THE (4) "U" BOLTS OVER THE SQUARE RUNGS AND THROUGH THE HOLES IN THE PIPE CLAMPS.

5- TIGHTEN ALL THE "U" BOLT NUTS APPLYING 10 – 15 FT LB. TORQUE TO EACH.

6- VERIFY THAT THE EXTENSION ASSEMBLY IS ATTACHED SECURELY TO THE LADDER.

OPERATION INSTRUCTIONS:

1- TO ENGAGE THE SAFETY LADDER EXTENSION, GRASP THE LOOP HANDLE AT THE TOP OF THE SLIDING PIPE ASSEMBLY AND PULL STRAIGHT UP UNTIL THE ANGLE AT THE BOTTOM OF THE SLIDING PIPE PASSES THE SQUARE LADDER RUNG ON WHICH YOU WANT IT TO SEAT.

2- ROTATE THE SLIDING PIPE 180 DEG. AND LOWER THE ANGLE UNTIL IT SEATS SECURELY ON THE SQUARE LADDER RUNG.

3- VERIFY THAT THE EXTENSION IS SECURELY SEATED BEFORE STEPPING ONTO THE LADDER.

APPROXIMATE WEIGHT: 13 LBS.
MATERIAL: ALUMINUM

INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M

BREAK ALL SHARP CORNERS & EDGES TO 0.01

TOLERANCES UNLESS OTHERWISE SPECIFIED:
INCHES = ± 1/16
1/16 = ± 1/32
1/32 = ± 1/64

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U.S.F. FABRICATION INC.
HIALEAH, FLORIDA

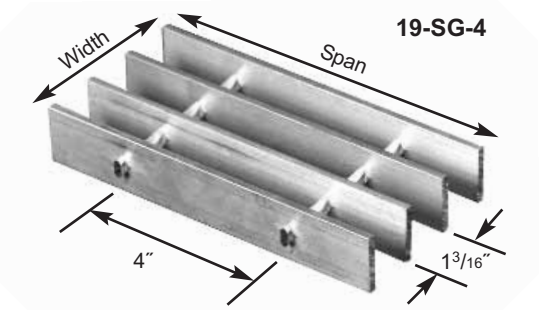
RETROFIT SAFETY EXTENSION FOR LADDER – ASSEMBLY DETAIL

DRAWN BY:	SCALE:	SHEET:	DATE:
RT	1=10	1 OF 2	10/19/15
APP'D BY:	DWG. NO:	SHEET SIZE:	REV:
RT	1000001804	B	0

19 SPACE

1" TALL ALUMINUM GRATING USED FOR SUMP GRATE

ALUMINUM **RECTANGULAR BAR** – 19-SG-4



% Open Area*		
Bars	1/8″	3/16″
4″ cc	85%	80%
2″ cc	81%	77%

ConSeal™ CS-55

Water Based Acrylic Coating

Water Based Damp Proof Coating for All Concrete Structures

Applications

For use on most concrete structures.

Sealing Properties

- Fast drying concrete damp-proof coating.
- Can be applied effectively with a brush, paint roller or sprayer.
- Soap and water clean up.
- Environmentally responsible. VOC content as low as 59 g/L.
- Suitable for indoor application without specialized paint areas.
- Nearly three times the coverage of typical tar or asphalt based products (300 - 350 sq. ft. per gallon).
- Smooth, hard, polymer film that protects against water intrusion.
- Wide range of standard colors.
- Custom colors available upon request.
- Recycled Content, % by weight:
  - Post Industrial: 17%

Specifications

ConSeal CS-55 complies with E.P.A. regulation 40CFR261.4 for solid waste management. CS-55 is made with environmentally safe ingredients; disposal of containers does not present environmental problems.

Immersion Testing

One Year Immersion Testing: No visible deterioration when tested in 5% Caustic Potash, 5% Hydrochloric Acid, 5% Sulfuric Acid, and 5% Hydrogen Sulfide.

Technical Data

Heavy Metals Testing

Parameter	EPA Limit	CS-55
Arsenic	5ppm	BDL
Barium	100ppm	1.12ppm
Cadmium	1ppm	BDL
Chromium	5ppm	BDL
Lead	5ppm	BDL
Mercury	0.2ppm	BDL
Selenium	1ppm	BDL
Silver	5ppm	BDL

Don't Just Seal It, ConSeal It!

© 2013 Concrete Sealants, Inc.

Concrete Sealants, Inc. 9325 State Route 201 ■ Tipp City, OH 45371 ■ **Toll Free** 800.332.7325
P. 937.845.8776 **F.** 937.845.3587 ■ **www.conseal.com**

ISO 9001 Registered

ConSeal™ CS-55

Water Based Acrylic Coating

ConSeal™ Concrete Sealants Inc.

Water Based Damp Proof Coating for Concrete

Technical Data Continued

Scrape Adhesion Performance

Film Millage	Asphalt Coating 0.071”	CS-55 0.0038”
Force	**Result**	**Result**
500g	Passed with minimal damage	Passed with no damage
1000g	Failed 2/3rds of coating scraped off	Passed with no damage
1500g	Failed, complete film removal	Passed with minimal damage
2000g	Failed, complete film removal	Passed with minimal damage
2500g	Failed, complete film removal	Passed with minimal damage

Limited Warranty

This information is presented in good faith, but we cannot anticipate all conditions under which this information and our products, or the products of other manufactures in combination with our products, may be used. We accept no responsibility for results obtained by the application of this information or the safety and suitability of our products, either alone or in combination with other products. Users are advised to make their own tests to determine the safety and suitability of each such product or product combinations for their own purposes. It is the **users' responsibility** to satisfy himself as to the suitability and completeness of such information for this own particular use. We sell this product without warranty, and buyers and users assume all responsibility and liability for loss or damage arising from the handling and use of this product, whether used alone or in combination with other products.

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ISO 9001 Registered

vaughn
concrete products, inc.

12650 Tucson Street Henderson, Colorado 80640-9443 (303) 659-3747 Fax (303) 659-1333
2671 S. Greeley Hwy Cheyenne, Wyoming 82007-3681 (307) 634-0695 Fax (307) 634-0694
10021 Amarillo Blvd E. Amarillo, Texas 79108-7542 (806) 374-3747 Fax (806) 335-3717
Toll Free Phone (877) 827-8255 Toll Free Fax (877) 827-7363
www.vaughnconcreteproducts.com

MIX DESIGN

General: Type III Portland Cement Will Be Used.
(See Attached Mill Certification Sheet)

Mix Design B:

Each Yard Of Concrete Contains:

700 lbs.	**Type III Portland Cement**
1620 lbs.	**Coarse Aggregate**
1300 lbs.	**Fine Aggregate**

Water Based On Admixture
24-28 gal. w/ 50 oz. ViscoCrete 2110 Admixture

This Mix Design Is Used To Yield A Minimum 28 Day Compressive Strength Of 5000 PSI.

Aggregate Industries
Technical Services Department

Vaughn Concrete Products Gradation Report
July 2018

AGGREGATE INDUSTRIES

Plant Platte Valley										
Concrete Sand		No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	Pan	Fineness
										Modulus
07/09/2018		100.0	91.0	63.5	38.8	15.4	3.9	1.0	0.0	2.87
07/10/2018		100.0	90.9	65.4	40.4	18.0	4.7	0.8	0.0	2.81
07/11/2018		100.0	92.0	67.1	39.4	17.3	4.1	1.2	0.0	2.80
07/12/2018		100.0	93.4	68.1	37.0	16.9	3.8	0.7	0.0	2.81
07/13/2018		100.0	91.8	67.9	38.4	18.2	2.4	0.9	0.0	2.81
07/16/2018		100.0	92.0	65.7	36.0	17.3	2.4	0.8	0.0	2.87
07/17/2018		100.0	92.7	66.3	35.9	16.7	2.9	0.6	0.0	2.86
07/18/2018		100.0	93.8	67.1	37.9	17.0	2.9	1.2	0.0	2.81
07/19/2018		100.0	92.8	64.4	34.7	13.0	3.6	0.5	0.0	2.92
07/20/2018		100.0	91.0	65.9	35.4	14.0	2.6	1.0	0.0	2.91
07/23/2018		100.0	90.9	66.7	33.0	12.8	1.9	0.3	0.0	2.95
07/24/2018		100.0	92.7	65.0	34.4	13.3	2.9	0.8	0.0	2.92
07/25/2018		100.0	93.3	67.4	35.3	14.0	2.6	0.8	0.0	2.87
07/26/2018		100.0	91.9	66.9	34.2	13.9	2.6	0.8	0.0	2.91
07/27/2018		100.0	91.0	63.1	36.4	14.9	3.7	0.9	0.0	2.91
07/30/2018		100.0	90.0	62.4	38.2	16.4	3.4	1.1	0.0	2.90
07/31/2018		100.0	92.3	64.4	37.9	15.3	2.9	1.1	0.0	2.87
	Average	100.0	92.0	65.7	36.7	15.6	3.1	0.9	0.0	2.87
	Std Dev For Avg	0.0	1.1	1.7	2.1	1.8	0.7	0.2	0.0	0.05

Aggregate Industries
Technical Services Department

Vaughn Concrete Products Gradation Report
July 2018

Plant:Platte Valley							
#67		1 in.	3/4 in.	1/2 in.	3/8 in.	No. 4	No. 8
07/09/2018		100.0	90.0	39.8	20.0	5.6	1.8
07/10/2018		100.0	94.8	53.7	26.4	3.3	1.1
07/11/2018		100.0	93.7	50.2	27.9	3.1	1.0
07/13/2018		100.0	95.0	51.7	25.2	2.9	1.1
07/16/2018		100.0	94.7	52.3	26.9	2.6	0.9
07/17/2018		100.0	90.4	38.7	20.6	2.0	1.3
07/18/2018		100.0	91.0	40.4	21.9	2.3	0.8
07/19/2018		100.0	90.0	39.9	20.6	2.0	1.1
07/20/2018		100.0	92.0	38.0	22.0	1.9	1.0
07/23/2018		100.0	91.6	40.2	21.0	2.3	1.3
07/24/2018		100.0	91.6	38.4	22.9	2.1	1.0
07/25/2018		100.0	90.4	39.1	20.4	2.3	1.0
07/26/2018		100.0	92.3	40.4	21.9	2.6	1.1
07/27/2018		100.0	90.0	37.4	20.7	2.1	0.9
07/30/2018		100.0	91.0	39.9	22.0	2.0	0.9
07/31/2018		100.0	92.0	36.9	20.0	1.9	0.8
	Average	100.0	91.9	42.3	22.5	2.6	1.1
	Std Dev For Avg	0.0	1.8	5.9	2.6	0.9	0.2

P.O. Box 529
Lyons, CO 80540
Plant (303) 823-2100
Sales (303) 475-3988

CEMENT MILL TEST REPORT

Cement Identified as:

Plant: CEMEX Lyons Cement **TYPE III & HE CEMENT** **Date: 9/14/2018**
Location: Lyons, CO
Production Dates:

Beginning: August 1, 2018
Ending: August 31, 2018

STANDARD CHEMICAL REQUIREMENTS (ASTM C114)	TEST RESULTS	ASTM C150 SPEC.	TYPE III	ASTM C1157 SPEC.	TYPE HE
Silicon Dioxide (SiO_2), %	**20.4**		----		----
Aluminum Oxide (Al_2O_3), %	**4.5**		----		----
Ferric Oxide (Fe_2O_3), %	**3.0**		----		----
Calcium Oxide (CaO), %	**63.4**		----		----
Magnesium Oxide (MgO), %	**1.0**	Maximum	6.0		----
Sulfur Trioxide (SO_3), % **	**3.9**	Maximum	3.5**		----
Loss on Ignition (LOI), %	**2.8**	Maximum	3.5		----
Insoluble Residue, %	**0.38**	Maximum	1.5		----
Alkalies (Na_2O equivalent), %	**18.62**		----		----
Tricalcium Silicate (C_3S), % *	**49**		----		----
Dicalcium Silicate (C_2S), % *	**20**		----		----
Tricalcium Aluminate (C_3A), % *	**7**	Maximum	15		----
Tetracalcium Aluminoferrite (C_4AF), % *	**9**		----		----
($C_4AF + 2C_3A$) or ($C_4AF + C_2F$), %	**22**		----		----
CO_2, %	**1.9**		----		----
Limestone, %	**7.0**	Maximum	5.0		----
$CaCO_3$ in Limestone, %	**93**	Minimum	70		----
PHYSICAL REQUIREMENTS					
(ASTM C 204) Blaine Fineness, cm^2/gm	**5260**		----		----
(ASTM C 430) -325 Mesh, %	**99.1**		----		----
(ASTM C 191) Time of Setting (Vicat)					
Initial Set, minutes	**95**	Min. - Max.	45 - 375	Min. - Max.	45 - 420
Final Set, minutes	**190**		----		----
(ASTM C 451) False Set, %	**73**	Minimum	50	Minimum	50
(ASTM C 185) Air Content, %	**7**	Maximum	12	Maximum	----
(ASTM C 151) Autoclave Expansion, %	**-0.04**	Maximum	0.80	Maximum	0.80
(ASTM C 187) Normal Consistency, %	**28.2**		----		----
(ASTM C 1038) Expansion in Water, %	**0.006**	Maximum	0.020	Maximum	0.020
(ASTM C 109) Compressive Strength, psi (MPa)	psi / MPa				
1 Day	**3820 / 26.3**	Minimum	1740 (12.0)	Minimum	1450 (10)
3 Day	**5010 / 34.5**	Minimum	3480 (24.0)	Minimum	2470 (17)
7 Day	**6200 / 42.7**		----		----

*** Note D in Table 1 of ASTM C150-17 allows for additional sulfate, provided expansion as measured by ASTM C1038 does not exceed 0.020%.*

** Adjusted for Limestone Addition per ASTM C 150-17, A1.6*

CEMEX hereby certifies that this cement meets or exceeds the chemical and physical Specifications of:

ASTM C150 - 17 for Type III Portland Cement
ASTM C1157 - 11 for Type HE Hydraulic Cement

By:
Timothy W. Rawlsky
Quality Control Manager
CEMEX - Lyons Cement Plant

Sika ViscoCrete® Technology

Sika® ViscoCrete® 2110

High Range Water Reducing Admixture

Construction

Description

Sika ViscoCrete 2110 is a high range water reducer and superplasticizer utilizing Sika's ViscoCrete' polycarboxylate polymer technology. Sika ViscoCrete 2110 meets the requirements for ASTMC-494 Types A and F and AASHTO M-194 Types A and F.

Applications

Sika ViscoCrete 2110 may be used in both ready mix and precast applications, as a plant added high range water reducer to provide excellent plasticity while maintaining slump for up to 90 minutes. Controlled set times make Sika ViscoCrete 2110 ideal for horizontal and vertical applications. Sika ViscoCrete 2110 is ideal for production of Self Consolidating Concrete (SCC).

Advantages

Sika ViscoCrete 2110 can be used for all levels of water reduction in various types of concrete ranging from dry cast applications, conventional concrete to SCC (Self Consolidating Concrete). Sika ViscoCrete 2110 will deliver water reduction up to 45% The special formulation of Sika ViscoCrete 2110 increases compressive strength of concrete and helps maintain the plasticity of the concrete over prolonged period of time. Sika ViscoCrete 2110 extends concrete workability time during warmer months when slump loss and fast stiffening of the fresh concrete can be a concern. The superplasticizing action of Sika ViscoCrete 2110 provides high slump / flowing concrete that can be placed with minimal or no vibration even at very low water cement ratios as low as 0.25.

Water Reduction: Sika ViscoCrete 2110 can be dosed in small amounts to obtain water reduction from 10-15%, and will achieve water reduction up to 45% at high dosage rates. Sika ViscoCrete 2110 is suitable for all levels of water reduction.

Plasticizing effect: The superplasticizing action of Sika ViscoCrete 2110 provides high-slump, flowing concrete that maintains excellent workability and may be placed with minimal vibration even at very low water cement ratio's as low as 0.25. Sika ViscoCrete 2110 plasticized concrete is highly fluid while maintaining complete cohesion within the concrete matrix to eliminate excessive bleeding or segregation.

Extended Slump Life and Set Control: Sika ViscoCrete 2110 has been formulated to provide controlled and predictable extended slump life for periods of 60 to 90 minutes with normal set times. The combined high range water reduction and superplasticizing action of Sika ViscoCrete 2110 provide the following benefits in hardened concrete:

Higher ultimate strengths allow for greater engineering design flexibility and structural economy. Reduced water cement ratios produce more durable, dense concrete with reduced permeability. Highly effective plasticizer reduces surface defects in concrete elements and improves aesthetic appearance.

Sika ViscoCrete 2110 has been formulated to provide maximum water reduction and extended slump retention throughout entire dosage range.

- Extended slump life
- Increased compressive strength when compared to reference concrete with same w/c ratio
- High early compressive strengths for earlier removal of forms and structural use of concrete.
- High ultimate strengths allow for greater engineering design flexibility and structural economies.
- Reduced water cement ratios produce more durable, dense concrete with reduced permeability.
- Highly effective plasticizer reduces surface defects in concrete elements and improves aesthetic appearance.
- Ideal for the production of Self Consolidating Concrete.

How to Use

Dosage

Dosage rates will vary according to materials used, ambient conditions and the requirements of a specific project. Sika recommends dosage at 3-8 fl. oz. per 100 lbs. (195-520 ml/100 kg) of cementitious materials for general concrete applications. If maximum water reduction is required, dosage up to 12 fl. oz./100 lbs (780 ml/100 kg) of cementitious may be used. In this case, delayed setting times may occur. Dosage rates outside the recommended range may be used where specialized materials such as microsilica are specified, extreme ambient conditions are encountered or unusual project conditions require special consideration. In this case please contact your local regional office or technical service department at 1-800-933-7452 for further information.

Construction

Cure Mechanism	Proper curing according to ACI guidelines should be always followed to achieve maximum possible quality of concrete.
Mixing	For best superplasticizing results, add Sika ViscoCrete 2110 directly to freshly mixed concrete in the concrete mixer at the end of the batching cycle. Sika ViscoCrete 2110 may also be dispensed as an integral material during the regular admixture batching cycle, or into freshly mixed concrete in a Ready Mix truck, at the concrete plant or at the job site. To optimize the superplasticizing effect after the addition of Sika ViscoCrete 2110, Sika recommends that the combined materials be mixed for 80-100 revolutions either in the concrete mixer or in the Ready Mix truck. **Combination with other admixtures:** Sika ViscoCrete 2110 is highly effective as a single admixture or in combination with other Sika admixtures. If used in combination with certain Sikament high range water reducers it may affect the plastic properties of fresh concrete. Please contact your local regional office or technical service department at 1-800-933-7452 for further information. **Combination with microsilica:** Sika ViscoCrete 2110 is particularly well suited for use with microsilica because of its water reduction capability. Do not introduce Sika ViscoCrete 2110 directly onto dry cementitious materials.
Packaging	Sika ViscoCrete 2110 is available in 55 gallon drum (208 liter), 275 gallon totes (1040 liters) drums and bulk delivery.
Storage and Shelf-life	Shelf life when stored in dry warehouse conditions between 50°F and 80°F (10°C - 27°C) is one year minimum. Sika ViscoCrete 2110 should be stored at above 40°F (5°C). If frozen, thaw and agitate thoroughly to return to normal state.
Typical Data	
Appearance	Orange liquid
Specific Gravity	Approx. 1.1
CAUTION: IRRITANT	May cause eye/skin/respiratory irritation. May be harmful if swallowed.
Handling and Storage	Avoid direct contact. Wear personal protective equipment (chemical resistant goggles/gloves/clothing) to prevent direct contact with skin and eyes. Use only in well ventilated areas. Wash thoroughly with soap and water after use. Remove contaminated clothing and launder before reuse.
First Aid	**Eyes:** Hold eyelids apart and flush thoroughly with water for 15 minutes. **Skin:** Remove contaminated clothing. Wash skin thoroughly for 15 minutes with soap and water. **Inhalation:** Remove person to fresh air. **Ingestion:** Do not induce vomiting. Dilute with water. Contact physician. **In all cases contact a physician immediately if symptoms persist.**
Clean Up	Use personal protective equipment (chemical resistant goggles/gloves/clothing). Without direct contact, remove spilled or excess product and place in suitable sealed container. Dispose of excess product and container in accordance with applicable environmental regulations.

KEEP CONTAINER TIGHTLY CLOSED • KEEP OUT OF REACH OF CHILDREN • NOT FOR INTERNAL CONSUMPTION • FOR INDUSTRIAL USE ONLY

All information provided by Sika Corporation ("Sika") concerning Sika products, including but not limited to, any recommendations and advice relating to the application and use of Sika products, is given in good faith based on Sika's current experience and knowledge of its products when properly stored, handled and applied under normal conditions in accordance with Sika's instructions. In practice, the differences in materials, substrates, storage and handling conditions, actual site conditions and other factors outside of Sika's control are such that Sika assumes no liability for the provision of such information, advice, recommendations or instructions related to its products, nor shall any legal relationship be created by or arise from the provision of such information, advice, recommendations or instructions related to its products. The user of the Sika product(s) must test the product(s) for suitability for the intended application and purpose before proceeding with the full application of the product(s).

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Prior to each use of any Sika product, the user must always read and follow the warnings and instructions on the product's most current Technical Data Sheet, product label and Material Safety Data Sheet which are available at www.sikausa.com or 800-933-7452. Nothing contained in any Sika materials relieves the user of the obligation to read and follow the warnings and instruction for each Sika product as set forth in the current Technical Data Sheet, product label and Material Safety Data Sheet prior to product use.

SIKA warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current Technical Data Sheet if used as directed within shelf life. User determines suitability of product for intended use and assumes all risks. Buyer's sole remedy shall be limited to the purchase price or replacement of product exclusive of labor or cost of labor. **NO OTHER WARRANTIES EXPRESS OR IMPLIED SHALL APPLY INCLUDING ANY WARRANTY OF MERCHANTIBILITY OR FITNESS FOR A PARTICULAR PURPOSE. SIKA SHALL NOT BE LIABLE UNDER ANY LEGAL THEORY FOR SPECIAL OR CONSEQUENTIAL DAMAGES. SIKA SHALL NOT BE RESPONSIBLE FOR THE USE OF THIS PRODUCT IN A MANNER TO INFRINGE ON ANY PATENT OR ANY OTHER INTELLECTUAL PROPERTY RIGHTS HELD BY OTHERS.**

Sika Corporation
201 Polito Avenue
Lyndhurst, NJ 07071
Phone: (201) 933-8800
Fax: (201) 933-6225
www.sikausa.com

Sika Canada Inc.
601, Delmar Avenue
Pointe-Claire, QC H9R 4A9
Phone: (514) 697-2610
Fax: (514) 697-3087
www.sika.ca

1-800-933-SIKA

Regional Information and Sales Centers. For the location of your nearest Sika representative, contact your regional center.

U.S. : **North East Region:** Fairless Hills, PA, Phone: (215) 295 -6600 **North Central Region:** Marion, OH, Phone: (800) 851-1545
South East Region: Conyers, GA, Phone: (770) 760-1300 **South Central Region:** Mesquite, TX, Phone: (972) 289-6480
Western Region: Santa Fe Springs, CA, Phone: (562) 903-3650

Canada: **Ontario:** Mississauga, ON, Phone: (905) 795-3177, **Alberta:** Edmonton, AB, Phone: (780) 486-6111

Quality Certification Numbers: Lyndhurst: FM 69711 (ISO 9000), FM 70421 (QS 9000), Marion: FM 69715, Kansas City: FM 69107, Santa Fe Springs: FM 69408

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Product Data Sheet
Edition 09.25.2009
Identification no. 147-540
Sika Air

Construction

Sika® Air

Air Entraining Admixture

Description

Sika Air admixture is an aqueous solution of organic materials.

Sika Air meets the requirements of ASTM C-260 for air entraining admixtures.

Applications

Sika Air is recommended for use whenever air entrained concrete is desired. Ready-mix, precast and block producers can achieve predictable and uniform entrained air contents in concrete, even where harsh lean mixes are used or fly-ash is added to the concrete.

Advantages

Durability:

- Air entrainment is recognized as the most effective prevention against concrete scaling in exposed environments. Air entrained concrete delivers particular benefits in the form of increased concrete durability. This is important in colder climates where frost and freeze-thaw cycles can cause scaling and damage to the concrete surface.
- Air entraining agents help to prevent scaling by creating microscopic air voids that water trapped in the concrete can expand into when the concrete freezes, thus preventing cracks caused by the natural expansion. Entrained air voids in the concrete will also increase durability in harsh environments where concrete is exposed to deicing salts, marine salts and sulfates.

Workability and Placeability:

- Workability and placeability are also improved by the lubricating action of the microscopic bubbles in the concrete. Concrete will flow better, and bleeding and shrinkage will be reduced because less water is needed to obtain the desired workability.

How to Use

Dosage

Dosage rates for Sika Air will typically fall between 0.5 and 3 fl. oz. per 100 lbs. (32 - 195 ml/100 kg) of cementitious to entrain between 4 and 6 percent air. Higher air contents may be obtained by increasing the dosage rate.

Dosage rates will vary depending on the air content required for a particular project. Typically air contents will be specified in the range of 4 to 8 percent by volume.

Other factors that may affect the amount of air entrained into the concrete including total cementitious content, type of pozzolanic materials, sand gradation, salt/clay in aggregates, temperature and water content. The use of fly ash, particularly high LOI fly ash, can result in a higher dosage of air entrainment. Sika recommends that trial mixes be performed whenever material or any other changes are made that may affect the amount of entrained air.

In mixes requiring a lower or higher amount dosage rate, please contact your local regional Sika office or Sika technical service department at 1-800-933-7452 for further information.

Construction

Mixing	Measure the required quantity per batch manually or with automatic dispenser equipment. Add Sika Air to mixing water or sand. Do not mix with dry cement. When Sika Air is used in combination with other admixtures, care must be taken to dispense each admixture separately into the mix. **Combination with Other Admixtures:** Combination with other admixtures, particularly water reducers and retarders, may increase the amount of entrained air in the mix. Air contents should be checked with an air-meter after batching and dosage adjustments made at the concrete plant.
Packaging	Sika Air is available in 55 gallon drum (208 liter), 275 gallon totes (1040 liters) drums and bulk delivery.
Storage and Shelf life	Sika Air should be stored at above 40°F (5°C). If frozen, thaw and agitate thoroughly to return to normal state. Shelf life when stored in dry warehouse conditions between 50°F and 80°F (10°C - 27°C) is one year.

Typical Data

Appearance	Dark Amber liquid.
Specific Gravity	Approx. 1.0
CAUTION: IRRITANT	Contains Aqueous Solution (CAS:Mixture). May cause eye/skin/respiratory irritaton. May be harmful if swallowed.
Handling and Storage	Avoid direct contact. Wear personal protective equipment (chemical resistant goggles/gloves/clothing) to prevent direct contact with skin and eyes. Use only in well ventilated areas. Wash thoroughly with soap and water after use. Remove contaminated clothing and launder before reuse.
First Aid	**Eyes:** Hold eyelids apart and flush thoroughly with water for 15 minutes. **Skin:** Remove contaminated clothing. Wash skin thoroughly for 15 minutes with soap and water. **Inhalation:** Remove person to fresh air. **Ingestion:** Do not induce vomiting. Dilute with water. Contact physician. **In all cases contact a physician immediately if symptoms persist.**
Safety	Tested and Certified by WQA according to NSF/ANSI 61 Section 5 for materials safety.
Clean Up	Use personal protective equipment (chemical resistant goggles/gloves/clothing). Without direct contact, remove spilled or excess product and place in suitable sealed container. Dispose of excess product and container in accordance with applicable environmental regulations.

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Sika Corporation
201 Polito Avenue
Lyndhurst, NJ 07071
Phone: (201) 933-8800
Fax: (201) 933-6225
www.sikaconstruction.com

Sika Canada Inc.
601, Delmar Avenue
Pointe-Claire, QC H9R 4A9
Phone: (514) 697-2610
Fax: (514) 697-3087
www.sika.ca

1-800-933-SIKA

Regional Information and Sales Centers. For the location of your nearest Sika representative, contact your regional center.

U.S. : **North East Region:** Fairless Hills, PA, Phone: (215) 295 -6600 **North Central Region:** Marion, OH, Phone: (800) 851-1545
South East Region: Conyers, GA, Phone: (770) 760-1300 **South Central Region:** Mesquite, TX, Phone: (972) 289-6480
Western Region: Santa Fe Springs, CA, Phone: (562) 903-3650

Canada: **Ontario:** Mississauga, ON, Phone: (905) 795-3177, **Alberta:** Edmonton, AB, Phone: (780) 486-6111

Quality Certification Numbers: Lyndhurst: FM 69711 (ISO 9000), FM 70421 (QS 9000), Marion: FM 69715, Kansas City: FM 69107, Santa Fe Springs: FM 69408

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BAYOU STEEL GROUP
VINTON

MILL TEST CERTIFICATE
MANUFACTURER: BAYOU STEEL GROUP VINTON

SOLD TO: VAUGHN CONCRETE PRODUCTS, INC.
12650 TUCSON STREET
HENDERSON CO 80640

SHIP TO: VAUGHN CONCRETE - WY
S. GREELEY HWY
CHEYENNE WY 82007

PROGRAM NUMBER: 80650918

MATERIAL: RV13706D11PA #4 X 40' GRADE 60 (ASTM A706) (ASTM A706/A706M)
DELIVERY LIST NUMBER:
P.O. CUSTOMER NUMBER: MIKE81916

ISSUING DATE: 23.08.2016
CERTIFICATE NUMBER: 44250
PAGE: 1/1

MECHANICAL PROPERTIES

HEAT NUMBER	YIELD STRENGTH psi	TENSILE STRENGTH psi	PERCENT ELONGATION %	BEND	ACTUAL W. PER FOOT lb/ft
1611538	70100	93500	15	ACCEPTABLE	0.633
1621627	69575	94300	16	ACCEPTABLE	0.635

CHEMICAL COMPOSITION

HEAT NUMBER	C %	Mn %	P %	S %	Si %	Ni %	Cr %	Mo %	Cu %	V %	Cb %	CE %			
1611538	0.2311	1.1369	0.0242	0.0362	0.1908	0.1396	0.2365	0.0426	0.2863	0.0344	0.0010	0.4539			
1621627	0.2567	1.1653	0.0197	0.0224	0.1623	0.1070	0.1652	0.0299	0.2831	0.0364	-0.001	0.4758			

WE HEREBY CERTIFY THAT THE ABOVE FIGURES ARE CORRECT AS CONTAINED IN THE RECORDS OF THE COMPANY.
MELTED AND MANUFACTURED IN THE U.S.A.
This reinforcing steel meets all the requirements of the Buy America Act requirements of 23 CFR 635.410
Approved by BSGV Quality Assurance
Manual REV-20 10/09/2014

Hector De Aguero

CERTIFIED BY THE QUALITY DEPARTMENT - SIGNATURE ON FILE

MAILING ADDRESS
BAYOU STEEL GROUP VINTON P.O. BOX 12843
EL PASO, TEXAS 79913-0843 915 886-2000

STREET ADDRESS
I-10 & VINTON ROAD
VINTON, TEXAS 79835-9998

BAYOU STEEL GROUP
VINTON

MILL TEST CERTIFICATE
MANUFACTURER: BAYOU STEEL GROUP VINTON

SOLD TO: VAUGHN CONCRETE PRODUCTS, INC.
12650 TUCSON STREET
HENDERSON CO 80640

SHIP TO: VAUGHN CONCRETE PRODUCTS, INC.
12650 TUCSON STREET
HENDERSON CO 80640

PROGRAM NUMBER: 80655321

MATERIAL: RV16706D14PA #5 X 40' GRADE 60 (ASTM A706) (ASTM A706/A706M)
DELIVERY LIST NUMBER: 910039207
P.O. CUSTOMER NUMBER: M29-2

ISSUING DATE: 12.04.2017
CERTIFICATE NUMBER: 47716
PAGE: 1/1

MECHANICAL PROPERTIES

HEAT NUMBER	YIELD STRENGTH psi	TENSILE STRENGTH psi	PERCENT ELONGATION %	BEND	ACTUAL W. PER FOOT lb/ft
1710721	71290	93226	18	ACCEPTABLE	0.993
1720786	69355	95645	17	ACCEPTABLE	0.991

CHEMICAL COMPOSITION

HEAT NUMBER	C %	Mn %	P %	S %	Si %	Ni %	Cr %	Mo %	Cu %	V %	Cb %	CE %			
1710721	0.2570	0.9620	0.0151	0.0266	0.1432	0.1013	0.2213	0.0184	0.2630	0.0319	-0.000	0.4476			
1720786	0.2808	0.9606	0.0171	0.0287	0.1778	0.1147	0.1906	0.0210	0.3027	0.0330	-0.000	0.4730			

WE HEREBY CERTIFY THAT THE ABOVE FIGURES ARE CORRECT AS CONTAINED IN THE RECORDS OF THE COMPANY.
MELTED AND MANUFACTURED IN THE U.S.A.
This reinforcing steel meets all the requirements of the Buy America Act requirements of 23 CFR 635.410
Approved by BSGV Quality Assurance
Manual REV-20 10/09/2014

Hector De Aguino

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MAILING ADDRESS
BAYOU STEEL GROUP VINTON P.O. BOX 12843
EL PASO, TEXAS 79913-0843 915 886-2000

STREET ADDRESS
I-10 & VINTON ROAD
VINTON, TEXAS 79835-9998

BAYOU STEEL GROUP
VINTON

MILL TEST CERTIFICATE
MANUFACTURER: BAYOU STEEL GROUP VINTON

SOLD TO: VAUGHN CONCRETE PRODUCTS, INC.
12650 TUCSON STREET
HENDERSON CO 80640

SHIP TO: VAUGHN CONCRETE PRODUCTS, INC.
12650 TUCSON STREET
HENDERSON CO 80640

PROGRAM NUMBER: 0080655686

MATERIAL: RV19706D15PA #6 X 40' GRADE 60 (ASTM A706) (ASTM A706/A706M)
DELIVERY LIST NUMBER:
P.O. CUSTOMER NUMBER: M29-2

ISSUING DATE: 27.04.2017
CERTIFICATE NUMBER: 47985
PAGE: 1/1

MECHANICAL PROPERTIES

HEAT NUMBER	YIELD STRENGTH psi	TENSILE STRENGTH psi	PERCENT ELONGATION %	BEND	ACTUAL W. PER FOOT lb/ft
1720891	68182	92159	15	ACCEPTABLE	1.457

CHEMICAL COMPOSITION

HEAT NUMBER	C %	Mn %	P %	S %	Si %	Ni %	Cr %	Mo %	Cu %	V %	Cb %	CE %			
1720891	0.2644	1.1131	0.0107	0.0235	0.1664	0.0883	0.2195	0.0183	0.1690	0.0270	0.0013	0.4771			

WE HEREBY CERTIFY THAT THE ABOVE FIGURES ARE CORRECT AS CONTAINED IN THE RECORDS OF THE COMPANY.
MELTED AND MANUFACTURED IN THE U.S.A.
This reinforcing steel meets all the requirements of the Buy America Act requirements of 23 CFR 635.410
Approved by BSGV Quality Assurance
Manual REV-20 10/09/2014

Hector De Cequino

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MAILING ADDRESS
BAYOU STEEL GROUP VINTON P.O. BOX 12843
EL PASO, TEXAS 79913-0843 915 886-2000

STREET ADDRESS
I-10 & VINTON ROAD
VINTON, TEXAS 79835-9998

Oklahoma Steel and Wire

Highway 70 South
Madill, OK 73446
(580) 795-7311 (800) 654-4164 Fax (580) 795-7422

Physical Test Report

Date: 05/02/2017
Customer Name VAUGHN CONCRETE PRODUCTS
Customer Address: 10021 AMARILLO BLVD EAST

AMARILLO, TX 79107
Customer Order Number: 00322907
PONumber: MIKE 3/27-4
Item Number: 3026-0
Item Description: 6X6XD10XD10 8'X20' BLK

First Bundle #: 212686
Last Bundle #: 212691
Pieces Per Bundle: 15
Number of Bundles: 6
Number of Pieces: 90

Description	Original Diameter	Original Area	Breaking Strength LBS	Tensile Strength PSI	Yield Strength LBS	Reduced Diameter	Reduced Area	Percent Reduction of Area	Bend Test	Weld Shear Test 1	Weld Shear Test 2	Weld Shear Test 3	Weld Shear Test 4	Required Weld Shear
Line Wire	0.357	0.100	10588	105776	0	0.000	0.000	100.00	Pass	4748	4677	4492	4310	3504
Cross Wire	0.357	0.100	11098	110871	0	0.000	0.000	100.00						

CHEMICAL PROPERTIES

Description	Heat Number	Carbon	Manganese	Phosphorus	Sulfur	Silicon
Line Wire	1720919	0.080	0.410	0.011	0.026	0.150
Cross Wire	1720919	0.080	0.410	0.011	0.026	0.150

This material has been produced and tested
in acordance withthe requirements of ASTM 1064-16
and we hereby certify that the above test results are
representative of those obtainedon the material in this shipment.
The raw material used to produce this product was
melted and rolled in the United States.

Quality Manager
Oklahoma Steel and Wire Co., Inc.

Sworn and Subscribed to before me this
26th Day of June, 2017 A.D.

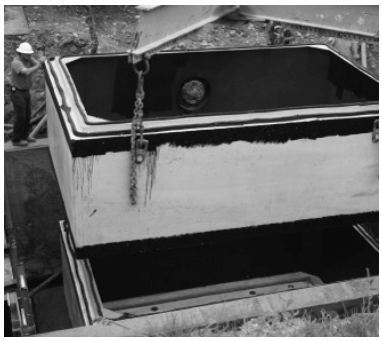
Notary Public

My Commisson Expires

NOTARY PUBLIC State of OK
TINO DIAZ
Comm. # 09004486
Expires 05-27-2021

ConSeal™ CS-50

Solvent Based
Liquid Butyl Primer



Surface Preparation Coating and Installation Aid for Concrete and Metal Surfaces

Applications

For use on concrete or metal surfaces, CS-50 Solvent Based Surface Primer is a concrete surface preparation coating and installation aid for bonding preformed sealants. CS-50 Solvent Based Surface Primer can be applied in advance of product installation.

Sealing Properties

When applied to concrete or metal, ConSeal CS-50 Liquid Butyl Primer creates a butyl rubber film that acts to both seal the structure and improve the bond of preformed sealants.

Physical Properties

Description

Color:	Black
% Solids:	20% minimum
Solvent Type:	VMP Naptha
Flash Point:	76°F
Weight / Gallon:	7.6 Pounds
Dry Time @ 77°F (25°C):	15-20 minutes
Dry Time @ 40°F (4°C):	30-40 minutes
Clean Up:	Mineral Spirits
Coverage Per Gallon:	Approx. 300 sq ft on wet cast concrete.
Min. Storage Temperature:	32°F
Min. Application Temperature:	0°F
Surface When Dry:	Flat Black, non-tacky
Shelf Life:	6 months

Limited Warranty

This information is presented in good faith, but we cannot anticipate all conditions under which this information and our products, or the products of other manufactures in combination with our products, may be used. We accept no responsibility for results obtained by the application of this information or the safety and suitability of our products, either alone or in combination with other products. Users are advised to make their own tests to determine the safety and suitability of each such product or product combinations for their own purposes. It is the **users' responsibility** to satisfy himself as to the suitability and completeness of such information for this own particular use. We sell this product without warranty, and buyers and users assume all responsibility and liability for loss or damage arising from the handling and use of this product, whether used alone or in combination with other products.

Don't Just Seal It, ConSeal It!

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Concrete Sealants, Inc. 9325 State Route 201 ■ Tipp City, OH 45371 ■ **Toll Free** 800.332.7325
P. 937.845.8776 **F.** 937.845.3587 ■ **www.conseal.com**

ISO 9001 Registered

ConSeal™ Concrete Sealants INC.

CS102

Butyl Rubber Sealant For All Precast Structures; Meets Specs.

APPLICATIONS

For self-sealing joints in: Manholes, Concrete Vaults, Septic Tanks, Concrete Pipe, Box Culverts, Utility Vaults, Burial Vaults, and Vertical Panel Structures.

SEALING PROPERTIES

- Provides permanently flexible watertight joints.
- Low to high temperature workability: 30°F to 120°F (-1°C to 48°C)
- Rugged service temperature: -30°F to +200°F (-34°C to +93°C)
- Excellent chemical and mechanical adhesion to clean, dry surfaces.
- Sealed Joints will not shrink, harden or oxide upon aging.
- No priming normally necessary. When confronted with difficult installation conditions, such as wet concrete or temperatures below 40°F (4°C), priming the concrete will improve the bonding action. Consult Concrete Sealants for the proper primer to meet your application.

HYDROSTATIC STRENGTH

ConSeal CS-102 meets the hydrostatic performance requirement as set forth In ASTM C-990 section 10.1 (Performance requirement: 10psi for 10 minutes in straight alignment – in plant, quality control test for joint materials.)

SPECIFICATIONS

ConSeal CS-102 meets or exceeds the requirements of Federal Specification SS-S-210 (210-A), AASHTO M-198B, and ASTM C-990-91.

P.O. Box 176, New Carlisle OH, 45344 • 937.845.8776 or 800.332.7325
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ConSeal™ Concrete Sealants INC.

CS102

Butyl Rubber Sealant For All Precast Structures; Meets Specs.

PHYSICAL PROPERTIES

	Spec	Required*	CS 102
Hydrocarbon blend content % by weight	ASTM D4 (mod.)	50% min.	51%
Inert mineral filler % by weight	AASHTO T111	30% min.	35%
Volatile Matter % by weight	ASTM D6	2% max.	1.2
Specific Gravity, 77°F	ASTM D71	1.15-1.50	1.25
Ductility, 77°F	ASTM D113	5.0 min.	10
Penetration, cone 77°F, 150 gm. 5 sec.	ASTM D217	50-100	55-60
Penetration, cone 32°F, 150 gm. 5 sec.	ASTM D217	40 mm	40-65
Flash Point, C.O.C., °F	ASTM D92	350°F min.	450°F
Fire point, C.O.C., °F	ASTM D92	375°F min.	475°F

IMMERSION TESTING

- 30-Day Immersion Testing: No visible deterioration when tested in 5% Caustic Potash, 5% Hydrochloric Acid, 5% Sulfuric Acid, and 5% saturated Hydrogen Sulfide. *

- One Year Immersion Testing: No visible deterioration when tested in 5% Formaldehyde, 5% Formic Acid, 5% Sulfuric Acid, 5% Hydrochloric Acid, 5% Sodium Hydroxide, 5% Hydrogen Sulfide and 5% Potassium Hydroxide.

- Requirements of ASTM C-990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

LIMITED WARRANTY
This information is presented in good faith, but we cannot anticipate all conditions under which this information and our products, or the products of other manufacturers in combination with our products, may be used. We accept no responsibility for results obtained by the application of this information or the safety and suitability of our products, either alone or in combination with other products. Users are advised to make their own tests to determine the safety and suitability of each such product or product combinations for their own purposes. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for this own particular use. We sell this product without warranty, and buyers and users assume all responsibility and liability for loss or damage arising from the handling and use of this product, whether used alone or in combination with other products.

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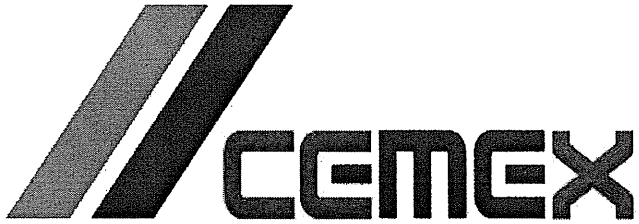
MATERIAL SAFETY DATA SHEET (MSDS) FOR PORTLAND CEMENT

(Complies with OSHA's Hazard Communication Standard, 29 CFR 1910.1200)



CEMEX, INC.

Section 1 - IDENTIFICATION

Supplier/Manufacturer

CEMEX, Inc.
5134 Ute Highway
Lyons, CO 80540

Emergency Contact Information

(303) 823-2100

Chemical name and synonyms

Portland Cement (CAS #65997-15-1)

Product name

"CEMEX Type I"
"CEMEX Type I/II"
"CEMEX Type I/II-Low Alkali"
"CEMEX Product"
"CEMEX Type III-Low Alkali"
"CEMEX Type V-Low Alkali"

Chemical family

Calcium salts

Formula

$3CaO.SiO_2$	(CAS#12168-85-3)
$2CaO.SiO_2$	(CAS#10034-77-2)
$3CaO.Al_2O_2$	(CAS#12042-78-3)
$4CaO..Al_2O_3Fe_2O_3$	(CAS#12068-35-8)
$CaSO_2.2H_2O$	(CAS#13397-24-5)

Other salts:

Small amounts of MgO, and trace amounts of K_2SO_4 and Na_2SO_4 may also be present.

Section 2 - COMPONENTS

Hazardous Ingredients

Portland cement clinker (CAS#65997-15-1) - approximately - 93.5-96.0% by weight
ACGIH TLV-TWA (1996)=10 mg total dust/m^3
OSHA PEL (8-hour TWA)=50 million particles/ft^3

Gypsum (CAS#7778-18-9) - approximately - 4.0-6.5% by weight
ACGIH TLV-TWA (1996)=10 mg total dust/m^3
OSHA PEL (8-hour TWA)= 10 mg total dust/m^3
OSHA PEL (8-hour TWA)= 5 mg respirable dust/m^3

Respirable quartz (CAS#14808-60-7) - approximately - 0.02-0.03% by weight
ACGIH TLV-TWA (1996)=0.10 mg respirable quartz dust/m^3
OSHA PEL (8-hour TWA)=(10 mg respirable dust/m^3)/(percent silica +2)
NIOSH REL (8-hour TWA)=0.05 mg respirable dust/m^3

Trace Ingredients

Trace amounts of naturally occurring chemicals might be detected during chemical analysis. Trace constituents may include up to 0.75% insoluble residue, some of which may be free crystalline silica, calcium oxide (Also known as lime or quick lime), magnesium oxide, potassium sulfate, sodium sulfate, chromium compounds, and nickel compounds.

Section 3 - HAZARD IDENTIFICATION

Emergency Overview

Masonry cement is a light gray powder that poses little immediate hazard. A single short-term exposure to the dry powder is not likely to cause serious harm. However, exposure of sufficient duration to wet Masonry cement can cause serious, potentially irreversible tissue (skin or eye) destruction in the form of chemical (caustic) burns. The same type of tissue destruction can occur if wet or moist areas of the body are exposed for sufficient duration to dry Masonry cement.

Potential Health Effects

Relevant Routes of Exposure:
Eye contact, skin contact, inhalation, and ingestion.

Effects Resulting from Eye Contact:
Exposure to airborne dust may cause immediate or delayed irritation or inflammation. Eye contact by large amounts of dry powder or splashes of wet Masonry cement may cause effects ranging from moderate eye irritation to chemical burns or blindness. Such exposures require immediate first aid (see Section 4) and medical attention to prevent significant damage to the eye.

Effects Resulting from Skin Contact:
Discomfort or pain cannot be relied upon to alert a person to hazardous skin exposure. Consequently, the only effective means of avoiding skin injury or illness involves minimizing skin contact, particularly with wet cement. Exposed persons may not feel discomfort until hours after the exposure has ended and significant injury has occurred.

Dry Masonry cement contacting wet skin or exposure to moist or wet Masonry cement may cause more severe skin effects including thickening, cracking or fissuring of the skin. Prolonged exposure can cause severe skin damage in the form of (alkali) chemical burns.

Some individuals may exhibit an allergic response upon exposure to Masonry cement, possibly due to trace elements of chromium. The response may appear in a variety of forms ranging from a mild rash to severe skin ulcers. Persons already sensitized may react to their first contact with the product. Other persons may first experience this effect after years of contact with Masonry cement products.

Effects Resulting from Inhalation:
Masonry cement may contain trace amounts of free crystalline silica. Prolonged exposure to respirable free silica can aggravate other lung conditions and cause silicosis, a disabling and potentially fatal lung disease.

Exposure to Masonry cement may cause irritation to the moist mucous membranes of the nose, throat, and upper respiratory system. It may also leave unpleasant deposits in the nose.

Effects Resulting from Ingestion:
Although small quantities of dust are not known to be harmful, ill effects are possible if larger quantities are consumed. Masonry cement should not be eaten.

Carcinogenic potential:
Masonry cement is **not** listed as a carcinogen by NTP, OSHA, or IARC. It may however, contain trace amounts of substances listed as carcinogens by these organizations.

Crystalline silica, a contaminate in Masonry cement, is now classified by IARC as known human carcinogen (Group I). NTP has characterized respirable silica as "reasonably anticipated to be [a] carcinogen".

Medical conditions which may be aggravated be, inhalation or dermal exposure:
Pre-existing upper respiratory and lung diseases.
Unusual (hyper) sensitivity to hexavalent chromium (chromium^{+6}) salts.

Section 4 - FIRST AID

Eyes

Immediately flush eyes thoroughly with water. Continue flushing eye for at least 15 minutes, including under lids, to remove all particles. Call physician immediately.

Skin

Wash skin with cool water and pH-neutral soap or a mild detergent. Seek medical treatment in all cases of prolonged exposure to wet cement, cement mixtures, liquids from fresh cement products, or prolonged wet skin exposure to dry cement.

Inhalation of Airborne Dust

Remove to fresh air. Seek medical help if coughing and other symptoms do not subside.

Ingestion

Do not induce vomiting. If conscious, have the victim drink plenty of water and call a physician immediately.

Section 5 - FIRE AND EXPLOSION DATA

Flash point .....None	Lower Explosive Limit.....None
Upper Explosive Limit.....None	Auto ignition temperature.....Not Combustible
Extinguishing media.....Not Combustible	Special fire fighting Procedures.....None
Hazardous combustion products..None	Unusual fire and explosion hazards...None

Section 6 - ACCIDENTAL RELEASE MEASURES

Collect dry material using a scoop. Avoid actions that cause dust to become airborne. Avoid inhalation of dust and contact with skin.

Wear appropriate personal protective equipment as described in Section 8.

Scrape up wet material and place in an appropriate container. Allow the material to "dry" before disposal. Do not attempt to wash Masonry cement down drains.

Dispose of waste material according to local, state and federal regulations.

Section 7 - HANDLING AND STORAGE

Keep Masonry cement dry until used. Normal temperatures and pressures do not affect the material.

Promptly remove dusty clothing or clothing which is wet with cement fluids and launder before reuse. Wash thoroughly after exposure to dust or wet cement mixtures or fluids.

Section 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

Skin Protection

Prevention is essential to avoiding potentially severe skin injury. Avoid contact with unhardened Masonry cement. If contact occurs, promptly wash affected area with soap and water. Where prolonged exposure to unhardened Masonry cement products might occur, wear impervious clothing and gloves to eliminate skin contact. Wear sturdy boots that are impervious to water to eliminate foot and ankle exposure.

Do not rely on barrier creams: barrier creams should not be used in place of gloves.

Periodically wash areas contacted by dry Masonry cement or by wet cement or concrete fluids with a pH neutral soap. Wash again at the end of work. If irritation occurs, immediately wash the affected area and seek treatment. If clothing becomes saturated with wet concrete, it should be removed and replaced with clean dry clothing.

Respiratory Protection

Avoid actions that cause dust to become airborne. Use local or general exhaust ventilation to control exposures below applicable exposure limits.

Use NIOSH/MSHA approved (under 30 CFR 11) or NIOSH approved (under 42 CFR 84) respirators in poorly ventilated areas, if an applicable exposure limit is exceeded, or when dust causes discomfort or irritation. (Advisory: Respirators and filters purchased after June 10, 1998 must be certified under 42 CFR 84.)

Ventilation

Use local exhaust or general dilution ventilation to control exposure within applicable limits.

Eye Protection

Where potentially subject to splashes or puffs of cement, wear safety glasses with side shields or goggles. In extremely dusty environments and unpredictable environments wear unvented or indirectly vented goggles to avoid eye irritation or injury. Contact lenses should not be worn when working with Masonry cement or fresh cement products.

Section 9 - PHYSICAL AND CHEMICAL, PROPERTIES

Appearance.....Gray Powder
Physical state.....Solid (powder)
Solubility in water...Slightly soluble (0.1 to 1.0%)
Vapor density.....Not applicable
Melting point.....Not applicable
Evaporation rate.....Not applicable

Odor.....No distinct odor
pH (in water).....12 to 13
Vapor pressure.....Not applicable
Boiling point.....Not applicable (i.e., > 1000 C)
Specific gravity (H20 = 1.0).....2.87-3.00

Section 10 - STABILITY AND REACTIVITY

Stability

Stable.

Conditions to avoid

Unintentional contact with water.

Incompatibility

Wet Masonry cement is alkaline. As such it is incompatible with acids, ammonium salts and phosphorous.

Hazardous decomposition

Will not spontaneously occur. Adding water produces (caustic) calcium hydroxide

Hazardous Polymerization

Will not occur.

Section 11 - TOXICOLOGICAL INFORMATION

For a description of available, more detailed toxicological information contact the supplier or manufacturer.

Section 12 - ECOLOGICAL INFORMATION

Ecotoxicity

No recognized unusual toxicity to plants or animals

Relevant physical and chemical properties

(See Sections 9 and 10.)

Section 13 - DISPOSAL

Dispose of waste material according to local, state and federal regulations. (Since Masonry cement is stable, uncontaminated material may be saved for future use).

Dispose of bags in an approved landfill or incinerator.

Section 14 - TRANSPORTATION DATA

Hazardous materials description/proper shipping name

Masonry is cement is not hazardous under U.S. Department of Transportation (DOT) regulations.

Hazard class

Not applicable

Identification number

Not applicable.

Required label text

Not applicable.

Hazardous substances/reportable quantities (RQ)

Not applicable.

Section 15 - OTHER REGULATORY INFORMATION

Status under USDOL-OSHA Hazard Communication Rule, 29 CFR 1910.1200

Masonry cement is considered a "hazardous chemical" under this regulation, and should be part of any hazard communication program.

Status under CERCLA/SUPERFUND 40 CFR 117 and 302

Not listed.

Hazard Category under SARA(Title III), Sections 311 and 312

Masonry cement qualifies as a "hazardous substance" with delayed health effects.

Status under SARA (Title III), Section 313

Not subject to reporting requirements under Section 313.

Status under TSCA (as of May 1997)

Some substances in Masonry cement are on the TSCA inventory list.

Status under the Federal Hazardous Substances Act

Masonry cement is a "hazardous substance" subject to statutes promulgated under the subject act.

Status under California Proposition 65

This product contains up to 0.05 percent of chemicals (trace elements) known to the State of California to cause cancer, birth defects or other reproductive harm. California law requires the manufacturer to give the above warning in the absence of definitive testing to prove that the defined risks do not exist.

Section 16 - OTHER INFORMATION

Prepared by

Kevin Keegan
Director - Health and Safety
CEMEX, Inc.
Houston, Texas

Approval date or Revision date

Approved: July, 1997
Revised: March, 2001

Other important information

Masonry cement should only be used by knowledgeable persons. A key to using the product safely requires the user to recognize that Masonry cement chemically reacts with water, and that some of the intermediate products of this reaction (that is those present while a Masonry cement product is "setting") pose a more severe hazard than does dry Masonry cement itself.

While the information provided in this material safety data sheet is believed to provide a useful summary of the hazards of Masonry cement as it is commonly used, the sheet cannot anticipate and provide the all of the information that might be needed in every situation. Inexperienced product users should obtain proper training before using this product.

SELLER MAKES NO WARRANTY, EXPRESSED OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE OR CONCERNING THE ACCURACY OF ANY INFORMATION PROVIDED BY CEMEX, Inc. except that the product shall conform to contracted specifications. The information provided herein was believed by CEMEX, Inc. to be accurate at the time of preparation or prepared from sources believed to be reliable, but it is the responsibility of the user to investigate and understand other pertinent sources of information to comply with all laws and procedures applicable to the safe handling and use of product and to determine the suitability of the product for its intended use. Buyer's exclusive remedy shall be for damages and no claim of any kind, whether as to product delivered or for non-delivery of product, and whether based on contract, breach of warranty, negligence, or otherwise shall be greater in amount than the purchase price of the quantity of product in respect of which damages are claimed. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is based on contract, breach of warranty, negligence or otherwise.

In particular, the data furnished in this sheet do not address hazards that may be posed by other materials mixed with Masonry cement to produce Masonry cement products. Users should review other relevant material safety data sheets before working with this Masonry cement or working on Masonry cement products, for example, Masonry cement concrete.

Material Safety Data Sheet

Sika ViscoCrete 2110

1 . Product and company identification

Product name : Sika ViscoCrete 2110

Supplier : Sika Corporation, Construction
201 Polito Avenue
Lyndhurst, NJ 07071
www.sikaconstruction.com

Telephone no. : (201) 933 - 8800

Fax no. : (201) 804 - 1076

In case of emergency : CHEMTREC: 800-424-9300
INTERNATIONAL: 703-527-3887

Manufacturer : Sika Corporation, Operations
201 Polito Avenue
Lyndhurst, NJ 07071
www.sikacorp.com

Telephone no. : (201) 933 - 8800

Validation date : **23. February 2011.**

Print date : 23. February 2011.

Product type : Liquid.

2 . Composition/information on ingredients

There are no ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

3 . Hazards identification

OSHA/HCS status : This material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Potential acute health effects

Inhalation : May cause respiratory irritation.

Ingestion : May be harmful if swallowed.

Skin : May cause skin irritation.

Eyes : May cause eye irritation.

See toxicological information (section 11)

4 . First aid measures

Eye contact : Check for and remove any contact lenses. Get medical attention if irritation occurs. Immediately flush eyes with plenty of water for at least 15 minutes.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. Maintain an open airway.

Ingestion : Wash out mouth with water. Move exposed person to fresh air. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if adverse health effects persist or are severe. Never give anything by mouth to an unconscious person.

4 . First aid measures

Notes to physician : No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

5 . Fire-fighting measures

Flammability of the product : In a fire or if heated, a pressure increase will occur and the container may burst.

Extinguishing media

Suitable : Use an extinguishing agent suitable for the surrounding fire.

Not suitable : None known.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Hazardous combustion products : No specific data.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Consult local authorities for acceptable exposure limits.

Engineering measures : No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants. If this product contains ingredients with exposure limits, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal protection

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

9 . Physical and chemical properties

Flash point : Closed cup: Not applicable.

Odor : Characteristic.

pH : 5.5

Density : ~1.094 g/cm^3 [20°C (68°F)]

10 . Stability and reactivity

Stability : The product is stable.

Conditions to avoid : No specific data.

Materials to avoid : No specific data.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

11 . Toxicological information

Acute toxicity

Conclusion/Summary : Not available.

12 . Ecological information

Environmental effects : No known significant effects or critical hazards.

13 . Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Additional information
DOT Classification	Not regulated.		-	-	-
TDG Classification	Not regulated.		-	-	-
ADR/RID Class	Not regulated.		-	-	-
IMDG Class	Not regulated.		-	-	-
IATA-DGR Class	Not regulated.		-	-	-

PG* : Packing group

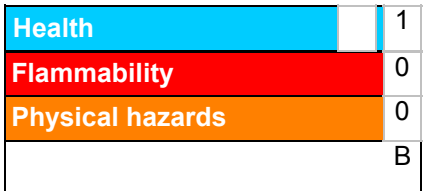
15 . Regulatory information

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.
SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: No products were found.
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: No products were found.

United States inventory (TSCA 8b) : All components are listed or exempted.

16 . Other information

Hazardous Material Information System (U.S.A.) :



16 . Other information

Personal Protection Equipment

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

Date of printing : **23.02.2011.**

Date of issue : **23.02.2011.**

Date of previous issue : **No previous validation.**

Version : **1.01**

Indicates information that has changed from previously issued version.

Notice to reader

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All sales of Sika products are subject to its current terms and conditions of sale available at www.sikacorp.com or 201-933-8800.

Material Safety Data Sheet

Sika Air

1 . Product and company identification

Product name : Sika Air

Supplier : Sika Corporation, Operations
201 Polito Avenue
Lyndhurst, NJ 07071
www.sikacorp.com

Telephone no. : (201) 933 - 8800

Fax no. : (201) 804 - 1076

In case of emergency : CHEMTREC: 800-424-9300
INTERNATIONAL: 703-527-3887

Manufacturer : Sika Corporation, Operations
201 Polito Avenue
Lyndhurst, NJ 07071
www.sikacorp.com

Telephone no. : (201) 933 - 8800

Validation date : **10. April 2008.**

Print date : 10. April 2008.

Product type : Liquid.

2 . Hazards identification

OSHA/HCS status : While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this MSDS contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.

Potential acute health effects

Inhalation : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

See toxicological information (section 11)

3 . Composition/information on ingredients

There are no ingredients or additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

4 . First aid measures

Notes to physician : No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

5 . Fire-fighting measures

Flammability of the product : In a fire or if heated, a pressure increase will occur and the container may burst.

Extinguishing media

Suitable : Use an extinguishing agent suitable for the surrounding fire.

Not suitable : None known.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

5 . Fire-fighting measures

Hazardous combustion products : No specific data.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble or absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Expose controls/personal protection

Consult local authorities for acceptable exposure limits.

Engineering measures : No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants. If this product contains ingredients with exposure limits, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

8 . Expose controls/personal protection

Personal protection

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

9 . Physical and chemical properties

Physical state : Liquid.

10 . Stability and reactivity

Stability : The product is stable. Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid : No specific data.

Materials to avoid : No specific data.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

11 . Toxicological information

Acute toxicity

Conclusion/Summary : Not available.

12 . Ecological information

Environmental effects : No known significant effects or critical hazards.

13 . Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Additional information
DOT Classification	Not regulated.		-	-	-
TDG Classification	Not regulated.		-	-	-
ADR/RID Class	Not regulated.		-	-	-
IMDG Class	Not regulated.		-	-	-
IATA-DGR Class	Not regulated.		-	-	-

PG* : Packing group

15 . Regulatory information

U.S. Federal regulations : **United States inventory (TSCA 8b):** Not determined.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: No products were found.
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: No products were found.

Clean Water Act (CWA) 311: sodium hydroxide

Clean Air Act (CAA) 112 accidental release prevention: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

State regulations : **Connecticut Carcinogen Reporting**: None of the components are listed.
Connecticut Hazardous Material Survey: None of the components are listed.
Florida substances: None of the components are listed.
Illinois Chemical Safety Act: None of the components are listed.
Illinois Toxic Substances Disclosure to Employee Act: None of the components are listed.
Louisiana Reporting: None of the components are listed.
Louisiana Spill: None of the components are listed.
Massachusetts Spill: None of the components are listed.
Massachusetts Substances: None of the components are listed.
Michigan Critical Material: None of the components are listed.
Minnesota Hazardous Substances: None of the components are listed.
New Jersey Hazardous Substances: None of the components are listed.
New Jersey Spill: None of the components are listed.
New Jersey Toxic Catastrophe Prevention Act: None of the components are listed.
New York Acutely Hazardous Substances: None of the components are listed.
New York Toxic Chemical Release Reporting: None of the components are listed.
Pennsylvania RTK Hazardous Substances: None of the components are listed.
Rhode Island Hazardous Substances: None of the components are listed.

United States inventory (TSCA 8b) : **United States inventory (TSCA 8b):** Not determined.

16 . Other information

Hazardous Material Information System (U.S.A.) :

Health	0
Flammability	0
Physical hazards	0
Personal protection	D

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

Date of printing : **10.04.2008.**

Date of issue : **10.04.2008.**

Date of previous issue : **No previous validation.**

Version : **1**

Indicates information that has changed from previously issued version.

Notice to reader

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All sales of Sika products are subject to its current terms and conditions of sale available at www.sikacorp.com or 201-933-8800.

MATERIAL SAFETY DATA SHEET

ConSeal™ Concrete Sealants INC.

CS-50

Liquid Butyl Primer

COMPOSITION/ INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS	CAS NO.	% COMPOSITION	OSHA PEL	AGGIH TLV
VM & P Naptha	64742-89-8	50 - 60	300 ppm	300 ppm
Toluene	108-88-3	< 0.5	100 ppm	100 ppm
Xylene	1330-20-7	6 - 7	100 ppm	100 ppm
Ethyl Benzene	100-41-4	10 - 15	100 ppm	100 ppm
Hydrocarbon Resin	62258-49-5	7 - 10	NE	NE
Butyl Rubber	9010-85-9	6 - 7.5	NE	NE

HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS

EYE CONTACT: Can cause severe eye irritation, redness, tearing and blurred vision.

SKIN CONTACT: Prolonged an repeated contact can cause moderate irritation, defatting and dermatitis.

INHALATION: Excessive inhalation of vapors can cause nausea, respiratory irritation, central nervous system effects, including dizziness, weakness, fatigue, nausea, headache, and possible unconsciousness and even death.

INGESTION: Swallowing can cause gastrointestinal irritation, nausea, vomiting, and diarrhea. Aspiration of material into lungs can cause chemical pneumitis, which is fatal.

CHRONIC EFFECTS: Overexposure in laboratory animals has been found to cause the following effects: Liver abnormalities, Kidney damage, Lung damage, and Spleen damage. Overexposure of this material has been suggested as a cause of Liver abnormalities in humans.

FIRST AID MEASURES

EYES: Flush eyes with large amounts of water, lifting both the upper and lower lids. SEEK MEDICAL ATTENTION IMMEDIATLEY.

SKIN: Wash exposed area with waterless hand cleaner, soap and water, or a mild detergent. Do not use solvents on skin as they promote absorption of this material. Remove contaminated clothing. Launder contaminated clothing thoroughly before reuse. The area should be examined by a medical person if irritation or pain persists after washing.

INHALATION: Remove from exposed area to fresh air immediately. If breathing is difficult, administer oxygen. If breathing has stopped, give artificial respiration. Keep person warm, quiet, and SEEK MEDICAL ATTENTION IMMEDIATELY.

INGESTION: Do not induce vomiting. Keep warm, quiet, and SEEK MEDICAL ATTENTION IMMEDIATELY. Aspiration of this material into lungs due to vomiting can cause chemical pneumitis, which can be fatal. Give oxygen if respiratory is shallow.

P.O. Box 176, New Carlisle OH, 45344 • 937.845.8776 or 800.332.7325
FAX 937-845-3587 • www.conseal.com

ConSeal™ Concrete Sealants INC.

CS-50

Liquid Butyl Primer

FIRE FIGHTING MEASURES

FLASH POINT: 36 °F **METHOD USED:** TCC

FLAMMABLE LIMINTS IN AIR, % BY VOLUME: UEL UPPER: 7.1 **LEL LOWER:** 1.0

FLAMMABILITY CLASSIFICATION: OSHA: 1B DOT: Flammable Liquid

Extinguishing Media: Dry chemical, carbon dioxide, foam

Unusual Fire and Explosion Hazards: This product is flammable. Store away from sources of heat and open flames. Vapor accumulation will flash or explode if ignited by spark or flame. Do not mix with strong oxidants. Use non-sparking tools in confined spaces.

Special Fire fighting Procedures: DO NOT USE WATER, which may spread fire. Water may be used to cool exposed containers to prevent pressure build up. Respiratory protection is required for fire fighting personal.

DECOMPOSITION PRODUCTS UNDER FIRE CONDITIONS: fumes, smoke, carbon monoxide, carbon dioxide, hydrocarbon vapors, hydrogen chloride, phosgene, chlorine, and various complex hydrocarbons during combustion.

ACCIDENTAL RELEASE MEASURES

Procedures: Eliminate all ignition sources such as flames, flares, including pilot lights and electrical sparks. Persons not wearing protective equipment should be excluded from the area of spill until clean up has been completed. Stop spill at source, dike area of spill to prevent spreading. Pump liquids into salvage tank. Remaining material should be taken up using sand, clay, earth, floor absorbent, or other absorbent material and shoveled into containers.

Waste Disposal: Dispose of in accordance with local, state and federal regulations. Before attempting clean up, refer to hazardous information listed on this sheet.

STORAGE AND HANDLING

Precautions to be taken in handling and storage. Keep away from heat, sparks, and open flames. Keep containers closed when not in use. Use adequate ventilation. Avoid prolonged or repeated inhalation of vapor and skin contact. Store in accordance with NFDA, State and local regulation. Use non-sparking type tools in confined areas.

P.O. Box 176, New Carlisle OH, 45344 • 937.845.8776 or 800.332.7325
FAX 937-845-3587 • www.conseal.com

ConSeal™ Concrete Sealants INC.

CS-50

Liquid Butyl Primer

EXPOSURE CONTROLS/ PERSONAL PROTECTION

Respiratory Protection: Avoid breathing of vapor or spray mist. Use a NIOSH/OSHA approved respirator as required to prevent overexposure. In accordance with 29 CFR 1910.134, use either atmosphere supplied respiratory or an air purifying respirator for organic vapors.

Eye Protection: Safety goggles or glasses with side shields.

Protective Gloves/ Clothing: Wear chemical gloves or other protective clothing as required to minimize skin contact.

Ventilation: Provide local exhaust ventilation in volume and pattern to keep TLV of all hazardous ingredients below acceptable limit. (Use of explosion-proof ventilation as requires to control vapor concentrations.)

PHYSICAL AND CHEMICAL PROPERTIES

SPECFIC GRAVITY (H_20=1) : 0.80
VOLATILE (% VOLUME) : 88.00 %
SOLUBILITY IN WATER : Nil
EVAPORATION RATE (BuAc=1) : >1
PERCENT VOLATILE BY VOLUME(%) : 77.3
BOILING POINT : 200 -216 °F
MELT / FREEZE PT. : N/A
VAPOR DENSITY (Air = 1): <1
VAPOR PRESURE (mm of Mercury): 23 @ 25 °C
APPEARANCE / ODOR : Black liquid with petroleum solvent odor.

STABILITY AND REACTIVITY

STABILITY: Stable. Hazardous polymerization will not occur.

CONDICTIONS TO AVOID: Stored away from heat and open flames.

MATERIALS TO AVOID: Material is not compatible with strong oxidizers, strong acids, or bases.

HAZARDOUS DECOMPOSITION OR BY-PRODUCTS: Hazardous decomposition produce fumes, smoke, carbon monoxide, carbon dioxide, hydrocarbon vapors, hydrogen chloride, phosgene, chlorine, and various complex hydrocarbons during combustion.

TOXICOLOGICAL INFORMATION

Please refer to Section 3 for available information on potential health effects.

ECOLOGICAL INFORMATION

No specific ecological data are available for this product. Please refer to section 6 for information regarding accidental releases and Section 15 for regulatory reporting information.

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ConSeal™ Concrete Sealants INC.

CS-50

Liquid Butyl Primer

DISPOSAL CONSIDERSTIONS

Please refer to Sections 5, 6, and 15 for disposal and regulatory information.

TRANSPORT INFORMATION DEPARTMENT OF TRANSPORTATION (DOT)

DOT Shipping Description: FLAMMABLE LIQUID, CLASS 3, UN1133, GROUP II

REGULATORY INFORMATION

This product contains the following toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to Know Act of 1986 and of 40 CFR 372.

CAS #	Chemical Name	% by Weight
108-88-3	Toluene	<0.5
1330-20-7	Xylene	6 - 7
100-41-4	Ethyl Benzene	10 - 15

This information must be included in all MSDS that are copied and distributed for this material.

OTHER INFORMATION

HAZARD RATING SYSTEM:

Hazardous Materials Identification System (HMIS)

	H.M.I.S	KEY
HEALTH	2	4 = Severe
FIRE	3	3 = Serious
REACTIVITY	0	2 = Moderate
		1 = Slight
		0 = Minimal

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MATERIAL SAFETY DATA SHEET

ConSeal™ Concrete Sealants INC.

CS-102

Butyl Sealant For All Precast Structures: Meets Specs.

PRODUCT IDENTIFICATION

PRODUCT NAME: CS-102
PRODUCT DESCRIPTION: Butyl Sealant

H.M.I.S RATING
HEALTH : 0
FIRE : 1
REACTIVITY : 0

NFPA RATING
HEALTH : 0
FIRE : 1
REACTIVITY : 0

HAZARDOUS INGREDIENTS

Not applicable for this product.

HAZARDOUS COMPONENTS

Not applicable for this product.

PHYSICAL DATA

SPECFIC GRAVITY (H_20=1) : 1.25
VOLATILE (% VOLUME) : 0.00 %
SOLUBILITY IN WATER : Insoluble
EVAPORATION RATE (BuAc=1) : N/A
VOLATILE ORGANIC CONTENT : N/A
APPEARANCE / ODOR : Black tacky solid, slight petroleum odor

BOILING POINT : N/A
MELT / FREEZE PT. : N/A
VAPOR DENSITY : N/A
VAPOR PRESURE : N/A

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: 450 °F **METHOD USED:** COC

FLAMMABLE LIMINTS IN AIR, % BY VOLUME: **UEL UPPER:** N/D **LEL LOWER:** N/D

Extinguishing Media: Dry chemical, carbon dioxide, foam, water

Unusual Fire and Explosion Hazards: None known

Special Fire fighting Procedures: None Known

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ConSeal™ Concrete Sealants INC.

CS-102

Butyl Sealant For All Precast Structures: Meets Specs.

REACTIVITY DATA

STABILITY: Stable

MATERIALS TO AVOID: Strong oxidizing agents

CONDICTIONS TO AVOID: None known

HAZARDOUS POLYMERIZATION: Will not occur

HAZARDOUS DECOMPOSITION OR BY-PRODUCTS: Upon ignition may form CO_2, CO, and various hydrocarbon fumes.

