

2331-121 Avenue NE  
Edmonton, AB  
T6S 1B2



Ph: (780) 475-8801  
Fx: (780) 475-8892  
[www.rushton.ca](http://www.rushton.ca)

## HAMMERHEAD RESOURCES INC.

c/o FUELLED

### 3.0 MM BTU/HR LINE HEATER PACKAGE (SOUR)

P.O.NO.: 18-044 R1  
Project No: Waskahigan Saxon MGS Project  
Rushton Job No. : C-3964  
Date: April 25, 2018

#### TABLE OF CONTENTS

- 1.0 Identification
  - 1.1 Manual Revision Log
  - 1.2 Equipment Identification
- 2.0 Start-Up Instructions
- 3.0 Drawings
  - 3.1 Mechanical Flow
  - 3.2 Line Heater (Non-Code)
  - 3.3 Process Coils
  - 3.4 Skid
- 4.0 Parts Distributors
- 5.0 Equipment Specifications
  - 5.1 Instruments
  - 5.2 Burner Train
- 6.0 Process Coils
  - 6.1 Travel Sheet
  - 6.2 AB 28
  - 6.3 Registration AB
  - 6.4 Plate Rubbing
  - 6.5 Radiographic Report
  - 6.6 PWHT
- 7.0 Reports
  - 7.1 Hydro / Pneumatic Test Report & Calibration Certificates
  - 7.2 Electrical Permit



## 1.0 Identification

### 1.1 Manual Revision Log





## 1.2 Equipment Identification

2331-121 Avenue NE  
Edmonton, AB  
T6S 1B2



Ph: (780) 475-8801  
Fx: (780) 475-8892  
[www.rushton.ca](http://www.rushton.ca)

**EQUIPMENT IDENTIFICATION**  
**FOR RUSHTON**  
**LINE HEATER PACKAGE**

**CUSTOMER:** Hammerhead Resources Inc.      **P.O. NO.:** 18-044 R1  
**PROJECT:** KARR BATTERY      **RUSHTON JOB NO.:** C-3964 A  
**LOCATION:** LSD# 01-16-65-03 W6M

**3.0 MM BTU/HR LINE HEATER**

**DESCRIPTION:** 6 COILS (4) Passes x 4" x 18'-0" LG x 1440 PSIG x -20/250°F x 0.125" C.A  
**SERIAL NO.:** C3964A.CB  
**C.R.N. NO.:** Y6789.2  
**A #:** 672696



## 2.0 Start-Up Instructions

# **INSTALLATION:**

Heat Medium/Heater package needs to set on a flat level foundation.

## **ELECTRICAL GENERAL INFORMATION**

**If Burner Management System is to be wired at site please read the following tips:**

- 1.) All Burner Trains Manufactured by Rushton supported by the various BMS providers must be wired per our standard electrical schematic drawings. Deviation from these wiring drawings should have approval prior to electrical installation, otherwise you run the risk of deficiencies from field inspection.
  
- 2.) Class 1, Zone 2 Area (outside building)  
Electrical seals do not need to be installed on components installed outdoors. You only need to have a seal installed where the area classification changes. The electrical connection to the windbox changes from a “Zone 2” area to an “Unclassified” area, which means the windbox will always need to have a seal, but you don’t need a second seal at the BMS for the ignition cable. If all other components are installed outdoors, then no other seals are required.
  
- 3.) Class 1, Zone 1 area (inside building)  
All components installed in a Zone 1 area must have electrical seals installed on teck cables that will leave the area (ie. LSSL and thermocouples that go outdoors to the BMS). Technically, you only need to have one seal installed at a junction box on the wall where it transitions from Zone 1 to Zone 2, however, practically speaking the teck cable will not stop at the wall and will instead go from the component directly to the BMS. Since there is no seal at the wall, there must be a seal at each end of the cable instead. That means a component installed indoors that connects directly to the BMS outdoors must have a seal at both ends of the cable.  
Alternatively, all components inside the building can be connected to a conduit and terminate at an explosion proof sealed junction box on the wall. If the junction box has a poured seal around the wires, any teck cables that connect to the conduit will not require a cable seal. If the junction box is not internally sealed, the cable or conduit will need to have a seal at the connection to the junction box. Since the conduit or cable seal is installed at the wall, there does not need to be a second seal at the BMS.

- 4.) For all projects the commissioning agent will require documentation showing the electrical hazardous area classification of the appliance (ie. Fuel train and BMS control panel). This is typically a site drawing that shows Class 1, Zone 1 (Div1) and Class 1, Zone 2 (Div 2) locations at the plant. On this drawing, the location of the gas appliance the commissioning agent is inspecting should be clearly shown and it should clearly indicate the indoor area classification as well as the outdoor area classification.
- 5.) If this documentation cannot be provided the commissioning agent will assume all outdoor areas are Zone 2 and all indoor areas are Zone 1, which is generally a safe assumption. It is possible to have an indoor area classified as a Zone 2 area if there is "adequate ventilation" to limit the Lower Explosive Limit (LEL) to less than 25% in the case of a gas leak. In this case, the commissioning agent must have documentation from the client to confirm the ventilation is properly configured.
- 6.) Most Burner Management Systems (BMS) are only rated to be installed in a Class 1, Zone 2 (Div 2) area. That means if they are installed inside the building, the commissioning agent needs proof the area is classified as Class 1, Zone 2. If the inside of the building is not properly classified, then this is a code deficiency that will need to be addressed. This can be addressed by installing the proper ventilation to reclassify the building, or by moving the BMS outdoors into a Zone 2 area.



# BURNER START UP

## EFFICIENCY RECOMMENDATIONS

Following these steps you will maximize your burner design while adhering to B149.3 and safe work practice. These recommendations are to improve Burner efficiencies to maintain a target efficiency range of 72% to 82%.

- 1.) To achieve the Heater rated design, Rushton drawings and specifications must be followed along with the below steps. The drawings represent the fire tube absorbed (NET) Duty.
- 2.) Burner mixer orifices are sized and drilled to meet the BTU requirements of this specific application based on a fuel gas heating value of 1000 Btu/hr./SCF. Heater efficiencies are taken into consideration during orifice sizing for the appliance.
- 3.) The main burner regulator (627R) is to be field set typically 12 to 15 PSI (82 to 103 kPA).
- 4.) After the burner regulator has been set the pressure switch low low (PSLL) shall to be set @ 0.5 times the regulator set point. The pressure switch high high (PSHH) shall to be set @ 1.25 times the regulator set point.

# LIGHTING INSTRUCTIONS

- 1.) Before initiating the lighting procedure any bolt down tagged loosen before commissioning has to be loosened to allow for expansion and contraction, this would typically be the leg at the burner end.
- 2.) Check that the burner nozzle is in alignment with the fire tube. There may be misalignment due to vibration during transport or site personnel making or checking orifice adjustments.
- 3.) Adjust primary air shutter on mixing chamber by fully closing air shutter then opening two full turns and locking into position with the locking nut. Final adjustment may be required after to ensure a blue flame with yellow feathers at the end of the flame.
- 4.) If burner is equipped with a secondary air plate located at burner nozzle this should be 30% open. Final adjustment may be required after stack samples are taken to achieve 2-8% O<sub>2</sub> levels in the stack.
- 5.) Close the ball valve located upstream of burner train strainer.
- 6.) Close main ball valve located @ the burner housing.
- 7.) Open the ball valve upstream of burner train strainer, check PI directly downstream of main regulator, it must READ the regulator set pressure stated on the drawing. After appliance is commissioned & running this pressure shall be maintained while following a high fire burner.
- 8.) Ensure ¼" ball valve upstream of pilot regulator is open and PI mounted on regulator is reading 5 PSIG.
- 9.) To ignite pilot push pilot ignite button on burner management panel (this may take several attempts until the pilot line is purged and flame is established).
- 10.) The pilot should be allowed to run for half to one hour to allow fire tube and stack to warm up prior to ignition of the main burner/burners.
- 11.) Check burner management panel it will show mains are open, at this point the ball valve at the burner housing can be slowly opened to allow the main burner to ignite.

- 12.) Once main burner is established adjust primary air to establish a blue flame with yellow feathers at the end of the flame.
- 13.) The bath temperature will slowly start to increase, operations will monitor the bath temperature indicator and set temperature controller accordingly.
- 14.) Maintain an oxygen level at stack sample point of 2% to 8% for best efficiency and to minimize carbon monoxide emissions. To achieve these percentages the use of a flue gas analyzer is recommended. Refer to item #4.
- 15.) A stack temperature of 350°F to 650°F above the bath temperature is recommended and higher stack temperatures may result in lower efficiency. A lower stack temperature may cause condensing of the combustion gases doubled with colder ambient conditions this may result in the flame arrester freezing off.
- 16.) A 4 to 1 turn down of these appliances is allowable as long as the efficiencies are maintained in the 72% to 82% range.

### **TROUBLE SHOOTING:**

#### **BURNER OF PILOT FAILURE:**

The orifice of the air-gas mixer may be stopped up. Clean out. Do not drill a larger orifice. Blow out supply gas line - it may be full of liquid

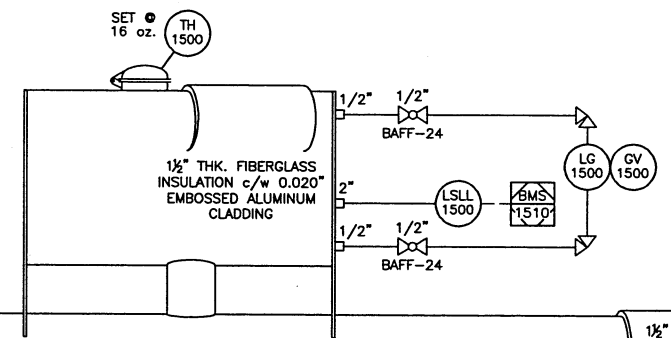


## 3.0 Drawings

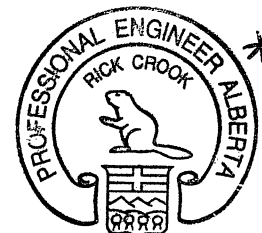
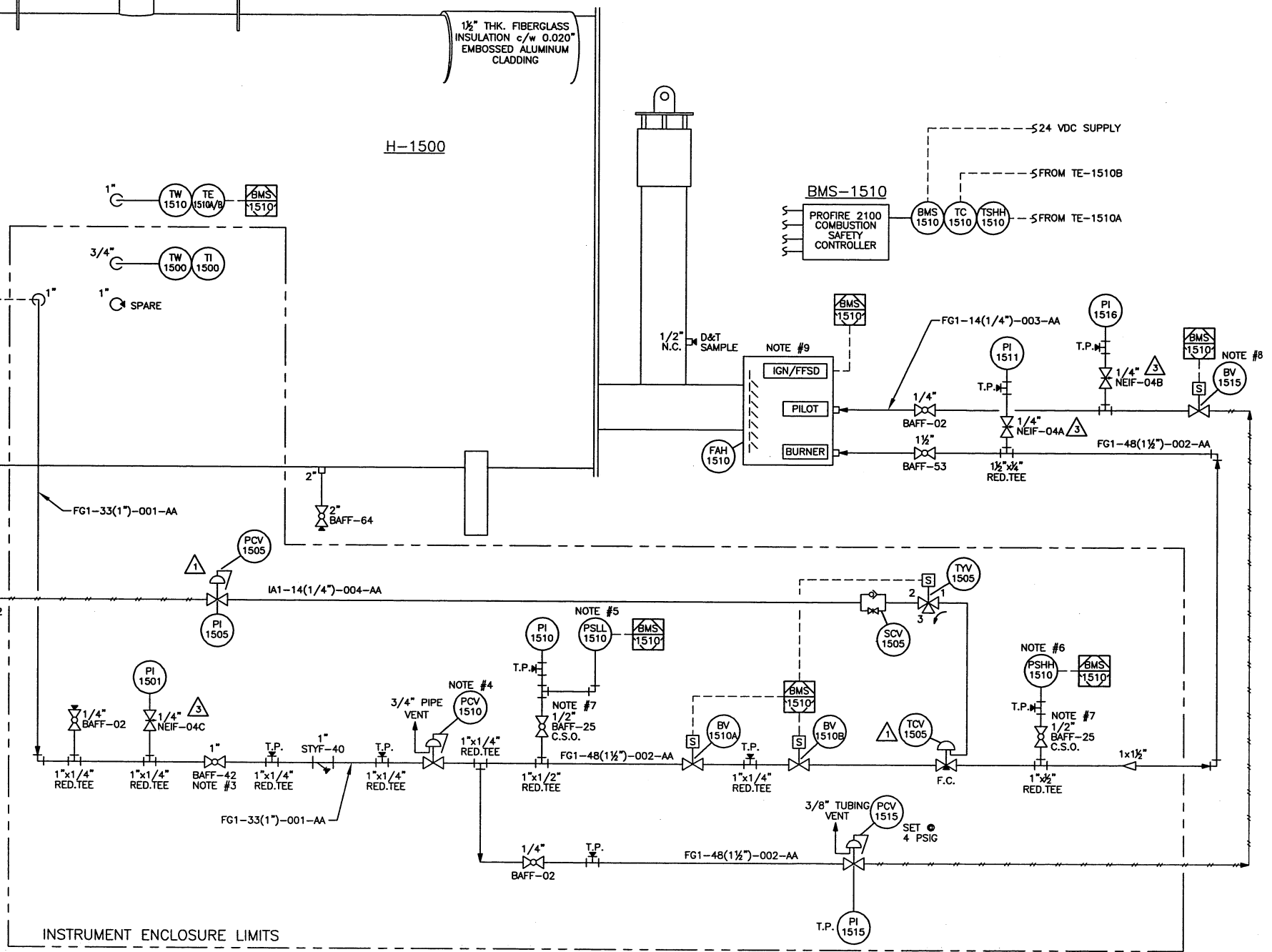
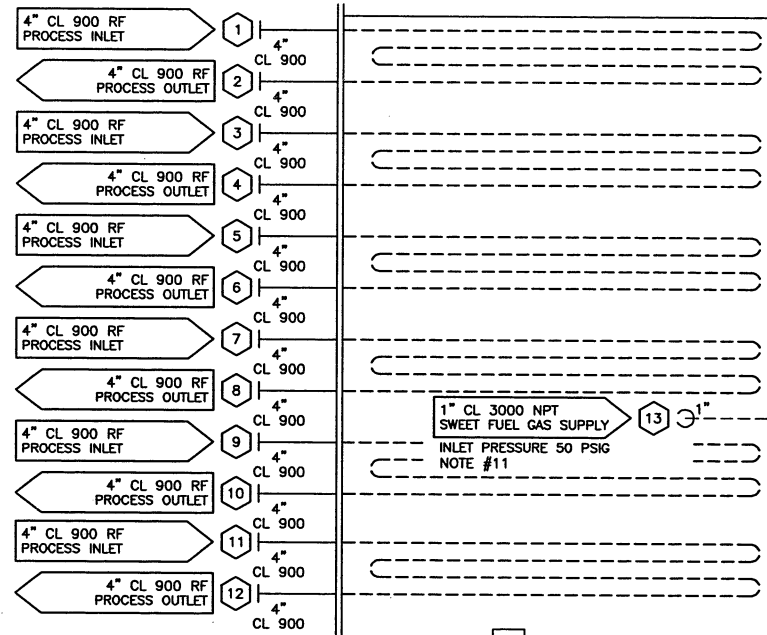
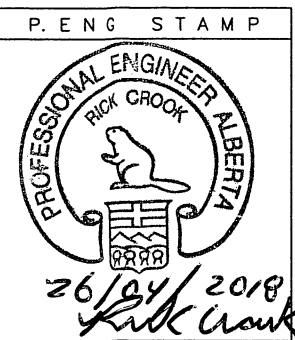
### 3.1 Mechanical Flow

RUSHTON PERMIT TO PRACTICE NUMBER: P 13249

**H-1500**  
**PROCESS LINE HEATER**  
 3.0 MM BTU/HR, 84" OD x 20'-0" LG  
 30" OD x 38'-3" LG, (3/8" THK.) FIRE TUBE  
 30" OD x 22'-0" HIGH REMOVABLE STACK c/w RAIN CAP  
 36" OD x 5'-6" LG EXPANSION TANK  
 (24) PASSES OF 4" CL 900 RF SCH 80 [(4) PASSES PER COIL, (6) COILS]  
 PROCESS COIL DP: 1440 psig @ 250°F  
 S/N: C3964A.CB; REGISTERED IN AB CRN: Y6789.2



**BMS-1510**  
**BURNER MANAGEMENT SYSTEM**  
 PROFIRE 2100 IGNITION FLAME SAFETY CONTROLLER c/w FLAME ROD/IGNITOR, CSA 22.2-199 APPROVED, PROFIRE MODEL PFTC12-K  
 K-TYPE THERMOCOUPLE, CLASS 1 Div 1 HEAD, PROFIRE FLAME BACKUP THERMOCOUPLE, PROFIRE IGNITION TRANSFORMER 1/2" VDC (MOUNTED INSIDE FLAME ARRESTOR HOUSING) AND THERMOWELL, 1/2"x1"x9" LG, AISI 316 SS, MAWP 7000 psig, 15' LONG IGNITION CABLE PILOT ASSEMBLY NOZZLE MIXER & SIZE #65 ORIFICE



*\* INSTRUMENTATION (MANA)*  
*CHECKED AGAINST*  
*PSV/PT SET*  
*PRESSURES*

26/04/2018  
 Rick Crook

- NOTES:**
- INSTRUMENT TUBING TO BE 3/8" (0.035" W.T.) 316SS c/w 316SS SWAGelok TUBE FITTINGS.
  - FIELD APPROVAL TO B149.3 COMPLIANCE IS DONE AFTER PACKAGE IS COMMISSIONED.
  - INSTALL ALL FUEL TRAIN VALVE HANDLES WHEN IN OPEN POSITION THEY POINT TO THE DIRECTION OF FLOW.
  - PCV-1510 TO BE FIELD SET: ENSURE 3/4" SCREEN CAP IS INSTALLED ON THE TERMINATION OF VENT PIPE.
  - PSLL TO BE FIELD SET @ 0.5X THE PCV-1510 SET PRESSURE.
  - PSHH TO BE FIELD SET @ 1.25X THE PCV-1510 SET PRESSURE.
  - INSTALL TAG VALVE MUST BE C.S.O. DURING NORMAL OPERATION.
  - SOLENOID MUST BE MOUNTED OUTSIDE THE ENCLOSURE AND CLOSE TO THE PILOT ENTRY INTO THE FLAME CELL HOUSING.
  - PILOT IGNITOR TRANSFORMER SHALL BE MOUNTED IN THE TOP PORTION OF THE FLAME ARRESTOR HOUSING, PREFERABLY @ 12 O'CLOCK POSITION.
  - ELECTRICAL AREA CLASSIFICATION INSIDE THE ENCLOSURE IS CLASS I DIV. 1, DIRECTLY OUTSIDE THE ENCLOSURE IS CLASS I DIV. 2.
  - SWEET FUEL GAS (TIE-IN #13) SHALL BE PROTECTED WITH A PSV SET @ 65 psig.
  - FINAL VENT TERMINATIONS OF REGULATORS PRIOR TO CERTIFICATION INSPECTION IS TO BE ACCESSED AND COMPLETED BY CUSTOMER AFTER PACKAGE IS SET ON SITE FOUNDATION.

**TIME CARD**  
 ( 1 ) REQ'D  
 C-3964-PP

REV	DESCRIPTION	DATE	BY
A	ISSUED FOR APPROVAL	02/13/18	A.F.
0	ADDED INSTRUMENT AIR TIE-IN, REVISED COIL FLANGE RATING & INSTRUMENT TAGGING, ADDED (1) BAFF-02, ISSUED FOR CONSTRUCTION	03/08/18	A.F.
1	REVISED VENTING ON PCV-1505 & TCV-1505, RE-ISSUED FOR CONSTRUCTION	04/11/18	A.F.
2	REVISED NOTES #1 & #4, REVISED H-1500 DESCRIPTION, RE-ISSUED FOR CONSTRUCTION	04/19/18	A.F.
3	REVISED TAGS FOR NEIF-04A, NEIF-04B & NEIF-04C	04/25/18	A.F.
4	AS-BUILT	04/26/18	A.F.

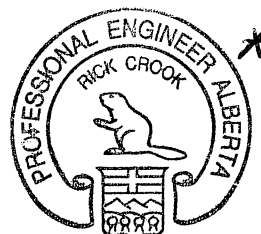
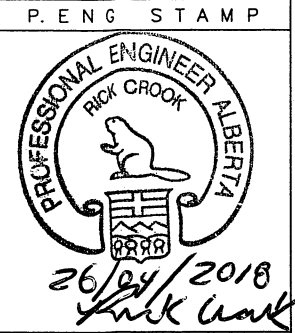


CUSTOMER: HAMMERHEAD RESOURCES INC.		LOCATION: 01-16-65-03 W6M	
c/o FUELLED ENERGY MARKETING INC.		KARR BATTERY	
<b>MECHANICAL FLOWSHEET</b>			
3.0 MM BTU/HR PROCESS LINE HEATER PACKAGE (SOUR)			
DATE: 02/13/18	DRN BY: A.F.	SCALE: N.T.S.	CHKD BY: [Signature]
APPRD BY: [Signature]	DWG NO: C-3964-B1	REV: 4	

RUSHTON PERMIT TO PRACTICE NUMBER: P 13249

TAG #S	QTY	DESCRIPTION
LG/GV 1500	1	Essex 84A gauge valves, 1/2" NPT, cast brass ASTM 8554 body c/w 5/8" redline glass and guard.
LSLL 1500	1	Kimray model CEC2-2200 SLS SS6SPDT low level switch c/w test button, CSA C22.2 approved, MAWP 2000 psig.
TH 1500	1	JAYCO thief hatch model JT-8, Standard service. 16oz Pressure setting. 0.4 oz vacuum relief aluminium construction, buna pressure and vacuum gaskets.
TI/TW 1500	1	Gaugetech GT34-08 Bimetal Thermometer, 1/2" MNPT, center back mount, 50 to 500 °F, dual scale °F/°C, 3" dial, 4" stem, 304 high polish stainless steel case/ring/stem, shatter proof 4mm thick glass, hermetically sealed, rubber/silicone filling gasket, re-calibration hex head screw to zero pointer, ±1% Full scale accuracy ASME B40.3 Grade A, MAWP 85 Psig c/w Gaugetech Stepped Thermowell, p/n: S34-040-316, 1/2" x 3/4" x 4" lg, 316 stainless steel construction, 2 1/2" "U" Length, ø0.260" dia. bore, 4.25" OAL, MAWP 7000 Psig
BAFF 64	1	Meridian Ball Valve 2" NPT, p/n: MERM12B2, reg port, A105 carbon steel 1-piece bar-stock body/ gland ring, A276-304 stainless steel ball, A276-316 stainless steel stem, glass fiber filled PTFE ball seat, PTFE packing, blowout proof stem, NACE MR-0175 Compliant, MAWP 1500 psig
BAFF 24	2	Meridian Ball Valve 1/2" NPT, p/n: MERM12BK, reg port, A105 carbon steel 1-piece bar-stock body/ gland ring, A276-304 stainless steel ball, A276-316 stainless steel stem, glass fiber filled PTFE ball seat, PTFE packing, blowout proof stem, Compliant, MAWP 2000 psig
<b>BURNER TRAIN</b>		
FAH 1510	1	Zirc Burner Assembly, 3.0 MM BTU/HR Flame Arrestor, 2 Piece Assembly c/w (28) 9/16" ø holes on a 32 1/2" B.C.D. straddling centerline, (1) 1 1/2" coupling side gas connection & (1) 1/4" pilot connection. Model FAB 42-24-30A(2)M200B200160N20030 c/w (1) 42" Aluminum Flame Element, (2) ACL-M200 Mixers, Pre-drill "N" orifices (2) ACL-B20016 Venturi Barrels & (1) ACL-ON2X20030 Dual Combustion Optimizer Burner Nozzle, Flame Cell Hinged on right side viewing from Flame Cell Intake, Burner Pressure is 10 psig and field adjustable c/w ACL-M50A, 1/2" NPT pilot mixer-Nipple, group ULC (Only)
BMS/TSHH/TE/TW/TC 1510	1	Profire 2100 Ignition Flame Safety Controller c/w flame rod/ignitor, CSA 22.2-199 approved, Profire model PFTC12-K Dual type K thermocouple, Class I Div 1 head, Profire flame backup thermocouple, Profire ignition transformer 12/24 VDC (mounted inside flame arrestor housing) and thermowell, 1/2" x 3/4" x 9" lg, A.I.S.I. 316 SS, MAWP 7000 psig. 15' long ignition cable pilot assembly nozzle mixer & size #65 orifice
BV 1510A/1510B	2	Asco Gas Shutoff Valve 1" NPT, p/n: HV298568-002, ø1" orifice, 304 stainless steel body, FKM seals & discs, low-temp HNBR diaphragm, 305 stainless steel core tube, Inconel springs, 13 Cv flow, 23.6 peak watts power consumption, 24 VDC, NACE MR-0175 Compliant, CSA 6.5 C/I Safety Shutoff, ANSI/ISA-12.27.01-2003 Single Seal, MAWP 100 Psig
BV 1515	1	Asco Gas Shutoff Valve 1/4" NPT, p/n:HV427246-002, ø5/32" orifice, 304 stainless steel body, FKM seals/discs, PTFE rider ring, Inconel springs, 0.52 Cv flow, 10.6 peak watts power consumption, 24 VDC, NACE MR-0175 Compliant, CSA 6.5 C/I Safety Shutoff, ANSI/ISA-12.27.01-2003 Single Seal, MAWP 100 Psig
PCV 1510	1	1" NPT Fisher 627R regulator, ductile iron body, aluminum spring case, 3/8" orifice, 5-20 psi spring, field set, MAWP 1000 psig
PCV 1505/1515	2	Fisher 67 CFR pressure regulator, 1/4" NPT, 0-35 psig spring range vented bonnet, ASTM B85/alloy 380 aluminum body, MAWP 250 psig
PI 1505	1	WGI Classic 250 Series Bottom Mount Pressure Gauge 1/4" NPT, p/n: WJ4642, 0-30 Psig range, 2 1/2" dial, dual scale, Black Steel case, Brass tube soldered to brass socket, glass lense, dry fill, white Aluminum dial, ASME Grade B, MAWP 1500 Psig
PI 1501	1	Gaugetech Bottom Mount Pressure Indicator, p/n GTG-2518A-12, 1/4" MNPT, 0-100 psig range, 2 1/2" face, dual scale psig/kPag, phosphor bronze bourdon tube & brass socket, plexi glass window, S.S case, Neoprene gasket, glycerin /H2o fill, accuracy ±3/2/3% ASME B40.1 grade B, MAWP 1500 psig
PI 1510/1511	2	WGI Elite 250 Series Pressure Gauge 1/4" NPT, p/n: WJ7842P, 0-30 Psig range, 2 1/2" dial, dual scale, bottom mount, 304 S.S. case, 316L S.S. tube/socket, acrylic/ safety glass lense, silicone fill fluid, nitrile vent plug, white aluminum dial, ASME B40.1 Grade A, MAWP 1100 Psig
PI 1515	1	WGI Classic 250 Series Bottom Mount Pressure Gauge 1/4" NPT, p/n WJ4640, 0-15 Psig range, 2 1/2" Dial, Dual Scale, Black Steel case, Brass tube soldered to brass socket, Glass Lens, Fill Fluid none, white Aluminum dial, ASME Grade B, MAWP 1500 Psig @ 140°F
PI 1516	1	Wika Series 233.53 Lower Mount Pressure Indicator, 1/4" MNPT, p/n 7309326, 0-15 psig range, 2 1/2" Face, Dual scale, 316SS bourdon tube and connection, 304SS case, dry, MAWP 600 psig, NACE
PSHH 1510	1	CCS Dual Snap Electric Pressure Switch 1/2" NPT, p/n: 6900GZE-12, 3-20 psig adjustable pressure range, set @ TBD psig & rising, 316 stainless steel pressure port/diaphragm, Viton O-ring, aluminium housing II amp SPDT, 750 psig proof pressure, hermetically sealed electrical assembly, 2-30 VDC, dual seal ANSI/ISA-2337.01-2003, 2 Psig Approx. dead band, NACE MR-1075 Compliant, CSA Explosion Proof Class I Div. I & II Groups A,B C, MAWP 500 psig

TAG #S	QTY	DESCRIPTION
PSLL 1510	1	CCS Dual Snap Electric Pressure Switch 1/2" NPT, p/n: 646GZE1-7011, 0.4-15 psig adjustable pressure range, set @ Field Set Psig & Falling, 316 stainless steel pressure port/diaphragm, aluminum housing, Viton O-rings, 750 Psig proof pressure, approx. 1 psi dead band, 2-28 VDC, dual seal ANSI/ISA-2337.01, NACE MR-1075 Compliant, CSA Explosion Proof Class I Div. I & II Groups A,B C & D MAWP 500 Psig
SCV 1505	1	NAS-AS Series Speed Controller 1/4" NPT, p/n: NAS-4000-NO2, aluminum alloy body/ needle, zinc alloy lock nut, NBR o-ring, proof pressure 217.5 Psig, free flow rate 1670 Ft <sup>3</sup> /Hr, controlled flow rate 1670 Ft <sup>3</sup> /Hr, MAWP 145 psig
TCV 1505	1	DynaFlo DF-100 Series Control Valve 1" NPT, p/n: DF100-GC6-6DN-34S, ø3/4" port, 8.32 Cv flow rating @100% open, LCC carbon steel body, 316 stainless steel stem, 17-4Ph stainless steel seat ring, HNBR O-rings, PTFE Packing, nitrile actuator diaphragm, 3/8" Max stem travel, Max actuator casing pressure 50 Psig, Class IV shutoff, Fail Closed, MAWP 2250 Psig
TYV 1505	1	ASCO 3-Way Solenoid Valve 1/4" NPT, p/n: EF8320G202, ø 3/32" orifice, 303 stainless steel body, NBR seals/discs, 302 stainless steel core springs, 0.12 Cv, 11.6 watt power consumption, normally closed operation, 24 VDC, Explosion Proof Class I Div. I & Div. II, Groups A,B,C & D, MAWP 115 psig
BAFF 53	1	NEO Ball Valve 1 1/2" NPT, p/n:1½-2500, full port, A351-Gr.CF8M two piece body/ball, 316 stainless steel stem, Teflon stem packing/joint gasket, 304 stainless steel gland packing, blow out proof stem, CSA 3.16 Certified, MAWP 2000 psig WOG
BAFF 42	1	NEO Cat. No. 2500, 1" NPT ball valve, 316 SS, CGA 3.16 approved and marked, MAWP 2000 psig WOG
BAFF 25	2	Meridian Ball Valve, 1/2" NPT CL 800, p/n: MAC2CFK, full port, A216 Gr. WCB carbon steel body, A276/316 stainless steel stem, A351/CF8M stainless steel ball, RPTFE ball seats, PTFE stem seal packing, Fire safe To API 607 5th Edition, tested to API 598, NACE MR-0175, MAWP 2000 psig
BAFF 02	4	NEO Cat. No. 2500, 1/4" NPT ball valve, 316 SS, CGA 3.16 approved and marked, MAWP 2000 psig WOG
NEIF 04A	1	WGI Instrument Needle Valve 1/4" MNPT x 1/4" FNPT, p/n: WN1612-PN, A175SS body/ bonnet, 316 stainless steel stem, PTFE Teflon stem packing, ø1/8" Orifice, hard seat, NACE MR-0175 Compliant, MAWP 6000 Psig
NEIF 04B	1	WGI Instrument Needle Valve 1/4" MNPT x 1/4" FNPT, p/n: WN-1432-P, SA-479-316 stainless steel body/ bonnet/stem, PTFE Teflon packing, ø1/8" orifice, hard seat, NACE MR-0175 Compliant, MAWP 6000 Psig
NEIF 04C	1	WGI Miniature Needle Valve 1/4" MNPT x 1/4" FNPT, p/n: WN-0512, SA-105N carbon steel body/bonnet, SA-479-316 stainless steel spindle/tip, PTFE/grafoil seals, rotating stem, ø1/8" orifice, hard seat, NACE MR-0175 Compliant, MAWP 6000 Psig
STYF 40	1	1" NPT Alberta Strainer YS-3000 Y-strainer, carbon steel ASTM A105N body & cover, 304SS screen c/w 1/32" perforations, MAWP 1940 psig( Shop remove basket and install 100 mesh s:s screen material over the basket.)



*\* INSTRUMENTATION (MAWP)  
CHECKED AGAINST  
REV/PT SET  
PRESSURES*

*26/04/2018  
Rick Crook*

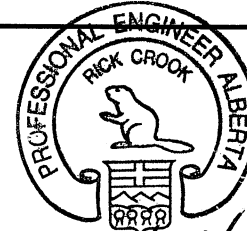
TIME CARD  
( 1 ) REQ'D  
  
C-3964-PP

REV	DESCRIPTION	DATE	BY
A	ISSUED FOR APPROVAL	02/13/18	A.F.
0	ADDED (1) BAFF-02, ISSUED FOR CONSTRUCTION	03/08/18	A.F.
1	REVISED FAH-1510 DESCRIPTION	03/18/18	A.F.
2	REVISED DESCRIPTIONS FOR TI/TW-1500, PI-1501, TCV-1505, NEIF-04A, NEIF-04B, & NEIF-04C	04/25/18	A.F.
3	AS BUILT	04/26/18	A.F.



CUSTOMER: HAMMERHEAD RESOURCES INC.		LOCATION: 01-16-65-3 W6M	
c/o FUELLED ENERGY MARKETING INC.		KARR BATTERY	
<b>BILL OF MATERIALS</b>			
3.0 MM BTU/HR PROCESS LINE HEATER PACKAGE (SOUR)			
DATE: 02/13/18	DRN BY: A.F.	SCALE: N.T.S.	CHKD BY: <i>AC</i>
APPRO: <i>AC</i>	DWG NO: C-3964-B2	REV: 3	

NOTES:  
\* REDUCED C.A. FOR 1/4" PIPE



*PROCESS PIPING MATERIAL  
CHECKED AGAINST DP, DT, CA*

*26/04/2019 Rick Crook*

Doc. No: C-3964-LL	Rev. No: 3	<b>PIPING CONSTRUCTION DATA REPORT</b>	Date: 04/13/2018
Service: SWEET			

Drawing No. Rev. No. Line No.	Fluid (air/Strm. Etc.) FROM/TO	Des. Press. PSI (kPa)	Des. Temp. °F (°C)	Test Press. PSI (kPa)	Test Medium	Pipe Mat'l Spec & Grade	C.A in (mm)	Pipe NPS & Schedule	Flange Material & Rating	P.W.H.T. Y/N Preheat Temp. °F	NDE
DWG # C-3964-B1 Rev. 4											
DWG # C-3964-C1 Rev. 1											
FG1-33(1")-001-AA	FUEL GAS H-1500 / PCV 1510	285 (1965)	-20/250 (-29/121)	428 (2951)	WATER	SA-106B	0.0625/ *0.0559 (1.6"/1.419)	1" / 1/4" SCH 80 (TE)	N/A	N/A	V.T.
FG1-48(1 1/2")-002-AA	FUEL GAS PCV 1510 / H-1500 & PCV-1515	65 (448)	-20/200 (-29/93)	72 (496)	AIR	SA-106B	0.0625/ *0.0576 (1.6"/1.463)	1 1/2" / 1" / 1/2" / 1/4" SCH 80 (TE)/ 1 1/2"x1" SCH 80 SWAGE (TE)	N/A	N/A	V.T.
FG1-14(1/4")-003-AA	FUEL GAS BV-1515 / H-1500	65 (448)	-20/200 (-29/93)	72 (496)	AIR	SA-106B	*0.0576 (*1.463)	1/4" SCH 80 (TE)	N/A	N/A	V.T.
IA1-14(1/4")-004-AA	INSTRUMENT AIR PCV-1505 / TCV 1505	27 (186)	-20/100 (-29/38)	30 (207)	AIR	SA-106B	*0.0576 (*1.463)	1/4" SCH 80 (TE)	N/A	N/A	V.T.
INSTRUMENT AIR TUBING	INSTRUMENT AIR	65 (448)	-20/200 (-29/93)	72 (496)	AIR	316SS	0 (0)	3/8" DIA. (0.035" W.T.)	N/A	N/A	V.T.



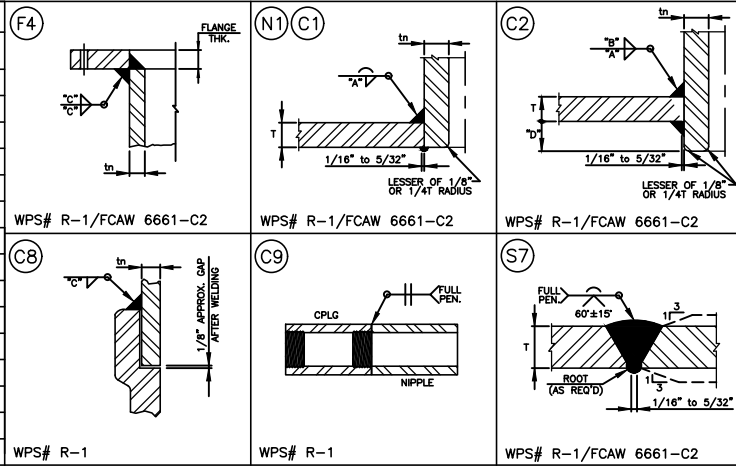
### 3.2 Line Heater (Non-Code)



RUSHTON PERMIT TO PRACTICE NUMBER: P 13249

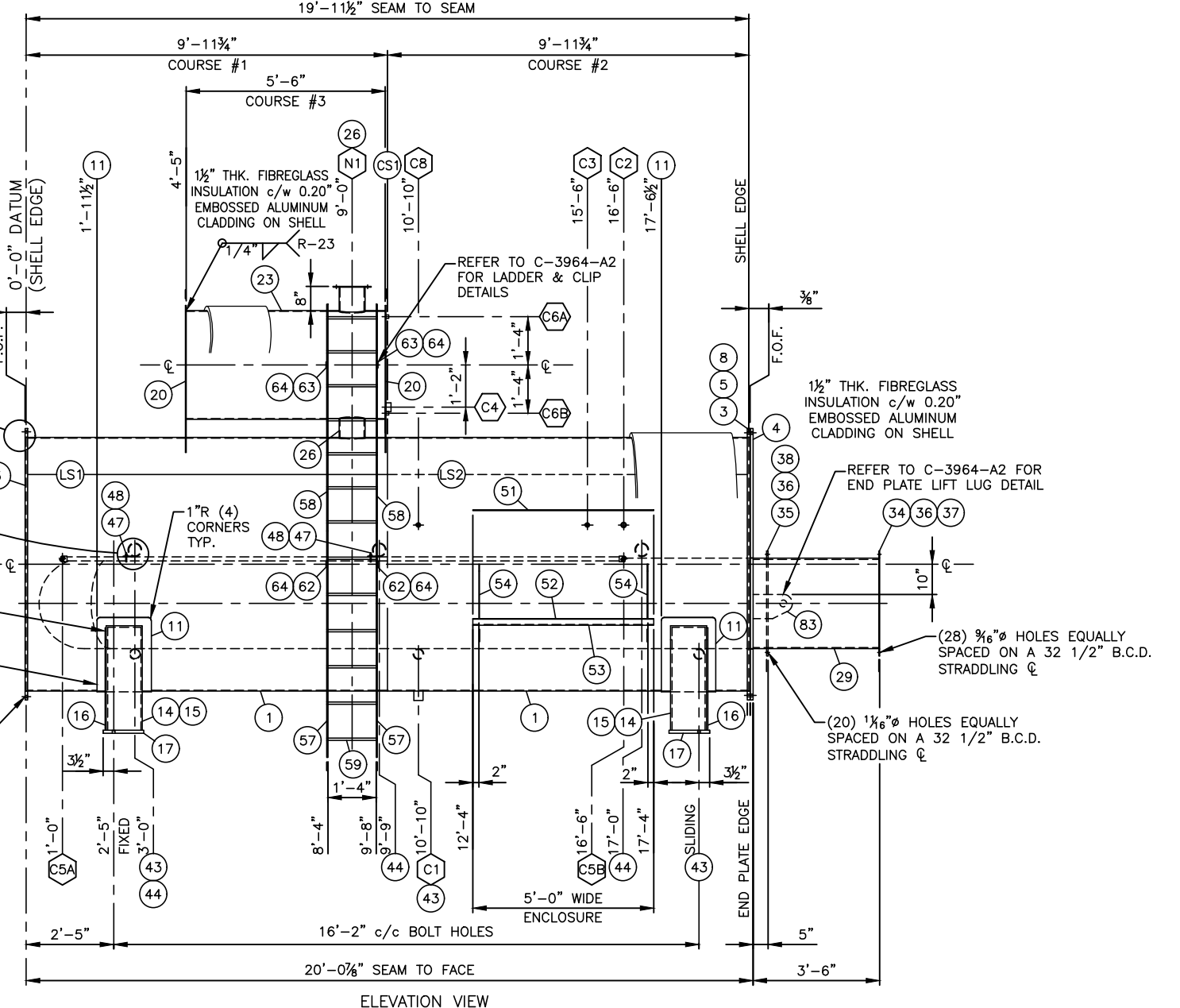
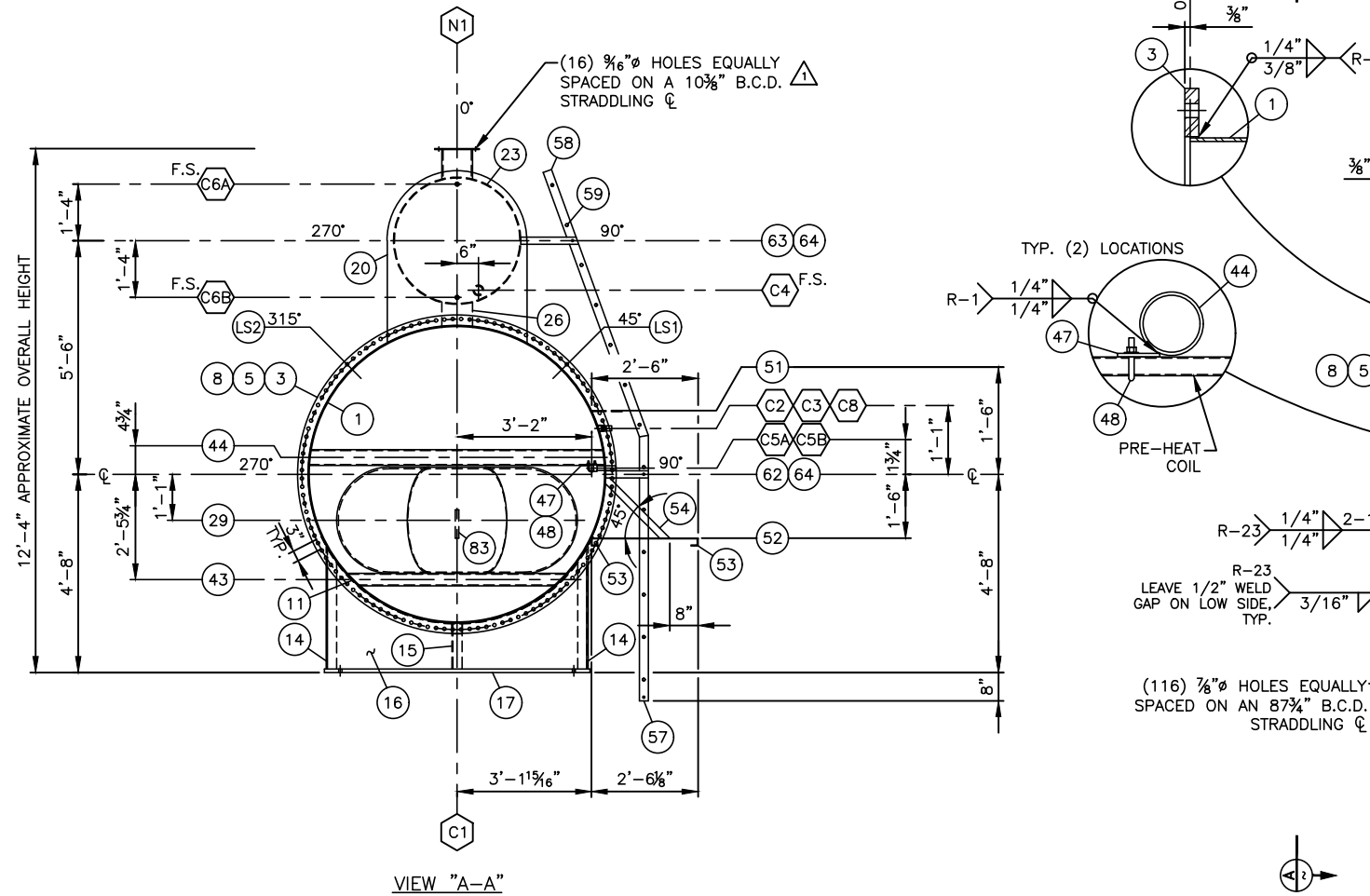
**NOZZLE SCHEDULE**

ITEM NO.	QNTY REQ'D	SIZE (NPS)	RATING	SERVICE	WELDING DETAILS	WELD SIZE "A" "B" "C"	INT. PROJ. "D"
N1	1	8"	PLATE FLANGE	THIEF HATCH	F4, N1	1/4"	1/4"
C1	1	2"	CL 3000	HEATER DRAIN	C1	1/4"	
C2	1	1"	CL 3000	SPARE c/w PLUG	C1	1/4"	
C3	1	3/4"	CL 3000	TI	C1	1/4"	
C4	1	2"	CL 3000	LSL	C1	1/4"	
C5A/B	2	1"	PIPE	PRE-HEAT COIL	C2, C8	1/4" 1/4" 1/4"	
C6A/B	2	1/2"	CL 3000	LG	C1	1/4"	
C7	1	1/2"	CL 3000	SAMPLE c/w PLUG	C1	1/4"	
C8	1	1"	PIPE	TE	C1, C9	1/4"	



**DESIGN NOTES:**

- LONG & CIRC. SEAMS USE WELD DETAIL "S7".
  - ALL FILLET WELDS TO BE 3/16" MIN. ALL AROUND FOR TEE & LAP JOINT CONNECTIONS UNLESS NOTED.
  - ALL BUTT WELDS ON FIRE TUBES TO BE FULL PENETRATION TYPE FOR GROOVE WELDS.
- FABRICATION NOTES:**
- ALL DIMENSIONS ARE TO REFERENCE LINE UNLESS NOTED OTHERWISE.
  - HEATER TO BE THOROUGHLY DRAINED & CLEANED WITH ALL OPENINGS PLUGGED BEFORE SHIPMENT.
  - ALL BOLT HOLES TO STRADDLE NATURAL C/S UNLESS NOTED.
  - ALL FIRE TUBE SUPPORT PIPES THAT ARE SEAL WELDED TO SHELL MUST HAVE A MINIMUM OF A 1/4" HOLE DRILLED ON BOTH THE TOP AND BOTTOM SIDES FOR VENT/DRAIN PURPOSES.
- GENERAL NOTES:**
- APPROXIMATE OVERALL WEIGHT (INCLUDING FIRE TUBE, STACK & PROCESS COILS): 29,100 lbs
  - APPROXIMATE OVERALL FLOODED WEIGHT: 73,700 lbs
  - APPROXIMATE OVERALL VOLUME (EXCLUDING FIRE TUBE, EXPANSION TANK & PROCESS COILS): 676.8 cu.ft.
  - HEATER TO BE FILLED WITH WATER AND LET STAND FOR 4 HOURS MIN. AND BE VISUALLY INSPECTED FOR LEAKS.
  - STACK TO BE BOLTED IN PLACE AND TEST FITTED TO ENSURE LEVEL AND STRUCTURAL SUPPORTS ARE MAKING CONTACT SUCH THAT NO EXCESSIVE LOADING IS APPLIED TO HEATER END PLATE AND STACK FLANGE BOLTING.



<b>TIME CARD</b>
( 1 ) REQ'D
C-3964-LH

DRAWING NUMBER	REFERENCE DRAWINGS
VSL-TOLR-STD	VESSEL FABRICATION TOLERANCES
WELD-PROC-STD	STANDARD WELD FIT-UP & DETAILS
C-3964-A2	LINE HEATER DETAILS
C-3964-A3	LINE HEATER BILL OF MATERIALS
C-3964-A4	LINE HEATER PROCESS COILS
C-3964-B1	MECHANICAL FLOWSHEET
C-3964-C1	MAIN PIPING PLAN

REV	DESCRIPTION	DATE	BY
A	ISSUED FOR APPROVAL	02/12/18	R.M.
0	ISSUED FOR CONSTRUCTION	03/06/18	R.M.
1	REVISED THIEF HATCH, RE-ISSUED FOR CONSTRUCTION	04/20/18	A.F.

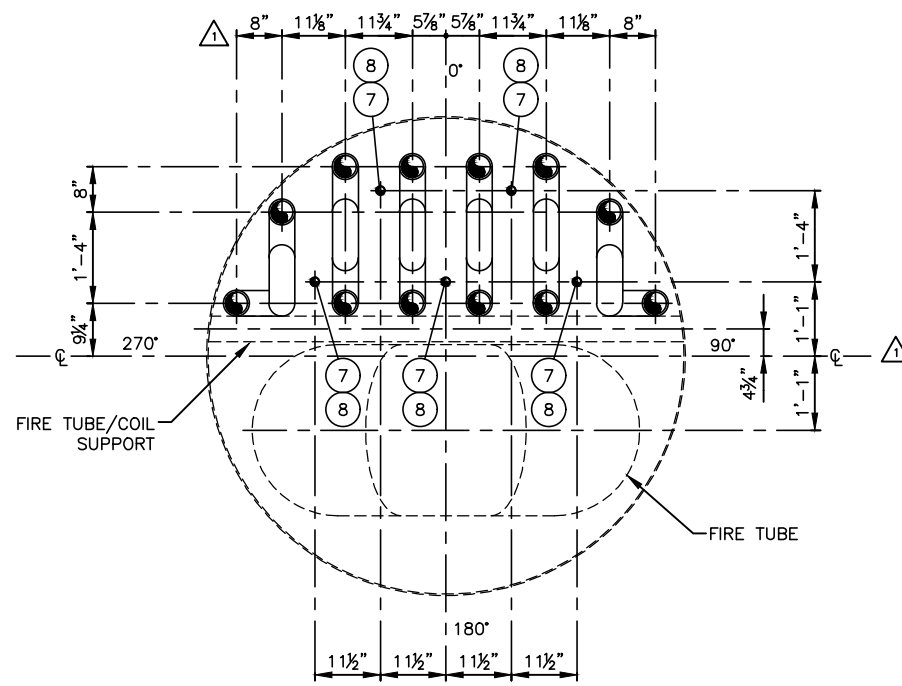
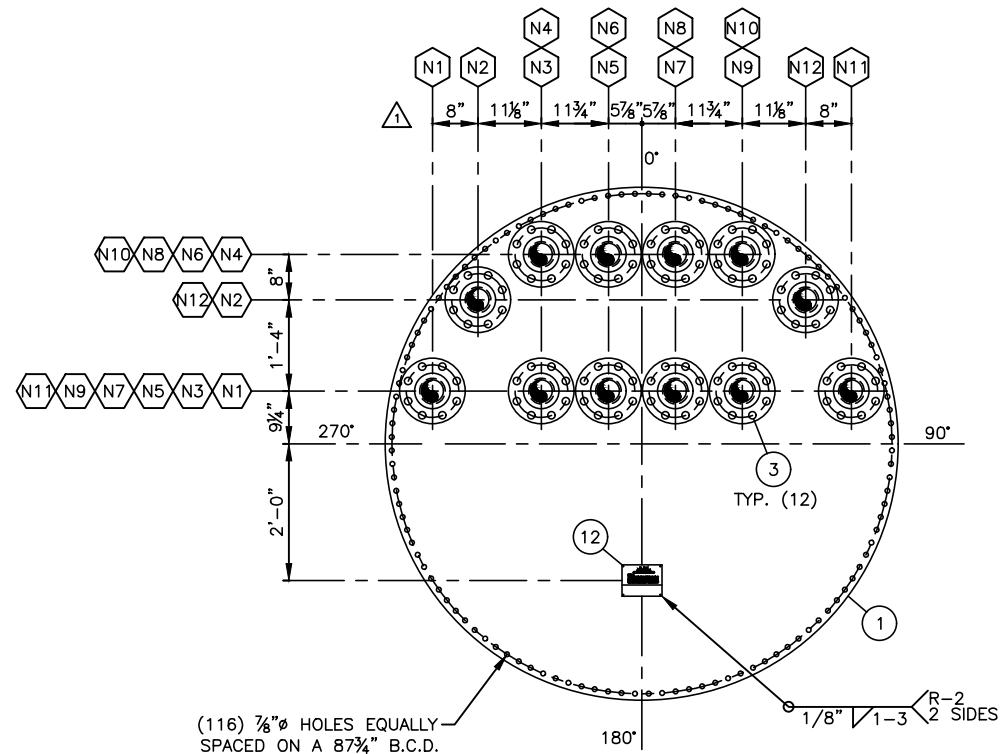
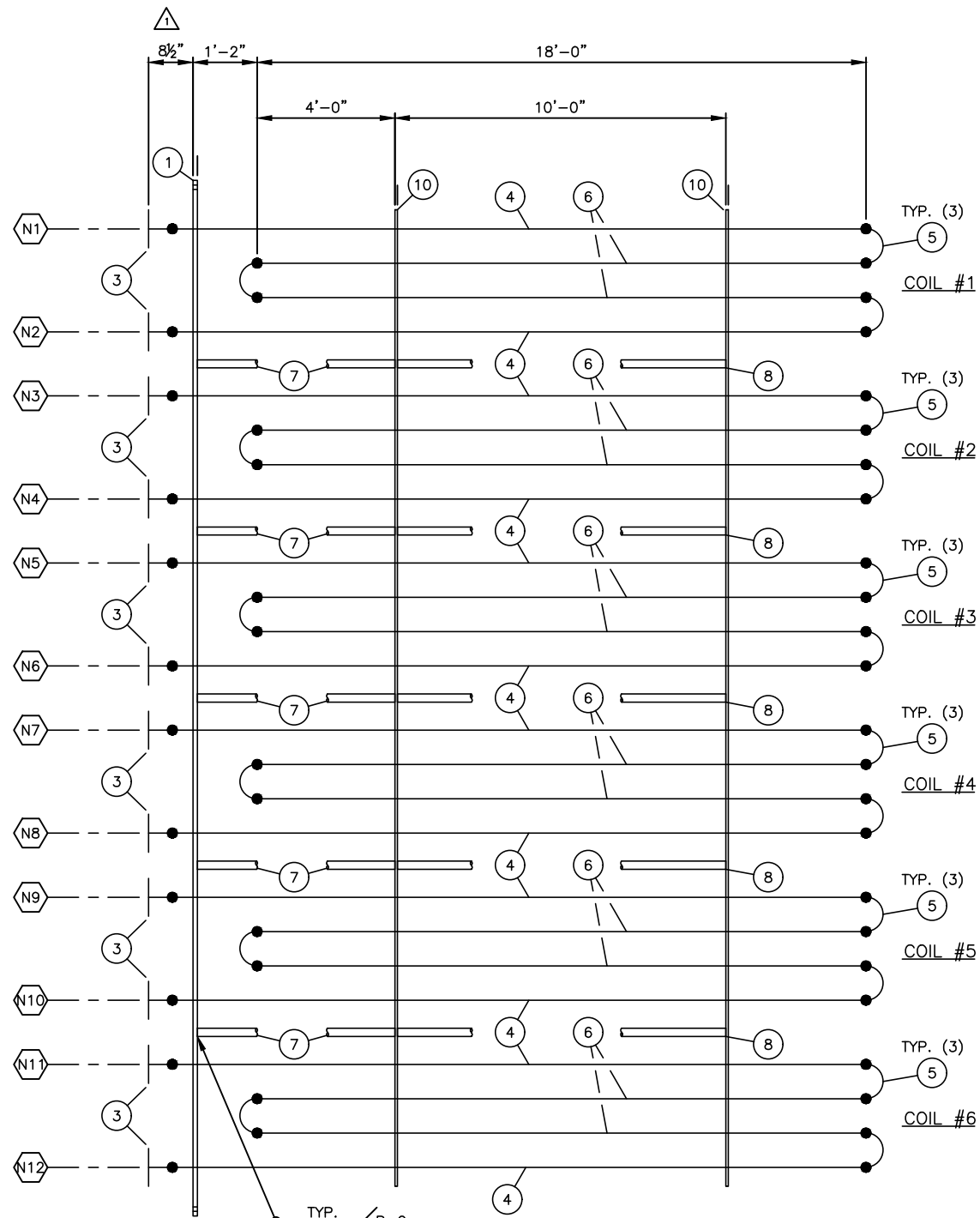


CUSTOMER: HAMMERHEAD RESOURCES INC.		LOCATION: 01-16-65-03 W6M	
c/o FUELLED ENERGY MARKETING INC.			
<b>3.0 MM BTU/HR LINE HEATER</b>			
84" O.D. x 20'-0" LG HEATER / 36" O.D. x 5'-6" EXPANSION TANK			
DATE: 02/12/18	DRN BY: R.M.	SCALE: 1/2"=1'-0"	CHKD BY:
APPRD BY:	DWG NO: C-3964-A1	REV: 1	



### 3.3 Process Coils

RUSHTON PERMIT TO PRACTICE NUMBER: P 13249



BILL OF MATERIALS

ITEM NO.	QNTY REQ'D	DESCRIPTION	MATERIAL
1	1	COIL END PLATE - 90" OD x 7/8" THK. PLATE	G40.21-44W
2			
3	12	FLANGE - 4" CL 900 RFWN SCH. 80	SA-105N
4	12	PIPE - 4" SCH. 80 SML'S PIPE x 19'-5 3/4" LG	SA-106B
5	18	RETURN BEND - 4" SCH. 80 SR BW 180°	SA-234-WPB
6	12	PIPE - 4" SCH. 80 SML'S PIPE x 18'-0" LG	SA-106B
7	5	TUBE SHEET SPACER - 1 1/4" SCH. 40 PIPE x 5'-1 1/8" LG	SA-53B
8	5	TUBE SHEET SPACER - 1 1/4" SCH. 40 PIPE x 10'-0" LG	SA-53B
9			
10	2	TUBE SHEET - 3/8" THK. PLATE (SHOP CUT TO SUIT)	G40.21-44W
11			
12	1	NAME PLATE BRACKET - 3/16" THK. PLATE	G40.21-44W

NOZZLE SCHEDULE

ITEM NO.	QNTY REQ'D	SIZE (NPS)	RATING	SERVICE	WELDING DETAILS	WELD SIZE "A" "B" "C"	INT. PROJ. "D"
N1	1	4"	CL 900	COIL INLET	F1, N10, S7	1/4" 1/4"	
N2	1	4"	CL 900	COIL OUTLET	F1, N10, S7	1/4" 1/4"	
N3	1	4"	CL 900	COIL INLET	F1, N10, S7	1/4" 1/4"	
N4	1	4"	CL 900	COIL OUTLET	F1, N10, S7	1/4" 1/4"	
N5	1	4"	CL 900	COIL INLET	F1, N10, S7	1/4" 1/4"	
N6	1	4"	CL 900	COIL OUTLET	F1, N10, S7	1/4" 1/4"	
N7	1	4"	CL 900	COIL INLET	F1, N10, S7	1/4" 1/4"	
N8	1	4"	CL 900	COIL OUTLET	F1, N10, S7	1/4" 1/4"	
N9	1	4"	CL 900	COIL INLET	F1, N10, S7	1/4" 1/4"	
N10	1	4"	CL 900	COIL OUTLET	F1, N10, S7	1/4" 1/4"	
N11	1	4"	CL 900	COIL INLET	F1, N10, S7	1/4" 1/4"	
N12	1	4"	CL 900	COIL OUTLET	F1, N10, S7	1/4" 1/4"	

NOTES

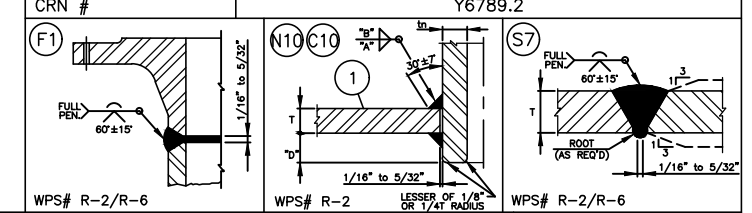
- COIL TO BE THOROUGHLY DRAINED & CLEANED WITH ALL OPENINGS PLUGGED BEFORE SHIPMENT.
- ALL BOLT HOLES TO STRADDLE NATURAL φ'S UNLESS NOTED OTHERWISE.
- ALL DIMENSIONS ARE TO REFERENCE LINE UNLESS NOTED.
- IMPACT TEST EXEMPT PER TABLE 323.2.2A.
- DESIGN AND CONSTRUCTED IN ACCORDANCE WITH THE 2016 EDITION OF THE ASME CODE B31.3 FOR PROCESS PIPING SECTION PARA 304.1.2.
- COIL TO BE REGISTERED IN ALBERTA.

GENERAL SPECIFICATIONS

MATERIALS	COIL #1 to COIL #6
PIPE	SA-106-Gr.B SML'S
RETURN BENDS	SA-234-WPB
FLANGES	SA-105N
REDUCERS	N/R
HEATING SURFACE	90.25 sq.ft. (8.38 sq.m) EACH/541.50 sq.ft. (50.31 sq.m) TOTAL
VOLUME	6.12 cu.ft (0.17 cu.m) EACH/36.72 cu.ft. (1.04 cu.m) TOTAL
OAL	76.67 ft (23.37 m) EACH/460.02 ft (140.21 m) TOTAL

DESIGN DATA

DESIGN PRESSURE	1440 PSIG (9928 kPag)
DESIGN TEMPERATURE	-20/250°F (-29/121°C)
QUALITY FACTOR	1.0
RADIOGRAPHY	100% PER B31.3
CORROSION ALLOWANCE	0.125" (3.2mm)
PWHT	YES @ 1150°F ± 25°F FOR 1 HOUR
HYDROTEST PRESSURE	2160 PSIG (14893 kPag)
CRN #	Y6789.2



TIME CARD  
( 1 ) REQ'D  
C-3964-CB

SERIAL NUMBER:  
C3964A.CB

DRAWING NUMBER	REFERENCE DRAWINGS
VSL-TOLR-STD	VESSEL FABRICATION TOLERANCES
WELD-PROC-STD	STANDARD WELD FIT-UP & DETAILS
C-3964-A1	LINE HEATER
C-3964-A2	LINE HEATER DETAILS
C-3964-A3	LINE HEATER BILL OF MATERIALS
C-3964-B1	MECHANICAL FLOWSHEET
C-3964-C1	MAIN PIPING PLAN

REV	DESCRIPTION	DATE	BY
A	ISSUED FOR APPROVAL	02/10/18	R.M.
0	ISSUED FOR CONSTRUCTION	02/26/18	R.M.
1	REVISED FLANGES TO CL 900, REVISED COIL DESIGN TO FIT CL 900	03/08/18	A.F.
	FLANGES, REVISED DESIGN PRESSURE, RE-ISSUED FOR CONSTRUCTION		
2	ADDED CRN NUMBER	04/26/18	A.F.

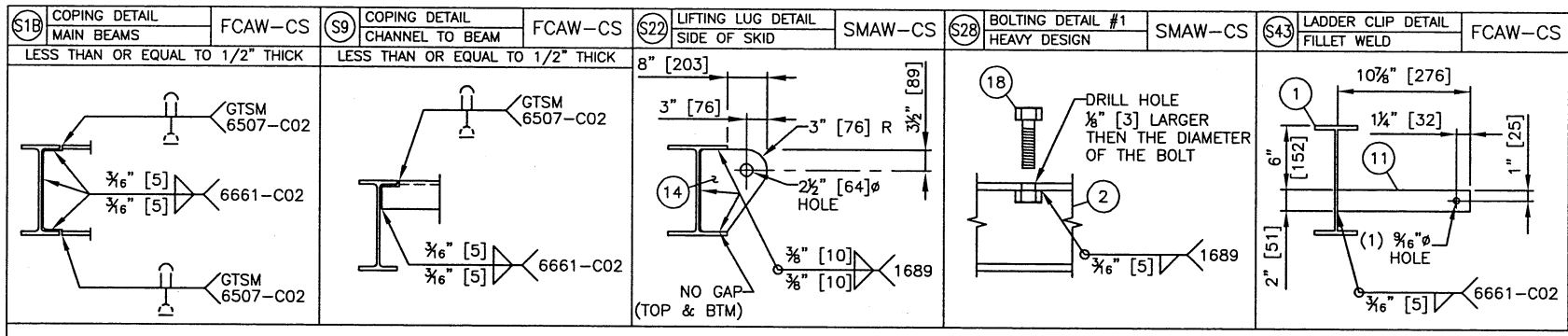


CUSTOMER: HAMMERHEAD RESOURCES INC.		LOCATION: 01-16-65-03 W6M	
c/o FUELLED ENERGY MARKETING INC.		KARR BATTERY	
<b>3.0 MM BTU/HR LINE HEATER</b>			
PROCESS COILS			
DATE: 02/10/18	DRN BY: R.M.	SCALE: 3/4"=1'-0"	CHKD BY: APPRD BY: DWG NO: C-3964-A4
			REV: 2

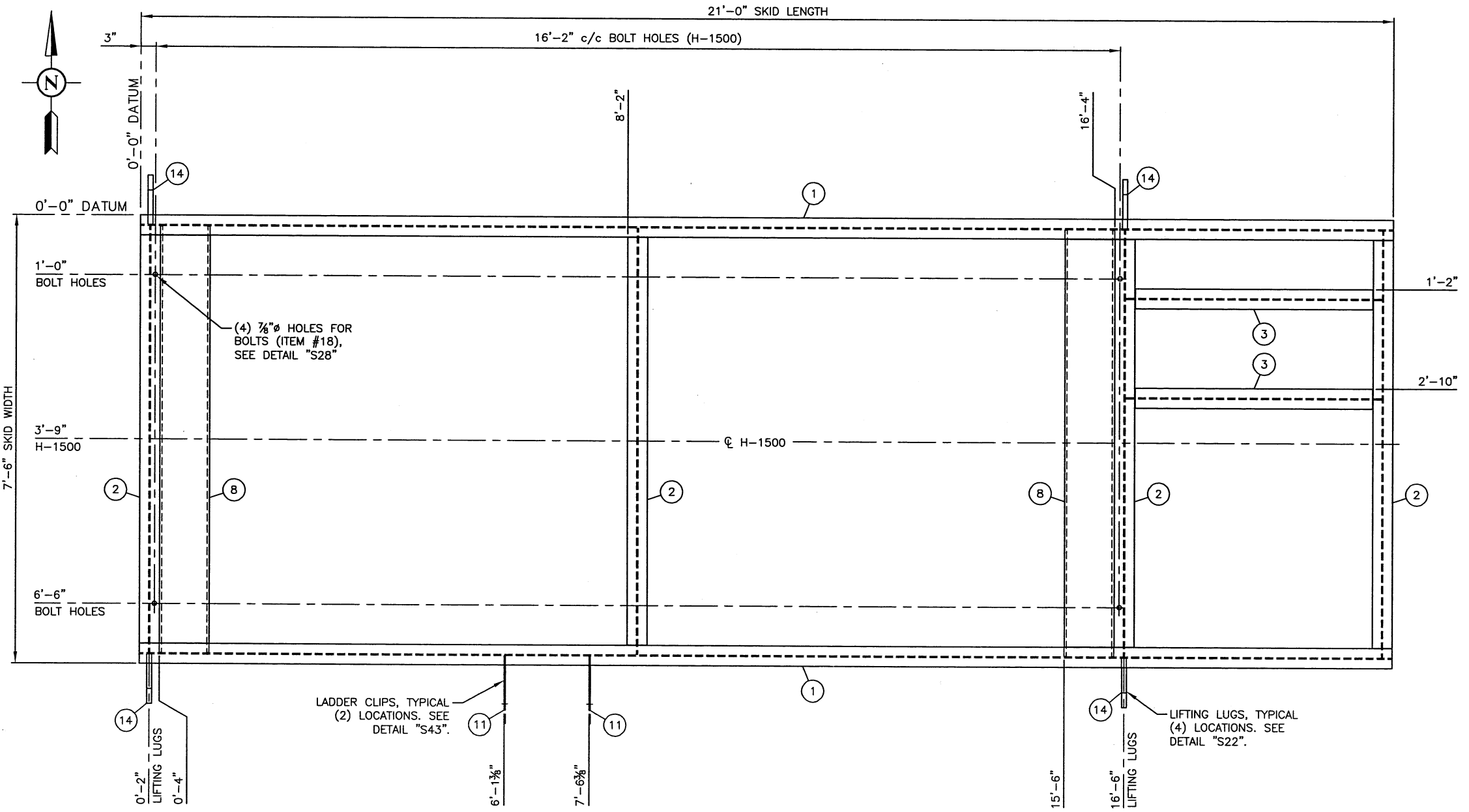


### 3.4 Skid

RUSHTON PERMIT TO PRACTICE NUMBER: P 13249



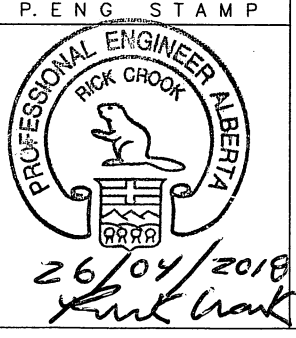
BILL OF MATERIALS				
ITEM NO.	QNTY REQ'D	DESCRIPTION		MATERIAL
1	2	W10 @ 19#	x 21'-0" LG	G40.21-50W
2	4	W10 @ 19#	x 7'-1 5/8" LG	G40.21-50W
3	2	W10 @ 19#	x 4'-3 5/8" LG	G40.21-50W
4				
5				
6				
7				
8	2	C10 @ 15.3#	x 7'-1 5/8" LG	G40.21-44W
9				
10				
11	2	LADDER CLIP - 2" x 1/4" THK	x 0'-10 7/8" LG	G40.21-44W
12				
13				
14	4	LIFT LUGS - 1" THK PLATE (SEE DETAIL)		G40.21-44W
15				
16				
17				
18	4	BOLTS - 3/4" x 2 1/2" LG c/w (1) NUT & WASHER EACH		Gr. 5
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				



PLAN VIEW

NOTES

- ALL FILLET WELDS TO BE 3/8" [5] MIN. ALL AROUND UNLESS OTHERWISE NOTED.
- W10 CROSS MEMBERS TO BE COPED TO MAIN MEMBERS AND FLANGE TO FLANGE WELDS TO BE FULL PEN. TYP.
- WELDING SHALL CONFORM TO CSA W59. WELDERS MUST BE QUALIFIED UNDER THE PROVISIONS OF CSA W47.1.
- CSA W48.1 SERIES WELDING ELECTRODES SHALL BE USED FOR SMAW WELDING. CSA W48.5 SERIES WELDING ELECTRODES SHALL BE USED FOR FCAW WELDING.
- SKID IS DESIGNED FOR A FOUR (4) POINT LIFT.
- SKID AND LUGS TO BE DESIGNED FOR SHIPPING AND LIFTING PURPOSES ONLY, WITH EMPTY VESSELS AND PIPING.
- TOTAL APPROXIMATE SKID WEIGHT: 1,900 lbs
- P.ENG. STAMPED SKID DRAWING FOR ALBERTA.



TIME CARD	REV	DESCRIPTION	DATE	BY
(1) REQ'D	A	ISSUED FOR APPROVAL	02/14/18	R.M.
	0	ISSUED FOR CONSTRUCTION	03/08/18	A.F.
C-3964-SK				

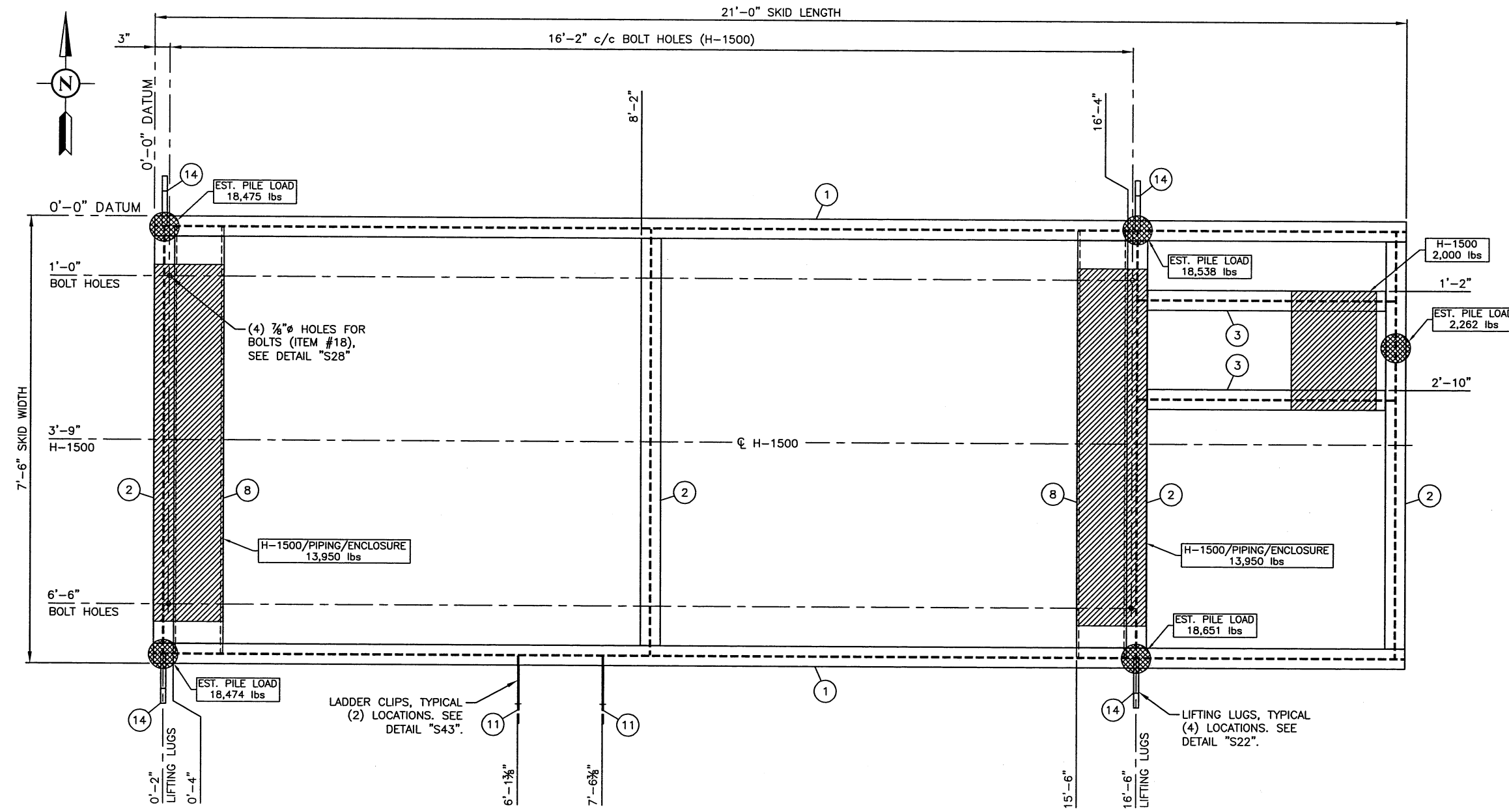


CUSTOMER: HAMMERHEAD RESOURCES INC.		LOCATION: 01-16-65-03 W6M	
c/o FUELLED ENERGY MARKETING INC.		KARR BATTERY	
<b>STRUCTURAL STEEL SKID</b>			
3.0 MM BTU/HR PROCESS LINE HEATER PACKAGE (SOUR)			
DATE: 02/14/18	DRN BY: R.M.	SCALE: 1"=1'-0"	CHKD BY: [Signature]
APPR BY: [Signature]	DWG NO: C-3964-D1	REV: 0	

RUSHTON PERMIT TO PRACTICE NUMBER: P 13249

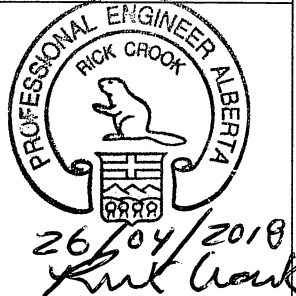
H-1500 WEIGHT	29,100 lbs
SKID OVERALL WEIGHT	1,900 lbs
ENCLOSURE OVERALL WEIGHT	300 lbs
PIPING/INSTRUMENT WEIGHT	500 lbs
PACKAGE DRY WEIGHT	31,800 lbs
PACKAGE OPERATING WEIGHT	76,400 lbs

\* NOTE: PILE LOADS SHOWN ARE VERTICAL, AND ARE BASED ON OPERATIONAL DEAD WEIGHT LOADS



PLAN VIEW

P. ENG. STAMP



TIME CARD	REV	DESCRIPTION	DATE	BY
( 1 ) REQ'D	0	ISSUED FOR CONSTRUCTION	03/08/18	A.F.
C-3964-SK				



CUSTOMER: HAMMERHEAD RESOURCES INC.		LOCATION: 01-16-65-03 W6M	
c/o FUELLED ENERGY MARKETING INC.		KARR BATTERY	
<b>EQUIPMENT WEIGHTS &amp; PILE LOADS</b>			
3.0 MM BTU/HR PROCESS LINE HEATER PACKAGE (SOUR)			
DATE: 02/14/18	DRN BY: R.M.	SCALE: 1"=1'-0"	CHKD BY: APPROV: <i>RC</i>
DWG NO: C-3964-D2		REV: 0	



## 4.0 Parts Distributors

2331-121 Avenue NE  
Edmonton, AB  
T6S 1B2



Ph: (780) 475-8801  
Fx: (780) 475-8892  
[www.rushton.ca](http://www.rushton.ca)

## PARTS DISTRIBUTORS

<u>Item # (From Bill of Materials)</u>	<u>Supplier</u>	<u>Phone</u>
STYF 40	<b>Alberta Strainers</b> 9577-60 Avenue Edmonton, AB T6E 0C2	780-448-0258
BAFF 63, 42, 02	<b>Armor Alloys Ltd.</b> 4515 Roper Road Edmonton, AB T6B 3S5	780-463-2207
TCV 1505	<b>Dyna-Flo Control Valve Services Ltd.</b> 1911-66 Avenue Edmonton, AB T6P 1M5	780-469-4000
TI/TW 1500, PI 1501	<b>MDI Industrial Sales Ltd.</b> 9868 33 <sup>rd</sup> Avenue Edmonton, AB T6N 1C6	780-462-2975
BMS/TSHH/TE/TW/TC 1510 1113	<b>Profire Combustion Inc.</b> Bay 11, 55 Alberta Avenue Spruce Grove, AB T7X 3A6	780-960-3278
BV 1510A/1510B, 1515, PCV 1510, 1505/1515, SCV 1505, TYV 1505	<b>Spartan Controls</b> 8403-51 Avenue Edmonton, AB T6E 5L9	780- 468-5463
PSHH 1510, PSLI 1510	<b>Telematic Controls</b> 3364-114 Avenue SE Calgary, AB T2Z 3V6	403-253-7939
PI 1505/1510, 1511, 1515, NEIF 04A, 04B, 04C	<b>Unified Valve</b> #4, 12181-44th Street SE Calgary, AB T2Z 4H3	403-215-7800
LG/GV 1500, LSLI 1500, PI 1516	<b>Wika Instruments</b> 9220-25 Avenue Edmonton, AB T6N 1E1	780-438-6662
BAFF 64, 24, 25	<b>Wolseley</b> 6308 Davies Road Edmonton, AB T6E 4M9	780-468-7161
TH 1500, FAH 1510	<b>Zirco Ltd. (1989)</b> 5614 A Burbank Road SE Calgary, AB T2H 1Z4	403-259-3303





## 5.0 Equipment Specifications

### 5.1 Instruments

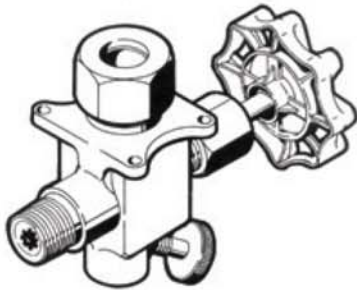
## EQUIPMENT SPECIFICATIONS

<u>Item # (From Bill Of Materials)</u>	<u>Description</u>
LG/GV 1500	Essex 84A gauge valves, 1/2" NPT, cast brass ASTM 8554 body c/w 5/8" redline glass and guard.
LSSL 1500	Kimray model CEC2-2200 SLS SS6SPDT low level switch c/w test button, CSA C22.2 approved, MAWP 2000 psig.
TH 1500	JAYCO thief hatch model JT-8, Standard service. 16oz Pressure setting. 0.4 oz vacuum relief aluminium construction, buna pressure and vacuum gaskets.
TI/TW 1500	Gaugetech GT34-08 Bimetal Thermometer, 1/2" MNPT, center back mount, 50 to 500 °F, dual scale °F/°C, 3" dial, 4" stem, 304 high polish stainless steel case/ring/stem, shatter proof 4mm thick glass, hermetically sealed, rubber/silicone filling gasket, re-calibration hex head screw to zero pointer, ±1% Full scale accuracy ASME B40.3 Grade A, MAWP 85 Psig c/w Gaugetech Stepped Thermowell, p/n: S34-040-316, 1/2" x 3/4" x 4" lg, 316 stainless steel construction, 2 1/2" "U" Length, ø0.260" dia. bore, 4.25" OAL, MAWP 7000 Psig
BAFF 64	Meridian Ball Valve 2" NPT, p/n: MERM12B2, reg port, A105 carbon steel 1-piece bar-stock body/ gland ring, A276-304 stainless steel ball, A276-316 stainless steel stem, glass fiber filled PTFE ball seat, PTFE packing, blowout proof stem, NACE MR-0175 Compliant, MAWP 1500 psig
BAFF 24	Meridian Ball Valve 1/2" NPT, p/n: MERM12BK, reg port, A105 carbon steel 1-piece bar-stock body/ gland ring, A276-304 stainless steel ball, A276-316 stainless steel stem, glass fiber filled PTFE ball seat, PTFE packing, blowout proof stem, Compliant, MAWP 2000 psig

## PENBERTHY SERIES N7 GAGECOCKS

### INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

Before installation these instructions must be read fully and understood



#### TABLE OF CONTENTS

Product warranty .....	1
<b>1 About the manual.....</b>	<b>2</b>
<b>2 Introduction .....</b>	<b>2</b>
2.1 Features and specifications .....	2
2.2 Design ratings at max. and min. operating temperatures .....	3
2.3 Application data .....	3
<b>3 Inspection and performance confirmation .....</b>	<b>3</b>
3.1 Receiving inspection .....	3
3.2 User's rating inspection .....	3
<b>4 Installation.....</b>	<b>4</b>
4.1 Mounting.....	4
4.2 Sight glass installation .....	4
4.3 Guard rod installation.....	4
<b>5 Operation .....</b>	<b>4</b>
5.1 Pre-operational check.....	4
5.2 Hydrostatic test.....	4
5.3 Operating.....	4
<b>6 Maintenance .....</b>	<b>5</b>
6.1 Preventative maintenance.....	5
6.2 Maintenance procedures .....	5
6.3 Removal - disassembly - reassembly.....	5
<b>7 Disposal at end of useful life .....</b>	<b>6</b>
<b>8 Telephone assistance .....</b>	<b>6</b>
<b>9 Exploded parts diagram .....</b>	<b>7</b>
<b>Table of figures</b>	
Table 1 - Design ratings .....	2
Table 2 - Tubular glass ratings.....	3
Figure 1 - Mounting.....	4
Figure 2 - Exploded parts diagram .....	7

#### PRODUCT WARRANTY

Pentair warrants its Penberthy products as designed and manufactured to be free of defects in the material and workmanship for a period of one year after the date of installation or eighteen months after the date of manufacture, whichever is earliest. Pentair will, at its option, replace or repair any products which fail during the warranty period due to defective material or workmanship.

Prior to submitting any claim for warranty service, the owner must submit proof of purchase to Pentair and obtain written authorization to return the product. Thereafter, the product shall be returned to Pentair with freight prepaid.

This warranty shall not apply if the product has been disassembled, tampered with, repaired or otherwise altered outside of the Pentair factory, or if it has been subject to misuse, neglect or accident.

The responsibility of Pentair hereunder is limited to repairing or replacing the product at its expense. Pentair shall not be liable for loss, damage or expenses related directly or indirectly to the installation or use of its products, or from any other cause or for consequential damages. It is expressly understood that Pentair is not responsible for damage or injury caused to other products, buildings, personnel or property, by reason of the installation or use of its products.

*This is Pentair's sole warranty and in lieu of all other warranties, expressed or implied which are hereby excluded, including in particular all warranties of merchantability or fitness for a particular purpose.*

This document and the warranty contained herein may not be modified and no other warranty, expressed or implied, shall be made by or on behalf of Pentair unless made in writing and signed by the company's general manager or director of engineering.

# PENBERTHY SERIES N7 GAGECOCKS

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 1 ABOUT THE MANUAL

This manual has been prepared as an aid and guide for personnel involved in installation or maintenance. All instructions must be read and understood thoroughly before attempting any installation, operation, or maintenance.

#### Safety instructions

Pentair does not have control over the manner in which its gagecock set is handled, installed or used, and Pentair cannot and does not warrant or guarantee that a gagecock set is suitable for or compatible with the user's specific application.

#### WARNING

*Failure to follow any instruction could possibly result in a malfunction or failure of the gagecock resulting in leakage causing serious personal injury or property damage.*

### 2 INTRODUCTION

#### 2.1 Features and specifications

Penberthy Series N7 tubular glass gagecocks are supplied in pairs (upper and lower) and are designed to house each end of a transparent sight glass tube. This gagecock/glass combination forms a gage that indicates liquid level as well as liquid characteristics accurately.

Standard features of N7 gagecocks in non steam-water applications are: a ball check shut-off to stop leakage of contained fluid in case of accidental tubular glass breakage, integral bonnet, integral drain cock and handwheel.

**Important:** Under most circumstances, Series N7 gagecocks are not recommended without the ball check shut-off. Gagecocks without the ball check shut-off feature will not stop leakage of contained fluid in the event of accidental tubular glass breakage. However, in circumstances where the fluid being gauged tends to surge in a rapid manner, the ball checks could tend to give a false level reading or could seat accidentally.

Series N7 gagecocks are not suitable for steam-water applications unless they are furnished with one of the following optional features:

1. Non-automatic gagecocks – ball checks removed from both upper and lower gagecocks.
2. Automatic gagecocks – vertical rising ball check and ball inspection plug in the lower gagecock in conjunction with a steam cleaner in the lower gagecock stem. The upper gagecock is equipped with a horizontal ball check and a leaky ball seat formed in the body.

**TABLE 1 - DESIGN RATINGS**

Body material	Model	Glass packing	Maximum allowable working pressure	Maximum steam pressure
Bronze	N7A	Neoprene® (Standard)	200 psig [1380 kPaG] at -20° F [-29°C] to +100° F [38°C] 165 psig [1140 kPaG] at +300°F [149°C]	125 [860 kPaG]
		Teflon® (Optional)	200 psig [1380 kPaG] at -20° F [-29°C] to +100° F [38°C] 125 psig [860 kPaG] at +400°F [204°C]	125 [860 kPaG]
Bronze	N7B	Neoprene® (Standard)	400 psig [2760 kPaG] at -20°F [-29°C] to + 100°F [38°C] 335 psig [2310 kPaG] at +300°F [149°C]	250 [1720 kPaG]
		Teflon® (Optional)	400 psig [2760 kPaG] at -20°F [-29°C] to + 100°F [38°C] 250 psig [1720 kPaG] at +400°F [204°C]	250 [1720 kPaG]
Iron	N7A	Neoprene® (Standard)	500 psig [3450 kPaG] at -20°F [-29°C] to +100°F [38°C] 375 psig [2590 kPaG] at +300°F [149°C]	350 [2410 kPaG]
		Teflon® (Optional)	500 psig [3450 kPaG] at -20°F [-29°C] to +100°F [38°C] 250 psig [1720 kPaG] at +450°F [232°C]	350 [2410 kPaG]
Iron	N7B	Neoprene® (Standard)	500 psig [3450 kPaG] at -20°F [-29°C] to +100°F [38°C] 375 psig [2590 kPaG] at +300°F [149°C]	350 [2410 kPaG]
		Teflon® (Optional)	500 psig [3450 kPaG] at -20°F [-29°C] to +100°F [38°C] 250 psig [1720 kPaG] at +450°F [232°C]	350 [2410 kPaG]
316 Stainless Steel & Steel	N7A and N7B	Neoprene® (Standard)	500 psig [3450 kPaG] at -20°F [-29°C] to +300°F [149°C]	350 [2410 kPaG]
		Teflon® (Optional)	500 psig [3450 kPaG] at -20°F [-29°C] to +500°F [260°C]	350 [2410 kPaG]

Pressure/temperature ranges in above table are subject to the limitations of the tubular glass. See Table 2.

Teflon® and Neoprene® are registered trademarks of E. I. duPont de Nemours and Company.

# PENBERTHY SERIES N7 GAGECOCKS

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

**TABLE 2 - TUBULAR GLASS – RATINGS ½" (16 mm) AND ¾" (19 mm) OD**

Vessel tappings ctr. to ctr.		Up to 150°F (66°C)			From 150° F (66°C) thru 425°F (218°C)		
distance		High pressure	Heavy wall	Red line	High pressure	Heavy wall	Red line
Inches	[mm]	psig [kPaG]	psig [kPaG]	psig [kPaG]	psig [kPaG]	psig [kPaG]	psig [kPaG]
10	[254]	410 [2830]	600 [4140]	340 [2340]	310 [2140]	345 [2380]	275 [1900]
15	[381]	385 [2650]	600 [4140]	310 [2140]	280 [1930]	325 [2240]	265 [1830]
20	[508]	355 [2450]	600 [4140]	285 [1970]	265 [1830]	315 [2170]	260 [1790]
25	[635]	300 [2070]	580 [4000]	260 [1790]	250 [1720]	300 [2070]	250 [1720]
30	[762]	275 [1900]	550 [3790]	230 [1590]			
35	[889]	240 [1650]	500 [3450]	200 [1380]			
40	[1016]	210 [1450]	420 [2900]	180 [1240]			
45	[1143]	200 [1380]	360 [2480]	170 [1170]			
50	[1270]	180 [1240]	340 [2340]	160 [1100]			
55	[1397]	150 [1030]	N/A	140 [970]			
60	[1524]	140 [970]	N/A	120 [830]			
65	[1651]	125 [860]	N/A	100 [690]			
70	[1778]	100 [690]	N/A	90 [620]			

N/A - Not Available

### WARNING

*Under no circumstances should N7 gagecocks be used for steam-water applications unless they are equipped with one of the optional features. Use of standard N7 gagecocks without these features can result in sudden release of pressure causing serious personal injury or property damage.*

### 2.2 Design ratings at maximum and minimum operating temperatures

To determine the maximum allowable working pressure for a specific temperature within the design limits stated in Table 1, the user must refer to applicable technical data sheets, or when provided, the specifically stated design limits on a product proposal.

### 2.3 Application data

**Note:** For specific application data, within the above ranges, consult the product proposal for the specific model and size gagecock set, or request the supply of the applicable technical data sheet.

### WARNING

*Never exceed these design ratings or application data limits. Exceeding design ratings or application data limits can cause serious personal injury or property damage.*

### 3 INSPECTION & PERFORMANCE CONFIRMATION

#### 3.1 Receiving inspection

Upon receipt of a gagecock set, check all components carefully for damage incurred in shipping. If damage is evident or suspected, do not attempt installation. Notify the carrier immediately and request a damage inspection.

#### 3.2 User's rating inspection

The user is to confirm:

1. That the gagecock set model number and pressure/temperature rating stamped on nameplate [163] conform to the description on the user's purchase order.
2. That the operating conditions described in the purchase order agree with the actual operating conditions at the installation site.
3. That the actual operating conditions at the installation site are within the application data shown on the applicable technical data sheet or product proposal referred to above.
4. That the materials of construction of the gagecocks are compatible with both the contained fluid and surrounding atmosphere in the specific application.

**Important:** If the size, model or performance data of the gagecock set as received does not conform with any of the criteria above, do not proceed with installation. Contact an authorized Penberthy distributor for direction.

# PENBERTHY SERIES N7 GAGECOCKS

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### 4 INSTALLATION

Use only qualified, experienced personnel who are familiar with this equipment and thoroughly understand all the instructions in this manual for the installation of this equipment. Refer to relevant technical data sheets or product proposal to obtain dimensional information for the specific size and model of gagecock set.

#### 4.1 Mounting

1. Prior to actual installation, turn handwheel or lever of each gagecock clockwise until the stem closes against the seat.
2. Mount upper and lower gagecocks to vessel using PTFE tape, or equivalent, on all male pipe thread connections as shown in Figure 1.
3. Tighten vessel connections to a pressure tight joint making certain that sight glass connections are aligned vertically and to vessel centers as called for on the application specification.

#### 4.2 Sight glass installation

1. Turn upper gagecock counterclockwise (approx.  $\frac{1}{8}$  turn).
2. Loosen glass packing nut to insure there is no compressive force on glass packing.
3. Insert sight glass up into upper gagecock sight glass connection.
4. Tighten upper gagecock to its original position while holding sight glass with upward force to insure its clearing of lower sight glass connection. Check vertical alignment of gagecocks.
5. Loosen glass packing nut on lower gagecock and pull glass down into lower sight glass connection to a positive stop.
6. Tighten upper and lower glass packing nuts.

**Note:** In some circumstances, it may be necessary to remove glass packing nut, glass packing retainer and glass packing, and mount them on sight glass prior to insertion of glass into upper and lower gagecock bodies. See Figure 2 for proper assembly sequence.

#### 4.3 Guard rod installation

Guard rods (four required) are assembled downward through the upper gagecock with swaged portion on rods at the top. Bottom of rods are positioned into respective holes in the lower gagecock.

### 5 OPERATION

#### 5.1 Pre-operational check

1. Check that all installation procedures have been completed.
2. Check to determine that all connections are pressure tight.

#### 5.2 Hydrostatic test

1. Take all precautions necessary to handle the possibility of leakage.
2. Hydrostatic pressure test installation to at least 100 psig (690 kPaG) or gage limit and correct any leakage before proceeding.

#### 5.3 Operating

##### WARNING

*Gagecock assemblies should be brought into service slowly to avoid excessive shock or stress on the tubular glass. Rapid pressurization of a gagecock assembly can cause glass breakage with resulting sudden release of pressure causing serious personal injury or property damage.*

To avoid excessive thermal shock or mechanical stress on the tubular glass, the connecting gagecocks should be opened slightly and the gage temperature and pressure allowed to equalize slowly with the vessel.

If the gagecocks are furnished with ball checks, the gagecocks must be opened all the way after the pressure and temperature have equalized to permit operation of the automatic ball check in the event of gage failure.

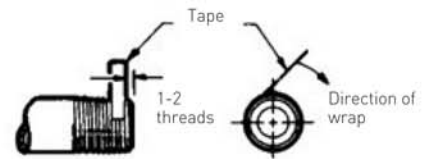


FIGURE 1

# PENBERTHY SERIES N7 GAGECOCKS

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

---

### 6 MAINTENANCE

Use only qualified, experienced personnel who are familiar with this equipment and understand all the instructions in this manual for all maintenance thoroughly.

During system shut down, the gagecocks should be left open to permit the gage to lose pressure and cool with the rest of the system. Failure to leave the gagecocks open during system shut down will trap high pressure fluid in the gage.

#### WARNING

*Do not proceed with any maintenance unless the gagecock has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature and has been drained or purged of all fluids. Failure to do so can cause serious personal injury or property damage.*

#### 6.1 Preventative maintenance

Create maintenance schedules, safety manuals and inspection details for each specific installation of a gagecock set.

For maintenance purposes on all installations, check gagecocks regularly for signs of:

1. leakage around stem area.
2. an internal stem leak.
3. leakage around stuffing box connections.
4. internal or external corrosion.

Upon evaluation of your own operating experience, determine an appropriate maintenance schedule necessary for the specific application. Realistic maintenance schedules can only be determined with full knowledge of the services and application situation involved.

#### 6.2 Maintenance procedures

1. Stem packing leakage can often be stopped by tightening the stem packing nut. If leakage persists, the stem packing should be replaced by following steps 'a' through 'f' of Disassembly and steps 'a' through 'f' of Reassembly.
2. Signs of internal stem leak is an indication of a worn or damaged stem or seat.
  - A. To replace stem, follow Disassembly steps 'a' through 'f' and Reassembly steps 'a' through 'f'.
  - B. To renew seat surface, follow Disassembly steps 'a' through 'f'. Renew seat by using a fine lapping compound and a mandrel with the same size, shape and seat angle as the stem. Flush gagecock body clean and reassemble by following steps 'a' through 'f' of Reassembly.

**Note:** Series N7 gagecocks have an integral seat. Gagecock body must be replaced when seat becomes worn or damaged beyond repair.

3. Signs of leakage around the stuffing box indicates worn out glass packing or improper compression of glass packing. To replace glass packing, follow Disassembly steps 'a', 'b' and 'g' through 'l' and Reassembly steps 'a', 'b' and 'g' through 'n'. In the event of improper packing compression, leakage can be stopped by tightening glass packing nut.
4. It is the user's responsibility to choose a material of construction compatible with both the contained fluid and surrounding atmosphere in the user's specific application. If internal or external corrosion are present, an investigation must be carried out immediately by the user as to the cause of the problem, including consulting with an authorized Penberthy distributor.
5. For broken sight glass replacement, follow Disassembly steps 'a', 'b' and 'g' through 'l', and Reassembly steps 'a', 'b' and 'g' through 'n'.

**Important:** New glass packing must be used when replacing glass.

#### 6.3 Removal - Disassembly - Reassembly

##### WARNING

*Do not proceed with the disassembly of a gagecock unless the gagecock has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature and has been drained or purged of all fluids. Failure to comply can cause serious personal injury or property damage.*

1. Disassembly
  - a. Close upper and lower gagecocks.
  - b. Open drain cock and allow gagecocks to drain.
  - c. Remove handwheel screw, nameplate and handwheel or lever from stem.
  - d. Loosen and remove stem packing nut.
  - e. Remove stem by turning counterclockwise, along with stem packing and stem packing retainer.
  - f. Slip stem packing and stem packing retainer off the stem
  - g. Remove guard rods if present.
  - h. Loosen glass packing nuts on both upper and lower gagecocks.
  - i. Slide sight glass upward into upper gagecock until bottom of tubular glass clears the stuffing box connection on the lower gagecock.
  - j. While holding tubular glass in this upward position, rotate upper gagecock counterclockwise (approx. 1/6 turn) to allow clearance to remove sight glass from upper gagecock.
  - k. Remove sight glass from upper gagecock.
  - l. Remove glass packing nuts, glass packing glands, glass packing and glass packing retainers from both upper and lower gagecocks.

# PENBERTHY SERIES N7 GAGECOCKS

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

---

2. Reassembly
  - a. Refer to exploded view Figure 2.
  - b. Prepare for installation of new packing by cleaning all packing chambers and glands of upper and lower gagecocks.
  - c. Slip stem packing retainer (18) on stem (17) and install new stem packing (25).
  - d. Thread stem assembly into gagecock by turning clockwise until stem seats and then back off one turn.
  - e. Assemble stem packing nut (26) and tighten in place.
  - f. Assemble handwheel (28) or lever (261), nameplate (163) and handwheel screw (100) on stem and tighten securely into place.
  - g. Replace glass packing nut (37), glass packing gland (36), new glass packing (34) and glass packing retainers (35) on each end of tubular glass (48).
  - h. Insert glass packing retainer (35A) into stuffing box of lower gagecock.
  - i. With upper gagecock turned  $\frac{1}{8}$  turn counterclockwise from vertical, insert one end of sight glass into stuffing box connection in upper gagecock to sufficient depth to insure clearance of lower glass packing nut.
  - j. Tighten upper gagecock to original position while holding sight glass in place with upward force to insure its clearing lower sight glass connection. Check vertical alignment of gagecocks.
  - k. Slide sight glass down into lower gagecock sight glass connection to a positive stop.
  - l. Tighten glass packing nuts.
  - m. Close both gagecocks by turning handwheel or lever clockwise until stem seats.
  - n. Replace guard rods (40).
3. Refer to Section 4 'Installation' and Section 5 'Operation of gagecock' when returning to service.

### 7 DISPOSAL AT END OF USEFUL LIFE

---

Penberthy Series N7 gagecocks are used in a variety of fluid applications. By following the appropriate federal and industry regulations, the user must determine the extent of preparation and treatment the N7 gagecocks must incur before their disposal. A Material Safety Data Sheet (MSDS) may be required before disposal services accept certain components. Metal, glass and polymers should be recycled whenever possible. Refer to order and applicable technical data sheets for materials of construction.

### 8 TELEPHONE ASSISTANCE

---

If you are having difficulty with your Series N7 gagecocks, contact your local Penberthy distributor. You may also contact the factory direct at (956) 430-2500 and ask for an applications specialist. So that we may assist you more effectively, please have as much of the following information available as possible when you call:

- Model #
- Name of the company from whom you purchased the N7 gagecocks
- Invoice # and date
- Process conditions (pressure, flow rates, tank shape, etc)
- A brief description of the problem
- Troubleshooting procedures that failed

If attempts to solve your problem fail, you may request to return your N7 gagecocks to the factory for intensive testing. You must obtain a Return Authorization (R.A.) number from Pentair before returning anything. Failure to do so will result in the unit being returned to you without being tested, freight collect. To obtain an R.A. number, the following information (in addition to that above) is needed:

- Reason for return
- Person to contact at your company
- 'Ship-to' address

There is a minimum charge for evaluation of non-warranty units. You will be contacted before any repairs are initiated should the cost exceed the minimum charge. If you return a unit under warranty, but it is not defective, the minimum charge will apply.



**PENBERTHY** SERIES N7 GAGECOCKS  
 INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

**9 EXPLODED PARTS DIAGRAM**

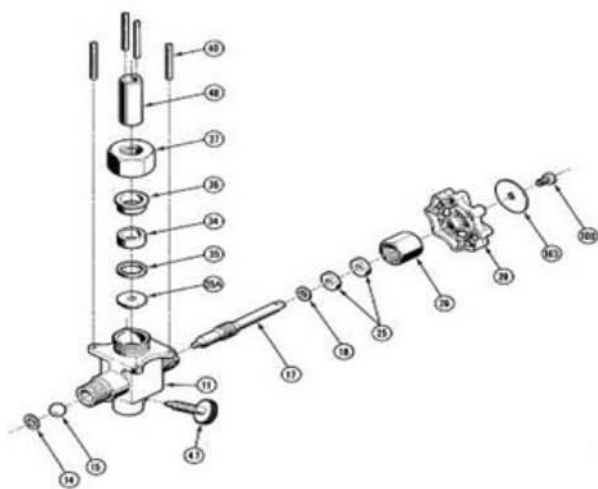


FIGURE 2

**PARTS LIST**

Ref #	Item
11	Body
14	Retainer, ball
15	Ball
17	Stem
18	Retainer, stem packing
25	Packing, stem
26	Nut, stem packing
28	Handwheel
34	Packing, glass
35	Retainer, glass packing
35A	Retainer, glass packing
36	Gland, glass packing
37	Nut, glass packing
40	Rod
47	Stem, drain
48	Glass
100	Screw
163	Nameplate
261	Lever

**RECOMMENDED SPARE PARTS**

Ref. no.	Item	Min. qty.
18	Retainer, stem packing	2
25	Packing, stem	4
26	Nut, stem packing	1
34	Packing, glass	2
35	Retainer, glass packing	2
35A	Retainer, glass packing	1
37	Nut, glass packing	1
48	Glass	1

**Note:** Part No. 35A Retainer, glass packing, on lower gagecock only.

Recommended maximum quantities should provide spare parts for 10% of the gagecocks in service.



**PENTAIR VALVES & CONTROLS**

[www.pentair.com/valves](http://www.pentair.com/valves)

All Pentair trademarks and logos are owned by Pentair plc. All other brand or product names are trademarks or registered marks of their respective owners. Because we are continuously improving our products and services, Pentair reserves the right to change product designs and specifications without notice. Pentair is an equal opportunity employer. © 2016 Pentair plc. All rights reserved.

#### APPLICATIONS:

Senses a specific liquid level and produces electric output.  
High or low level control.  
Electric output can activate alarms, solenoid valves or other electrically switched devices.

#### FEATURES:

316 SS Wetted Parts  
Sealed Hermetic Reed Switch  
SPDT Reed Switch  
CSA Certificate #1662451, USA and Canada  
Expl. Proof – Class I, Groups A,B,C,D  
Class II, Groups E,F,G, Class III  
Class I, Zone 1, AExdIIC, ExdIIC  
(Stainless steel float only)  
Additional seal not required

#### NEMA4X

Available with manual override for testing.  
Minimum Specific Gravity 0.4.  
NACE MR0175 compliant Wetted Parts  
• Certification documents Available upon request, specify when ordering

ELECTRICAL RATINGS	
STANDARD	0.83A @ 120VAC
	2A @ 50VDC
	3A MAXIMUM
	PWR: 3W MIN, 100W MAX
LOW POWER	0.2A @ 120VAC
	1A @ 25VDC
	1A MAXIMUM
	PWR : 25W MAX

#### OPERATION:

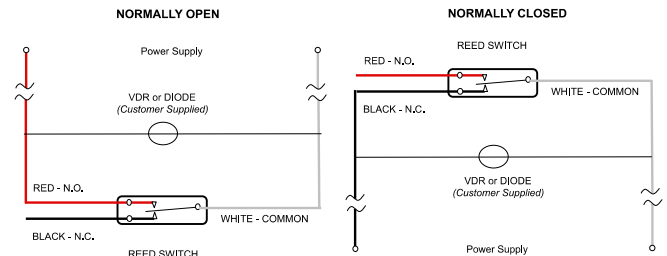
The FLOAT is counterbalanced by the FLOAT LEVER. As the liquid level increases the FLOAT is lifted. A MAGNET in the FLOAT LEVER moves downward and closer to the REED SWITCH which is located in the enclosure in the BODY. This closes the REED SWITCH. As the liquid level decreases the FLOAT moves downward, moving the MAGNET away from the REED SWITCH, causing it to open.

The optional MANUAL OVERRIDE allows the operator to manually activate the FLOAT LEVER to test the switch and the devices it controls.

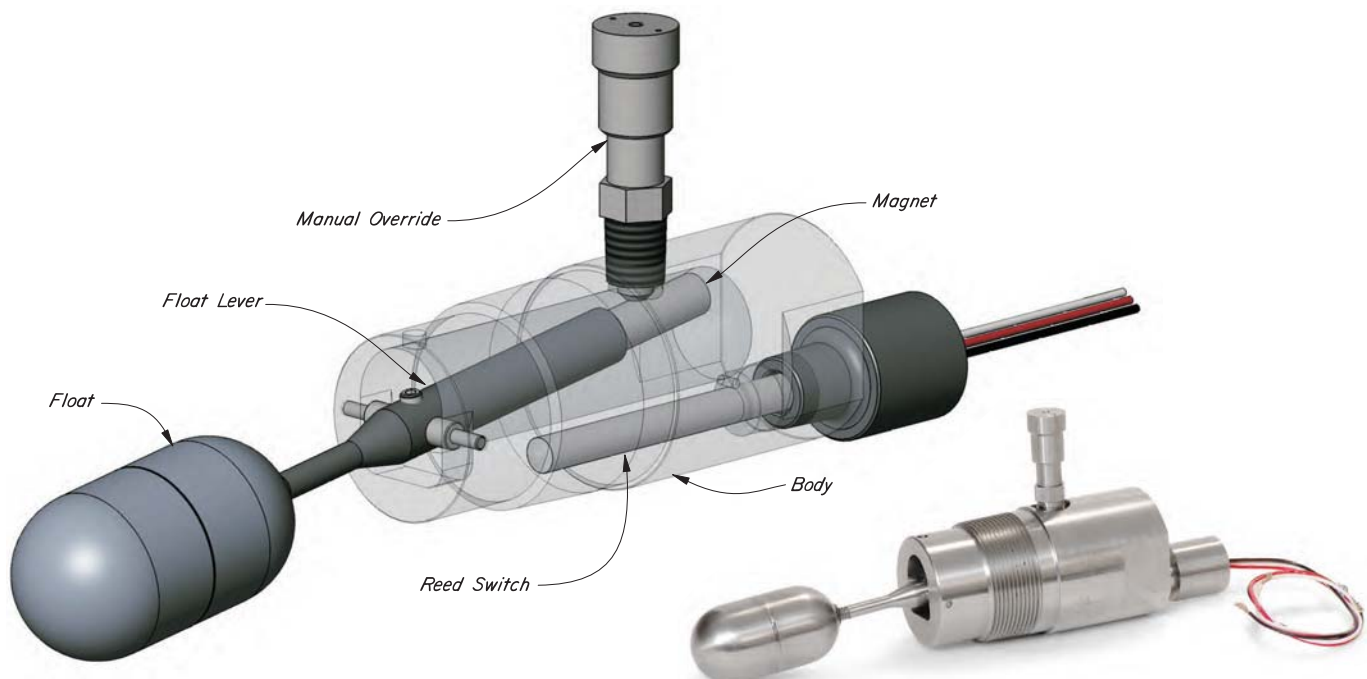
#### WIRING INSTRUCTIONS:

Do not exceed the amperage and voltage for the switch. Switch contacts may experience damage in applications using relays, motors, etc. where a power surge or voltage spike may occur during relay engagement or motor startups. For these conditions a shunt path for over-voltage should be installed.

- For **DC** applications:  
use an **(1N4001)** or similar diode wired in parallel as shown.
- For **AC** applications:  
use a 110 VAC Varistor (**Digi-Key BC1408-ND**) or similar wired in parallel as shown.



**RED** - Normally Open  
**BLACK** - Normally Closed  
**WHITE** - Common

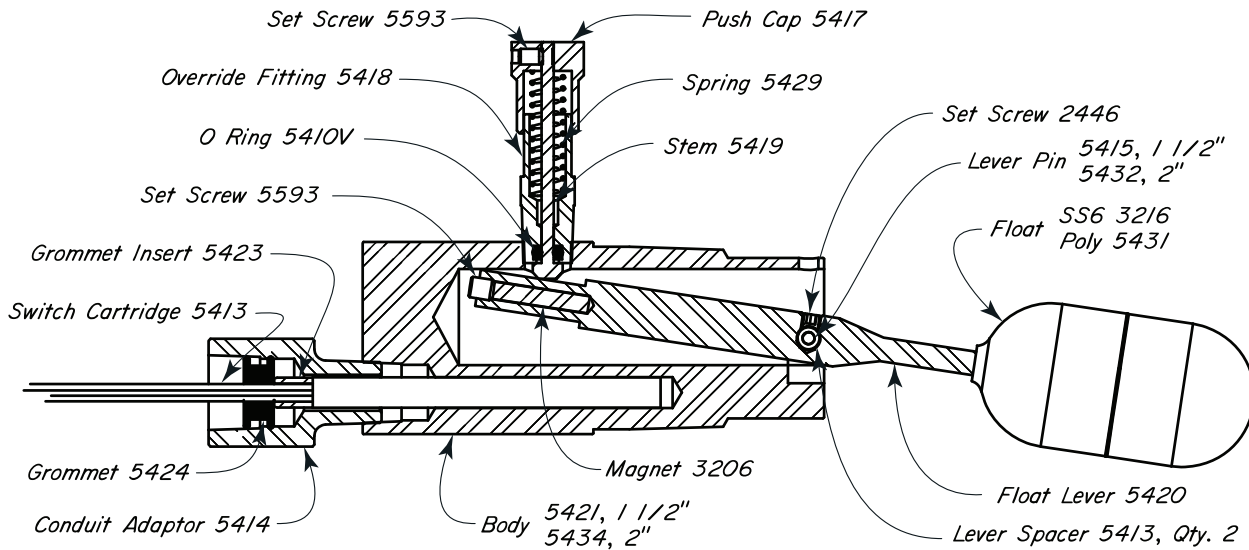


Kimray is an ISO 9001- certified manufacturer.