HEALTH HAZARDS

ACUTE: None known

CHRONIC: None known

SIGNS AND SYMPTOMS OF EXPOSURE: None known

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: None known

TOXICITY DATA: National Toxicology Program: No
I.A.R.C. Monographs: No
OSHA: No

EMERGENCY AND FIRST AID PROCEDURES:

Eye contact: Flush with warm water for 15 minutes. If irritation persists, contact physion.
Skin contact: wash contaminated area with soap and water .
Ingestion: DO NOT INDUCE VOMITING, Contact a physician.

ROUTES OF ENTRY:

Inhalation: No
Eyes: No
Skin: No
Ingestion: Not likely

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ConSeal™ Concrete Sealants INC.

CS-102

Butyl Sealant For All Precast Structures: Meets Specs.

PRECAUTIONS FOR SAFE HANDLING AND USE

Steps To Be Taken In Case Material Is Released Or Spilled: Remove sources of ignition.

Waste Disposal: Dispose of in accordance with local, state and federal regulations.

Precautions to be taken in handling and storage: Rotate stock. Do not stack cartons on end.

CONTROL MEASURES

Respiratory Protection: Not required under normal applications.

Ventilation:
Local exhaust : N/A
Mechanical : N/A
Special : N/A
Other : N/A

Protective Gloves: Chemical resistant, Imperious

Eye Protection: Safety goggles or glasses

Other protective clothing or equipment: N/A

Hygienic Practices: Wash hands with soap and water after working with this material. Practice good personal hygiene.

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CS-55 Black

Water-Based Acrylic Coating

REVISION DATE: 10/15/2009

PRODUCT IDENTIFICATION

PRODUCT NAME: CS-55 Black
PRODUCT CLASS: Waterbased Acrylic Damproofing Coating

HAZARDOUS INGREDIENTS

Occupational

Component	CAS No.	% by weight	Exposure Limits TLV	PEL	Vapor Pressure
Butoxy dipropanol	29911-28-2	1.37	N.E.	N.E.	
2-butoxyethanol	111-76-2	2.6	25 ppm	50 ppm	
Ammonia	7664-41-7	0.2	25ppm	50ppm	760mm Hg@ 20°C

N.E. = Not Established
N.A. = Not Applicable

PHYSICAL DATA

BOILING RANGE: 212 -344°F
EVAPORATION RATE: Slower than butyl acetate
VAPOR DENSITY: Heavier than air
% VOLATILE WEIGHT: 65.63
APPEARANCE: Black Liquid
WT/GAL: 8.65 LBS.

FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION: OSHA Combustible Liquid Class IIIB
DOT not regulated

Flash Point: over 201°F TCC
LEL: 0.6%

Extinguishing Media: Foam, carbon dioxide, dry chemical, water fog.

Unusual Fire and Explosion Hazards: The material will not support combustion unless the water has evaporated.

Special Firefighting Procedures: Water may be used to cool closed containers, to prevent pressure build-up.

HEALTH HAZARD DATA

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ConSeal™ Concrete Sealants INC.

CS-55 Black

Water-Based Acrylic Coating

Effects of Overexposure:

Eye Contact: May cause irritation.
Skin: May cause irritation and drying of the skin.
Ingestion: May be harmful if swallowed. Ingestion may cause gastrointestinal irritation.
Inhalation: Concentrated vapors may be harmful. May cause dizziness, headache and nausea. May cause irritation to lungs, nose and throat.

Medical Conditions Prone to Aggravation by Exposure: None known.

Primary Routes of Entry: Dermal, eye contact, inhalation, ingestion.

TOXICITY:

Ammonia
Toxic by ingestion. LD50, Oral-rat: 350 mg/kg. LCLo, Inhalation-rat: 2000ppm/4Hr.

Although the concentration in this product is low, the vapor pressure of ammonia makes it possible to exceed the TLV or PEL in container head space or other confined areas. The liberation of ammonia may be retarded by chemical neutralization in this product.

BUTOXY DIPROPANOL
Moderately toxic by ingestion. LD50, Oral-rat: 2.68 ml/kg. LC50, Inhalation-rat: 486ppm/4 Hr.

High concentrations of vapor, absorption through the skin and or ingestion of butoxy dipropanol may cause irritation of the respiratory tract, experienced as nasal discomfort and discharge, with possible chest pain and coughing. Headache, nausea, vomiting, dizziness and drowsiness may occur.

2-BUTOXYETHANOL
LD-50, Oral-rat: 7,282 mg/kg

EMERGENCY AND FIRST AID MEASURES:
Splash (eyes): Flush immediately with copious quantities of running water for at least 15 minutes. Consult physician. **Splash (skin):** Wash effected area with soap and water. Consult physician if irritation persists. **Ingestion:** Consult physician. **Inhalation:** Remove to fresh air.

REACTIVITY DATA

STABILITY: Stable.

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CS-55 Black

Water-Based Acrylic Coating

HAZARDOUS POLYMERIZATION: Will Not Occur.

HAZARDOUS DECOMPOSITION PRODUCTS: Normal combustion products including carbon dioxide, carbon monoxide, metal oxide fumes and oxides of nitrogen.

CONDITIONS TO AVOID: None known.

INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizers.

SPILL OR LEAK PROCEDURE

Steps To Be Taken In Case Material Is Released Or Spilled: Remove sources of ignition. Ventilate area. Cover with inert material and remove. Use non-sparking tools.

Waste Disposal: Dispose of in accordance with local, state and federal regulations.

SAFE HANDLING AND USE INFORMATION

Respiratory Protection: If spray mists are generated, wear NIOSH/MSHA approved particulate respirator. Wear approved organic vapor respirator if vapor level is above exposure limits in Section 5.

Ventilation: Use mechanical ventilation to keep vapor levels below limits in Section 2 and LEL in Section 4.

Protective Gloves: Solvent resistant gloves recommended for direct contact.

Eye Protection: Safety goggles or glasses recommended during pouring, dispensing, paint application, or other situations where eye hazards exist.

Hygienic Practices: Remove and wash contaminated clothing before re-use. Wash hands with soap and water.

SPECIAL PRECAUTIONS

Precautions To Be Taken In Handling: Avoid contact with skin or breathing concentrated vapors. Do not open containers in unventilated areas. Keep ignition sources away. Protect from freezing.

Other Precautions: Do not take internally. Do not get in eyes. Avoid prolonged or repeated contact with skin. Use under well ventilated conditions. For personal hygiene protection always wash thoroughly after handling product. Always wash up before eating, smoking, or using toilet facilities.

REGULATORY INFORMATION

TSCA (Toxic Substances Control Act): All ingredients are on the TSCA Chemical Substances Inventory.

Canadian Regulations:
CEPA (Canadian Environmental Protection Act): All ingredients are on the DSL (Domestic Substances List).

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CS-55 Black

Water-Based Acrylic Coating

WHMIS Classifications:
Class B, Division 2B, Toxic.

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12850-87th Avenue
Surrey, BC. Canada. V3W 3H9
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Fx: 604-594-8845
www.singervalve.com

SINGER MODEL 106/206-RF-PR-SC-NO

Rate of Flow and Pressure Reducing Valve with Solenoid Override
Schematic A-8287A2

DESCRIPTION:

Model 106/206-RF-PR-SC-NO is a pilot operated valve designed to automatically reduce a high inlet pressure into a lower outlet pressure and to keep the flow below a pre-determined maximum. The valve will maintain a relatively steady downstream pressure regardless of fluctuations in the supply pressure or flow rate until the flow reaches the setpoint of the Rate of Flow Pilot. The flow is then held to the pre-determined maximum value.

A Solenoid Valve in the pilot system closes the valve when energized.

Unless otherwise specified, the valve will be assembled for service temperatures to 140° F (60° C).

DESCRIPTION OF OPERATION:

The valve is normally open when pressure is applied to the valve inlet. When the same pressure is applied to the bonnet, the valve closes tight. Refer to 106/206-PG 'Description of Operation'. By controlling the pressure in the bonnet, the valve can be made to open fully, close tight or open partially.

The bonnet pressure (and therefore the position of the valve) is controlled by a pilot circuit consisting of Fixed Restriction (5), Pressure Reducing pilot (7) and Rate of Flow Pilot (9).

When there is no demand (and the downstream pressure is at the setting of Pressure Reducing Pilot [7]), Pilot (7) is closed. Pressure from the inlet side of the valve is directed to the bonnet through Fixed Restriction (5). The Main Valve closes. When flow is required, Pressure Reducing Pilot (7) senses a drop in pressure and opens. Flow through Pilot (7) is greater than flow through Fixed Restriction (5). The bonnet pressure is reduced and the Main Valve opens to supply the demand. Speed of opening is determined by the setting of Flow Stabilizer (6). Refer to Model 26 instructions for details and adjustment.

Under flowing conditions Pressure Reducing Pilot (7) reacts to small changes in the downstream pressure to modulate the bonnet pressure (and valve position) as required to keep the downstream pressure constant. Note that the Main Valve position follows the position of Pilot (7). When Pilot (7) closes, the Main Valve closes. When Pilot (7) opens, the Main Valve opens.

Rate of Flow Pilot (9) senses the pressure drop on Orifice Plate (8). When the pressure drop on the orifice plate increases to the setting of Pilot (9), Pilot (9) starts modulating the Main Valve similar to the operation of the Pressure Reducing Pilot explained above. When Rate of Flow Pilot (9) controls the valve, the downstream pressure will drop below the setting of the Pressure Reducing Pilot (7).

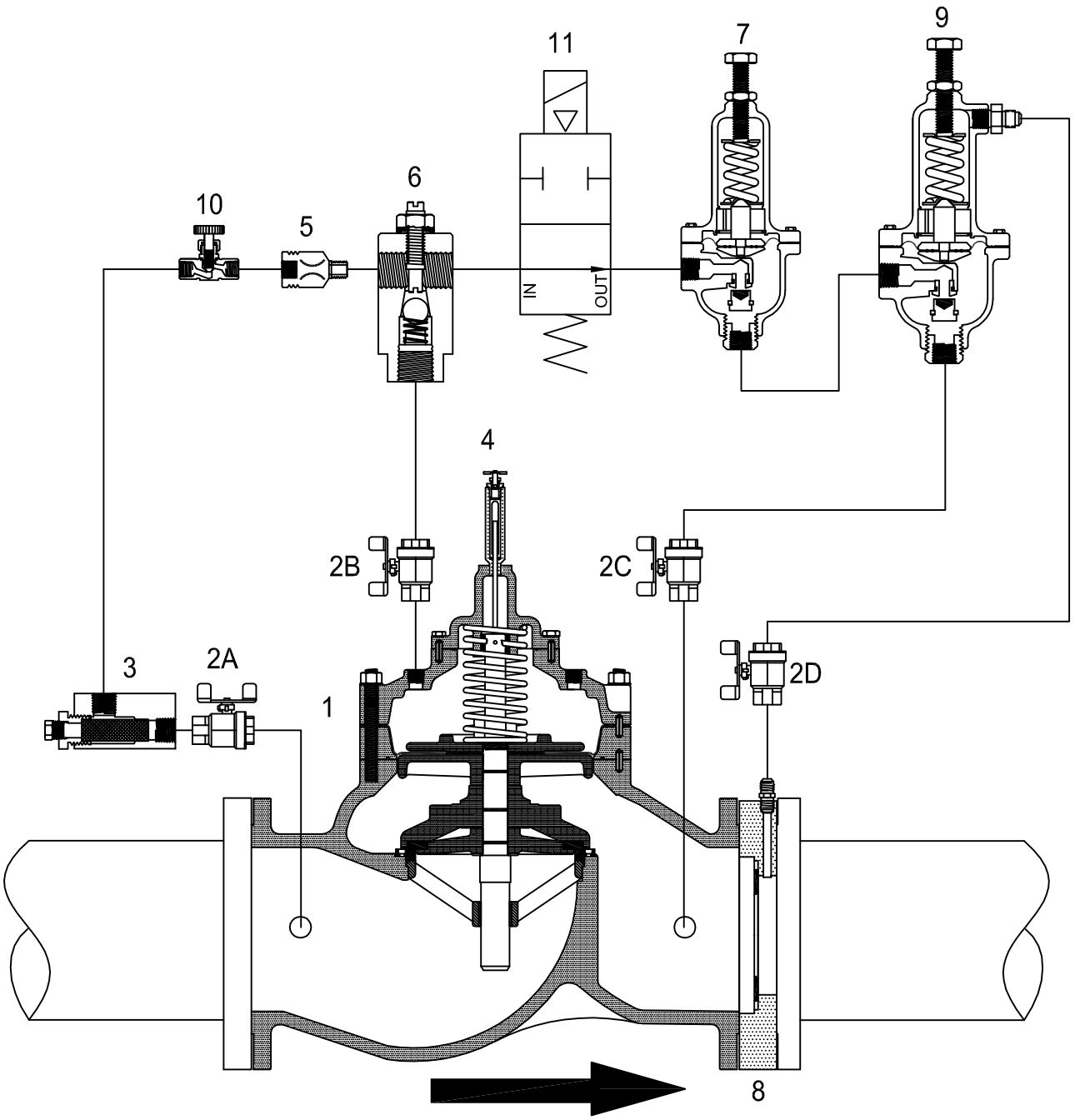
When Solenoid Valve (11) is de-energized, the valve acts as described above. When the Solenoid Valve is energized (closed), inlet pressure is directed to the bonnet closing the Main Valve. Closing speed is controlled by Closing Speed Control (10).

INSTALLATION:

1. Refer to 106/206-PG 'Installation'.
2. Check Solenoid Valve (11) for correct pressure and voltage. Connect to a suitable power source. ***NEVER ENERGIZE A COIL WHEN IT IS REMOVED FROM SOLENOID***.
3. Install Orifice Housing (8) on the outlet of Main Valve (1). Orifice Plate and Orifice Screws are on the upstream (Main Valve) side of the Housing.

ADJUSTING PROCEDURE:

1. Open isolating valves (2A), (2B), (2C) and (2D).
2. De-energize Solenoid Valve (11).
3. Crack outlet stop valve and slowly open inlet stop valve wide.
4. Bleed air from Main Valve bonnet. Use bleed valve on Position Indicator (4).
5. Open outlet stop valve wide.
6. Set reduced (downstream) pressure by turning Pressure Reducing Pilot (7) adjusting screw:
   - To increase pressure, turn adjusting screw clockwise.
   - To reduce pressure, turn adjusting screw counterclockwise.
7. **NOTE THAT THERE MUST BE FLOW THROUGH THE VALVE WHEN PRESSURE IS ADJUSTED BUT THE FLOW MUST BE LESS THAN THE SETTING OF THE RATE OF FLOW PILOT**.
8. **IF THE VALVE DOES NOT OPEN** (pressure remains low), check the adjustment of Flow Stabilizer (6). SEE MODEL 26 INSTRUCTIONS.
9. **IF THE VALVE BEGINS TO OSCILLATE OR HUNT:**
   - Bleed air from Main Valve bonnet. SEE 106/206-PG 'INSTALLATION'.
   - Adjust Flow Stabilizer (6). SEE MODEL 26 INSTRUCTIONS.
10. Increase demand until the downstream pressure drops below the setpoint of Pilot (7).
11. This flow should be the setpoint of the Rate of Flow Pilot (9). See 160-RF instructions for setting of the Rate of Flow Pilot.



1. Main Valve - Model 106/206-PG.
2. Isolating Valve.
3. Strainer - Model J0098B.
4. Position Indicator - Model X107.
5. Fixed Restriction.
6. Flow Stabilizer - Model 26.
7. Pressure Reducing Pilot - Model 160 c/w bracket.
8. Orifice Housing and Orifice Plate.
9. Rate of Flow Pilot - Model 160-RF.
10. Closing Speed Control.
11. Solenoid Valve - Normally Open.

Singer Model 106/206-RF-PR-SC-NO

Rate of Flow and Pressure Reducing
Valve with Solenoid Override

SINGER VALVE INC.

12850-87th avenue
surrey, bc
canada. v3w-3h9

Date: May 7, 1998	Appd. By:
Drawn By: Scott Grover	A-8287A2
106/206-RF-PR-SC-NO	

SINGER VALVE
Result-Based Solutions. Globally.

12850-87th Avenue
Surrey, BC. Canada. V3W 3H9
Ph: 604-594-5404
Fx: 604-594-8845
www.singervalve.com

MODEL S106/S206-PG POWER OPERATED GLOBE VALVE

Sizes 6” to 16" (S106-PG) 12” to 24" (S206-PG)
Installation, Operating and Maintenance Instructions

DESCRIPTION:

This valve is the basic component used for most Singer Automatic Valves. It is a hydraulically operated valve.

DESCRIPTION OF OPERATION:

The valve opens when the bonnet (area above the diaphragm) is connected to the downstream side of the valve AND a pressure drop of 5 psi (35 kPa) is available across the valve. The valve also opens when the bonnet is vented to atmosphere, regardless of pressure drop, provided that the line pressure is 5 psi (35 kPa) or more.

The valve closes when the inlet pressure is directed to the bonnet.

The valve can be made to modulate by varying the bonnet pressure between inlet pressure and outlet pressure. This is done by the pilot circuit.

In some cases the line media is unsuitable for use in the pilot system. In these circumstances external water pressure can be used in the pilot system. The external pressure must be equal to or higher than the line pressure.

Unless otherwise specified, the valve is assembled with components suitable for water service up to 180° F (80° C). For other service conditions, contact your Singer Valve representative.

STORAGE:

This valve must be stored indoors, away from direct sunlight.

INSTALLATION:

Use washers under nuts when bolting valve flanges to pipe flanges to protect the Epoxy Coating.

Control valves must be installed in a horizontal pipe with the bonnet up. Smaller valves (6” and smaller) can be installed in a vertical pipe if the order states the orientation. Disassembly is difficult but not impossible in valves installed in vertical pipe.

A stable, non-failing source of pressure is necessary to operate a pilot operated control valve.

Operating fluid must be clean and free of air.

Under high velocity conditions the pressure signal, when the pick-up point is located on the main valve inlet, may be adversely affected. As an example, a relief valve will operate more effectively and control more accurately if the operating pressure and sensing pressure is connected to the header.

Ideally, six pipe diameters of straight pipe is required on the inlet of any control valve but

- Fully open **Gate Valve** can be installed on the inlet of a valve, provided it is used as an isolating valve and never used in partially open condition.
- A **Butterfly Valve** with stem horizontal can not be installed in the inlet of a control valve unless operating pressure and sensing lines are connected upstream of the butterfly valve, in a location that gives true system pressure.
- A **Butterfly Valve** with stem vertical can be installed in the inlet of a control valve as long as velocity does not exceed 15 ft/sec. The butterfly valve can not be used for throttling. If problems develop at high flows, operating pressure and possible sensing can be connected upstream of the butterfly valve, in a location that gives true system pressure.
- A control valve can be installed with no straight pipe on the inlet if the operating and sensing lines are connected to a location that gives true system pressure.

The connection point should be made at the pipe centerline to avoid air pick-up at the top of the pipe.

1. **It is possible that diaphragms may take a set after shipping and storage. It is highly recommended that Bonnet and Body Bolts or Nuts be tightened after installation but before pressurizing the valve. If a leak develops after pressurizing, de-pressurize the valve and tighten the bolts or nuts.**

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Installation (Cont.):

2. For most convenient operation and maintenance, line isolation valves should be installed.
3. A suitable bypass should be provided to allow for servicing of the valve without interrupting the flow.
4. Install pressure gauges upstream and/or downstream of valve as appropriate. This will facilitate ease of setting the pilot system.
5. A strainer with a suitable basket should be installed ahead of the valve to protect it from foreign material.
6. Sufficient space should be provided around the valve for disassembly.
7. Flush system of all foreign matter before installing the valve.
8. Check direction of flow (inlet of valve is marked OR an arrow on the side of body indicates flow direction) and install the valve accordingly.
9. VENT AIR FROM THE BONNET After installation, when the valve is pressurized, vent air from the bonnet:
   - Valves with no Limit Switch: Loosen pipe plug at the centre of the bonnet to bleed air. If equipped with position indicator, use bleed-cock on indicator.
   - Valves with Limit Switch: Refer to Drawing A0707A. Use bleed screw (63) to vent air.

SERVICE SUGGESTIONS:

POSSIBLE CAUSE / REMEDY

FAILS TO OPEN

1. Insufficient inlet pressure. / Increase pressure

2. Pressure in the bonnet is not released:
- Isolating valves on pilot lines closed. - Open valves
- Pilot components not functioning. - Refer to specific instructions on pilot components
- Foreign material in pilot system. - Clear obstruction

FAILS TO CLOSE

Lack of pressure in the bonnet due to:
- Pilot components not functioning. - Refer to specific instructions on pilot components.
- Foreign material in pilot system. - Clear obstructions.
- Ruptured diaphragm. - Replace worn parts.
- Obstruction in the valve. - Remove obstructions.
- Worn main valve disc. - Replace disc.

PULSATIONS

- Air in the bonnet. - Vent air. Refer to "Installation (9)" above.
- Improper adjustment to pilot components. - Refer to specific instructions on pilot components.
- Valve oversized. A smaller valve in parallel may be required.

MAINTENANCE:

The SINGER Model S106/S206-PG requires a minimum of maintenance. All parts are accessible for inspection and repair without removing the valve from the line.

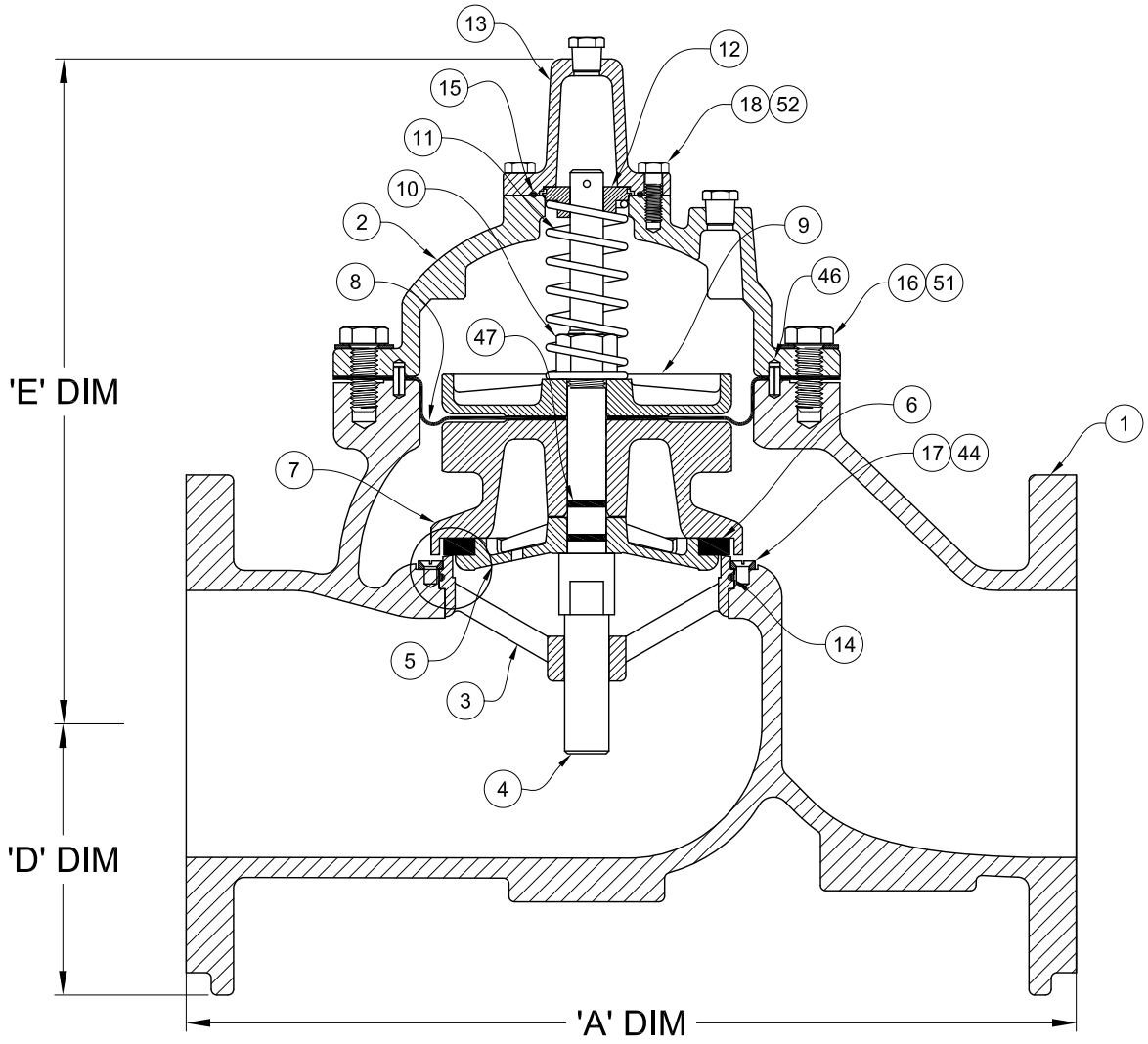
1. Close upstream and downstream isolating gate valves.
2. Disconnect body and bonnet pilot lines.
3. Remove bonnet. If bonnet does not come free readily, it can be pried loose with a small pry-bar.
4. Remove inner valve assembly for inspection. Do not remove seat ring unless inspection shows that it is damaged. **Be very careful not to damage the epoxy coating when removing and installing the inner valve assembly.**
5. Replace worn or defective parts and reassemble.

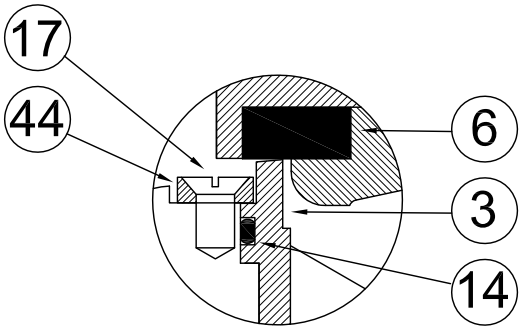
NOTE REGARDING FREEZING:

This valve does not drain completely when inlet and outlet pipes are drained. Where freezing conditions are expected, one of the following must be performed:

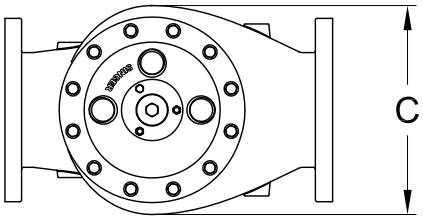
- Drain valve and pilot system completely.
- Add suitable anti-freeze to valve and pilot system **(Non-potable water service only).**
- Provide insulation and/or heating to keep the valve from freezing.

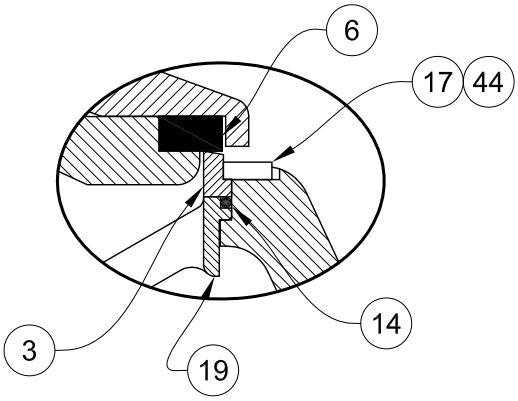
A0961A





ONE PIECE SEAT & BOTTOM GUIDE DETAILS





TWO PIECE SEAT & BOTTOM GUIDE DETAILS

SINGER VALVE
Result-Based Solutions. Globally.™

www.singervalve.com 12850-87th Avenue. Surrey, B.C. V3W 3H9

Drawn By:	Approved By:
STEPHEN BISHOP	
Date:	Drawing:
APRIL 25th 2008	A0961A

6" & 8" S106 PG ASSEMBLY

SINGER VALVE
Result-Based Solutions. Globally.

12850-87th Avenue
Surrey, BC. Canada. V3W 3H9
Ph: 604-594-5404
Fx: 604-594-8845
www.singervalve.com

Material Specifications & Dimensions

6" and 8" (150mm and 200mm) S106-PG
For Drawing A0961A

Item	Part Name	Material
1	Body	Ductile Iron
2	Bonnet	Ductile Iron
3	Seat Ring / Bottom Guide	Stainless Steel
4	Stem	Stainless Steel
5	Disc Retainer	Ductile Iron
6 **	**Resilient Disc**	**EPDM**
7	Inner Valve	Ductile Iron
8 **	**Diaphragm**	**Reinforced EPDM**
9	Clamp Plate	Ductile Iron
10	Stem nut	Brass B-16
11	Spring	Stainless Steel
12	Guide Bushing	Brass B-16
13	Stem Cap	Ductile Iron
14 **	**Seat Ring Seal**	**Buna-N**

Item	Part Name	Material
15 **	**Stem Cap Seal**	**Buna-N**
16	Bonnet Bolt	Stainless Steel
17	Seat Ring Screws	Stainless Steel
18	Stem Cap Capscrew	Stainless Steel
44	Seat Retaining Washer	Stainless Steel
46	Locating Pin	Steel
47 **	**Stem Seal**	**Buna-N**
51	Bonnet Washer	18-8 Stainless Steel
52	Stem Cap Washer	18-8 Stainless Steel

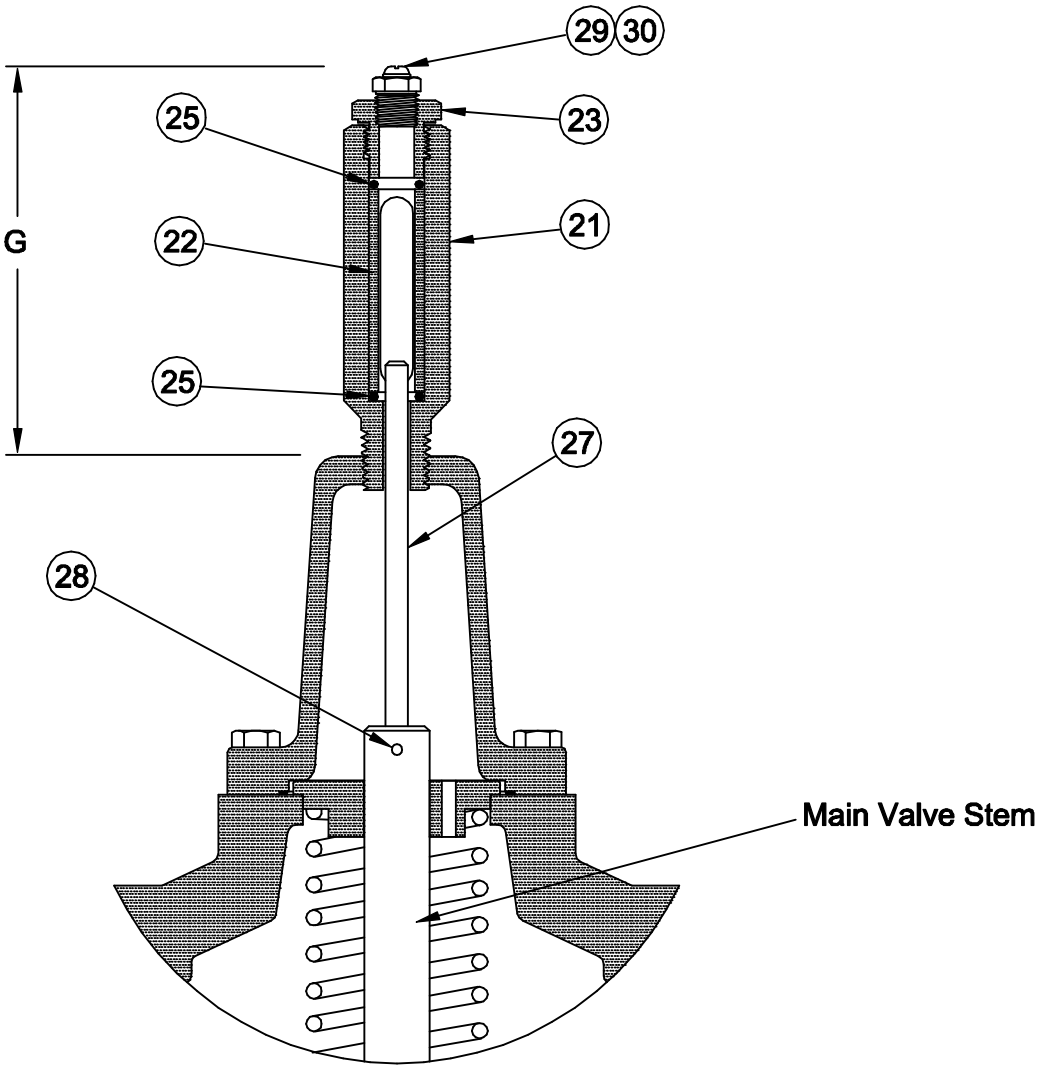
** Recommended spare parts (included in the Rebuild Kit)

S106-PG		**Globe**			
		A	**D**	**E**	**C**
6" 150mm	**150F / PN10, PN16**	20" 508mm	6.09" 155mm	15.00" 381mm	12.16" 309mm
	300F / PN25, PN40	21" 533mm	6.84" 174mm	15.00" 381mm	12.68" 322mm
8" 200mm	**150F / PN10, PN16**	25.38" 645mm	7.63" 194mm	19.75" 502mm	17.20" 437mm
	300F / PN25, PN40	26.38" 670mm	7.88" 200mm	19.75" 502mm	17.20" 437mm

For Anti-Cavitation (-AC) trim equipped valves please see PG-AC spec sheet

SSX107 Position Indicator

SIZES: 2-1/2" TO 8" 106, 4" TO 10" 206



Item	Description	Standard Material
21	Indicator Body	Stainless Steel
22	Sight Tube	Pyrex Glass
23	Indicator Cap	Stainless Steel
25	Sight Tube Gasket	Buna-N
27	Indicator	Stainless Steel
28	Retaining Pin	Stainless Steel
29	Bleed Screw	Stainles Steel
30	Bleed Washer	Stainles Steel & Buna-N

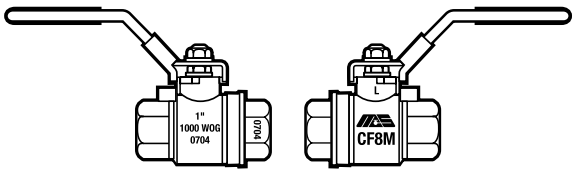
Valve Size	2-1/2"	3"	4"	6"	8"	10"
Dimension 'G' - 106	4-1/2"	4-1/2"	4-3/4"	5"	6-1/2"	N/A
Dimension 'G' - 206	N/A	N/A	4-1/2"	4-3/4"	5"	6-1/2"

A0564C_SS

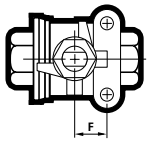
M. A. Stewart & Sons Ltd.
VALVES AND FITTINGS

G Series Investment Cast Stainless Steel Ball Valves

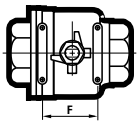
G2E

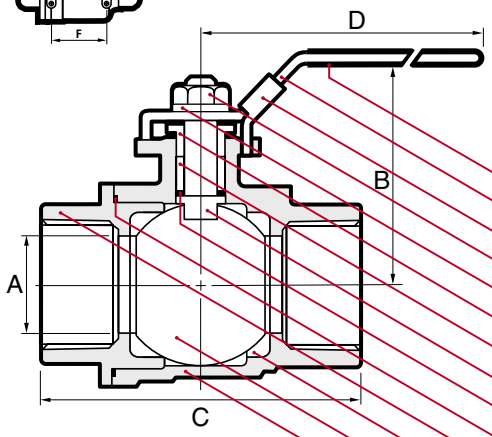


Sizes 1/4" to 2"



Sizes 2 1/2" & 3"





- Full port
- NPT ends to ANSI B1.20.1
- Two piece body
- Blowout-proof stem
- Adjustable packing nut
- Locking lever handle
- Actuator mounting pad
- Floating ball
- 1000 PSI, WOG 1/4" to 3"
- P-T 450°F @ 100 PSI

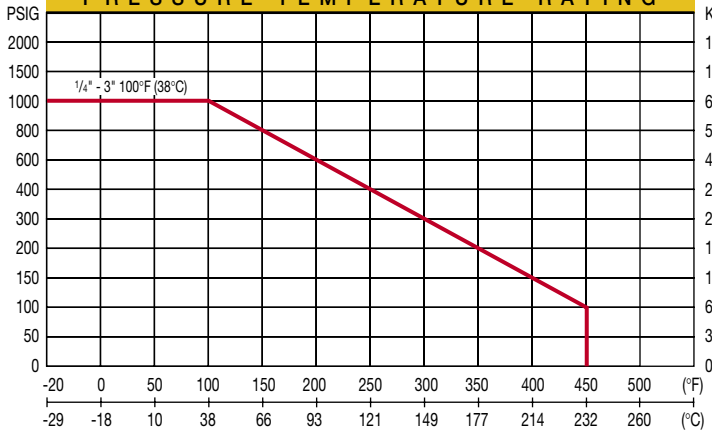
4.2

NAME / MATERIAL
1. Handle Grip / Vinyl
2. Handle / Stainless Steel 304 - A276
3. Locking Device / Stainless Steel 304 - A276
4. Handle Nut / Stainless Steel 304 - A 276
5. Stem Washer / Stainless Steel 304 - A276
6. Gland Nut / Stainless Steel 304 - A276
7. Packing / Reinforced Teflon 15% GFT
8. Stem / Stainless Steel 316 / A276
9. Thrust Washer / Reinforced Teflon 15% GFT
10. Gasket / Reinforced Teflon 15% GFT
11. Cap / Stainless Steel 316 - A351 - CF8M
12. Seat / Reinforced Teflon 15% GFT
13. Ball / Stainless Steel 316 - A 351 - CF8M
14. Body / Stainless Steel 316 - A 351 - CF8M

- *Markings to MSS-SP25*
- *Material test results & inspection certificates available upon request*
- *CRN numbers available upon request*
- *Mounting pads are dimpled at drilling locations*

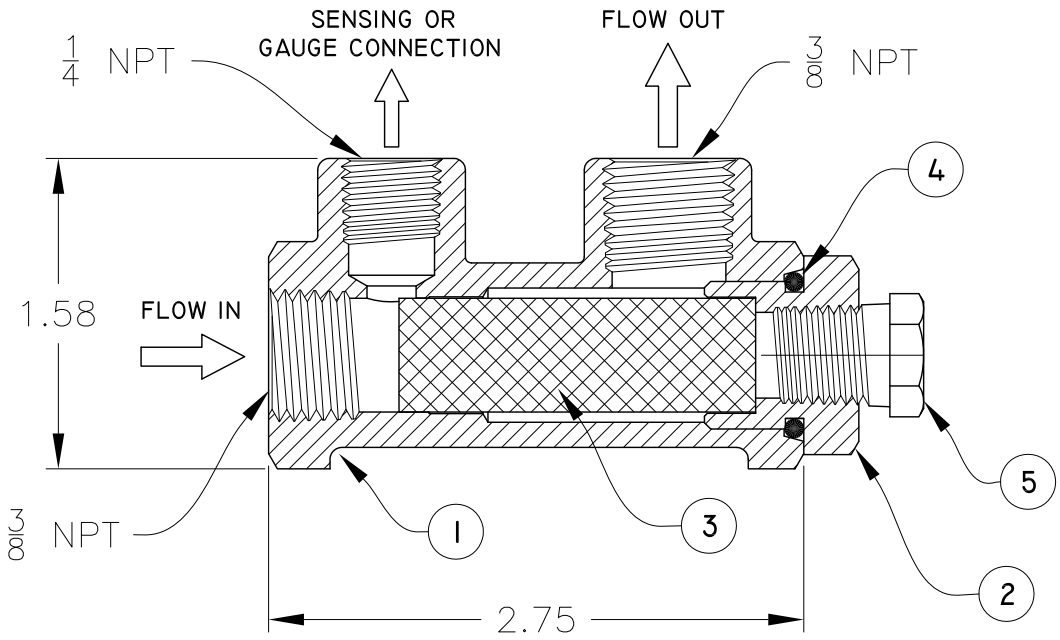
DIMENSIONS										
size	8	10	15	20	25	32	40	50	65	80
mm/in	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
A	9.6	9.6	12.7	20.0	24.0	31.8	38.1	50.0	65.0	78.0
mm/in	0.378	0.378	0.500	0.787	0.945	1.252	1.50	1.968	2.559	3.071
B	54.0	54.0	54.6	64.8	67.8	79.4	84.4	100.7	135.0	145.00
mm/in	2.126	2.126	2.150	2.551	2.669	3.126	3.323	3.965	5.315	5.709
C	49.4	49.4	56.0	66.0	77.7	90.4	102.4	119.0	151.4	171.4
mm/in	1.945	1.945	2.205	2.598	3.059	3.559	4.031	4.685	5.961	6.748
D	98.0	98.0	98.0	122.0	122.0	152.0	152.0	178.0	247.0	247.0
mm/in	3.858	3.858	3.858	4.803	4.803	5.984	5.984	7.008	9.724	9.724
F	12.7	12.7	12.7	14.9	14.9	17.7	17.7	23.6	72.1	72.1
mm/in	0.500	0.500	0.500	0.587	0.587	0.697	0.697	0.929	2.839	2.839
CV	7.0	7.0	15.0	45.0	65.0	125.0	175.0	380.0	500.0	900.0
weights	0.20	0.21	0.235	0.43	0.63	1.11	1.49	2.60	5.42	8.38
kg/lb	0.440	0.462	0.517	0.946	1.386	2.442	3.278	5.720	11.924	18.436

PRESSURE TEMPERATURE RATING

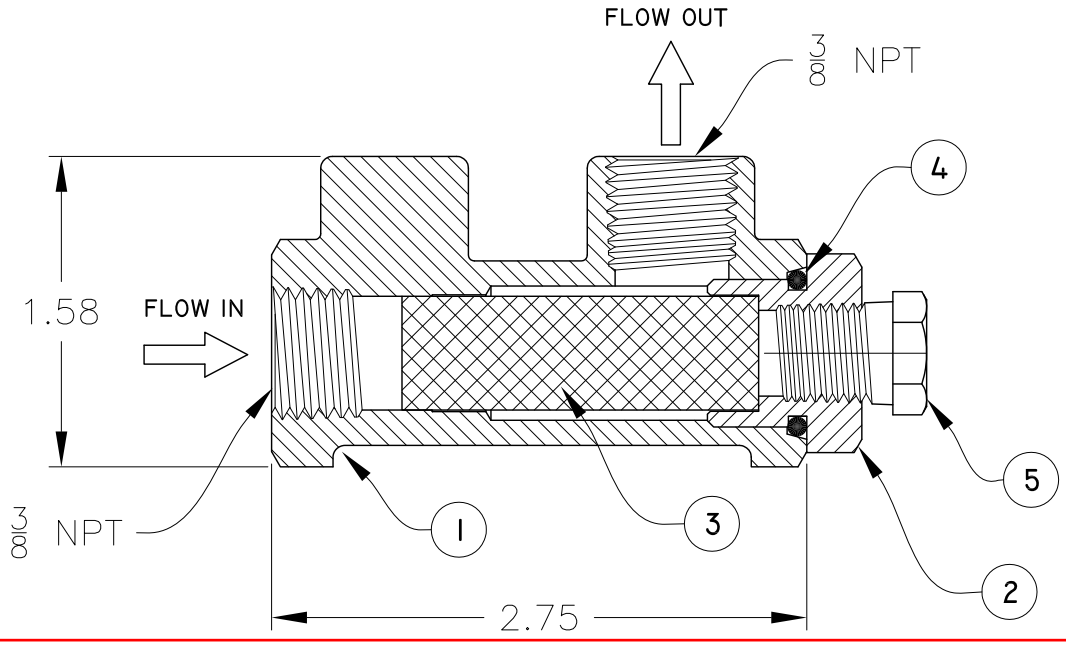


A0966B

SINGER MODEL J0097A STRAINER



SINGER MODEL J0098A STRAINER

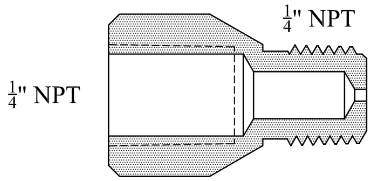


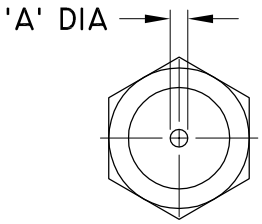
ITEM	DESCRIPTION	MATERIAL
1.	BODY	STAINLESS STEEL 316
2.	SCREEN RETAINER	STAINLESS STEEL 316
3.	SCREEN (40 Mesh)	STAINLESS STEEL 316
4.	SCREEN RETAINER SEAL	BUNA
5.	BLOW DOWN PLUG	STAINLESS STEEL 316

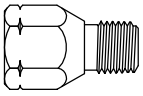
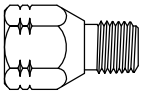
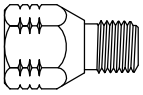
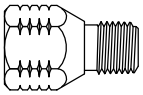
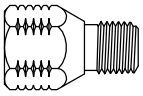
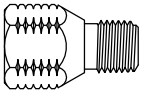
SINGER VALVE
Result-Based Solutions. Globally.™
www.singervalve.com 12850–87th Avenue. Surrey, B.C. V3W 3H9

Drawn By:	Approved By:
STEPHEN BISHOP	
Date: APRIL 12th 2012	Drawing: A0966B

SINGER MODEL J0097A & J0098A STRAINER





"A" Diameter	No. of ID Grooves		Stainless steel 303 part number	Stainless steel 316 part number
1/16" / 1.6mm	1		M1009E-SS	M1009E-S3
3/32" / 2.4mm	2		M1149E-SS	M1149E-S3
1/8" / 3.2mm	3		M1010E-SS	M1010E-S3
1/4" / 6.4mm	4		M1997A-SS	M1997A-S3
7/64" / 2.8mm	5		M2023A-SS	M2023A-S3
3/16" / 4.8mm	6		M1813B-SS	M1813B-S3

Series/Model No.: 25	Dwg by: SG	SINGER VALVE
	Apvd by: KO	Result-Based Solutions. Globally.
Description: Fixed restriction	Dwg date: 07/31/15	www.singervalve.com 12850-87th Avenue. Surrey, B.C. V3W 3H9
	Dwg No.: M1009E-S	
	Rev: A	

General Description

Series "N" needle valves are ideal as speed controls on hydraulic and pneumatic systems where a reverse flow check is not needed. They provide excellent control and a reliable shutoff in a very small envelope.

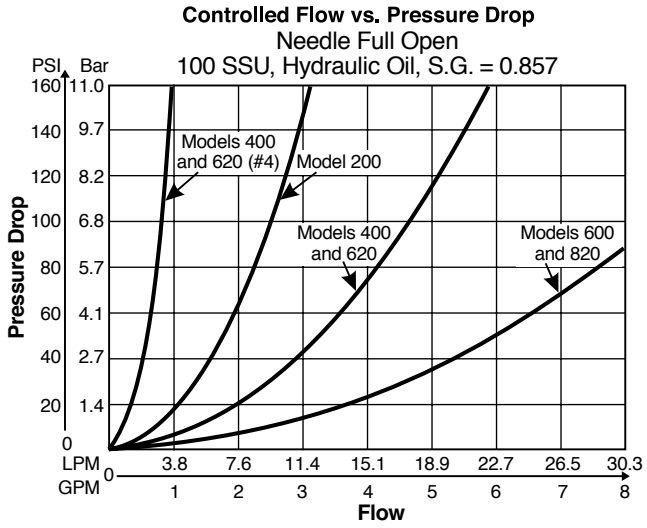
Operation

A two-step needle allows fine adjustment at low flow by using the first three turns of the adjusting knob; the next three turns open the valve to full flow, and also provide standard throttling adjustments.

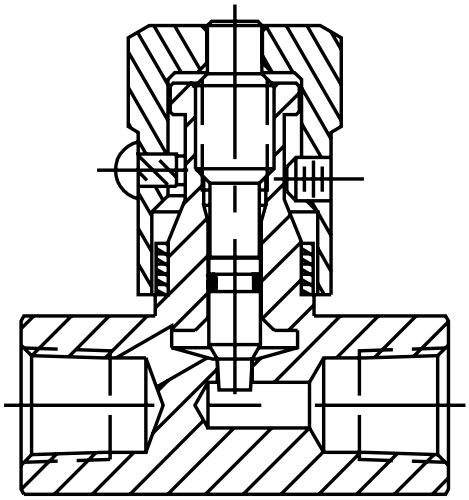
Features

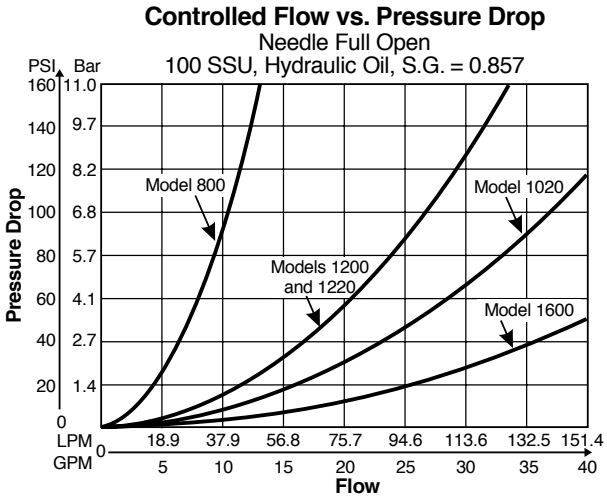
- The exclusive "Colorflow" color-band reference scale on the valve stem is a great convenience and time-saver in setting the valve originally and in returning it to any previous setting.
- A simple set screw locks the valve on any desired setting.
- A tamperproof option (T) feature is also available to prevent accidental or intentional adjustment of flow setting.

Performance Curves

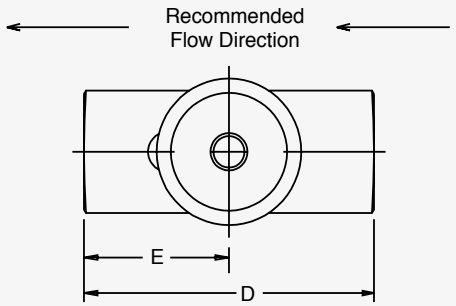


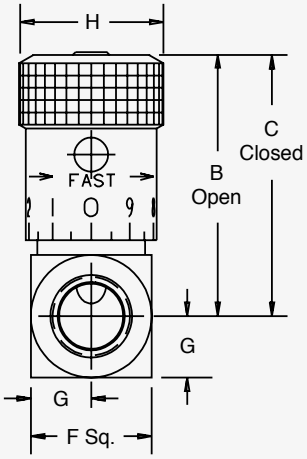
Specifications	
Maximum Operating Pressure	Brass: 140 Bar (2000 PSI); except for N1600 brass which is 35 Bar (500 psi) Steel & Stainless Steel: 345 Bar (5000 psi) for 200 thru 1220; 207 Bar (3000 psi) for all other sizes
Operating Temperature	-40°C to +121°C (-40°F to +250°F)

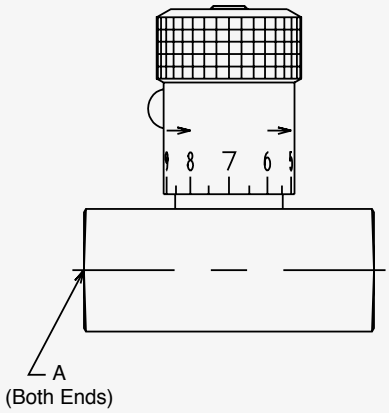


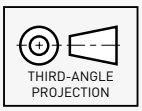


1/8" 1/4" 3/8" 1/2" 5/8" 3/4" 1" 1-1/4" 1-1/2"









Needle Valves - Series N

Model Number	Max Flow LPM (gpm)	A	B	C	D	E	F	G	H
N400	19 (5)	1/4–18 NPTF	45.5 (1.79)	40.4 (1.59)	50.8 (2.00)	25.4 (1.00)	20.6 (0.81)	10.4 (0.41)	20.6 (0.81)
N600	30 (8)	3/8–18 NPTF	55.4 (2.18)	49.5 (1.95)	63.5 (2.50)	31.8 (1.25)	25.4 (1.00)	12.7 (0.50)	25.4 (1.00)
N800	57 (15)	1/2–14 NPTF	68.6 (2.70)	61.5 (2.42)	66.5 (2.62)	33.3 (1.31)	31.8 (1.25)	15.7 (0.62)	30.2 (1.19)
N1200	95 (25)	3/4–14 NPTF	85.9 (3.38)	71.4 (2.81)	82.6 (3.25)	41.1 (1.62)	38.1 (1.50)	19.1 (0.75)	35.1 (1.38)

*Inch equivalents for millimeter dimensions are shown in (**)

Ordering Information

Options | Series: N | Size | Material | Needle Options | Other Options | Seal Compound | Design Series

Options

Code	Description
Omit	NPTF
8	BSPT
9	BSPP

Size

Sizes available: Brass			
400	600	800	1200
Sizes available: Stainless Steel			
400	600	800	

Material

Code	Description
Omit	Standard Knob
B	Brass
S	Steel
*SS	Stainless Steel

Series F Brass Valves can be used for both air and oil service.

* Available in 400, 600 and 800 sizes.

Needle Options

Code	Description
Omit	Standard Knob
4	Fine Metering (200, 400, 600, 620 sizes)

Other Options

Code	Description
Omit	Standard Knob
T*	Tamperproof
F	Finger Screw

* Not available above 1200 size.

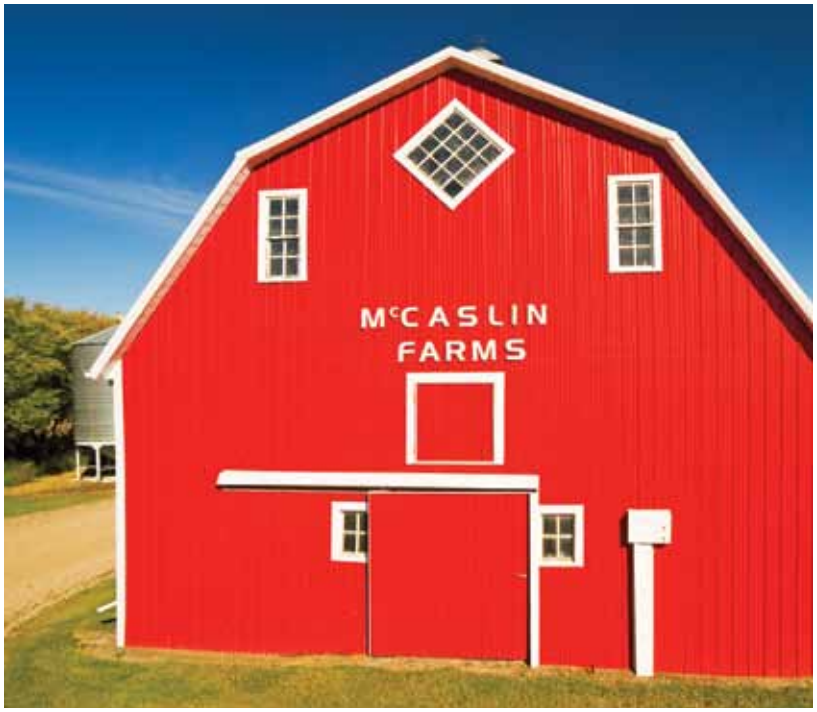
Seal Compound

Code	Description
Omit	Nitrile (Standard)
V	Fluorocarbon

Design Series

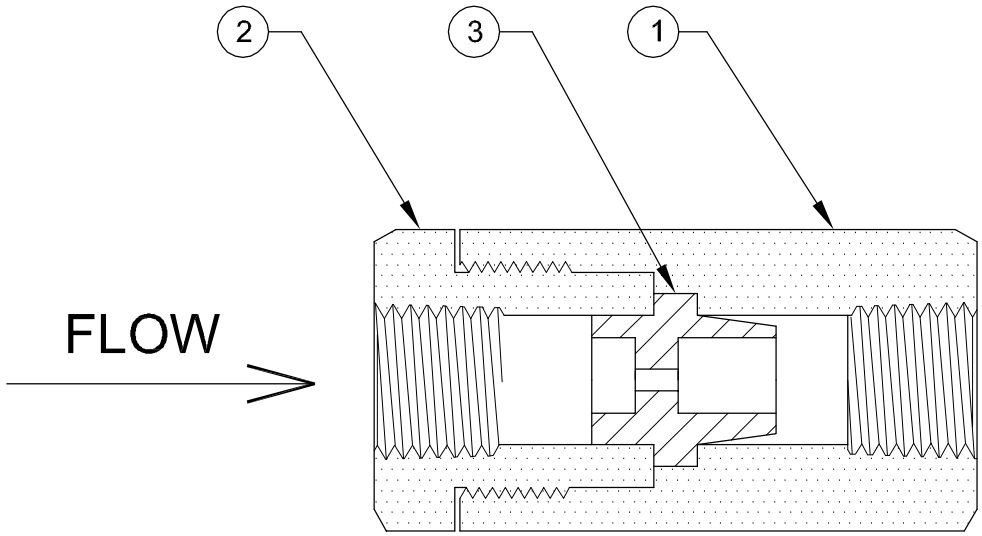
NOTE: Not required when ordering.

Model Number	Weight Kg (lbs.)
N400	0.2 (0.5)
N600	0.3 (0.7)
N800	0.7 (1.5)
N1200	1.0 (2.3)



1/8" 1/4" 3/8" 1/2" 5/8" 3/4" 1" 1-1/4" 1-1/2"

A0678A



Orifice Inserts available:

0.15 GPM
0.25 GPM
0.35 GPM
0.50 GPM
0.60 GPM
0.80 GPM
1.00 GPM
1.20 GPM
1.50 GPM
1.70 GPM
2.00 GPM
2.50 GPM
3.00 GPM
3.50 GPM
4.00 GPM
4.50 GPM
5.00 GPM
5.50 GPM

Item	Description	360 Standard Assy Mat'l	360-SS Optional Assy Mat'l
1.	Body	Brass	Stainless Steel 316
2.	Inlet Connector	Brass	Stainless Steel 316
3.	Orifice	Resilient	Resilient

Model 360 maintains a constant flow from 10 psi pressure drop to 100 psi pressure drop.

SINGER VALVE INC.

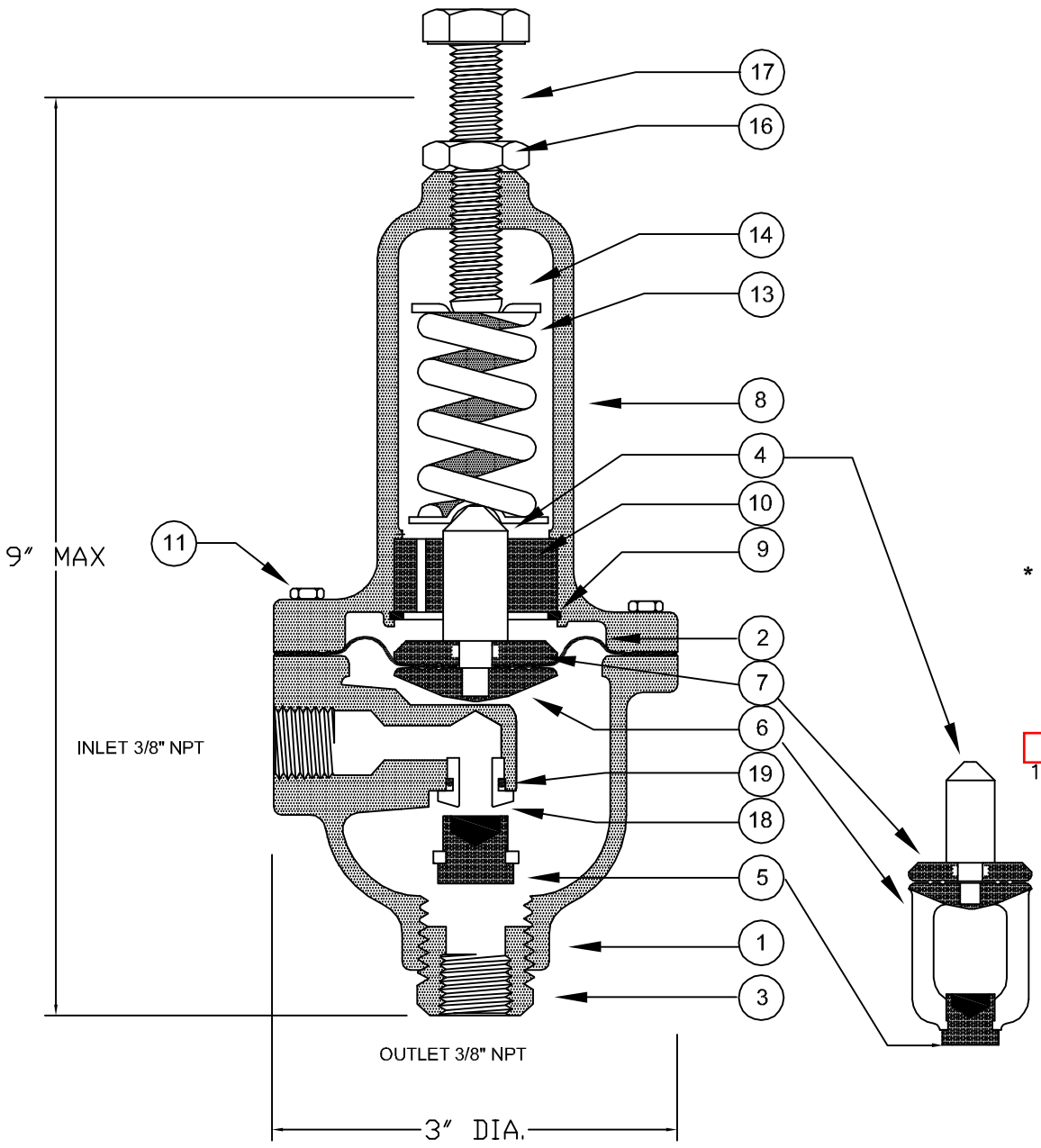
12850-87th AVENUE
SURREY, BC
CANADA. V3W 3H9

DATE: January 18, 2003	APP'D BY:
DRAWN BY: Nicole Moeller	A0678A

Singer Model 360

A0708D

SINGER MODEL 160
PRESSURE REDUCING PILOT



Item	Description	Material
1.	Body	Stainless Steel 316
* **2.**	**Diaphragm**	**EPDM**
3.	Outlet Connector	Stainless Steel 316
4.	Stem	Stainless Steel 303
* **5.**	**Inner Valve**	**Stainless Steel 316 & EPDM**
6.	Yoke	Stainless Steel 316
7.	Clamp Plate	Stainless Steel 316
8.	Spring Casing	Stainless Steel 316
9.	Retaining Ring	Stainless Steel 302
10.	Guide Bushing	DELRIN
11.	Casing Screw (8)	Stainless Steel 303
13.	Spring	Spring Steel
14.	Spring Step (2)	Stainless Steel 302
16.	Locknut	Stainless Steel 303
17.	Adjusting Screw	Stainless Steel 303
18.	Seat Ring	Stainless Steel 316
19.	Seat Ring Seal	Buna-N
** 20.	Bucking Spring	Stainless Steel 302

*** Recommended Spare Parts - supplied in Parts KIT.**

** NOT SHOWN – USED ONLY WITH SPRING RANGE 5 – 50 PSI.

SPRING RANGES	ADJUSTMENT (PSI/TURN)
5 – 50 PSI	7
10 – 80 PSI	12
20 – 200 PSI	26
100 – 300 PSI	35

February 2002

SINGER VALVE
Result-Based Solutions. Globally.™
www.singervalve.com 12850-87th Avenue. Surrey, B.C. V3W 3H9

Drawn By:	Approved By:
Kari Oksanen	Kari Oksanen
Date: November 15, 2003	**Drawing:** A0708D

Model 160-SS

SINGER VALVE
Result-Based Solutions. Globally.

12850-87th Avenue
Surrey, BC. Canada. V3W 3H9
Ph: 604-594-5404
Fx: 604-594-8845
www.singervalve.com

SINGER MODEL 160

Pressure Reducing Pilot Drawing A0708D
Installation, Operating and Maintenance Instructions

DESCRIPTION AND OPERATION:

Model 160 is a direct acting, spring and diaphragm type pressure reducing valve. The valve is held open by the spring. The outlet pressure acting on the diaphragm opposes the spring to close the valve.

INSTALLATION:

1. Install the valve as shown in the enclosed schematic or drawing.
2. Note the direction of flow and install the valve accordingly.
3. The valve should be installed with the adjusting screw pointing up.

ADJUSTMENT:

Turn the adjusting screw clockwise for increased pressure, counterclockwise for reduced pressure setting. Range of adjustment is shown on the name plate.

DISMANTLING:

1. Close upstream and downstream isolating valves.
2. Remove the valve from the pilot system.
3. Remove the adjusting screw.
4. Remove the body screws (11) and remove the spring casing assembly.
5. Loosen the diaphragm if it adheres to the body and remove the Stem/Yoke assembly. Be careful to avoid damage to the stem as any interference or friction between the stem (4) and guide bushing (10) can cause problems.

If further disassembly is required:

INNER VALVE REPLACEMENT:

Hold the inner valve (5) HEX in a vise and use a screwdriver or similar tool to turn the Yoke (6).

DIAPHRAGM REPLACEMENT:

- Note the orientation of the diaphragm to help install the replacement diaphragm properly.
- Hold the inner valve (5) HEX in a vise and use a **3/16" Allen Key (Hex Drive)** on top of the stem (4) to turn the stem counterclockwise. If required, use a screwdriver or similar tool at the Yoke (6) to prevent the yoke from turning. BE CAREFUL NOT TO DAMAGE THE STEM GUIDING SURFACE.
- Replace the diaphragm and orient it to straddle the legs of the yoke.

REASSEMBLY:

Reassembly is the reverse of disassembly. Ensure that parts are replaced in the sequence shown on the drawing.

TEST PROCEDURE:

Connect a source of air or water to the inlet. Attach a 3/8" line with a pressure gauge and shut-off valve to the outlet. Back off the adjusting screw, then proceed to turn it in. The gauge should show an increase within the range marked on the valve. Open the shut-off valve slightly and bleed flow to atmosphere. Pressure should drop slightly and return to setting when the shut-off valve is closed. This check should be performed at various settings.

SERVICE SUGGESTION:

POSSIBLE CAUSE / REMEDY

FAILS TO OPEN:

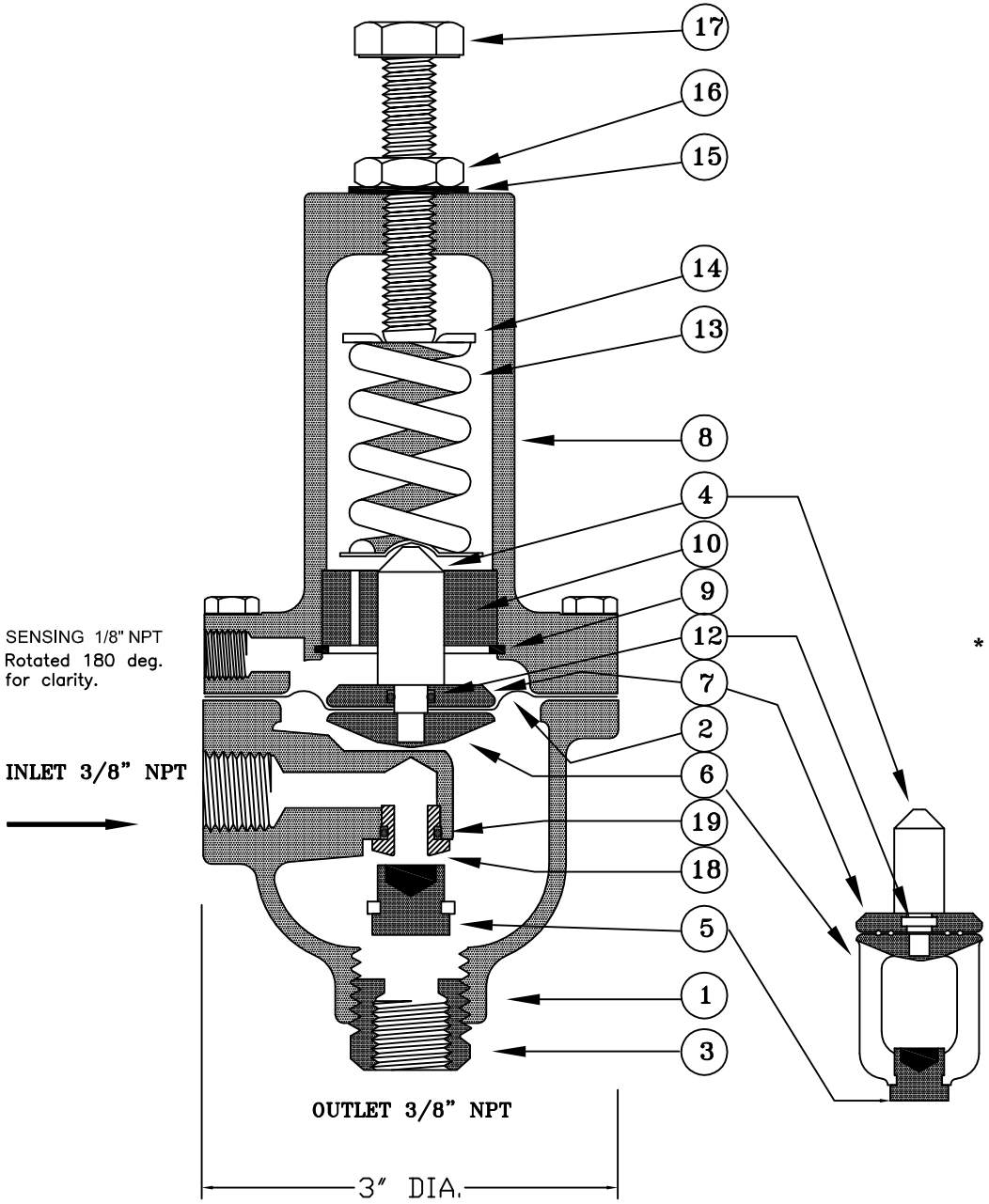
Valve underset.

FAILS TO CLOSE:

Valve overset.
Obstruction on seat.
Ruptured diaphragm.
Worn inner valve.

A0709C-SS

SINGER MODEL 160-RF SS
Rate of Flow Pilot



Item Description Material

	1.	Body	Stainless Steel
*	**2.**	**Diaphragm**	**EPDM**
	3.	Outlet Connector	Stainless Steel
	4.	Stem	Stainless Steel
*	**5.**	**Inner Valve**	**Stainless Steel & EPDM**
	6.	Yoke	Stainless Steel
	7.	Clamp Plate	Stainless Steel
	8.	Spring Casing	Stainless Steel
	9.	Retaining Ring	Stainless Steel
	10.	Guide Bushing	DELRIN
	11.	Casing Screw (8)	Stainless Steel
*	**12.**	**Clamp Plate Seal**	**Buna-N**
	13.	Spring	Stainless Steel
	14.	Spring Step (2)	Stainless Steel
	15.	Thread Seal	Steel & Buna-N
	16.	Locknut	Stainless Steel
	17.	Adjusting Screw	Stainless Steel
	18.	Seat Ring	Stainless Steel
	19.	Seat Ring Seal	Buna-N
**	20.	Bucking Spring	Stainless Steel

* **Recommended Spare Parts - supplied in Parts KIT.**

** NOT SHOWN – USED ONLY WITH SPRING RANGE 2 – 20 PSI.

SPRING RANGES
2 – 20 PSID
25 – 50 PSID

SINGER VALVE
Result-Based Solutions. Globally.
www.singervalve.com 12850-87th Avenue. Surrey, B.C. V3W 3H9

Drawn By:	Approved By:
Scott Grover	Scott Grover
Date:	Drawing:
January 2014	A0709C-SS

Model 160-RF SS

SINGER VALVE
Result-Based Solutions. Globally.

12850-87th Avenue
Surrey, BC. Canada. V3W 3H9
Ph: 604-594-5404
Fx: 604-594-8845
www.singervalve.com

SINGER MODEL 160-RF

Rate of Flow Pilot Drawing A0709E
Installation, Operation and Maintenance Instructions

DESCRIPTION AND OPERATION:

Model 160-RF is a direct acting, spring and diaphragm type normally open pilot. The valve is held open by the spring. The spring force is combined with pressure connected to the upper sensing port acting on the diaphragm to push the valve open. Pilot outlet pressure acting on the underside of the diaphragm pushes the pilot closed.

In a typical application, the outlet of the pilot is also the upstream side of an orifice plate and the downstream side of the orifice plate is connected to the sensing connection of the pilot. The pilot senses the differential pressure produced by the orifice. When this differential pressure becomes equal to the setpoint of the pilot, the pilot closes.

INSTALLATION:

1. Install the valve as shown in the enclosed schematic or drawing.
2. Note the direction of flow and install the valve accordingly.
3. **The valve must be installed with the adjusting screw pointing up.**
4. **After pressurizing, bleed air from the spring casing by loosening Bleed Screw (22).**

ADJUSTMENT:

Turn the adjusting screw clockwise for increased flow, counterclockwise for reduced flow setting. Range of adjustment is shown on the name plate.

DISMANTLING:

1. Close upstream and downstream isolating valves.
2. Remove the valve from the pilot system.
3. Remove Adjusting Screw and Thread Seal.
4. Remove the body screws (11) and remove the spring casing assembly.
5. Loosen the diaphragm if it adheres to the body and remove the Stem/Yoke assembly. Be careful to avoid damage to the stem as any interference or friction between the Stem (4) and Guide Bushing (10) can cause problems.

INNER VALVE REPLACEMENT:

Hold the inner valve (5) HEX in a vise and use a screwdriver or similar tool to turn the Yoke (6).

DIAPHRAGM REPLACEMENT:

Note the orientation of the diaphragm to help install the replacement diaphragm properly.

Hold the inner valve (5) HEX in a wise and use a **3/16" Allen Key** (Hex Drive) on top of the stem (4) to turn the stem counterclockwise. If required, use a second screwdriver or similar tool at the Yoke (6) to prevent the yoke from turning. **BE CAREFUL NOT TO DAMAGE THE STEM GUIDING SURFACE.**

Replace the diaphragm and orient it to straddle the legs of the yoke.

REASSEMBLY:

Reassembly is the reverse of disassembly. Ensure that parts are replaced in the sequence shown on the drawing.

ASCO® Red-Hat®

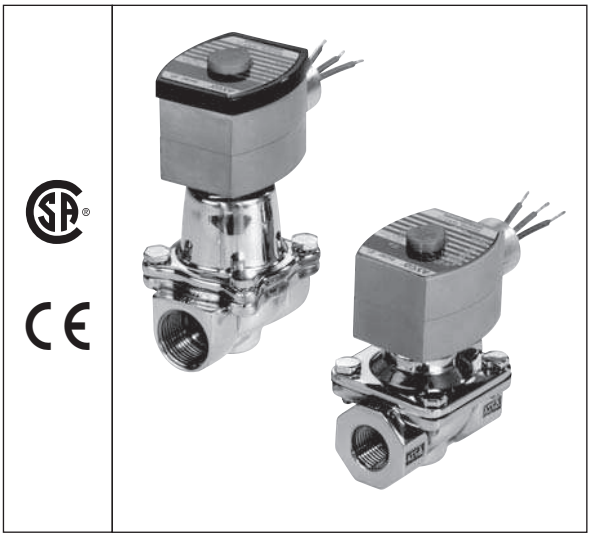
Pilot Operated
General Service Solenoid Valves
Brass or Stainless Steel Bodies
3/8" to 2 1/2" NPT

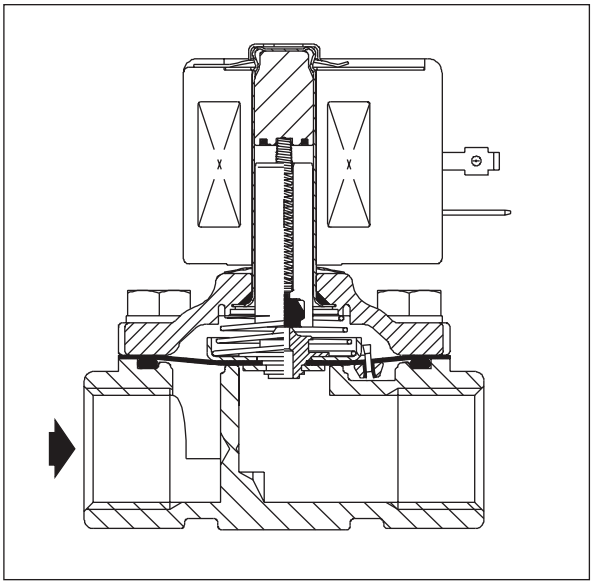
NC
NO

2/2 SERIES 8210

Features

- Wide range of pressure ratings, sizes, and resilient materials provide long service life and low internal leakage.
- High Flow Valves for liquid, corrosive, and air/inert gas service.
- Industrial applications include:
  - Car wash
  - Laundry equipment
  - Air compressors
  - Industrial water control
  - Pumps





Construction

Valve Parts in Contact with Fluids		
Body	Brass	304 Stainless Steel
Seals and Discs	NBR or PTFE	
Disc-Holder	PA	
Core Tube	305 Stainless Steel	
Core and Plugnut	430F Stainless Steel	
Springs	302 Stainless Steel	
Shading Coil	Copper	Silver

Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption				Spare Coil Part Number			
		AC			General Purpose		Explosionproof	
	DC Watts	Watts	VA Holding	VA Inrush	AC	DC	AC	DC
F	-	6.1	16	40	238210	-	238214	-
F	11.6	10.1	25	70	238610	238710	238614	238714
F	16.8	16.1	35	180	272610	97617	272614	97617
F	-	17.1	40	93	238610	-	238614	-
F	-	20	43	240	99257	-	99257	-
F	-	20.1	48	240	272610	-	272614	-
H	30.6	-	-	-	-	74073	-	74073
H	40.6	-	-	-	-	238910		238914

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz). 6, 12, 24, 120, 240 volts DC. Must be specified when ordering. Other voltages available when required.

Solenoid Enclosures

Standard: Red-Hat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; Red-Hat - Type I.
Optional: Red-Hat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; Red-Hat - Explosionproof and Watertight, Types 3, 4, 4X, 7, and 9.
(To order, add prefix "EF" to catalog number, except Catalog Numbers 8210B57, 8210B58, and 8210B59. Valves not available with Explosionproof enclosures.)
Note: Wattages 16.1 and 20.1 meet Type 7 Groups A, B, C, and D and Type 9 Groups E and F only.
See Optional Features Section for other available options.

Nominal Ambient Temperature Ranges:

Red-Hat II/
Red-Hat AC: 32˚F to 125˚F (0˚C to 52˚C)
Red-Hat II DC: 32˚F to 104˚F (0˚C to 40˚C)
Red-Hat DC: 32˚F to 77˚F (0˚C to 25˚C)
(104˚F/40˚C occasionally)
Refer to Engineering Section for details.

Approvals:

CSA certified. Red-Hat II meets applicable CE directives.
Refer to Engineering Section for details.

ASCO®

Specifications (English units)

Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Operating Pressure Differential (psi)							Max. Fluid Temp. °F		Brass Body			Stainless Steel Body			Watt Rating/ Class of Coil Insulation ⑦	
				Max. AC			Max. DC												
			Min.	Air-Inert Gas	Water	Light Oil @ 300 SSU	Air-Inert Gas	Water	Light Oil @ 300 SSU	AC	DC	Catalog Number	Constr. Ref. No. ④	UL ⑤ Listing	Catalog Number	Constr. Ref. No. ④	UL ⑤ Listing	AC	DC
NORMALLY CLOSED (Closed when de-energized), NBR or PTFE ② Seating																			
3/8	3/8	1.5	①	150	125	-	40	40	-	180	150	8210G73 ③	1P	●	8210G36 ③	1P	●	6.1/F	11.6/F
3/8	5/8	3	0	150	150	-	40	40	-	180	150	8210G93	5D	❍	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	200	150	135	125	100	100	180	150	8210G1	6D	❍	-	-	-	6.1/F	11.6/F
3/8	5/8	3	5	300	300	300	-	-	-	175	-	8210G6	5D	❍	-	-	-	17.1/F	-
1/2	7/16	2.2	①	150	125	-	40	40	-	180	150	8210G15 ③	2P	●	8210G37 ③	2P	●	6.1/F	11.6/F
1/2	5/8	4	0	150	150	-	40	40	-	180	150	8210G94	5D	❍	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	40	40	-	175	150	-	-	-	8210G87	7D	●	17.1/F	11.6/F
1/2	5/8	4	5	200	150	135	125	100	100	180	150	8210G2	6D	❍	-	-	-	6.1/F	11.6/F
1/2	5/8	4	5	300	300	300	-	-	-	175	-	8210G7	5D	❍	-	-	-	17.1/F	-
1/2	5/8	4	5	-	300	-	-	300	-	180	125	8210G227	5D	❍	-	-	-	17.1/F	40.6/H
3/4	5/8	4.5	0	150	150	125	40	40	-	175	150	-	-	-	8210G88	7D	●	17.1/F	11.6/F
3/4	3/4	5	5	125	125	125	100	90	75	180	150	8210G9	9D	❍	-	-	-	6.1/F	11.6/F
3/4	3/4	5	0	150	150	-	40	40	-	180	150	8210G95	8D	❍	-	-	-	10.1/F	11.6/F
3/4	3/4	6.5	5	250	150	100	125	125	125	180	150	8210G3	11D	❍	-	-	-	6.1/F	11.6/F
3/4	3/4	6	0	-	-	-	200	180	180	-	77	8210B26 ② ‡	10P	-	-	-	-	-	30.6/H
3/4	3/4	6	0	350	300	200	-	-	-	200	-	8210G26 ② ‡	40P	●	-	-	-	16.1F	-
1	1	13	0	-	-	-	100	100	80	-	77	8210B54 ‡	31D	-	8210D89	15D	-	-	30.6/H
1	1	13	0	150	125	125	-	-	-	180	-	8210G54	41D	●	8210G89	45D	●	16.1/F	-
1	1	13	5	150	150	100	125	125	125	180	150	8210G4	12D	❍	-	-	-	6.1/F	11.6/F
1	1	13.5	0	300	225	115	-	-	-	200	-	8210G27 ‡	42P	●	-	-	-	20.1/F	-
1	1	13.5	10	300	300	300	-	-	-	175	-	8210G78 ②	13P	-	-	-	-	17.1/F	-
1 1/4	1 1/8	15	0	-	-	-	100	100	80	-	77	8210B55 ‡	32D	-	-	-	-	-	30.6/H
1 1/4	1 1/8	15	0	150	125	125	-	-	-	180	-	8210G55	43D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	5	150	150	100	125	125	125	180	150	8210G8	16D	❍	-	-	-	6.1/F	11.6/F
1 1/2	1 1/4	22.5	0	-	-	-	100	100	80	-	77	8210B56 ‡	33D	-	-	-	-	-	30.6/H
1 1/2	1 1/4	22.5	0	150	125	125	-	-	-	180	-	8210G56	44D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	5	150	150	100	125	125	125	180	150	8210G22	18D	●	-	-	-	6.1/F	11.6/F
2	1 3/4	43	5	150	125	90	50	50	50	180	150	8210G100	20P	●	-	-	-	6.1/F	11.6/F
2 1/2	1 3/4	45	5	150	125	90	50	50	50	180	150	8210G101	21P	●	-	-	-	6.1/F	11.6/F
NORMALLY OPEN (Open when de-energized), NBR Seating (PA Disc-Holder, except as noted)																			
3/8	5/8	3	0	150	150	125	125	125	80	180	150	8210G33	23D	●	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	250	200	200	250	200	200	180	180	8210G11 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	125	125	80	180	150	8210G34	23D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G30	37D	●	10.1/F	11.6/F
1/2	5/8	4	5	250	200	200	250	200	200	180	180	8210G12 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
3/4	3/4	5.5	0	150	150	125	125	125	80	180	150	8210G35	25D	●	-	-	-	10.1/F	11.6/F
3/4	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G38	38D	●	10.1/F	11.6/F
3/4	3/4	6.5	5	-	-	-	250	200	200	-	180	8210C13	24D	●	-	-	-	-	16.8/F
3/4	3/4	6.5	5	250	200	200	-	-	-	180	-	8210G13	46D	●	-	-	-	16.1/F	-
1	1	13	0	125	125	125	-	-	-	180	-	8210B57 ⑥ ⑩	34D	●	-	-	-	20/F	-
1	1	13	5	-	-	-	125	125	125	-	180	8210D14	26D	●	-	-	-	-	16.8/F
1	1	13	5	150	150	125	-	-	-	180	-	8210G14	47D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	0	125	125	125	-	-	-	180	-	8210B58 ⑥ ⑩	35D	●	-	-	-	20/F	-
1 1/4	1 1/8	15	5	-	-	-	125	125	125	-	180	8210D18	28D	●	-	-	-	-	16.8/F
1 1/4	1 1/8	15	5	150	150	125	-	-	-	180	-	8210G18	48D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	0	125	125	125	-	-	-	180	-	8210B59 ⑥ ⑩	36D	●	-	-	-	20/F	-
1 1/2	1 1/4	22.5	5	-	-	-	125	125	125	-	180	8210D32	29D	●	-	-	-	-	16.8/F
1 1/2	1 1/4	22.5	5	150	150	125	-	-	-	180	-	8210G32	49D	●	-	-	-	16.1/F	-
2	1 3/4	43	5	-	-	-	125	125	125	-	150	8210103	30P	●	-	-	-	-	16.8/F
2	1 3/4	43	5	125	125	125	-	-	-	180	-	8210G103	50P	●	-	-	-	16.1/F	-
2 1/2	1 3/4	45	5	-	-	-	125	125	125	-	150	8210104	27P	●	-	-	-	-	16.8/F
2 1/2	1 3/4	45	5	125	125	125	-	-	-	180	-	8210G104	51P	●	-			16.1/F	-

Notes: ① 5 psi on Air; 1 psi on Water.
② Valve provided with PTFE main disc.
③ Valve includes Ultem (G.E. trademark) piston.
④ Letter "D" denotes diaphragm construction; "P" denotes piston construction.
⑤ ❍ Safety Shutoff Valve; ● General Purpose Valve.
Refer to Engineering Section (Approvals) for details.
⑥ Valves not available with Explosionproof enclosures.
⑦ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
⑧ AC construction also has PA seating.
⑨ No disc-holder.
⑩ Stainless Steel disc-holder.
‡ Must have solenoid mounted vertical and upright.

PFP Premium Stainless Steel Liquid Filled Gauge

Optional U-Clamp

RoHS compliant

Note: RoHS applies only to SS internals

Description & Features:

- Liquid filled stainless steel case protects against vibration and pulsation
- Bayonet ring
- Highly accurate
- Back, bottom, or panel mounted
- Stainless steel or brass wetted parts
- Dry case available
- CRN registered
- 5 year warranty

Applications:

- Outdoor and severe ambient and process conditions
- Use where harmful vibration and pulsation are present
- Hydraulic equipment, pressure washers, oil field equipment, pumps, compressors and process systems

Specifications	Stainless Steel Internals	Brass Internals
Dial	2.5” (63mm), 4” (100mm), 6” (150mm) white aluminum with black and red markings	4” (100mm) white aluminum with black and red markings
Case	AISI 304 SS	AISI 304 SS
Lens	Polycarbonate	Polycarbonate
Ring	AISI 304 SS	AISI 304 SS
Socket	316 SS 2.5”, 4”: Welded one-piece socket	OT 58 brass
Connection	¼” NPT or ½” NPT standard 2.5” (63mm): ¼” NPT only	¼” NPT or ½” NPT standard
Bourdon Tube	316 SS, drawn seamless	Phosphor bronze
Movement	304 SS 4” (100mm): Over/under stops (optional)	OT 59 brass
Pointer	2.5” (63mm): Aluminum, anodized black 4” (100mm), 6” (150mm): Aluminum, anodized black, micrometer adjustable	4” (100mm) aluminum, anodized black, micrometer adjustable
Welding	TIG	Silver alloy
Fill Liquid	Glycerin	Glycerin
Over-Pressure Limit	30% for pressures up to 600 psi (4,147 kPa), 15% for pressures over 600 psi (4,147 kPa)	25% for pressures up to 1,400 psi (9,653 kPa), 15% for pressures over 1,400 psi (9,653 kPa)
Socket Gasket	2.5” (63mm): Buna N for two-piece internal socket seal 6” (150mm): Buna N for one-piece external socket seal, Silicone rubber option	6” (150mm): Buna N for one-piece external socket seal, Silicone rubber option
Fill Plug	Buna N (Silicone rubber option)	Buna N (Silicone rubber option)
Lens Ring Gasket	Buna N (Silicone rubber option)	Buna N (Silicone rubber option)
Working Pressure	Maximum 75% of full scale value	Maximum 75% of full scale value
Ambient/Process Temperature	Dry: -40°F to 200°F (-40°C to 93°C) Glycerin Filled: -4°F to 150°F (-20°C to 65°C)	Dry: -40°F to 200°F (-40°C to 93°C) Glycerin Filled: -4°F to 150°F (-20°C to 65°C)
Accuracy	2.5” (63mm): ±1.5% of full scale value 4” (100mm), 6” (150mm): ±1% ANSI/ASME Grade 1A	4” (100mm): ±1% ANSI/ASME Grade 1A
Enclosure Rating	IP66, EN60529-1 (IEC529-1)	IP66, EN60529-1 (IEC529-1)

PFP Premium Stainless Steel Liquid Filled Gauge

Dual Scale Order Codes (products in bold are normally in stock)

Dial Size	2.5" (63mm)		4" (100mm)				4" (100mm)			
Connection	¼" Bottom	¼" Back (CB)	¼" Bottom	½" Bottom	¼" Back (LB)	½" Back	¼" Bottom	¼" Back (LB)	½" Bottom	½" Back (LB)
Movement, Socket, Tube	SS	SS	Brass	Brass	Brass	Brass	SS	SS	SS	SS
30" Hg Vac/kPa	**PFP820**	**PFP840**	PFP600	PFP2284	PFP1000	-	**PFP640**	PFP1090	PFP655	PFP2308
30"/0/15 psi/kPa	**PFP860**	PFP870	PFP1020	PFP2285	PFP1028	-	PFP1036	PFP1244	PFP1044	PFP2309
30"/0/30 psi/kPa	**PFP861**	PFP871	PFP1021	PFP2286	PFP1029	-	**PFP1037**	PFP1245	**PFP1045**	PFP2310
30"/0/60 psi/kPa	**PFP862**	**PFP872**	PFP1022	PFP2287	PFP1030	-	**PFP1038**	PFP1246	PFP1046	PFP2311
30"/0/100 psi/kPa	PFP863	PFP873	PFP1023	PFP2288	PFP1031	-	PFP1039	PFP1247	PFP1047	PFP2312
30"/0/150 psi/kPa	**PFP864**	PFP874	PFP1024	PFP2289	PFP1032	-	PFP1040	PFP1248	PFP1048	PFP2313
30"/0/200 psi/kPa	PFP866	PFP876	PFP1026	PFP2290	PFP1034	-	PFP1042	PFP1249	PFP1050	PFP2314
30"/0/300 psi/kPa	**PFP867**	PFP877	PFP1027	PFP2291	PFP1035	-	**PFP1043**	PFP1250	PFP1051	PFP2315
0/15 psi/kPa	**PFP821**	**PFP921**	**PFP601**	PFP2292	PFP1001	-	**PFP641**	PFP1091	**PFP656**	PFP2316
0/30 psi/kPa	**PFP822**	**PFP922**	**PFP602**	PFP2293	PFP1002	-	**PFP642**	PFP1092	**PFP657**	PFP2317
0/60 psi/kPa	**PFP823**	**PFP923**	**PFP603**	PFP2294	PFP1003	-	**PFP643**	PFP1093	**PFP658**	PFP2318
0/100 psi/kPa	**PFP824**	**PFP924**	**PFP604**	PFP2295	PFP1004	-	**PFP644**	**PFP1094**	**PFP659**	PFP2319
0/160 psi/kPa	**PFP825**	**PFP925**	**PFP605**	PFP2296	PFP1005	-	**PFP645**	**PFP1095**	**PFP660**	PFP2320
0/200 psi/kPa	**PFP826**	**PFP926**	**PFP606**	PFP2297	PFP1006	-	**PFP646**	PFP1096	**PFP661**	PFP2321
0/300 psi/kPa	**PFP827**	**PFP927**	**PFP607**	PFP2298	PFP1007	-	**PFP647**	PFP1097	**PFP662**	PFP2322
0/400 psi/kPa	**PFP880**	**PFP881**	**PFP610**	PFP2299	PFP1016	-	**PFP650**	**PFP1251**	**PFP666**	PFP2323
0/600 psi/kPa	**PFP828**	**PFP928**	PFP608	PFP2300	PFP1008	-	**PFP648**	PFP1098	**PFP663**	PFP2324
0/1,000 psi/kPa	**PFP829**	**PFP929**	PFP609	PFP624	-	PFP1009	PFP649	PFP1099	**PFP664**	PFP2325
0/1,500 psi/kPa	**PFP834**	**PFP934**	-	PFP625	-	PFP1010	PFP2301	PFP1252	**PFP665**	PFP1190
0/2,000 psi/kPa	**PFP830**	**PFP930**	-	PFP626	-	PFP1011	PFP2302	PFP1253	**PFP667**	PFP1191
0/3,000 psi/kPa	**PFP831**	**PFP931**	-	PFP627	-	PFP1012	PFP2303	PFP1254	**PFP668**	PFP1192
0/5,000 psi/kPa	**PFP832**	**PFP852**	-	PFP628	-	PFP1013	PFP2304	**PFP1255**	**PFP669**	PFP1193
0/6,000 psi/kPa	**PFP836**	**PFP851**	-	PFP631	-	PFP1015	PFP2305	PFP1259	PFP675	PFP1197
0/10,000 psi/kPa	**PFP833**	**PFP853**	-	PFP629	-	PFP1014	PFP2306	PFP1256	PFP670	PFP1194
0/15,000 psi/kPa	**PFP835**	PFP855	-	PFP630	-	PFP1018	PFP2307	PFP1257	PFP671	PFP1195
0/20,000 psi/kPa	PFP837	-	-	PFP639	-	PFP1019	-	PFP1258	**PFP672**	PFP1196

Other ranges and connection sizes available upon request. 316 SS case and mountable bezel available upon request. For scale change, refer to How to Order Guide for scale codes. **For options, attach suffix to end of order code: i.e. PFP929-25UC for U-CLAMP.**

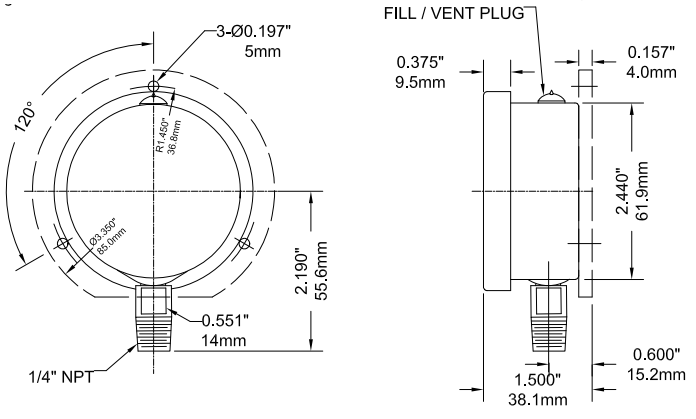
Option suffix:

25BF = 2.5" (63mm) Back Flange
25FF = 2.5" (63mm) Front Flange
25UC = 2.5" (63mm) U-Clamp
25DRY = Supply 2.5" gauge less liquid fill
2.5 BOOT = 2.5" (63mm) black rubber boot

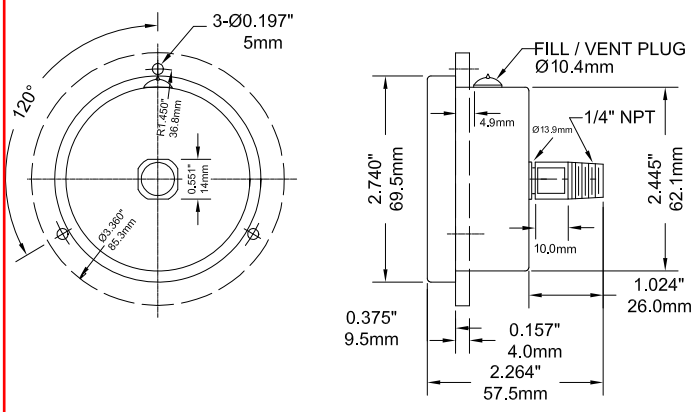
4BF = 4" (100mm) Back Flange
4FF = 4" (100mm) Front Flange
4UC-P = 4" (100mm) Premium U-Clamp
DRY = Supply 4" gauge less liquid fill

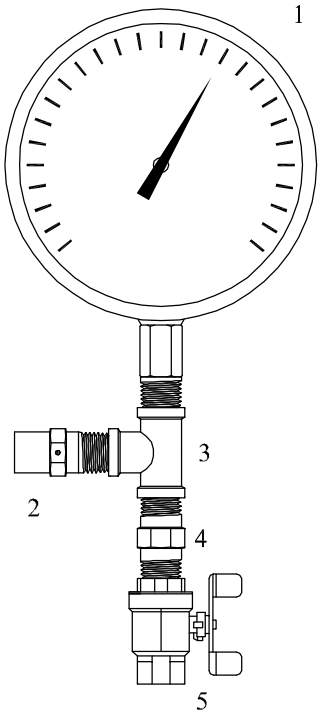
SF25 = Silicone Filled for 2.5"
SF4 = Silicone Filled for 4"
SG-25 = Safety Glass 2.5"
SG-4 = Safety Glass Lens 4"
REST = Restrictor Screw

2.5" Bottom Connection with optional Back Flange



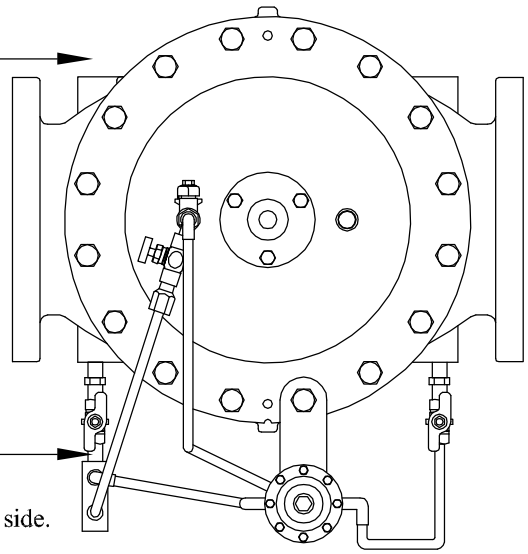
2.5" Back Connection with optional Front Flange





Specify install on non-pilot
system side.
Inlet or outlet or both.

A



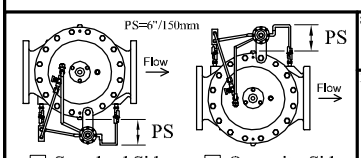
B

Specify install on pilot system side.
Inlet or outlet or both.
If inlet, downstream of ball valve
If outlet, upstream of ball valve

X = Accessory
G = Gauge
B = Bleed
V = Valve
A = Assembly

CONTROL VALVE BILL OF MATERIALS (for dimension information and material specifications see component datasheets)

1. Pressure Gauge, $\frac{1}{4}$"
2. Bleed Valve, J0222A
3. Tee, $\frac{1}{4}$"
4. Nipple, $\frac{1}{4}$"
5. Gauge Cock/Ball Valve, $\frac{1}{4}$"



Series/Model No.	Model XGBVA
Description	Pressure Gauge & Bleed Valve Assembly
Dwg by	SG
Apvd by	SG
Dwg date	03/13/17
Dwg No.	XGBVA
Rev	B

SINGER VALVE
Result-Based Solutions. Globally.

www.singervalve.com 12850-87th Avenue. Surrey, B.C. V3W 3H9

Part # 4405N-16-16

- 4405N: Coupling Series
- 4405N: 5 Digit Parts Only — *Indicates the 1st digit of elbow angle*
- 4405N: Thread Style — *1st digit also indicates elbow in 4 digit parts*
- 16: Thread Size
- 16: Hose Size

Pulsar offers a wide variety of coupling styles:

Series	Description
2000…	Push-on hose couplings
3000…	Reusable fittings for one and two wire braid hoses
3500…	Reusable fittings for SAE100R5 dimension hoses
4000…	Swage or crimp fittings for teflon hose
4100…	Reusable fittings for teflon hose
5000…	Two-piece (separate stem and ferrule) crimp fittings for most hoses
8600…	Interlock (internal skive) two-piece crimp fittings for spiral hoses
4200/4400…	One-piece (integral stem and ferrule) crimp fittings for most hoses
4500…	One-piece crimp fittings for SAE100R5 hoses
9500…	One-piece crimp fittings for spiral hoses
9600…	One-piece crimp fittings for spiral hoses

Within these broad divisions, the last two digits will specify the thread style, as detailed above.
Angle fittings are designated by inserting the degree of the angle as the third digit. For example, a 5005 would indicate a two-piece crimp fitting with a female JIC thread, and a 5095 would indicate a similar fitting but with a 90° elbow.
Five digit part numbers are used for less common (particularly metric) fittings where some uncertainty may be caused by inserting the elbow number in the third position.
Dash sizes following the base part number indicate first the nominal thread or tube size, and lastly the nominal hose diameter.
Please note that for truck hoses, notably SAE100R5 and SAE100R14, the nominal hose size does not exactly match the actual inside diameter, since these hoses were designed to replace common copper tubing. For example, 151-06 hose measures $^{5}/_{16}$" I.D., since it was designed to replace $^{3}/_{8}$" ("-06") copper tubing, which measures $^{5}/_{16}$" I.D.

109T... Twin SAE 100R17 Forklift Hose

Our single wire braid compact hose is now available in a bonded twin configuration for use on forklift masts. The specifications are the same as our standard hose except the cover is smooth.

Tube: Seamless oil resistant nitrile rubber
Reinforcement: One or two high tensile steel wire braids.
Cover: Oil, abrasion and weather resistant black neoprene rubber
Temperature Range: -40° to 100°C (-40° to 212°F), petroleum base fluids intermittent to 125°C (257°F).

Part Number	Hose I.D.	Hose O.D.	Working Pressure	Min. Burst Pressure	Min. Bend Radius	Weight Lb/ft	Recommended Coupling Series	
109-06	3/8"	0.62"	3000 psi	12000 psi	2.5"	0.13	4200	5000

157... SAE 100R4 Teflon® Hose

Teflon® hoses were designed to replace copper tube in high temperature flexing applications where rubber hose would fail. They have a Teflon® tube with a stainless wire cover and are commonly used for compressor discharge lines on mobile air brake systems. 157 is also used in many chemical applications.

Tube: Extruded Teflon®
Reinforcement: One high-tensile Type 304 stainless steel wire braid
Temperature Range: -54° to 232°C (-65° to 450°F), intermittent -73° to 260°C (-100° to 500°F).

Part Number	Hose I.D.	Hose O.D.	Working Pressure	Min. Burst Pressure	Min. Bend Radius	Weight Lb/ft	Recommended Coupling Series	
157-04	3/16"	0.30"	3000 psi	12000 psi	2.0"	0.08	4000	4100
157-05	1/4	0.38	3000	12000	3.0	0.10	4000	4100
157-06	5/16	0.44	2500	10000	4.0	0.11	4000	4100
157-08	13/32	0.54	2000	8000	5.0	0.12	4000	4100
157-10	1/2	0.64	1500	6000	7.0	0.15	4000	4100
157-12	5/8	0.77	1200	4800	8.0	0.17	4000	4100
157-16	7/8	1.03	1000	4000	9.0	0.26	4000	4100

Teflon® is a registered trademark of Dupont.

4000 SERIES CRIMP COUPLINGS

4000 Series fittings for 157 Teflon hose can be crimped or swaged. Special tooling is available to simplify ferrule installation and fitting insertion.

4016B... BRASS NPTF MALE

Part Number	Thread	Hose I.D.
4016B-02-04	1/8-27	3/16"
4016B-04-04	1/4-18	3/16"
4016B-04-05	1/4-18	1/4"
4016B-04-06	1/4-18	5/16"
4016B-06-06	3/8-18	5/16"
4016B-06-08	3/8-18	13/32"
4016B-08-08	1/2-14	13/32"
4016B-08-10	1/2-14	1/2"
4016B-12-12	3/4-14	5/8"
4016B-16-16	1-11 1/2	7/8"

4005B... BRASS JIC 37° FEMALE SWIVEL

Part Number	Thread	Hose I.D.
4005B-04-04	7/16-20	3/16"
4005B-05-05	1/2-20	1/4"
4005B-06-06	9/16-18	5/16"
4005B-08-08	3/4-16	13/32"
4005B-10-10	7/8-14	1/2"
4005B-12-12	1 1/16-12	5/8"
4005B-16-16	1 5/16-12	7/8"

4004B... Brass SAE 45° FEMALE SWIVEL

Part Number	Thread	Hose I.D.
4004B-06-06	5/8-18	5/16"
4004B-12-12	1 1/16-14	5/8"

(Use 4005B for other SAE sizes)

4016SS... STAINLESS NPTF MALE

Part Number	Thread	Hose I.D.
4016SS-02-04	1/8-27	3/16"
4016SS-04-04	1/4-18	3/16"
4016SS-04-05	1/4-18	1/4"
4016SS-04-06	1/4-18	5/16"
4016SS-06-06	3/8-18	5/16"
4016SS-08-08	1/2-14	13/32"
4016SS-08-10	1/2-14	1/2"
4016SS-12-12	3/4-14	5/8"
4016SS-16-16	1-11 1/2	7/8"

4005SS... STAINLESS JIC 37° FEMALE SWIVEL

Part Number	Thread	Hose I.D.
4005SS-04-04	7/16-20	3/16"
4005SS-05-05	1/2-20	1/4"
4005SS-06-06	9/16-18	5/16"
4005SS-08-08	3/4-16	13/32"
4005SS-10-10	7/8-14	1/2"
4005SS-12-12	1 1/16-12	5/8"
4005SS-16-16	1 5/16-12	7/8"

SINGER VALVE

Result-Based Solutions. Globally.™

ISO 9001:2000 CERTIFICATION — Intertek — An ISO 9001:2000 Registered Company

SUBMITTAL NO. _____

MODEL NUMBER:

SINGLE POINT INSERTION
ELECTROMAGNETIC FLOW METER
(SPI-MV)

SELECTION AND CONFIGURATION

SPI-MV- XXX - X - XX - XX - X - X

VALVE SIZE

- ☐ 1 004 - 4" 106
- ☐ 2 006 - 6" S106
- ☐ 3 008 - 8" S106
- ☐ 4 010 - 10" S106
- ☐ 5 012 - 12" S106
- ☐ 6 016 - 16" S106
- ☐ 7 020 - 20" S106
- ☐ 8 024 - 24" S106
- ☐ 9 028 - 28" S206
- ☐ 10 036 - 36" S106

CONVERTER

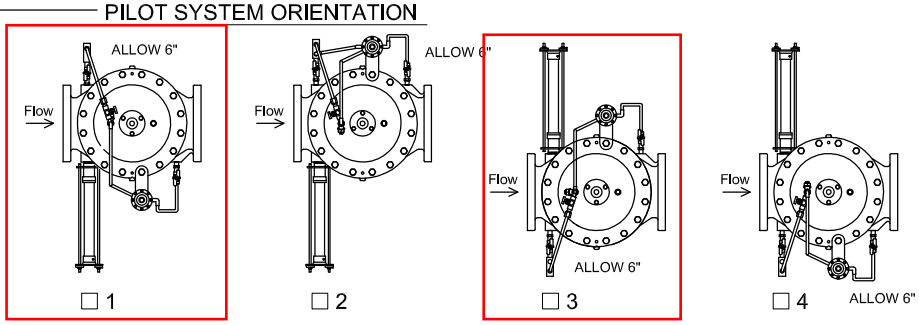
- ☐ 1 L - LOCAL CONVERTER
- ☐ 2 P - PANEL-MOUNTED CONVERTER

ENCLOSURE

- ☐ 1 SA - STANDARD ALUMINUM (IP67)
- ☐ 2 SS** - STAINLESS STEEL (IP66)
- ☐ 3 FG** - FIBERGLASS (IP66)
- ☐ 4 PC** - POLYCARBONATE (IP67)

** FOR PANEL-MOUNTED CONVERTER ONLY

PILOT SYSTEM ORIENTATION



☐ 1 ☐ 2 ☐ 3 ☐ 4

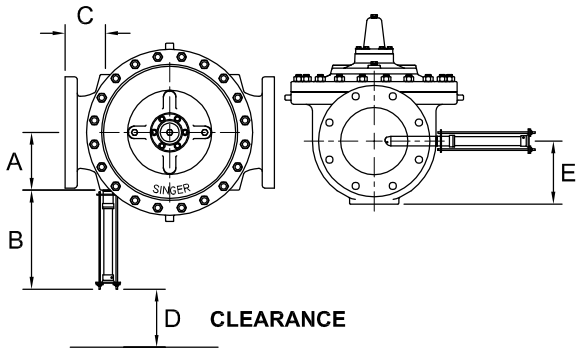
CABLE LENGTH

- ☐ 1 A - 5 FEET (STANDARD)
- ☐ 2 B - 10 FEET
- ☐ 3 C - 20 FEET
- ☐ 4 D - OTHER: _____

SUPPLY VOLTAGE

- ☐ 1 AC - 120-240VAC, 50-60 Hz (25VA)
- ☐ 2 DC - 24 VDC (21W)

DIMENSIONS



A. _____
B. _____
C. _____
D. _____
E. _____

TRANSMITTER/CONVERTER CONFIGURATION

- ☐ 1 Flow Output Range:
  - 4 mA: _____
  - 20 mA: _____
- ☐ 2 Display Units: _____
- ** ☐ 3 Alarm (High Flow): _____
- ** ☐ 4 Alarm (Low Flow): _____

** OPTIONAL

ATTACHED DATA SHEETS & ACCESSORIES

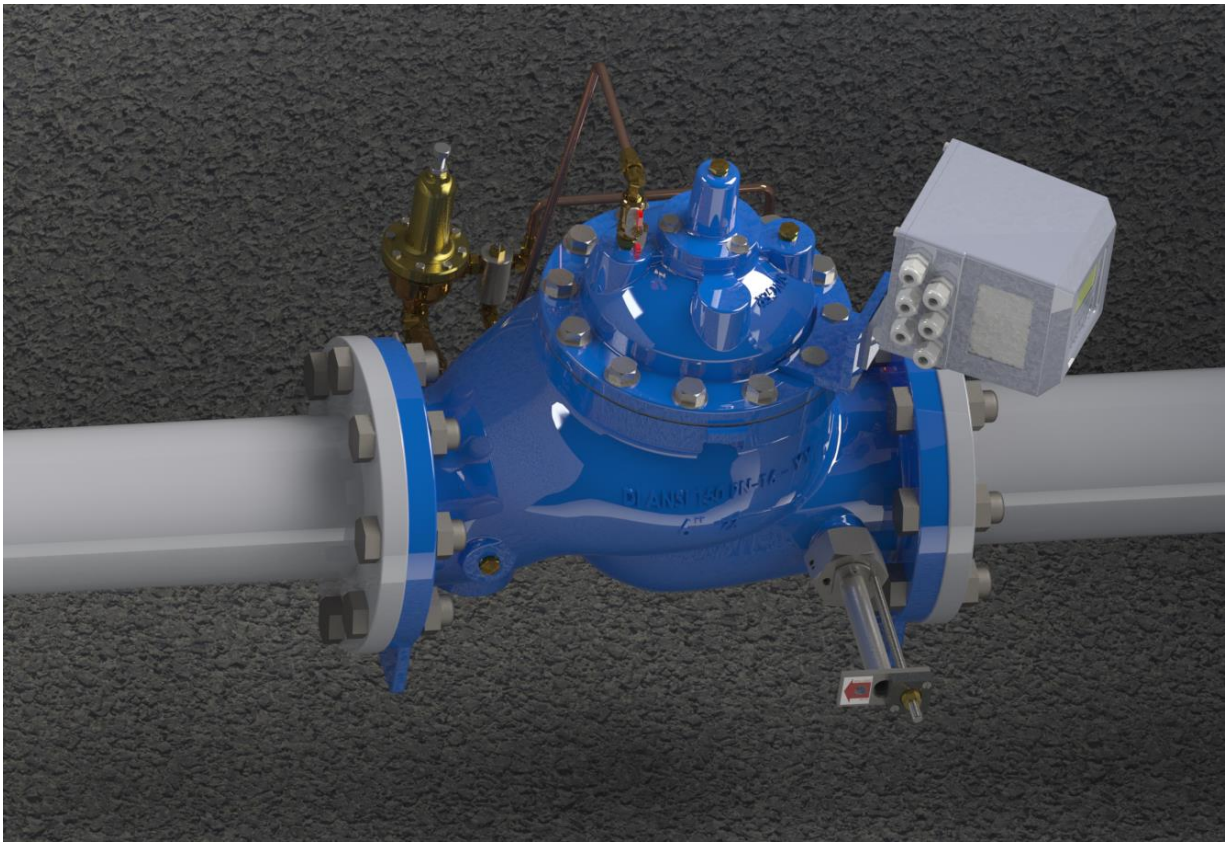
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

OTHER

_____
_____
_____
_____

This quotation/submittal is for valve(s) described above and reflects our understanding of functions required. We assume no responsibility for meeting all stated or implied requirements beyond functions listed above. If above does not adequately describe functions/operation of above products, please ask for a more comprehensive description and mention areas where above description is deficient.

IOM A-0985A – SPI-MV
SINGLE POINT INSERTION FLOW METER VALVE
Installation and Operation Manual

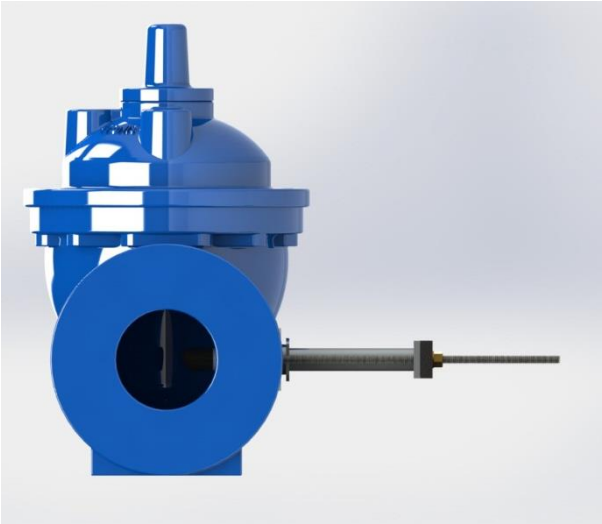


SINGER™

McCROMETER

Please read and understand the contents of this manual. Revision 3.0

Table of Contents



1 Health and Safety: Read First

Throughout this manual are safety warning and caution information boxes. Each warning and caution box will be identified by a large symbol indicating the type of information contained in the box. The symbols are explained below:

This symbol indicates important safety information. Failure to follow the instructions can result in serious injury or death.

This symbol indicates important information. Failure to follow the instructions can result in permanent damage to the meter or installation site.

When installing, operating, and maintaining equipment where hazards may be present, you must protect yourself by wearing Personal Protective Equipment (PPE) and be trained to enter confined spaces. Examples of confined spaces are manholes, pumping stations, pipelines, pits, septic tanks, sewage digesters, vaults, degreasers, storage tanks, boilers, and furnaces.

You must follow all state and local laws, as well as Occupational Safety And Health Administration (OSHA) regulations concerning Personal Protective Equipment, confined-space entry, and exposure to bloodborne pathogens.

WARNING!

Incorrect installation or removal of SPI Mag meters can result in serious injury or death. Read the instructions in this manual on the proper procedures carefully.

WARNING!

Never enter a confined space without testing the air at the top, middle, and bottom of the space. The air may be toxic, oxygen deficient, or explosive. Do not trust your senses to determine if the air is safe. You cannot see or smell many toxic gases.

WARNING!

Never enter a confined space without the proper safety equipment. You may need a respirator, gas detector, tripod, lifeline, and other safety equipment.

WARNING!

Never enter a confined space without standby/rescue personnel within earshot. Standby/rescue personnel must know what action to take in case of an emergency.

WARNING!

Pressurized pipes should only be hot tapped, cut, or drilled by qualified personnel. If possible, depressurize and drain the pipe before attempting any installation.

WARNING!

Carefully read all safety warning tags attached to the meter.

2 Information

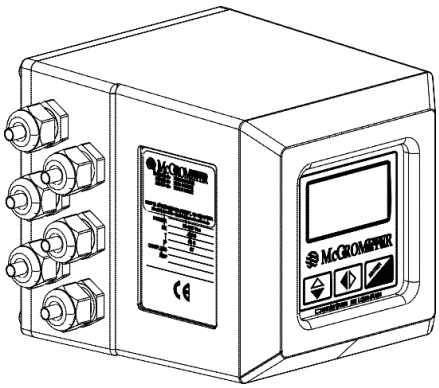
Read this entire manual prior to installing the SPI and/or changing any settings. Retain this manual in your records. DO NOT DISCARD.

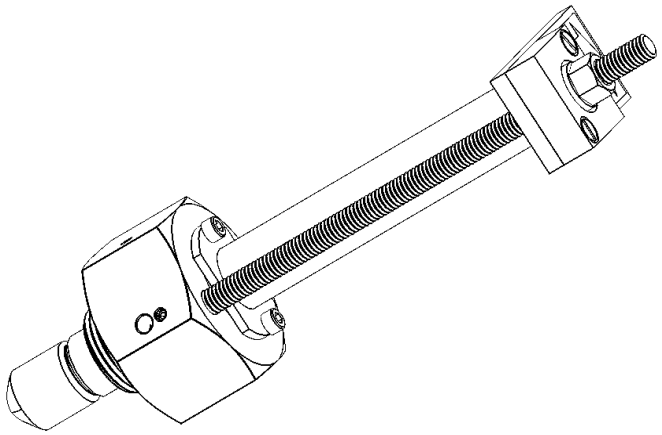
2.1 Design Information

With over 100 years of combined waterworks experience, Singer Valve and McCrometer have teamed up to provide a unique solution for in-valve flow measurement. Using McCrometer's proven Single Point Insertion Meter technology along with the reliability of a Singer Valve, the SPI-MV allows users to have both a flow meter solution along with any function of control valve. Whether it is pressure reducing, level control, or sustaining - all can now be installed with a very accurate flow meter solution. Combined with a dual solenoid control pilot system and a Singer Process Control Panel, the SPI-MV can provide flow feedback signals and perform automated flow control, and is capable of functioning within your existing SCADA system.

The Singer Model 106-SPI-MV is a Single Point Insertion Electromagnetic Flow Meter, installed and calibrated for a Singer valve to provide an accurate flow rate that can be utilized with the metering valve as a standalone option or built into a 106-2SC-PCO pilot system and panel to provide complete valve control. The SPI flow meter combines an innovative sensor with a comprehensive electronics package to provide accurate flow measurement for monitoring applications. The insertable sensor uses electromagnetic technology to measure water velocity. SPI has many features to suit a wide variety of applications, and is easily set up using the keypad and readouts.

The streamlined, debris-shedding sensor shape allows the SPI to be used under many flow conditions. The compact insertion design fits in confined spaces and offers complete accessibility. The flow meter can be removed for easy inspection and cleaning. This cost effective flow meter option is available for valve sizes from 3" (75mm) to 36" (900mm). The flow sensor comes pre-calibrated from McCrometer's NIST traceable Calibration Lab and requires no recalibration in the field. With no moving parts and a single-piece design, the SPI's sensor contains nothing to wear or break, and it is generally immune to clogging by sand, grit or other debris.





2.2 Specifications

2.2.1 Flow Measurements

Accuracy: +/-2% of reading +/- 0.03 ft/s zero stability
Velocity Range: +0.3 – 32 ft/s with reverse flow indication

2.2.2 Power Requirements

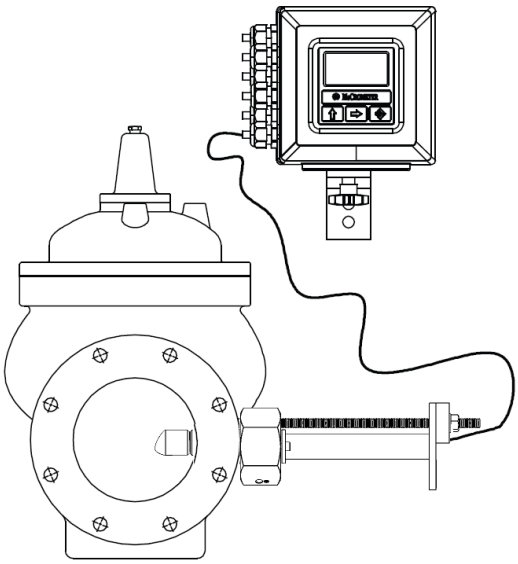
AC: 90 - 265V, 45 - 66 Hz (20W/25VA)
DC: 10 – 35V (21W)
****Note: Specify power supply type when ordering**

2.2.3 Environmental Specifications

Insertion Tube Operating Temperature: Up to 160°F (71°C) at 250 PSI
Insertion Sensor Rating: IP68 (submersible)
Local Converter Operating Temperature: -4°F to 140°F (-20°C to 60°C)
Local Converter Enclosure Rating: IP67 (Temporary Immersion in up to 7ft)

2.2.4 Material Specifications

Probe Head: Polyurethane
Probe Pipe Sleeve: 316 Seamless Stainless Steel Pipe
Electrode: 580 Grade Carbon Rod
Nipple & Compression Assembly: 316 Stainless Steel
Compression Seal: Buna "N" O – Ring Seal
Thread Seal Between Probe and Probe Pipe: Mixture of Loctite 7649 and Loctite 564
Thread Sealant Tape between Nipple & Valve: PTFE
Sensor Cable: Twinmax Polyurethane
Local Converter Enclosure: Die Cast Aluminum (Standard)



3 Start-up Guide

WARNING: Read all manual sections referred to by this guide for full instructions and ensured safety.

NOTE: If SPI Sensor is not factory installed in the Singer Valve please refer to Appendix 12.1. for Step-by-step install instructions before proceeding with Start-up Guide.

NOTE: Where required, the **L2 Passcode is 000002**.

Basic Start-up Site Requirements Checklist:

- ☐ External power available to power SPI-MV.
- ☐ Pipe primed and pressurized with water.
- ☐ Ability to shut off flow and isolate Singer valve for zero flow calibration.
- ☐ Ability to flow varying flow through valve.

Proper Installation Checklist:

- ☐ Verify SPI-MV is installed with sufficient straight pipe upstream of the valve. See Section 4: *Application Details*.
- ☐ Verify SPI-MV sensor probe and the converter are grounded to a grounding ring, grounding rod, or similar. See section 8.6: *Grounding*.

Before Powering the SPI Convertor Checklist:

- ☐ Verify the correct power type (AC/DC) is being used by checking the SPI-MV convertor data plate. In AC convertors the power terminal block is green. In DC converters the power terminal block is red. See section 8.5.1: *Terminal Board*.
- ☐ Verify the power wires (L/N/G, or L1/L2/G, or 24V/0V/G) are wired to the SPI-MV convertor correctly. See section 8.5.5: *Converter Power Hook-Up*.
- ☐ Verify the SPI-MV sensor probe wires are wired to the SPI-MV convertor correctly. See section 8.5.2: *Sensor Wiring* for more details.
- ☐ If 4-20mA outputs or Pulse Outputs are being used, verify wires are wired to the SPI-MV convertor correctly. See sections 8.5.3 and 8.5.4 for more details.
- ☐ Verify all cables entering the converter are through the built-in cable compression glands and that all glands are tightened to maintain the converter's IP67 rating. See section 8.2: *Installing Cables to Converter and Service Loop* for more details.
- ☐ Ensure the SPI-MV converter rear panel is closed tightly to maintain the converter's IP67 rating.

During Converter Power-up Checklist:

- ☐ Ensure converter powers up and passes self-test. See section 8.5.6: *Converter Start-Up*.
  - If convertor fails self-test, error codes will display. Contact factor for support.

Converter Configuration Checklist:

- ☐ Use Left/Right arrow to navigate, See section 9.1 Front Panel Display to the Alarms Menu. Ensure there are no alarms present. If alarms are present See section 10 Alarm Messages.
- ☐ Press Enter/Esc to access the Quick Start Menu. See section 9.4.
- ☐ Perform Zero Calibration – See section 9.5.8:
- ☐ Set Flow Range and Units – See section 9.4.1: *Fs1*.
- ☐ Use Left/Right arrow to navigate, See section 9.1 Front Panel Display to the preferred display to be maintained during operation.

NAME: **DATE:**

SIGNED:

4 Application Details

4.1 Basic Insertion Parameters

For most application you need 3 Pipe diameters straight pipe upstream flange to flange from any in-line device, elbow, or tee.

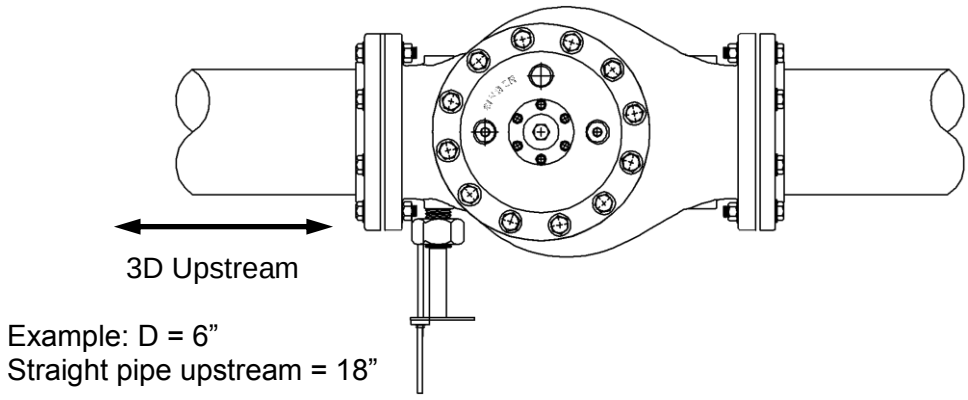


Figure 1: SPI-MV Basic Insertion

4.2 Exceptions

4.2.1 Gate Valve

Gate valve fully open will not cause any effect and can be mounted next to SPI-MV valve. Gate valve not fully open will cause a flow disturbance and will need 3D from SPI-MV valve

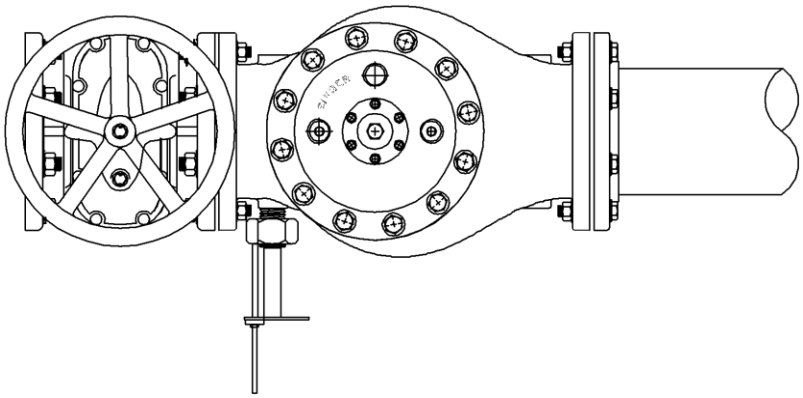


Figure 2: SPI-MV with Gate Valve

4.2.2 Butterfly Valves

A horizontal butterfly valve will cause a larger flow disturbance and will need three pipe diameters from SPI-MV valve

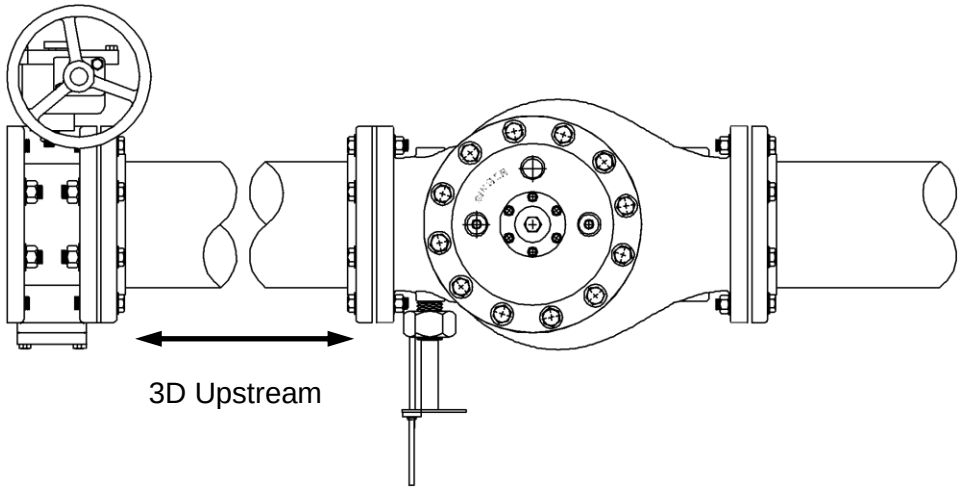


Figure 3: SPI-MV with Horizontal Butterfly Valve

A vertical butterfly valve fully open will cause a small disturbance and therefore will need only one pipe diameter to the SPI-MV valve.

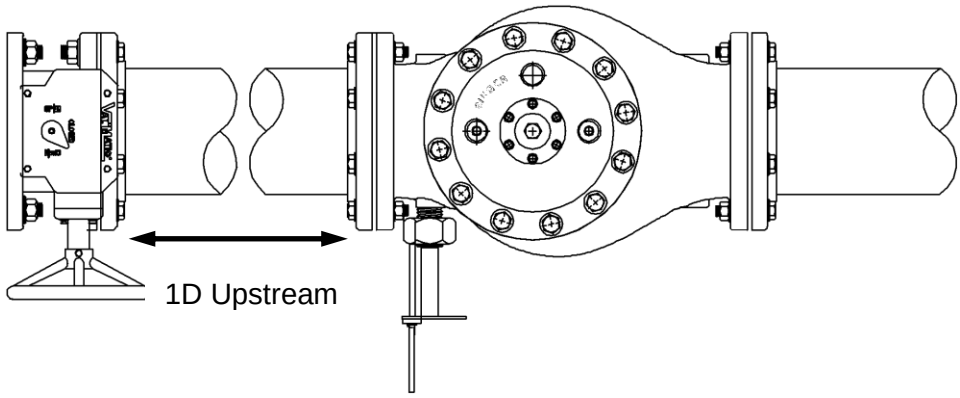


Figure 4: SPI-MV with Vertical Butterfly Valve

4.2.3 Reducers

Concentric Reducer: Does not affect system

Eccentric Reducer: 3D required

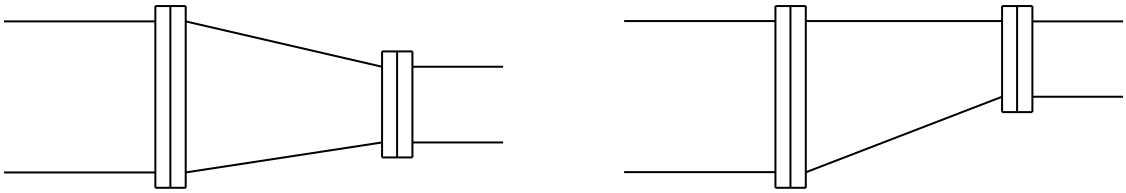


Figure 5: Reducers

4.2.4 Pumps

Pumps usually have a check valve which works well to stabilize flow, therefore use the usual 3 pipe diameter upstream after check valve for pump applications.

4.3 Anti-Cavitation Valve

During high pressure loss across a valve, the valve may experience cavitation. When cavitation occurs across the valve, the SPI-MV will experience a decrease in accuracy. An application where cavitation may occur is rectified by having a Singer Valve fitted with a Singer Anti-Cavitation Cage. If the valve is fitted with an anti-cavitation cage, the SPI-MV is able to maintain its high precision of accuracy. However, each cage is customized to the application and special testing is required to calibrate the SPI-MV when fitted with a cage.

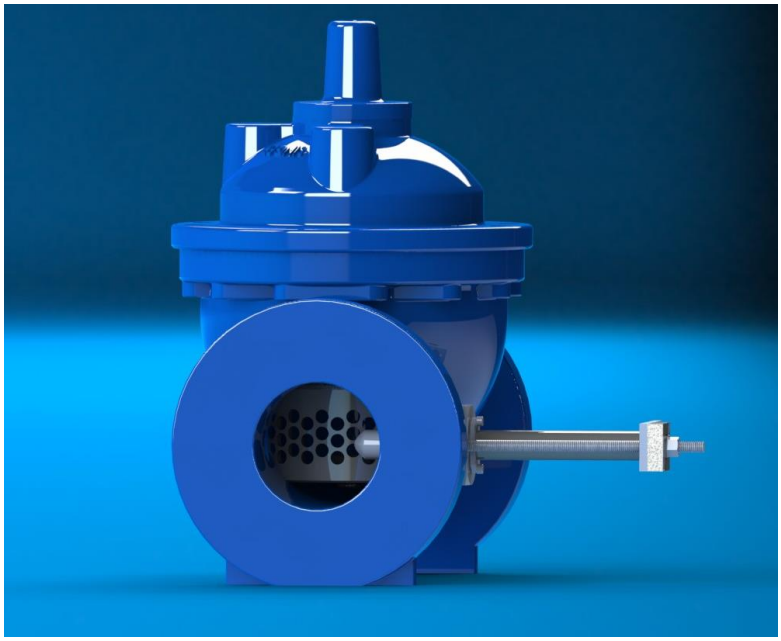


Figure 6: SPI-MV with Anti-Cavitation Cage

Check with a qualified Singer representative or contact Singer directly to see if your system will experience cavitation.

5 Sensor

The SPI insertion sensor makes use of Faraday's Law of Electromagnetic Induction to measure water velocity. Faraday's Law states:

A conductor, moving through a magnetic field, produces a voltage.

Because water is a conductor, water moving through a magnetic field produces a voltage. The magnitude of the voltage is directly proportional to the velocity of the water. The sensor generates an electromagnetic field in the water. A faster water velocity produces a higher voltage. The two velocity electrodes, along with the ground electrode measure this voltage. By accurately measuring this voltage, the velocity is determined.

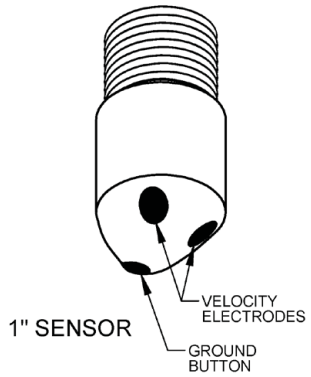


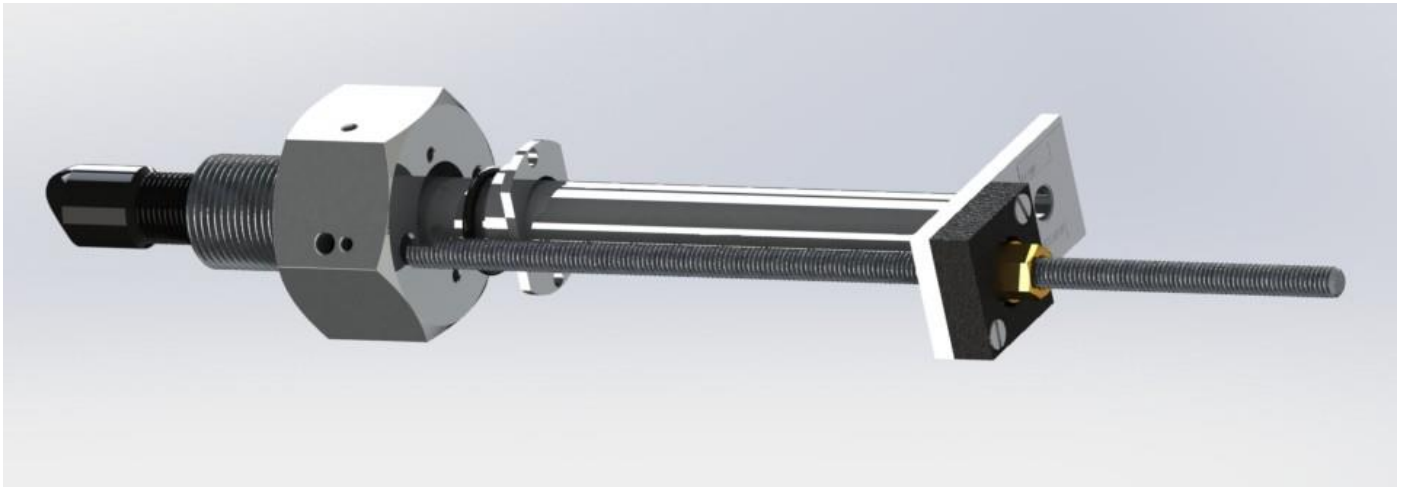
Figure 7: Sensor Electrodes

The velocity measurement provided by the sensor is used to calculate flow. Flow is the amount of fluid moving through a pipe in a period of time. To calculate the flow, two things are needed: The cross-sectional area of the pipe and the average velocity.

Flow = Average Velocity x Area

Each sensor is paired with a Converter that performs these calculations to convert the sensor signal into a flow value. The converter displays the flow on screen as well as retransmitting it as a 4-20mA signal.

5.1 Insertion Hardware



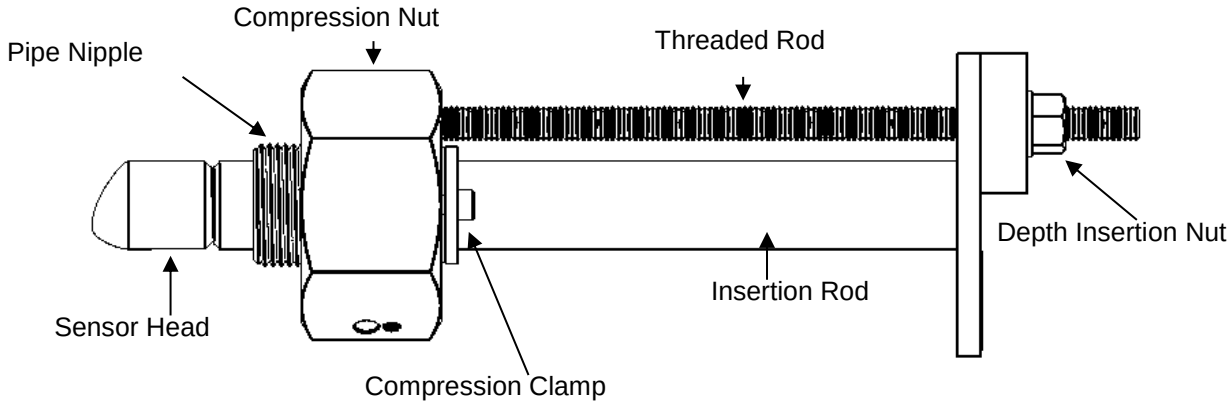


Figure 8: SPI Probe Insertion Assembly

5.2 Insertion Depth

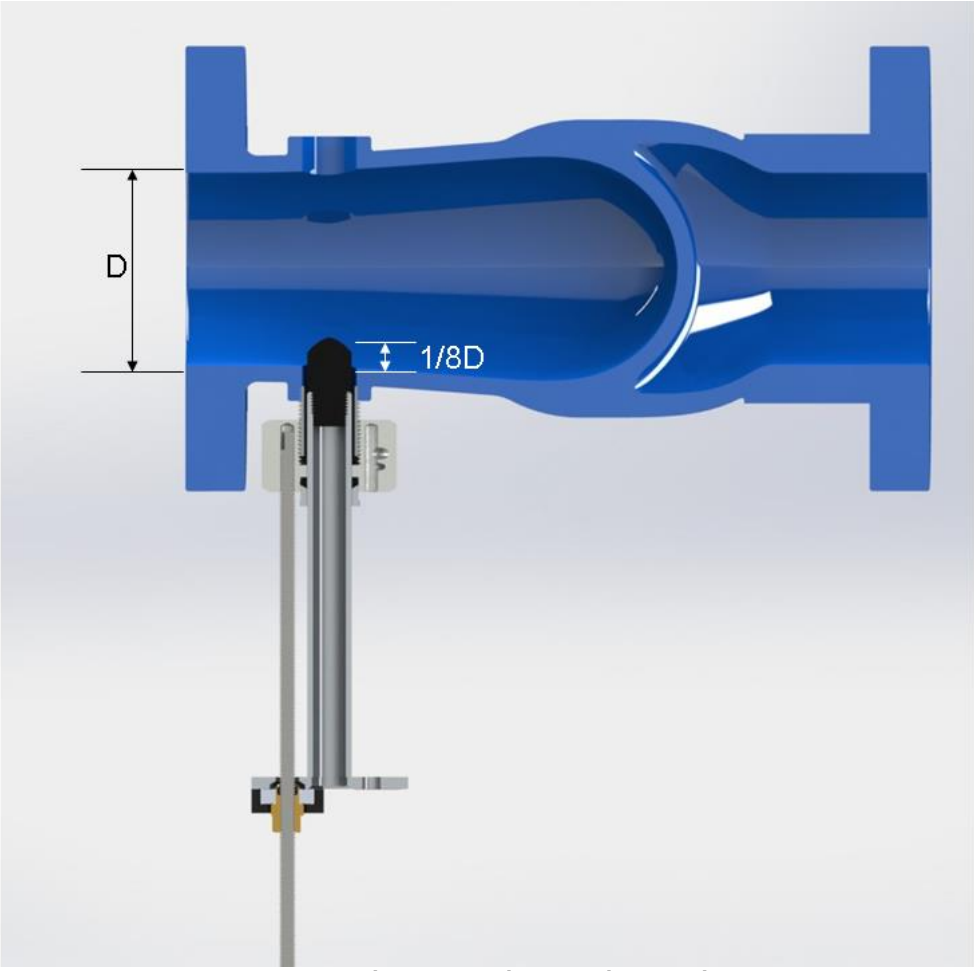


Figure 9: Probe Insertion Depth

McCrometer calibrates the SPI-MV sensor to calculate flow of the valve at an insertion depth of 1/8 the diameter of the valve. The 1/8 insertion depth is measured from the internal boss edge to the sensor electrodes. Singer will install the SPI sensor into main valve at the correct insertion depth before all orders are shipped. An insertion clamp lock nut will be added to the threaded rod to ensure that the sensor is maintained at this depth. See *Appendix 12.1 Installation Guide* for detailed installation instructions.

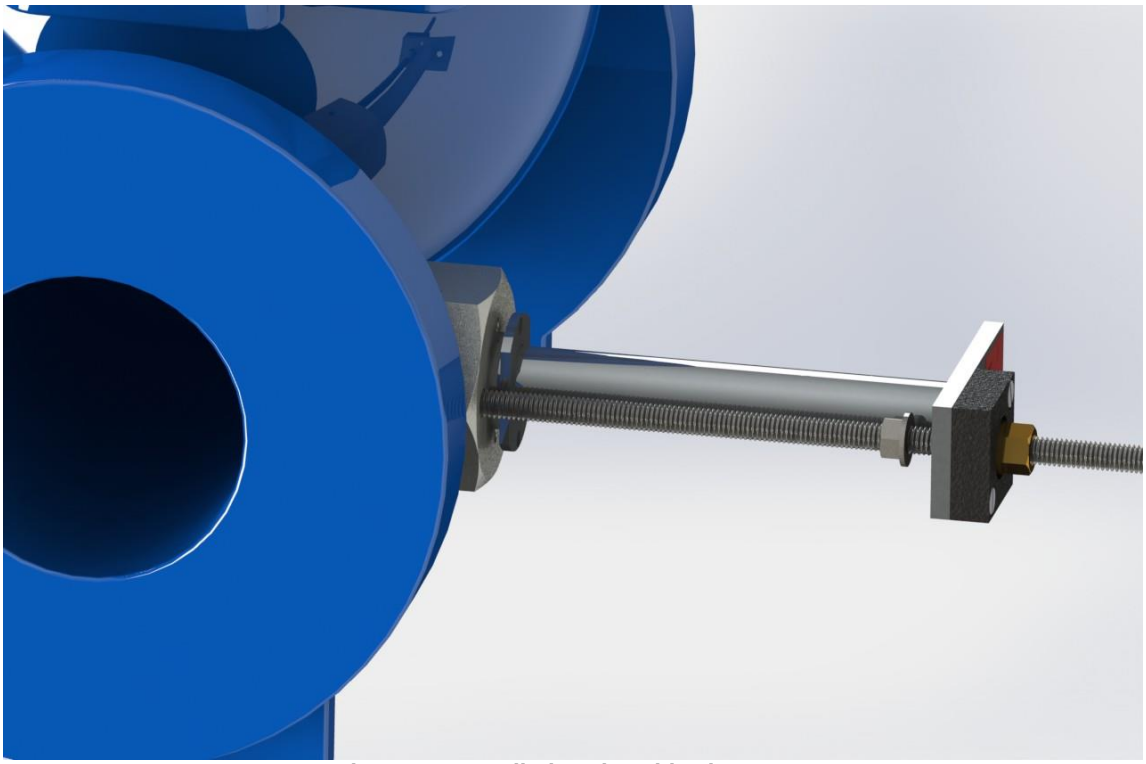


Figure 10: Installed Probe with Clamp Nut

NOTE: Do not remove the insertion clamp nut. An offset of insertion depth will cause an incorrect reading. A lock nut or two jam nuts may be used in place of a clamp nut. At minimum, the correct depth must be marked on the threaded rod before removal.

NOTE: Old style Singer valves bodies **cannot** be retrofitted to have an SPI meter.

6 Meter Removal

To remove the meter, follow the steps below:

WARNING!
The pipe may be under pressure. Serious injury or death may result if proper procedures are not followed.

DEPRESSURIZE THE LINE BEFORE ATTEMPTING REMOVAL OF THE SENSOR.

Loosen the compression clamp seal with an Allen key until the seal just begins to leak. This will relieve the pressure on the compression seal allowing the sensor to be removed. Draping a towel around the compression seal can reduce any spraying water.

Rotate the Depth Insertion Nut to start removing the sensor. This will cause the sensor to rise out of the compression nut and move along the threaded rod. Completely unthread the sensor off the threaded rod to remove the sensor from the valve.