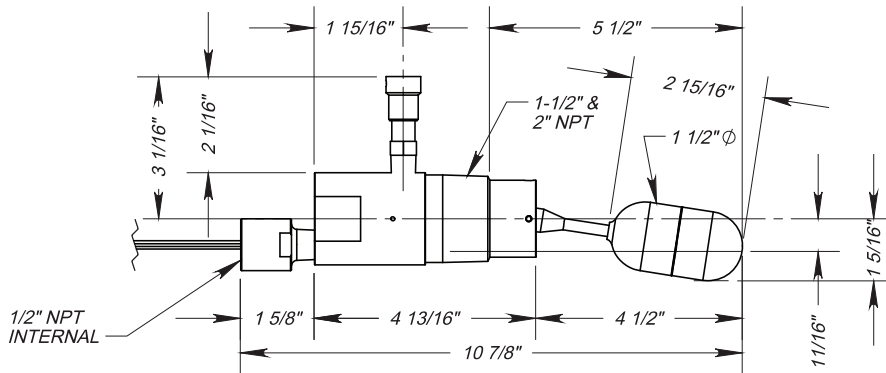
# FLOAT OPERATED LEVEL CONTROLLER



ELEC. LEVEL SWITCH (HORIZ.) WITH MANUAL OVERRIDE  
STEEL



## DIMENSIONS



## NOTES:

\*These parts are recommended spare parts and are stocked as repair kits.  
For optional Float cages see page C1:80.1  
For standard & optional Seals, Metals & Material specifications see Technical Data on pages C1:I - C1:V

PART #	ACCESSORIES	QTY.
5418	M/O Assembly	1
5587A	Pull Assembly w/20' Cable	1
5594	Annulus Plug	1

## SWITCHES AVAILABLE:

PART NO.	BODY CONNECTION	MODEL NO.	FLOAT	TEMP RANGE	MAX W.P.
CEB2	1 1/2" NPT	1200 SLS M/O	SS6	-40F to 350F	2000
CEB2PP	1 1/2" NPT	1200 SLS M/O	HDPE	-40F to 180F	2000
CEB3	1 1/2" NPT	1200 SLS M/O W/CABLE	SS6	-40F to 350F	2000
CEB3PP	1 1/2" NPT	1200 SLS M/O W/CABLE	HDPE	-40F to 180F	2000
CEC2	2" NPT	2200 SLS M/O	SS6	-40F to 350F	2000
CEC2PP	2" NPT	2200 SLS M/O	HDPE	-40F to 180F	2000
CEC3	2" NPT	2200 SLS M/O W/CABLE	SS6	-40F to 350F	2000
CEC3PP	2" NPT	2200 SLS M/O W/CABLE	HDPE	-40F to 180F	2000

## LOW POWER SWITCHES AVAILABLE:

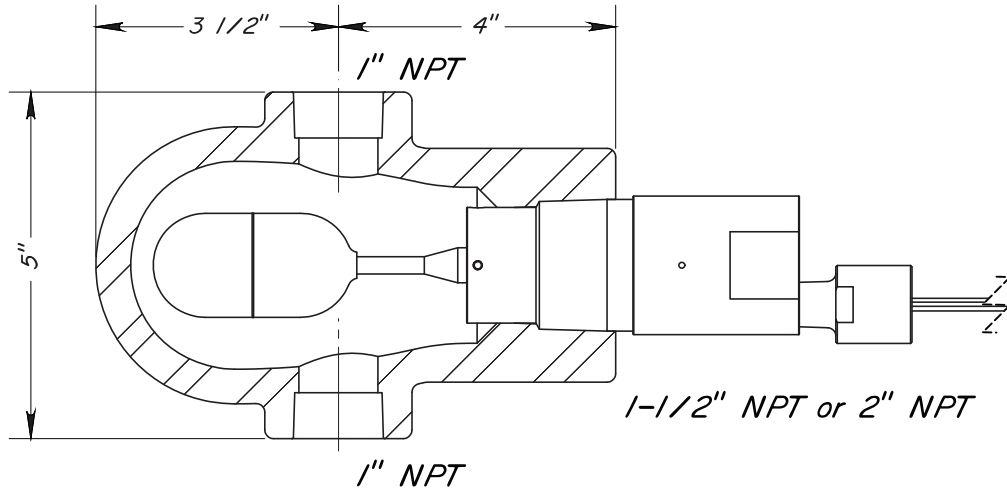
PART NO.	BODY CONNECTION	MODEL NO.	FLOAT	TEMP RANGE	MAX W.P.
CEB2LPW	1 1/2" NPT	1200 SLS L/P M/O	SS6	-40F to 350F	2000
CEB2LPWPP	1 1/2" NPT	1200 SLS L/P M/O	HDPE	-40F to 180F	2000
CEB3LPW	1 1/2" NPT	1200 SLS L/P M/O W/CABLE	SS6	-40F to 350F	2000
CEB3LPWPP	1 1/2" NPT	1200 SLS L/P M/O W/CABLE	HDPE	-40F to 180F	2000
CEC2LPW	2" NPT	2200 SLS L/P M/O	SS6	-40F to 350F	2000
CEC2LPWPP	2" NPT	2200 SLS L/P M/O	HDPE	-40F to 180F	2000
CEC3LPW	2" NPT	2200 SLS L/P M/O W/CABLE	SS6	-40F to 350F	2000
CEC3LPWPP	2" NPT	2200 SLS L/P M/O W/CABLE	HDPE	-40F to 180F	2000

Kimray is an ISO 9001- certified manufacturer.

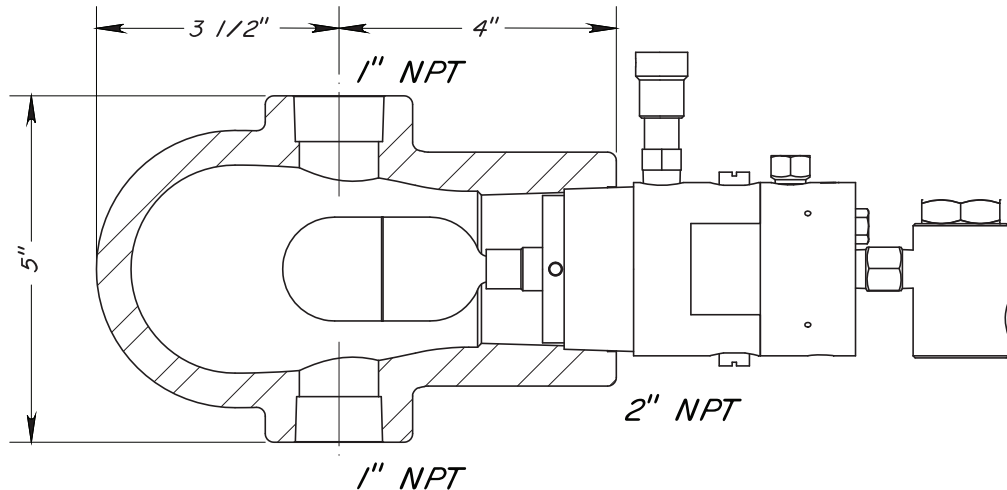
#### CERTIFICATIONS:

Canadian Registration Number (CRN):  
 0F05370.2134567890NTY (External Float Cage)  
 0H13594.2134567890NTY (Pneumatic Level Switch)

#### ELECTRONIC



#### PNEUMATIC



#### EXTERNAL FLOAT CAGES AVAILABLE:

PART NO.	SWITCH CONNECTION	DESCRIPTION	TEMP RANGE	MAX W.P.
5522	1 1/2" NPT	EXT. FLOAT CAGE	-50F to 500F	4000
5523	2" NPT	EXT. FLOAT CAGE	-50F to 500F	4000

#### NOTES:

For standard & optional Seals, Metals & Material specifications see Technical Data on pages C1:I - C1:V

NACE MR0175 compliant material: ASME SA-352-LCB

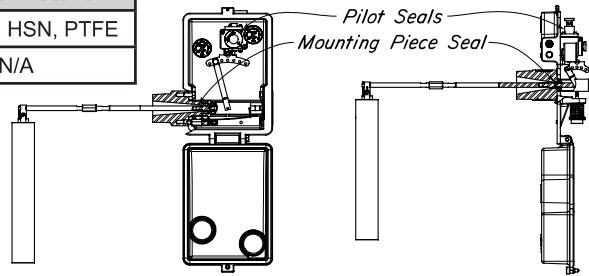
# FLOAT OPERATED LEVEL CONTROLLER



## SEALS

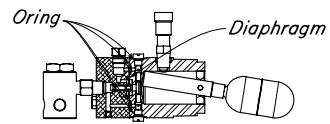
**Table 1 - GEN II Seal Options**

Product Type	Part	Standard Material	Optional Material
Pneumatic & Electric	Mounting Piece	LTV	AFLAS®, HSN, PTFE
Pneumatic	Pilot Seals	FKM	N/A



**Table 2 - Level Switch Seal Options**

Product Type	Part	Standard Material	Optional Material
Electric Switch	O-rings	FKM	AFLAS®, HSN, Nitrile
Pneumatic Switch	O-rings	FKM	AFLAS®, HSN, Nitrile
	Diaphragm	FKM	LTN



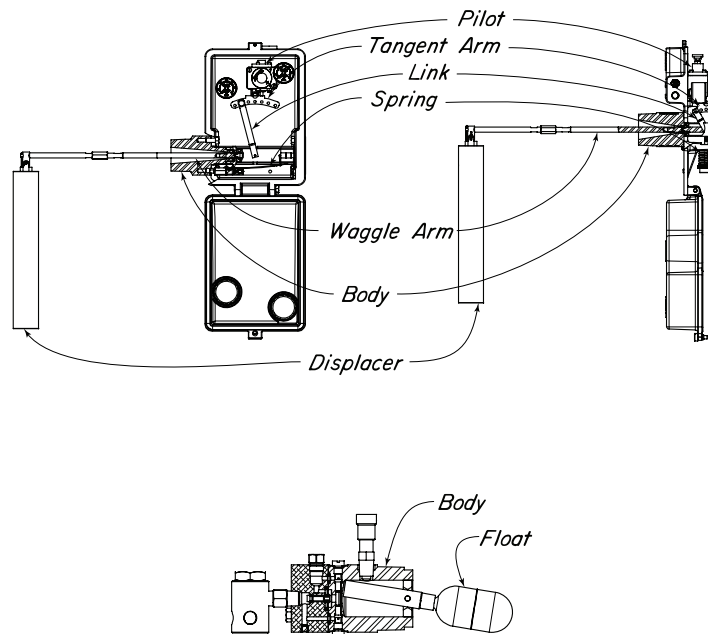
**Table 3 - Seal Specifications**

		NITRILE	HIGHLY SATURATED NITRILE	FKM	AFLAS®	LTN
<b>Kimray Suffix</b>		-	HSN	V	AF	LTN
<b>Resistance</b>	<b>Abrasion</b>	G	G	G	GE	G
	<b>Acid</b>	F	E	E	E	F
	<b>Chemical</b>	FG	FG	E	E	FG
	<b>Cold</b>	G	G	PF	P	E
	<b>Flame</b>	P	P	E	E	P
	<b>Heat</b>	G	E	E	E	G
	<b>Oil</b>	E	E	E	E	E
	<b>Ozone</b>	P	G	E	E	P
	<b>Set</b>	GE	GE	E	PF	GE
	<b>Tear</b>	FG	FG	F	PF	FG
	<b>Water/Steam</b>	FG	E	P	GE	FG
	<b>Weather</b>	F	G	E	E	F
	<b>CO2</b>	FG	GE	PG	GE	FG
	<b>H2S</b>	P	FG	P	E	P
<b>Methanol</b>	G	E	PF	PF	P	
<b>Properties</b>	<b>Dynamic</b>	GE	GE	GE	GE	GE
	<b>Electrical</b>	F	F	F	E	F
	<b>Impermeability</b>	G	G	G	G	G
	<b>Tensile Strength</b>	GE	E	GE	FG	GE
	<b>Temp. Range (°F)</b>	-40 to +220°F	-15° to +300°F	-10° to +350°F	+25° to +450°F	-85° to +120°F
	<b>Temp. Range (°C)</b>	-40 to +105°C	-26° to +149°C	-23° to +177°C	0° to +232°C	-65° to +49°C
<b>Form</b>	O,S,D	O,S,D	O,S,D	O,S,D	O,D	

RATINGS: P-POOR, F-FAIR, G-GOOD, E-EXCELLENT

**Table 4 - Materials of Construction**

	Component	Standard Material	Optional Material
<b>Pneumatic &amp; Electric GEN II Level Controllers</b>	Body	ASTM SA-352LCB	ASTM A-351CF8M
	Pilot	ASTM B-221 6061-T6	N/A
	Link	303SS ASTM A-582	N/A
	Tangent Arm	316 S.S. ASTM A-240	N/A
	Waggle Arm	316 S.S. ASTM A-479	N/A
	Displacer	PVC	316 S.S. ASTM A-240
	Spring	17-7 PH Condition C 302SS ASTM A-313	N/A
<b>Pneumatic Level Switches</b>	Body	Aluminum ASTM B-221 6061-T6	N/A
	Float	316 S.S. ASTM A-240	N/A
<b>External Float Cages</b>	Electronic & Pneumatic Level Switch Float Cage	ASTM A-352 LCB	ASTM A-351CF8M
	Horizontal GEN II Float Cage	ASTM A-106 GR. B	N/A
	Vertical External GEN II Float Cage	SA-106B, SA-234 WPB, SA-516-70	N/A



**Table 5 - Material Specification**

	Body		Inner Parts		
	CAST STEEL	CAST DUCTILE	303 STAINLESS STEEL	316 STAINLESS STEEL	6061-T6 ALUMINUM
<b>KIMRAY SUFFIX</b>	LCB	C6	S3	S6	AL
<b>ASTM GROUP</b>	ASTM A-352	ASTM A-351	ASTM A-582	ASTM A-479	ASTM B-221
<b>GRADE</b>	LCB	CF8M	303	316	6061-T6
<b>UNS</b>	J02505	J92900	S30300	S31600	A96061
<b>NACE Compliant</b>	Yes	Yes	No	No	No



# JAYCO THIEF HATCH MAINTENANCE

BEFORE PROCEEDING WITH MAINTENANCE ON THE THIEF HATCH, CONSULT YOUR COMPANY'S SAFETY AND OPERATIONS MANUALS CONCERNING THE DANGERS INVOLVED WITH WORKING ON A THIEF HATCH AND TANK BATTERY. **USE EXTREME CAUTION!**

## OBSERVE...

- THE OPERATION OF THE THIEF HATCH, IS IT HOLDING PRESSURE?
- DOES IT RELIEF PRESSURE AS SET?

## CLEAN...

- KEEP THE GASKETS AND MOVING PARTS FREE OF DIRT AND RESIDUE

## INSPECT...

- THE GASKETS FOR WEAR, CRACKING AND SWELLING; REPLACE AS NEEDED
- THE ALUMINUM SEATS ON THE BASE AND PLUNGER FOR DAMAGE AND REPAIR OR REPLACE AS NEEDED

## REPAIR OR REPLACE...

- REPLACE GASKETS WITH JAYCO GASKETS SETS ONLY
- IF H<sub>2</sub>S IS PRESENT OR OTHER CHEMICALS THAT REACT WITH THE CURRENT GASKETS, REPLACE WITH VITON® GASKET SETS
- IF AMBIENT TEMPERATURE IS ABOVE 200 DEGREES F, REPLACE GASKETS WITH VITON®

ORDER JAYCO PARTS FROM YOUR LOCAL OILFIELD SUPPLY COMPANY OR TANK MANUFACTURER

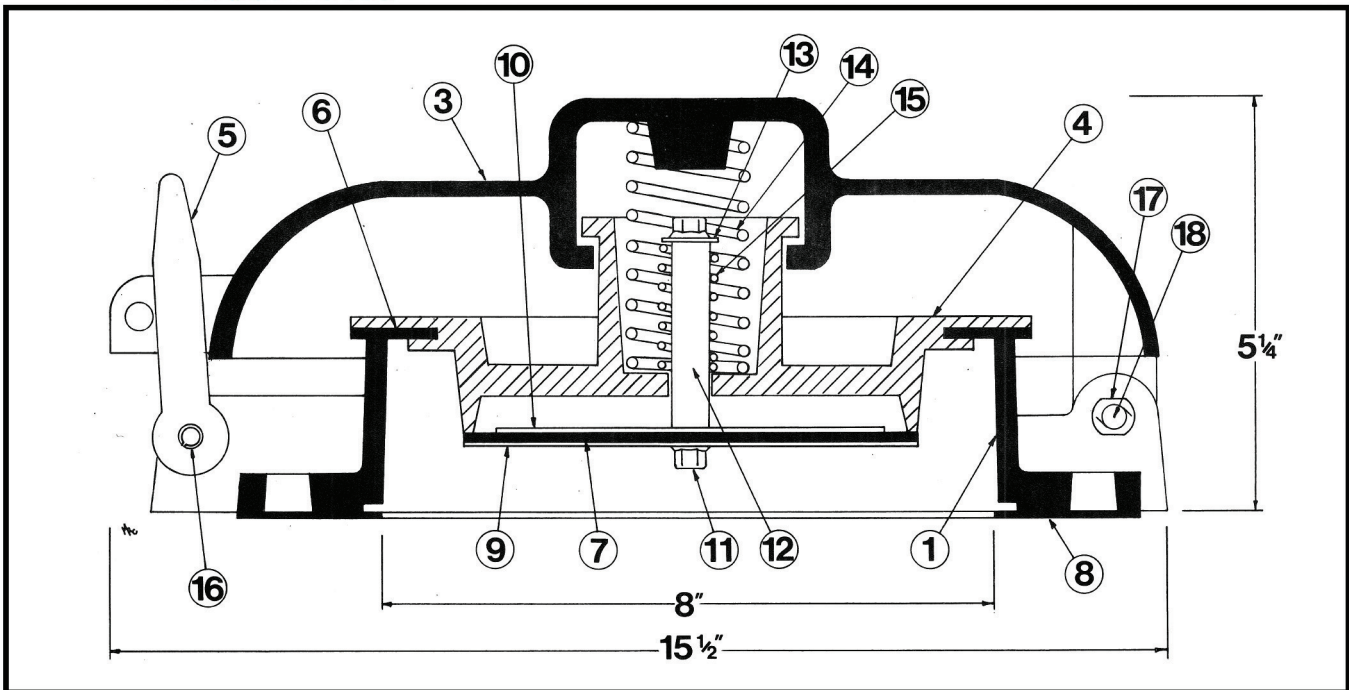
## THE FOLLOWING PAGES WILL ASSIST YOUR SELECTION OF REPLACEMENT PARTS

**\*\* KEEP THE THIEF HATCH CLEAN AND INSPECT ON A REGULAR BASIS \*\***

IF LEAKS PERSIST, ORDER THE REDESIGNED JAYCO PLUNGER ASSEMBLY DESIGNED FOR GREATER SEALING - PART NO. JT1818S WITH SUPREME65 (HIGH GRADE BUNA N) GASKETS OR JT1818V WHICH HAS VITON® GASKETS.

PAGE 1	IDENTIFYING THE STYLE OF PLUNGER FOR ORDERING REPLACEMENT PARTS
PAGE 2	JT-8.1 PARTS LIST FOR JAYCO HATCHES MADE AFTER OCTOBER 2011
PAGE 3	JT-20.1 PARTS LIST FOR JAYCO HATCHES MADE AFTER OCTOBER 2011
PAGE 4	EXPANDED VIEW OF THE NEW JAYCO PLUNGER WITH PART NUMBERS





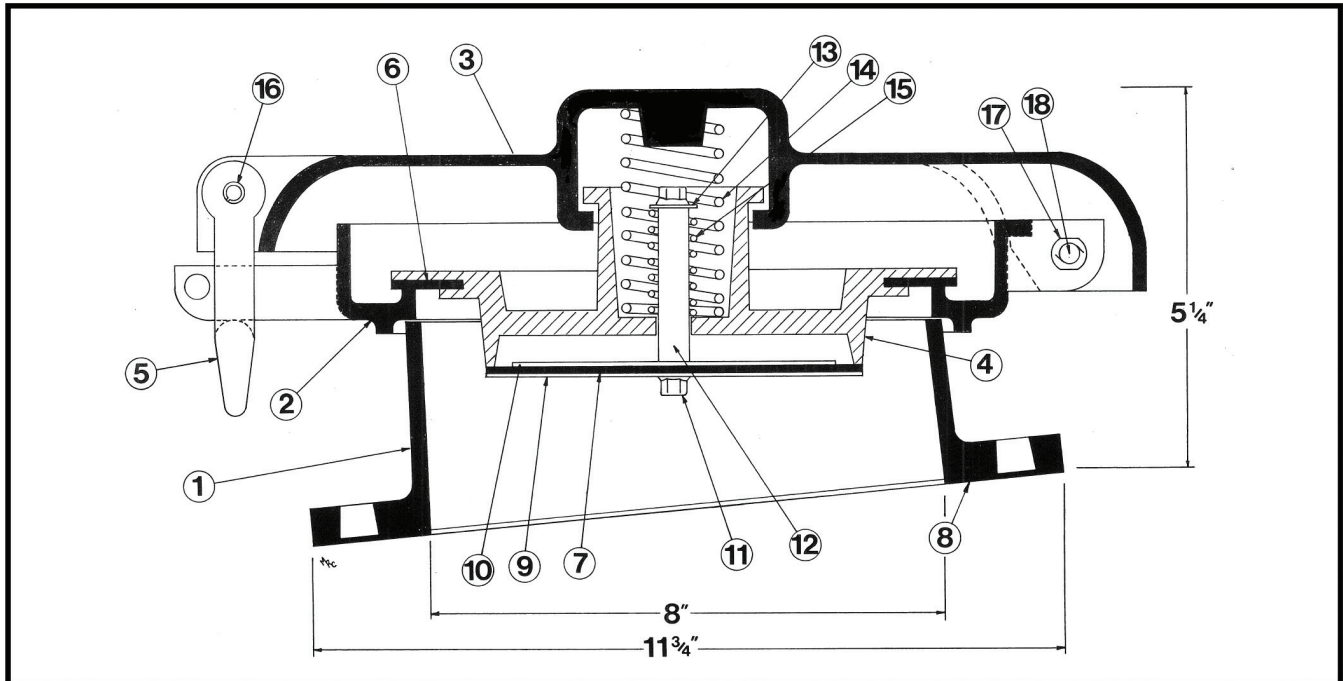
1. BASE		JT8172	ALUMINUM
3. LID		JT18176	ALUMINUM
4. PRESSURE/VACUUM VALVE COMPLETE		JT1818S	ALUMINUM
5. LATCH		JT8205	ALUMINUM
** 6. PRESSURE GASKET		JT1815S	SUPREME65
PRESSURE GASKET (SOUR SERVICE)		JT1815V	VITON®
** 7. VACUUM GASKET		JT1820S	SUPREME65
VACUUM GASKET (SOUR SERVICE)		JT1820V	VITON®
8. BASE GASKET		JT1810S	SUPREME65
BASE GASKET (SOUR SERVICE)		JT1810V	VITON®
9. WASHER (LOWER)		JT1865	ALUMINUM
10. WASHER (UPPER)		JT0860	ALUMINUM
11. SCREW HHTL 1/4-20 X 3/4		JT0871	STAINLESS
12. STEM 1/2 X 2 1/2		JT0850	ALUMINUM
13. WASHER 1/4		JT0855	PLATED
14. SPRING, PRESSURE	4 oz (PLAIN) (STANDARD)	JT0835	PLATED OR SS
	2 oz (BLACK)	JT0830	STAINLESS
	6 oz (YELLOW)	JT0837	STAINLESS
	8 oz (ORANGE)	JT0838	STAINLESS
	12 oz (WHITE)	JT0846	STAINLESS
	16 oz (BLUE)	JT0847	STAINLESS
** 15. SPRING, VACUUM		JT0825	STAINLESS
16. LATCH ROLL PIN		JV0130	ZINC PLATED
17. PUSH NUT, 1/4 (USE ONLY ONCE - THEN REPLACE)		JT0887	
18. HINGE PIN (SHORT)		JT0875	GALVANIZED
BOLT, TOP ASSEMBLY HHWL		JT0857	ZINC PLATED
WASHER, INTERNAL LOCK, BOTTOM		JT0872	STAINLESS

IN KEEPING WITH, AND FOR THE PURPOSE OF PRODUCT IMPROVEMENT, JAYCO RESERVES THE RIGHT TO MAKE DESIGN CHANGES WITHOUT PRIOR NOTICE.

\*\* REPAIR KIT

VITON® IS A REGISTERED TRADEMARK OF DUPONT DOW ELASTOMERS

BULLETIN NUMBER 1015 12



1. BASE		JT2035	ALUMINUM
2. LONG PAN		JT2045	ALUMINUM
3. LID		JT2055	ALUMINUM
4. PRESSURE/VACUUM VALVE COMPLETE		JT1818S	ALUMINUM
5. LATCH		JT8205	ALUMINUM
** 6. PRESSURE GASKET		JT1815S	SUPREME65
PRESSURE GASKET (SOUR SERVICE)		JT1815V	VITON®
** 7. VACUUM GASKET		JT1820S	SUPREME65
VACUUM GASKET (SOUR SERVICE)		JT1820V	VITON®
8. BASE GASKET		JT1810S	SUPREME65
BASE GASKET (SOUR SERVICE)		JT1810V	VITON®
9. WASHER (LOWER)		JT1865	ALUMINUM
10. WASHER (UPPER)		JT0860	ALUMINUM
11. SCREW HHTL 1/4-20 X 3/4		JT0871	STAINLESS
12. STEM 1/2 X 2 1/2		JT0850	ALUMINUM
13. WASHER 1/4		JT0855	PLATED
14. SPRING, PRESSURE	4 oz (PLAIN) (STANDARD)	JT0835	PLATED OR SS
	2 oz (BLACK)	JT0830	STAINLESS
	6 oz (YELLOW)	JT0837	STAINLESS
	8 oz (ORANGE)	JT0838	STAINLESS
	12 oz (WHITE)	JT0846	STAINLESS
	16 oz (BLUE)	JT0847	STAINLESS
** 15. SPRING, VACUUM		JT0825	STAINLESS
16. LATCH ROLL PIN		JV0130	ZINC PLATED
17. PUSH NUT, 1/4 (USE ONLY ONCE - THEN REPLACE)		JT0887	
18. HINGE PIN (SHORT)		JT0885	GALVANIZED
BOLT, TOP ASSEMBLY HHWL		JT0857	ZINC PLATED
WASHER, INTERNAL LOCK, BOTTOM		JT0872	STAINLESS

IN KEEPING WITH, AND FOR THE PURPOSE OF PRODUCT IMPROVEMENT, JAYCO RESERVES THE RIGHT TO MAKE DESIGN CHANGES WITHOUT PRIOR NOTICE.

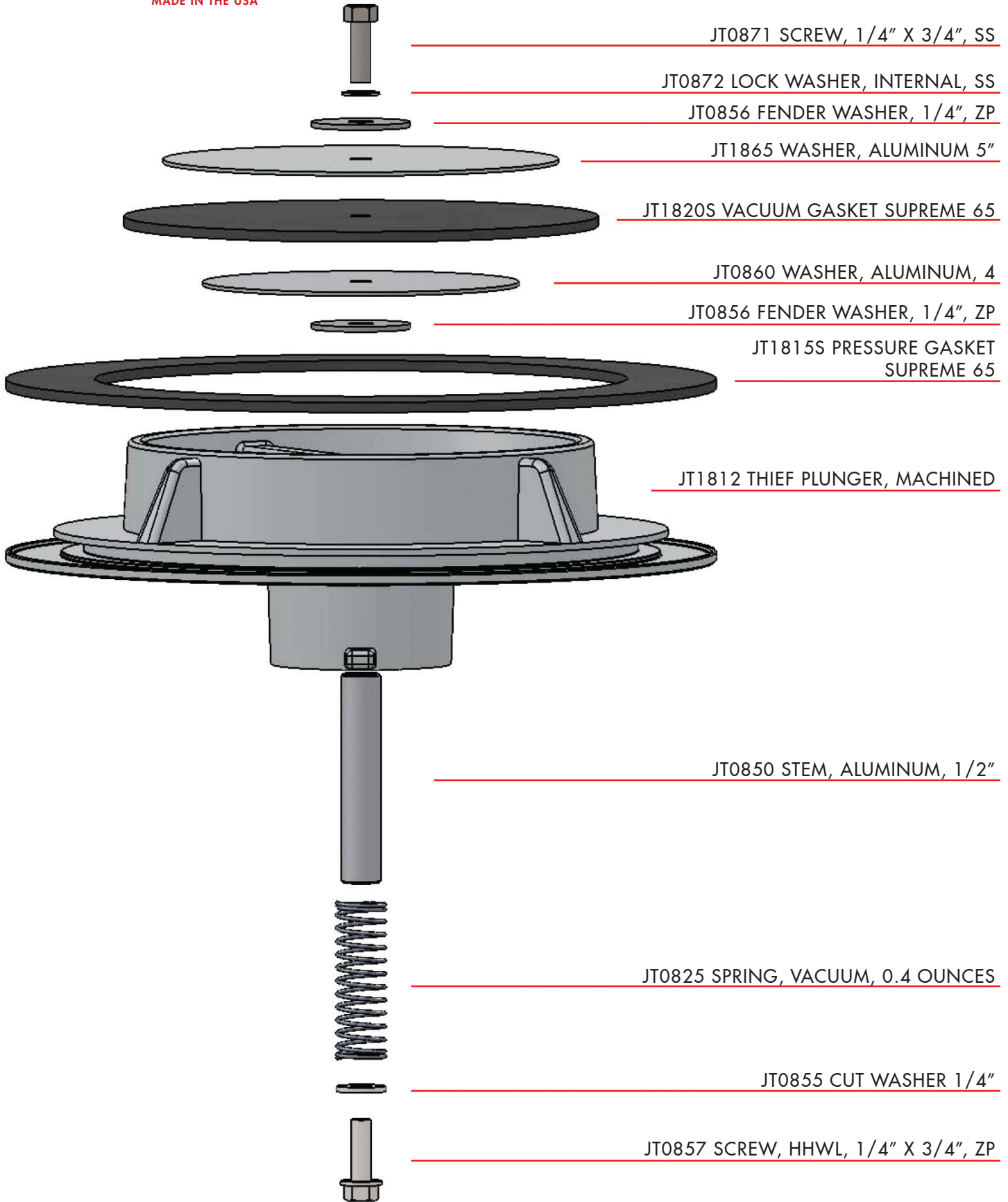
\*\* REPAIR KIT

VITON® IS A REGISTERED TRADEMARK OF DUPONT DOW ELASTOMERS

BULLETIN NUMBER 1015 12

# JAYCO PARTS LIST

## JT1818S PLUNGER



## Rear Connection Bi-metal Thermometers



### ► Overview

Gaugetech® Bi-metal Thermometers are manufactured according to ASME B.40.3 under strict compliance with ISO 9000. The high polished 304 stainless steel case is corrosion resistant. Bi-metal coils are stress relieved and heat treated for maximum accuracy and fast response. Dial faces are concave assuring close proximity of the pointer to the figure intervals.

Silicone oil filling is highly recommended on applications where excess vibration may be present.

These instruments are used in pulp and paper, oil and gas, petrochemical, industrial and food processing industries.

**For applications where the process media may be corrosive or contained under pressure, the use of a Thermowell is required to prevent damage to the thermometer and facilitate its removal from the process. Thermowells are available in various lengths, connections, sizes and materials. Please consult the Thermowell section of this catalog.**



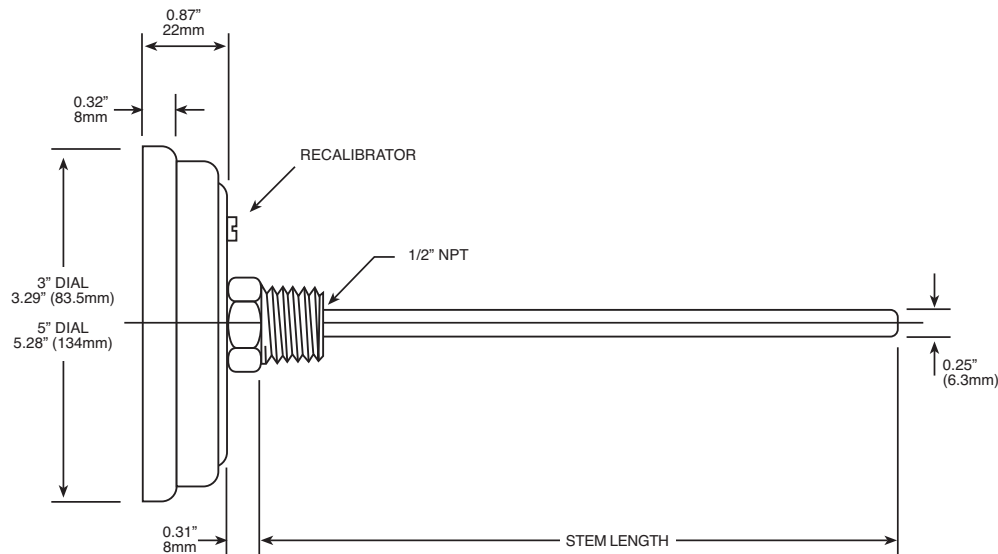
### ► Specifications

Case and ring	304 SS, high polish, hermetically sealed to prevent fogging and exclusion of moisture, ensuring long life of internal components.
Gasket	Natural white rubber compatible with silicone filling.
Stem	304 SS, high polish, welded at tip and case, 1/4" (63mm) diameter for lengths to 24". Other dimensions and stem lengths available.
Coil	Bi-metallic, dampened with 100,000 c.s. silicone grease on ranges to 500°F. Heat treated and stress relieved to maintain a constant expansion ratio and specified accuracy.
Connection	304SS, adjustable angle, 1/2" NPT
Window	Food grade shatter proof glass, 0.16"(4mm) thick
Pointer	Balanced, black aluminum. Pointer flutter eliminated by application of 100,000 c.s. silicone grease to bimetal coil on ranges up to and including 500°F.
Dial	Aluminum, baked enamel finish, white background with black markings. Concave design with celcius on lower plane and fahrenheit on the upper. This allows close proximity of pointer to divisions on scale for accurate readings.
Recalibration	Hex head adjustment screw with screw driver slot allows the operator to re-zero the pointer for maximum accuracy in selected area of the 270° degree dial. Thermometer must be inserted at least 2.5" (63.5mm) into agitated bath with a certified thermometer as a test comparison.
Over range	Bi-metal maybe be over or under ranged temporarily to 50% of full scale value.
Silicone filling	May be filled with silicone for severe vibration applications.
Accuracy	±1.0% Full Scale ASME B40.3 Grade A
Options	Other threaded connections, stem diameters and lengths, silicone filling and special dials.
Shipping weight	GT-32: 0.7 lbs (0.3kg) GT-52: 1.2 lbs (0.54kg)

# Rear Connection Bi-Metal Thermometers



## ► Dimensions



Drawings are not to scale.

## ► How to order

**Models and Range codes shown in bold are typically stocked in our warehouse.**

\* Not recommended for continuous service over 800°F (425°C)

\*\* Specify length in inches (72" maximum)

BASE PRODUCT			RANGE OPTIONS						FAHRENHEIT		CELSIUS		
DIAL SIZE	STEM LENGTH**	PRODUCT CODE	DUAL SCALE			FAHRENHEIT ONLY (SPECIAL ORDER)		CELSIUS ONLY (SPECIAL ORDER)		Figure Intervals	Minor Divisions	Figure Intervals	Minor Divisions
			RANGE CODE	°F OUTER SCALE	°C INNER SCALE	RANGE CODE	°F	RANGE CODE	°C				
3"	2.5" (63.5mm)	<b>GT-32</b>	<b>01</b>	-100°F to 100°F	-75°C to 40°C	<b>01F</b>	-100°F to 100°F	<b>01C</b>	-75°C to 40°C	20°	2'	10°	1°
	4" (101.6mm)	<b>GT-34</b>	<b>02</b>	-40°F to 160°F	-40°C to 70°C	<b>02F</b>	-40°F to 160°F	<b>02C</b>	-40°C to 70°C	20°	2'	10°	1°
	6" (152.4mm)	<b>GT-36</b>	<b>03*</b>	25°F to 125°F	-5°C to 50°C	<b>03F*</b>	25°F to 125°F	<b>03C*</b>	-5°C to 50°C	10°	1'	5°	1/2°
	9" (228.6mm)	<b>GT-39</b>	04	0°F to 200°F	-20°C to 95°C	<b>04F</b>	0°F to 200°F	<b>04C</b>	-20°C to 95°C	20°	2'	10°	1°
	12" (304.8mm)	<b>GT-312</b>	05	20°F to 240°F	-10°C to 115°C	<b>05F</b>	20°F to 240°F	<b>05C</b>	-10°C to 115°C	20°	2'	10°	1°
	15" (381.0mm)	GT-315	<b>27</b>	0°F to 250°F	-20°C to 120°C	<b>27F</b>	0°F to 250°F	<b>27C</b>	-20°C to 120°C	50°	2'	20°	2°
	18" (457.2mm)	GT-318	<b>06</b>	50°F to 300°F	10°C to 150°C	<b>06F</b>	50°F to 300°F	<b>06C</b>	10°C to 150°C	50°	2'	20°	2°
	24" (609.6mm)	GT-324	07	50°F to 400°F	10°C to 205°C	<b>07F</b>	50°F to 400°F	<b>07C</b>	10°C to 205°C	50°	5'	50°	2°
			<b>08</b>	50°F to 500°F	10°C to 260°C	<b>08F</b>	50°F to 500°F	<b>08C</b>	10°C to 260°C	50°	5'	50°	2°
			<b>09</b>	150°F to 750°F	50°C to 400°C	<b>09F*</b>	150°F to 750°F	<b>09C*</b>	50°C to 400°C	100°	10'	50°	5°
5"	2.5" (63.5mm)	<b>GT-52</b>	<b>10*</b>	200°F to 1000°F	100°C to 550°C	<b>10F*</b>	200°F to 1000°F	<b>10C*</b>	100°C to 550°C	100°	10'	100°	5°
	4" (101.6mm)	<b>GT-54</b>	<b>HOW TO ORDER</b>						<b>ADDITIONAL OPTIONS</b>				
	6" (152.4mm)	<b>GT-56</b>	Specify base product code. Add range code required.						<b>CODE</b>	<b>OPTION</b>	<b>CODE</b>	<b>OPTION</b>	
	9" (228.6mm)	<b>GT-59</b>	Add option code required.						F	Silicone Filled	M	Maximum Registering Pointer	
	12" (304.8mm)	<b>GT-512</b>	Example: GTA-32-02-F										
	15" (381.0mm)	GT-515	(Adjustable Angle, 3" dial, 2.5" stem, range code 02, filled)										

## ► Overview

Thermowells are recommended for temperature instruments in process systems where pressure, velocity, or viscous, abrasive, and corrosive materials are present individually or in combination. A properly selected thermowell will protect the temperature instrument from damage resulting from these process variables.

Additionally, a thermowell enables removal of the temperature instrument for replacement, repair, or testing without affecting the process system. We stock a wide range of popular industry thermowells to suit industrial & bi-metal thermometers, thermocouples, RTD's & temperature recorders.

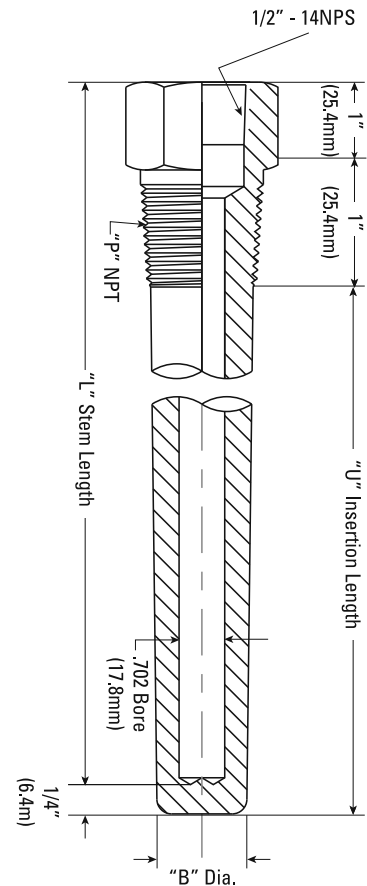
We welcome special inquiries on thermowells, please contact our sales desk.

## ► Specifications

Type	.260 Bore Standard Stepped .702 Bore Straight
Instrument Connection	1/2" FNPT
Process Connection	1/2" MNPT 3/4" MNPT 1" MNPT
Materials	316SS
Stem Lengths	2.5" 4" 6" 9" 12"

## ► Ordering & Dimensions

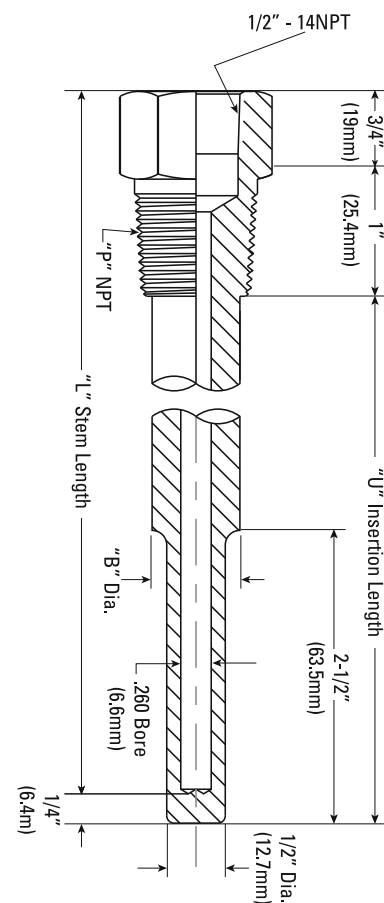
.702 Bore Testwell - Standard Straight									
Process Connection "P"	Model Number	Stem Length "L"		Insertion Length "U"		"B" Diameter		Overall Length	
		in	mm	in	mm	in	mm	in	mm
3/4" NPT	76210200	3.75	95	2	51	.825	21	4	102
	76210400	4.75	120	3	76	.825	21	5	127
	76210600	5.75	146	4	102	.825	21	6	152
1" NPT	78210200	3.75	95	2	51	1	25	4	102
	78210400	4.75	120	3	76	1	25	5	127
	78210600	5.75	146	4	102	1	25	6	152



Drawing is not to scale.

► **Ordering & Dimensions**

<b>.260 Bore Thermowells - Standard Stepped</b>									
Process Connection "P"	Model Number	Stem Length "L"		Insertion Length "U"		"B" Diameter		Overall Length	
		in	mm	in	mm	in	mm	in	mm
1/2" - 14 - NPT In Stock	S12-025-304	2.5	64	1.25	32	-	-	2.75	70
	S12-025-316	2.5	64	1.25	32	-	-	2.75	70
	S12-040-304	4.0	102	2.5	64	-	-	4.25	108
	S12-040-316	4.0	102	2.5	64	-	-	4.25	108
	S12-060-304	6.0	152	4.5	114	0.63	16	6.25	159
	S12-060-316	6.0	152	4.5	114	0.63	16	6.25	159
	S12-090-304	9.0	229	7.5	191	0.63	16	9.25	235
	S12-090-316	9.0	229	7.5	191	0.63	16	9.25	235
	S12-120-304	12.0	305	10.5	267	0.63	16	12.25	311
S12-120-316	12.0	305	10.5	267	0.63	16	12.25	311	
3/4" - 14 - NPT In Stock	S34-025-304	2.5	64	1.25	32	-	-	2.75	70
	S34-025-316	2.5	64	1.25	32	-	-	2.75	70
	S34-040-304	4.0	102	2.5	64	-	-	4.25	108
	S34-040-316	4.0	102	2.5	64	-	-	4.25	108
	S34-060-304	6.0	152	4.5	114	0.75	19	6.25	159
	S34-060-316	6.0	152	4.5	114	0.75	19	6.25	159
	S34-090-304	9.0	229	7.5	191	0.75	19	9.25	235
	S34-090-316	9.0	229	7.5	191	0.75	19	9.25	235
	S34-120-304	12.0	305	10.5	267	0.75	19	12.25	311
S34-120-316	12.0	305	10.5	267	0.75	19	12.25	311	
1" - 11.5 - NPT	S10-025-304	2.5	64	1.25	32	-	-	2.75	70
	S10-025-316	2.5	64	1.25	32	-	-	2.75	70
	S10-040-304	4.0	102	2.5	64	-	-	4.25	108
	S10-040-316	4.0	102	2.5	64	-	-	4.25	108
	S10-060-304	6.0	152	4.5	114	0.83	22	6.25	159
	S10-060-316	6.0	152	4.5	114	0.83	22	6.25	159
	S10-090-304	9.0	229	7.5	191	0.83	22	9.25	235
	S10-090-316	9.0	229	7.5	191	0.83	22	9.25	235
	S10-120-304	12.0	305	10.5	267	0.83	22	12.25	311
	S10-120-316	12.0	305	10.5	267	0.83	22	12.25	311



Drawing is not to scale.



# Meridian™ Ball Valve

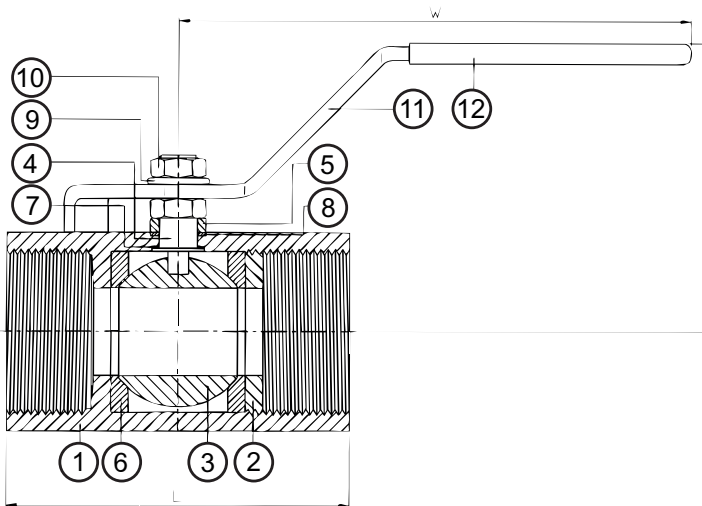
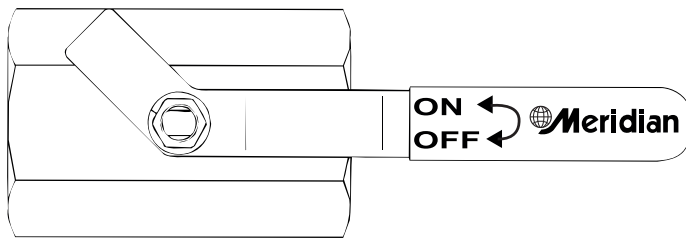
Model #: M12B

## 2000 WOG 1-PIECE REDUCED BORE



### FEATURES

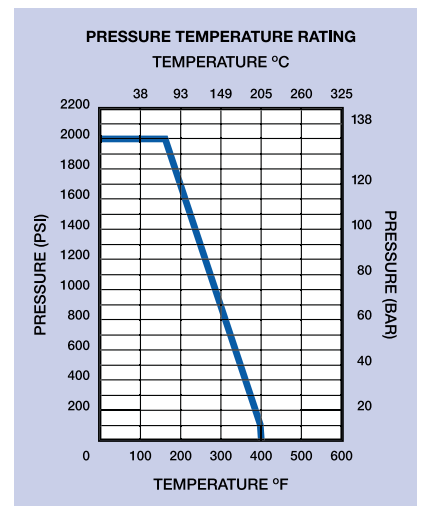
- Threaded ends conform to ASME B1.20.1 (NPT)
- Blow-out proof stem
- 2000 psi
- Stainless steel ball and stem
- Glassfibre filled PTFE seats
- PTFE seal and packing
- NACE MR01-75



ITEM	PARTS	MATERIAL
1	BODY	ASTM A108-1020
2	RETAINER	ASTM A108-1020
3	BALL	ASTM A276-304
4	STEM	ASTM A276-316
5	GLAND RING	ASTM A108-1020
6	BALL SEAT	R-PTFE
7	THRUST WASHER	PTFE
8	PACKING	PTFE
9	SPRING WASHER	AISI 304
10	STEM NUT	AISI 304
11	HANDLE	AISI 304
12	HANDLE SLEEVE	PVC

DN	d	L	H	W	Weight KG	Cv
8	5	43.1	28.5	61	0.12	2.5
10	7.2	47.35	33.5	86	0.15	4.5
15	9	61.72	60.5	110	0.3	7
20	12.5	69.85	62.0	110	0.43	9
25	15	85.73	66.7	121	0.63	16
32	20	93.67	82.6	146	1.42	24
40	25	101.6	82.6	146	1.45	37
50	32	114.3	87.4	152	2.6	68

NPS	d	L	H	W	Weight LB	Cv
1/4"	0.20	1.70	1.12	2.40	0.3	2.5
3/8"	0.28	1.86	1.32	3.39	0.3	4.5
1/2"	0.35	2.43	2.38	4.33	0.7	7
3/4"	0.49	2.75	2.44	4.33	0.9	9
1"	0.59	3.38	2.63	4.76	1.4	16
1-1/4"	0.79	3.69	3.25	5.75	3.1	24
1-1/2"	0.98	4.00	3.25	5.75	3.2	37
2"	1.26	4.50	3.44	5.98	5.7	68



Canada's Valve Specialist

DUE TO CONTINUOUS DEVELOPMENT OF OUR PRODUCTS, WE RESERVE THE RIGHT TO MODIFY OUR PRODUCT DESIGN OR CONSTRUCTION WITHOUT PRIOR NOTICE.





## 5.2 Burner Train

## BURNER TRAIN

### EQUIPMENT SPECIFICATIONS

<u>Item # (From Bill Of Materials)</u>	<u>Description</u>
FAH 1510	Zirco Burner Assembly, 3.0 MM BTU/HR Flame Arrestor, 2 Piece Assembly c/w (28) 9/16"∅ holes on a 32 1/2" B.C.D. straddling centerline, (1) 1 1/2" coupling side gas connection & (1) 1/4" pilot connection. Model FAB 42-24-30A(2)M200B200160N20030 c/w (1) 42" Aluminum Flame Element, (2) ACL-M200 Mixers, Pre-drill "N" orifices (2) ACL-B20016 Venturi Barrels & (1) ACL-ON2X20030 Dual Combustion Optimizer Burner Nozzle, Flame Cell Hinged on right side viewing from Flame Cell Intake, Burner Pressure is 10 psig and field adjustable
BMS/TSHH /TE/TW/TC 1510	Profire 2100 Ignition Flame Safety Controller c/w flame rod/Ignitor, CSA 22.2-199 approved, Profire model PFTC12-K Dual type K thermocouple, Class I Div 1 head, Profire flame backup thermocouple, Profire ignition transformer 12/24 VDC (mounted inside flame arrestor housing) and thermowell, 1/2" x 3/4" x 9" lg, A.I.S.I. 316 SS, MAWP 7000 psig. 15' long ignition cable pilot assembly nozzle mixer & size #65 orifice c/w ACL-M50A, 1/2" NPT pilot mixer-Nipple, group ULC (Only)
BV 1510A/ 1510B	ASCO Gas Shutoff Valve 1" NPT, p/n: HV298568-002, ∅1" orifice, 304 stainless steel body, FKM seals & discs, low-temp HNBR diaphragm, 305 stainless steel core tube, Inconel springs, 13 Cv flow, 23.6 peak watts power consumption, 24 VDC, NACE MR-0175 Compliant, CSA 6.5 C/I Safety Shutoff, ANSI/ISA-12.27.01-2003 Single Seal, MAWP 100 Psig
BV 1515	ASCO Gas Shutoff Valve 1/4" NPT, p/n:HV427246-002, ∅5/32" orifice, 304 stainless steel body, FKM seals/discs, PTFE rider ring, Inconel springs, 0.52 Cv flow, 10.6 peak watts power consumption, 24 VDC, NACE MR-0175 Compliant, CSA 6.5 C/I Safety Shutoff, ANSI/ISA-12.27.01-2003 Single Seal, MAWP 100 Psig
PCV 1510	1" NPT Fisher 627R regulator, ductile iron body, aluminum spring case, 3/8" orifice, 5-20 psi spring, field set, MAWP 1000 psig
PCV 1505/ 1515	Fisher 67 CFR pressure regulator, 1/4" NPT, 0-35 psig spring range vented bonnet, ASTM B85/alloy 380 aluminum body, MAWP 250 psig
PI 1505/ 1510	WGI Classic 250 Series Bottom Mount Pressure Gauge 1/4" NPT, p/n: WJ4642, 0-30 Psig range, 2 1/2" dial, dual Scale, Black Steel case, Brass tube soldered to brass socket, glass lens, dry fill, white Aluminum dial, ASME Grade B, MAWP 1500 Psig

## EQUIPMENT SPECIFICATIONS

<u>Item # (From Bill Of Materials)</u>	<u>Description</u>
PI 1501	Gaugetech Bottom Mount Pressure Indicator, p/n GTG-2518A-12, 1/4" MNPT, 0-100 psig range, 2 1/2" face, dual scale psig/kPag, phosphor bronze bourdon tube & brass socket, plexi glass window, S.S case, Neoprene gasket, glycerin /H2o fill, accuracy $\pm 3/2/3\%$ ASME B40.1 grade B, MAWP 1500 psig
PI 1511	WGI Elite 250 Series Pressure Gauge 1/4" NPT, p/n: WJ7842P, 0-30 Psig range, 2 1/2" dial, dual scale, bottom mount, 304 S.S. case, 316L S.S. tube/socket, acrylic/ safety glass lens, silicone fill fluid, nitrile vent plug, white aluminum dial, ASME B40.1 Grade A, MAWP 1100 Psig
PI 1515	WGI Classic 250 Series Bottom Mount Pressure Gauge 1/4" NPT, p/n WJ4640, 0-15 Psig range, 2 1/2" Dial, Dual Scale, Black Steel case, Brass tube soldered to brass socket, Glass Lens, Fill Fluid none, white Aluminum dial, ASME Grade B, MAWP 1500 Psig @ 140°F
PI 1516	Wika Series 233.53 Lower Mount Pressure Indicator, 1/4" MNPT, p/n 7309326, 0-15 psig range, 2 1/2" Face, Dual scale, 316SS bourdon tube and connection, 304SS case, dry, MAWP 600 psig, NACE
PSHH 1510	CCS Dual Snap Electric Pressure Switch 1/2" NPT, p/n: 6900GZE-12, 3-20 psig adjustable pressure range, set @ TBD psig & rising, 316 stainless steel pressure port/diaphragm, Viton O-ring, aluminium housing II amp SPDT, 750 psig proof pressure, hermitically sealed electrical assembly, 2-30 VDC, dual seal ANSI/ISA-2337.01-2003, 2 Psig Approx. dead band, NACE MR-1075 Compliant, CSA Explosion Proof Class I Div. I & II Groups A,B C, MAWP 500 psig
PSLL 1510	CCS Dual Snap Electric Pressure Switch 1/2" NPT, p/n: 646GZE1-7011, 0.4-15 psig adjustable pressure range, set @ Field Set Psig & Falling, 316 stainless steel pressure port/diaphragm, aluminum housing, Viton O-rings, 750 Psig proof pressure, approx. 1 psi dead band, 2-28 VDC, dual seal ANSI/ISA-2337.01, NACE MR-1075 Compliant, CSA Explosion Proof Class I Div. I & II Groups A,B C & D MAWP 500 Psig
SCV 1505	NAS-AS Series Speed Controller 1/4" NPT, p/n: NAS-4000-NO2, aluminum alloy body/ needle, zinc alloy lock nut, NBR o-ring, proof pressure 217.5 Psig, free flow rate 1670 Ft <sup>3</sup> /Hr, controlled flow rate 1670 Ft <sup>3</sup> /Hr, MAWP 145 psig

## EQUIPMENT SPECIFICATIONS

<u>Item # (From Bill Of Materials)</u>	<u>Description</u>
TCV 1505	1" NPT Dyna Flo control valve, model DF100-GC6-6DN-34S, 3/4" IV, steel body, 3/4" unbalanced stainless trim, 10 psi spring, minimum fire stop kit, MAWP 2250 psig
TYV 1505	ASCO 3-Way Solenoid Valve 1/4" NPT, p/n: EF8320G202, ø 3/32" orifice, 303 stainless steel body, NBR seals/discs, 302 stainless steel core springs, 0.12 Cv, 11.6 watt power consumption, normally closed operation, 24 VDC, Explosion Proof Class I Div. I & Div. II, Groups A,B,C & D, MAWP 115 psig
BAFF 53	NEO Ball Valve 1 1/2" NPT, p/n:1½-2500, full port, A351-Gr.CF8M two piece body/ball, 316 stainless steel stem, Teflon stem packing/joint gasket, 304 stainless steel gland packing, blow out proof stem, CSA 3.16 Certified, MAWP 2000 psig WOG
BAFF 42	NEO Cat. No. 2500, 1" NPT ball valve, 316 SS, CGA 3.16 approved and marked, MAWP 2000 psig WOG
BAFF 25	Meridian Ball Valve, 1/2" NPT CL 800, p/n: MAC2CFK, full port, A216 Gr. WCB carbon steel body, A276/316 stainless steel stem, A351/CF8M stainless steel ball, RPTFE ball seats, PTFE stem seal packing, Fire safe To API 607 5th Edition, tested to API 598, NACE MR-0175, MAWP 2000 psig
BAFF 02	NEO Cat. No. 2500, 1/4" NPT ball valve, 316 SS, CGA 3.16 approved and marked, MAWP 2000 psig WOG
NEIF 04A	WGI Instrument Needle Valve 1/4" MNPT x 1/4" FNPT, p/n: WN1612-PN, A175SN body/ bonnet, 316 stainless steel stem, PTFE Teflon stem packing, ø1/8" Orifice, hard seat, NACE MR-0175 Compliant, MAWP 6000 Psig
NEIF 04B	WGI Instrument Needle Valve 1/4" MNPT x 1/4" FNPT, p/n: WN-1432-P, SA-479-316 stainless steel body/ bonnet/stem, PTFE Teflon packing, ø1/8" orifice, hard seat, NACE MR-0175 Compliant, MAWP 6000 Psig

## EQUIPMENT SPECIFICATIONS

<u>Item # (From Bill Of Materials)</u>	<u>Description</u>
NEIF 04C	WGI Miniature Needle Valve 1/4" MNPT x 1/4" FNPT, p/n: WN-0512, SA-105N carbon steel body/bonnet, SA-479-316 stainless steel spindle/tip, PTFE/graphite seals, rotating stem, $\varnothing$ 1/8" orifice, hard seat, NACE MR-0175 Compliant, MAWP 6000 Psig
STYF 40	1" NPT Alberta Strainer YS-3000 Y-strainer, carbon steel ASTM A105N body & cover, 304SS screen c/w 1/32" perforations, MAWP 1940 psig( Shop remove basket and install 100 mesh stainless screen material over the basket.)

 | ***PF2100 USER MANUAL***



# TABLE OF CONTENTS

PF2100 MANUAL V2.32

## 1 INTRODUCTION

- 1.1 Important Safety Information
- 1.2 HW & FW Versioning
- 1.3 Approvals
- 1.4 Available Models
- 1.5 Included Components
- 1.6 Common Applications & Optional Hardware
- 1.7 System Diagram
- 1.8 Terminal Card Descriptions

## 2 INSTALLATION

- 2.1 Installation Warnings
- 2.2 Mounting Considerations
- 2.3 Terminal Card Diagram
- 2.4 Wiring

## 3 USER INTERFACE & SETTINGS

- 3.1 User Interface
- 3.2 Menu Navigation
- 3.3 Menu Map
- 3.4 Initial System Settings
- 3.5 Optional Settings
- 3.6 System Operation

## 4 SYSTEM BEHAVIOR

- 4.1 System Behavior
- 4.2 Process Control
- 4.3 Contact Behavior

## 5 EXPANSION CARDS

- 5.1 4-20mA Expansion Card
- 5.2 Modbus Expansion Card

## 6 TROUBLESHOOTING

- 6.1 Common Issues & Solutions
- 6.2 Shutdown Messages
- 6.3 Alarm Codes
- 6.4 Warning Messages
- 6.5 Flame Detection Troubleshooting Guide
- 6.6 Thermocouple Troubleshooting Guide

## APPENDICES

- A PID Tuning Procedure
- B Field Calibration
- C Resetting to Defaults



# 1 | INTRODUCTION

The PF2100 BMS (Burner Management System) is an electronic control and monitoring system designed for use on a wide array of natural draft burner industrial applications. It provides electronic pilot ignition, flame detection, temperature control, and remote monitoring. In addition to being an extremely useful tool, it improves safety by preventing the flame from being lit under unsafe conditions.

## 1.1 | Important Safety Information

Installation and use must conform to the directions in this manual.

System must be properly connected to earth-ground for effective operation of flame detection circuitry.

Electrical devices connected to the controller must meet certain electrical standards and be within voltage limits.

Replacement fuses must be ceramic and of correct rating.

Avoid unauthorized replacement of the fuse.

### **WARNINGS**

This equipment is suitable for use in class 1, division 2, groups abcd or non-hazardous locations only.

Do not service unless area is known to be non-hazardous.

Do not open when energized.

### **EXPLOSION HAZARD**

Do not disconnect while circuit is live unless area is known to be non-hazardous or equivalent.

Substitution of components may impair suitability for class 1, division 2.

### **FOR ANY QUESTIONS PLEASE VISIT OR CALL US.**

[www.profireenergy.com](http://www.profireenergy.com) | 1.855.PRO.FIRE



## 1.2 | HW & FW Versioning

This version of the manual was written for use with PF2100 systems that have the following hardware and firmware versions.

ITEM	HW VERSION	FW VERSION
Door Card	v1.71	E1.8.206
Terminal Card	v2.2	E1.8.206
4-20mA Card	v3.0	v4.1
Modbus Card	v2.0	v4.3

System hardware and firmware versions can be found printed on separate labels inside of the enclosure on each circuit board.

## 1.3 | Approvals

CSA C22.2 No. 199, 3rd Edition  
ANSI Z21.20, 15th Edition  
UL 372, 6th Edition

Class I, Zone 2,  
AEx, nA IIC, T4, IP66  
Ex nA IIC T4 IP66



CSA C22.2 No. 0-M91  
CSA C22.2 No. 0.4-04  
CSA C22.2 No. 94-91  
CSA C22.2 No. 213-M1987  
CSA E60079-0:2007  
CSA C22.2 No. 60079-15:12  
ANSI-HSA-12.12.01-2007  
UL No. 60079-0, Ed. 6  
UL No. 60079-15, Ed. 4

## 1.4 | Available Models

The PF2100 is available in two configurations: Base Model and Internal Coil Model.

The Base Model is for use with externally mounted ignition coils. This is useful when the controller must be mounted more than 5m (15ft) away from the burner. An external ignition coil can be purchased separately from Profire for use with this model.

The Internal Coil Model includes a built-in ignition coil and can be used whenever the controller can be mounted less than 5m (15ft) away from the burner.

Optional expansion cards are also available:

- 4-20mA Expansion Card (1PS166)
- Modbus Expansion Card (1PS167)

## BASE MODELS

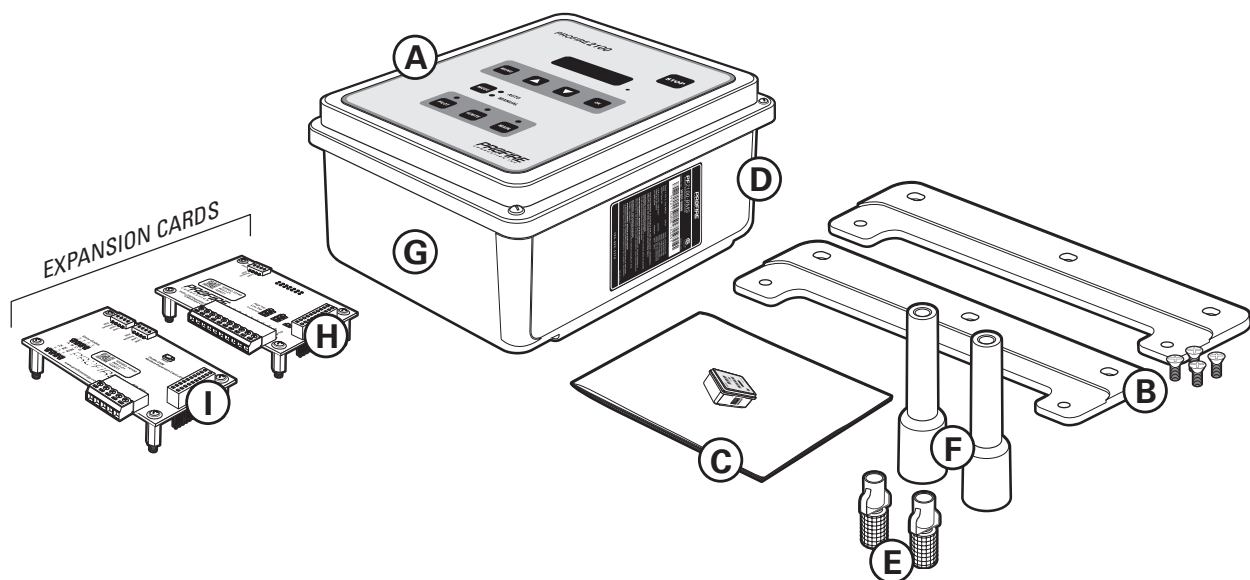
MODEL #	MODEL DESCRIPTION
E0000	Base Model
E0400	Base Model with 4-20mA Expansion Card
E0M00	Base Model with Modbus Expansion Card
E04M0	Base Model with 4-20mA Expansion Card and Modbus Expansion Card

## INTERNAL COIL MODELS

MODEL #	MODEL DESCRIPTION
EC000	Internal Coil Model
EC400	Internal Coil Model with 4-20mA Expansion Card
ECM00	Internal Coil Model with Modbus Expansion Card
EC4M0	Internal Coil Model with 4-20mA Expansion Card and Modbus Expansion Card

## 1.5 | Included Components

CODE	DESCRIPTION	E0000	E0400	E0M00	E04M0	EC000	EC400	ECM00	EC4M0
A	PF2100	•	•	•	•	•	•	•	•
B	Mounting Brackets & Screws	•	•	•	•	•	•	•	•
C	Installation Guide	•	•	•	•	•	•	•	•
D	Internal Coil					•	•	•	•
E	Ferrules (2)					•	•	•	•
F	Straight Silicone Boots (2)					•	•	•	•
G	Ignition Cable (20ft)					•	•	•	•
H	4-20mA Expansion Card		•		•		•		•
I	Modbus Expansion Card			•	•			•	•



## GENERAL FEATURES

- Designed for use with natural draft fire tube heaters
- Meets or exceeds all relevant codes and standards
- Easy installation with clearly marked component I/O
- Easily accessible removable terminal connections
- Rapid 3 second shut-down on flame-out
- Electronic spark ignition
- Low-power operating mode to accommodate solar panel or TEG applications
- Auto-relight or manual operation
- Transient protected and fail-safe circuits
- All solid state circuit components
- CSA compliant for Class I, Division 2 locations
- Certified for use on B.149 compliant valve trains
- Optional internal or external ignition coil

## INPUTS & OUTPUTS

- Digital inputs for safety interlock device connections (6)
- Digital outputs (5)
- 4-20mA output (1)
- Flame-rod input (1)
- Thermocouple inputs (3)

## TECHNICAL SPECIFICATIONS

TEMPERATURE RATINGS	MIN	MAX
Operating Range	-40°C (-40°F)	+55°C (+130°F)
Storage Range	-40°C (-40°F)	+80°C (176°F)

POWER CONSUMPTION	12V	24V
Controller only, display ON	2.6 W	2.9 W
Controller only, display OFF	1.1 W	1.2 W
Maximum Total Current Draw	5A	5A
Maximum Valve Current Draw	2A	2A
Ignition Voltage (Internal Coil)	up to 20 kV	up to 40 kV

TERMINAL BLOCKS	VALUE
Maximum Wire Gauge	12 AWG

STATUS CONTACT	VALUE
Type	Dry
MAX Voltage	40VDC
MAX Continuous Current	250mA
Impedance (When Closed)	15Ω

PHYSICAL DIMENSIONS	VALUE
Width	30.9 cm (12.15 in)
Height	23.4 cm (9.23 in)

<b>PHYSICAL DIMENSIONS</b>	<b>VALUE</b>
Depth	13.4 cm (5.28 in)

<b>WEIGHT</b>	<b>VALUE</b>
E0000 Model	4.0lbs / 1.8kg
E0400 Model	4.5lbs / 2.0kg
E0M00 Model	4.5lbs / 2.0kg
EC000 Model	6.0lbs / 2.6kg

<b>FUSES</b>	<b>VALUE</b>
Main Fuse Rating	5A / 250 V Ceramic, Fast Blow
Status Contact Fuse Rating	250mA / 125V Ceramic, Fast Blow
Replacement Main Fuse	Littelfuse 0314005.HXP
Replacement Status Contact Fuse	Littelfuse 0453.250 or 0451.250

## 1.6 | Common Applications & Optional Hardware

Below are examples of some of the many applications that the PF2100 can be used in.

Line Heater	Tank Heater	Gas Production Unit
Dehydrator	Separator	Amine Reboiler
Combustor	Treater	Thermal Oxidizer

Depending on your installation type, other components may be required. Commonly requested hardware includes:

### **Mounting Hardware**

Channel Bar  
Conduit Ports  
Liquid Tight Ports  
Rubber Grommets

### **Wire**

Ignition Wire  
Thermocouple Wire

### **Rods And Connectors**

Kanthal Ignition Rods (Various Lengths)

### **Valves**

DC Solenoids  
Safety Valves with Proof of Closure  
Proportional Valves



### Thermocouples

Single, Type K  
Dual Element, Type K

### Pilot Assembly

Nozzles  
Brackets  
Mixers  
Orifices

### Autonomy

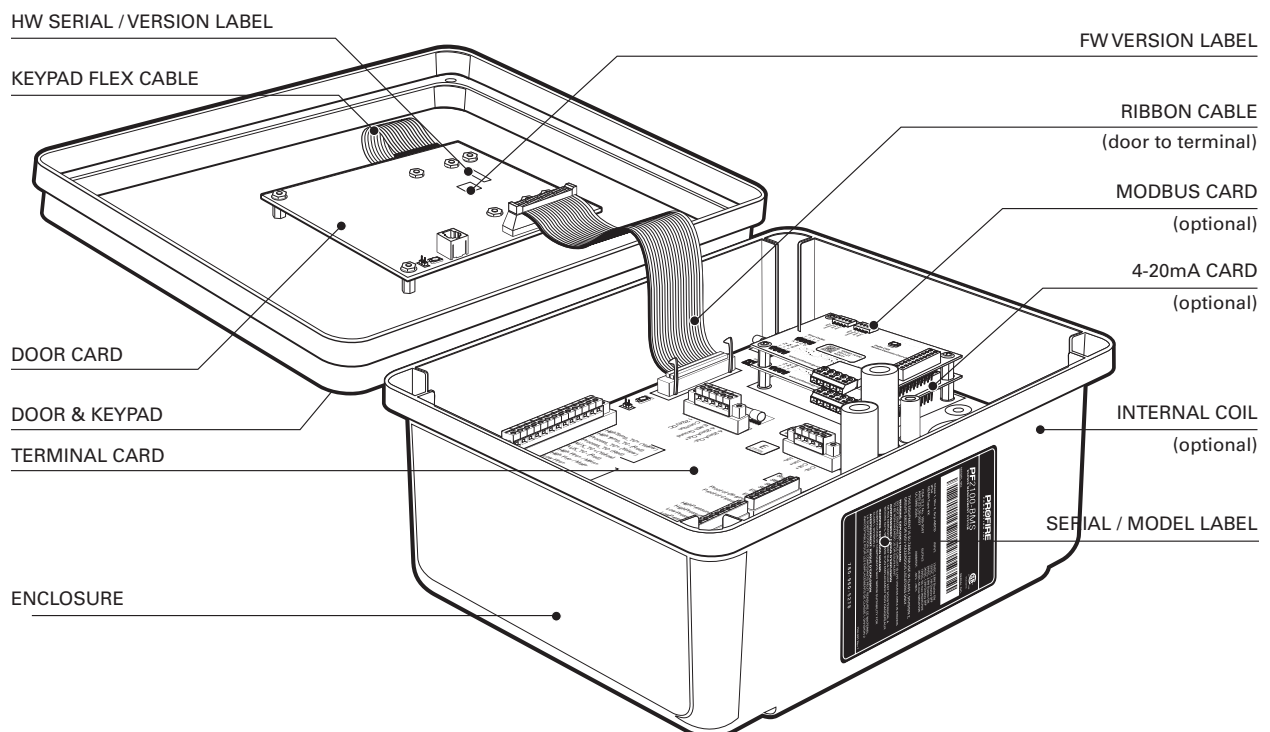
Batteries  
Solar Chargers  
Solar Panels

### Accessories

4-20mA Expansion Cards  
Modbus Expansion Cards  
External Ignition Coil

Please contact Profire Sales for further information.

## 1.7 | System Diagram



## 1.8 | Terminal Card Descriptions

This table provides connection details and a brief description of each terminal.

TERMINAL	EXPECTED CONNECTIONS	DESCRIPTION
12/24VDC	Input power from a DC source	Input power 10VDC- 28VDC, 5A MAX
Common	Ground back to DC source	Internally connected to EGND
EGND	Earth Ground	
4-20mA Out +	Proportional Valve positive terminal or PLC 4-20mA positive input	This output can be used for either Proportional Valve Control or echoing the Process Temperature to a PLC.
4-20mA Out -	Ground return for the 4-20mA output	A resistance of 120Ω to 250Ω is expected.
HighTemp_TC + (YELLOW)	High Temp Thermocouple positive lead	"TYPE K" thermocouple must be connected between the "+" and "-" terminals and must not be electrically connected to ground.
HighTemp_TC - (RED)	High Temp Thermocouple negative lead	
Process_TC + (YELLOW)	Process Thermocouple positive lead	An uninterrupted connection using "TYPE K" thermocouple wire is required for an accurate reading.
Process_TC - (RED)	Process Thermocouple negative lead	
AUX_TC + (YELLOW)	Aux Thermocouple positive lead	
AUX_TC - (RED)	Aux Thermocouple negative lead	
High Fire/Main +	High Fire / Main Valve positive terminal	Solenoid valves must be connected between the "+" and "-" terminals. The negative terminal is not directly connected to ground so a common return wire for the High Fire, Low Fire and Pilot valves cannot be used.
High Fire/Main -	High Fire / Main Valve negative terminal. Do not connect to ground.	
Low Fire +	Low Fire Valve positive terminal	Maximum continuous current is 2A. If Low Power mode is enabled, a peak load of 4A is permitted.
Low Fire -	Low Fire Valve negative terminal. Do not connect to ground.	
Pilot +	Pilot Valve positive terminal	
Pilot -	Pilot Valve negative terminal. Do not connect to ground.	
Ion +	Flame Detection positive input. Connect to flame rod or external coil Ion terminal (depending on configuration)	A Kanthal rod should be placed directly in the pilot flame and connected to this input. The pilot assembly must be grounded for the flame detection to function properly. Input is protected from high voltage and can be connected in series with the high voltage terminals of an external ignition coil, allowing a single flame rod to be used for both ignition and flame detection.  A 65VAC signal is applied to the flame rod. The source impedance is very high so there is no danger of sparking.
Ion -	Flame Detection negative input. Connect to ground screw on pilot assembly or burner housing.	Ground return for flame detection.
Coil +	Driver for the low voltage primary of the ignition coil.	The primary of the ignition coil should be connected to this terminal. The 12/24VDC input power will be applied for 1 ms and turned off for 50 ms while sparking.
Coil -	Ground return for the ignition coil.	
		This output is protected by a 250mA thermal fuse.



<b>TERMINAL</b>	<b>EXPECTED CONNECTIONS</b>	<b>DESCRIPTION</b>
Status +	Connect to PLC positive input contact or other alarm device.	The status "+" and "-" contacts will be closed when the system is running and opened when the system is shutdown. Dry contact output to indicate system status to an external device. ie. PLC. Note that the contacts are DC only and are not internally connected to power or ground.  40VDC, 250mA, 15Ω
Status -	Connect to PLC negative input contact or other alarm device.	
Start +	Remote start input from an external device. ie. PLC.	Dry contact switch is expected. The input is internally pulled up to 9VDC via a 3.75kΩ resistance. Jumper "+" and "-" if not used.
Start -	Ground	
ESD +	External Shutdown input, typically plant ESD loop.	All input contacts can use a single common ground return if desired.
ESD -	Ground	
Proof of Closure +	Proof of Closure from main valve(s).	All input contacts can use a single common ground return if desired.
Proof of Closure -	Ground	
High Pressure +	Input from a mechanical High Pressure switch.	All input contacts can use a single common ground return if desired.
High Pressure -	Ground	
Low Pressure +	Input from a mechanical Low Pressure switch.	All input contacts can use a single common ground return if desired.
Low Pressure -	Ground	
Level +	Input from a float-switch mounted in the bath.	Dry contact switch is expected. The input is internally pulled up to 9VDC via a 3.75kΩ resistance. Jumper "+" and "-" if not used.  All input contacts can use a single common ground return if desired.
Level -	Ground	



## 2 | INSTALLATION

The PF2100 can be used with many different systems. Before you begin installation, identify which system the BMS will be used to control. In addition to this document, Profire has an Installation Guide and several installation specific Whitepapers available describing common scenarios. These can be found at [www.profireenergy.com](http://www.profireenergy.com).

The steps provided here are general and can help you to identify questions that need to be answered to complete the installation process. If you are new to the PF2100, you should read this whole section and follow the instructions closely.

### Steps

1. Review all installation warnings
2. Install the system
3. Connect the required wiring including Power, Valves, Thermocouples, and Ignition Coil / Flame Detection wiring
4. Connect any additional wiring as required for your specific application. Commonly used lines include the Status Contact, Dry Contact Inputs, 4-20mA Temperature Output, and Expansion Cards

To know which options are required, you should consult the engineer or technician who designed the site. You should also be familiar with the local electrical and gas code for the site.

### 2.1 | Installation Warnings

Before installing the PF2100, please review the following list of warnings. Failure to consider these warnings may result in death, electrocution, property damage, product damage, and/or government fines.

1. The PF2100 is not intended for use on burners greater than 12.5 MMBtuh. It is against code in many locations.
2. To use the PF2100 on burners greater than 5 MMBtuh, it is recommended that the low fire feature with two safety shutoff valves be used. At least one of these valves should use Proof of Closure. This is required in many locations.
3. Failure to properly ground the pilot assembly back to the PF2100's Ion terminal may result in accidental electrocution, product damage, or simply failure to ignite the pilot.
4. The PF2100 generates 20kV- 40kV at its high voltage output terminal which can cause cardiac arrest. Do not touch or place any object near the ignition coil's high voltage terminal or connected ignition wire while the product is operating. Even without making physical contact with the terminal, it is possible to draw a spark from several inches away, especially if the pilot bracket is not properly grounded.
5. Never leave the PF2100 running unattended without the door screws securely tightened down. This is to prevent moisture from getting inside of the enclosure and damaging



the product. Moisture damage to the internal circuitry is not covered by the product warranty if the door has been left open.

6. All conduit ports drilled into the PF2100 enclosure must be CSA/NEMA Type 4 rated and be sealed in order to maintain the Type 4 rating.

## 2.2 | Mounting Considerations

The PF2100 is typically mounted near the burner it is controlling or in another location that is both safe and easily accessible. The recommended mounting height is 1.5m (5ft) above the ground or platform for the comfort of the operators.

### PLEASE CONSIDER THE FOLLOWING WHEN CHOOSING AN INSTALL LOCATION:

#### **Accessibility**

The system should be easily accessible so that the operator can change settings and observe its operation. It is preferable that the system be mounted facing away from the sun to make it easier to read the display and LED indicators on the front panel.

#### **Security**

In some situations, it may be desirable to mount the system in a location not accessible to the general public to prevent accidental or intentional tampering.

#### **Operator Safety**

Avoid placing the system in locations that are dangerous to the operator. Examine the area surrounding the potential installation site and look for such things as nearby open flames or close proximity to tanks that might overflow, and other harmful situations.

#### **Performance**

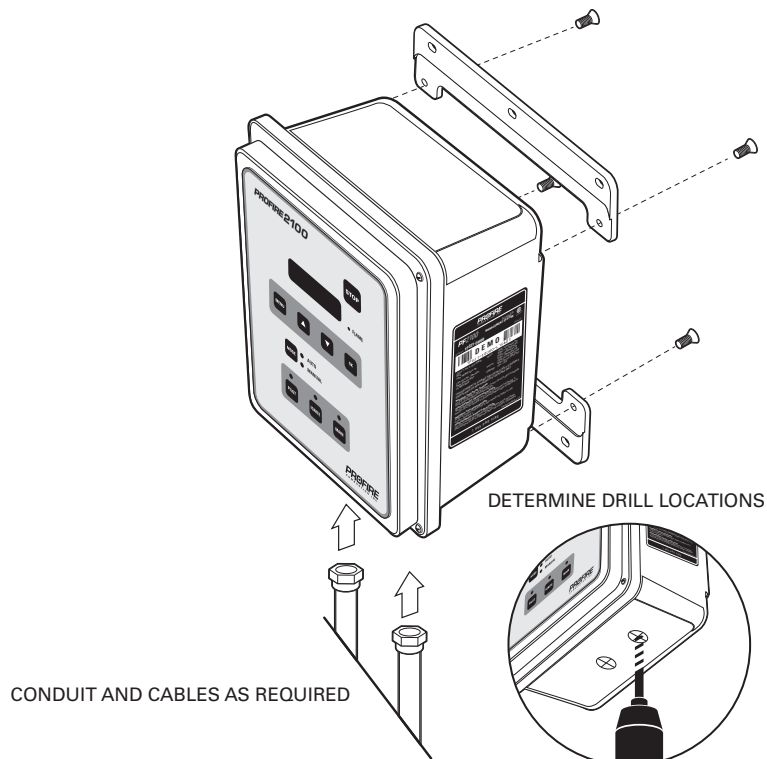
Choose a mounting location that allows ground and ignition wires to be kept as short as possible. This ensures the best ignition and flame detection.

#### **Product Protection**

To protect the system from being damaged, it should not be mounted:

1. Where chemicals may splatter or bubble over from a tank onto the system. Chemicals on the keypad may interfere with an operator's ability to control the product or view the display and LED indicators.
2. Directly to a heated tank where excessive heat may damage the product. Refer to the maximum operating temperature listed in this document.
3. On anything that may tip over due to wind or snow. Some examples include poles not set properly into the ground or tripods not secured with anchor bolts or guy wires.
4. In locations that may be prone to flooding.

## CONDUIT AND CABLE CONSIDERATIONS

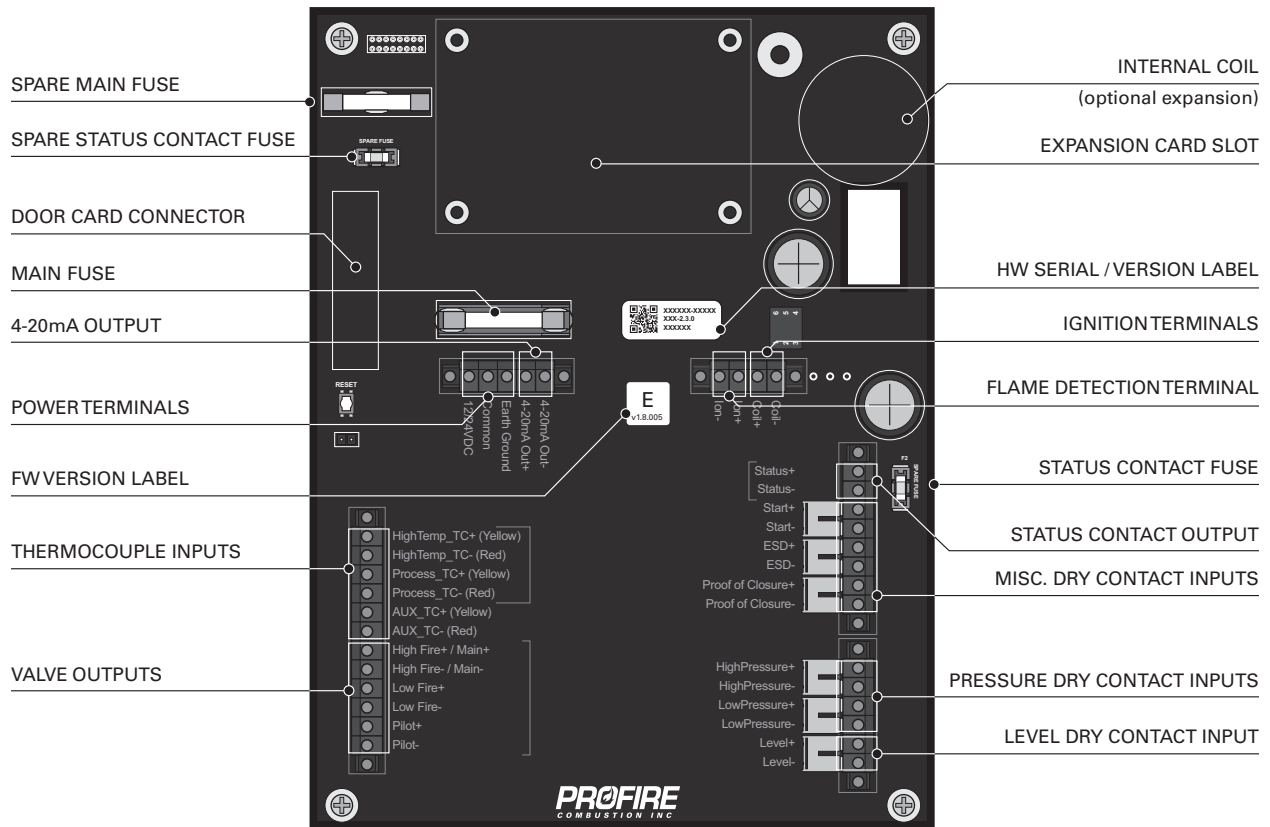


## MOUNTING INSTRUCTIONS

1. Remove the included bag of components taped to the mounting brackets.
2. Attach the two mounting brackets to the back of the PF2100 enclosure using the 4 provided screws.
3. Determine the best location to drill holes in the product enclosure for the wires to enter. It is recommended that these holes be drilled on the bottom of the enclosure (as shown).
4. Install grommets or conduit ports as required.
5. Securely mount the enclosure to a pole, structure or building as indicated by the site engineer or technician.



## 2.3 | Terminal Card Diagram



## 2.4 | Wiring

The wiring precautions in this section are important for all PF2100 installations. Please set up your installations accordingly.

NOTE: If you have not wired a PF2100 system, please refer to the PF 2100 Install Guide for detailed wiring instructions. Skipping or performing any steps in the guide incorrectly can result in the PF2100 not functioning properly.

### POWER

The PF2100 can be powered from 12VDC or 24VDC. The maximum current that the PF2100 can safely handle without blowing the main fuse is 5A. The system on its own draws about 100mA. The rest of the current is used by additional hardware such as valves. Make sure that you select a power supply that is rated appropriately for the total amount of current that will be consumed by all devices attached to it.

## VALVES

There are four valve control outputs on the PF2100: Pilot, Low Fire, 4-20mA Output, and High Fire/Main. Ensure that each valve has a separate return wire. Multiple valves sharing common return wires will not function properly.

### **Pilot Valve**

The Pilot valve is required and must be wired for all installations.

### **Low Fire Valve**

The Low Fire valve may also be required by local code or for proper operation of your particular application. Low Fire is often used on high Btuh burners (burners that exceed 5 MM Btuh) to establish a draft before opening the High Fire valve. Failure to do this on high Btuh burners can cause the burner to starve itself of oxygen which puts out the flame.

### **4-20mA Output**

The 4-20mA Output can be used to control a proportional valve designed for a 4-20mA current loop. Using a proportional valve allows for finer control of the burner's temperature as opposed to the 2 or 3 levels possible with normal valves. Typically the 4-20mA Output is used in conjunction with a normal valve. The 4-20mA Output also supports low fire.

### **High Fire/Main Valve**

The High Fire valve is required and must be wired for all installations. This valve is sometimes called the Main Valve, especially when Low Fire is not used.

NOTE: It is possible to connect multiple valves to the same control output in parallel or series. If you do this, be sure that the configuration you are using meets local codes and does not exceed the total current rating of the PF2100.

NOTE: The negative valve control wires are NOT connected directly to ground. Therefore, you cannot use a common return wire for all valves.

## THERMOCOUPLES

The High Temp and Process thermocouple inputs are mandatory and must be connected to a Dual Element thermocouple. The Auxiliary thermocouple is only needed when a second process temperature (such as the outlet temperature on a line heater) must be monitored. Otherwise, the Auxiliary thermocouple terminals can be left unconnected.

All thermocouples are cold junction compensated. For this reason, it is important to make sure that Type-k thermocouple wire and connectors are used exclusively. The temperature compensation is done using an ambient temperature sensor located on the terminal card near the thermocouple terminals.

### **Process Thermocouple**

This thermocouple is normally used on the primary temperature control device. The system shuts down if an open circuit is detected on this thermocouple. It should be placed in the same thermowell as the High Temp thermocouple using a dual element thermocouple.

### **High Temperature Thermocouple**

This thermocouple is used for the high-temp shutdown. The system shuts down if an open circuit, short-circuit or short-to-ground is detected on this thermocouple. It should be placed in the same thermowell as the Process thermocouple using a dual element thermocouple.



### **AUX Thermocouple**

This thermocouple is optional and can be enabled in menu 5. It can be used to monitor stack temperature or to control a secondary process temperature. The system shuts down if an open circuit is detected and the AUX thermocouple is enabled.

### **All Thermocouples Must Be:**

Isolated from ground

Isolated from power

Type-k thermocouples

Connected with 20 AWG or larger Type-k extension wire

Placed a safe distance from high voltage lines and shielded when necessary

### **STATUS CONTACT**

The status contact is a dry contact output containing a solid state relay. It acts as a switch that the PF2100 controls. Neither contact is internally connected to power or ground so these connections must be provided externally as required. When the system is running, the contacts are internally connected together and when the system is not running, the contacts are open circuited. These contacts are often used for monitoring the PF2100's status remotely. An alarm, siren, trouble lamp, or PLC are examples of devices that might use this contact.

THE STATUS CONTACTS ARE RATED FOR DC ONLY so it is important to observe the correct polarity when attaching a device. The positive status contact terminal should always be at a voltage potential greater than or equal to the negative terminal. Do not exceed the voltage and current ratings which are 40VDC, 250mA. The impedance when closed is 15Ω. There is a fuse on the status contact to protect it. A spare fuse is also included.

### **DRY CONTACT INPUTS**

There are 6 dry contact inputs on the PF2100. The expected connection to each of these is a switch. These contacts must all be closed (shorted) in order for the system to start. Jumpers are provided for each of these by default. If you need to use a particular contact for your application, simply remove the associated jumper and connect a switch in its place.

#### **Start Contact**

The Start Contact can be used to attach a remote start/stop switch. This is often connected to a PLC dry contact output. When the contact is open, the system is stopped. For safety reasons, a double action is required to start the system remotely via this contact. This is accomplished by closing the switch, opening it, and then closing it again. Once the system is running, open the switch again to stop it.

#### **ESD Contact**

The ESD Contact can be used to attach an emergency shutdown switch. This is often connected to a mushroom switch mounted on a remote panel or to a PLC dry contact output. When the contact is open, the system is stopped. The system cannot be started via this contact but this contact must be closed in order to start the system.

#### **Proof of Closure Contact**

The Proof of Closure Contact can be used to receive the feedback signal from a Main Valve that has a Proof of Closure output. If multiple main valves with Proof of Closure outputs are used, these can be wired together in series. Before the system attempts to light the pilot, it

will check that the Proof of Closure Contact is closed. If it is open, it will not light the pilot.

### **High Pressure Contact**

The High Pressure Contact can be connected to a High Pressure Switch installed in the fuel train. Typically, this switch is placed immediately after the Main valve in the fuel train. When the system initially starts, it ignores this input. It lights the pilot and opens the main valve as normal. If the High Pressure Contact is open after the mains are turned on, the system shuts down. See the [4-20mA Expansion Card](#) section for more details.

### **Low Pressure Contact**

The Low Pressure Contact can be connected to a Low Pressure Switch installed in the fuel train. Typically, this switch is placed immediately before the Main valve in the fuel train. The Low Pressure Contact operates using averaged time to help reject brief fluctuations in gas pressure. The contact must be open continuously for 2 or 6 seconds (depending on the "Pressure/Level Delay" setting) before the system will shut down. If "Auto Restart" is enabled, the system restarts automatically when the Low Pressure Contact re-closes. See the [4-20mA Expansion Card](#) section for more details.

## **IGNITION COIL / FLAME DETECTION**

This section provides some tips to set up the system for reliable ignition and flame detection.

### **Internal vs. External Coil**

If less than 5m (15ft) of ignition wire is required to connect the PF2100 to the burner housing, the internal coil configuration can be used. Otherwise the external coil configuration must be used.

The PF2100 system is available with an internal coil or an external coil can be purchased with or without a separate enclosure.

### **Wire Lengths**

When wiring the ignition and flame detection circuits, the wire length must be carefully considered. If the wire lengths are too long, the PF2100 may not be able to deliver enough energy to the ignition rod to ignite the pilot. The PF2100 may also fail to receive a signal from the flame rod for detecting flame.

### **Grounding**

Properly grounding the pilot assembly back to the PF2100 is critical for proper ignition and flame detection. A ground wire should run from the Ion- or EGND terminal of the PF2100 to the pilot assembly. This wire can either be connected to a ground screw on the pilot bracket or to the burner housing. If connected to the burner housing, use a multimeter to verify that the burner housing has electrical continuity with the pilot assembly. If not, another wire must be added to connect it.

### **Single Rod vs. Dual Rod**

A single Kanthal rod can be used for both ignition and flame detection to save cost if desired. This often results in a performance trade-off between ignition and flame detection. This option is only available with external coils.

Using two Kanthal rods (one for ignition and one for flame detection) allows for greater flexibility in rod placement and often yields better performance.

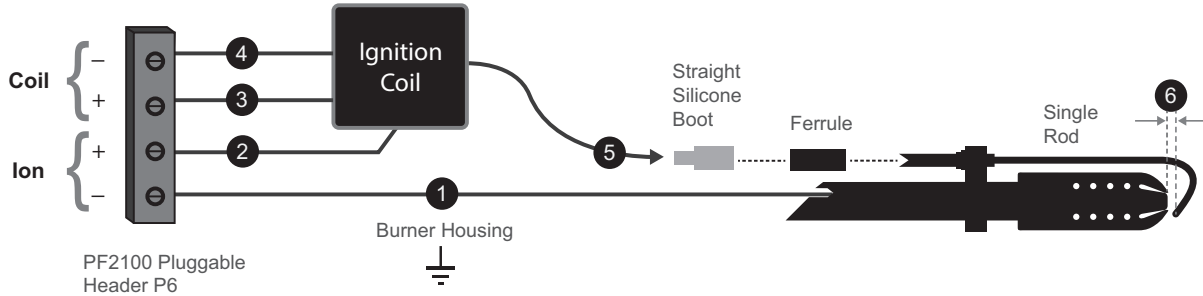


Note that there are three possible ways to wire the ignition coil and flame detection circuit with the PF2100 as illustrated in the table.

CONFIGURATION (COIL TYPE)	SINGLE ROD	DUAL ROD
Internal Coil		•
External Coil	•	•

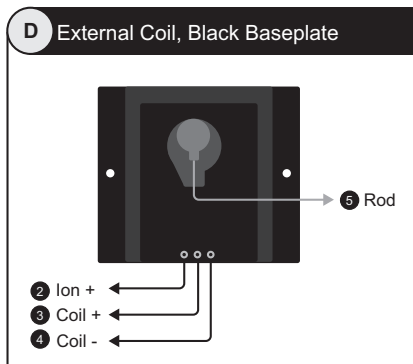
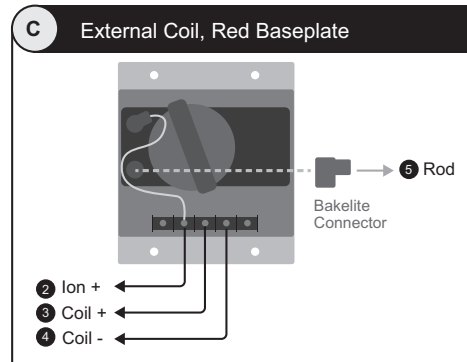
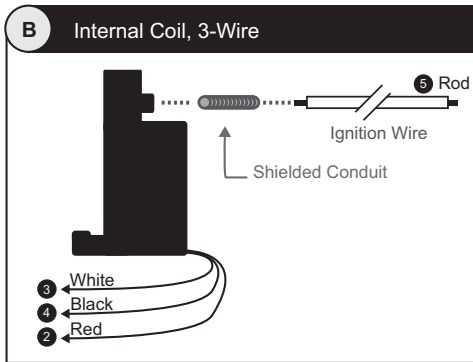
### Single Rod Coil Wiring

Use this configuration when you want to save cost by using a single rod.



#### Compatible Ignition Coils:

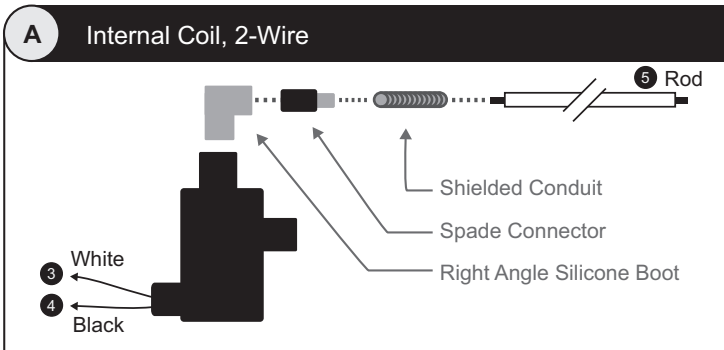
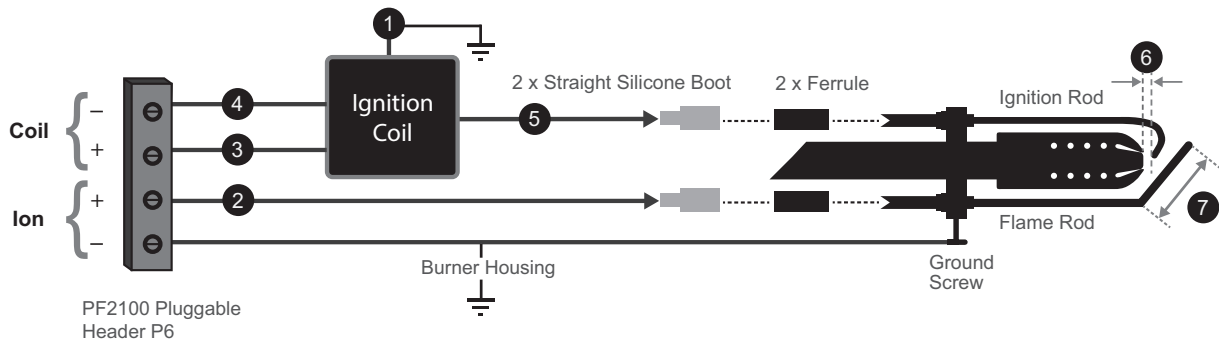
- B = Internal Coil, 3-Wire
- C = External Coil, Red Baseplate
- D = External Coil, Black Baseplate





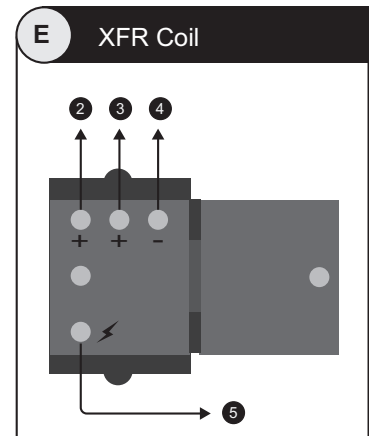
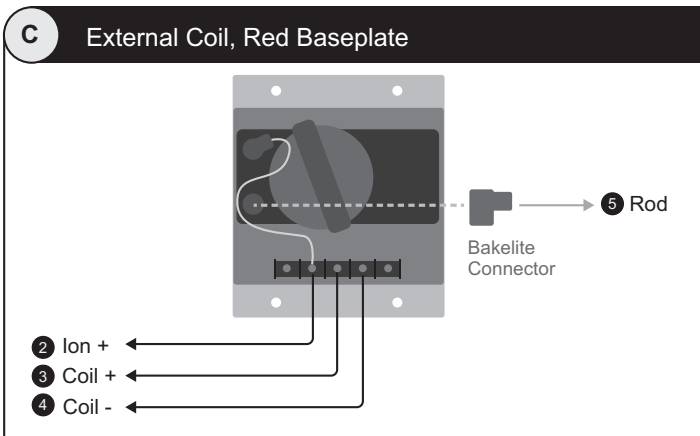
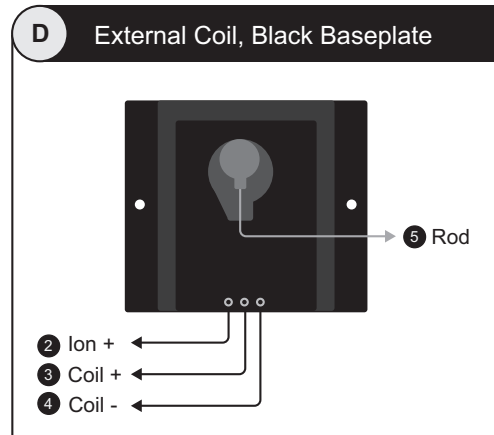
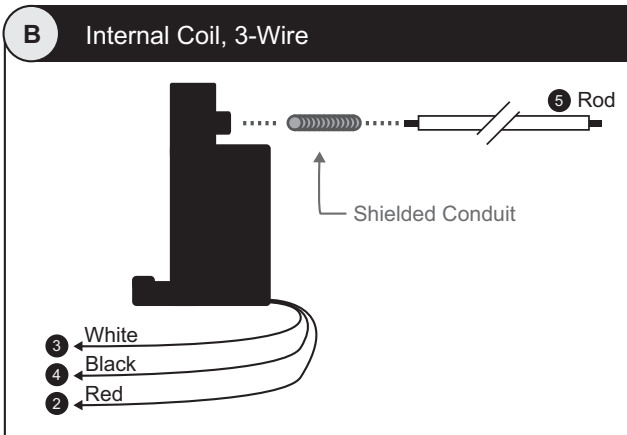
## Dual Rod Coil Wiring

Use this configuration when you want greater flexibility for rod placement.



### Compatible Ignition Coils:

- A = Internal Coil, 2-Wire
- B = Internal Coil, 3-Wire
- C = External Coil, Red Baseplate
- D = External Coil, Black Baseplate
- E = XFR Coil



### **Rod Positioning**

Rod positioning is important for proper ignition and flame detection. The ignition rod should be positioned (by bending it if necessary) so that there is a  $\frac{1}{8}$ " to  $\frac{1}{4}$ " gap between it and the front of the pilot nozzle. The flame rod should be positioned (by bending it if necessary) such that 2" to 3" of its length is within the pilot flame. Make sure the ignition rod and flame rod are not directly in line with each other. Otherwise, the ignition rod may cast a shadow on the flame rod and cause the system to determine that no flame is present at the flame rod.

### **Flame Anchoring**

Flame anchoring refers to how much in contact the flame is with the pilot nozzle. Poor flame anchoring causes poor flame detection. Poor flame anchoring can be caused when there is too much gas pressure resulting in the flame burning primarily outside of the nozzle as opposed to along the inside and outside surfaces of the nozzle. It can also be caused by wind or draft from the main burner.

### **Using Extra Rods to Improve Flame Detection**

In some challenging installations such as non-enclosed or high velocity burners, adding one or two additional rods may be necessary. A second flame detection rod can help in cases where the flame may blow away from the primary rod from time-to-time. The addition of a ground rod positioned further away from the nozzle tip can assist with detecting flames that are not well anchored.

# 3 | USER INTERFACE & SETTINGS

The user interface has keys, indicator lights, and a display screen for the software interface (including things such as menus and status screens).

## 3.1 | User Interface

The physical interface consists of three parts:

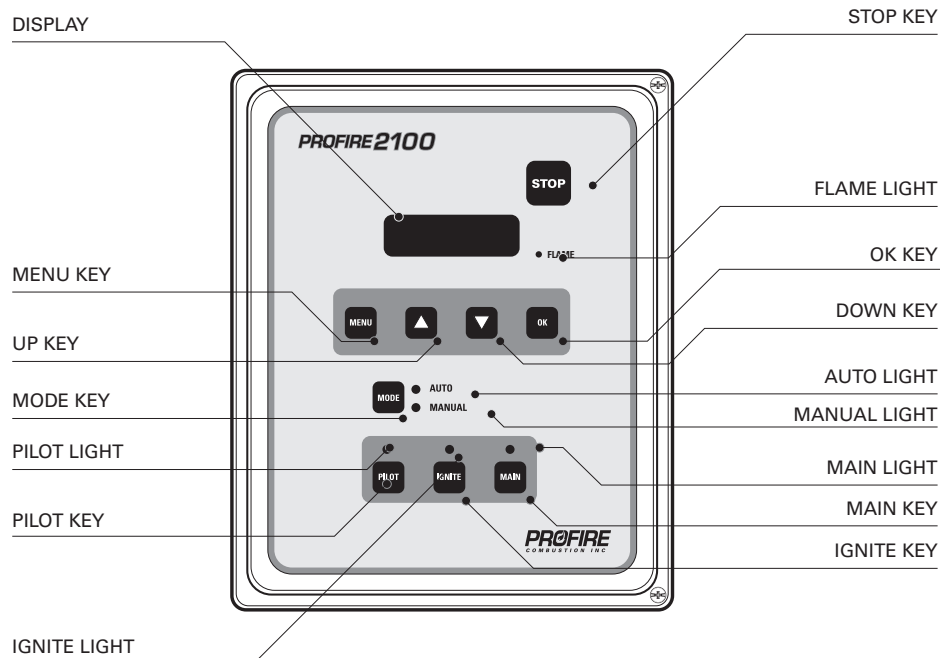
1. An illuminated display
2. Indicator lights
3. A keypad

### DISPLAY

The screen on the PF2100 displays two lines of text which are used to show system status, warnings, alarms, prompts, and menus. It is illuminated for ease of reading in both bright sunlight and darkness.

When the system first powers on, the display will show the system name and firmware version for a few seconds, after this it will show the Home Screen.

### KEYPAD DIAGRAM



## INDICATOR LIGHTS

### **Flame Light**

Indicates that the system is detecting the pilot flame.

### **Auto Light**

Indicates that the system is running in auto mode.

### **Manual Light**

Indicates that the system is running in manual mode.

### **Pilot Light**

Indicates that the pilot valve is open.

### **Ignite Light**

Indicates that the system is sparking to ignite the pilot.

### **Main Light**

Indicates that the main valve is open.

## KEYS

### **Stop Key**

Used to stop the system immediately or in other words, turn off the burner.

### **Menu Key**

Used to navigate through the menu.

### **Up Key**

Used to adjust a setting upwards and to scroll up through lists.

### **Down Key**

Used to adjust a setting downwards and to scroll down through lists.

### **OK Key**

Used to enter a menu, acknowledge a prompt, save an edited setting, or return to the home screen.

### **Mode Key**

Used to toggle between Manual and Auto modes of operation.

### **Pilot Key**

Used in Manual Mode to test the Pilot Valve.

### **Ignite Key**

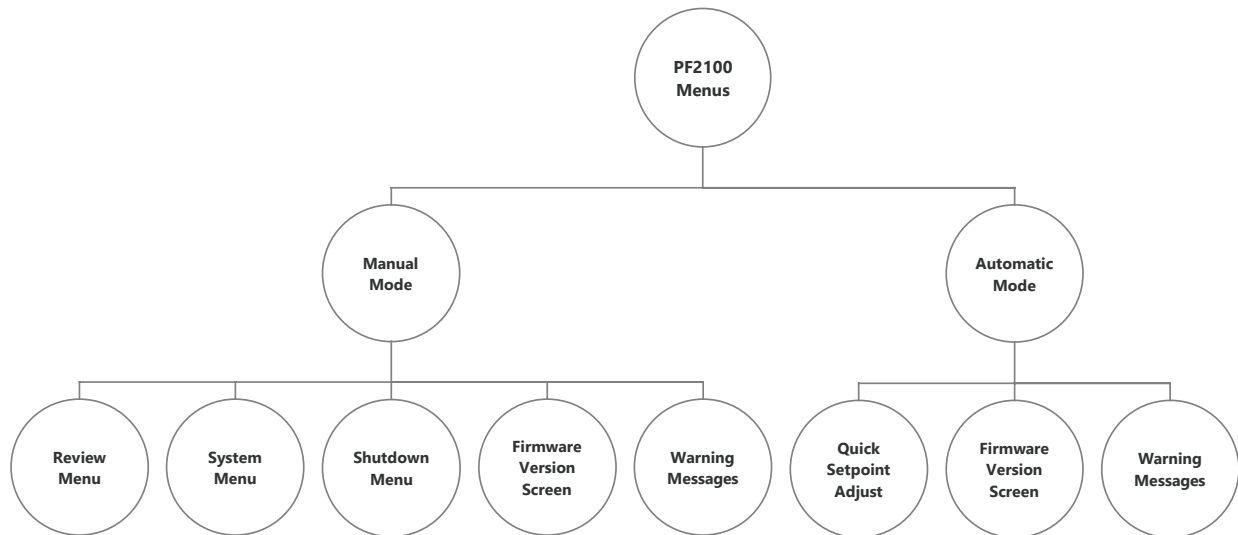
Used in Manual Mode to test the Ignition Circuit.

### **Main Key**

Used in Manual Mode to test the Main Valve.

## 3.2 | Menu Navigation

The software user interface is shown on the PF2100 display. While the system is powered, the state of the system is displayed on the screen. The user can also change settings via this interface. Below is a diagram showing the various types of information that can be accessed through the interface. The default system screen at startup and when idling is the Home Screen. Most items are accessed through the Home Screen but some can be accessed from anywhere in the interface.



Certain settings can be viewed only in Manual Mode or only in Auto Mode.

### MANUAL VS. AUTO MODE

When the system first powers on, it will normally be in Manual Mode. If the Auto Restart feature is enabled and no alarm conditions are present, it may switch automatically to Auto Mode after power up. Otherwise, the user must manually put the system into Auto Mode by using the Keypad, the Start Contact, or the Modbus Expansion Card. See the [System Start Up](#) section for more details.

The main difference between these two modes is that all settings can be adjusted in Manual Mode and a limited number of settings can be adjusted in Auto Mode. The following table illustrates the differences in menu access.

ITEM	MANUAL MODE	AUTO MODE
User Can View and Adjust Menu Settings	Yes*	via Quick Setpoint Adjust
User Can Access the Review Menu	Yes	No
Process Control Can Be Running	Yes	Yes
System will try to Relight the Burner if the Pilot is Turned Off Due to Normal Process Control	Yes	Yes
System State Shown on the Home Screen	Always	During State Change
System will Attempt to Relight the Burner if the Flame Goes Out Unexpectedly	No	Yes
Process Setpoint can be Easily Adjusted via the "Quick Setpoint Adjust" feature	No	Yes
The System can be Controlled Manually via the Pilot, Ignite, and Main keys	Yes	No
Manual Indicator Light On	Yes	No
Auto Indicator Light On	No	Yes

\*Menus 1-3 only when process control is running, all menus when stopped.



## HOME SCREEN

The Home Screen is shown on the display after power up, after waking the display from sleep, and after the user acknowledges a shutdown message. It is the starting point for most user interaction with the menu system. To return to the Home Screen from any point in the user interface, the user can press and hold the “OK” key for three seconds.

On the Home Screen, the Process Temperature is always shown on the bottom line of the display. The top line differs depending on mode. In Manual Mode, the top line shows the system state. In Auto Mode, it shows the Process Setpoint instead.