Figure 11: Removing Probe

Figure 12: Valve with Probe Removed

6.1 Maintenance

The SPI is essentially a maintenance free meter with no user serviceable parts. However, the metered fluid may contain solids or other contaminants that coat the sensor electrodes. A periodic inspection may be recommended to ensure the sensor electrodes are clean. To clean the unit, remove the sensor following all of the instructions and safety warning contained in Section above. Once the sensor is removed from the pipe, carefully wipe down the sensor with a soft cloth and a mildly abrasive detergent, such as a liquid kitchen detergent. Once the sensor is clean, reinsert the sensor by rotating the Depth Insertion Nut until the sensor end butts up against the Insertion Clamp Nut. Tighten the Compression Seal and ensure the sensor is level again.

7 SPI Converter Overview

The SPI Signal Converter is the reporting, input and output control device for the sensor. The converter allows the measurements, control of the sensor and data recording to be communicated through the display and inputs & outputs. The SPI microprocessor-based signal converter has a twelve-point curve-fitting algorithm to improve accuracy, dual 4-20mA analog outputs, and an 8-line graphical backlit LCD display with 3-key touch programming. The converter will output rate of flow and total volume. The converter also comes standard with password protection and many more features.

The converter is available in both local (Figure 13) and panel mount (Figure 14) configurations. Local Converters are IP67 rated and stand-alone while Panel-Mount Converters are IP65 rated and intended for integration into a control panel inside an enclosure.

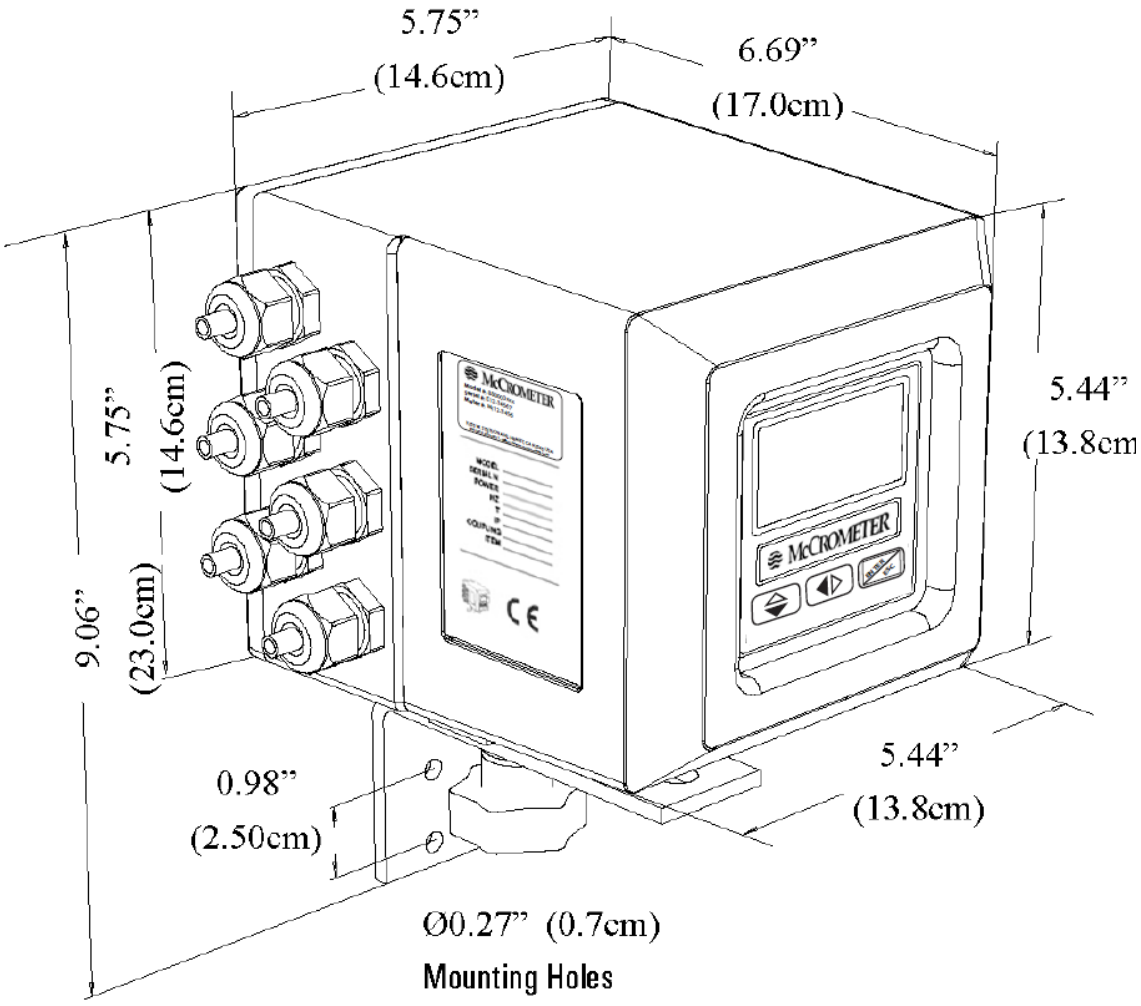


Figure 13: Local Converter Dimensions

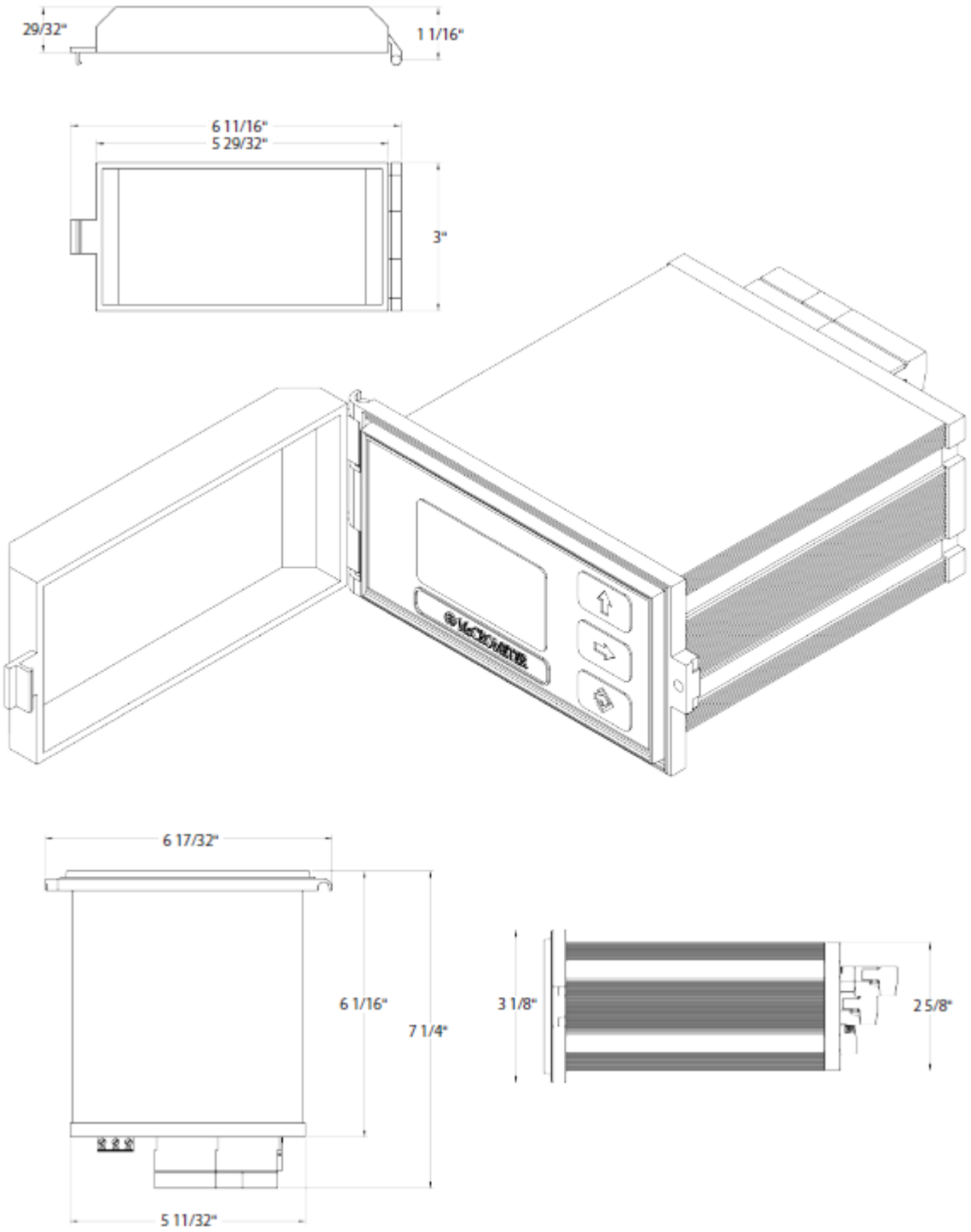


Figure 14: Panel-Mount Converter Dimensions

8 Converter Installation

8.1 Mounting the Converter

If possible, mount the converter in an electronics shed or environmental enclosure. If the converter is mounted outdoors a sun shield is recommended. The sun shield should be oriented in a direction to reduce sun damage and ensure readability. The Local Converter is mounted using 2 bolts. The Panel- Mount Converter is secured to a panel using two screws. A service loop in the cables is required.

8.2 Installing Cables to Converter and Service Loop

Any cable running through a conduit must exit the conduit and have a minimum of an 8" service loop before entering the electronics enclosure through the cable glands. All cable compression glands must be properly tightened to prevent moisture intrusion and maintain the IP67 rating. This allows the electronics enclosure to be rotated and the rear panel to be accessed. If electrically bonding (grounding) the enclosure to metallic conduit or raceways, secure a lead wire to the enclosures back panel screw and attach the lead to a listed and approved conduit grounding bushing. To ensure IP67 rating use only round cable 0.125" to 0.375" in diameter.

IMPORTANT: Do not cut or alter the cable length on power or signal cables!
Connections to the sensor must be made with cable supplied by McCrometer specifically for that purpose. Do not substitute the supplied cable with other types of cable, even for short runs. For repairs or added lengths of cable, the entire cable between the sensor and the converter must be replaced. (Consult factory for replacement cable.)

WARNING: Do not connect any form of conduit directly to the converter enclosure. Doing so will allow moisture and potentially dangerous gasses to enter directly into the converter. Attaching any conduit to the enclosure, or altering the enclosure in any way will void the warranty.

Attaching conduit to the enclosure or altering the enclosure in any way will remove the IP67 rating and void the warranty.

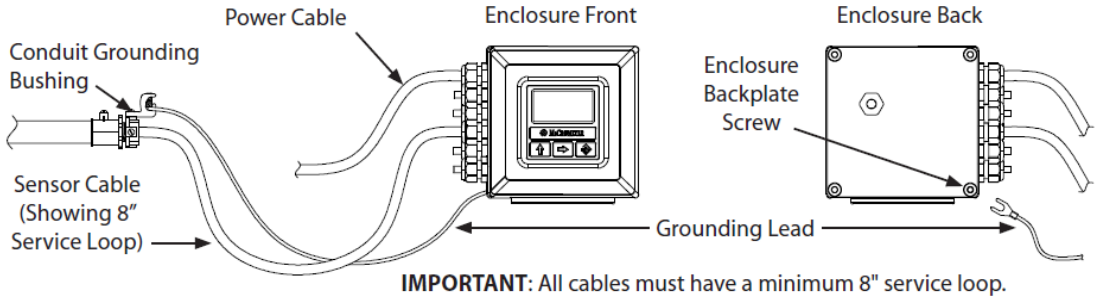


Figure 15: Cable Installation

8.3 Pulling Sensor Cable through Electrical Conduit

It is very important to protect the end of the sensor cable when pulling it through a conduit. Water can accumulate in low portions of conduit. Always use the factory supplied cable cover, or similar method, to seal the end of the cable against water when pulling the cable through conduit. This will ensure proper operation of the meter.

Pulling the Sensor Cable:

1. Tie a rope or cable-snake securely around the middle of the cable cover.
2. Carefully pull the rope or snake until the sensor cable end clears the conduit.
3. Bring the cable end to the converter location. If necessary, secure the cable so that it does not fall back through the conduit.
4. Remove the cable cover by pulling the rip wire. The cable cover will tear off (discard the cover).

CAUTION: Do not cut the cable cover off. Doing so may damage the sensor cable and adversely effect the calibration of the meter.

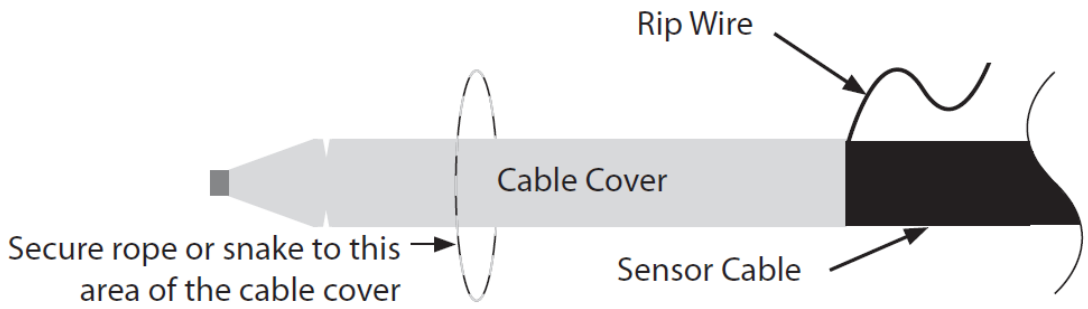


Figure 16: Cable Cover

8.4 Sensor Cable

SPI sensor cable is supplied standard as a 20 ft length.

Never under any circumstance cut the sensor cable. Specify length of cable needed when ordering the valve or have a Singer trained professional install the cable correctly.

The length of sensor cable should to be minimized to ensure the best quality signal. If a long cable is needed for a specific application, install the converter near the SPI-MV valve and run a 4-20mA signal to the end location

8.5 Sensor Electrical Cable Connections

All electrical cables enter the converter through compression fittings located on the side of the converter. Ensure that all compression glands are properly tightened and all unused fittings are plugged so the case remains sealed.

Always disconnect the power cord before attempting any electrical connections

8.5.1 Terminal Board

All connections are made on the terminal board. To access the terminal board, loosen the four screws on the back of the converter to remove the rear cover.

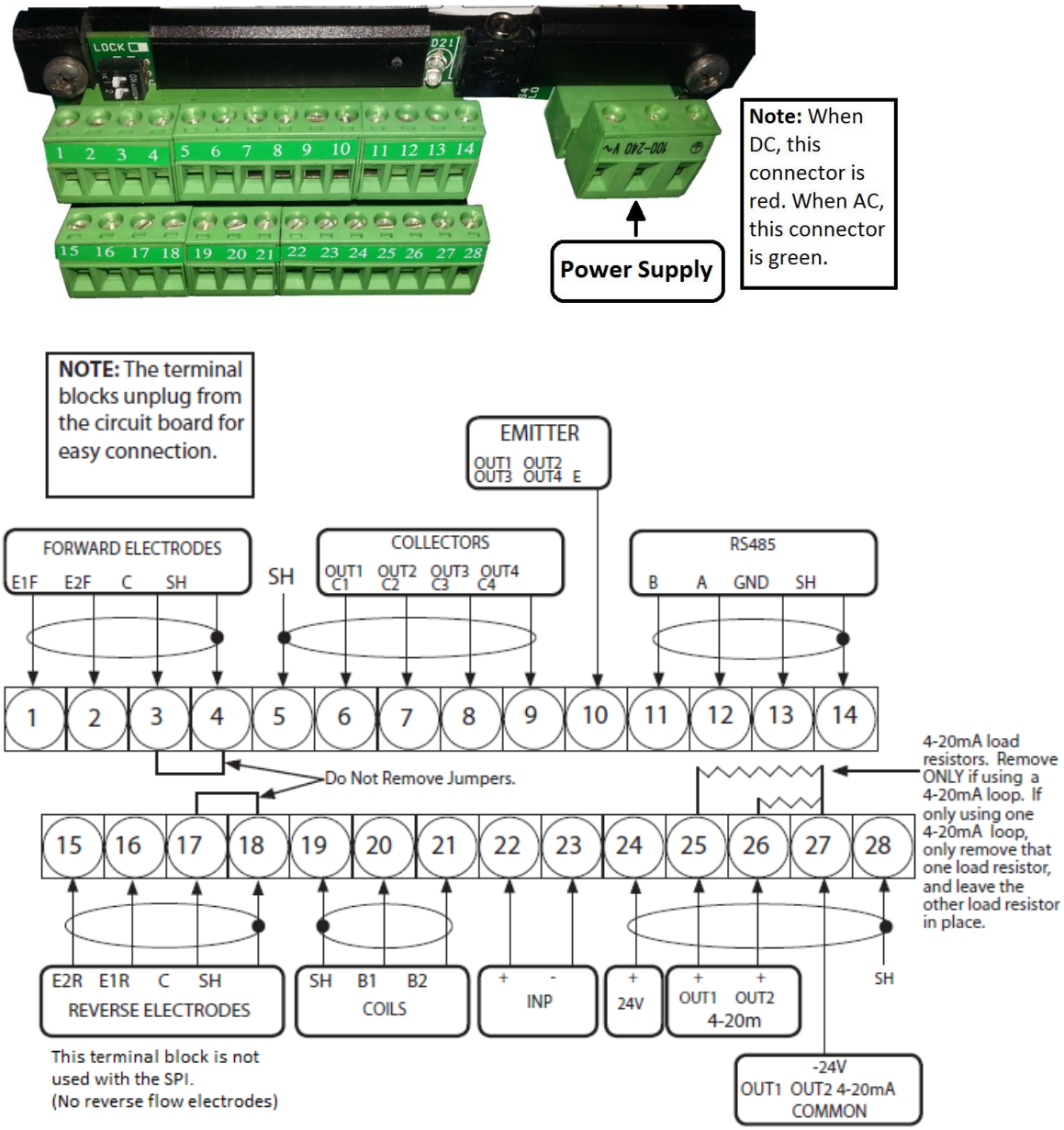


Figure 17: Terminal Board Layout

8.5.2 Sensor Wiring

Table 1: Terminal Block Assignments

Terminal	Wire Color	Connected To
#1	Blue	Sensing electrode
#2	White	Sensing electrode
#3	Black	Reference ground
#19	Black	Magnet shield / overall cable shield
#20	Red	Coil
#21	Yellow	Coil

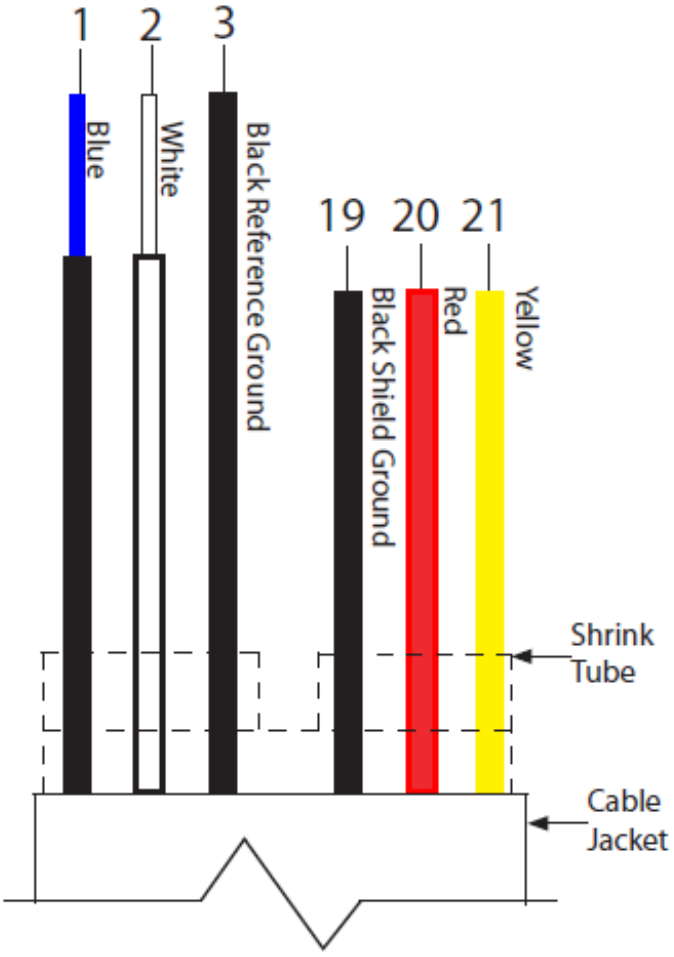


Figure 18: Wire Labeling

Figure 19: SPI Cable Wires

8.5.3 4-20mA Hook-Up

Two isolated 4-20mA current loops are used to output flow data to external devices. Maximum load impedance is 1,000Ω, and the maximum voltage without load is 27VDC. The converter has the capability to detect a loss of load on this output. To disable this function set the value "mA Val. Fault" under the ALARMS menu to zero. A graphical example of the usage of the current loop with external device is shown below:

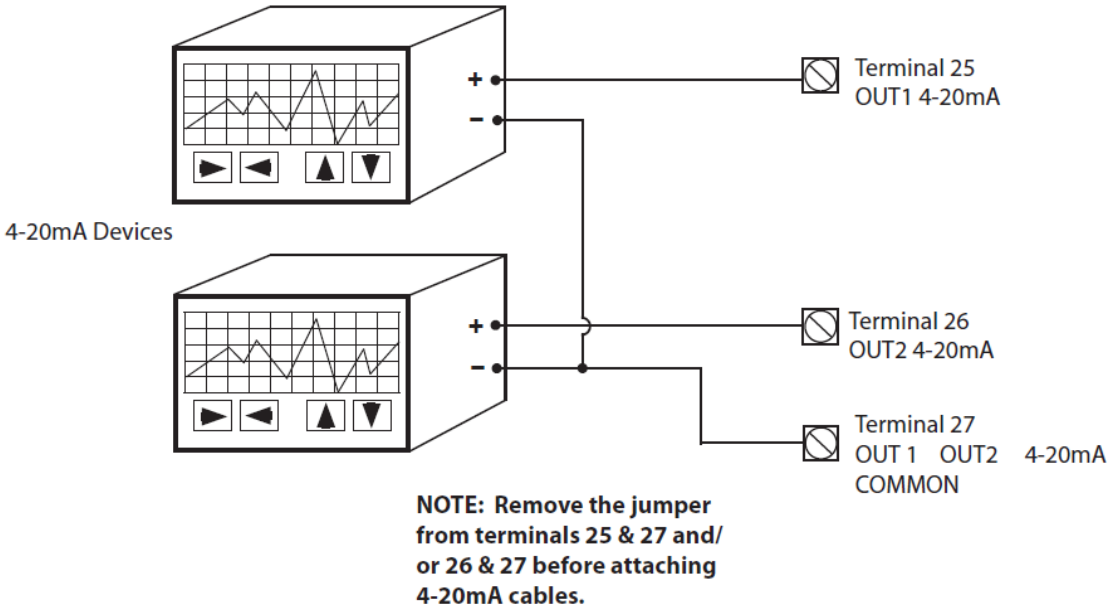


Figure 20: 4-20mA Hook-Up

If the external device requires a voltage input, a precision resistor placed across the input terminals of the external device will change the current to voltage. Calculate the required resistor using Ohm's law (V = I x R). For example, a 250Ω resistor will provide an input voltage of one to five volts with the transmitter range being set from 4mA to 20mA. An additional 4 to 20mA loop output is available.

IMPORTANT

The converter powers the 4-20mA loops. Do not use external power for the 4-20mA loop as it may cause permanent damage to the converter.

8.5.4 Opto-Isolated Pulse Output Hook-Up

The four pulse outputs are open collector transistor outputs used for communicating with or activating external devices.

Output Specifications:

- Opto-isolated output with collector and emitter terminals floating and freely connectable
- Max switching voltage: 40 VDC
- Max switching current: 100mA
- Max saturation voltage between collector and emitter: 1.2V@100mA
- Max switching frequency (load on the collector or emitter, RL=470Ω, VOUT=24VDC): 1250Hz
- Max reverse current bearable on the input during an accidental polarity reversion (VEC): 100mA
- Insulation from other secondary circuits: 500 V

See Table 2 and Table 3 in section 9.10 *Menu 6 - Outputs* for available output functions.

Figure 21 below shows the recommended wiring for a pulse output. The connection to output 1 is shown. For other outputs, replace terminal 6 with the terminal corresponding to the desired output (see Figure 17).

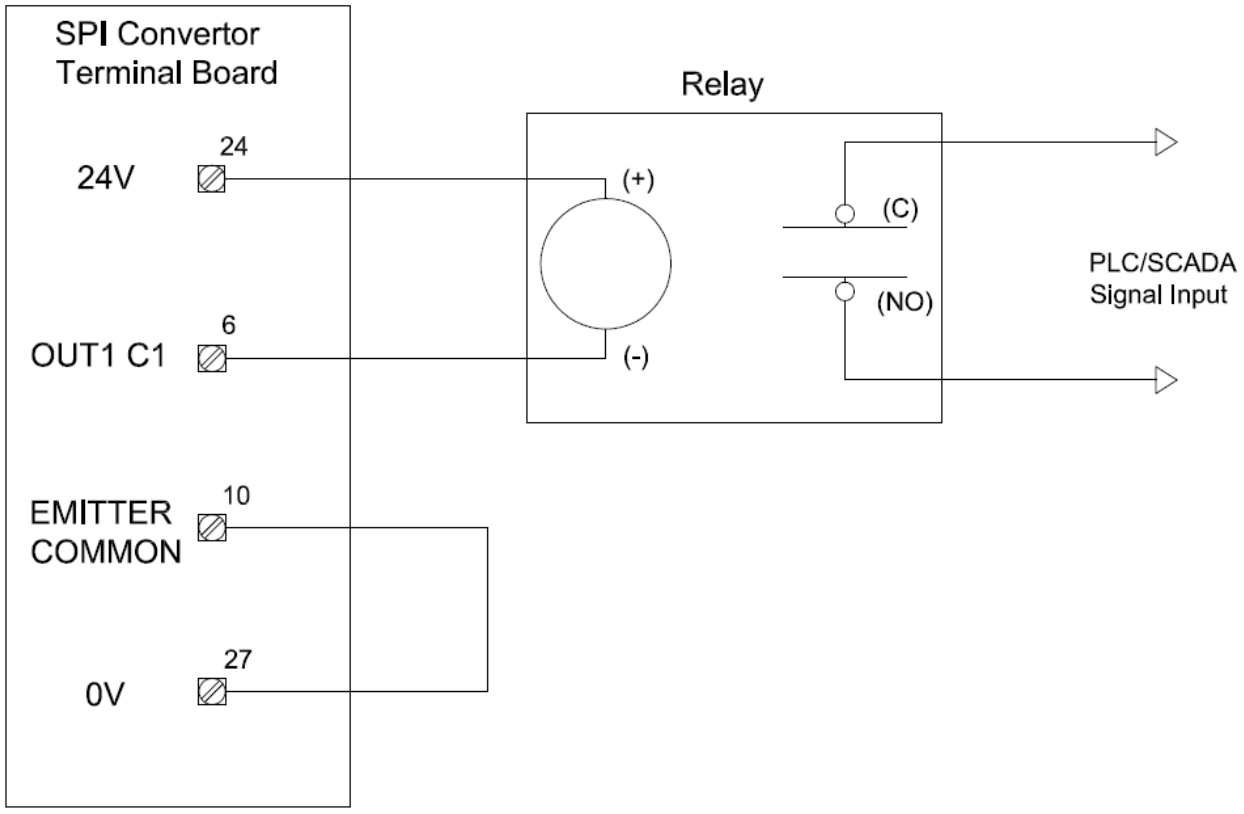


Figure 21: Opto-Isolated Pulse Output 1 Connection via Relay

8.5.5 Converter Power Hook-Up

WARNING!
Hazardous supply voltage can shock, burn, or cause death.

The power supply line must be equipped with external surge protection for current overload (fuse or circuit breaker with limiting capacity not greater than 10A). It must be easily accessible for the operator and clearly identified. Power connection is made using the power terminal block on the upper right side of the terminal board.

NOTE: The terminal block unplugs from the circuit board for easy connection. Connect earth ground to the protective grounding terminal before making other connections. The power supply of a standard converter is 90-265VAC, 44-66Hz at maximum 20W. DC converter is available as an option.

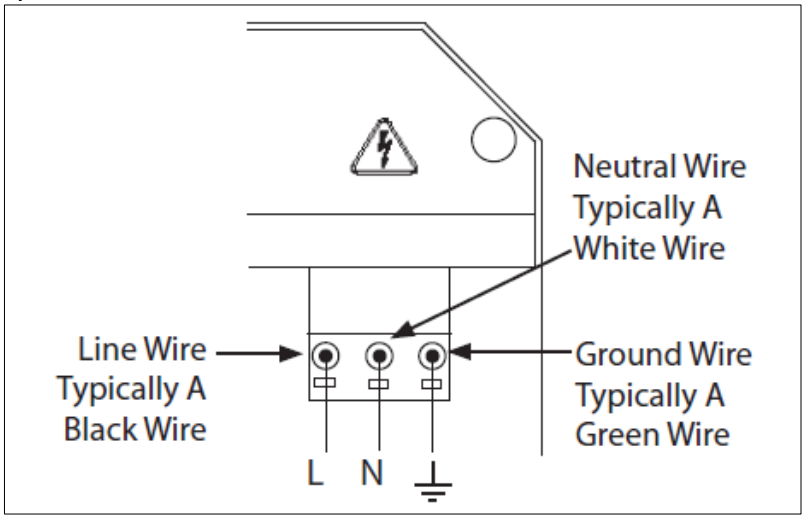


Figure 22: AC Power Wiring

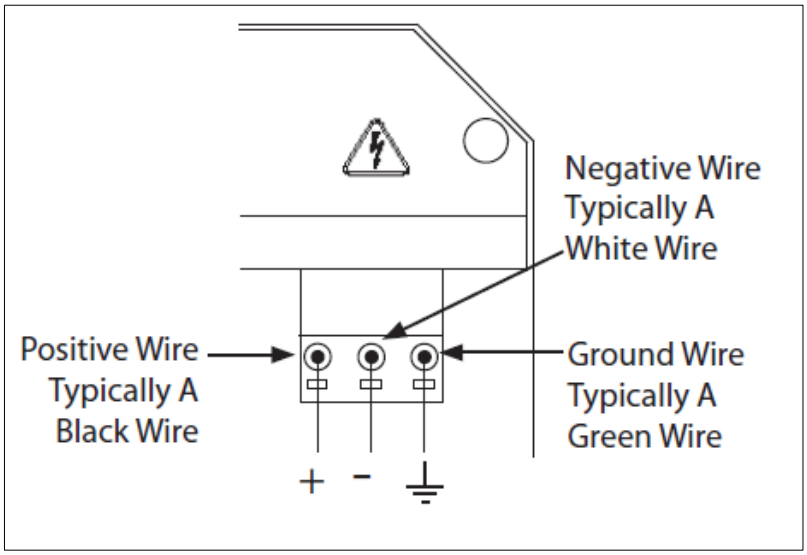


Figure 23: DC Power Wiring

8.5.6 Converter Start-Up

Before starting up the converter please verify the following:

- Power supply voltage must correspond to that specified on the data plate (located on the side of the converter)
- Electric connections must be wired as described in this manual
- Ground connections must be properly installed

When the converter is powered it initiates a verification cycle of the converter. During the verification cycle the converter displays an incrementing diagnostic number from 0 through 90. When the diagnostic is complete, if an error is found, an error code will be displayed. A text message will also be displayed on the alarm screen. If an error is found, contact factory for support.

8.6 Grounding

One of the most important installation details for magnetic flowmeters, in general, is proper process ground. A proper ground ensures that the fluid and sensor are at the same potential so that only the induced flow signal is measured. The most stable ground reference is the earth ground itself. By connecting the fluid, sensor, and converter to a stable and noise free reference point, the SPI will offer the best performance.

Note: The AC supply ground may not provide adequate grounding. In some cases, an AC ground can induce noise to the low voltage signals generated by the magnetic flowmeter. It is recommended to wire the ground connection to a separate low impedance earth ground or a dedicated instrumentation ground.

These are the recommended grounding arrangements:

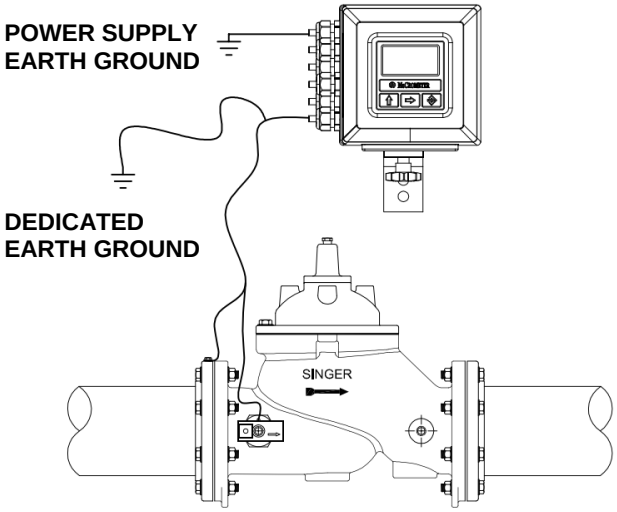


Figure 24: Grounding for conductive pipe or conductive-lined pipe

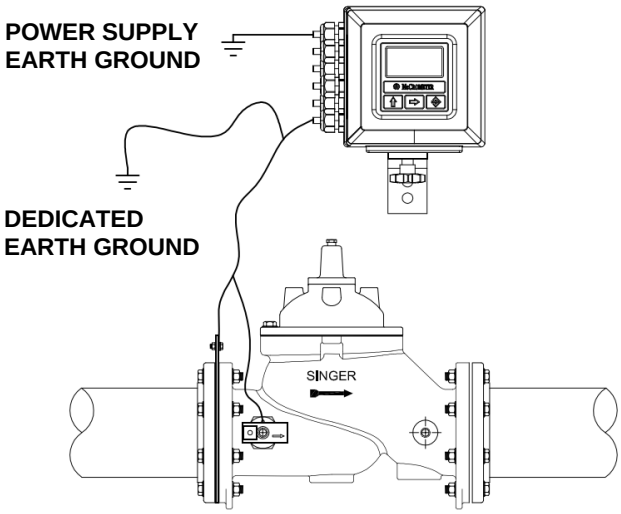


Figure 25: Grounding with grounding rings

See Figure 26, Figure 27, and Figure 28 below for examples of proper converter and probe grounding.

Figure 26: Converter & probe with ground wiring

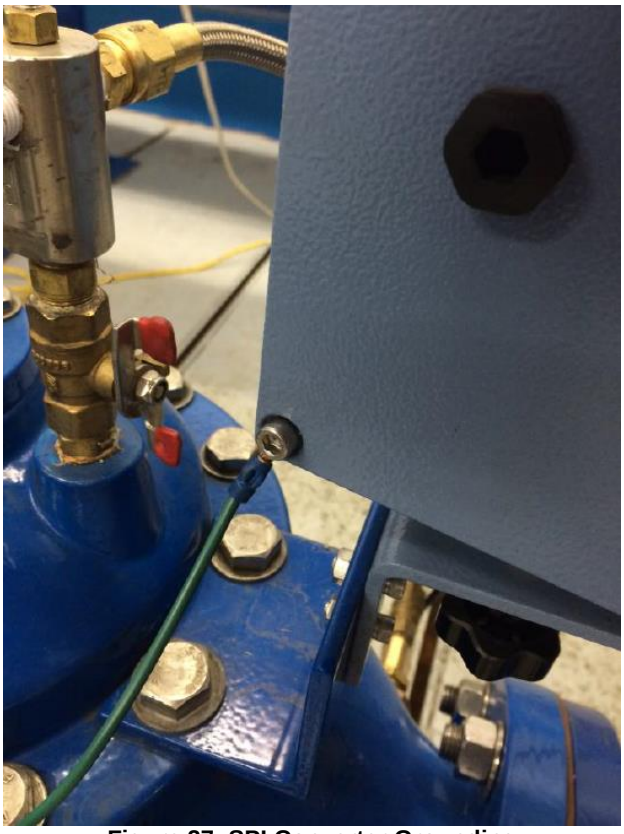


Figure 27: SPI Converter Grounding

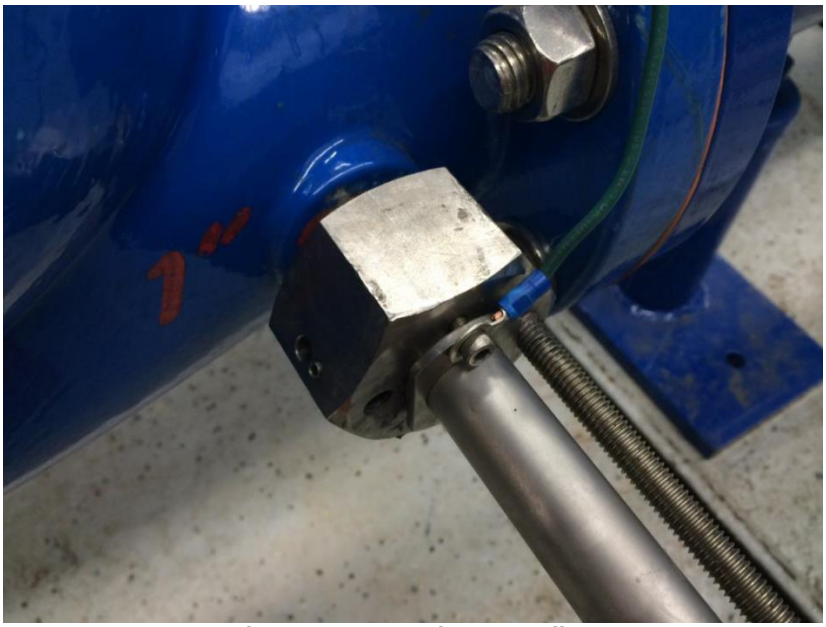
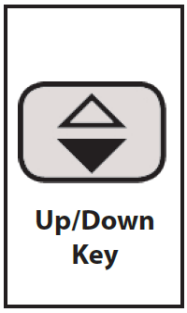
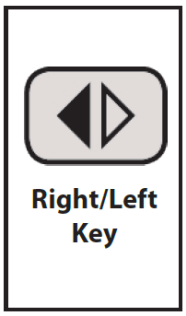


Figure 28: SPI Probe Grounding

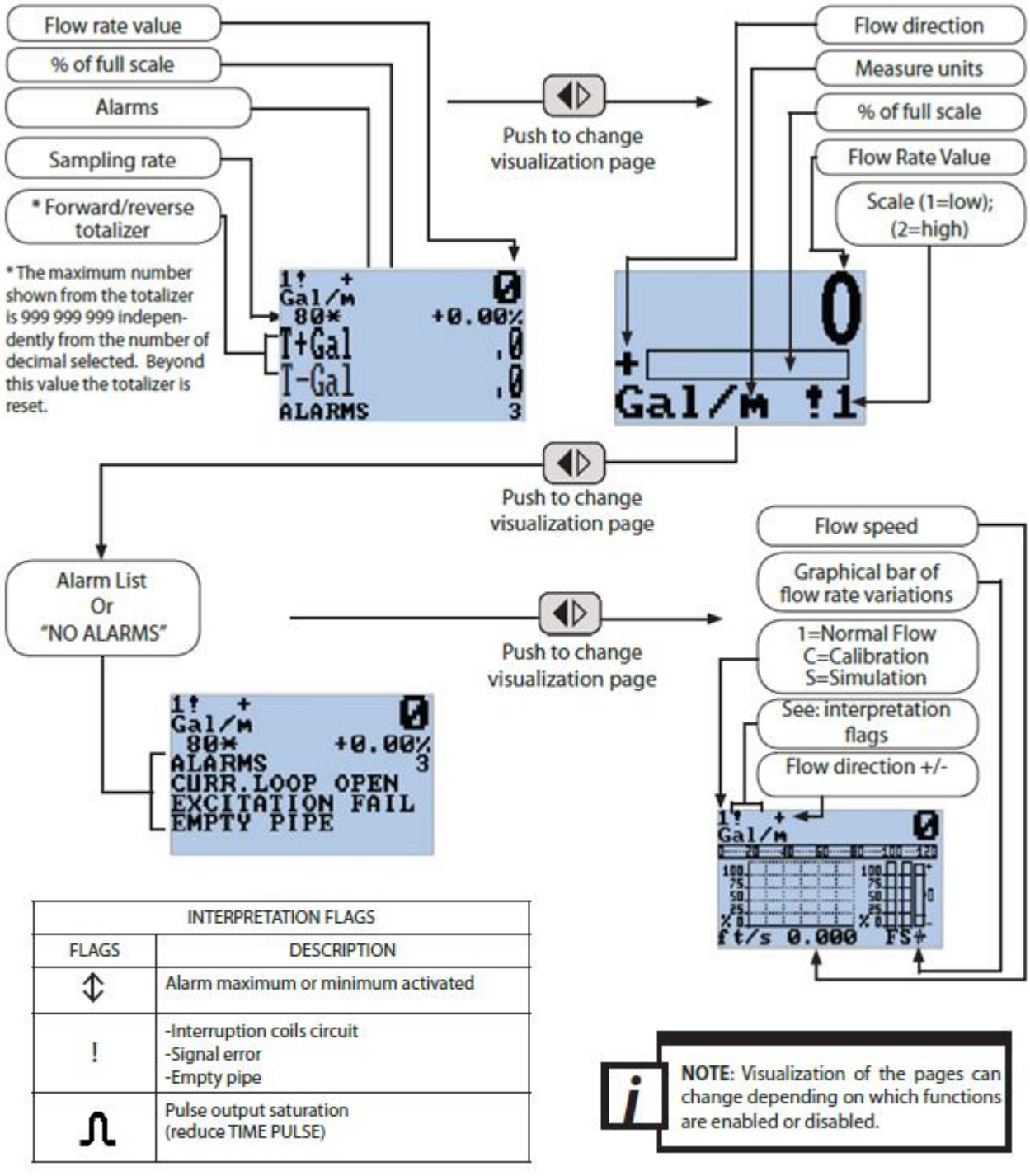
9 Menu Navigation

To navigate through the menus on the converter, the keys on the keypad use the following conventions:

Key:	Function:
 Up/Down Key	UP/DOWN KEY (for moving cursor up or down) **SHORT PRESSING (< 1 SECOND):** Moves the cursor up to the previous subject on the menu Increases the numeric figure of the parameter highlighted by the cursor **LONG PRESSING (> 1 SECOND):** Moves the cursor down to the next subject on the menu Decreases the numeric figure of the parameter highlighted by the cursor
 Right/Left Key	RIGHT/LEFT KEY (for moving cursor right or left) **SHORT PRESSING (< 1 SECOND):** Moves the cursor to the right on the input field Moves the cursor to the following subject of the menu Changes the display of the process data **LONG PRESSING (> 1 SECOND):** Moves the cursor to the left on the input field Moves the cursor to the previous subject on the menu **Note:** Push and hold for eight seconds to cycle through contrast settings.
 Enter/Esc Key	ENTER/ESC KEY (for changing settings) **SHORT PRESSING (< 1 SECOND)**: Opens the Quick Start menu for the instrument configuration Enters the selected function Cancels the selected function under progress **LONG PRESSING (> 1 SECOND):** Confirms the selected function Leaves the current menu

9.1 Front Panel Display

Short-press the Right/Left arrow key to view different visualization screens.

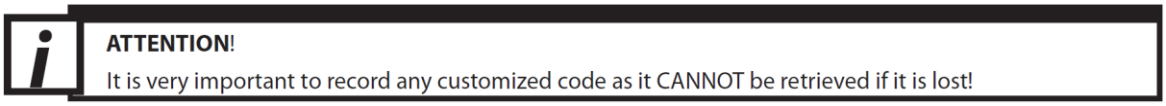


INTERPRETATION FLAGS	
FLAGS	DESCRIPTION
↕	Alarm maximum or minimum activated
!	-Interruption coils circuit -Signal error -Empty pipe
⎍	Pulse output saturation (reduce TIME PULSE)

Figure 29: Front Panel Display

9.1.1 Factory Pre-Setting

The converter is delivered with “Quick start menu” enabled and with **passcode L2 = 000002**. Press the Enter/Esc key to access the Quick start menu.



9.2 SPI Menu Structure

The following is the menu structure for the SPI converter.
Main menu access requires the **L2 passcode 000002**.

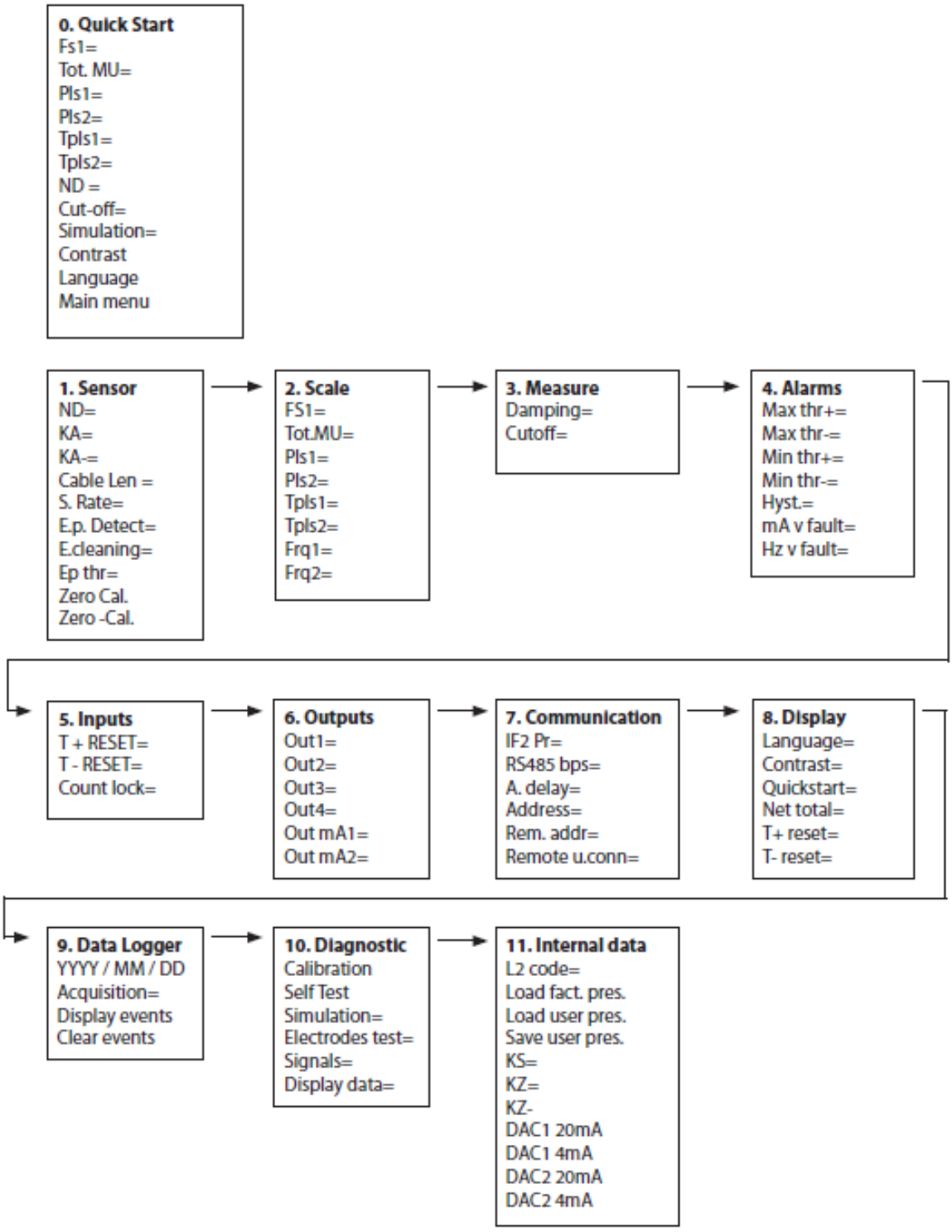


Figure 30: Menu Structure

9.3 Programming Example

The steps below demonstrate how to modify the full scale value from 4 Gal/m to 5 Gal/m from the "Quick start menu".

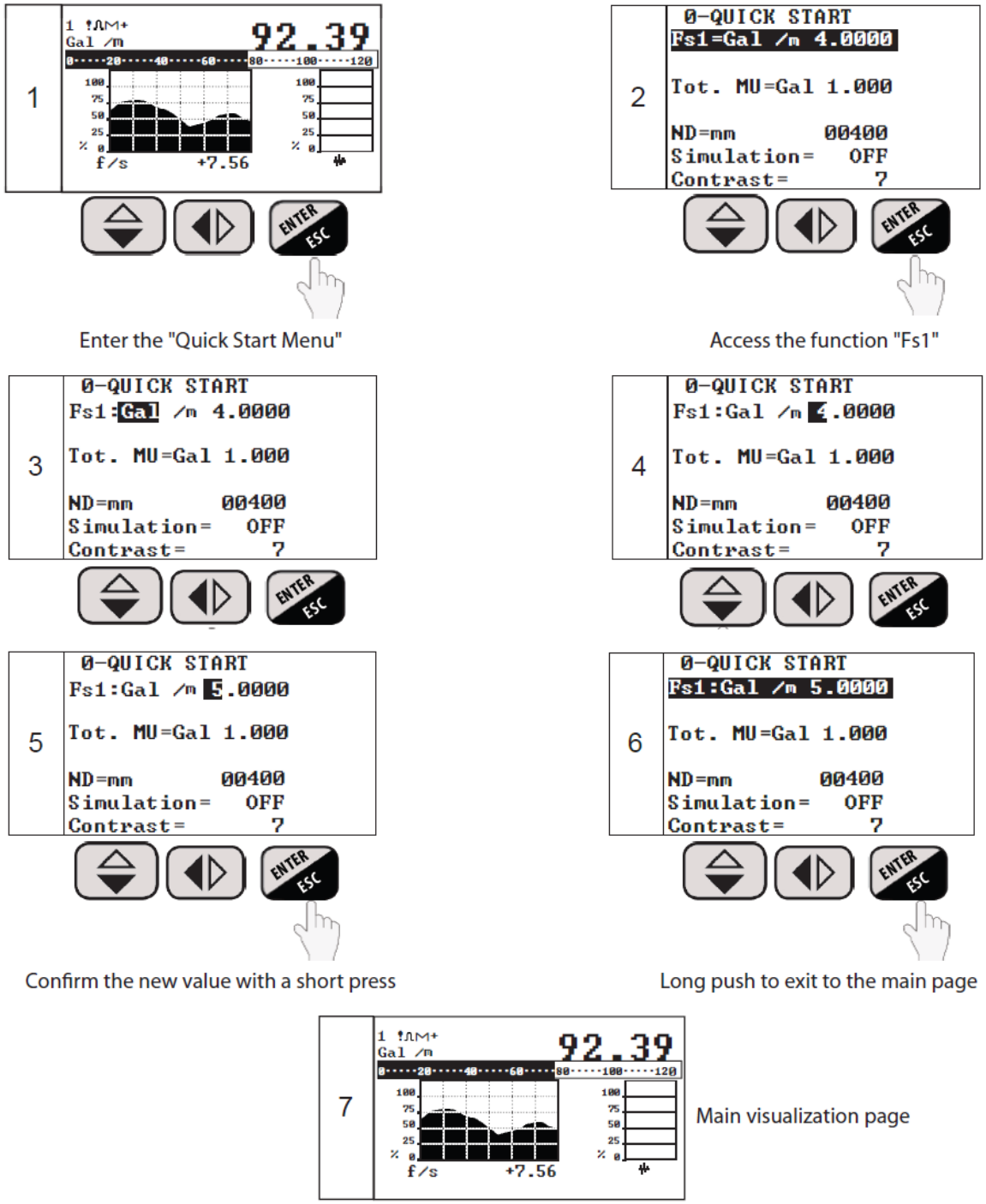


Figure 31: Programming Example: Changing Full Scale Value

9.4 Quick Start Menu

The functions in the Quick Start menu and the Main menu are explained below. Please note that some functions are only displayed if other functions are enabled or with the insertion of additional modules. Access the Quick Start Menu by pressing the Enter/Esc key from the visualization page.

NOTE: If the Quick Start Menu is disabled:
From the flow visualization, press the Enter/Esc key. The L2 passcode screen will appear. Enter the **passcode of 000002**, then press the Enter/Esc key to access the main menu. When the Quick Start Menu is enabled, you can enter the Main menu from the "Quick start menu".

9.4.1 Fs1

The units of measure and full scale range of the meter that defines the 20mA output. Generally this value is set 10% over the anticipated max flow. US standard & metric units are selectable from this menu. See *Appendix 12.3 Units of Measure* for available units of measure.

To change the full scale value, highlight the "Fs1" menu and press the Enter/Esc key. The unit will highlight. Press the Up/Down key to scroll thru the different available units.

Once you have selected the desired unit, press the Right/Left key twice to highlight the lower case letter that represents the time unit. Again press the Up/Down key to scroll thru the available time units. Once the unit of measure and time unit have been selected, press the Right/Left key to select the numeric value. Press the Up/ Down key to set the digit and Right/Left key to move to the next digit. Once the desired value is entered, press the Enter/Esc key to exit/highlight the menu.

NOTE: If a unit you are looking for is not in the current list, press the Right/Left key and scroll to the "/" between the unit of measure and time unit selections and press the Up/Down key to switch between U.S. Standard and Metric units.

Once the desired value is entered, quick push the Enter/Esc key to highlight the entire line and then long push Enter/Esc to exit back to the display.

9.4.2 Tot. MU

The totalizer unit/multiplier and decimal resolution. See *Appendix 12.3 Units of Measure* for available units of measure. To change the totalizer unit/multiplier, select the Tot. MU menu and press the Enter/Esc key. This will highlight the unit/multiplier.

Press the Up/Down key to scroll through the available units until the desired unit has been selected.

NOTE: The totalizer multiplier is built into the unit of measure, so for gallons multiplied by 1000, select KGal.

Once the unit of measure is selected, press the Right/Left key twice to highlight the numeric value to the right. Then press the Up/Down key to change the decimal resolution displayed for this totalizer. Changing the decimal resolution will not change the multiplier. The available selections are 00001, 001.0, 01.00, and 1.000.

NOTE: If the desired unit of measure is not in the current list, press the Right/Left key and scroll to the blank space between the unit/multiplier and the numeric decimal resolution selection and press the Up/Down key to switch between U.S. Standard and Metric units.

9.4.3 Pls1

The pulse increment value and unit of measure for the pulse output 1. This option is only available when “out1” in “Menu 6 – Outputs” (section 9.10.1) is set to #1 IMP+.

9.4.4 Pls2

The pulse increment value and unit of measure for the pulse output 2. This option is only available when “out2” in “Menu 6 – Outputs” (section 9.10.2) is set to #2 IMP+.

9.4.5 Tpls1

Duration of the pulse output 1 expressed in milliseconds. The pulse duration can be set from .4 to 9999.99. This option is only available when “out1” in “Menu 6 – Outputs” (section 9.10.1) is set to
#1 IMP+. Factory set to 50ms, which should not need to be changed.

9.4.6 Tpls2

Duration of the pulse output 2 expressed in milliseconds. The pulse duration can be set from .4 to 9999.99. This option is only available when “out2” in “Menu 6 – Outputs” (section 9.10.2) is set to #2 IMP+. Factory set to 50ms, which should not need to be changed.

9.4.7 ND

Inside Pipe Diameter in millimeters. This is factory set to match the measured ID of the Singer Valve it is calibrated for. Should not be changed from factory setting.

9.4.8 Cutoff

Cut off point below which all flow is reported as zero. This value is set as a percentage of the full scale. This setting ensures no noise will be reported when zero flow is present.

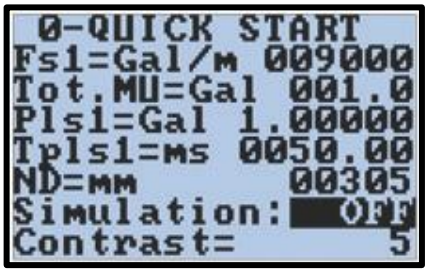
NOTE: When running a Zero Calibration (section 9.5.8), ensure the cutoff value is set to 2.0.

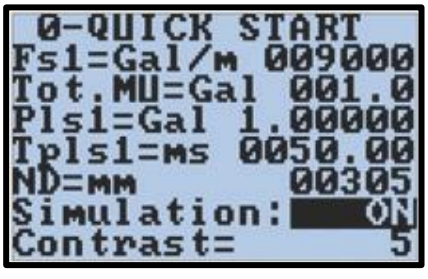
9.4.9 Simulation

Simulation Enable. Setting this menu to ON will generate an internal signal that simulates flow and allows the outputs and all connected instruments to be tested. After simulation is set to ON, the flow can be set to a percentage based on the current FS1 setting -125% to 125%.

To enable the simulation function, use the Right/Left key to highlight the Simulation menu and press the Enter/ Esc key. Enter **L2 passcode 000002**.

The simulation function can now be toggled from OFF to ON by using the Up/Down key. Select ON to turn on the Simulation mode and press the Enter/Esc key.

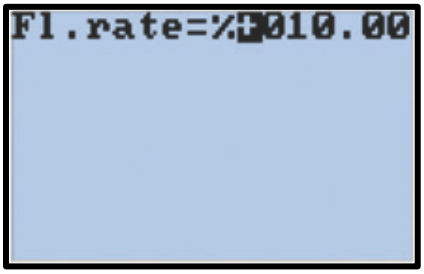




Press and hold the Enter/Esc key to exit back to the visualization page.

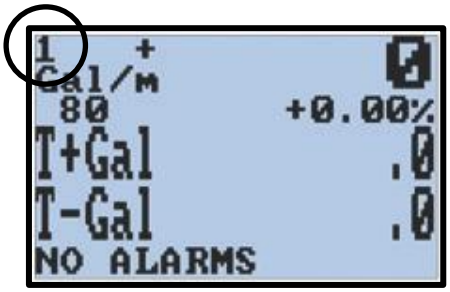
NOTE: There will now be an “S” in the upper left corner; this indicates the simulation mode is active.

Press the Enter/Esc key. This will bring up the flow simulation set up screen. Use the Right/Left key and the Up/ Down key to enter in the flow rate percentage value for the simulation. Press the Enter/Esc key to enter that value.



The converter will start to read flow. It may take a few seconds for the readings to appear. Repeat the above steps as needed to observe the different flow rates desired.

To exit out of simulation mode, re-enter into the simulation set up screen (see above) and then press and hold the Enter/Esc key. This will exit out to the visualization screen, and the “S” in the upper left corner of the screen will return to a “1”.



9.4.10 Contrast

Display contrast set point. The display contrast can be changed to make the display appear more visible based on the users preference. This menu can be set 0 to 15 with the change only taking affect once the menu selection has been selected by pressing the enter key.

NOTE: If set to high or too low the display can become unreadable. If this happens wait 60 seconds from the time of the last button push for the display to time out to the visualization page. From the visualization page press and hold the Right/Left button. The display will cycle through a different preset display contrast settings every 8 seconds. Release the button once you have found a setting that can be read.

9.4.11 Language

Choose a language to display the converter menus in. Available options are EN = English, IT = Italian, FR = French, SP = Spanish and DE = German.

9.4.12 Main menu

Allows access to the main menu which contains advanced configuration menus.
Enter the **L2 Passcode 000002.**

9.5 Menu 1- Sensor

9.5.1 ND Inside Pipe Diameter

Inside Pipe Diameter in millimeters. This is factory set to match the measured ID of the Singer Valve it is calibrated for. Should not be changed from factory setting.

9.5.2 KA

Factory calibrated gain for the forward flow. Do not change the value.

9.5.3 Cable length

Cable length set in increments of 10 meters, rounded to the nearest 10 meter increment.

9.5.4 S. rate

Factory calibrated frequency sampling rate. Do not change the value.

9.5.5 E.P. Detect

Set the empty pipe alarm to on or off. Factory default = ON.

NOTE: Setting the E.P. Detect to "off" will disable an alarm when an empty pipe is present. When the pipe is empty, sensor may display environmental/electrical noise as flow.

9.5.6 E.I. cleaning

Factory set value. Do not change the value.

9.5.7 E.p. thr

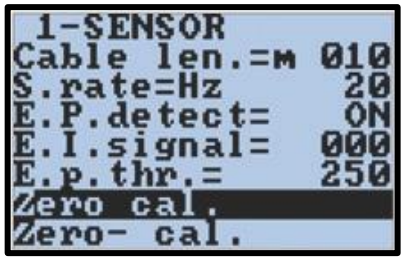
Empty Pipe Threshold is the numeric value selected during the Empty Pipe Calibration function. In some cases it may be required to manually adjust this value to be more compatible with an installation. For assistance adjusting this value contact Technical Support. Available settings are from 0 – 250 with a factory default of 195.

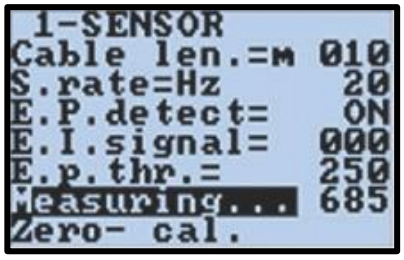
NOTE: If there is a high level of noise, the E.P Alarm may be active even though the pipe is full of water. Ensure grounding is correct to eliminate as much noise as possible.

9.5.8 Zero Cal

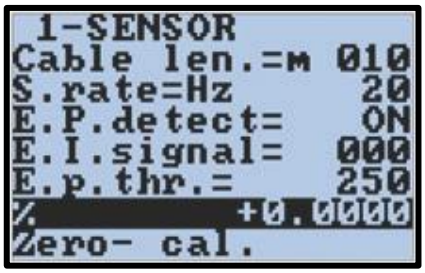
Zero point calibration function for the forward flow. To perform the Zero point Calibration, select the Zero Cal. Menu and press the Enter/Esc key. This will enable the zeroing function. You will see a percent value that is positive or negative.

IMPORTANT - The water must be perfectly still before starting the Zero Cal process or an offset will be introduced into the flow report.





Now press and hold the Up/Down button and release when the message "Measuring. . . " appears. The converter counts up from zero to 1,000, after which the zero point is set. The new value should be less than before the autozero was performed. If not, then verify that there is no flow in the pipe and repeat.



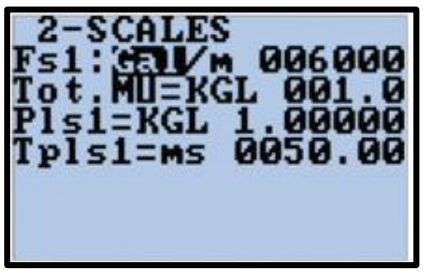
Note: If the zero cal starts measuring and jumps out, there is too much noise to complete the zero cal. Ensure grounding is correct to eliminate as much noise as possible.

9.6 Menu 2 – Scales

9.6.1 Fs1

The units of measure and full scale range of the meter that defines the 20mA output. Generally this value is set 10% over the anticipated max flow. US standard & metric units are selectable from this menu. See *Appendix 12.3 Units of Measure* for available units of measure.

To change the full scale value, highlight the “Fs1” menu and press the Enter/Esc key. The unit will highlight. Press the Up/Down key to scroll thru the different available units.



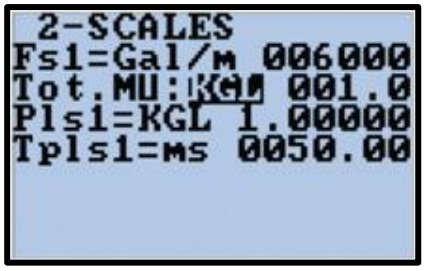
Once you have selected the desired unit, press the Right/Left key twice to highlight the lower case letter that represents the time unit. Again press the Up/Down key to scroll thru the available time units. Once the unit of measure and time unit have been selected, press the Right/Left key to select the numeric value. Press the Up/ Down key to set the digit and Right/Left key to move to the next digit. Once the desired value is entered, press the Enter/Esc key to exit/highlight the menu.

NOTE: If a unit you are looking for is not in the current list, press the Right/Left key and scroll to the "/" between the unit of measure and time unit selections and press the Up/Down key to switch between U.S. Standard and Metric units.

Once the desired value is entered, quick push the Enter/Esc key to highlight the entire line and then long push Enter/Esc to exit back to the display.

9.6.2 Tot. MU

The totalizer unit/multiplier and decimal resolution. See *Appendix 12.3 Units of Measure* for available units of measure. To change the totalizer unit/multiplier, select the Tot. MU menu and press the Enter/Esc key. This will highlight the unit/multiplier.



Press the Up/Down key to scroll through the available units until the desired unit has been selected.

NOTE: The totalizer multiplier is built into the unit of measure, so for gallons multiplied by 1000, select KGal.

Once the unit of measure is selected, press the Right/Left key twice to highlight the numeric value to the right. Then press the Up/Down key to change the decimal resolution displayed for this totalizer. Changing the decimal resolution will not change the multiplier. The available selections are 00001, 001.0, 01.00, and 1.000.

NOTE: If the desired unit of measure is not in the current list, press the Right/Left key and scroll to the blank space between the unit/multiplier and the numeric decimal resolution selection and press the Up/Down key to switch between U.S. Standard and Metric units.

9.6.3 Pls1

The pulse increment value and unit of measure for the pulse output 1. This option is only available when “out1” in “Menu 6 – Outputs” (section 9.10.1) is set to #1 IMP+.

9.6.4 Pls2

The pulse increment value and unit of measure for the pulse output 2. This option is only available when “out2” in “Menu 6 – Outputs” (section 9.10.2) is set to #2 IMP+.

9.6.5 Tpls1

Duration of the pulse output 1 expressed in milliseconds. The pulse duration can be set from .4 to 9999.99. This option is only available when “out1” in “Menu 6 – Outputs” (section 9.10.1) is set to
#1 IMP+. Factory set to 50ms, which should not need to be changed.

9.6.6 Tpls2

Duration of the pulse output 2 expressed in milliseconds. The pulse duration can be set from .4 to 9999.99. This option is only available when “out2” in “Menu 6 – Outputs” (section 9.10.2) is set to #2 IMP+. Factory set to 50ms, which should not need to be changed.

9.6.7 Frq1

Full scale frequency value for output 1. This option is only available when out1 in *Menu 6 - Outputs* is set to #1 FREQ+. The value is set in hertz between 1.0 to 1,000.0.

NOTE: When the high frequency output is present the maximum value may go up to 10,000.0 Hz.

9.6.8 Frq2

Full scale frequency value for output 1. This option is only available when out2 in *Menu 6 - Outputs* is set to #2 FREQ+. The value is set in hertz between 1.0 to 1,000.0.

IMPORTANT

The converter cannot detect the type of device it is connected to so it is up to the user to verify the setting is compatible with the external device receiving the pulse. Incorrect settings can damage the receiving device. See section 8.10, "Menu 6 - Outputs", for output specifications.

9.7 Menu 3 - Measure

9.7.1 AC Filter

This filter deals with AC noise from the power source, poor earth grounding and electrical noise on the fluid column.

NOTE: This is a factory set filter. Changing this filter will have a direct effect on meter response time and should only be adjusted with the assistance of Technical Support.

9.7.2 Damping

This sets the dampening or filter setting for the meter. This setting can be changed to make the meter more or less responsive and/or stable. The available dampening filter values range from 0 (no dampening or dampening OFF) to a maximum dampening of 1,000 seconds. There are also some specialized “SMART” settings. The “SMART” settings are not intended for use with the SPI flow meter and should not be selected. With the dampening turned off the converter responds immediately to any change in flow, but this can result in a noisy output. With the dampening set to values between 0.2 seconds and 1000 seconds the converter buffers and averages flow data over the period of time specified. Larger values tend to provide a quieter and more stable output but will respond more sluggishly to large changes or transitions in flow rate. Typically, the damping is set to 10-20 seconds.

NOTE: This is a factory set filter. Changing this filter will have a direct effect on meter response time and should only be adjusted with the assistance of Technical Support.

9.7.3 Cut-off

Cut off point which all flow is reported as zero. This value is set as a percentage of the full scale.

9.8 Menu 4 - Alarms

9.8.1 Max Thr +

Maximum flow threshold, forward flow. This is the set point to trigger a high flow alarm set as a percentage of full scale. This function is disabled when set to zero.

9.8.2 Max Thr –

Maximum flow threshold, reverse flow. This is the set point to trigger a high flow alarm set as a percentage of full scale. This function is disabled when set to zero.

9.8.3 Min thr +

Minimum flow threshold, forward flow. This is the set point to trigger a low flow alarm set as a percentage of full scale. This function is disabled when set to zero.

9.8.4 Min thr –

Minimum flow threshold, reverse flow. This is the set point to trigger a high flow alarm set as a percentage of full scale. This function is disabled when set to zero.

9.8.5 Hyst

Set 0-25%. This sets the lag in response based on a percentage of the full scale. Example if the alarm triggers at 100% and the hysteresis is set to 2% then once triggered the current rate must change beyond 2% to exit out of the current alarm state. This setting applies to all alarms.

9.8.6 mA v. fault

Current output value during alarm events set as a percentage 0-120% of the current output range. The current range 0/4mA to 20/22mA is set in *Menu 6 - Outputs*. For example, if an empty pipe alarm is present and the mA v. fault value is set to 10% and the current scaling is set 4 to 20mA, then the current output would send a 2mA signal until the empty pipe alarm is cleared. This function is disabled when set to zero.

9.8.7 Hz v. fault

Frequency output value during alarm events set as a percentage 0-125% of the frq1/frq2 range. For example, if an empty pipe alarm is present and the Hz v. fault value is set to 110% and the Frq1 scaling is 100 Hz, then the frequency output on channel 1 would send a 110 Hz signal until the empty pipe alarm is cleared. This function is disabled when set to zero.

9.9 Menu 5 - Inputs

9.9.1 T+ reset

Positive Totalizer Reset Enable. Set by turning on or off. This allows for the positive total totalizer to be reset through the input.

9.9.2 T- reset

Negative Totalizer Reset Enable. Set by turning on or off. This allows for the negative total totalizer to be reset through the input.

9.9.3 Puls.reset

Pulse Output Reset Enable. Set by turning on or off. This allows for the totalized pulses to be reset through the input.

9.9.4 Count lock

Totalizer Count Lock Input Enable, Set by turning on or off. This allows for the totalizers to be locked (frozen) when the input is active.

9.10 Menu 6 - Outputs

9.10.1 Out 1

Transistor output channel 1. See Table 2 and Table 3 for available settings.

9.10.2 Out 2

Transistor output channel 2. See Table 2 and Table 3 for available settings.

9.10.3 Out 3

Transistor output channel 3. See Table 3 for available settings.

9.10.4 Out 4

Transistor output channel 4. See Table 3 for available settings.

9.10.5 Out mA1

Current output channel 1. See Table 4 for available settings.

9.10.6 Out mA2

Current output channel 2. See Table 4 for available settings.

Table 2: Outputs available for open collector transistor outputs #1 & #2 only:

Function Symbol	Function Explanation
#1 IMP+	Pulse on output 1 for forward flow rate. Only assignable to channel 1. This option will trigger 1 pulse per totalizer count for the forward flow totalizer.
#1 IMP-	Pulse on output 1 for reverse flow rate. Only assignable to channel 1. This option will trigger 1 pulse per totalizer count for the reverse flow totalizer.
#1 IMP	Pulse on output 1 for forward and reverse flow rate. Only assignable to channel 1. This option will trigger 1 pulse per totalizer count for both the forward and reverse flow
#2 IMP +	Pulse on output 2 for forward flow rate. Only assignable to channel 2. This option will trigger 1 pulse per totalizer count for the forward flow totalizer.
#2 IMP -	Pulse on output 2 for reverse flow rate. Only assignable to channel 2. This option will trigger 1 pulse per totalizer count for the reverse flow totalizer.
#2 IMP	Pulse on output 2 for forward and reverse flow rate. Only assignable to channel 2. This option will trigger 1 pulse per totalizer count for both the forward and reverse flow
#1 FREQ+	Frequency on output 1 for forward flow rate. Only assignable to channel 1. This option will trigger a frequency output for forward flow.
#1 FREQ-	Frequency on output 1 for reverse flow rate. Only assignable to channel 1. This option will trigger a frequency output for reverse flow.
#1 FREQ	Frequency on output 1 for forward and reverse flow rate. Only assignable to channel 1. This option will trigger a frequency output for both forward and reverse flow.
#2 FREQ+	Frequency on output 2 for forward flow rate. Only assignable to channel 2. This option will trigger a frequency output for forward flow.
#2 FREQ-	Frequency on output 2 for reverse flow rate. Only assignable to channel 2. This option will trigger a frequency output for reverse flow.
#2 FREQ	Frequency on output 2 for forward and reverse flow rate. Only assignable to channel 2. This option will trigger a frequency output for both forward and reverse flow.

NOTE: Only the highlighted options are available for the SPI.

Table 3: Outputs available for open collector transistor outputs #1 through #4.

Function Symbol	Function Explanation
SIGN	Flow direction output (energized = reverse flow)
RANGE	Not Supported
MAX AL+	Max. forward flow rate output (energized = alarm off)
MAX AL-	Max. reverse flow rate output (energized = alarm off)
MAX AL	Max. forward and reverse flow rate output (energized = alarm off)
MIN AL+	Min. forward flow rate output (energized = alarm off)
MIN AL-	Min. reverse flow rate output (energized = alarm off)
MIN AL	Min. forward and reverse flow rate output (energized = alarm off)
MAX+MIN	Max. and min. flow rate alarm output (energized = alarm off)
EMPTY PIPE	Empty pipe alarm output (energized = alarm off)
OVERFLOW	Out of range alarm output (energized = flow rate is in range)
Hardw AL.	Cumulative alarm output; interrupt coils, empty pipe, and/or measure error (energized = alarms off)
EXT. COMM.	Not Supported

NOTE: Only the highlighted options are available for the SPI.

Table 4: CURRENT VALUES IN mA ASSOCIATED TO THE % VALUE OF FULL SCALE

POSSIBLE FIELD	REVERSE FLOW VALUE		ZERO	DIRECT FLOW VALUE	
	≤ - 110%	-100%	0%	+100%	≥+110%
OutmA= 0 ÷ 20 +	0	0	0	20	20
OutmA= 0 ÷ 22 +	0	0	0	20	20
OutmA= 4 ÷ 20 +	**4**	**4**	**4**	**20**	**20**
OutmA= 4 ÷ 22 +	4	4	4	20	20
OutmA= 0 ÷ 20 -	20	20	0	0	0
OutmA= 0 ÷ 22 -	22	20	0	0	0
OutmA= 4 ÷ 20 -	20	20	4	4	4
OutmA= 4 ÷ 22 -	22	20	4	4	4
OutmA= 0 ÷ 20	20	20	0	20	20
OutmA= 0 ÷ 22	22	20	0	20	22
OutmA= 4 ÷ 20	20	20	4	20	20
OutmA= 4 ÷ 22	22	20	4	20	22
OutmA= 0 ÷ 20 —0+	0	0	10	20	20
OutmA= 0 ÷ 22 —0+	0	1	11	21	22
OutmA= 4 ÷ 20 —0+	4	4	12	20	20
OutmA= 4 ÷ 22 —0+	4	4.8	12.8	20.8	22

NOTE: mA outputs 1 & 2 should be set to **4 ÷ 20+**.

9.11 Menu 7 - Communication

9.11.1 IF2 pr.

Protocol for IF2 port. Set to DPP or HTP. This set the protocol used for communication to the IF2 device, either Data Packet Protocol (DPP) or Hyper Text Protocol (HTP). Default is DPP.

9.11.2 RS485 bps

RS485 output speed. This sets the RS485 baud rate (4800, 9600, 19200, or 38400).

9.11.3 A. delay

Instrument answer delay. This sets the answer delay in microseconds (0, 20, 40, 60, 80, 100, 120, or 140).

9.11.4 Address

DEVICE ADDRESS (0 to 255) – This sets the address of the device for RS485 communication.

9.11.5 Rem. addr.

REMOTE ADDRESS (0 to 255) – This sets the address of a second remote converter.

9.11.6 Remote u.conn.

Pressing this connects the remote terminal. The connection will be interrupted after 10 seconds of inactivity

9.12 Menu 8 - Display

9.12.1 Language

This sets the converter language EN (English), IT (Italian), FR (French), SP (Spanish), or DE (German).

9.12.2 Contrast

Display contrast set point. The display contrast can be changed to make the display appear more visible based on user preference. This menu can be set 0 to 15. The change will take affect once the menu selection has been selected by pressing the Enter/Esc key. The factory default is 5.

NOTE: if set to high or too low the display can become unreadable. If this happens then wait 60 seconds from the time of the last button push for the display to time out to the visualization page. From the visualization page press and hold the Right/Left button. The display will cycle through a different preset display contrast settings every 8 seconds. Release the button once you have found a setting that can be read.

9.12.3 Quick start

Quick Start Menu Enable. This setting toggles between on and off. If set to "off" it will hide the quick start menu.

9.12.4 Net total

Totalizer Net Enable. This setting toggles between on and off. Setting this menu to on will replace the current forward and reverse totalizers with the net totalizers on the visualization.

9.12.5 T+ reset

Totalizer reset, forward. Resets the forward flow totalizer.

9.12.6 T- reset

Totalizer reset, reverse. Resets the reverse flow totalizer.

To reset the totalizer, highlight the totalizer reset option to be reset. Quick press the Enter/Esc key. The display will show “EXECUTE?”. Press and hold the Enter/Esc to continue. The display will flash "Done". The visualization pages will now show the totalizer as reset.

NOTE: There is no function to reset the Net Totalizer. Reset both the "+" and the "-" totalizers to reset the Net total.

9.13 Menu 9 - Data Logger

9.13.1 YYYY/MM/DD

Date and time. This sets the date and time in the converter. The format for entering the date and time is year / month / day and time is hours : minutes : seconds.

9.13.2 Acquisition

Event logger for internal alarms. This setting toggles between on and off. This menu enables event logging to capture alarm events internally for diagnostic purposes. This data can’t be extracted.

9.13.3 Display events

Displays the stored alarm events on-screen in order up to a maximum of 64 events.

9.13.4 Clear events

Clears all stored events.

9.14 Menu 10 - Diagnostics

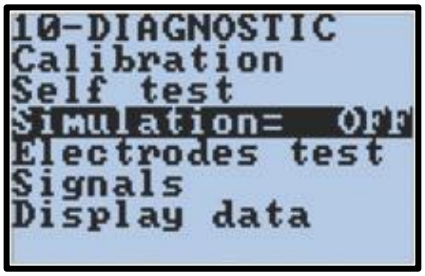
9.14.1 Self-test

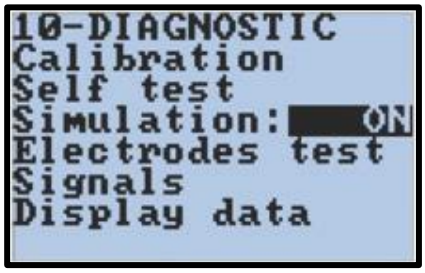
Converter self-test. Executed command. Running the self-test will cause the converter to run an internal diagnostic test that will check for internal hardware and software errors. The converter will reboot. Once the self-test is complete if any errors are found then the error code for each error will be displayed. Contact factory for support.

9.14.2 Simulation

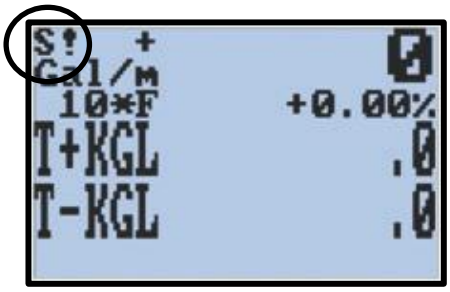
Simulation enable. Setting this menu to ON will generate an internal signal that simulates flow and allows the outputs and all connected instruments to be tested. After simulation is set to ON, the flow can be set to a percentage based on the current FS1 setting of -125% to 125%.

To enable the simulation function, use the Right/Left key to highlight the Simulation menu and press the Enter/ Esc key. Toggle the simulation function from OFF to ON using the Up/Down key. Press and hold the Enter/ Esc key to exit back to the main menu and once again to exit to the visualization page.



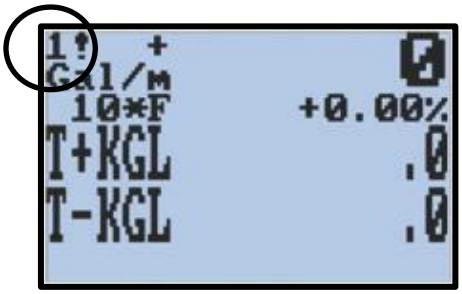


NOTE: you will now have an “S” in the upper left corner; this indicates the simulation mode is active.



Press the Enter/Esc key. This will bring up the flow simulation set up screen. Use the Right/Left key and the Up/ Down key to enter in the flow rate percentage value for the simulation. Press the Enter/Esc key to enter that value.

The converter will start to read flow. It may take a few seconds for the readings to appear. Repeat the above steps as needed to observe the different flow rates desired.



To exit out of simulation mode, re-enter into the simulation set up screen (see above) and then press and hold the Enter/Esc key. This will exit out to the visualization screen, and the “S” in the upper left corner of the screen will return to a “1”.

9.14.3 Electrodes test

Executed function. This function tests the internal electrode circuits for proper operation. This is a factory service menu.

9.14.4 Signals

This menu displays graphical representations to various input and output signals. This is a Factory service menu.

9.14.5 Display data

Numeric display for various internal settings and raw measured signals. This is a Factory service menu.

9.15 Menu 11 - Internal Data

9.15.1 L2 code

Level 2 passcode. This menu changes the 2 level passcode. The factory default is **000002**

CAUTION - if the passcode is changed from the default value and is lost, it CANNOT be recovered. In the event the passcode is lost the converter can be returned to the factory to be reset. Note all data is lost during this process.

9.15.2 Load fact. Pres.

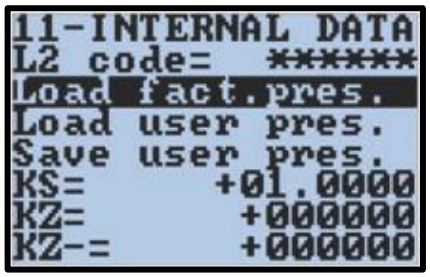
Load factory presets. This is an executed menu. Executing this menu will reset all programmed values to the original factory default values.

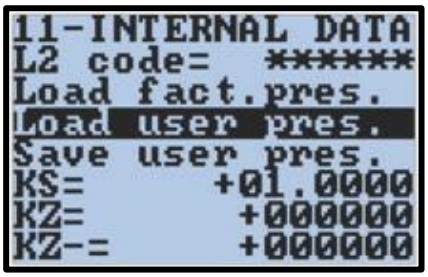
NOTE: This menu is customized for a specific sensor. Confirm the converter has not been moved or paired with another sensor prior to executing this menu.

9.15.3 Load user pres.

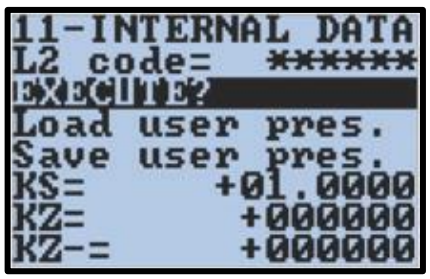
Load User Presets. This is an executed menu. Executing this menu will reset all programmed values to a user defined set of programming values. These values are set using the “Save user pres.” Menu.

To reload the factory or user presets select the desired set of presets by highlighting the menu and press the Enter/Esc key.



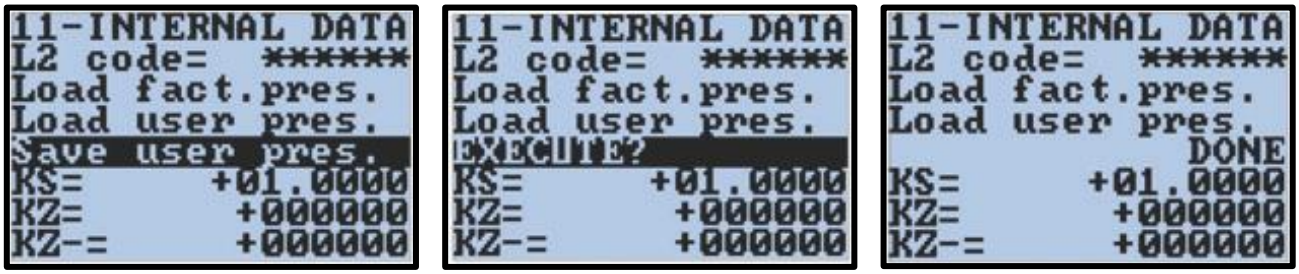


You will be asked if you want to “execute?” the function. Press and hold the Enter/Esc key. This will load the saved preset values. The display will flash “DONE” once the converter has finished reprogramming the preset values.



9.15.4 Save user pres.

Saves user presets. This is an executed menu. To save a user defined program start by reviewing each and every programming menu and confirm that each value is set as desired. Once it is confirmed the programming is set as desired, navigate to the “Save user pres.” menu and press the Enter/Esc key. You will be prompted if you want to “execute?”. Press and hold the Enter/ Esc key and the display will flash “DONE”. Your user defined presets have now been saved and can be recalled anytime by executing the “Load user pres.” function.



9.15.5 KS

Field adjustment coefficient. This value is a direct multiplier that is used as a field adjustment/correction coefficient.

9.15.6 KZ

Forward zero point coefficient. The forward zero point coefficient is selected when the zero calibration is run. This menu will allow for manual adjustments of the forward zero point.

9.15.7 KZ-

Reverse zero point coefficient. Used ONLY for forward and reverse sensors. The reverse zero point coefficient is selected when the zero calibration is run. This menu will allow for manual adjustments of the reverse zero point

9.15.8 DAC1 20mA

Current output channel 1 20 mA trim. This is a factory service menu.

9.15.9 DAC1 4mA

Current output channel 1 4 mA trim. This is a factory service menu.

9.15.10 DAC2 20mA

Current output channel 2 20 mA trim. This is a factory service menu.

9.15.11 DAC2 4mA

Current output channel 2 4 mA trim. This is a factory service menu.

10 Alarm Messages

During meter setup, you may see alarm messages. These alarms and some common solutions are explained in Table 5 below. Contact factory for further support.

Table 5: Alarm Messages

MESSAGES	ANOMALIES	ACTION TO TAKE
NO ALARMS	Everything works regularly	--
MAX ALARM	The flow rate is higher than the maximum threshold set	Check the maximum flow rate setting and process conditions. (Menus Max Thr and +Fs1)
MIN ALARM	The flow rate is lower than the minimum threshold set	Check the minimum flow rate threshold setting and process conditions. (Menu +Fs1)
FLOW RATE >FS	The flow rate is higher than the full scale value set on the instrument	Check the full scale value setting on the instrument and the process conditions/ (Menu Fs1)
PULSE/FREQ .FS	The output channel is saturated.	Set a bigger frequency unit or, if the connected counting device allows it, reduce the pulse duration value. (Menu Tpls)
EMPTY PIPE	The measuring pipe is empty or the detection system has not been properly calibrated	Check whether the pipe is empty.
INPUT NOISY or MEASURE ERROR	The measure is strongly effected by external noise or the cable connecting the converter to the sensor is broken	Check the status of the cables connecting the sensor, the grounding connections of the devices or the possible presence of noise sources
EXCITATION FAIL	The coils or the cable connecting the sensor are interrupted	Check the connecting cables to the sensor
CURR. LOOP OPEN	The 0/4-20ma output on board or the optional one are not correctly closed on a valid load	Verify the load is applied to the output (max 1000 ohm) or a resistor is in place. To disable the alarm, set the “mA VAL.FAULT” value (menu alarm) to 0.

11 Troubleshooting Guide

Table 6 below provides suggestions for fixing common problems. Contact factory for further support.

Table 6: Troubleshooting

Problem	Troubleshooting Steps
Not getting expected 4-20mA output	• Ensure the wiring is firmly connected on the 4-20mA output terminals • Verify the FS1 setting in the Quick Start menu is set to the correct value • Measure output on the 4-20mA terminals and compare it to the calculated current value
Curr. Loop Open Alarm	• Ensure the wiring is firmly connected on the 4-20mA output terminals and terminated on both ends. • If the 4-20mA output is not being used, ensure the 4- 20mA terminals have a load resistor installed • Remove the wires from the 4-20mA terminals and measure the current output direct
Excitation Fail (0800) Alarm	• Ensure the wiring is firmly connected • Disconnect the coil wires from the converter and check their resistance with a standard multi-meter. Contact the factory for the proper value for the sensor. • Ensure the wiring is firmly connected to any PreAmp being used.
Noisy Input Alarm	• Verify there is a jumper on terminals 3 and 4 • Verify the converter ground is to earth ground • Check for damaged cable between the sensor and converter
Empty Pipe Alarm	• Confirm the pipe is full • Verify there is a jumper on terminals 3 and 4 • Check EP Threshold. Set to 192 if short cable (less than 50 ft.), set to <120 if longer cable (50 ft. to 100 ft.). Consult the factory for assistance in selecting the correct value. • Conduct a bucket test to confirm the EP Threshold value is set correctly. Consult the factory for assistance. • Check for damaged cable between the sensor and converter
Unstable Flow Readings	• Check grounding connections • Check power circuit. What other devices are on the circuit • Install dedicated ground circuit
Menu Not Accessible	• Confirm the password being used is 000002 • Verify dip switches in the back panel next to the terminals 1 and 2 are both down.
Rate Of Flow Report Is Not As Expected	• Confirm the unit is programmed correctly by requesting a program setting report from the factory.

12 Appendix

12.1 Installation Guide

Purpose:

To provide a step by step procedure for installing the SPI flow meter inline to ensure correct insertion depth and calibration.

12.1.1 SPI Probe Installation:

Step 1:

Ensure you have a 1” NPT drilled hole on the inlet of the valve.

Step 2:

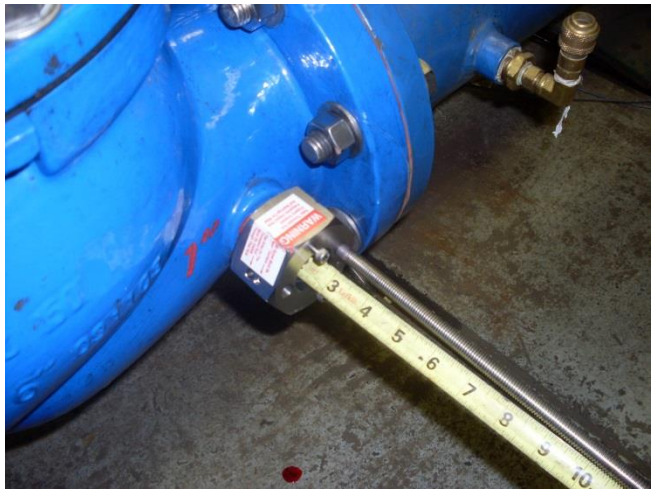
Put a generous amount of thread sealant on the pipe nipple and thread it into the 1” NPT hole on the valve

Step 3:
Put a generous amount of lock tight on the other side of the pipe nipple and thread the compression nut on the pipe nipple. Ensure there is an o-ring in the compression nut on the sensor side.

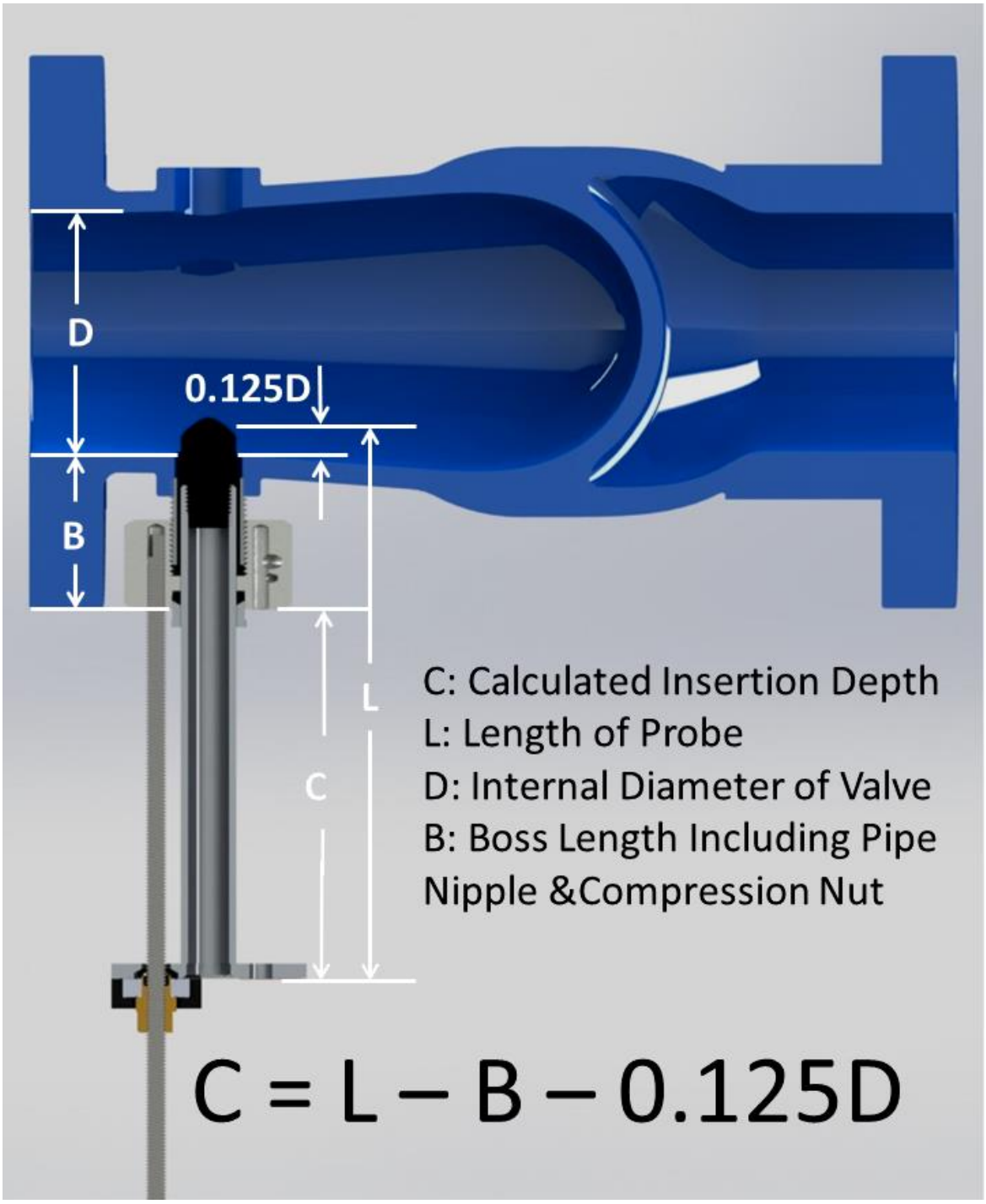
Step 4:
Tighten the compression nut which in turn will tighten the pipe nipple. Tighten till hand tight to ensure tight water seal. Ensure the ready rod threading holes are horizontal in final tightened position.

Step 5:
Put some anti-seize on the ready rod and thread the rod into the upstream side of the compression nut. Once threaded tighten set screw

Step 6:
Measure the Length of the Probe, the Boss Length, and the Inner Diameter (also shown in Converter Quick Start Menu)..



Calculate the insertion depth based on the measured values:

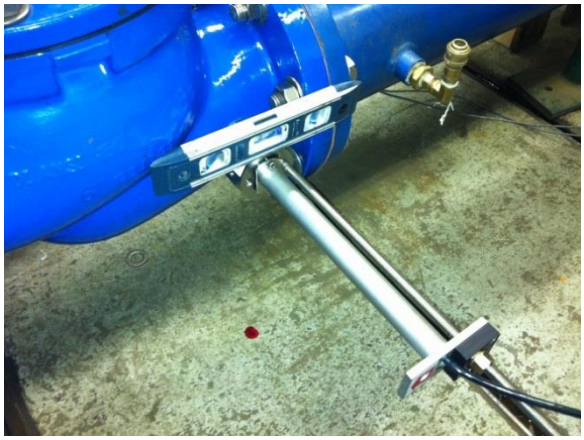


- **LENGTH OF PROBE (L)** is measured from the middle of the electrodes on the sensor to the end of the sensor.
- **BOSS LENGTH (B)** is a measurement from the inner of the valve to the end of the compression nut. This is the Fittings & Body Width
- **0.125D** is the insertion depth of the probe into the valve. This is 1/8 of the internal diameter of the valve

Step 7:
Insert the SPI sensor ensuring the flow arrow points down steam and tighten the nut with the socket wrench provided with the SPI package.


Step 8:
Tighten till the correct insertion depth and tighten the compression clamp. Once the compression clamp tightens on the o-ring the SPI sensor is sealed

Step 9:
Ensure both the compression nut and SPI sensor are horizontal to ensure correct sensor alignment.



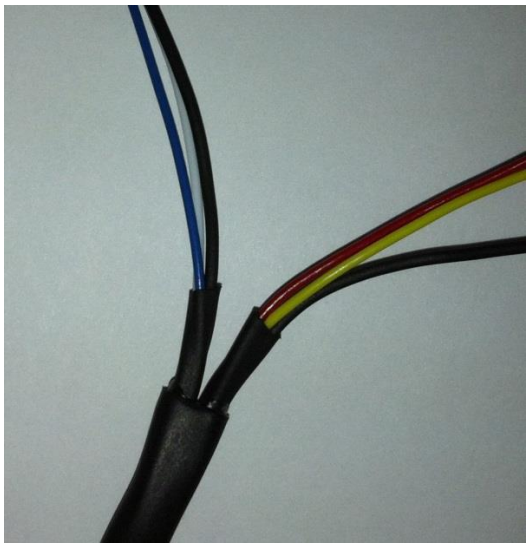

12.1.2 Converter Wiring Installation:

Step 1:
Locate and pull the rip wire on the sensor cable. Open the back of the Converter.

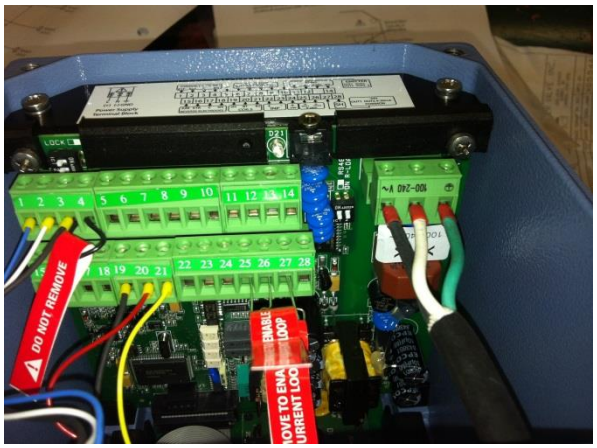
Step 2:
Thread the sensor cable through the enclosure connection and tighten the enclosure connector.

Step 3:
Install the Sensing Electrodes, Reference Ground, Coils and Shield wires. Take note of how the Ground and Shield black wires are heat wrapped separately to indicate which wire is which.

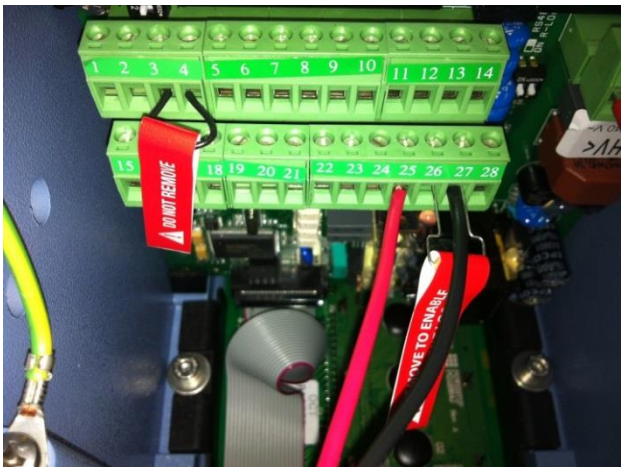
Terminal	Wire Colour	Connection
#1	Blue	Sensing Electrode
#2	White	Sensing Electrode
#3	Black	Reference Ground
#19	Black	Cable Shield
#20	Red	Coil
#21	Yellow	Coil

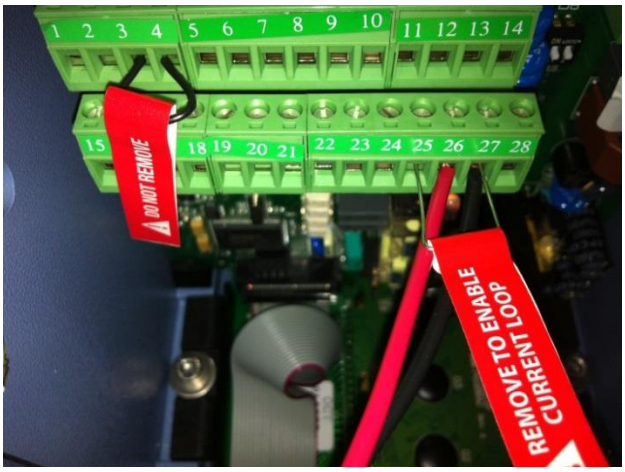


Step 4:
Install power cable provided with SPI package. Thread the power cable through the enclose connections and tighten the enclosure connector. Install Line (black), Neutral (white), Ground (green) wires.



Step 5 (Optional):
Installing the 4-20mA wiring can be done in 1 of 2 outputs or both. Note there are load resistors that need to remain unless the 4-20mA current loop is being used. To install wiring for 4-20mA remove only the load resistor of the output you are using.
Output 1: Common 27 & Output 25
Output 2: Common 27 & Output 26





12.2 Installation Record

The following table can be used to record probe insertion measurements for reinsertion after maintenance.

Date	Sensor Length (C)	Nipple & Nut Length (B)	1/8 Valve Diameter (A)	Insertion Depth (Y)

12.3 Units of Measure

The units available for Full Scale Range (FS1) and Totalizer (Tot.MU) in the Converter are shown in the tables below:

U.S Standard	
Gal	U.S. Gallons
IGL	Imperial Gallons
KGL	Thousand Gallons
IKG	Thousand Imperial Gallons
ttG	Ten Thousand Gallons
MGL	Mega Gallons*
in^3	Cubic Inches*
ft^3	Cubic Feet
hf^3	Hundred Cubic Feet
kf^3	Thousand Cubic Feet
Ain	Acre Inches
Aft	Acre Feet
bbl	Standard Barrels
BBL	Oil Barrels

Metric	
ml	milliliters*
l	Liters
dal	Decaliter
hl	Hectoliter
Ml	Megaliters
cm^3	Cubic Centimeters*
dm^3	Cubic Decimeter
m^3	Cubic Meters

Time	
s	Seconds
m	Minutes
h	Hours
d	Days

*These units only available for the Totalizer (Tot. MU)

SINGER™

McCROMETER

Please read and understand the contents of this manual.

M1602H

PIPE SIZE	1½	2	2½	3	4	6	8	10	12	14	16	18	20	24	28
'A' DIA +.000 -.010	1.870	2.442	2.849	3.442	4.411	6.442	8.442	10.692	12.593	–	16.000	–	–	24.000	29.000
PADDLE NUMBER 150LB	–	–	M1608A	M1500A	M1509A	M1480A	M1510B	M1588A	M1611A	M1709A	M1595A	M1504A	M1566A	M1628A	–
PADDLE DIA (REF)	–	–	4.625	5.25	6.625	8.5	10.625	13.125	15.875	17.5	20	21	23.5	28	–
PADDLE NUMBER 300LB	–	–	M1567A	–	M1568A	M1560A	–	M1589A	M1864A	M1710A	M1596A	M1871A	–	–	–
PADDLE DIA (REF)	–	–	4.875	–	6.75	9.625	–	14.125	16.125	18.875	21	23.25	–	–	–

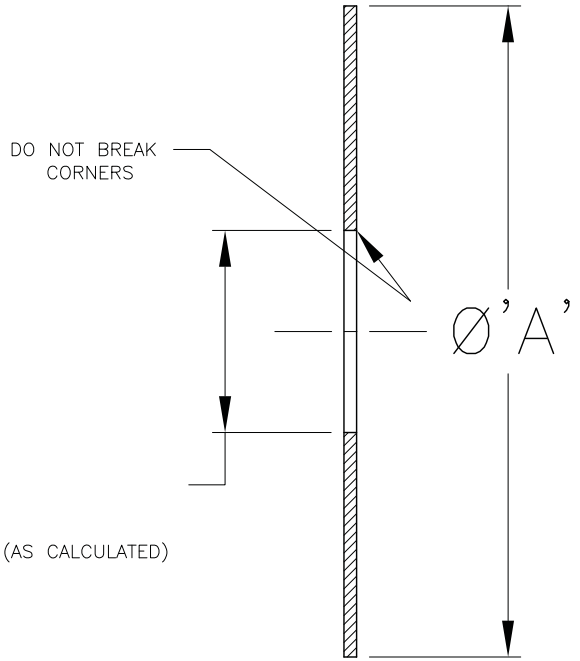
FILENAME: H:\MISC\M1602H

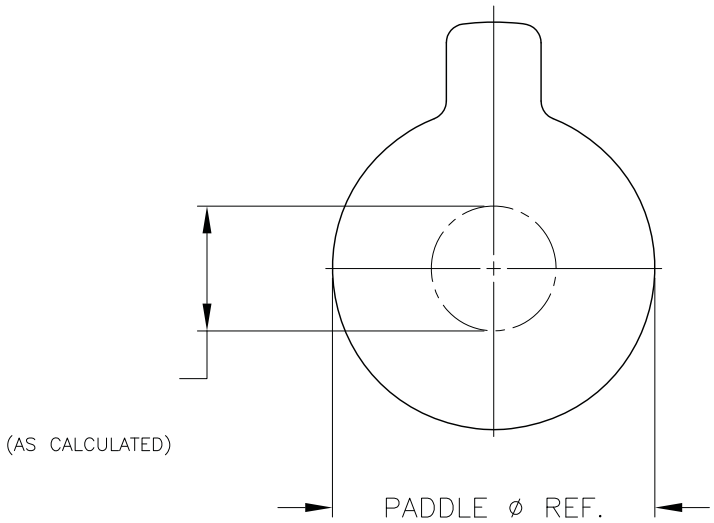
TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMAL: XXX = ±.005, XX = ±.010

FRACTIONAL: ± 1/64

ANGULAR: ± 1°





MATERIAL:

11 GAUGE (.120) 18-8 STAINLESS STEEL PLATE.

REV.	D.C.O.	DESCRIPTION	DATE
H	2585	ADDED 24" & 28" TO TABULATION	APRIL 27th 2004
G	–	ADDED 14" TO TABULATION	NOVEMBER 1999
F	–	ADDED PADDLE DETAILS, DRAWING REVISION CHANGED TO MATCH REVISION BLOCK	OCTOBER 1998
E	2106	REDRAWN ON AUTOCAD, REMOVED CHAMFER FROM BORE. ASSIGNED DWG. NUMBER	NOVEMBER 1997
D	–	ADDED 12" AND 16" TO TABULATION	SEPTEMBER 1990
C	749		NOVEMBER 1976
B	734		AUGUST 1976
A	576		JANUARY 1975

VALVE SERIAL NUMBER:

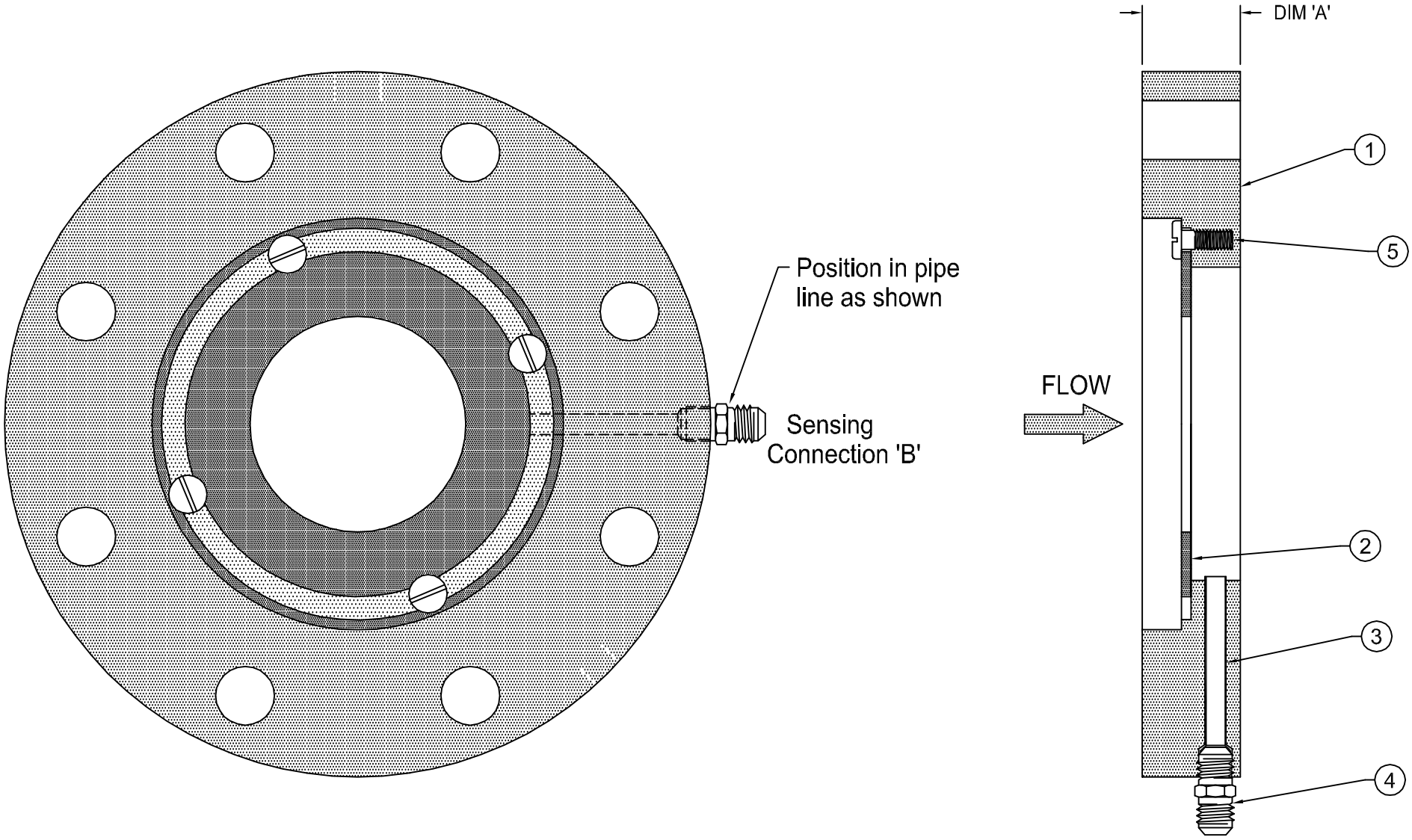
SINGER VALVE INC.
12850–87th AVENUE
SURREY, BC
CANADA. V3W 3H9

DATE: NOVEMBER 18, 1999 | APP'D BY:

DRAWN BY: STEVE BISHOP | M1602H

ORIFICE PLATE – MACHINING DETAIL

SINGER VALVE ORIFICE HOUSING ASSEMBLY



ITEM	PART NAME	STANDARD MATERIAL
1.	Orifice housing	Ductile iron
2.	Orifice plate	Stainless steel
3.	Adaptor tube	Copper
4.	Fitting	Brass
5.	Plate screw	Stainless steel

DIM 'A'	DIM 'A'	DIM 'A'
RF 150#	RF 300#	PFC 150#
1-1/4"	1-7/16"	1-3/4"

A0665B

SINGER VALVE
Result-Based Solutions. Globally.™

12850-87th Avenue
Surrey, BC. Canada. V3W 3H9
Ph: 604-594-5404
Fx: 604-594-8845
www.singervalve.com

SINGER MODEL 106-RPS-AC

Pressure Sustaining Valve with Anti-Cavitation Trim
Schematic A-10161A

Installation, Operating and Maintenance Instructions

DESCRIPTION:

This valve is a pilot operated pressure relief or pressure Sustaining valve designed to open when the inlet pressure exceeds a predetermined setting.

The Main Valve is equipped with ANTI-CAVITATION TRIM to prevent damage caused by cavitation. Anti-Cavitation valves are designed for specific operating conditions. Any attempt to operate the valve outside of its design parameters is likely to result in unsatisfactory results.

DESCRIPTION OF OPERATION:

Main Valve (1) is normally open when sufficient pressure is applied to the valve inlet. When the same pressure is applied to the bonnet, the valve closes tight because the area of the diaphragm is greater than the area of the seat. By controlling the bonnet pressure, the valve can be made to open, close or throttle.

The bonnet pressure is controlled with a pilot circuit consisting primarily of Fixed Restriction (4), Closing Speed Control (5) and Sustaining Pilot (6). Pilot (6) senses the inlet pressure of the Main Valve. When this pressure is less than the spring setting, Pilot (6) is closed. Pressure from the upstream side of Main Valve (1) is directed to the bonnet of the Main Valve through Fixed Restriction (4) and Closing Speed Control (5), keeping the Main Valve closed. When the inlet pressure is greater than the spring setting, Pilot (6) opens to allow flow. This flow is greater than the flow coming through the Fixed Restriction, bonnet pressure of the Main Valve is reduced, causing the Main Valve to open.

On pressure sustaining service, where the valve is to maintain a predetermined inlet pressure, Pilot (6) will modulate the bonnet pressure and therefore modulates the Main Valve. If the inlet pressure rises slightly, Pilot (6) opens a little wider and causes the Main Valve to open further. If the inlet pressure drops, Pilot (6) closes slightly and the Main Valve also closes slightly. The valve maintains the inlet pressure with varying flows.

INSTALLATION:

1. See 106-PG-AC “Installation”.
2. Improved accuracy of control can be achieved by connecting the sensing of Pilot (6) to header or upstream of the valve.
3. After pressurizing the valve, bleed air from the bonnet.

ADJUSTING PROCEDURE:

1. Turn adjusting screw of Relief Pilot (6) counterclockwise until spring is free.
2. Apply pressure to valve inlet. Main Valve (1) should be wide open.
3. Turn adjusting screw slowly clockwise until pressure at the Main Valve inlet reaches desired point.
4. Lock adjusting screw in place. Valve is now set to relieve at the desired pressure.

TROUBLESHOOTING AND MAINTENANCE:

Unstable operation: Bleed air from the Bonnet. Connect sensing line to header. Install Opening Speed Control.

Valve does not open: Pilot (6) set too high. Isolating Valve(s) closed. Opening Speed Control closed. Pilot Diaphragm ruptured. Not enough pressure drop on the Main Valve.

Valve does not close: Closing Speed Control (5) closed. Strainer (3) plugged. Other obstruction in the line from inlet to bonnet. Main Valve Diaphragm ruptured. Obstruction in the Main Valve. At high velocities and difficult installation, Strainer (3) may have to be moved to a location that provides a true upstream pressure.

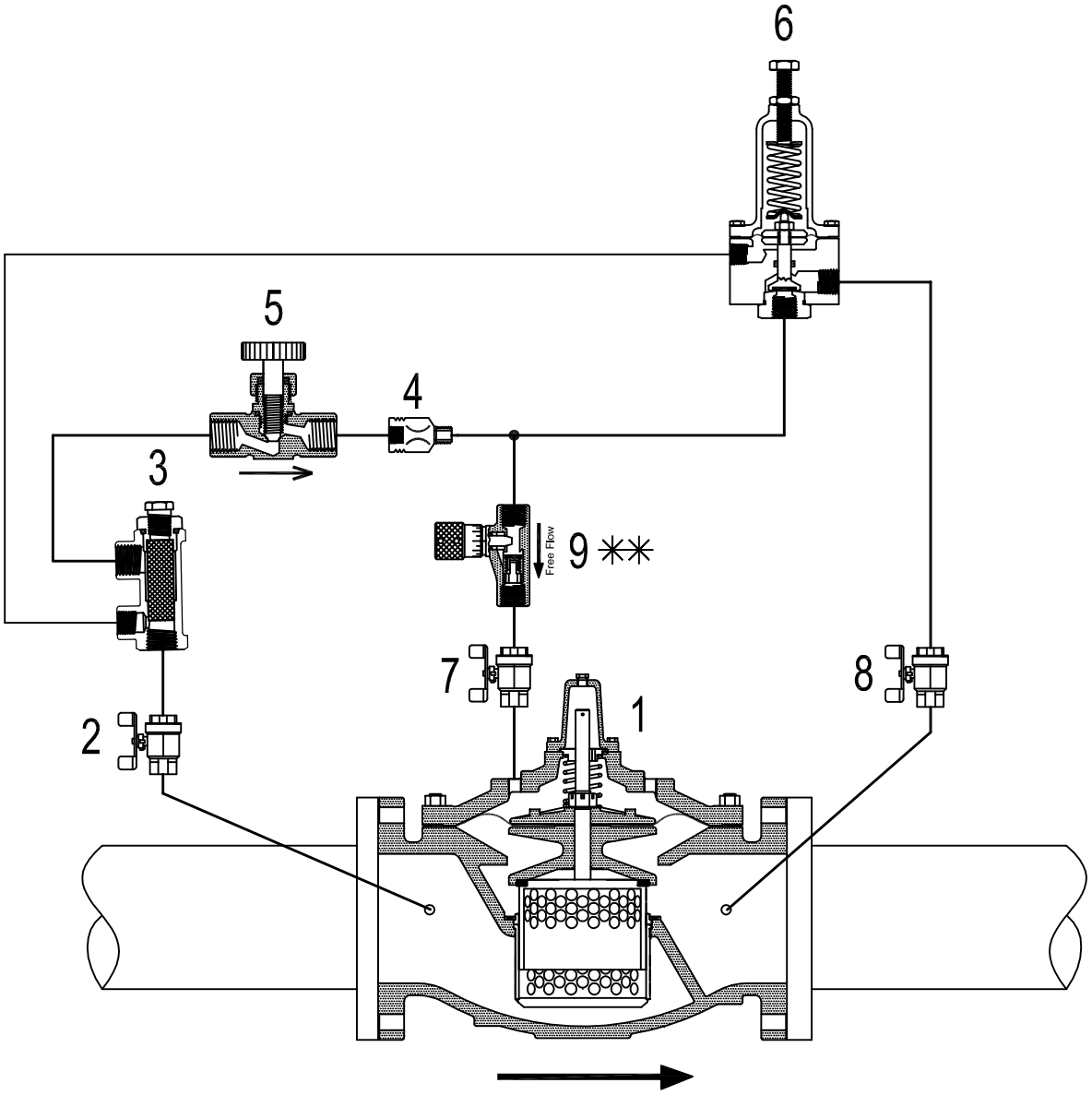
Maintenance: Clean Strainer. Frequency depends on local conditions. Clean Main Valve and Pilot as required. Lubricate the Body Seal in the Pilot. No other lubrication is required. Check condition of Main Valve and Pilot Diaphragms and other resilient parts. Replace when required.

To increase pressure setting of Pilot (6), turn adjusting screw clockwise. As an approximate guide:

Range	1 turn equals
5 - 50 psi	8 psi change
10 - 80 psi	10 psi change
20 - 200 psi	25 psi change
100 - 300 psi	40 psi change
200 - 500 psi	42 psi change

To close Main Valve faster, turn Closing Speed Control (5) counterclockwise, to close Main Valve slower, turn Closing Speed Control (5) clockwise **- do not close tight.**

A-10161A



1. Main Valve - Model 106-PG-AC.
2. Isolating Valve - 4" and larger ONLY.
3. Strainer - J0097A - 4" and larger only.
4. Fixed Restriction -1/16".
5. Closing Speed Control - Model 852-B.
6. Relief/Sustaining Pilot - Model 81-RP/83-RP (High Pressure).
7. Isolating Valve - 4" and larger only.
8. Isolating Valve.

✳✳ 9. Opening Speed Control - OPTIONAL Micrometer Flow Control.

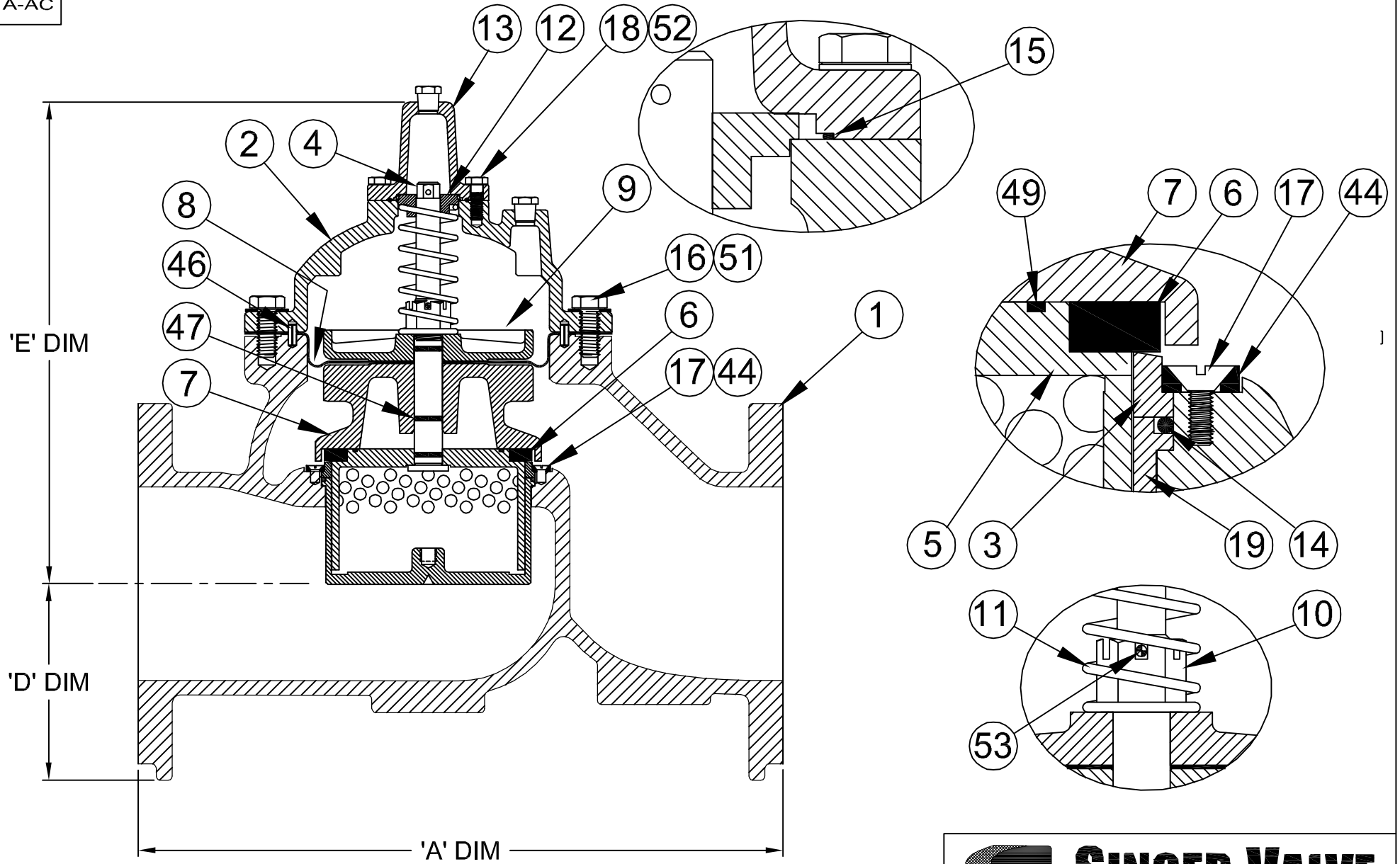
Pressure Relief / Pressure Sustaining Valve.
with Anti-Cavitation Trim.

SINGER VALVE
Result-Based Solutions. Globally.™
www.singervalve.com 12850-87th Avenue. Surrey, B.C. V3W 3H9

Drawn By:	Approved By:
Marc Payot	Eugene Bahia
Date:	Drawing:
May 14, 2008	A-10161A

Model 106-RPS-AC

A0961A-AC



SINGER VALVE
Result-Based Solutions. Globally.

www.singervalve.com 12850-87th Avenue. Surrey, B.C. V3W 3H9

Drawn By:	Approved By:
STEPHEN BISHOP	
Date:	Drawing:
JUNE 11th 2010	A0961A-AC

6" & 8" S106-PG-AC ASSEMBLY

SINGER VALVE
Result-Based Solutions. Globally.

12850-87th Avenue
Surrey, BC. Canada. V3W 3H9
Ph: 604-594-5404
Fx: 604-594-8845
www.singervalve.com

Material Specifications & Dimensions

6" and 8" (150mm and 200mm) S106-PG-AC
For Drawing A0961A-AC

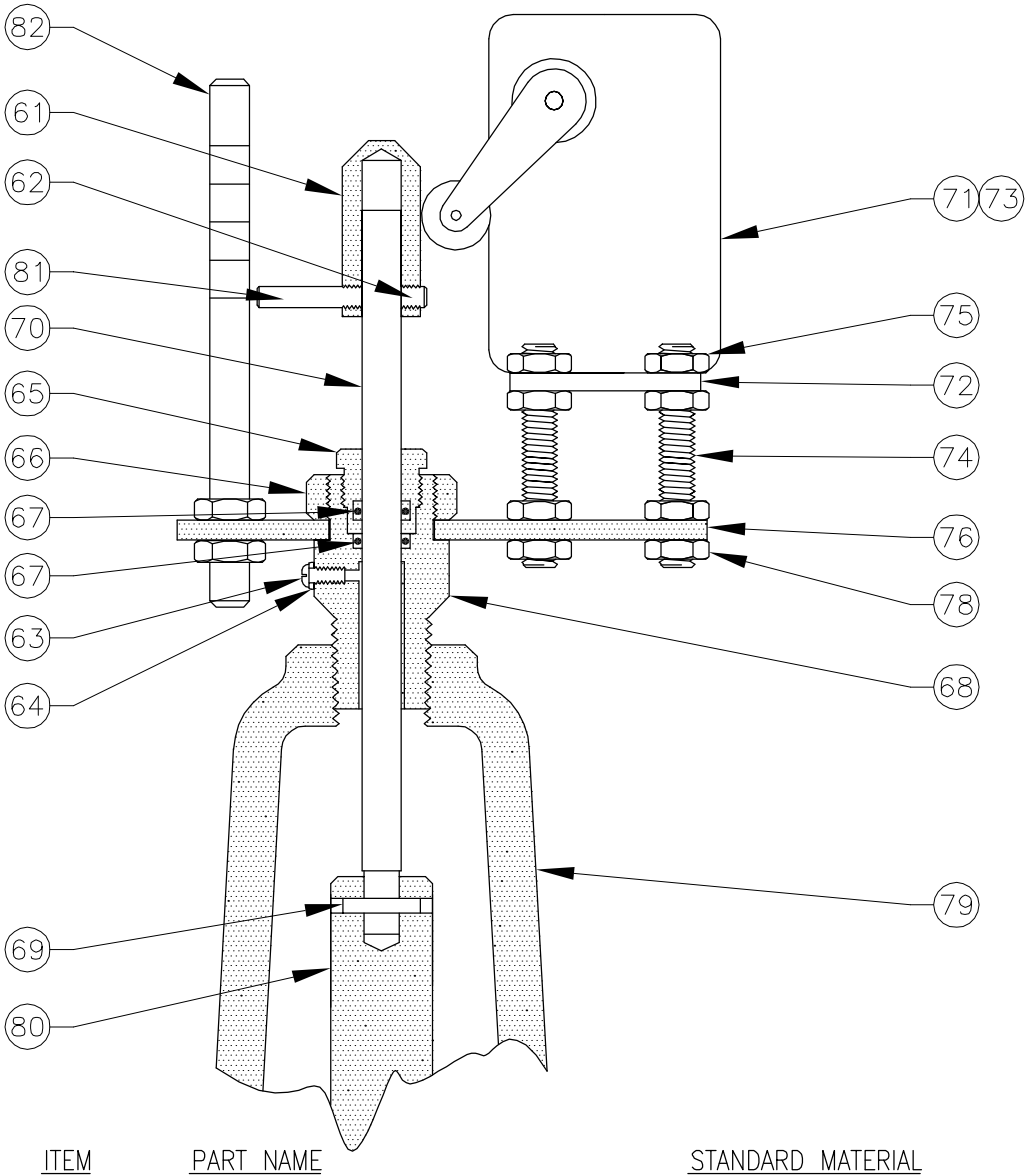
Item	Part Name	Material
1	Body	Ductile Iron
2	Bonnet	Ductile Iron
3	Seat Ring	Stainless Steel
4	Stem	Stainless Steel
5	Outlet Cage	Stainless Steel
6	****Resilient Disc**	**EPDM**
7	Inner Valve	Ductile Iron
8	****Diaphragm**	**Reinforced EPDM**
9	Clamp Plate	Ductile Iron
10	Stem nut	Brass B-16
11	Spring	Stainless Steel
12	Guide Bushing	Brass B-16
13	Stem Cap	Ductile Iron
14	**** Seat Ring Seal**	**Buna-N**
15	**** Stem Cap Seal**	**Buna-N**

Item	Part Name	Material
16	Bonnet Bolts	Stainless Steel
17	Seat Ring Screws	Stainless Steel
18	Stem Cap Screws	Stainless Steel
19	Inlet Cage	Stainless Steel
44	Retaining Washer	Stainless Steel
46	Locating Pin	Steel
47	**** Stem Seal**	**Buna-N**
49	**** Cage Seal**	**Buna-N**
51	Bonnet Washer	Stainless Steel
52	Stem Cap Washer	Stainless Steel
53	Cotter Pin	Brass

**** Recommended spare parts (included in the Rebuild Kit)**

S106-PG		Globe			
		A	**D**	**E**	**C**
6" 150mm	**150F / PN10, PN16**	20" 508mm	6.09" 155mm	15.43" 392mm	12.20" 310mm
	300F / PN25, PN40	21" 533mm	6.84" 174mm	15.43" 392mm	12.69" 322mm
8" 200mm	**150F / PN10, PN16**	25.38" 645mm	7.63" 194mm	20.19" 513mm	17.20" 437mm
	300F / PN25, PN40	26.38" 670mm	7.88" 200mm	20.19" 513mm	17.20" 437mm

SINGER MODEL XI37
LIMIT SWITCH / POSITION INDICATOR ASSEMBLY



ITEM	PART NAME	STANDARD MATERIAL
		Stainless Steel
61	Stem hat	Stainless steel
62	Set screw	Stainless steel
63	Bleed screw	Stainless steel and resilient
64	Bleed screw seal	Delrin
65	Seal bushing	Brass
66	Jam nut	Resilient
67	Stem seal	Brass
68	Adaptor	Stainless steel
69	Retaining pin	Stainless steel
70	Actuator stem	--
71	Limit switch	Brass
72	Limit switch mounting bracket	Stainless steel
73	Limit switch mounting screw	Stainless steel
74	Limit switch support rod	Stainless steel
75	Locknut	Brass
76	Base bracket	Stainless steel
78	Adjusting locknut	Ductile iron
79	Stem cap	Stainless steel
80	Stem	Stainless steel
81	Pointer	Stainless steel
82	Indicator rod	

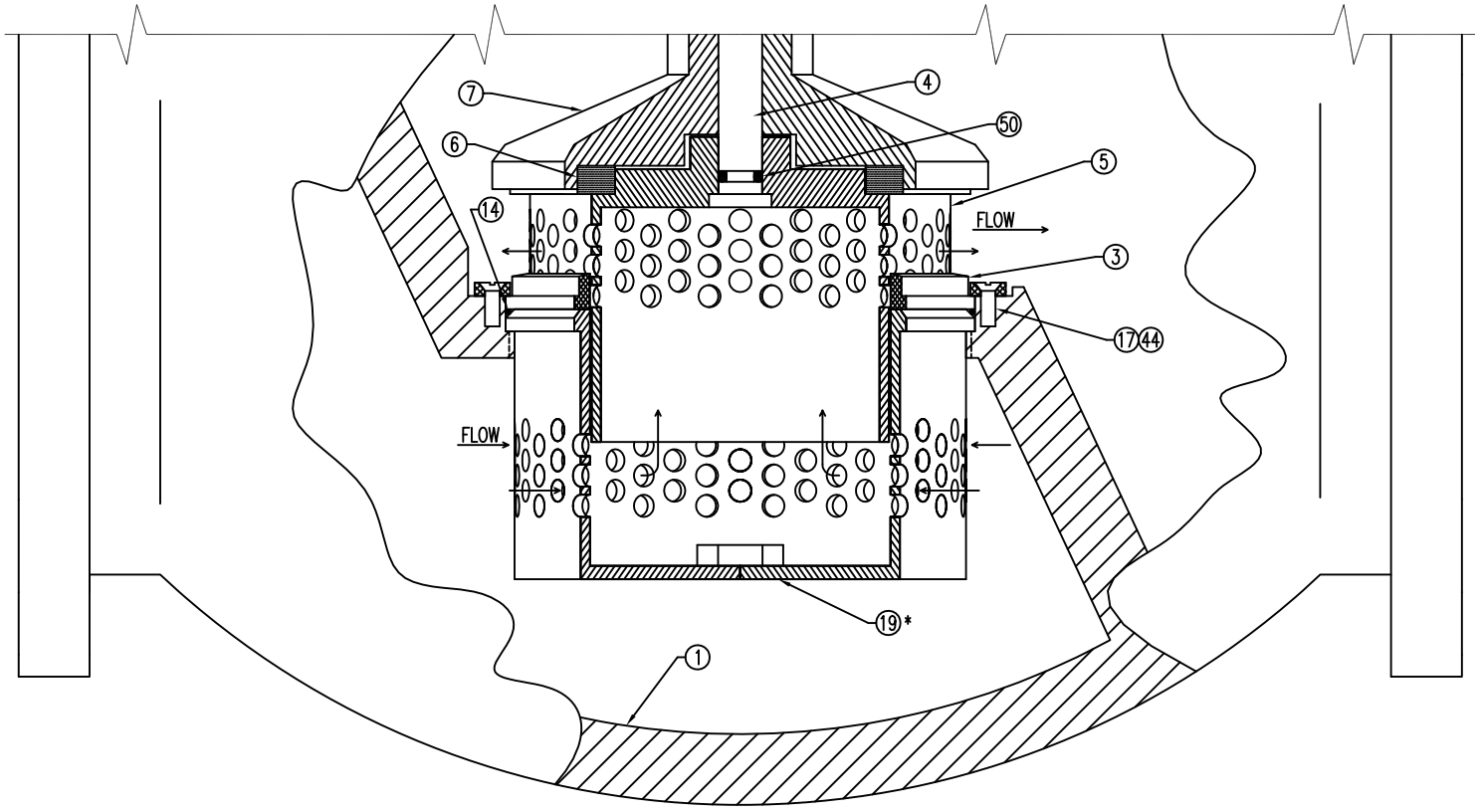
A0680C

ANTI-CAVITATION (AC) TRIM

FOR GLOBE PATTERN 106–SERIES VALVES ONLY

ITEM #	PART NAME	STANDARD MATERIAL
1	Body	Ductile Iron
3	Seat Ring	Stainless Steel 316
4	Stem	Stainless Steel 316
5	Outlet Cage	Stainless Steel CF16A
6	Resilient Disc	EPDM or Buna–N
7	Inner Valve	Ductile Iron

ITEM #	PART NAME	STANDARD MATERIAL
14	Seat Ring Seal	Buna–N
17	Seat Ring Screw	Stainless Steel 18–8
19	Inlet Cage	Stainless Steel CF16A
44	Retaining Washer	Stainless Steel 303
50	Stem Seal	BUNA–N



The following parameters MUST be provided to properly design the anti–cavitation trim.
Singer Valve cannot predict the operation of those valves which fall outside the specified parameters.

Large variation in pressure drop may require special consideration or may even make the application impossible.

Min Flow . . . . . _____ Max Flow . . . . . _____

Min Inlet Pressure . . _____ Max Inlet Pressure . . _____

Min Outlet Pressure . _____ Max Outlet Pressure . _____

Application (i.e. Pressure Reducing, Relief, Etc.) . . . _____

_____

Other Application Notes . . _____

_____

Engineer to Specify

SINGER VALVE
Result-Based Solutions. Globally.™

www.singervalve.com 12850-87th Avenue. Surrey, B.C. V3W 3H9

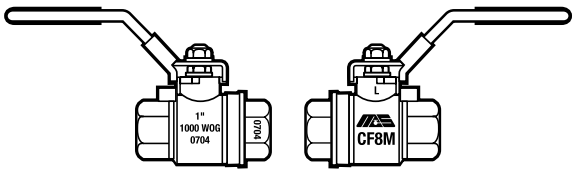
Drawn By:	Approved By:
Scott Grover	Kari Oksanen
Date: November 30, 2005	Drawing: A0680C

Model 106-( )-AC

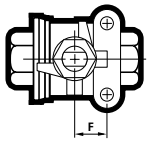
M. A. Stewart & Sons Ltd.
VALVES AND FITTINGS

G Series Investment Cast Stainless Steel Ball Valves

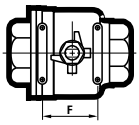
G2E

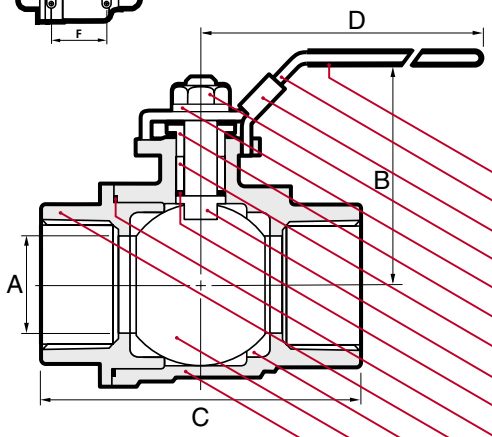


Sizes 1/4" to 2"



Sizes 2 1/2" & 3"





- Full port
- NPT ends to ANSI B1.20.1
- Two piece body
- Blowout-proof stem
- Adjustable packing nut
- Locking lever handle
- Actuator mounting pad
- Floating ball
- 1000 PSI, WOG 1/4" to 3"
- P-T 450°F @ 100 PSI

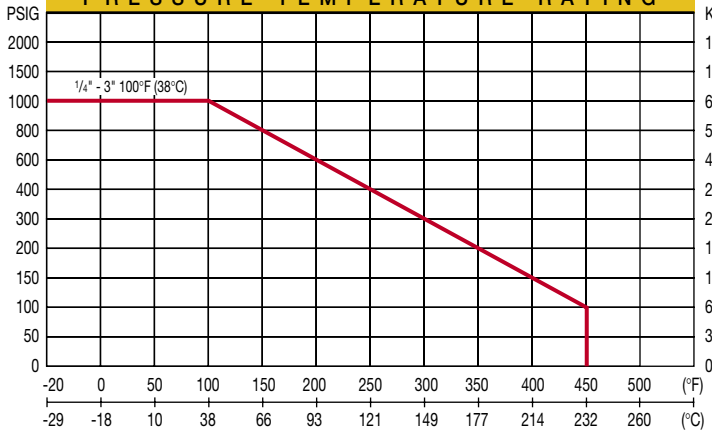
4.2

NAME / MATERIAL
1. Handle Grip / Vinyl
2. Handle / Stainless Steel 304 - A276
3. Locking Device / Stainless Steel 304 - A276
4. Handle Nut / Stainless Steel 304 - A 276
5. Stem Washer / Stainless Steel 304 - A276
6. Gland Nut / Stainless Steel 304 - A276
7. Packing / Reinforced Teflon 15% GFT
8. Stem / Stainless Steel 316 / A276
9. Thrust Washer / Reinforced Teflon 15% GFT
10. Gasket / Reinforced Teflon 15% GFT
11. Cap / Stainless Steel 316 - A351 - CF8M
12. Seat / Reinforced Teflon 15% GFT
13. Ball / Stainless Steel 316 - A 351 - CF8M
14. Body / Stainless Steel 316 - A 351 - CF8M

- *Markings to MSS-SP25*
- *Material test results & inspection certificates available upon request*
- *CRN numbers available upon request*
- *Mounting pads are dimpled at drilling locations*

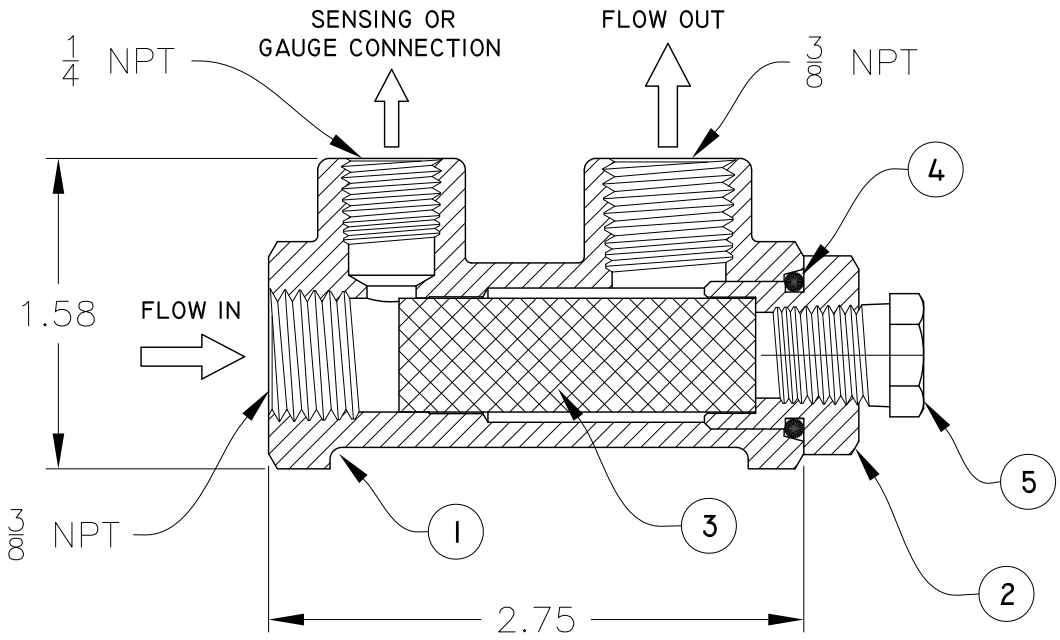
DIMENSIONS										
size	8	10	15	20	25	32	40	50	65	80
mm/in	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
A	9.6	9.6	12.7	20.0	24.0	31.8	38.1	50.0	65.0	78.0
mm/in	0.378	0.378	0.500	0.787	0.945	1.252	1.50	1.968	2.559	3.071
B	54.0	54.0	54.6	64.8	67.8	79.4	84.4	100.7	135.0	145.00
mm/in	2.126	2.126	2.150	2.551	2.669	3.126	3.323	3.965	5.315	5.709
C	49.4	49.4	56.0	66.0	77.7	90.4	102.4	119.0	151.4	171.4
mm/in	1.945	1.945	2.205	2.598	3.059	3.559	4.031	4.685	5.961	6.748
D	98.0	98.0	98.0	122.0	122.0	152.0	152.0	178.0	247.0	247.0
mm/in	3.858	3.858	3.858	4.803	4.803	5.984	5.984	7.008	9.724	9.724
F	12.7	12.7	12.7	14.9	14.9	17.7	17.7	23.6	72.1	72.1
mm/in	0.500	0.500	0.500	0.587	0.587	0.697	0.697	0.929	2.839	2.839
CV	7.0	7.0	15.0	45.0	65.0	125.0	175.0	380.0	500.0	900.0
weights	0.20	0.21	0.235	0.43	0.63	1.11	1.49	2.60	5.42	8.38
kg/lb	0.440	0.462	0.517	0.946	1.386	2.442	3.278	5.720	11.924	18.436

PRESSURE TEMPERATURE RATING

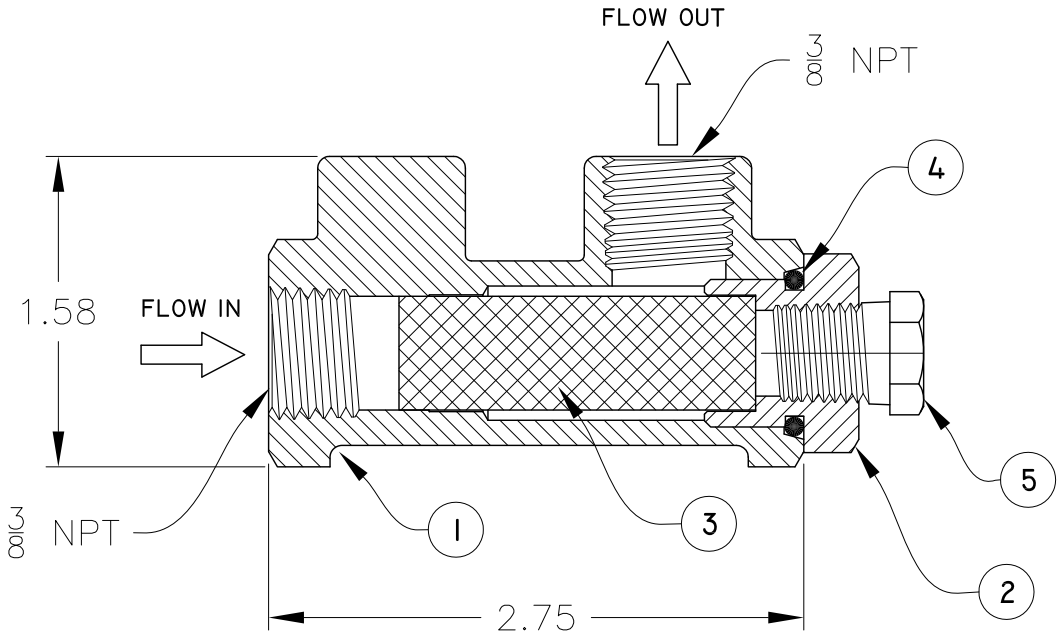


A0966B

SINGER MODEL J0097A STRAINER



SINGER MODEL J0098A STRAINER



ITEM	DESCRIPTION	MATERIAL
1.	BODY	STAINLESS STEEL 316
2.	SCREEN RETAINER	STAINLESS STEEL 316
3.	SCREEN (40 Mesh)	STAINLESS STEEL 316
4.	SCREEN RETAINER SEAL	BUNA
5.	BLOW DOWN PLUG	STAINLESS STEEL 316

SINGER VALVE
Result-Based Solutions. Globally.™
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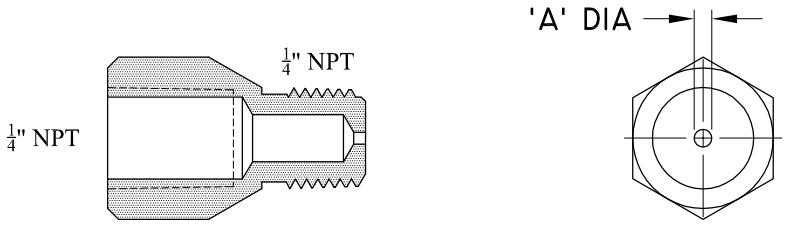
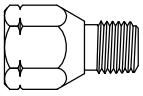
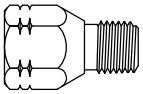
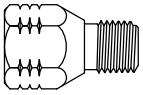
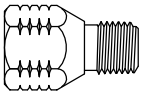
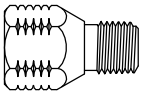
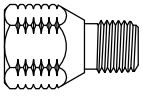
Drawn By:	Approved By:
STEPHEN BISHOP	
Date:	Drawing:
APRIL 12th 2012	A0966B

SINGER MODEL J0097A & J0098A STRAINER



"A" Diameter	No. of ID Grooves		Stainless steel 303 part number	Stainless steel 316 part number
1/16" / 1.6mm	1		M1009E-SS	M1009E-S3
3/32" / 2.4mm	2		M1149E-SS	M1149E-S3
1/8" / 3.2mm	3		M1010E-SS	M1010E-S3
1/4" / 6.4mm	4		M1997A-SS	M1997A-S3
7/64" / 2.8mm	5		M2023A-SS	M2023A-S3
3/16" / 4.8mm	6		M1813B-SS	M1813B-S3

Series/Model No.	25	Dwg by	SG
		Apvd by	KO
Description	Fixed restriction	Dwg date	07/31/15
		Dwg No.	M1009E-S
		Rev	A

SINGER VALVE
Result-Based Solutions. Globally.
www.singervalve.com 12850-87th Avenue. Surrey, B.C. V3W 3H9

General Description

Series "N" needle valves are ideal as speed controls on hydraulic and pneumatic systems where a reverse flow check is not needed. They provide excellent control and a reliable shutoff in a very small envelope.