The accessibility of other features from the Home Screen also differs depending on mode. For example, the System Menus and Review Menu are only accessible in Manual Mode whereas the Quick Setpoint Adjust feature is only available in Auto Mode. For more information on which features are available in which modes, refer to the [Adjust Settings & Review Status](#) section.

## AVAILABLE FEATURES WITHIN OPERATIONAL MODES

<b>MODE</b>	<b>DISPLAY</b>	<b>MENUS</b>	<b>REVIEW</b>	<b>SETPOINT ADJUST</b>
Manual	System State Process Temperature	Yes	Yes	No
Auto	Process Setpoint Process Temperature	No	No	Yes

## SYSTEM STATE

The System State is the Process Control State of the system. It is shown on the display for a few seconds before and after a state change. In Manual Mode, the top line of the Home Screen always shows the System State. Go to the [Process Control Settings](#) section for a complete list of the Process Control States.

## QUICK SETPOINT ADJUSTMENT

The Quick Setpoint Adjust feature is only available on the Home Screen while running in Auto Mode. It allows the user to quickly adjust the Process Setpoint using the up and down keys. The change takes effect immediately and does not need to be saved by pressing ok. If password protection is enabled, a password will need to be entered before this feature can be used. If the Pilot Off and/or Low Fire Setpoints are enabled, this feature will also adjust them. In this case, each press of the up or down key will adjust all of these setpoints by 1 degree up or down. All other setpoints are not affected by this feature.

## SYSTEM MENUS

The System Menus store all of the system settings in an organized fashion. These menus are also used to show historical and system status information as well as to provide access to calibration features. These menus cannot be accessed while the system is running in Auto Mode. Some menus can only be accessed while the system is stopped. Some menus require a Level 2 password and others require an optional Level 1 password.

## REVIEW MENU

The Review Menu provides a quick way for an operator to check key setpoints and system status (accessible only in Manual Mode).

## FIRMWARE VERSION SCREEN

The Firmware Version Screen shows the firmware version of all cards in the system including the Door Card, Terminal Card, and any installed Expansion Cards.

## WARNING MESSAGES

When the system detects a warning condition, it will flash a warning message across the bottom line of the Home Screen. Some messages can be dismissed by pressing the OK key (eg, "Unit restarted from LVL event"). Others persist until the warning condition is resolved (eg, "LO Volt Warning").

## SHUTDOWN SCREEN

When the system shuts down as a result of an alarm condition, it will flash the word "SHUTDOWN" in large text on the display alternately with a more detailed message explaining the reason that the system shut down. The Shutdown Screen can always be dismissed by pressing "OK," toggling the Start Contact, or sending the Start Command via Modbus.

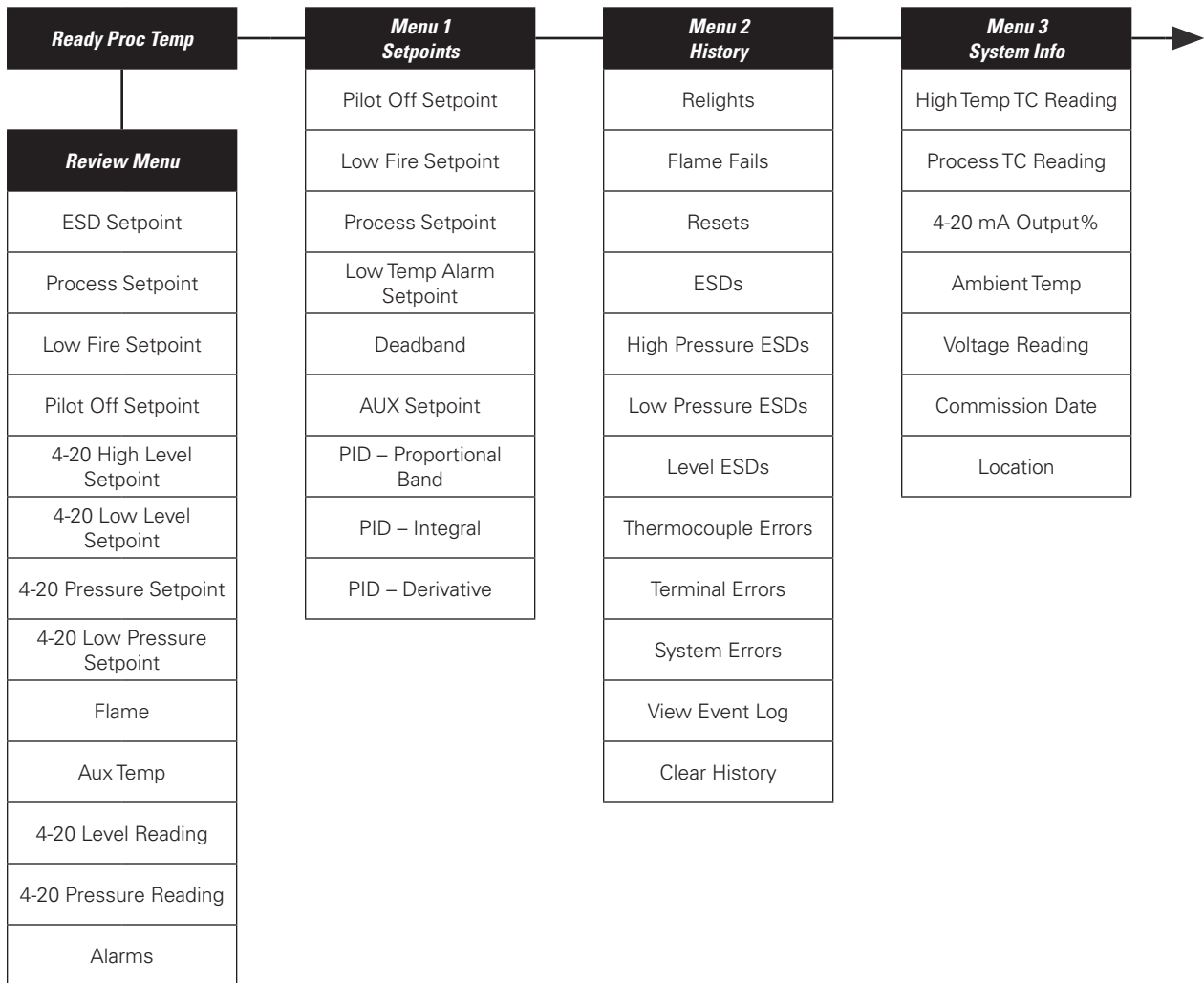
# 3.3 | Menu Map

For a complete description of each item, please refer to the menu definitions section. The debug functions are not shown here; if needed they are located in the [Field Calibration](#) section of the manual.

## NAVIGATION

1. Press MENU until you get to the desired menu.  
(The Review menu is accessible by pushing the Down arrow.)
2. Press OK to select an option.
3. Press MENU until you get to the submenu option you want to change/view.
4. Press  $\Delta$  or  $\nabla$  to adjust the selected setting.
5. Press OK to set the new value.
6. Press MENU to cancel changes.
7. Press OK to exit to the home screen.







<b>Menu 4 System Startup</b>	<b>Menu 5 Control Setup</b>	<b>Menu 6 Expansion Cards</b>
Auto Restart	High Temp ESD Setpoint	4-20 Expansion Card Enable
Purge Time	Process Control In-put	4-20 Level Low Setpoint
Pilot to Main Delay	Low Fire Enable	4-20 Level High Setpoint
Restart Attempts	Low to High Fire Delay	4-20 Level Range
Level Event Restart	Pilot off Enable	4-20 Level Units
Pressure/Level Delay	AUX Temp Mode	4-20 Pressure Low Setpoint
Alarm Mode	4-20 Output Mode	4-20 Pressure High Setpoint
Password Enable	4-20 Low Fire Setting	4-20 Pressure Range
Display Sleep	4-20 Gain Setting	4-20 Pressure Units
Pilot Valve Power Setting		MODBUS Enable/Address
Main Valve Power Setting		4-20 Card FW Version
System Voltage Setting		MODBUS Card FW Version
Temperature Display Units		
Commission Date Entry		
Commission Location Entry		
Rest to Factory Defaults		



## SETPOINTS (MENU 1)

This menu is used to adjust the Process Control Setpoints.

<b>MENU MAP</b>	<b>ON SCREEN</b>	<b>BRIEF DESCRIPTION</b>	<b>RANGE</b>	<b>DEFAULT SETTING</b>
Pilot Off Setpoint	Pilot Off Setpnt	Adjusts the temperature at which the Pilot Valve will turn off when Pilot Off is enabled.	1 to 1349°C 34 to 2460°F	85°C 185°F
Low Fire Setpoint	Low Fire Setpnt	Adjusts the temperature at which the Low Fire Valve will turn off when Low Fire is enabled.	2 to 1349°C 36 to 2460°F	Hidden, 85°C 185°F
Process Setpoint	Proc Setpnt	Adjusts the temperature at which the High Fire/Main Valve will turn off	1 to 1349°C 34 to 2460°F	80°C 176°F
Low Temp Alarm Setpoint	Low Temp Alarm Setpnt	Adjusts the temperature where the Status Contact will close, if enabled.	Disabled, 1 to 1349°C 34 to 2460°F	Disabled
Deadband	Deadband	Adjusts the Deadband. Used with the Process Setpoint and sometimes Low Fire and Aux Setpoints.	1 to 150°C 1 to 240°F	2°C 3°F
Aux Setpoint	AUX Setpnt	Adjusts the Auxiliary Setpoint	0 to 1350°C 32 to 2462°F	Hidden, 20°C 68°F
PID – Proportional Band	PID PB:	Expressed in percent, this is inversely proportional to the PID controller's proportional gain.	0.0 to 999.9%	10.0%
PID – Integral	PID I:	Expressed in Minutes per Reset, this is the amount of time required for the PID integral term to yield the same output as the proportional term.	0.0 to 999.9 min/rst	4.0 min/rst
PID – Derivative	PID D:	Expressed in Minutes, this causes the PID to compensate based on the changing error. Disabled by default	0.0 to 999.9 min	0.0 min

## HISTORY (MENU 2)

This menu contains informational event counters and the event log.

<b>MENU MAP</b>	<b>ON SCREEN</b>	<b>BRIEF DESCRIPTION</b>	<b>RANGE</b>	<b>DEFAULT SETTING</b>
Relights	Re-Lights	Number of Pilot Relight attempts.	0 to 1000	N/A
Flame Fails	Flame Fails	Number of Shutdowns due to failure to light the pilot.	0 to 1000	N/A
Resets	Resets	Number of power failures or manual resets.	0 to 1000	N/A
ESDs	ESDs	Number of system shutdowns caused by faults.	0 to 1000	N/A
High Pressure ESDs	HPR ESDs	Number of High Pressure Shutdowns.	0 to 1000	N/A
Low Pressure ESDs	LPR ESDs	Number of Low Pressure Shutdowns.	0 to 1000	N/A
Level ESDs	LVL ESDs	Number of Level Contact Shutdowns.	0 to 1000	N/A
Thermocouple Errors	TC Errs	Number of Thermocouple Shutdowns.	0 to 1000	N/A
Terminal Card Errors	Term Errs	Number of Terminal Card Shutdowns.	0 to 1000	N/A
System Errors	Sys Errs	Number of System Errors Shutdowns.	0 to 1000	N/A
View Event Log	View Event Log?	Log of recent events	Yes/No	No
Clear History	Clear History?	Clears all History and logged events	Yes/No	No

### SYSTEM INFO (MENU 3)

This menu contains diagnostic information about the system.

<b>MENU MAP</b>	<b>ON SCREEN</b>	<b>BRIEF DESCRIPTION</b>	<b>RANGE</b>	<b>DEFAULT SETTING</b>
High Temp TC Reading	Hi Temp TC	Current High Temp Thermocouple reading	-50°C to 1350°C	N/A
Process Temp TC Reading	Proc TC	Current Process Thermocouple reading	-50°C to 1350°C	N/A
4-20mA Output Percent	4-20 Output	Current status of the 4-20mA Output	0 to 100%	N/A
Ambient Temp	Ambient Temp	Current ambient temperature. Used for thermocouple cold junction compensation.	-55°C to 65°C -70°F to 150°F	N/A
Voltage Reading	System Voltage	Current voltage applied to the system	8V to 35V	N/A
Commision Date	Commission Date	Date that the system was commissioned (if entered by user)	DD-MMM-YYYY	N/A
Location	Location	The install location of the system (if entered by user)	N/A	N/A
Control State	Control State	Debug Information	N/A	Hidden
Terminal Card State	Term Card	Debug Information	N/A	Hidden

### SYSTEM SETUP (MENU 4)

This menu contains various optional system settings. It cannot be accessed while the PF2100 is running.

<b>MENU MAP</b>	<b>ON SCREEN</b>	<b>BRIEF DESCRIPTION</b>	<b>RANGE</b>	<b>DEFAULT SETTING</b>
Auto Restart	Auto Restart	Enables system to restart from a power failure, low pressure, or high voltage event	On/Off	Off
Purge Time	Purge Time	Adjusts the time from all valves closed to Pilot relight attempts	10- 900 sec	30 sec
Pilot to Main Delay	Pilot to Main Delay	Adjusts the time from Pilot proven to Main Valve opening	5- 600 sec	15 sec
Restart Attempts	Restart Attempts	Adjusts the number of Restart Attempts after an unexpected flame failure before a shutdown	0- 3	3
Level Event Restart	Level Event Restart	Enables recovery from a Low Level event	On/Off	Off
Pressure/Level Delay	PRS/LVL Delay	Pressure and Level shutdown delay	On/Off	Off
Alarm Mode	Alarm Mode	Adjusts the behaviour of Status Contact relative to Start Contact	Alm when Off, No Alm When Off	No Alm when Off
Password Enable	Password	Enable Password Protection (Menu 1-3)	On/Off	Off
Display Sleep	Display Sleep	Enable Sleep Mode for the Display	Never, After 10 Min	Never
Pilot Valve Power Setting	Pilot Solenoid PWM	Adjusts the Pilot Valve PWM duty cycle	Off, 80%, 60%, 40%, 20%	60%
Main Valve Power Setting	Main Solenoid PWM	Adjusts the Main Valve PWM duty cycle	Off, 80%, 60%, 40%, 20%	60%
System Voltage Setting	System Voltage	Configures the expected input voltage for the system	12V, 24V	12V



<b>MENU MAP</b>	<b>ON SCREEN</b>	<b>BRIEF DESCRIPTION</b>	<b>RANGE</b>	<b>DEFAULT SETTING</b>
Temperature Display Units	Temp Units	Configures the temperature units displayed by the system	Fahrenheit, Celsius	Celsius
Commission Date Entry	Commission Date	Set the date that the system was commissioned	DD-MMM-YYYY	01-JUN-2012
Commission Location Entry	Commission Loc	Set the install location of the system. 14 Characters Max.	A-Z, 0-9, -/	
Reset to Factory Defaults	Restore Factory Defaults?	Restore all settings to the factory default	Yes/No	No

## CONTROL SETUP (MENU 5)

This menu contains various optional Process Control settings. It cannot be accessed while the PF2100 is running.

<b>MENU MAP</b>	<b>ON SCREEN</b>	<b>BRIEF DESCRIPTION</b>	<b>RANGE</b>	<b>DEFAULT SETTING</b>
High Temp ESD Setpoint	High Temp ESD Setpoint	Adjusts the High Temperature shutdown setpoint	2 to 1350°C 36 to 2462°F	90°C 194°F
Process Control Input	Process Control	Configure the thermocouple used as the Process Temperature	Process TC, AUXTC	Process TC
Low Fire Enable	Low Fire	Enables Low Fire feature and setpoint	Disabled, on at Proc Setpnt, on at Low Fire Setpnt	Disabled
Low to High Fire Delay	Low to High Fire Delay	Adjusts the time from Low Fire Valve opening to High Fire Valve opening, when Low Fire is enabled. Values set above 255 seconds are automatically set to the value minus 255 seconds. For example, inputting 275 seconds sets the actual delay to 20 seconds.	30- 300 sec	Hidden, 30 sec
Pilot Off Enable	Pilot Off	Enables Pilot Off feature and setpoint	Disabled, Enabled	Enabled
Aux Temp Mode	AUX Temp Mode	Configures how the Auxiliary Thermocouple is used.	Disabled, Display Only, Temp Main Ctl, Temp ESD	Disabled
4-20 Output Mode	4-20 Out Mode	Configures 4-20 Output mode	Valve Control 1 Valve Control 2, Temp Output	Valve Control 1
4-20 Low Fire Setting	4-20 Out Lo Fire Setting	Sets the minimum output for the 4-20mA Output when used for Valve Control.	0 to 70%	40%
4-20 Gain Setting	4-20 Out Cntrl Gain	Sets the adjustment speed of the control loop for the 4-20mA Output when used for Valve Control.	0.1 to 1%/s	0.5%/s

## EXPANSION CARDS (MENU 6)

This menu contains settings relating to [expansion cards](#).

MENU MAP	ON SCREEN	BRIEF DESCRIPTION	RANGE	DEFAULT SETTING
4-20 Input Card Enable	4-20 Input Card Enabled	Enable the 4-20mA Expansion Card and setpoints	No/Yes	No
4-20 Level Units	4-20 LVL Units	Adjusts the display units for the 4-20mA Level Input	%, m3, BBL, GAL,L	Hidden, m3
4-20 Level Range	4-20 LVL Range	Adjusts Max Level of the tank	0-10000	Hidden, 120m3
4-20 Level Zero Offset	4-20 LVL Zero Offset	Adjusts the level reading corresponding to a 4mA input	0 to Low Setpoint	Hidden, 0
4-20 Level Low Setpoint	4-20 LVL Low Setpnt	Adjusts 4-20 Low Level trip point	0-Max Volume	Hidden, 60m3
4-20 Level High Setpoint	4-20 LVL High Setpnt	Adjusts 4-20 High Level trip point	0-Max Volume	Hidden, 117m3
4-20 Pressure Units	4-20 PRS Units	Adjusts the display units for the 4-20mA Pressure Input	PSI, kPa, inWC, cmWC, ksc	Hidden, PSI
4-20 Pressure Range	4-20 PRS Range	Adjusts Max pressure of the fuel train	0-2000	Hidden, 30.0 PSI
4-20 Pressure Low Setpoint	4-20 PRS Low Setpnt	Adjusts 4-20 Low Pressure trip point	0-High Setpoint	Hidden, 3.0 PSI
4-20 Pressure High Setpoint	4-20 PRS High Setpnt	Adjusts 4-20 High Pressure trip point	Low setpoint – Max Pressure	Hidden, 25.0 PSI
MODBUS Enable/Address	Modbus Card	Enable control and address for the Modbus Expansion Card	Disabled, 1-128	Disabled
4-20 Card FW Version	4-20 FW	Display Expansion Card FW Version	N/A	N/A
MODBUS Card FW Version	MBUS FW	Display Expansion Card FW Version	N/A	N/A

## REVIEW MENU

This read only menu allows various commonly needed system settings and status parameters to be reviewed while the system is running.

MENU MAP	ON SCREEN	BRIEF DESCRIPTION
ESD Setpoint	ESD Setpnt	Temp at which system will shutdown
Process Setpoint	ProcSetpnt	Temp at which High Fire / Main Valve will turn off
Low Fire Setpoint	LF Setpnt	Temp at which Low Fire Valve will turn off if Low Fire is enabled
Pilot Off Setpoint	Pilot off	Temp at which Pilot Valve will turn off if Pilot is enabled
4-20 High Level Setpoint	HLV	Level at which 4-20mA Output contacts will toggle
4-20 Low Level Setpoint	LLV	Level below which the system will shutdown or wait if Level Event Restart is enabled
4-20 High Pressure Setpoint	HPR	Pressure above which the system will shutdown after Main
4-20 Low Pressure Setpoint	LPR	Pressure below which the system will shutdown or wait if Auto Restart is enabled
Flame	Flame	Current Flame Quality
Aux Temp	AUX Temp	Current Aux Temp reading
4-20 Level Reading	LVL	Current 4-20mA Level input reading
4-20 Pressure Reading	PRS	Current 4-20mA Pressure input reading



<b>MENU MAP</b>	<b>ON SCREEN</b>	<b>BRIEF DESCRIPTION</b>
TC Debug Screen	DH=vw TH=xx TP=yy TA=zz	Shows the current readings of all temperature sensors simultaneously always in degrees celsius regardless of the display unit setting  DH=Door Card High Temp, Thermocouple TH=Terminal Card, High Temp Thermocouple TP=Terminal Card Process Thermocouple TA=Terminal Card Ambient Thermocouple
Alarms	Alarms	Lists up to 3 simultaneous alarm codes if any are present

## 3.4 | Initial System Settings

The following settings need to be modified for every installation.

1. Valve Modulation Settings (Pilot and Main)
2. System Voltage
3. Process Control Settings
4. Process Setpoints (High Temp ESD, Pilot Off, Process, Low Fire, Low Alarm, Deadband)

### VALVE MODULATION SETTINGS

The Pilot and Main Valve outputs can be modulated with a pulsed DC signal to conserve power using Pulse Width Modulation (PWM). The duty cycle of the modulation can be adjusted independently for each valve. Each can be set to 100%, 80%, 60%, 40%, or 20%. The 100% setting applies continuous DC voltage (ie, no modulation) to the valve and is the highest power option. The 20% setting applies DC voltage 20% of the time and is the lowest power option. Only valves that are compatible with modulation should be used with a duty cycle of less than 100%. These valves are sometimes called “Low Power” or “Peak-and-Hold” valves since they require only short periodic voltage pulses to hold the valve open. Do not use a duty cycle of 100% with low power valves as this can damage them.

If a multimeter is used to measure the valve power, the measured voltage will be reduced proportionally with the PWM setting.

The pilot and main valve power settings can be adjusted to match the needs of various applications.

#### **Pilot Valve Power Setting (Menu 4)**

Adjusts the PWM Duty Cycle of the Pilot Valve output.

#### **Main Valve Power Setting (Menu 4)**

Adjusts the PWM Duty Cycle of both the Low Fire and High Fire Valve outputs.

### SYSTEM VOLTAGE

The PF2100 is designed to operate with a nominal 12VDC or 24VDC Power Supply. The system will not be damaged by applying any voltage in or near this range regardless of menu settings. Note that attached valves are typically not designed to accept both 12VDC and 24VDC. If the valve voltage ratings are exceeded, the valves may become damaged.

### System Voltage Setting (Menu 4)

This setting defines voltage limits to protect and allow the proper operation of the attached valves. If the PF2100 detects that the input voltage is getting close to these limits, it will display a warning message. If the voltage exceeds these limits, the system will shut down and cut power to the valves.

The following options are available:

VOLTAGE SETTING	CHOOSE THIS OPTION WHEN...
12 V	The Power Supply and all valves are 12 VDC
24 V	The Power Supply and all valves are 24 VDC

The exact limits used are shown in the following table. Note that the high voltage limits also depend on the Pilot Valve Power Setting and Main Valve Power Setting which can also be found in Menu 4.

V SETTING	PILOT / MAIN VALVE PWM SETTING	LOW V ALARM	LOW V WARNING	HIGH V WARNING	HIGH V ALARM
12V	At least one equal to 100%	<= 8.4V	<= 9.9V	>= 14.6V	>= 15.6V
12V	Both less than 100%	<= 8.4V	<= 9.9V	>= 16.1V	>= 16.8V
24V	At least one equal to 100%	<= 17.9V	<= 19.9V	>= 28.6V	>= 30.0V
24V	Both less than 100%	<= 17.9V	<= 19.9V	>= 33.1V	>= 40.0V

### PROCESS CONTROL SETTINGS

For the PF2100, Process Control refers to controlling the temperature of a process. This process usually involves heating fluid in a tank or pipe. A primary temperature control signal is required for Process Control. This is called the Process Temperature or Proc Temp. Optionally, an auxiliary temperature control signal can also be accepted. This signal is called the Auxiliary Temperature or Aux Temp.

Note that these two signals are not necessarily the same as Proc TC and Aux TC which are the names of the physical thermocouple inputs on the Terminal Card. The Aux Temp signal is only compared to the Aux Setpoint, if enabled.

There are four settings that directly affect Process Control: Process Control Input, Low Fire Enable, Pilot Off Enable, and Aux Temp Mode.

Note that changing any of these settings may cause the Process setpoints (High Temp ESD, Pilot Off, Low Fire, Process, Low Temp Alarm, Deadband, and Aux) to reset to factory defaults. A warning message will display if this occurs.

#### Process Control Input (Menu 5)

This setting selects which thermocouple inputs will be used as the primary and auxiliary temperature control signals as shown in the following table.

SETTING	PROC TEMP	AUX TEMP
Proc TC	Proc TC	Aux TC
Aux TC	Aux TC	Proc TC

In previous firmware versions this could also be set to Disabled. In this case, Process Control was disabled and the system allowed the burner to always be lit and running. The typical use for this was to have an external device, such as a PLC, controlling the process. The PLC would turn the system on and off using the Start contacts. This behaviour can still be achieved by setting all Process Setpoints to maximum.



### Low Fire Enable (Menu 5)

This setting is used to toggle the use of the Low Fire Setpoint for Primary Process Control. Low Fire can be enabled in two different modes: "On at Proc Setpoint" and "On at Low Fire Setpoint". In the first case, the Low Fire Valve will close when it exceeds the Low Fire Setpoint but will not reopen until it drops below the Process Setpoint minus Deadband. In the second case, the Low Fire Valve will close when it exceeds the Low Fire Setpoint and will reopen after it drops below the Low Fire Setpoint minus Deadband.

### Pilot Off Enable (Menu 5)

This setting is used to enable/disable use of the Pilot Off Setpoint for Primary Process Control.

### Aux Temp Mode (Menu 5)

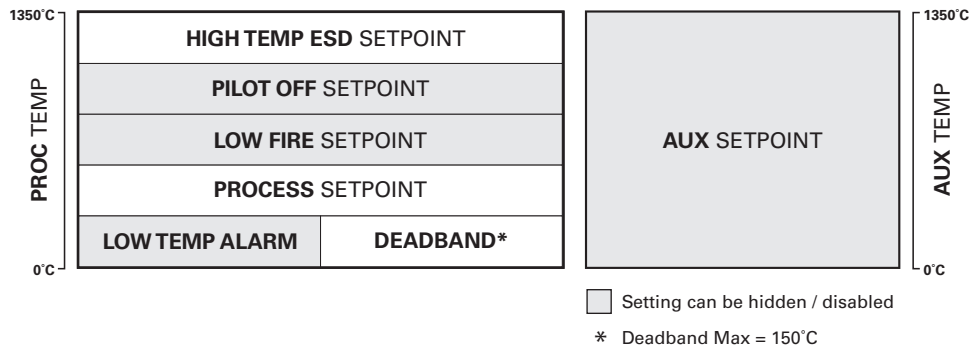
When this setting is set to Temp Main Ctl, Auxiliary Process Control is enabled. See the [Auxiliary Temperature Settings](#) section for more details.

## PROCESS SETPOINTS

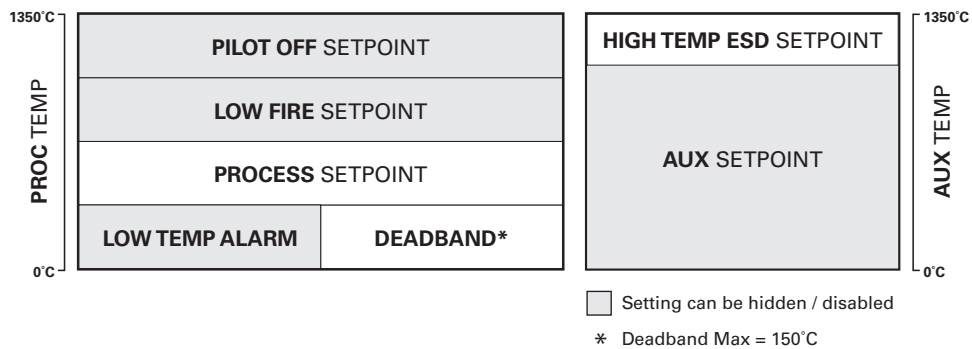
There are seven Process Setpoints in total, four of which may be disabled (hidden from menus). The order of the setpoints varies depending on the value of the Process Control Input setting.

The following diagrams illustrate the upper and lower bounds of each setpoint and their order. Setpoints that are shaded may be disabled. When a setpoint is disabled, the upper and lower bounds of the adjacent setpoints are adjusted accordingly.

### Process Control Input Setting: PROC TC



### Process Control Input Setting: AUX TC



For Process Control, the Proc Temp signal is the one compared to the Pilot Off, Low Fire, Process, and Deadband setpoints.



### **High Temp ESD Setpoint (Menu 5)**

This setting is used to protect the burner and other equipment from overheating. If either the High Temp or Process thermocouple readings exceed this setpoint, the burner will immediately shut down. This setting can be set to a maximum of 1350°C. The minimum value is 1°C higher than the setpoint below it. Depending on which settings are enabled, this will be the Pilot Off, Low Fire, or Process Setpoint.

### **Pilot Off Setpoint (Menu 1)**

If the Process Temperature goes above this setting, the Pilot Valve will close and the system state will change to "Waiting on Temp". This is often done to conserve pilot gas when it is not needed. This setting is hidden if Pilot Off in menu 5 is set to Disabled. This setting can be set to a maximum of 1°C below the High Temp ESD Setpoint. The minimum value is the same as the setpoint below it. Depending on which settings are enabled, this will be the Low Fire or Process Setpoint.

### **Low Fire Setpoint (Menu 1)**

If the Process Temperature goes above this setting, the Low Fire Valve will close and the system state will change to "Pilot On". This setting is hidden if Low Fire in menu 5 is set to Disabled. This setting can be set to a maximum of 1°C below the High Temp ESD Setpoint or the Pilot Off Setpoint if it is enabled. The minimum value is 1°C above the Process Setpoint.

### **Process Setpoint (Menu 1)**

If the Process Temperature goes above this setting, the Main Valve will close and the system state will change to "Low Fire". This setting can be set to a maximum of 1°C below the High Temp ESD Setpoint, the Pilot Off Setpoint if enabled, or 1°C below the Low Fire Setpoint if enabled. The minimum value is the Low Temp Alarm or Deadband (whichever is larger).

### **Low Temp Alarm Setpoint (Menu 1)**

If the Process Temperature goes below this setting, the Low Temp Alarm will be asserted and the status contact will open. This setting can be set to a maximum of the Process Setpoint value. The minimum value is 1°C. Set to 0°C to disable the Low Temp Alarm.

### **Deadband (Menu 1)**

The Deadband setting provides a temperature margin below the Process Setpoint. For the main valve to open, the temperature must be below Process Setpoint minus the Deadband setting.

The Deadband setting also provides a temperature margin below the Low Fire Setpoint when the Low Fire Enable setting is set to "On At Low Fire Setpoint". In this case, the Low Fire valve will open when the Process Temperature is below the Low Fire Setpoint minus the Deadband setting and will close when it is above the Low Fire Setpoint.

The Deadband setting also provides a temperature margin below the Aux Setpoint when the Aux Temp Mode setting is set to "Temp Main Ctl". In this case, the main valve(s) will open when the Auxiliary Temperature is below the Aux Setpoint minus the Deadband setting and will close when it is above the Aux Setpoint.

This setting can be set to a maximum of 150°C or the Process Setpoint, whichever is lower. The minimum value is 1°C.

### **AUX Setpoint (Menu 1)**

This setpoint is enabled only if Aux Temp Mode in menu 5 is set to "Temp Main Ctl" or "Temp ESD". In the first case, if the Auxiliary Temperature goes above the Aux Setpoint, the main valve(s) will close. The pilot will remain on until the Process Temp exceeds the Pilot Off Setpoint (if Pilot Off is enabled). In the second case, the system will shut down if the Auxiliary Temperature goes above the Aux Setpoint. This setting can be set to a maximum of 1350°C. The minimum value is 0°C.



## 3.5 | Optional Settings

### 4-20MA OUTPUT SETTINGS

The 4-20mA Output is built into the Terminal Card (not part of the 4-20mA Expansion Card). It can be used to echo the process temperature to a PLC or control a proportional valve.

#### 4-20 Output Mode (Menu 5)

Set the 4-20mA Output mode to Process Temperature, Valve Control 1, or Valve Control 2.

The 4-20mA Output is intended to drive a proportional valve. The signal is scaled such that 4mA = Valve Closed and 20mA = Valve Fully Open. A PID control loop based on Process Temperature feedback is used to determine how much the valve should be open at any given point in time. More details can be found in the [PID Controller](#) section.

The Valve Controls use a traditional safety solenoid valve connected to the PF2100's Low Fire outputs. The Low Fire setting must also be enabled by setting it to "On at Proc Setpoint."

1. Process Temperature  
In this mode, the 4-20mA Output will encode the Proc Temp signal as a 4-20mA signal. Note that the Proc Temp may correspond to either the Process Thermocouple or the AUX Thermocouple input depending on the Process Control setting. The signal is scaled such that 4mA = 0C and 20mA = the High Temp ESD Setpoint.
2. Valve Control 1  
When the PF2100 enters Low Fire, the proportional valve begins fully closed and linearly ramps so that it reaches the 4-20 Low Fire setting just as the Low to High Fire Delay elapses. Once High Fire begins, the PID Controller adjusts the valve accordingly.
3. Valve Control 2  
When the PF2100 starts, the proportional valve idles at the 4-20 Low Fire setting. Once High Fire begins, the PID Controller adjusts the valve accordingly.

#### 4-20 Low Fire Setting (Menu 5)

This setting is only available when the 4-20 Output Mode is set to Valve Control 1 or Valve Control 2. It specifies the minimum value that the proportional valve will ever be open. This is the starting position of the main valve each time it is turned on. It can be set to any value from 0% to 70%.

### ALARM / STATUS CONTACT SETTINGS

The Status Contact will always open if the system is shut down due to an alarm condition. There are two settings that affect the behavior of the Status Contact: Alarm Mode and Low Temp Alarm Setpoint.

#### Alarm Mode (Menu 4)

The Alarm Mode is used to select whether the Status Contact will open when the unit is stopped remotely via the Start Contact. It can be set to:

1. Alarm When Off  
The Status Contact opens when the unit is stopped (turned off) remotely via the Start Contact.

2. No Alarm When Off  
The Status Contact remains closed when the unit is stopped (turned off) remotely via the Start Contact.

#### **Low Temp Alarm Setpoint (Menu 1)**

When enabled the Status Contact will remain open until the Process Temperature exceeds this setpoint. See the [Process Setpoints](#) section for more detail.

### **AUXILIARY TEMPERATURE SETTINGS**

There are two settings that affect the way that the Auxiliary Temperature signal is used by the system: Process Control and Aux Temp Mode.

#### **Process Control (Menu 5)**

This setting is used to select the thermocouple input that is associated with the Auxiliary Temperature signal. See the [Process Control Settings](#) section for more details.

#### **AUX Temp Mode (Menu 5)**

Aux Temp mode can be set to any of the following:

1. Disabled  
The Aux Temp signal is ignored by the system.
2. Display Only  
The Aux Temp signal is only used for display purposes. It can be read on the PF2100 display in manual mode via the Review Menu. It can also be read remotely via the Modbus Expansion Card if it is installed and enabled.
3. Temp Main Ctl  
The Aux Temp signal is used as a secondary Process Control input. This modifies the normal Process Control by adding the additional requirement that the signal be below the Aux Setpoint for the main valve(s) to open.
4. Temp ESD  
The Aux Temp signal is used as an auxiliary ESD input. In addition to the normal Process Control, if the Aux Temp signal ever rises above the Aux Setpoint, the system will shut down.

### **COMMISSIONING SETTINGS**

The date and location of commissioning can be stored in the PF2100. This information is optional and can be input by the customer directly. These two settings can be viewed in menu 3 and edited in menu 4.

#### **Commission Date (Menu 4)**

This is the date on which the PF2100 was commissioned. Use the Up and Down keys to edit the date and OK to advance to the next date field.

#### **Commission Location (Menu 4)**

This is the location where the PF2100 was installed. Use the Up and Down keys to edit each character and OK to advance to the next character.

### **DISPLAY SETTINGS**

There are two settings that affect the behavior of the display: Display Sleep and Temperature Display Units.



### **Display Sleep (Menu 4)**

When enabled, the display will turn off to conserve power after 10 minutes of inactivity (no user key presses). Otherwise, the display will always remain on.

### **Temperature Display Units (Menu 4)**

The PF2100 always operates in Celsius. This includes storage of temperature setpoints, thermocouple measurements, temperature calculations, and modbus communications. This setting only affects the temperature units on the display. This may lead to small rounding errors when operating in Fahrenheit.

## **PASSWORD SETTING**

There are two levels of password protection. Menus 1-3 and the Quick Setpoint Adjust feature may be optionally protected by the Level 1 Password. Menus 4-7 are always protected by the Level 2 Password. These passwords cannot be modified.

Level 1 Password: ▲ ▼ ▲ ▲ ■

Level 2 Password: ▲ ▼ ▲ ▲ ▼ ▲ ■

For convenience, once a password has been entered it unlocks all menus that it protects for a period of time. Therefore it does not need to be re-entered when returning to the menu later. The menus will remain unlocked for 10 minutes or until the user manually locks the menus again. To lock the menus manually, press and hold the OK button for 3 or more seconds. The display will briefly show "Password Logout" to indicate that the menus are locked again.

### **Password Enable (Menu 4)**

When enabled, the Level 1 or Level 2 Password must be entered to access menus 1-3 and the Quick Setpoint Adjust feature.

## **PID CONTROLLER**

A PID Controller is a type of feedback control algorithm commonly used in industrial control applications. The purpose of the controller is to maintain a process variable as close as possible to a user defined setpoint. This is accomplished by continuously measuring the difference between the current value of the process variable and the desired setpoint value and then adjusting some manipulated variable to compensate for the difference. The PID Controller gets its name from the initials of the three tuning coefficients that are built into the control algorithm: the Proportional coefficient, the Integral coefficient, and the Derivative coefficient. These coefficients set the Controller's response to three types of errors: the current error (Proportional), the sum of all past errors (Integral), and the predicted future error (Derivative).

### **PF2100 PID Controller**

The PID Controller is used to maintain the Process Temperature as closely as possible to the Process Setpoint. The Controller adjusts the 4-20mA output signal which in turn drives a proportional valve. The more the valve is open, the more gas passes through, and the more heat is applied to the process. Feedback is provided to the control algorithm by subtracting the thermocouple measurement (the Process Temperature) from the desired temperature (the Process Setpoint).

### **PID Controller (Menu 1)**

To perform temperature control with a proportional valve, the PF2100 uses a PID Controller with temperature as its input. The PID Controller uses three parameters to specify how it performs its control: PID-Proportional Band, PID-Integral, PID-Derivative. The default

parameters are sufficient for most common heater applications, but they can be tuned for faster control if necessary. See [Appendix A](#) for the recommended tuning procedure for the PID Controller.

## RESTART SETTINGS

The PF2100 can be configured to automatically restart after certain alarm conditions clear. The number of restart attempts is configurable. There are three settings that affect restart behavior: Auto Restart, Level Event Restart, and Restart Attempts.

The number of restart attempts the system will make differs depending on the mode and the reason that the burner is being re-lit.

MODE	PROCESS CONTROL	FLAME OUT
Manual	3	0
Auto	3	User Configurable

### Auto Restart (Menu 4)

If this setting is enabled, the system will restart automatically once all alarm conditions are cleared and if the reason that the system stopped running was any of the following:

1. System Input Voltage too low (including power cycle)
2. System Input Voltage too high
3. Low Pressure Contact open
4. 4-20mA Pressure Input below Low Setpoint

### Level Event Restart (Menu 4)

If this setting is enabled, the system will restart automatically once all alarm conditions are cleared and if the reason that the system stopped running was any of the following:

1. Level Contact open
2. 4-20mA Level Input below Low Setpoint

### Restart Attempts (Menu 4)

A restart attempt is an attempt by the system to light the burner. These can occur under two types of circumstances:

1. As a result of normal process control. Examples Include:  
 The system is started by a user by switching to Auto Mode.  
 The system is started remotely via the Start Contact.  
 The Pilot Turns off as a result of process control and then is automatically turned back on after the temperature drops below the Pilot Off Setpoint.  
 The system automatically restarts after recovering from one of the situations described in the [Auto Restart](#) or [Level Restart](#) sections.
2. As a result of the pilot flame unexpectedly going out.  
 Examples Include:  
 The gas supply is cut off.  
 Excessive wind blows out the burner flame.  
 Insufficient oxygen supply snuffs out the burner flame.  
 The flame detection rod becomes dirty and unable to detect flame.



## TIMING DELAY SETTINGS

There are four time delay settings that can be adjusted to match the needs of various applications.

### Purge Time (Menu 4)

This setting is used to set the minimum amount of time that must elapse between when all valves are known to be closed and the next time that the pilot is lit. This will be the minimum elapsed time between relights and also the minimum amount of time before lighting the burner after a loss of power. The purge time ensures that dangerous amounts of gas are not present in the fire tube before the pilot is lit thus reducing the risk of an explosion. Generally, the larger the burner, the larger the purge time should be. Local codes may dictate the amount of purge time required for a given application. This setting can be set to a minimum of 10s and a maximum of 900s.

### Pilot-To-Main Delay (Menu 4)

This setting is used to set the minimum amount of time that must elapse between the pilot successfully lighting and the main (or low fire) valve opening. The Pilot-to-Main Delay is used to ensure that enough draft is established before opening the main valve. If this is not done, the volume of gas flowing through the main valve can snuff out the flame due to insufficient oxygen supply. Generally, the larger the burner, the larger the delay should be. This setting can be set to a minimum of 5s and a maximum of 600s.

### Low-To-High Fire Delay (Menu 5)

This setting is used to set the minimum amount of time that must elapse between the low fire valve opening and the high fire valve opening. This setting is only available if Low Fire is enabled in menu 5. The Low-to-High Fire Delay is used to ensure that enough draft is established before switching to high fire. If this is not done, the volume of gas flowing through the high fire valve can snuff out the flame due to insufficient oxygen supply. Generally, the larger the burner, the larger the delay should be. This setting can be set to a minimum of 30s and a maximum of 300s. Values set above 255s are automatically set to the value minus 255s.

### Pressure/Level Delay (Menu 4)

This setting is used to reject spurious electrical noise that may be present on the Low Pressure Contact, Level Contact, and the 4-20mA Expansion Card (if installed). This noise can come from electrical interference, mechanical vibration, or small oscillations in gas pressure and tank level. The rejection is accomplished by requiring these contacts to remain open for a continuous period of time (called the "delay") before shutting down. In the case of the 4-20mA Expansion Card, the Pressure and Level readings must remain below their respective low setpoints for the delay time before shutting down. If the Level Event Restart is enabled in the restart settings, the delays are applied before entering a waiting state as opposed to shutting down.

This setting can be set to either enabled or disabled. When disabled, there is a small delay. When enabled, the delay is lengthened. There are separate delays for Pressure and Level, as well as for contacts and 4-20mA input readings. The following tables list the delays used in all cases.

**Pressure Delay Table**

SETTING	LOW PRESSURE				HIGH PRESSURE			
	Rising	Falling	Opening	Closing	Rising	Falling	Opening	Closing
Enabled	2s	6s	6s	0s	2s	2s	0s	0s
Disabled	2s	2s	2s	0s	2s	2s	0s	0s

### Level Delay Table

SETTING	LOW LEVEL				HIGH LEVEL			
	Rising	Falling	Opening	Closing	Rising	Falling	Opening	Closing
Enabled	2s	20s	20s	0s	0s	0s	N/A	N/A
Disabled	2s	2s	2s	0s	0s	0s	N/A	N/A

## 3.6 | System Operation

This section includes information about how to start and stop the system, how to review key system settings, how to adjust setpoints while the system is running, and how to check the system firmware versions.

### STARTING THE SYSTEM

There are five different ways to start the system:

#### Auto Mode Option

The system is set to Manual Mode by default. Setting the system to Auto Mode is the most common way to start the system.

1. Make sure the system is stopped, all alarms are clear, and the Home Screen displays "Ready".
2. Press the Mode Key. A confirmation prompt will show on the Display.
3. Press the OK Key to confirm that you want to start the system.

This changes the system to Auto Mode. Based on the defined system settings, the system will automatically restart from faults. The system will take over turning the valves on and off according to the system settings and the current Process Temperature.

#### System Test And Start Option

This method is used during the initial installation when testing the pilot valve, main valve, ignition circuit, and flame detection circuitry in a slow sequence.

1. Make sure the system is set to Manual Mode and is stopped with all alarms clear. The Home Screen should display "Ready".
2. Press and hold the Pilot Key to open the Pilot Valve. Listen for the Pilot Valve to click open and let the gas through. Continue to hold the Pilot Key and press and hold the Ignite Key to begin sparking. Check the Pilot Nozzle for sparks and flame. If you cannot see the Pilot Nozzle, listen for the sound of sparking and try to determine if it is coming from the ignition rod.
3. Release the Ignite Key and check that the display shows a Flame Quality of 100%.
4. After about 5 seconds, the display will show "Pilot On" if the



Pilot lit successfully.

5. Press the Main Key to open the Main Valve. The system will count down the Pilot-to-Main Delay and then open the Main Valve if the Process Temperature is within the expected range.
6. The system will take over turning the valves on and off according to the system settings and the current Process Temperature.
7. Press the Mode Key to switch the system into Auto Mode. This allows the system to automatically restart from faults specified in the system settings.

If any of these checks fail, consult the [troubleshooting](#) section of this guide.

### **Automatic Restarts**

If the Auto Restart feature is enabled, the system will attempt to automatically start after a power failure. This will only succeed if all alarms are clear.

### **Start Contact Option**

The Start Contact option can be used to start the system from a remote switch located elsewhere on the site or through a PLC output contact.

1. If there are any Shutdown Messages showing on the display, open the Start Contact and then close it again to acknowledge those messages.
2. Open the Start Contact and then close it again to remotely start the system in Auto Mode. This will only work if all alarms are clear.

### **Modbus Card Option (if installed)**

This method can be used to start the system via a remote device over a Modbus RTU network.

1. Have the remote device write "1234" to the 40100 register to place the system into Auto Mode.
2. Set the remote device to poll the 40100 register and wait for it to clear to zero. This indicates that the system has processed the command.
3. Set the remote device to poll the 10001 register and wait for it to change to 1. This indicates that the system is running.

## **STOPPING THE SYSTEM**

There are five different ways to stop the system:

### **Stop Key Option**

This is the most common way to stop the system.

1. Press the Stop key. The system will stop immediately.

### **Auto Key Option**

This method of stopping the system is used during the initial installation when testing the pilot valve, main valve, ignition circuit, and flame detection circuitry in a slow sequence.

1. Press the Mode Key to switch the system into Manual Mode. This prevents the system from automatically restarting from faults specified in the system settings.



2. Press the Main Key to close the Main Valve and disable process control.
3. Press the Pilot Key to close the Pilot Valve and stop the system.

### **Start Contact Stop**

The system can be stopped using the same remote switch or PLC output as with starting the system using the Start Contact input.

1. Open the Start Contact and leave it open. The system will stop immediately.

### **Shutdown Conditions**

Whenever any shutdown condition is present, the system will stop and stay stopped until the condition is removed and the fault is acknowledged. Shutdown condition examples include the Process Temperature rising above the High Temp ESD Setpoint, the High Pressure Contact Opening, the ESD Contact Opening, etc. Many conditions can cause shutdowns. Some conditions will only trigger a shutdown if it is enabled in the system settings. See the fault chart in this guide for more details.

### **Modbus Card Option (if installed)**

This method can be used to stop the system using a remote device over a Modbus RTU network.

1. Have the remote device write "4321" to the 40100 register to stop the system.
2. Set the remote device to poll the 40100 register and wait for it to clear to zero. This indicates that the system has processed the command.
3. Set the remote device to poll the 10001 register and wait for it to change to 0. This indicates that the system has stopped.

## **ADJUST SETTINGS & REVIEW STATUS**

There are four ways to check and adjust system settings and to view system status:

### **Home Screen**

The Home Screen is accessible at any time. Press and hold the OK Key for 3 seconds.

1. Manual Mode: The Home Screen displays the System State and the Process Temperature.
2. Auto Mode: The Home Screen displays the Process Setpoint and the Process Temperature.

### **Quick Setpoint Adjust (auto mode only)**

This feature allows some Process Setpoints to be adjusted as a group even when the system is running. Affected setpoints are the Low Fire Setpoint (if enabled), the Process Setpoint, and the Pilot Off Setpoint (if enabled). These Process Setpoints can be adjusted directly from the Home Screen using the Up and Down Keys. The adjustments are limited by the maximum ranges of the Process Setpoints. Any changes made take effect immediately. This feature is protected by the L1 Password when password protection is enabled in Menu 4.

### **Review Menu (manual mode only)**

The Review Menu is a diagnostic menu used to check key setpoints and view real time system measurements such as temperature, pressure, and level. To access it, press the Up or Down Key while on the Home Screen.



## System Menus

Menus 1, 4, 5, and 6 are used for checking and adjusting settings. Menus 2 and 3 show diagnostic values. Menu 7 is used for calibration and is hidden by default. The System Menus are accessed by pressing the Menu Key from the Home Screen while in Manual Mode. Some menus are not accessible while the system is running. Menu 3 contains some system status information not found elsewhere in the menu system. Refer to the Menu Map table for more details.

When the system is stopped, all settings can be checked and adjusted. When the system is running, only some settings may be checked or adjusted. The following table illustrates the circumstances under which various settings can be checked and adjusted. For more information about the menu system and the user interface, see the [Menu Map](#) section.

<b>MODE</b>	<b>HOME SCREEN</b>	<b>QUICK SETPOINT CHANGE AVAILABLE</b>	<b>REVIEW MENU AVAILABLE</b>	<b>SYSTEM MENUS AVAILABLE</b>
Manual Mode, System Stopped	System State Process Temperature	No	Yes	1-6 (and sometimes 7)
Manual Mode, System Running	System State Process Temperature	No	Yes	1-3
Auto Mode, System Running	Process Setpoint Process Temperature	Yes	No	None

## DIAGNOSTIC OPTIONS

### Viewing Event Counters

Menu 2 contains a series of counters that increment automatically in response to various events. These counters can be used to troubleshoot issues with a particular installation. Each counter will count to a maximum of 1000 and then will stop incrementing. At the bottom of Menu 2 is an option to clear these counters. Clearing the counters also clears the event log.

1. ESDs: Increments each time the system shuts down as a result of the ESD Contact opening, the High Temp ESD Setpoint being exceeded by either Process Temp or Aux Temp (if enabled), or a high or low voltage alarm.
2. Flame Fails: Increments each time the system shuts down as a result of failing to ignite the pilot within the allocated number of retries.
3. High Pressure ESDs: Increments each time the system shuts down as a result of the High Pressure Contact opening or the 4-20 Pressure reading exceeding the 4-20 High Pressure Setpoint.
4. Level ESDs: Increments each time the system shuts down as a result of the Level Contact opening or the 4-20 Level reading dropping below the 4-20 Low Level Setpoint.
5. Low Pressure ESDs: Increments each time the system shuts down as a result of the Low Pressure Contact opening or the 4-20 Pressure reading dropping below the 4-20 Low Pressure Setpoint.
6. Thermocouple Errors: Increments each time the system shuts down as a result of a thermocouple issue such as a short circuit, open circuit, or ground short.
7. Relights: Increments each time the system attempts to

automatically re-ignite the pilot. The first ignition attempt after a manual start is not counted.

8. Resets: Increments each time the door card is reset by a power loss or by manually pressing the reset button.
9. System Errors: Increments each time the system shuts down as a result of an internal system error.
10. Terminal Card Errors: Increments each time the system shuts down as a result of a terminal card error.

### Viewing the Event Log

The Event Log can be accessed from the end of Menu 2. The log contains entries for various types of events such as System Starts, Stops, Shutdowns, Menu Accesses, etc. The log holds a maximum of 32 events. The first event (#1) is the most recent and the last event (#32) is the oldest.

When the log is full, the oldest event is removed from the list to make room for the next newest event. Navigate through the log using the up and down arrow keys. Press OK to return to the Home Screen. The log can be cleared using the item at the end of Menu 2. Clearing the log also resets all event counters to zero.

The following is an alphabetical list of all possible Event Log entries including a brief description of their meaning and the associated counter which will increment when that event occurs:

ENTRY	DESCRIPTION	ASSOCIATED COUNTER
AUTO	The system switched to Auto Mode because the user pressed the MODE and OK button.	
AUX ESD	The "Aux Temp Mode" setting is set to "Temp ESD" and the Aux Temp signal exceeded the "Aux Setpoint".	ESDs
ESD	The system shut down as a result of the ESD contact being open.	ESDs
FLAME FAIL	The pilot went out and could not be relit automatically within the specified number of attempts (3 attempts on initial start; user defined for other cases).	Flame Fails
HI PRS ESD	The system shut down because the High Pressure Contact was opened or the "4-20mA High Pressure Setpoint" was exceeded.	High Pressure ESDs
HI VOLT	The system input voltage exceeded the High Voltage Alarm threshold.	ESDs
HT ESD	The "High Temp ESD Setpoint" was exceeded by either "Proc Temp" or "Aux Temp" (if enabled) and caused the system to shutdown.	ESDs
LEVEL ESD	The system shut down because the Level Contact was opened or the "4-20mA Low Level Setpoint" was dropped below.	Level ESDs
LO PRS ESD	The system shut down because the Low Pressure Contact was opened or the "4-20mA Low Pressure Setpoint" was dropped below.	Low Pressure ESDs
LO VOLT	The system input voltage dropped below the Low Voltage Alarm threshold.	ESDs
LOW ALARM	The "Proc Temp" signal dropped below the "Low Temp Alarm Setpoint".	
MANUAL	The system switched to Manual Mode because the user pressed the MODE button.	
MENU:CTL	Menu 5 "Control" was entered. This will show even if no settings are modified.	
MENU:SETPT	Menu 1 "Setpoints" was entered. This will show even if no settings are modified.	
MENU:SYS	Menu 4 "System" was entered. This will show even if no settings are modified.	
POC STOP	The "Proof of Closure Contact" was open when it should not have been causing the system to shutdown.	



<b>ENTRY</b>	<b>DESCRIPTION</b>	<b>ASSOCIATED COUNTER</b>
RELIGHT	The pilot was successfully relit after it went out unexpectedly.	Relights
RESET	The system was reset due to a loss of power or a manual press of the Door Card's reset button.	Resets
RETRY	The Pilot failed to light and one or more retry attempts were made.	
RUNNING	The system successfully lit the pilot.	
START	The system switched to Auto mode at a point in time when the pilot was not lit.	
STOPPED	The system stopped because the user pressed the STOP button while the Pilot Valve was open.	
SYSTEM ERR	An internal system error has occurred.	System Errors
TCERR:AUX	The AUX Thermocouple is out of range.	Thermocouple Errors
TCERR:HT	The High Temp Thermocouple is out of range or grounded.	Thermocouple Errors
TCERR:PROC	The Process Thermocouple is out of range.	Thermocouple Errors
TC NOT EQ	The system detected an unacceptable difference between the Process and High Temp Thermocouple readings. The acceptable difference varies with the HT ESD Setpoint (ESD) as follows:  15C when ESD < 200C 25C when 200C <= ESD < 400C 35C when 400C <= ESD < 800C 45C when 800C <= ESD	
TERM ERR	Communications between the Terminal Card and the Door Card has been interrupted.	Terminal Card Errors

### Viewing Firmware Versions

From anywhere in the User Interface, press the Up and Down Keys simultaneously. The system will show four different firmware versions in sequence:

<b>CARD</b>	<b>CURRENT FW VERSION</b>	<b>NOTE</b>
Door Card	DC FW: E1.8.115	
Terminal Card	TC FW: E1.8.101	
4-20mA Expansion Card	4-20 FW: v4.1	Will show "—" if not installed or not enabled in Menu 6
Modbus Expansion Card	MBUS FW: v4.1	Will show "—" if not installed or not enabled in Menu 6

# 4 | SYSTEM BEHAVIOR

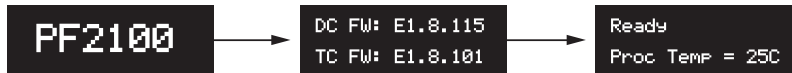
This section of the manual describes the behavior of the PF2100 when various features are enabled vs disabled. Simplified state diagrams are provided and discussed to give a high level understanding of how the system works.

## 4.1 | System Behavior

The following diagrams illustrate the behavior of the PF2100 during common system events. Note that when the PF2100 changes states while in Auto mode, the new state will be shown momentarily on the display. In Manual Mode, the current state is always shown on the display.

### SYSTEM START UP

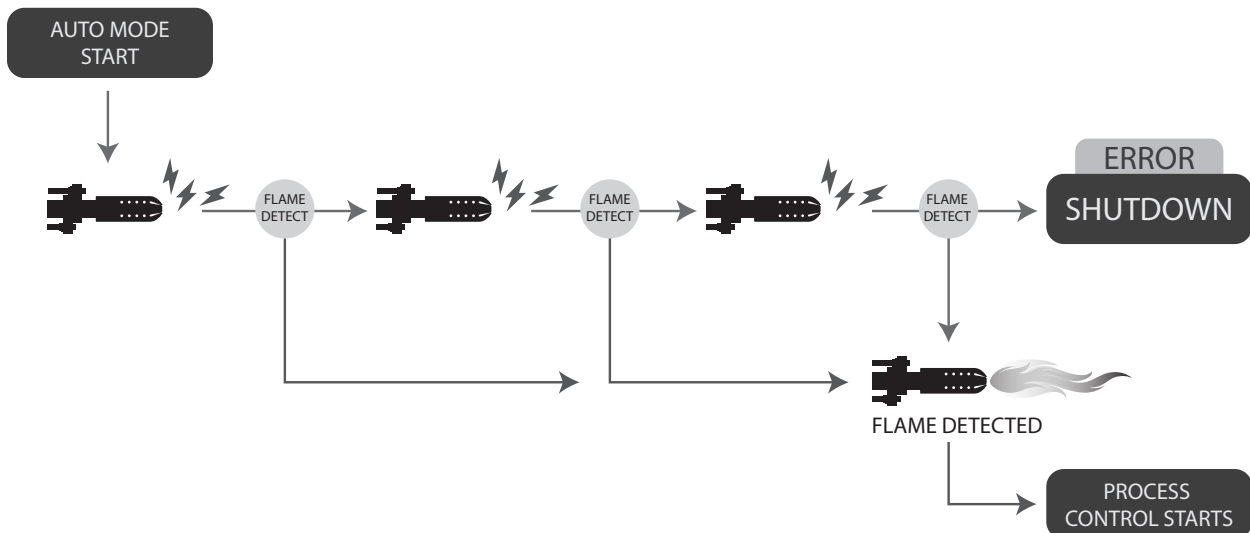
When the system is powered on, the start up sequence is as follows:



1. PF2100 displayed in large text
2. Firmware versions of the Door and Terminal Card
3. The Home Screen showing the system state. The system state will be "Ready" if no alarms are present. Otherwise, the state will be "Alarm".

### STARTING IN AUTO MODE

When the system is started in Auto Mode (by pressing the Mode and OK Keys), it will run through the ignition sequence automatically. In Auto Mode, the PF2100 will automatically attempt to relight the pilot if it ever goes out unexpectedly.

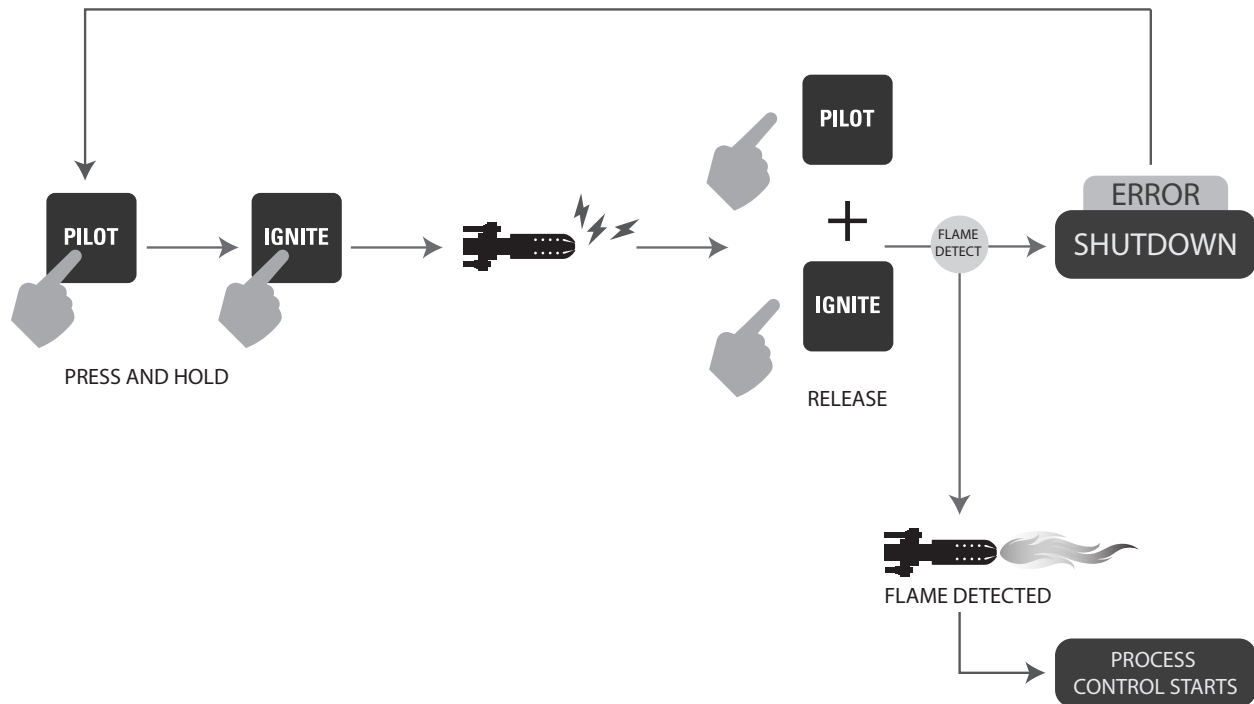


The [Process Control](#) sequence will be explained in more detail later.



## STARTING IN MANUAL MODE

When the system is started in Manual Mode (using the Pilot, Ignite, and Main Keys), it must be manually moved through the ignition sequence. In Manual Mode, the PF2100 will NOT automatically attempt to relight the pilot if it ever goes out unexpectedly. It will only attempt to relight the pilot if it was turned off by the system as a result of normal process control (ie, Waiting on Temp, Waiting for Level, etc).

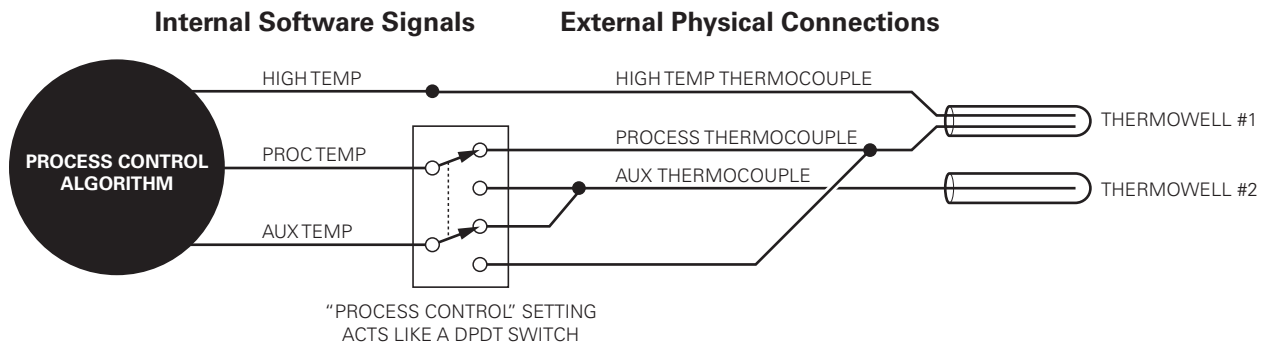


The [Process Control](#) sequence will be explained in more detail later.

## 4.2 | Process Control

The PF2100 maintains a process at a user specified temperature. The system monitors the temperature and adjusts to increase or decrease the temperature as needed. This is an automated sequence of events based on user settings. This process of monitoring and controlling is called Process Control. The system uses a gas fired heater with an electronic ignition circuit and several electronic fuel valves (also called solenoids). It also has a flame detection circuit and up to three temperature measuring thermocouples.

The PF2100 has three inputs: High Temp, Proc Temp, and Aux Temp. By default, these signals correspond to the High Temp Thermocouple, the Process Thermocouple, and the Aux Thermocouple respectively. The Process Control setting allows the Process and Aux thermocouples to be swapped. This is useful in circumstances that will be explained later.



It is expected that the High Temp Thermocouple and the Process Thermocouple will always be mounted in a common thermowell. This is usually accomplished by using a duel element thermocouple. The software uses these two thermocouples as a check for each other as a failsafe. If the readings from these two thermocouples do not agree within a specified amount of error, the system will shut down.

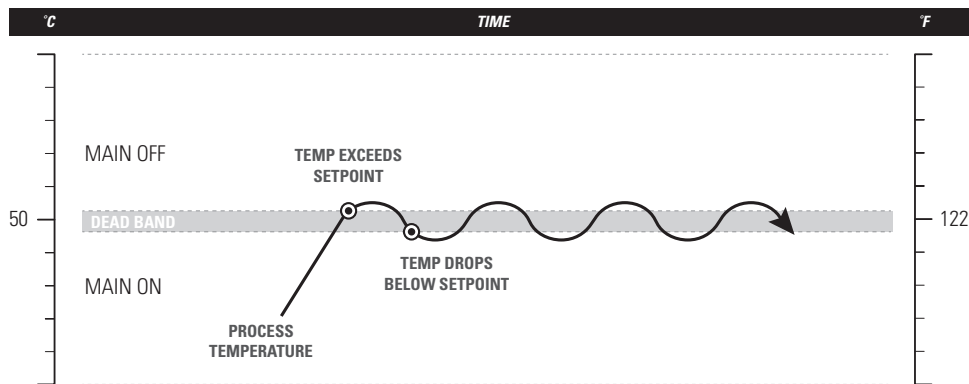
The High Temp signal is used to protect the burner and other process equipment from being damaged due to excessive heat. It cannot be disabled through any combination of process control settings.

The Proc Temp signal is the primary control signal for Process Control. This signal is compared to the Deadband, Low Temp Alarm Setpoint, Process Setpoint, Low Fire Setpoint, and the Pilot Off Setpoints in order to control the temperature of the process.

The Aux Temp signal can be used as a secondary control signal. The way that this signal is used will vary depending on the Aux Temp Mode setting. If enabled, an Aux Setpoint gets compared to this signal.

## STANDARD PROCESS CONTROL

Using very basic settings, the PF2100 behaves as follows.



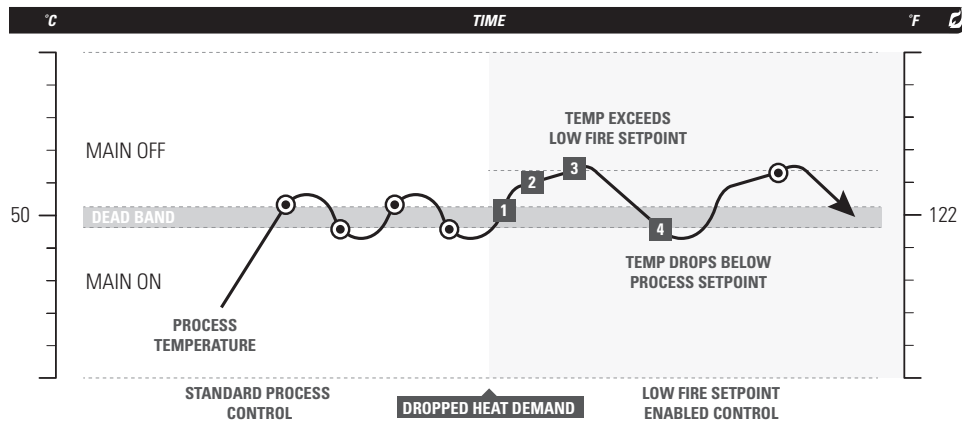
1. The Main Valve opens and the Process Temperature increases.
2. The Process Temperature exceeds Process Setpoint, the Main Valve closes, and the Process Temperature begins to drop.
3. The Process Temperature drops below the Process Setpoint minus Deadband, the Main Valve opens, and the Process Temperature begins to increase again.

## LOW FIRE: ON AT PROC SETPOINT

This example has the Process (High Fire) and Low Fire Setpoints enabled. It has been set to turn on at the Process Setpoint. This example uses two valves, a Low Fire valve and a High Fire valve. Both valves start open in this example.



The system behaves the same as in the [standard process control](#) diagram until the demand for heat drops.



1. The Process Temperature reaches the Process Setpoint and the main valve closes.
2. The Process Temperature continues to rise.
3. The Process Temperature exceeds the Low Fire Setpoint, the Low Fire Valve closes, and the Process Temperature drops.
4. The Process Temperature drops below the Process Setpoint minus the Deadband, the High Fire Valve opens, and the Process Temperature begins to increase again.

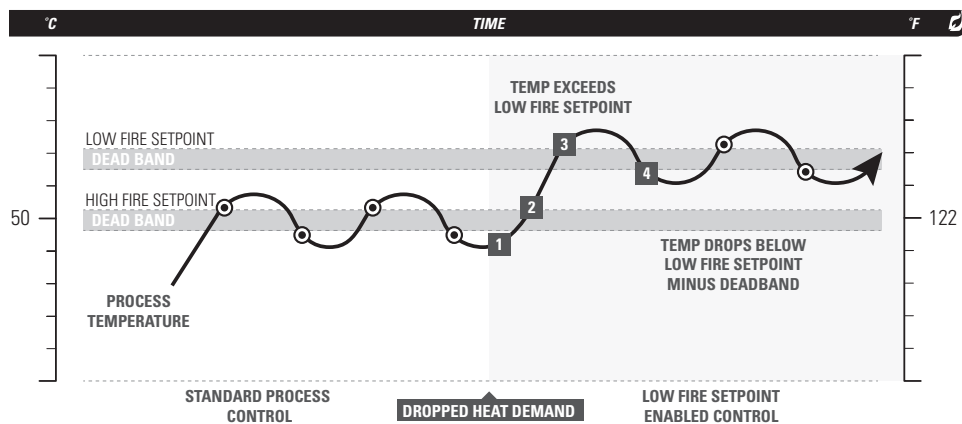
### PROPORTIONAL VALVE CONTROL

The Low Fire: On Proc Setpoint can be used in conjunction with a proportional valve connected to the 4-20mA Output. In this mode, the PID Controller adjusts the proportional valve and attempts to fix the temperature at the Process Setpoint.

### LOW FIRE: ON AT LOW FIRE SETPOINT

This example has the Low Fire feature enabled and set to “On at Low Fire Setpoint.” In this case, the Low Fire Valve will close when it exceeds the Low Fire Setpoint, and will reopen after it drops below the Low Fire Setpoint minus Deadband.

The system behaves the same as in the [standard process control](#) diagram until the demand for heat drops.



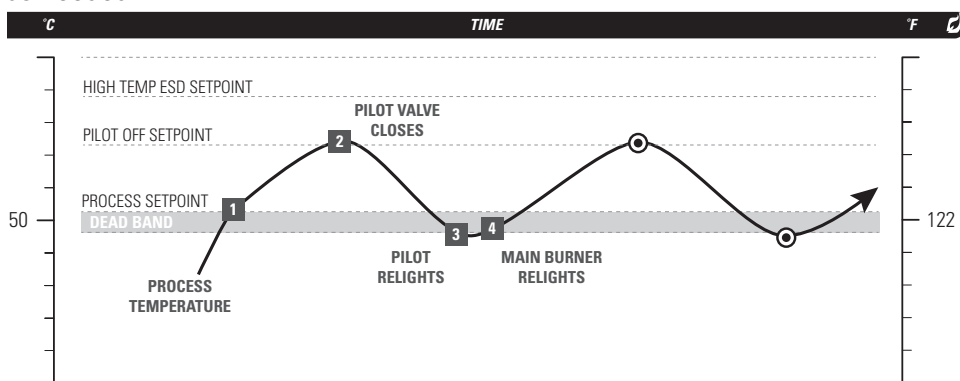


1. The Process Temperature continues to rise.
2. The Process Temperature exceeds the High Fire Setpoint, the High Fire Valve closes, and the Process Temperature continues to rise.
3. The Process Temperature exceeds the Low Fire Setpoint, the Low Fire Valve closes, and the Process Temperature drops.
4. The Process Temperature drops below the Low Fire Setpoint minus Deadband, the Low Fire Valve opens, and the Process Temperature begins to rise again.

## PILOT OFF

This scenario is the same as the basic scenario except that the Pilot Off feature has now been enabled. In this case, when the Proc Temp rises above the Pilot Off Setpoint the Pilot Valve will close and will not re-light until the temperature is below the Process Setpoint minus Deadband.

The system behaves the same as in the [standard process control](#) diagram with the added ability to shut off the pilot as needed.



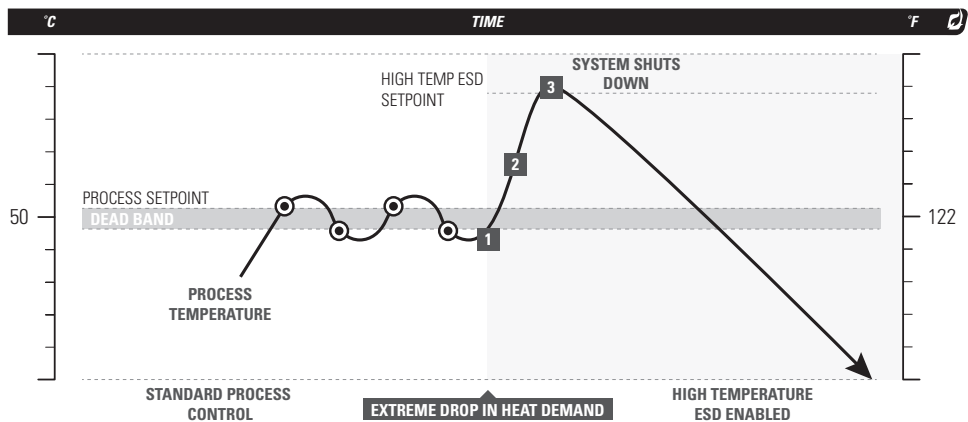
1. The temperature exceeds the Proc Setpoint and the Main Valve closes.
2. The temperature continues to rise and the Proc Temp exceeds the Pilot Off Setpoint, the Pilot Valve closes, and the Proc Temp begins to decrease.
3. The Proc Temp drops below the Process Setpoint minus Deadband, the pilot relights, and the Proc Temp begins to increase again.
4. The Pilot-to-Main Delay elapses, the Main Valve opens, and the Proc Temp begins to increase faster.

## HIGH TEMP ESD

The High Temp ESD Setpoint is always compared against the High Temp Thermocouple regardless of the Process Control setting. The system will immediately shut down if this thermocouple exceeds this setpoint. Because the High Temp Thermocouple and Process Thermocouple must always be in the same thermowell, these two thermocouples can be thought of as being the same. Note that the internal signal to which the Process Thermocouple is associated (Proc Temp or Aux Temp) will change depending on the Process Control setting.

This particular graph is a representation of a high temperature shutdown. Once the Process Temperature exceeds the High Temp ESD Setpoint, the system will shut down and require user input to acknowledge the error.

The system behaves the same as in the [standard process control](#) diagram until the demand for heat drops.



1. Heat demand suddenly and substantially decreases. This could be caused by a rapid decrease in flow by the line heater or a sudden emptying of a tank heater.
2. The Process Temp rises sharply.
3. The High Temp Thermocouple temperature rises above the High Temp ESD Setpoint, the system immediately shuts down, and the High Temp Thermocouple temperature begins to decrease slowly.

### AUX TEMP MODE: TEMP MAIN CTL

When Aux Temp Mode is set to Temp Main Ctl, it enables the Auxiliary Temperature input. The Proc Temp signal measures the outlet temperature of a line heater and the Aux Temp signal measures the bath temperature. If the heat demand increases, the bath temperature may rise quickly. The Aux Setpoint is used to shut off the Main Valves to protect the bath and fire tube in the event of excessive bath temperature.

### AUX TEMP MODE: TEMP ESD

If the Aux Temp Mode is set to Temp ESD, then the Aux Temp signal must be below the Aux Setpoint or the system will shut down. Normally this happens independent of the High Temp ESD previously described. However, it is possible for the High Temp ESD Setpoint and the Aux ESD Setpoint to both be applied to the same thermocouple. This happens when Process Control is set to Aux TC and Aux Temp Mode is set to Temp ESD. In this case, whichever setpoint is lower will be used.

In this mode, the Aux Setpoint is used as another ESD setpoint. It is always compared against the Auxiliary Temperature signal which depends on the Process Control setting. The system will immediately shut down if this signal exceeds this setpoint.

### AUTOMATIC RESTART EVENTS

In all waiting states, the system turns off the burner and pilot and waits for some event to occur before restarting. There are two other groups of waiting states which may be optionally enabled: Auto Restart and Level Event Restart. Each of these states can be entered automatically from any other Process Control state if the associated condition is satisfied.

Several waiting states are enabled when the Auto Restart feature is enabled. The conditions and the triggering states are as follows:

- Waiting on Low Voltage- System Voltage below Low Alarm
- Waiting on High Voltage- System Voltage above High Alarm,
- Waiting on Low Pressure- Low Pressure Contact open or 4-20mA Pressure below Setpoint

One waiting state is enabled when the Level Event Restart feature is enabled:

- Waiting on Low Level- Level Contact Open or 4-20mA Level below Low Setpoint

Once the triggering condition is cleared, the system will automatically restart via the Relight procedure.

### **RELIGHT PROCEDURE**

After the system has been initially started, if it needs to be automatically relit, the system responds based on the reason the pilot is off. If the event is a controlled one, the PF2100 follows the Process Control sequence using the system settings. If the pilot goes out unexpectedly, the PF2100 checks to see which mode it is in. In Manual mode, the system goes straight to shutdown; in Auto mode, the system goes through [Auto Mode Start Up](#). Note that the number of retries varies depending on the reason for pilot being off, three for Process Control, none for Manual mode, and the user defined amount in Auto mode.

## **4.3 | Contact Behavior**

This section discusses the behavior of the PF2100's input and output contacts and its response to external signals.

### **STATUS OUTPUT**

The Status Output Contact is generally used to remotely determine whether the system is operating normally. It can be connected to a PLC and used to trigger a remote alarm so that a service technician can be sent to the site in the event of trouble.

In general, the contact will be closed when the system is running and it will be open when the system is not running. Five exceptions to this are as follows:

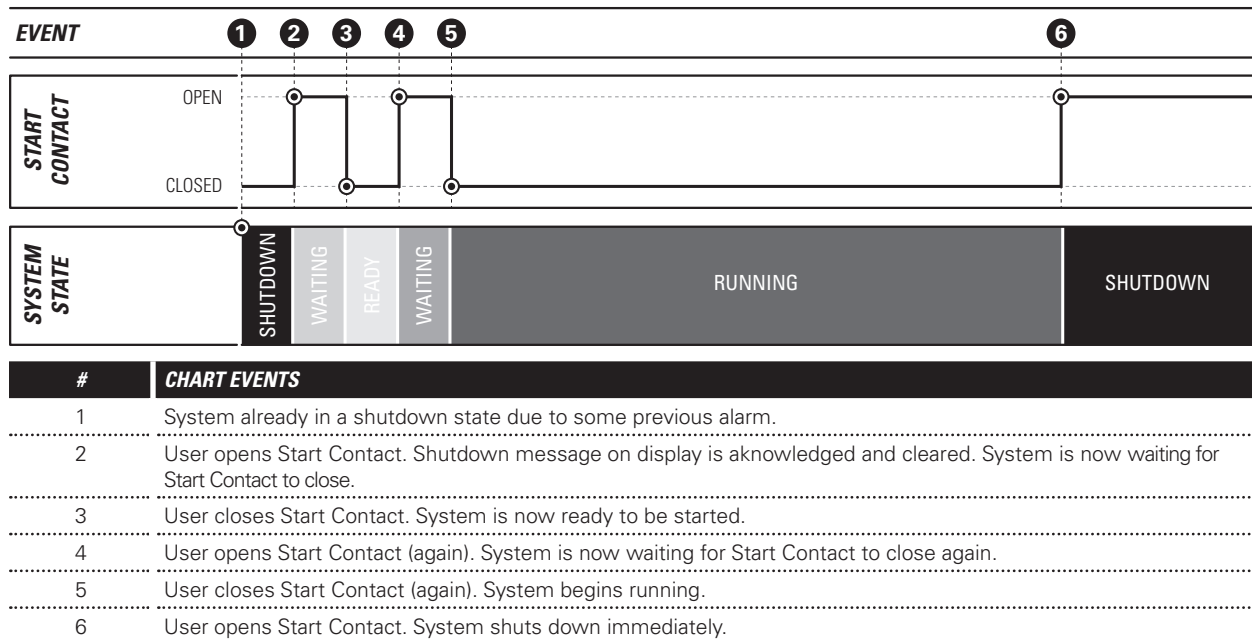
1. On Start: When the system is first started, the status contact will remain open until after the pilot has been successfully lit.
2. Alarm Mode: If the Alarm Mode setting in menu 4 is No Alarm When Off, the contact will remain closed if the system is stopped because the Start Contact is open.
3. Low Temp Alarm: If the Low Temp Alarm feature is enabled in menu 1 and the Process Temperature is currently below the Low Temp Alarm Setpoint, the Status Contact will be open. The contact will close again as soon as the temperature rises above the Low Temp Alarm Setpoint.
4. While Waiting: If the system is in a waiting state, the status contact will remain closed.



- While Restarting: If the flame blows out and the system is in the process of relighting the pilot, the status contact will remain closed. If the pilot fails to relight within the specified number of relight attempts, then the contact will open.

## START INPUT

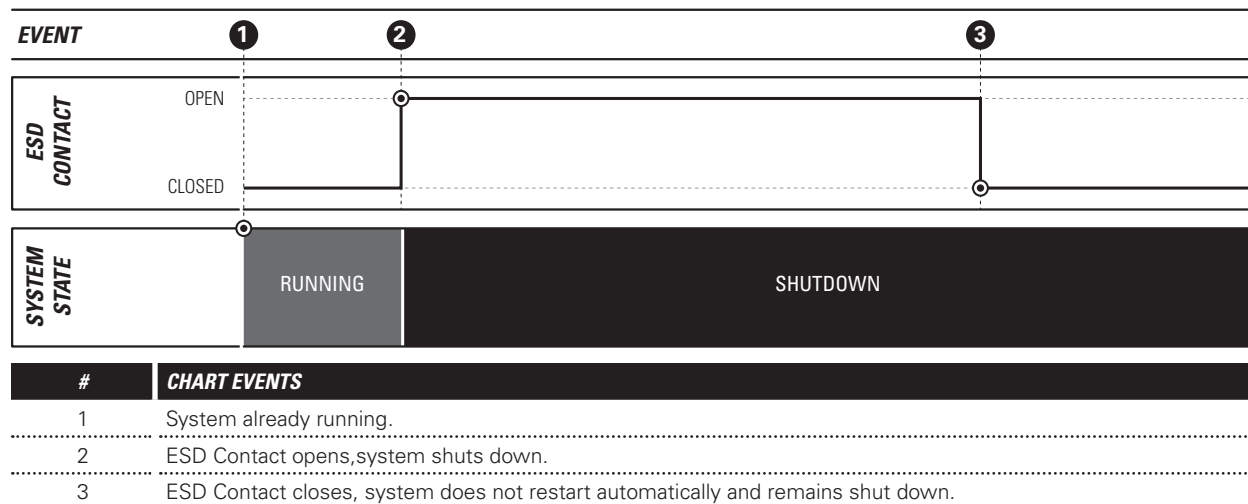
The Start Input Contact is used to remotely stop and start the PF2100. This can be done by connecting it to an output relay on a PLC or to a switch located elsewhere on the site. Generally speaking, the system will begin running when the contact is closed and will stop running when the contact is open. The exception to this is when the system shuts down as a result of an alarm condition. In this case, the contact must be closed to acknowledge the shutdown condition and must then be opened and closed again to restart the system. The status contact can give some idea as to whether the system is shutdown. However, it is not always possible to do so, so it is recommended to always start the system using the close-open-close sequence described above. This will always work even if the system is not waiting for a shutdown message to be acknowledged. Once the start sequence has been entered, the system will start after the purge time has elapsed. When the start contact is opened, the system will always stop immediately.



If this contact is not needed, it must be shorted out with the provided jumper or a wire.

## ESD INPUT

The ESD Input Contact is used to stop the PF2100 in the event of an emergency. This is normally done by connecting the contact to the site's ESD Loop. The PF2100 will shutdown immediately when the contact is opened and cannot be restarted until the contact is closed. The PF2100 will not restart automatically if the ESD contact is subsequently reclosed but must instead be restarted via the start contact, the keypad, or the Modbus card (if installed).



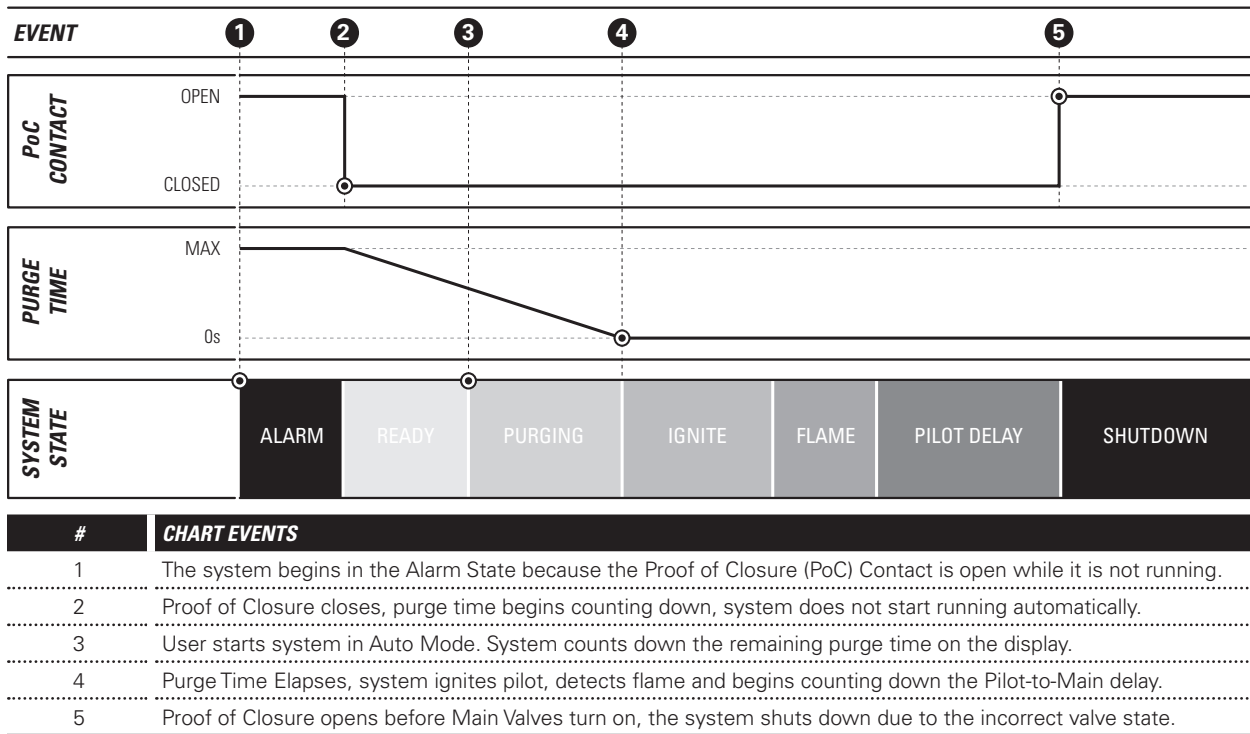
If this contact is not needed, it must be shorted out with the provided jumper or a wire.

## PROOF OF CLOSURE INPUT

When the PF2100 is started, it drives the Main Valves to the closed position. If, for some reason, the valves do not close, a dangerous situation can result. This condition might arise if a valve is mechanically damaged, frozen open, or has been wired incorrectly. If undetected, the PF2100 may attempt to light the burner while a dangerous amount of gas is present resulting in an explosion. To prevent this, the Proof of Closure Input Contact can be used to monitor the mechanical position of the Main Valves. This feature requires the use of valves that have a built-in Proof of Closure output. If more than one Main Valve is used, the Proof of Closure outputs from each valve are wired together in series before being connected to the PF2100's Proof of Closure input.

The Proof of Closure contact must be closed in order for the Purge Timer to count down. If it is ever opened while the system is not running, the Purge Timer is reset and must count down again before the system can be started. In short, the Proof of Closure contact must be closed for the entire duration of the Purge Time or the system will not start. While running, if the Proof of Closure contact ever opens when it is not expected to be open, the system will shut down.





If this contact is not needed, it must be shorted out with the provided jumper or a wire.

## LEVEL INPUT

The Level Input is generally used in tank heater applications. A level switch is installed in the tank to determine when the tank fluid level drops below to position of the fire tube. This switch is then connected to the Level Input Contact on the PF2100. If the fluid level drops below the switch position, the switch opens and the PF2100 will stop heating the tank. This is to prevent damage to the tank and fire tube which may result from applying heat to the empty tank. Generally, this situation arises when a tanker truck arrives on site and empties the tank into the truck. The system can be setup to begin heating the tank again automatically after the level of fluid rises back above the switch position. This is done by enabling the "Level Event Restart" setting in menu 4.

The response to the contact opening is delayed by 2s to reject electrical noise that is common on some sites. If long periods of severe noise are common on a particular site, the delay can be increased to 20s by enabling the "Pressure/Level Delay" feature in menu 4.

If this contact is not needed, it must be shorted out with the provided jumper or a wire.

Chart 1: Level Event Restart = Disabled

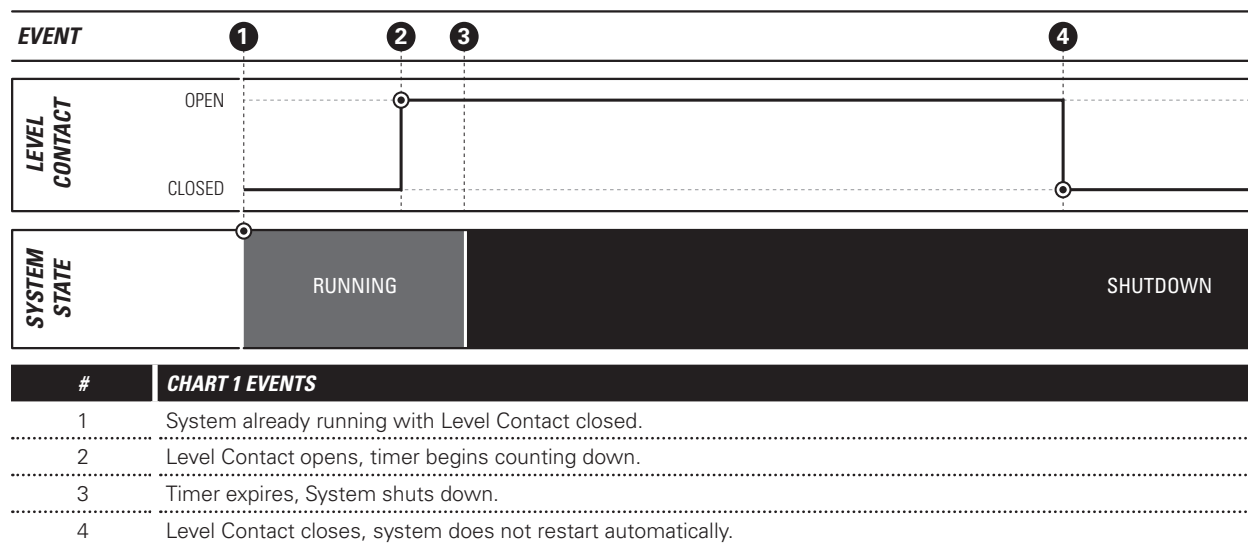
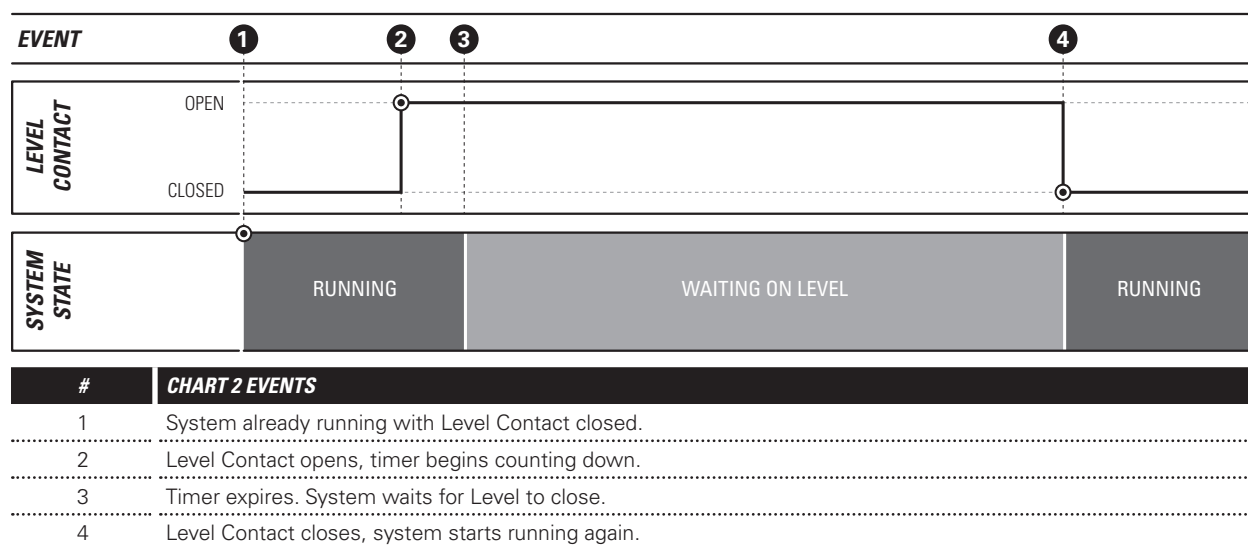


Chart 2: Level Event Restart = Enabled



## LOW PRESSURE INPUT

The Low Pressure Input is used to monitor fuel train pressure. Insufficient fuel pressure may result in the flame burning back into the fuel train causing damage or improper operation. A low pressure switch can be installed on the fuel train and then connected to the Low Pressure Input Contact on the PF2100. If the fuel pressure drops below the switch's mechanically set pressure setting, the switch opens and the PF2100 will close all valves and stop running. The system can be setup to begin running again automatically after the pressure returns above the switch's pressure setting. This is done by enabling the Auto Restart feature in menu 4.

The response to the contact opening is delayed by 2s to reject electrical noise that is common on some sites. If long periods of severe noise are common on a particular site, the delay can be increased to 6s by enabling the "Pressure/Level Delay" feature in menu 4.



If this contact is not needed, it must be shorted out with the provided jumper or a wire.

Chart 1: Low Pressure Restart=Disabled

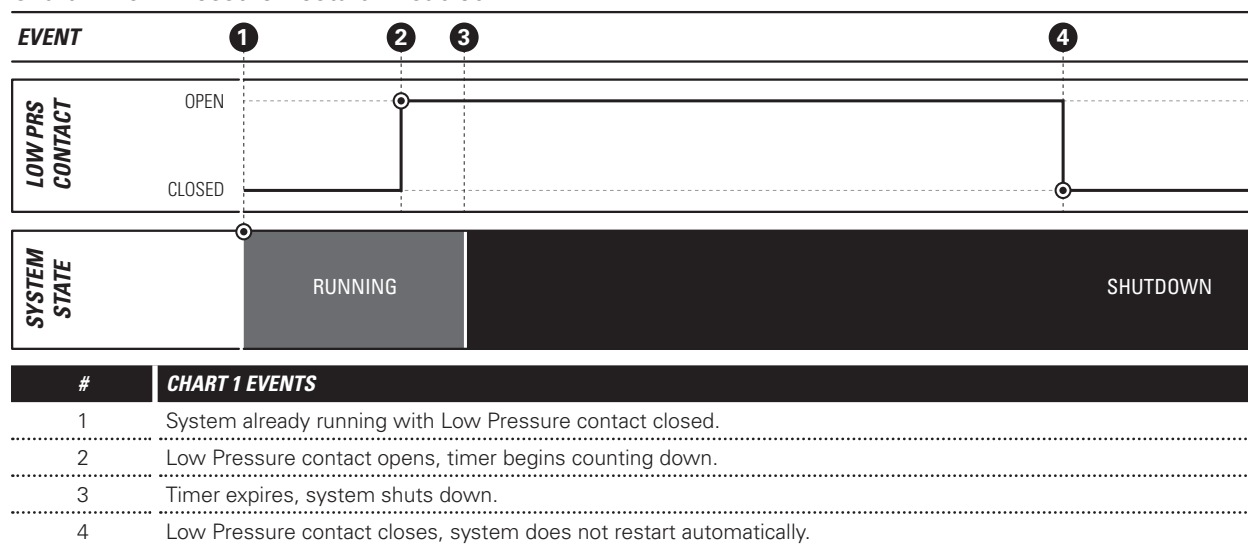
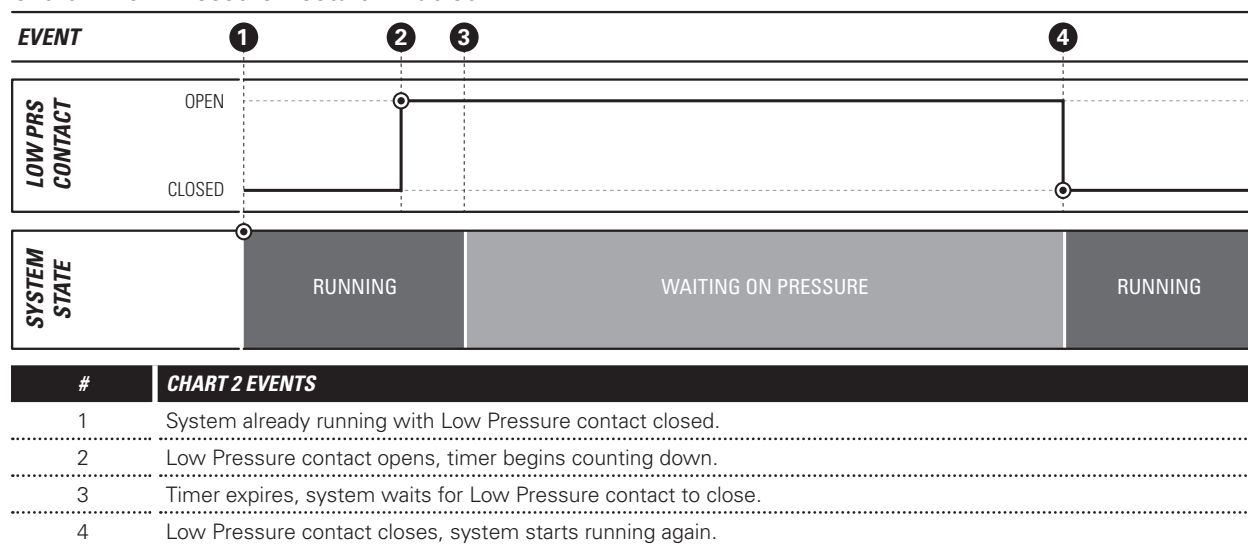


Chart 2: Low Pressure Restart=Enabled



## HIGH PRESSURE INPUT

The High Pressure Input Contact is used to monitor fuel train pressure when excess fuel pressure may result in damage to the pilot nozzle or otherwise cause improper operation. A high pressure switch can be installed on the fuel train and then connected to the High Pressure Input Contact on the PF2100. If the fuel pressure increases above the switch's mechanically set pressure setting, the switch opens and the PF2100 will close all valves and stop running. The system always shuts down from a High Pressure Event and cannot be programmed to automatically restart if the event clears.

The system can be started when the High Pressure Contact is open. This is to allow for easy recovery from the common issue of leaky regulators. If the regulator upstream from the high pressure switch is leaky, it can allow pressure to accumulate at the switch's position over time while the system is not

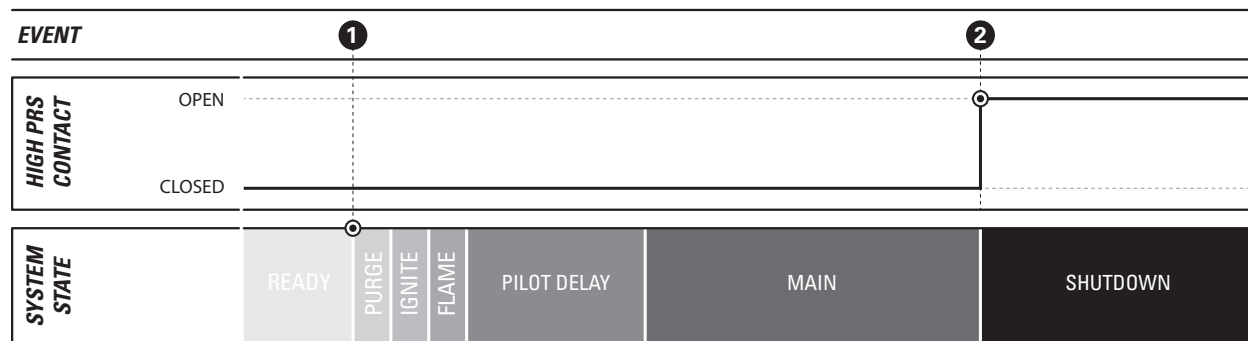


running. Since there is no way to relieve this pressure other than to open a downstream valve, the system must be allowed to start running under this condition. So the system will start, light the pilot, and open the main valve to allow the built-up pressure to be relieved. If the pressure does not drop low enough to close the High Pressure Contact within 2s after the main valve has been opened, the system will shutdown. Otherwise, it will continue running.

The response to the contact opening is always immediate and cannot be configured.

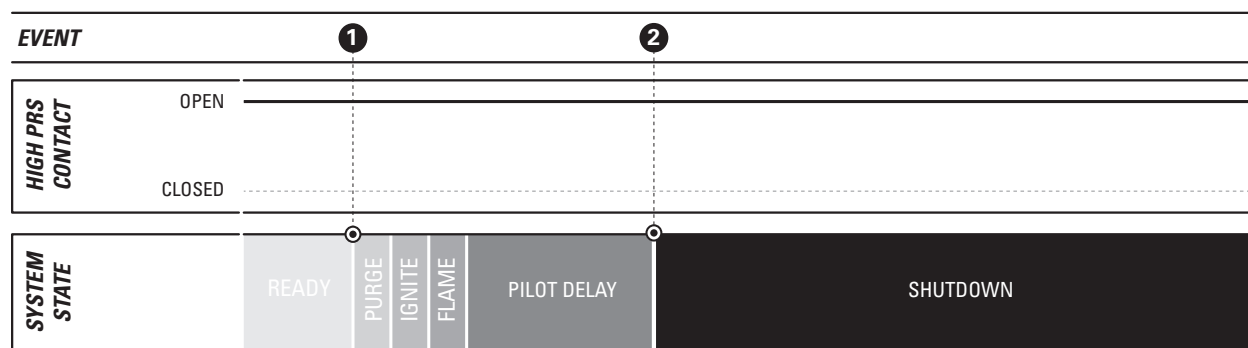
If this contact is not needed, it must be shorted out with the provided jumper or a wire.

Chart 1: High Pressure Contact Opens While Running



#	CHART 1 EVENTS
1	System started by user with High Pressure Contact closed.
2	High Pressure Contact opens while the system is running with the mains open. System shuts down.

Chart 2: High Pressure Contact Open On Start



#	CHART 2 EVENTS
1	System started by user with High Pressure Contact open.
2	Main valve opens, system reads that the High Pressure Contact is open and goes straight to shutdown.



# 5 | EXPANSION CARDS

## 5.1 | 4-20mA Expansion Card

An optional 4-20mA Expansion Card can be installed in the PF2100 which provides two 4-20mA inputs as well as a pair of complementary dry contact outputs:

### 4-20MA FUEL TRAIN PRESSURE MEASUREMENT

This card can be used as an alternative to the High and Low Pressure Contacts which are built into the PF2100. This input can be wired to a 4-20mA Pressure Transmitter to obtain an actual reading of the fuel train pressure. The transmitter range and units can be set along with low and high pressure thresholds. The reading can be displayed on the PF2100 display or read remotely via Modbus if the optional Modbus Expansion Card is also installed.

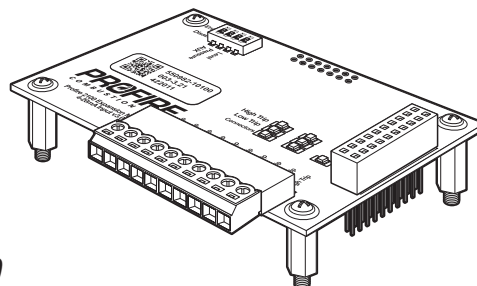
### 4-20MA TANK LEVEL MEASUREMENT

This can be used as an alternative to the Level Contact which is built into the PF2100. This input can be wired to a 4-20mA Level Transmitter to obtain an actual reading of the tank level. The transmitter range and units can be set along with low and high level thresholds. The reading can be displayed on the PF2100 display or read remotely via Modbus if the optional Modbus Expansion Card is also installed.

### TANK HIGH LEVEL DRY CONTACTS

Both Normally Open (NO) and Normally Closed (NC) contacts are provided. When the Level reading is above the High Level Setpoint, the NO contact will close and the NC contact will open. The opposite is true whenever the Level reading is below the High Level Setpoint. This can be used to control auxiliary equipment such as a warning light, an alarm, or the pump that is filling the tank.

Refer to the "4-20mA Expansion Card Manual" for details on installation and operation of this card.



### 4-20mA **EXPANSION CARD**

Some PF2100 models come with this card pre-installed.

### 4-20MA EXPANSION CARD SETTINGS

These settings all apply to the 4-20mA Expansion Card which must be installed in the PF2100's expansion slot. These settings can all be found in Menu 6. Some of these settings will be hidden if the card is not installed or enabled.

## 4-20 EXPANSION CARD ENABLE (MENU 6)

For the Tank Level Settings to be visible, the LVL DIP Switch on the 4-20mA Input Card must be enabled.

### Tank Level Settings:

1. 4-20 LEVEL ZERO OFFSET (menu 6): Specifies the offset value for the tank's level transmitter.
2. 4-20 LOW LEVEL SETPOINT (menu 6): If the 4-20mA LVL input drops below this setpoint, the burner will turn off to prevent damage to the tank and fire tube.
3. 4-20 HIGH LEVEL SETPOINT (menu 6): If the 4-20mA LVL input exceeds this setpoint, the LVL output contacts on the 4-20mA Input Card will toggle.
4. 4-20 LEVEL RANGE (menu 6): Specifies the maximum capacity of the tank's 4-20mA level transmitter.
5. 4-20 LEVEL UNITS (menu 6): Specifies the units of measurement. Note that this may have an impact on measurement accuracy.

### Fuel Train Pressure Settings

For the Fuel Train Pressure Settings to be visible, the PRS DIP Switch on the 4-20mA Input Card must be enabled.

1. 4-20 LOW PRESSURE SETPOINT (menu 6): If the 4-20mA PRS input drops below this setpoint, the burner will turn off to prevent flame from burning back into the fuel train.
2. 4-20 HIGH PRESSURE SETPOINT (menu 6): If the 4-20mA PRS input exceeds this setpoint, the system will shut down.
3. 4-20 PRESSURE RANGE (menu 6): Specifies the maximum capacity of the tank's 4-20mA Pressure transmitter.
4. 4-20 PRESSURE UNITS (menu 6): Specifies the units of measurement. Note that this may have an impact on measurement accuracy.

## 4-20MA EXPANSION CARD BEHAVIOR

The 4-20mA Expansion Card provides an alternate method of monitoring tank level and fuel train pressure. This is via 4-20mA loop transmitters. These devices can be used in place of the switches attached to the level and pressure contacts on the PF2100. Using transmitters allows actual measurements of the level and pressure to be shown on the PF2100's display or read remotely via Modbus (if the Modbus Card is installed).

## 4-20MA LEVEL INPUT & OUTPUT CONTACTS

The 4-20mA Level Input is used to monitor tank level in the same way as the Level Contact. The behavior and features are identical to those described in the previous [Contact Behavior](#) section. The difference is that a Level Transmitter is used instead of a Level Switch and the Low Level setpoint is set via a menu instead of the physical position of the switch on the tank. When the 4-20mA signal is below the Low Level setpoint, the system will stop. When it is above the setpoint, the system will run.

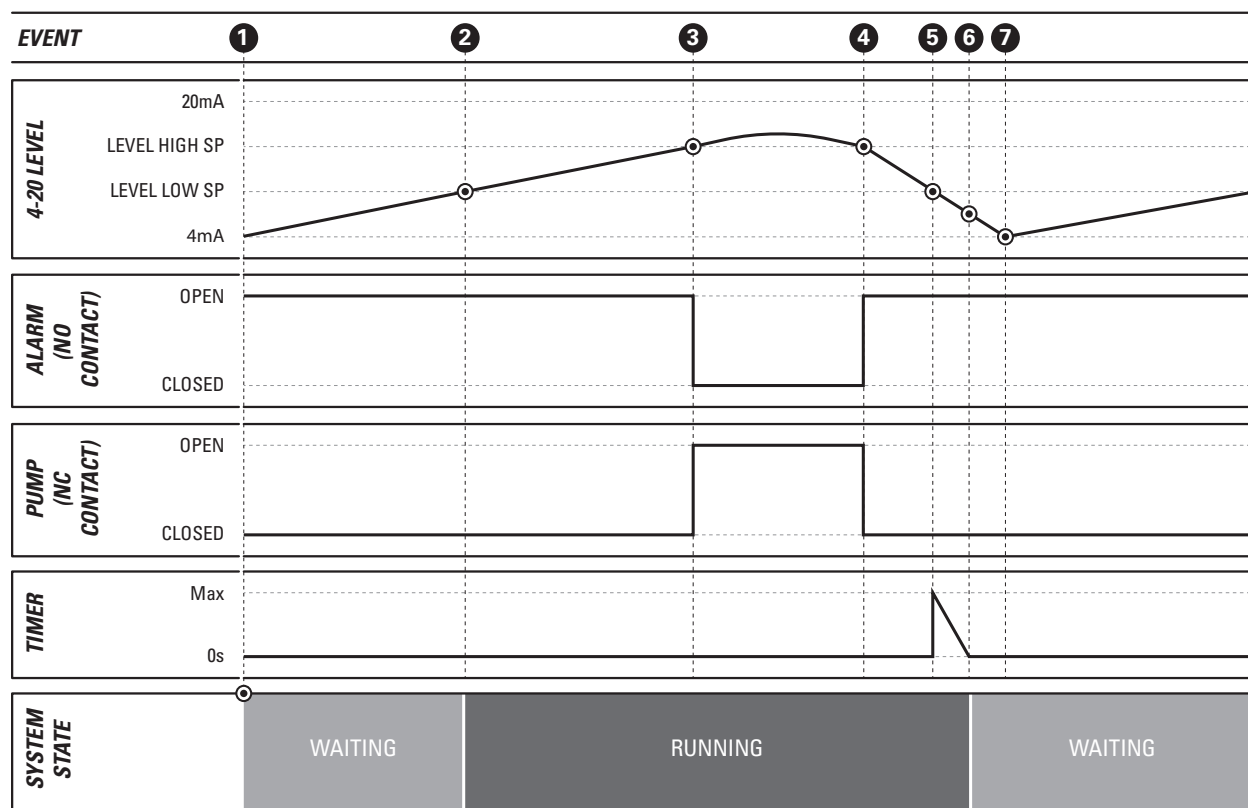
The 4-20mA Expansion Card also has a pair of High Level Output Contacts which toggle when the Level Input exceeds the Level High Setpoint. One contact is normally open and the other is normally closed. "Normally," in this case, means "when the level is below the high setpoint." The normally closed contact could be used to turn off the pump that is filling the tank and the normally open contact could be used to



sound a remote alarm to signal that the tank is full.