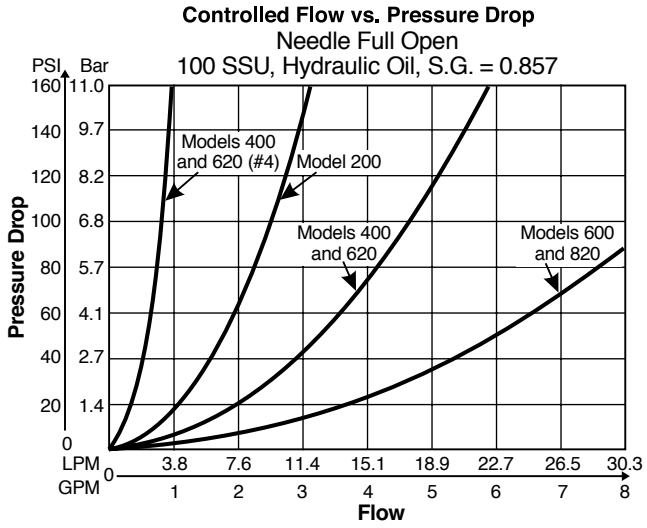
Operation

A two-step needle allows fine adjustment at low flow by using the first three turns of the adjusting knob; the next three turns open the valve to full flow, and also provide standard throttling adjustments.

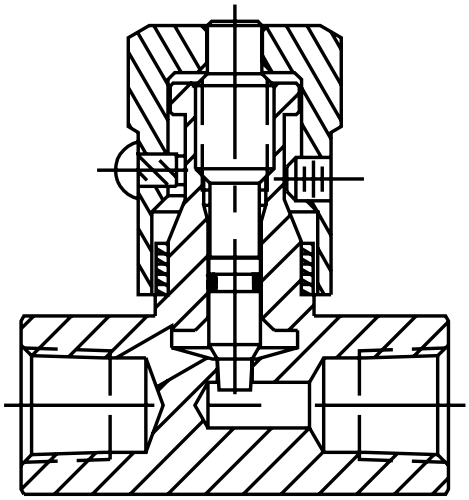
Features

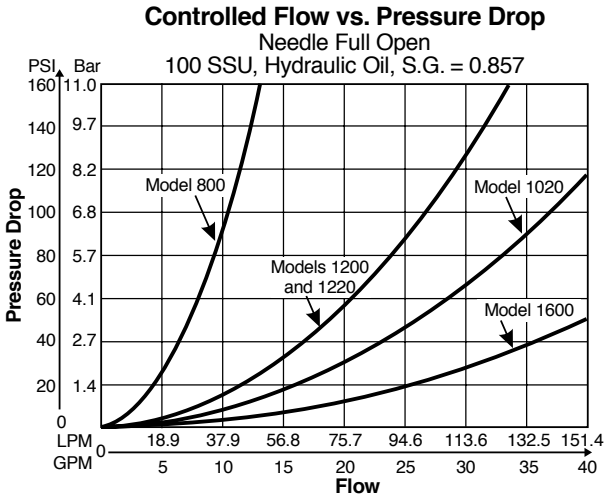
- The exclusive "Colorflow" color-band reference scale on the valve stem is a great convenience and time-saver in setting the valve originally and in returning it to any previous setting.
- A simple set screw locks the valve on any desired setting.
- A tamperproof option (T) feature is also available to prevent accidental or intentional adjustment of flow setting.

Performance Curves

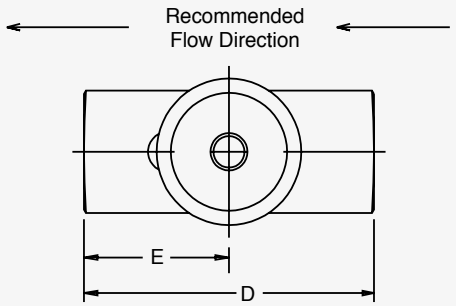


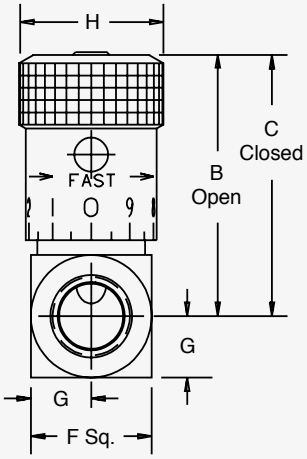
Specifications	
Maximum Operating Pressure	Brass: 140 Bar (2000 PSI); except for N1600 brass which is 35 Bar (500 psi) Steel & Stainless Steel: 345 Bar (5000 psi) for 200 thru 1220; 207 Bar (3000 psi) for all other sizes
Operating Temperature	-40°C to +121°C (-40°F to +250°F)

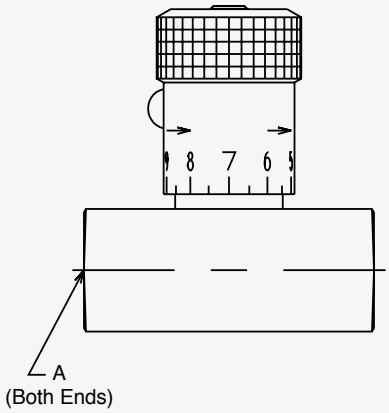


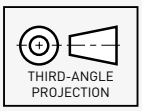


1/8" 1/4" 3/8" 1/2" 5/8" 3/4" 1" 1-1/4" 1-1/2"









Needle Valves - Series N

Model Number	Max Flow LPM (gpm)	A	B	C	D	E	F	G	H
N400	19 (5)	1/4–18 NPTF	45.5 (1.79)	40.4 (1.59)	50.8 (2.00)	25.4 (1.00)	20.6 (0.81)	10.4 (0.41)	20.6 (0.81)
N600	30 (8)	3/8–18 NPTF	55.4 (2.18)	49.5 (1.95)	63.5 (2.50)	31.8 (1.25)	25.4 (1.00)	12.7 (0.50)	25.4 (1.00)
N800	57 (15)	1/2–14 NPTF	68.6 (2.70)	61.5 (2.42)	66.5 (2.62)	33.3 (1.31)	31.8 (1.25)	15.7 (0.62)	30.2 (1.19)
N1200	95 (25)	3/4–14 NPTF	85.9 (3.38)	71.4 (2.81)	82.6 (3.25)	41.1 (1.62)	38.1 (1.50)	19.1 (0.75)	35.1 (1.38)

*Inch equivalents for millimeter dimensions are shown in (**)

Ordering Information

Options | Series: N | Size | Material | Needle Options | Other Options | Seal Compound | Design Series

Options

Code	Description
Omit	NPTF
8	BSPT
9	BSPP

Size

Sizes available: Brass			
400	600	800	1200
Sizes available: Stainless Steel			
400	600	800	

Material

Code	Description
Omit	Standard Knob
B	Brass
S	Steel
*SS	Stainless Steel

Series F Brass Valves can be used for both air and oil service.

* Available in 400, 600 and 800 sizes.

Needle Options

Code	Description
Omit	Standard Knob
4	Fine Metering (200, 400, 600, 620 sizes)

Other Options

Code	Description
Omit	Standard Knob
T*	Tamperproof
F	Finger Screw

* Not available above 1200 size.

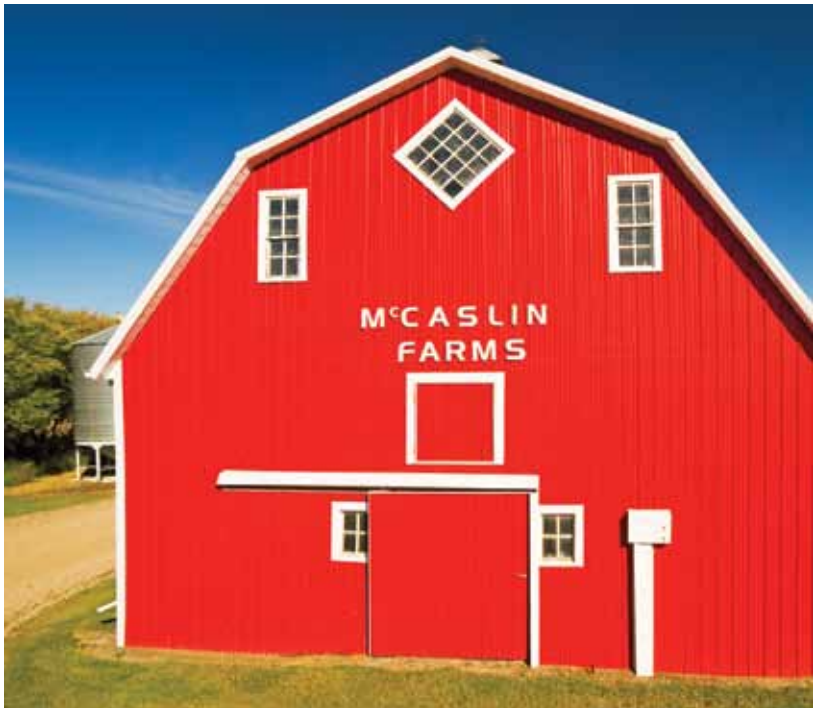
Seal Compound

Code	Description
Omit	Nitrile (Standard)
V	Fluorocarbon

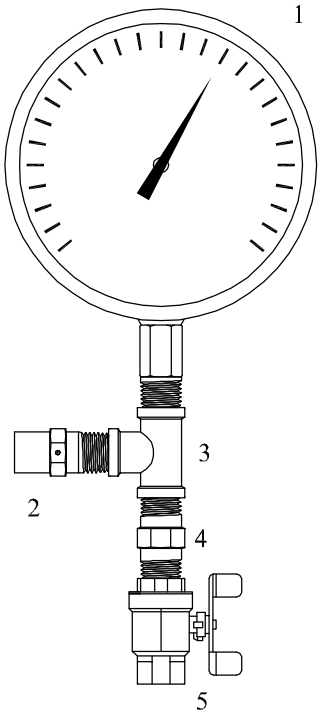
Design Series

NOTE: Not required when ordering.

Model Number	Weight Kg (lbs.)
N400	0.2 (0.5)
N600	0.3 (0.7)
N800	0.7 (1.5)
N1200	1.0 (2.3)

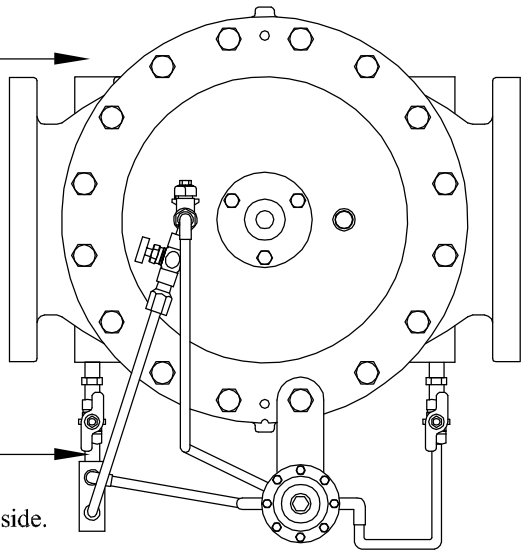


1/8" 1/4" 3/8" 1/2" 5/8" 3/4" 1" 1-1/4" 1-1/2"



Specify install on non-pilot
system side.
Inlet or outlet or both.

A



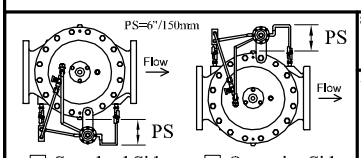
B

Specify install on pilot system side.
Inlet or outlet or both.
If inlet, downstream of ball valve
If outlet, upstream of ball valve

X = Accessory
G = Gauge
B = Bleed
V = Valve
A = Assembly

CONTROL VALVE BILL OF MATERIALS (for dimension information and material specifications see component datasheets)

1. Pressure Gauge, $\frac{1}{4}$"
2. Bleed Valve, J0222A
3. Tee, $\frac{1}{4}$"
4. Nipple, $\frac{1}{4}$"
5. Gauge Cock/Ball Valve, $\frac{1}{4}$"



Series/Model No.	Model XGBVA
Description	Pressure Gauge & Bleed Valve Assembly
Dwg by	SG
Apvd by	SG
Dwg date	03/13/17
Dwg No.	XGBVA
Rev	B

SINGER VALVE
Result-Based Solutions. Globally.
www.singervalve.com 12850-87th Avenue. Surrey, B.C. V3W 3H9

PFP Premium Stainless Steel Liquid Filled Gauge

Optional U-Clamp

RoHS compliant

Note: RoHS applies only to SS internals

Description & Features:

- Liquid filled stainless steel case protects against vibration and pulsation
- Bayonet ring
- Highly accurate
- Back, bottom, or panel mounted
- Stainless steel or brass wetted parts
- Dry case available
- CRN registered
- 5 year warranty

Applications:

- Outdoor and severe ambient and process conditions
- Use where harmful vibration and pulsation are present
- Hydraulic equipment, pressure washers, oil field equipment, pumps, compressors and process systems

Specifications	Stainless Steel Internals	Brass Internals
Dial	2.5” (63mm), 4” (100mm), 6” (150mm) white aluminum with black and red markings	4” (100mm) white aluminum with black and red markings
Case	AISI 304 SS	AISI 304 SS
Lens	Polycarbonate	Polycarbonate
Ring	AISI 304 SS	AISI 304 SS
Socket	316 SS 2.5”, 4”: Welded one-piece socket	OT 58 brass
Connection	¼” NPT or ½” NPT standard 2.5” (63mm): ¼” NPT only	¼” NPT or ½” NPT standard
Bourdon Tube	316 SS, drawn seamless	Phosphor bronze
Movement	304 SS 4” (100mm): Over/under stops (optional)	OT 59 brass
Pointer	2.5” (63mm): Aluminum, anodized black 4” (100mm), 6” (150mm): Aluminum, anodized black, micrometer adjustable	4” (100mm) aluminum, anodized black, micrometer adjustable
Welding	TIG	Silver alloy
Fill Liquid	Glycerin	Glycerin
Over-Pressure Limit	30% for pressures up to 600 psi (4,147 kPa), 15% for pressures over 600 psi (4,147 kPa)	25% for pressures up to 1,400 psi (9,653 kPa), 15% for pressures over 1,400 psi (9,653 kPa)
Socket Gasket	2.5” (63mm): Buna N for two-piece internal socket seal 6” (150mm): Buna N for one-piece external socket seal, Silicone rubber option	6” (150mm): Buna N for one-piece external socket seal, Silicone rubber option
Fill Plug	Buna N (Silicone rubber option)	Buna N (Silicone rubber option)
Lens Ring Gasket	Buna N (Silicone rubber option)	Buna N (Silicone rubber option)
Working Pressure	Maximum 75% of full scale value	Maximum 75% of full scale value
Ambient/Process Temperature	Dry: -40°F to 200°F (-40°C to 93°C) Glycerin Filled: -4°F to 150°F (-20°C to 65°C)	Dry: -40°F to 200°F (-40°C to 93°C) Glycerin Filled: -4°F to 150°F (-20°C to 65°C)
Accuracy	2.5” (63mm): ±1.5% of full scale value 4” (100mm), 6” (150mm): ±1% ANSI/ASME Grade 1A	4” (100mm): ±1% ANSI/ASME Grade 1A
Enclosure Rating	IP66, EN60529-1 (IEC529-1)	IP66, EN60529-1 (IEC529-1)

Dual Scale Order Codes (products in bold are normally in stock)

Dial Size	2.5" (63mm)		4" (100mm)				4" (100mm)			
Connection	¼" Bottom	¼" Back (CB)	¼" Bottom	½" Bottom	¼" Back (LB)	½" Back	¼" Bottom	¼" Back (LB)	½" Bottom	½" Back (LB)
Movement, Socket, Tube	SS	SS	Brass	Brass	Brass	Brass	SS	SS	SS	SS
30" Hg Vac/kPa	**PFP820**	**PFP840**	PFP600	PFP2284	PFP1000	-	**PFP640**	PFP1090	PFP655	PFP2308
30"/0/15 psi/kPa	**PFP860**	PFP870	PFP1020	PFP2285	PFP1028	-	PFP1036	PFP1244	PFP1044	PFP2309
30"/0/30 psi/kPa	**PFP861**	PFP871	PFP1021	PFP2286	PFP1029	-	**PFP1037**	PFP1245	**PFP1045**	PFP2310
30"/0/60 psi/kPa	**PFP862**	**PFP872**	PFP1022	PFP2287	PFP1030	-	**PFP1038**	PFP1246	PFP1046	PFP2311
30"/0/100 psi/kPa	PFP863	PFP873	PFP1023	PFP2288	PFP1031	-	PFP1039	PFP1247	PFP1047	PFP2312
30"/0/150 psi/kPa	**PFP864**	PFP874	PFP1024	PFP2289	PFP1032	-	PFP1040	PFP1248	PFP1048	PFP2313
30"/0/200 psi/kPa	PFP866	PFP876	PFP1026	PFP2290	PFP1034	-	PFP1042	PFP1249	PFP1050	PFP2314
30"/0/300 psi/kPa	**PFP867**	PFP877	PFP1027	PFP2291	PFP1035	-	**PFP1043**	PFP1250	PFP1051	PFP2315
0/15 psi/kPa	**PFP821**	**PFP921**	**PFP601**	PFP2292	PFP1001	-	**PFP641**	PFP1091	**PFP656**	PFP2316
0/30 psi/kPa	**PFP822**	**PFP922**	**PFP602**	PFP2293	PFP1002	-	**PFP642**	PFP1092	**PFP657**	PFP2317
0/60 psi/kPa	**PFP823**	**PFP923**	**PFP603**	PFP2294	PFP1003	-	**PFP643**	PFP1093	**PFP658**	PFP2318
0/100 psi/kPa	**PFP824**	**PFP924**	**PFP604**	PFP2295	PFP1004	-	**PFP644**	**PFP1094**	**PFP659**	PFP2319
0/160 psi/kPa	**PFP825**	**PFP925**	**PFP605**	PFP2296	PFP1005	-	**PFP645**	**PFP1095**	**PFP660**	PFP2320
0/200 psi/kPa	**PFP826**	**PFP926**	**PFP606**	PFP2297	PFP1006	-	**PFP646**	PFP1096	**PFP661**	PFP2321
0/300 psi/kPa	**PFP827**	**PFP927**	**PFP607**	PFP2298	PFP1007	-	**PFP647**	PFP1097	**PFP662**	PFP2322
0/400 psi/kPa	**PFP880**	**PFP881**	**PFP610**	PFP2299	PFP1016	-	**PFP650**	**PFP1251**	**PFP666**	PFP2323
0/600 psi/kPa	**PFP828**	**PFP928**	PFP608	PFP2300	PFP1008	-	**PFP648**	PFP1098	**PFP663**	PFP2324
0/1,000 psi/kPa	**PFP829**	**PFP929**	PFP609	PFP624	-	PFP1009	PFP649	PFP1099	**PFP664**	PFP2325
0/1,500 psi/kPa	**PFP834**	**PFP934**	-	PFP625	-	PFP1010	PFP2301	PFP1252	**PFP665**	PFP1190
0/2,000 psi/kPa	**PFP830**	**PFP930**	-	PFP626	-	PFP1011	PFP2302	PFP1253	**PFP667**	PFP1191
0/3,000 psi/kPa	**PFP831**	**PFP931**	-	PFP627	-	PFP1012	PFP2303	PFP1254	**PFP668**	PFP1192
0/5,000 psi/kPa	**PFP832**	**PFP852**	-	PFP628	-	PFP1013	PFP2304	**PFP1255**	**PFP669**	PFP1193
0/6,000 psi/kPa	**PFP836**	**PFP851**	-	PFP631	-	PFP1015	PFP2305	PFP1259	PFP675	PFP1197
0/10,000 psi/kPa	**PFP833**	**PFP853**	-	PFP629	-	PFP1014	PFP2306	PFP1256	PFP670	PFP1194
0/15,000 psi/kPa	**PFP835**	PFP855	-	PFP630	-	PFP1018	PFP2307	PFP1257	PFP671	PFP1195
0/20,000 psi/kPa	PFP837	-	-	PFP639	-	PFP1019	-	PFP1258	**PFP672**	PFP1196

Other ranges and connection sizes available upon request. 316 SS case and mountable bezel available upon request. For scale change, refer to How to Order Guide for scale codes. **For options, attach suffix to end of order code: i.e. PFP929-25UC for U-CLAMP.**

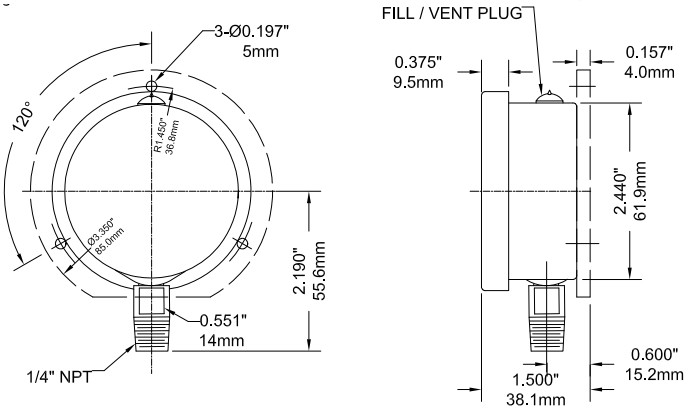
Option suffix:

25BF = 2.5" (63mm) Back Flange
25FF = 2.5" (63mm) Front Flange
25UC = 2.5" (63mm) U-Clamp
25DRY = Supply 2.5" gauge less liquid fill
2.5 BOOT = 2.5" (63mm) black rubber boot

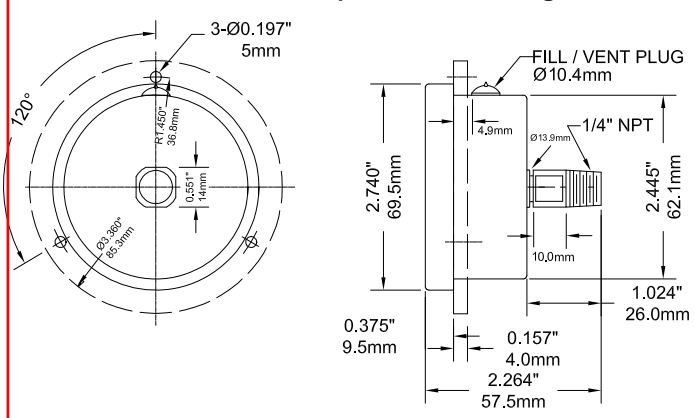
4BF = 4" (100mm) Back Flange
4FF = 4" (100mm) Front Flange
4UC-P = 4" (100mm) Premium U-Clamp
DRY = Supply 4" gauge less liquid fill

SF25 = Silicone Filled for 2.5"
SF4 = Silicone Filled for 4"
SG-25 = Safety Glass 2.5"
SG-4 = Safety Glass Lens 4"
REST = Restrictor Screw

2.5" Bottom Connection with optional Back Flange



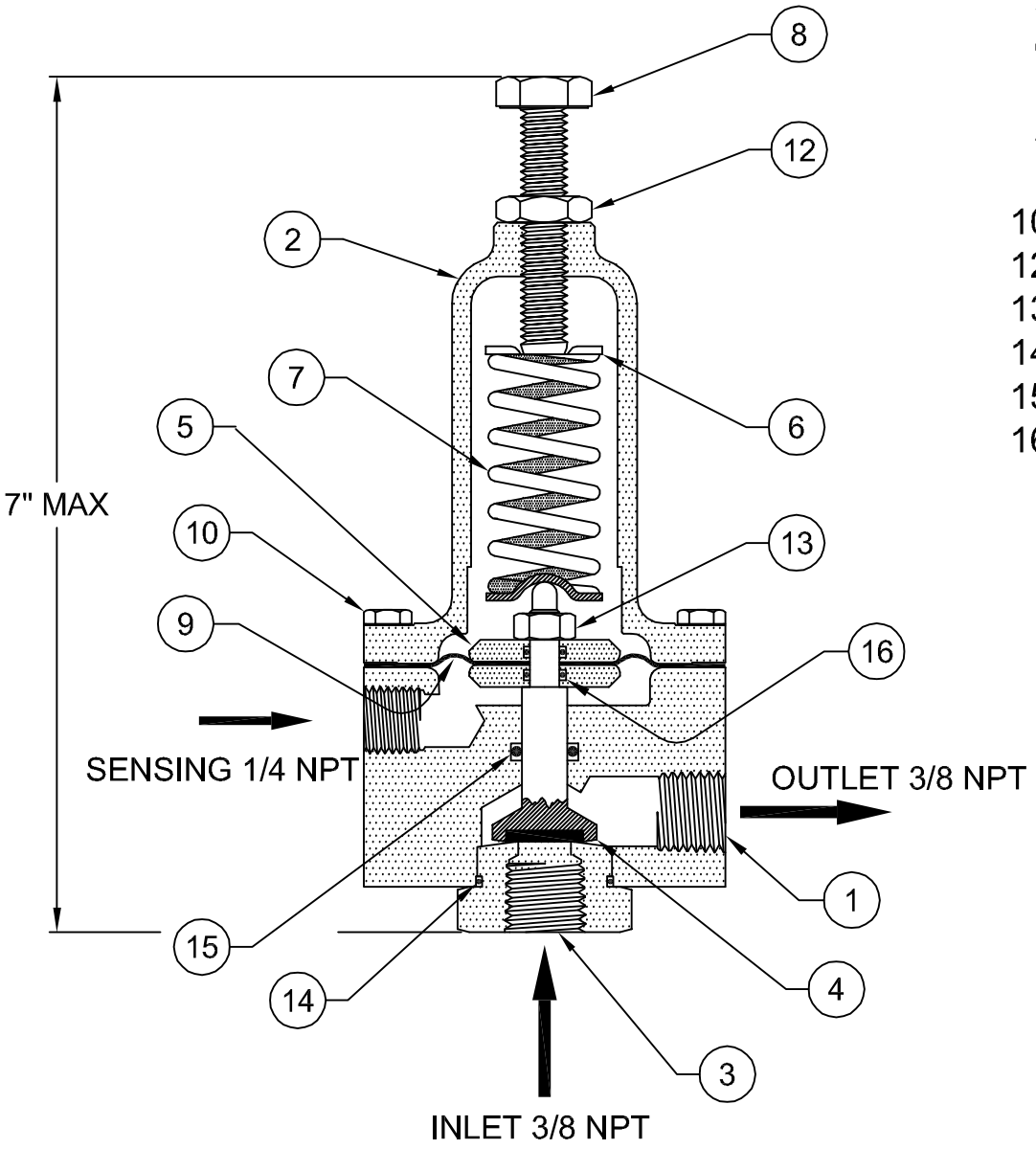
2.5" Back Connection with optional Front Flange



A0661C-SS

PRESSURE RELIEF PILOT

(FOR HIGH PRESSURE APPLICATIONS
SEE DRAWING A0781A MODEL 83RP)



Item	Description	Material
1.	Body	Stainless Steel
2.	Spring Casing	Stainless Steel
3.	Seat Ring	Stainless Steel
4.	Inner Valve	Stainless Steel & Buna-N
5.	Clamp Plate	Stainless Steel
6.	Spring Step	Stainless Steel
7.	Spring	Spring Steel
8.	Adjusting Screw	Stainless Steel
9.	Diaphragm	Buna-N
10.	Body Capscrew	Stainless Steel
12.	Locknut	Stainless Steel
13.	Inner Valve Nut	Stainless Steel
14.	Seat Ring Seal	Buna-N
15.	Body Seal	Buna-N
16.	Clamp Plate Seal	Buna-N

Spring Ranges:	Adjustment (psi/turn):
5 - 50 psi	8 psi
10 - 80 psi	10 psi
20 - 200 psi	25 psi
100 - 300 psi	40 psi

Rev: September 2002

SINGER VALVE
Result-Based Solutions. Globally.
www.singervalve.com 12850-87th Avenue. Surrey, B.C. V3W 3H9

Drawn By:	Approved By:
Steve Bishop	Kari Oksanen
Date:	Drawing:
March 10, 1999	A0661C-SS

Model 81-RP-SS

SINGER VALVE
Result-Based Solutions. Globally.

12850-87th Avenue
Surrey, BC. Canada. V3W 3H9
Ph: 604-594-5404
Fx: 604-594-8845
www.singervalve.com

SINGER MODEL 81-RP

Pressure Relief Pilot Drawing A0661C-SS
Installation, Operation and Maintenance Instructions

DESCRIPTION:

Model 81-RP is a normally closed pilot that opens when the control pressure below the diaphragm exceeds the force of the spring.

INSTALLATION:

1. Flush system of all foreign matter before installing the valve.
2. The valve can be installed in any position.
3. Check direction of flow and install the valve accordingly. Refer to enclosed schematic and check the arrow in the valve body.
4. Connect control tubing from the sensing connection of the valve to the point of control. Refer to enclosed schematic.

ADJUSTING PROCEDURE:

1. Loosen the locknut.
2. Turn the adjusting screw clockwise for increased setting, counterclockwise for reduced setting.
3. Lock adjustment by tightening adjusting screw locknut.

DISASSEMBLY:

1. Turn Adjusting Screw (8) counterclockwise until Spring (7) is free.
2. Remove Body Capscrews (10).
3. Remove Seat Ring (3).
4. Resilient part of Inner Valve can be inspected once the Seat Ring has been removed.
5. To remove Inner Valve (4), use a ¾" socket (not impact socket) to prevent the Inner Valve from turning when removing Inner Valve Nut (13).

SERVICE SUGGESTIONS:

FAILS TO OPEN

- Spring overset.
- Foreign material in valve.
- Diaphragm ruptured.

FAILS TO CLOSE

- Spring underset.
- Foreign material in valve.

Part # 4405N-16-16

- 4405N: Coupling Series
- 4405N: 5 Digit Parts Only — *Indicates the 1st digit of elbow angle*
- 4405N: Thread Style — *1st digit also indicates elbow in 4 digit parts*
- 16: Thread Size
- 16: Hose Size

Pulsar offers a wide variety of coupling styles:

Series	Description
2000…	Push-on hose couplings
3000…	Reusable fittings for one and two wire braid hoses
3500…	Reusable fittings for SAE100R5 dimension hoses
4000…	Swage or crimp fittings for teflon hose
4100…	Reusable fittings for teflon hose
5000…	Two-piece (separate stem and ferrule) crimp fittings for most hoses
8600…	Interlock (internal skive) two-piece crimp fittings for spiral hoses
4200/4400…	One-piece (integral stem and ferrule) crimp fittings for most hoses
4500…	One-piece crimp fittings for SAE100R5 hoses
9500…	One-piece crimp fittings for spiral hoses
9600…	One-piece crimp fittings for spiral hoses

Within these broad divisions, the last two digits will specify the thread style, as detailed above.
Angle fittings are designated by inserting the degree of the angle as the third digit. For example, a 5005 would indicate a two-piece crimp fitting with a female JIC thread, and a 5095 would indicate a similar fitting but with a 90° elbow.
Five digit part numbers are used for less common (particularly metric) fittings where some uncertainty may be caused by inserting the elbow number in the third position.
Dash sizes following the base part number indicate first the nominal thread or tube size, and lastly the nominal hose diameter.
Please note that for truck hoses, notably SAE100R5 and SAE100R14, the nominal hose size does not exactly match the actual inside diameter, since these hoses were designed to replace common copper tubing. For example, 151-06 hose measures $^{5}/_{16}$" I.D., since it was designed to replace $^{3}/_{8}$" ("-06") copper tubing, which measures $^{5}/_{16}$" I.D.

109T... Twin SAE 100R17 Forklift Hose

Our single wire braid compact hose is now available in a bonded twin configuration for use on forklift masts. The specifications are the same as our standard hose except the cover is smooth.

Tube: Seamless oil resistant nitrile rubber
Reinforcement: One or two high tensile steel wire braids.
Cover: Oil, abrasion and weather resistant black neoprene rubber
Temperature Range: -40° to 100°C (-40° to 212°F), petroleum base fluids intermittent to 125°C (257°F).

Part Number	Hose I.D.	Hose O.D.	Working Pressure	Min. Burst Pressure	Min. Bend Radius	Weight Lb/ft	Recommended Coupling Series	
109-06	3/8"	0.62"	3000 psi	12000 psi	2.5"	0.13	4200	5000

157... SAE 100R4 Teflon® Hose

Teflon® hoses were designed to replace copper tube in high temperature flexing applications where rubber hose would fail. They have a Teflon® tube with a stainless wire cover and are commonly used for compressor discharge lines on mobile air brake systems. 157 is also used in many chemical applications.

Tube: Extruded Teflon®
Reinforcement: One high-tensile Type 304 stainless steel wire braid
Temperature Range: -54° to 232°C (-65° to 450°F), intermittent -73° to 260°C (-100° to 500°F).

Part Number	Hose I.D.	Hose O.D.	Working Pressure	Min. Burst Pressure	Min. Bend Radius	Weight Lb/ft	Recommended Coupling Series	
157-04	3/16"	0.30"	3000 psi	12000 psi	2.0"	0.08	4000	4100
157-05	1/4	0.38	3000	12000	3.0	0.10	4000	4100
157-06	5/16	0.44	2500	10000	4.0	0.11	4000	4100
157-08	13/32	0.54	2000	8000	5.0	0.12	4000	4100
157-10	1/2	0.64	1500	6000	7.0	0.15	4000	4100
157-12	5/8	0.77	1200	4800	8.0	0.17	4000	4100
157-16	7/8	1.03	1000	4000	9.0	0.26	4000	4100

Teflon® is a registered trademark of Dupont.

4000 SERIES CRIMP COUPLINGS

4000 Series fittings for 157 Teflon hose can be crimped or swaged. Special tooling is available to simplify ferrule installation and fitting insertion.

4016B... BRASS NPTF MALE

Part Number	Thread	Hose I.D.
4016B-02-04	1/8-27	3/16"
4016B-04-04	1/4-18	3/16"
4016B-04-05	1/4-18	1/4"
4016B-04-06	1/4-18	5/16"
4016B-06-06	3/8-18	5/16"
4016B-06-08	3/8-18	13/32"
4016B-08-08	1/2-14	13/32"
4016B-08-10	1/2-14	1/2"
4016B-12-12	3/4-14	5/8"
4016B-16-16	1-11 1/2	7/8"

4005B... BRASS JIC 37° FEMALE SWIVEL

Part Number	Thread	Hose I.D.
4005B-04-04	7/16-20	3/16"
4005B-05-05	1/2-20	1/4"
4005B-06-06	9/16-18	5/16"
4005B-08-08	3/4-16	13/32"
4005B-10-10	7/8-14	1/2"
4005B-12-12	1 1/16-12	5/8"
4005B-16-16	1 5/16-12	7/8"

4004B... Brass SAE 45° FEMALE SWIVEL

Part Number	Thread	Hose I.D.
4004B-06-06	5/8-18	5/16"
4004B-12-12	1 1/16-14	5/8"

(Use 4005B for other SAE sizes)

4016SS... STAINLESS NPTF MALE

Part Number	Thread	Hose I.D.
4016SS-02-04	1/8-27	3/16"
4016SS-04-04	1/4-18	3/16"
4016SS-04-05	1/4-18	1/4"
4016SS-04-06	1/4-18	5/16"
4016SS-06-06	3/8-18	5/16"
4016SS-08-08	1/2-14	13/32"
4016SS-08-10	1/2-14	1/2"
4016SS-12-12	3/4-14	5/8"
4016SS-16-16	1-11 1/2	7/8"

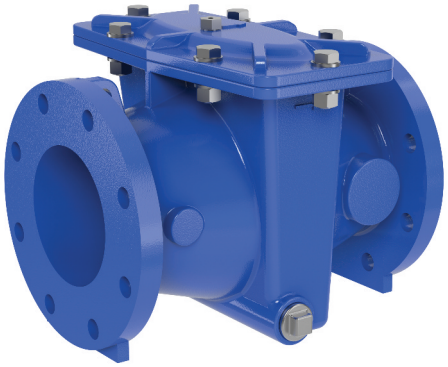
4005SS... STAINLESS JIC 37° FEMALE SWIVEL

Part Number	Thread	Hose I.D.
4005SS-04-04	7/16-20	3/16"
4005SS-05-05	1/2-20	1/4"
4005SS-06-06	9/16-18	5/16"
4005SS-08-08	3/4-16	13/32"
4005SS-10-10	7/8-14	1/2"
4005SS-12-12	1 1/16-12	5/8"
4005SS-16-16	1 5/16-12	7/8"

CLA-VAL™

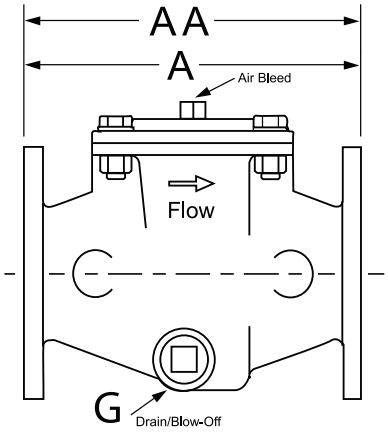
— MODEL — X43H

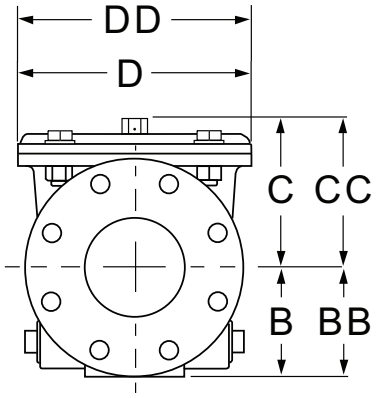
H Style Strainer



- **Low Pressure Drop**
- **Ductile Iron Fusion Bonded Epoxy Coated Construction with a 316 Stainless Steel Strainer**
- **Large Flow Area H-Style Design**
- **Service Without Removal From Line**
- **The materials of construction and epoxy coating used in this product meets the intent of the federal NSF-61 lead content mandate**

The Cla-Val Model X43H Strainer offers an effective means of removing unwanted solid particles in pipeline flow. These strainers are ideal for preventing fouling, debris and particle buildup in Cla-Val Automatic Control Valves. The large flow area design, with a flat stainless steel strainer mesh perpendicular to flow, is optimized for low pressure drop applications. Maintenance is fast and easy with the compact H-pattern, requiring only top cover removal. Though the strainer may be installed in any position, installation with the cover up is recommended.





Dimensions

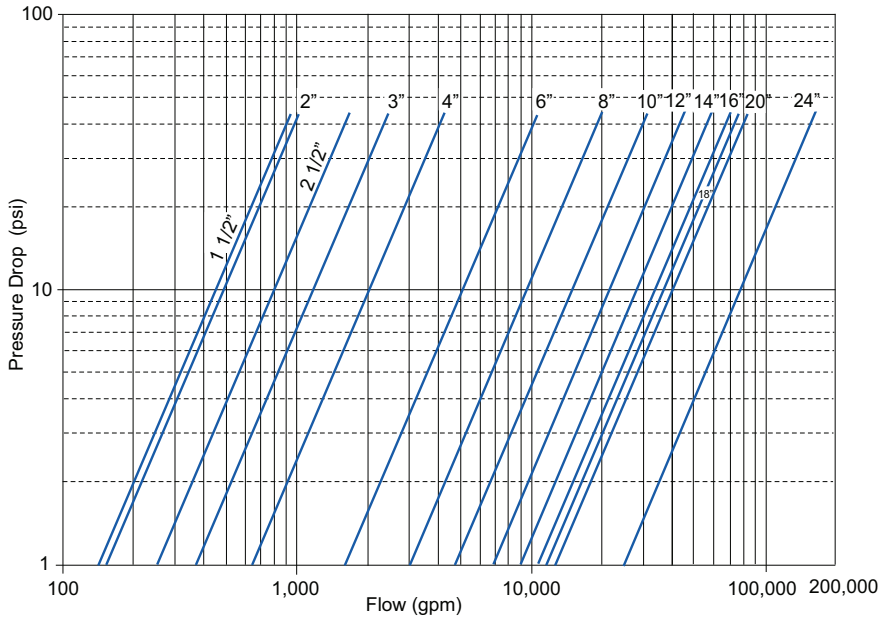
Strainer Size (inches)	1 ½	2	2 ½	3	4	6	8	10	12	14	16	18	20	24	30	36	48
A 150 ANSI	9.06	9.06	9.06	11.81	11.81	15.75	19.69	22.83	24.02	25.59	31.50	31.50	37.40	43.31	45.27	45.67	45.67
AA 300 ANSI	9.13	9.13	9.13	11.89	11.89	15.83	19.76	22.91	24.09	25.67	31.57	31.57	37.48	43.39	- -	- -	- -
B 150 ANSI	2.50	3.26	3.66	4.06	4.33	5.63	6.69	8.40	9.40	10.24	12.20	13.18	19.09	19.09	22.49	26.00	34.00
BB 300 ANSI	3.26	3.26	3.66	4.06	5.02	5.63	7.50	8.86	10.20	10.94	12.70	15.00	19.09	19.09	- -	- -	- -
C Max. 150 ANSI	3.78	3.78	3.78	5.91	5.91	7.52	8.82	11.61	15.16	14.96	19.69	19.69	23.98	23.98	25.10	36.20	34.11
CC Max. 300 ANSI	5.20	5.20	5.35	6.22	6.22	7.99	9.33	12.79	15.67	15.67	19.69	19.69	23.98	23.98	- -	- -	- -
D Dia. 150 ANSI	7.87	7.87	7.87	9.25	9.25	15.74	18.11	22.05	26.77	26.77	35.43	35.43	46.85	46.85	46.85	61.65	61.65
DD Dia. 300 ANSI	7.99	7.99	7.99	9.37	9.37	15.86	18.23	22.17	26.85	26.85	35.43	35.43	46.85	46.85	- -	- -	- -
G Drain/Blow-off Plug NPT	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1¼	2	2	2	2	2	2	2	2	2
Approx. Ship Wt. Lbs.	33	36	39	59	73	143	212	432	626	683	970	1073	1175	1962	2249	4123	4828

Strainer Size (mm)	40	50	65	80	100	150	200	250	300	350	400	450	500	600	750	900	1200
A 150 ANSI	230	230	230	300	300	400	500	580	610	650	800	800	950	1100	1150	1160	1160
AA 300 ANSI	232	232	232	302	302	402	502	582	612	652	802	802	952	1102	- -	- -	- -
B 150 ANSI	64	83	93	103	110	143	170	213	240	260	310	335	485	485	571.5	660.5	862.5
BB 300 ANSI	83	83	93	103	128	143	191	225	259	278	321	380	485	486	- -	- -	- -
C Max. 150 ANSI	96	96	96	150	150	191	224	295	385	380	500	500	609	609	637.5	919.5	866.5
CC Max. 300 ANSI	132	132	136	158	158	203	237	325	398	398	500	500	609	609	- -	- -	- -
D Dia. 150 ANSI	200	200	200	235	235	400	460	560	680	680	900	900	1190	1190	1190	1566	1566
DD Dia. 300 ANSI	203	203	203	238	238	403	463	563	682	682	900	900	1190	1190	- -	- -	- -
G Drain/Blow-off Plug NPT	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1¼	2	2	2	2	2	2	2	2	2
Approx. Ship Wt. (kg)	15	16	18	27	33	65	96	196	284	310	440	600	810	890	1020	1870	2190

Specifications

Sizes (Inches):	1½, 2, 2½, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 30, 36 and 48
Sizes (mm):	40, 50, 65, 80,100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 750, 900, 1200
Ends:	Flanged, ANSI Class 150 and 300 (**Note:** 300# Flanges are Raised Face)
Max Pressure Rating:	150# - 250 psi • 300# - 400 psi
Temperature:	Maximum 175°F
Materials:	
Body & Cover:	Ductile Iron ANSI B16.42; Fusion Bonded Epoxy Coating Standard
Cover Seal:	Buna-N® Synthetic Rubber
Strainer:	316 Stainless Steel; Ductile Iron, Epoxy Coated Frame
Strainer Mesh Sizes:	Standard 10 mesh / 2000 Micron / Openings 0.078 inch • Optional .039 and .059 inch openings available
Drain/Blow-Off:	Connection furnished with Standard Stainless Steel Plug
Cover Fasteners:	Stainless Steel

Model X43H Flow Chart



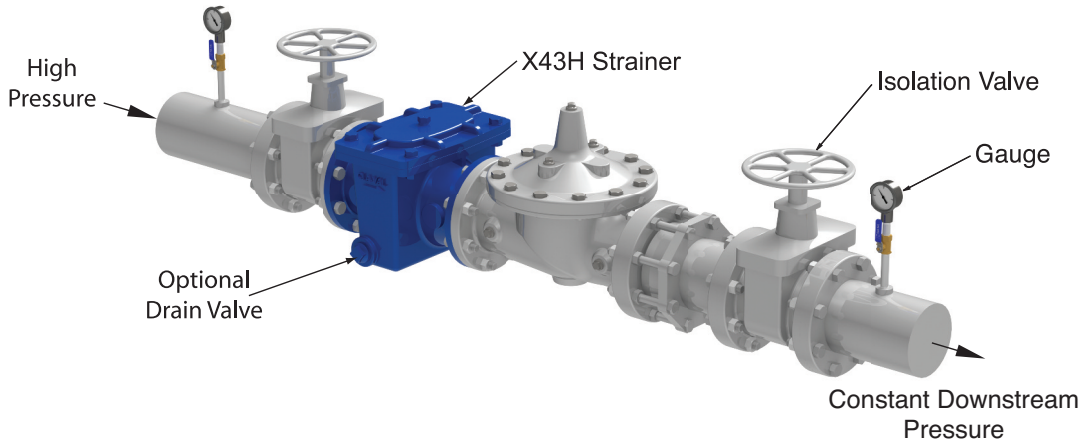
C_V Factor

Size (inches)	1 ½	2	2 ½	3	4	6	8	10	12	14	16	18	20	24	*30	*36	*48
Size (millimeters)	**40**	**50**	**65**	**80**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**600**	**750**	**900**	**1200**
C_V (Gal/Min. - gpm.)	96	150	254	367	654	1644	3922	4566	6800	8949	11692	12796	18264	26302	CF	CF	CF
C_V (Litres/Sec - l/s.)	23	36	61	88	157	395	942	1097	1634	2150	2809	3074	4388	6319	CF	CF	CF

C_V in gpm = gpm @ 1psid head loss • C_V in l/s = l/s @ 1bar head loss

*Consult factory to confirm flow data for 30-inch/750mm and larger strainers

Model X43H Strainer Typical Application



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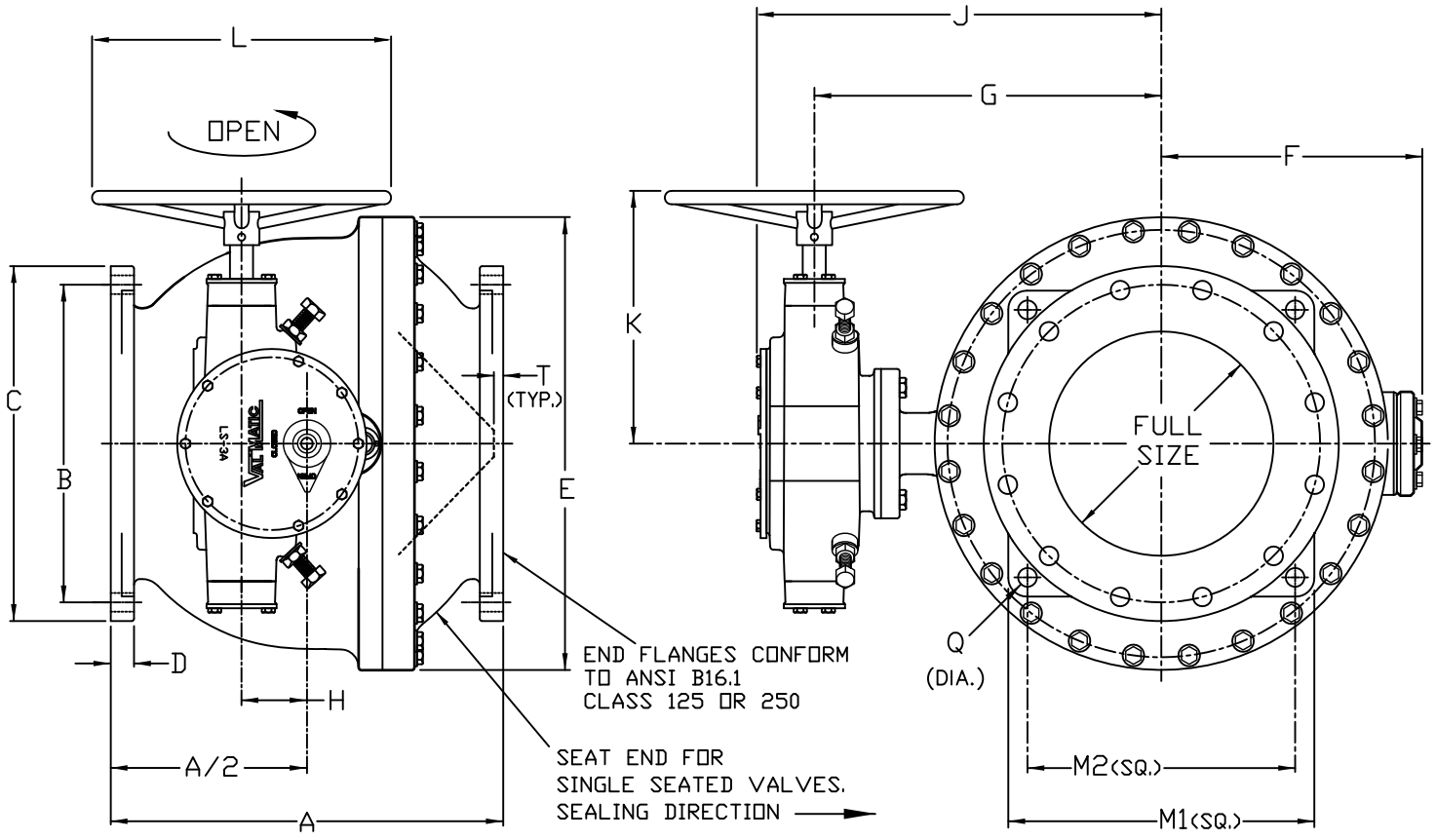


VALVE DEPICTS 12" 150 SIZE WITH LS-3A ACTUATOR

FLANGE DIMENSIONS, INCHES

VALVE SIZE	AWWA PRESS. CLASS	A	B	C	D	E	F	G	H	J	K	L	M1	M2	Q	T	ACT. SIZE	TURNS TO OPEN	NO. OF BOLTS	BOLT SIZE	SHPG. WT.
4	150	12.38	7.50	9.00	0.95	11.75	7.25	10.25	1.50	12.58	9.38	8	8.25	7.11	0.75	2.00	LS-1A	15	8	5/8	160
	300	13.00	7.88	10.00	1.25	11.75	7.25	10.50	1.50	12.58	9.38	8	9.25	7.87	0.88	2.38	LS-1A	15	8	3/4	177
6	150	15.75	9.50	11.00	1.00	14.75	8.50	11.38	2.00	13.63	11.25	12	10.13	8.57	0.88	2.25	LS-2.2A	20	8	3/4	245
	300	16.00	10.63	12.50	1.44	15.00	9.50	12.38	2.00	14.63	11.25	12	11.31	9.63	0.88	2.38	LS-2A	20	12	3/4	284
8	150	18.00	11.75	13.50	1.13	17.88	10.38	13.63	2.00	15.88	11.25	12	12.00	10.34	0.88	2.00	LS-2A	20	8	3/4	386
	300	18.00	13.00	15.00	1.63	18.13	11.75	15.00	2.00	17.25	12.25	16	13.25	11.49	1.00	2.00	LS-2A	20	12	7/8	450
	300	18.00	13.00	15.00	1.63	18.13	11.75	16.13	3.50	19.13	13.88	12	13.25	11.49	1.00	2.00	LS-3.2A	35	12	7/8	472
10	150	19.50	14.25	16.00	1.19	21.13	12.38	16.00	3.50	18.88	13.88	12	14.25	12.20	1.00	1.25	LS-3A	35	12	7/8	390
	300	21.13	15.25	17.50	1.88	21.63	13.88	17.50	3.50	20.38	13.88	12	15.25	13.34	1.13	2.00	LS-3A	35	16	1	507
12	150	21.00	17.00	19.00	1.25	24.25	14.38	18.13	3.50	21.13	14.88	16	16.63	14.32	1.00	0.50	LS-3A	35	12	7/8	794
	300	24.00	17.75	20.50	2.00	24.50	16.50	20.25	3.50	23.13	14.88	16	17.68	15.55	1.25	2.00	LS-3A	35	16	1 1/8	1002
	300	24.00	17.75	20.50	2.00	24.50	16.38	20.50	5.00	23.50	16.63	16	17.68	15.55	1.25	2.00	LS4.2A	50	16	1 1/8	1033
14	150	26.25	18.75	21.00	1.38	27.50	16.38	20.25	5.00	23.25	16.63	16	18.50	15.82	1.13	1.63	LS-4A	50	12	1	867
	300	27.75	20.25	23.00	2.13	27.75	18.75	22.38	3.50	25.38	14.88	16	19.75	17.32	1.25	2.38	LS-3A	35	20	1 1/8	1025
	150	26.25	18.75	21.00	1.38	27.50	16.38	20.00	3.50	22.88	14.88	16	18.50	15.82	1.13	1.63	LS-3A	35	12	1	836
	300	27.75	20.25	23.00	2.13	27.75	18.75	22.63	5.00	25.63	19.88	24	19.75	17.32	1.25	2.38	LS-4A	50	20	1 1/8	1079
16	150	27.00	21.25	23.50	1.44	30.63	18.63	22.25	5.00	25.50	19.88	24	20.25	17.59	1.13	0.63	LS-4A	50	16	1	1264
	300	28.13	22.50	25.50	2.25	31.63	21.75	25.35	3.50	28.38	14.88	16	21.68	19.18	1.38	1.13	LS-3A	35	20	1 1/4	1475
	150	27.00	21.25	23.50	1.44	30.63	18.63	22.25	3.50	25.13	14.88	16	20.25	17.59	1.13	0.63	LS-3A	35	16	1	1210
	300	28.13	22.50	25.50	2.25	31.63	21.75	25.63	5.00	28.63	21.38	30	21.68	19.18	1.38	1.13	LS-4A	50	20	1 1/4	1552
18	150	30.00	22.75	25.00	1.56	33.88	20.38	24.38	5.00	27.38	21.38	30	21.75	18.74	1.25	0.63	LS-4A	50	16	1 1/8	1774
	300	31.00	24.75	28.00	2.38	34.50	23.63	27.63	5.00	30.63	21.38	30	23.88	20.94	1.38	1.13	LS-4A	50	24	1 1/4	2132
20	150	32.00	25.00	27.50	1.69	36.75	21.88	25.75	5.00	28.75	21.38	30	23.68	20.50	1.25	0.25	LS-4A	50	20	1 1/8	2375

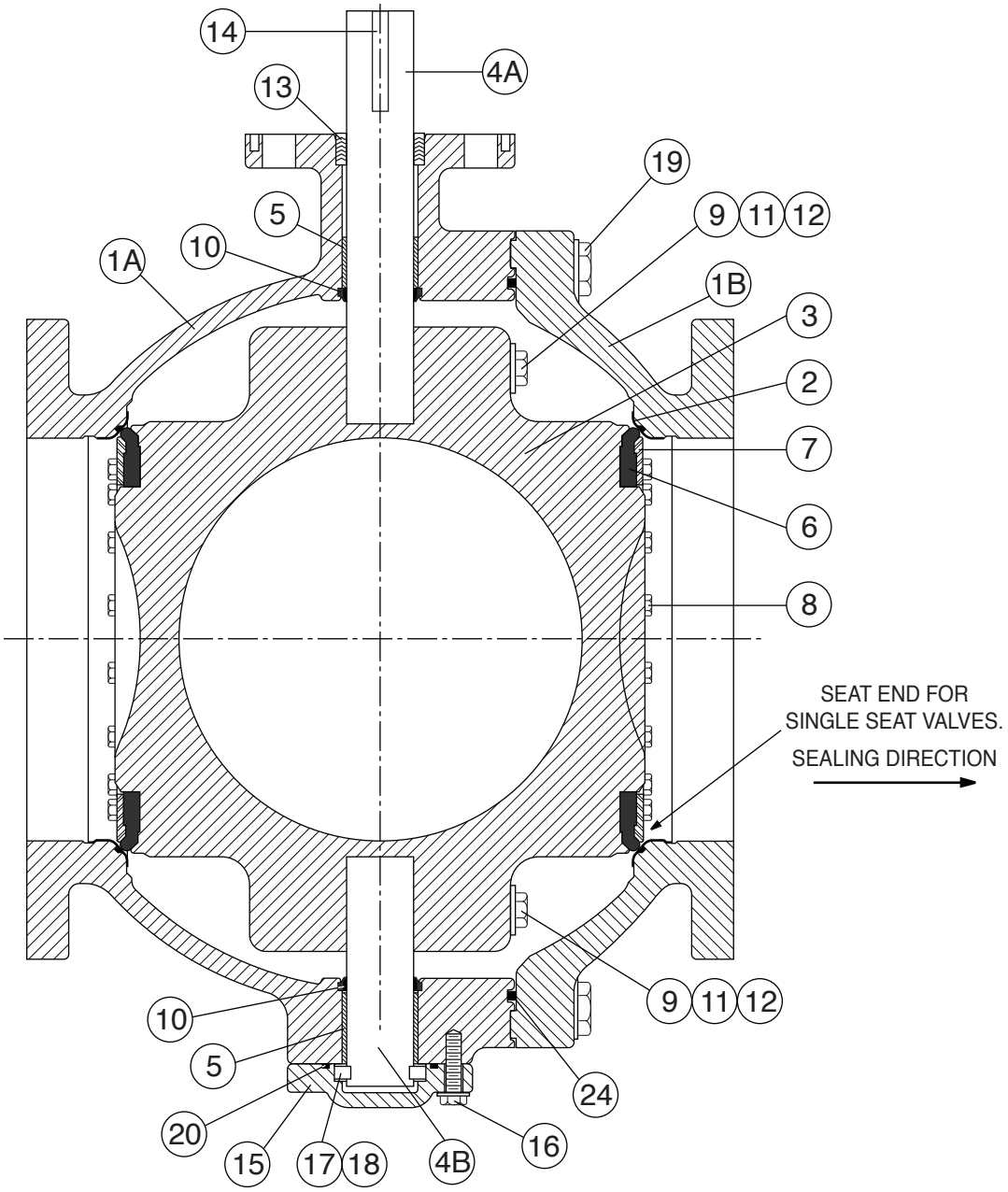
Revised 3-13-12

AWWA FLANGED BALL VALVE WITH HANDWHEEL ACTUATOR

DATE 5-6-11

VAL-MATIC VALVE AND MANUFACTURING CORP.

DRWG. NO. VMC-4104/LSA



1. VALVES CONFORM TO AWWA STANDARD C-507, LATEST EDITION.
2. SEE DRAWING VM-4104-M FOR STANDARD MATERIALS OF CONSTRUCTION.

Revised 4-26-12

4" - 48" AWWA FLANGED BALL VALVE CONSTRUCTION	DATE 5-6-11
VAL-MATIC® VALVE AND MANUFACTURING CORP.	DRWG. NO. VM-4104

BALL VALVE

4”- 48” AWWA CLASS 150 AND 300 SERIES 4000

STANDARD MATERIALS OF CONSTRUCTION

PART NO.	PART NAME	MATERIAL
1A, 1B	~~BODY (CLASS 150)~~ BODY (CLASS 300)	~~CAST IRON ASTM A126, CLASS B~~ DUCTILE IRON ASTM A536, GRADE 65-45-12
2	BODY SEAT	STAINLESS STEEL ASTM A240, T316
3	~~BALL (CLASS 150)~~ BALL (CLASS 300)	~~CAST IRON ASTM A126, CLASS B~~ DUCTILE IRON ASTM A536, GRADE 65-45-12
4A, 4B	~~SHAFT (CLASS 150)~~ SHAFT (CLASS 300)	~~STAINLESS STEEL ASTM A276, T304 OR~~ STAINLESS STEEL ASTM A564, T630
5	SLEEVE BEARING	TEFLON-LINED, FIBERGLASS BACKED
6	RESILIENT SEAT	BUNA N
7	SEAT RETAINING RING	STAINLESS STEEL ASTM A743, GRADE CF8M
8	NYLOK® CAP SCREWS	STAINLESS STEEL ASTM F593, T316
9	TAPER PIN	STAINLESS STEEL ASTM A582, T416
10	GRIT SEAL	MOLYTHANE
11	TAPER PIN NUT	STAINLESS STEEL ASTM F593, T316
12	TAPER PIN WASHER	STAINLESS STEEL ASTM A276, T316
13	PACKING, V-TYPE	BUNA-N
14	KEY	CARBON STEEL
15	THRUST BEARING CAP	CAST IRON ASTM A126, CLASS B
16	CAP SCREWS	Stainless Steel
17	THRUST BEARING SHIMS	BRASS
18	THRUST BEARING	BRONZE ASTM B763, ALLOY C99500
19	BODY BOLTS	Stainless Steel
20	CAP O-RING	RESILIENT, ASTM D2000
24	BODY O-RING	RESILIENT, ASTM D2000

NYLOK IS A REGISTERED TRADE MARK OF THE NYLOK FASTENER CORPORATION.

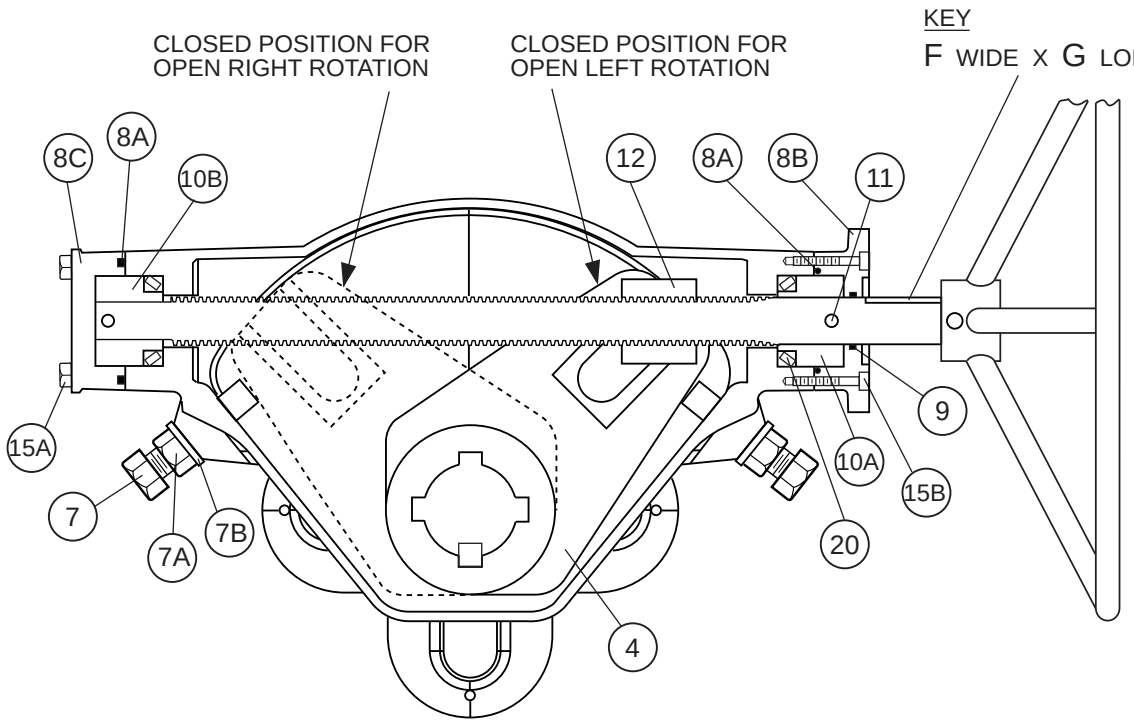
NOTE: ALL SPECIFICATIONS AS LAST REVISED.

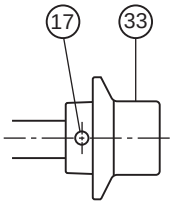
MATERIALS OF CONSTRUCTION

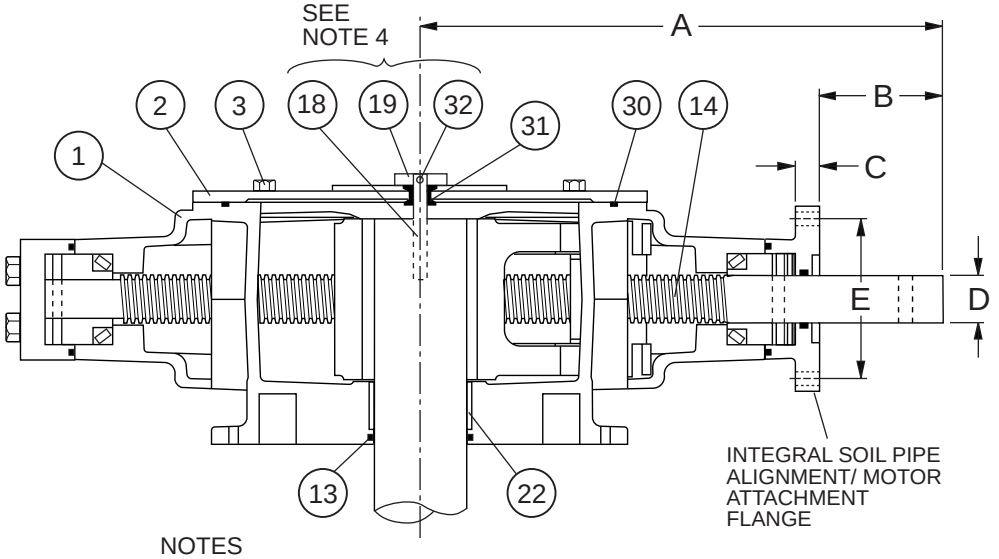
DATE 5/6/11

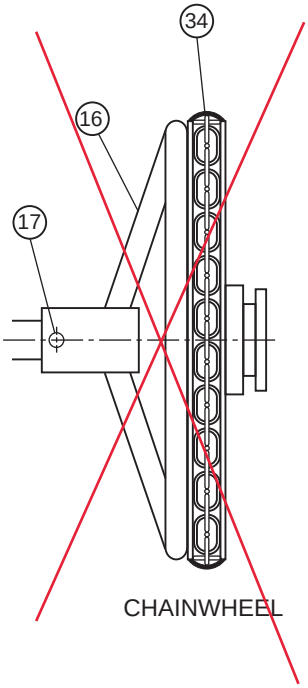
VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. VM-4104-M









NOTES

1. THE DIRECTION OF OPENING MAY BE REVERSED BY PULLING KEY WITH THE VALVE IN THE CLOSED POSITION, CYCLING ACTUATOR 90˚, AND THEN REINSERTING KEY AS SHOWN BY DOTTED LINES.
2. ACTUATOR MEETS AWWA C504, AND AWWA C507 LATEST REVISION.
3. SEE DRAWING NO. VM-LS1A-M FOR STANDARD MATERIALS OF CONSTRUCTION.
4. FOR BURIED OR SUBMERGED SERVICE, UNIT PACKED WITH GREASE, NO INDICATION.

DIMENSION, INCHES							
ACTUATOR SIZE	A	B	C	D	E	F	G
LS-1A	6.89	2.52	0.63	1.00	4.00	0.25	2.00
LS-2A	7.71	2.52	0.63	1.00	4.00	0.25	2.00
LS-3A	11.06	3.25	0.63	1.25	4.00	0.25	2.75
LS-4A	12.81	3.25	0.63	1.25	4.00	0.25	2.75

Revised 4-19-11

TRAVELING NUT ACTUATOR

DATE 8-22-08

VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. VM-LS1A

TRAVELING NUT ACTUATOR

SIZES LS-1A THROUGH LS-4A

PART NO.	PART NAME	MATERIAL
1	HOUSING	DUCTILE IRON ASTM A536, GRADE 65-45-12
2	HOUSING COVER	DUCTILE IRON ASTM A536, GRADE 65-45-12
3	COVER BOLTS	STAINLESS STEEL T316
4	LEVER	DUCTILE IRON ASTM A536, GRADE 65-45-12
7	STOP BOLT	PLATED STEEL
7A	LOCK NUT	PLATED STEEL
7B	STOP BOLT THREAD SEAL	PLATED STEEL WITH BUNA-N
8A	END CAP O-RING	BUNA-N
8B	END CAP (FOR SOIL PIPE ALIGNMENT OR MOTOR ATTACHMENT)	DUCTILE IRON ASTM A536, GRADE 65-45-12
8C	END CAP (BLIND END)	DUCTILE IRON ASTM A536, GRADE 65-45-12
9	STEM O-RING	BUNA-N
10A	STEM COLLAR (INPUT END)	ALUMINUM BRONZE (SIZES LS-1A & LS-2A) ~~CARBON STEEL (SIZES LS-3A thru LS-4A)~~
10B	STEM COLLAR (BLIND END)	ALUMINUM BRONZE (SIZES LS-1A & LS-2A) ~~CARBON STEEL (SIZES LS-3A thru LS-4A)~~
11	COLLAR PIN	ALLOY STEEL
12	CROSSHEAD	ALUMINUM BRONZE
13	SHAFT O-RING	BUNA-N
14	STEM	HIGH TENSILE STEEL (NICKEL PLATED EXPOSED END)
15A	END CAP HEX HD. BOLTS	STAINLESS STEEL T316
15B	END CAP SOCKET HD. BOLTS	STAINLESS STEEL T316
16	HANDWHEEL (OPTIONAL)	STEEL
17	PIN	STAINLESS STEEL T316
18	DOWEL PIN (NOTE 2)	PLATED STEEL ASTM A307
19	INDICATOR (NOTE 2)	CAST IRON ASTM A126, CLASS B
20	TAPERED ROLLER BEARING	HARDENED ALLOY STEEL (SEE NOTE 1)
22	SHAFT BEARING	TEFLON / FIBERGLASS BACKED
30	COVER O-RING	BUNA-N
31	GROMMET	BUNA-N
32	SET SCREW (NOTE 2)	STEEL
33	OPERATING NUT (OPTIONAL FOR ABOVE GROUND SERVICE, STANDARD FOR BURIED SERVICE)	CAST IRON ASTM A126, CLASS B
~~34~~	~~CHAINWHEEL KIT (OPTIONAL)~~	~~DUCTILE IRON~~

NOTES:

1. FOR SIZES LS-3A & LS-4A, TAPERED ROLLER BEARINGS (PART NO. 20) ARE USED ON INBOARD SIDE OF EACH STEM COLLAR.
2. NOT FURNISHED FOR BURIED/SUBMERGED SERVICE.

NOTE: ALL SPECIFICATIONS AS LAST REVISED.

Revised 7-10-17

MATERIALS OF CONSTRUCTION

DATE 8/22/08

VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. VM-LS1A-M

FUSION BONDED EPOXY (FBE) COATING

General Description:

Fusion Bonded Epoxy is a one-part, heat cured, thermosetting epoxy coating that is applied as a dry powder to the sandblasted surface of a pre-heated valve and then fused and cured in a high-temperature oven. The result is a durable coating with exceptional abrasion and chemical resistance ideally suited for valves in water and wastewater applications.