**To use the 4-20mA Level Input, it must be setup as follows:**

1. Attach a properly calibrated Level Transmitter to the 4-20 Level Input
2. Enable the Level DIP Switch on the 4-20 Card
3. Enable the 4-20 Card in menu 6
4. Set the Level Low Setpoint, High Setpoint, Range, and Units in menu 6
5. Disable the Level Contact by installing a jumper in it



#	CHART 1 EVENTS
1	System started with tank empty. Pump starts filling tank. Burner is off and system is waiting on level input because 4-20mA level input is below the low setpoint.
2	Tank level rises above low setpoint. System begins running (heating tank).
3	Tank level rises above the high setpoint, the pump turns off and the remote alarm turns on to signal a truck to come and empty the tank.
4	An operator arrives on site and begins emptying the tank into a tanker truck. The pump turns back on and the alarm turns off.
5	The tank level drops below the low setpoint and the level delay timer begins counting down.
6	The level delay timer reaches zero after 2 or 20s (depending on the "Pressure/Level Delay" setting) and the system stops heating the tank and returns to the "Waiting on Level" state.
7	The tank is empty and the tanker truck leaves the site. The tank level begins rising again.

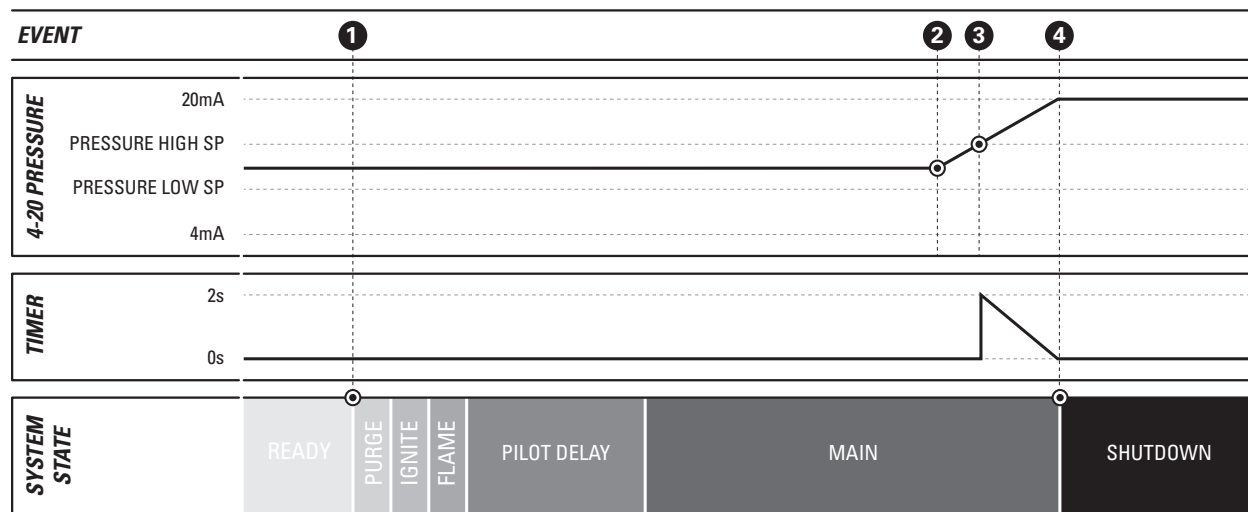
## 4-20MA PRESSURE INPUT

The 4-20 Pressure Input is used to monitor fuel train pressure in the same way as the Pressure Contacts. The behavior and features are identical to those described in the previous [Low Pressure Contact](#) and [High Pressure Contact](#) sections. The difference is that a Pressure Transmitter is used instead of a pair of Pressure Switches and the setpoints are set via a menu instead of mechanically on the switches. When the 4-20 signal is below the low setpoint or above the high setpoint, the system will stop. When it is between the two setpoints, it will run. It can be setup to restart from a low event but not from a high event.

### To use the 4-20 Pressure Input, it must be setup as follows:

1. Attach a properly calibrated Pressure Transmitter to the 4-20 Pressure Input
2. Enable the Pressure DIP Switch on the 4-20 Card
3. Enable the 4-20 Card in menu 6
4. Set the Pressure Low Setpoint, High Setpoint, Range, and Units in menu 6
5. Disable the Low Pressure and High Pressure Contacts by installing a jumper in each of them

Chart 1: Pressure Increases While Running



#	CHART 1 EVENTS
1	System started by user with pressure between low and high setpoints.
2	Pressure regulator fails while the mains are turned on. Pressure begins increasing.
3	Pressure exceeds High Setpoint. High pressure timer begins counting down.
4	Pressure continues to climb. After 2s, system shuts down.



Chart 2: Pressure High From Start

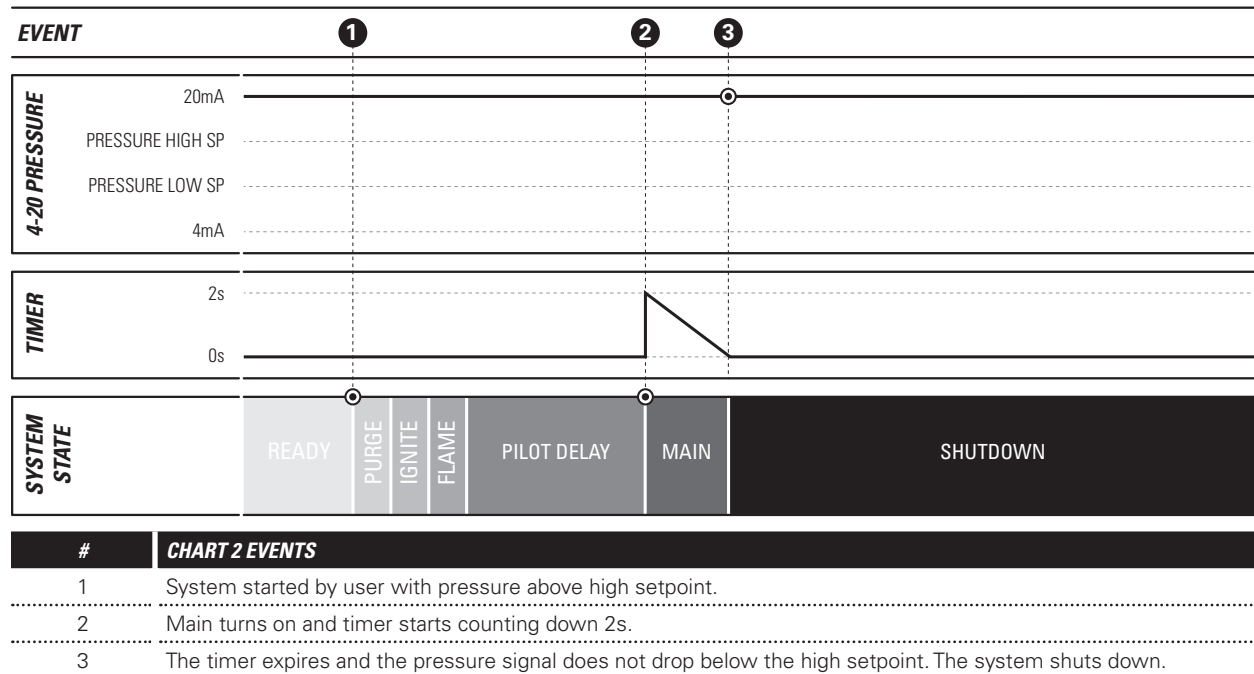


Chart 3: Pressure High On Start But Clears When Main Opens

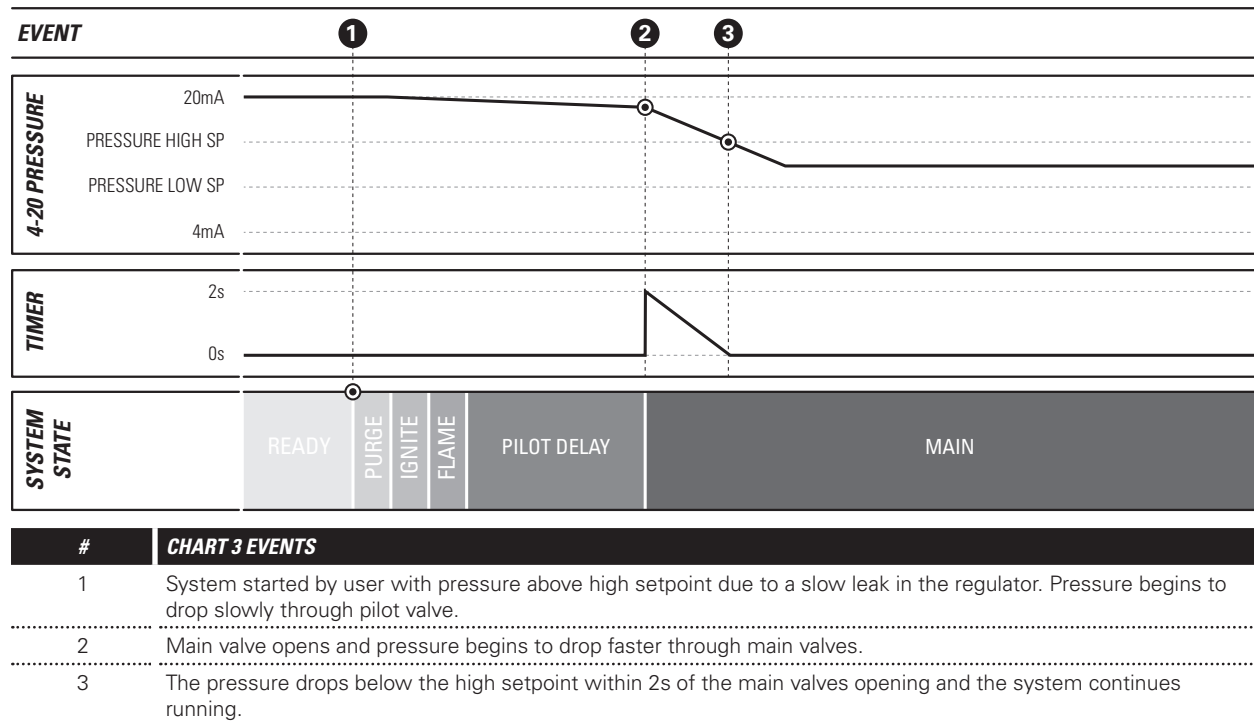


Chart 4: Auto Restart = Enabled

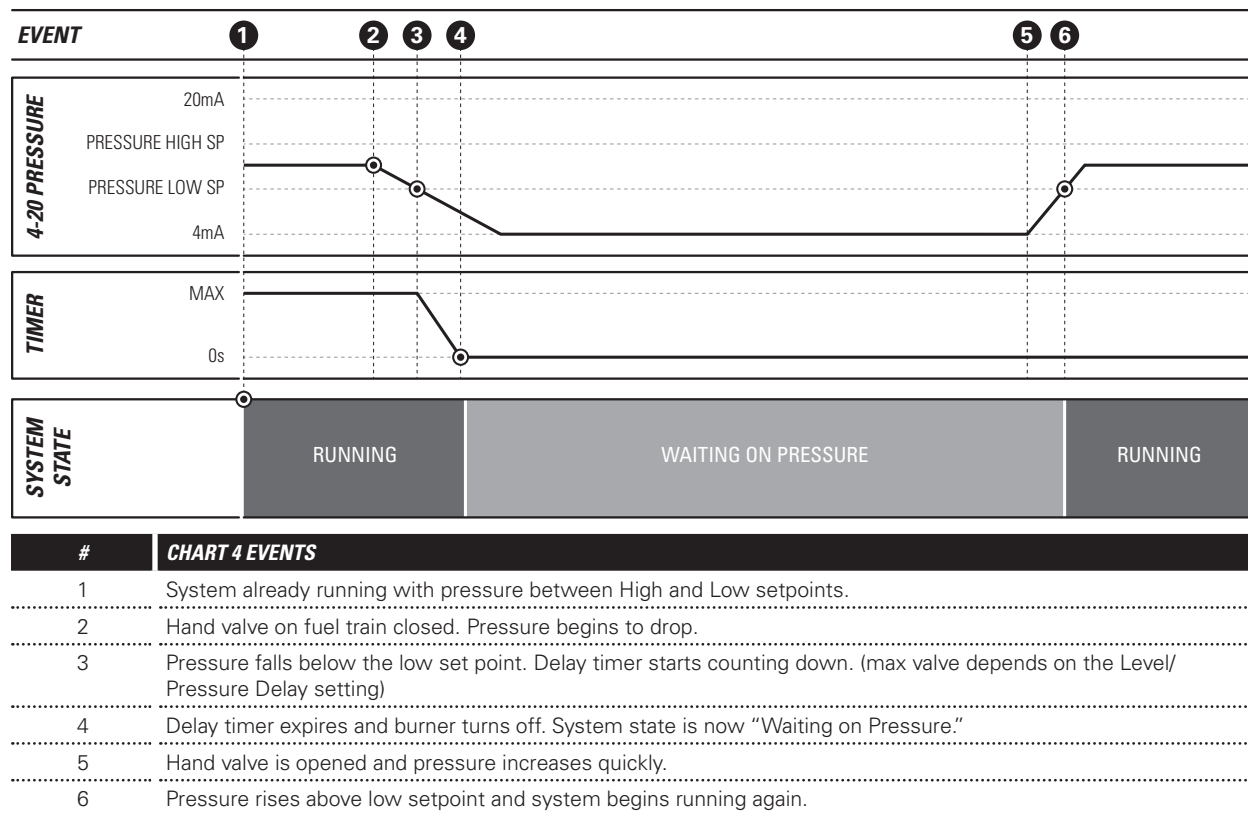
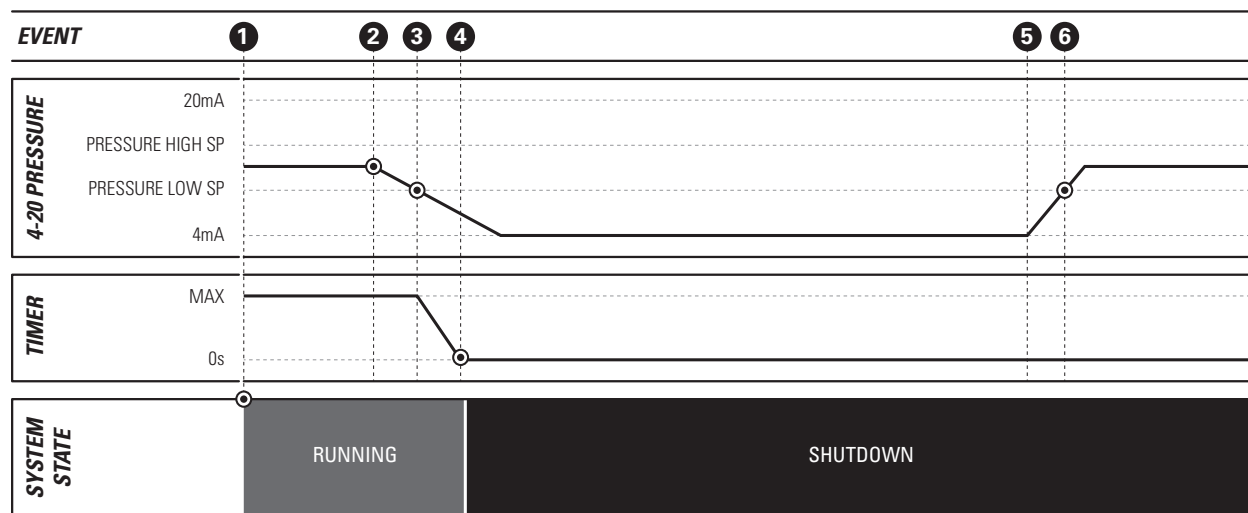


Chart 5: Level Event Restart = Disabled



#	CHART 5 EVENTS
1	System already running with pressure between High and Low setpoints.
2	Hand valve on fuel train closed. Pressure begins to drop.
3	Pressure falls below the low set point. Delay timer starts counting down. (max valve depends on the Level/Pressure Delay setting)
4	Delay timer expires and system shuts down.
5	Hand valve is opened and pressure increases quickly.
6	Pressure rises above low setpoint but system does not restart and remains shut down.

#### 4-20MA TEMPERATURE OUTPUT

If the 4-20mA Output is not being used to control a proportional valve, it can be configured to output the process temperature encoded as a 4-20mA signal. This is useful if a PLC on site needs to know the process temperature. In this case, wire the PF2100's 4-20mA Output to a PLC's 4-20mA Input. Note that the PF2100 provides the loop power. The PLC resistance is expected to be in the range of 120 Ohms and 250 Ohms.

The 4-20mA output signal will be scaled such that 4mA represents OC and 20mA represents HT ESD Setpoint.



## 5.2 | Modbus Expansion Card

An optional Modbus Expansion Card can be installed in the PF2100 which provides the following additional features:

### REMOTE MONITORING

This card allows for remote monitoring of the PF2100 status including process temperature, auxiliary temperature, and 4-20mA Input Card status (if installed).

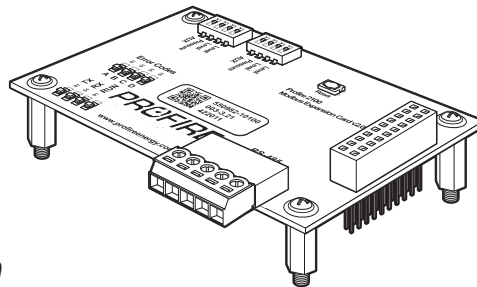
### REMOTE START / STOP

This card can also be used to remotely start and stop the system and to adjust some setpoint values.

### REMOTE SETPOINT ADJUSTMENT

This card can be used to remotely adjust some setpoints such as High Fire, Low Fire, and Pilot Off setpoints. Note that these settings are not stored in memory. If the system is powered off and then on again, these settings will revert back to the last values entered directly using the keypad.

Refer to the “Modbus Expansion Card Manual” for further details on installation and operation of this card.



## MODBUS EXPANSION CARD

Some PF2100 models come with this card pre-installed.

### MODBUS EXPANSION CARD SETTINGS

This setting applies to the Modbus Expansion Card which must be installed in the PF2100's expansion slot.

#### Modbus Enable/Address (menu 6)

The Modbus Card is disabled by setting the address to zero and enabled by setting the address to any non-zero value. The address is shown on the display as a decimal number which can be set to any value in the range of 1 to 254. This corresponds to hexadecimal values 0x01 to 0xFE.



# 6 | TROUBLESHOOTING

This section is designed to help you troubleshoot the PF2100. A list of common issues and solutions, reference tables containing Shutdown Messages, Alarm Codes, and Warning Messages, and step-by-step guides for troubleshooting specific issues are included in this section.

If you are having trouble with your PF2100 System, please consult the following resources in this order:

1. Consult this section for solutions to see if one matches your needs.
2. Consult the support section of our website at [www.profireenergy.com](http://www.profireenergy.com).
3. Contact us on our support line at 1-855-PRO-FIRE (776-3473).

## 6.1 | Common Issues & Solutions

Under each issue is a list of possible solutions.

### EXPANSION CARDS

#### **Cannot Write Setpoints via Modbus**

1. Check that the system has the latest firmware. Firmware older than v1.8.005 did not support this feature.
2. Check that the Modbus Card has the latest firmware. Firmware older than v4.0 did not support this feature.

### FLAME DETECTION

#### **System Has Visible Flame But Cannot Detect It**

1. The flame rod, pilot assembly and the gap between them should be fully engulfed in flame. If not, adjust the rod positioning.
2. Check that the flame detection wiring does not exceed the recommended maximum length.
3. Check that the Ion+ wire is securely connected as per the appropriate wiring diagram.
4. Check that the ground connection between the PF2100 and the pilot assembly is secure.
5. Put the PF2100 into Manual Mode and use the Review Menu to check the flame quality level.
6. Consult the instructions in the Flame Detection Troubleshooting Guide for further details on Flame Detection.

## SHUTDOWN

### **System Shuts Down with a High/Low Voltage Message Shutdown**

1. Make sure that the system voltage setting matches the power supply's nominal voltage.
2. Check that the system has the latest firmware. Firmware older than v1.8.005 was prone to shutdown on transient voltage spikes and dips.
3. Make sure that some other load is not causing the supply to drop periodically. Remove other devices from the supply or, monitor the supply voltage with a data logger.
4. Make sure the power supply is rated appropriately for the valves and other peripheral devices attached to the PF2100.

### **System Shuts Down On High Temperature ESD**

1. Check that the HT ESD setpoint is not set too close to the operating temperature of the system. Measurement accuracy and process control overshoot can cause the system to shutdown if they are too close.

### **System Shuts Down On an Open TC Error**

1. Check the thermocouple connections inside the PF2100. Note that both the Process and High Temp thermocouples are required.
2. Check for breaks in the thermocouple wiring.

### **System Shuts Down On TCS Not Being Equal**

1. Press the Up and Down arrows together.
2. Press the Up arrow until you get to a screen with 4 temperature readings, DH, TH, TP and TA.
3. If the TH and TP readings are close but DH is different, follow these steps:
4. Go to the calibration menu.
5. Step through the menu to Cal High Temp = xxxC.
6. Press the Up arrow once.
7. Press OK.
8. Go back to the screen with the temperature readings and make sure the issue is corrected.

## SOLAR POWER

### **Solar Output Voltage is 12V when 24V is Expected**

1. Check solar panel wiring. They should be wired in parallel rather than in series.

### **Expected Battery Life is Not Achieved**

1. The PF2100 is not set up by default to use low power valves with a PWM setting of 20%.
2. The PF2100 is not set up to put the display to sleep when not in use.
3. The solar panel is undersized.
4. The solar panel is shaded or not located in full sun.



### **The Battery is Not Being Charged at All**

1. Check the Solar Charger for damage or defective parts. Look for flashing error codes on the controller's LEDs.
2. The solar panel is undersized.
3. The solar panel is shaded or not located in full sun.
4. The battery is defective.

## **SOLENOIDS**

### **Valves Are Not Opening**

1. Check if the positive and negative wires are reversed.
2. Make sure that each valve has a separate negative return wire connected to the correct terminal. A common ground wire cannot be used and will not work.
3. Check if the proper PWM setting is used for each valve.
4. Check if the valve voltage ratings match the system voltage (12V or 24V).

### **System Shuts Down With Terminal Card Command Refused, Master Power, Solenoid Feedback.**

Check the solenoid wiring to make sure that no wires are crossed and that separate return wires are used for each valve.

## **STATUS CONTACT**

### **Status Contact Opens but System Continues To Run**

Check that the system has the latest firmware. Some firmware versions older than v1.8.005 had a bug that might lead to this under certain circumstances. If you can't update your firmware immediately, repositioning the flame rod so that it is more fully immersed in the flame can lessen the occurrence of this issue.

### **Status Contact Remains Closed Even When The System is Stopped**

The status contacts are polarity sensitive. Try reversing the Status+ and Status- wires.

### **Status Contact Never Closes**

The current or voltage ratings on the status contact may have been exceeded. Verify that you are not exceeding these ratings. If the ratings were exceeded, check the terminal Card HW version to determine the appropriate solution. (v1.6: Replace the Terminal Card.) (v1.7: Replace the Status Contact Fuse on the Terminal Card.)

## **THERMOCOUPLES**

### **Thermocouple Readings are Bouncing**

1. Verify that the Valve PWM Settings are correct for the valves

being used. Using incorrect settings for a valve can result in more noise than necessary. The lowest noise will result when the PWM setting is set to 20% for low power valves and 100% for regular valves.

2. Verify that proper system grounding is in place. Especially check that all solenoids are connected to earth ground.

### Thermocouple Readings are Incorrect

1. Check if the thermocouple wiring polarity is reversed. Yellow should be connected to positive, and red to negative.
2. Check that no thermocouple pairs are crossed (ie, positive from one TC paired with negative from another TC).
3. Make sure that only Type-k thermocouple wire and connectors are used. Even small sections of other types of wire can significantly disrupt the measurement.
4. If a head connection is used, verify that none of the above wiring issues exist there either.
5. Check if the thermocouple is defective by trying a different thermocouple that is known to be good or by connecting the suspect thermocouple to a process calibrator.
6. Check that the PF2100 is in proper calibration using a process calibrator. If not, recalibrate the system.

## 6.2 | Shutdown Messages

The following is a list of messages that may flash on the PF2100 display after the system has shutdown. Typically, the word "SHUTDOWN" in large text will flash alternately with one of the messages below. These messages indicate the reason that the system last shutdown and can be cleared by pressing the OK key (except where noted). Use the table below to determine the meaning of these messages. This table is organized alphabetically.

ON SCREEN	DESCRIPTION	POSSIBLE SOLUTIONS
Ambient Temps Not Equal	The Ambient Temperature read by the Door Card does not match the one reported by the Terminal Card.	The door card and terminal card are different temperatures. Check to see if one board is being heated by an external source such as direct sun on the door or being mounted on a hot tank.
Aux High Temp	Aux Temp Mode is set to "Temp ESD" and the Auxiliary Temperature exceeded the High Temp ESD Setpoint.	Verify proper settings and check for issues outside the system.
Aux Thermocouple Error	The Auxiliary Thermocouple is open.	Check wiring.
Comparison Setpoints	One of the Setpoints in the Door Card does not match the corresponding value in the Terminal Card.	Reset system to factory defaults.
Comparison: C_byte x y	The Door Card's internal control byte (x) did not match the Terminal Card's internal status byte (y).	Remove solenoid wires; if the problem is resolved check the solenoid wiring. If the problem remains the same, the boards or ribbon cable may need to be replaced.



<b>ON SCREEN</b>	<b>DESCRIPTION</b>	<b>POSSIBLE SOLUTIONS</b>
Comparison: ESD DC:xxx TC:xxx	The Door Card and Terminal Card do not agree on the state of the ESD Contact. "xxx" will be either "ON" or "OFF".	Remove ESD wires and jumper the terminals, if the problem is resolved check the wiring. If the problem remains the boards or ribbon cable may need to be replaced.
Comparison: LVL DC:xxx TC:xxx	The Door Card and Terminal Card do not agree on the state of the Level Contact. "xxx" will be either "ON" or "OFF".	Remove ESD wires and jumper the terminals, if the problem is resolved check the wiring. If the problem remains the boards or ribbon cable may need to be replaced.
Comparison: MAN DC:xxx TC:xxx	The Door Card and Terminal Card do not agree on the state of the Main Valve Output. "xxx" will be either "ON" or "OFF".	Remove solenoid wires; if the problem is resolved check the solenoid wiring. If the problem remains the same, the boards or ribbon cable may need to be replaced.
Comparison: PLT DC:xxx TC:xxx	The Door Card and Terminal Card do not agree on the state of the Pilot Valve Output. "xxx" will be either "ON" or "OFF".	Remove solenoid wires; if the problem is resolved check the solenoid wiring. If the problem remains the same, the boards or ribbon cable may need to be replaced.
Comparison: PoC DC:xxx TC:xxx	The Door Card and Terminal Card do not agree on the state of the Proof of Closure Contact. "xxx" will be either "ON" or "OFF".	Remove ESD wires and jumper the terminals, if the problem is resolved check the wiring. If the problem remains the boards or ribbon cable may need to be replaced.
Comparison: PRH DC:xxx TC:xxx	The Door Card and Terminal Card do not agree on the state of the High Pressure Contact. "xxx" will be either "ON" or "OFF".	Remove ESD wires and jumper the terminals, if the problem is resolved check the wiring. If the problem remains the boards or ribbon cable may need to be replaced.
Comparison: PRL DC:xxx TC:xxx	The Door Card and Terminal Card do not agree on the state of the Low Pressure Contact. "xxx" will be either "ON" or "OFF".	Remove ESD wires and jumper the terminals, if the problem is resolved check the wiring. If the problem remains the boards or ribbon cable may need to be replaced.
Comparison: STRT DC:xxx TC:xxx	The Door Card and Terminal Card do not agree on the state of the Start Contact. "xxx" will be either "ON" or "OFF".	Remove ESD wires and jumper the terminals, if the problem is resolved check the wiring. If the problem remains the boards or ribbon cable may need to be replaced.
Control Error	The Internal Control State is not valid.	One of the boards will likely need to be replaced.
DC MSP430 No Communications	The TC430 Temperature chip on the Door Card is not responding.	Faulty Door Card
EEPROM Error	The EEPROM settings are corrupted.	Faulty Door Card
ESD Input	The ESD Input was open while the system was running or attempting to start.	Check wiring.
Expansion Card Error / 4-20 Exp Card: 4-20 Level Low	The 4-20mA Level Input was below the Level Low Setpoint while the system was running with the Level Event Restart feature disabled.	Verify proper settings and check for issues outside the system.
Expansion Card Error / 4-20 Exp Card: 4-20 Level Open	The 4-20mA Level Input is open (reading below ~ 3.75mA)	Check wiring.
Expansion Card Error / 4-20 Exp Card: 4-20 PRS High	The 4-20mA Pressure Input was above the Pressure High Setpoint while the system was running with the Main Valve open.	Verify proper settings and check for issues outside the system.
Expansion Card Error / 4-20 Exp Card: 4-20 PRS Low	The 4-20mA Pressure Input was below the Pressure Low Setpoint while the system was running with the Auto Restart feature disabled.	Verify proper settings and check for issues outside the system.
Expansion Card Error / 4-20 Exp Card: 4-20 PRS Open	The 4-20mA Pressure Input is open (reading below ~ 3.75mA)	Check wiring.
Expansion Card Error / 4-20 Exp Card: Card Fail	The 4-20mA Expansion Card is not responding.	This may indicate that the card is not installed correctly or that the feature is enabled when the card is not present.

<b>ON SCREEN</b>	<b>DESCRIPTION</b>	<b>POSSIBLE SOLUTIONS</b>
Expansion Card Error / Modbus Card: Card Fail	The Modbus Expansion Card is not responding.	This may indicate that the card is not installed correctly or that the feature is enabled when the card is not present.
Flame detected before start	Flame was detected prior to the system igniting the pilot.	This may indicate a leaky valve, inadequate purge time, or a faulty Terminal Card.
Flame Fail	The system failed to ignite the pilot within the allocated number of retry attempts.	See the Flame Detection Troubleshooting section.
Flame Rod Test Error / Adjust Flame Rod Position	The Flame Rod or associated wiring may be shorted to ground thus preventing it from properly detecting flame.	If the error shows up immediately and does not allow you to start the system, remove the 4 pin terminal block to the ignition coil and try starting again. If you can start the system, there is a wiring problem. If you cannot start the system, one of the boards or the ribbon cable may be faulty.  If the system runs for a while and then shuts down with this error after a random amount of time, the problem is that the flickering of the flame is lining up with the internal self test. Usually moving the rod more into the flame will resolve this issue.
High Pressure	The High Pressure Contact remained open for more than 2s after the main valve opened. This error can also be triggered by the 4-20 Input Card if the Pressure reading remains above the 4-20 Pressure High Setpoint for 2s after the main valve opened.	Verify proper settings and check for issues outside the system.
High Temp	The Process Temperature rose above the High Temp ESD Setpoint.	Verify proper settings and check for issues outside the system.
High Temp Setpoint Mismatch	The Door Card and Terminal Card do not agree on the value of the High Temp ESD Setpoint.	Reset to factory defaults.
High Voltage xx.x Volts	The system voltage remained above the High Voltage Alarm point for 20s or more and Auto Restart is disabled. "xx.x" is the voltage reading at the point in time when the shutdown occurred.	Verify proper settings and check for issues outside the system.
HT Thermocouple Error	The High Temp Thermocouple is open.	Check wiring.
Ignite Key Stuck	The Ignite Key was held for more than 30s while in manual mode.	Check for mechanical failure of the key.
Key Stuck Error / xxxx	One of the keypad keys was stuck at System Startup. The particular key stuck will be displayed in place of xxxx and will be one of the following:  DOWN, IGN, MAIN, MODE, OK, PLT, MENU, STOP, UP	This may indicate a defective keypad. This error must be resolved in order to continue using the system.
Level Input	The Level Contact is open and "Level Event Restart" is set to "Off". This error can also be triggered by the 4-20 Input Card if the Level reading is below the 4-20 Level Low Setpoint and "Level Event Restart" is set to "Off"	Verify proper settings and check for issues outside the system.
Low Pressure	The Low Pressure Contact is open and "Auto Restart" is set to "Off". This error can also be triggered by the 4-20 Input Card if the Pressure reading is below the 4-20 Pressure Low Setpoint and "Auto Restart" is set to "Off".	Verify proper settings and check for issues outside the system.



<b>ON SCREEN</b>	<b>DESCRIPTION</b>	<b>POSSIBLE SOLUTIONS</b>
Low Voltage xx.x Volts	The system voltage remained below the Low Voltage Alarm point for 20s or more and "Auto Restart" is set to "Off" "xx.x" is the voltage reading at the point in time when the shutdown occurred.	Verify proper settings and check for issues outside the system.
Master Power Error	The Master Power switch to the powered valve outputs was in the wrong state.	Remove all valve wires and run the system. If the problem resolves, there is a wiring issue with the solenoids. If the problem remains, the Terminal Card is likely damaged. Check the solenoid connections for shorts to ground or across the terminals before installing a new board.
Modbus Card: Shutdown	The system shut down because a remote shutdown command was received via Modbus.	Check the data being sent through the Modbus connection.
Modbus Card: Shutdown / Remote Cmd Error	The system received an undefined command from the Modbus Expansion Card.	Check the data being sent through the Modbus connection.
Pilot Key Stuck	The Pilot Key was held for more than 30s while in manual mode.	Check for mechanical failure of the key.
Pro Thermocouple Error	The Process Thermocouple is open or shorted.	Check wiring.
Proof of Closure / Should be Closed	The Proof of Closure Contact was detected to be Open when it was not expected to be.	This may indicate a faulty valve or wiring.
Purge Values Mismatch	The Door Card and Terminal Card do not agree on the value of the Purge Time Setting.	Reset to factory defaults.
Run CRC Error	Main Program Memory CRC Error	Reset to factory defaults.
Solenoid Feedback Error / Check Solenoid Wiring	The solenoids were observed to have a state opposite to the one being driven by the PF2100.	Remove all valve wires and run the system. If the problem resolves, there is a wiring issue with the solenoids. If the problem remains, the Terminal Card is likely damaged. Check the solenoid connections for shorts to ground or across the terminals before installing a new board.
System Error	Illegal Process Control or Display State	Reset to factory defaults.
Terminal Card Ambient Fail	The Terminal Card could not measure the ambient temperature. The Door Card failed to detect this.	Reset to factory defaults. Likely a faulty terminal card.
Terminal Card Command Refused	The Terminal Card received a valid command from the Door Card but the command was refused because it would result in an invalid or unsafe state. The Door Card failed to detect this.	Remove all valve wires and run the system. If the problem resolves, there is a wiring issue with the solenoids. If the problem remains, the Terminal Card is likely damaged.
Terminal Card Communication	The Terminal Card is not communicating with the Door Card. This may indicate a faulty ribbon cable or incompatible firmware. The Door Card failed to detect this.	Make sure the ribbon cable is properly installed. Likely a fault with door, ribbon or terminal.
Terminal Card High TC Grounded	The Terminal Card detected that the High Temp Thermocouple was shorted to ground. The Door Card failed to detect this.	Check for continuity from the high temp TC to ground. If there is no connection remove the thermocouple and replace it with a jumper. If the problem persists it is likely a door or terminal card fault.
Terminal Card High Temp Alarm	The Terminal Card detected that the High Temp Thermocouple exceeded the High Temp ESD Setpoint. The Door Card failed to detect this.	Check for continuity from the high temp TC to ground. If there is no connection remove the thermocouple and replace it with a jumper. If the problem persists it is likely a door or terminal card fault.



<b>ON SCREEN</b>	<b>DESCRIPTION</b>	<b>POSSIBLE SOLUTIONS</b>
Terminal Card Reciprocal Comp	The Terminal Card detected that the Door Card status or High Temp ESD Setpoint did not match. The Door Card failed to detect this.	Reset to factory defaults. Remove all wires but power, install default jumpers. If the problem persists there is likely a problem with the one of the boards.
Terminal Card Shutdown Detect	The Terminal Card detected an alarm condition. The Door Card failed to detect this.	Reset to factory defaults. Remove all wires except power; install default jumpers. If the problem persists there is likely a problem with the one of the boards.
Terminal Card Voltage Sense	The Terminal Card detected that the system voltage was outside of allowable limits. The Door Card failed to detect this.	Reset to factory defaults. Remove all wires except power; install default jumpers. If the problem persists there is likely a problem with the one of the boards.
Thermocouples Not Equal / Check Wiring	The High Temp and Process Thermocouples are reading temperatures that are too far apart.  This may indicate a failed thermocouple or improper wiring.	Check thermocouple readings with dry block or process calibrator.
User Stop	The user pressed the Stop key on the keypad.	

## 6.3 | Alarm Codes

The following is a list of alarm codes that may show on the Alarm screen of the PF2100 display. These codes indicate a persistent problem that must be cleared before the system can be restarted. Use the table below to determine the meaning of these codes.

<b>ON SCREEN</b>	<b>DESCRIPTION</b>	<b>POSSIBLE SOLUTIONS</b>
4-20Lvl	The 4-20 Input Card's Level Input is reading a value below the 4-20 Level Low Setpoint and "Level Event Restart" is set to "Off".	Verify proper settings and check for issues outside the system.
4-20Prs	The 4-20 Input Card's Pressure Input is reading a value below the 4-20 Pressure Low Setpoint and "Auto Restart" is set to "Off".	Verify proper settings and check for issues outside the system.
AuxTC	The system is in a mode that requires the Aux Thermocouple and the Aux Thermocouple is open or otherwise wired incorrectly.	Check wiring.
DC_TC	The TC430 temperature sensor on the Door Card is not responding.	
ESD_Inp	The ESD Contact is Open.	Check wiring.
FlmTest	There is a problem with the Flame Detection wiring or circuitry.	Check wiring.
PoC_Inp	The Proof of Closure contact is open.	Check wiring.
HiVolt	The system voltage is above the High Voltage Alarm point.	Verify proper settings and check for issues outside the system.
HT_ESD	The Process Temperature is above the High Temp ESD Setpoint.	Verify proper settings and check for issues outside the system.



<b>ON SCREEN</b>	<b>DESCRIPTION</b>	<b>POSSIBLE SOLUTIONS</b>
HT_TC	The High Temp Thermocouple is open or otherwise wired incorrectly.	Check wiring.
LoVolt	The system voltage is below the Low Voltage Alarm point.	Verify proper settings and check for issues outside the system.
LowPrs	The Low Pressure Contact is Open or the 4-20mA Expansion Card's Pressure Input is reading a value below the 4-20 Pressure Low Setpoint. In either case, "Auto Restart" is set to "Off"	Verify proper settings and check wiring.
Lvl_Inp	The Low Level Contact is Open or the 4-20mA Expansion Card's Level Input is reading a value below the 4-20 Level Low Setpoint. In either case, "Level Event Restart" is set to "Off"	Verify proper settings and check wiring.
MbusErr	The Modbus Card is not responding.	This may indicate that it is not installed correctly or that it is enabled when not present at all.
ProcTC	The Process Thermocouple is open or otherwise wired incorrectly.	Check wiring.
RemShut	Modbus Shutdown Command Received	Check the data being sent through the Modbus connection.
Sys_Err	System Error – The Terminal Card is not communicating with the Door Card.	This may indicate a faulty ribbon cable or incompatible firmware.
TC_MM	The High Temp and Process Thermocouples are reading temperatures that are too far apart.  This may indicate a failed thermocouple, improper wiring, or a damaged Door or Terminal Card.	Check thermocouple readings with dry block or process calibrator.
Val_MM	The Door and Terminal Card's setpoints do not match.	Reset to factory defaults.

## 6.4 | Warning Messages

The following is a list of warning messages that may flash periodically on the PF2100 display. These messages indicate a problem that may be developing or a condition from which the system may automatically restart once cleared. Use the table below to determine the meaning of these messages.

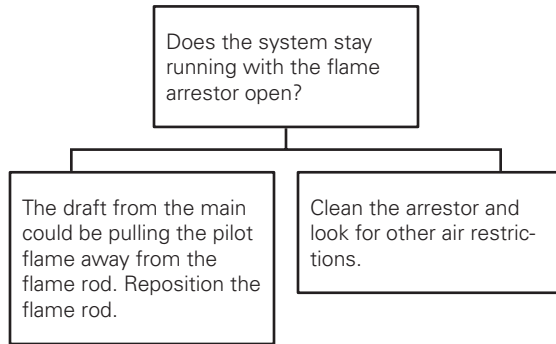
<b>ON SCREEN</b>	<b>DESCRIPTION</b>
Check all settings / Other settings have changed	A major process control setting was changed and the process control setpoints were reset to factory defaults. This includes the High Temp ESD Setpoint, the Pilot Off Setpoint, the Low Fire Setpoint, the Process Setpoint, the Low Temp Alarm Setpoint, the Deadband setting, and the Aux Setpoint.
Hi Volt Warning	The system voltage is getting close to the High Voltage Alarm threshold and may stop or shutdown soon.
High Prs Warning	The High Pressure Contact is open or the 4-20 Pressure Input is above the 4-20 Pressure High Setpoint. The contact must be closed shortly after the main valve opens and the 4-20 Pressure is below the setpoint or the system will shutdown.
LO Volt Warning	The system voltage is getting close to the Low Voltage Alarm threshold and may stop or shutdown soon.
Low Temp Alarm	The process temperature is below the Low Temp Alarm Setpoint and the Status Contact is Open.
Unit restarted from LVL event	The system has recently restarted from a Level event. Press OK to clear this message.
Unit restarted from PRS event	The system has recently restarted from a Low Pressure event. Press OK to clear this message.
Unit restarted from VLT event	The system has recently restarted from a Low or High Voltage event. Press OK to clear this message.
Waiting: 420 LVL	The system will automatically restart once the 4-20 Input Card's Level Input rises above the Low Setpoint.
Waiting: 420 PRS	The system will automatically restart once the 4-20 Input Card's Pressure Input drops below the High Setpoint.
Waiting: HiVolt	The system will automatically restart once the system voltage falls below the High Voltage Alarm Threshold.
Waiting: LoVolt	The system will automatically restart once the system voltage rises above the Low Voltage Alarm Threshold.
Waiting: Low PRS	The system will automatically restart once the Low Pressure Contact is closed.
Waiting: LVL	The system will automatically restart once the Level Contact is closed.
Waiting:STRT Inp	The system will automatically restart once the Start Contact is closed.



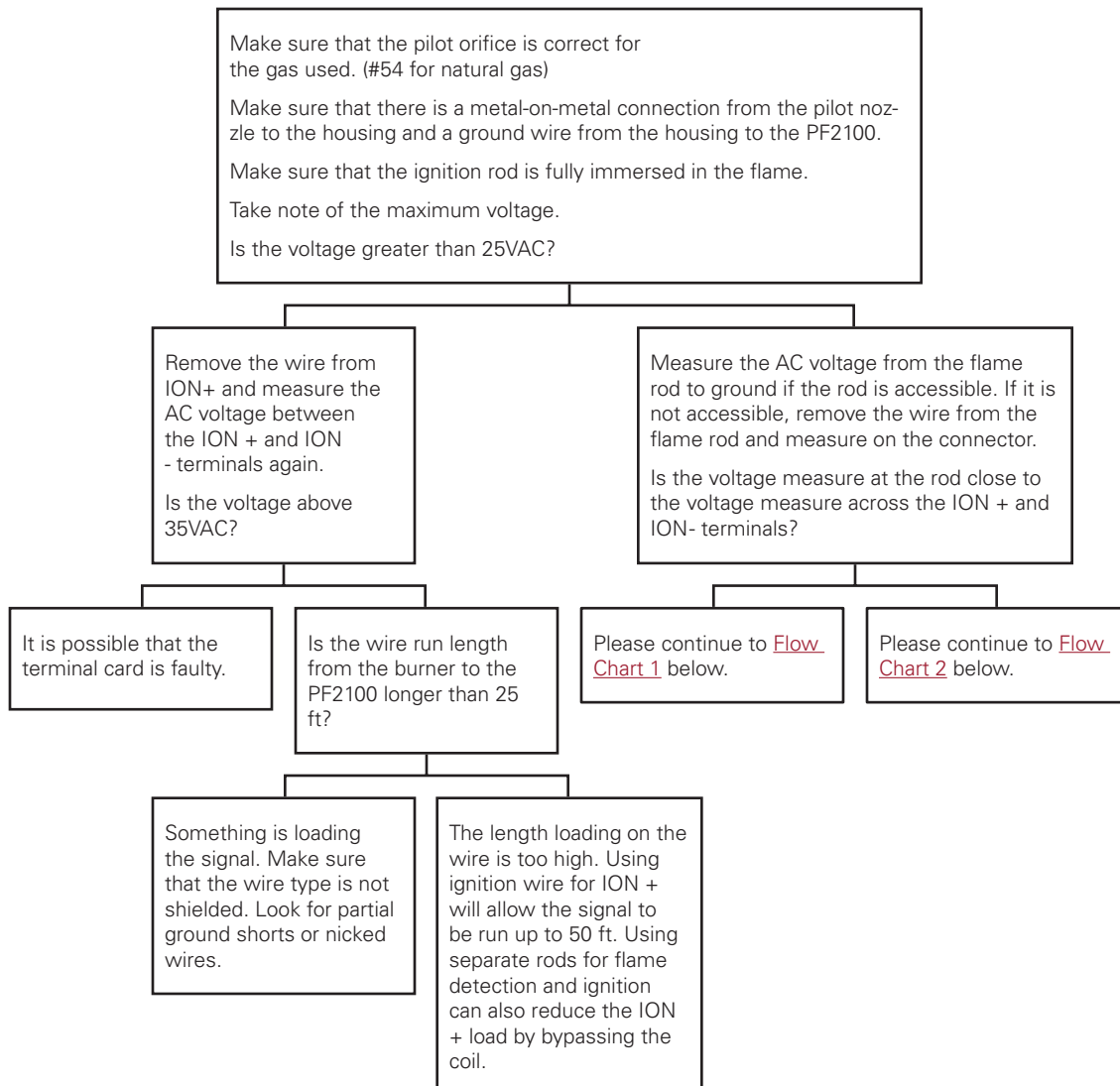
## 6.5 | Flame Detection Troubleshooting Guide

### SYSTEM IS NOT DETECTING FLAME.

The flame quality drops from 100% (pilot) when the main comes on.

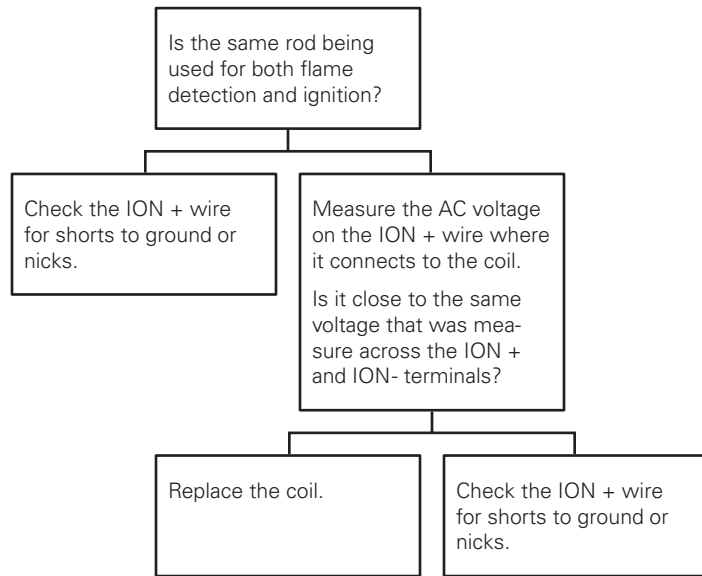


Flame quality remains 100% (pilot) when the main comes on.

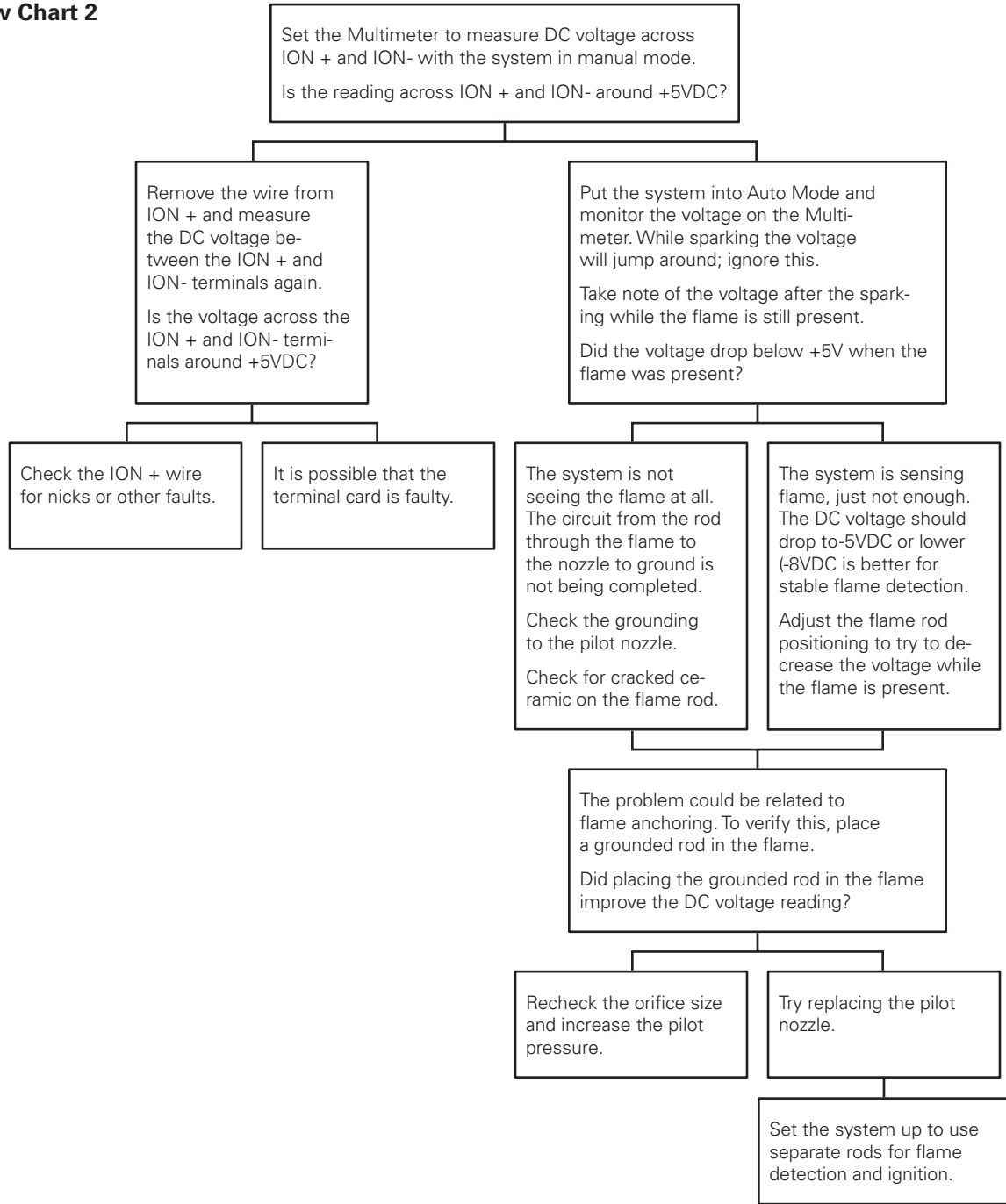


---

**Flow Chart 1**

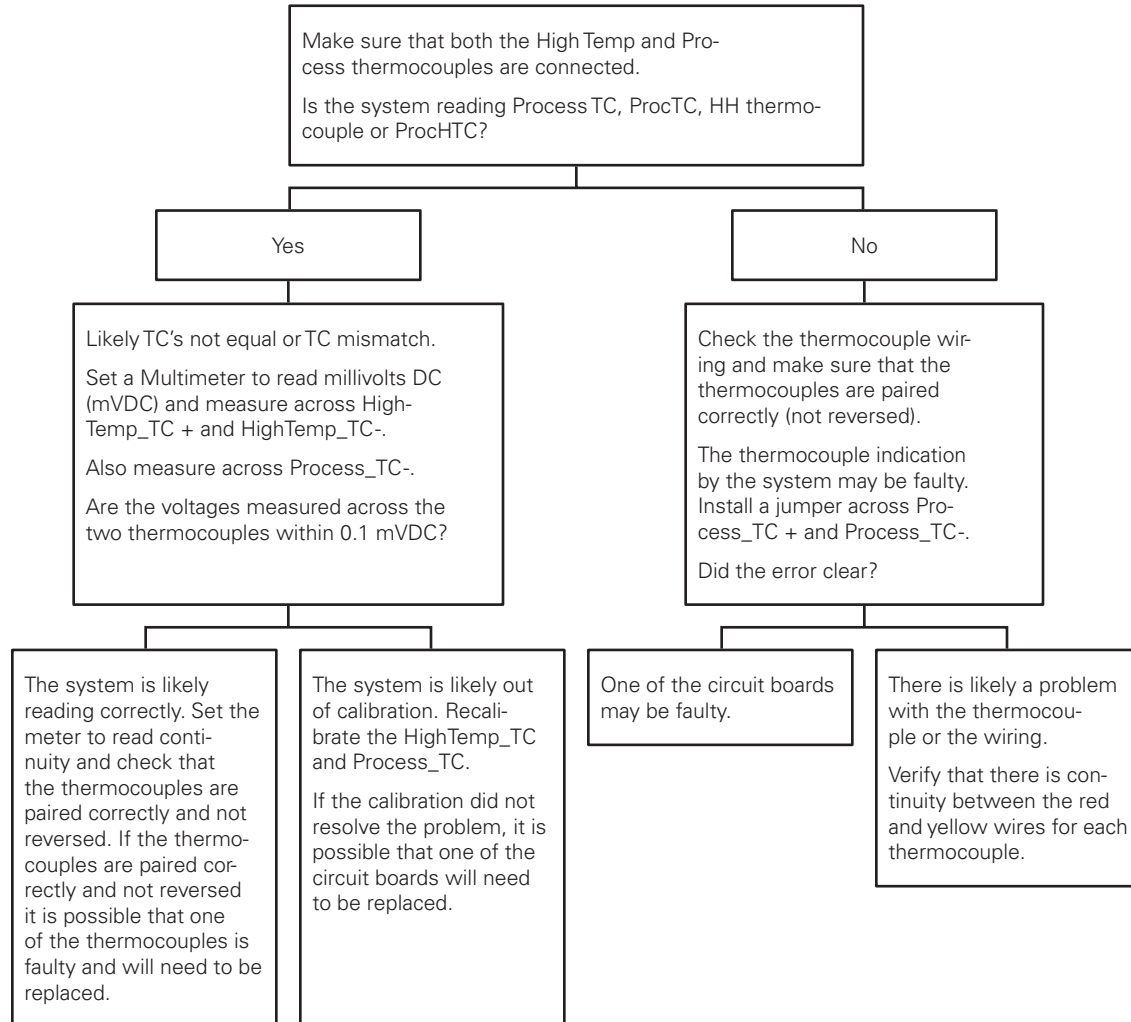


**Flow Chart 2**



## 6.6 | Thermocouple Troubleshooting Guide

Problem with Thermocouples.



# APPENDICES

## A | PID Tuning Procedure

The PF2100's default PID settings should result in good temperature control in most common heater applications. If the temperature control is unstable or if faster control response is needed, the following procedure can be followed to adjust the PID settings. This procedure is not a comprehensive method for adjusting PID Controllers but provides some general guidelines. This procedure is iterative and therefore may require a significant amount of time to follow.

### TUNE THE PROPORTIONAL BAND SETTING

1. Start with the Proportional Band Setting set to a large value such as 500% and with the Integral and Derivative settings set to their default values (4.0min/rst and 0.0min respectively).
2. Make a small step change (such as 5%) to the Process Setpoint and monitor the resulting temperature change.
3. Repeat decreasing the Proportional Band Setting in 50% steps until a Process Setpoint change results in overshoot of the Process Setpoint or until oscillation results.
4. Increase the Proportional Band Setting until overshoot and oscillation no longer occur.

### TUNE THE INTEGRAL SETTING

1. Set the Integral setting to 10min/rst.
2. Make a small change to the Process Setpoint and monitor the temperature change.
3. Repeat decreasing the Integral in ½ minute steps until a Process Setpoint change results in overshoot of the Process Setpoint or until oscillation results
4. Increase the Integral Setting until stable.

### TUNE THE DERIVATIVE SETTING

If there is noise on the thermocouple inputs, using the Derivative Setting can dampen the effects of the Proportional and Integral Settings. For this reason, the Derivative Setting can usually be left set at zero unless a very fast response is needed. If it is required, follow this tuning procedure:

1. Set the Derivative Setting to 10 minutes.
2. Decrease the Derivative Setting until a small Process Setpoint change results in a fast response with some oscillation
3. Increase the Derivative Setting until the oscillation in response to a Process Setpoint change is dampened



## B | Field Calibration

It is possible to field calibrate the thermocouples, the 4-20mA Output, and the two 4-20mA Inputs on the 4-20mA Expansion Card. In general, it should not be necessary to do this in the field because the system has already been calibrated at the factory. However, there are circumstances where this may be necessary such as if the door or terminal card was replaced in the field or if the system is very old and has drifted out of calibration. Before recalibrating the system, it is strongly recommended that you explore all other possible solutions first. Be sure to verify that system settings are correct and that the devices attached to the system are calibrated correctly. If it is deemed necessary to proceed with recalibrating the PF2100, follow the procedures below carefully. Failure to perform the calibration correctly may result in worse performance than if the system had been left alone.

The PF2100 uses a two-point calibration system to provide readings with greater accuracy than a single-point offset calibration. The first point compensates for any fixed offset in the system and the second point defines the slope. If the calibration fails for any reason, there is an option in the calibration menu to clear all calibration data.

### CALIBRATING THE THERMOCOUPLES

For thermocouples, the first calibration point is zero volts which corresponds to the ambient temperature of the terminal block where the thermocouple plugs into the Terminal Card. The second calibration point is referenced to a known temperature that is well above the ambient temperature. This temperature is typically the hottest temperature at which the system will operate but should not be higher than 1350°C and should not be lower than ambient + 20°C.

1. Make sure that the system is stopped.
2. Remove the 3 pairs of thermocouple wires (High Temp, Process, and Aux) from the P8 Pluggable Header on the Terminal Card.
3. Press the UP and Down Keys simultaneously to unlock the Calibration Menu (menu 7) and to show the temperature debug screen in the ready menu, which are normally hidden.
4. Short each pair of thermocouple inputs individually using a jumper or short piece of copper wire (ie, short HT+ to HT-, short Proc+ to Proc-, and short Aux+ to Aux-) and make note of the TH, TP, and TA temperature values show on the debug screen (press down or up on the ready screen until all temperatures are shown at once).
5. Reconnect the 3 pairs of thermocouple wires (High Temp, Process, and Aux) using the full length of wire used at the installation to the P8 Pluggable Header on the Terminal Card.
6. Set the High Temp, Process, and Aux thermocouples to a calibrated reference temperature equal to the temperature values read in step 4 using a dry block or other calibrated reference.
7. Press the Menu Key repeatedly until menu 7 is shown.
8. Press OK. If prompted, enter the L2 Password: ▲▼▲▲▼▲■
9. "Cal Proc TC Zero" will show on the display.
10. Press OK and the message "Calibrating Wait..." will appear on the display for about 5 seconds. Afterwards, the message "Parameter Saved" will show on the display briefly.
11. Press the Menu Key to go to the next item.
12. Repeat steps 10 and 11 for the "Cal HiTemp TC Zero" and "Cal



Aux TC Zero” menu items.

13. Set the High Temp, Process, and Aux thermocouples to a known reference temperature using a dry block or other calibrated reference. The reference temperature should be at least 20C above the ambient temperature and preferably close to the maximum planned operating temperature.
14. “Cal Proc TC Span” will show on the display.
15. Use the Up and Down Keys to adjust the temperature displayed on the PF2100 to match the temperature being applied to the thermocouple. Note that multiple key presses may be required before the temperature value on the display changes. This is because each key press is adjusting a fractional multiplication factor internal to the system.
16. Press OK and the message “Parameter Saved” will show on the display briefly.
17. Press the Menu Key to go to the next item.
18. Repeat steps 15-17 for the “Cal HiTemp TC Span” and “Cal Aux TC Span” menu items.
19. Press and hold the OK key for 3 seconds until the message “Password Logout” is displayed on the screen. The Calibration Menu is now hidden again.

NOTE: If using a dry block for calibration, make sure that the thermocouple is removed from the bath and inserted into the dry block long enough for the temperature reading to settle before executing the calibration. If a process calibrator is used, ensure that the thermocouple wire is inserted directly into the process calibrator to avoid extra sources of error and be aware that the length of wire within the thermocouple will not be accounted for, resulting in a less accurate calibration result.

## CALIBRATING THE 4-20mA OUTPUT

For the 4-20mA Output, the first calibration point is 4mA and the second calibration point is 20mA. You will need a current meter capable of measuring current to 0.1mA accuracy.

1. Make sure that the system is stopped.
2. Connect a current meter in series with the 4-20mA Output.
3. Set the current meter to a range setting that covers both 4mA and 20mA.
4. Press the UP and Down Keys simultaneously to unlock the Calibration Menu (Menu 7) which is normally hidden.
5. Press the Menu Key repeatedly until Menu 7 is shown.
6. Press OK. If prompted, enter the L2 Password:▲▼▲▲▼▲■
7. Press the Menu Key repeatedly until “Cal 4-20 Out Zero” is shown on the display.
8. Use the Up and Down Keys to adjust the output current until the current meter reads 4.0mA.
9. Press OK and the message “Parameter Saved” will show on the display briefly.
10. Press the Menu Key repeatedly until “Cal 4-20 Out Span” is shown on the display.
11. Use the Up and Down Keys to adjust the output current until the current meter reads 20.0mA.
12. Press OK and the message “Parameter Saved” will show on

the display briefly.

13. Press and hold the OK key for 3 seconds until the message "Password Logout" is displayed on the screen. The Calibration Menu is now hidden again.

## **CALIBRATING THE 4-20mA INPUTS**

For the 4-20mA Output, the first calibration point is 4mA and the second calibration point is 20mA. You will need a handheld process calibrator such as the Fluke 725.

1. Make sure that the system is stopped.
2. Make sure that the card is installed and enabled in menu 6. The LVL and PRS DIP switches must also be enabled on the 4-20 mA card.
3. Press the UP and DOWN Keys.
4. Press the Menu Key repeatedly until menu 7 is shown.
5. Press OK. If prompted, enter the L2 Password: ▲▼▲▲▼▲■
6. Connect the process calibrator's negative lead to the ground pin on the 4-20mA Input Card.

### **Calibrate the Level Zero**

1. Press the Menu Key repeatedly until "4-20 Level Zero Calibration = No" is shown on the display.
2. Use the Up or Down key to select "Yes" and begin the calibration process. The display will now read "Apply 4mA then press OK".
3. Disconnect any wiring that is connected to the Level input and instead attach the process calibrator's positive lead in its place.
4. Turn on the process calibrator and set it to source a current of 4mA (0%).
5. Press the OK key and the message "Calibrating Wait..." will appear for several seconds followed by the message "Parameter Set" after the calibration has successfully completed.

### **Calibrate the Level Input's Span point:**

1. Press the Menu Key repeatedly until "Calibrate 4-20 LVL Span?" is shown on the display.
2. Use the Up or Down key to select "Yes" and begin the calibration process. The display will now read "Apply 20mA then press OK".
3. Set the process calibrator to source a current of 20mA (100%).
4. Press the OK key and the message "Calibrating Wait..." will appear for several seconds followed by the message "Parameter Set" after the calibration has successfully completed.
5. Disconnect the process calibrator from the Level input and reconnect any wiring that was removed from it previously.

### **Calibrate the Pressure Input's Zero point:**

1. Press the Menu Key repeatedly until "Calibrate 4-20 PRS Zero?" is shown on the display.



2. Use the Up or Down key to select "Yes" and begin the calibration process. The display will now read "Apply 4mA then press OK"
3. Disconnect any wiring that is connected to the Pressure input and instead attach the process calibrator's positive lead in its place.
4. Turn on the process calibrator and set it to source a current of 4mA (0%).
5. Press the OK key and the message "Calibrating Wait..." will appear for several seconds followed by the message "Parameter Set" after the calibration has successfully completed.

**Calibrate the Pressure Input's Span point:**

1. Press the Menu Key repeatedly until "Calibrate 4-20 PRS Span?" is shown on the display.
2. Use the Up or Down key to select "Yes" and begin the calibration process. The display will now read "Apply 20mA then press OK"
3. Set the process calibrator to source a current of 20mA (100%).
4. Press the OK key and the message "Calibrating Wait..." will appear for several seconds followed by the message "Parameter Set" after the calibration has successfully completed.
5. Disconnect the process calibrator from the Pressure input and reconnect any wiring that was removed from it previously.

Disconnect the process calibrator's negative lead from the ground pin on the 4-20mA Input Card.

**RESETTING CALIBRATION DATA**

If you want to reset the calibration settings to default, use the "Cal Data" option at the end of menu 7.

**This process resets the following calibrations to defaults:**

- Calibration of the Thermocouples
- Calibration of the 4-20mA Output
- Calibration of the 4-20mA Input

1. Make sure that the system is stopped
2. Press the UP and Down Keys simultaneously to unlock the Calibration Menu (menu 7) which is normally hidden.
3. Press the Menu Key repeatedly until menu 7 is shown.
4. Press OK. If prompted, enter the L2 Password: ▲▼▲▲▼▲■
5. Press the Menu Key repeatedly until "Cal Data" is shown on the display
6. Use the Up or Down keys to select "Yes"
7. Press OK and the message "Parameter Saved" will show on the display briefly.
8. Press and hold the OK key for 3 seconds until the message "Password Logout" is displayed on the screen. The Calibration Menu is now hidden again.

## CALIBRATION (MENU 7)

This menu is used to adjust the calibration of thermocouples, 4-20mA Output, and 4-20mA Expansion Card inputs. This menu is hidden by default.

<b>MENU MAP</b>	<b>ON SCREEN</b>	<b>BRIEF DESCRIPTION</b>	<b>RANGE</b>	<b>DEFAULT SETTING</b>	<b>SECTION</b>
Cal Process TC Zero	Cal Proc TC Zero?	Calibrate Process Thermocouple zero point by shorting the Input	N/A	N/A	
Cal High Temp TC Zero	Cal HiTemp TC Zero?	Calibrate High Temp Thermocouple zero point by shorting the Input	N/A	N/A	
Cal Aux TC Zero	Cal AUX TC Zero?	Calibrate Aux Thermocouple zero point by shorting the Input	N/A	N/A	
Cal Process TC Span	Cal Proc TC Span: xxC	Calibrate Process Thermocouple span point by applying a calibrated reference then adjust the on screen value	N/A	N/A	
Cal High Temp TC Span	Cal HiTemp TC Span: xxC	Calibrate High Temp Thermocouple span point by applying a calibrated reference then adjust the on screen value	N/A	N/A	
Cal Aux TC Span	Cal AUX TC Span: xxC	Calibrate Aux Thermocouple span point by applying a calibrated reference then adjust the on screen value	N/A	N/A	
Cal 4-20 Level Zero	Calibrate 4-20 LVL Zero?	Calibrate 4-20mA Level Input zero point by applying a calibrated 4mA reference	N/A	N/A	
Cal 4-20 Level Span	Calibrate 4-20 LVL Span?	Calibrate 4-20mA Level Input span point by applying a calibrated 20mA reference	N/A	N/A	
Cal 4-20 Pressure Zero	Calibrate 4-20 PRS Zero?	Calibrate 4-20mA Pressure Input zero point by applying a calibrated 4mA reference	N/A	N/A	
Cal 4-20 Pressure Span	Calibrate 4-20 PRS Span?	Calibrate 4-20mA Pressure Input span point by applying a calibrated 20mA reference	N/A	N/A	
Cal 4-20 Out Zero	Cal 4-20 Out Zero: x	Calibrate 4-20mA Output zero point by adjusting until a multimeter reads 4mA	N/A	N/A	
Cal 4-20 Out Span	Cal 4-20 Out Span: x	Calibrate 4-20mA Output zero point by adjusting until a multimeter reads 20mA	N/A	N/A	3.5.8
Display TC Zero Factors	Cal Factors Zero w x y z	Thermocouple zero point calibration factors for Debug	N/A	N/A	3.5.8
Display TC Span Factors	Cal Factors Span w x y z	Thermocouple span point calibration factors for Debug	N/A	N/A	3.5.8
Display 4-20 PRS Factors	4-20 PRS Factors Z=x S=y	4-20mA Pressure zero point and span point calibration factors for Debug	N/A	N/A	3.5.8
Display 4-20 LVL Factors	4-20 LVL Factors Z=x S=y	4-20mA Level zero point and span point calibration factors for Debug	N/A	N/A	3.5.8
Clear Cal	Clear All Cal Capital Data	Restore all calibration factors to 0	Yes/No	No	3.5.8



## C | Resetting to Defaults

The system settings can all be reset to factory defaults by following these instructions:

1. Make sure that the system is stopped.
2. Navigate to the “Reset to Factory Defaults” menu item at the bottom of Menu 4.
3. Use the Arrow keys to change the setting to “Yes” and then press the OK key.
4. The system will display “Parameter Saved” and will then reboot.
5. After rebooting, the system will display the message “CONFIGURATION RESET TO DEFAULT” alternating with “Check Settings and Setpoints.”
6. Press the OK key to acknowledge this warning.

This process only resets the user settings back to factory defaults and does not affect the calibration settings. To reset the calibration settings to defaults, refer to the [Field Calibration](#) section.

Note that older versions of firmware did reset both the user settings and the calibration settings to defaults. Also note that all settings are stored on the Door Card. If the Door Card is replaced for any reason, the settings will need to be re-entered and calibration may need to be performed.

**FOR ANY QUESTIONS PLEASE VISIT OR CALL US.**

[www.profireenergy.com](http://www.profireenergy.com) | 1.855.PRO.FIRE





[www.profireenergy.com](http://www.profireenergy.com)

© 2015 PROFIRE





2-Way Normally Closed  
**Low Power - Peak & Hold**  
**Low Temperature Gas Shutoff Valve (DC)**  
 Stainless Steel Body • 1/4" to 1" NPT

**2/2**  
**SERIES**  
**HV427246**  
**HV427371**  
**HV298568**

**Features**

- Peak and hold design for low power consumption
- Ambient temperature range; -40°F to 125°F (-40°C to 52°C)
- Zero minimum differential pressure
- Maximum operating pressure differential up to 50 psi
- Robust design provides consistent and reliable operation
- Meets Automatic Gas Valves Z21.21, CSA 6.5 C/I Safety Shutoff standard
- Complies with ANSI/ISA-12.27.01.2003 single seal requirements
- Meets the metallurgical requirements of NACE MR-0175
- Resilient soft seating for tight shutoff
- For on-off control of fuel gas in commercial and industrial gas burners

**Fluid:** Fuel Gas

**Construction**

Valve Parts in Contact with Fluids	
Body	304 Stainless Steel
Seals and Disc	Low Temp. NBR (1/2", 3/4") Low Temp. FKM (1/4", 3/8", 1")
Diaphragm	Low Temp. NBR (1/2", 3/4") Low Temp. HNBR (1")
Core Tube	305 Stainless Steel
Core and Plugnut	430F Stainless Steel
Springs	Inconel
Rider Ring	PTFE

**Electrical**

Standard Coil and Class of Insulation	Watt Rating (DC)		Hold PWM Duty Cycle (@ 500-2000 Hz)	Ambient Temp. °F (°C)	Spare Coil Family
	Peak Watts	Hold Watts			Explosionproof
H	10.6	0.85 ①	29%	-40 to 125°F (-40 to 52°C)	238514
	10.6	1.40 ①	37%		238514
	11.6	0.5 ①	21%		238914
	23.6	0.85 ①	19%		274646

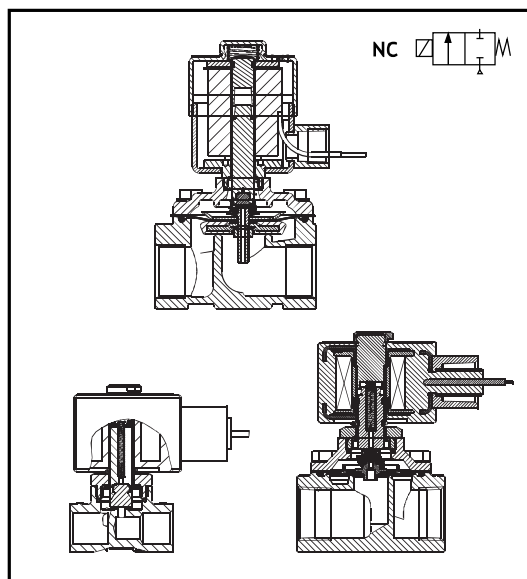
**Standard Voltages:** 12, 24VDC  
 ① Peak and hold design requires full line voltage for 0.2 to 0.5 seconds to open valve; then refer to the specified Hold PWM Duty Cycle in the above table.  
*External PWM controller required; Consult factory for additional information.*  
**IMPORTANT:** Supervisory and leakage current above .010 amp will cause improper operation. Consult your local ASCO sales office for additional assistance.

**Solenoid Enclosures**

1/4" through 3/4" - Explosionproof & Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9.  
 1" - Explosionproof, Types 3, 7, and 9.

**Leads**

Standard: 72" leads



**Approvals**

- CSA Certified:
- 1) Solenoid (for HV427246 & HV427371 Series DC Constructions), and valve (HV298568 DC Construction) for Hazardous Locations, File 013976.
  - 2) Automatic Gas Valves Z21.21, CSA 6.5 C/I Safety Shutoff, File 112872.
  - 3) Standard C22.2 No. 139 "Electrically Operated Valves", File 112872.
  - 4) ANSI/ISA-12.27.01.2003 Single Seal.
- Consult factory for Canadian Registration Numbers (CRN).*  
 UL Listed Explosionproof Solenoid.

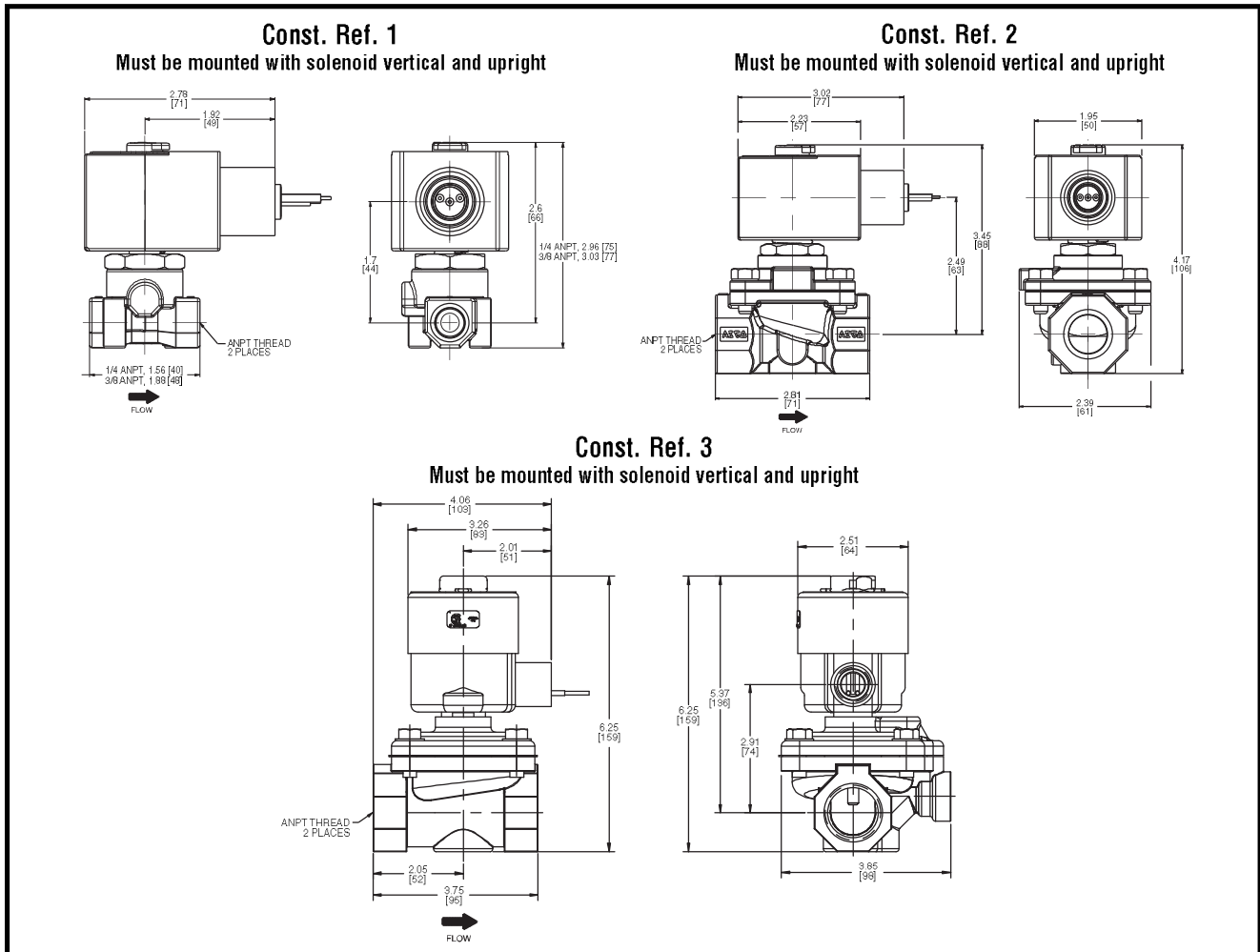
COMBUSTION

**Specifications**

Pipe Size (in)	Orifice Size (in)	Cv Flow	Gas Capacity		Operating Pressure Differential (psi) ④		Fluid Temp. Range °F (°C) ③	Catalog Number	Voltage	Const. Ref.	Agency			Wattage
			Btu/hr. ①	Btu/hr. ②	Min.	Max.					UL	FM	CSA	
<b>COMBUSTION (Fuel Gas) - Normally Closed (Closed when de-energized)</b>														
1/4	5/32	0.52	27,000	410,000	0	50	-40 to 125°F (-40 to 52°C)	HV427246001	12 VDC	1	<input type="checkbox"/>	-	<input type="checkbox"/>	10.6
								HV427246002	24 VDC		<input type="checkbox"/>	-	<input type="checkbox"/>	
3/8	7/32	0.82	44,000	527,000	0	35	-40 to 125°F (-40 to 52°C)	HV427246101	12 VDC	1	<input type="checkbox"/>	-	<input type="checkbox"/>	10.6
								HV427246102	24 VDC		<input type="checkbox"/>	-	<input type="checkbox"/>	
1/2	5/8	4.3	231,900	3,529,000	0	50	14 to 125°F (-10 to 52°C)	HV427371001	12 VDC	2	<input type="checkbox"/>	-	<input type="checkbox"/>	11.6
								HV427371002	24 VDC		<input type="checkbox"/>	-	<input type="checkbox"/>	
3/4	5/8	4.5	242,600	3,693,000	0	50	14 to 125°F (-10 to 52°C)	HV427371101	12 VDC	2	<input type="checkbox"/>	-	<input type="checkbox"/>	11.6
								HV427371102	24 VDC		<input type="checkbox"/>	-	<input type="checkbox"/>	
1	1	13	701,000	8,268,480	0	35	14 to 125°F (-10 to 52°C)	HV298568001	12 VDC	3	-	-	<input type="checkbox"/>	23.6
								HV298568002	24 VDC		-	-	<input type="checkbox"/>	

○ = Safety Shutoff Valve. □ UL Listed Hazardous Location, solenoid only. ① 1" W.C. Drop @ 2" W.C. Inlet Pressure, 1,000 Btu/cu.ft. or more, 0.64 Specific Gravity Gas.  
 ② 10% of MOPD pressure drop @ 25% of MOPD inlet pressure, 1,000 Btu/cu.ft. or more, 0.64 Specific Gravity Gas (based on CSA 6.5).  
 ③ Dewpoint - To prevent freezing of condensed water vapor in the valve, the fuel gas must have a dewpoint at least 10°C (18°F) below the minimum temperature to which any point of the system will be exposed.  
 ④ Safe Working Pressure (SWP); 100 psi, is the line or system pressure to which the valve may be subjected without being damaged.  
 To ensure proper operation, the Maximum Operating Pressure Differential (MOPD) stamped on nameplate must be adhered to.

**Dimensions: inches [mm]**



**COMBUSTION**

May 2013

# 627 Series Pressure Reducing Regulators

## WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion and/or fire causing property damage and personal injury or death.

Fisher® regulators must be installed, operated, and maintained in accordance with federal, state, and local codes, rules and regulations, and Emerson Process Management Regulator Technologies, Inc. (Regulator Technologies) instructions.

If the regulator vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Call a gas service person to service the unit. Only a qualified person must install or service the regulator.



W4793

Figure 1. Typical 627 Direct-Operated Pressure Reducing Regulator

## Introduction

### Scope of the Manual

This manual provides instructions for the installation, adjustment, maintenance, and parts ordering information for the 627 Series regulators. These regulators are usually shipped separate for line installation, although sometimes they are shipped installed on other equipment. Refer to the Instruction Manual of the other equipment for installation and operating instructions.

### Description

The 627 Series direct-operated pressure reducing regulators (Figure 1) are for high and low pressure systems. These regulators can be used with natural gas, air, or a variety of other gases. Performance characteristics vary according to construction.

## WARNING

Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this regulator is overpressured or is installed where service conditions could exceed the limits given in the Specifications section, Tables 1, 2, 3, and 4, or where conditions exceed any ratings of the adjacent piping or piping connections.

To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding



# 627 Series

## Specifications

The Specifications section gives some general specifications for the 627 Series regulators. The nameplates give detailed information for a particular regulator as it comes from the factory.

### Available Constructions

**Type 627:** Direct-operated pressure reducing regulator equipped with a pitot tube for greater regulated capacities (Figure 7).

**Type 627R:** Type 627 with internal relief and with an open throat (Figure 8).

**Type 627LR:** Type 627R with light rate relief spring (Figure 9).

**Type 627M:** Type 627 with a stem seal between the body outlet pressure and diaphragm case. Pressure is measured under the diaphragm through the 1/4 NPT downstream control line connection (Figure 10).

**Type 627MR:** Type 627M with internal relief (Figure 11).

**Type 627H:** Type 627 with a diaphragm limiter to deliver a higher outlet pressure (Figure 12).

**Type 627HM:** Type 627H with a stem seal between the body outlet pressure and diaphragm case. Pressure is measured under the diaphragm through the 1/4 NPT downstream control line connection (Figure 13).

### Body Sizes and End Connection Styles

BODY SIZE		END CONNECTION STYLE	CONSTRUCTION AVAILABLE
NPS	DN		
3/4	----	NPT	All
1	25	NPT, CL150 RF, CL300 RF, CL600 RF, and Long Body	
2	50	NPT, CL150 RF, CL300 RF, CL600 RF, and Long Body	

### Maximum Inlet Pressure<sup>(1)</sup> (Body Rating)

**NPT Stainless Steel:** 2000 psig / 138 bar

**Flanged Stainless Steel:** 1440 psig / 99.3 bar

**NPT Steel:** 2000 psig / 138 bar

**Flanged Steel:** 1500 psig / 103 bar

**Ductile Iron:** 1000 psig / 69.0 bar

### Maximum Valve Disk Inlet Pressure Rating<sup>(1)</sup>

**Nylon (PA) Disk:** 2000 psig / 138 bar

**Nitrile (NBR) Disk:** 1000 psig / 69.0 bar

**Fluorocarbon (FKM) Disk:** 300 psig / 20.7 bar

### Maximum Operating Inlet Pressure, Pressure Differential, and Outlet Pressure Ranges<sup>(1)</sup>

See Table 1 for pressures by orifice size and spring range

### Maximum Spring and Diaphragm Casing Pressure<sup>(1)</sup>

See Table 2

### Maximum Body Outlet Pressure<sup>(1)(2)</sup>

(Types 627M, 627MR, and 627HM Only)

**NPT Steel:** 2000 psig / 138 bar

**Flanged Steel:** 1500 psig / 103 bar

**Ductile Iron:** 1000 psig / 69.0 bar

### Orifice Sizes

See Table 1

### Internal Relief Performance

**Type 627R:** See Table 3

**Type 627LR:** See Table 4

**Type 627MR:** Limited by field-installed control line piping

### Elastomer Temperature Capabilities<sup>(1)(3)</sup>

MATERIAL	DISK/ DIAPHRAGM	TEMPERATURE	
		°F	°C
Nitrile (NBR)	Disk	-40 to 180	-40 to 82
	Diaphragm		
Fluorocarbon (FKM)	Disk	0 to 180	-18 to 82
	Diaphragm		
Nylon (PA)	Disk	-40 to 180	-40 to 82
Neoprene (CR) for Types 627H and 627HM only	Diaphragm	-40 to 180	-40 to 82

### Flow Coefficients

See Table 5

### IEC Sizing Coefficients

See Table 6

### Pressure Registration

**Type 627, 627H, 627R, or 627LR:** Internal

**Type 627M, 627HM, or 627MR:** External through 1/4 NPT control line connection in the diaphragm casing

### De-Icer System

See Figure 3 and Type 627M Regulator De-Icer System Application section

### Relief Indicator

For Types 627R, 627LR, and 627MR (see Figures 8, 9, and 11)

### Spring Case Vent Connection

3/4 NPT with removable screened vent assembly

### Approximate Weights

**Ductile Iron, Steel, or Stainless Steel Casings:** 10 pounds / 4 kg

**Aluminum Casings:** 6.3 pounds / 3 kg

1. The pressure/temperature limits in this Instruction Manual or any applicable standard limitation should not be exceeded.

2. Types 627, 627H, 627R, and 627LR are limited by maximum diaphragm casing pressure.

3. Stainless steel body is rated to -40°F / -40°C. Steel and Ductile Iron bodies are rated to -20°F / -29°C.

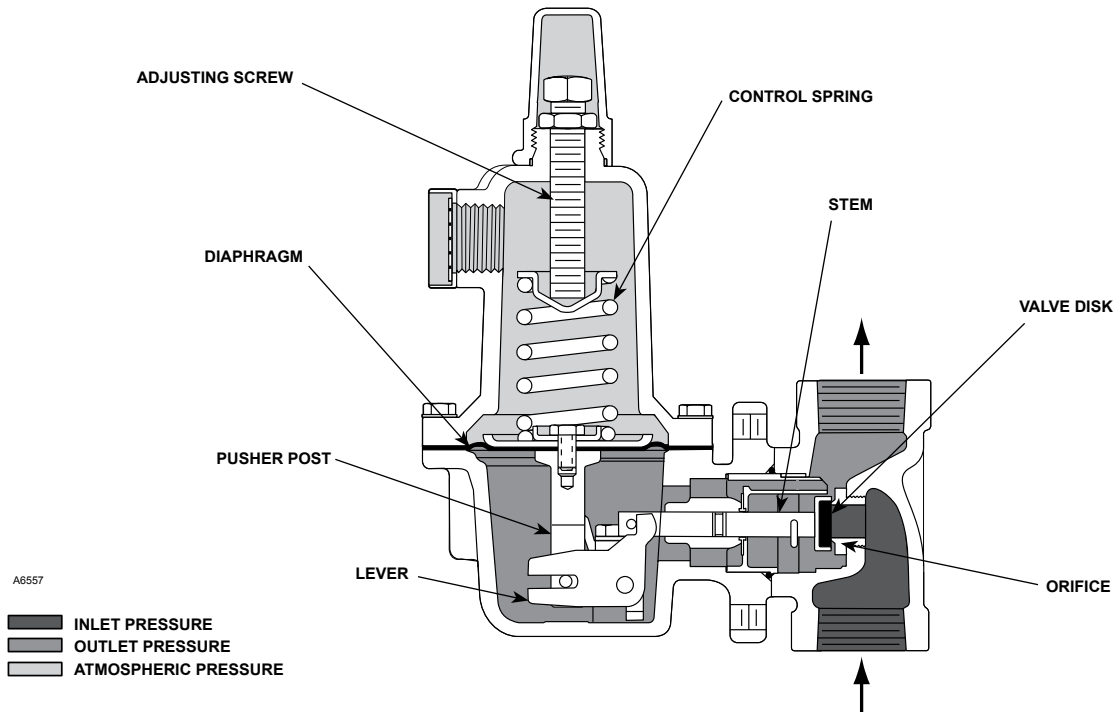


Figure 2. Type 627 Operational Schematic

those limits. The Type 627R, 627LR, or 627MR regulator with internal relief will provide downstream overpressure protection within the limits given in the Specifications section, Tables 1, 2, 3, and 4. If these limits are exceeded, additional downstream overpressure protection must be provided by the user.

Additionally, physical damage to the regulator could cause personal injury or property damage due to escaping gas. To avoid such injury or damage, install the regulator in a safe location.

## Principle of Operation

Refer to Figure 2. When downstream demand decreases, the pressure under the diaphragm increases. This pressure overcomes the regulator setting (which is set by a spring). Through the action of the pusher post assembly, lever, and valve stem the valve disk moves closer to the orifice and reduces gas flow. If demand downstream increases, pressure under the diaphragm decreases. Spring force pushes the pusher post assembly downward and the valve disk moves away from the orifice.

## Product Description

**Types 627 and 627H Direct-Operated Pressure Reducing Regulators**—The Types 627 and 627H regulators provide economical pressure reducing control for a variety of residential, commercial, and industrial applications. The regulator pitot tube located in a high velocity stream provides dynamic boost that compensates for outlet pressure drop.

**Type 627 Long Body**—The Type 627 Long Body regulator can be used as a drop-in replacement for existing Type 630 installations without the need to modify piping.

**Internal Relief for Type 627R, 627LR, or 627MR Regulator**—The Type 627R internal relief performance values were obtained **by removing the disk assembly** from the regulator. For the Type 627R, 627LR, or 627MR regulator, the internal relief across the diaphragm provides overpressure protection in many applications. As outlet pressures build up above the start-to-discharge point, the diaphragm moves off the relief valve seat allowing the excess pressure to bleed out through the screened vent.

For extra protection, should failure conditions exist which would prevent normal operation of the regulator

# 627 Series

**Table 1. Maximum Inlet Pressures and Outlet Pressure Ranges**

TYPE	OUTLET PRESSURE RANGE, SPRING PART NUMBER, AND COLOR CODE	ORIFICE SIZE		MAXIMUM INLET PRESSURE <sup>(1)</sup>					
				Nylon (PA) Disk		Nitrile (NBR) Disk		Fluorocarbon (FKM) Disk	
		Inches	mm	psig	bar	psig	bar	psig	bar
627 and 627M <sup>(3)</sup>	5 <sup>(2)</sup> to 20 psig / 0.34 to 1.4 bar 10B3076X012 Yellow	3/32	2.4	2000	138	1000	69.0	300	20.7
		1/8	3.2	1000	69.0	1000	69.0	300	20.7
		3/16	4.8	750	51.7	750	51.7	300	20.7
		1/4	6.4	500	34.5	500	34.5	300	20.7
		3/8	9.5	300	20.7	300	20.7	300	20.7
		1/2	13	250	17.2	250	17.2	250	17.2
	15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	3/32	2.4	2000	138	1000	69.0	300	20.7
		1/8	3.2	1500	103	1000	69.0	300	20.7
		3/16	4.8	1000	69.0	1000	69.0	300	20.7
		1/4	6.4	750	51.7	750	51.7	300	20.7
		3/8	9.5	500	34.5	500	34.5	300	20.7
		1/2	13	300	20.7	300	20.7	300	20.7
	35 to 80 psig / 2.4 to 5.5 bar 10B3078X012 Blue	3/32	2.4	2000	138	1000	69.0	300	20.7
		1/8	3.2	2000	138	1000	69.0	300	20.7
		3/16	4.8	1750	121	1000	69.0	300	20.7
		1/4	6.4	1500	103	1000	69.0	300	20.7
		3/8	9.5	1000	69.0	1000	69.0	300	20.7
		1/2	13	750	51.7	750	51.7	300	20.7
	70 to 150 psig / 4.8 to 10.3 bar 10B3079X012 Red	3/32	2.4	2000	138	1000	69.0	300	20.7
		1/8	3.2	2000	138	1000	69.0	300	20.7
3/16		4.8	2000	138	1000	69.0	300	20.7	
1/4		6.4	1750	121	1000	69.0	300	20.7	
3/8		9.5	1250	86.2	1000	69.0	300	20.7	
1/2		13	750	51.7	750	51.7	300	20.7	
627R and 627MR	5 <sup>(2)</sup> to 20 psig / 0.34 to 1.4 bar 10B3076X012 Yellow	3/32	2.4	2000	138	1000	69.0	300	20.7
		1/8	3.2	1000	69.0	1000	69.0	300	20.7
		3/16	4.8	750	51.7	750	51.7	300	20.7
		1/4	6.4	500	34.5	500	34.5	300	20.7
		3/8	9.5	300	20.7	300	20.7	300	20.7
		1/2	13	200	13.8	200	13.8	200	13.8
	15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	3/32	2.4	2000	138	1000	69.0	300	20.7
		1/8	3.2	1500	103	1000	69.0	300	20.7
		3/16	4.8	1000	69.0	1000	69.0	300	20.7
		1/4	6.4	750	51.7	750	51.7	300	20.7
		3/8	9.5	300	20.7	300	20.7	300	20.7
		1/2	13	200	13.8	200	13.8	200	13.8
	35 to 80 psig / 2.4 to 5.5 bar 10B3078X012 Blue	3/32	2.4	2000	138	1000	69.0	300	20.7
		1/8	3.2	1750	121	1000	69.0	300	20.7
		3/16	4.8	1000	69.0	1000	69.0	300	20.7
		1/4	6.4	750	51.7	750	51.7	300	20.7
		3/8	9.5	300	20.7	300	20.7	300	20.7
		1/2	13	200	13.8	200	13.8	200	13.8
	70 to 150 psig / 4.8 to 10.3 bar 10B3079X012 Red	3/32	2.4	2000	138	1000	69.0	300	20.7
		1/8	3.2	1000	69.0	1000	69.0	300	20.7
3/16		4.8	500	34.5	500	34.5	300	20.7	
1/4		6.4	300	20.7	300	20.7	300	20.7	
3/8		9.5	200	13.8	200	13.8	200	13.8	
1/2		13	200	13.8	200	13.8	200	13.8	
627LR	15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	3/32	2.4			1000	69.0	300	20.7
		1/8	3.2			1000	69.0	300	20.7
		3/16	4.8			750	51.7	300	20.7
		1/4	6.4			500	34.5	300	20.7
627H and 627HM <sup>(3)</sup>	140 to 250 psig / 9.7 to 17.2 bar 10B3078X012 Blue	3/32	2.4	2000	138	1000	69.0		
		1/8	3.2	2000	138	1000	69.0		
		3/16	4.8	1750	121	1000	69.0		
		1/4	6.4	1500	103	1000	69.0		
		3/8	9.5	1000	69.0	750	51.7		
		1/2	13	750	51.7	500	34.5		
	240 to 500 psig / 16.5 to 34.5 bar 10B3079X012 Red	3/32	2.4	2000	138	1000	69.0		
		1/8	3.2	2000	138	1000	69.0		
		3/16	4.8	1750	121	1000	69.0		
		1/4	6.4	1500	103	1000	69.0		

1. For inlet pressure in excess of 1000 psig / 69.0 bar, refer to the maximum body and disk pressure ratings in the Specifications section.  
 2. For pressure settings under 10 psig / 0.69 bar, inlet pressure should be limited to approximately 100 psig / 6.9 bar so the setpoint adjustment can be obtained.  
 3. The unbalance forces change from the wide-open monitor mode to an active regulator mode such that the Type 627M or 627HM should have a 3/8 inch / 9.5 mm or larger orifice.  
 ■ - Shaded areas indicate that Fluorocarbon (FKM) and Nylon (PA) disk material are not available.

**Table 2. Maximum Spring and Diaphragm Casing Pressure<sup>(1)</sup>**

MAXIMUM PRESSURE DESCRIPTION	DIAPHRAGM CASING MATERIAL	TYPE 627		TYPES 627R AND 627LR		TYPE 627M		TYPE 627MR		TYPES 627H AND 627HM	
		psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
Maximum pressure to spring and diaphragm casings to prevent leak to atmosphere other than relief action (internal parts damage may occur)	Die cast aluminum	250	17.2	250	17.2	Not Available		Not Available		Not Available	
	Ductile iron					250	17.2	Not Available		Not Available	
	Steel or Stainless steel							250	17.2	800	55.2
Maximum pressure to spring and diaphragm casings to prevent burst of casings during abnormal operation (leak to atmosphere and internal parts damage may occur)	Die cast aluminum	375	25.9	375	25.9	Not Available		Not Available		Not Available	
	Ductile iron	465	32.1	465	32.1	465	32.1	465	32.1	Not Available	
	Steel or Stainless steel	1500	103	1500	103	1500	103	1500	103	1500	103
Maximum diaphragm casing overpressure (above setpoint) to prevent damage to internal parts	All materials	60	4.1	120	8.3	60	4.1	120	8.3	120	8.3

1. If the spring case is pressurized, a metal adjusting screw cap is required. Contact your local Sales Office for details.

(for example, disk broken off or disk erosion), the pusher post contacts the lever retainer causing the relief valve assembly to open. Since the diaphragm continues to rise as downstream pressure builds, it opens the relief valve; thereby, opening the valve. This internal relief may be adequate for the application.

**Downstream Control Line for Type 627M, 627HM, or 627MR Regulator**—A Type 627M, 627HM, or 627MR regulator has a blocking throat stem seal with O-rings and a 1/4 NPT control line connection in the diaphragm case. A regulator with a downstream control line is used for monitoring applications or other applications where other equipment is installed between the regulator and the pressure control point. The stem seal separates the body outlet pressure from the diaphragm case.

## Installation

Regulator operation within ratings does not preclude the possibility of damage from debris in the lines or from external sources. A regulator should be inspected for damage periodically and after any overpressure condition. Key numbers referenced in this section are shown in Figures 7 through 13. Ensure that the operating temperature capabilities listed in Specifications section are not exceeded.

### Note

**If the regulator is shipped mounted on another unit, install that unit according to the appropriate Instruction Manual.**

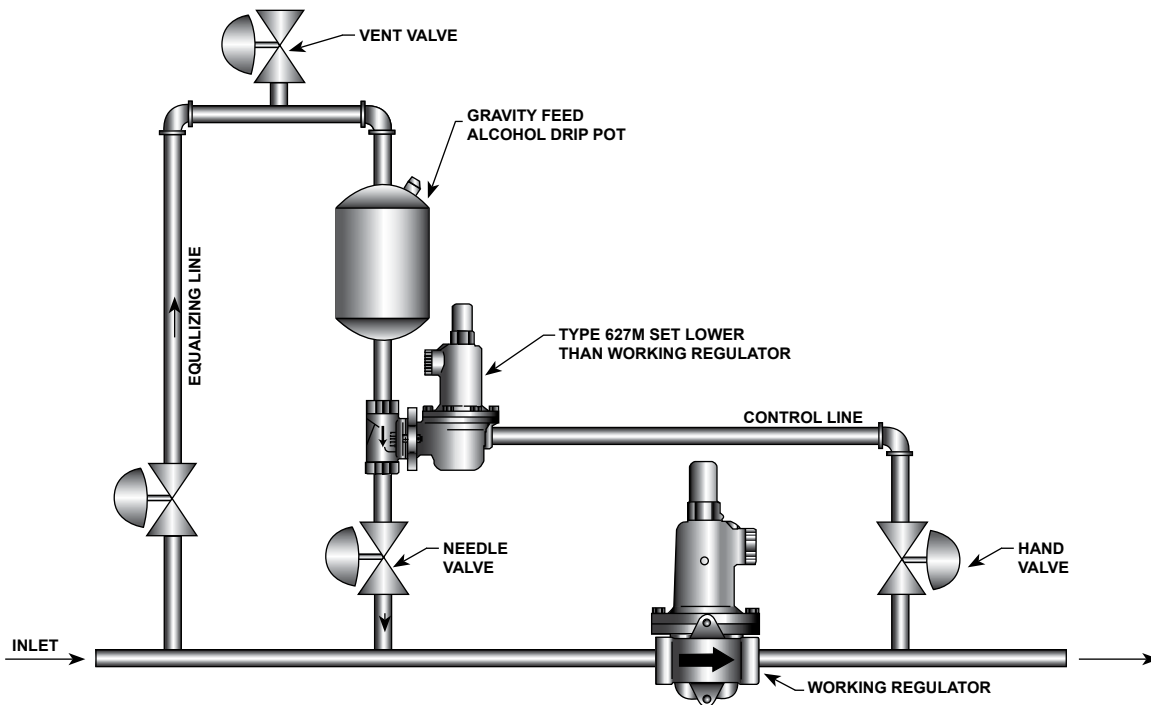
Perform steps 1 through 6 for all types of regulators:

1. Only personnel qualified through training and experience should install, operate, or maintain this regulator.
2. For a regulator that is shipped separately, make sure that there is no damage to or foreign material in the regulator.
3. Ensure that all tubing and piping have been blown free of foreign debris.
4. The regulator may be installed in any position as long as the flow through the body is in the direction indicated by the arrow cast on the body.
5. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the regulator.



**A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and cause personal injury, death, or property damage due to fire or explosion. Vent a regulator in hazardous gas service to a remote, safe location away from air intakes or any hazardous area. The vent line or stack opening must be protected against condensation or clogging.**

6. Position the body (key 1) and/or diaphragm spring case (key 29) so it will not collect moisture or debris into the screened vent. If the regulator requires repositioning, refer to the Body Area Maintenance Procedures and/or the Diaphragm and Spring Case Area Maintenance Procedures in the Maintenance section to reposition the screened vent for the application.



A3725

**Figure 3. De-Icer System Operational Schematic**

**Perform steps 7 through 9 for Types 627M, 627HM, and 627MR regulators only:**

7. A Type 627M, 627HM, or 627MR regulator requires a downstream control line. Install the control line before putting the regulator into operation.
8. Ensure that the downstream control line piping is at least 3/8 inch / 9.5 mm or larger outside diameter tubing and connected to a straight section of outlet piping 10 diameters downstream of the regulator.
9. A hand valve should be installed in the control line. This hand valve can be used to throttle down and dampen outlet pulsations in control pressure which may cause instability or cycling of the regulator.

**Remote Vent Line Installation**

All 627 Series regulators have a vent assembly installed in the 3/4 NPT spring case vent opening. The vent assembly can be removed to install a remote vent line if necessary. Remote vent lines must have the largest practical diameter. It should be as short as possible with minimum number of bends or elbows.

Protect the remote vent opening against entrance of rain, snow, or any other foreign material that may plug

the vent or vent line and prevent proper operation of the regulator. Periodically check the vent opening to be sure it is not plugged with foreign debris.

**Type 627M or 627HM Regulator De-Icer System Application**

For the Type 627M or 627HM regulator de-icer system, refer to the application shown in Figure 3. With a large pressure drop across the working regulator, ice can form within this regulator. The formation of ice decreases the size of the orifice, so the regulator is unable to supply enough flow to satisfy the downstream demand. When the downstream pressure falls below the outlet pressure setting of the Type 627M or 627HM regulator, the disk assembly of the Type 627M or 627HM regulator moves off its orifice, permitting alcohol to flow into the main gas line. The alcohol carried to the main regulator by the flowstream prevents additional ice from forming on the orifice. When normal flow resumes, and as pressure in the downstream system is restored, the Type 627M or 627HM regulator shuts off.

**Overpressure Protection**

627 Series regulators have outlet pressure ratings that are lower than their inlet pressure ratings. A pressure-



**Table 3. Type 627R Internal Relief Performance<sup>(1)</sup>**

OUTLET PRESSURE RANGE, SPRING PART NUMBER, AND COLOR CODE	OUTLET PRESSURE SETTING		MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE		MAXIMUM INLET PRESSURE TO KEEP MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE FROM BEING EXCEEDED <sup>(2)</sup>											
					Orifice Size, Inches / mm											
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
					psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
5 <sup>(3)</sup> to 20 psig / 0.34 to 1.4 bar  10B3076X012 Yellow	10	0.69	60	4.1	1250	86.2	740	51.0	320	22.1	190	13.1	95	6.6	75	5.2
			100	6.9	2000	138	1500	103	620	42.7	390	26.9	180	12.4	130	9.0
			125	8.6	2000	138	1900	131	830	57.2	480	33.1	220	15.2	160	11.0
			175	12.1	2000	138	2000	138	1100	75.8	670	46.2	320	22.1	220	15.2
			200	13.8	2000	138	2000	138	1300	89.6	770	53.1	360	24.8	260	17.9
	250	17.2	2000	138	2000	138	1600	110	960	66.2	450	31.0	320	22.1		
	15	1.0	60	4.1	1000	69.0	620	42.7	260	17.9	170	11.7	90	6.2	70	4.8
			100	6.9	2000	138	1400	96.5	610	42.1	370	25.5	170	11.7	130	9.0
			125	8.6	2000	138	1900	131	810	55.8	480	33.1	220	15.2	160	11.0
			175	12.1	2000	138	2000	138	1100	75.8	670	46.2	320	22.1	220	15.2
			200	13.8	2000	138	2000	138	1300	89.6	770	53.1	360	24.8	260	17.9
	250	17.2	2000	138	2000	138	1600	110	960	66.2	450	31.0	320	22.1		
	20	1.4	60	4.1	850	58.6	490	33.8	210	14.5	130	9.0	80	5.5	65	4.5
			100	6.9	2000	138	1300	89.6	600	41.4	360	24.8	170	11.7	120	8.3
			125	8.6	2000	138	1800	124	800	55.2	480	33.1	220	15.2	160	11.0
175			12.1	2000	138	2000	138	1100	75.8	670	46.2	320	22.1	220	15.2	
200			13.8	2000	138	2000	138	1300	89.6	770	53.1	360	24.8	260	17.9	
250	17.2	2000	138	2000	138	1600	110	960	66.2	450	31.0	320	22.1			
15 to 40 psig / 1.0 to 2.8 bar  10B3077X012 Green	15	1.0	60	4.1	1000	69.0	380	26.2	210	14.5	130	9.0	80	5.5	65	4.5
			100	6.9	2000	138	1300	89.6	590	40.7	350	24.1	170	11.7	120	8.3
			125	8.6	2000	138	1800	124	800	55.2	470	32.4	220	15.2	160	11.0
			175	12.1	2000	138	2000	138	1100	75.8	640	44.1	320	22.1	220	15.2
			200	13.8	2000	138	2000	138	1300	89.6	780	53.8	370	25.5	260	17.9
	250	17.2	2000	138	2000	138	1600	66.2	960	66.2	450	31.0	320	22.1		
	20	1.4	60	4.1	630	43.4	200	13.8	150	10.3	100	6.9	70	4.8	65	4.5
			100	6.9	2000	138	1200	82.7	550	37.9	330	22.8	160	11.0	120	8.3
			125	8.6	2000	138	1700	117	760	52.4	450	31.1	210	14.5	160	11.0
			175	12.1	2000	138	2000	138	1100	75.8	630	43.4	320	22.1	220	15.2
			200	13.8	2000	138	2000	138	1300	89.6	770	53.1	360	24.8	260	17.9
	250	17.2	2000	138	2000	138	1600	66.2	960	66.2	460	31.7	320	22.1		
	30	2.1	100	6.9	2000	138	950	65.5	450	31.1	260	17.9	140	9.7	110	7.6
			125	8.6	2000	138	1500	103	670	46.2	400	27.6	190	13.1	150	10.3
			175	12.1	2000	138	2000	138	1000	69.0	610	42.1	300	20.7	220	15.2
			200	13.8	2000	138	2000	138	1200	82.7	760	52.4	360	24.8	260	17.9
			250	17.2	2000	138	2000	138	1600	110	970	66.9	460	31.7	320	22.1
	40	2.8	100	6.9	1500	103	700	48.3	330	22.8	200	13.8	120	8.3	108	7.4
			125	8.6	2000	138	1300	89.6	560	38.6	340	23.4	180	12.4	140	9.7
			175	12.1	2000	138	1800	124	1000	69.0	550	37.9	290	20.0	220	15.2
200			13.8	2000	138	2000	138	1200	82.7	730	50.3	350	24.1	250	17.2	
250			17.2	2000	138	2000	138	1600	110	970	66.9	460	31.7	320	22.1	

1. The internal relief performance values are obtained by removing the disk assembly.  
 2. For inlet pressures in excess of 1000 psig / 69.0 bar, refer to the maximum body and disk pressure ratings in the Specifications section.  
 3. For pressure settings under 10 psig / 0.69 bar, inlet pressure should be limited to approximately 100 psig / 6.9 bar so the setpoint adjustment can be obtained.  
 - Shaded areas indicate maximum inlet pressures allowed during system malfunction only. Table 1 gives the maximum inlet pressure for normal regulator operation.

- continued -

relieving or pressure-limiting device must be provided by the user for the Types 627, 627H, 627M, and 627HM regulators if the inlet pressure can exceed the outlet pressure rating, since these regulators do not have internal relief.

Types 627R and 627LR regulators provide internal relief which limits the total outlet pressure buildup over setpoint. Use Tables 3 and 4 to determine the total outlet pressure. This internal relief may be adequate for the application, if not, provide additional pressure relief or a pressure-limiting device downstream.

## Startup and Adjustment

### Startup



**WARNING**

**To avoid personal injury or property damage due to explosion or damage to regulator or downstream components during startup, release downstream**

# 627 Series

**Table 3. Type 627R Internal Relief Performance<sup>(1)</sup> (continued)**

OUTLET PRESSURE RANGE, SPRING PART NUMBER, AND COLOR CODE	OUTLET PRESSURE SETTING		MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE		MAXIMUM INLET PRESSURE TO KEEP MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE FROM BEING EXCEEDED <sup>(2)(3)</sup>												
					Orifice Size, Inches / mm												
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13		
	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	
35 to 80 psig / 2.4 to 5.5 bar  10B3078X012 Blue	40	2.8	125	8.6	2000	138	1100	75.8	500	34.5	300	20.7	170	11.7	140	9.7	
			150	10.3	2000	138	1600	110	750	51.7	440	30.3	230	15.9	180	12.4	
			175	12.1	2000	138	2000	138	980	67.6	580	40.0	290	20.0	220	15.2	
			200	13.8	2000	138	2000	138	1200	82.7	720	49.6	340	23.4	250	17.2	
			250	17.2	2000	138	2000	138	1600	110	940	64.8	450	31.0	320	22.1	
	50	3.4	125	8.6	1400	96.5	820	56.5	400	27.6	230	15.9	150	10.3	140	9.7	
			150	10.3	2000	138	1400	96.5	650	44.8	370	25.5	210	14.5	170	11.7	
			175	12.1	2000	138	1900	131	700	48.3	530	36.5	270	18.6	210	14.5	
			200	13.8	2000	138	2000	138	1100	75.8	670	46.2	330	22.8	240	16.5	
			250	17.2	2000	138	2000	138	1500	103	920	63.4	430	29.6	320	22.1	
	60	4.1	125	8.6	900	62.1	450	31.0	270	18.6	190	13.1	140	9.7	130	9.0	
			150	10.3	1700	117	1100	75.8	540	37.2	300	20.7	190	13.1	160	11.0	
			175	12.1	2000	138	1700	117	780	53.8	470	32.4	250	17.2	200	13.8	
			200	13.8	2000	138	2000	138	1000	69.0	610	42.1	310	21.4	230	15.9	
			250	17.2	2000	138	2000	138	1400	96.5	880	60.7	420	29.0	310	21.4	
	70	4.8	150	10.3	1200	82.7	850	58.6	430	29.6	250	17.2	170	11.7	160	11.0	
			175	12.1	2000	138	1400	96.5	670	46.2	400	27.6	230	15.9	190	13.1	
			200	13.8	2000	138	2000	138	920	63.4	550	37.9	280	19.3	230	15.9	
			250	17.2	2000	138	2000	138	1300	89.6	830	57.2	400	27.6	310	21.4	
			150	10.3	800	55.2	500	34.5	300	20.7	200	13.8	160	11.0	150	10.3	
80	5.5	175	12.1	1500	103	1200	82.7	550	37.9	330	22.8	210	14.5	190	13.1		
		200	13.8	2000	138	1700	117	800	55.2	480	33.1	270	18.6	220	15.2		
		250	17.2	2000	138	2000	138	1200	82.7	770	53.1	390	26.9	300	20.7		
		175	12.1	1900	131	600	41.4	400	27.6	260	17.9	200	13.8	175	12.1		
		200	13.8	2000	138	1200	82.7	630	43.4	380	26.2	250	17.2	210	14.5		
70 to 150 psig / 4.8 to 10.3 bar  10B3079X012 Red	70	4.8	250	17.2	2000	138	2000	138	1100	75.8	680	46.9	360	24.8	290	20.0	
			175	12.1	1400	96.5	250	17.2	240	16.5	200	13.8	190	13.1	175	12.1	
			200	13.8	2000	138	960	66.2	520	35.9	330	22.8	240	16.5	210	14.5	
			250	17.2	2000	138	2000	138	1000	69.0	620	42.7	350	24.1	280	19.3	
	100	6.9	200	13.8	1500	103	250	17.2	240	16.5	230	15.9	210	14.5	210	14.5	
125	8.6	250	17.2	2000	138	1000	69.0	500	34.5	390	26.9	290	20.0	260	17.9		
				150	10.3	1200	82.7	260	17.9	260	17.9	260	17.9	260	17.9	260	17.9

- The internal relief performance values are obtained by removing the disk assembly.
  - For inlet pressures in excess of 1000 psig / 69.0 bar, refer to the maximum body and disk pressure ratings in the Specifications section.
  - For pressure settings under 10 psig / 0.69 bar, inlet pressure should be limited to approximately 100 psig / 6.9 bar so the setpoint adjustment can be obtained.
- - Shaded areas indicate maximum inlet pressures allowed during system malfunction only. Table 1 gives the maximum inlet pressure for normal regulator operation.