Advantages of FBE:

1. The coating is applied in accordance with AWWA Standard C550 “Protective Epoxy Coatings for Valves and Hydrants” and certified by to the requirements of ANSI/ NSF Standard 61 - “Drinking Water System Components - Health Effects” for coating valves and fittings.
2. FBE coatings are applied in an automated one-part process so that the mixing, surface preparation, and multiple-coat problems associated with liquid paints are eliminated.
3. The electrostatic application process for FBE provides a smooth, even coating thickness with no runs, sags, or thin spots common with applying liquid paints.
4. FBE coatings are durable and provide twice the impact strength of liquid epoxies. The surface provides high abrasion resistance and has become a standard seating material for resilient gate and check valves.
5. FBE has a long-term performance history in water and sewage environments including salt water, slurries, methane and hydrogen sulfide exposure.

Application Process:

1. FBE is applied in an automated manufacturing process in accordance with the coating manufacturers’ procedures and industry standards to assure consistency and high quality.
2. The valve is cleaned, sandblasted, and preheated in an oven.
3. An electrical charge is applied to the body and the powder is deposited over the surfaces of the valve to the specified thickness.
4. The epoxy is post cured in an oven to cure specifications and allowed to air cool to room temperature.
5. The final surface is visually and electrically (when specified) tested to verify thickness and that it is holiday free.

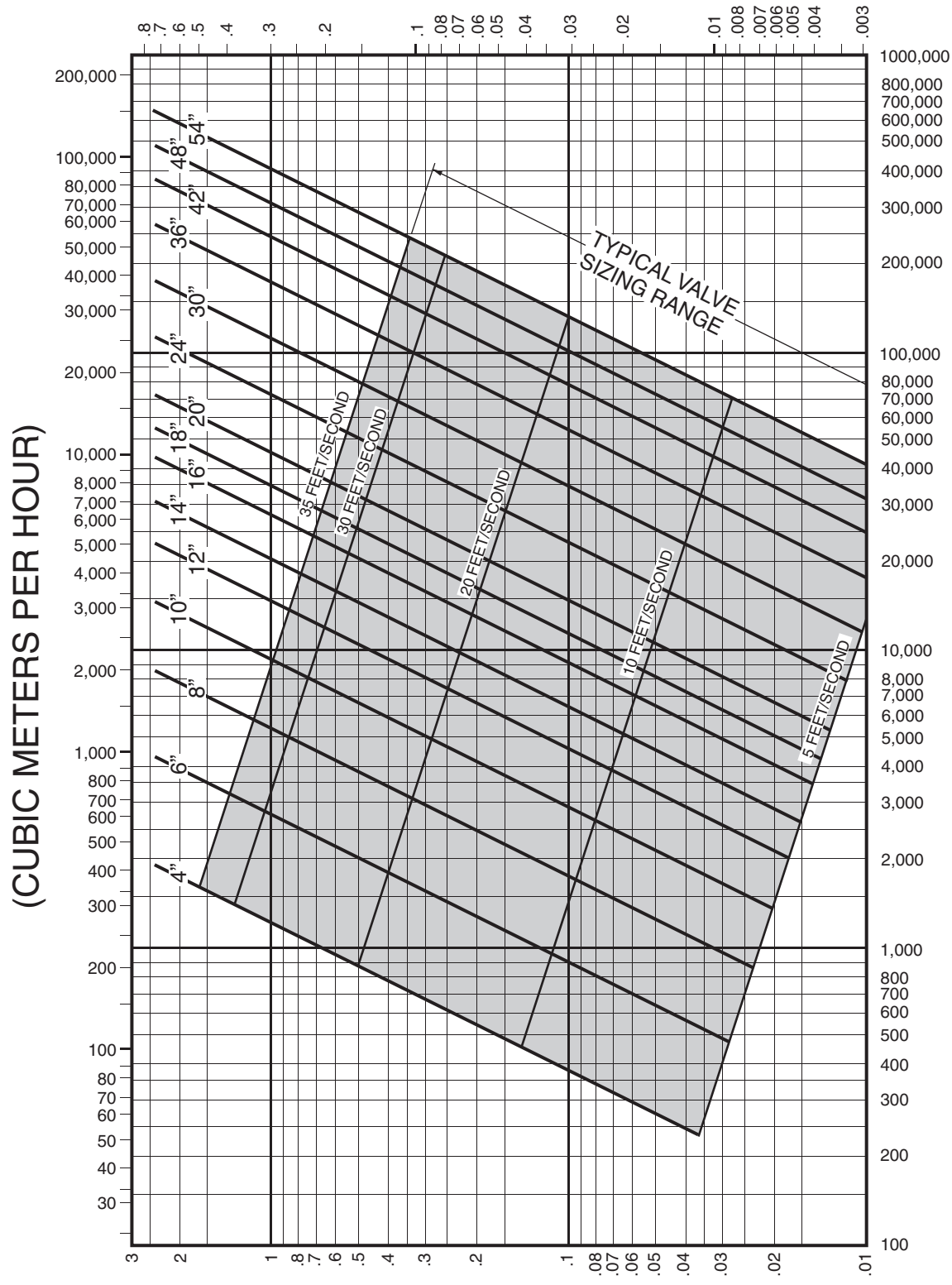
Typical Performance Characteristics:

1.	Color:	Blue	
2.	Thickness	12-20 mils	1 Coat
3.	Gloss at 60 deg:	60-80 units	Din 67 530
4.	Impact Resistance	>5 Joule (44 in-lb)	Din 30 677-2
5.	Elongation:	>5%	Din 30 671
6.	Hardness:	>100	Din 53 153
7.	Water Immersion:	No visible change	90C, 672 Hours
8.	Salt Spray Test:	>3000 hours	Din 53167
9.	Adhesion:	16 Mpa (2320 psi)	7 days, 90C EN 24 624

Revised 2-15-17

FUSION BONDED EPOXY (FBE) COATING	DATE 7-17-02
VAL-MATIC® VALVE AND MANUFACTURING CORP.	DRWG. NO. SS-1847

(METERS OF WATER)



(CUBIC METERS PER HOUR)

FLOW OF WATER IN GALLONS PER MINUTE

SIZE	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
Cv	1,910	4,310	8,520	14,700	22,800	30,500	42,700	56,100	70,500	106,000	172,000	257,000	369,000	480,000	620,000

HEAD LOSS IN FEET OF WATER

Revised 8-19-16

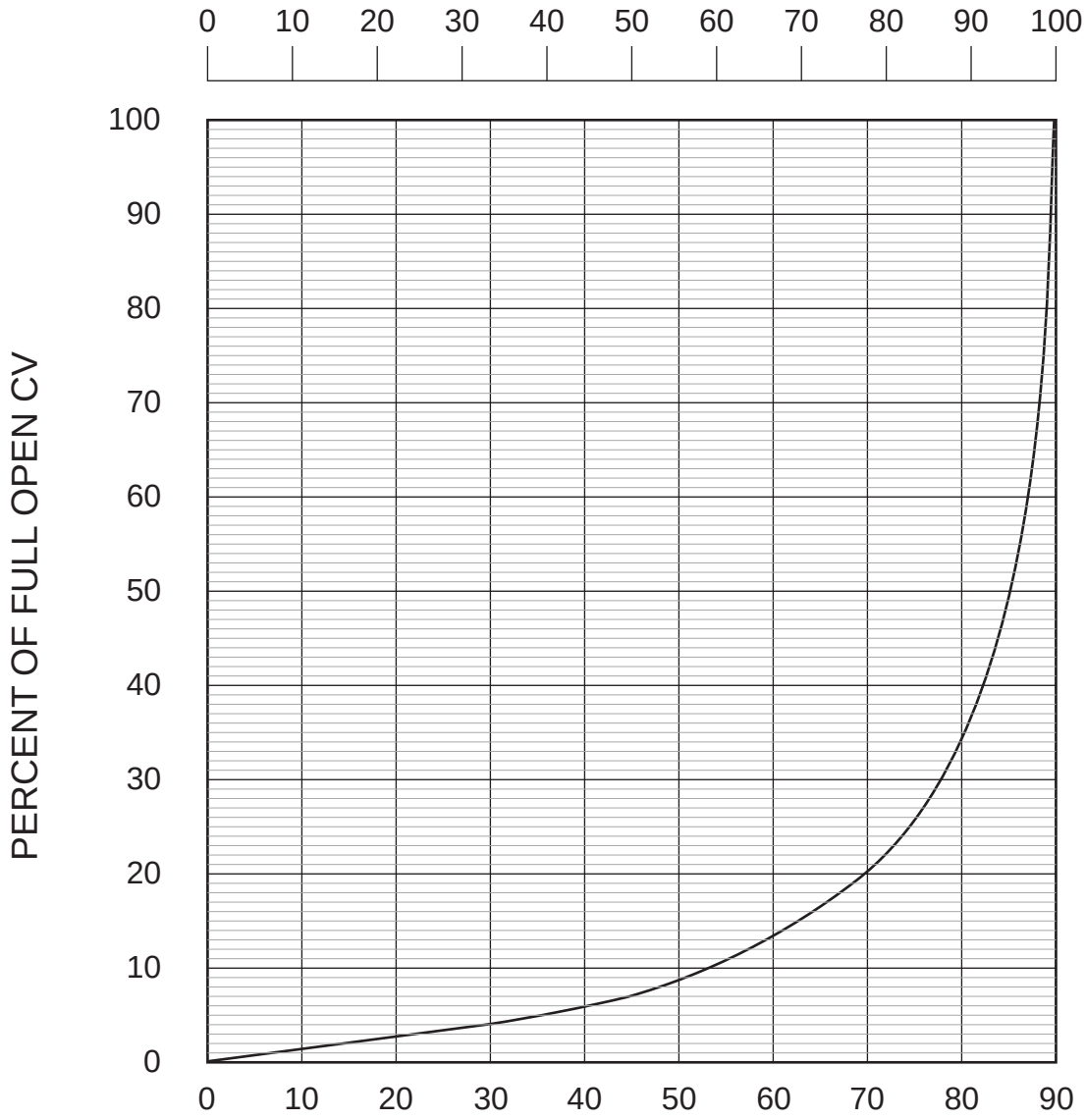
HEAD LOSS CHART FOR CLASS 150 AND 300 BALL VALVE

DATE 4-23-08

VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. SS-2285

BALL POSITION (PERCENT OPEN)



BALL POSITION (DEGREES FROM CLOSED POSITION)

THE ABOVE GRAPH IS BASED ON INDEPENDENT LABORATORY TEST DATA.

FLOW CHARACTERISTICS OF SERIES 4000 BALL VALVES	DATE 6-17-08
VAL-MATIC® VALVE AND MANUFACTURING CORP.	DRWG. NO. SS-2298

DJ400 DISMANTLING JOINT 3" - 12"
CLASS "F" FLANGE

SUBMITTAL INFORMATION

MATERIALS

FLANGED SPOOL
AWWA C207 Class F Steel Ring Flange, compatible with ANSI Class 250 & 300 bolt circles. Pipe is standard weight class per ASTM A53.

END RING AND BODY
The end ring and body are made from ASTM A536 65-45-12 Ductile Iron.

GASKETS
Compounded for water and sewer service meeting the requirements of ASTM D 2000. Other compounds available on request.

Bolts and Nuts ASTM A588 HSLA bolt material. Stainless Steel, Types 304 or 316 is optional.

TIE RODS
High tensile steel per ASTM A193 grade B7. Stainless steel, type 304 or 316 is optional.

COATINGS
Fusion bonded epoxy, NSF 61 certified. All surfaces are coated, including flange faces.

PRESSURE

When properly installed on a pipe that is within the coupling manufacturer's tolerances, Romac style DJ400 can work at pressures up to the maximum rating of the flange. AWWA C207 Class F flanges are rated for 300 psi working pressure.

ASSEMBLY TOLERANCE

Two inch adjustment see catalog. For a different length, contact Romac Engineering.

SIZE

3" – 12", See drawing B2090-A for more detail.

STANDARD

The DJ400 meet the specifications set forth in AWWA C219 Standard

Document # 20-8-0029 1/17

This information is based on the best data available at the date printed above. Please check with Romac for any updates or changes.

ROMAC INDUSTRIES, INC.
www.romac.com
21919 20th Avenue SE • Suite 100 • Bothell, WA 98021
Phone (425) 951-6200 • 1-800-426-9341 • Fax (425) 951-6201

ROMAC INDUSTRIES, INC.
STYLE DJ400 DISMANTLING JOINT WITH TIE RODS
& ANSI B16.5 CLS 300 FLANGES
SUBMITTAL INFORMATION

MATERIALS	
Flanged Spool	3-12"- ANSI B16.5 Class 300 RF Flange compatible with ANSI/ASME Class 250 and 300 bolt circles. Pipe is Schedule 40 ASTM A53.
End Ring and Body	The end ring and body are made from ASTM A536 65-45-12 Ductile Iron.
Gasket and O-ring	Compounded for water and sewer service meeting the requirements of ASTM D 2000. Other compounds available on request.
Bolts and Nuts	ASTM A588 HSLA bolt material. Ten inch uses ductile iron through bolts per ASTM A536 with HSLA heavy hex nuts. Stainless Steel, Types 304 or 316 is optional.
Tie Rods	High tensile steel per ASTM A193 grade B7, nuts ASTM A 194 grade 2H. Stainless steel, type 304 (ASTM A193 GR B8) or 316 (ASTM A193 GR B8M) is optional.
Coatings	Fusion bonded epoxy, NSF 61 certified. All surfaces are coated, including flange faces.
PRESSURE	When properly installed the Romac style DJ400 can be designed to work at pressures up to the maximum rating of the flange. ANSI B16.5 CLS 300 are rated for 750 psi maximum.
ASSEMBLY TRAVEL	Two inches flange face to flange face.
SIZES	3" – 12"

Phone (425) 951 6200 • Toll Free 800 426 9341 • Fax (425) 951 6201 • www.romac.com

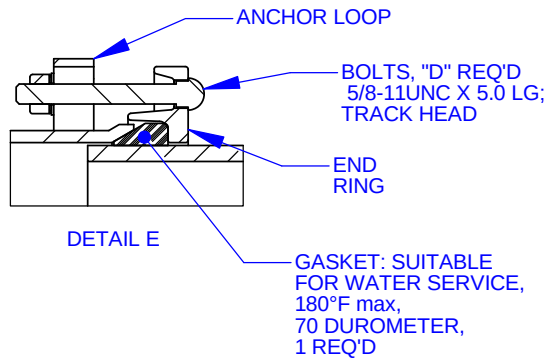
B2090-A

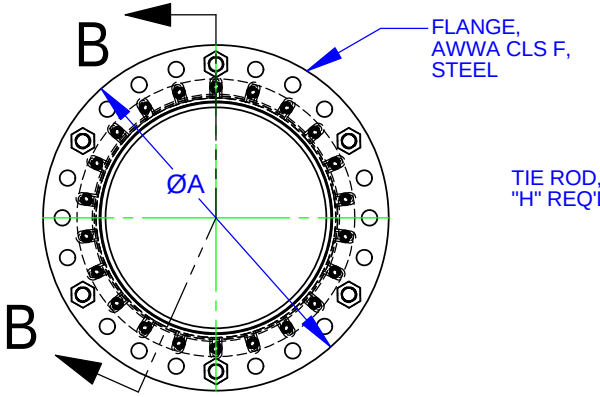
NOM SIZE	DIMENSIONS					END RING BOLTS	TIE RODS				SPOOL		APPROX WEIGHT
	FLANGE OD	FLANGE THK	C - LENGTH			QTY	SIZE (UNC)	LENGTH	STEEL QTY	SS QTY	OD	PIPE THK	
	A	B	NOM.	MIN.	MAX.	D	F	G	H		J	K	LBS
3 *	8.25	1.13	13.00	11.50	14.50	4	3/4 - 10	19.25	2	2	3.50	0.22	45
4	10.00	1.13	13.00	11.50	14.50	4	3/4 - 10	19.25	2	2	4.50	0.24	61
6	12.50	1.31	13.25	11.75	14.75	6	3/4 - 10	20.00	2	2	6.63	0.28	96
8	15.00	1.31	13.50	12.00	15.00	6	7/8 - 9	20.50	2	2	8.63	0.32	131
10	17.50	1.50	14.00	12.50	15.50	8	1- 8	21.50	2	2	10.75	0.37	183
12	20.50	1.63	14.50	13.00	16.00	8	1 1/8 - 7	22.75	2	4	12.75	0.38	267
14	23.00	1.94	15.50	14.00	17.00	8	1 1/8 - 7	24.25	2	4	14.00	0.25	351
16	25.50	2.14	16.00	14.50	17.50	10	1 1/4 - 7	25.75	2	4	16.00	0.25	449
18	28.00	2.25	16.25	14.75	17.75	10	1 1/4 - 7	25.75	2	4	18.00	0.25	533
20	30.50	2.33	16.50	15.00	18.00	12	1 1/4 - 7	26.25	4	4	20.00	0.25	632
24	36.00	2.69	17.25	15.75	18.75	14	1 1/2 - 6	28.25	4	4	24.00	0.25	954
28	40.75	3.13	19.00	17.50	20.50	16	1 3/4 - 5	31.50	4	4	28.00	0.25	1300
30	43.00	3.15	18.75	17.25	20.25	16	1 3/4 - 5	31.25	4	6	30.00	0.38	1537
36	50.00	3.46	19.75	18.25	21.25	18	2 - 4 1/2	33.25	4	6	36.00	0.38	2078
42	57.00	3.81	21.00	19.50	22.50	22	2 - 4 1/2	35.25	6	8	42.00	0.50	2939
48	65.00	4.50	22.50	21.00	24.00	24	2 - 4 1/2	38.00	6	10	48.00	0.50	4356

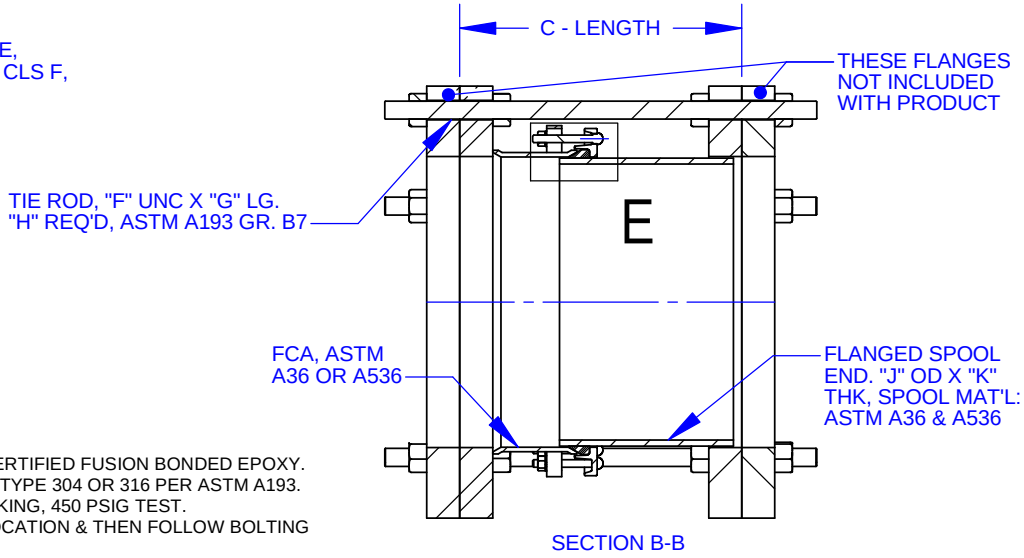
* 3" SIZE USES AN ANSI CLS 300 FLANGE WITH A FLAT FACE

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
0	INITIAL RELEASE	10/17/2002	NST III
1	ADDED 3" SIZE	11/15/2002	NST III
2	UPDATED APPROX WEIGHT 3"-48"	7/6/2009	PNN
3	ADDED 28" SIZE	10/21/2015	NST III







SECTION B-B

NOTES:
1. COATING: CUSTOMER SPECIFIED. ROMAC NSF 61 SHOPCOAT PAINT OR NSF 61 CERTIFIED FUSION BONDED EPOXY.
2. FASTENERS: CUSTOMER SPECIFIED. HSLA PER ASTM A588 OR STAINLESS STEEL TYPE 304 OR 316 PER ASTM A193.
3. PRESSURE RATED UP TO FLANGES PROVIDED. 4"-48" AWWA CLS F 300 PSIG WORKING, 450 PSIG TEST.
4. WHEN INSTALLING, POSITION THE FLANGED COUPLING END IN THE REQUIRED LOCATION & THEN FOLLOW BOLTING INSTRUCTIONS.
5. NOT INTENDED TO PROVIDE LATERAL MOVEMENT IN PIPELINE.

PROPRIETARY NOTICE

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UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES

TOLERANCES ARE ON:
1 PL DECIMALS ± .060
2 PL DECIMALS ± .030
3 PL DECIMALS ± .010
ANGLES ± 1°
FRACTIONS ± 1/64

SIGNATURES

DRAWN

CHECKED

APPROVAL ORGANIZATIONS

ENGINEERING

ROMAC INDUSTRIES INC.,
BOTHELL, WA

TITLE

DISMANTLING JOINT DJ400 3"-48" AWWA CLS F

DWG. NO.	SIZE	REV. NO.	SCALE	SHEET
B2090-A	A	3	NTS	1 OF 1

DRAWING FILE NAME: B2090 DJ400 - 03 - 48 CLS F TRAD

MODEL NAME: dismantling joint ansi cls 300 flg

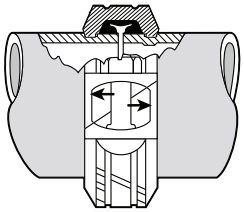
CONFIGURATION NAME:24" full assembly

AUTHOR: PETER NIELSEN

Zero-Flex® Rigid Coupling

STYLE 07

SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS



Exaggerated for clarity

The unique angle-pad design of the Zero-Flex® Style 07 coupling adjusts to standard pipe and roll or cut groove tolerances, positively clamping the pipe to resist flexural and torsional loads. The wider key section fills more of the groove area.

The Victaulic standard rigid coupling offering for grade "EHP" or "T" gaskets is the Style 107 installation-ready rigid coupling. For all available sizes, the Style 107 is the standard rigid coupling Victaulic supplies in North America for piping systems using Grade "EHP" or "T" gaskets. Contact Victaulic for further details.

Style 07 couplings are rated up to 750 psi/5175 kPa, dependant on size, for 1 – 12"/25 – 300 mm piping systems. Rigid couplings provide rigidity for valve connections, machinery rooms, fire mains, and long straight runs. Support and hanging requirements correspond to ASME B31.1 Power Piping Code, ASME B31.9 Building Services Code and NFPA 13 Sprinkler Systems. Angle-pad design permits assembly by removing one nut/bolt and scissoring housing over gasket. This reduces the number of components to handle during assembly, speeds and eases installation.

Performance data presented in this document is based on use with standard wall, carbon steel pipe. For use with stainless steel pipe, please reference document 17.09 for pressure ratings and end loads. When used on light wall stainless steel pipe, the Victaulic RX roll set must be used to roll groove the pipe. For further information regarding roll grooving stainless steel, refer to document 17.01.

For 14 – 24"/350 – 600 mm sizes Victaulic offers the Advanced Groove System (AGS) line of products. Request publication 20.02 for information on the rigid W07 AGS coupling.

MATERIAL SPECIFICATIONS

Housing: Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

Housing Coating: Orange enamel.
- **Optional:** Hot dipped galvanized and others.

Coupling Gasket: (specify choice‡)

- **Grade "E" EPDM**
  EPDM (Green color code). Temperature range –30°F to +230°F/–34°C to +110°C. Recommended for cold and hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. UL classified in accordance with ANSI/NSF 61 for cold +86°F/+30°C and hot +180°F/+82°C potable water service. NOT RECOMMENDED FOR PETROLEUM SERVICES.

- **Grade "T" nitrile**
  Nitrile (Orange color code). Temperature range –20°F to +180°F/–29°C to +82°C. Recommended for petroleum products, air with oil vapors, vegetable and mineral oils within the specified temperature range. Not recommended for hot water services over +150°F/+66°C or for hot dry air over +140°F/+60°C.

‡ Services listed are General Service Recommendations only. It should be noted that there are services for which these gaskets are not recommended. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service recommendations and for a listing of services which are not recommended.

NOTE: Additional gasket styles are available. Contact Victaulic for details.

Bolts/Nuts: Heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.

JOB/OWNER
System No. _____
Location _____

CONTRACTOR
Submitted By _____
Date _____

ENGINEER
Spec Sect _____ Para _____
Approved _____
Date _____

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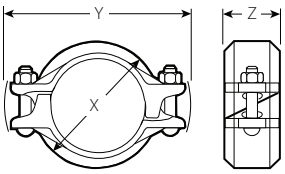
Zero-Flex® Rigid Coupling

STYLE 07

DIMENSIONS



TYPICAL 1 – 12"

Size		Max. Work Pressure *	Max. End Load *	Allow. Pipe End Sep. †	Bolt/Nut@ No – Size	Dimensions – Inches/mm			Approx. Wgt. Each
Nominal Size Inches mm	Actual Outside Diameter Inches mm	psi kPa	Lbs. N	Inches mm	Inches	X	Y	Z	Lbs. kg
1 25	1.315 33.7	750 5175	650 2890	0.05 1.2	2 – ⅜ x 2	2.36 60	4.22 107	1.84 47	1.6 0.7
1 ¼ 32	1.660 42.4	750 5175	1,620 7210	0.05 1.2	2 – ⅜ x 2	2.69 68	4.62 117	1.84 47	1.6 0.7
1 ½ 40	1.900 48.3	750 5175	2,130 9480	0.05 1.2	2 – ⅜ x 2	2.94 75	5.81 148	1.84 47	1.6 0.7
2 50	2.375 60.3	750 5175	3,320 14775	0.07 1.7	2 – ½ x 2 ½	3.35 85	5.78 147	1.84 47	2.3 1.0
2 ½ 65	2.875 73.0	750 5175	4,875 21695	0.07 1.7	2 – ½ x 2 ¾	3.88 98	6.38 162	1.84 47	2.6 1.2
76.1 mm	3.000 76.1	750 5175	5,300 23585	0.07 1.7	2 – 12 x 70.0	4.21 107	6.61 168	1.84 47	3.6 1.6
3 80	3.500 88.9	750 5175	7,215 32105	0.07 1.7	2 – ½ x 2 ½	4.54 115	6.81 173	1.84 47	3.0 1.4
4 100	4.500 114.3	750 5175	11,925 53065	0.16 4.1	2 – ½ x 2 ¾	5.81 148	8.21 209	2.07 53	5.3 2.4
108.0 mm	4.250 108.0	750 5175	10,635 47325	0.16 4.1	2 – 12 x 70.0	5.56 141	7.98 203	2.07 53	5.2 2.4
5 125	5.563 141.3	750 5175	18,225 81100	0.16 4.1	2 – ⅝ x 3 ¼	7.03 179	9.89 251	2.07 53	7.4 3.4
133.0 mm	5.250 133.0	700 4825	15,145 67395	0.16 4.1	2 – 16 x 82.5	6.69 170	9.60 244	2.07 53	7.4 3.4
139.7 mm	5.500 139.7	700 4825	16,625 73980	0.16 4.1	2 – 16 x 82.5	6.94 176	9.82 249	2.07 53	7.6 3.4
6 150	6.625 168.3	700 4825	24,130 107380	0.16 4.1	2 – ⅝ x 3 ¼	8.26 210	10.83 275	2.07 53	8.3 3.8
159.0 mm	6.250 159.0	700 4825	21,465 95520	0.16 4.1	2 – 16 x 82.5	7.84 199	10.54 268	2.07 53	9.2 4.2
165.1 mm	6.500 165.1	700 4825	23,225 103305	0.16 4.1	2 – ⅝ x 3 ¼	8.13 207	10.84 275	2.07 53	8.3 3.8
8 § 200	8.625 219.1	600 4130	35,000 155750	0.19 4.8	2 – ¾ x 4 ¼	10.54 268	13.74 349	2.51 64	15.1 6.8
10 § 250	10.750 273.0	500 3450	45,400 202030	0.13 3.3	2 – ⅞ x 6 ½	12.86 327	16.98 431	2.56 65	23.5 10.7
12 § 300	12.750 323.9	400 2750	51,000 226950	0.13 3.3	2 – ⅞ x 6 ½	14.86 377	18.88 480	2.56 65	28.2 12.8
14 – 24 350 – 600	AGS™	**For 14 – 24"/350 – 600 mm sizes Victaulic offers the Advanced Groove System (AGS) line of products. Request publication 20.02 for information on the rigid W07 AGS coupling.**							

§ Couplings 8, 10, 12"/200, 250, 300 mm sizes available to JIS standard. Refer to section 06.17 for details.

* Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard **roll** or **cut** grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe.

WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1½ times the figures shown.

† For field installation only on roll grooved pipe or cut grooved pipe. Zero-Flex Style 07 couplings are essentially rigid and do not permit expansion/contraction.

@ Number of bolts required equals number of housing segments.

Metric thread size bolts are available (color coded gold) for all coupling sizes upon request. Contact Victaulic for details.

Style 07 couplings must **not** be used to join PVC pipe.

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Zero-Flex® Rigid Coupling

STYLE 07

INSTALLATION

Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

NOTE

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

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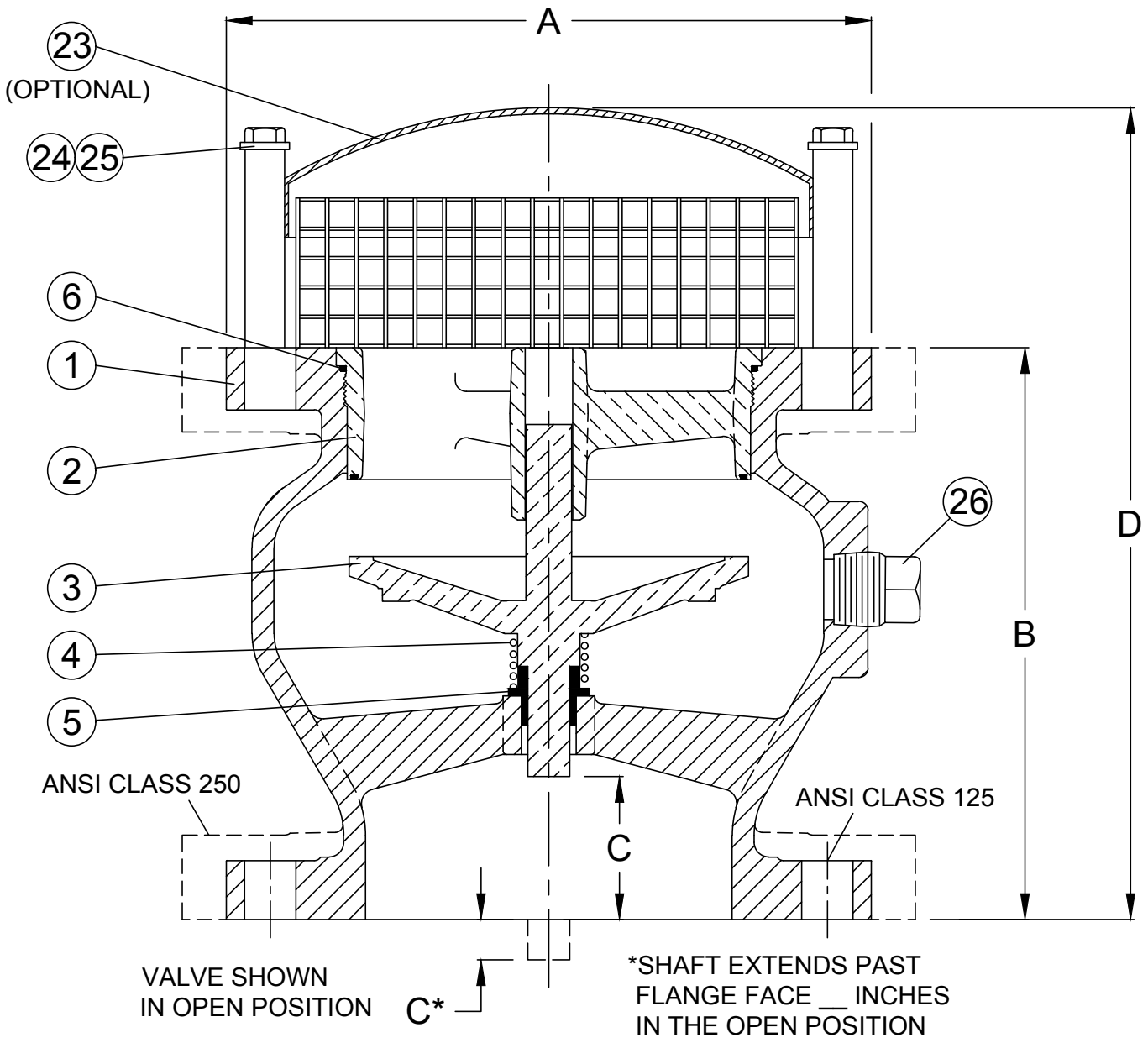


SEE DRAWING NO. VM-1800AVB.1-M FOR STANDARD MATERIALS OF CONSTRUCTION.

PART NO.	NAME
1.	BODY
2.	SEAT W/BUNA-N
3.	DISC
4.	SPRING
5.	BUSHING
6.	O-RING
23.	HOOD ASSEMBLY
24.	HOOD RETAINING SCREWS
25.	HOOD WASHER
26.	½" PLUG (2"-2.5") 1" PLUG (3"+)

DIMENSIONS, INCHES									
VALVE SIZE	MODEL NO. 125 # CLASS (CWP)		250 # CLASS (CWP)		A (125#)	A (250#)	B	C	D
2	~~1802AVB.1~~	~~200~~	1852AVB.1	400	7.00	7.50	5.50	1.00	8.82
2.5	1825AVB.1	200	1875AVB.1	400	7.00	7.50	5.50	1.00	8.82
3	1803AVB.1	200	1853AVB.1	400	7.50	8.25	6.00	1.38	9.80
4	1804AVB.1	200	1854AVB.1	400	9.00	10.00	7.25	1.75	10.5
5	1805AVB.1	200	1855AVB.1	400	10.00	11.00	8.50	2.00	11.8
6	1806AVB.1	200	1856AVB.1	400	11.00	12.50	9.75	2.50	13.8
8	1808AVB.1	200	1858AVB.1	400	13.50	15.00	12.5	3.25	17.4
10	1810AVB.1	200	1860AVB.1	400	16.00	17.50	15.5	4.25	20.4
12	1812AVB.1	200	1862AVB.1	400	19.00	20.50	14.3	-0.63	20.8

REV 2-7-17

FLANGED VACUUM BREAKER

DATE 9-23-16

VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. VMC-1800AVB

VACUUM BREAKER

2” - 10” SERIES NO. 1800AVB.1 ANSI CLASS 125 & 250 (LEAD FREE)

STANDARD MATERIALS OF CONSTRUCTION

PART NO.	PART NAME	MATERIAL
1	BODY	CAST IRON ASTM A126, CLASS B
2	SEAT	SILICON BRONZE ASTM B584, C87600 WITH BUNA-N SEAL
3	DISC	SILICON BRONZE ASTM B584, C87600
4	SPRING	STAINLESS STEEL T316, ASTM A313
5	BUSHING	ALUMINUM BRONZE ASTM B505, C95400
6	O-RING	EPDM (NSF61 AND WRAS APPROVED)
23	HOOD ASSEMBLY (OPTIONAL)	STEEL #1020
24	HOOD RETAINING SCREWS (OPT.)	STEEL GRADE 2-ZINC PLATED
25	HOOD WASHER (OPTIONAL)	STEEL-ZINC PLATED
26	PLUG	STEEL

NOTE: ALL SPECIFICATIONS AS LAST REVISED.

MATERIALS OF CONSTRUCTION

DATE 10/12/16

VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. VM-1800AVB.1-M

FUSION BONDED EPOXY (FBE) COATING

General Description:

Fusion Bonded Epoxy is a one-part, heat cured, thermosetting epoxy coating that is applied as a dry powder to the sandblasted surface of a pre-heated valve and then fused and cured in a high-temperature oven. The result is a durable coating with exceptional abrasion and chemical resistance ideally suited for valves in water and wastewater applications.

Advantages of FBE:

1. The coating is applied in accordance with AWWA Standard C550 “Protective Epoxy Coatings for Valves and Hydrants” and certified by to the requirements of ANSI/ NSF Standard 61 - “Drinking Water System Components - Health Effects” for coating valves and fittings.
2. FBE coatings are applied in an automated one-part process so that the mixing, surface preparation, and multiple-coat problems associated with liquid paints are eliminated.
3. The electrostatic application process for FBE provides a smooth, even coating thickness with no runs, sags, or thin spots common with applying liquid paints.
4. FBE coatings are durable and provide twice the impact strength of liquid epoxies. The surface provides high abrasion resistance and has become a standard seating material for resilient gate and check valves.
5. FBE has a long-term performance history in water and sewage environments including salt water, slurries, methane and hydrogen sulfide exposure.

Application Process:

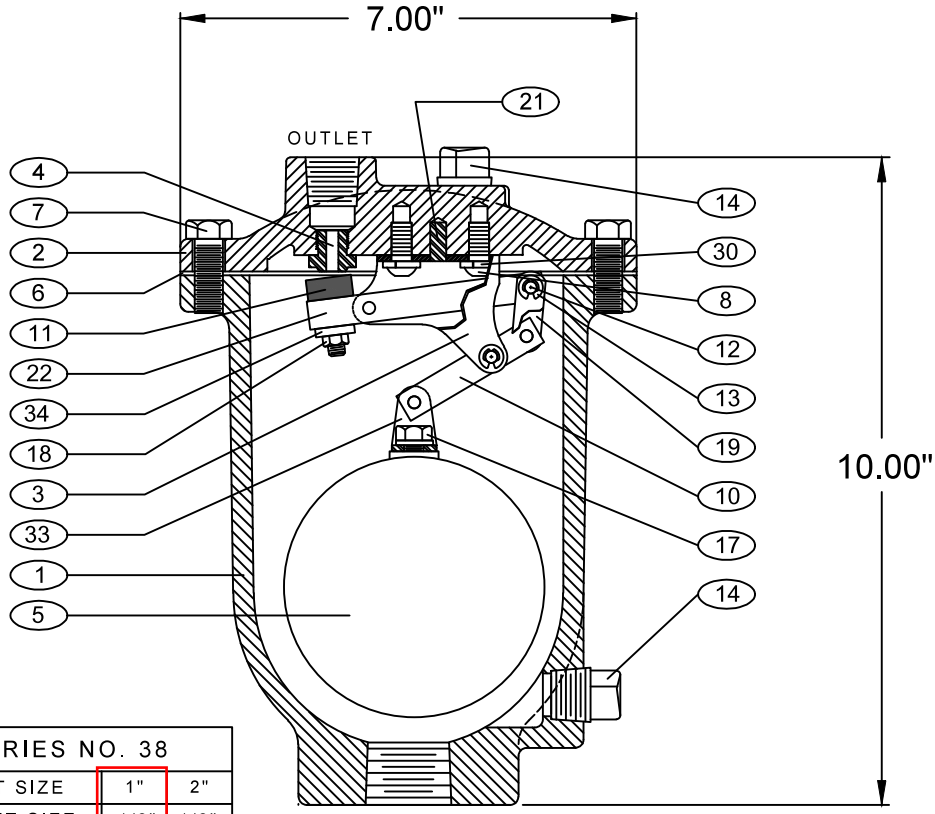
1. FBE is applied in an automated manufacturing process in accordance with the coating manufacturers’ procedures and industry standards to assure consistency and high quality.
2. The valve is cleaned, sandblasted, and preheated in an oven.
3. An electrical charge is applied to the body and the powder is deposited over the surfaces of the valve to the specified thickness.
4. The epoxy is post cured in an oven to cure specifications and allowed to air cool to room temperature.
5. The final surface is visually and electrically (when specified) tested to verify thickness and that it is holiday free.

Typical Performance Characteristics:

1.	Color:	Blue	
2.	Thickness	12-20 mils	1 Coat
3.	Gloss at 60 deg:	60-80 units	Din 67 530
4.	Impact Resistance	>5 Joule (44 in-lb)	Din 30 677-2
5.	Elongation:	>5%	Din 30 671
6.	Hardness:	>100	Din 53 153
7.	Water Immersion:	No visible change	90C, 672 Hours
8.	Salt Spray Test:	>3000 hours	Din 53167
9.	Adhesion:	16 Mpa (2320 psi)	7 days, 90C EN 24 624

Revised 2-15-17

FUSION BONDED EPOXY (FBE) COATING	DATE 7-17-02
VAL-MATIC® VALVE AND MANUFACTURING CORP.	DRWG. NO. SS-1847



SERIES NO. 38				
INLET SIZE			1"	2"
OUTLET SIZE			1/2"	1/2"
WORKING PRESSURE	150 PSI CWP	MODEL NO.	38	38.2
		ORIFICE SIZE	3/16"	3/16"
	300 PSI CWP	MODEL NO.	38.5	38.6
		ORIFICE SIZE	5/32"	5/32"
	500 PSI CWP	MODEL NO.	38HP	38HP.2
		ORIFICE SIZE	1/8"	1/8"

SEE DRAWING NO. VM-38-M FOR STANDARD MATERIALS OF CONSTRUCTION
SEE DRAWING NO. VM-38DISV-M FOR SUPER VALVE MATERIALS OF CONSTRUCTION

CLASSIFIED C UL US
WATER QUALITY
NSF / ANSI 61
2LA8

1. BODY
2. COVER
3. LEVER FRAME
4. SEAT
5. FLOAT
6. GASKET
7. COVER BOLT
8. RETAINING SCREW
10. FLOAT ARM
11. ORIFICE BUTTON
12. PIVOT PIN
13. RETAINING RING
14. PIPE PLUG
17. FLOAT RETAINER
18. LOCK NUT
19. LINK
21. LOCATING PIN
22. ORIFICE BUTTON ARM
30. WASHER
33. CLEVIS
34. LOCK WASHER

Revised 8-19-14 (Rev 1)

AIR RELEASE VALVE

DATE 6-16-10

VAL-MATIC VALVE AND MANUFACTURING CORP.

DRWG. NO. VMC-38

AIR RELEASE VALVE

SERIES NO. 38

DI SUPER VALVE MATERIALS OF CONSTRUCTION

PART NO.	PART NAME	MATERIAL
1	BODY	DUCTILE IRON ASTM A536, GRADE 65-45-12
2	COVER	DUCTILE IRON ASTM A536, GRADE 65-45-12
3	LEVERAGE FRAME	STAINLESS STEEL T316, ASTM A240
4	SEAT	STAINLESS STEEL T316, ASTM A582
5	FLOAT	STAINLESS STEEL T316, ASTM A240
6	GASKET	COMPRESSED NON-ASBESTOS FIBER
7	COVER BOLT	STAINLESS STEEL T316, ASTM F593
8	RETAINING SCREW	STAINLESS STEEL T316, ASTM F879
10	FLOAT ARM	STAINLESS STEEL T316, ASTM A582
11	ORIFICE BUTTON	STAINLESS STEEL & EPDM
12	PIVOT PIN	STAINLESS STEEL T316, ASTM A276
13	RETAINING RING	STAINLESS STEEL PH 15-7 MO
14	PIPE PLUG	STAINLESS STEEL
17	FLOAT RETAINER	STAINLESS STEEL T316, ASTM F593
18	LOCK NUT	STAINLESS STEEL T316, ASTM F594
19	LINK	STAINLESS STEEL T316, ASTM A240
21	LOCATING PIN	STAINLESS STEEL T420
22	ORIFICE BUTTON ARM	STAINLESS STEEL T316, ASTM A582
30	WASHER	STAINLESS STEEL T316, ASTM A240
33	CLEVIS	STAINLESS STEEL T316, ASTM A240
34	LOCK WASHER	STAINLESS STEEL T316, ASTM A240

NOTE: ALL SPECIFICATIONS AS LAST REVISED.

FUSION BONDED EPOXY (FBE) COATING

General Description:

Fusion Bonded Epoxy is a one-part, heat cured, thermosetting epoxy coating that is applied as a dry powder to the sandblasted surface of a pre-heated valve and then fused and cured in a high-temperature oven. The result is a durable coating with exceptional abrasion and chemical resistance ideally suited for valves in water and wastewater applications.

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1. The coating is applied in accordance with AWWA Standard C550 “Protective Epoxy Coatings for Valves and Hydrants” and certified by to the requirements of ANSI/ NSF Standard 61 - “Drinking Water System Components - Health Effects” for coating valves and fittings.
2. FBE coatings are applied in an automated one-part process so that the mixing, surface preparation, and multiple-coat problems associated with liquid paints are eliminated.
3. The electrostatic application process for FBE provides a smooth, even coating thickness with no runs, sags, or thin spots common with applying liquid paints.
4. FBE coatings are durable and provide twice the impact strength of liquid epoxies. The surface provides high abrasion resistance and has become a standard seating material for resilient gate and check valves.
5. FBE has a long-term performance history in water and sewage environments including salt water, slurries, methane and hydrogen sulfide exposure.

Application Process:

1. FBE is applied in an automated manufacturing process in accordance with the coating manufacturers’ procedures and industry standards to assure consistency and high quality.
2. The valve is cleaned, sandblasted, and preheated in an oven.
3. An electrical charge is applied to the body and the powder is deposited over the surfaces of the valve to the specified thickness.
4. The epoxy is post cured in an oven to cure specifications and allowed to air cool to room temperature.
5. The final surface is visually and electrically (when specified) tested to verify thickness and that it is holiday free.

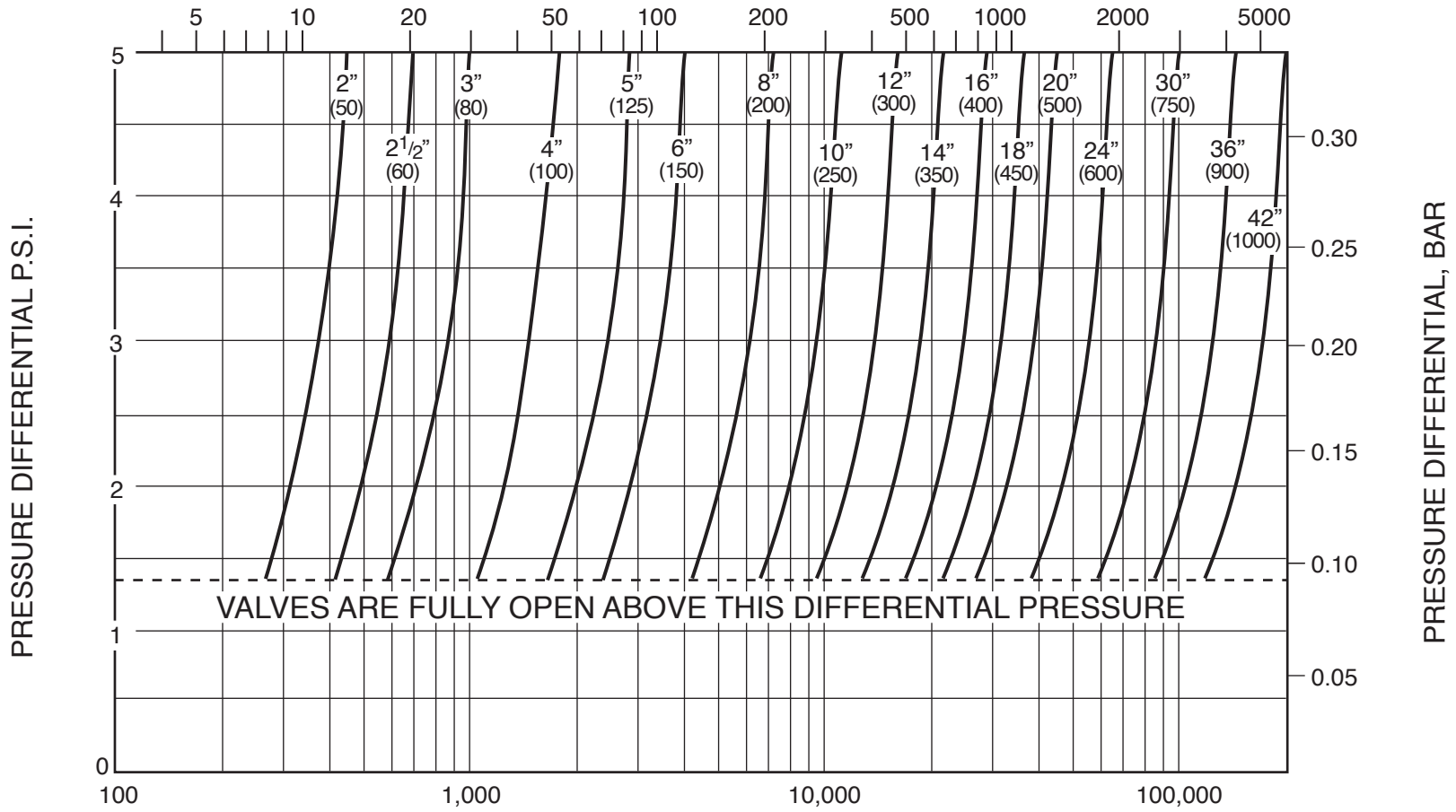
Typical Performance Characteristics:

1.	Color:	Blue	
2.	Thickness	12-20 mils	1 Coat
3.	Gloss at 60 deg:	60-80 units	Din 67 530
4.	Impact Resistance	>5 Joule (44 in-lb)	Din 30 677-2
5.	Elongation:	>5%	Din 30 671
6.	Hardness:	>100	Din 53 153
7.	Water Immersion:	No visible change	90C, 672 Hours
8.	Salt Spray Test:	>3000 hours	Din 53167
9.	Adhesion:	16 Mpa (2320 psi)	7 days, 90C EN 24 624

Revised 2-15-17

FUSION BONDED EPOXY (FBE) COATING	DATE 7-17-02
VAL-MATIC® VALVE AND MANUFACTURING CORP.	DRWG. NO. SS-1847

FLOW OF AIR IN STANDARD CUBIC METERS PER MINUTE



FLOW OF AIR IN S.C.F.M.
(STANDARD CUBIC FEET OF FREE AIR PER MINUTE)

Revised 3-4-13

VENTING CAPACITY FOR VACUUM BREAKERS, IN. (mm)	DATE 2-10-04
VAL-MATIC® VALVE AND MANUFACTURING CORP.	DRWG. NO. SS-1971

87A-900 SERIES

Stainless Steel ASME Class 300 Flanged Full Port Ball Valve - 1.5" through 2.5"

For **STANDARDS COMPLIANCE** and **STANDARD FEATURES** refer to page D-3.

5 YEAR WARRANTY

STANDARD MATERIAL LIST

	PART	MATERIAL
1	Body	ASTM A351 CF8M
2	Retainer	ASTM A351 CF8M
3	Ball	ASTM A276 Type 316 or A351 CF8M
4	Stem	ASTM A276 Type 316
5	Packing Gland	ASTM A276 Type 316
6	Stem Seals	PTFE
7	Seats	RPTFE
8	Gland Screws	ASTM A193 B8 Class 1
9	Gland Plate	316 SS
10	Stem Nut	18-8 SS
11	Lever	316 SS
12	Stem Bearing	RPTFE
13	Stop	ASTM A276 Type 316
14	Stop Screw	316 SS
15	Lock Plate	302 or 304 SS
16	Body Seal	RPTFE
17	Grounding Spring	SS
18	Body Joint Stud	ASTM A193 Grade B8M
19	Body Joint Nut	ASTM A194 Grade 8
20	Lockwasher	302 or 304 SS

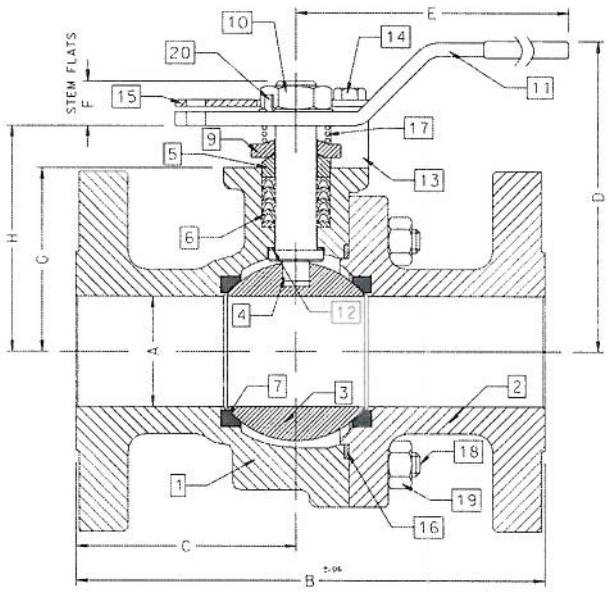
VARIATIONS AVAILABLE:

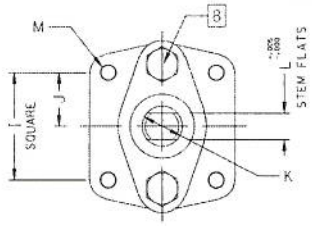
87H - Hastelloy
87M - Monel
87N - Nickel
87S - 304L SS

OPTIONS AVAILABLE: (More information in Section J)

- Minimum quantities apply
- To specify an option, replace the "01" standard suffix with the suffix of the option.
- To specify multiple options, replace the "01" suffix with the desired suffixes in the numerical order shown below. NOTE: Not all suffixes can be combined together.

(SUFFIX)	OPTION
-01	Standard Configuration
-04-	2.25" Stem Extension (Carbon Steel, Zinc Plated)
-14-	Side Vented Ball (Uni-Directional)
-21-	UHMWPE Seats
-24-	Graphite packing, spiral wound graphite body seal, RPTFE bearing (API 607, 6th edition, ISO 10497:2010)
-35-	PTFE Seats and Seals
-38-	PEEK Seats and Graphite Packing (3" Only)
-49-	No Lubrication. Assembled Dry.
-57-	Oxygen Cleaned
-65-	MPTFE Seats and Graphite Packing (Fire Safe)
-69-	Drilled and Tapped Purge Ports with Plugs
-70-	4" Extended Bonnet
-73-	316 SS Spiral Wound Gaskets w/PTFE Filler
-76-	Live Loaded (Lever)
-77-	Live Loaded (Gear, Actuator)
-80-	Multi-Seal (Super TFE)
-82-	Flat Face Flanges
-90-	Double Packed 4" Extended Bonnet
-9P-	Double Packed 4" Extended Bonnet with Monitoring Port
-EP-	Garlock EVSP Stem Packing w/Spiral Wound Graphite Gasket (Fire Safe by Design)
-KF-	PCTFE Stem Bearing
-MG-	Gear Operator with Standard Handwheel
-MH-	Gear Operator with Standard Handwheel & Locking Device
-MJ-	Gear Operator with Oversize Handwheel
-MK-	Gear Operator with Oversize Handwheel & Locking Device
-MP-	Positive Material Identification
-TC-	With Test Certificate
-TD-	Tested to API Spec 6D
-UL-	UL & CSA Listed (w/Markings)





ACTUATOR MOUNTING

FOR PRESSURE/TEMPERATURE RATINGS, REFER TO PAGE M-11, GRAPH NO. 6

PRODUCT NUMBER	SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	WT.
87A-907-01	1.5"	1.50	7.50	3.50	4.62	6.65	0.72	2.41	3.09	1.949	0.974	0.625	0.412	5/16-18	21
87A-908-01	2"	2.00	8.50	4.00	5.61	8.41	0.80	3.31	4.08	1.949	0.974	0.750	0.477	5/16-18	37
87A-909-01	2.5"	2.50	9.50	4.44	6.24	8.41	0.80	3.94	4.71	1.949	0.974	0.750	0.477	5/16-18	57

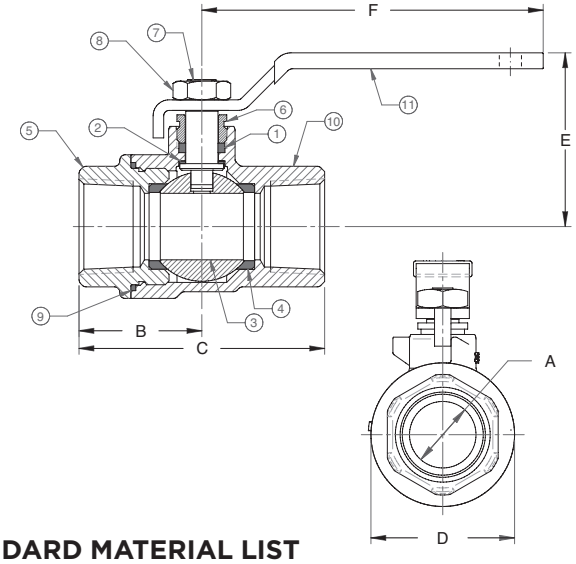
76F-100-A SERIES

STAINLESS STEEL FULL PORT BALL VALVE

Female NPT Thread, 1/4"-3" 1000 CWP (psig), Cold Non-Shock. (See referenced P/T chart)
150 psig Saturated Steam.
Vacuum Service to 29 inches Hg.
MSS SP-110 Compliant.
Designed, cast, machined, assembled, and 100% factory tested in USA.

FEATURES

- Investment cast components
- Reinforced seats
- Blowout-proof stem design
- Adjustable packing gland
- Stainless steel lever and nut



STANDARD MATERIAL LIST

	PART	MATERIAL
1	Stem packing	MPTFE
2	Stem bearing	RPTFE
3	Ball	A276-316SS (1/4" to 2", except 1.25") A276-316SS or A351-CF8M stainless (1.25") A351-CF8M stainless (3")
4	Seat (2)	RPTFE (2" & smaller); RTFM (3")
5	Retainer	ASTM A276-316SS (1/4" & 3/8") ASTM A351-CF8M stainless (1/2" to 3")
6	Gland	A276-316 Stainless Steel
7	Stem	A276-316 Stainless Steel
8	Lever nut	304 Stainless Steel
9	Body Seal	RPTFE (1/2" to 3")
10	Body	A351-CF8M
11	Lever and grip	SS w/vinyl

DIMENSIONS

PRODUCT NO.	SIZE	A	B	C	D	E	F	WT.
76F-101-01	1/4"	0.37	0.95	1.91	1.12	1.60	3.85	0.47
76F-102-01	3/8"	0.37	0.95	1.91	1.12	1.60	3.85	0.44
76F-103-01A	1/2"	0.50	1.21	2.35	1.27	1.73	3.85	0.57
76F-104-01A	3/4"	0.81	1.39	2.77	1.62	1.96	3.85	0.91
76F-105-01A	1"	1.00	1.67	3.34	2.00	2.27	4.75	1.38
76F-106-01A	1.25"	1.25	1.96	3.92	2.73	3.21	7.77	4.17
76F-107-01A	1.5"	1.50	2.05	4.10	2.92	3.31	7.77	4.69
76F-108-01A	2"	2.00	2.37	4.74	3.75	3.69	7.77	6.90
76F-100-01A	3"	3.00	3.70	7.40	5.68	5.23	10.00	22.40

- Fire safe to API 607 (requires -24 suffix)
- Meets NACE MR0175 (2000) & MR0103 (2012)
- CSA CGA 3.16-M88 (Requires "GS" suffix)
- NSF/ANSI 61 Section 8, Annex G (1/4" to 2")
- NSF/ANSI 372 - Drinking Water System Components - Lead Content

OPTIONS AVAILABLE

(MORE INFORMATION IN SECTION J)

- Minimum quantities apply
- To specify an option, replace the "01" standard suffix with the suffix of the option.
- To specify multiple options, replace the "01" suffix with the desired suffixes in the numerical order shown below. NOTE: Not all suffixes can be combined together.

(SUFFIX)	OPTION	SIZES
-01	Standard Configuration	All
-P -01-	BSPP (Parallel) Thread Connection	1/2" to 2"
-T -01-	BSPT (Tapered) Thread Connection	1/2" to 3"
-02-	Stem Grounded	1/2" to 3"
-04-	2.25" Stem Extension (Carbon Steel, Zinc Plated)	1/2" to 2"
-08-	90º Reversed Stem	1/2" to 2"
-11-	Therma-Seal™ Insulating Tee Handle	1/4" to 2"
-14-	Side Vented Ball (Uni-Directional)	3/8" to 3"
-24-	Graphite packing, PTFE body seal, RPTFE bearing (Fire Safe API 607, 6th edition, ISO 10497:2010)	1/2" to 3"
-27-	SS Latch-Lock Lever & Nut	3/8" to 3"
-30-	Cam-Lock and Grounded	1/2" to 2"
-32-	SS Tee Handle & Nut	1/2" to 2"
-35-	PTFE Trim	3"
-39-	SS Hi-Rise Locking Wheel Handle, SS Nut	1/2" to 2"
-40-	Cyl-Loc and Grounded	1/2" to 2"
-44-	Seal Welded	1/4" to 3"
-45-	Less Lever & Nut	1/2" to 3"
-46-	Latch Lock Lever - Lock in Closed Position Only	1/2" to 2"
-47-	SS Latch Lock Oval Handle	1/2" to 2"
-48-	SS Oval Handle (No Latch) & Nut	1/4" to 2"
-49-	No Lubrication. Assembled Dry.	1/2" to 3"
-50-	2.25" CS Locking Stem Extension	1/2" to 2"
-56-	Multifill Seats & Packing	1/2" to 3"
-57-	Oxygen Cleaned	1/4" to 3"
-60-	Static Grounded Ball & Stem	1/2" to 3"
-GS	CSA CGA 3.16 (RTFE Seat - All sizes)	All

Pressure/Temperature Ratings - Page M-12, Graph No. 8

**LEAD FREE: The wetted surfaces of this product shall contain no more than 0.25% lead by weighted average. Complies with Federal Public Law 111-380. ANSI 3rd party approved and listed.*

REV. 14FEB18

FLOW DATA

FLOW DATA

The listed C_v "factors" are derived from actual flow testing, at Apollo's Pageland, South Carolina factory. These tests were completed using standard "off the shelf" valves with no special preparation and utilizing standard schedule 40 pipe. It should be understood that these factors are for the valve only and also include the connection configuration. The flow testing is done utilizing water as a fluid media and is a direct statement of the gallons of water flowed per minute with a 1 psig pressure differential across the valve/connection unit. Line pressure is not a factor. Because the C_v is a factor, the formula can be used to estimate flow of most media for valve sizing.

FLOW OF LIQUID

$$Q = C_V \sqrt{\frac{\Delta P}{SpGr}}$$

$$\text{or } \Delta P = \frac{(Q)^2\,(SpGr)}{(C_v)^2}$$

WHERE:

- Q = Flow in US gpm
- ΔP = Pressure drop (psig)
- SpGr = Specific gravity at flowing temperature
- C_v = Valve constant

FLOW OF GAS

$$Q = 1360\ C_V \sqrt{\frac{(\Delta P)\,(P_2)}{(SpGr)\,(T)}}$$

$$\text{or } \Delta P = \frac{5.4 \times 10^{-7}\,(SpGr)\,(T)\,(Q)^2}{(Cv)^2\,(P_2)}$$

WHERE:

- Q = Flow in SCFH
- ΔP = Pressure drop (psig)
- SpGr = Specific gravity (based on air = 1.0)
- P2 = Outlet pressure–psia (psig + 14.7)
- T = (temp. °F + 460)
- C_v = Valve constant

CAUTION: The gas equation shown, is valid at very low pressure drop ratios. The gas equation is NOT valid when the ratio of pressure drop (ΔP) to inlet pressure (P1) exceeds 0.02.

NOTE: Only use the gas equation shown if (P1-P2)/P1 is less than 0.02.

CV FACTORS FOR APOLLO® VALVES (CONTINUED ON M-4)

VALVE	SIZE (IN.)														
	1/4	3/8	1/2	3/4	1	1.25	1.5	2	2.5	3	4	6	8	10	12
70B-140 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
70-100/200 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	---
70-300/400 Series	--	--	15	30	43	48	84	108	--	--	--	--	--	--	--
70-600 Series	2.3	4.5	5.4	12	14	21	34	47	--	--	--	--	--	--	--
70-800 Series	8.4	7.2	15	30	43	48	84	--	--	--	--	--	--	--	--
71-AR Series	--	--	--	30	43	48	84	108	190	370	--	--	--	--	--
71-100/200 Series	--	--	--	30	43	48	84	108	190	370	--	--	--	--	--
72-100/900 Series	--	--	26	48	65	125	170	216	--	--	--	--	--	--	--
72-1xx-A/72-9xx-A Series	--	--	26	48	65	125	170	245	--	--	--	--	--	--	--
73A-100 Series	8.4	7.2	15	30	43	48	84	108	--	--	--	--	--	--	--
73-300/400 Series	--	--	26	48	65	125	170	216	--	--	--	--	--	--	--
74-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
75-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
76-AR Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
76F-100 Series	8.1	15	15	51	68	125	177	389	--	--	--	--	--	--	--
76FJ-100 Series	8.1	15	15	51	68	125	177	389	--	--	--	--	--	--	--
76FK-100 Series	8.1	15	15	51	68	125	177	389	--	--	--	--	--	--	--
76-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	--	--	--	--	--
76-300/400 Series	--	--	26	48	65	125	170	216	--	--	--	--	--	--	--
76-600 Series	2.3	4.5	5.4	12	14	21	34	47	--	--	--	--	--	--	--
76J-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	--	--	--	--	--
76J-AR Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
76K-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	--	--	--	--	--
76K-AR Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
7K-100 Series	--	--	15	51	68	125	177	389	503	--	--	--	--	--	--
77-AR Series	8.1	15	15	51	68	--	177	389	--	--	--	--	--	--	--

REV. 21APR17

FLOW DATA
FOR APOLLO® BALL VALVES

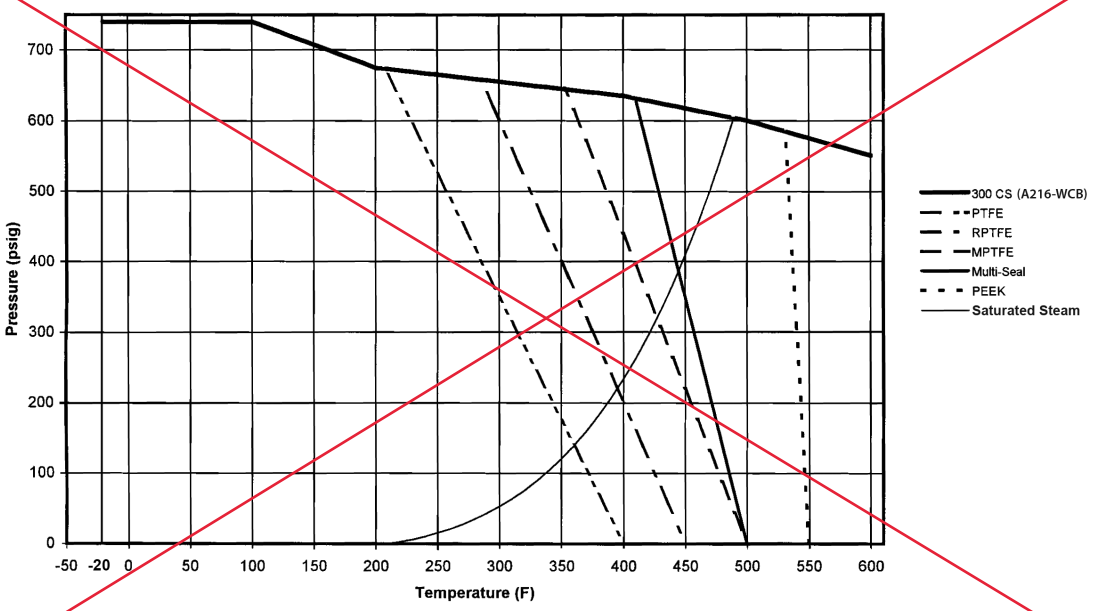
CV FACTORS FOR APOLLO® VALVES (CONTINUED FROM M-3)

VALVE	SIZE (IN.)														
	1/4	3/8	1/2	3/4	1	1.25	1.5	2	2.5	3	4	6	8	10	12
77C-100/200 Series	4.5	7.2	16	36	68	125	177	389	503	--	--	--	--	--	--
77D-140 Series	4.5	7.2	16	36	68	125	177	389	--	--	--	--	--	--	--
77D-640 Series	--	--	--	11	24	35	--	--	--	--	--	--	--	--	--
77G-UL Series	4.5	7.2	16	36	68	125	177	389	503	--	--	--	--	--	--
77W Series	--	--	16	36	68	125	177	389	--	--	--	--	--	--	--
77-100/200 Series	8.1	15	15	51	68	125	177	389	503	--	--	--	--	--	--
79 Series	8.5	8.5	9.8	32	44	66	148	218	440	390	--	--	--	--	--
80 Series	8.4	7.2	15	30	43	48	84	108	190	370	--	--	--	--	--
82-100/200 Series	8.1	14	26	51	68	120	170	376	510	996	1893	--	--	--	--
83A/83B Series	8.1	14	26	51	68	120	170	376	--	--	--	--	--	--	--
83R-100/200 Series	--	--	--	--	--	--	170	376	--	996	1893	--	--	--	--
86A/86B Series	8.1	14	26	51	68	120	170	376	--	--	--	--	--	--	--
86R-100/200 Series	--	--	--	--	--	--	170	376	--	996	1893	--	--	--	--
87A-100 Series	--	--	--	--	--	--	86	104	234	375	673	1099	1902	3890	--
87A-200 Series	--	--	15	19	75	--	195	410	545	1021	2016	4837	9250	15170	22390
87A-700 Series	--	--	--	--	--	--	86	104	234	375	673	1099	1902	3890	--
87A-900 Series	--	--	15	19	75	--	195	410	545	1021	2016	4837	9250	15170	22390
87A-F00 Series	--	--	--	--	75	--	195	410	545	1021	2016	4837	--	--	--
87B-100 Series	--	--	--	--	--	--	--	--	--	375	673	1099	1902	3890	--
87J-100 Series	--	--	--	--	--	--	86	104	234	375	673	1099	1902	3890	--
87J-200 Series	--	--	15	19	75	--	195	410	545	1021	2016	4837	9250	15170	22390
87J-700 Series	--	--	--	--	--	--	86	104	234	375	673	1099	1902	3890	--
87J-900 Series	--	--	15	19	75	--	195	410	545	1021	2016	4837	9250	15170	22390
87K-100 Series	--	--	--	--	--	--	86	104	234	375	673	1099	1902	3890	--
87K-200 Series	--	--	15	19	75	--	195	410	545	1021	2016	4837	9250	15170	22390
87K-700 Series	--	--	--	--	--	--	86	104	234	375	673	1099	1902	3890	--
87K-900 Series	--	--	15	19	75	--	195	410	545	1021	2016	4837	9250	15170	22390
88A-100 Series	--	--	--	--	--	--	86	104	234	375	673	1099	1902	3890	--
88A-200 Series	--	--	15	19	75	--	195	410	545	1021	2016	4837	9250	15170	22390
88A-700 Series	--	--	--	--	--	--	86	104	234	375	673	1099	1902	3890	--
88A-900 Series	--	--	15	19	75	--	195	410	545	1021	2016	4837	9250	15170	22390
88A-F00 Series	--	--	--	--	75	--	195	410	545	1021	2016	4837	--	--	--
88B-100 Series	--	--	--	--	--	--	--	--	--	375	673	1099	1902	3890	--
89-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	--	--	--	--	--
9A-100 Series	8.3	6.7	5.7	10	16	25	40	62	--	--	--	--	--	--	--
90-100 Series	8.3	6.7	5.7	10	16	25	40	62	--	--	--	--	--	--	--
92-100 Series	8.3	6.7	5.7	10	16	25	40	62	--	--	--	--	--	--	--
93-100 Series	8.3	6.7	5.7	10	16	25	40	62	--	--	--	--	--	--	--
94A-100/200 Series	6	7	19	34	50	104	268	309	629	1018	1622	--	--	--	--
96-100 Series	8.3	6.7	5.7	10	16	25	40	62	--	--	--	--	--	--	--
399-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	--	--	--	--	--
489-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	--	--	--	--	--

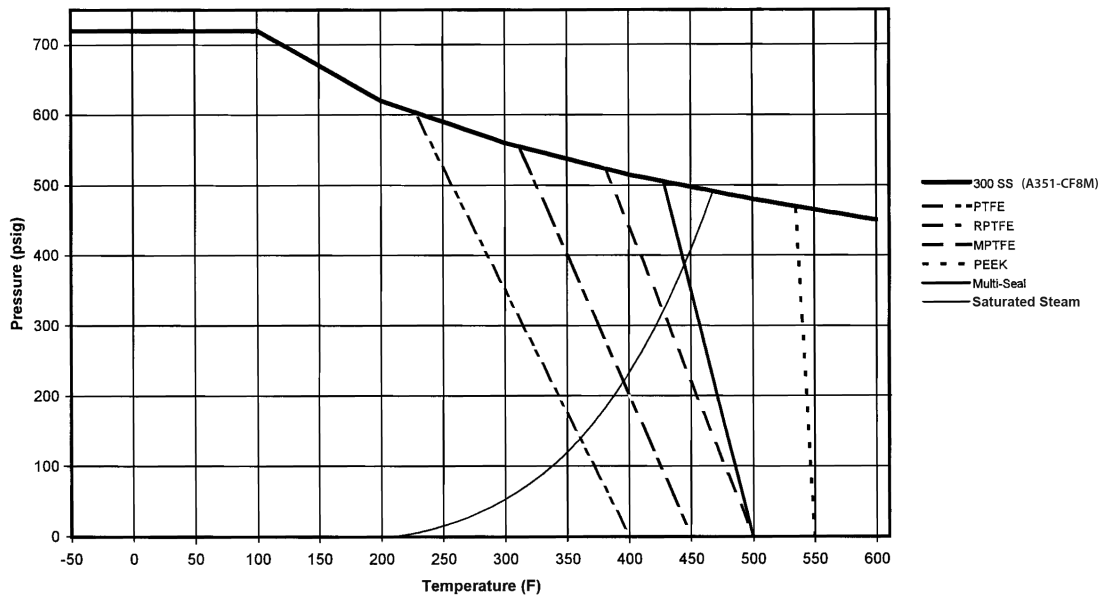
PRESSURE/TEMPERATURE RATINGS

ENGINEERING DATA

CLASS 300 (CS) ASTM A216-WCB GRAPH 5



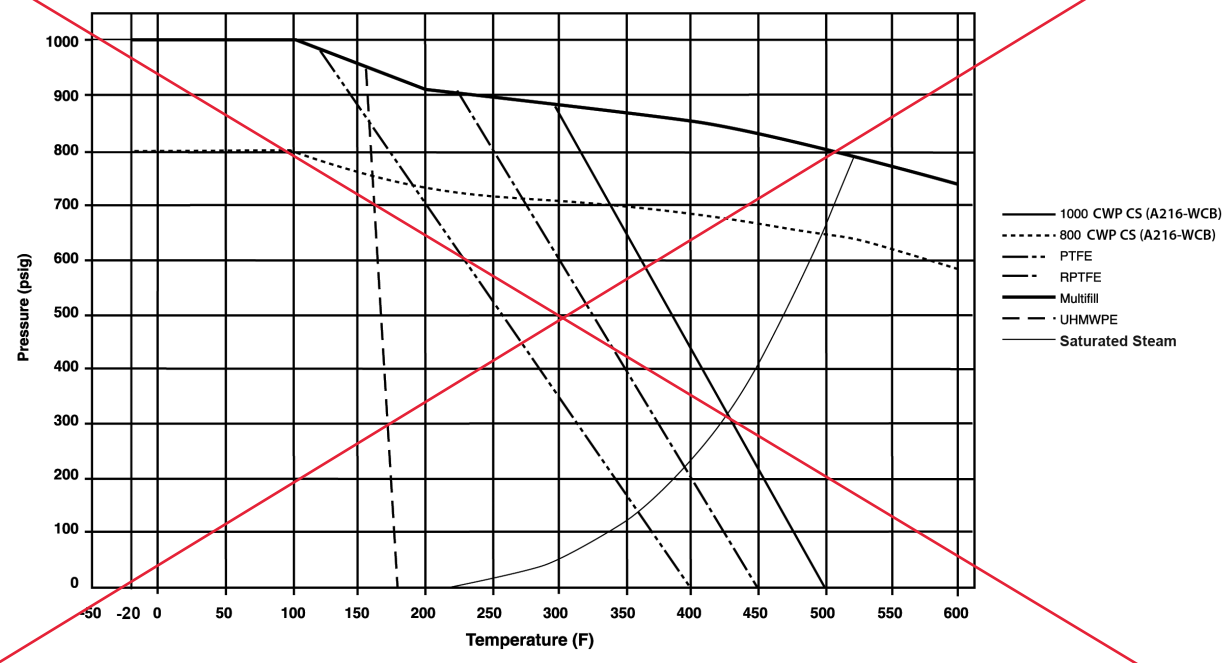
CLASS 300 (SS) ASTM A351-CF8M GRAPH 6



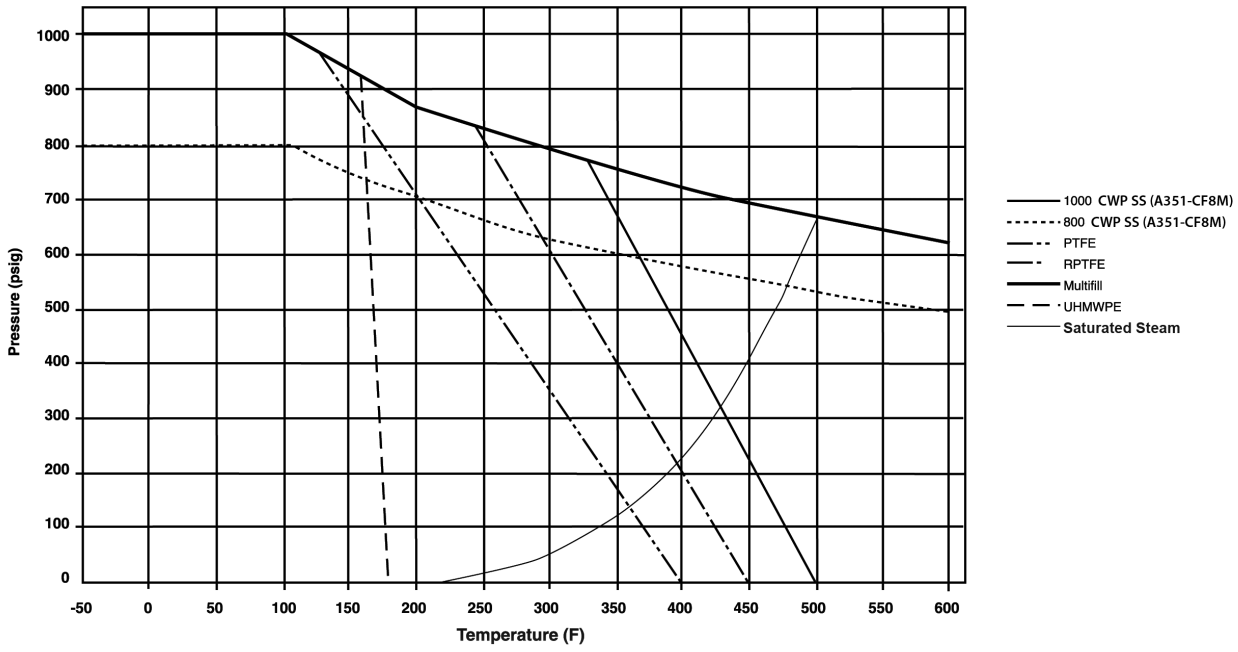
PRESSURE/TEMPERATURE RATINGS

ENGINEERING DATA

1000 CWP (CS) ASTM A216-WCB GRAPH 7



1000 CWP (SS) ASTM A351-CF8M GRAPH 8



Model HBV2/HBVAF2/HBDUC
HOSE CONNECTION VACUUM BREAKERS
(38-300/400 SERIES)

Job Name:	Contractor:
Job Location:	P.O. Number:
Engineer:	Representative:
Tag:	Wholesale Distributor:

DESCRIPTION
The Apollo® Models HBV2, HBVAF2 and HBDUC Hose Connection Vacuum Breakers are designed to prevent cross-connection caused by back-siphonage. The Apollo® Model HBDUC Hose Bibb Dual Check Backflow Preventer also prevents backflow due to low head back-pressure.