**Table 4. Type 627LR Internal Relief Performance<sup>(1)</sup>**

OUTLET PRESSURE RANGE, SPRING PART NUMBER, AND COLOR CODE	OUTLET PRESSURE SETTING		MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE		MAXIMUM INLET PRESSURE TO KEEP MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE FROM BEING EXCEEDED <sup>(2)</sup>							
					Orifice Size, Inches / mm							
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4	
	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
15 to 40 psig / 1.03 to 2.8 bar  10B3077X012 Green	30	2.1	55	3.8	500	34.5	270	18.6	110	7.6	80	5.5
			60	4.1	850	58.6	480	33.1	200	13.8	120	8.3
			66	4.5	1000	69.0	660	45.5	290	20.0	175	12.1
	40	2.8	66	4.5	380	26.2	190	13.1	85	5.9	80	5.5
			70	4.8	700	48.3	370	25.5	150	10.3	115	7.9
			75	5.2	1000	69.0	560	38.6	240	16.5	160	11.0

- The internal relief performance values are obtained by removing the disk assembly.
- For inlet pressures in excess of 1000 psig / 69.0 bar, refer to the maximum body and disk pressure ratings in the Specifications section.

Table 5. Flow Coefficients

ORIFICE		3/4 NPT			NPS 1 / DN 25 BODY			NPS 2 / DN 50 BODY		
Inch	mm	Wide-Open C <sub>g</sub> for External Relief Sizing	Wide-Open C <sub>g</sub> for External Relief Sizing	C <sub>1</sub>	Wide-Open C <sub>g</sub> for External Relief Sizing	Wide-Open C <sub>g</sub> for External Relief Sizing	C <sub>1</sub>	Wide-Open C <sub>g</sub> for External Relief Sizing	Wide-Open C <sub>g</sub> for External Relief Sizing	C <sub>1</sub>
3/32	2.4	6.9	0.24	29.2	6.9	0.24	28.5	6.9	0.23	29.7
1/8	3.2	12.5	0.43	29.1	12.5	0.43	29.4	12.5	0.42	29.5
3/16	4.8	29	1.01	28.6	29	0.93	31.2	29	1.02	28.5
1/4	6.4	50	1.63	30.6	50	1.71	29.3	52	1.66	31.3
3/8	9.5	108	2.99	36.1	108	3.42	31.6	115	3.39	33.9
1/2	13	190	4.87	39.0	190	5.29	35.9	200	5.01	39.9

Table 6. IEC Sizing Coefficients

ORIFICE SIZE		X <sub>T</sub>			F <sub>D</sub>	F <sub>L</sub>
Inch	mm	3/4 NPT Body	NPS 1 / DN 25 Body	NPS 2 / DN 50 Body		
3/32	2.4	0.539	0.514	0.558	0.50	0.85
1/8	3.2	0.536	0.547	0.539		0.79
3/16	4.8	0.517	0.616	0.514		0.85
1/4	6.4	0.592	0.543	0.620		0.87
3/8	9.5	0.824	0.632	0.727		0.89
1/2	13	0.962	0.815	1.01		0.86

Table 7. Maximum Torque Values

KEY NUMBER <sup>(1)</sup>	DESCRIPTION	MAXIMUM TORQUE	
		FOOT-POUNDS	N•m
2	Orifice	25	34
3	Cap screw (with aluminum diaphragm casing)	16	22
	Cap screw (with ductile iron or steel/stainless steel diaphragm casing)	25	34
18	Lever cap screw	7	9.5
22	Diaphragm connector nut	17	23
26	Guide retainer (for Types 627R, 627LR, and 627MR only)	3	4.1
37	Spring case cap screw (with aluminum or ductile iron diaphragm casing)	7	9.5
	Spring case cap screw (with steel/stainless steel diaphragm casing)	35	47
46	Diaphragm cap screw (with Type 627 or 627M)	7	9.5
	Diaphragm cap screw (with Type 627H or 627HM)	14	19

1. Refer to Figures 7 through 13 for key number locations.

**pressure to prevent an overpressure condition on the diaphragm of the regulator.**

**In order to avoid an overpressure condition and possible equipment damage, pressure gauges should always be used to monitor pressures during startup.**

1. Slowly open the upstream shut-off valve.
2. Slowly open the downstream shut-off valve.
3. Check all connections for leaks.
4. Make final control spring adjustments according to the adjustment procedures.

## Adjustment

The range of allowable pressure settings is marked on the nameplate. If a pressure setting beyond this range is necessary, substitute the appropriate regulator control spring. Change the nameplate to indicate the new pressure range.

Before increasing the setting, refer to Table 1, 2, 3, or 4. Review the pressure limits for the control spring range being used and be certain that the new pressure setting will not result in an overpressure condition.

### Note

**Always use a pressure gauge to monitor pressure when making adjustments.**

# 627 Series

Refer to Figures 7 through 13 for key number locations.

1. Remove the adjusting screw cap (key 36).
2. Loosen the locknut (key 34).
3. Increase the outlet pressure setting by turning the adjusting screw (key 35) clockwise. Decrease the outlet pressure setting by turning the adjusting screw counterclockwise.
4. When the desired pressure is obtained, hold the adjusting screw (key 35) in place and tighten the locknut (key 34).

## Shutdown

### WARNING

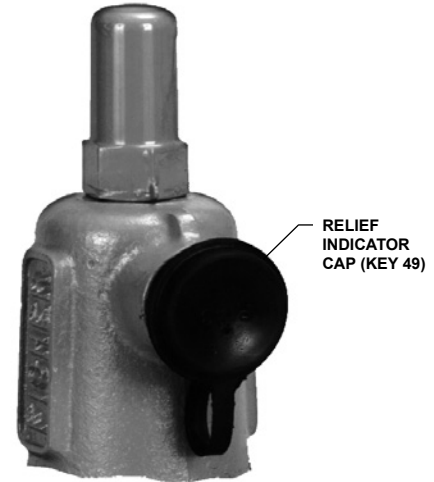
**To avoid personal injury or property damage due to explosion or damage to regulator or downstream components during shutdown, release downstream pressure to prevent an overpressure condition on the diaphragm of the regulator.**

1. Close the nearest upstream shut-off valve.
2. Close the nearest downstream shut-off valve.
3. Open the vent valve between the regulator and the downstream shut-off valve nearest to it.
4. For a Type 627, 627H, 627R, or 627LR regulator, the regulator will open to release pressure between the upstream shut-off valve and the regulator.
5. A Type 627M, 627HM, or 627MR regulator requires venting the control line and downstream pressure from the regulator before maintenance. The pressure between these shut-off valves is released through the open regulator because the disk assembly remains open in response to the decrease in control line pressure.

## Maintenance

Unless otherwise specified, the following maintenance procedures apply to all types of regulators. For a summary of maximum torque values required for all types of regulators, refer to Table 7.

Due to normal wear, damage from external sources, or debris in the air or gas line, regulator parts such as the disk assembly, orifice, and diaphragm must



W4665

Figure 4. Relief Indicator

be inspected periodically and replaced as necessary to ensure correct performance. The frequency of inspection and replacement depends upon the severity of conditions and the requirements of state and federal laws. Normal wear of the orifice and disk assembly is accelerated with high pressure drops and with large amounts of impurities in the flowstream. Instructions are given below for replacing the disk assembly, orifice, diaphragm, and O-rings. These procedures may also be used for disassembly required for inspection and replacement of other parts.

### Problem Indication for Types 627R, 627LR, and 627MR Regulators

#### WARNING

**Isolate the regulator from all pressure to avoid personal injury and equipment damage due to explosion or sudden release of process pressure. Cautiously release pressure from the regulator before attempting disassembly.**

The vent assembly is equipped with a relief indicator (key 49, Figure 4). The cap for the relief indicator snaps over the vent assembly opening. If the relief valve opens wide, exhaust gas pops the cap off the screen vent assembly opening indicating a problem with the regulator. If the cap pops off, refer to the shutdown and to the Body Area Maintenance Procedures to inspect the disk assembly and orifice.

If the disk assembly and orifice are not damaged, refer to the Diaphragm and Spring Case Area Maintenance Procedures in this section.

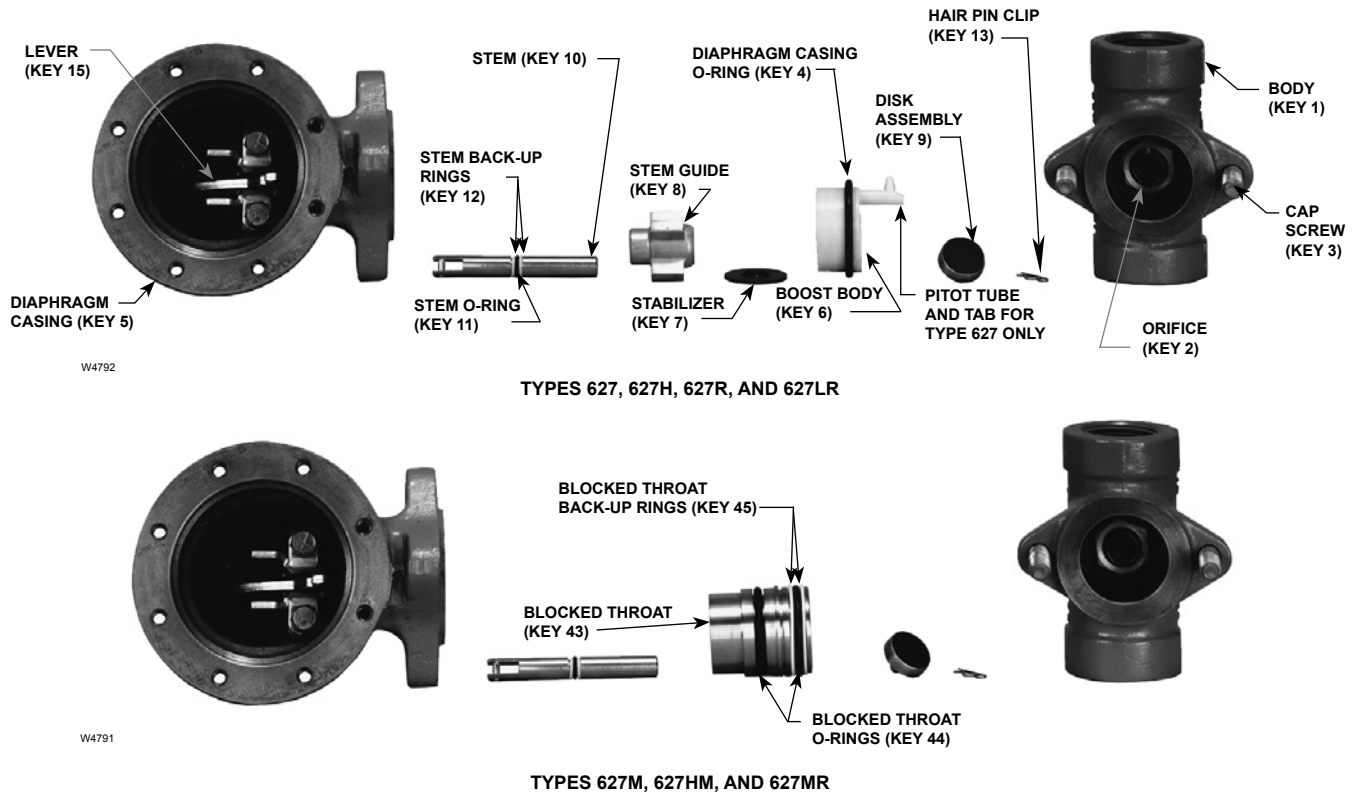


Figure 5. Stem Assemblies

The disk assembly and orifice can be inspected, removed, and replaced without removing the regulator body from the line connections. Refer to the Body Area Maintenance Procedures.

## Body Area Maintenance Procedures

These procedures are for gaining access to the disk assembly, orifice, diaphragm casing O-ring, and stem assembly. All pressure must be released from the diaphragm casing before performing these steps.

While using the following procedures, refer to Figures 7 through 13 for key number locations.

### Replacing the Disk Assembly or Orifice

1. To inspect and replace the disk assembly (key 9) or orifice (key 2), remove the cap screws (key 3, Figure 5), and separate the diaphragm casing (key 5) from the body (key 1).
2. Inspect and, if necessary, remove the orifice (key 2). If removed, coat the threads of the replacement orifice with lubricant and torque to 25 foot-pounds / 34 N•m.

3. Inspect the disk assembly (key 9) and, if necessary, remove the hair pin clip (key 13) that holds the disk assembly (key 9) in place. If replacing the disk assembly is the only maintenance required, skip to step 16.

### Replacing the Stem Assembly

If it is necessary to perform maintenance on the stem assembly, continue with steps 4 through 8 and 15 through 19 for Types 627, 627H, 627R, and 627LR regulators, or steps 9 through 19 for Types 627M, 627HM, and 627MR regulators.

### Perform steps 4 through 8 for Types 627, 627H, 627R, and 627LR Regulators only:

4. Use steps 5 through 8 to remove and replace the stem assembly.
5. Remove the boost body (key 6), stabilizer (key 7), and stem guide (key 8) from the diaphragm casing (key 5). Unhook and remove the stem (key 10) from the diaphragm casing (key 5).
6. Remove and inspect the diaphragm casing O-ring (key 4, Figure 7, 8, 9, or 12) and replace it if necessary.

# 627 Series

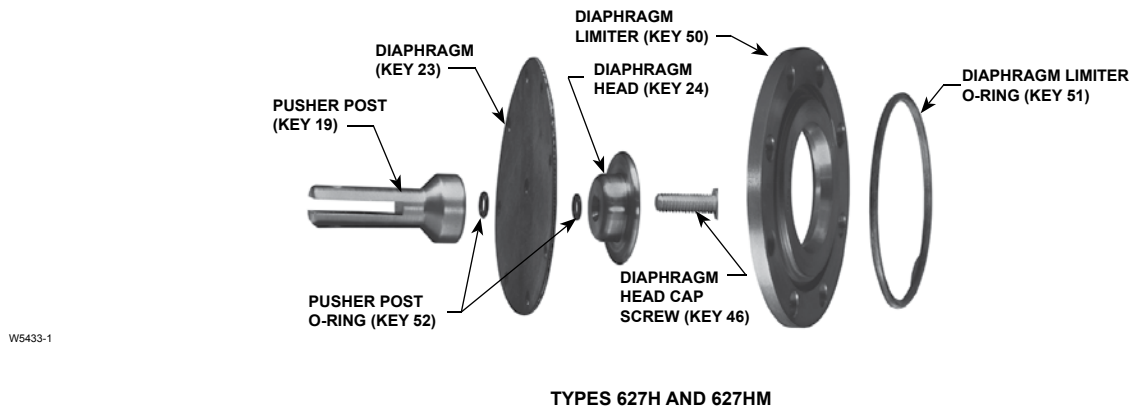
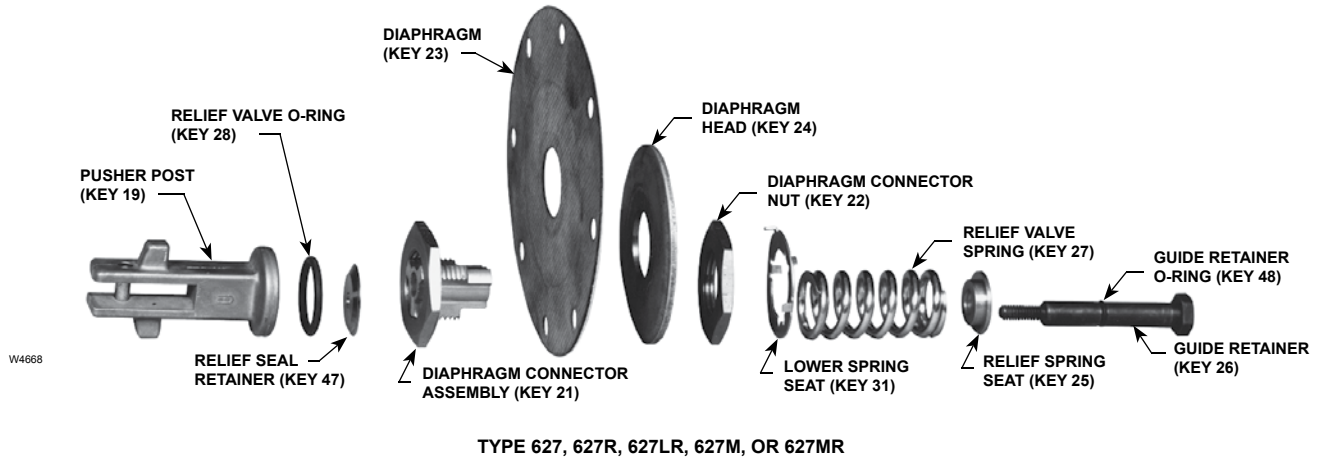


Figure 6. Diaphragm Assemblies

7. Apply lubricant to a replacement diaphragm casing O-ring (key 4, Figure 7, 8, 9, or 12) and install it onto the boost body (key 6). Skip to step 14.
8. For the Type 627 or 627H regulators, be sure to insert the pitot tube (tab) into the outlet side of the body (see Figure 7 or 12). Skip to step 14.
- Perform steps 9 through 19 for Types 627M, 627HM, and 627MR Regulators only:**
9. Use steps 10 through 14 to remove and replace the stem assembly.
10. To remove the blocked throat (key 43), insert a screw driver blade into the groove provided in the throat and pry it out of the diaphragm casing (key 5). Inspect and replace parts as necessary.
11. Inspect and, if necessary, replace the blocked throat O-rings (key 44, Figure 5) and back-up rings (key 45, Figure 5).
12. Apply lubricant to replacement blocked throat O-rings (key 44) and back-up rings (key 45).
13. Apply lubricant to the replacement stem O-ring (key 11) and stem back-up rings (key 12) and install them on the stem (key 10).
14. For assembly, lubricate the stem (key 10) and insert the diaphragm casing (key 5) and hook it on the lever (key 15).
15. Lubricate the contact points of the lever (key 15).
16. Insert parts into the diaphragm casing (key 5) that were removed in steps 5 and 6 or step 10 (see Figure 5).
17. Install the disk assembly (key 9), line up the hole in the disk assembly and stem (key 10) and insert the hair pin clip (key 13).
18. Position the diaphragm casing (key 5) plus attached parts in relation to the body (key 1) so that they are correct for the application.

19. Secure the diaphragm casing (key 5) to the body with the cap screws (key 3, Figure 5). For an aluminum diaphragm casing, torque the cap screws (key 3) to 16 foot-pounds / 22 N•m. For ductile iron or steel diaphragm casings, torque the cap screws (key 3) to 25 foot-pounds / 34 N•m.
20. It may be necessary to reposition the diaphragm spring case to prevent rain, ice, and foreign debris from entering the spring case. Refer to the Diaphragm and Spring Case Area Maintenance Procedures, steps 1, 2, and 21 through 25.

## Diaphragm and Spring Case Area Maintenance Procedures

These procedures are for gaining access to the control spring, diaphragm assembly, and lever assembly. All spring pressure must be released from the diaphragm casing before these steps can be performed.

While using the following procedures, refer to Figures 7 through 13 for key number locations.

1. Remove the adjusting screw cap (key 36), loosen the lock nut (key 34), and turn the adjusting screw (key 35) counterclockwise until all compression is removed from the control spring (key 32).
2. Remove the spring case cap screws (key 37), the nameplates, and lift off the spring case (key 29). If changing the control spring (key 32) or repositioning the spring case (key 29) is the only maintenance required, install the replacement control spring or rotate the spring case so it is correct for the application. Skip to step 21. For diaphragm area maintenance, continue with step 3.
3. Remove the diaphragm limiter O-ring and diaphragm limiter (keys 51 and 50, on the Type 627H or 627HM only). Remove the diaphragm assembly by tilting it so that the pusher post (key 19) slips off the lever (key 15).
4. If it is necessary to replace the lever assembly, remove the lever cap screws (key 18).
5. Install the replacement lever (key 15) into the lever retainer (key 16) by inserting the lever pin (key 17). Secure the lever assembly into the diaphragm casing with the cap screws (key 18) and torque the cap screws to 7 foot-pounds / 9.5 N•m.

If it is necessary to perform maintenance on the diaphragm assembly, continue with steps 6 through 11 and step 20 for Types 627, 627H, 627M, and 627HM regulators, or steps 12 through 19 for Types 627R, 627LR, and 627MR regulators.

### Perform steps 6 through 11 for Types 627, 627H, 627M, and 627HM Regulators only:

6. For Types 627, 627H, 627M, and 627HM regulators (Figures 5 and 6), use steps 7 through 11 to disassemble and reassemble the diaphragm assembly.
7. Remove the diaphragm head cap screw (key 46), lower spring seat (key 31, Type 627 or 627M only), and diaphragm head (key 24). On the Type 627H or 627HM, remove the pusher post O-rings (key 52). Separate the diaphragm (key 23) from the pusher post (key 19).
8. Install the diaphragm (key 23), in reverse order in step 7, on the pusher post (key 19), insert and finger tighten the diaphragm head cap screw (key 46).
9. Hook the pusher post on the lever (key 15), then turn the diaphragm (key 23) to match the holes in the diaphragm with the holes in the spring casing.
10. Unhook the pusher post from the lever (key 15) and torque the diaphragm head cap screw (key 46) to 7 foot-pounds / 9.5 N•m for the Type 627 or 627M. On the Type 627H or 627HM, torque the diaphragm head cap screw to 14 foot-pounds / 19 N•m.
11. Hook the pusher post on the lever (key 15) and check the hole alignment. If necessary, loosen the cap screw (key 46) and reposition the diaphragm (key 23) on the pusher post (key 19). Retorque the screw (see step 10). Skip to step 20.

### Perform steps 12 through 19 for Types 627R, 627LR, and 627MR Regulators only:

12. For Types 627R, 627LR, and 627MR regulators (Figure 6), use steps 13 through 19 to disassemble and reassemble the diaphragm assembly.
13. Remove the guide retainer (key 26) and separate the diaphragm parts. Refer to Figure 6 for the sequence of parts.
14. To remove the diaphragm (key 23), remove the diaphragm connector nut (key 22) and lift off the diaphragm head (key 24) and diaphragm (key 23) from the connector assembly (key 21). Do not attempt to disassemble the connector assembly (key 21).

# 627 Series

15. Position the replacement diaphragm (key 23) on the connector assembly (key 21), install the diaphragm head (key 24) and connector nut (key 22), then torque to 17 foot-pounds / 23 N•m.
16. If necessary, replace the guide retainer O-ring (key 48) and, set the guide retainer (key 26) aside, ready for assembly.
17. On the pusher post (key 19) install the relief seal O-ring (key 28) and apply lubricant. Also, install the relief seal retainer (key 47), diaphragm connector assembly (key 21, with attached parts) relief spring (key 27), upper relief spring seat (key 33), and guide retainer (key 26). Torque the guide retainer (key 26) to 3 foot-pounds / 4.1 N•m.
18. Hook the pusher post (key 19) (with attached parts) on the lever (key 15) to check the alignment of the holes in the diaphragm with the holes in the spring casing. If the holes do not line up, unhook the pusher post from the lever, hold the pusher post, and rotate the diaphragm to the correct position.
19. Install the lower spring seat (key 31) over the relief spring so it rests flat on the connector nut (key 22).
20. Insert the diaphragm assembly into the diaphragm casing (key 5) and hook the pusher post on the lever (key 15).
21. Install the control spring (key 32) and upper spring seat (key 33), and apply lubricant to the upper spring seat (key 33).
22. Install the spring case (key 29) so that the screened vent assembly (key 30) is in the correct position for the application. Place the nameplates over the screw holes, insert the spring case cap screws (key 37), and finger tighten.
23. Screw in the adjusting screw (key 35) to put slack into the diaphragm (key 23).
24. Using a crisscross pattern, finish tightening the spring case cap screws (key 37) to 7 foot-pounds / 9.5 N•m of torque.
25. If necessary, refer to the installation and/or the Startup and Adjustment procedures.
26. Install the adjusting locknut (key 34) after regulator adjustment.

## Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment serial number or FS number that can be found on the nameplate.

When ordering replacement parts, reference the key number of each needed part as found in the following parts list. Separate kits containing all recommended spare parts are available.

## Parts List

### Note

**In this parts list, parts marked NACE are intended for corrosion-resistant service as detailed in the NACE International Standard MR0175.**

Key	Description	Part Number
	Type 627 Parts Kit with Aluminum/Nitrile (NBR) trim (include keys 4, 9, 11, 12, and 23)	R627X000A12
	Type 627 Parts Kit with Stainless steel/ Nitrile (NBR) trim (include keys 4, 9, 11, 12, and 23)	R627X000S12
	Type 627H Parts Kit with SST/Nylon (PA) trim	R627HX00S12
	Type 627R Parts Kit with Aluminum/ Nitrile (NBR) trim (include keys 4, 9, 11, 12, 23, 28, and 48)	R627RX00A12
	Type 627R Parts Kit with Stainless steel/ Nitrile (NBR) trim (include keys 4, 9, 11, 12, 23, 28, and 48)	R627RX00S12
1	Body <sup>(1)</sup>	
	Ductile iron	
	1000 psig / 69.0 bar maximum inlet pressure	
	3/4 NPT	30B3046X012
	1 NPT	30B3048X012
	2 NPT	30B3096X012
	Ductile iron (Long Body)	
	1000 psig / 69.0 bar maximum inlet pressure	
	1 NPT	39B2451X012
	2 NPT	39B0414X012
	Steel	
	2000 psig / 138 bar maximum inlet pressure	
	3/4 NPT	30B3050X012
	1 NPT	30B3051X012
	2 NPT	30B7452X012
	Steel (Long Body)	
	2000 psig / 138 bar maximum inlet pressure	
	1 NPT	39B0412X012
	2 NPT	39B0415X012
	Steel, CL600 RF flanged	
	1500 psig / 103 bar maximum inlet pressure	
	NPS 1 / DN 25	40B6754X012
	NPS 2 / DN 50	40B6756X012
	Steel, CL300 RF flanged	
	750 psig / 51.7 bar maximum inlet pressure	
	NPS 1 / DN 25	41B8978X012
	NPS 2 / DN 50	41B8080X012

1. Bodies can be used for both standard and NACE constructions.



# 627 Series

Key	Description	Part Number	Key	Description	Part Number
1	Body <sup>(1)</sup> (continued)		4*	Diaphragm Case O-ring	
	Steel, CL150 RF flanged			Nitrile (NBR)	
	290 psig / 20.0 bar maximum inlet pressure			For Type 627, 627H, or 627R only	17A2325X022
	NPS 1 / DN 25	43B8656X022		Fluorocarbon (FKM)	
	NPS 2 / DN 50	44B0666X012		For Types 627, 627R, and 627LR only	10A0037X012
	Steel, BWE		5	Diaphragm Case	
	1000 psig / 69.0 bar maximum inlet pressure			For Type 627, 627R, or 627LR	
	NPS 1 / DN 25	33B6723X012		Aluminum without 1/8-inch / 3.2 mm gauge tap	40B3084X012
	NPS 2 / DN 50	38B1688X012		Aluminum with 1/8-inch / 3.2 mm gauge tap	
	Steel, PN 16/25/40 RF			for 627 Series (except Types 627H and 627HM)	11B5380X012
	580 psig / 40.0 bar maximum inlet pressure			Ductile iron without 1/8-inch / 3.2 mm gauge tap	30B3053X012
	NPS 1 / DN 25	44B0386X012		Ductile iron with 1/8-inch / 3.2 mm gauge tap	
	NPS 2 / DN 50	44B3342X012		for 627 Series (except Types 627H and 627HM)	31B0641X012
	Stainless Steel <sup>(2)</sup> , NPT			For Type 627, 627R, or 627LR	
	2000 psig / 138 bar maximum inlet pressure			Steel	30B3104X012
	3/4 NPT	30B3050X062		Ductile iron with 1/4 NPT gauge tap for	
	1 NPT	30B3051X092		627 Series (except Types 627H and 627HM)	39A5987X012
	2 NPT	30B7452X052		Steel with 1/4 NPT gauge tap for 627 Series	
	Stainless Steel <sup>(2)</sup> , CL150 RF flanged			(except Type 627H)	30B8734X012
	275 psig / 18.9 bar maximum inlet pressure			For Type 627M or 627MR	
	NPS 1 / DN 25	43B8656X052		Ductile iron	39A5987X012
	NPS 2 / DN 50	44B0666X022		Steel	30B8734X012
	Stainless Steel <sup>(2)</sup> , CL300 RF flanged			For Type 627H, Steel	30B3104X012
	720 psig / 49.6 bar maximum inlet pressure			For Type 627, Stainless steel	30B3104X082
	NPS 1 / DN 25	41B8978X072		For Type 627HM, Steel	30B8734X012
	NPS 2 / DN 50	41B8080X072	6	Boost Body (not for Type 627M, 627HM,	
	Stainless Steel <sup>(2)</sup> , CL600 RF flanged			or 627MR), Delrin <sup>®</sup>	
	1440 psig / 99.2 bar maximum inlet pressure			For Type 627 or 627H	30B3056X012
	NPS 1 / DN 25	40B6754X102		For Type 627R or 627LR	30B3057X012
	NPS 2 / DN 50	40B6756X062	7	Stabilizer	
	Stainless Steel <sup>(2)</sup> , PN 16/25/40 RF			Nitrile (NBR)	
	580 psig / 40.0 bar maximum inlet pressure			For Types 627, 627H, 627R, and 627LR only	10B3060X012
	NPS 1 / DN 25	44B0386X032		Fluorocarbon (FKM)	
	NPS 2 / DN 50	44B3342X032		For Types 627, 627R, and 627LR only	10B3060X022
2*	Orifice		8	Stem Guide (for Types 627, 627H, 627R, and	
	Aluminum			627LR only), Powdered metal	20B3061X012
	3/32 inch / 2.4 mm	0R044109022	9*	Disk Assembly (for all Orifice Size)	
	1/8 inch / 3.2 mm	1A936709012		Aluminum holder and Nitrile (NBR) disk	1C4248X0212
	3/16 inch / 4.8 mm	00991209012		303 Stainless steel holder and Nitrile (NBR) disk	1C4248X0202
	1/4 inch / 6.4 mm	0B042009012		Aluminum holder and Nylon (PA) disk	1C4248X00A2
	3/8 inch / 9.5 mm	0B042209012		303 Stainless steel holder and Nylon (PA) disk	1C4248X0062
	1/2 inch / 13 mm	1A928809012		316 Stainless steel holder and Nylon (PA) disk	1C4248X0262
	303 Stainless steel			316 Stainless steel holder and Nitrile (NBR) disk	1C4248X0252
	3/32 inch / 2.4 mm	0R044135032		303 Stainless steel holder and	
	1/8 inch / 3.2 mm	1A936735032		Fluorocarbon (FKM) disk	1C4248X0052
	3/16 inch / 4.8 mm	00991235032		Aluminum holder and Fluorocarbon (FKM) disk	1C4248X0182
	1/4 inch / 6.4 mm	0B042035032		316 Stainless steel holder and	
	3/8 inch / 9.5 mm	0B042235032		Fluorocarbon (FKM) disk	1C4248X0192
	1/2 inch / 13 mm	1A928835032	10	Stem	
	316 Stainless steel, NACE construction only			303 Stainless steel	10B3059X012
	3/32 inch / 2.4 mm	0R0441X0012		316 Stainless steel (NACE)	10B3059X022
	1/8 inch / 3.2 mm	1A9367X0022	11*	Stem O-ring	
	3/16 inch / 4.8 mm	009912X0012		Nitrile (NBR)	1D687506992
	1/4 inch / 6.4 mm	0B0420X0012		Fluorocarbon (FKM) For Types 627, 627R,	
	3/8 inch / 9.5 mm	0B0422X0012		627LR, 627M, and 627MR only	1N430406382
	1/2 inch / 13 mm	1A9288X0012	12*	Stem Back-up Ring,	
3	Cap Screw (not shown), (2 required)			Polytetrafluoroethylene (PTFE) (2 required)	1K786806992
	627 Series		13	Hair Pin Clip, Stainless steel	10B3058X012
	For Ductile iron/Steel diaphragm case	1A560724052	14	Drive Pin, Plated steel	1H3671X0012
	For Aluminum diaphragm case		15	Lever, Plated steel	20B3063X012
	(not applicable for Types 627H and 627HM)	1A352524052	16	Lever Retainer, Plated steel	30B3097X012
	Type 627 Only		17	Lever Pin	
	For Ductile iron/Steel diaphragm case	1A5607X0052		Stainless steel	10B3083X012
	For Aluminum case with Steel diaphragm case	10A3869X012		316 Stainless steel (NACE)	10B3083X022
	For SST Case and body	1A5607X0052			
	For Aluminum Case and SST body	10A3869X022			

\*Recommended spare part.

1. Bodies can be used for both standard and NACE constructions.

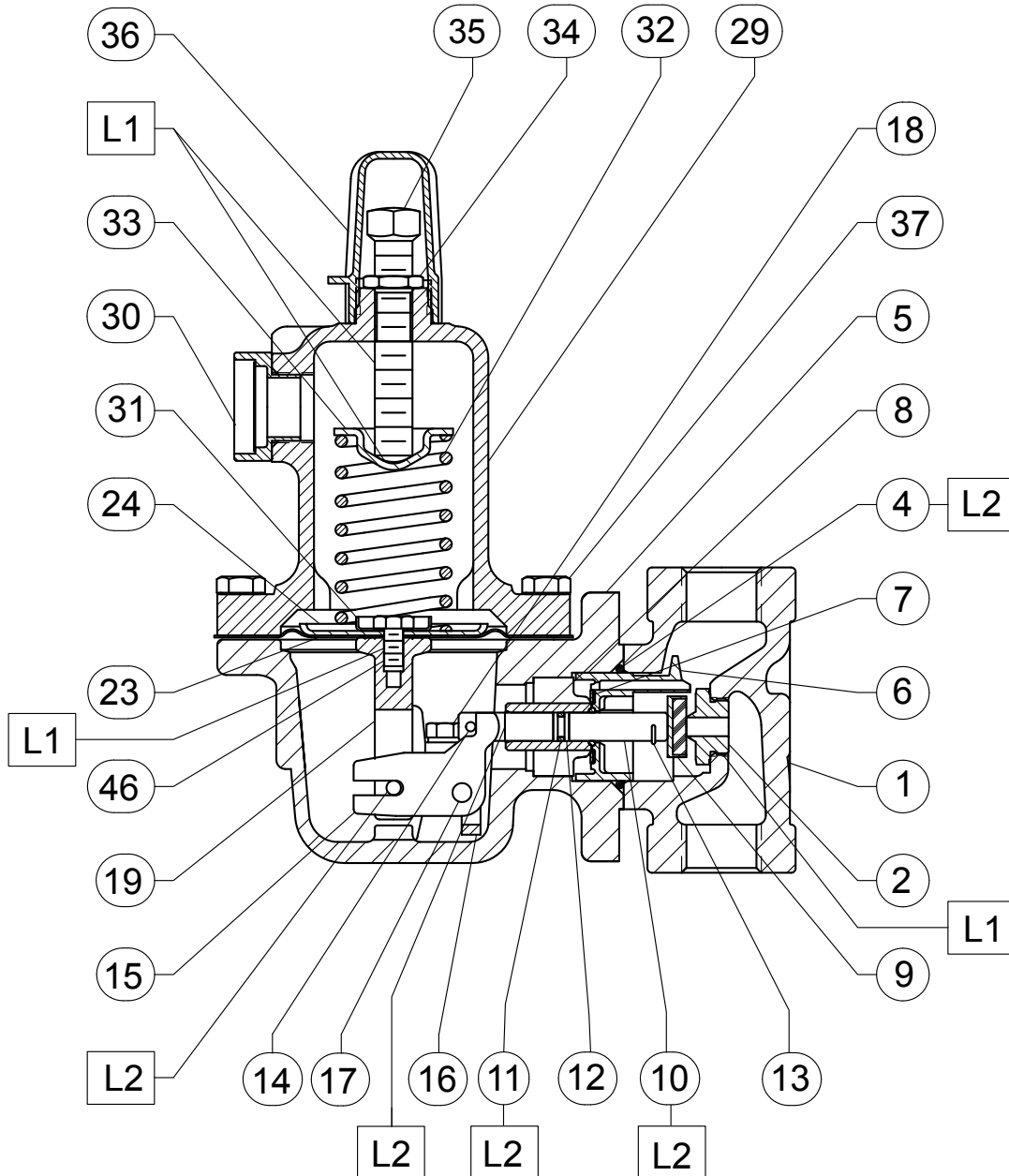
2. Stainless steel body material can be used for applications in temperature ranges down to -40°F / -40°C and are only available for Types 627, 627R, and 627H.

Delrin<sup>®</sup> is a mark owned by E.I. du Pont de Nemours and Co.

# 627 Series

Key	Description	Part Number	Key	Description	Part Number
18	Lever Cap Screw (2 required) Plated steel	10B7454X012	30	Screened Vent Assembly, Plastic	10B3093X012
	316 Stainless steel (NACE)	1B2905X0012	31	Lower Spring Seat, Plated steel	1D666625072
19	Pusher Post, Aluminum			For Type 627 or 627M	20B3073X012
	For Type 627 or 627M	10B3098X012		For Type 627R, 627LR, or 627MR	
	For Type 627R, 627LR, or 627MR	10B3098X022	32	Control Spring, Plated steel	
	For Type 627H or 627HM,			5 to 20 psig / 0.34 to 1.4 bar, Yellow	10B3076X012
	416 Stainless steel	10B3098X032		15 to 40 psig / 1.0 to 2.8 bar, Green	10B3077X012
	Stainless steel (NACE)	10B3098X102		35 to 80 psig / 2.4 to 5.5 bar, Blue	10B3078X012
21	Diaphragm Connector (for Type 627R, 627LR, or 627MR only), Stainless steel	28B8832X012		70 to 150 psig / 4.8 to 10.3 bar, Red	10B3079X012
22	Diaphragm Connector Nut (for Type 627R, 627LR, or 627MR only), Stainless steel	10B7449X012		140 to 250 psig range / 9.7 to 17.2 bar, Blue, used for Type 627H or 627HM	10B3078X012
23*	Diaphragm		33	Upper Spring Seat, Plated steel	1D667125072
	Nitrile (NBR)		34	Locknut, Plated steel	1D667728982
	For Type 627 or 627M with Aluminum or		35	Adjusting Screw, Plated steel	
	Ductile iron diaphragm case	10B3069X012		For Type 627, 627M, 627H, or 627HM	10B3081X012
	For Type 627 or 627M with			For Type 627R, 627LR, or 627MR	10B3080X012
	Steel diaphragm case	10B8735X012	36	Adjusting Screw Cap, Plastic	20B3082X012
	For Type 627R, 627LR, or 627MR with		37	Spring Case Cap Screw, Plated steel	
	Aluminum or Ductile iron diaphragm case	10B3068X012		(8 required)	
	For Type 627R, 627LR, or 627MR with			For Aluminum or ductile iron diaphragm case	1A391724052
	Steel diaphragm case	10B8736X012		For Steel diaphragm case	1A368324052
	For Type 627H or 627HM with Steel			For Stainless steel case and body	1A3683X0062
	diaphragm case (diaphragm is Neoprene (CR)			For Aluminum case and SST body	1A3917X0062
	with Nylon (PA) fabric)	12B0178X012		For Type 627H/HM, steel diaphragm case	1A346424052
	Fluorocarbon (FKM)			For Type 627H, Stainless steel case and body	1A3464X0022
	For Types 627R, 627LR, and 627MR		43	Blocked Throat (For Type 627M, 627HM, or	
	with Steel case	10B8736X022		627MR only), Stainless steel	10B3085X012
	For Types 627 and 627M with Steel case	10B8735X042	44*	Blocked Throat O-ring	
	For Types 627R, 627LR, and 627MR			Nitrile (NBR) For Type 627M, 627HM, or	
	with Ductile Iron and Aluminum Casing	10B3068X022		627MR only (2 required)	1E264306992
	For Types 627 and 627M			Fluorocarbon (FKM)	
	with Ductile Iron and Aluminum Casing	10B3069X032		For Types 627M and 627MR only	1E2643X0022
24	Diaphragm Head, Plated steel		45*	Blocked Throat Back-up Ring (For Type 627M, 627HM, or 627MR only), PTFE (2 required)	10B3106X012
	For Type 627 or 627M, Plated steel	1D666428982	46	Diaphragm Head Cap Screw, Steel	
	For Type 627R, 627LR, or 627MR, Plated steel	10B3071X012		For Type 627 or 627M	1B290524052
	For Type 627H or 627HM, 416 Stainless steel	12B0175X012		For Type 627H or 627HM	1C379124052
25	Relief Spring Seat (For Type 627R or 627MR only), Steel	10B7446X012	47	Relief Seal Retainer (For Type 627R, 627LR, or 627MR only), Stainless steel	10B7445X012
26	Guide Retainer (For Type 627R, 627LR, or 627MR only), Stainless steel	10B7450X012	48*	Guide Retainer O-ring	
27	Relief Spring (For Type 627R or 627MR only), Plated steel	10B6757X012		Nitrile (NBR)	
	For Type 627LR	1B541327022		For Type 627R, 627LR, or 627MR only	1D682506992
28*	Relief Seal O-ring			Fluorocarbon (FKM)	
	Nitrile (NBR)			For Types 627R, 627LR, and 627MR only	1N423906382
	For Type 627R, 627LR, or 627MR only	1J108506992	49	Relief Indicator (For Type 627R, 627LR, or 627MR only), Rubber (not shown)	30B3100X012
	Fluorocarbon (FKM)		50	Diaphragm Limiter	
	For Types 627R, 627LR, and 627MR only	1J1085X0042		(For Types 627H and 627HM only)	22B0176X012
29	Spring Case		51*	Diaphragm Limiter O-ring	
	For Type 627, 627R, or 627LR			For Types 627H and 627HM only	1K877606992
	Aluminum	40B3086X012	52*	Pusher Post O-ring (2 required)	
	Ductile iron	30B3055X012		For Types 627H and 627HM only	1C853806992
	Steel	30B3102X012	58	Pipe Plug, Zinc	1D8293T0022
	Stainless steel (Types 627 and 627R only)	30B3102X092	67	Drive Screw, 18-8 Stainless steel	1A368228982
29	Spring Case (continued)		72	Pipe Plug, Zinc-plated steel	1A767524662
	For Type 627M or 627MR				
	Ductile iron	30B3055X012			
	Steel	30B3102X012			
	For Type 627H or 627HM				
	Steel	30B3102X012			
	Stainless steel (Type 627H only)	30B3102X092			

\*Recommended spare part.

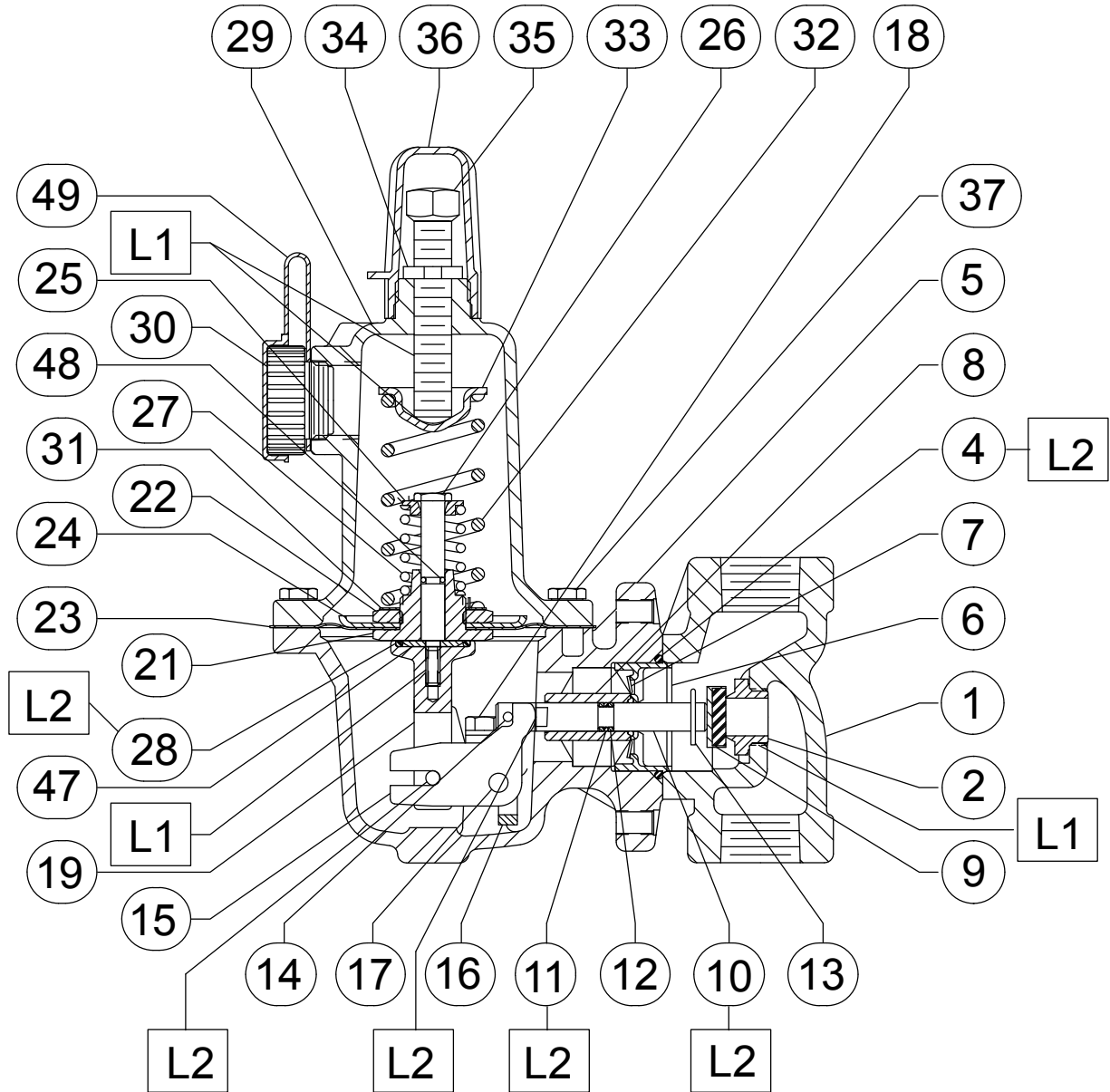


30B3092\_G

□ APPLY LUBRICANT<sup>(1)</sup>  
 L1 = MULTI-PURPOSE LITHIUM POLYMER TYPE GREASE  
 L2 = EXTREME LOW-TEMPERATURE BEARING GREASE  
 PARTS NOT SHOWN: 3

1. Lubricants must be selected such that they meet the temperature requirements.

Figure 7. Type 627 Regulator Assembly

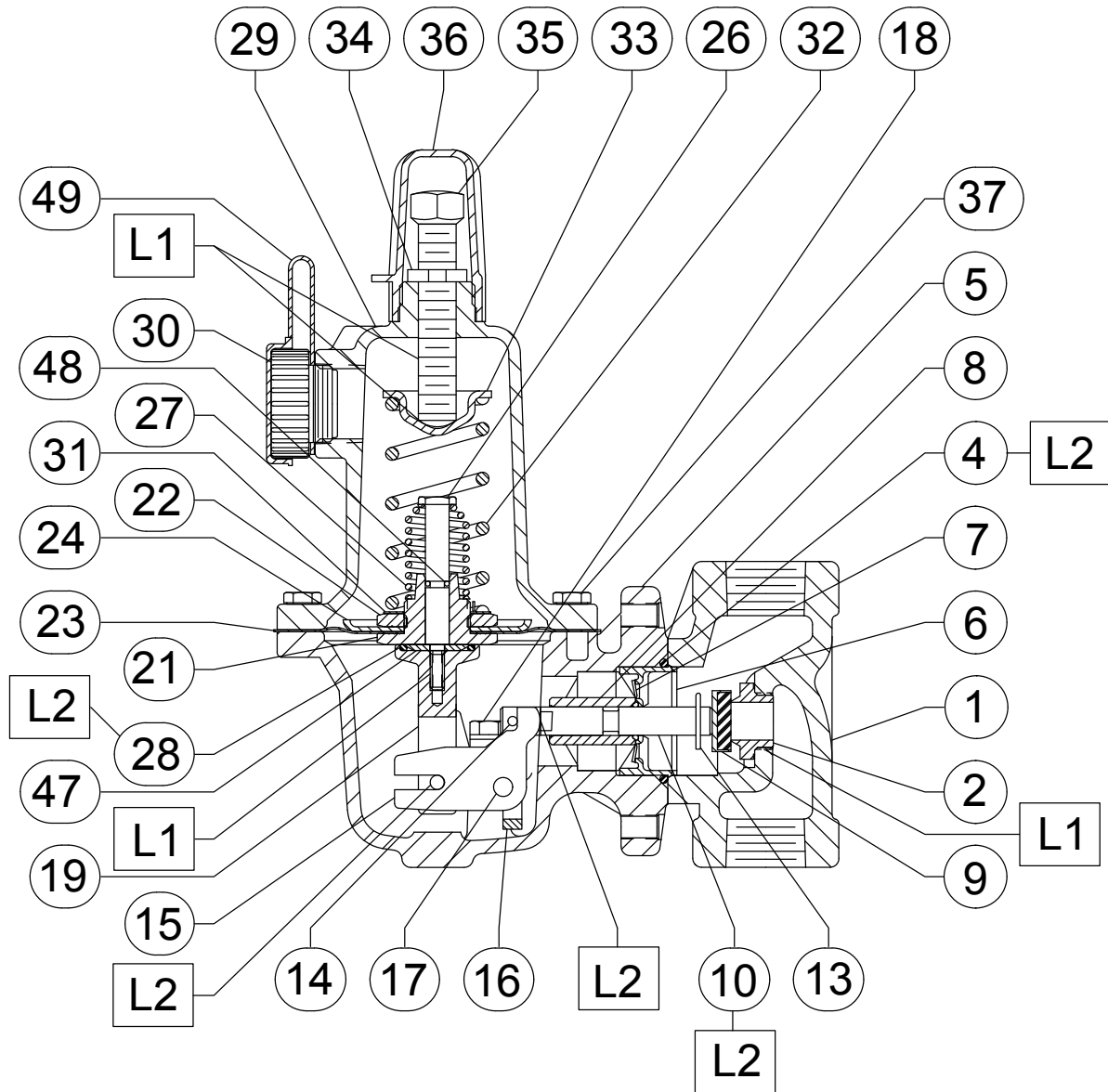


30B3089\_G

- APPLY LUBRICANT<sup>(1)</sup>
- L1 = MULTI-PURPOSE LITHIUM POLYMER TYPE GREASE
- L2 = EXTREME LOW-TEMPERATURE BEARING GREASE
- PARTS NOT SHOWN: 3

1. Lubricants must be selected such that they meet the temperature requirements.

**Figure 8. Type 627R Regulator Assembly**



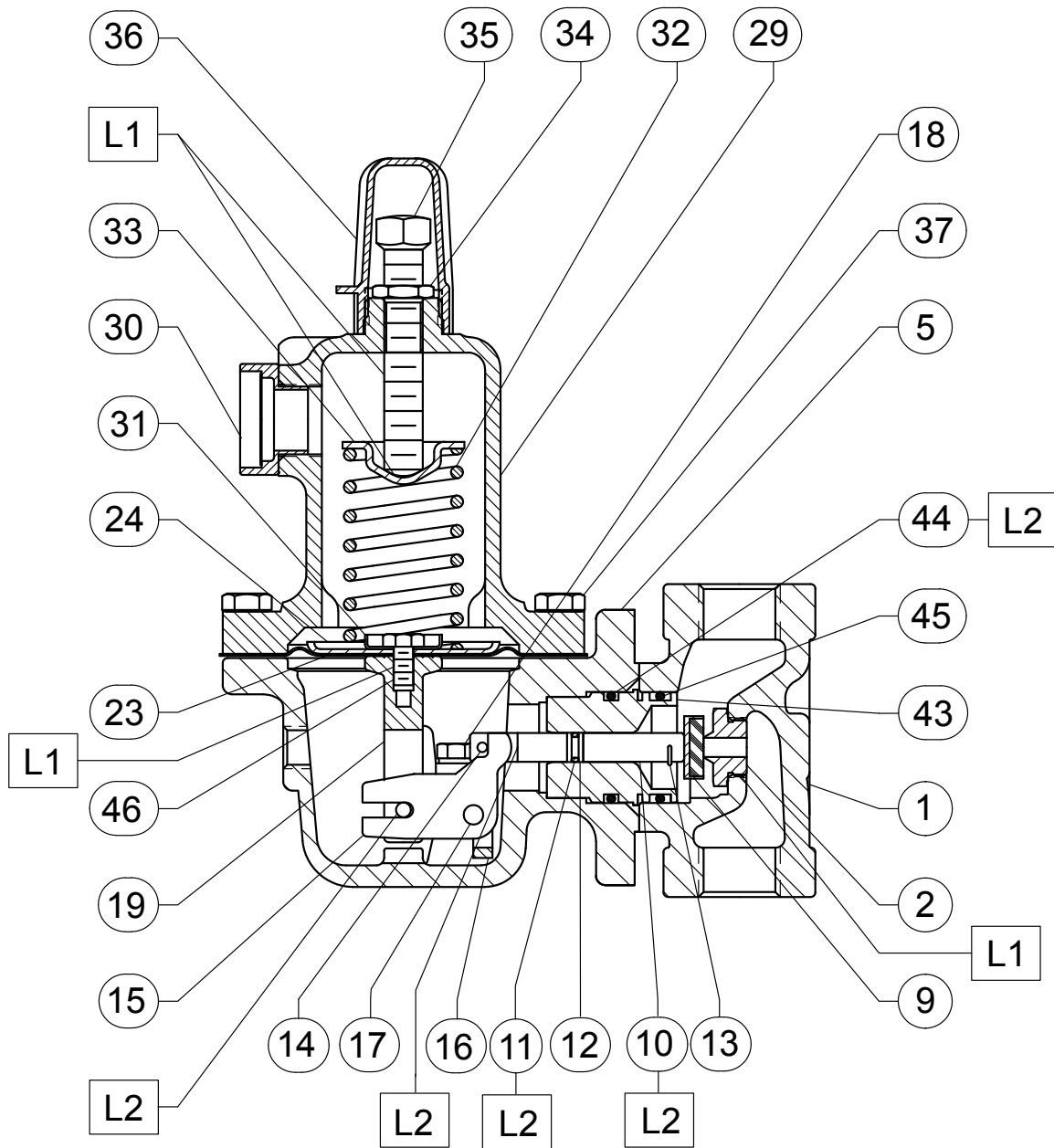
38B4843\_C

□ APPLY LUBRICANT<sup>(1)</sup>  
 L1 = MULTI-PURPOSE LITHIUM POLYMER TYPE GREASE  
 L2 = EXTREME LOW-TEMPERATURE BEARING GREASE  
 PARTS NOT SHOWN: 3

1. Lubricants must be selected such that they meet the temperature requirements.

Figure 9. Type 627LR Regulator Assembly

# 627 Series

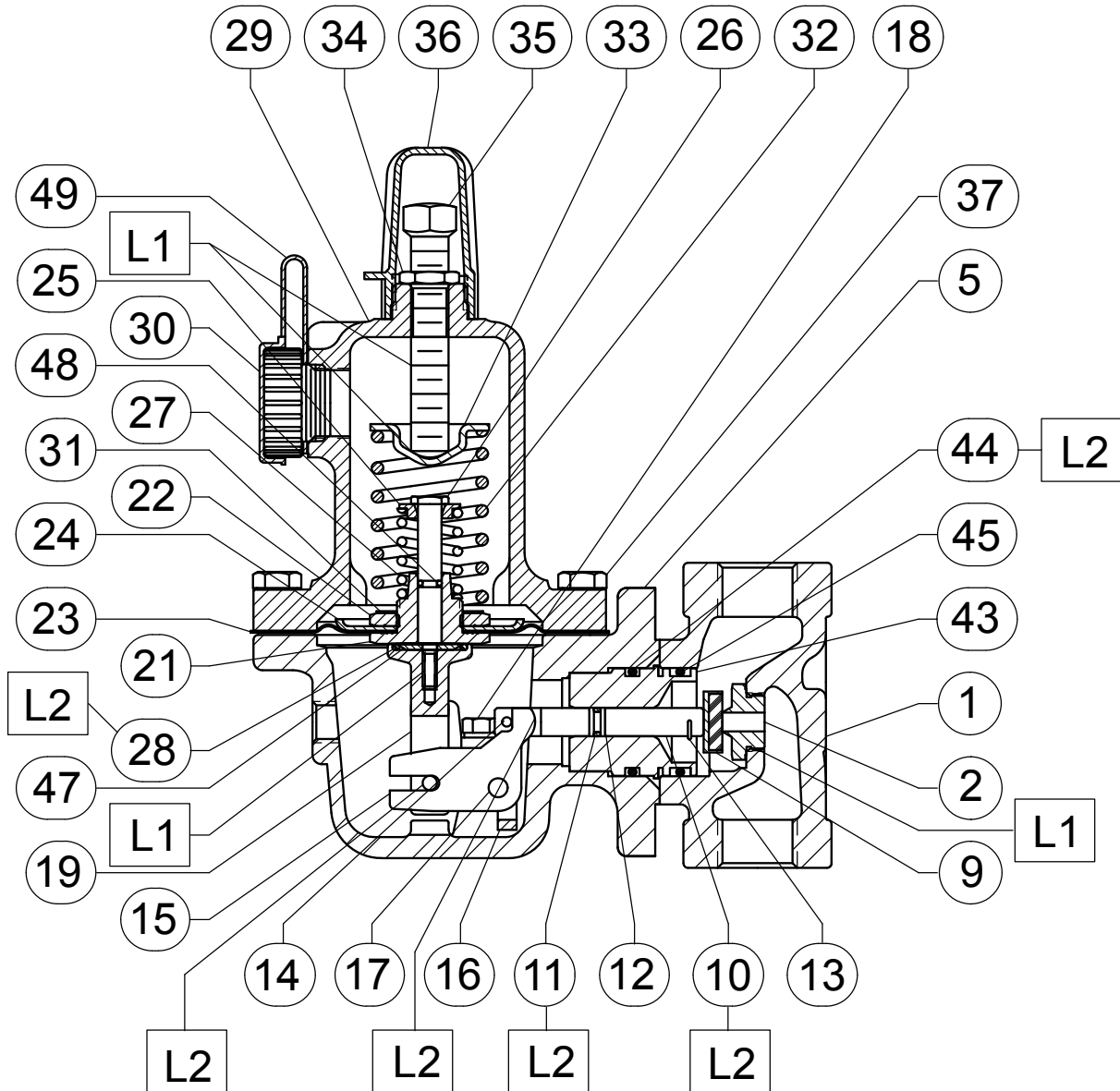


30B6433\_E

□ **APPLY LUBRICANT<sup>(1)</sup>**  
 L1 = MULTI-PURPOSE LITHIUM POLYMER TYPE GREASE  
 L2 = EXTREME LOW-TEMPERATURE BEARING GREASE  
**PARTS NOT SHOWN: 3**

1. Lubricants must be selected such that they meet the temperature requirements.

**Figure 10. Type 627M Regulator Assembly**

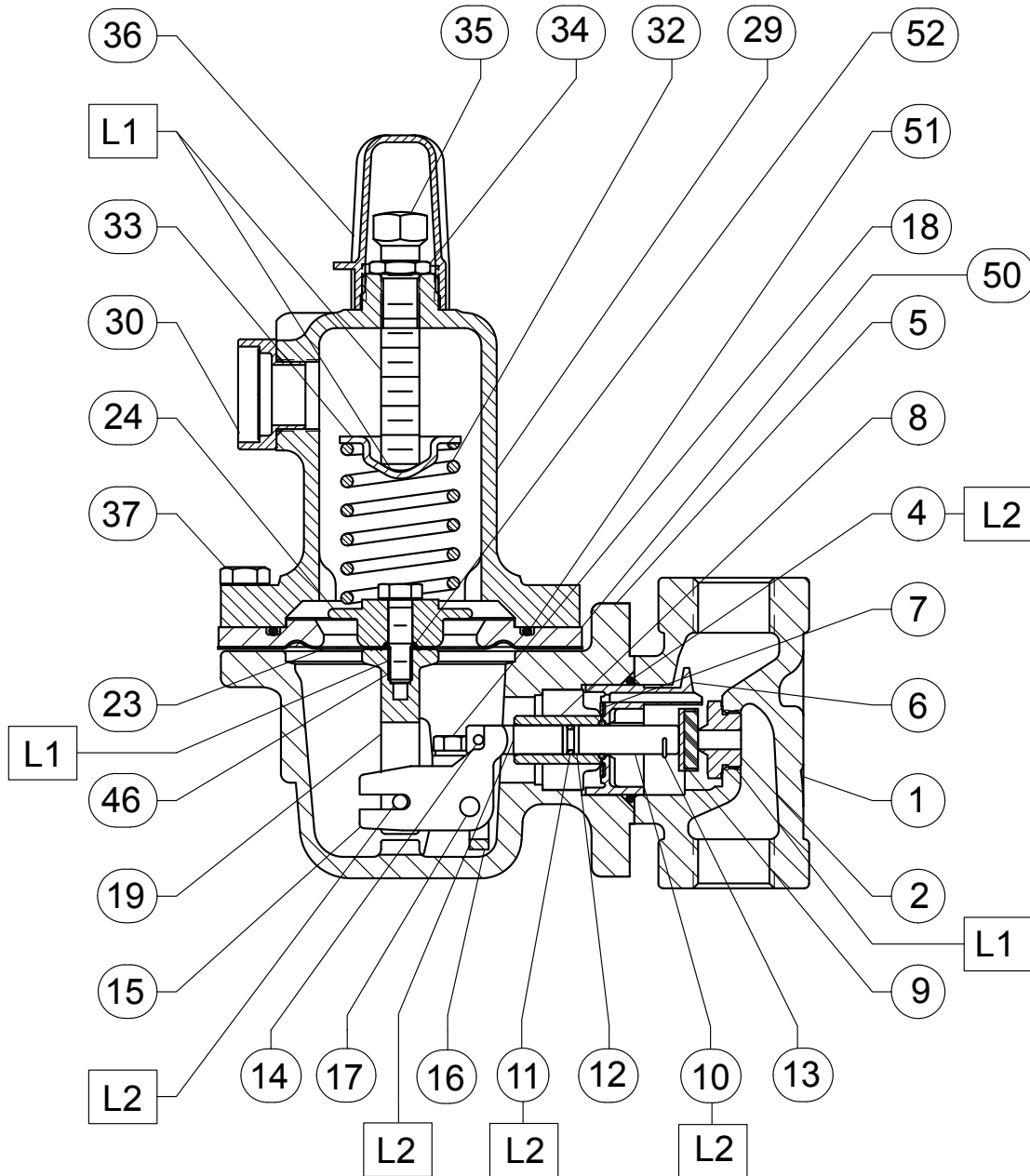


30B6434\_E

□ APPLY LUBRICANT<sup>(1)</sup>  
 L1 = MULTI-PURPOSE LITHIUM POLYMER TYPE GREASE  
 L2 = EXTREME LOW-TEMPERATURE BEARING GREASE  
 PARTS NOT SHOWN: 3

1. Lubricants must be selected such that they meet the temperature requirements.

Figure 11. Type 627MR Regulator Assembly



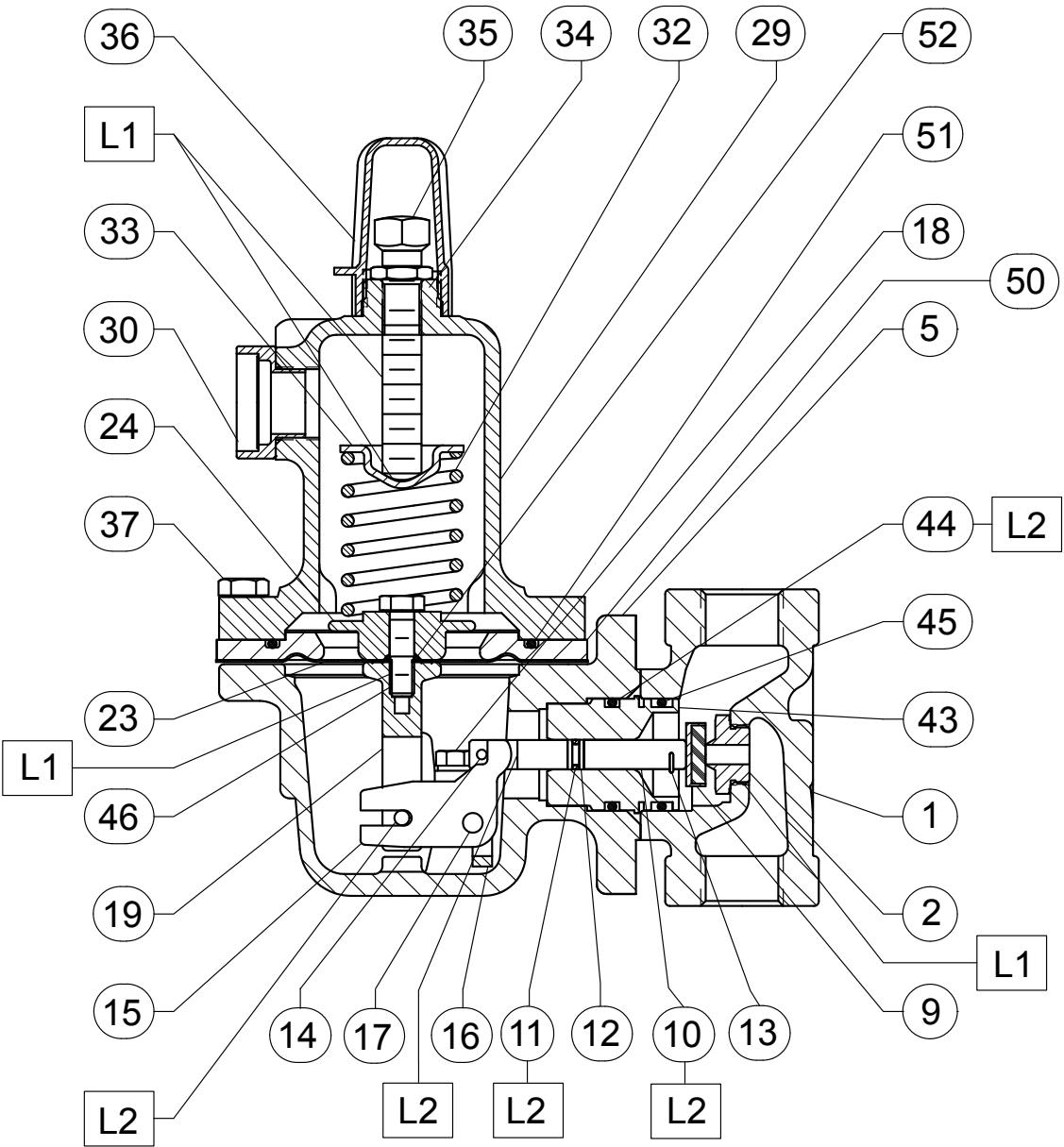
31B5374\_D

**APPLY LUBRICANT<sup>(1)</sup>**  
 L1 = MULTI-PURPOSE LITHIUM POLYMER TYPE GREASE  
 L2 = EXTREME LOW-TEMPERATURE BEARING GREASE  
 PARTS NOT SHOWN: 3

1. Lubricants must be selected such that they meet the temperature requirements.

**Figure 12. Type 627H Regulator Assembly**





31B9872\_D

□ APPLY LUBRICANT<sup>(1)</sup>  
 L1 = MULTI-PURPOSE LITHIUM POLYMER TYPE GREASE  
 L2 = EXTREME LOW-TEMPERATURE BEARING GREASE  
 PARTS NOT SHOWN: 3

1. Lubricants must be selected such that they meet the temperature requirements.

Figure 13. Type 627HM Regulator Assembly

## Industrial Regulators

### Emerson Process Management Regulator Technologies, Inc.

USA - Headquarters  
McKinney, Texas 75069-1872, USA  
Tel: +1 800 558 5853  
Outside U.S. +1 972 548 3574

Asia-Pacific  
Shanghai 201206, China  
Tel: +86 21 2892 9000

Europe  
Bologna 40013, Italy  
Tel: +39 051 419 0611

Middle East and Africa  
Dubai, United Arab Emirates  
Tel: +971 4811 8100

## Natural Gas Technologies

### Emerson Process Management Regulator Technologies, Inc.

USA - Headquarters  
McKinney, Texas 75069-1872, USA  
Tel: +1 800 558 5853  
Outside U.S. +1 972 548 3574

Asia-Pacific  
Singapore 128461, Singapore  
Tel: +65 6770 8337

Europe  
Bologna 40013, Italy  
Tel: +39 051 419 0611  
Chartres 28008, France  
Tel: +33 2 37 33 47 00

## TESCOM

### Emerson Process Management Tescom Corporation

USA - Headquarters  
Elk River, Minnesota 55330-2445, USA  
Tels: +1 763 241 3238  
+1 800 447 1250

Europe  
Selmsdorf 23923, Germany  
Tel: +49 38823 31 287

Asia-Pacific  
Shanghai 201206, China  
Tel: +86 21 2892 9499

For further information visit [www.fisherregulators.com](http://www.fisherregulators.com)

The Emerson logo is a trademark and service mark of Emerson Electric Co. All other marks are the property of their prospective owners. Fisher is a mark owned by Fisher Controls International LLC, a business of Emerson Process Management.

*The contents of this publication are presented for informational purposes only, and while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. We reserve the right to modify or improve the designs or specifications of such products at any time without notice.*

Emerson Process Management Regulator Technologies, Inc., does not assume responsibility for the selection, use or maintenance of any product. Responsibility for proper selection, use and maintenance of any Emerson Process Management Regulator Technologies, Inc. product remains solely with the purchaser.

March 2017

# 67C Series Instrument Supply Regulators



TYPE 67CF FILTER REGULATOR  
WITH OPTIONAL GAUGE



TYPE 67C OR 67CR REGULATOR

*Figure 1. 67C Series Regulators*

## Introduction

### Scope of the Manual

This manual provides instructions and parts lists for 67C Series instrument supply regulators. Instructions and parts lists for other equipment mentioned in this instruction manual, as well as for other 67C Series regulators, are found in separate manuals.

### Product Descriptions

The 67C Series direct-operated regulators are typically used to provide constantly controlled, reduced pressures to pneumatic and electro-pneumatic controllers and other instruments. They are suitable for most air or gas applications. Other applications include providing reduced pressures to air chucks, air jets and spray guns.

- The Types 67C and 67CS are the standard instrument supply regulators without a filter or internal relief.

- The Types 67CF and 67CFS are equipped with a filter for removing particles from the supply gas.
- The Types 67CR and 67CSR have an internal relief valve with a soft seat for reliable shutoff with no discernible leakage.
- The Types 67CFR and 67CFSR have a filter and internal relief valve with a soft seat for reliable shutoff with no discernible leakage.

### Principle of Operation

Downstream pressure is registered internally on the lower side of the diaphragm. When the downstream pressure is at or above the set pressure, the valve plug is held against the orifice and there is no flow through the regulator. When demand increases, downstream pressure drops slightly allowing the spring to extend, moving the stem down and the valve plug away from the orifice. This allows flow through the regulator.

# 67C Series

## Specifications

The Specifications section gives some general specifications for the 67C Series regulator. A label on the spring case gives the control spring range for a given regulator as it comes from the factory.

### Body Size, Inlet and Outlet Connection Style

1/4 NPT

### Maximum Inlet Pressure (Body Rating)<sup>(1)</sup>

**All except Types 67CS and 67CSR:**

250 psig / 17.2 bar

**Types 67CS and 67CSR:** 400 psig / 27.6 bar

### Outlet Pressure Ranges

See Table 1

### Maximum Emergency Outlet Pressure<sup>(1)</sup>

50 psi / 3.4 bar over outlet pressure setting

### Wide-Open Flow Coefficients

**Main Valve:**  $C_g$ : 11.7;  $C_v$ : 0.36;  $C_i$ : 32.2

**Internal Relief Valve:**  $C_g$ : 1.45;  $C_v$ : 0.045;  $C_i$ : 32.8

### IEC Sizing Coefficients

**Main Valve:**  $X_T$ : 0.66;  $F_L$ : 0.89;  $F_D$ : 0.50

### Accuracy

#### Inlet Sensitivity for Nitrile (NBR) and

#### Silicone (VMQ) Elastomers: Less than 0.2 psig /

14 mbar change in outlet pressure for every

25 psig / 1.7 bar change in inlet pressure

#### Inlet Sensitivity for Fluorocarbon (FKM)

#### Elastomers: Less than 0.4 psig / 28 mbar change

in outlet pressure for every 25 psig / 1.7 bar

change in inlet pressure

#### Repeatability for Nitrile (NBR) and Silicone (VMQ)

#### Elastomers: 0.1 psig / 7 mbar<sup>(2)</sup>

#### Repeatability for Fluorocarbon (FKM)

#### Elastomers: 0.3 psig / 21 mbar<sup>(2)</sup>

#### Air Consumption: Testing repeatedly shows

no discernible leakage

### Types 67CR, 67CSR, 67CFR and 67CFSR

### Internal Relief Performance

Low capacity for minor seat leakage only; other overpressure protection must be provided if inlet pressure can exceed the maximum pressure rating of downstream equipment or exceeds maximum outlet pressure rating of the regulator.

### Approximate Weights

#### Types 67C, 67CR, 67CF and 67CFR:

1 lb / 0.5 kg

#### Types 67CS and 67CSR:

2.5 lbs / 1.1 kg

#### Types 67CFS and 67CFSR:

4 lbs / 1.8 kg

### Temperature Capabilities<sup>(1)</sup>

#### With Nitrile (NBR)

*Standard Bolting:* -20 to 180°F / -29 to 82°C

*Stainless Steel Bolting:* -40 to 180°F / -40 to 82°C

#### With Fluorocarbon (FKM):

*Polyethylene Filter<sup>(5)</sup> (standard):*

0 to 180°F / -18 to 82°C

*Polyvinylidene (PVDF), Stainless steel or*

*Glass Filter (Optional):*

0 to 300°F / -18 to 149°C

#### With Silicone (VMQ)<sup>(3)</sup> Diaphragm and Low

**Temperature bolting:** -60 to 180°F / -51 to 82°C

**With Gauges:** -40 to 180°F / -40 to 82°C

### Smart Bleed™ Check Valve Setpoint

6 psi / 0.41 bar differential

### Types 67CF, 67CFR, 67CFS and 67CFSR

### Filter Capabilities

**Free Area:** 12 times pipe area

#### Micron Rating:

*Polyethylene Filter<sup>(5)</sup> (standard):* 5 microns

*Glass Fiber Filter (Optional):* 5 microns

*PVDF or Stainless Steel Filter (Optional):* 40 microns

### Drain Valve and Spring Case Vent Location

Aligned with inlet standard, other positions optional

### Pressure Registration

Internal

### Options

#### All Types

- Handwheel adjusting screw
- Inlet screen
- NACE MR0175 or NACE MR0103 construction<sup>(4)</sup>
- Panel mount (includes spring case with 1/4 NPT vent, handwheel and panel mounting nut)
- Closing cap (available on spring case with 1/4 NPT vent)
- Fluorocarbon (FKM) elastomers for high temperatures and/or corrosive chemicals
- Silicone (VMQ) elastomers for cold temperatures
- Fixed Bleed Restriction
- Triple scale outlet pressure gauge (Brass or Stainless steel)
- Stainless steel stem on the valve plug
- Tire valve or pipe plug in second outlet

#### Types 67CFR and 67CFSR only

- Smart Bleed internal check valve
- Large dripwell with manual or automatic drain

#### Types 67CF and 67CFR only

- Stainless steel drain valve

1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.

2. Repeatability is the measure of the regulator's ability to return to setpoint consistently when traveling from steady state to transient to steady state.

3. Silicone (VMQ) is not compatible with hydrocarbon gas.

4. Product complies with the material requirements of NACE MR0175. Environmental limits may apply.

5. Do not use in high aromatic hydrocarbon service.

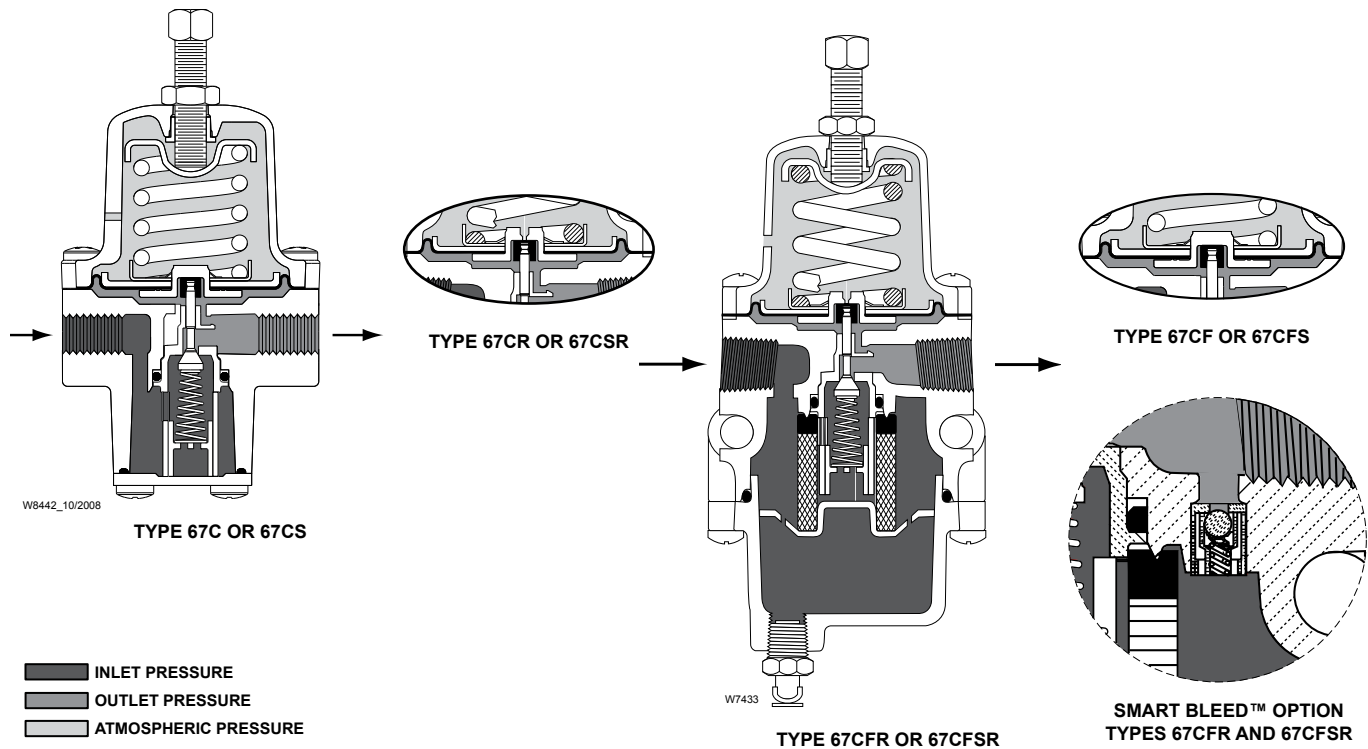


Figure 2. 67C Series Operational Schematics

### Internal Relief (Types 67CR, 67CSR, 67CFR and 67CFSR)

If for some reason, outside of normal operating conditions, the downstream pressure exceeds the setpoint of the regulator, the force created by the downstream pressure will lift the diaphragm until the diaphragm is lifted off the relief seat. This allows flow through the token relief. The relief valve on the Type 67CR, 67CSR, 67CFR or 67CFSR is an elastomer plug that prevents leakage of air from the downstream to atmosphere during normal operation, thereby conserving plant air.

### Smart Bleed Airset

In some cases, it is desired to exhaust downstream pressure if inlet pressure is lost or drops below the setpoint of the regulator. For example, if the regulator is installed on equipment that at times has no flow demand but is expected to backflow on loss of inlet pressure. The Types 67CFR and 67CFSR can be ordered with the Smart Bleed option which includes an internal check valve for this application. During operation, if inlet pressure is lost or decreases below the setpoint of the regulator, the downstream pressure will back flow upstream through the regulator and check valve. This option eliminates the need for a fixed

bleed downstream of the regulator, thereby conserving plant air.

### Note

**During normal operation the check valve's metal to metal seat allows limited flow through the regulator from the inlet to outlet, even when there is no downstream demand. To prevent downstream pressure buildup, the Smart Bleed option is only available with the internal relief version of the 67C Series.**

### Overpressure Protection

The 67C Series regulators have maximum outlet pressure ratings that are lower than their maximum inlet pressure ratings. A pressure relieving or pressure limiting device is needed if inlet pressure can exceed the maximum outlet pressure rating.

Types 67CR, 67CSR, 67CFR and 67CFSR have a low capacity internal relief valve for minor seat leakage only. Other overpressure protection must be provided if the maximum inlet pressure can exceed the maximum pressure rating of the downstream equipment or exceeds the maximum outlet pressure rating of the regulator.

**Table 1. Outlet Pressure Ranges and Control Spring Data**

TYPE	OUTLET PRESSURE RANGES		CONTROL SPRING DATA						
			Color	Material	Part Number	Wire Diameter		Free Length	
	psig	bar				In.	mm	In.	mm
67C, 67CR, 67CF and 67CFR	0 to 20	0 to 1.4	Green stripe	Music Wire	GE07809T012	0.135	3.43	1.43	36.2
	0 to 35	0 to 2.4	Silver		T14059T0012	0.156	3.96	1.43	36.2
	0 to 60	0 to 4.1	Blue stripe		T14058T0012	0.170	4.32	1.43	36.2
	0 to 125	0 to 8.6	Red stripe		T14060T0012	0.207	5.26	1.43	36.2
	0 to 35	0 to 2.4	Silver stripe	Inconel®	T14113T0012	0.156	3.96	1.43	36.2
	0 to 60	0 to 4.1	Blue		T14114T0012	0.172	4.37	1.43	36.2
	0 to 125	0 to 8.6	Red		T14115T0012	0.207	5.26	1.43	36.2
			Black		10C1730X012	0.250	6.35	1.77	44.9
67CS, 67CSR, 67CFS and 67CFSR	0 to 20	0 to 1.3	Green	Inconel®	10C1729X012	0.135	3.43	1.50	38.1
	0 to 35	0 to 2.4	Silver stripe		T14113T0012	0.156	3.96	1.43	36.2
	0 to 60	0 to 4.1	Blue		T14114T0012	0.172	4.37	1.43	36.2
	0 to 125	0 to 8.6	Red		T14115T0012	0.207	5.26	1.43	36.2
	0 to 150	0 to 10.3	Black		10C1730X012	0.250	6.35	1.77	44.9

## Installation

### Note

If the regulator is shipped mounted on another unit, install that unit according to the appropriate Instruction Manual.



### WARNING

Personal injury, property damage, equipment damage or leakage due to escaping gas or bursting of pressure-containing parts may result if this regulator is overpressured or is installed where service conditions could exceed the limits given in the Specifications section or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation or standard) to prevent service conditions from exceeding those limits.

The internal relief valve of the Type 67CR, 67CSR, 67CFR or 67CFSR does not provide full overpressure protection. The internal relief valve is designed for minor seat leakage only. If maximum inlet pressure to the regulator exceeds maximum pressure ratings of the downstream equipment or exceeds maximum allowable outlet pressure of the regulator, additional overpressure protection is required.

**A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and cause personal injury, death or property damage due to fire or explosion. Vent a regulator in hazardous gas service to a remote, safe location away from air intakes or any hazardous area. The vent line or stack opening must be protected against condensation or clogging.**

Before installing a Type 67C, 67CR, 67CS, 67CSR, 67CF, 67CFR, 67CFS or 67CFSR regulator, be sure the installation complies with the following installation guidelines:

1. Regulator operation within ratings does not preclude the possibility of damage from debris in the lines or from external sources. Regulators should be inspected for damage periodically and after any overpressure condition.
2. Only personnel qualified through training and experience should install, operate and maintain a regulator. Make sure that there is no damage to or foreign material in the regulator. Also ensure that all tubing and piping is free of debris.
3. Install the regulator so that flow is from the IN to the OUT connection as marked on the regulator body.
4. For best drainage, orient the drain valve (key 2) to the lowest possible point on the dripwell (key 5). This orientation may be improved by rotating the dripwell with respect to the body (key 1).
5. A clogged spring case vent hole may cause the regulator to function improperly. To keep this vent hole from being plugged (and to keep the spring case from collecting moisture, corrosive

Inconel® is a mark owned by Special Metals Corporation.

chemicals or other foreign material) orient the vent to the lowest possible point on the spring case or otherwise protect it.

Inspect the vent hole regularly to make sure it is not plugged. Spring case vent hole orientation may be changed by rotating the spring case with respect to the body. A 1/4 NPT spring case vent may be remotely vented by installing obstruction-free tubing or piping into the vent. Protect the remote vent by installing a screened vent cap on the remote end of the vent pipe.

6. For use in regulator shutdown, install upstream block and vent valves and downstream block and vent valves (if required) or provide some other suitable means of properly venting the regulator inlet and outlet pressures. Install a pressure gauge to monitor instruments on startup.
7. Apply a good grade of pipe compound to the external pipe threads before making connections, making sure not to get the pipe compound inside the regulator.
8. Install tubing fitting or piping into the 1/4 NPT inlet connection on the body (key 1) and into the 1/4 NPT body outlet connection.
9. The second 1/4 NPT outlet can be used for a gauge or other use. If not used, it must be plugged.

## Installing a 67CF Series Regulator in an Existing Installation

When installing a 67CF Series regulator in an existing installation, it may be necessary to use spacers (key 34, Figure 13) to adapt the installation. If the mounting bolts are too long, place a spacer on the bolt (see Figure 13). To be sure the regulator is secure, the bolts should have at least two full threads of engagement.

## Startup and Adjustment

Key numbers are referenced in Figures 3 through 9.

1. With proper installation completed and downstream equipment properly adjusted, slowly open the upstream and downstream shutoff valve (when used) while using pressure gauges to monitor pressure.



## WARNING

**To avoid personal injury, property damage or equipment damage caused by bursting of pressure containing parts or explosion of accumulated gas, never adjust the control spring to produce an outlet pressure higher than the upper limit of the outlet pressure range for that particular spring. If the desired outlet pressure is not within the range of the control spring, install a spring of the proper range according to the diaphragm parts maintenance procedure.**

2. If outlet pressure adjustment is necessary, monitor outlet pressure with a gauge during the adjustment procedure. The regulator is adjusted by loosening the locknut (key 18), if used, and turning the adjusting screw or handwheel (key 19) clockwise to increase or counterclockwise to decrease the outlet pressure setting. Retighten the locknut to maintain the adjustment position.

## Shutdown

First, close the nearest upstream block valve and then close the nearest downstream block valve (when used). Next, open the downstream vent valve. Since the regulator remains open in response to the decreasing downstream pressure, pressure between the closed block valves will be released through the open vent valve.

## Maintenance

Regulator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement of parts depends on the severity of service conditions and applicable codes and government regulations. Open the Type 67CF, 67CFR, 67CFS or 67CF SR drain valve (key 2) regularly to empty accumulated liquid from the dripwell (key 5).

### Note

**If sufficient clearance exists, the body (key 1) may remain mounted on other equipment or in a line or panel during maintenance unless the entire regulator will be replaced.**



## WARNING

**To avoid personal injury, property damage or equipment damage caused by sudden release of pressure or explosion of accumulated gas, do not attempt any maintenance or disassembly without first isolating the regulator from system pressure and relieving all internal pressure from the regulator.**

## Types 67C, 67CR, 67CS and 67CSR

### Trim Maintenance

Key numbers are referenced in Figures 3, 4 and 12.

1. Remove four bottom plate screws (key 3) from the bottom plate (key 39) and separate the bottom plate and O-ring (key 4) from the body (key 1).
2. Inspect the removed parts for damage and debris. Replace any damaged parts.
3. To remove the valve cartridge assembly, grasp the end of cartridge (key 10) and pull it straight out of body (key 1). Replace with new cartridge assembly. The cartridge assembly may be disassembled and parts may be cleaned or replaced. If the soft seat (key 15) was removed, make sure it is properly snapped into place before installing the valve cartridge assembly.
4. Check O-ring (key 14) for wear and replace, if necessary. Apply lubricant to the O-ring and place in the body. Align cartridge key to keyway in body and insert. Reinstall the O-ring (key 4), secure the bottom plate (key 39) with screws (key 3) and torque to 15 to 30 in. lbs. / 1.7 to 3.4 N•m.

### Diaphragm Maintenance

Key numbers are referenced in Figures 3 and 4.

1. Back out the adjusting screw or handwheel (key 18) until compression is removed from the spring (key 17).
2. Remove the spring case screws (key 3) to separate the spring case (key 7) from the body (key 1). Remove the upper spring seat (key 20) and spring (key 17).
3. Remove the diaphragm assembly (key 16), inspect the diaphragm and replace the assembly, if necessary.

4. Place the diaphragm assembly (key 16) on the body (key 1) as shown in Figure 3 or 4. Push down on the diaphragm assembly to make sure the valve plug (key 11) strokes smoothly and approximately 1/16 in. / 1.6 mm.

#### Note

**In step 5, if installing a control spring of a different range, be sure to delete the spring range originally appearing on the label and indicate the new spring range.**

5. Stack the control spring (key 17) and upper spring seat (key 20) onto the diaphragm assembly (key 16).
6. Install the spring case (key 7) on the body (key 1) with the vent oriented to prevent clogging or entrance of moisture. Install the six spring case screws (key 3) using a crisscross pattern and torque to 15 to 30 in. lbs. / 1.7 to 3.4 N•m.

#### Note

**On Types 67CS and 67CSR, lubricate the adjusting screw (key 18) thread to reduce galling of the Stainless steel.**

7. When all maintenance is complete, refer to the Startup and Adjustment section to put the regulator back into operation and adjust the pressure setting. Tighten the locknut (key 19) if used and install the closing cap (key 33) if used.

## Types 67CF, 67CFR, 67CFS and 67CFSR

### Filter Element and Trim Maintenance

Key numbers are referenced in Figures 5, 6 and 12.

1. Remove four dripwell screws (key 3) from the dripwell (key 5) and separate the dripwell and O-ring (key 4) from the body (key 1). The filter retainer (key 9), thrust washer (key 37), filter element (key 6) and gasket (key 26) may come off with dripwell. If not, remove these parts.
2. Inspect the removed parts for damage and debris. Replace any damaged parts. If a replacement is not available, the filter element may be cleaned.
3. To remove the valve cartridge assembly, grasp the end of cartridge and pull it straight out of body (key 1). Replace with new cartridge assembly. The cartridge assembly may be disassembled and parts may be cleaned or replaced. If the soft seat (key 15) was removed, make sure it is properly snapped into place before installing the valve cartridge assembly.



4. Check O-ring (key 14) for wear and replace, if necessary. Apply lubricant to the O-ring (key 14), then align cartridge key to keyway in body and insert. Reinstall the gasket (key 26), filter element (key 6), thrust washer (key 37) and filter retainer (key 9). Reinstall the O-ring (key 4), secure the dripwell with screws (key 3) and torque to 15 to 30 in. lbs. / 1.7 to 3.4 N•m.

## Diaphragm Maintenance

Key numbers are referenced in Figures 5 and 6.

5. Back out the adjusting screw or handwheel (key 18) until compression is removed from the spring (key 17).
  6. Remove the six spring case screws (key 3) to separate the spring case (key 7) from the body (key 1). Remove the upper spring seat (key 20) and spring (key 17).
  7. Remove the diaphragm assembly (key 16), inspect the diaphragm and replace the assembly, if necessary.
  8. Place the diaphragm assembly (key 16) on the body (key 1) as shown in Figure 5. Push down on the diaphragm assembly to make sure the valve plug (key 11) strokes smoothly and approximately 1/16 in. / 1.6 mm.
- Note**
- In step 5, if installing a control spring of a different range, be sure to delete the spring range originally appearing on the label and indicate the new spring range.**
9. Stack the control spring (key 17) and upper spring seat (key 20) onto the diaphragm assembly (key 16).
  10. Install the spring case (key 7) on the body (key 1) with the vent oriented to prevent clogging or entrance of moisture. Install the six spring case screws (key 3) using a crisscross pattern and torque to 15 to 30 in. lbs. / 1.7 to 3.4 N•m.

**Note**

**On Types 67CFS and 67CF SR, lubricate the adjusting screw (key 18) thread to reduce galling of Stainless steel.**

11. When all maintenance is complete, refer to the Startup and Adjustment section to put the regulator back into operation and adjust the pressure setting. Tighten the locknut (key 19) if used and install the closing cap (key 33) if used.

## Parts Ordering

When corresponding with the local Sales Office about this regulator, include the type number and all other pertinent information printed on the label. Specify the eleven-character part number when ordering new parts from the following parts list.

## Parts List

Key	Description	Part Number
<b>Parts Kits</b>		
	Types 67C, 67CR, 67CS and 67CSR Includes valve cartridge assembly (contains keys 10, 11, 12, 13, 14 and 15), O-ring (key 4), diaphragm assembly (key 16), and four screws (key 3)	
	Type 67C (without relief)	
	Brass stem with Nitrile (NBR) plug	R67CX000012
	Aluminum stem with Nitrile (NBR) plug (NACE)	R67CX000N12
	Type 67CR (with relief)	
	Brass stem with Nitrile (NBR) plug	R67CRX00012
	Aluminum stem with Nitrile (NBR) plug (NACE)	R67CRX000N12
	Type 67CS (without relief)	
	Stainless steel stem with Nitrile (NBR) plug (NACE)	R67CSX00012
	Type 67CSR (with relief)	
	Stainless steel stem with Nitrile (NBR) plug (NACE)	R67CSRX00012
	Types 67CF, 67CFR and 67CF SR Includes valve cartridge assembly (contains keys 10, 11, 12, 13, 14 and 15), diaphragm assembly (key 16), O-ring (key 4), filter element (key 6), filter gasket (key 26), thrust washer (key 37) and four screws (key 3)	
	Type 67CF (without relief)	
	Brass stem with Nitrile (NBR) plug	R67CFX00012
	Aluminum stem with Nitrile (NBR) plug (NACE)	R67CFX000N12
	Type 67CFR (with relief)	
	Brass stem with Nitrile (NBR) plug	R67CFRX00012
	Aluminum stem with Nitrile (NBR) plug (NACE)	R67CFRX000N12
	Type 67CF SR (with relief)	
	Stainless steel stem with Nitrile (NBR) plug (NACE)	R67CF SRX00012
	<b>Valve Cartridge Assembly Only<sup>(1)</sup></b>	
	Type 67C, 67CR, 67CF or 67CFR	
	Brass stem with Nitrile (NBR) plug with Nitrile (NBR) O-ring	T14121T0012
	with Silicone (VMQ) O-ring	T14121T0032
	Aluminum stem with Fluorocarbon (FKM) plug	T14121T0022
	with Nitrile (NBR) plug	T14121T0042
	Aluminum stem (NACE) with Nitrile (NBR) plug	T14121T0052
	with Fluorocarbon (FKM) plug	T14121T0062
	Stainless steel stem with Nitrile (NBR) plug	T14121T0072
	Type 67CS, 67CSR, 67CFS or 67CF SR	
	316 Stainless steel stem with Nitrile (NBR) plug and O-rings (NACE)	T14121T0092
	with Fluorocarbon (FKM) plug and O-rings	T14121T0102
	with Nitrile (NBR) plug and Silicone (VMQ) O-rings	T14121T0112

\*Recommended Spare Part.

1. Valve cartridge assembly includes keys 10, 11, 12, 13, 14 and 15.

# 67C Series

Key	Description	Part Number
	<b>Automatic Drain Conversion Kits</b>	
	<b>Types 67CF, 67CFR, 67CFS and 67CFSR</b>	
	Includes auto-drain (key 2), four flange screws (key 3), dripwell O-ring (key 4) and dripwell (key 5).	
	Note: Temperature rating is 40 to 175°F / 4 to 79°C.	
	Types 67CF and 67CFR	
	Nitrile (NBR)	R67ADNX0012
	Fluorocarbon (FKM)	R67ADFX0012
	Types 67CFS and 67CFSR	
	Nitrile (NBR)	R67ADNX0022
	Fluorocarbon (FKM)	R67ADFX0022
1	<b>Body</b>	
	Type 67C or 67CR, Aluminum	T40643T0RG2
	Type 67CS or 67CSR, CF3M/CF8M Stainless steel	GE00909X012
	Type 67CF or 67CFR, Aluminum	T80510T0012
	Type 67CFS or 67CFSR, CF3M/CF8M Stainless steel	40C1887X012
	Type 67CFR with Smart Bleed™, Aluminum	GE03477X012
2	<b>Drain Valve</b>	
	Manual Type 67CF or 67CFR	
	Brass	1K418918992
	316 Stainless steel	AH3946X0052
	Type 67CFS or 67CFSR	
	316 Stainless steel	AH3946X0052
	Automatic (only used with large capacity dripwell)	
	Type 67CFS or 67CFSR	
	Nitrile (NBR)	GG00554X012
	Fluorocarbon (FKM)	GG00554X022
3	<b>Flange Screw</b>	
	Type 67C, 67CR, 67CF or 67CFR	
	Standard spring case and spring case with 1/4 NPT vent (10 required)	T13526T0012
	For wire seal	
	Zinc-plated steel (9 required)	T13526T0012
	Steel (with hole) (1 required)	14B3987X012
	Type 67CS, 67CSR, 67CFS or 67CFSR (10 required)	T13526T0042
4*	<b>O-ring</b>	
	Type 67C, 67CR, 67CS or 67CSR	
	Nitrile (NBR)	T14380T0012
	Fluorocarbon (FKM)	T14380T0022
	Silicone (VMQ)	T14380T0032
	Type 67CF, 67CFR, 67CFS or 67CFSR	
	Nitrile (NBR)	T14057T0042
	Fluorocarbon (FKM)	T14057T0022
	Silicone (VMQ)	T14057T0032
5	<b>Dripwell</b>	
	Type 67CF or 67CFR, Aluminum	
	<b>Standard</b>	T21040T0012
	Large Capacity, manual drain	GE34605X012
	Large Capacity, automatic drain	GE34606X012
	Type 67CFS or 67CFSR, CF3M/CF8M Stainless steel	
	<b>Standard</b>	20C1726X012
	Large Capacity, manual drain	GE34607X012
	Large Capacity, automatic drain	GE31792X012
6*	<b>Filter Element</b>	
	(Types 67CF, 67CFR, 67CFS and 67CFSR)	
	Polyethylene (5 microns) ( <b>standard</b> )	GE32761X012
	Glass fiber (5 microns)	17A1457X012
	Polyvinylidene fluoride (PVDF) (40 microns)	GE32762X012
	316 Stainless steel (40 microns)	15A5967X022

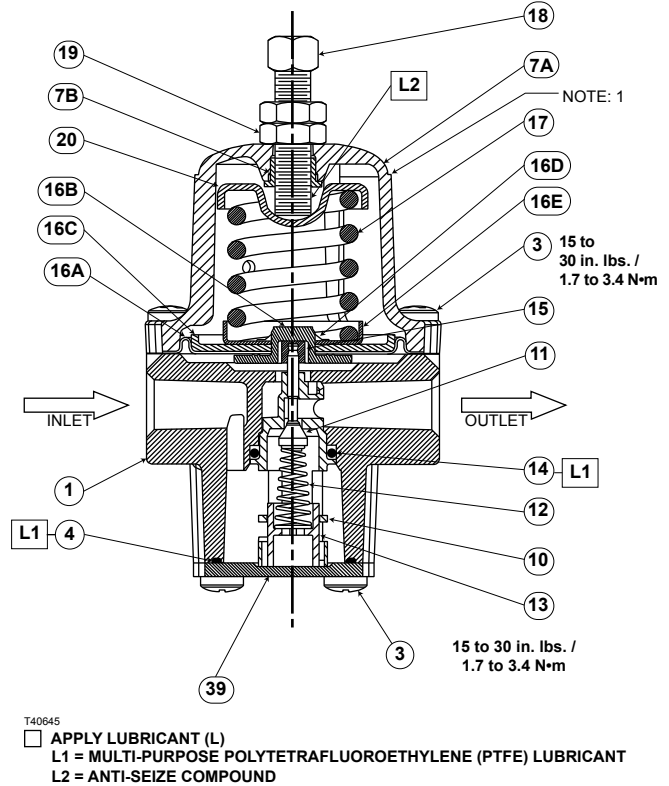
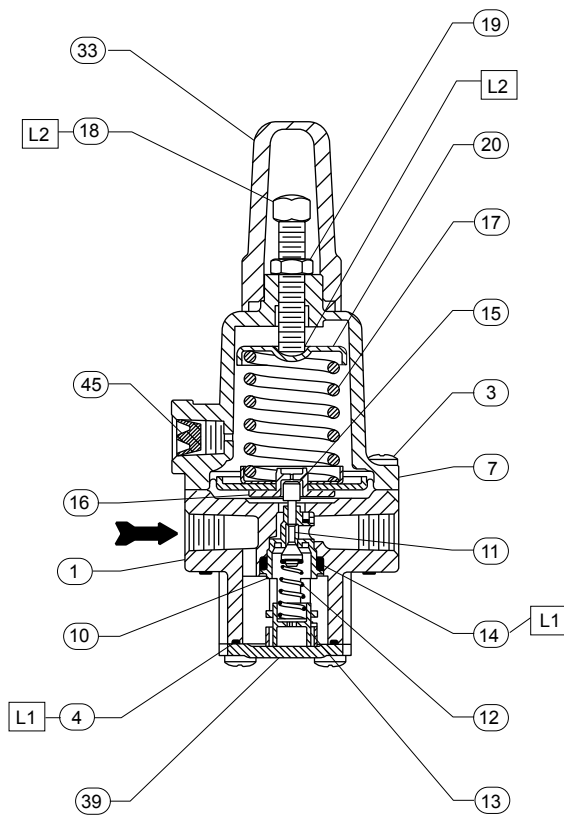


Figure 3. Type 67C or 67CR Assembly

Key	Description	Part Number
7	<b>Spring Case Assembly</b>	
	Type 67C, 67CR, 67CF or 67CFR, Aluminum/Steel	
	Drilled hole vent ( <b>standard</b> )	T14070T0012
	Single hole vent	T14070T0022
	Type 67CS, 67CSR, 67CFS or 67CFSR, CF3M/CF8M Stainless steel	20C1727X012
9	<b>Filter Retainer</b>	
	Type 67CF or 67CFR, Zinc-plated	T14052T0012
	Type 67CFS or 67CFSR, 316 Stainless steel	T14052T0022
10 <sup>*(1)</sup>	<b>Valve Cartridge</b>	T80434T0012
11 <sup>*(1)</sup>	<b>Valve Plug</b>	
	Type 67C, 67CR, 67CF or 67CFR	
	Brass stem, Nitrile (NBR) plug	T14053T0012
	Aluminum stem, Fluorocarbon (FKM) plug	T14053T0022
	Aluminum stem, Nitrile (NBR) plug	T14053T0032
	Type 67CS, 67CSR, 67CFS or 67CFSR	
	Stainless steel stem, Nitrile (NBR) plug	T14053T0042
	Stainless steel stem, Fluorocarbon (FKM) plug	T14053T0052
12 <sup>*(1)</sup>	<b>Valve Spring</b>	
	Type 67C, 67CR, 67CF or 67CFR	
	302 Stainless steel	T14105T0012
	Inconel® (NACE)	T14116T0012
	Type 67CS, 67CSR, 67CFS or 67CFSR, Inconel® (NACE)	T14116T0012
13 <sup>*(1)</sup>	<b>Valve Retainer, Rynite®</b>	T14071T0012
14 <sup>*(1)</sup>	<b>O-ring</b>	
	Nitrile (NBR)	T14063T0012
	Fluorocarbon (FKM)	T14063T0022
	Silicone (VMQ)	T14063T0032
15 <sup>*(1)</sup>	<b>Soft Seat</b>	
	Nitrile (NBR)	T14055T0012
	Fluorocarbon (FKM)	T14055T0022

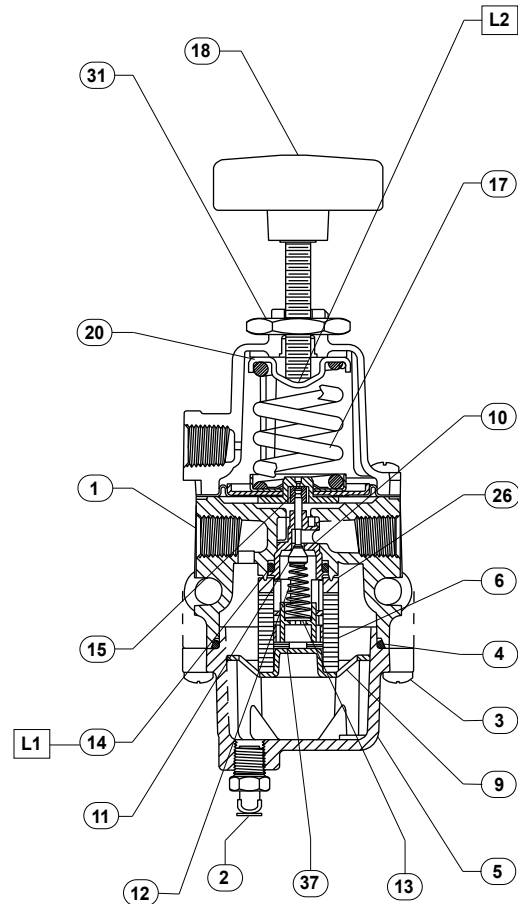
\*Recommended Spare Part.  
 1. Valve cartridge assembly includes keys 10, 11, 12, 13, 14 and 15.  
 Inconel® is a mark owned by Special Metals Corporation.  
 Rynite® is a mark owned by E.I. du Pont de Nemours and Co.



GE03521

□ APPLY LUBRICANT (L):  
L1 = MULTI-PURPOSE POLYTETRAFLUOROETHYLENE (PTFE) LUBRICANT  
L2 = ANTI-SEIZE COMPOUND

Figure 4. Type 67CS or 67CSR Assembly



T40580

□ APPLY LUBRICANT (L):  
L1 = MULTI-PURPOSE POLYTETRAFLUOROETHYLENE (PTFE) LUBRICANT  
L2 = ANTI-SEIZE COMPOUND

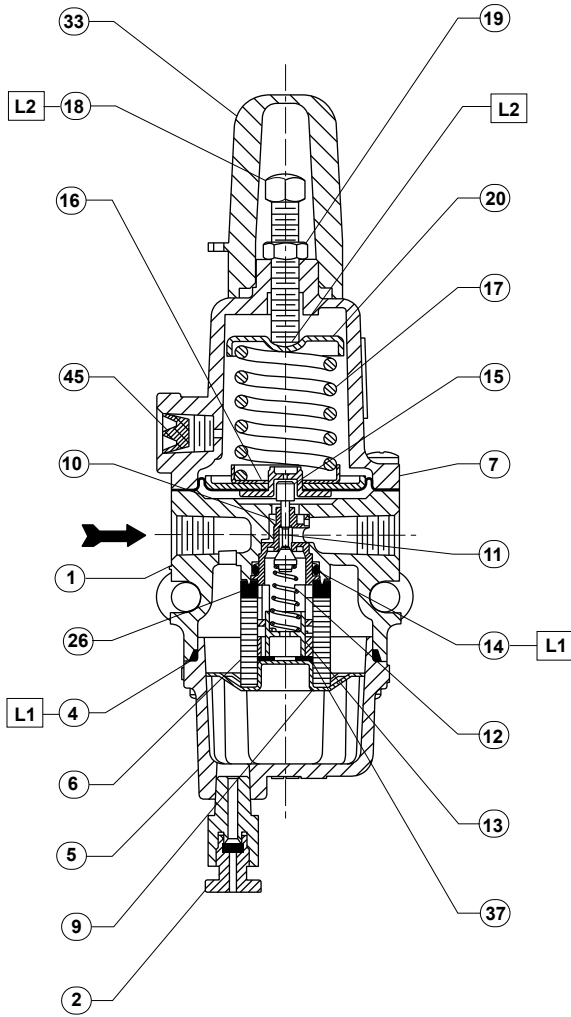
Figure 5. Type 67CF or 67CFR Assembly

Key	Description	Part Number
16*	Diaphragm Assembly Type 67C or 67CF (without relief) Nitrile (NBR) Fluorocarbon (FKM) Type 67CR or 67CFR (with relief) Nitrile (NBR) Fluorocarbon (FKM) Silicone (VMQ) Type 67CS or 67CFS (without relief) Nitrile (NBR) Fluorocarbon (FKM) Type 67CSR or 67CFSR (with relief) Nitrile (NBR) Fluorocarbon (FKM) Silicone (VMQ)	T14119T0022 T14119T0042 T14119T0012 T14119T0032 T14119T0052 T14119T0062 T14119T0072 T14119T0082 T14119T0092 T14119T0102
17	Spring Type 67C, 67CR, 67CF or 67CFR, Plated steel (standard) 0 to 20 psig / 0 to 1.4 bar, Green stripe 0 to 35 psig / 0 to 2.4 bar, Silver 0 to 60 psig / 0 to 4.1 bar, Blue stripe 0 to 125 psig / 0 to 8.6 bar, Red stripe	GE07809T012 T14059T0012 T14058T0012 T14060T0012

Key	Description	Part Number
17	Spring (continued) Type 67CR or 67CFR (NACE), Inconel® (NACE) 0 to 35 psig / 0 to 2.4 bar, Silver stripe 0 to 60 psig / 0 to 4.1 bar, Blue 0 to 125 psig / 0 to 8.6 bar, Red Type 67CS, 67CSR, 67CFS or 67CFRS, Inconel® (NACE) 0 to 20 psig / 0 to 1.3 bar, Green 0 to 35 psig / 0 to 2.4 bar, Silver stripe 0 to 60 psig / 0 to 4.1 bar, Blue 0 to 125 psig / 0 to 8.6 bar, Red 0 to 150 psig / 0 to 10.3 bar, Black	T14113T0012 T14114T0012 T14115T0012 10C1729X012 T14113T0012 T14114T0012 T14115T0012 10C1730X012
18	Adjusting Screw Type 67C, 67CR, 67CF or 67CFR, Zinc-plated steel For standard spring case Square head (standard) Handwheel Wire seal (not shown) For spring case with 1/4 NPT vent, Zinc-plated steel Square head for closing cap, Handwheel Wire seal (not shown)	T14061T0012 T14102T0012 T14104T0012 T14101T0012 T14103T0012 T14198T0012

\*Recommended Spare Part.  
Inconel® is a mark owned by Special Metals Corporation.