FEATURES
HBV2 (38-314)
- Tamper-proof protection
- Corrosion resistant
- Manual drain feature

HBVAF2 (38-414)
- For wall and yard hydrant application
- Tamper-proof protection
- Corrosion resistant
- Anti-Freeze automatic drain feature

HBDUC (38-304-02)
- Corrosion resistant body and checks
- Low head loss
- Easy to install with break-away set screw

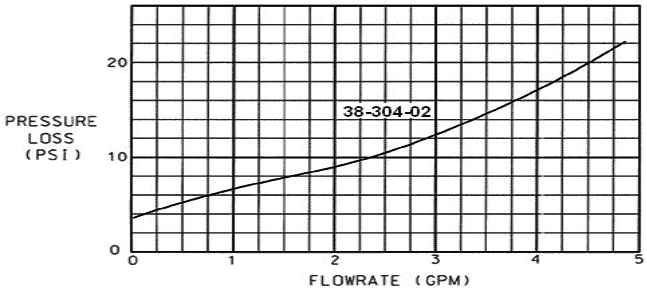
MATERIAL SPECIFICATIONS

Part Name (HBV2/HBVAF2)	**Material**
Body	Brass
Check Disc/Diaphragm	Buna-N
Spring	Stainless Steel

Part Name (HBDUC)	**Material**
Body	Brass
Seats	EPDM
Check Components	Stainless Steel
Check Guide	Acetal

PERFORMANCE RATING
Maximum Supply Pressure 125 psi
Temperature Range 33 °F – 180 °F

APPROVALS
ASSE® 1011, CSA® B64.2 and IAPMO® listed (38-314/414)
ASSE® 1052 (38-304-02); CSA® and IAPMO® pending

FLOW CURVE


ORDERING INFORMATION (HOSE BIBB VACUUM BREAKERS)
3 8 – X 1 4 – X X

SERIES
FINISH

SERIES
- ❒ **3 –** 300 Series (*¾" Hose Connection*)
- ❒ **4 –** 400 Series (*¾" Hose Connection*)

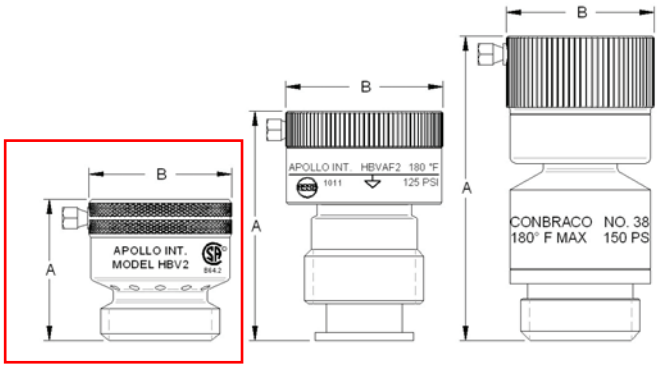
FINISH
- ❒ **AS –** Satin Brass
- ❒ **CS –** Satin Chrome *HBV2 Only*

Example: 38-414-AS = ¾" Satin Brass Anti-Freeze Hose Connection Vacuum Breaker

ORDERING INFORMATION (HOSE BIBB DUAL CHECK)
3 8 – 3 0 4 – 0 2
Satin Brass Finish Only

DIMENSIONS (in.)

Model No.	HBV2-34	HBVAF2-34	HBDUC-34
Item No.	38-314-AS	38-414-AS	38-304-02
A	1-1/4	2	2-11/16
B	1-1/4	1-3/8	1-5/16
Wt. (lbs)	0.15	0.25	0.46



Conbraco Industries, Inc. 701 Matthews Mint Hill Rd. Matthews NC 28105 USA; www.apollovalves.com; 704-841-6000

This specification is provided for reference only. Conbraco reserves the right to change any portion of this specification without notice and without incurring obligation to make such changes to Conbraco products previously or subsequently sold.

MODEL 88C SERIES TRANSMITTER MODEL NUMBER CODE

88 ELECTRONIC PRESSURE TRANSMITTER

AGENCY APPROVAL

C = Approved by Factory Mutual (FM) & Canadian Standards Association (CSA) for Explosion Proof.

PRESSURE RANGE

	PSI	BAR
001 =	3-15	0.2-1
002 =	0-6 to 0-15	0-0.4 to 0-1
003 =	0-15 to 0-30	0-1 to 0-2
004 =	0-20 to 0-100	0-1.4 to 0-7
005 =	0-60 to 0-300	0-4 to 0-20
006 =	0-200 to 0-1000	0-14 to 0-70
007 =	0-600 to 0-3000	0-40 to 0-200
008 =	0-1000 to 0-5000	0-70 to 350

Other ranges available upon request.

MATERIAL

	BASE	DIAPHRAGM	FILL	PROCESS CONNECTOR
A =	316L stn stl	316L stn stl	silicone	1/2" female NPT

OUTPUT

2 = 4-20mA

CALIBRATION RANGE (specify)

Will be calibrated at the maximum range in psi if not specified.

88 C 004 A 2 (0 to 50 psi) example

Model 88C pressure transmitter, 100 psi maximum range, 316L stainless steel base and diaphragm, silicone oil fill, 1/2" female NPT process connection, 4-20mADC output, approved by FM and CSA, calibrated to 0 to 50 psi.

SECTION I *SPECIFICATIONS*

DESCRIPTION

The Model 88 is a durable and cost effective full featured pressure transmitter. A fully adjustable, all stainless steel transmitter, it is designed for years of stable performance in even the toughest environmental and media conditions. Approvals include ratings for CSA, for both intrinsic safety and explosion-proof, and FM for explosion-proof only. All Model 88 transmitters meet NACE standards for offshore applications.

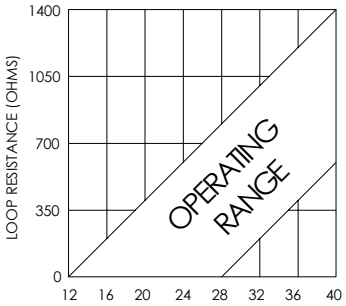
The small size and lightweight of the Model 88 eliminate the need for bulky mounting hardware and mechanical supports. A lightweight mounting bracket may be all that is required for installation. The integral junction box permits simple field wiring without the need for additional hardware, adding to the speed and ease of installation.

A 4-20mA output is standard with a 12-40VDC power supply. With all 316 stainless steel welded construction, the Model 88 is compatible with corrosive media and hazardous environments.

FUNCTIONAL SPECIFICATIONS
Service: Liquid, Gas or Vapor
Range Limits:
For specific pressure range codes reference model code on preceding pages.
Output: 4-20 mADC, limited to 30 mADC
Power Supply: 12 to 40VDC with reverse polarity protection
Zero Adjust: 10%
Span Adjust: 10%
Turndown: 5:1, (15 PSI=2.5:1 & 6 & 30 PS1=2:1)
Temperature Limits:
Electronics (Ambient) -40°F to 140°F (-40°C to 60°C). (Model 88S has low limit of 10°F).
Process Interface -40°F to 212°F (-40°C to 100°C)
Process Interface (88S) 10°F to 250°F (-12°C to 121°C)
Storage -40°F to 212°F (-40°C to 100°C)
Over-range: 300% Upper Range Limit (URL)
Humidity Limits: 0-100% RH

Note 1:For intrinsically safe operation reference Barrier Entity Requirements for power supply limits.

Loop Resistance: 1400 ohms max @40 volts



Supply Voltage

PERFORMANCE SPECIFICATIONS
Accuracy: ±0.25% of calibrated span including linearity (BFSL), hysteresis and repeatability (±0.50% on 6 PSI)
Response Time: Time constant of 20 milliseconds
Stability: ±0.5% URL for six months
Temperature Effect:
(includes zero & span)
Compensated -20°F to 180°F (-29°C to 82°C)
Between 30°F and 130°F (-1°C & 54°C): ±1% of URL per 50°F (28°C) Between -20°F and 180°F (-29°C & 82°C):±1.6% of URL per 50°F (28°C)

Power Supply Effect: ±0.005% FS per volt
Surge Protection: Standard
Vibration Effect: ±0.1% of URL for 3g to 200Hz.
Overrange Effect: ±0.15% FS per 300% of max range

PHYSICAL SPECIFICAIIONS
Materials of Construction
Process Wetted Parts: 316LSS
Non Wetted Parts: 316SS
Cast Head: CF-8M (316 CastSS)
"O"Ring: Buna N
Fill Fluid: DC 200 Silicone (Standard) Mineral (Optional)
Process Connection: Reference Specific Model
Electrical Conncction: 1/2" NPT Female
Weight: 1.67 Lbs (.76KG)

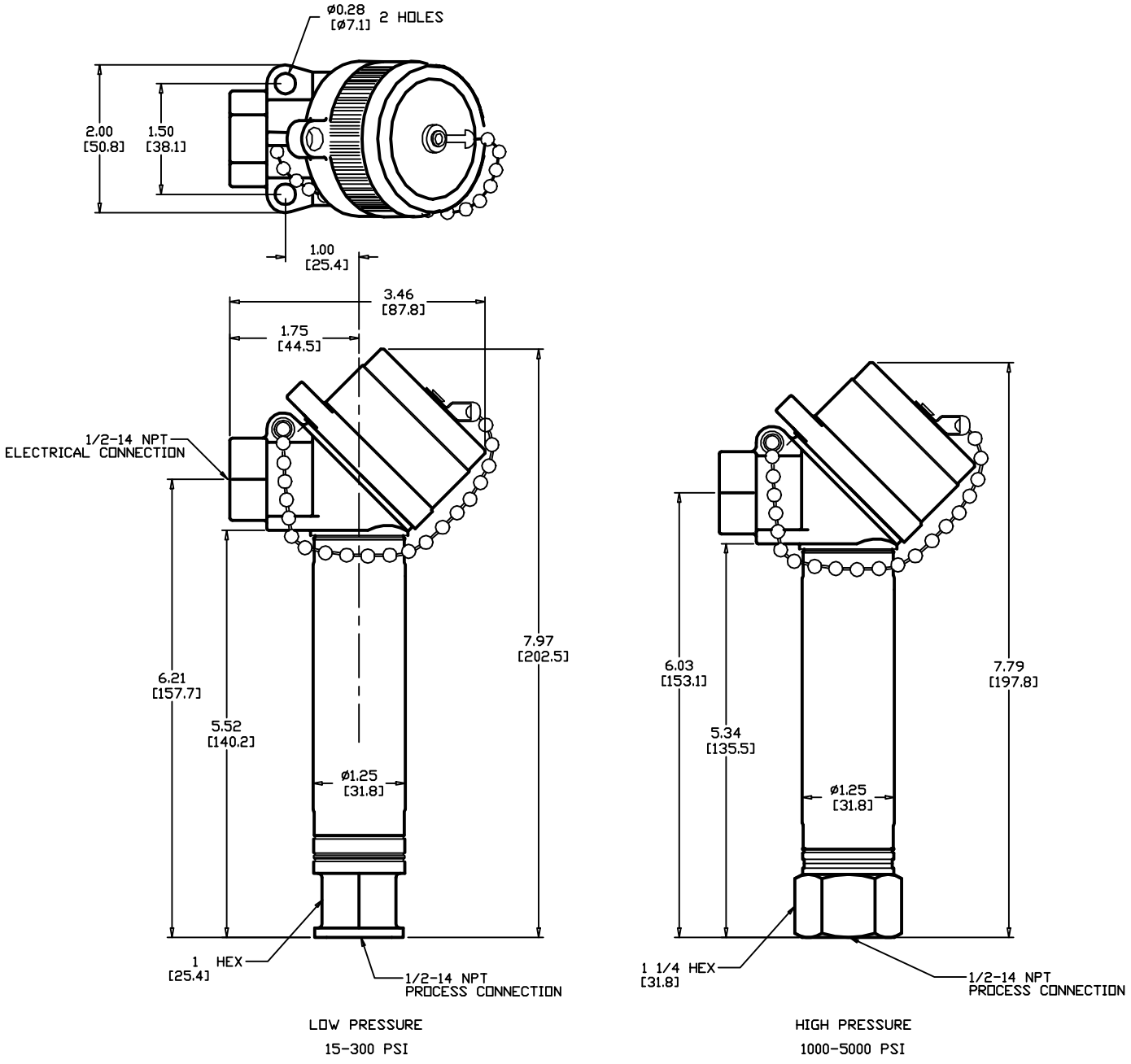


FIGURE 1-1
OUTLINE DIMENSIONS MODEL 88C

CLASSIFICATION (FM, CSA, CENELEC)

All models with a "C" or "F" option are FM approved as Explosion-proof for Class I, Div 1, Groups B, C, D: Dust-ignition proof for Class II, Div 1, Groups E, F & G and suitable for Class III, Div 1; Hazardous Location, NEMA 4 enclosure. Conduit seal must be within 18 inches of transmitter.

CANADIAN STANDARDS ASSOCIATION (USA) APPROVALS:

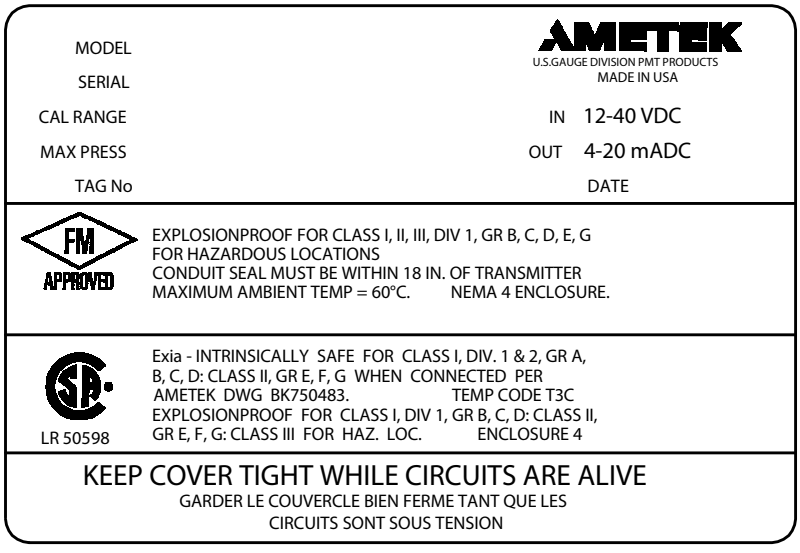
All Models with a "C" or "F" option meet CSA requirements for intrinsically sale operation in Hazardous Locations as designated by Class I, Div. 1&2, Groups A, B, C, & D and Class II, Groups E, F & G.
Temperature code T3C.
All models with a "C" or "F" option meet CSA requirements for Explosion-proof in Hazardous Locations as designated by Class I, Div 1, Groups B, C, & D, Class II. Groups E, F, & G and Class III. The enclosure meets CSA requirements for Enclosure 4.

BARRIER REMARKS:
A. Installation of barrier should be in accordance with the manufacturer's instructions.

CSA - Figure 2-4

B. Barrier output terminals should not be exposed without de-energizing all system input power.
C. Resistance from barrier to ground should not exceed one ohm, and non-hazardous location equipment associated with this system shall not employ or generate in excess of 250 Vrms (360 volts peak).
D. Barrier Entity requirements:

CSA - Vmax=28 VDC, Imax-104 mA, Rmin=290 ohms.



MODEL 88C PIPING

Transmitter mounting is shown in Figure 2-1A and 2-1B of Figure 2-1 below.

Conduit drain should be provided to prevent moisture buildup in the conduit compartment.

Figure 2-1C shows a transmitter mounting with an elbow used to prevent sediment in the process from clogging the line.

Figure 2-1D shows a transmitter mounting with an elbow used to eliminate trapped vapor.

Figure 2-1E shows a tee which can be used for calibration.

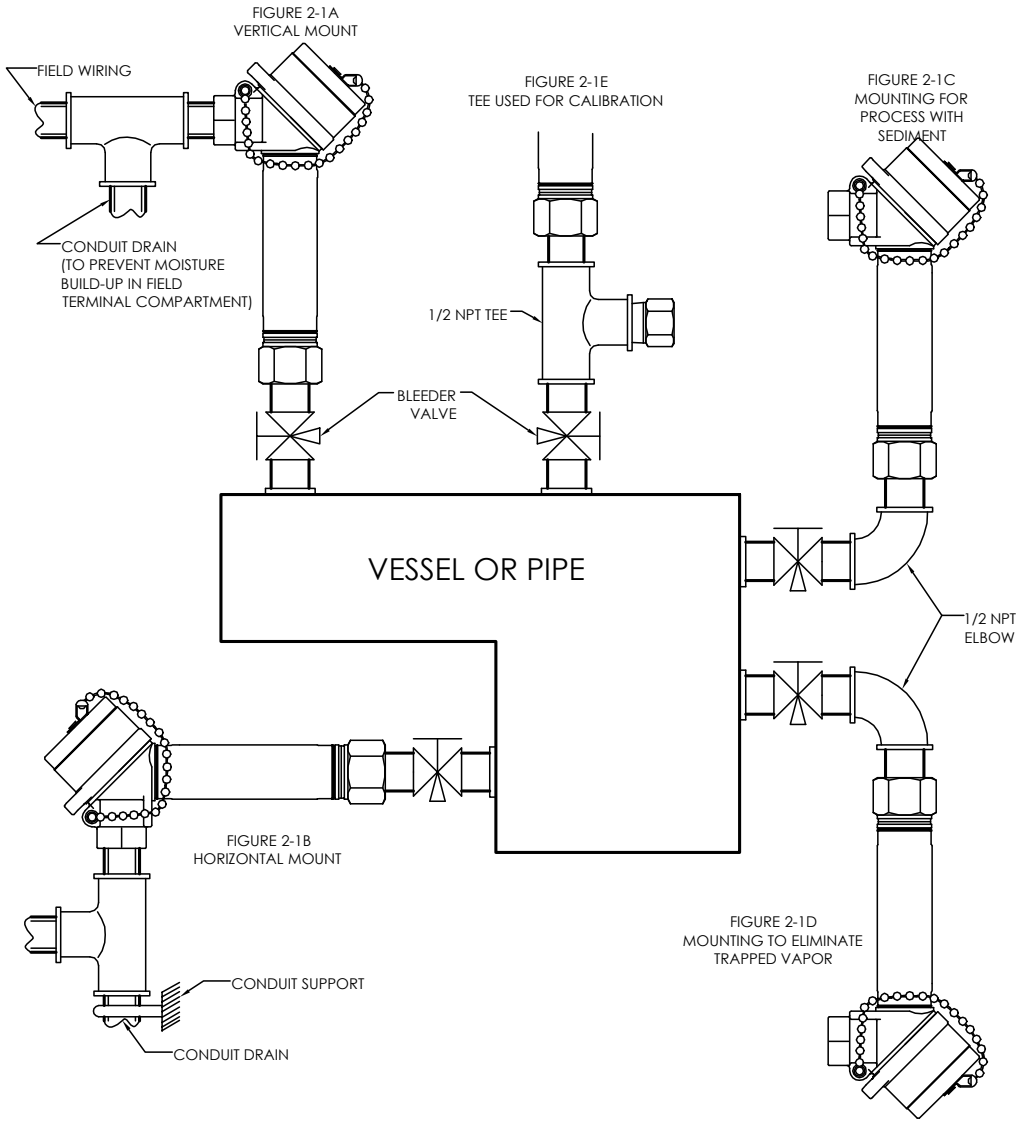


FIGURE 2-1
MODEL 88C/D PIPING

WIRING

WARNING: Power must be off while connections are made to the field terminals.

There are two field terminals (+ Signal & - Signal) located on the terminal board in the field terminal compartment. (The circuit is protected from reversing polarity).

To wire the transmitter to receiver and power supply:

1. The field terminal will accept a stripped wire lead from No. 14 AWG to No. 22 AWG.

2. Install wire between the negative terminal of the transmitter and the positive terminal of the receiver, see figure 2-3.

3. Install wire between the positive terminal of the transmitter and the positive terminal of the power supply, see figure 2-3.

4. Install wire between the negative terminal of the receiver and the negative terminal of the power supply, see figure 2-3.

5. The transmitter housing should be connected to earthground for safety reasons. Figure 2-3 shows the case ground screw that is to be used to attach a properly grounded safety wire.

6. Seal wires entering the housing with sealing compound to prevent water from entering the field terminal compartment.

There are two test terminals (TP+ & TP-) located on the terminal board in the field terminal compartment.

Test terminals have the same output signal (4 to 20mADC) as the signal terminals and are provided as an in-circuit monitor, see Figure 2-3.

NOTE: The cover must be closed tightly to ensure explosion proof design.

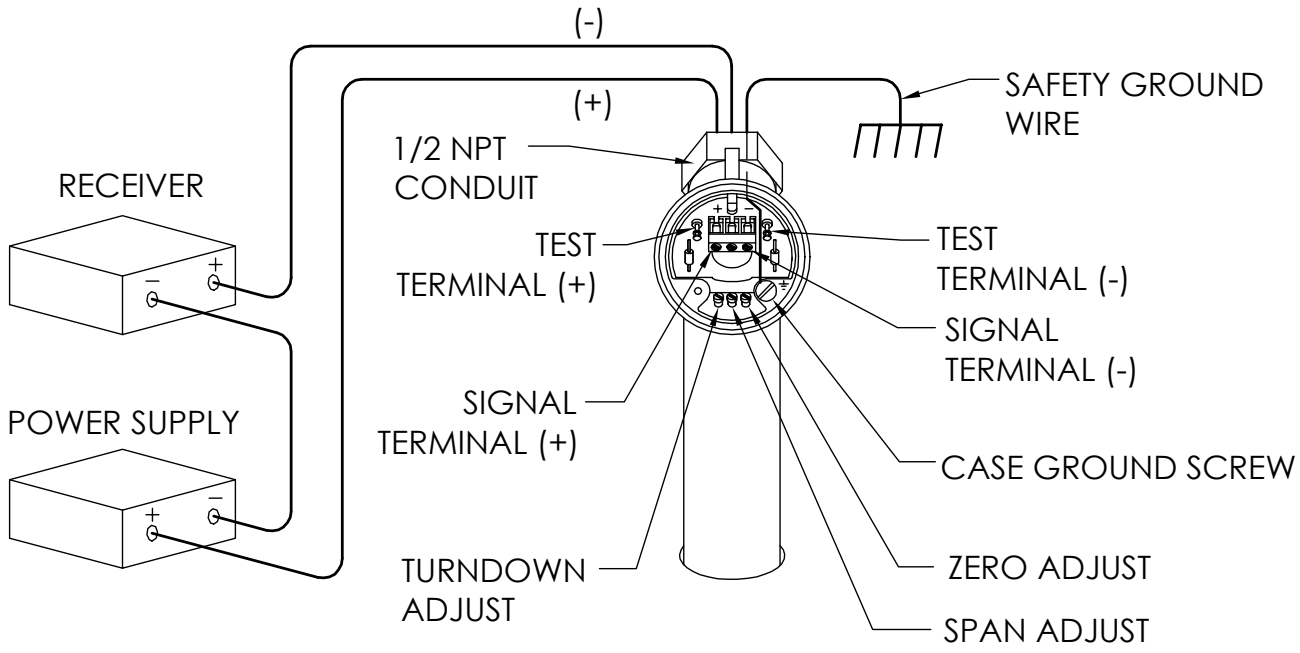
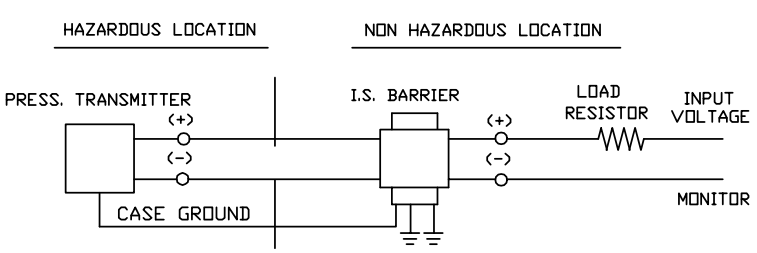


FIGURE 2-3
MODEL 88F WIRING

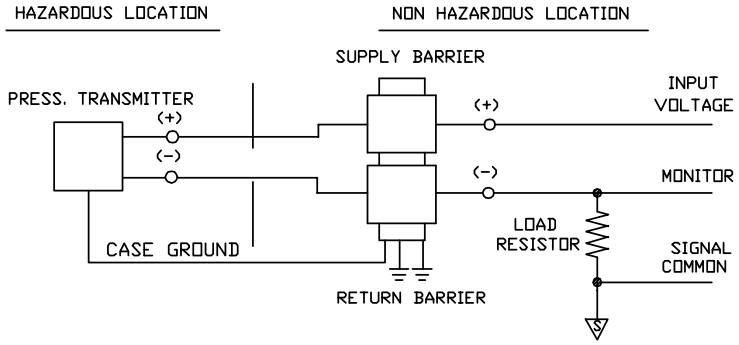
BASIC INSTALLATION CIRCUIT DIAGRAM



SINGLE BARRIER CONFIGURATION

SUGGESTED LIST OF CSA APPROVED BARRIERS:

MANUFACTURER	MODEL NO.	PUBLICATION NO.
STAHL	8901/31-280/100/70	8901603310
STAHL	8903/31-315/050/70	8903601310
HONEYWELL	38545-0000-0110-113-F585	S-385-22
MTL	728+	PS700-10
MTL	708	PS700-10



TWO BARRIER CONFIGURATION

SUGGESTED LIST OF CSA APPROVED BARRIERS:

MANUFACTURER	MODEL NO.	PUBLICATION NO.
STAHL	8901/31-280/100/70 (SUPPLY)	8901603310
STAHL	8901/33-086/000/00 (RETURN)	8901603310
STAHL	8903/31-315/050/70 (SUPPLY)	8903601310
STAHL	8901/33-086/000/00 (RETURN)	8901603310
MTL	787 OR 787S (SUPPLY + RETURN)	PS700-10

NOTES :

1) USE ANY CSA CERTIFIED SINGLE CHANNEL ZENER DIODE BARRIER, HAVING SAFETY PARAMETERS OF 28 V MAX/290 OHM MIN.,FOR THE SINGLE BARRIER CONFIGURATION OR FOR THE SUPPLY BARRIER IN THE 2 BARRIER CONFIGURATION.
FOR THE RETURN BARRIER,IN THE 2 BARRIER CONFIGURATION,USE ANY CSA CERTIFIED DIODE-RETURN BARRIER.
2) TO ASSURE AN INTRINSICALLY SAFE SYSTEM, THE TRANSMITTER MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURER'S FIELD WIRING INSTRUCTIONS.
3) INTRINSICALLY SAFE FOR HAZARDOUS LOCATIONS,CLASS I; GROUPS A,B,C,D, CLASS II;GROUPS E,F,G, AND CLASS III

FIGURE 2-4
WIRING INTRINSICALLY SAFE (CSA)

XSEL® Process Gauge - Stainless Steel
Type 232.34 - Dry Case
Type 233.34 - Liquid-filled Case

Applications

- For applications with high dynamic pressure pulsations or vibration a liquid filled case and socket restrictor are available
- Suitable for corrosive environments and gaseous or liquid media that will not obstruct the pressure system
- Process industry: chemical/petrochemical, power stations, mining, on and offshore, environmental technology, mechanical engineering and plant construction

Product features

- Excellent load-cycle stability and shock resistance
- Solid front thermoplastic case
- Positive pressure ranges to 30,000 psi (2,000 bar)
- XSEL® Process Gauge with 5 year warranty on gauge and 10 year warranty on pressure system (see terms and condition
- All lower mount connection gauges are factory prepared for liquid filling

(LBM: must install membrane prior to field filling)

Specifiations

Design
ASME B40.100

Sizes
4½" & 6" (115 & 160 mm) dial size

Accuracy class
± 0.5% of span (ASME B40.100 Grade 2A)
± 1.0% of span (ASME B40.100 Grade 1A)
for ≥ 20,000 psi (1,600 bar) range and above

Ranges
Vacuum / Compound to 400 psi (25 bar)
Pressure from 15 psi (1 bar) to 30,000 psi (2,000 bar)
or other equivalent units of pressure or vacuum

Working pressure

Steady:	full scale value
Fluctuating:	0.9 x full scale value
Short time:	1.5 x full scale value

Operating temperature

Ambient:	-40°F to +140°F (-40°C to +60°C) - dry
	-4°F to +140°F (-20°C to +60°C) - glycerine filled
	-40°F to +140°F (-40°C to +60°C) - silicone filled
Medium:	max. +212°F (+100°C)

Bourdon Tube Pressure Gauge Model 232.34

Temperature error
Additional error when temperature changes from reference temperature of 68°F (20°C) ±0.4% of span for every 18°F (10°K) rising or falling.

Weather protection
Weather resistant (NEMA 3 / IP54) - without membrane
Weather tight (NEMA 4X / IP65) - dry case or filled case with membrane installed

Pressure connection
Material: 316L stainless steel
Lower mount (LM) or lower back mount (LBM)
1/4" or 1/2" NPT with M4 internal tap

Restrictor
Material: Stainless steel (0.6 mm), standard

Bourdon tube
Material: 316L stainless steel
≤ 1,000 psi (69 bar): C-shape
≥ 1,500 psi (100 bar): Helical

Movement
Stainless steel
Internal overload stop set at 1.1x full scale
Underload stop-optional
Dampened movement-optional

Dial
White aluminum with black lettering, stop pin at 6 o'clock
Standard WIKA psi single scales (4½" only) with large figures at beginning and end for quick and easy identification.

Pointer
Black aluminum, adjustable

Case
Black fiberglass-reinforced thermoplastic (POCAN)
Solid front, blowout back
Turret-style case with built in rear flange lugs

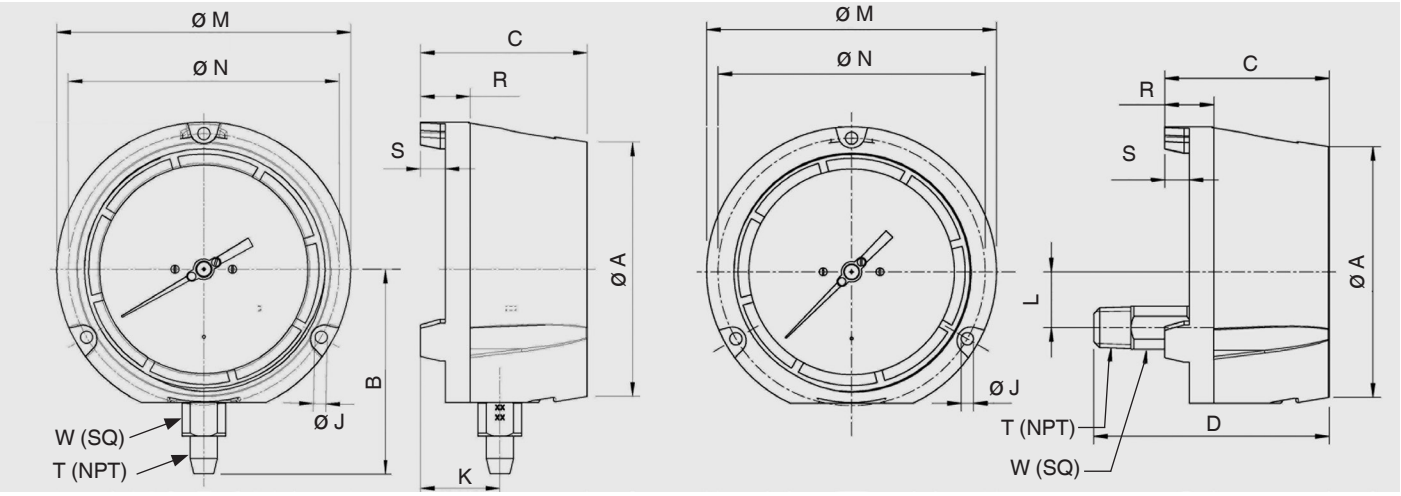
Window
Clear acrylic with Buna-N gasket

Case filling Type 233.34
Glycerine 99.7% and >= 40 psi (2.5 bar)
Glycerine 86.5%/Water 13.5% - < 40 psi (2.5 bar)

Optional extras

- Silicone dampened movement
- Panel mounting adaptor kit (field assembled)
- Silicone case filling
- Halocarbon case filling
- Cleaned for oxygen service
- Instrument glass or safety glass window
- Drag pointer (maximum reading indicator)
- Alarm contacts switches (magnetic or inductive)
- Special process connections
- Custom dial layout
- External zero adjustment (4.5" size only)
- Case and ring in red or yellow thermoplastic (4½" LM only)
- Insight® reflective dial options available in white, fluorescent yellow, fluorescent orange or glow-in-the-dark

Dimensions



Size		A	B	C	D	J	K	L	M	N	R	S	T	W	Weight[1]	
4.5"	mm	128	103	84	120.3	6.3	40	28.5	148	136.5	25	12.5		22	2 lb.	dry
	in	5	4.06	3.31	4.74	0.248	1.57	1.12	5.83	5.37	0.99	0.49	1/2"	0.87	3 lb.	filled
6"	mm	164	122.5	88	123.4	7.1	40.2	28.5	190	177.8	25.4	12.7		22	3 lb.	dry
	in	6.46	4.82	3.46	4.86	0.28	1.58	1.12	7.5	7	1	0.5	1/2"	0.87	4 lb.	filled

[1] Weight without optional accessories

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We reserve the right to make modifications to the specifications and materials.

WIKA Instrument, LP
1000 Wiegand Boulevard
Lawrenceville, GA 30043-5868
Tel: 888-WIKA-USA • 770-513-8200
Fax: 770-338-5118
E-Mail: info@wika.com
www.wika.com

McMASTER-CARR®

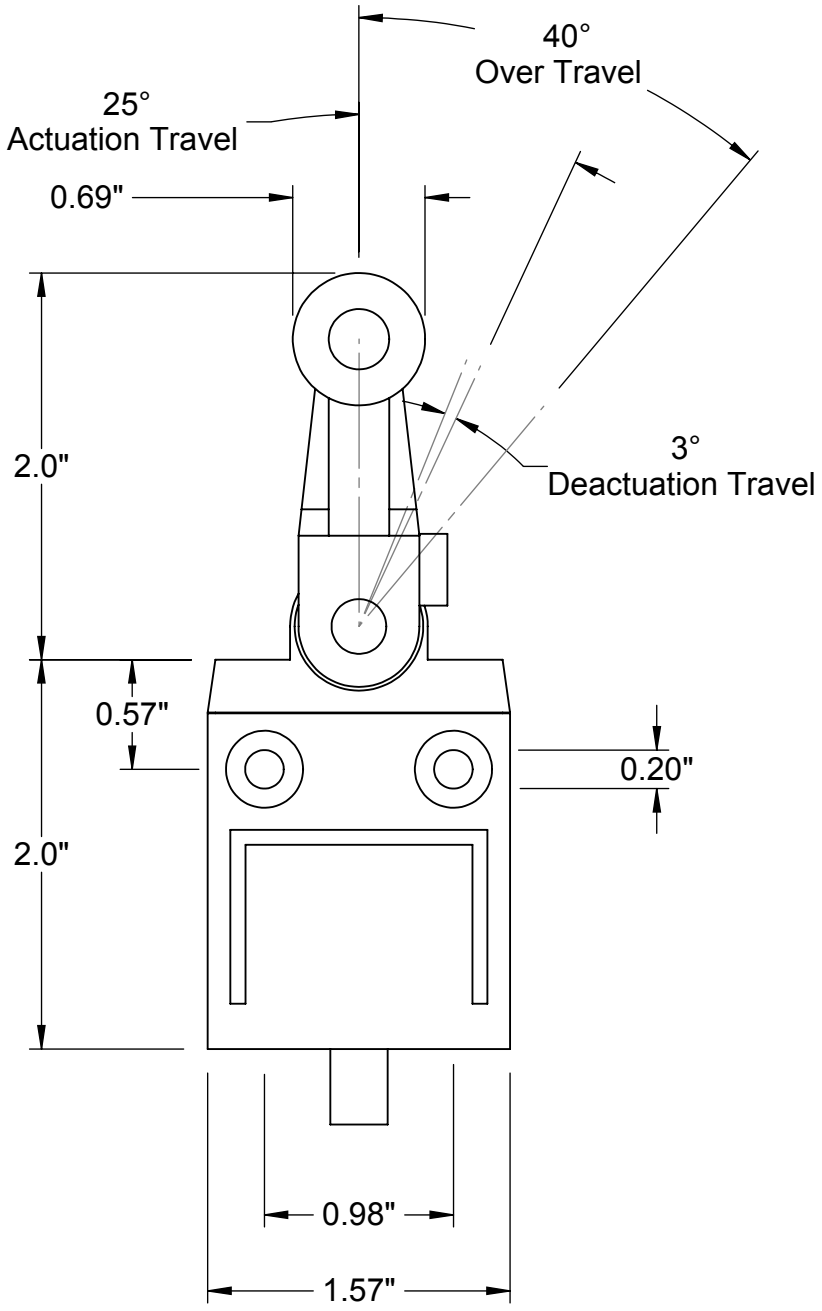
Low-Profile Washdown Limit Switch

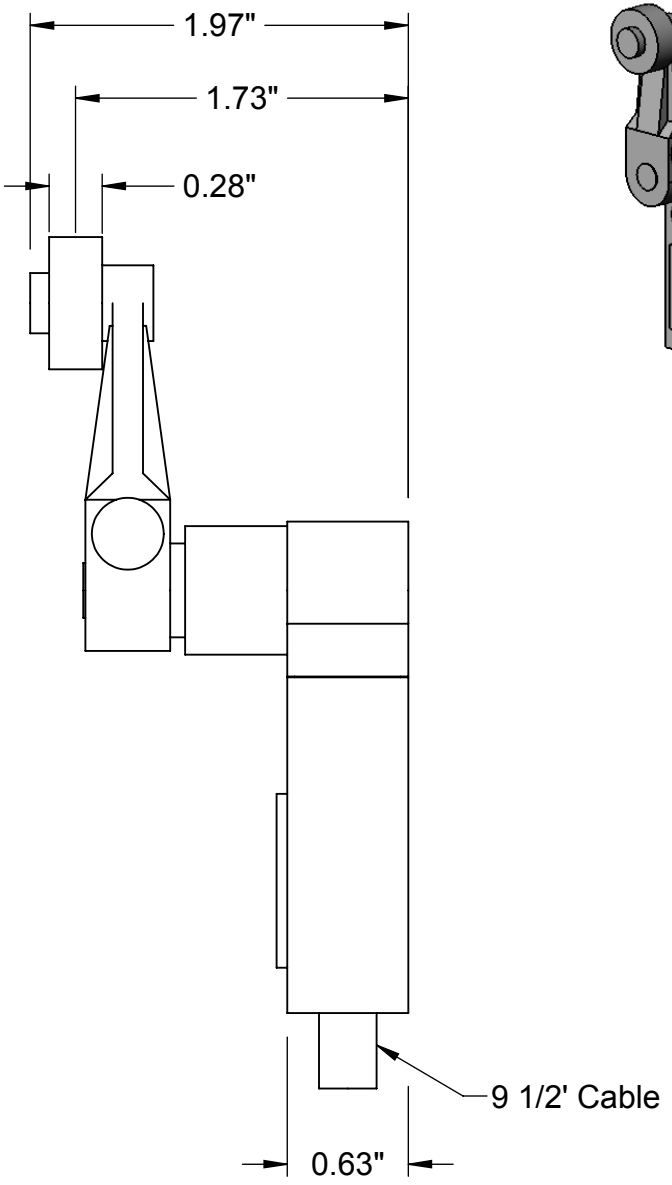
Roller Lever Actuator with Wire Leads, 250V AC

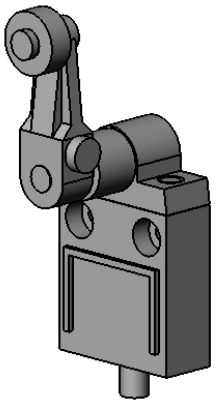
Application	Power
Switch Type	Limit
Actuator Style	Roller Lever
Number of Circuits Controlled	1
Switch Starting Position	1 Off (Normally Open) or 1 On (Normally Closed)
Switch Action	Springs Back (Momentary)
Industry Designation	SPDT
Switching Current	5A
Switching Voltage	250V AC
Maximum Voltage	250V AC/DC
Actuator Height	2"
Housing	
Length	1.6"
Height	2"
Depth	0.6"
Housing Material	Aluminum
Mounting Fasteners Included	No
Mounting Holes	
Number of	2
Diameter	0.2"
Electrical Connection Type	Hardwire
Wire Connection Type	Wire Leads
Wire Leads	
Number of	4
Length	9 1/2 ft.
Cable Insulation Industry Designation	SJTO
Environment	Oily, Washdown

Environmental Rating	NEMA 4, NEMA 13, IP67
Specifications Met	UL Listed, CSA Certified
RoHS	Not Compliant

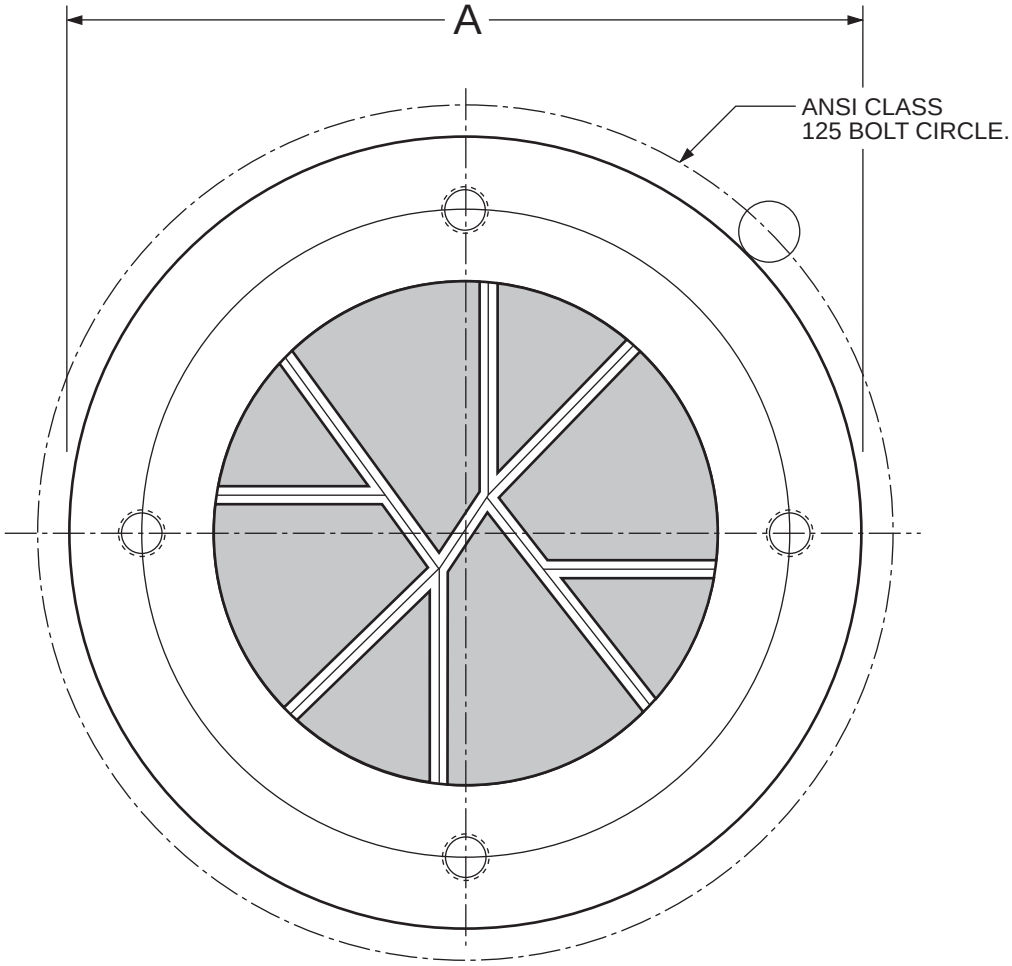
With a slim design, these switches can be stacked together or fit into narrow spaces. They're rated NEMA 4 and 13 and IP67 for protection from washdowns and oil/coolant spraying. When an object comes into contact with them, it sends a signal to open or close a circuit. They're often used on conveyor systems and bin filling operations.

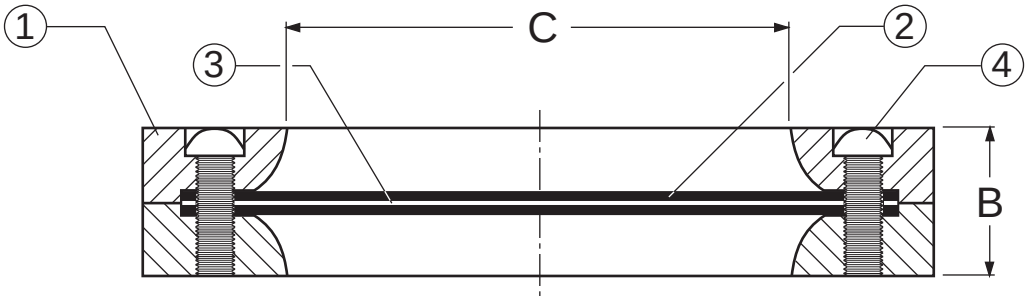






McMASTER-CARR® CAD http://www.mcmaster.com	PART NUMBER **7628K77**
© 2018 McMaster-Carr Supply Company Information in this drawing is provided for reference only.	Low-Profile Washdown Roller Lever Limit Switch with Cable





INSTALLATION DIMENSIONS, INCHES ANSI CLASS 125				
SIZE	MODEL NO.	A	B	C
4	1504	6.75	0.75	4.00
6	1506	8.88	1.00	6.00
8	1508	10.88	1.25	8.00
12	1512	16.00	2.00	12.00

Revised 8-6-07

FROSTSAFE TWO-WAY DAMPER

DATE 11-7-05

VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. VM-1500

4”, 6, 8”,12” FROSTSAFE TWO-WAY DAMPER

SERIES NO. 1500

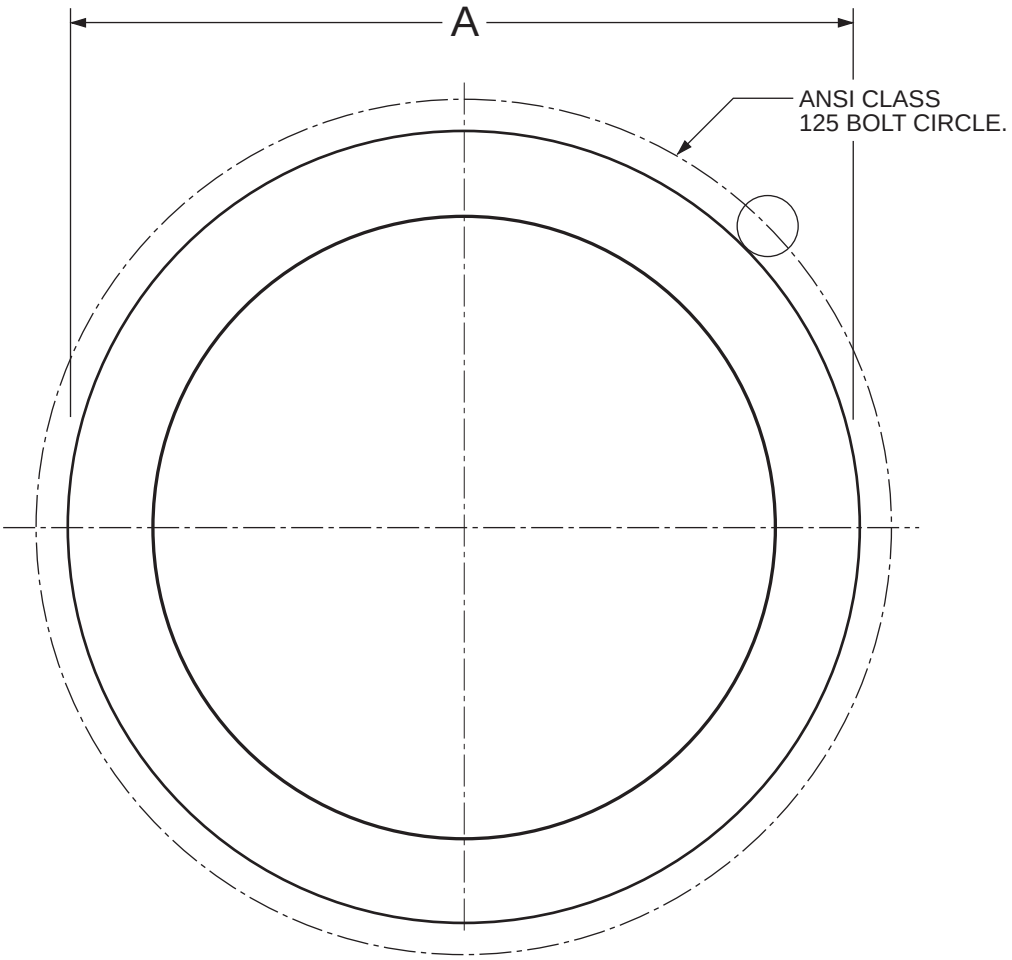
STANDARD MATERIALS OF CONSTRUCTION

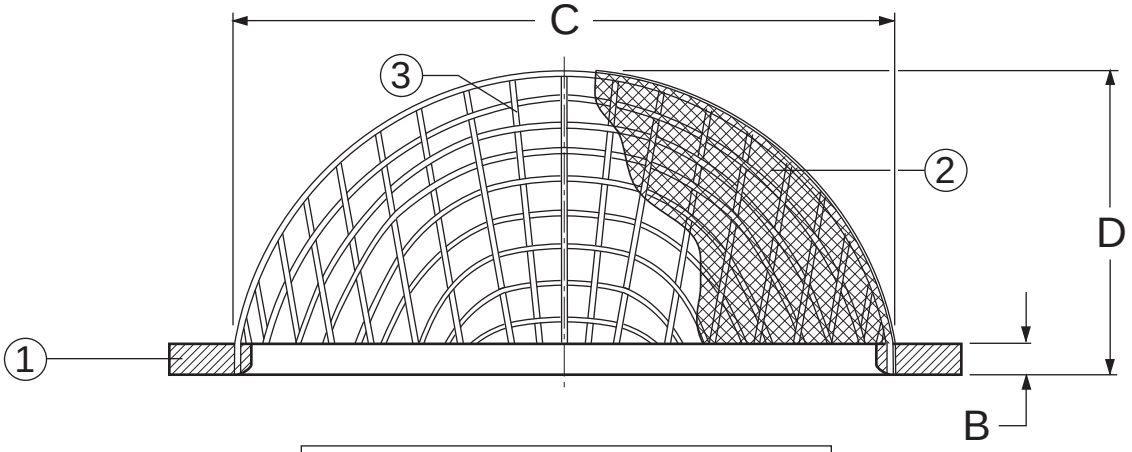
PART NO.	PART NAME	MATERIAL
1	BODY	HIGH DENSITY POLYETHYLENE (HDPE)
2	RUBBER MEMBRANE	NYLON REINFORCED HIGH GRADE NEOPRENE
3	DAMPER SEAL	PETG
4	BODY BOLT	316 STAINLESS STEEL

NOTE: ALL SPECIFICATIONS AS LAST REVISED.

Revised 8-6-07

MATERIALS OF CONSTRUCTION	DATE 11/7/05
VAL-MATIC® VALVE AND MANUFACTURING CORP.	DRWG. NO. VM-1500-M





INSTALLATION DIMENSIONS, INCHES ANSI CLASS 125					
SIZE	MODEL NO.	A	B	C	D
4	1604	6.75	.375	3.76	2.37
6	1606	8.63	.375	5.75	3.37
8	1608	10.88	.375	7.77	4.37
12	1612	16.00	.375	11.75	6.00

Revised 8-6-07

VENTSAFE SECURITY CAGE®

DATE 11-7-05

VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. VM-1600

VENTSAFE SECURITY CAGE®

SERIES NO. 1600

STANDARD MATERIALS OF CONSTRUCTION

PART NO.	PART NAME	MATERIAL
1	BODY	45 SHORE D PVC
2	SCREEN, 20 MESH	304 STAINLESS STEEL
3	CAGE, 2 MESH	304 STAINLESS STEEL

NOTE: ALL SPECIFICATIONS AS LAST REVISED.

Revised 6-8-06

MATERIALS OF CONSTRUCTION	DATE 11/7/05
VAL-MATIC® VALVE AND MANUFACTURING CORP.	DRWG. NO. VM-1600-M

Pipe Penetration Seals

PROCO's PEN-SEAL Pipe Penetration Seals have been designed to assist in achieving an efficient, low-cost mechanical seal between any Electrical Conduit, Concrete, Cast Iron, Steel, Copper, or PVC/CPVC pipes passing through Walls, Floors, Tanks, Pipeline Casings, and Vaults. The PEN-SEAL, while being used to seal the gap in electrical conduit lines, will also act as an insulator.

The PEN-SEAL has been designed to provide a gas and watertight seal. All sizes have been tested to withstand a hydrostatic seal up to 20 psig or 40 feet of head pressure in addition to withstanding temperatures up to 250° F.

PEN-SEAL's standard elastomer material is EPDM, which is suitable for temperatures ranging from -40° F to 250° F. EPDM is suitable for most applications in water—above ground and direct burial—and will provide the electrical insulation where cathodic protection is required. Silicone material is also available for higher temperature applications up to 400° F.

Where the PEN-SEAL may come in contact with Hydrocarbons, Oil, Gas, Jet Fuel, and miscellaneous solvents, a Nitrile material is available with temperatures ranging from -40° F to 210° F.

The PEN-SEAL utilizes glass-reinforced plastic for the pressure plates and all hardware is manufactured from Steel Zinc Dichromate. For corrosion resistance, 316 Stainless Steel hardware is also available.

Various applications for the PROCO PEN-SEAL:

- Wall Sleeves
- Floor Sleeves
- Interior Piping
- Noise Dampener
- Electrical Contractors
- Precast Concrete
- Mining
- Marine
- Water & Wastewater
- HVAC
- Valve Pits
- Offshore Oil Platforms
- Telecommunications
- Dual Containment Seal
- Underground Steel Tanks
- Coal Preparation Plants
- Pulp & Paper
- Power Generation

Sizing Tables

Sizing for Standard Weight Steel, PVC and CPVC Pipe

Table 1		Standard Weight Steel or PVC Pipe Sleeve[1]				Cast or Core Bit Drilled Hole[1]		
NOMINAL PIPE SIZE (Inches)	ACTUAL PIPE O.D. (Inches)	SLEEVE NOMINAL PIPE SIZE (Inches)	SLEEVE ACTUAL I.D. (Inches)	PEN-SEAL PART NUMBER	REQUIRED NUMBER OF LINKS	HOLE I.D. (Inches)	PEN-SEAL PART NUMBER	REQUIRED NUMBER OF LINKS
0.5	0.840	2.000	2.067	PS-200	4	2.000	PS-200	4
0.75	1.050	2.500	2.469	PS-275	6	2.500	PS-275	6
1	1.315	2.500	2.469	PS-200	5	3.000	PS-315	4
1.25	1.660	3.000	3.068	PS-275	8	3.000	PS-275	8
1.5	1.900	3.000	3.068	PS-200	7	3.500	PS-300	5
2	2.375	3.500	3.548	PS-200	8	4.000	PS-300	6
2.5	2.875	4.000	4.026	PS-200	9	4.000	PS-200	9
3	3.500	5.000	5.047	PS-300	8	5.000	PS-300	8
3.5	4.000	6.000	6.065	PS-315	10	6.000	PS-315	10
4	4.500	6.000	6.065	PS-300	10	6.000	PS-300	10
5	5.563	8.000	7.981	PS-340	13	8.000	PS-340	13
6	6.625	10.000	10.020	PS-475	10	10.000	PS-475	10
8	8.625	12.000	12.000	PS-475	12	12.000	PS-475	12
10	10.750	14.000	13.250	PS-425	10	14.000	PS-475	14
12	12.750	16.000	15.250	PS-425	12	16.000	PS-475	17
14	14.000	18.000	17.250	PS-475	18	18.000	PS-575	16
16	16.000	20.000	19.250	PS-475	21	20.000	PS-575	18
18	18.000	22.000	21.250	PS-475	23	22.000	PS-575	20
20	20.000	24.000	23.250	PS-475	25	24.000	PS-575	22
22	22.000	26.000	25.250	PS-475	28	26.000	PS-575	24
24	24.000	28.000	27.250	PS-475	30	28.000	PS-575	26
26	26.000	30.000	29.250	PS-475	33	30.000	PS-575	28
28	28.000	32.000	31.250	PS-475	35	32.000	PS-575	30
30	30.000	34.000	33.250	PS-475	37	34.000	PS-575	32
32	32.000	36.000	35.250	PS-475	40	36.000	PS-575	34
34	34.000	40.000	39.250	PS-500	29	38.000	PS-575	36
36	36.000	42.000	41.250	PS-500	31	40.000	PS-575	38
42	42.000	48.000	47.250	PS-500	36	46.000	PS-575	44
48	48.000	54.000	53.250	PS-500	41	52.000	PS-575	50

Notes:
1. *Minimum recommended sleeve length or wall thickness is 4" for PEN-SEAL Model PS-325 and smaller and 6" for Models PS-400 and larger.*
2. *PEN-SEAL sets are sold in belts of ten (10) links.*

Sizing Tables

Sizing for Intermediate Metal Conduit (IMC)

Table 7		Standard Weight Steel or PVC Pipe Sleeve[1]				Cast or Core Bit Drilled Hole[1]		
NOMINAL PIPE SIZE (Inches)	ACTUAL PIPE O.D. (Inches)	SLEEVE NOMINAL PIPE SIZE (Inches)	SLEEVE ACTUAL I.D. (Inches)	PEN-SEAL PART NUMBER	REQUIRED NUMBER OF LINKS	HOLE I.D. (Inches)	PEN-SEAL PART NUMBER	REQUIRED NUMBER OF LINKS
0.5	0.815	2.000	2.067	PS-200	4	2.000	PS-200	4
0.75	1.029	2.000	2.067	PS-200	4	2.500	PS-275	6
1	1.290	2.500	2.469	PS-275	6	3.000	PS-300	4
1.25	1.638	3.500	3.548	PS-315	5	3.000	PS-275	7
1.5	1.883	3.500	3.548	PS-300	5	3.500	PS-300	5
2	2.360	4.000	4.026	PS-300	6	4.000	PS-300	6
2.5	2.857	4.000	4.026	PS-200	9	4.000	PS-200	9
3	3.476	5.000	5.047	PS-300	8	5.000	PS-300	8
3.5	3.971	6.000	6.065	PS-325	5	6.000	PS-325	5
4	4.466	6.000	6.065	PS-300	10	6.000	PS-300	10

Sizing for Rigid Steel Conduit (RSC)

Table 8		Standard Weight Steel or PVC Pipe Sleeve[1]				Cast or Core Bit Drilled Hole[1]		
NOMINAL PIPE SIZE (Inches)	ACTUAL PIPE O.D. (Inches)	SLEEVE NOMINAL PIPE SIZE (Inches)	SLEEVE ACTUAL I.D. (Inches)	PEN-SEAL PART NUMBER	REQUIRED NUMBER OF LINKS	HOLE I.D. (Inches)	PEN-SEAL PART NUMBER	REQUIRED NUMBER OF LINKS
0.5	0.840	2.000	2.067	PS-200	4	2.000	PS-200	4
0.75	1.050	2.500	2.469	PS-275	6	2.500	PS-275	6
1	1.315	2.500	2.469	PS-200	5	3.000	PS-300	4
1.25	1.660	3.500	3.548	PS-315	5	3.000	PS-275	7
1.5	1.900	3.500	3.548	PS-300	5	3.500	PS-200	5
2	2.375	4.000	4.026	PS-300	6	4.000	PS-300	6
2.5	2.875	4.000	4.026	PS-200	9	4.000	PS-200	9
3	3.500	5.000	5.047	PS-300	8	5.000	PS-300	8
3.5	4.000	6.000	6.065	PS-325	5	6.000	PS-325	5
4	4.500	6.000	6.065	PS-300	10	6.000	PS-300	10
5	5.563	8.000	7.981	PS-425	6	8.000	PS-425	6
6	6.625	8.000	7.981	PS-300	15	10.000	PS-475	10

Notes:
1. *Minimum recommended sleeve length or wall thickness is 4" for PEN-SEAL Model PS-325 and smaller and 6" for Models PS-400 and larger.*
2. *PEN-SEAL sets are sold in belts of ten (10) links.*

ALPHA™ RESTRAINED JOINT
RESTRAINED FLANGED COUPLING

SUBMITTAL INFORMATION

USE

Provides a Restrained Joint for multi-purpose use from IPS PVC through Cast iron to flanged fittings. The ALPHA FC can accommodate up to 4 degrees of deflection. The XL may have limited deflection at the top of the range (2 degrees max.).

FLANGE

Compatible with ANSI Class 125 and 150 bolt circles.

MATERIALS

CASTINGS
All cast components (end rings, center ring, and bolt guides) are ductile iron, meeting or exceeding the requirements of ASTM A 536, grade 65-45-12.

GRIPPERS
Ductile (nodular) iron, meeting or exceeding ASTM A 536, Grade 65-45-12. Machine sharpened and heat treated. Xylan 1424 coated for superior corrosion resistance.

GASKETS
SBR compounded for water and sewer service per ASTM D2000, classified by UL to meet NSF61 or NBR compounded for water and sewer service per ASTM D2000, NSF61 Certified. O-Ring style flange gasket is NBR in accordance with ASTM D2000, NSF61 Certified. Other compounds available upon request.

DRAW HOOKS
Uncoated 304 stainless steel.

RAMP RUNNERS
Nylon 66, Black, 14% Glass filled

BOLTS AND NUTS
5/8-11 bolts with heavy hex nuts. E-coated nuts, 304 stainless steel. Fasteners provided with anti-galling protection.

COATINGS
Flanged coupling body is Romacoat fusion bonded epoxy, NSF 61 Certified. End rings are Romabond polyester.

PRESSURE

When properly installed, the Romac ALPHA coupling can be used at a working pressures equal to the rating of the installed pipe up to 350 psi.

PIPE MATERIALS

The Romac ALPHA series couplings can be used on DI, Oversized Cast Iron, PVC (IPS, C900, C909), and HDPE (SDRs 9, 11, 13.5 and 17). Stiffener not required.

SIZES & RANGES

See catalog.

This information is based on the best data available at the date printed above. Please check with Romac for any updates or changes.

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ROMAC INDUSTRIES, INC.
www.romac.com
21919 20th Avenue SE • Suite 100 • Bothell, WA 98021
Phone (425) 951-6200 • 1-800-426-9341 • Fax (425) 951-6201

ALPHA™ FC

RESTRAINED FLANGE COUPLING ADAPTER

The Alpha FC provides the quickest way to adapt plain end pipe to flanged fittings.

- Once you've assembled the flanged joint, installation is simply inserting the plain end pipe and tightening one nut.
- Flange is compatible with flat face flanges with ANSI Class 125 and 150 bolt circles.
- Standard Alpha Flanged Couplings fit IPS PVC through Ductile Iron pipe diameters.
- Alpha XL Flanged Couplings fit Ductile Iron through Oversize Cast Iron pipe diameters.
- One nut dismantling allows for quick and easy access of valves and other fittings.
- The Alpha Flanged Coupling also accommodates flanged spool pieces for mating to valves and other fittings.
- US Patent: 8,894,100

The o-ring style flange gasket is bonded to the flange coupling body.

SIMPLE AND FAST INSTALLATION

STEP 1: Assemble the flange joint using flange bolts.

STEP 2: Insert pipe and tighten nut.

ALPHA FC is the fast way to connect and restrain plain end pipe to a flanged connection

ALPHA™ FC

RESTRAINED FLANGE COUPLING ADAPTER

MATERIAL SPECIFICATIONS

CASTINGS: All cast components (end ring, center ring and bolt guide) are ductile iron, meeting or exceeding the requirements of ASTM A 536, grade 65-45-12.

FLANGE: Compatible with flat face flanges with ANSI Class 125 and 150 bolt circles.

GRIPPERS: Ductile (nodular) iron, meeting or exceeding ASTM A 536, grade 65-45-12. Machine sharpened and heat treated. Xylan 1424 coated for enhanced corrosion protection.

GASKET: SBR compounded for water and sewer service per ASTM D2000 - classified by UL to meet NSF61, or NBR compounded for water and sewer service in accordance with ASTM D2000 and NSF61 Certified. Other compounds available upon request. Flange gasket is o-ring style (NBR is standard).

DRAW-HOOK FASTENERS: 304L stainless steel.

RAMP RUNNERS: Reinforced nylon.

BOLT & NUT: 304 stainless steel, 5/8-11 bolt with heavy hex e-coated nut. Fasteners provided with anti-galling protection.

COATINGS: Flange coupling body is Romacoat fusion bonded epoxy. End ring is Romabond Polyester.

WORKING PRESSURE: up to 350 PSI.

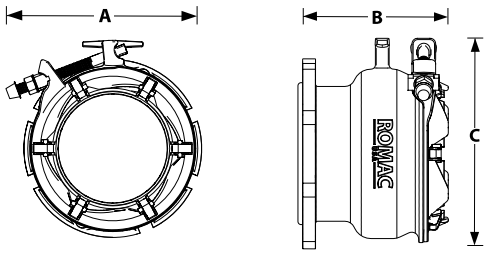
GASKET RANGE CONFIGURATIONS

Alpha Flange Couplings are available in two configurations.

STANDARD ALPHA FLANGED COUPLING
Alpha Flanged Coupling accommodate IPS PVC pipe through Ductile Iron pipe diameters.

ALPHA XL FLANGED COUPLING
Alpha XL Flanged Coupling covers Ductile Iron through Oversize Cast Iron pipe diameters.

DIMENSIONS



Certified to NSF/ANSI 61-G

NOMINAL PIPE SIZE	ALPHA FC GASKET RANGES — ALPHA RANGE	GASKET RANGE (END RING, select gasket range)	DIMENSIONS A O.D.	DIMENSIONS B LENGTH	DIMENSIONS C HEIGHT	APPROXIMATE WEIGHT (lbs.)
4"	STD. ALPHA	4.50 - 4.90	11.20	8.15	10.25	29
	ALPHA XL	4.80 - 5.10				
6"	STD. ALPHA	6.60 - 7.00	11.35	8.24	12.45	40
	ALPHA XL	6.90 - 7.20				
8"	STD. ALPHA	8.60 - 9.10	13.40	9.96	15.55	57
	ALPHA XL	9.05 - 9.40				
10"	STD. ALPHA	10.75 - 11.20	15.45	10.18	17.65	82
	ALPHA XL	11.10 - 11.45				
12"	STD. ALPHA	12.75 - 13.30	17.50	10.28	19.70	105
	ALPHA XL	13.20 - 13.60				

Information contained in this document is subject to change. Contact Romac Industries for any updates.