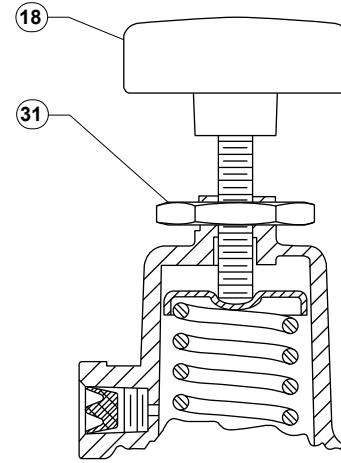
# 67C Series



40C1728

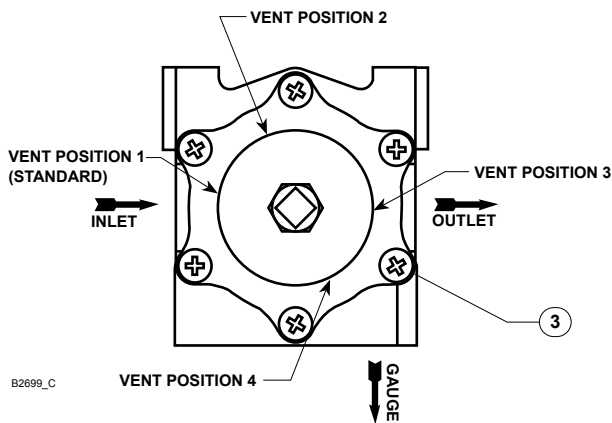
□ APPLY LUBRICANT (L):  
 L1 = MULTI-PURPOSE POLYTETRAFLUOROETHYLENE (PTFE) LUBRICANT  
 L2 = ANTI-SEIZE COMPOUND

**Figure 6.** Type 67CFS or 67CF SR Assembly



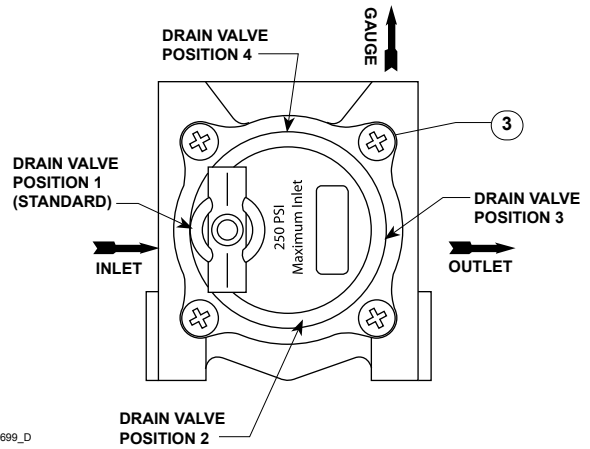
40C1728

**Figure 7.** 67C Series Optional Panel Mount



B2699\_C

**Figure 8.** 67C Series Spring Case Vent Positions



B2699\_D

**Figure 9.** Types 67CF, 67CFR, 67CFS and 67CF SR Drain Valve Positions

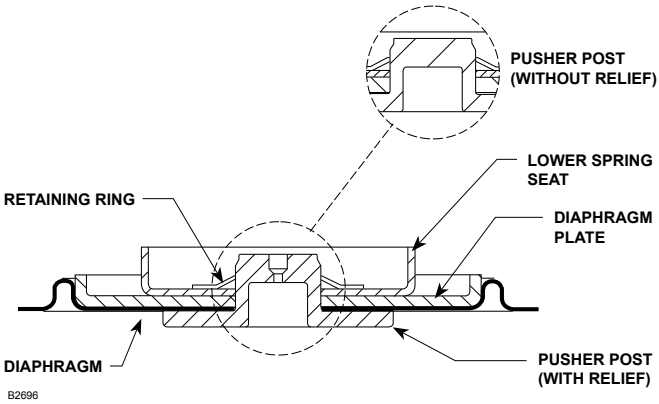


Figure 10. Diaphragm Assembly (key 16)

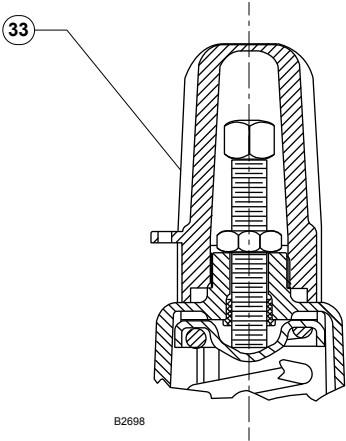


Figure 11. Optional Closing Cap  
(Only Available with the 1/4 in. / 6.4 mm Spring Case Vent)

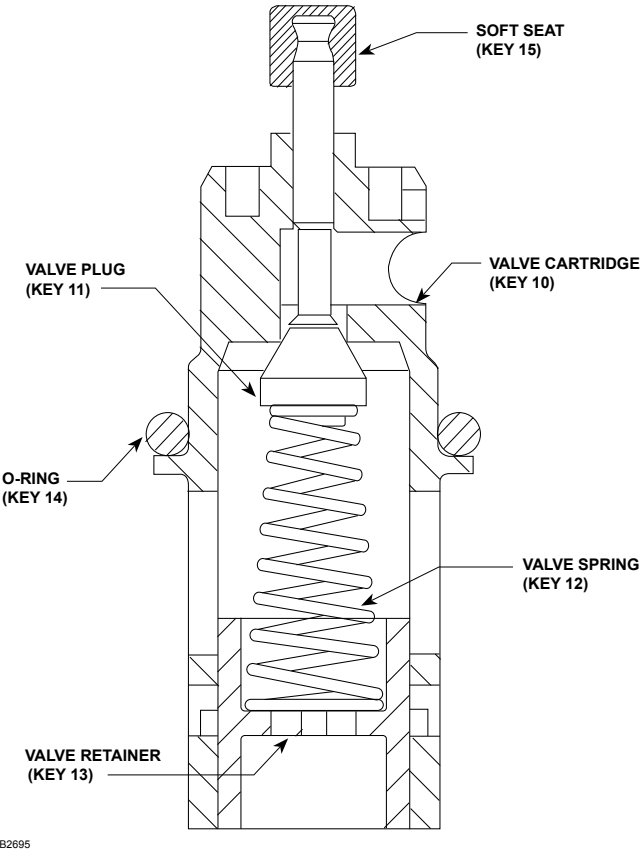


Figure 12. Valve Cartridge Assembly

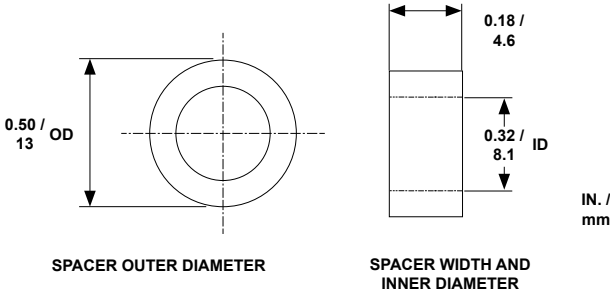


Figure 13. Spacer Diameter and Assembly  
(For Installing in an Existing Installation  
if the Mounting Bolts are Too Long)

# 67C Series

Key	Description	Part Number	Key	Description	Part Number
18	Adjusting Screw (continued) Type 67CS, 67CSR, 67CFS or 67CFSR Square head with or without closing cap, 316 Stainless steel Handwheel, Zinc-plated steel	T14101T0022 T14103T0012	26*	Filter Gasket Type 67CF, 67CFR, 67CFS or 67CFSR with Nitrile (NBR) O-ring with Fluorocarbon (FKM) O-ring	T14081T0012 T14081T0022
19	Locknut Type 67C, 67CR, 67CF or 67CFR Zinc-plated steel 316 Stainless steel Type 67CS, 67CSR, 67CFS or 67CFSR 316 Stainless steel	1A946324122 1A9463X0042 1A9463X0042	30	NACE Tag (not shown), 18-8 Stainless steel	19A6034X012
20	Upper Spring Seat Type 67C or 67CR only 1/4 NPT Vent Type 67C, 67CR, 67CF or 67CFR <b>Standard</b>	T14051T0042 T14051T0012	31	Panel Mounting Nut, 303 Stainless steel	10B2657X012
22	Pressure Gauge (not shown) Type 67C, 67CR, 67CF or 67CFR, Brass 0 to 30 psig / 0 to 2.1 bar / 0 to 0.2 MPa 0 to 60 psig / 0 to 4.1 bar / 0 to 0.4 MPa 0 to 160 psig / 0 to 11.0 bar / 0 to 1.1 MPa For all types, Stainless steel 0 to 30 psig / 0 to 2.1 bar / 0 to 0.2 MPa 0 to 60 psig / 0 to 4.1 bar / 0 to 0.4 MPa 0 to 160 psig / 0 to 11.0 bar / 0 to 1.1 MPa	11B8579X022 11B8579X032 11B8579X042 11B9639X012 11B9639X022 11B9639X032	32	Wire Seal (not shown) Type 67C or 67CR 304 Stainless steel	1U7581000A2 23B9152X012
23	1/4 in. / 6.4 mm Pipe Plug (not shown) Type 67C, 67CR, 67CF or 67CFR Socket head, Steel For all types Hex head, Stainless steel	1C333528992 1A767535072	33	Closing Cap, Resin	
24	Tire Valve (not shown) Type 67C, 67CR, 67CF or 67CFR	1H447099022	34	Spacer (2 required) (Figure 13) Type 67CF or 67CFR, Steel Type 67CFS or 67CFSR, 18-8 Stainless steel	T14123T0012 T14123T0022
			37*	Thrust Washer (Type 67CF, 67CFR, 67CFS or 67CFSR) with Nitrile (NBR) O-rings with Fluorocarbon (FKM) O-rings	T14196T0012 T14196T0022
			39	Bottom Plate, 316 Stainless steel Type 67C or 67CR Type 67CS or 67CSR	GE03520XRG2 GE03520X012
			45	Screen Vent, 18-8 Stainless steel Type 67CS, 67CSR, 67CFS or 67CFSR	0L078343062

## Parts for Mounting on Fisher™ 2500 Series Controller (Type 67CF or 67CFR)

Key	Description	Part Number
35	Mounting adaptor plate, Steel (not shown)	T21043T0012
36	O-ring, Nitrile (NBR) (not shown)	1E591406992
38	Gasket, Neoprene (CR) (not shown)	1C898603012

\*Recommended Spare Part.

✉ Webadmin.Regulators@emerson.com

Facebook.com/EmersonAutomationSolutions

🔍 Fisher.com

LinkedIn.com/company/emerson-automation-solutions

Twitter.com/emr\_automation

### Emerson Automation Solutions Regulator Technologies

#### Americas

McKinney, Texas 75070 USA  
T +1 800 558 5853  
+1 972 548 3574

#### Europe

Bologna 40013, Italy  
T +39 051 419 0611

#### Asia Pacific

Singapore 128461, Singapore  
T +65 6770 8337

#### Middle East and Africa

Dubai, United Arab Emirates  
T +971 4 811 8100

D102601X012 © 2003, 2017 Emerson Process Management Regulator Technologies, Inc. All rights reserved. 03/17.

The Emerson logo is a trademark and service mark of Emerson Electric Co. All other marks are the property of their prospective owners. Fisher™ is a mark owned by Fisher Controls International LLC, a business of Emerson Automation Solutions.

The contents of this publication are presented for information purposes only, and while effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available on request. We reserve the right to modify or improve the designs or specifications of our products at any time without notice.

Emerson Process Management Regulator Technologies, Inc. does not assume responsibility for the selection, use or maintenance of any product. Responsibility for proper selection, use and maintenance of any Emerson Process Management Regulator Technologies, Inc. product remains solely with the purchaser.



WGI Classic series pressure gauges are for general service applications where cost savings are needed. WGI Classic series gauges are used in many different industries such as pumping systems, hydraulic or pneumatic systems and compressor packages and also as a contractors gauge.

Inquire about CRN Number



## Specifications

### Case Material

Black Case - Power Coated

### Fill Fluid

None

### Lens Material

Glass

### Dial

White aluminum with black and red lettering (UV Resistant Paint)

### Pointer

Black aluminum

### Accuracy

± 3%-2%-3% ASME B40.1 Grade B

### Tube & Socket

Brass tube soldered to brass socket

### Temperature Limits

-20°C (-4°F) to 70°C (158°F) ambient and medium

### Pressure Ranges

-30" Hg. Vacuum to 1000 psi/kPa

### Sizes

1 1/2", 2", 2 1/2" & 3 1/2"

### Index

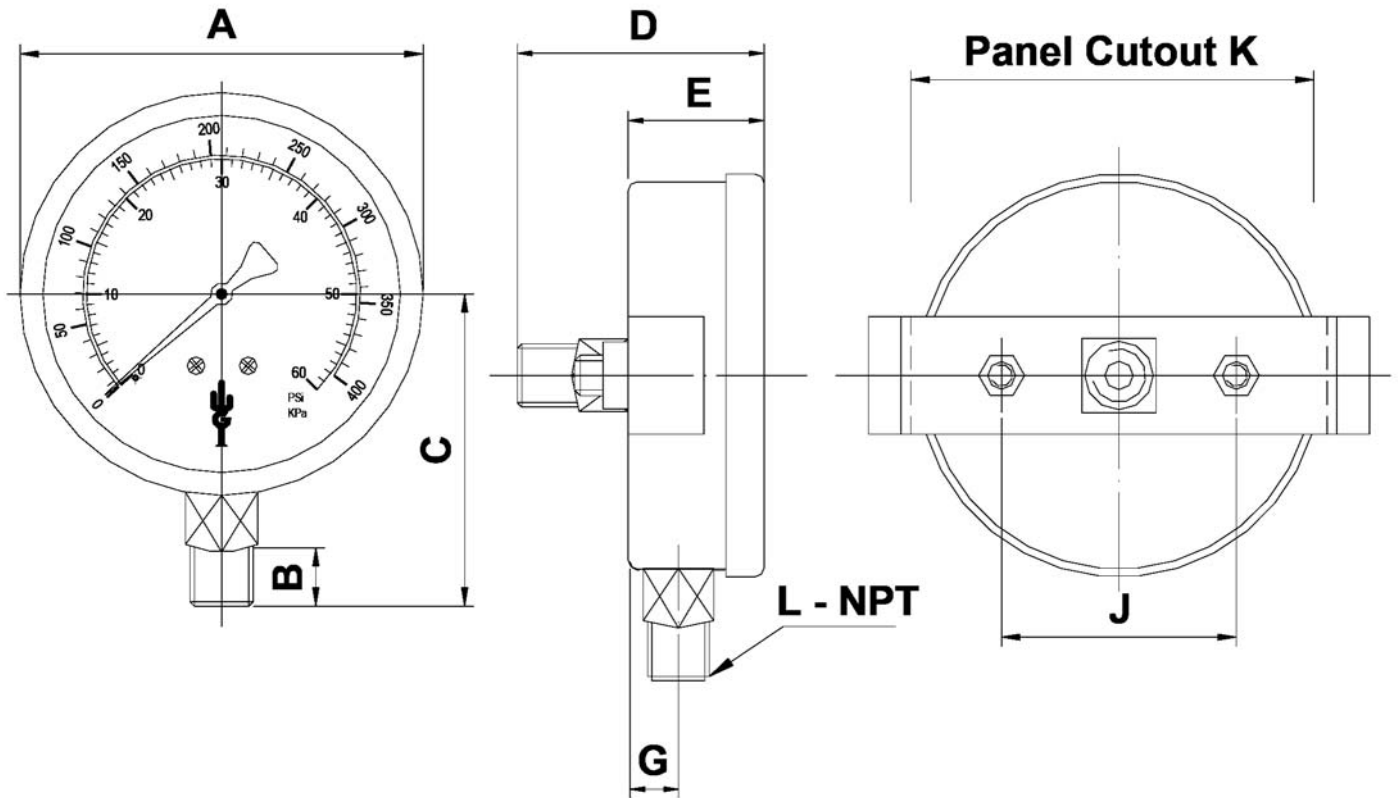
BTM = Bottom Mount  
 CBM = Center Back  
 CBU = Center Back U-Clamp  
 LBU = Lower Back U-Clamp

## Dimensions: mm / inch

Connection	Classic 150		Classic 200				Classic 250			Classic 350	
	1/8" BTM	1/8" CBM	1/4" BTM	1/8" CBM	1/4" CBM	1/4" CBU	1/4" BTM	1/4" CBM	1/4" CBU	1/4" BTM	1/4" CBU
Pressure Range	1 1/2" Dial	1 1/2" Dial	2" Dial	2" Dial	2" Dial	2" Dial	2 1/2" Dial	2 1/2" Dial	2 1/2" Dial	3 1/2" Dial	3 1/2" Dial
30" Hg Vac	WJ0405	WJ0605	WJ1405	N/S	WJ2005	WJ2605	WJ4605	N/S	WJ6205	WJ8005	WJ8805
30" Hg. x 30 psi	WJ0412	WJ0612	WJ1412	N/S	WJ2012	WJ2612	WJ4612	N/S	WJ6212	WJ8012	WJ8812
30" Hg. x 160 psi	N/S	N/S	N/S	N/S	WJ2018	WJ2618	WJ4618	N/S	WJ6218	WJ8018	WJ8818
30" Hg. x 300 psi	N/S	N/S	N/S	N/S	N/S	WJ2624	WJ4624	N/S	WJ6224	WJ8024	WJ8824
0-15 psi / kPa	WJ0440	WJ0640	WJ1440	N/S	WJ2040	WJ2640	WJ4640	WJ5440	WJ6240	WJ8040	WJ8840
0-30 psi / kPa	WJ0442	WJ0642	WJ1442	WJ1842	WJ2042	WJ2642	WJ4642	WJ5442	WJ6242	WJ8042	WJ8842
0-60 psi / kPa	WJ0446	WJ0646	WJ1446	WJ1846	WJ2046	WJ2646	WJ4646	WJ5446	WJ6246	WJ8046	WJ8846
0-100 psi / kPa	WJ0448	WJ0648	WJ1448	WJ1848	WJ2048	WJ2648	WJ4648	WJ5448	WJ6248	WJ8048	WJ8848
0-160 psi / kPa	WJ0452	WJ0652	WJ1452	WJ1852	WJ2052	WJ2652	WJ4652	WJ5452	WJ6252	WJ8052	WJ8852
0-200 psi / kPa	WJ0454	WJ0654	WJ1454	WJ1854	WJ2054	WJ2654	WJ4654	WJ5454	WJ6254	WJ8054	WJ8854
0-300 psi / kPa	WJ0458	WJ0658	WJ1458	N/S	WJ2058	WJ2658	WJ4658	N/S	WJ6258	WJ8058	WJ8858
0-400 psi / kPa	WJ0460	WJ0660	WJ1460	N/S	WJ2060	WJ2660	WJ4660	N/S	WJ6260	WJ8060	WJ8860
0-600 psi / kPa	WJ0464	WJ0664	WJ1464	N/S	WJ2064	WJ2664	WJ4664	N/S	WJ6264	WJ8064	WJ8864
0-1000 psi / kPa	WJ0472	WJ0672	WJ1472	N/S	WJ2072	WJ2672	WJ4672	N/S	WJ6272	WJ8072	WJ8872

## Dimensions

Classic Series – Bottom, Center Back Mount & U-Clamp



### Dimensions: mm / inch

Series	A	B	C	D	E	G	J	K	L
WJ04	42/1.65	10.0/0.39	34.0/1.3	n/a	23.0/0.9	8.0/0.3	n/a	n/a	1/8" npt
WJ06	42 / 1.65	10.0 / 0.39	n/a	41.0 / 1.6	25.0 / 0.98	n/a	n/a	n/a	1/8" npt
WJ14	52.5 / 2.06	10.0 / 0.39	46.0 / 1.8	n/a	28.0 / 1.1	10.0 / 0.4	n/a	n/a	1/4" npt
WJ18	52.5 / 2.06	12.0 / 0.47	n/a	48.0 / 1.8	28.0 / 1.1	n/a	n/a	n/a	1/4" npt
WJ20	52.5 / 2.06	12.0 / 0.47	n/a	48.0 / 1.8	28.0 / 1.1	n/a	n/a	n/a	1/4" npt
WJ26	58.0 / 2.2	12.0 / 0.47	n/a	48.0 / 1.8	30.0 / 1.18	n/a	35	51.5 / 2.0	1/4" npt
WJ46	68.0 / 2.6	12.0 / 0.47	50.0 / 1.9	n/a	28.0 / 1.1	10.0 / 0.4	n/a	n/a	1/4" npt
WJ54	68.0 / 2.6	12.0 / 0.47	n/a	48.0 / 1.8	28.0 / 1.1	n/a	n/a	n/a	1/4" npt
WJ62	68.0 / 2.6	12.0 / 0.47	n/a	48.0 / 1.8	30.0 / 1.18	n/a	48	62.5 / 2.0	1/4" npt
WJ80	89.0 / 3.5	12.0 / 0.47	50.0 / 1.9	n/a	29.0 / 1.14	12.0 / 0.47	n/a	n/a	1/4" npt
WJ88	98.0 / 3.8	12.0 / 0.47	n/a	51.0 / 2.0	32.0 / 1.2	n/a	75	88.0 / 3.4	1/4" npt



## GTG2518 Series (2.5"/63mm)

Stainless Steel Pressure Gauges  
1/4" NPT Bottom or Center Back Mount



### ► Applications

Chemical and petrochemical industries, conventional and nuclear power plants, pumps, hydro-cleaning machines, presses, engine compressors, turbines, diesel engines and refrigerating plants, food and beverage, pharmaceutical industries



### ► Specifications

Accuracy	ASME B40.1, Grade B, ±3-2-3%
Ambient temperature	- 40°C to 65°C
Process temperature	Max 100°C (Dry) Max 65°C (Filled)
Operating pressure	75% of the scale value
Over pressure limit	25% of full scale value
Case	AISI 304 SS
Ring	AISI 304 SS, crimped ring
Bourdon Tube	AISI 316 SS
Socket	AISI 316 SS
Movement	AISI 304 SS
Dial	Aluminum, black & red graduation on white background
Pointer	Aluminum, black
Window	Plexiglas
Fill	Glycerine/H <sub>2</sub> O (standard) Silicone (optional) Halocarbon (optional)
Gaskets/Vent/Blow out Plugs	Neoprene
Standard Scale	psi/kPa (standard), special dials & scales available
Connection	1/4" NPT (standard)

### ► How to order

Bottom Mount: GTG2518A + Range Code  
Center Back Mount: GTG2518D + Range Code

Panel Mount Accessories: GTFF-2.5: Front Flange 304SS  
GTUC-2.5: U-Clamp

Range Code		Range Code		Range Code		Range Code	
<b>01</b>	<b>30" Hg - 0</b>	<b>08</b>	<b>30" Hg-300 psi/kPa</b>	<b>15</b>	<b>0-300 psi/kPa</b>	<b>22</b>	<b>0-2000 psi/kPa</b>
02	30" Hg-15 psi/kPa	<b>09</b>	<b>0-15 psi/kPa</b>	<b>16</b>	<b>0-400 psi/kPa</b>	<b>23</b>	<b>0-3000 psi/kPa</b>
<b>03</b>	<b>30" Hg-30 psi/kPa</b>	<b>10</b>	<b>0-30 psi/kPa</b>	<b>17</b>	<b>0-500 psi/kPa</b>	24	0-4000 psi/kPa
<b>04</b>	<b>30" Hg-60 psi/kPa</b>	<b>11</b>	<b>0-60 psi/kPa</b>	<b>18</b>	<b>0-600 psi/kPa</b>	<b>25</b>	<b>0-5000 psi/kPa</b>
05	30" Hg-100 psi/kPa	<b>12</b>	<b>0-100 psi/kPa</b>	19	0-800 psi/kPa	<b>26</b>	<b>0-6000 psi/kPa</b>
<b>06</b>	<b>30" Hg-150 psi/kPa</b>	<b>13</b>	<b>0-160 psi/kPa</b>	<b>20</b>	<b>0-1000 psi/kPa</b>	<b>27</b>	<b>0-10,000 psi/kPa</b>
07	30" Hg-200 psi/kPa	<b>14</b>	<b>0-200 psi/kPa</b>	<b>21</b>	<b>0-1500 psi/kPa</b>		

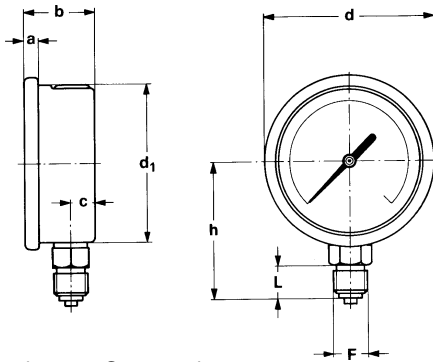
Ranges shown in bold are typically stocked in our warehouse.

# GTG2518 Series (2.5"/63mm)

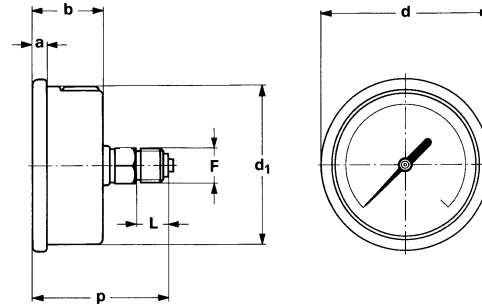
Stainless Steel Pressure Gauges  
1/4" NPT Bottom or Center Back Mount



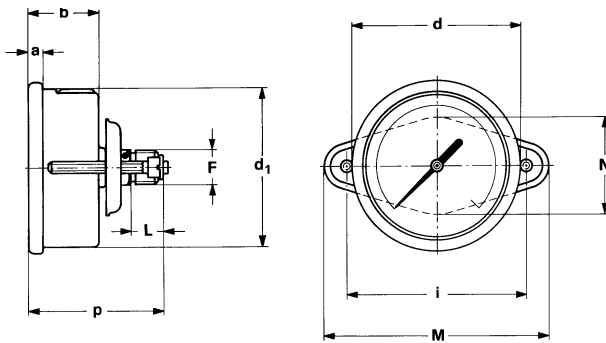
## ► Dimensions



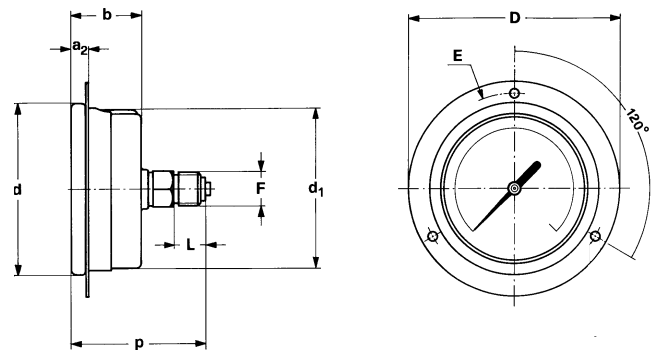
Lower Connection



Flush Mounting Back Connection



Flush Mounting, "U-Clamp" Back Connection



Flush Mounting, Front Flange Back Connection

NS	A	A <sub>2</sub>	b	c	d	d <sub>1</sub>	E	F	I	L	M	N	P
63	6	7	30	9	68	61	75	13	71	12	90	38	56

## ► Accessories



Flange: GTFF-2.5



U-Clamp: GTUC-2.5

Drawings are not to scale. Dimensions in millimeters.

WGI Elite series pressure gauges have a 304 stainless steel case for use in harsh or corrosive environments, liquid filled for significant cushioning and pulsation dampening which reduces pointer flutter and internal damage. These Gauges are used in oil and gas equipment, refineries, hydraulic equipment, agricultural equipment, pressure washers, pumps, compressors and process systems.

## Specifications

### Case Material

304 stainless steel, top nitrile vent plug with valve and lens seal

### Fill Fluid

Silicone

### Lens Material

Acrylic & safety glass (safety glass Standard on WH109)

### Dial

White aluminum with black and red lettering (UV Resistant Paint)

### Pointer

Black aluminum

### Accuracy

Elite 150/250 ± 2%-1%-2% ASME B40.1 Grade B  
Elite 600 + 400 ± 1% full scale ASME B40.1 Grade A

### Tube & Socket

316L stainless steel NACE MR 0175

### Temperature Limits

-60°C to 70°C ambient and medium

### Pressure Ranges

-30" Hg. Vacuum to 15,000 psi/kPa

### Sizes

1½", 2", 2½", 4" & 6"



Inquire about CRN Number

### Index

BTM = Bottom Mount

CBM = Center Back

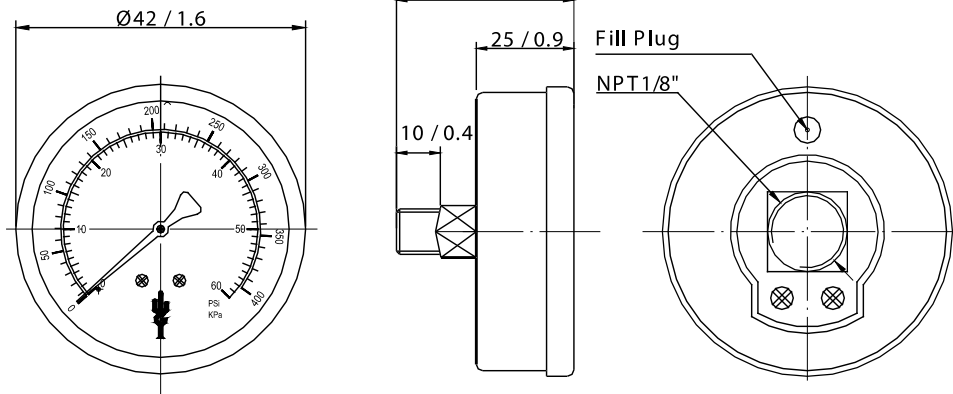
CBU = Center Back U-Clamp

LBU = Lower Back U-Clamp

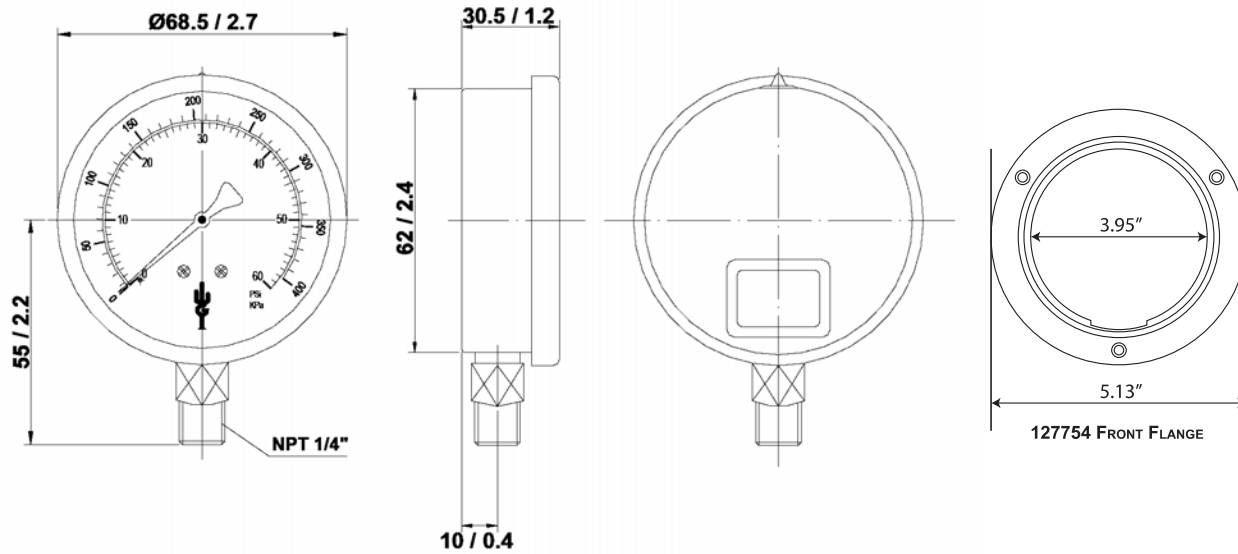
	Elite 150	Elite 150	Elite 200	Elite 200	Elite 250	Elite 250	Elite 400	Elite 400	Elite 400	Elite 600
Connection	1/8" BTM	1/8" CBM	1/4" BTM	1/4" CBM	1/4" BTM	1/4" CBU	1/4" BTM	1/4" LBU	1/2" BTM	1/2" BTM
Pressure Range	1½" Dial	1½" Dial	2" Dial	2" Dial	2½" Dial	2½" Dial	4" Dial	4" Dial	4" Dial	6" Dial
30" Hg Vac/-kPa	n/s	n/s	n/s	n/s	WJ7805P	WJ7405P	WH10705P	WH10805P	WH10905P	WH20905P
30" Hg. x 15 psi/kPa	n/s	n/s	n/s	n/s	WJ7810P	WJ7410P	WH10710P	WH10810P	WH10910P	WH20910P
30" Hg. x 30 psi/kPa	n/s	n/s	n/s	n/s	WJ7812P	WJ7412P	WH10712P	WH10812P	WH10912P	WH20912P
30" Hg. x 60 psi/kPa	n/s	n/s	n/s	n/s	WJ7814P	WJ7414P	WH10714P	WH10814P	WH10914P	WH20914P
30" Hg. x 100 psi/kPa	n/s	n/s	n/s	n/s	WJ7816P	WJ7416P	WH10716P	WH10816P	WH10916P	WH20916P
30" Hg. x 150 psi/kPa	n/s	n/s	n/s	n/s	WJ7818P	WJ7418P	WH10718P	WH10818P	WH10918P	WH20918P
30" Hg. x 300 psi/kPa	n/s	n/s	n/s	n/s	WJ7824P	WJ7424P	WH10724P	WH10824P	WH10924P	WH20924P
0-15 psi/kPa	n/s	n/s	n/s	n/s	WJ7840P	WJ7440P	WH10740P	WH10840P	WH10940P	WH20940P
0-30 psi/kPa	WJ1142P	WJ1042P	WJ1342P	WJ1542P	WJ7842P	WJ7442P	WH10742P	WH10842P	WH10942P	WH20942P
0-60 psi/kPa	WJ1146P	WJ1046P	WJ1346P	WJ1546P	WJ7846P	WJ7446P	WH10746P	WH10846P	WH10946P	WH20946P
0-100 psi/kPa	WJ1148P	WJ1048P	WJ1348P	WJ1548P	WJ7848P	WJ7448P	WH10748P	WH10848P	WH10948P	WH20948P
0-160 psi/kPa	WJ1152P	WJ1052P	WJ1352P	WJ1552P	WJ7852P	WJ7452P	WH10752P	WH10852P	WH10952P	WH20952P
0-200 psi/kPa	WJ1154P	WJ1054P	WJ1354P	WJ1554P	WJ7854P	WJ7454P	WH10754P	WH10854P	WH10954P	WH20954P
0-300 psi/kPa	WJ1158P	WJ1058P	WJ1358P	WJ1558P	WJ7858P	WJ7458P	WH10758P	WH10858P	WH10958P	WH20958P
0-400 psi/kPa	n/s	n/s	n/s	n/s	WJ7860P	WJ7460P	WH10760P	WH10860P	WH10960P	WH20960P
0-500 psi/kPa	n/s	n/s	n/s	n/s	WJ7862P	WJ7462P	WH10762P	WH10862P	WH10962P	WH20962P
0-600 psi/kPa	n/s	n/s	n/s	n/s	WJ7864P	WJ7464P	WH10764P	WH10864P	WH10964P	WH20964P
0-800 psi/kPa	n/s	n/s	n/s	n/s	WJ7868P	WJ7468P	WH10768P	WH10868P	WH10968P	WH20968P
0-1000 psi/kPa	n/s	n/s	n/s	n/s	WJ7872P	WJ7472P	WH10772P	WH10872P	WH10972P	WH20972P
0-1500 psi/kPa	n/s	n/s	n/s	n/s	WJ7874P	WJ7474P	WH10774P	WH10874P	WH10974P	WH20974P
0-2000 psi/kPa	n/s	n/s	n/s	n/s	WJ7876P	WJ7476P	WH10776P	WH10876P	WH10976P	WH20976P
0-3000 psi/kPa	n/s	n/s	n/s	n/s	WJ7878P	WJ7478P	WH10778P	WH10878P	WH10978P	WH20978P
0-5000 psi/kPa	n/s	n/s	n/s	n/s	WJ7882P	WJ7482P	WH10782P	WH10882P	WH10982P	WH20982P
0-6000 psi/kPa	n/s	n/s	n/s	n/s	WJ7884P	WJ7484P	WH10784P	WH10884P	WH10984P	WH20984P
0-7500 psi/kPa	n/s	n/s	n/s	n/s	WJ7886P	WJ7486P	WH10786P	WH10886P	WH10986P	WH20986P
0-10000 psi/kPa	n/s	n/s	n/s	n/s	WJ7890P	WJ7490P	WH10790P	WH10890P	WH10990P	WH20990P
0-15000 psi/kPa	n/s	n/s	n/s	n/s	WJ7892P	WJ7492P	WH10792P	WH10892P	WH10992P	WH20992P

**Dimensions**

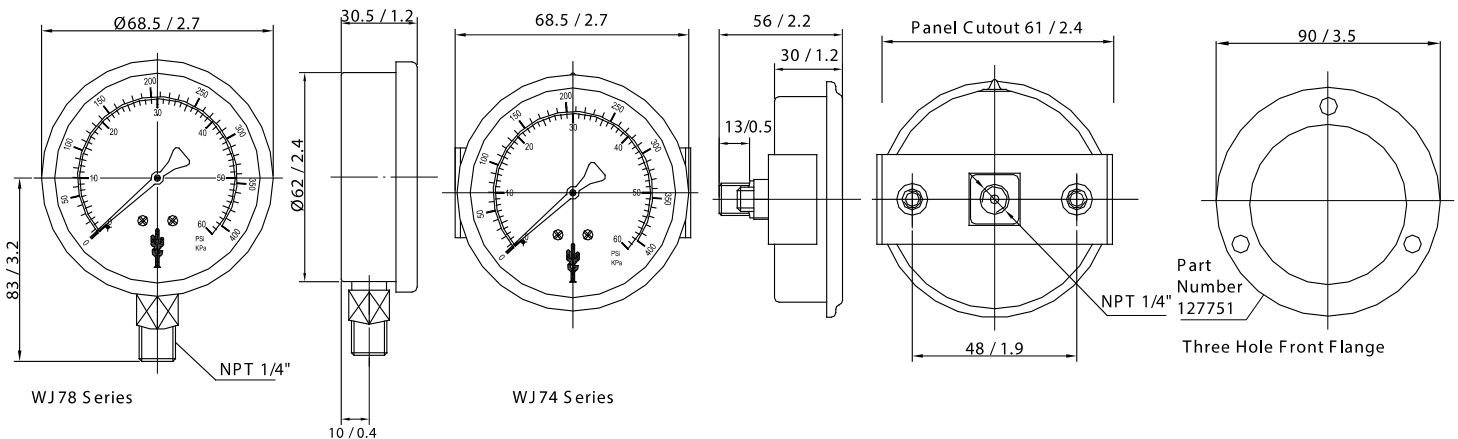
**Elite 150 Stainless Steel – Center Back Mount**



**Elite 200 Stainless – Bottom Mount**

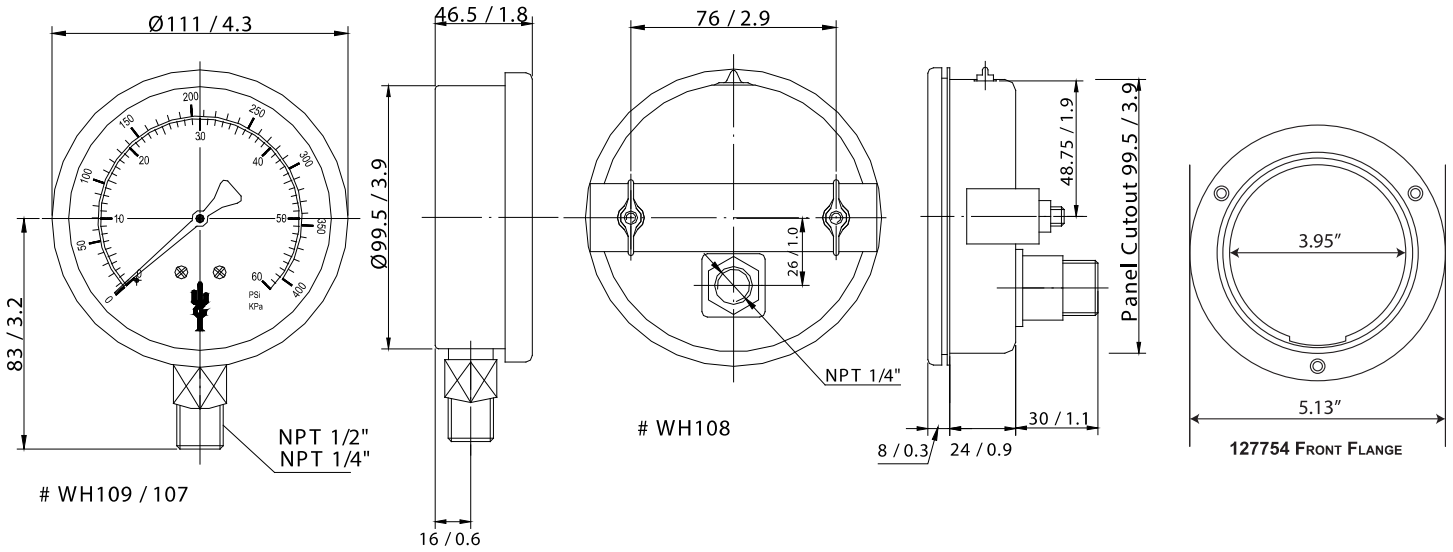


**Elite 250 Stainless Steel – Bottom Mount & U-Clamp**

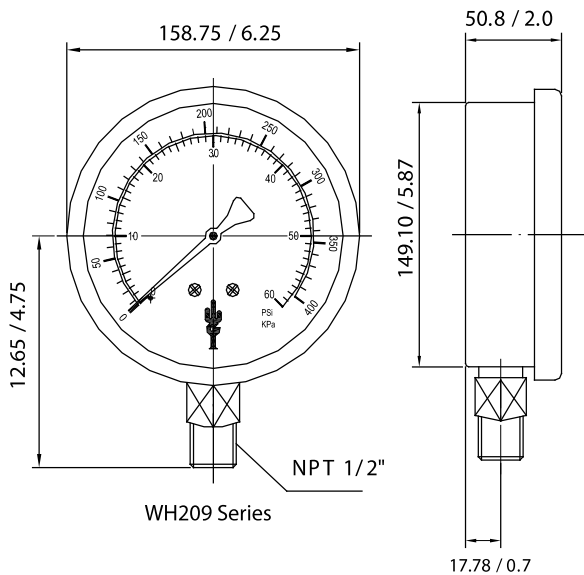


## Dimensions

### Elite 400 Stainless Steel – Lower Back U-Clamp



### Elite 600 Stainless – Bottom Mount



# Bourdon Tube Pressure Gauges Stainless Steel Series Type 232.53 - Dry Case Type 233.53 - Liquid-filled Case

WIKA Datasheet 23X.53

## Applications

- With liquid filled case for applications with high dynamic pressure pulsations or vibration
- 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
- All stainless steel construction
- Positive pressure ranges to 15,000 psi (1,000 bar)

## Specifications

### Design

ASME B40.100 & EN 837-1

### Sizes

2", 2½" & 4" (50, 63 and 100 mm)

### Accuracy class

2" & 2½": ± 2/1/2% of span (ASME B40.100 Grade A)

4": ± 1.0% of span (ASME B40.100 Grade 1A)

### Ranges

Vacuum / compound to 200 psi (16 bar)

Pressure from 15 psi (1 bar) to 15,000 psi (1,000 bar) or other equivalent units of pressure or vacuum

### Working pressure

2" & 2½": Steady: 3/4 scale value  
Fluctuating: 2/3 full scale value  
Short time: full scale value

4": Steady: full scale value  
Fluctuating: 0.9 x full scale value  
Short time: 1.3 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: +212°F (+100°C) maximum



Bourdon Tube Pressure Gauge Model 232.53 - 2½"

### 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 tight (NEMA 4X / IP65)

### Pressure connection

Material: 316 stainless steel  
Lower mount (LM) or center back mount (CBM)  
Lower back mount (LBM) for 4" size  
1/8" NPT, 1/4" NPT or 1/2" NPT limited to wrench flat area

### Bourdon tube

Material: 316 stainless steel  
> 1,500 psi (100 bar): C-shape,  
≤ 1,500 psi (100 bar): Helical type

### Movement

Stainless steel

### Dial

White aluminum with black lettering, 2" and 2½" with stop pin

## Pointer

Black aluminum

## Case

304 stainless steel with vent plug and SS crimp ring  
Welded case / socket connection

## Window

Polycarbonate

## Liquid filling

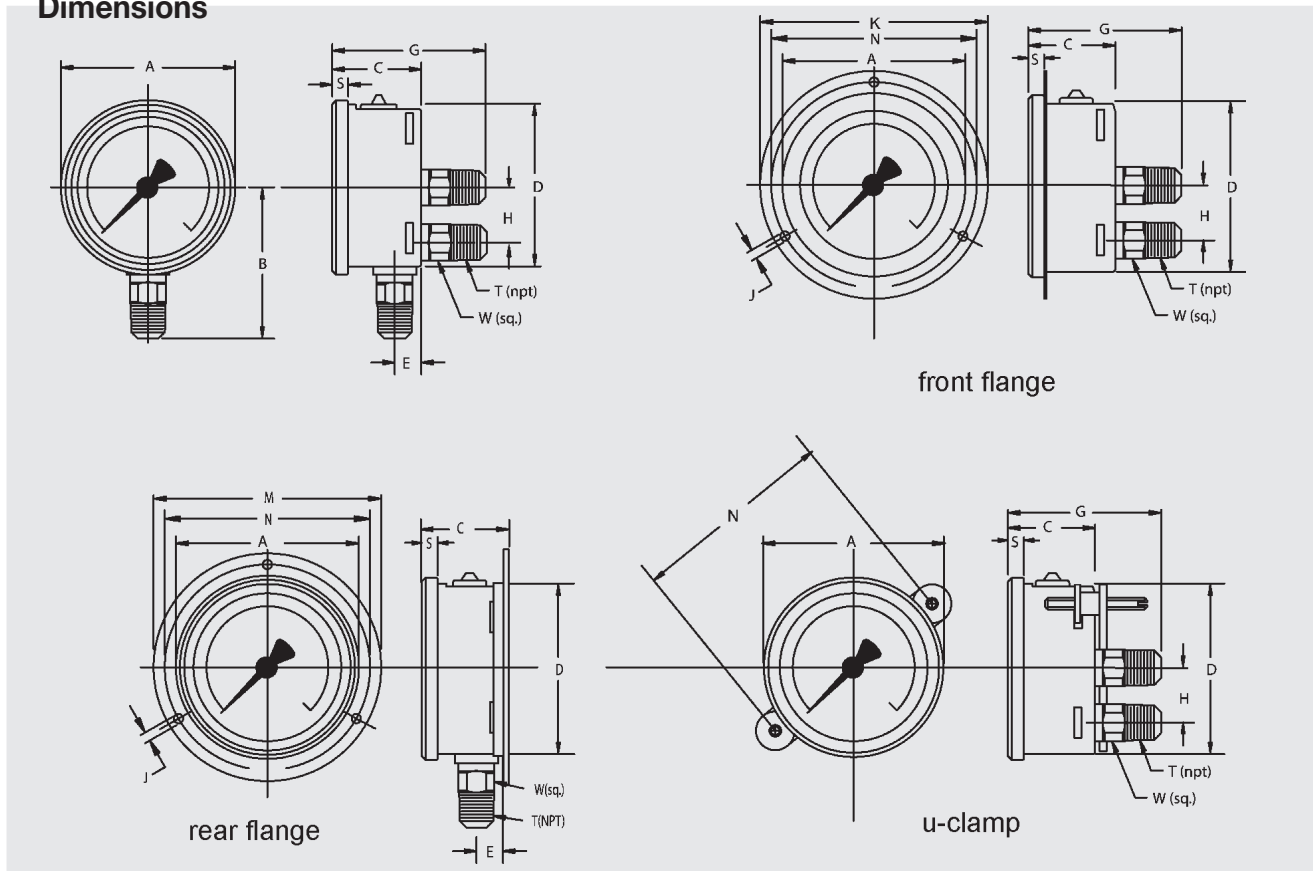
Glycerine 99.7% - Type 233.53

## Optional extras

- SS restrictor
- SS front flange
- SS rear flange (2½" and 4" only)
- Zinc-plated steel or SS u-clamp bracket (field installable - see note)
- Cleaned for oxygen service
- Red drag pointer or mark pointer (2½" and 4" only)
- External zero adjustment (4" size only)
- Other pressure connections
- Silicone or Halocarbon Oil case filling
- Other pressure scales available:  
bar, kPa, MPa, kg/cm<sup>2</sup> and dual scales

Note: U-clamp bracket for 2" must be ordered with gauge

## Dimensions



Size		A	B	C	D	E	G	H	J	K	M	N	S	T	W	Weight
2"	mm	55	48	30	50	12	53	-	3.6	71	71	60	5.5		14	0.27 lb. dry
	in	2.17	1.89	1.18	1.97	0.47	2.09	-	0.14	2.80	2.80	2.36	0.22	1/4"	0.55	0.33 lb. filled
2.5"	mm	69	54	32	62	13	54	-	3.6	85	88.1	75	6.5		14	0.36 lb. dry
	in	2.69	2.13	1.26	2.45	0.51	2.13	-	0.14	3.35	3.47	2.95	0.26	1/4"	0.55	0.44 lb. filled
4"	mm	107	87	48	100	15.5	79.5	30	4.8	132	132	116	8		22	1.10 lb. dry
	in	4.21	3.43	1.89	3.91	0.61	3.13	1.18	0.19	5.20	5.20	4.57	0.31	1/2"	0.87	1.76 lb. filled

Recommended panel cutout is dimension D + 3 mm

### Ordering information

Pressure gauge model / Nominal size / Scale range / Size of connection / Optional extras required  
Specifications and dimensions given in this leaflet represent the state of engineering at the time of printing.  
Modifications may take place and materials specified may be replaced by others without prior notice.



**WIKAI Instrument Corporation**  
1000 Wiegand Boulevard  
Lawrenceville, GA 30043  
Tel (770) 513-8200 Toll-free 1-888-WIKA-USA  
Fax (770) 338-5118  
E-Mail info@wika.com  
www.wika.com



CustomControlSensors

# Hazardous Areas Adjustable Pressure Switch

## 6900G\*E\* - Diaphragm Sensor

### DESCRIPTION

- Highly reliable devices utilizing the CCS Dual-Snap® Belleville disc spring principle pioneered by CCS' engineers.
- Engineering based on aerospace technology.
- Rigid, compact and internally adjustable for convenient field set point adjustment.
- Repeatable and stable set points.
- Vibration and shock resistant.
- High cycle life.
- High over-pressure capability. (System and Proof)
- Certified explosion proof hermetically sealed electrical assembly for environmental protection.
- Various options for wetted materials and electrical ratings to meet a wide range of application requirements and media compatibility.

### SERIES:

- 6900GE\*
- 6900GZE\*

### ADJUSTABLE SET POINT RANGE:

- 1 to 3400 PSIG
- 0.07 to 234 bar
- 6.89 to 23400 kPa

### OPERATING TEMPERATURE:

Temperature limits change with O-ring selection.

- 40° to 186°F
- 40° to 86°C

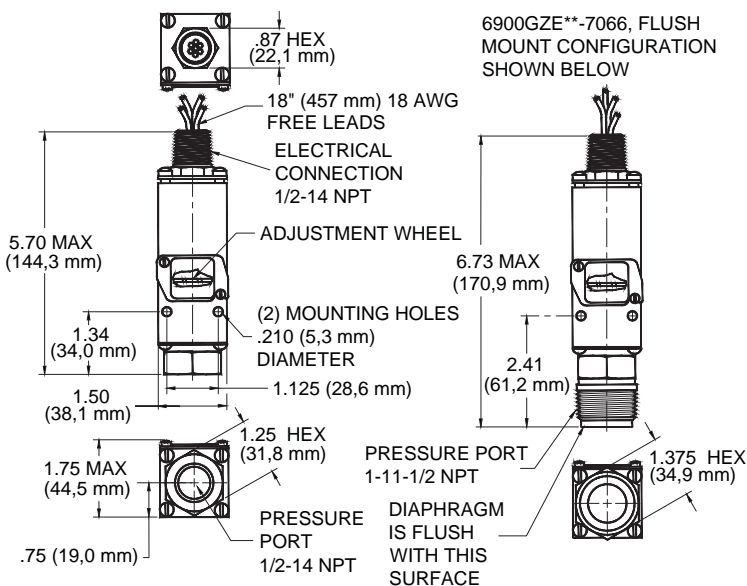
### STANDARD FEATURES:

- CE Mark
- CCC
- CRN
- Dual Seal: ANSI/ISA-12.27.01
- NACE MR0175 / ISO 15156
- NEMA: 4, 7, 9,13 / IP66
- U.L. / CSA Listed
- Hermetically Sealed Electrical Assembly
- 316 SST Electrical Assembly

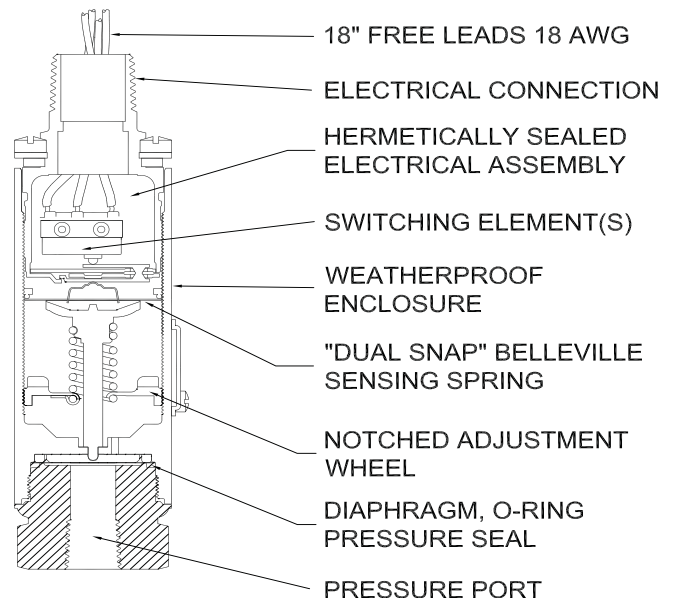


SHIPPING WEIGHT: APPROXIMATELY 25 OUNCES (708 GRAMS)

### INSTALLATION DRAWING



### DESIGN PRINCIPLES



SERIES 6900GE

**FIELD SETTING:** Loosen access cover. Adjust adjustment screw using screwdriver slot as illustrated, then attach to a variable pressure source with a suitable gage, and check that the circuit continuity operates at the pressures desired. Clockwise to increase settings. Counterclockwise to decrease setting.

**NOTE:** DO NOT USE ELECTRICAL HEX FOR TORQUING.







CustomControlSensors

# Hazardous Areas Adjustable Pressure Switch

## 6900G\*E\* - Diaphragm Sensor

### OPERATING AND ORDERING DATA

SERIES 6900GE*	WETTED PARTS: 1/4"-18 NPT ALUMINUM PRESSURE PORT, POLYIMIDE DIAPHRAGM, Buna N O-RING				
	ADJUSTABLE SET POINT RANGE		APPROX. DEAD BAND PSI (BAR)	SYSTEM PRESSURE PSIG (BAR)	PROOF PRESSURE PSIG (BAR)
	INCREASING PRESSURE PSIG (BAR)	DECREASING PRESSURE PSIG (BAR)			
6900GE*12	3-20 (0.21-1.4)	1-18 (0.07-1.2)	2 (0.14)	500 (34.5)	750 (51.7)
6900GE*14	6-75 (0.41-5.1)	2-71 (0.14-4.9)	4 (0.28)		
6900GE*16	12-150 (0.8-10.3)	4-142 (0.28-9.8)	8 (0.6)		
6900GE*18	30-375 (2.0-25.9)	10-355 (0.7-24.4)	20 (1.4)	1500 (103)	2000 (138)
6900GE*20	300-1000 (20.7-69)	250-950 (17.2-66)	50 (3.5)	2000 (138)	3000 (207)
6900GE*22	700-2200 (48.3-152)	600-2100 (41.4-145)	100 (6.9)	3000 (207)	4500 (310)
6900GE*24	1800-3400 (124-234)	1580-3180 (109-219)	220 (15.2)	5000 (345)	7500 (517)

SERIES 6900GZE*	WETTED PARTS: 1/2"-14 NPT 316 STAINLESS STEEL PRESSURE PORT & DIAPHRAGM, VITON O-RING				
	ADJUSTABLE SET POINT RANGE		APPROX. DEAD BAND PSI (BAR)	SYSTEM PRESSURE PSIG (BAR)	PROOF PRESSURE PSIG (BAR)
	INCREASING PRESSURE PSIG (BAR)	DECREASING PRESSURE PSIG (BAR)			
6900GZE*12	3-20 (0.21-1.4)	1-18 (0.07-1.2)	2 (0.14)	500 (34.5)	750 (51.7)
6900GZE*14	9-75 (0.6-5.1)	3-69 (0.21-4.8)	6 (0.41)		
6900GZE*16	18-150 (1.2-10.3)	6-138 (0.41-9.5)	12 (0.8)		
6900GZE*18	45-375 (3.1-25.9)	15-345 (1.0-23.8)	30 (2.0)	1500 (103)	2000 (138)
6900GZE*20	300-1000 (20.7-69)	225-925 (15.5-64)	75 (5.1)	2000 (138)	3000 (207)
6900GZE*22	700-2200 (48.3-152)	520-2020 (35.9-139)	180 (12.4)	3000 (207)	4500 (310)
6900GZE*24	1800-3400 (124-234)	1520-3120 (105-215)	280 (19.3)	5000 (345)	7500 (517)

SERIES 6900GZE*-7066 FLUSH MOUNT	WETTED PARTS: 1" 316 STAINLESS STEEL PRESSURE PORT & WELDED DIAPHRAGM				
	ADJUSTABLE SET POINT RANGE		APPROX. DEAD BAND PSI (BAR)	SYSTEM PRESSURE PSIG (BAR)	PROOF PRESSURE PSIG (BAR)
	INCREASING PRESSURE PSIG (BAR)	DECREASING PRESSURE PSIG (BAR)			
6900GZE*12-7066	3-15 (0.21-1.0)	1-13 (0.07-0.9)	2 (0.14)	500 (34.5)	750 (52)
6900GZE*14-7066	12-75 (0.83-5.1)	6-69 (0.41-4.8)	6 (0.41)		
6900GZE*16-7066	18-150 (1.2-10.3)	6-138 (0.41-9.5)	12 (0.8)		
6900GZE*18-7066	45-375 (3.1-25.9)	15-345 (1.0-23.8)	30 (2.0)	1500 (103)	2000 (138)
6900GZE*20-7066	300-1000 (20.7-69)	225-925 (15.5-64)	75 (5.1)	2000 (138)	3000 (207)
6900GZE*22-7066	700-2200 (48.3-152)	520-2020 (35.9-139)	180 (12.4)	3000 (207)	4500 (310)

### HOW TO ORDER

Follow these steps to build your part number:

- Specify the series based on your required set point, range, dead band, system pressure and proof pressure.
- Add desired options model code letter.
- Add the applicable standard suffix number.

(Ex: 6900GCE12-7044)

### PRESSURE CONVERSION

1 BAR = 14.5 PSI  
1 kPa = 0.145 PSI

### OPTIONS MODEL CODES

- A:** Viton® O-Ring (STD on GZE models)
- C:** 316 Stainless Steel Welded Capsule
- F:** Ethylene Propylene O-Ring
- M:** DPDT Electrical
- Y:** ATEX / GOST Certified Electrical Assembly (Consult CCS Sales Department for GOST options and requirements.)

### OPTIONAL STANDARD MODIFIED SUFFIXES

- 7008:** Gold Contacts
- 7042:** Stainless Steel Body
- 7044:** Monel Port and Diaphragm
- 7045:** Hastelloy C-276 Port and Diaphragm
- 7054:** 2 Meter Free Leads
- 7076:** 18 inch Teflon Free Leads (Low Temp Wire)
- 7081:** M20 Explosion Proof Electrical Conduit Connection
- 7082:** 316 SST Port, Piston & Body, E.N.P. Front cover & Locks. 1/4-18 NPT Female Pressure port.
- 7085:** 316 SST Port, Piston & Body, E.N.P. Front cover & Locks. 1/4-18 NPT Female Pressure port. 2 Meter Free Leads.
- 7088:** 1/4" -18 NPT Female 316 Stainless Steel Pressure Port
- 7089:** 1/2" -14 NPT Male 316 Stainless Steel Pressure Port

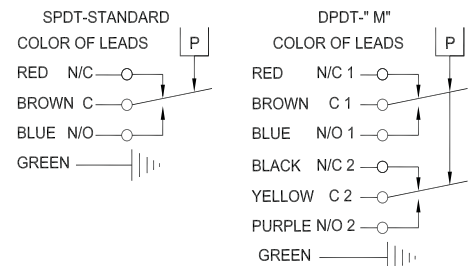
### ELECTRICAL ENCLOSURE CERTIFICATIONS

- \* c-UL, U.L./CSA Explosion Proof: Div. 1, 2 hermetically sealed electrical assembly P/N 46-1058 (46-1061 for M model option), listed by both Underwriter's Laboratories, Inc. (File No. E32961) and Canadian Standard Association (CSA) Testing Laboratories (File No. LR22921) for hazardous locations, Class 1, Groups A, B, C, and D; Class 2 Groups E, F, and G.
- \* ATEX certified for potentially explosive atmospheres electrical assembly series 46-XXXXXXX, Models 6\*\*\*\*\*, Ex d IIC T6, Directive 94/9/EC Sira 08ATEX1046X. (Option Y)
- \* IECEx - SIRA certified, SIR 10,0193X (Option Y)

### ELECTRICAL CHARACTERISTICS SCHEMATIC AND WIRING CODE RATING OF SWITCH ELEMENT

VOLTS	AMPERES	
	SPDT	DPDT "M"
	Res.	Res.
125 AC - 50/60 Hz	11	11
250 AC - 50/60 Hz	11	11
30 DC	5	5
125 DC	.5	.5
*125 AC - 50/60 Hz	1 max	1 max
*30 DC	1 max	1 max

\*Gold Contacts -7008 Suffix



### CERTIFICATIONS

Consult CCS website for complete certification and approval listing.

**DUAL-SNAP®**

ccsdualsnap.com

Models: 6900G\*E\*, Page 2 of 2  
Form 830G, 10.22.13

Note: Additional modified standard suffixes are available, consult CCS sales department or CCS Representative.



CustomControlSensors

# Hazardous Areas Adjustable Pressure Switch

## 646G\*E\*- Diaphragm Sensor



### DESCRIPTION

- Highly reliable devices utilizing the CCS Dual-Snap® Belleville disc spring principle pioneered by CCS' engineers.
- Engineering based on aerospace technology.
- Rigid, midsize and internally adjustable for convenient field set point adjustment.
- Repeatable and stable set points.
- Vibration and shock resistant.
- High cycle life.
- High over-pressure capability. (System and Proof)
- Certified explosion proof hermetically sealed electrical assembly for environmental protection.
- Various options for wetted materials and electrical ratings to meet a wide range of application requirements and media compatibility.

SHIPPING WEIGHT: APPROXIMATELY 60 OUNCES (1700 GRAMS)

### SERIES:

- 646GE\*
- 646GZE\*

### ADJUSTABLE SET POINT RANGE:

- .4 to 5000 PSIG
- .028 to 345 bar
- 2.76 to 34474 kPa

### OPERATING TEMPERATURE:

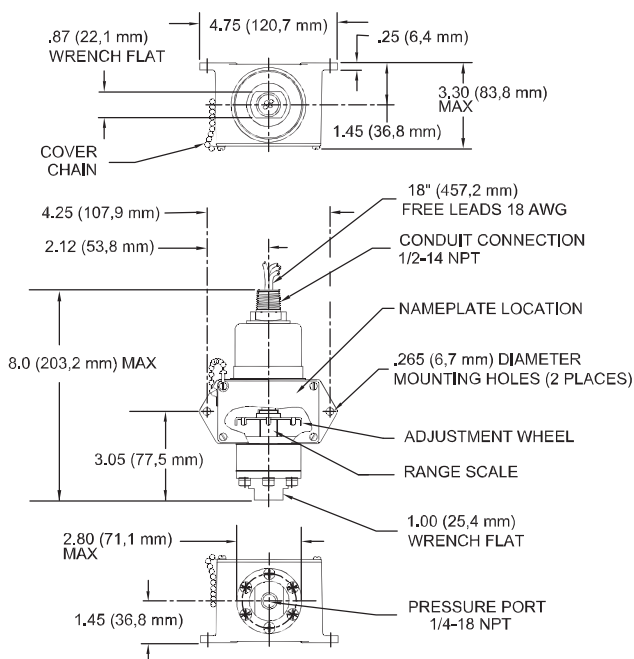
Temperature limits change with O-ring selection.

- 40° to 186°F
- 40° to 86°C

### STANDARD FEATURES:

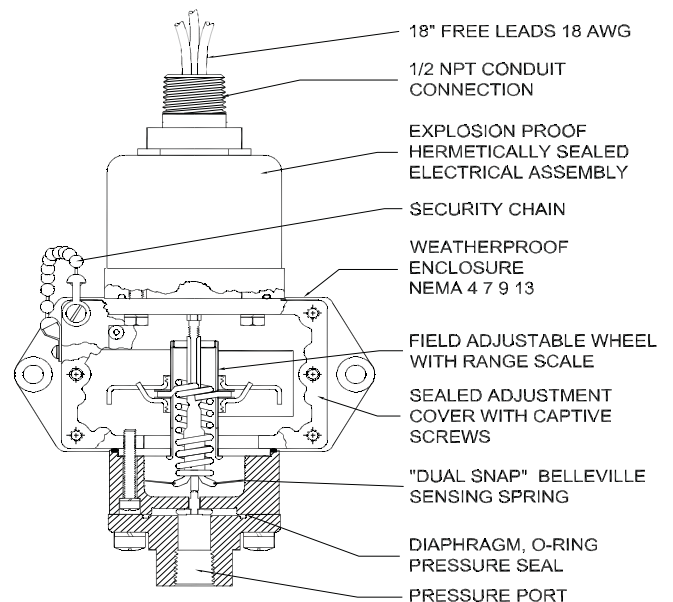
- CE Mark
- CCC
- CRN
- Dual Seal: ANSI/ISA-12.27.01
- NACE MR0175 / ISO 15156
- NEMA: 4, 7, 9, 13 / IP66
- U.L. / CSA Listed
- Hermetically Sealed Electrical Assembly

### INSTALLATION DRAWING



MODEL 646GE1 ILLUSTRATED

### DESIGN PRINCIPLES



646GE SERIES

**FIELD SETTING:** Open access cover. Adjust wheel as illustrated. Clockwise to increase settings. Counterclockwise to decrease settings.

**NOTE:** DO NOT USE ELECTRICAL HEX FOR TORQUING.

DUAL-SNAP®

ccsdualsnap.com



Models: 646G\*E\*, Page 1 of 2  
Form 830G, 8.21.13



CustomControlSensors

# Hazardous Areas Adjustable Pressure Switch

## 646G\*E\*- Diaphragm Sensor

### OPERATING AND ORDERING DATA

SERIES 646GE*	WETTED PARTS: 1/4"-18 NPT ALUMINUM PRESSURE PORT, POLYIMIDE DIAPHRAGM, BUNA N O-RING				
	ADJUSTABLE SET POINT RANGE		APPROX. DEAD BAND PSI (BAR)	SYSTEM PRESSURE PSIG (BAR)	PROOF PRESSURE PSIG (BAR)
	INCREASING PRESSURE PSIG (BAR)	DECREASING PRESSURE PSIG (BAR)			
646GE*1	1.2-16 (0.07-1.1)	.4-15.2 (.03-1.04)	.8 (0.06)	500 (35)	750 (52)
646GE*2	8-75 (0.6-5.2)	3-70 (0.2-4.8)	5 (0.34)	3000 (207)	5000 (345)
646GE*11	20-150 (1.4-10.3)	8-138 (0.6-9.5)	12 (0.8)		
646GE*3	50-375 (3.5-25.9)	22-347 (1.5-23.9)	28 (1.9)		
646GE*5	330-1000 (22.8-68.9)	265-935 (18.3-64.5)	65 (4.5)		
SERIES 646GZE*	WETTED PARTS: 1/2"-14 NPT 316 STAINLESS STEEL PRESSURE PORT, POLYIMIDE DIAPHRAGM, VITON O-RING				
	ADJUSTABLE SET POINT RANGE		APPROX. DEAD BAND PSI (BAR)	SYSTEM PRESSURE PSIG (BAR)	PROOF PRESSURE PSIG (BAR)
	INCREASING PRESSURE PSIG (BAR)	DECREASING PRESSURE PSIG (BAR)			
646GZE*1	1.2-16 (0.07-1.1)	.4-15.2 (.03-1.04)	.8 (0.06)	500 (35)	750 (52)
646GZE*2	8-75 (0.6-5.2)	3-70 (0.2-4.8)	5 (0.34)	3000 (207)	5000 (345)
646GZE*11	20-150 (1.4-10.3)	8-138 (0.6-9.5)	12 (0.8)		
646GZE*3	50-375 (3.5-25.9)	22-347 (1.5-23.9)	28 (1.9)		
646GZE*5	330-1000 (22.8-68.9)	265-935 (18.3-64.5)	65 (4.5)		
646GZE*7	950-2300 (65.5-158.6)	775-2125 (53.4-146.5)	175 (12.1)		
SERIES 646GZ*-7011	WETTED PARTS: 1/2"-14 NPT 316 STAINLESS STEEL PRESSURE PORT & DIAPHRAGM, VITON O-RING				
	ADJUSTABLE SET POINT RANGE		APPROX. DEAD BAND PSI (BAR)	SYSTEM PRESSURE PSIG (BAR)	PROOF PRESSURE PSIG (BAR)
	INCREASING PRESSURE PSIG (BAR)	DECREASING PRESSURE PSIG (BAR)			
646GZE*1-7011	1.4-16 (.09-1.1)	.4-15 (0.03-1.03)	1 (0.07)	500 (35)	750 (52)
646GZE*2-7011	10-75 (.7-5.2)	3-68 (0.2-4.7)	7 (0.5)	3000 (207)	5000 (345)
646GZE*11-7011	20-150 (1.4-10.3)	6-136 (0.4-9.4)	14 (0.97)		
646GZE*3-7011	50-375 (3.5-25.9)	16-341 (1.1-23.5)	34 (2.3)		
646GZE*5-7011	330-1000 (22.8-68.9)	250-920 (17.2-63.4)	80 (5.5)		
646GZE*7-7011	950-2300 (65.5-158.6)	750-2100 (51.7-144.8)	200 (13.8)		
646GZE*9-7011	2100-3400 (144.8-234.4)	1820-3120 (125.5-215.1)	280 (19.3)	5000 (345)	7500 (517)
646GZE*10-7011	3200-5000 (220.6-344.7)	2720-4520 (187.5-311.6)	480 (33.1)		

### HOW TO ORDER

Follow these steps to build your part number:

1. Specify the series based on your required set point, range, dead band, system pressure and proof pressure.
2. Add desired options model code letter.
3. Add the applicable standard suffix number.

(Ex: 646GZE2-7076)

### PRESSURE CONVERSION

1 BAR = 14.5 PSI  
1 kPa = 0.145 PSI

### OPTIONS MODEL CODES

- A:** Viton® O-Ring (STD on GZE models)
- C:** 316 Stainless Steel Welded Capsule (Ranges 9-10 not available)
- F:** Ethylene Propylene O-Ring
- M:** DPDT Electrical
- Y:** ATEX / GOST Certified Electrical Assembly (Consult CCS Sales Department for GOST options and requirements.)
- X:** Double Break Electrical Assembly

### OPTIONAL STANDARD MODIFIED SUFFIXES

- 7005:** Viton/Dracon Diaphragm, Viton O-Ring & Stainless Steel Port Cap (GZ models only)
- 7008:** Gold Contacts
- 7023:** Manual Reset After Increasing
- 7044:** Monel Port and Diaphragm (GC models only) (Ranges 1, 9 and 10 not available)
- 7045:** Hastelloy C-276 Port and Diaphragm (GC models only) (Ranges 1, 9 and 10 not available)
- 7054:** 2 Meter Free Leads
- 7076:** 18 inch Teflon Free Leads (Low Temp Wire)

Note: Additional modified standard suffixes are available, consult CCS sales department or CCS Representative.

### CERTIFICATIONS

Consult CCS website for complete certification and approval listing.

### ELECTRICAL ENCLOSURE CERTIFICATIONS

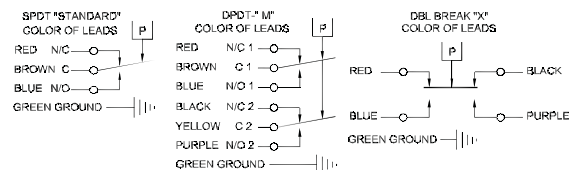
\* c-UL, U.L./CSA Explosion Proof: Div. 1, 2 hermetically sealed electrical assembly P/N 17-51 (17-73 for M model option), listed by both Underwriter's Laboratories, Inc. (File No. E32961) and Canadian Standard Association (CSA) Testing Laboratories (File No. LR22921) for hazardous locations, Class 1, Groups A, B, C, and D; Class 2 Groups E, F, and G.

\* ATEX - Baseefa certified for potentially explosive atmospheres. Models 646\*\*Y, II 2 GD Ex d IIC, Ex tb IIC, Baseefa 05ATEX0011X. (Option Y)

### ELECTRICAL CHARACTERISTICS SCHEMATIC AND WIRING CODE

VOLTS	AMPERES		
	SPDT Res.	DPDT "M" Res.	DBI Brk "X" Res.
125 AC - 50/60 Hz	15	5	15
250 AC - 50/60 Hz	15	5	15
480 AC - 50/60 Hz	15	-	15
28 DC	2	5	-
125 DC	.5	.5	1
250 DC	.2	-	.5
*125 AC - 50/60 Hz	1 max	1 max	-
*30 DC	1 max	1 max	-

\*Gold Contacts -7008 Suffix



### DUAL-SNAP®

ccsdualsnap.com

Models: 646G\*E\*, Page 2 of 2  
Form 830G, 8.21.13

Compact size saves space.

Speed may be accurately controlled even at low speeds.

Constant speed easily set.

Retainer prevents accidental loss of needle.



### How to Order

**N** **AS** **1** 000 — **M5**

Area Code

Nil	Japan, Asia, Australia, UK
N	U.S.A.

Body size

1	M3, M5
2	1/8, 1/4
3	3/8
4	1/2
5	1/2

Port size

Port size	Applicable model
M3	M3 x 0.5 AS1000
M5	M5 x 0.8 AS1000
01	Rc1/8 AS2000
02	Rc1/4 AS2000, 3000, 4000, 5000
03	Rc3/8 AS3000, 4000, 5000
04	Rc1/2 AS4000, 5000

Port thread

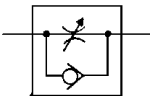
Nil	M3, M5
N	NPT
F	G

### Specifications

Proof pressure <sup>Note 1)</sup>	1.5MPa (1.05MPa)
Maximum operating pressure <sup>Note 1)</sup>	1MPa (0.7MPa)
Minimum operating pressure <sup>Note 1)</sup>	0.05MPa (0.1MPa)
Ambient and fluid temperature	-5° to 60°C (No freezing)
Number of needle rotation <sup>Note 1)</sup>	8 turns (10 turns)

Note 1) ( ) : Values for AS1000.

### JIS Symbol



### Model

Model	Port size	Free flow		Controlled flow		Applicable cylinder bore size (mm)	Weight (g)
		Air flow [ℓ/min (ANR)]	Effective area (mm <sup>2</sup> )	Air flow [ℓ/min (ANR)]	Effective area (mm <sup>2</sup> )		
AS1000-M3	M3 x 0.5	20	0.3	20	0.3	2.5, 4, 6	4.7
AS1000-M5	M5 x 0.8	90	1.4	80	1.2	6, 10, 16, 20, 25	33
AS2000-01	1/8	340	5.2	250	3.8	20, 25, 32, 40	90
AS2000-02	1/4	340	5.2	250	3.8		115
AS3000-02	1/4	810	12.3	810	12.3	32, 40, 50, 63	130
AS3000-03	3/8	810	12.3	810	12.3		124
AS4000-02	1/4	1,670	25.5	1,670	25.5	40, 50, 63, 80, 100	221
AS4000-03	3/8	1,670	25.5	1,670	25.5		214
AS4000-04	1/2	1,670	25.5	1,670	25.5		205
AS5000-02	1/4	2,840	44	2,840	44	40, 50, 63, 80, 100	242
AS5000-03	3/8	4,270	66	4,270	66		233
AS5000-04	1/2	4,270	66	4,270	66		224

Note) Supply pressure: 0.5MPa, Temperature: 20°C.

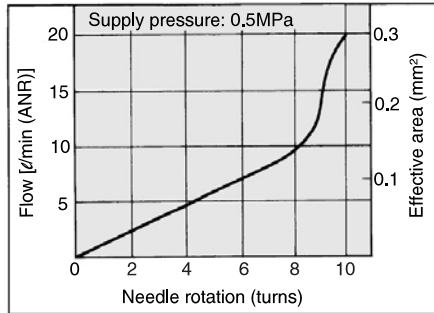
### Accessories

Description	Part No.	Applicable model
Nipple	M-5N	AS1000

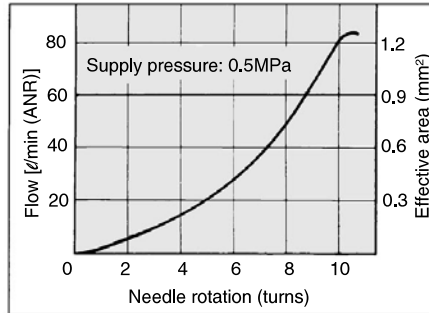
Note) AS1000 with nipple: AS1000-M5-N

## Flow Characteristics

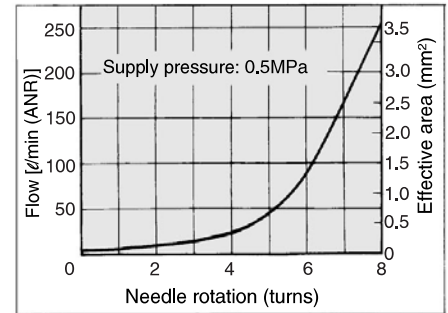
**AS1000-M3**



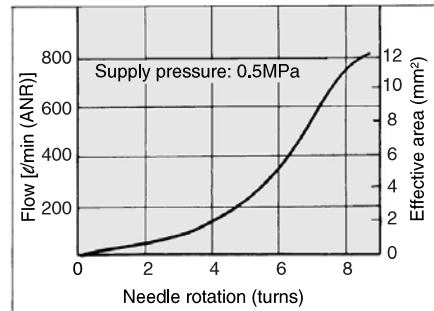
**AS1000-M5**



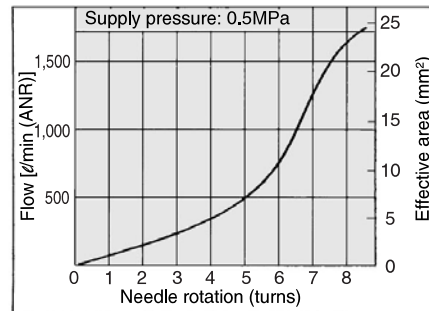
**AS2000**



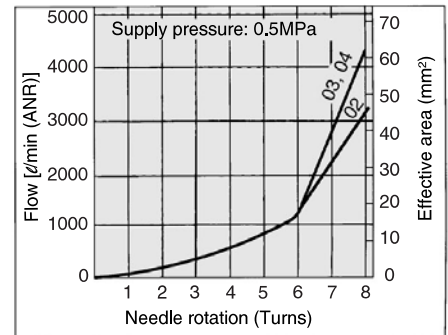
**AS3000**



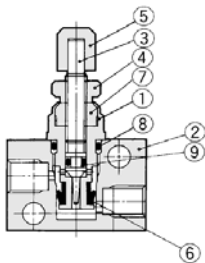
**AS4000**



**AS5000**



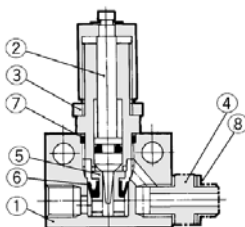
### AS1000-M3/Construction



#### Component Parts

No.	Description	Material	Note
①	Body B	Brass	Electroless nickel plated
②	Body	Brass	Electroless nickel plated
③	Needle	Brass	Electroless nickel plated
④	Lock nut	Brass	Electroless nickel plated
⑤	Handle	Brass	Electroless nickel plated
⑥	U-packing	NBR	
⑦	Needle guide	Brass	Electroless nickel plated
⑧	O-ring	NBR	4.5 x 3 x 0.75
⑨	O-ring	NBR	2.2 x 0.8 x 0.7

### AS1000-M5/Construction



#### Component Parts

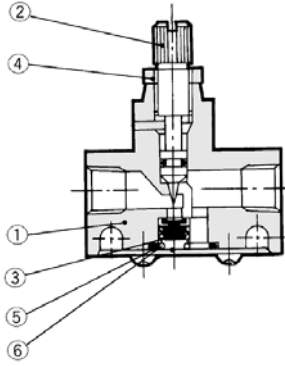
No.	Description	Material
①	Body	Zinc alloy
②	Needle	Stainless steel
③	Lock nut*	Brass
④	Nipple	Stainless steel

\*Electroless nickel plated

#### Replacement Parts

No.	Description	Material	Part no.
⑤	Valve seat	Brass	1429138
⑥	U-packing	NBR	142964
⑦	O-ring	NBR	ø9 x ø7 x ø1
⑧	Gasket	PVC	M-5G1

## AS2000, 3000/Construction



### Component Parts

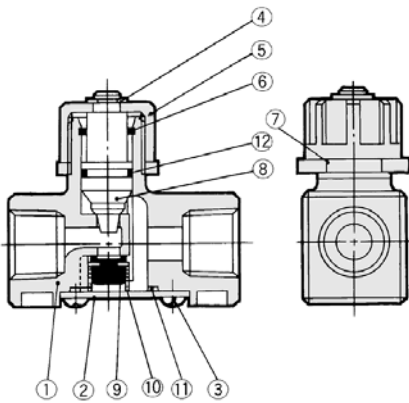
No.	Description	Model	
		AS2000	AS3000
①	Body	Zinc alloy	Aluminum alloy
②	Needle*	Brass	Brass
④	Lock nut*	Brass	Carbon steel

### Replacement Parts

No.	Description	Model	
		AS2000	AS3000
③	Valve	143022	14283
⑤	O-ring	143021	14284
⑥	Spring	143023	14282

\*Electroless nickel plated

## AS4000/Construction



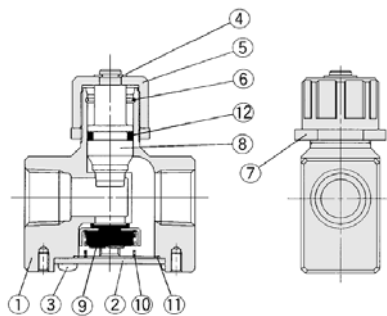
### Component Parts

No.	Description	Material	Note
①	Body	Aluminum alloy	Chromated
②	Cap	Rolled steel	Zinc chromate
③	Head cap screw	Steel wire	4 x 0,7 x 8
④	E type snap ring	Stainless steel	JIS B2805 Nominal 6
⑤	Handle	Zinc alloy	
⑥	Ring	Steel wire	Zinc chromated
⑦	Lock nut	Zinc alloy	
⑧	Needle	Aluminum alloy	
⑫	O ring	NBR	143112

### Replacement Parts

No.	Description	Material	Part No.
⑨	Valve	NBR, Brass	143145
⑩	Spring	Stainless steel	143146
⑪	O-ring	NBR	143147

## AS5000/Construction



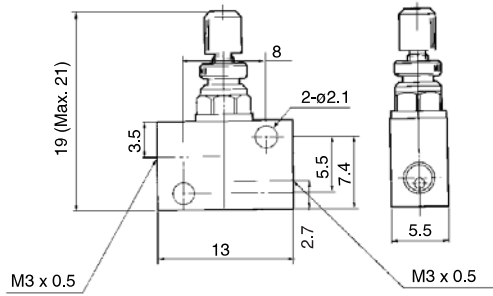
### Component Parts

No.	Description	Material	Note
①	Body	Aluminum alloy	Chromated
②	Cap	Rolled steel	Nickel plated
③	Head cap screw	Steel wire	M4 x 0,7 x 8 Nickel plated
④	E type snap ring	Stainless steel	JIS B 2805 Nominal 6
⑤	Handle	Zinc alloy	Chromated
⑥	Ring	Stainless steel	
⑦	Lock nut	Zinc alloy	Chromated
⑧	Needle	Aluminum alloy	Chromated
⑫	O-ring	NBR	JIS B2401 P12

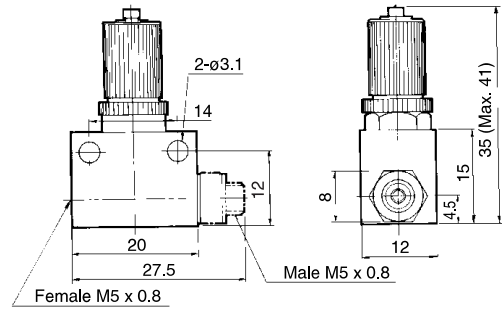
### Replacement Parts

No.	Description	Material	Part No.
⑨	Valve	NBR, Stainless steel	14143
⑩	Spring	Stainless steel	14144
⑪	Packing	NBR	14147

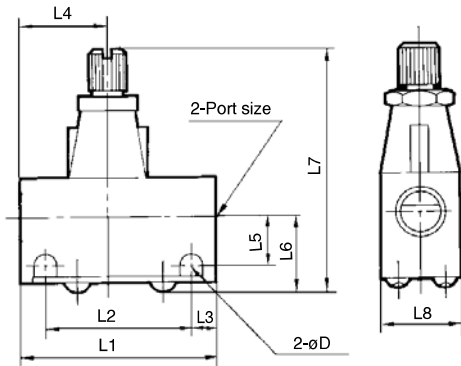
### AS1000-M3/Dimensions



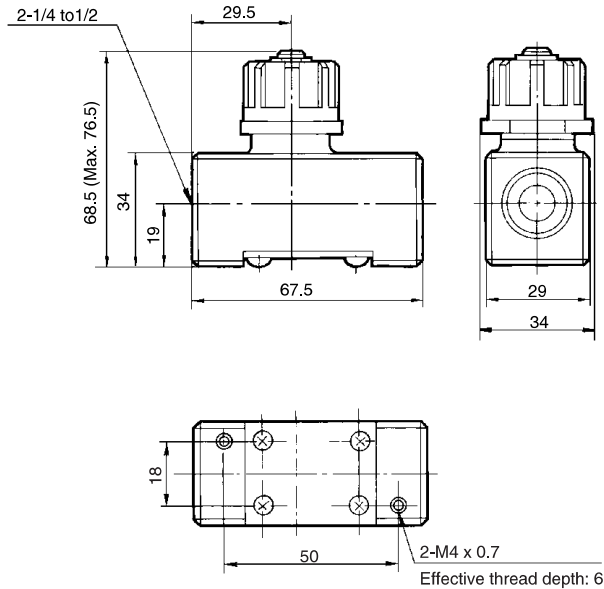
### AS1000-M5/Dimensions



### AS2000, 3000/Dimensions



### AS4000/Dimensions

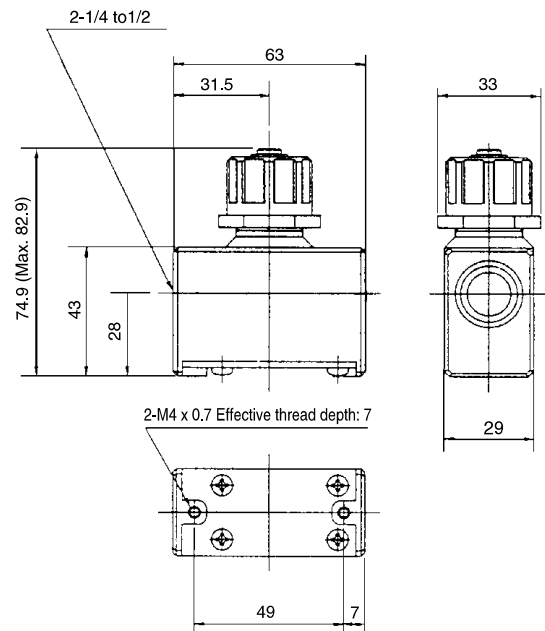


#### Dimensions

Model	Port size	L1	L2	L3	L4	L5	L6	L7		L8	D
								Max.	Min.		
AS2000-01	Rc1/8	40	30	5	17	10	15.5	54.5	50	16	4.5
AS2000-02	Rc1/4	40	30	5	23	11.5	17	56	51.5	20	4.5
AS3000-02, 03	Rc1/4, 3/8	56	45.5	5.25	25	13.2	20.6	68	61	26	5.5

- AS1000-M3.....SAS001, #1
- AS1000-M5.....SAS001, #2
- AS2000-01 .....SAS001, #3
- AS2000-02 .....SAS001, #4
- AS3000-02 to 03 ...SAS001, #5
- AS4000-02 to 04 ...SAS001, #7

### AS5000/Dimensions



# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual



**Figure 1**  
*DF100 Control Valve*

### TABLE OF CONTENTS

<b>Introduction</b>	<b>2</b>	<b>Re-Assembly</b>	<b>9</b>
General	2	Bonnet Sub-Assembly	9
Scope	2	Stem Installation	10
Specifications	3	Valve Plug Installation	10
Cv Values - Table 1	3	Seat Ring Installation	10
Max. Shut Off Pressures - Table 2	4	Bonnet Installation	10
FNPT Valve Dimension Diagram - Figure 2	5	Actuator Re-assembly	10
Flanged Valve Dimension Diagram - Figure 3	5	<b>Actuator Conversion</b>	<b>11</b>
RF and RTJ Valve Dimensions - Table 3	6	<b>Packing Diagram - Figure 5</b>	<b>12</b>
<b>Unpacking</b>	<b>6</b>	<b>Fail Open Actuator Cross-Section - Figure 6</b>	<b>13</b>
<b>Installation</b>	<b>6</b>	<b>Fail Open Body Diagram - Figure 7</b>	<b>14</b>
Air Piping	7	<b>Fail Closed Body Diagram - Figure 8</b>	<b>14</b>
Periodic Inspection	7	<b>Valve Cross-Section - Figure 9</b>	<b>15</b>
<b>Maintenance</b>	<b>7</b>	<b>Part List</b>	<b>16</b>
Actuator Casing Disassembly	7	<b>Model Builder</b>	<b>20</b>
Figure 4 - Wrench / Flat Detail	7		
Bonnet Removal	8		
Plug Removal	9		
Packing Removal	9		
Seat Ring Removal	9		





# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual

### NOTICE

These instructions are meant to be used with the Dyna-Flo DF100 Technical Bulletin as they refer to Figures and Tables therein. If you do not have the Technical Bulletin, contact Dyna-Flo immediately, or visit [www.dynaflo.com](http://www.dynaflo.com)

Each control valve is factory checked. Check the calibration for the specific application, before a valve is put into service.

It is the intention of this document to provide users with an accurate guide for safe installation and maintenance of the DF100 Control Valves. Revisions and updates are available at above mentioned website.

## INTRODUCTION

The Model DF100 Series control valve is designed for throttle control and on/off control of a variety of fluids. These tough, compact valves are ideal for use in oil and gas separators, treaters, scrubbers or as dump valves. The DF100 is well suited for many other high pressure fluid applications up to 2250 psig (155 Bar). The DF100 Series control valve is available in 1 inch sizes in either a globe or tee style valve body with threaded end connections.

The Dyna-Flo DF100 Series control valve is manufactured to a high level of quality specifications to ensure superior performance and customer satisfaction.

---

## GENERAL

**The following instructions are to be thoroughly reviewed and understood prior to installing, operating or performing maintenance on this equipment. Work on this equipment should be performed by experienced personnel. Throughout the manual, safety and caution notes appear and must be strictly followed, to prevent serious injury or equipment malfunction.**

---

## SCOPE

The control valve configuration and construction materials were selected to meet particular pressure, temperature, and process fluid conditions. Some material combinations are limited in their pressure and temperature ranges. Do not apply any other conditions to the valve without first contacting your Dyna-Flo sales office.

This manual is written to be a practical and useful guide maintaining the Dyna-Flo DF100 Control Valve.

---

### CAUTION

**To avoid personal injury or installation damage as a result of the sudden release of process pressure or the breaking of parts, do not install the valve assembly where service conditions could exceed the limits stated in this manual or on the equipment nameplates. Use government codes, accepted industry standards and good piping practices to select pressure-relieving equipment for protection of your installation. It is also important to wear the proper protective equipment when performing any installation or maintenance activity.**

---

# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual



### SPECIFICATIONS

#### Port Diameters

1/4", 3/8", 1/2", 3/4"

#### Valve Pressure Class / End Connection

- 1" FNPT ASME B16.34 Class 900

#### Maximum Pressure Drop

2,250 Psig (15,513 kPag)

#### Maximum Inlet Temperature and Pressures

2,250 Psig (15,513 kPag) from -46 to 93°C (-50 to 200°F)  
2,185 Psig (15,513 kPag) at 149°C (300°F)

#### Standard Shut-off Classification

ANSI Class IV ANSI / FCI 70-2

#### Dimensions

See Figure 2

#### Flow Characteristics

Quick Opening

#### Flow Direction

Up or Down

- Flow Down recommended for Quick Open application
- Flow Up recommended for Throttling applications

#### Approximate Weight

20 lb (9 kg)

#### Maximum Travel

3/8 inch (10 mm)

#### Material Temperature Capabilities

Body Assembly

-46 to 149°C (-50 to 300°F)

Actuator Assembly

-40 to 82°C (-40 to 180°F)

#### Body Style

Available in Globe or Tee body style

#### Bonnet/Body Connection

Threaded

#### Actuator Configuration

The DF100 utilizes a on/off style spring and diaphragm actuator. Fail closed is field-reversible.

#### Maximum Actuator Casing Pressure

50 Psig (345 kPa)

#### Effective Actuator Diaphragm Area

33 inches<sup>2</sup> (213 cm<sup>2</sup>)

#### Actuator Pressure Connections

1/4 inch FNPT

For more information and other options contact your Dyna-Flo sales office.

Table 1

### DF100 Sizing Coefficient Values

Body	Port Size Inch (mm)	C <sub>V</sub> Value (100%)	X <sub>T</sub> Value (100%)	F <sub>L</sub> Value (100%)
Flow Up	1/4 (6.4)	1.7	0.67	0.92
	3/8 (9.5)	3.2	0.67	0.92
	1/2 (12.7)	4.8	0.67	0.92
	3/4 (19.1)	8.0	0.67	0.92
Flow Down	1/4 (6.4)	1.8	0.67	0.91
	3/8 (9.5)	3.7	0.67	0.91
	1/2 (12.7)	5.2	0.67	0.91
	3/4 (19.1)	8.32	0.67	0.91



# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual

Table 2

### Maximum Allowable Shutoff Pressure Drops

Actuator Action	Flow Direction (pressure tends to)	Port Diameter Inch	Number of Springs		Number of Springs	
			0 - 20 Psig Operating Signal		0 - 35 Psig Operating Signal	
			2	6	2	6
			Psi (kPa)	Psi (kPa)	Psi (kPa)	Psi (kPa)
Fail Closed	Flow Up (open valve)	1/4	1,578 (10,878)	2,250 (15,513)	1,578 (10,880)	2,250 (15,513)
		3/8	657 (4,530)	1,972 (13,596)	657 (4,530)	1,972 (13,596)
		1/2	341 (2,351)	1,025 (7,067)	341 (2,351)	1,025 (7,067)
		3/4	60 (414)	180 (1,241)	60 (414)	180 (1,241)
	Flow Down (close valve)	1/4	523 (3,606)	1,578 (10,880)	523 (3,606)	1,578 (10,880)
		3/8	837 (5,771)	2,250 (15,513)	837 (5,771)	2,250 (15,513)
		1/2	*	2,250 (15,513)	*	2,250 (15,513)
		3/4	*	1,603 (11,052)	*	2,250 (15,513)
Fail Open	Flow Up (open valve)	1/4	2,250 (15,513)	*	2,250 (15,513)	2,250 (15,513)
		3/8	2,250 (15,513)	*	2,250 (15,513)	2,250 (15,513)
		1/2	1,867 (12,873)	*	2,250 (15,513)	2,235 (15,410)
		3/4	759 (5,233)	*	1,882 / 130	834 (5,750)
	Flow Down (close valve)	1/4	2,250 (15,513)	*	2,250 (15,513)	2,250 (15,513)
		3/8	2,250 (15,513)	*	2,250 (15,513)	2,250 (15,513)
		1/2	2,250 (15,513)	*	2,250 (15,513)	2,250 (15,513)
		3/4	1,367 (9,425)	*	2,250 (15,513)	1,502 (10,356)

\* - Valve will not shut off.

# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual

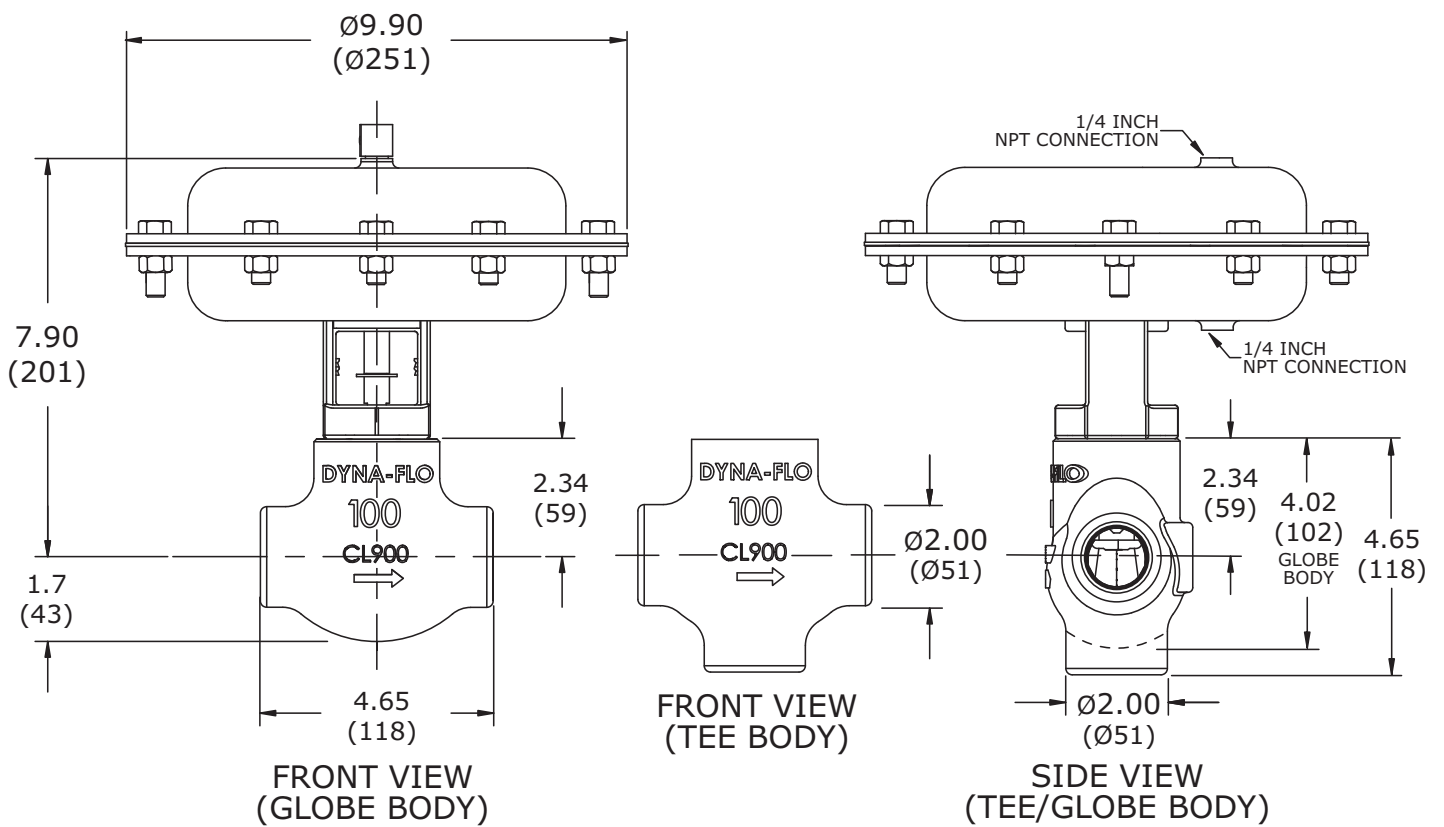


Figure 2 3 FNPT Style Valve Dimensions



# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual

Table 3

**DF100 RF and RTJ Valve Dimensions** (Refer to Figure 3)  
Inches (mm)

Connection	Class	A	B
RF	ASME 150	6.75 (171)	3.38 (86)
	ASME 300	7.25 (184)	3.63 (92)
	ASME 600	7.75 (197)	3.88 (99)
	ASME 900	8.63 (219)	4.32 (110)
RTJ	ASME 150	—	—
	ASME 300	7.63 (194)	3.82 (97)
	ASME 600	7.75 (197)	3.88 (99)
	ASME 900	8.63 (219)	4.32 (110)

**NOTE:** FNPT valves dimensions are available in Figure 3.

## UNPACKING VALVE FROM SHIPPING CONTAINER

Check the packing list against materials received, while unpacking the valve. The Packing List describes valve and accessories in each shipping container.

When lifting the valve from shipping container, it is advisable to grasp the valve by the bonnet and body to remove from package. Use caution, the approximate weight of the valve is 20 lbs. (9 kg); the actuator assembly may make lifting and carrying the valve awkward.

## INSTALLATION

### Flow

The DF100 control valve is a bi-directional valve, although it is recommended that the DF100 be installed in flow up position. The arrow on the front of the valve body (Key 1) indicates recommended flow direction (flow up) (See Figure 9 on Page 15). Before installing the valve, clean dirt, welding chips, scale or other foreign material from the line. Look for signs of gasket leakage through the line flanges. Make repairs, if required.

### WARNING

**The DF100 control valve is sold standard in fail closed configuration. Do not tighten bonnet to body joint without first eliminating plug to seat contact! Tightening the bonnet / body joint with plug to seat contact will damage the seat and plug! Reference steps 1 of Bonnet Removal / Disassembly on Page 9.**

# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual



### INSTALLATION (Continued)

- 1 When operating conditions allow, install the valve for the preferred flow direction. Refer to Table 2 for guide lines on shutoff pressure drops.

#### NOTE

The normal method of installation is with the actuator in vertical position above the valve body.

#### WARNING

Keep hands, hair and clothing away from all moving parts when operating the valve! Serious injury can result from failure to do so!

- 2 When possible, stroke the valve and check for smooth operation through the full-stroke. Unsteady valve stem movement could be an indication of an internal problem.

### Air Piping

The actuators are designed to accept 1/4" NPT connection. Use 3/8" OD tubing (or equivalent) for all air lines. All connections must be free of leaks.

#### CAUTION

Do not exceed supply pressure indicated on serial plate located on the upper casing of the actuator.

### Periodic Inspection

#### CAUTION

Use safe work practices and lock out procedures when isolating valves and actuators! Always be aware of flammable instrument gas!

- 1 Before performing any maintenance operation and to avoid injury from sudden release of process pressure:
  - A Use Safety lock-out procedures to be sure that the above provisions stay in effect while you complete the work on your equipment.
- 2 Check for process fluid leakage to the atmosphere through the body to bonnet joint and (if equipped) any NPT connection.
- 3 Examine the valve for damage caused by corrosive fumes or process drippings.

- 4 Clean the valve and repaint areas of severe oxidation.
- 5 Ensure all accessories, mounting brackets and fasteners are secure.

### MAINTENANCE

#### Actuator Casing Disassembly

#### WARNING

When disassembling a Fail Closed DF100, it is necessary to retain the valve stem and plug in the slightly open position. This is done by inserting a 3/8" open end wrench as shown in Figure 4. Failure to retain the stem and plug will result in damage to the seating surfaces!

#### The following steps outline a Fail Closed actuator disassembly

- 1 If the machined flats of the valve stem are not visible through the bonnet window, it will be necessary to apply supply pressure to the valve in order to unseat the plug and expose the stem flats.
- 2 Insert a 3/8" open end wrench onto the machined flats of the valve stem (See Figure 4). Remove the supply pressure so that the wrench rests flat on the face of the bonnet (Key 2), keeping the valve stem (key 5) flats from retreating back into the bonnet and also keeping the plug (Key 4) from seating.



Figure 4 Wrench / Stem Flat Detail



# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual

### MAINTENANCE (Continued)

#### Actuator Casing Disassembly (Continued)

- 3 Vent the pneumatic actuator loading pressure. Make sure the 3/8" wrench is securely in place and keeping the valve stem from moving.

#### NOTE

The valve body can be serviced in-line (and without necessarily disassembling the actuator, refer to step 1 of Bonnet Removal / Disassembly on Page 9 for instructions). Release, or remove, all process pressure and fluid before servicing. If the valve is to be serviced out of line, it is important that the body (Key 1) be firmly held in a clamping device. Serious injury can result from failure to do so!

- 4 Begin by removing the 10 **short** (1") cap screws (Key 26) from the actuator casings (Key 15 & 24) using two 9/16" wrenches or an impact wrench with a 9/16" socket. Be sure to leave the 2 **long** cap screws.

#### CAUTION

The springs inside the actuator casings are still under compression. It is necessary to take proper safety precautions and to follow proper procedures.

- 5 Once the 10 **short** cap screws have been completely removed, begin loosening the two **long** (1-1/4") cap screws in an alternating pattern. During removal, try to keep the upper casing (Key 24) level until the springs are no longer under compression, then completely remove the long cap screws and upper casing.

#### NOTE

For a Fail Open actuator configuration, the actuator springs will not be immediately visible. The sequence of steps for disassembly of a Fail Open actuator are as follows: steps 7, 11, 10, 9, 8 & 6.

- 6 Remove the 6 actuator springs (Key 23) from the diaphragm plate (Key 20). To avoid plug and seat ring damage, be sure to manually pull the diaphragm plate up (for fail closed configuration) so the plug is off the seat ring. (See Maintenance WARNING on Page 7)
- 7 A 5/8" wrench is required to remove the travel stop (Key 22). Be sure to hold the 3/8" wrench (applied to the stem flats) with your other hand so that the stem does not rotate during travel stop removal.

- 8 Remove the diaphragm plate spacer (Key 21) and inspect the spacer for damage.
- 9 Remove the diaphragm plate (Key 20). Inspect the diaphragm plate for corrosion and damage.
- 10 Remove the diaphragm and inspect surface for wear, stretching and tears. Replace if necessary.
- 11 Remove the diaphragm plate washer (Key 18).

See steps 1-10 of Actuator Conversion for instructions on how to re-assemble the actuator for a Fail Open configuration.

- 12 To replace o-ring under lower casing use a 1-1/2" deep socket or wrench to remove the bonnet lock nut (Key 17).
- 13 Remove the flat washer (Key 16) and lower diaphragm casing (Key 15). Take note of the position of the lower casing for reassembly purposes.
- 14 Remove the casing o-ring (Key 13) and inspect for damage and disfigurement. Replace.

#### Bonnet Removal / Disassembly

#### WARNING

Before attempting to remove the bonnet take extreme caution to assure that process pressures have been removed and relieved. During the first full counter clockwise turn of the bonnet, the threads should begin to feel loose and the bonnet should rattle on the threads. If this does not occur, process pressure may still be present. Stop disassembly and investigate further. On Tee style bodies, a plug may be removed to assure drainage.

#### NOTE

To remove the bonnet (Key 2) from the valve body (Key 1), it is not necessary to disassemble the actuator or even remove the body from the line. Service the body only after all process pressure and fluid are released or removed. If the valve is to be serviced out of line, it is important that the body be firmly held in a clamping device. Serious injury can result from failure to do so!

# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual



### MAINTENANCE (Continued)

#### Bonnet Removal / Disassembly (Continued)

- 1 With the 3/8" wrench still applied to the valve stem flats, use another wrench and remove the bonnet from the body. (See Maintenance WARNING on Page 7)

#### Plug Removal

- 2 Hold the 3/8" wrench (applied to the stem flats) in one hand, apply a 5/8" open end wrench to the flats of the valve plug (Key 4) and remove the plug from the stem (Key 5). Inspect the plug and stem for thread damage, scratches or galling and replace plug if necessary. (See page 10 for Plug Installation steps)

#### Packing Removal

- 3 Place the bonnet in a clamping device and remove the bushing (Key 6) by sliding it off the valve stem (Key 5). Remove the bushing o-ring (Key 29) from the bushing and inspect the bushing for damage. Once the bushing (Key 6) is removed the disc springs (Key 8) may slide out, it may be easier to remove them at this point before removing the valve stem (Key 5) (Step 4).
- 4 Remove the travel indicator (Key 12). Remove the valve stem (Key 5) by sliding it out towards the diaphragm end of the bonnet, away from the packing retainer end. Replace any damaged parts.
- 5 Remove the disc springs if not already removed (Key 8), packing follower (Key 9), packing rings (Key 11). Inspect entire packing box content for damage, corrosion, deformation and replace if necessary.

#### Flip the Bonnet

- 5 Using a standard mechanic's "pick set" or a small flat head screwdriver, remove the stem o-ring (Key 14), try not to scratch or damage the bonnet walls. Inspect and replace o-ring if necessary.
- 6 Remove and inspect the stem bushing (Key 7), replace if necessary. For instructions on stem bushing insertion, see Bonnet Installation steps on page 11.

#### Seat Ring Removal

- 1 Remove the body o-ring (Key 29) and replace.
- 2 Using a 1-1/16" socket remove the valve seat ring (Key 3) from the body. Inspect the seat for galling, scratches, corrosion and thread damage. Replace seat if necessary.

- 3 Using a mechanic's "pick set" or small flat head screw driver, carefully remove the seat gasket (Key 28) from the body. Be careful not to scratch the seat surface.
- 4 Once the seat and gasket are removed from the body, thoroughly inspect the inside of the valve body for scratches, erosion, and damage. Replace body if necessary.

#### NOTE

If there may be a delay before valve re-assembly, it may be a good idea to cover the valve body.

### REASSEMBLY

#### Bonnet Sub-assembly (Reference Figure 5)

- 1 With the bonnet (Key 2) sitting actuator side up, install the stem bushing (Key 7) through the bonnet window and up into the stem bore. Make sure that the "keeper lips" (ridge) of the bushing is inserted up into the bonnet. It may be necessary to depress the "tabs" of the bushing in order to insert it. Push the bushing into the bonnet until the bushing "snaps" into place.
  - 2 Lubricate the stem o-ring (Key 14) with o-ring lubricant and install the o-ring into the o-ring groove in the top of the bonnet. Use a flat head screwdriver to help work the o-ring carefully into the groove so as not to cut the o-ring or damage the bonnet.
- #### Flip the bonnet
- 3 Lubricate the packing rings (Key 11) and install the packing rings into the packing bore as per Figure 5. Make sure the rings touch the spacer.
  - 4 Install the packing follower (Key 9) over the packing rings with the flat face towards the packing rings.
  - 5 Install the 4 disc springs (Key 8), see Figure 5 for the order of installation.
  - 6 Lubricate the bushing o-ring (Key 29) and slide it onto the bushing (Key 6) as shown in Figure 5. Insert the bushing with the bushing o-ring facing the Belleville washers (Key 8) into the bonnet (Key 2) so that the bushing (Key 6) has an approximate 0.80" gap between it and the bonnet (Key 2). See Figure 5 for detail.
  - 7 Install the bushing washer (Key 32) on to the bushing seat inside of the valve body. See Figure 5 and 9 for detail.

#### Flip the bonnet





# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual

### REASSEMBLY (Continued)

#### Stem Installation (Continued)

- 8 It is important to insert the valve stem (Key 5) into the bonnet starting from the actuator end (opposite from the packing retainer) with the plug threads first. Be careful when inserting the stem so that the stem flats do not damage the stem o-ring. The plug end on the valve stem should protrude slightly past the bushing so that the stem flats are still visible in the bonnet window. Align the stem flats to run parallel to the bonnet window.

#### Valve Plug Installation

- 9 Apply medium strength liquid thread locker to the threads of the valve plug (Key 4).
- 10 Apply a 3/8" open end wrench to the machined stem flats. Thread the plug (Key 4) and using a 5/8" wrench (applied to the flats of the plug) fully tighten the plug into the stem (approximately 24 lbf-ft). **NOTE:** To avoid damage, it may be necessary to manually pull up on the valve stem until the valve plug makes contact with the bushing (Key 6) during bonnet installation. Packing box parts are loose inside until bonnet is tightened.

#### Seat Ring Installation

With the body secured in a clamping device (do not over tighten device on valve body)

- 1 Clean and inspect the inside of the valve body (Key 1), make sure there is no debris or damage. Coat both sides of the seat ring gasket (Key 28) with nickel based anti-seize compound. Place the seat ring gasket inside the body, use a small flat head screwdriver to help carefully align the gasket to be concentric with the bore.
- 2 Apply the nickel based anti-seize compound to the threads of the seat ring (Key 3). Carefully place the seat ring inside the body (hex head up) and thread the seat ring into the body. Torque seat ring to 150 lbf-ft.

#### NOTE

**Any significant resistance to seat ring installation should be investigated. Dry threads could prevent proper seating of the seat ring against the gasket, allowing leakage.**

- 3 Lubricate the body o-ring (Key 30) with o-ring lubricant. Install the o-ring on the top gasket face of the body.

- 4 Lubricate the internal threads of the body with nickel based anti-seize compound.

#### Bonnet Installation

#### NOTE

**It is important to make sure that the valve plug will not make contact with the seat ring during bonnet installation. Apply a 3/8" wrench to the stem flats if necessary. (See NOTE in Step 10 of Valve Plug Installation on Page 10)**

- 5 Thread the bonnet sub-assembly into the body until hand tight. Use a wrench to tighten the bonnet into the body approximately 300 lbf-ft. (Make sure the bushing washer (Key 32) is properly seated on the bushing seat inside the valve body. See Step 7, page 10.)
- 6 Lubricate the casing o-ring (Key 13) with o-ring lubricant and insert it into the top o-ring groove of the bonnet.

#### Actuator Reassembly (Fail Closed)

#### WARNING

**When disassembling a Fail Closed DF100, it is necessary to retain the valve stem and plug in the slightly open position. This is done by inserting a 3/8" open end wrench as shown in Figure 4. Failure to retain the stem and plug will result in damage to the seating surfaces!**

- 1 If maintenance has occurred and the valve has been disassembled, after the bonnet has been installed into the valve body leave the body in the clamping device.
- 2 Place the lower diaphragm casing (Key 15) over the valve stem so that it rests on the casing o-ring (Key 13). Orientate the NPT connection of the casing so that it is centered within the bonnet window (Key 2). Reference Figures 2 and 9 for correct NPT orientation.
- 3 Install the flat washer (Key 16) over the valve stem so that it rests on the lower casing.
- 4 Apply nickel based anti-seize compound to the exposed bonnet threads.
- 5 While holding the lower casing in place, thread the bonnet locknut (Key 17) onto the bonnet using a 1-1/2" deep socket tighten to 200 lbf-ft.

# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual



- 6 Install the diaphragm plate washer (Key 18) over the valve stem (Key 5).
- 7 Place the diaphragm (Key 19) over the stem so that it is in contact with the diaphragm plate washer. Be sure to align the holes of the diaphragm with the bolt holes on the lower casing (Key 15).
- 8 Slide the diaphragm plate (Key 20) over the stem so that it rests with the flat face against the diaphragm. Reference Figure 8 for correct diaphragm plate placement.
- 9 Install the diaphragm plate spacer (Key 21) over the stem so that it rests on top of the diaphragm plate.
- 10 Apply medium strength liquid thread locker to the threads of the travel stop (Key 22) and thread it onto the valve stem. **Be sure to hold the 3/8" wrench applied to the stem flats to keep the stem from rotating while tightening the travel stop.** Using a 5/8" socket, torque down the travel stop to 100 lbf-in.
- 11 Place the springs (Key 23) on the diaphragm plate in a circular pattern, with each spring centered on the plate protrusions.

### NOTE

**A conversion from fail open to fail closed (or vice versa) may not be possible without 4 extra springs (dependant on shutoff pressure needed see Table 2).**

- 12 Place the upper casing (Key 24) over the springs, be sure that the NPT connection of the upper casing is aligned with the NPT connection of the lower casing. Also, be sure that the bolt holes of the upper casing are aligned with the bolt holes of the lower casing.
- 13 Install both of the **long** (1-1/4") cap screws (Key 25) opposite from each other and in line with the valve body. Partially thread a nut (Key 27) onto one of the **long** cap screws.
- 14 It may be necessary to compress the springs by pushing slightly on the upper casing to thread a nut onto the second **long** cap screw. Using two 9/16" wrenches or socket set, tighten the two **long** cap screws using an alternating pattern. Until the 10 **short** cap screws can be installed and the nuts threaded on. Try to keep the upper diaphragm casing level during this process.

- 15 Completely tighten the 12 nuts.
- 16 Install the vent cap (Key 31) to the NPT connection on the upper casing.
- 17 It will be necessary to apply supply pressure to the actuator in order to remove the 3/8" wrench on the stem flats.

## ACTUATOR CONVERSION

### Fail Open Assembly

#### NOTE

**If actuator conversion is all that is required and o-ring and bonnet maintenance is unnecessary, complete disassembly of the lower casing will not be required. Follow steps 1-11 of actuator disassembly on page 6. Actuator assembly and maintenance should only be performed by trained individuals adhering to proper procedures and safety precautions.**

Reference Figure 6 on Page 13 for diagram.

#### NOTE

**A conversion from fail open to fail closed (or vice versa) may not be possible without 4 extra springs (dependant on shutoff pressure needed see Table 2).**

- 1 If the actuator has not yet been disassembled, refer to Actuator Casing Disassembly on Page 7. It may be unnecessary to disassemble the actuator passed step 11.
- 2 Install the diaphragm plate spacer (Key 22) over the stem.
- 3 Set the required springs (Key 24) onto the inside of the lower casing, spacing them equally in a circular pattern. Position the springs so that they will line up with the raised bumps of the diaphragm plate (Key 21).
- 4 Place the diaphragm plate over the valve stem so that the concave face touches the springs and the protrusion locates inside the spring.
- 5 Place the diaphragm (Key 20) over the stem so that it is in contact with the diaphragm plate. Make sure the holes on the diaphragm are aligned with the bolt holes on the casing.
- 6 Install the diaphragm plate washer (Key 19) over the valve stem so that it rests on top of the diaphragm.



# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual

### ACTUATOR CONVERSION (Continued)

#### Fail Open Assembly (Continued)

- 7 Apply medium strength liquid thread locker to the threads of the travel stop (Key 22) and thread it onto the stem.
- 8 Apply a 3/8" wrench to the machined flats of the valve stem (Key 5) to prevent stem movement during travel stop installation. Using a 5/8" socket, torque down the travel stop to 100 lbf-in.

- 9 Install the two **long** (1-1/4") cap screws (Key 26) opposite each other making sure they are in line with the valve body (this is to prevent future complications). Install the 10 **short** (1") cap screws (Key 27) and thread a nut (Key 28) onto all 12 cap screws. Using two 9/16" wrenches or socket set, completely tighten all the nuts and cap screws.
- 10 Install the vent cap (Key 31) to the NPT connection on the lower casing. Remove the 3/8" wrench from the stem flats.

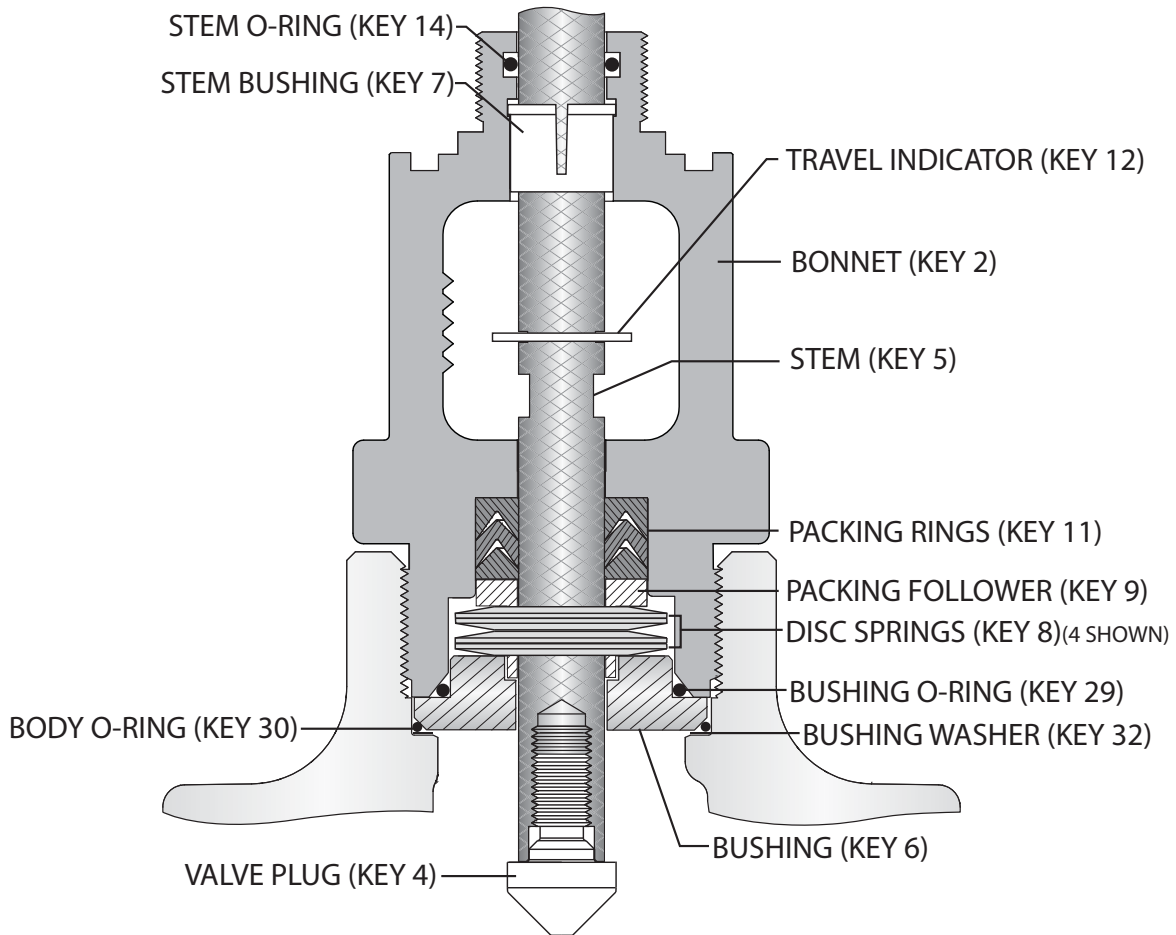


Figure 5 Packing Installation Diagram

# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual

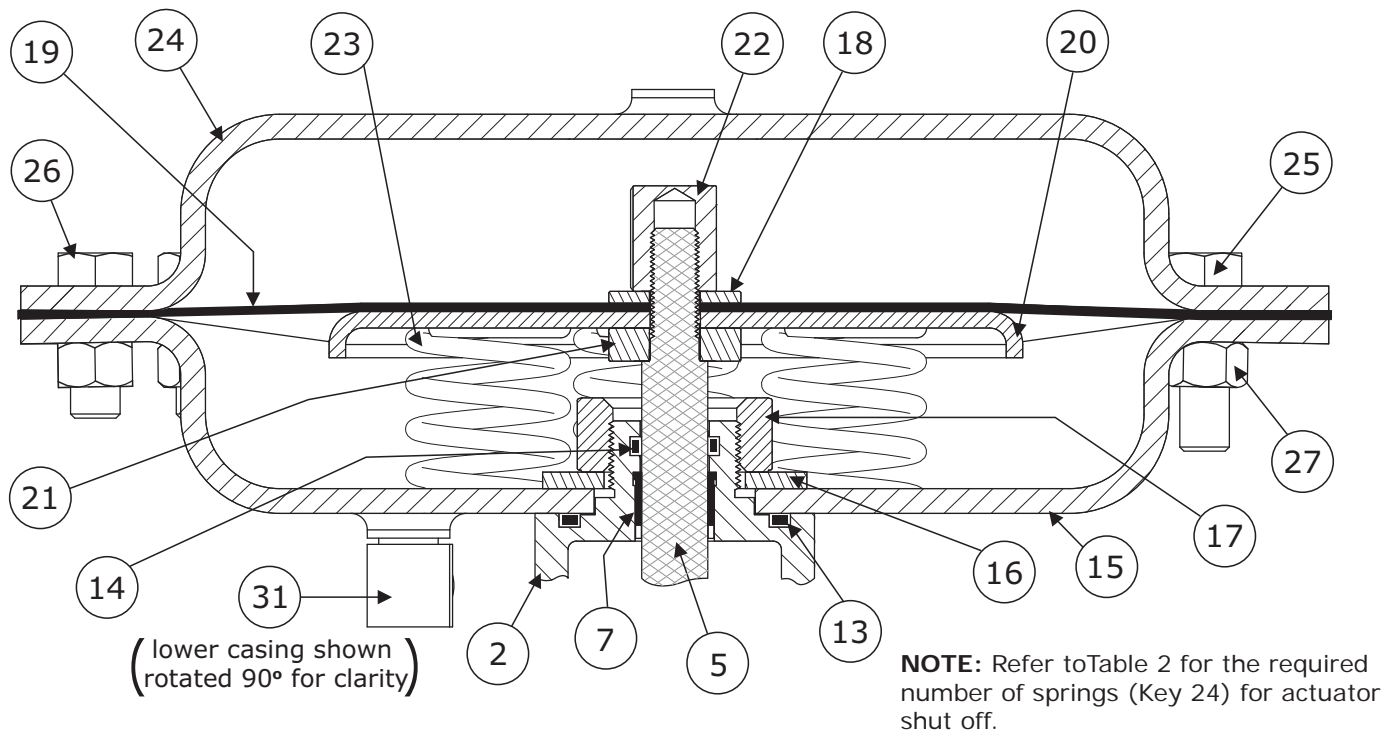
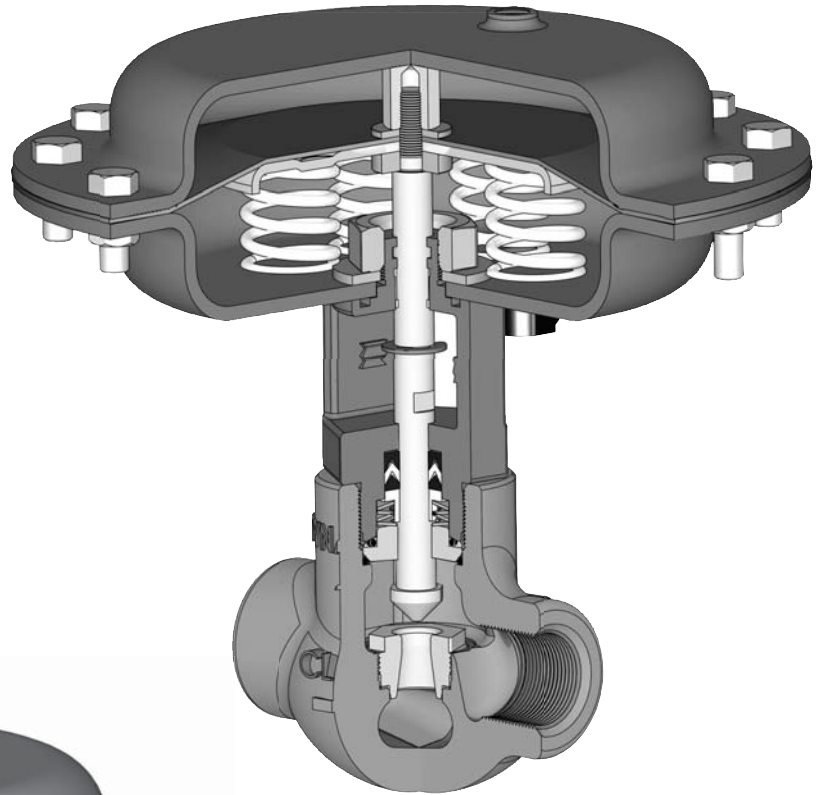


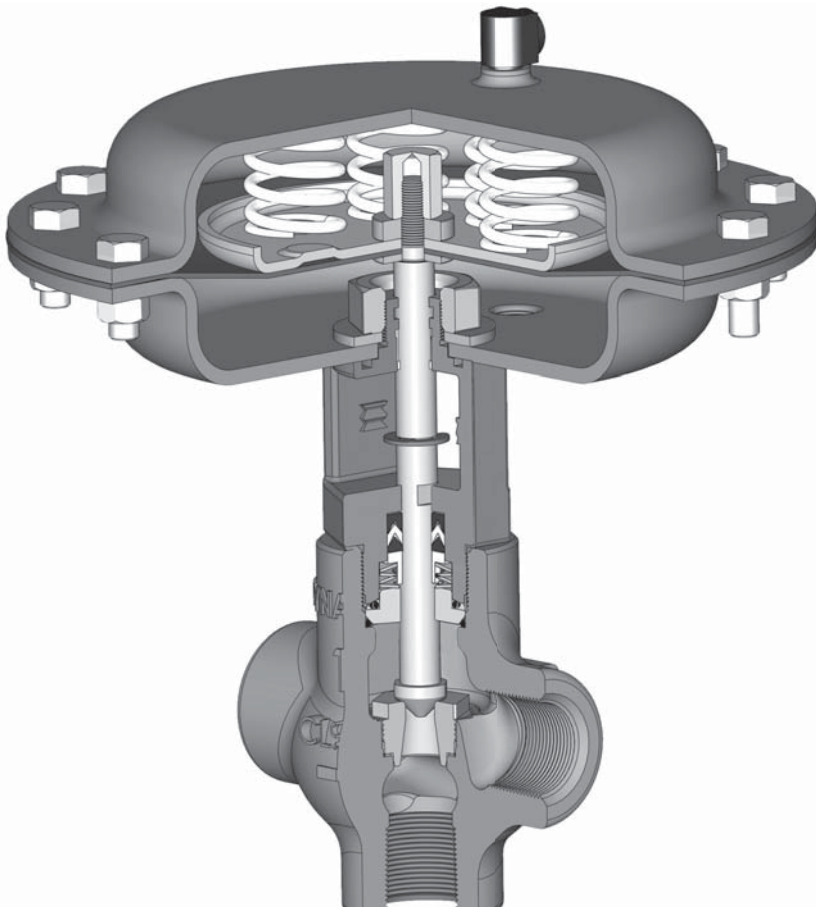
Figure 6 Fail Open Cross Section

# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual



**Figure 7**  
*Fail Open Globe Body  
Cross Section*



**Figure 8**  
*Fail Closed Tee Body  
Cross Section*

# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual

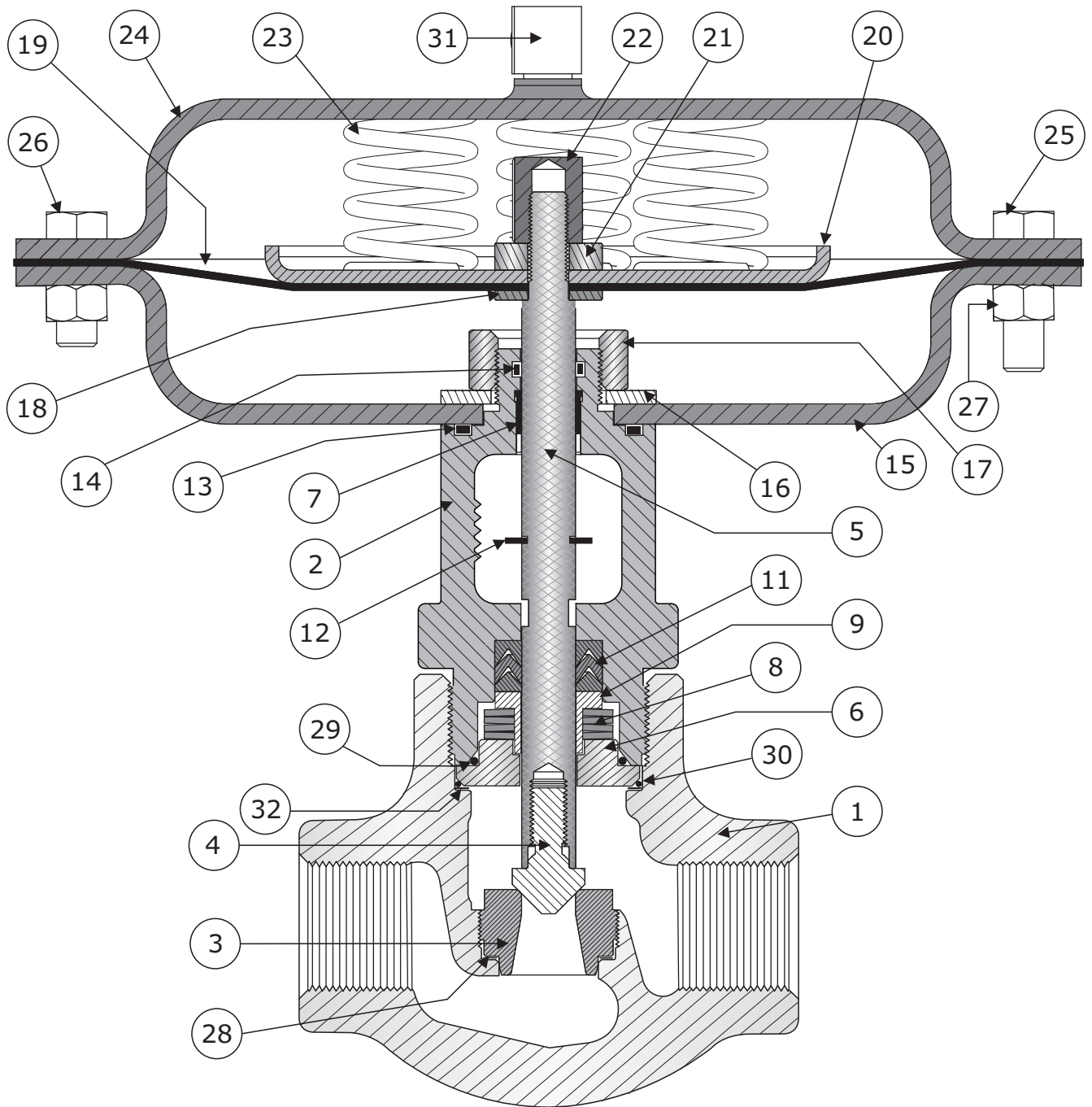


Figure 9 Fail Closed Cross Section FNPT



# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual

### PARTS LIST

Key	Description	Material	Part Number
1	Body	LCC	
	Globe		DF10301X01D
	Tee		DF10307X01D
2	Bonnet	LCC	DF10201X21D
3	Seat Ring		
	1/4 Inch Port	S17400 DH1150	DF10514X01D
	3/8 Inch Port	S17400 DH1150	DF10538X01D
	1/2 Inch Port	S17400 DH1150	DF10512X01D
	3/4 Inch Port	S17400 DH1150	DF10502X01D
	1/4 Inch Port	S17400 DH1150 Nitrided	DF10514X01D-N
	3/8 Inch Port	S17400 DH1150 Nitrided	DF10538X01D-N
	1/2 Inch Port	S17400 DH1150 Nitrided	DF10512X01D-N
	3/4 Inch Port	S17400 DH1150 Nitrided	DF10534X01D-N
	1/4 Inch Port	S17400 DH1150 - Alloy 6	DF10514X04D
	3/8 Inch Port	S17400 DH1150 - Alloy 6	DF10538X04D
	1/2 Inch Port	S17400 DH1150 - Alloy 6	DF10512X04D
	3/4 Inch Port	S17400 DH1150 - Alloy 6	DF10534X04D
	1/4 Inch Port	S17400 DH1150 Tungsten Carbide	DF10514X07D
	3/8 Inch Port	S17400 DH1150 Tungsten Carbide	DF10538X07D
	1/2 Inch Port	S17400 DH1150 Tungsten Carbide	DF10512X07D
	3/4 Inch Port	S17400 DH1150 Tungsten Carbide	DF10534X07D
4	Valve Plug		
	1/4 — 1/2 Inch (1/4 & 3/8 Inch Port)	S17400 DH1150	DF10501X01D
	3/4 Inch	S17400 DH1150	DF10502X01D
	1/4 — 1/2 Inch (1/4 & 3/8 Inch Port)	S17400 DH1150 Nitrided	DF10501X01D-N
	3/4 Inch	S17400 DH1150 Nitrided	DF10502X01D-N
	1/4 Inch	S17400 DH1150 - Alloy 6	DF10614X04D
	3/8 Inch	S17400 DH1150 - Alloy 6	DF10638X04D
	1/2 Inch	S17400 DH1150 - Alloy 6	DF10612X04D
	3/4 Inch	S17400 DH1150 - Alloy 6	DF10634X04D
	1/4 — 1/2 Inch (1/4 & 3/8 Inch Port)	S17400 DH1150 Tungsten Carbide	DF10501X07D
3/4 Inch	S17400 DH1150 Tungsten Carbide	DF10502X07D	
5	Valve Stem	S31600/S31603 Dual Grade	DF10302X01D
6	Bushing	S17400 DH1150	DF10216X01D
7	Stem Bushing	Ryton (PPS)	DF10205X01D
8	Disc Springs (4 Required)	N07718	Part of Spring Pack
9	Packing Follower	S31600	Part of Spring Pack
11	Packing Rings	PTFE / Carbon PTFE	DF10206X01D
12	Travel Indicator	Zinc Plated Steel	DF10310X01D
13	Casing O-Ring	Hydrogenated Nitrile (HNBR)	DF10209X01D
14	Stem O-Ring	Hydrogenated Nitrile (HNBR)	DF10210X01D

# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual



### PARTS LIST

Key	Description	Material	Part Number
15	Lower Casing	44W	DF10401X01D
16	Flat Washer	Zinc Plated Steel	FWZN100
17	Bonnet Locknut	Zinc Plated Steel	DF10208X01D
18	Diaphragm Plate Washer	S30300	DF10405X01D
19	Diaphragm	Nitrile / Polyester	DF10404X01D
20	Diaphragm Plate	Steel	DF10403X02D
21	Diaphragm Plate Spacer	S30300	DF10406X01D
22	Travel Stop	Zinc Plated Steel	DF10211X01D
23	Spring (Max. 6 Req'd)	Zinc Plated Steel	DF10407X01D
24	Upper Casing	44W	DF10408X01D
25	Long Cap Screw (2 Required)	Zinc Plated Steel	H5FZ38.114
26	Short Cap Screw (10 Required)	Zinc Plated Steel	H5FZ38.100
27	Nut (12 Required)	Zinc Plated Steel	NHFZ38
28	Seat Ring Gasket	S30400	DF10306X01D
29	Bushing O-Ring	Hydrogenated Nitrile (HNBR)	DF10217X11D
30	Body O-Ring	Hydrogenated Nitrile (HNBR)	DF10218X01D
31	Vent Cap	Plastic	Y602-12D
32	Bushing Washer	S30400	DF10220X01D
Spring Pack Assembly (Keys 8 & 9)		S31600 / N07718	DF10219X01D

#### DF100 Parts Kits

Description	Part Number
-------------	-------------

##### DF100 Trim Kit (S17400 DH1150 Plug / Seat Ring)\*

1/4 Inch Trim Size	RDF1014X01D
3/8 Inch Trim Size	RDF1038X01D
1/2 Inch Trim Size	RDF1012X01D
3/4 Inch Trim Size	RDF1034X01D

##### DF100 Trim Kit (S17400 DH1150 Nitrided Plug / Seat Ring)\*

1/4 Inch Trim Size	RDF1014X03D
3/8 Inch Trim Size	RDF1038X03D
1/2 Inch Trim Size	RDF1012X03D
3/4 Inch Trim Size	RDF1034X03D

\* - See Note on page 18.





# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual

DF100 Parts Kits	
Description	Part Number
<b>DF100 Trim Kit</b> (S17400 DH1150 / Alloy 6 Plug / Seat Ring)*	
1/4 Inch Trim Size	RDF1014X04D
3/8 Inch Trim Size	RDF1038X04D
1/2 Inch Trim Size	RDF1012X04D
3/4 Inch Trim Size	RDF1034X04D
<b>DF100 Trim Kit</b> (S17400 DH1150 Tungsten Carbide Plug / Seat Ring)*	
1/4 Inch Trim Size	RDF1014X07D
3/8 Inch Trim Size	RDF1038X07D
1/2 Inch Trim Size	RDF1012X07D
3/4 Inch Trim Size	RDF1034X07D
<b>Valve Repair Kit</b> (Packing Set, Stem Bushing, Stem O-Ring, Casing O-ring, Body O-Ring, Bonnet O-Ring, Seat Ring Gasket)	RDF100X001D
<b>NOTE:</b> * - Includes Seat Gasket, Bonnet O-Ring, Body O-ring.	

### **PARTS ORDERING**

Whenever corresponding with Dyna-Flo about a DF100 Control Valve, refer to the nameplate for the serial number of the unit. Please order by the complete part number (as given in the following parts list) of each part required.

# Model DF100 Control Valve

## Operation, Parts, and Instruction Manual



### ***Our Commitment to Quality***

Dyna-Flo is committed to continuous improvement. While all efforts have been made to ensure the accuracy of the content in this document, modifications or improvements to the information, specifications, and designs may occur at any time without notice. This document was published for informational purposes only, and does not express or imply suitability, a warranty, or guarantee regarding the products or services described herein or their use or applicability.

Neither Dyna-Flo Control Valve Services Ltd., nor any of their affiliated entities assumes responsibility for the selection, use and maintenance of any product. Responsibility for selection, use and maintenance of any product remains with the purchaser and end-user.

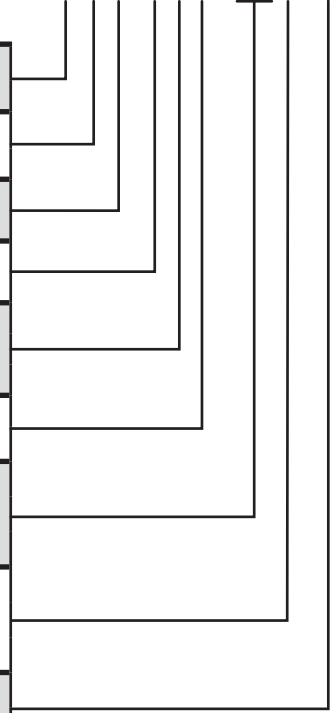


# Model DF100 Control Valve

## MODEL NUMBERING SYSTEM

**SAMPLE PART NUMBER: DF100-GC3-6BF-14S-X**

<b>BODY STYLE</b>			<b>G</b>
<b>G</b> GLOBE STYLE	<b>T</b> TEE STYLE		
<b>ACTUATOR STYLE</b>			<b>C</b>
<b>C</b> FAIL CLOSED	<b>O</b> FAIL OPENED		
<b>SPRING RANGE</b>			<b>3</b>
<b>3</b> SIZE 25 ACTUATOR WITH 3 - 15 SPRING	<b>6</b> SIZE 25 ACTUATOR WITH 6 - 30 SPRING		
<b>NUMBER OF SPRINGS</b>			<b>6</b>
<b>2</b> 2 SPRINGS	<b>6</b> 6 SPRINGS		
<b>ASME RATING</b>			<b>B</b>
<b>A</b> ASME CLASS 150	<b>B</b> ASME CLASS 300		
<b>C</b> ASME CLASS 600	<b>D</b> ASME CLASS 900 (STANDARD FOR NPT)		
<b>CONNECTION STYLE</b>			<b>F</b>
<b>N</b> NPT (NATIONAL PIPE THREAD)			
<b>TRIM SIZE</b>			<b>14</b>
<b>14</b> 1/4 INCH	<b>38</b> 3/8 INCH		
<b>12</b> 1/2 INCH	<b>34</b> 3/4 INCH		
<b>TRIM MATERIAL</b>			<b>S</b>
<b>A</b> S17400 / ALLOY 6	<b>N</b> S17400 NITRIDED		
<b>S</b> S17400 DH1150	<b>T</b> TUNGSTEN CARBIDE		
<b>SPECIAL</b>			<b>X</b>
<b>X</b> SPECIAL			



**DF100** - - - - -

# ASCO<sup>®</sup> TODAY

Over 2000 of today's most popular products



[www.ascovalve.com](http://www.ascovalve.com)

  
**EMERSON**  
Industrial Automation



Delivery, Quality, and Value are ASCO's commitment to you. The ASCO Today program features a range of flow control products and accessories available for shipment the same day you order them. **ASCO guarantees\* to ship any order received before 3 PM EST for up to 25 pieces per product from this catalog the same day or ASCO pays the shipping costs.** Orders entered after 3 PM EST will ship the following business day. (Saturdays, Sundays, and Holidays are excluded.) Orders for same day shipment cannot be cancelled or adjusted once entered.

The products listed in this catalog provide the performance required for a variety of system and process applications including boiler, air handling, process control, and water and steam control. The control voltages available for each product are the primary voltages used in industrial and commercial applications today. We are committed to providing you with an unmatched level of customer service, quality, and reliability. The performance information shown is abbreviated to allow for easy selection of ASCO Today delivery products. If you cannot find the product you need or if you need more detailed specifications, visit [www.ascovalve.com](http://www.ascovalve.com), or call 800-972-2726.

## How to Order

Find the valve that you are looking for in the provided tables.

The tables provide information on the following characteristics to help in making your choice:

- Pipe Size
- Orifice Size
- Cv Flow
- Operating Pressure Differential
- Maximum Fluid Temperature
- ASCO Catalog Number (for reference only)
- Body Material
- Seal Material
- Coil Voltage
- Coil Wattage
- Approvals

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
				Air	Water	Light Oil												
2/2 Normally Closed																		
1/2	5/8	4	0	150	150	-	180	8210G094	BR	NBR	120/60,110/50	20229	10.1	○	-	302272	238610-032-D*	3.2

### ① Valve Order Code

When ordering a Valve Product, simply supply the **Valve Order Code** located in the table. **Example: 20229**

### ② Rebuild Kit Order Code

When ordering a Rebuild Kit for a valve, supply the **Rebuild Kit Order Code** located in the table. **Example: 302272**

### ③ Replacement Coil Order Code

If a replacement coil is needed for a valve, supply the **Replacement Coil Order Code** located in the table. **Example: 238610-032-D\***

When ordering products other than solenoid valves, please supply the Order Code located in each table.

**Solenoid valves with DC voltages have been highlighted to simplify product evaluation.**

**Definitions of symbols and abbreviations can be found on page 30 & 31 of this catalog.**

**CAUTION:** Users should consult [www.ascovalve.com](http://www.ascovalve.com) or Catalog 35 to see complete specifications for the product selected from this catalog.

**⚠WARNING:** Improper selection or use of products and related items in this catalog can cause death, serious injury, or property damage.

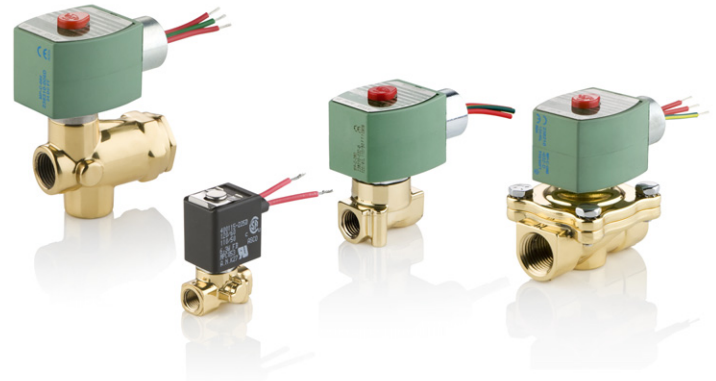
\*As industry requirements change, ASCO reserves the right to modify the contents of this catalog and program parameters without notification. Updates on this program can be obtained from the ASCO website [www.ascovalve.com](http://www.ascovalve.com) or by calling 800-972-2726, or by contacting your local ASCO representative or distributor and referencing the ASCO Today program.

# Table of Contents

<b>• General Service</b>		
2-Way Normally Closed	2-7	
2-Way Normally Open	8	
2-Way Slow Closing	11	
3-Way Normally Closed	12-15	
3-Way Normally Open	12-15	
3-Way Universal	12-15	
4-Way Inline	16-17	
4-Way NAMUR	17	
<b>• Plastic Body</b>		
2-Way Normally Closed	4	
3-Way Normally Closed	14	
<b>• Air Operated</b>		
2-Way Angle Body Piston	9	
2-Way Normally Closed	9	
3-Way Normally Closed	9	
<b>• Hot Water/Steam</b>		
2-Way Normally Closed	10	
2-Way Normally Open	11	
2-Way Slow Closing	11	
<b>• Cryogenic</b>		
2-Way Normally Closed	11	
<b>• Group Mount</b>		
2-Way Normally Closed	18	
3-Way Normally Closed	18	
4-Way Inline	18	
<b>• ISO Pneumatic</b>		
4-Way Pad Mount	18	
<b>• Intrinsically Safe</b>		
3-Way Normally Closed	19	
3-Way Universal	19	
4-Way Inline	19	
<b>• Low Power</b>		
3-Way Normally Closed	19	
3-Way Universal	19	
4-Way Inline	19	
<b>• Offshore/Harsh Environment Valves</b>		
3-Way Normally Closed	20	
3-Way Normally Open	20	
3-Way Universal	20	
<b>• Combustion</b>		
<b>Fuel Gas</b>		
2-Way Normally Open	21	
2-Way Normally Closed	21, 23	
2-Way Manual Reset	21	
Electro-Hydraulic	21-22	
Cable Release	22	
<b>Fuel Oil</b>		
2 & 3-Way Normally Closed	22	
<b>• Manual Reset</b>		
3-Way Universal	24	
3-Way Low Power	24	
<b>• Dust Collector</b>		
2-Way Pulse Valves	24	
2-Way Remote Pilot Valves	24	
<b>• Miniature Valves</b>		
2-Way Normally Closed	25	
3-Way Universal	25	
<b>• Pressure/Temperature Switch</b>		
H Series	26	
P Series	27-28	
S Series	28	
Accessories	28	
<b>• Accessories</b>		
Adjustable Flow Control	29	
Pipe Line Strainers	29	
Quick Exhaust/Shuttle Valves	29	
Check Valves	29	
Din Connectors	30	
Electronic Timer	30	
Mufflers	30	
<b>• Prefix and Suffix Definitions</b>	30	
<b>• Coil Temperature Ratings</b>	31	
<b>• Abbreviation Descriptions</b>	31	

**Two-way (2/2) general service solenoid valves have one inlet port and one outlet port.**

- Control of air, water, light oil, and non-corrosive media
- Normally closed (opens when energized) and normally open (closes when energized) operation
- Size range of 1/8" to 3"



**General Service - 2/2 Normally Closed 1/8"**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Air	Water	Light Oil								UL	FM			
<b>2/2 Normally Closed</b>																		
1/8	3/64	0.06	0	750	750	725	180	8262H001	BR	NBR	120/60,110/50	<b>21959</b>	6.1	○	○	323581	238210-032-D*	2.3
		0.06	0	750	750	725	180	8262H001	BR	NBR	240/60,220/50	<b>22056</b>	6.1	○	○	323581	238210-058-D*	2.3
	1/16	0.08	0	220	220	220	180	SC8256A002V	BR	FKM	24/DC	<b>21833</b>	6.9	□	-	-	400125-142-*	0.5
		0.08	0	220	220	220	180	U8256A002V	BR	FKM	24/DC	<b>21834</b>	6.9	□	-	-	400125-142-D*	0.5
	3/32	0.21	0	370	330	190	180	8262H014	BR	NBR	120/60,110/50	<b>21972</b>	6.1	○	○	323581	238210-032-D*	2.3
		0.21	0	370	330	190	180	EF8262H014	BR	NBR	120/60,110/50	<b>21973</b>	6.1	○	○	323581	238214-032-D*	2.3
		0.21	0	235	160	160	180	8262H014	BR	NBR	24/DC	<b>21975</b>	10.6	○	○	323557	238310-006-D*	2.3
		0.21	0	235	160	160	180	8262H014	BR	NBR	12/DC	<b>21974</b>	10.6	○	○	323557	238310-004-D*	2.3
	7/64	0.19	0	135	126	80	180	SC8256B045V	BR	FKM	120/60, 110/50	<b>21836</b>	6.3	□	-	-	400125-225-*	0.6
		0.19	0	63	63	63	180	U8256B045V	BR	FKM	24/DC	<b>21844</b>	6.9	□	-	-	400125-142-D*	0.6
		0.19	0	135	126	80	180	U8256B045V	BR	FKM	120/60	<b>21843</b>	6.3	□	-	-	400125-225-D*	0.6
		0.19	0	135	126	80	180	U8256B046V	SS	FKM	120/60, 110/50	<b>21838</b>	6.3	□	-	-	400125-225-*	0.6
	1/8	0.35	0	185	180	120	180	OPSF8262H002	BR	NBR	120/60,110/50	<b>22064</b>	6.1	○	○	325145	238212-032-*	2.3
			0	185	180	120	180	8262H002	BR	NBR	120/60,110/50	<b>21960</b>	6.1	○	○	3235145	238210-032-D*	2.3
			0	185	180	120	180	8262H002	BR	NBR	24/60	<b>21965</b>	6.1	○	○	3235145	238210-005-D*	2.3
			0	185	180	120	180	8262H002	BR	NBR	240/60,220/50	<b>21963</b>	6.1	○	○	3235145	238210-058-D*	2.3
			0	185	180	120	180	8262H002	BR	NBR	480/60,440/50	<b>21964</b>	6.1	○	○	3235145	238210-088-D*	2.3
			0	185	180	120	180	EF8262H002	BR	NBR	120/60,110/50	<b>21962</b>	6.1	○	○	3235145	238214-032-D*	2.3
			0	185	180	120	180	8262H002V	BR	FKM	120/60,110/50	<b>21961</b>	6.1	○	○	323581-V	238210-032-D*	2.3
			0	130	110	95	180	8262H002	BR	NBR	12/DC	<b>21966</b>	10.6	○	○	323587	238310-006-D*	2.3
0			130	110	95	180	8262H002	BR	NBR	24/DC	<b>21967</b>	10.6	○	○	323587	238310-004-D*	2.3	
0			155	180	140	180	8262H006	SS	NBR	120/60,110/50	<b>21968</b>	6.1	○	○	323583	238210-032-D*	2.3	

## General Service - 2/2 Normally Closed 1/4"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)		
			Min.	Max.										UL	FM					
				Air	Water	Light Oil														
2/2 Normally Closed																				
1/4	3/64	0.06	0	750	750	725	180	8262H019	BR	NBR	120/60,110/50	21976	6.1	○	○	323581	238210-032-D*	2.3		
		0.06	0	750	640	550	180	8262H019	BR	NBR	24/DC	22057	10.6	○	○	323587	238310-006-D*	2.3		
		0.06	0	750	750	725	180	8262H080	SS	NBR	120/60,110/50	21992	6.1	○	○	323583	238210-032-D*	2.3		
		0.06	0	1500	1500	1500	140	8262H200	BR	UR	120/60,110/50	22037	10.1	●	-	323593-W	238610-032-D*	2.4		
		0.06	0	1500	1500	1500	140	SC8262H200	BR	UR	120/60,110/50	22059	10.1	●	-	323593-W	238612-032-*	2.4		
	3/32	0.21	0	235	160	160	180	8262H086	SS	NBR	24/DC	22062	10.6	○	○	323587	238310-006-D*	2.3		
		0.21	0	370	330	160	180	8262H020	BR	NBR	120/60,110/50	21977	6.1	○	○	323581	238210-032-D*	2.3		
		0.21	0	235	160	160	180	8262H020	BR	NBR	24/DC	21979	10.6	○	○	323587	238310-006-D*	2.3		
		0.21	0	235	160	160	180	8262H020	BR	NBR	12/DC	21978	10.6	○	○	323587	238310-004-D*	2.3		
		0.21	0	500	350	270	180	8262H021	BR	NBR	120/60,110/50	22038	9.1	○	○	323581	238210-132-D*	2.3		
1/8	5/32	0.35	0	130	110	90	180	8262H007	SS	NBR	24/DC	22061	10.6	○	○	323587	238310-006-D*	2.4		
		0.35	0	185	180	90	180	8262H022	BR	NBR	120/60,110/50	21980	6.1	○	○	323581	238210-032-D*	2.0		
		0.35	0	185	180	90	180	8262H022	BR	NBR	24/60	21984	6.1	○	○	323581	238210-005-D*	2.0		
		0.35	0	185	180	90	180	8262H022	BR	NBR	240/60,220/50	21983	6.1	○	○	323581	238210-058-D*	2.0		
		0.35	0	185	180	90	180	EF8262H022	BR	NBR	120/60,110/50	21981	6.1	○	○	323581	238214-032-D*	2.0		
		0.35	0	185	180	90	180	JKF8262H022	BR	NBR	120/60,110/50	21982	6.1	○	○	323581	238212-032-*	2.0		
		0.35	0	185	180	120	180	SC8262H022	BR	NBR	120/60,110/50	22065	6.1	○	○	323581	238212-032-*	2.0		
		0.35	0	130	110	90	180	8262H022	BR	NBR	24/DC	21986	10.6	○	○	323587	238310-006-D*	2.0		
		0.35	0	130	110	90	180	8262H022	BR	NBR	12/DC	21985	10.6	○	○	323587	238310-004-D*	2.0		
		0.35	0	185	180	90	180	8262H007	SS	NBR	120/60,110/50	21969	6.1	○	○	323583	238210-032-D*	2.4		
		0.35	0	185	180	90	180	EF8262H007	SS	NBR	120/60,110/50	21970	6.1	○	○	323583	238214-032-D*	2.4		
		0.35	0	340	300	215	180	8262H232	BR	NBR	120/60,110/50	22021	10.1	○	○	323593	238610-032-D*	2.4		
		0.35	0	340	300	215	180	EF8262H232	BR	NBR	120/60,110/50	22022	10.1	○	○	323593	238614-032-D*	2.4		
		0.35	0	340	300	215	180	SC8262H232	BR	NBR	120/60,110/50	22066	10.1	○	○	323593	238612-032-*	2.4		
		0.35	0	130	125	115	180	8262H232	BR	NBR	24/DC	22063	11.6	○	○	323593	238710-006-D*	2.4		
1/4	5/32	0.52	0	210	200	145	180	8262H202	BR	NBR	120/60,110/50	22002	10.1	○	○	323593	238610-032-D*	2.4		
		0.52	0	210	200	145	180	8262H202	BR	NBR	240/60,220/50	22004	10.1	○	○	323593	238610-058-D*	2.4		
		0.52	0	210	200	145	180	EF8262H202	BR	NBR	120/60,110/50	22003	10.1	○	○	323593	238614-032-D*	2.4		
		0.52	0	210	200	145	180	SC8262H202	BR	NBR	120/60,110/50	22043	10.1	○	○	323593	238612-032-*	2.4		
		0.52	0	-	150	109	180	8262H202T	BR	PTFE	120/60,110/50	22036	10.1	●	-	323593-T	238610-032-D*	2.4		
		0.52	0	63	63	63	180	8262H202	BR	NBR	24/DC	22005	11.6	○	○	323593	238710-006-D*	2.4		
		0.52	0	210	200	145	180	8262H220	SS	NBR	120/60,110/50	22015	10.1	○	○	323595	238610-032-D*	2.4		
		0.52	0	210	200	145	180	EF8262H220	SS	NBR	120/60,110/50	22016	10.1	○	○	323595	238614-032-D*	2.4		
		7/32	5/32	0.73	0	100	100	100	180	8262H208	BR	NBR	120/60,110/50	22006	10.1	○	○	323593	238610-032-D*	2.4
				0.73	0	100	100	100	180	8262H208	BR	NBR	24/60	22010	10.1	○	○	323593	238610-005-D*	2.4
0.73	0			100	100	100	180	8262H208	BR	NBR	240/60,220/50	22009	10.1	○	○	323593	238610-058-D*	2.4		
0.73	0			100	100	100	180	EF8262H208	BR	NBR	120/60,110/50	22008	10.1	○	○	323593	238614-032-D*	2.4		
0.73	0			100	100	100	180	SC8262H208	BR	NBR	120/60,110/50	22039	10.1	○	○	323593	238612-032-*	2.4		
0.73	0			35	35	35	180	8262H208	BR	NBR	24/DC	22011	11.6	○	○	323593	238710-006-D*	2.4		
0.73	0			100	100	100	180	8262H226	SS	NBR	120/60,110/50	22017	10.1	○	○	323595	238610-032-D*	2.4		
0.73	0			55	54	40	180	8262H013	BR	NBR	120/60,110/50	21971	6.1	○	○	323581	238210-032-D*	2.3		
9/32	5/16	0.88	0	65	75	60	180	8262H210	BR	NBR	120/60,110/50	22012	10.1	○	○	323593	238610-032-D*	2.3		
		0.88	0	90	90	90	180	8262H212	BR	NBR	120/60,110/50	22013	17.1	○	○	323593	238610-132-D*	2.4		
		0.88	0	90	90	90	180	EF8262H212	BR	NBR	120/60,110/50	22014	17.1	○	○	323593	238614-132-D*	2.4		
		0.88	0	90	90	90	180	SD8262H212	BR	NBR	120/60,110/50	22060	17.1	○	○	323593	238612-132-*	2.4		
		0.88	0	90	90	90	180	8262H230	SS	NBR	120/60,110/50	22019	17.1	○	○	323595	238610-132-D*	2.6		
		0.88	0	90	90	90	180	EF8262H230	SS	NBR	120/60,110/50	22020	17.1	○	○	323595	238614-132-D*	2.6		
		0.88	0	36	36	33	180	8262H038	SS	NBR	120/60,110/50	21990	6.1	○	○	323583	238210-032-D*	2.6		
		0.88	0	36	36	33	180	8262H090	BR	NBR	120/60,110/50	21994	6.1	○	○	323581	238210-032-D*	2.3		
		0.88	0	27	23	21	180	8262H090	BR	NBR	24/DC	21997	10.6	○	●	323587	238310-006-D*	2.3		
5/16	5/16	0.88	5	125	125	-	180	8210B020	BR	NBR	120/60,110/50	00241	6.5	●	-	302270	216099-003-D*	1.0		
		1.5	10	750	750	750	200	8223G021	BR	NYLON	120/60,110/50	20369	10.1	-	-	302313	238610-032-D*	2.9		





Plastic Body - 2/2 Normally Closed 1/8" - 1/4"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Air	Water	Light Oil								UL	FM			
2/2 Normally Closed																		
1/8	1/8	0.30	0	125	-	-	125	USM8260101	PL	NBR	120/60INT	22823	24.9	-	-	-	186548-016-*	0.5
1/4	1/8	0.30	0	125	-	-	125	USM8260100	PL	NBR	120/60INT	00851	24.9	-	-	-	186548-016-*	0.5
	9/64	0.35	0	120	120	-	130	8260G054	PL	NBR	120/60,110/50	20937	6.1	●	-	302971	238210-032-D*	0.8
		0.35	0	120	120	-	130	8260G071	PL	NBR	120/60,110/50	20938	6.1	●	-	302971	238210-032-D*	0.8

General Service - 2/2 Normally Closed 3/8"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)	
			Min.	Air	Water	Light Oil								UL	FM				
2/2 Normally Closed																			
3/8	1/8	0.35	0	185	180	90	180	8263H002	BR	NBR	120/60,110/50	22030	6.1	○	○	323581	238210-032-D*	1.8	
		0.35	0	340	300	215	180	8263H232	BR	NBR	120/60,110/50	22040	17.1	○	○	323593	238610-132-D*	1.8	
	5/32	0.52	0	210	185	100	180	8263H200	BR	NBR	120/60,110/50	22031	10.1	○	○	323593	238610-032-D*	1.8	
	7/32	2.9	5	230	230	230	195	SC8238T402	BR	NBR	120/60	21899	4.0	□	-	323457	43005573	1.8	
		0.73	0	125	100	100	180	8263H206	BR	NBR	120/60,110/50	22032	17.1	○	○	323593	238610-132-D*	1.8	
	9/32	0.88	0	100	85	70	180	8263H210	BR	NBR	120/60,110/50	22033	17.1	○	○	323593	238610-132-D*	2.3	
		1.2	5	125	125	-	180	8210B021	BR	NBR	120/60,110/50	00245	6.5	●	-	302270	216099-003-D*	1.0	
	5/16	1.5	10	750	750	750	200	8223G023	BR	NYLON	120/60,110/50	20374	10.1	-	-	302313	238610-032-D*	2.9	
		1.5	10	1500	1500	1500	200	8223G027	BR	NYLON	120/60,110/50	20378	17.1	-	-	302314	238610-132-D*	2.9	
	3/8	3/8	1.5	5	150	125	-	180	8210G073	BR	NBR	120/60,110/50	20194	6.1	●	-	302271	238210-032-D*	2.0
			1.5	5	150	125	-	180	EF8210G073	BR	NBR	120/60,110/50	20195	6.1	●	-	302271	238214-032-D*	2.0
			1.5	5	150	125	-	180	8210G036	SS	NBR	120/60,110/50	20176	6.1	●	-	302326	238210-032-D*	2.0
			1.5	5	150	125	-	180	EF8210G036	SS	NBR	120/60,110/50	20178	6.1	●	-	302326	238214-032-D*	2.0
			1.8	0	7	5	-	180	8030G010	BR	NBR	120/60,110/50	20003	6.1	○	○	302787	238210-032-D	1.5
			1.8	0	15	-	-	180	8030G013VM	BR	NBR	120/60,110/50	20008	10.1	-	-	302788-VM	238610-032-D*	2.3
			1.8	0	15	15	-	180	8030G013	BR	NBR	120/60,110/50	20006	10.1	○	●	302788	238610-032-D*	2.3
	5/8	3/8	3	0	150	150	-	180	SC8210G093	BR	NBR	120/60,110/50	21878	10.1	-	-	302272	238612-032-*	3.2
			3	0	150	150	-	180	8210G093	BR	NBR	120/60,110/50	20221	10.1	○	-	302272	238610-032-D*	3.2
			3	0	150	150	-	180	EF8210G093	BR	NBR	120/60,110/50	20224	10.1	○	-	302272	238614-032-D*	3.2
			3	0	40	40	-	150	8210G093	BR	NBR	24/DC	20228	11.6	○	-	302372	238710-006-D*	3.2
			3	0	40	40	-	150	8210G093	BR	NBR	12/DC	20227	11.6	○	-	302372	238710-004-D*	3.2
			3	5	200	150	135	180	8210G001	BR	NBR	120/60,110/50	20032	6.1	○	-	302273	238210-032-D*	3.2
			3	5	200	150	135	180	8210G001	BR	NBR	24/60	20039	6.1	○	-	302273	238210-005-D*	3.2
			3	5	200	150	135	180	8210G001	BR	NBR	240/60,220/50	20036	6.1	○	-	302273	238210-058-D*	3.2
			3	5	200	150	135	180	EF8210G001	BR	NBR	120/60,110/50	20034	6.1	○	-	302273	238214-032-D*	3.2
			3	5	200	150	135	180	JKF8210G001	BR	NBR	120/60,110/50	20035	6.1	○	-	302273	238212-032-*	3.2
			3	5	200	150	135	180	SC8210G001	BR	NBR	120/60,110/50	21037	6.1	○	-	302273	238212-032-*	3.2
			3	5	125	100	100	150	8210G001	BR	NBR	24/DC	20041	11.6	○	-	302373	238710-006-D*	3.2
			3	5	125	100	100	150	8210G001	BR	NBR	12/DC	20040	11.6	○	-	302373	238710-004-D*	3.2
			5/8	3	5	300	300	300	175	8210G006	BR	NBR	120/60,110/50	20093	17.1	○	-	302274	238610-132-D*
	3	5		300	300	300	175	EF8210G006	BR	NBR	120/60,110/50	20094	17.1	○	-	302274	238614-132-D*	3.2	
	3/4	3.4	0	50	-	-	125	8215G010	AL	NBR	120/60,110/50	20286	10.1	○	●	302350	238610-032-D*	2.8	

## General Service - 2/2 Normally Closed 1/2"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)	
			Min.	Max.										UL	FM				
				Air	Water	Light Oil													
<b>2/2 Normally Closed</b>																			
7/16		2.2	5	40	40	-	150	8210G015	BR	NBR	24/DC	<b>21851</b>	11.6	●	-	302374	238710-006-D*	2.0	
		2.2	5	150	125	-	180	8210G015	BR	NBR	120/60,110/50	<b>20126</b>	6.1	●	-	302275	238210-032-D*	2.0	
		2.2	5	150	125	-	180	8210G015	BR	NBR	24/60	<b>20130</b>	6.1	●	-	302275	238210-005-D*	2.0	
		2.2	5	150	125	-	180	8210G015	BR	NBR	240/60,220/50	<b>20128</b>	6.1	●	-	302275	238210-058-D*	2.0	
		2.2	5	150	125	-	180	EF8215G015	BR	NBR	120/60,110/50	<b>20127</b>	6.1	●	-	302275	238214-032-D*	2.0	
		2.2	5	150	125	-	180	8210G037	SS	NBR	120/60,110/50	<b>20179</b>	6.1	●	-	302327	238210-032-D*	2.0	
		2.2	5	150	125	-	180	EF8210G037	SS	NBR	120/60,110/50	<b>20181</b>	6.1	●	-	302327	238214-032-D*	2.0	
		2.8	0	4	6	-	180	8030G016	BR	NBR	120/60,110/50	<b>20010</b>	6.1	○	●	302789	238210-032-D*	2.7	
		2.8	0	15	15	-	200	8030G017	BR	NBR	120/60	<b>21443</b>	16.1	○	-	302790	272610-032-D*	2.7	
	2.8	0	15	-	-	180	8030G017VH	BR	NBR	120/60	<b>21444</b>	16.1	-	-	302790-VH	272610-032-D*	2.7		
3/8		3.2	25	1500	1500	1500	200	8223G003	BR	NYLON	120/60,110/50	<b>20359</b>	17.1	-	-	302315	238610-132-D*	3.4	
		3.2	25	1500	1500	1500	200	8223G010	SS	PTFE	120/60,110/50	<b>20364</b>	17.1	-	-	302322	238610-132-D*	3.4	
17/32		4.5	5	230	230	230	195	SC8238T405	BR	BR	120/60	<b>21900</b>	4.0	□	-	323457	43005573	2.0	
		4.5	5	230	230	230	195	SC8238T405	BR	BR	24/60	<b>21901</b>	4.0	□	-	323457	43005582	2.0	
1/2		4	0	150	150	-	180	8210G094	BR	NBR	120/60,110/50	<b>20229</b>	10.1	○	-	302272	238610-032-D*	3.2	
		4	0	150	150	-	180	8210G094	BR	NBR	24/60	<b>20246</b>	10.1	○	-	302272	238610-005-D*	3.2	
		4	0	150	150	-	180	8210G094	BR	NBR	240/60,220/50	<b>20243</b>	10.1	○	-	302272	238610-058-D*	3.2	
		4	0	150	150	-	180	EF8210G094	BR	NBR	120/60,110/50	<b>20236</b>	10.1	○	-	302272	238214-032-D*	3.2	
		4	0	150	150	-	180	JKF8210G094	BR	NBR	120/60,110/50	<b>20242</b>	10.1	○	-	302272	238612-032-*	3.2	
		4	0	150	150	-	180	JSF8210G094	BR	NBR	120/60,110/50	<b>21778</b>	10.1	○	-	302272	238612-032-*	3.2	
		4	0	150	150	-	180	SC8210G094	BR	NBR	120/60,110/50	<b>21031</b>	10.1	○	-	302272	238612-032-*	3.2	
		4	0	150	150	-	180	8210G094MO	BR	NBR	120/60,110/50	<b>20231</b>	10.1	○	-	302272-MO	238610-032-D*	3.2	
		4	0	150	150	-	180	8210G094V	BR	FKM	120/60,110/50	<b>20233</b>	10.1	○	-	302272-V	238610-032-D*	3.2	
		4	0	150	-	-	180	8210G094N	BR	NBR	120/60,110/50	<b>20232</b>	10.1	○	-	302272-N	238610-032-D*	3.2	
		4	0	40	40	-	150	8210G094	BR	NBR	24/DC	<b>20248</b>	11.6	○	-	302372	238710-006-D*	3.2	
		4	0	40	40	-	150	8210G094	BR	NBR	12/DC	<b>20247</b>	11.6	○	-	302372	238710-004-D*	3.2	
		4	0	40	40	-	150	SC8210G094	BR	NBR	24/DC	<b>21621</b>	11.6	○	-	302372	238712-006-*	3.2	
		4	0	150	150	125	175	8210G087	SS	NBR	120/60,110/50	<b>20201</b>	17.1	●	-	302328	238610-132-D*	3.3	
		4	0	150	150	125	175	EF8210G087	SS	NBR	120/60,110/50	<b>20204</b>	17.1	●	-	302328	238614-132-D*	3.3	
		4	0	150	150	125	175	EF8210G087V	SS	FKM	120/60,110/50	<b>20206</b>	17.1	●	-	302328-V	238614-132-D*	3.3	
		4	0	150	150	-	175	8210G087E	SS	EPDM	120/60,110/50	<b>20202</b>	17.1	-	-	302328-E	238610-132-D*	3.3	
	5/8		4	0	40	40	-	150	8210G087	SS	NBR	24/DC	<b>21722</b>	11.6	●	-	302423	238710-006-D*	3.3
			4	0	40	40	-	150	EF8210G087	SS	NBR	24/DC	<b>20209</b>	11.6	●	-	302423	238714-006-D*	3.2
			4	5	200	150	135	180	8210G002	BR	NBR	120/60,110/50	<b>20043</b>	6.1	○	-	302273	238210-032-D*	3.2
			4	5	200	150	135	180	8210G002	BR	NBR	24/60	<b>20058</b>	6.1	○	-	302273	238210-005-D*	3.2
			4	5	200	150	135	180	8210G002	BR	NBR	240/60,220/50	<b>20053</b>	6.1	○	-	302273	238210-058-D*	3.2
			4	5	200	150	135	180	8210G002	BR	NBR	480/60,440/50	<b>20056</b>	6.1	○	-	302273	238210-088-D*	3.2
			4	5	200	150	135	180	EF8210G002	BR	NBR	120/60,110/50	<b>20049</b>	6.1	○	-	302273	238214-032-D*	3.2
			4	5	200	150	135	180	EF8210G002MO	BR	NBR	120/60,110/50	<b>20050</b>	6.1	○	-	302273-MO	238214-032-D*	3.2
			4	5	200	150	135	180	JKF8210G002	BR	NBR	120/60,110/50	<b>20051</b>	6.1	○	-	302273	238212-032-*	3.2
			4	5	200	150	135	180	SC8210G002	BR	NBR	120/60,110/50	<b>20995</b>	6.1	○	-	302273	238212-032-*	3.2
		4	5	200	150	135	180	JSF8210G002	BR	NBR	120/60,110/50	<b>20989</b>	6.1	●	-	302273	238212-032-*	3.2	
		4	5	200	150	135	180	8210G002MO	BR	NBR	120/60,110/50	<b>20046</b>	6.1	●	-	302273-MO	238210-032-D*	3.2	
		4	5	200	150	135	180	8210G002V	BR	FKM	120/60,110/50	<b>20048</b>	6.1	-	-	302273-V	238210-032-D*	3.2	
		4	5	125	-	-	140	8210G002Q	BR	NBR	120/60	<b>21311</b>	15.1	□	-	304006	270110-032-D*	3.2	
		4	5	125	100	100	150	8210G002	BR	NBR	24/DC	<b>20062</b>	11.6	○	-	302373	238710-006-D*	3.2	
		4	5	125	100	100	150	8210G002	BR	NBR	12/DC	<b>20061</b>	11.6	○	-	302373	238710-004-D*	3.2	
		4	5	125	100	100	150	EF8210G002	BR	NBR	24/DC	<b>20063</b>	11.6	○	-	302373	238714-006-D*	3.2	
		4	5	125	100	100	150	SC8210G002	BR	NBR	24/DC	<b>21134</b>	11.6	○	-	302373	238712-006-*	3.2	
		4	5	300	300	300	175	8210G007	BR	NBR	120/60,110/50	<b>20095</b>	17.1	□	-	302274	238610-132-D*	3.2	
		4	5	300	300	300	175	EF8210G007	BR	NBR	120/60,110/50	<b>20098</b>	17.1	□	-	302274	238614-132-D*	3.2	
3/4			4.4	0	50	-	-	125	8215G020	AL	NBR	120/60,110/50	<b>20290</b>	10.1	○	●	302350	238610-032-D*	2.8
			4.4	0	50	-	-	125	EF8215G020	AL	NBR	120/60,110/50	<b>20292</b>	10.1	○	●	302350	238614-032-D*	2.8
			4.4	0	50	-	-	104	SC8215G020	AL	NBR	120/60,110/50	<b>21785</b>	10.1	-	-	302350	238612-032-*	2.8
			4.4	0	25	-	-	104	8215G020	AL	NBR	12/DC	<b>20294</b>	11.6	○	●	302430	238710-004-D*	2.8

General Service - 2/2 Normally Closed 3/4"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
				Air	Water	Light Oil												
2/2 Normally Closed																		
5/8	5	0	150	150	125	175	8210G088	SS	NBR	120/60,110/50	20210	17.1	●	-	302328	238610-132-D*	3.4	
		0	150	150	125	180	EF8210G088	SS	NBR	120/60,110/50	20213	17.1	●	-	302328	238614-132-D*	3.4	
		0	150	150	-	175	8210G088E	SS	EPDM	120/60,110/50	20211	17.1	-	-	302328-E	238610-132-D*	3.4	
		0	40	40	125	150	8210G088	SS	NBR	24/DC	21723	11.6	●	-	302423	238710-006-D*	3.4	
3/4	5	0	2	2	-	180	8030G003	BR	NBR	120/60,110/50	20000	10.1	○	●	302791	238610-032-D*	3.4	
		0	4	4	-	180	8030G043	BR	NBR	120/60,110/50	20014	17.1	○	●	302791	238610-132-D*	3.4	
		0	150	150	-	180	8210G095	BR	NBR	120/60,110/50	20250	10.1	○	-	302276	238610-032-D*	3.4	
		0	150	150	-	180	8210G095	BR	NBR	24/60	20265	10.1	○	-	302276	238610-005-D*	3.4	
		0	150	150	-	180	8210G095	BR	NBR	240/60,220/50	20262	10.1	○	-	302276	238610-058-D*	3.4	
		0	150	150	-	180	EF8210G095	BR	NBR	120/60,110/50	20257	10.1	○	-	302276	238614-032-D*	3.4	
		0	150	150	-	180	JKF8210G095	BR	NBR	120/60,110/50	20261	10.1	○	-	302276	238612-032-*	3.4	
		0	150	150	-	180	SC8210G095	BR	NBR	120/60,110/50	21784	10.1	○	-	302276	238612-032-*	3.4	
		0	150	150	-	180	8210G095MO	BR	NBR	120/60,110/50	20252	10.1	●	-	302276-MO	238610-032-D*	3.4	
		0	150	150	-	180	8210G095V	BR	FKM	120/60,110/50	20253	10.1	●	-	302276-V	238610-032-D*	3.4	
		0	15	-	-	180	8210G095VH	BR	NBR	120/60,110/50	20254	10.1	-	-	302276-VH	238610-032-D*	3.4	
		0	40	40	-	150	8210G095	BR	NBR	24/DC	20267	11.6	○	-	302375	238710-006-D*	3.4	
	0	40	40	-	150	8210G095	BR	NBR	12/DC	20266	11.6	○	-	302375	238710-004-D*	3.4		
	3/4	5	5	125	125	125	180	8210G009	BR	NBR	120/60,110/50	20107	6.1	○	-	302277	238210-032-D*	3.4
			5	125	125	125	180	8210G009	BR	NBR	24/60	20119	6.1	○	-	302277	238210-005-D*	3.4
			5	125	125	125	180	8210G009	BR	NBR	240/60,220/50	20114	6.1	○	-	302277	238210-058-D*	3.4
			5	125	125	125	180	EF8210G009	BR	NBR	120/60,110/50	20110	6.1	○	-	302277	238214-032-D*	3.4
			5	125	125	125	180	JKF8210G009	BR	NBR	120/60,110/50	20112	6.1	○	-	302277	238212-032-*	3.4
			5	125	125	125	180	SC8210G009	BR	NBR	120/60,110/50	21016	6.1	○	-	302277	238212-032-*	3.4
		5	5	125	125	125	180	8210G009MO	BR	NBR	120/60,110/50	20109	6.1	●	-	302277-MO	238210-032-D*	3.4
			5	100	90	75	150	8210G009	BR	NBR	24/DC	20121	11.6	○	-	302376	238710-006-D*	3.4
			5	100	90	75	150	8210G009	BR	NBR	12/DC	20120	11.6	○	-	302376	238710-004-D*	3.4
			0	50	-	-	125	8215G030	AL	NBR	120/60,110/50	20297	10.1	○	●	302350	238610-032-D*	2.8
			0	50	-	-	125	EF8215G030	AL	NBR	120/60,110/50	20299	10.1	○	●	302350	238614-032-D*	2.8
0			25	-	-	104	8215G030	AL	NBR	12/DC	20301	11.6	○	●	302430	238710-004-D*	2.8	
6.5	5	0	25	-	-	104	EF8215G030	AL	NBR	80-90/DC	21745	11.6	○	●	302430	238714-029-D*	2.8	
		5	125	-	-	125	8215G003	AL	NBR	120/60,110/50	20284	6.1	○	-	302349	238210-032-D*	2.8	
		0	200	180	180	77	8210B026	BR	PTFE	24/DC	00248	30.6	-	-	302377	074073-005-D	3.5	
		0	350	300	200	200	8210G026	BR	PTFE	120/60	21412	16.1	●	-	302278	272610-032-D*	3.0	
		0	350	300	200	200	EF8210G026	BR	PTFE	120/60	21742	16.1	●	-	302278	272614-032-D*	3.0	
		5	250	150	100	180	8210G003	BR	NBR	120/60,110/50	20064	6.1	○	-	302279	238210-032-D*	3.7	
	6.5	5	250	150	100	180	EF8210G003	BR	NBR	120/60,110/50	20066	6.1	○	-	302279	238214-032-D*	3.7	
		5	250	150	100	180	JKF8210G003	BR	NBR	120/60,110/50	20068	6.1	○	-	302279	238212-032-*	3.7	
		5	250	150	100	180	SC8210G003	BR	NBR	120/60,110/50	21018	6.1	○	-	302279	238212-032-*	3.7	
		5	125	125	125	150	8210G003	BR	NBR	24/DC	20076	11.6	○	-	302378	238710-006-D*	3.7	
		5	125	125	125	150	8210G003	BR	NBR	12/DC	20074	11.6	○	-	302378	238710-004-D*	3.7	
		5	125	125	125	150	SC8210G003	BR	NBR	24/DC	21605	11.6	○	-	302378	238712-006-*	3.7	
7.8	25	750	750	750	200	8223G005	BR	NYLON	120/60,110/50	20362	17.1	-	-	302316	238610-132-D*	4.4		

General Service - 2/2 Normally Closed 1" - 3"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.		Light Oil								UL	FM			
2/2 Normally Closed																		
1	1	13	0	150	125	125	180	8210G054V	BR	FKM	120/60	21585	16.1	-	-	302283-V	272610-032-D*	8.8
		13	0	150	125	125	180	8210G054	BR	NBR	120/60	21414	16.1	●	-	302283	272610-032-D*	8.8
		13	0	150	125	125	180	EF8210G054	BR	NBR	120/60	21415	16.1	●	-	302283	272614-032-D*	8.8
		13	0	100	100	80	77	8210B054	BR	NBR	24/DC	00263	30.6	●	-	302381	074073-005-D*	8.8
		13	0	150	125	125	180	8210G089	SS	NBR	120/60	21420	16.1	●	-	302329	272610-032-D*	8.8
		13	0	150	125	125	180	EF8210G089	SS	NBR	120/60	21744	16.1	●	-	302329	272614-032-D*	8.8
		13	5	150	150	100	180	8210G004	BR	NBR	120/60,110/50	20077	6.1	●	-	302280	238210-032-D*	5.4
		13	5	150	150	100	180	8210G004	BR	NBR	24/60	20089	6.1	●	-	302280	238210-005-D*	5.4
		13	5	150	150	100	180	8210G004	BR	NBR	240/60,220/50	20085	6.1	●	-	302280	238210-058-D*	5.4
		13	5	150	150	100	180	EF8210G004	BR	NBR	120/60,110/50	20079	6.1	●	-	302280	238214-032-D*	5.4
		13	5	150	150	100	180	JKF8210G004	BR	NBR	120/60,110/50	20084	6.1	●	-	302280	238212-032-*	5.4
		13	5	150	150	100	180	SC8210G004	BR	NBR	120/60,110/50	21019	6.1	●	-	302280	238212-032-*	5.4
		13	5	150	150	100	180	8210G004MO	BR	NBR	120/60,110/50	20078	6.1	●	-	302280-MO	238210-032-D*	5.4
		13	5	125	125	125	150	8210G004	BR	NBR	24/DC	20091	11.6	●	-	302379	238710-006-D*	5.4
13	5	125	125	125	150	8210G004	BR	NBR	12/DC	20090	11.6	●	-	302379	238710-004-D*	5.4		
13.5	0	300	225	115	200	8210G027	BR	NBR	120/60	21413	20.1	●	-	302282	272610-132-D*	8.3		
13.5	0	300	225	115	200	EF8210G027	BR	NBR	120/60	21743	20.1	●	-	302282	272614-132-D*	8.3		
13.5	10	300	300	300	175	8210G078	BR	NBR	120/60,110/50	03082	17.1	-	-	302281	238610-132-D*	7.9		
1 1/8	1 5/8	21	0	25	-	-	125	8215B050CSA	AL	NBR	120/60,110/50	00569	15.4	●	●	302352	099257-001-D*	3.3
		21	0	25	-	-	104	EF8215B050	AL	NBR	120/60,110/50	20307	15.4	●	-	302358	099257-001-D*	3.3
		21	0	25	-	-	104	SC8215B050	AL	NBR	120/60,110/50	02836	15.4	●	-	302352	400525-125-*	3.3
		21	0	25	-	-	77	8215B050	AL	NBR	24/DC	00572	14.9	●	●	302432	062691-002-D*	3.3
		21	0	25	-	-	77	8215B050	AL	NBR	12/DC	00571	14.9	●	●	302432	062691-001-D*	3.3
		21	0	25	-	-	77	EF8215B050	AL	NBR	80-90/DC	21740	14.9	●	-	302432	062691-010-D*	3.3
1 1/4	1 1/8	15	0	150	125	125	180	8210G055	BR	NBR	120/60	21416	16.1	●	-	302283	272610-032-D*	8.8
		15	5	150	150	100	180	8210G008	BR	NBR	120/60,110/50	20102	6.1	●	-	302280	238210-032-D*	6.6
		15	5	150	150	100	180	8210G008	BR	NBR	24/60	21386	6.1	●	-	302280	238210-005-D*	6.6
		15	5	150	150	100	180	EF8210G008	BR	NBR	120/60,110/50	20103	6.1	●	-	302280	238214-032-D*	6.6
		15	5	125	125	125	150	8210G008	BR	NBR	24/DC	20106	11.6	●	-	302379	238710-006-D*	6.6
	1 5/8	32	0	25	-	-	125	8215B060CSA	AL	NBR	120/60,110/50	00577	15.4	●	●	302352	099257-001-D*	3.3
		32	0	25	-	-	104	EF8215B060	AL	NBR	120/60,110/50	20309	15.4	●	-	302358	099257-001-D*	3.3
		32	0	25	-	-	77	8215B060	AL	NBR	12/DC	00579	14.9	●	●	302432	062691-001-D*	3.3
		22.5	0	100	100	80	77	8210B056	BR	NBR	24/DC	00270	30.6	-	-	302385	074073-005-D*	8.8
		22.5	0	150	125	125	180	8210G056	BR	NBR	120/60	21417	16.1	●	-	302286	272610-032-D*	8.8
1 1/2	1 1/4	22.5	0	150	125	125	180	EF8210G056	BR	NBR	120/60	21418	16.1	●	-	302286	272614-032-D*	8.8
		22.5	5	150	150	100	180	8210G022	BR	NBR	120/60,110/50	20132	6.1	●	-	302284	238210-032-D*	7.7
		22.5	5	150	150	100	180	8210G022	BR	NBR	24/60	21387	6.1	●	-	302284	238210-005-D*	7.7
		22.5	5	150	150	100	180	EF8210G022	BR	NBR	120/60,110/50	20134	6.1	●	-	302284	238214-032-D*	7.7
		22.5	5	125	125	125	150	8210G022	BR	NBR	24/DC	20137	11.6	●	-	302383	238710-006-D*	7.7
		35	0	25	-	-	125	8215B070CSA	AL	NBR	120/60,110/50	00581	15.4	●	●	302352	099257-001-D*	3.3
		35	0	25	-	-	104	EF8215B070	AL	NBR	120/60,110/50	20311	15.4	-	-	302358	099257-001-D*	3.3
	1 5/8	35	0	25	-	-	104	SC8215B070	AL	NBR	120/60,110/50	02835	15.4	-	-	302352	400525-125-*	3.3
		35	0	25	-	-	77	8215B070	AL	NBR	24/DC	02834	14.9	●	●	302432	062691-002-D*	3.3
		35	0	25	-	-	77	8215B070	AL	NBR	12/DC	00583	14.9	●	●	302432	062691-001-D*	3.3
2	1 3/4	43	5	150	125	90	180	8210G100	BR	NBR	120/60,110/50	20268	6.1	●	-	304355	238210-032-D*	9.9
		43	5	150	125	90	180	EF8210G100	BR	NBR	120/60,110/50	20270	6.1	●	-	304355	238214-032-D*	9.9
		43	5	50	50	50	150	8210G100	BR	NBR	24/DC	20275	11.6	●	-	304359	238710-006-D*	9.9
	2 3/32	60	0	25	-	-	125	8215B080CSA	AL	NBR	120/60,110/50	00589	15.4	●	●	302353	099257-001-D*	6.3
		60	0	25	-	-	104	EF8215B080	AL	NBR	120/60,110/50	20314	15.4	●	-	302359	099257-001-D*	6.3
		60	0	15	-	-	77	8215B080	AL	NBR	24/DC	00590	14.9	●	●	302433	062691-002-D*	6.3
2 1/2	1 3/4	45	5	150	125	90	180	8210G101	BR	NBR	120/60,110/50	20276	6.1	●	-	304355	238210-032-D*	11.5
	3	117	0	5	-	-	104	8215A090CSA	AL	NBR	120/60,110/50	00567	28.2	●	-	302354	206409-011-D*	12.0
3	3	138	0	5	-	-	104	8215A040CSA	AL	NBR	120/60,110/50	00565	28.2	●	-	302354	206409-011-D*	13.0

Refer to inside cover for ordering information.

General Service - 2/2 Normally Open 1/8" - 2"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)	
			Min.	Max.										UL	FM				
				Air	Water	Light Oil													
<b>2/2 Normally Open</b>																			
1/8	1/16	0.09	0	500	300	225	180	8262G091	BR	NBR	120/60,110/50	20453	6.1	●	-	302041	238210-032-D*	2.0	
	3/32	0.15	0	275	200	150	180	8262G093	BR	NBR	120/60,110/50	20454	6.1	●	-	302041	238210-032-D*	2.6	
	1/8	0.21	0	125	100	85	180	8262G031	BR	NBR	120/60,110/50	20432	6.1	●	-	302041	238210-032-D*	2.0	
		0.21	0	125	100	85	180	8262G035	SS	NBR	120/60,110/50	20434	6.1	●	-	302043	238210-032-D*	2.6	
1/4	3/64	0.06	0	750	700	700	140	8262G260	BR	NBR	120/60,110/50	20499	10.1	●	-	302045	238610-032-D*	2.6	
	3/32	0.17	0	300	250	230	140	8262G261	BR	NBR	120/60,110/50	20500	10.1	●	-	302045	238610-032-D*	2.6	
	1/8	0.35	0	130	110	100	180	8262G262	BR	NBR	120/60,110/50	20501	10.1	●	-	302051	238610-032-D*	2.6	
		0.35	0	130	110	100	180	8262G138	SS	NBR	120/60,110/50	20456	10.1	●	-	302053	238610-032-D*	2.6	
	5/32	0.49	0	85	75	60	180	8262G263	BR	NBR	120/60,110/50	20506	10.1	●	-	302051	238610-032-D*	2.6	
	7/32	0.83	0	45	45	40	180	8262G264	BR	NBR	120/60,110/50	20509	10.1	●	-	302051	238610-032-D*	2.6	
		0.83	0	45	45	40	180	EF8262G148V	SS	FKM	120/60,110/50	20459	10.1	●	-	302055-V	238614-032-D*	2.6	
	9/32	0.96	0	30	25	20	180	8262G265	BR	NBR	120/60,110/50	20510	10.1	●	-	302051	238610-032-D*	2.6	
3/8	5/8	3	0	15	-	-	180	8210G033VH	BR	NBR	120/60,110/50	20147	10.1	-	-	302334-VH	238610-032-D*	3.4	
		3	0	150	150	125	180	8210G033	BR	NBR	120/60,110/50	20146	10.1	●	-	302334	238610-032-D*	3.4	
		3	0	150	150	125	180	EF8210G033	BR	NBR	120/60,110/50	20149	10.1	●	-	302334	238614-032-D*	3.4	
		3	0	125	125	80	150	8210G033	BR	NBR	24/DC	20153	11.6	●	-	302449	238710-006-D*	3.4	
1/2	7/16	2.2	0	15	15	-	200	8030G071	BR	NBR	120/60	21448	20.1	●	-	302798	272610-132-D*	3.4	
	5/8	3	0	150	150	100	180	8210G030	SS	NBR	120/60,110/50	20141	10.1	●	-	302347	238610-032-D*	3.4	
		3	0	150	150	100	180	EF8210G030	SS	NBR	120/60,110/50	20142	10.1	●	-	302347	238614-032-D*	3.4	
		4	0	150	150	125	180	8210G034	BR	NBR	120/60,110/50	20154	10.1	●	-	302334	238610-032-D*	3.4	
		4	0	150	150	125	180	EF8210G034	BR	NBR	120/60,110/50	20157	10.1	●	-	302334	238614-032-D*	3.4	
		4	0	150	150	125	180	SC8210G034	BR	NBR	120/60,110/50	21782	10.1	●	-	302334	238612-032-*	3.4	
		4	0	125	125	80	150	8210G034	BR	NBR	24/DC	20164	11.6	●	-	302449	238710-006-D*	3.4	
	5/8	4	5	250	200	200	180	8210G012	BR	NBR	120/60,110/50	20122	10.1	●	-	314680	238610-032-D*	3.2	
	3/4	4	0	125	-	-	125	8215G023	AL	NBR	120/60,110/50	20295	10.1	●	-	302361	238610-032-D*	2.8	
	3/4	5/8	3	0	150	150	100	180	8210G038	SS	NBR	120/60,110/50	20183	10.1	●	-	302347	238610-032-D*	3.4
3			0	150	150	100	180	EF8210G038	SS	NBR	120/60,110/50	20184	10.1	●	-	302347	238614-032-D*	3.4	
3/4		3/4	4.6	0	125	-	-	125	8215G033	AL	NBR	120/60,110/50	20303	10.1	●	-	302361	238610-032-D*	3.0
			4.6	0	125	-	-	125	EF8215G033	AL	NBR	120/60,110/50	20304	10.1	●	-	302361	238614-032-D*	3.0
			4.6	0	125	-	-	125	JKF8215G033	AL	NBR	120/60,110/50	20932	10.1	●	-	302361	238612-032-*	3.0
			5.5	0	2	2	-	180	8030G083	BR	NBR	120/60,110/50	20027	10.1	●	-	302799	238610-032-D*	3.4
			5.5	0	150	150	125	180	8210G035	BR	NBR	120/60,110/50	20166	10.1	●	-	302335	238610-032-D*	3.2
			5.5	0	150	150	125	180	EF8210G035	BR	NBR	120/60,110/50	20168	10.1	●	-	302335	238614-032-D*	3.2
			5.5	0	150	150	125	180	SC8210G035	BR	NBR	120/60,110/50	21783	10.1	●	-	302335	238612-032-*	3.2
			5.5	0	150	150	125	180	8210G035V	BR	FKM	120/60,110/50	21852	10.1	-	-	302335-V	238610-032-D*	3.2
			5.5	0	125	125	80	150	8210G035	BR	NBR	24/DC	20175	11.6	●	-	302450	238710-006-D*	3.2
			6.5	5	250	200	200	180	8210G013	BR	NBR	120/60	21606	16.1	●	-	302336	272610-032-D*	4.0
1	1	13	5	125	125	125	180	8210D014	BR	NBR	24/DC	21849	16.8	●	-	302338	097617-005-D*	5.0	
		13	0	125	125	125	180	8210B057	BR	NBR	120/60,110/50	00272	20	●	-	302337	099257-005-D*	6.5	
		13	5	150	150	125	180	8210G014	BR	NBR	120/60	21419	16.1	●	-	302338	272610-032-D*	5.0	
		13	5	150	150	125	180	EF8210G014	BR	NBR	120/60	21741	16.1	●	-	302338	272614-032-D*	5.0	
	1 5/8	22	0	25	-	-	125	8215C053	AL	NBR	120/60,110/50	00617	15.4	●	-	304691	099257-001-D*	1.3	
		22	0	25	-	-	104	EF8215C053	AL	NBR	120/60,110/50	20308	15.4	●	-	304695	099257-001-D*	1.3	
1 1/4	1 1/8	15	5	150	150	125	180	8210G018	BR	NBR	120/60	21720	16.1	●	-	302338	272610-032-D*	6.0	
	1 5/8	33	0	25	-	-	125	8215C063	AL	NBR	120/60,110/50	00619	15.4	●	-	304691	099257-001-D*	3.3	
1 1/2	1 1/4	22.5	0	125	125	125	180	8210B059	BR	NBR	120/60,110/50	00275	20	●	-	302340	099257-005-D*	8.5	
		22.5	5	150	150	125	180	8210G032	BR	NBR	120/60	21721	16.1	●	-	302341	272610-032-D*	8.0	
	1 5/8	37	0	25	-	-	125	8215C073	AL	NBR	120/60,110/50	00623	15.4	●	-	304691	099257-001-D*	3.3	
2	1 3/4	43	5	125	125	125	180	8210G103	BR	NBR	120/60	21724	16.1	●	-	304361	272610-032-D*	12.0	
		43	5	125	125	125	180	EF8210G103	BR	NBR	120/60	21586	16.1	●	-	304361	272614-032-D*	12.0	
	2 2/32	58	0	25	-	-	125	8215C083	AL	NBR	120/60,110/50	00625	15.4	●	-	304692	099257-001-D*	5.3	

Angle body piston valves are two-way (2/2) air operated valves that can replace motorized or air actuated ball valve packages in any application.

- Normally closed operation
- Straight through flow for maximum Cv
- Size range of 3/8" to 2"



### Angle Body Piston Valves

Pipe Size (ins.)	Orifice (ins.)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Valve Head Dia. (mm)	Valve Order Code	Pilot Pressure (psi)		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.									Min.	Max.			
				Fluids	Water	Steam											
<b>2/2 Normally Closed - Entry Under the Disc</b>																	
3/8	3/8	2.3	0	240	150	366	8290A791	SS	PTFE	32	8290A791	60	150	-	-	1.3	
1/2	1/2	4.1	0	180	150	366	8290A792	SS	PTFE	32	8290A792	60	150	-	-	1.4	
		5.7	0	240	150	366	8290A384	BZ	PTFE	50	8290A384	60	150	-	-	2.7	
		5.7	0	240	150	366	8290A393	SS	PTFE	50	8290A393	60	150	-	-	2.7	
		5.7	0	240	150	366	8290B002	BZ	PTFE	63	8290B002	60	150	-	-	3.6	
		5.7	0	240	150	366	8290B045	SS	PTFE	63	8290B045	60	150	-	-	3.6	
3/4	3/4	7.6	0	90	90	366	8290A793	SS	PTFE	32	8290A793	60	150	-	-	1.6	
		11	0	150	150	366	8290A385	BZ	PTFE	50	8290A385	60	150	-	-	2.9	
		11	0	240	150	366	8290B005	BZ	PTFE	63	8290B005	60	150	-	-	3.9	
		11	0	240	150	366	8290B048	SS	PTFE	63	8290B048	60	150	-	-	3.9	
1	1	15	0	90	90	366	8290A395	SS	PTFE	50	8290A395	60	150	-	-	3.7	
		19	0	150	120	366	8290B010	BZ	PTFE	63	8290B010	60	150	-	-	4.7	
		19	0	150	120	366	8290B053	SS	PTFE	63	8290B053	60	150	-	-	4.7	
1 1/4	1 1/4	36	0	90	90	366	8290A016	BZ	PTFE	63	8290A016	60	150	-	-	6.0	
		36	0	180	150	366	8290A017	BZ	PTFE	90	8290A017	60	150	-	-	7.7	
1 1/2	1 1/2	45	0	60	60	366	8290A020	BZ	PTFE	63	8290A020	60	150	-	-	8.0	
		45	0	120	120	366	8290A021	BZ	PTFE	90	8290A021	60	150	-	-	9.5	
		45	0	120	120	366	8290A064	SS	PTFE	90	8290A064	60	150	-	-	9.5	
2	2	66	0	40	40	366	8290A024	BZ	PTFE	63	8290A024	60	150	-	-	10.0	
		66	0	90	90	366	8290A025	BZ	PTFE	90	8290A025	60	150	-	-	16.0	
		66	0	90	90	366	8290A068	SS	PTFE	90	8290A068	60	150	-	-	16.0	

To use the 8290 online configurator, visit [www.ascovalve.com/8290Configurator](http://www.ascovalve.com/8290Configurator).

Air operated valves are standard valves modified by substituting a piston operator in place of the solenoid. An air operated valve will operate the same as the solenoid version except that it is driven by air as opposed to electricity.

- Operator air control is isolated from main line fluids
- Two way (2/2) normally closed (opens when energized) and normally open (closes when energized) operations
- Three way (3/2) normally closed (Pressure to cylinder port when energized) operation
- Size range of 1/4" to 1"



### Air Operated

Pipe Size (in)	Orifice (in)	Cv Flow	Main Line Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Pneumatic Operator Pressure Range (psi)	Valve Catalog Number	Body Material	Sealing Material	Valve Order Code	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.									UL	FM			
				Air	Water	Light Oil											
<b>2/2 Normally Closed</b>																	
3/8	5/8	2.8	0	125	125	125	180	30-125	P210C093	BR	NBR	00012	-	-	182032	-	2.5
1/2	5/8	3.6	0	125	125	125	180	30-125	P210C094	BR	NBR	00013	-	-	182032	-	2.5
3/4	3/4	5.5	5	125	125	125	180	30-125	P210D009	BR	NBR	00016	-	-	180621	-	2.5
		5.5	0	125	125	125	180	30-125	P210D095	BR	NBR	00018	-	-	182033	-	2.5
1	1	13	5	125	125	125	180	30-125	P210D004	BR	NBR	00014	-	-	180214	-	4
<b>3/2 Normally Closed</b>																	
1/4	1/8	0.31	0	125	125	125	200	30-125	P320A009	BR	NBR	00025	-	-	180446	-	2.3

Hot Water and Steam valves are built with rugged materials to stand up to the harsh media and the environmental conditions of water/steam applications.

- Two-way (2/2) normally closed (opens when energized) and normally open (closes when energized) operations
- Two-way (2/2) normally closed (opens when energized) slow closing operation to reduce water hammer effects
- Size range of 1/4" to 2"



Hot Water & Steam 2/2 Normally Closed 1/4" - 2"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)			Max. Fluid Temp. °F		Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals			Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)		
			Min.	Max.		Hot Water	Steam							Hot Water	Steam	UL				CSA	FM
				Hot Water	Steam																
<b>2/2 Normally Closed</b>																					
1/4	5/32	0.52	0	210	110	210	344	8263H300 ①	BR	PTFE	120/60,110/50	22034	10.1	●	●	-	325029	238810-032-D*	1.8		
	3/8	1.2	1	-	125	-	353	8222G070 ①	BR	PTFE	120/60,110/50	21400	6.1	●	-	-	304030	238410-032-D*	2.4		
3/8	5/32	0.52	0	200	110	210	344	8263H305 ①	BR	PTFE	120/60,110/50	22035	10.1	●	●	-	325029	238810-032-D*	1.8		
		0.52	0	200	110	210	344	8263H319 ①	SS	PTFE	120/60,110/50	22054	10.1	●	●	-	325034	238810-032-D*	1.8		
	3/8	2.5	1	-	80	-	324	8222G064	BR	PTFE	120/60,110/50	21399	6.1	●	-	-	304030	238210-032-D*	2.4		
		2.5	1	-	125	-	353	8222G074 ①	BR	PTFE	120/60,110/50	21200	6.1	●	-	-	304030	238410-032-D*	2.4		
	1/2	4.4	5	150	50	210	300	8220G401	BR	EPDM and/or PTFE	120/60,110/50	21920	6.1	●	●	-	323482	238210-032-D*	2.2		
		4.4	5	150	125	210	353	8220G403	BR	EPDM and/or PTFE	120/60,110/50	21935	10.1	●	●	-	323468	238810-032-D*	2.2		
5/8	3	0	100	-	210	-	8210G093HW	BR	EPDM	120/60,110/50	20222	10.1	●	-	-	302306	238610-032-D*	3.2			
	3	5	125	-	210	-	8210G001HW	BR	EPDM	120/60,110/50	20033	6.1	●	-	-	302305	238812-032-D*	3.2			
1/2	3/8	2.5	1	-	80	-	324	8222G066	BR	PTFE	120/60,110/50	21199	6.1	●	-	-	304030	238210-032-D*	3.2		
		2.5	1	-	125	-	353	8222G076 ①	BR	PTFE	120/60,110/50	21401	6.1	●	-	-	304030	238410-032-D*	3.2		
	1/2	4.7	5	150	50	210	300	8220G404	BR	EPDM and/or PTFE	120/60,110/50	21922	6.1	●	●	-	323482	238210-032-D*	2.2		
		4.7	5	150	50	210	300	8220G404	BR	EPDM and/or PTFE	24/60	21921	6.1	●	●	-	323482	238210-005-D*	2.2		
		4.7	5	150	125	210	353	8220G406	BR	EPDM and/or PTFE	120/60,110/50	21928	10.1	-	□	-	323468	238814-032-D*	2.2		
		4.7	5	150	125	210	353	SU8220G406	BR	EPDM and/or PTFE	120/60,110/50	21929	10.1	-	□	-	323468	238812-032-*	2.2		
	5/8	3.6	2	-	125	-	353	8222G047 ①	BR	PTFE	120/60,110/50	21041	10.1	●	-	-	304032	238810-032-D*	3.2		
		3	0	-	125	-	353	8222G002	BR	PTFE	120/60,110/50	21396	17.1	●	-	-	304669	238810-132-D*	3.4		
		4	0	100	-	210	-	8210G094HW	BR	EPDM	120/60,110/50	20230	10.1	●	-	-	302306	238610-032-D*	3.2		
		4	5	125	-	210	-	8210G002HW	BR	EPDM	120/60,110/50	20045	6.1	●	-	-	302305	238210-032-D*	3.2		
		4	5	125	-	210	-	8210G002HW	BR	EPDM	240/60,220/50	20054	6.1	●	-	-	302305	238210-058-D*	3.2		
		4	0	-	50	-	300	8222G094	BR	PTFE	120/60,110/50	21404	10.1	●	-	-	304031	238610-032-D*	3.2		
	3/8	4.5	0	-	15	-	250	8267G007	BR	PTFE	120/60	21454	16.1	●	-	-	302834	272810-032-D*	4.5		
	3/4	1/2	4.6	2	-	125	-	353	8222G049 ①	BR	PTFE	120/60,110/50	21043	10.1	●	-	-	304032	238810-032-D*	3.2	
3/4		5	0	100	-	210	-	8210G095HW	BR	EPDM	120/60,110/50	20251	10.1	●	-	-	302308	238610-032-D*	3.4		
		5	5	125	-	210	-	8210G009HW	BR	EPDM	120/60,110/50	20108	6.1	●	-	-	302307	238210-032-D*	3.4		
		5	5	125	-	210	-	8210G009HW	BR	EPDM	240/60,220/50	20115	6.1	●	-	-	302307	238210-058-D*	3.4		
		8.8	5	150	50	210	300	8220G407	BR	EPDM and/or PTFE	120/60,110/50	21923	6.1	●	●	-	323480	238210-032-D*	2.6		
		8.8	5	150	50	210	300	8220G407	BR	EPDM and/or PTFE	24/60	21924	6.1	●	●	-	323480	238210-005-D*	2.6		
		8.8	5	150	125	210	353	8220G409	BR	EPDM and/or PTFE	120/60,110/50	21930	10.1	●	●	-	323471	238810-032-D*	2.6		
		8.8	5	150	125	210	353	8220G409	BR	EPDM and/or PTFE	24/60	21931	10.1	●	●	-	323471	238810-005-D*	2.6		
		8.8	5	150	125	210	353	8220G409	BR	EPDM and/or PTFE	240/60,220/50	21932	10.1	●	●	-	323471	238810-058-D*	2.6		
5		0	-	50	-	300	8222G095	BR	PTFE	120/60,110/50	21405	10.1	●	-	-	304031	238610-032-D*	3.4			
5/8		5	0	-	125	-	353	8222G003 ①	BR	PTFE	120/60,110/50	21397	17.1	●	-	-	304669	238810-132-D*	3.6		
		5	0	-	125	-	353	8222G088 ①	SS	PTFE	120/60,110/50	21403	17.1	●	-	-	304057	238810-132-D*	3.4		
1/2		5	5	-	200	-	388	8222G005 ①	BR	Bronze	120/60,110/50	21398	10.1	-	-	-	304033	238810-032-D*	2.8		
		9.7	0	-	15	-	250	8267G019	BR	PPS	120/60	21457	16.1	●	-	-	302836	272810-032-D*	4.5		
1	1	11.5	5	150	50	210	300	8220G410	BR	EPDM and/or PTFE	120/60,110/50	21925	10.1	●	●	-	323478	238610-032-D*	4.4		
		11.5	5	150	50	210	300	8220G410	BR	EPDM and/or PTFE	24/60	21926	10.1	●	●	-	323478	238610-005-D*	4.4		
		11.5	5	150	125	210	353	8220G411	BR	EPDM and/or PTFE	120/60,110/50	21933	10.1	●	●	-	323479	238810-032-D*	4.4		
		11.5	5	150	125	210	353	EF8220G411	BR	EPDM and/or PTFE	120/60,110/50	21934	10.1	-	●	-	323479	238814-032-D*	4.4		
		13.5	5	125	150	210	353	EF8220G025	BR	EPDM, PTFE or TFE/P	120/60,110/50	21746	10.1	○	-	-	304392	238814-032-D	4.5		
1 1/4	1 1/8	15	5	150	50	210	300	8220G009	BR	EPDM	120/60,110/50	20322	10.1	●	-	-	304394	238610-032-D*	6.0		
		15	5	150	125	210	353	8220G027 ①	BR	EPDM	120/60,110/50	20330	10.1	●	-	-	304392	238810-032-D*	6.0		
1 1/2	1 1/4	22.5	5	150	50	210	300	8220G011	BR	EPDM	120/60,110/50	20323	10.1	●	-	-	304395	238610-032-D*	7.5		
		22.5	5	150	125	210	353	8220G029 ①	BR	EPDM	120/60,110/50	20331	10.1	●	-	-	304393	238810-032-D*	7.5		
2	1 3/4	43	5	150	50	210	300	8220G013	BR	EPDM	120/60,110/50	21090	10.1	●	-	-	304943	238610-032-D*	10.0		
		43	5	150	125	210	353	8220G031 ①	BR	PTFE	120/60,110/50	21095	10.1	●	-	-	306807	238810-032-D*	10.0		

① Class H coil for added ambient temperature capability.

**Hot Water & Steam 2/2 Normally Open / Normally Closed Slow Closing 3/8" - 1 1/2"**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)			Max. Fluid Temp. °F		Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.		Hot Water	Steam							UL	FM			
				Hot Water	Steam													
<b>2/2 Normally Open</b>																		
3/8	3/8	5.1	0	-	30	-	280	8267G011	BR	RULON	120/60	21455	16.1	●	-	302842	272810-032-D*	4.5
1/2	3/8	4.5	0	-	15	-	250	8267G015	BR	RULON	120/60	21456	16.1	●	-	302842	272810-032-D*	4.5
		3.5	5	150	-	210	-	8221G003	BR	EPDM	120/60,110/50	20342	6.1	●	-	310387-HW	238210-032-D*	3.4
3/4	3/4	5	5	150	125	210	353	8220G095 ①	BR	PTFE	120/60	21451	16.1	●	-	310416	272810-032-D*	3.6
	1/2	9.7	0	-	15	-	250	8267G023	BR	RYTON	120/60	21458	16.1	●	-	302844	272810-032-D*	4.5
1	1	13.5	5	150	125	210	353	8220G097	BR	PTFE	120/60	21853	16.1	●	-	310493	272810-032-D*	5.5
<b>2/2 Normally Closed Slow Closing - Hot water service only</b>																		
1/2	9/16	3.5	5	150	-	210	-	8221G003HW	BR	EPDM	120/60,110/50	20342	6.1	●	-	310387-HW	238210-032-D*	3.4
3/4	3/4	5.5	5	150	-	210	-	8221G005HW	BR	EPDM	120/60,110/50	20346	6.1	●	-	310388-HW	238210-032-D*	3.6
1	1	11.5	5	150	-	210	-	8221G007HW	BR	EPDM	120/60,110/50	21376	6.1	●	-	310420-HW	238210-032-D*	5.5
1 1/2	1 1/4	24	5	150	-	210	-	8221G011HW	BR	EPDM	120/60,110/50	21855	6.1	●	-	310421-HW	238210-032-D*	7.0

① Class H coil for added ambient temperature capability.

**Slow Closing 2/2 Normally Closed 3/8" - 2"**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
				Air	Water	Light Oil												
<b>2/2 Normally Closed</b>																		
3/8	9/16	3	5	-	150	-	180	8221G001	BR	NBR	120/60,110/50	20339	6.1	UL	-	310387	238210-032-D*	3.4
1/2	9/16	3.5	5	-	150	-	180	8221G003	BR	NBR	120/60,110/50	20341	6.1	UL	-	310387	238210-032-D*	3.4
3/4	3/4	5.5	5	-	150	-	180	8221G005	BR	NBR	120/60,110/50	20345	6.1	UL	-	310388	238210-032-D*	3.6
		5.5	5	-	-	-	150	8221G005	BR	NBR	24/DC	21854	6.1	UL	-	312532	238710-006-D*	3.6
1	1	11.5	5	-	150	-	180	8221G007	BR	NBR	120/60,110/50	20349	6.1	UL	-	310420	238210-032-D*	5.5
		11.5	5	-	125	-	180	8221G007	BR	NBR	24/DC	21725	11.6	UL	-	312686	238710-006-D*	5.5
1 1/4	1 1/8	13	5	-	150	-	180	8221G009	BR	NBR	120/60,110/50	20352	6.1	UL	-	310506	238210-032-D*	6.1
1 1/2	1 1/4	24	5	-	150	-	180	8221G011	BR	NBR	120/60,110/50	20354	6.1	UL	-	310421	238210-032-D*	7.0
2	1 3/4	36	5	-	150	-	180	8221G013	BR	NBR	120/60,110/50	20356	6.1	UL	-	310422	238210-032-D*	8.0

Cryogenic valves are constructed with special materials in order to withstand the severe service encountered controlling cryogenic fluids such as liquid oxygen, liquid nitrogen, liquid argon, and liquid CO<sub>2</sub>.

- Two-way (2/2) normally closed (opens when energized) operation
- Size range of 1/8" to 1/2"


**Cryogenic 2/2 NC 1/8"- 1/2"**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)			Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.									UL	FM			
				Cryogenic Fluid	Liquid CO <sub>2</sub>												
<b>2/2 Normally Closed</b>																	
1/8	3/64	0.06	0	-	1000	120	8264G009	BR	UR	120/60,110/50	21195	13.8	-	-	302850	238210-132-D*	1.8
	3/32	0.2	0	-	300	120	8264G010	BR	UR	120/60,110/50	21198	13.8	-	-	302850	238210-132-D*	1.8
	1/8	0.35	0	130	-	150	8263H240LT	BR	PTFE	120/60,110/50	22105	10.1	-	-	325037-LT	238610-032-D*	2.0
1/4	1/8	0.35	0	130	-	150	8262H232LT	BR	PTFE	120/60,110/50	22047	10.1	-	-	30218-LT	238610-032-D*	2.0
	7/32	0.73	0	100	-	150	8262H114LT	BR	PTFE	120/60,110/50	22103	17.1	-	-	325037-LT	238610-132-D*	2.3
	9/32	0.88	0	40	-	150	8262H210LT	BR	PTFE	120/60,110/50	22104	10.1	-	-	325037-LT	238610-032-D*	2.0
3/8	7/32	0.73	0	100	-	150	8263H206LT	BR	PTFE	120/60,110/50	22051	17.1	-	-	325037-LT	238610-132-D*	1.8
	9/32	0.88	0	40	-	150	8263H125LT	BR	PTFE	120/60,110/50	22050	10.1	-	-	325037-LT	238610-032-D*	2.3
1/2	5/8	4	0	90	-	150	8222G002LT ①	BR	PTFE	120/60,110/50	21143	17.1	-	-	304065	238810-132-D*	2.8

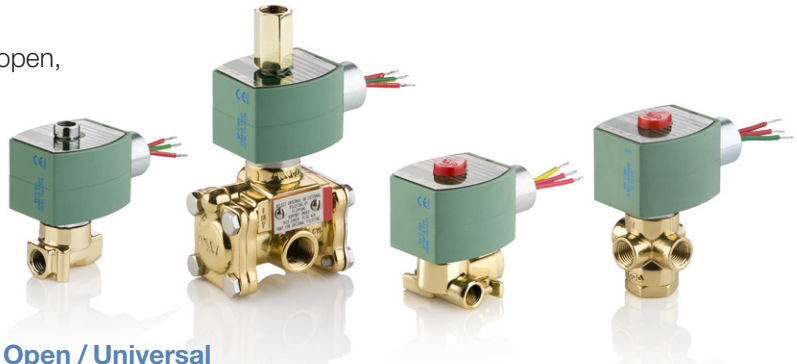
① Class H coil for added ambient temperature capability.

Refer to inside cover for ordering information.



**Three-way (3/2) general service solenoid valves have three ports and two orifices. When one orifice is open, the other is closed.**

- Control of air, water, light oil, non-corrosive media
- Normally closed (pressure to cylinder port when energized) operation
- Normally open (cylinder port exhausts when energized) operation
- Universal (can function as normally closed, normally open, diverter of 1 fluid, or selector of 2 fluids) operation
- Size range of 1/8" to 1"



**General Service - 3/2 Normally Closed / Normally Open / Universal**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
				Air	Water	Light Oil												
<b>3/2 Normally Closed</b>																		
1/8	3/64	0.06	0	200	200	200	180	8320G132	BR	NBR	120/60,110/50	20710	6.1	●	-	302120	238210-032-D*	2.1
		0.06	0	200	200	200	180	8320G132MS	BR	NBR	120/60,110/50	20900	6.1	●	-	302120-MS	238210-032-D*	2.1
		0.06	0	200	200	200	120	8320G132	BR	NBR	24/DC	21587	10.6	●	-	302216	238310-006-D*	2.1
	1/16	0.09	0	150	125	125	180	8320G013	BR	NBR	120/60,110/50	20674	6.1	●	-	302120	238210-032-D*	2.1
	3/32	0.12	0	100	100	100	180	8320G015	BR	NBR	120/60,110/50	20678	6.1	●	-	302120	238210-032-D*	2.1
<b>3/2 Normally Open</b>																		
1/8	3/64	0.06	0	200	200	200	180	8320G136	BR	NBR	120/60,110/50	20713	6.1	●	-	302156	238210-032-D*	2.1
		0.06	0	200	200	200	180	8320G136MS	BR	NBR	120/60,110/50	20903	6.1	●	-	302156-MS	238210-032-D*	2.1
	3/32	0.12	0	100	100	100	180	8320G029	BR	NBR	120/60,110/50	20687	6.1	●	-	302156	238210-032-D*	2.1
	3/16	0.35	0	250	250	250	200	8300G003G	BR	SS	120/60	21469	20.1	-	-	306680-G	272610-132-D*	3.0
<b>3/2 Universal</b>																		
1/8	3/64	0.06	0	175	175	175	140	8320G130	BR	NBR	120/60,110/50	20706	9.1	●	-	302084	238210-132-D*	2.1
		0.06	0	125	125	125	120	8320G130	BR	NBR	12/DC	20709	10.6	●	-	302190	238310-004-D*	2.1
	1/16	0.08	0	100	100	100	180	8320G001MS	BR	NBR	120/60,110/50	20662	9.1	●	-	302088-MS	238210-132-D*	2.1
		0.08	0	65	65	65	120	8320G001	BR	NBR	24/DC	20669	10.6	●	-	302191	238210-006-D*	2.1
		0.08	0	100	100	100	180	8320G001	BR	NBR	120/60,110/50	20661	9.1	●	-	302088	238210-132-D*	2.1
		0.08	0	100	100	100	180	8320G001	BR	NBR	24/60	21729	9.1	●	-	302088	238210-105-D*	2.1
		0.08	0	100	100	100	180	OPSP8320G001MS	BR	NBR	120/60,110/50	20666	9.1	●	-	302088-MS	238212-132-*	2.1
		0.08	0	100	100	100	180	8320G001	BR	NBR	120/60,110/50	20661	9.1	●	-	302088	238210-132-D*	2.1
	3/32	0.12	0	50	50	50	180	8320G083	BR	NBR	120/60,110/50	20697	6.1	●	-	302092	238210-032-D*	2.1
	1/8	0.21	0	30	30	30	180	8320G003	BR	NBR	120/60,110/50	20670	9.1	●	-	302096	238210-132-D*	2.1
0.21		0	30	30	30	180	8320G043	SS	NBR	120/60,110/50	20692	9.1	●	-	302098	238210-132-D*	2.1	

General Service - 3/2 Normally Closed / Normally Open 1/4"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)	
			Min.	Max.										UL	FM				
				Air	Water	Light Oil													
<b>3/2 Normally Closed</b>																			
1/4	1/16	0.09	0	210	225	225	200	8320G182	BR	NBR	120/60,110/50	20748	17.1	●	-	302141	238610-132-D*	2.5	
		0.09	0	210	225	225	200	EF8320G182	BR	NBR	120/60,110/50	20749	17.1	●	-	302141	238614-132-D*	2.5	
		0.09	0	160	160	160	150	EF8320G182	BR	NBR	24/DC	21259	11.6	●	-	302227	238714-006-D*	2.5	
		0.09	0	150	-	-	180	8320G701 ①	BR	NBR	120/60,110/50	21364	6.1	□	-	318814	238210-032-D*	2.5	
		0.09	0	160	160	160	150	8320G182	BR	NBR	24/DC	21862	11.6	●	-	302227	238710-004-D*	2.5	
		0.09	0	160	160	160	150	8320G182	BR	NBR	12/DC	21861	11.6	●	-	302227	238710-006-D*	2.5	
	3/32	1/8	0.12	0	100	-	-	180	8320G702 ①	BR	NBR	120/60,110/50	21883	6.1	□	-	318814	238210-032-D*	2.5
			0.12	0	150	-	-	200	8320G704 ①	BR	NBR	120/60,110/50	21365	10.1	□	-	318818	238610-032-D*	2.5
			0.12	0	150	-	-	200	EF8320G704 ①	BR	NBR	120/60,110/50	21575	10.1	●	-	318818	238614-032-D*	2.5
			0.12	0	150	150	150	200	8320G184	BR	NBR	120/60,110/50	20750	10.1	●	-	302142	238610-032-D*	2.5
			0.12	0	150	150	150	200	EF8320G184	BR	NBR	120/60,110/50	20753	10.1	●	-	302142	238614-032-D*	2.5
			0.12	0	150	150	150	200	8320G184MO	BR	NBR	120/60,110/50	21731	10.1	●	-	302142-MO	238610-032-D*	2.5
			0.12	0	150	150	150	200	8320G184MS	BR	NBR	120/60,110/50	21108	10.1	●	-	302142-MS	238610-032-D*	2.5
			0.12	0	150	150	150	200	EFHT8320G184	BR	NBR	120/60,110/50	20754	10.1	●	-	302142	238814-032-D*	2.5
			0.12	0	115	115	115	150	8320G184	BR	NBR	24/DC	20758	11.6	●	-	302227	238710-006-D*	2.5
			0.12	0	115	115	115	150	EF8320G184	BR	NBR	24/DC	20759	11.6	●	-	302227	238714-006-D*	2.5
			0.12	0	150	150	150	200	8320G202	SS	NBR	120/60,110/50	20941	10.1	●	-	312191	238610-032-D*	2.5
			0.12	0	150	150	150	200	EF8320G202	SS	NBR	120/60,110/50	20942	10.1	●	-	312191	238614-032-D*	2.5
		0.12	0	150	150	150	200	EFHT8320G202	SS	NBR	120/60,110/50	21870	10.1	●	-	312191	238814-032-D*	2.5	
		0.12	0	115	115	115	150	8320G202	SS	NBR	24/DC	21732	11.6	●	-	312192	238710-006-D*	2.5	
		0.12	0	115	115	115	150	EF8320G202	SS	NBR	24/DC	20949	11.6	●	-	312192	238714-006-D*	2.5	
		0.12	0	110	110	110	200	8320G089	BR	NBR	120/60,110/50	21730	9.1	●	-	302133	238210-132-D*	2.5	
		0.15	0	205	205	190	200	8314H035	BR	NBR	120/60,110/50	22109	10.1	●	-	323958	238610-032-D*	2.6	
		0.15	0	205	205	190	200	EF8314H035	BR	NBR	120/60,110/50	22115	10.1	●	-	323958	238614-032-D*	2.6	
	0.15	0	205	205	190	200	8314H121	SS	NBR	120/60,110/50	22113	10.1	●	-	323960	238610-032-D*	2.6		
	0.2	5	150	-	-	180	8317G023	BR	NBR	120/60,110/50	20650	10.1	●	-	302902	238610-032-D*	2.7		
	0.2	5	150	150	95	180	8317G035	BR	NBR	120/60,110/50	20652	10.1	●	-	314463	238610-032-D*	2.7		
	0.21	0	250	250	250	180	8300G058RF	BR	NBR	120/60	21474	20.1	-	-	306680-RF	272610-132-D*	4.5		
	1/8	3/16	0.25	0	85	85	85	200	8320G203	SS	NBR	120/60,110/50	20950	10.1	●	-	312191	238610-032-D*	2.5
			0.25	0	60	60	60	150	EF8320G203	SS	NBR	24/DC	21868	11.6	●	-	312192	238714-006-D*	2.5
			0.25	0	145	145	100	200	8314H036	BR	NBR	120/60,110/50	22110	10.1	●	-	323958	238610-032-D*	2.6
			0.25	0	85	85	85	200	8320G186	BR	NBR	120/60,110/50	20760	10.1	●	-	302143	238610-032-D*	2.5
			0.25	0	85	85	85	200	EF8320G186	BR	NBR	120/60,110/50	20761	10.1	●	-	302143	238614-032-D*	2.5
			0.25	0	85	85	85	200	EFHT8320G186	BR	NBR	120/60,110/50	21775	10.1	●	-	302143	238814-032-D*	2.5
	11/64	3/32	0.25	0	85	85	85	200	EF8320G203	SS	NBR	120/60,110/50	20951	10.1	●	-	312191	238614-032-D*	2.5
			0.35	0	45	45	45	200	EF8320G188	BR	NBR	120/60,110/50	20765	10.1	●	-	302144	238614-032-D*	2.5
	9/32	1/4	0.35	0	45	45	45	200	8320G188	BR	NBR	120/60,110/50	20764	10.1	●	-	302144	238610-032-D*	2.5
			0.8	10	200	200	200	180	8321G001	BR	NBR	120/60,110/50	20778	6.1	●	-	302925	238210-032-D*	3.8
			0.8	10	200	200	200	180	EF8321G001	BR	NBR	120/60,110/50	20779	6.1	●	-	302925	238214-032-D*	3.8
		0.8	10	200	200	200	120	8321G001	BR	NBR	24/DC	21381	10.6	●	-	302929	238310-006-D*	3.8	
		0.8	10	200	200	200	120	EF8321G001	BR	NBR	24/DC	20783	10.6	●	-	302929	238314-006-D*	3.8	
		0.2	5	150	150	95	180	EF8317G035	BR	NBR	120/60,110/50	20653	10.1	●	-	314463	238614-032-D*	2.7	
3/32	1/4	0.2	5	75	55	30	104	EF8317G035	BR	NBR	24/DC	20656	11.6	●	-	314466	238714-006-D*	2.7	
		0.2	5	150	150	95	180	EF8317G036	SS	NBR	120/60,110/50	20657	10.1	●	-	314469	238614-032-D*	2.7	
		0.39	0	150	150	150	180	EF8300G081RF	BR	NBR	120/60	21506	20.1	●	-	306681-RF	272614-132-D*	4.5	
1/4	9/32	0.45	0	190	190	190	200	8300G081F	BR	SS	120/60	21459	20.1	-	-	306681-F	272610-132-D*	4.5	
		0.45	0	250	250	250	200	8300D061F	BR	SS	120/60	01198	28.0	-	-	306682-F	222345-005-D*	4.5	
<b>3/2 Normally Open</b>																			
1/4	1/16	0.08	0	250	250	250	200	EF8320G192	BR	NBR	120/60,110/50	20768	7.1	●	-	302183	238614-132-D*	2.5	
		0.09	0	250	250	250	200	8320G192	BR	NBR	120/60,110/50	20767	17.1	●	-	302183	238610-132-D*	2.5	
		0.09	0	250	250	250	200	8320G192MS	BR	NBR	120/60,110/50	21110	17.1	●	-	302183-MS	238610-132-D*	2.5	
	3/32	1/8	0.12	0	150	140	140	200	8320G194	BR	NBR	120/60,110/50	20770	10.1	●	-	302184	238610-032-D*	2.5
			0.12	0	150	140	140	200	EF8320G194	BR	NBR	120/60,110/50	21752	10.1	●	-	302184	238614-032-D*	2.5
	3/32	1/8	0.15	0	175	175	175	200	8314H053	BR	NBR	120/60,110/50	22112	10.1	●	-	323970	238610-032-D*	2.6
			0.8	10	200	200	200	180	8321G003	BR	NBR	120/60,110/50	20791	6.1	●	-	302927	238210-032-D*	3.8

① NAMUR direct mount construction.

**Plastic Body - 3/2 Normally Closed 1/4"**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
				Air	Water	Light Oil												
<b>3/2 Normally Closed</b>																		
1/4	1/16	0.07	0	100	100	-	130	8360G071	PL	NBR	120/60,110/50	20925	9.1	☐	-	304323	238210-132-D*	2.0
	3/32	0.11	0	100	100	-	130	8360G077	PL	NBR	120/60,110/50	20927	6.1	☐	-	304328	238210-032-D*	2.0

**General Service - 3/2 Universal 1/4"**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
				Air	Water	Light Oil												
<b>3/2 Universal</b>																		
1/4	1/32	0.02	0	395	410	410	140	8320A170	BR	Cast UR	120/60,110/50	01471	16.7	●	-	302112	064982-001-D*	2.1
		0.05	0	200	200	200	200	8314H006	BR	NBR	120/60,110/50	22106	10.1	●	-	323961	238610-032-D*	2.6
	3/64	0.05	0	200	200	200	200	EF8314H006	BR	NBR	120/60,110/50	22114	10.1	●	-	323961	238614-032-D*	2.6
		0.09	0	75	75	75	150	EF8320G172	BR	NBR	24/DC	21103	11.6	●	-	302201	238714-006-D*	2.5
	1/16	0.09	0	125	130	130	200	8320G172	BR	NBR	120/60,110/50	20718	10.1	●	-	302114	238610-032-D*	2.5
		0.09	0	125	130	130	200	EF8320G172	BR	NBR	120/60,110/50	20719	10.1	●	-	302114	238614-032-D*	2.5
		0.09	0	75	75	75	150	8320G172	BR	NBR	24/DC	20725	11.6	●	-	302201	238710-006-D*	2.5
	3/32	0.12	0	100	100	100	200	EF8320G174MO	BR	NBR	120/60,110/50	20729	17.1	●	-	302116-MC	238614-132-D*	2.5
		0.12	0	100	100	100	200	8320G174	BR	NBR	120/60,110/50	20726	17.1	●	-	302116	238610-132-D*	2.5
		0.12	0	100	100	100	200	EF8320G174	BR	NBR	120/60,110/50	20728	17.1	●	-	302116	238614-132-D*	2.5
		0.12	0	100	100	100	200	EF8320G174MS	BR	NBR	120/60,110/50	20730	17.1	●	-	302116-MS	238614-132-D*	2.5
		0.12	0	100	100	100	200	EFHB8320G174 ①	BR	NBR	120/60,110/50	20731	17.1	●	-	302116	238814-132-D*	2.5
		0.12	0	60	60	60	150	8320G174	BR	NBR	24/DC	21860	11.6	●	-	302201	238710-006-D*	2.5
		0.12	0	60	60	60	150	EF8320G174	BR	NBR	24/DC	20737	11.6	-	-	302201	238714-006-D*	2.5
		0.12	0	60	60	60	150	EFHC8320G174 ①	BR	NBR	125/DC	21774	24.6	●	-	302201	238914-335-D*	2.5
		0.12	0	100	100	100	200	8320G200	SS	NBR	120/60,110/50	20939	17.1	●	-	312189	238610-132-D*	2.5
		0.12	0	100	100	100	200	EF8320G200	SS	NBR	120/60,110/50	20940	17.1	●	-	312189	238614-132-D*	2.5
		0.12	0	100	100	100	200	EFHB8320G200	SS	NBR	120/60,110/50	21772	17.1	●	-	312189	238814-132-D*	2.5
		0.12	0	60	60	60	150	EF8320G200 ①	SS	NBR	24/DC	20946	11.6	●	-	312190	238714-006-D*	2.5
		0.15	0	105	85	60	200	8314H007	BR	NBR	120/60,110/50	22107	10.1	●	-	323966	238610-032-D*	2.6
	3/16	0.25	0	150	150	150	180	8300G058RU	BR	NBR	120/60	21476	20.1	-	-	306680-RU	272610-132-D*	4.5
	1/8	0.25	0	50	50	50	200	EF8320G176	BR	NBR	240/60,220/50	21867	17.1	●	-	302116	238614-158-D*	2.5
		0.25	0	70	70	40	200	8314H008	BR	NBR	120/60,110/50	22108	10.1	●	-	323966	238610-032-D*	2.6
		0.25	0	50	50	50	200	8320G176	BR	NBR	120/60,110/50	20738	17.1	●	-	302116	238610-132-D*	2.5
		0.25	0	50	50	50	200	EF8320G176	BR	NBR	120/60,110/50	20740	17.1	●	-	302116	238614-132-D*	2.5
		0.25	0	50	50	50	200	8320G201	SS	NBR	120/60,110/50	20947	17.1	●	-	312189	238610-132-D*	2.5
		0.25	0	50	50	50	200	EF8320G201	SS	NBR	120/60,110/50	20948	17.1	●	-	312189	238614-132-D*	2.5
	11/64	0.35	0	20	20	20	200	8320G178	BR	NBR	120/60,110/50	20746	10.1	●	-	302118	238610-032-D*	2.5
		0.35	0	20	20	20	200	EF8320G178	BR	NBR	120/60,110/50	20747	10.1	●	-	302118	238614-032-D*	2.5
1/4	0.45	0	120	120	120	200	EF8300D061U	BR	METAL	120/60	20552	28.0	-	-	306688-U	222345-005-D*	4.5	
	0.49-0.56	0	150	150	150	248	EV8327G042	SS	FKM	120/50-60	21640	12.0	●	-	123670	276003-032-D*	3.2	
	0.49-0.56	0	150	150	150	248	EV8327G042	SS	FKM	24/DC	21681	11.6	●	-	123670	274714-006-D*	2.5	
	0.49-0.56	0	150	150	150	176	EF8327G041	BR	NBR	120/50-60	21639	12	○	-	123669	276002-032-D	2.3	
	0.49-0.56	0	-	-	-	176	EF8327G041	BR	NBR	24/DC	21680	11.6	○	-	123669	238714-006-D	2.3	

**General Service - 3/2 Normally Closed / Normally Open / Universal 3/8" - 1"**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
				Air	Water	Light Oil												
<b>3/2 Normally Closed</b>																		
3/8	1/4	0.45	0	250	250	250	200	8300D009F	BR	SS	120/60	<b>01186</b>	28.0	-	-	306682-F	222345-005-D*	4.5
		0.8	10	200	200	200	180	8321G002	BR	NBR	120/60,110/50	<b>20784</b>	6.1	●	-	302925	238210-032-D*	3.8
	9/32	0.8	10	200	200	200	180	EF8321G002	BR	NBR	120/60,110/50	<b>20785</b>	6.1	●	-	302925	238214-032-D*	3.8
		0.8	10	200	200	200	120	EF8321G002	BR	NBR	24/DC	<b>20790</b>	10.6	●	-	302929	238314-006-D*	3.8
		2.5	10	250	250	-	180	EF8316G014 ①	BR	NBR	120/60,110/50	<b>20607</b>	17.1	-	-	314495	238614-132-D*	4.5
		2.5	10	250	250	-	180	8316G014 ①	BR	NBR	120/60,110/50	<b>20606</b>	17.1	-	-	314495	238610-132-D*	4.5
	5/8	3	5	125	125	-	120	EF8316G054 ①	BR	NBR	24/DC	<b>21866</b>	10.1	-	-	314493	238314-006-D*	4.5
		3	10	150	125	-	180	8316G054 ①	BR	NBR	120/60,110/50	<b>20625</b>	6.1	-	-	314491	238210-032-D*	4.9
		3	10	150	125	-	180	EF8316G054 ①	BR	NBR	120/60,110/50	<b>20626</b>	6.1	-	-	314491	238214-032-D*	4.9
		5/16	0.75	0	120	120	120	200	8300G068F	BR	SS	120/60	<b>21480</b>	20.1	-	-	306683-F	272610-132-D*
1/2	5/16	3.2	10	150	125	-	180	8316G064MO ①	BR	NBR	120/60,110/50	<b>21882</b>	6.1	-	-	318183	238210-032-D*	4.9
		3.2	10	125	125	-	120	8316G064 ①	BR	NBR	24/DC	<b>21859</b>	10.6	-	-	314493	238210-006-D*	4.9
	5/8	3.2	10	125	125	-	120	EF8316G064 ①	BR	NBR	24/DC	<b>21100</b>	10.6	-	-	314493	238210-006-D*	4.9
		3.2	10	250	250	-	180	8316G024 ①	BR	NBR	120/60,110/50	<b>20613</b>	17.1	-	-	314495	238610-132-D*	4.0
		3.2	10	250	250	-	180	EF8316G024 ①	BR	NBR	120/60,110/50	<b>21356</b>	17.1	-	-	314495	238614-032-D*	4.9
		3.2	10	150	125	-	180	8316G064 ①	BR	NBR	120/60,110/50	<b>20637</b>	6.1	-	-	314491	238210-032-D*	4.9
		3.2	10	150	125	-	180	EF8316G064 ①	BR	NBR	120/60,110/50	<b>20638</b>	6.1	-	-	314491	238214-032-D*	4.9
3/4	11/16	4.8	10	250	250	-	180	8316G044 ①	BR	NBR	120/60,110/50	<b>20623</b>	17.1	-	-	314495	238610-132-D*	4.9
		4.8	10	150	125	-	180	EF8316G074 ①	BR	NBR	120/60,110/50	<b>20645</b>	6.1	-	-	314491	238210-032-D*	4.9
		4.8	10	150	125	-	180	8316G074 ①	BR	NBR	120/60,110/50	<b>20644</b>	6.1	-	-	314491	238210-032-D*	5.1
1	1	12.5	10	150	125	-	180	8316G034 ①	BR	NBR	120/60,110/50	<b>21728</b>	6.1	-	-	302661	238210-032-D*	8.8
<b>3/2 Normally Open</b>																		
3/8	9/32	0.8	10	200	200	200	180	8321G004	BR	NBR	120/60,110/50	<b>20793</b>	6.1	●	-	302927	238210-032-D*	3.8
		2.5	10	150	125	-	180	8316G056 ①	BR	NBR	120/60,110/50	<b>20635</b>	6.1	-	-	314492	238210-032-D*	4.9
	5/8	2.5	10	250	250	-	180	8316G016 ①	BR	NBR	120/60,110/50	<b>20611</b>	17.1	-	-	314496	238610-132-D*	4.5
3.2		10	250	250	-	180	8316G026 ①	BR	NBR	120/60,110/50	<b>20616</b>	17.1	-	-	314496	238210-132-D*	5.1	
1/2	5/8	3.2	10	250	250	-	180	8316G026MO ①	BR	NBR	120/60,110/50	<b>20617</b>	17.1	-	-	314496-MO	238610-132-D*	5.1
		3.2	10	150	125	-	180	8316G066 ①	BR	NBR	120/60,110/50	<b>20641</b>	6.1	-	-	314492	238210-032-D*	4.9
		3.2	10	150	125	-	180	EF8316G066 ①	BR	NBR	120/60,110/50	<b>21750</b>	6.1	-	-	314492	238214-032-D*	4.9
		3.2	10	150	125	-	180	8316G076 ①	BR	NBR	120/60,110/50	<b>20646</b>	6.1	-	-	314492	238210-032-D*	5.1
3/4	11/16	4.8	10	150	125	-	180	8316G076 ①	BR	NBR	120/60,110/50	<b>20646</b>	6.1	-	-	314492	238210-032-D*	5.1
<b>3/2 Universal</b>																		
3/8	1/4	0.45	0	120	120	120	200	8300D009U	BR	SS	120/60	<b>01189</b>	28.0	-	-	306682-U	222345-005-D*	4.5
1/2	3/8	0.86	0	35	35	35	200	8300G076U	BR	SS	120/60	<b>21489</b>	20.1	-	-	306684-U	272610-132-D*	5.0

① A Minimum Operating Pressure Differential must be maintained between the pressure and exhaust ports. Supply and exhaust piping must be full area, unrestricted. ASCO flow controls and other similar components must be installed in the cylinder lines only.

**Pneumatic pilot valves are three-way (3/2) valves made for pneumatically controlling other system components including cylinders and actuators.**

- 1/8" male threads (can be mounted directly to the ASCO Angle Body Piston Valves)
- Pad mount for use with ASCO pad single station sub-bases (must be ordered separately)

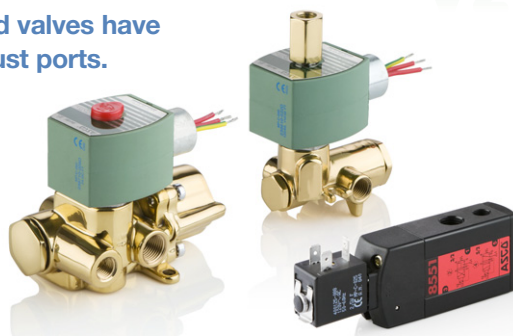

**3/2 Normally Closed Pneumatic**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
				Air	Water	Light Oil												
<b>3/2 Normally Closed</b>																		
1/8 Male	3/64	0.05	0	145	-	-	140	18900036	PA+FV	NBR	120/60,110/50	18900036-120/60	2.5	-	-	-	43004884	1.0
		0.05	0	145	-	-	140	18900036	PA+FV	NBR	24/DC	18900036-24/DC	2.5	-	-	-	43004869	1.0
		0.05	0	145	-	-	140	18900049	PA+FV	NBR	120/60,110/50	18900049-120/60	2.5	-	-	-	43004884	1.0
		0.05	0	145	-	-	140	18900049	PA+FV	NBR	24/DC	18900049-24/DC	2.5	-	-	-	43004869	1.0
<b>Pad Mounted</b>																		
①	3/64	0.05	0	145	-	-	140	18900001	PA+FV	NBR	120/60,110/50	18900001-120/60	2.5	-	-	-	43004884	1.0
		0.05	0	145	-	-	140	18900001	PA+FV	NBR	24/DC	18900001-24/DC	2.5	-	-	-	43004869	1.0
		0.05	0	145	-	-	140	18990001	PA+FV	NBR	-	18990001	-	-	-	-	-	1.0

① To convert pad mount products to 1/8" female piped version order single station sub-base (Zinc) catalog number 3530051 separately.

**Four-way four port (4/2) and five port (5/2) general service solenoid valves have one pressure port, two cylinder ports, and either one or two exhaust ports.**

- Control of air, water, light oil, non-corrosive media
- Size range of 1/4" to 3/4"
- Single and Dual solenoid operation
- Inline (pipe connections) and NAMUR (industry standard direct mount) configurations



**General Service - 4/2 Inline 1/4" - 3/4"**

Pipe Size (ins.)	Orifice (ins.)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)		
			Min.	Max.										UL	FM					
				Air	Water	Light Oil														
<b>4/2 Inline Single Solenoid</b>																				
1/4	5/64	0.1	0	150	-	-	130	8340G001	AL	PE	120/60,110/50	21064	17.1	●	-	302751	238610-132-D*	4.5		
		0.1	0	150	-	-	130	EF8340G001	AL	PE	120/60,110/50	21069	17.1	●	-	302751	238614-132-D*	4.5		
		0.1	0	150	-	-	130	JSP8340G001	AL	PE	120/60,110/50	21779	17.1	●	-	302751	238612-132-*	4.5		
		0.1	0	100	-	-	95	8340G001	AL	PE	24/DC	21066	22.6	●	-	302759	238710-106-D*	4.5		
	3/16	7/32	0.7	0	125	100	100	160	8342G001	BR	PTFE	120/60	21421	20.1	●	-	306191	272610-132-D*	4.0	
			0.7	0	125	100	100	160	EF8342G001	BR	NBR	120/60	21422	20.1	●	-	306191	272614-132-D*	4.0	
			0.7	0	125	100	100	160	EFHB8342G001 ②	BR	NBR	120/60	21773	20.1	●	-	306191	272814-132-D*	4.0	
			0.7	0	125	100	100	180	HB8342G001 ②	BR	NBR	120/60	21776	20.1	●	-	306191	272810-132-D*	4.0	
		7/32	0.7	0	125	100	100	160	EF8342G001MS	BR	NBR	120/60	21424	20.1	●	-	306191-MS	272614-132-D*	4.0	
			0.7	0	125	100	100	160	EF8342G001MMS	BR	NBR	120/60	21753	20.1	●	-	306806	272614-132-D*	4.0	
			0.7	0	125	100	100	160	8342G001MS	BR	PTFE	120/60	21423	20.1	●	-	306191-MS	272610-132-D*	4.0	
			0.7	0	125	100	100	160	8342G701	SS	PTFE	120/60	21563	20.1	●	-	310189	272610-132-D*	4.0	
	1/4	7/32	0.7	0	125	100	100	160	EF8342G701	SS	PTFE	120/60	21869	20.1	●	-	310189	272614-132-D*	4.0	
			0.8	10	250	250	250	180	8344G000 ①	BR	NBR	120/60,110/50	20815	17.1	-	-	302710	238610-132-D*	5.2	
			0.8	10	250	250	250	180	EF8344G000 ①	BR	NBR	120/60,110/50	21756	17.1	-	-	302710	238614-132-D*	5.2	
			0.8	10	250	250	250	180	8344G000MO ①	BR	NBR	120/60,110/50	20816	17.1	-	-	302710-MO	238610-132-D*	5.2	
		7/32	0.8	10	150	125	125	180	8344G070 ①	BR	NBR	120/60,110/50	20849	10.1	●	-	302709	238610-032-D*	5.2	
			0.8	10	150	125	125	180	EF8344G070 ①	BR	NBR	120/60,110/50	20851	10.1	●	-	302709	238614-032-D*	5.2	
			0.8	10	150	125	125	180	8344G070MO ①	BR	NBR	120/60,110/50	20850	10.1	●	-	302709-MO	238610-032-D*	5.2	
			0.8	10	125	125	125	150	8344G070 ①	BR	NBR	24/DC	21736	11.6	●	-	302731	238710-006-D*	5.2	
	3/8	3/16	0.7	0	125	100	100	160	8342G003	BR	PTFE	120/60	21426	20.1	●	-	306191	272610-132-D*	4.0	
			0.7	0	125	100	100	160	EF8342G003	BR	NBR	120/60	21427	20.1	●	-	306191	272614-132-D*	4.0	
			0.7	0	125	100	100	160	EF8342G003MS	BR	NBR	120/60	21428	20.1	●	-	306191-MS	272614-132-D*	4.0	
			0.7	0	125	-	-	160	EF8342G003PMS	BR	NBR	120/60	21754	20.1	●	-	314213	272614-132-D*	4.0	
			0.7	0	125	100	100	160	8342G003MS	BR	PTFE	120/60	21733	20.1	●	-	306191-MS	272610-132-D*	4.0	
			0.7	0	125	100	100	160	8342G703	SS	PTFE	120/60	21514	20.1	●	-	310189	272610-132-D*	4.0	
		1/4	7/32	0.8	10	250	250	250	180	8344G001 ①	BR	NBR	120/60,110/50	20819	17.1	●	-	302710	238610-132-D*	5.5
				0.8	10	250	250	250	180	EF8344G001 ①	BR	NBR	120/60,110/50	21757	17.1	●	-	302710	238614-132-D*	5.5
0.8				10	250	250	250	180	8344G001MO ①	BR	NBR	120/60,110/50	20820	17.1	●	-	302710-MO	238610-132-D*	5.5	
7/32			1.4	10	125	125	125	150	8344G072	BR	NBR	24/DC	21863	11.6	-	-	302733	238710-006-D*	5.5	
			1.4	10	125	125	125	150	EF8344G072	BR	NBR	24/DC	20864	11.6	●	-	302733	238714-006-D*	5.5	
			1.4	10	150	125	125	180	8344G072 ①	BR	NBR	120/60,110/50	20857	10.1	●	-	302711	238610-032-D*	5.5	
1/2		3/8	1.4	10	150	125	125	180	EF8344G072 ①	BR	NBR	120/60,110/50	20859	10.1	●	-	302711	238614-032-D*	5.5	
			1.4	10	150	125	125	180	EF8344G072MO ①	BR	NBR	120/60,110/50	20860	10.1	●	-	302711-MO	238614-032-D*	5.7	
			1.4	10	250	250	250	180	8344G027 ①	BR	NBR	120/60,110/50	20826	17.1	●	-	302712	238610-132-D*	6.0	
			1.4	10	250	250	250	180	EF8344G027 ①	BR	NBR	120/60,110/50	21758	17.1	●	-	302712	238614-132-D*	6.0	
			1.4	10	250	250	250	180	8344G027MO ①	BR	NBR	120/60,110/50	20827	17.1	●	-	302712-MO	238610-132-D*	6.2	
			1.4	10	150	125	125	180	8344G074 ①	BR	NBR	120/60,110/50	20865	10.1	●	-	302711	238610-032-D*	6.0	
		7/32	1.4	10	150	125	125	180	EF8344G074 ①	BR	NBR	120/60,110/50	20867	10.1	●	-	302711	238614-032-D*	6.0	
			1.4	10	150	125	125	180	EF8344G074MO ①	BR	NBR	120/60,110/50	20868	10.1	●	-	302711-MO	238614-032-D*	6.2	
			1.4	10	150	125	125	180	8344G074MO ①	BR	NBR	120/60,110/50	20866	10.1	●	-	302711-MO	238610-032-D*	6.2	
			5.2	10	150	125	125	180	8344G076 ①	BR	NBR	120/60,110/50	20871	10.1	-	-	302713	238610-032-D*	8.0	
3/4		3/4	5.2	10	150	125	125	180	EF8344G076 ①	BR	NBR	120/60,110/50	20872	10.1	●	-	302713	238614-032-D*	8.0	
			5.2	10	250	250	250	180	8344G029 ①	BR	NBR	120/60,110/50	20832	17.1	-	-	302714	238610-132-D*	8.0	

① A Minimum Operating Pressure Differential must be maintained between the pressure and exhaust ports. Supply and exhaust piping must be full area, unrestricted. ASCO flow controls and other similar components must be installed in the cylinder lines only.

② Class H coil for added ambient temperature capability.

General Service - 4/2 Inline 1/4"- 1/2"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
				Air	Water	Light Oil												
<b>4/2 Inline Dual Solenoid</b>																		
1/4	3/16	0.7	0	125	125	125	160	8342G020	BR	PTFE	120/60	21734	16.1	●	-	306193	272610-032-D*	4.8
		0.7	0	125	125	125	160	EF8342G020	BR	PTFE	120/60	21425	16.1	●	-	306193	272614-032-D*	4.8
	1/4	0.8	10	250	200	200	125	8344G044 ①	BR	NBR	120/60,110/50	20837	6.1	-	-	302721	238210-032-D*	5.9
		0.8	10	250	200	125	180	EF8344G044 ①	BR	NBR	120/60,110/50	21759	6.1	●	-	302721	238214-032-D*	5.9
		1	10	250	200	125	180	EF8344G044MO ①	BR	NBR	120/60,110/50	20839	6.1	-	-	302721-MO	238214-032-D*	6.7
3/8	3/16	0.7	0	125	125	125	160	8342G022	BR	PTFE	120/60	21735	16.1	●	-	306193	272610-032-D*	4.8
		0.7	0	125	125	125	160	EF8342G022	BR	NBR	120/60	21755	16.1	●	-	306193	272614-032-D*	4.8
	3/8	1.4	10	250	200	125	180	8344G080 ①	BR	NBR	120/60,110/50	20874	6.1	-	-	302723	238210-032-D*	7.1
		1.4	10	300	300	200	180	8344G050 ①	BR	NBR	120/60,110/50	20842	10.1	-	-	302724	238210-032-D*	7.1
1/2	3/8	1.4	10	250	200	125	180	8344G082 ①	BR	NBR	120/60,110/50	20877	6.1	●	-	302723	238210-032-D*	7.1

① A Minimum Operating Pressure Differential must be maintained between the pressure and exhaust ports. Supply and exhaust piping must be full area, unrestricted. ASCO flow controls and other similar components must be installed in the cylinder lines only.

General Service - 4/2, 5/2 Inline/NAMUR 1/8" - 1/2"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)	
			Min.	Max.										UL	FM				
				Air	Water	Light Oil													
<b>5/2 Inline Single Solenoid</b>																			
1/8	0.16	0.42	25	115	-	-	120	52000015	AL	NBR	120/60,110/50	52000015	1.6	□	-	-	-	1.0	
1/4	1/16	0.09	10	150	-	-	180	8345H003 ①	BR	NBR	120/60,110/50	21058	10.1	●	-	302698	238610-032-D*	4.8	
		0.09	10	150	-	-	180	EF8345H003 ①	BR	NBR	120/60,110/50	21059	10.1	●	-	302698	238614-032-D*	4.8	
		0.09	10	150	-	-	180	8345H003V ①	BR	NBR	120/60,110/50	21739	10.1	●	-	302698-V	238610-032-D*	4.8	
		0.09	10	150	150	150	180	8345G001 ①	BR	NBR	120/60,110/50	20879	10.1	●	-	314453	238610-032-D*	4.8	
		0.09	10	150	150	150	180	EF8345G001 ①	BR	NBR	120/60,110/50	20882	10.1	●	-	314453	238614-032-D*	4.8	
		0.09	10	150	150	150	180	EF8345G001MO ①	BR	NBR	120/60,110/50	20883	10.1	●	-	314453-MO	238614-032-D*	4.8	
		0.09	10	150	150	150	180	8345G001MO ①	BR	NBR	120/60,110/50	20880	10.1	●	-	314453-MO	238610-032-D*	4.8	
		0.09	10	150	150	150	180	8345G001V ①	BR	NBR	120/60,110/50	21738	10.1	●	-	314453-V	238610-032-D*	4.8	
		0.09	10	100	100	100	104	8345G001 ①	BR	NBR	24/DC	21737	11.6	●	-	314455	238710-006-D*	4.8	
	0.09	10	100	100	100	140	EF8345G001 ①	BR	NBR	24/DC	20890	11.6	●	-	314455	238714-006-D*	4.8		
	0.09	10	150	150	150	180	EFHT8345G001 ①②	BR	NBR	120/60,110/50	20884	10.1	●	-	314453	238814-032-D*	4.8		
	1/4	1/4	0.86	30	150	-	-	140	SC8551A017MS	AL	NBR	120/50-60	21796	2.5	□	-	-	400125-088-*	2.0
			0.86	30	150	-	-	140	WT8551A017MS	AL	NBR	120/60,110/50	21811	6.3	□	-	-	266763-902-D*	2.0
			0.86	30	150	-	-	104	EF8551A017MS	AL	NBR	120/60,110/50	21764	6.3	●	-	-	266762-902-D*	2.0
			0.86	30	150	-	-	140	SC8551A017MS	AL	NBR	24/DC	21797	3.0	□	-	-	400125-042-*	2.0
0.86			30	150	-	-	77	EF8551A017MS	AL	NBR	24/DC	21765	6.9	●	-	-	270007-006-D*	2.0	
<b>5/2 Inline Dual Solenoid</b>																			
1/4	1/4	0.86	30	150	-	-	140	SC8551A018MS	AL	NBR	120/50-60	21800	2.5	□	-	-	400125-088-*	2.3	
		0.86	30	150	-	-	104	EF8551A018MS	AL	NBR	120/60,110/50	21768	6.3	●	-	-	266762-902-D*	2.3	
		0.86	30	150	-	-	140	SC8551A018MS	AL	NBR	24/DC	21801	3.0	□	-	-	400125-042-*	2.3	
		0.86	30	150	-	-	77	EF8551A018MS	AL	NBR	24/DC	21769	6.9	●	-	-	270007-006-D*	2.3	
<b>4/2, 5/2 NAMUR Mount Single Solenoid</b>																			
1/4	1/4	0.70	0	125	-	-	160	8342G501	BR	PTFE	120/60	21528	20.0	□	-	322008	272610-132-D*	4.5	
		0.70	30	150	-	-	140	EV8551G309	SS	NBR/PUR	24/DC	21875	1.4	●	-	-	274714-902-D*	4.0	
		0.70	30	150	-	-	140	8551G401	AL	NBR	120/60,110/50	21864	10.1	●	-	-	238610-032-D*	2.0	
		0.86	30	150	-	-	140	SC8551A001MS	AL	NBR	120/50-60	21595	2.5	□	-	-	400125-088-*	2.0	
		0.86	30	150	-	-	140	WT8551A001MS	AL	NBR	120/60,110/50	21597	6.3	□	-	-	266763-902-D*	2.0	
		0.86	30	150	-	-	104	EF8551A001MS	AL	NBR	120/60,110/50	21599	6.3	●	-	-	266762-902-D*	2.0	
		0.86	30	150	-	-	140	SC8551A001MS	AL	NBR	24/DC	21596	3.0	□	-	-	400125-042-*	2.0	
		0.86	30	150	-	-	77	WT8551A001MS	AL	NBR	24/DC	21598	6.9	□	-	-	270008-006-D*	2.0	
		0.86	30	150	-	-	77	EF8551A001MS	AL	NBR	24/DC	21600	6.9	●	-	-	270007-006-D*	2.0	

① A Minimum Operating Pressure Differential must be maintained between the pressure and exhaust ports. Supply and exhaust piping must be full area, unrestricted. ASCO flow controls and other similar components must be installed in the cylinder lines only.

② Class H coil for added ambient temperature capability.

Group mount valves can be mounted together in different quantities to reduce piping and installation time and allowing for common inlet or exhaust ports.

- Control of air and inert gas only
- Two way (2/2) normally closed , three-way (3/2) normally closed, and four-way four port (4/2) operations
- Combinations of normally closed and normally open can be grouped together



**Group Mounted 2/2 Normally Closed, 3/2 Normally Closed, 4/2 1/8" - 1/4"**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Air											UL	FM			
			Min.	Max.														
<b>2/2 Normally Closed</b>																		
1/8	3/64	0.05	0	150	180	SC8280B002	AL	NBR	120/60,110/50	03035	6.3	☐	-	-	400125-225-*	1.5		
<b>3/2 Normally Closed</b>																		
1/8	3/64	0.05	0	150	180	SC8380B002	AL	NBR	120/60,110/50	03052	6.3	☐	-	-	400115-225-*	1.5		
		0.05	0	150	180	U8380B002	AL	NBR	120/60,110/50	03053	6.3	☐	-	-	400115-225-D*	1.5		
		0.05	0	150	77	U8380B002	AL	NBR	24/DC	03054	6.9	☐	-	-	400115-142-D*	1.5		
		0.07	0	100	180	U8380B003	AL	NBR	120/60,110/50	03076	6.3	☐	-	-	400115-225-D*	1.5		
<b>4/2 Inline Single Solenoid</b>																		
1/8	1/8	0.20	30	150	140	26300007	ZN	NBR	120/60,110/50	26300007-120/60	2.5	-	-	-	43004884	1.0		
		0.20	30	150	140	26300007	ZN	NBR	24/DC	26300007-24/DC	2.5	-	-	-	43004869	1.0		
1/4	5/64	0.1	0	150	104	8340A003	AL	PE	120/60,110/50	01892	16.7	●	-	302753	064982-001-D*	1.5		
	1/4	1.00	30	150	140	26400027	ZN	NBR	120/60,110/50	26400027-120/60	2.5	-	-	-	43004884	2.0		
		1.00	30	150	140	26400027	ZN	NBR	24/DC	26400027-24/DC	2.5	-	-	-	43004869	2.0		

① Includes flow control device assembled.

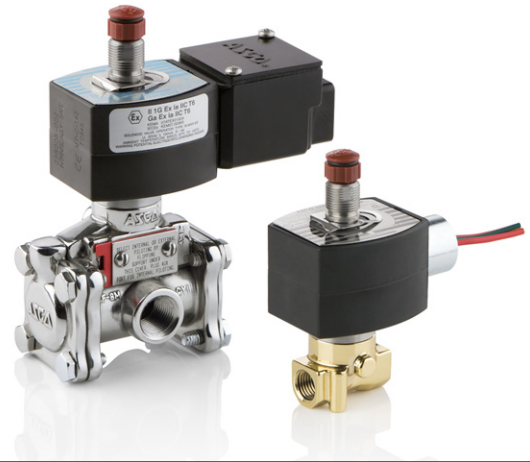
**5/2 Pneumatic Valves**

Pipe Size (in)	Orifice (ins.)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
				Air	Water	Light Oil												
<b>5/2 ISO Pad Mount</b>																		
ISO 1 Pad Mounted	1/4	1.05	45	145	-	-	140	54100883	PA + FV	NBR	120/60,110/50	54100883-120/60	2.5	-	-	-	43004884	2.0
		1.05	45	145	-	-	140	54100883	PA + FV	NBR	24/DC	54100883-24/DC	2.5	-	-	-	43004869	2.0
		1.05	45	145	-	-	140	54101006	ZN	NBR	120/60,110/50	54101006-120/60	2.5	-	-	-	43004884	2.0

Pipe Size (in)	Body Material	Single Station Catalog Number and Order Code	Joinable Catalog Number and Order Code	End Plate Set Catalog Number and Order Code
<b>ISO 1 Subbase</b>				
1/4	AL	35500138	35500093	-
3/8	AL	35500127	-	35500092

Low power valves minimize temperature rise and power draw allowing the user to reduce wiring and operate these DC valves directly off of computer control. Intrinsically safe valves are for use in an inherently safe system which will not ignite an explosive atmosphere.

- Three-way (3/2) normally closed and universal operations
- Four-way, four and five port (4/2 and 5/2) operation
- Size range of 1/4" to 1/2"



### Intrinsically Safe & Low Power

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)		Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max. Air								UL	FM			
<b>3/2 Universal Low Power</b>																
1/4	1/20	0.06	0	130/105 ③	149	8314H300	BR	LTNBR	24/DC	22121	0.55	●	-	325071	238710-913-D*	2.6
		0.06	0	130/105 ③	149	EF8314H300	BR	LTNBR	24/DC	22122	0.55	●	-	325071	238714-913-D*	2.6
		0.06	0	130/105 ③	149	EF8314H301	SS	LTNBR	24/DC	22123	0.55	●	-	325071	238714-913-D*	2.6
		0.06	0	130/105 ③	149	EF8314H301	SS	LTNBR	12/DC	22129	0.55	●	-	325071	238714-915-D*	2.6
	1/20 ④	0.06 ⑤	5	130	149	EF8317H307	BR	LTNBR	24/DC	22126	0.55	●	-	325109	238714-913-D*	2.7
		0.06 ⑤	5	130	149	EF8317H308	SS	LTNBR	24/DC	22127	0.55	●	-	325109	238714-913-D*	2.7
	1/16	0.08	0	150	140	EF8314G300	BR	LTNBR	24/DC	21071	1.4	●	-	316816	238714-902-D*	1.8
			0	150	140	EF8314G301	SS	LTNBR	24/DC	21072	1.4	●	-	316816	238714-902-D*	1.9
			0	150	140	8314G300	BR	LTNBR	24/DC	21156	1.4	●	-	316816	238710-902-D*	1.8
	1/16 ⑥	0.08	0	150	140	EF8314G301	SS	LTNBR	12/DC	21749	1.4	●	-	316816	238714-903-D*	1.9
0.08 ⑦			5	150	140	EF8317G307	BR	LTNBR	24/DC	21074	1.4	●	-	316839	238714-902-D*	1.8
0.08 ⑦			5	150	140	EF8317G308	SS	LTNBR	24/DC	21075	1.4	●	-	316845	238714-902-D*	1.8
<b>3/2 Normally Closed Low Power</b>																
1/4	5/16	1.5	0, 15	130	149	EF8316H301 ①	BR	LTNBR	24/DC	22130	0.55	●	-	325074	238714-913-D*	4.1
		1.5	0, 15	130	149	EV8316H381V	SS	LTNBR, FKM	24/DC	22131	0.55	●	-	325074-V	274714-909-D*	4.5
		1.5	0, 15	150	140	EF8316G301 ①	BR	LTNBR	24/DC	21751	1.4	●	-	316982	238714-902-D*	3.6
		1.5	0, 15	150	140	EV8316G381V	SS	LTNBR, FKM	24/DC	21225	1.4	●	-	316982-V	274714-902-D*	4.5
3/8	5/16	1.8	0, 15	130	149	EF8316H302 ①	BR	LTNBR	24/DC	22124	0.55	●	-	325074	238714-913-D*	4.1
		1.8	0, 15	130	149	EV8316H382V	SS	LTNBR, FKM	24/DC	22132	0.55	●	-	325074-V	274714-909-D*	5
		1.8	0, 15	150	140	EV8316G382V	SS	LTNBR, FKM	24/DC	21226	1.4	●	-	316982-V	274714-902-D*	4.5
1/2	5/8	4	0, 15	130	149	EF8316H304 ①	BR	LTNBR	24/DC	22125	0.55	●	-	325110	238714-913-D*	4.9
		4	0, 15	130	149	EV8316H384V	SS	LTNBR, FKM	24/DC	22133	0.55	●	-	325112-V	274714-909-D*	6
		4	0, 15	150	140	EV8316G384V	SS	LTNBR, FKM	24/DC	21342	1.4	●	-	318399-V	274714-902-D*	8.6
<b>4/2, 5/2 Low Power</b>																
1/4	1/4	0.8	10	130	149	EF8344H370 ①	BR	LTNBR	24/DC	22128	0.55	●	-	325073	238714-914-D*	3.4
		0.8 ⑧	10	150	140	EF8344G370	BR	NBR	24/DC	21076	1.4	●	-	316841	238714-902-D*	8.6
		0.86	35	130	149	EV8551H309	SS	NBR, PUR	24/DC	22141	0.55	●	-	-	274714-909-D*	3.8
<b>3/2 Universal Intrinsically Safe</b>																
1/4	1/20	0.06	0	130/105 ③	149	JIS8314B300 ②	BR	LTNBR	24/DC	22140	0.48 ⑨	-	●	325071	298008-002-*	2.6
		0.06	0	130/105 ③	149	JIS8314B301 ②	SS	LTNBR	24/DC	22139	0.48 ⑨	-	●	325071	298008-002-*	2.6
		0.06	0	130/105 ③	149	IS8314B301 ②	SS	LTNBR	24/DC	22166	0.48 ⑨	-	●	325071	298006-002-*	2.6
	1/20 ④	0.06 ⑤	5	130	149	JIS8317B307 ②	BR	LTNBR	24/DC	22136	0.48 ⑨	-	●	325109	298008-002-*	2.7
<b>3/2 Normally Closed Intrinsically Safe</b>																
1/4	5/16	1.5	15	130	149	JIS8316B301 ①②	BR	LTNBR	24/DC	22138	0.48 ⑨	-	●	325074	298008-002-*	4
3/8	5/8	3	10	130	149	JIS8316B354 ②	BR	LTNBR	24/DC	22137	0.48 ⑨	-	●	302018	298008-002-*	4.9
<b>4/2 Intrinsically Safe</b>																
1/4	3/8	0.8	10	130	149	JIS8344B370 ①②	BR	LTNBR	24/DC	22135	0.48 ⑨	-	●	325073	298008-002-*	5.2
<b>5/2 Intrinsically Safe</b>																
1/4	1/4	0.86	30	130	149	JIS8551B301 ①②	AL	LTNBR, NBR, PUR	24/DC	22134	0.48 ⑨	-	●	-	298008-002-*	2

① A Minimum Operating Pressure Differential must be maintained between the pressure and exhaust ports. Supply and exhaust piping must be full area, unrestricted. ASCO flow controls and other similar components must be installed in the cylinder lines only.

② Designed solely for installation in Intrinsically Safe areas, with properly approved and sized current and voltage coil rating safety barriers.

③ Normally closed = 130psi, Normally open = 105psi

④ Quick exhaust valve, pressure port = 1/20", exhaust port = 1/4". ⑤ Quick exhaust valve, pressure port Cv = .06, exhaust port Cv = .73

⑥ Quick exhaust valve, pressure port = 1/16", exhaust port = 1/4". ⑦ Quick exhaust valve, pressure port Cv = .08, exhaust port Cv = .73

⑧ Quick exhaust valve, pressure port Cv = .08, exhaust port Cv = 1

⑨ Wattage rating based on 30 mA loop current



Valves for offshore and other demanding oil and gas production operations. Solenoid, pneumatic, and manual operated options are available. Ideal for logic control and well control panels installed in offshore platforms

- Increased reliability – Innovative proven in use T-seal design avoids dormancy (sticking) on low demand applications (low cycle rate)
- Corrosion resistant: 316L Stainless Steel materials
- Low Power Options: 0.5w, 0.55w, 1.8w



### Offshore Valves 1/4"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
<b>3/2 Normally Closed</b>																		
1/4	-	1.4	36	200	149	8361A003	SS	TPU, VMQ, NBR	120/60, 110/50	22172	-	-	-	325169	-	1.5		
1/4	-	1.4	25	200	149	8361A013	SS	TPU, VMQ, NBR	120/60, 110/50	22173	-	-	-	325170	-	1.5		
1/4	-	1.4	36	150	149	EVHT8361H403	SS	TPU, VMQ, NBR, FPM	24 DC	22190	11.6	○	-	325173	274914-006-D	4		
<b>3/2 Universal</b>																		
1/4	-	1.4	-	200	149	8361A601	SS	TPU, VMQ, NBR	120/60, 110/50	22183	-	-	-	325169	-	1.6		
1/4	-	1.4	-	200	149	8361A611	SS	TPU, VMQ, NBR	120/60, 110/50	22184	-	-	-	325169	-	1.7		
<b>3/2 Normally Closed Low Power</b>																		
1/4	-	1.4	36	130	149	EV8361H307	SS	TPU, VMQ, NBR	24/DC	22174	0.55	○	-	325177	274714-909-D	4		
<b>3/2 Normally Open Low Power</b>																		
1/4	-	1.4	25	130	149	EV8361H318	SS	TPU, VMQ, NBR	24/DC	22175	0.55	○	-	325178	274714-909-D	6.5		

Harsh environment valves for offshore applications such as oil platforms where the environment is extremely hot, humid, and highly corrosive.

- Provides quick shutdown of valves and actuators
- Low power consumption suitable for solar panels and PLC/DCS applications
- UL, CSA, ATEX, IECEx approved



### Harsh Environment Valves 1/4"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)				Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.										UL	FM			
<b>3/2 Normally Closed</b>																		
1/4	1/16	0.08 - 0.16	0	150	-	-	122	EF8320A511	316L SS	FKM	24/DC	22146	1.3	○	-	-	-	2.5
1/4	3/64	0.05 - 0.11	0	125	-	-	122	EF8320A512	316L SS	FKM	24/DC	22163	0.55	○	-	-	-	2.5

### Combustion valves are for the control of combustible gases and fuel oil as listed.

- Two-way (2/2) normally closed (Shut-Off) and normally open (vent) operations
- Three-way (3/2) normally closed (pressure to cylinder port when energized) operation
- Solenoid operated (electrically), cable operated (mechanical operation for range hoods), manual reset (conjunction of solenoid and manual operation), electro-hydraulically operated (electric motor using hydraulic pumps for operation)
- Size range of 1/8" to 3"



### Fuel Gas 2/2 Normally Open, Normally Closed Manual Reset 1/2" - 2"

Pipe Size (in)	Orifice (in)	Cv Flow	Gas Capacity Btu/Hr	Operating Pressure (psi)		Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals			Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
				Fuel Gas. Min.	Max.								UL	FM	CSA			
<b>2/2 Normally Open</b>																		
1/2	3/4	4.4	206,250	0	5	125	8214G023	AL	NBR	120/60,110/50	21050	17.1	●	-	●	316234	238610-132-D*	2.0
3/4	3/4	5.1	247,500	0	5	125	8214G033	AL	NBR	120/60,110/50	21051	17.1	●	-	●	316234	238610-132-D*	
		8	370,000	0	30	77	S262SG02N3EG5	AL	NBR	120/60,110/50	S262SG02N3EG5	20.0	●	-	●	-	222345-009-D*	3.3
1	1 5/8	11	659,000	0	5	125	JB8214037CSA	AL	NBR	120/60,110/50	03184	20	●	-	●	316728	099257-005-D*	4.3
	1 1/2	18	1,120,000	0	25	77	S262SG02N3FJ5	AL	NBR	120/60,110/50	S262SG02N3FJ5	20.0	●	-	●	-	222345-009-D*	4.4
	1 5/8	21	1,179,000	0	5	125	JB8214053CSA	AL	NBR	120/60,110/50	03185	20	●	-	●	316728	099257-005-D*	4.3
1 1/4	1 5/8	32	1,538,000	0	5	125	JB8214063CSA	AL	NBR	120/60,110/50	03186	20	●	-	●	316728	099257-005-D*	4.3
	2	34	1,710,000	0	25	77	S262SG02N3GJ7	AL	NBR	120/60,110/50	S262SG02N3GJ7	20.0	●	-	●	-	222345-009-D*	4.4
2	4 1/2	75	3,840,000	0	15	77	S262SG02N3JK4	AL	NBR	120/60,110/50	S262SG02N3JK4	20.0	●	-	●	-	222345-009-D*	12.5
<b>2/2 Normally Closed Manual Reset (Free Handle)</b>																		
3/4	1 5/8	13	717,000	0	25	125	8044B001CSA	AL	NBR	120/60,110/50	03015	20	○	○	○	304093	099257-005-D*	4.3

### Fuel Gas 2/2 Normally Closed Electro-Hydraulic 1" - 3"

Pipe Size (in)	Cv Flow	Operating Pressure Differential (psi) Fuel Gas		Max. Fluid Temp. °F	Valve Catalog Number and Order Code	Body Material	Sealing Material	Approx. Shipping Weight (lbs.)	Actuator Catalog Number and Order Code		Voltage	Type of Operation	VA	Approvals			Approx. Shipping Weight (lbs.)
		Min.	Max.						General Purpose	Watertight				UL	FM	CSA	
<b>2/2 Normally Closed</b>																	
1	20	0	15	150	V710FBS	AL	NBR	4.2	AH2E202A4	AH2E102A4	120/50-60	Slow Opening	220	○	○	○	8.8
	20	0	15	150	V710FBS	AL	NBR	4.2	AH2E212A4	AH2E112A4	120/50-60	Fast Opening	220	○	○	○	8.8
1 1/4	44	0	15	150	V710GBS	AL	NBR	6.3	AH2E202A4	AH2E102A4	120/50-60	Slow Opening	220	○	○	○	8.8
	44	0	15	150	V710GBS	AL	NBR	6.3	AH2E212A4	AH2E112A4	120/50-60	Fast Opening	220	○	○	○	8.8
1 1/2	57	0	15	150	V710HBS	AL	NBR	6.1	AH2E202A4	AH2E102A4	120/50-60	Slow Opening	220	○	○	○	8.8
	57	0	15	150	V710HBS	AL	NBR	6.1	AH2E212A4	AH2E112A4	120/50-60	Fast Opening	220	○	○	○	8.8
2	74	0	15	150	V710JBS	AL	NBR	5.8	AH2E202A4	AH2E102A4	120/50-60	Slow Opening	220	○	○	○	8.8
	74	0	15	150	V710JBS	AL	NBR	5.8	AH2E212A4	AH2E112A4	120/50-60	Fast Opening	220	○	○	○	8.8
2 1/2	120	0	15	150	V710KBS	AL	NBR	12.7	AH2E202A4	AH2E102A4	120/50-60	Slow Opening	220	○	○	○	8.8
	120	0	15	150	V710KBS	AL	NBR	12.7	AH2E212A4	AH2E112A4	120/50-60	Fast Opening	220	○	○	○	8.8
3	160	0	15	150	V710LBS	AL	NBR	11.7	AH2E202A4	AH2E102A4	120/50-60	Slow Opening	220	○	○	○	8.8
	160	0	15	150	V710LBS	AL	NBR	11.7	AH2E212A4	AH2E112A4	120/50-60	Fast Opening	220	○	○	○	8.8
<b>2/2 Normally Closed with Proof of Closure</b>																	
1	20	0	15	150	V710FBSV22	AL	NBR	4.2	AH2E202S4	AH2E102S4	120/50-60	Slow Opening	220	○	○	○	8.8
	20	0	15	150	V710FBSV22	AL	NBR	4.2	AH2E212S4	AH2E112S4	120/50-60	Fast Opening	220	○	○	○	8.8
	20	0	15	150	V710FBSV15	AL	NBR	4.2	AH4E212A4	AH4E112A4	120/60, 110/50 AC	Fast Opening	220	○	○	○	8.8
1 1/4	44	0	15	150	V710GBSV22	AL	NBR	6.3	AH2E202S4	AH2E102S4	120/50-60	Slow Opening	220	○	○	○	8.8
	44	0	15	150	V710GBSV22	AL	NBR	6.3	AH2E212S4	AH2E112S4	120/50-60	Fast Opening	220	○	○	○	8.8
	44	0	15	150	V710GBSV15	AL	NBR	6.3	AH4E212A4	AH4E112A4	120/60, 110/50 AC	Fast Opening	220	○	○	○	8.8
1 1/2	57	0	15	150	V710HBSV22	AL	NBR	6.1	AH2E202S4	AH2E102S4	120/50-60	Slow Opening	220	○	○	○	8.8
	57	0	15	150	V710HBSV22	AL	NBR	6.1	AH2E212S4	AH2E112S4	120/50-60	Fast Opening	220	○	○	○	8.8
	57	0	15	150	V710HBSV15	AL	NBR	6.1	AH4E212A4	AH4E112A4	120/60, 110/50 AC	Fast Opening	220	○	○	○	8.8
2	74	0	15	150	V710JBSV22	AL	NBR	5.8	AH2E202S4	AH2E102S4	120/50-60	Slow Opening	220	○	○	○	8.8
	74	0	15	150	V710JBSV22	AL	NBR	5.8	AH2E212S4	AH2E112S4	120/50-60	Fast Opening	220	○	○	○	8.8
	74	0	15	150	V710JBSV15	AL	NBR	5.8	AH4E212A4	AH4E112A4	120/60, 110/50 AC	Fast Opening	220	○	○	○	8.8
2 1/2	120	0	15	150	V710KBSV22	AL	NBR	12.7	AH2E202S4	AH2E102S4	120/50-60	Slow Opening	220	○	○	○	8.8
	120	0	15	150	V710KBSV22	AL	NBR	12.7	AH2E212S4	AH2E112S4	120/50-60	Fast Opening	220	○	○	○	8.8
3	149	0	15	150	V710LBSV22	AL	NBR	11.7	AH2E202S4	AH2E102S4	120/50-60	Slow Opening	220	○	○	○	8.8
	149	0	15	150	V710LBSV22	AL	NBR	11.7	AH2E212S4	AH2E112S4	120/50-60	Fast Opening	220	○	○	○	8.8

Refer to inside cover for ordering information.

### Fuel Gas 2/2 Normally Closed Electro-Hydraulic 3"

Pipe Size (in)	Cv Flow	Operating Pressure Differential (psi) Natural Gas		Max. Fluid Temp. °F	Catalog Number	Body Material	Sealing Material	Valve and Actuator Order Code	Replacement Actuator	Voltage	Type of Operation	Approvals			Approx. Shipping Weight (lbs.)
		Min. Press.	Max. Press.									UL	FM	CSA	
<b>2/2 Normally Closed Assembled Valves and Actuators</b>															
3	320	0	8	150	H117AL112F1	IRON	NBR	H117AL112F1	H10A620B5F1	120/50-60	Slow opening	○	○	○	105
	320	0	8	150	H117AL112A209	IRON	NBR	H117AL112A209	H10A620B5F1F26	120/50-60	Slow opening	○	○	○	110

### Fuel Gas Cable Release 2/2 Normally Closed 3/4" - 2 1/2"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi) Fuel Gas		Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals			Rebuild kit	Approx. Shipping Weight (lbs.)
			Min.	Max.								UL	FM	CSA		
<b>2/2 Normally Closed</b>																
3/4	3/4	6.5	0	5	132	HV216585-001	AL	NBR	-	00092	-	○	-	-	2.3	
1	1 5/8	24	0	5	132	HV216585-002	AL	NBR	-	00093	-	○	-	-	3.8	
1 1/4	1 5/8	34	0	5	132	HV216585-003	AL	NBR	-	00094	-	○	-	-	3.8	
1 1/2	1 5/8	38	0	5	132	HV216585-004	AL	NBR	-	00095	-	○	-	-	3.8	
2	2 3/32	54	0	5	132	HV216585-005	AL	NBR	-	00096	-	○	-	-	5.8	
2 1/2	3	110	0	5	132	HV216585-006	AL	NBR	-	00097	-	○	-	-	12	

### Fuel Oil 2/2 Normally Closed, 3/2 Normally Closed Electro-Hydraulic 1/2" - 3/4"

Pipe Size (in)	Cv Flow	Operating Pressure Differential (psi) Fuel Oil		Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Seal Material	Voltage	Valve Catalog Number and Order Code	VA	Approvals			Approx. Shipping Weight (lbs.)
		Min.	Max.								UL	FM	CSA	
<b>2/2 Normally Closed</b>														
1/2	4.5	0	300	267	HOV1B302T171	BZ	PTFE	120/60, 110/50	HOV1B302T171	220	○	○	○	16.8
3/4	5.5	0	300	267	HOV1B307T171	BZ	PTFE	120/60, 110/50	HOV1B307T171	220	○	○	○	16.8
<b>3/2 Normally Closed</b>														
1/2	2.5	0	300	267	HOV13B162T170	BZ	PTFE	120/60, 110/50	HOV13B162T170	220	○	○	○	16.8
1/2	2.5	0	300	267	HOV13B162T171	BZ	PTFE	120/60, 110/50	HOV13B162T171	220	○	○	○	16.8
3/4	3	0	300	267	HOV13B167T171	BZ	PTFE	120/60, 110/50	HOV13B167T171	220	○	○	○	16.8
1/2	4.5	0	300	267	HOV1B302T170	BZ	PTFE	120/60, 110/50	HOV1B302T170	220	○	○	○	16.8
1/2	4.5	0	300	267	HOV1B302T171	BZ	PTFE	120/60, 110/50	HOV1B302T171	220	○	○	○	16.8
3/4	5.5	0	300	267	HOV1B307T170	BZ	PTFE	120/60, 110/50	HOV1B307T170	220	○	○	○	16.8
3/4	5.5	0	300	267	HOV1B307T171	BZ	PTFE	120/60, 110/50	HOV1B307T171	220	○	○	○	16.8
1	6	0	300	267	HOV1B312T171	BZ	PTFE	120/60, 110/50	HOV1B312T171	220	○	○	○	16.8
-	-	-	-	-	HO1B252A170	-	-	-	HO1B252A170	220	○	○	○	10.4
-	-	-	-	-	HO1B252A171	-	-	-	HO1B252A171	220	○	○	○	10.4

### Fuel Oil 2/2 Normally Closed, 3/2 Normally Closed 3/8" - 1/2"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)		Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals			Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)	
			Min.	Max.								UL	FM	CSA				
<b>2/2 Normally Closed</b>																		
3/8	1/4	1.2	0	110	100	225	JB8266D023L	BR	SS	120/60,110/50	21692	15.4	○	○	○	304099-L	099257-001-D*	3.0
1/2	1/4	1.2	0	110	100	225	8266D069V	BR	FKM	120/60,110/50	01118	15.4	○	○	○	304099-V	099257-001-D*	3.0
	5/16	1.8	0	70	70	225	JB8266D077L	BR	SS	120/60,110/50	21693	15.4	○	○	○	304101-L	099257-001-D*	3.0
<b>3/2 Normally Closed</b>																		
1/2	1/4	1	0	100	-	265	8377 009	BR	NBR	120/60,110/50	02881	15.4	m	m	m	304108	099257-001-D*	4.0

### Fuel Oil 2/2 Normally Closed 1/4"

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)		Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals			Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)	
			Min.	Max.								UL	FM	CSA				
<b>2/2 Normally Closed</b>																		
1/4	3/32	0.17	0	350	270	180	8262H021V	BR	FKM	120/60,110/50	22055	9.1	○	○	○	323581-V	238210-132-D*	2.4
	5/32	0.5	0	200	145	180	EF8262H220V	SS	FKM	120/60,110/50	22058	10.1	○	○	○	323595-V	238614-032-D*	2.4
	7/32	0.72	0	100	100	200	8262H208V	BR	FKM	120/60,110/50	22007	10.1	○	○	○	323593-V	238614-032-D*	2.4
		0.72	0	100	100	180	EF8262H226V	SS	FKM	120/60,110/50	22018	10.1	○	○	○	304352-V	238614-032-D*	2.4
	9/32	0.88	0	90	90	180	EF8262H230V	SS	FKM	120/60,110/50	22044	17.1	○	○	○	353595-V	238614-132-D*	2.6
	1/2	1.1	0	300	300	250	SV401A02V9BF7	BR	FKM	120/60,110/50	SV401A02V9BF7	17.1	○	○	○	-	238614-132-D*	3.2

Fuel Gas 2/2 Normally Closed 1/8" - 3"

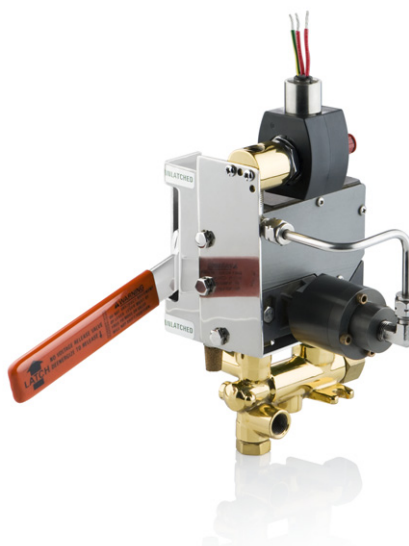
Pipe Size (in)	Orifice (in)	Cv Flow	Gas Capacity		Operating Pressure (psi)		Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals			Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Btu/Hr	Fuel Gas	Fuel Gas									UL	FM	CSA			
					Min	Max													
<b>2/2 Normally Closed</b>																			
1/8	5/16	1	53,700	0	15	125	SV311A02N6AF5	AL	NBR	120/60,110/50	SV311A02N6AF5	6.1	○	○	○	-	238210-032-D*	1.8	
		1	53,700	0	15	125	8040H006	AL	NBR	120/60,110/50	21183	6.1	○	○	○	318247	238210-032-D*	1.8	
1/4	9/32	1.0	77,775	0	45	167	8262H210B	BR	NBR	120/60,110/51	22042	10.1	○	○	○	323634-B	238610-032-D*	2.3	
	5/16	1.1	59,000	0	15	125	8040H007	AL	NBR	120/60,110/50	21184	6.1	○	○	○	318247	238210-032-D*	1.8	
		1	59,000	0	15	125	SV311A02N6BF5	AL	NBR	120/60,110/50	SV311A02N6BF5	6.1	○	○	○	-	238210-032-D*	1.8	
3/8	5/16	1.2	64,400	0	15	125	SV311A02N6CF5	AL	NBR	120/60,110/50	SV311A02N6CF5	6.1	○	○	○	-	238210-032-D*	1.8	
		1.2	64,400	0	15	125	8040H008	AL	NBR	120/60,110/50	21185	6.1	○	○	○	318247	238210-032-D*	1.8	
	0.456	4	215,000	0	0.5	77	K3A432U	AL	NBR	120/60,110/50	K3A432U	10.5	○	○	○	-	064982-004-D*	1.4	
		4	215,000	0	10	77	K3A532U	AL	NBR	120/60,110/50	K3A532U	16.7	○	○	○	-	216758-041-D*	1.4	
	5/8	2.8	150,000	0	50	125	8210G074	BR	NBR	120/60,110/50	20198	10.1	○	○	○	304076	238610-032-D*	3.2	
	3/4	3.4	183,000	0	5	125	8214G010	AL	NBR	120/60,110/50	21046	17.1	○	○	○	316233	238610-132-D*	2.0	
1/2	5/8	3.6	193,000	0	50	125	8210G075	BR	NBR	120/60,110/50	20199	10.1	○	○	○	304076	238610-032-D*	3.2	
	0.687	6	350,000	0	0.5	77	K3A441U	AL	NBR	24/60	K3A441U	10.5	○	○	○	-	064982-009-D*	1.4	
		6	350,000	0	0.5	77	K3A442U	AL	NBR	120/60,110/50	K3A442U	10.5	○	○	○	-	064982-004-D*	1.4	
		6	350,000	0	6	77	K3A542U	AL	NBR	120/60,110/50	K3A542U	16.7	○	○	○	-	216758-041-D*	1.4	
	3/4	4.4	238,500	0	5	125	8214G020	AL	NBR	120/60,110/50	21047	17.1	○	○	○	316233	238610-132-D*	2.0	
			374,000	0	50	125	8215G020B	AL	NBR	120/60,110/50	20291	10.1	○	○	○	304089	238610-032-D*	2.8	
		5.4	291,000	0	2	125	8040G022	AL	NBR	120/60,110/50	20030	10.1	○	○	○	306633	238610-032-D*	2.8	
		5.1	247,500	0	5	125	8214G030	AL	NBR	120/60,110/50	21048	17.1	○	○	○	316233	238610-132-D*	2.0	
	3/4	3/4	5.1	247,500	0	5	125	8214G030	AL	NBR	12/DC	21383	22.6	○	○	○	316790	238710-104-D*	2.0
			5.5	295,000	0	50	125	8210G076	BR	NBR	120/60,110/50	20200	10.1	○	○	○	304076	238610-032-D*	3.4
5.62			506,000	5	250	82	8210G003B	BR	NBR	120/60,110/50	21850	10.1	-	-	-	304091	238610-032-D*	3.7	
8			370,000	0	30	77	S261SG02N3EG5	AL	NBR	120/60,110/50	S261SG02N3EG5	20.0	○	○	○	-	222345-009-D*	3.3	
9.5		512,000	0	2	125	8040G023	AL	NBR	120/60,110/50	20031	10.1	○	○	○	306633	238610-032-D*	2.8		
		512,000	0	2	125	8040G023	AL	NBR	24/60	21126	10.1	○	○	○	306633	238610-005-D*	2.8		
0.812		9	520,000	0	0.5	77	K3A451U	AL	NBR	24/60	K3A451U	10.5	○	○	○	-	064982-009-D*	1.5	
		9	520,000	0	0.5	77	K3A452U	AL	NBR	120/60,110/50	K3A452U	10.5	○	○	○	-	064982-004-D*	1.5	
		9	520,000	0	3	77	K3A552U	AL	NBR	120/60,110/50	K3A552U	16.7	○	○	○	-	216758-041-D*	1.5	
1.25		12	667,000	0	5	77	K3A652U	AL	NBR	120/60,110/50	K3A652U	20.0	○	○	○	-	222345-009-D*	4.5	
1 5/8		11	593,000	0	5	125	JB8214235CSA	AL	NBR	120/60,110/50	22100	20.0	○	-	○	323632	099257-005-D*	5.1	
		11	593,000	0	5	125	JB8214235CCSA	AL	NBR	120/60,110/50	22089	20.0	○	○	○	-	099257-005-D*	5.6	
	11	593,000	0	5	125	JB8214235VICSA	AL	NBR	120/60,110/50	22090	20.0	○	○	○	323637	099257-005-D*	5.3		
	11	593,000	0	5	125	8214G236C	AL	NBR	120/60,110/50	22088	20.1	○	○	○	-	272610-132-D	2.5		
1	14	755,000	0	0.5	77	K3A462U	AL	NBR	120/60,110/50	K3A462U	10.5	○	-	○	-	064982-004-D*	1.7		
	14	755,000	0	1.5	77	K3A562U	AL	NBR	120/60,110/50	K3A562U	16.7	○	-	○	-	216758-041-D*	1.7		
	1.25	17	960,000	0	5	77	K3A662U	AL	NBR	120/60,110/50	K3A662U	20.0	○	-	○	-	222345-009-D*	4.7	
	1 5/8	16.8	900,000	0	0.5	125	8040C004CSA	AL	NBR	120/60,110/50	00185	15.4	○	○	○	304079	099257-001-D*	4.3	
		21	1,132,000	0	5	125	JB8214250CSA	AL	NBR	120/60,110/50	22092	20.0	○	-	○	323632	099257-005-D*	5.0	
		21	1,132,000	0	5	125	JB8214250CCSA	AL	NBR	120/60,110/50	22093	20.0	○	○	○	-	099257-005-D*	5.5	
21		1,132,000	0	5	125	JB8214250VICSA	AL	NBR	120/60,110/50	22094	20.0	○	○	○	323637	099257-005-D*	5.2		
21	1,132,000	0	5	77	8214250CSA	AL	NBR	12/DC	22086	14.9	○	-	○	323946	062691-001-D	2.3			
1 1/4	1.25	18	1,028,000	0	1.5	77	K3A772U	AL	NBR	120/60,110/50	K3A772U	20.0	○	-	○	-	222345-009-D*	5.2	
	1 5/8	19.6	1,100,000	0	0.5	125	8040C005CSA	AL	NBR	120/60,110/50	00186	15.4	○	-	○	304079	099257-001-D*	4.3	
		32	1,730,000	0	5	125	JB8214260CSA	AL	NBR	120/60,110/50	22095	20.0	○	-	○	323632	099257-005-D*	4.9	
		32	1,730,000	0	5	125	JB8214260CCSA	AL	NBR	120/60,110/50	22096	20.0	○	○	○	-	099257-005-D*	5.4	
	1.75	23	1,290,000	0	5.0	77	K3A672U	AL	NBR	120/60,110/50	K3A672U	20.0	○	-	○	-	222345-009-D*	4.5	
1 1/2	1.25	20	1,157,000	0	1.5	77	K3A782U	AL	NBR	120/60,110/50	K3A782U	20.0	○	-	○	-	222345-009-D*	4.5	
	1 5/8	35	1,900,000	0	5	125	JB8214270CSA	AL	NBR	120/60,110/50	22097	20.0	○	-	○	323632	099257-005-D*	4.7	
		35	1,900,000	0	5	125	JB8214270VICSA	AL	NBR	120/60,110/50	22098	20.0	○	○	○	323637	099257-005-D*	4.9	
	1.75	27	1,509,000	0	5	77	K3A682U	AL	NBR	120/60,110/50	K3A682U	20.0	○	-	○	-	222345-009-D*	4.7	
	2	37	1,790,000	0	25	77	S261SG02N3HJ7	AL	NBR	120/60,110/50	S261SG02N3HJ7	20.0	○	-	○	-	222345-009-D*	12.5	
2	2 3/32	55	2,940,500	0	5	125	JB8214280CSA	AL	NBR	120/60,110/50	22070	20.0	○	○	○	323499	099257-005-D*	6.2	
	4 1/2	80	4,180,000	0	25	77	S261SG02N3JK4	AL	NBR	120/60,110/50	S261SG02N3JK4	20.0	○	-	○	-	222345-009-D*	12.5	
2 1/2	3	104	5,765,500	0	5	125	JB8214290CSA	AL	NBR	120/60,110/50	22099	20.0	○	-	○	323947	222345-009-D*	12.6	
	4 1/2	110	5,700,000	0	25	77	S261SG02N3KK4	AL	NBR	120/60,110/50	S261SG02N3KK4	20.0	○	-	○	-	222345-009-D*	14.2	
3	3	105	5,796,000	0	5	125	JB8214240CSA	AL	NBR	120/60,110/50	22091	20.0	○	-	○	323947	222345-009-D*	11.7	
	4 1/2	135	7,100,000	0	25	77	S261SG02N3LK4	AL	NBR	120/60,110/50	S261SG02N3LK4	20.0	○	-	○	-	222345-009-D*	14.2	

**Manual reset valves use manual reset assemblies in conjunction with the solenoid in order to prevent inadvertent valve startup in their designed failure modes.**

No voltage release valves can be latched by moving the lever to the latched position when the solenoid is energized, the valve trips when the solenoid is de-energized. When tripped the valve can be manually cycled open/closed but the solenoid must be energized to re-latch.

Electrically tripped valves can be latched when the lever is moved to the latched position and the solenoid is de-energized. The valve trips when the solenoid is energized by a continuous or momentary (0.3 seconds minimum) electrical signal.

- Three-way (3/2) universal operation (can function as NC, NO, diverter of one fluid, or selector of 2 fluids)
- Size range of 1/4" to 1/2"



**Manual Reset 3/2 Universal 1/4"**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)			Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)	
			Min.	Air	Water								Light Oil	UL				FM
<b>3/2 Universal Operation No Voltage Release</b>																		
1/4	11/64	0.38	0	125	125	125	180	EF8308B040	BR	NBR	120/60,110/50	21569	20	□	-	318718	099257-005-D*	3.0
<b>3/2 Universal Operation Electrically Tripped</b>																		
1/4	11/64	0.38	0	125	125	125	180	EF8310B040	BR	NBR	120/60,110/50	21573	20	□	-	318720	099257-005-D*	3.0

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)			Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Approvals		Pilot Pressure (psi)		Fluid Temp. °F		Wattage	Pilot Valve Catalog Number	Approx. Shipping Weight (lbs.)
			Pilot Min.	Pilot Max.	Main Max.							UL	FM	Min.	Max.	Min.	Max.			
<b>3/2 Universal Low Power - No-Voltage Release</b>																				
3/8	1/4	0.45	25	125	125	140	EV8308G385	BR	FKM	24/DC	02982	●	-	25	125	-40	140	1.4	EF8314G300	8.0

**Dust collector valves are high-flow, fast operating valves designed for use in dust collector systems.**

- Integral pilot constructions contain solenoids for local control
- Remote constructions require a separate pilot solenoid valve



**Dust Collector 2/2 Normally Closed 1/8" - 1 1/2"**

Pipe Size (in)	Orifice (in)	Cv Flow	Operating Pressure Differential (psi)		Max. Fluid Temp. °F	Valve Catalog Number	Body Material	Sealing Material	Voltage	Valve Order Code	Wattage	Approvals		Rebuild Kit Order Code	Replacement Coil Order Code	Approx. Shipping Weight (lbs.)
			Min.	Max.								UL	FM			
<b>2/2 Normally Closed Integral Pilot Main Pulse Valves Inline</b>																
1	1 1/8	20	5	125	150	8353G041	AL	HYTREL	120/60,110/50	21005	6.1	-	-	316563	238210-032-D*	2.5
1 1/2	2	53	5	125	150	8353J039	AL	HYTREL	120/60,110/50	21542	10.1	-	-	322108	238610-032-D*	4.3
<b>2/2 Normally Closed Integral Pilot Main Pulse Valves with Compression Fittings</b>																
3/4	3/4	15	5	125	150	8353G052	AL	HYTREL	120/60,110/50	21017	6.1	-	-	316563	238210-032-D*	2.7
1	1 1/8	20	5	125	150	8353G053	AL	HYTREL	120/60,110/50	21025	6.1	-	-	316563	238210-032-D*	2.9
<b>2/2 Normally Closed Remote Pilot Main Pulse Valves Inline</b>																
3/4 ①	3/4	10.5	5	125	185	8353C030	AL	NBR	-	02425	-	-	-	096875	-	1.5
3/4 ②	3/4	10.5	5	125	185	8353C004	AL	NBR	-	02070	-	-	-	096875	-	1.5
3/4	3/4	10.5	5	125	185	8353C033	AL	NBR	-	02071	-	-	-	096875	-	1.5
1	1 1/8	20	5	125	150	8353C035	AL	HYTREL	-	02073	-	-	-	200262	-	1.7
1 1/2	2	53	10	125	150	8353H038	AL	HYTREL	-	21539	-	-	-	276886	-	3.5
<b>2/2 Normally Closed Remote Pilot Main Pulse Valves with Compression Fittings</b>																
3/4	3/4	15	5	125	150	8353055	AL	HYTREL	-	02827	-	-	-	200262	-	1.5
1	1 1/8	20	5	125	150	8353056	AL	HYTREL	-	02828	-	-	-	200262	-	2.9
1 1/2	2	50	10	125	150	8353A057	AL	HYTREL	-	21538	-	-	-	276886	-	3.8
<b>2/2 Normally Closed Pilot Valves</b>																
1/8	1/8	0.34	0	155	180	X8262C002-13200	BR	NBR	120/60,110/50	00951	8.1	-	-	308047	099216-001-D*	2.3
		0.35	0	125	180	USF8257A001	BR	NBR	120/60,110/50	03256	10	-	-	-	-	0.5

① Supplied with internal slip fit connection on outlet. ② Extended ends for Dresser connections.

Refer to inside cover for ordering information.

**ASCO 411 Series valves are miniature general service valves designed to control the flow of non-corrosive gases.**

- Two-way (2/2) normally closed (opens when energized)
- Three-way (3/2) universal (can function as NC, NO, diverter of 1 fluid, or selector of 2 fluids) operation
- Small size (.75" dia. x 1.5" height), reduced power, long life
- Pipe size with #10-32 UNF thread or Male #10-32 UNF mounting stud

**Miniature Series**

Pipe Size	Orifice Size (in)	Cv Flow	Max Operating Pressure (psi)	Body Material	Sealing Material	Valve Catalog Number and Order Code	Voltage	Watt Rating @ 20 C	Approx Shipping Weight (oz)
<b>2/2 Normally Closed - Inline Mount</b>									
#10-32 UNF	0.025	0.013	100	PBT	FKM	<b>411L1124HV</b>	24/DC	0.65	1.6
	0.080	0.070	30	PBT	FKM	<b>411L3112HV</b>	12/DC	2.0	1.6
		0.070	30	PBT	FKM	<b>411L3124HV</b>	24/DC	2.0	1.6
<b>3/2 Universal Operation - Inline Mount</b>									
#10-32 UNF	0.055/0.050	0.038/0.033	100	PBT	FKM	<b>411L2324HV</b>	24/DC	2.0	1.6
	0.080/0.050	0.070/0.033	30	PBT	FKM	<b>411L3324HV</b>	24/DC	2.0	1.6

Mounting Stud	Orifice Size (in)	CV Flow Factor (Cv)	Max Operating Pressure (psi)	Body Material	Sealing Material	Valve Catalog Number and Order Code	Voltage	Watt Rating @ 20 C	Approx Shipping Weight (oz)
<b>2/2 Normally Closed - Manifold Mount</b>									
#10-32 UNF	0.025	0.013	100	PBT	FKM	<b>411M1124HV</b>	24/DC	0.65	1.6
	0.055	0.038	100	PBT	FKM	<b>411M2112HV</b>	12/DC	2.0	1.6
	0.080	0.070	30	PBT	FKM	<b>411M3124HV</b>	24/DC	2.0	1.6
<b>3/2 Normally Closed - Manifold Mount</b>									
#10-32 UNF	0.025/0.025	0.013/0.008	100	PBT	FKM	<b>411M1224HV</b>	24/DC	2.0	1.6
	0.055/0.050	0.038/0.033	100	PBT	FKM	<b>411M2224HV</b>	24/DC	2.0	1.6



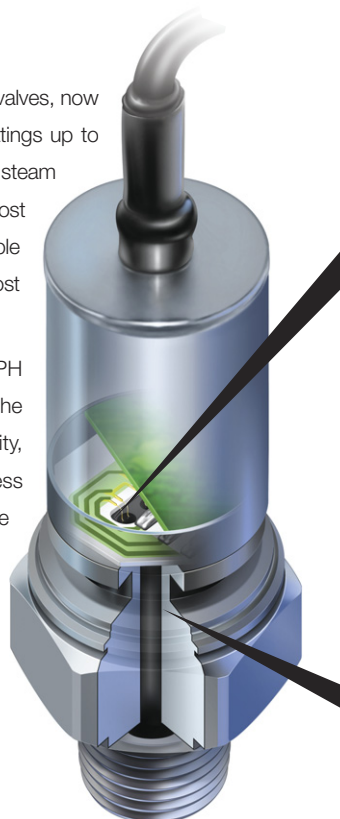
**Sensors**

ASCO, the leader in the design and manufacture of solenoid valves, now offers a complete line of pressure sensors. With pressure ratings up to 10,000 psi and the ability to handle rugged applications like steam and refrigeration, ASCO Pressure Sensors will satisfy your most demanding needs. The ASCO Pressure Sensor line is suitable for accurately measuring many process fluids in the most demanding, pulsating, and vibrating environments.

The one piece pressure cavity is machined from 17.4 PH stainless steel, which offers no source for contamination of the process fluid or the sensor. This design provides the stability, accuracy, flexibility, and EMI resistance that your process needs. This single machined, pressure cavity will also enable you to fill a large variety of applications by standardizing on fewer sensors as well as reducing your inventory.

ASCO Pressure Sensors demonstrate ASCO's commitment to the most reliable flow control solutions.

For detailed information go to the Get Literature section at [www.ascovalve.com](http://www.ascovalve.com)



**Sensing Element**

- Sensor elements adhered with inorganic material to provide low drift repeatable signal
- Sensor technology provides high sensitivity permitting thicker cavities
- MEM's technology
- Wide operating temperature range
- Ranges up to 10,000 psi
- Rugged construction design for harsh environments

**No Leak Path Design**

- Pressure cavity is one piece (17.4 PH Stainless Steel) construction
- Pressure sensing surface is integral to body, no separate diaphragm
- Excellent isolation, over pressure and burst characteristics
- No fill fluids utilized

Refer to inside cover for ordering information.

Pressure and temperature switches and transducers are designed to control other devices electrically based on pressure and temperature input. Pressure switches can come in various configurations such as:

- Adjustable deadband (independent adjustable set and reset points) pressure switch operation
- Fixed deadband (adjustable set points and fixed reset points) pressure switch operation
- Two-stage fixed deadband (2 independent switches with adjustable set points and fixed reset points) pressure switch operation
- Limited adjustable deadband (adjustable set and reset points over a defined limited deadband) pressure and temperature switch operation
- Temperature switches use a sealed chemical system to actuate the switch based on temperature changes
- H Series miniature pressure switches 1/8" to 1/4"
- P Series midsize pressure and temperature switches 1/4" to 1/2"
- S Series industrial grade pressure switches 1/4"



**H Series Pressure Switches 1/8" - 1/4"**

Pipe Size (in)	Adjustable Operating Range (psi)	Deadband Range (psi)	Proof Pressure (psi)	Catalog Number and Ordering Code	Type of Operation	Approx. Shipping Weight (lbs.)
<b>Adjustable Deadband</b>						
1/8	4-12	1.6	250	HB46A215	Open Frame	0.8
	4-12	3.0	250	HB46A215L	Open Frame	0.8
	35-80	3.5	250	HB16A215	Open Frame	0.8
	20-50	2.4	250	HB26A215	Open Frame	0.8
	40-120	7.0	250	HC26A215	Open Frame	0.8
	80-100	10.0	250	HC16A215	Open Frame	0.8
	80-100	21.0	250	HC16A215L	Open Frame	0.8
1/4	4-12	1.6	250	HB40A214	General Purpose Enclosure	1.6
	4-12	1.6	250	HB46A214	Open Frame	0.8
	8-25	1.8	250	HB30A214	General Purpose Enclosure	1.6
	8-25	1.8	250	HB36A214	Open Frame	0.8
	20-50	2.4	250	HB26A214	Open Frame	0.8
	40-120	7.0	250	HC20A214	General Purpose Enclosure	1.6
	40-120	7.0	250	HC26A214	Open Frame	0.8

**P Series Pressure Switches 1/4"**

Transducer Pipe Size (in)	Switch Pressure Operating Range (psi)	Proof Pressure (psi)	Minimum Deadband (psi)	Separation Range (psi)	Enclosure Type	Pressure Switch Catalog Number and Order Code	Approx. Shipping Weight (lbs.)	Transducer Part Number and Order Code					Approx. Shipping Weight (lbs.)
								Air or Gas	Air, Gas, or Oil	Water, Air, Oil, or Gas	Corrosive Fluids		
								Nylon & NBR	AL & NBR	BR & NBR	All 316 SS	316 SS & FKM	
<b>Adjustable Deadband</b>													
1/4	2-18	60	1.8	-	GP	PA20A	2	-	RD20A11	RD20A21	-	-	1.0
	4-36	150	4.0	-	GP	PA20A	2	-	RE20A11	-	-	-	1.0
	6-60	150	5.4	-	OF	PA16A	1.3	RE10A71	-	RE10A21	-	-	1.0
	6-60	150	5.4	-	GP	PA10A	2	RE10A71	-	RE10A21	-	-	1.0
	6-60	150	5.4	-	WT	PA11B	2.5	RE10A71	-	RE10A21	-	-	1.0
	10-100	200	9	-	OF	PA16A	1.3	RF10A71	RF10A11	RF10A21	RF10A44	RF10A42	1.0
	10-100	200	9	-	GP	PA10A	2	RF10A71	RF10A11	RF10A21	RF10A44	RF10A42	1.0
	10-100	200	9	-	WT	PA11B	2.5	RF10A71	RF10A11	RF10A21	RF10A44	RF10A42	1.0
	20-200	400	18	-	OF	PA16A	1.3	-	RG10A11	RG10A21	-	-	1.0
	20-200	400	18	-	GP	PA10A	2	-	RG10A11	RG10A21	-	-	1.0
	20-200	400	18	-	WT	PA11B	2.5	-	RG10A11	RG10A21	-	-	1.0
	40-400	500	36	-	OF	PA16A	1.3	-	-	RJ10A21	-	-	1.0
40-400	500	36	-	GP	PA10A	2	-	-	RJ10A21	-	-	1.0	
40-400	500	36	-	WT	PA11B	2.5	-	-	RJ10A21	-	-	1.0	
<b>Fixed Deadband</b>													
1/4	30"HG-14	50	1"HG	-	OF	PB26A	2	-	-	RV24A21	-	-	1.0
	30"HG-14	50	1"HG	-	WT	PB21B	2.5	-	-	RV24A21	-	-	1.0
	0-9	60	.4	-	OF	PB36A	1.3	-	-	RD30A21	-	-	1.0
	0-9	60	.4	-	WT	PB31B	2.5	-	-	RD30A21	-	-	1.0
	2-18	60	.4	-	GP	PB20A	2	-	RD20A11	RD20A21	-	-	1.0
	2-18	60	.4	-	WT	PB21B	2	-	RD20A11	RD20A21	-	-	1.0
	2-18	60	.4	-	OF	PB26A	1.3	-	RD20A11	RD20A21	-	-	1.0
	2-18	100	.6	-	OF	PB36A	1.3	-	-	-	RE30A44	-	1.0
	2-18	100	.6	-	WT	PB31B	2.5	-	-	-	RE30A44	-	1.0
	4-36	150	.7	-	GP	PB20A	2	-	RE20A11	-	-	-	1.0
	4-36	150	.7	-	WT	PB21B	2	-	RE20A11	-	-	-	1.0
	4-36	150	.7	-	OF	PB26A	1.3	-	RE20A11	-	-	-	1.0
	6-60	150	.9	-	OF	PB16A	1.3	RE10A71	-	RE10A21	-	-	1.0
	6-60	150	.9	-	GP	PB10A	2	RE10A71	-	RE10A21	-	-	1.0
	6-60	150	.9	-	WT	PB11B	2.5	RE10A71	-	RE10A21	-	-	1.0
	10-100	200	1.5	-	OF	PB16A	1.3	RF10A71	RF10A11	RF10A21	RF10A44	RF10A42	1.0
	10-100	200	1.5	-	GP	PB10A	2	RF10A71	RF10A11	RF10A21	RF10A44	RF10A42	1.0
	10-100	200	1.5	-	WT	PB11B	2.5	RF10A71	RF10A11	RF10A21	RF10A44	RF10A42	1.0
	20-200	400	3.0	-	OF	PB16A	1.3	-	RG10A11	RG10A21	-	-	1.0
	20-200	400	3.0	-	GP	PB10A	2	-	RG10A11	RG10A21	-	-	1.0
	20-200	400	3.0	-	WT	PB11B	2.5	-	RG10A11	RG10A21	-	-	1.0
	40-400	500	6	-	OF	PB16A	1.3	-	-	RJ10A21	-	-	1.0
	40-400	500	6	-	GP	PB10A	2	-	-	RJ10A21	-	-	1.0
	40-400	500	6	-	WT	PB11B	2.5	-	-	RJ10A21	-	-	1.0
<b>Two-Stage Fixed Deadband</b>													
1/4	4-36	150	2.0	3.6	WT	PC21B	2.5	-	RE20A11	-	-	-	1.0
	6-60	150	2.4	6.0	GP	PC10A	2	RE10A71	-	RE10A21	-	-	1.0
	6-60	150	2.4	6.0	WT	PC11B	2.5	RE10A71	-	RE10A21	-	-	1.0
	10-100	200	4	10	GP	PC10A	2	RF10A71	RF10A11	RF10A21	RF10A44	RF10A42	1.0
	10-100	200	4	10	WT	PC11B	2.5	RF10A71	RF10A11	RF10A21	RF10A44	RF10A42	1.0
	20-200	400	8	20	GP	PC10A	2	-	RG10A11	RG10A21	-	-	1.0
	20-200	400	8	20	WT	PC11B	2.5	-	RG10A11	RG10A21	-	-	1.0
	40-400	500	16	40	GP	PC10A	2	-	-	RJ10A21	-	-	1.0
	40-400	500	16	40	WT	PC11B	2.5	-	-	RJ10A21	-	-	1.0
60-600	2000	30	60	WT	PC21B	2.5	-	-	-	-	-	1.0	
<b>Limited Adjustable Deadband</b>													
1/4	100-1000	5000	65-100	-	OF	-	1.3	-	-	RL10A21	-	-	1.0
	100-1000	5000	65-100	-	GP	PG10A	2	-	-	RL10A21	-	-	1.0
	600-6000	9000	300-500	-	OF	-	1.3	-	-	-	-	RQ10B42	1.0
	600-6000	9000	300-500	-	GP	PG10A	2	-	-	-	-	RQ10B42	1.0



### S Series Pressure Switches 1/4"

Pipe Size (in)	Adjustable Switch Operating Range (psi)	Proof Pressure (psi)	Minimum Deadband (psi)	Separation Range (psi)	Enclosure Type	Pressure Switch Catalog Number and Ordering Code	Approx. Shipping Weight (lbs.)	Transducer Part Number and Order Code			Approx. Shipping Weight (lbs.)
								Air, Gas, or Oil	Water, Air, Oil, or Gas	Corrosive Fluids	
								AL & NBR	BR & NBR	All 316 SS	
<b>Adjustable Deadband</b>											
1/4	1.0-18	100	1.1	-	GP	SA20D	3	TD20A11	-	-	1.0
	1.0-18	100	1.1	-	WT	SA21D	3	TD20A11	-	-	1.0
	1.5-36	150	2.2	-	GP	SA20D	3	TE20A11	-	-	1.0
	1.5-36	150	2.2	-	WT	SA21D	3	TE20A11	-	-	1.0
	2-60	150	3.6	-	GP	SA10D	3	-	TE10A21	-	1.0
	2-60	150	3.6	-	WT	SA11D	3	-	TE10A21	-	1.0
	2-60	150	3.6	-	EF	SA12D	3.5	-	TE10A21	-	1.0
	3-100	200	6.0	-	GP	SA10D	3	TF10A11	TF10A21	TF10A44	1.0
	3-100	200	6.0	-	WT	SA11D	3	TF10A11	TF10A21	TF10A44	1.0
	3-100	200	6.0	-	EF	SA12D	3.5	TF10A11	TF10A21	TF10A44	1.0
	6-200	400	12	-	GP	SA10D	3	-	TG10A21	-	1.0
	6-200	400	12	-	WT	SA11D	3	-	TG10A21	-	1.0
6-200	400	12	-	EF	SA12D	3.5	-	TG10A21	-	1.0	
<b>Fixed Deadband</b>											
1/4	2-60	150	1.5	-	EF	SB12D	3.5	-	TE10A21	-	1.0
	3-100	200	2.5	-	WT	SB11D	3	TF10A11	TF10A21	TF10A44	1.0
	3-100	200	2.5	-	EF	SB12D	3.5	TF10A11	TF10A21	TF10A44	1.0
	6-200	400	5.0	-	WT	SB11D	3	-	TG10A21	-	1.0
	6-200	400	5.0	-	EF	SB12D	3.5	-	TG10A21	-	1.0
<b>Two-Stage Fixed Deadband</b>											
1/4	2-60	150	2.2	6	WT	SC11D	3	-	TE10A21	-	1.0
	3-100	200	3.5	10	WT	SC11D	3	TF10A11	TF10A21	TF10A44	1.0
	6-200	400	7.0	20	WT	SC11D	3	-	TG10A21	-	1.0
<b>Manual Reset on Decreasing Pressure</b>											
1/4	2-60	150	3.6	-	GP	SD10D	3	-	TE10A21	-	1.0
	3-100	200	6.0	-	GP	SD10D	3	TF10A11	TF10A21	TF10A44	1.0
	6-200	400	12	-	GP	SD10D	3	-	TG10A21	-	1.0

### P Series Temperature Switches 1/2"

Pipe Size (in)	Adjustable Operating Range °F	Rated Overrange Temp °F	Deadband Type	Deadband Range °F	Temperature Switch Catalog Number and Order Code		Temperature Transducer Catalog Number and Order Code	
					Open Frame	General Purpose	Copper	316 SS
1/2	50-160	260	Limited Adjustable	6-12	-	PG10A	KF10A1	-

Order Code	Description
PP03	P Series Mounting Bracket
QP01	Temperature Transducer 1/2" Brass S Union
SP02	S Series Pressure Switch Adjustment Nut Cover
TA31A11	S Series Replacement Pressure Transducer

### How to Order P and S Series Pressure Switches

1. Review the operating specifications.
2. Select the Pressure Switch Order Code corresponding to the desired operation.
3. **Read across** and select the Transducer **Order Code** for the compatible fluid.
4. Pressure Switch and Transducer unit have to be ordered separately.
5. The third digit of each of the catalog numbers must be identical e.g., PA36A and RD30A11.

Components will ship separate; minor field assembly is required.

## Accessories – Flow control device accessories designed to optimize your flow control process.

- Flow Control Devices – Limit volume of media flow
- Pipe Line Strainers – Prevent contaminant from flowing downstream
- Quick Exhaust/Shuttle Valves – High flow interim valve for faster air flow
- Check Valves – Prevent reverse direction media flow
- DIN Connectors – Used with ASCO DIN solenoids to reduce installation and maintenance time
- Electronic Timer – Electric signal control based on adjustable timing inputs
- Muffler – Exhaust noise suppression device and debris prevention

### Adjustable Flow Control

Pipe Size (in)	Orifice Size (in)	Cv Flow Factor		Opening Pressure (psi)	Maximum Operating Pressure Differential (psi) Air-Inert Gas, Water, and Light Oil	Max. Fluid Temp. °F	Catalog Number	Order Code
		Meter Flow	Free Flow					
<b>Forged Brass Body</b>								
1/4	3/8	.22	1.2	1	300	180	V022A001	00038
3/8	3/8	.90	1.4	1	300	180	V022 002	00035
1/2	7/16	1.2	2.6	1	300	180	V022 003	00036



### Pipe Line Strainer

Pipe Size (in)	Cv Flow Factor	Screen Mesh Size	Total Free Hole Area (in.²)	Particle Retention Size		Blow-Off Pipe Size (in)	Max. Fluid Temp. °F	Safe Working Pressure (psi)	Catalog Number	Order Code
				Microns	Inches					
<b>CA Body with Stainless Steel Strainer Element and NBR Seals</b>										
①	.50	80x80	.116	178	.007	-	130	175	PKG8604 002	02160
<b>Forged Brass Body with Stainless Steel Strainer Element and PTFE or FKM Seals</b>										
1/4	1.7	60x60	.325	155	.0061	-	400	750	8600A002	02141
1/2	2.6	100x100	.50	140	.0055	-	400	750	8600A014	02143
3/4	4.7	100x100	.75	140	.0055	-	400	750	8600A015	02144

① 1/4" OD compression fittings not supplied.



### Quick Exhaust/Shuttle Valves

Pipe Size (in)	Cv Flow Factor		Opening Pressure (psi)	Maximum Operating Pressure Differential (psi)	Max. Air Temp. °F	Catalog Number	Body Material	Order Code
	Pressure to Cylinder	Cylinder to Exhaust						
1/4	0.8	1.0	5	125	125	V043 006	ZN	00044
1/4	2.0	2.0	5	125	125	V043 001	ZN	00039
3/8	3.5	4.5	5	125	125	V043 002	ZN	00040



### Check Valves

Pipe Size (in)	Orifice Size (in)	Cv Flow Factor	Opening Pressure (psi)	Maximum Operating Pressure Differential (psi) Air-Inert Gas, Water, and Light Oil	Max. Fluid Temp. °F	Catalog Number	Order Code
1/4	9/32	.70	1	150	200	V012 001	00028
3/8	3/8	1.2	1	150	200	V012 002	00029
1/2	7/16	2.5	1	150	200	V012 003	00030
3/4	1/2	3.6	1	150	200	V012 004	00031



### Din Connectors

Description	Orientation	Rotatable	Order Code
<b>Size 11 mm, Form B</b>			
1/2" conduit	Ground Down	180°	290413-001
PG 9 cable gland ①	Ground Down	180°	290414-001
<b>Size 18 mm, Form A</b>			
1/2" conduit	Ground Down	90°	290410-001
PG 11 cable gland	Ground Down	90°	290411-001
6' leads with North American outlet plug	Ground Up	-	272852
PG 11 cable gland for ASCO Timer Drain Valve	Ground Up	90°	272873

① Available in 10 pack as order code 226061-001-\*



### Electronic Timer

Supply Voltage	Max. Current Consumption	Max. Ambient Temp. °F	Switch Capacity	Inrush Current Capacity	Repeat Accuracy	Scale Accuracy	Adjustable On Time	Adjustable Off Time	Catalog Number and Order Code
24-240V AC/DC 50/60 Hz	4 mA	122	1 Amp	10 Amps for 10 mSec	+/- 0.1%	+/- 10%	2 - 40 Sec	30 Sec to 45 Min	272839-001



### Muffler

Pipe Size (in)	Body Material	Catalog Number and Order Code
1/8	BR	264645-001
1/4	BR	264645-002



### Prefix/Suffix Definitions

Prefix	
D	Shielded Core Design
EF	Explosionproof Enclosure
EV	Explosionproof Enclosure in Stainless Steel
HB	High Temperature Leaded Coil, Class H
HC	Battery Charging Circuits (125 or 250 DC), Class H
HT	High Temperature Leaded Coil, Class H
IS	Intrinsically Safe
J	Wiring Box
JB	Wiring Box with Leads
KF	Screw Terminals, Class F
OF	Open Frame Enclosure
P	Panel Mount
SC	DIN Enclosure (ISO 4400/DIN 43650), Class F (Class H High Temperature for 2, 11, 11.9, 17, and 22.9 watts)
SD	DIN Enclosure (ISO 4400/DIN 43650), Class F
SF	Spade Coil, Class F
SM	Spade Coil, Class B
SP	Spade Enclosure, Class F
SU	DIN Enclosure (ISO 4400/DIN 43650), High Temperature, Class H
U	Open Frame Enclosure
WB	Thermoplastic Encapsulated Watertight Junction Box
WT	Watertight Enclosure
X	Special Construction, varies with TPL number

Suffix	
B	LP Gas Service
C	Position Indication Switch
E	Ethylene Propylene (EPDM)
F	Valve Operation Type (Normally Closed)
HW	Hot Water Construction
L	Metal Seat
LT	Low Temperature Construction
M	Metered Flow Control
MO	Manual Operator, Momentary
MS	Manual Operator, Screw Type
N	Oxygen Service
P	Dry Gas, Non-Lubricated Air
Q	Long Life, Quiet Design
R	Resilient Seating
T	Polytetrafluorethylene (PTFE)
U	Valve Operation Type (Universal)
V	Fluorocarbon (FKM)
VH	Vacuum (High) Construction
VI	Visual Indicator
VM	Vacuum Service (Medium)

## Coil Specifications

Maximum Ambient Temperature Ratings for ASCO Coils ①					
Wattage ③	UL Approved Class F Temp. °F	Design Limit Class F Temp. °F	UL Approved Class H Temp. °F	Design Limit Class H Temp. °F	UL Approved and Design Limit Type 7 & 9 Temp. °F ②
0.5	-	-	-	158	-
0.65	-	-	-	77	-
1.6	122	122	-	-	-
2.0	-	-	-	158	-
2.5	140	140	-	-	-
3.0	125	125	-	-	-
5.9	125	125	-	-	-
6.0	-	-	125	125	-
6.1	125 ④	245	140	284	140
6.3	135	135	-	-	104
6.5	104	104	-	-	-
6.9	77	77	131 ④	131 ④	104
9.1	125 ④	173	-	-	-
10.0	140	140	-	-	-
10.1	125 ④	245	140	284	140
11.2	140	140	-	-	-
10.6	125	125	131 ④	131 ④	104
11.6	104	104	131 ④	131 ④	104
12.0	131	131	-	-	104
12.1	-	125	-	-	-
13.8	-	125	-	140	-
14.9	77	77	104	104	-
15.4	77	171	104	213	104
16.1	-	-	140	284	140
16.7	104	104	104	104	104
17.1	131 ④	245	-	212	140
20.0	77	125	-	-	104
20.1	-	173	-	212	140
22.6	104	104	131 ④	131 ④	-
24.6	-	-	104	104	104
28.0	-	-	-	-	104
28.2	125	125	-	-	-
30.6	-	-	77	-	104

① Temperature ratings based on fluids at standard temperature.  
 ② 104°F for Zone G.  
 ③ For information on 0.44 and 1.4 watt valves please see Catalog 35.  
 ④ 131°F for 8262H, 8263H, and 8314H series only.

## Abbreviations and Symbols

Abbreviation Descriptions	
AL	Aluminum
BR	Brass
BZ	Bronze
CA	Acetal, Celcon, Delrin
EPDM	Ethylene Propylene
FKM	Fluorocarbon Elastomer
GP	General Purpose (Enclosure Type)
LED	Light Emitting Diode
NBR	Nitrile Butylene
NC	Normally Closed (Operation Type)
NO	Normally Open (Operation Type)
NPBR	Nickel Plated Brass
OF	Open Frame (Enclosure Type)
PA	Poly Amide
PA+FV	Glass Filled Poly Amide
PBT	Polybutylene Terephthalate
PC	Polycarbonate
PE	Polyethylene
PEEK	Polyetheretherketone
PL	Plastic
PTFE	Polytetrafluoroethylene
POM	Poly Oxymethylene
SPDT	Single Pole Double Throw (Mechanical Switch Type)
SS	Stainless Steel
U	Universal (Operation Type)
UNF	Unified National Fine (Thread type)
UR	Urethane
VDR	Varistor for Surge Suppression
WT	Watertight (Enclosure Type)
ZN	Zinc
○	Safety Shutoff
●	General Service
□	Recognized Solenoid

## General Information on Elastomer Materials Frequently Used

### NBR (Buna “N”, Nitrile)

NBR is commonly referred to as a nitrile rubber and is the standard synthetic elastomer for accomplishing resilient-type seating or sealing in ASCO valves. It has excellent compatibility for most air, water, and light oil applications. It has a useful temperature range of 0°F to 180°F (-18°C to 82°C).

### EPDM (Ethylene Propylene)

EPDM is selected for applications above the NBR temperature range, such as handling hot water and steam. Ethylene propylene has an extremely wide range of fluid compatibility, but has the distinct disadvantage that it cannot be used with petroleum-based fluids or contaminated fluids (such as lubricated air). It has a useful temperature range of -10°F to 300°F (-23°C to 149°C).

### FKM

FKM is a fluorocarbon elastomer primarily developed for handling such hydrocarbons as jet fuels, gasolines, solvents, etc., which normally cause detrimental swelling to NBR. FKM has a high temperature range similar to EPDM, but with the advantage of being somewhat more resistant to “dry heat.” FKM has a wide range of chemical compatibility. It has a useful temperature range of 0°F to 350°F (-18°C to 177°C).

### PTFE

PTFE, and PTFE with fillers are considered more a plastic than a resilient-type material. They are virtually unattacked by any fluid. Their temperature usage has ranged from discs for cryogenic valves to discs for steam valves. They are not easily fabricated and are known to have “cold flow” characteristics which may contribute to objectionable leakage, particularly on gases.



## Global Contacts

### Australia

Tel (61) 2-9-451-7077

### Brazil

Tel (55) 11-4208-1700

### Canada

Tel (1) 519-758-2700

### China

Tel (86) 21-3395-0000

### France

Tel (33) 1-47-14-32-00

### Germany

Tel (49)-7237-9960

### Japan

Tel (81) 798-65-6361

### Mexico

Tel (52) 55-5809-5640

### Singapore

Tel (65) 6556-1100

### United Kingdom

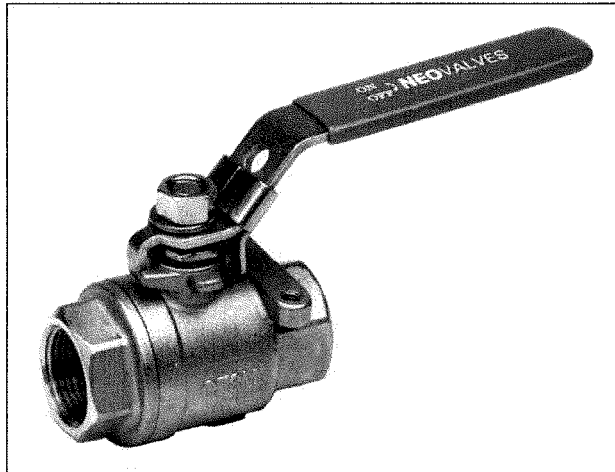
Tel (44) 1695-713600



# STAINLESS STEEL BALL VALVES

## Two-Piece Full Bore

CAT. NO. 2500

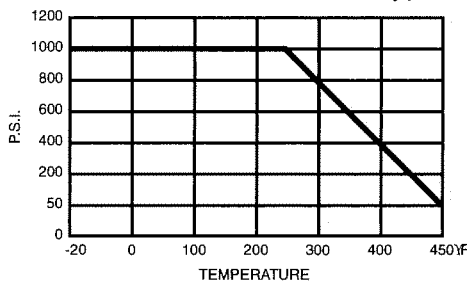


- For chemical and industrial applications
- Adjustable stem packing
- Design for easy actuator mounting
- Blow-out-proof stem design
- Body and end caps quality investment casting
- Padlocking Devices
- SUITABLE FOR ACTUATION
- **CSA 3.16 Certified** (minus 40°C) for Natural and Propane Gas. (Sizes 1/4" - 2")

### SPECIFICATIONS

- Pressure Rating: 2000 psi WOG 1/4" to 1"  
1500 psi WOG 1 1/4" to 2"  
1000 psi WOG 2 1/2" to 3"
- End Types: NPT

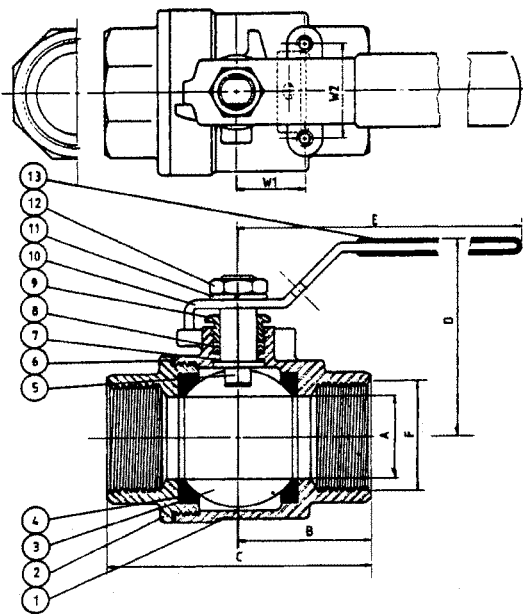
CAT. NO. 2500  
Full Bore 1/4" - 3"



### Material List

No.	Part Name	Specification	QTY.
1	Body	ASTM-A351-GRADE-CF8M	1
2	End Cap	ASTM-A351-GRADE-CF8M	1
3	Ball	ASTM-A351-GRADE-CF8M	1
4	Seat	TFM1600 * or RPTFE	2
5	Stem	SS316	1
6	Joint Gasket	TEFLON	1
7	Thrust Washer	REINFORCED TFE *	1
8	Stem Packing	TEFLON	1 Set
9	Packing Gland	SS304	1
10	Handle	SS304	1
11	Stem Washer	SS304	1
12	Stem Nut	SS304	1
13	Locking Cover	PLASTIC	1
	Locking Device	SS304	

\* TFM 1600 on sizes 1/4" - 2"



### DIMENSIONS (mm)

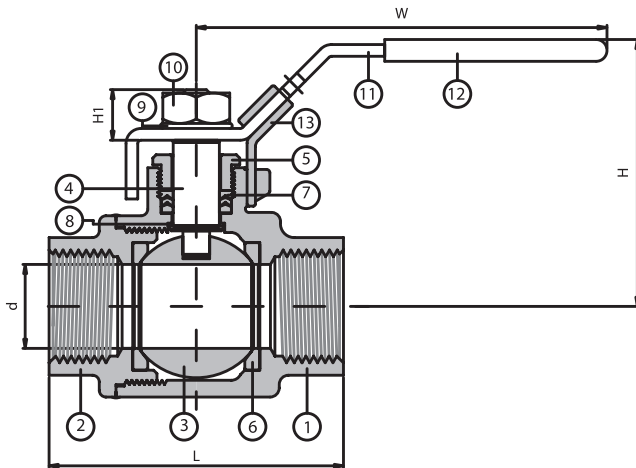
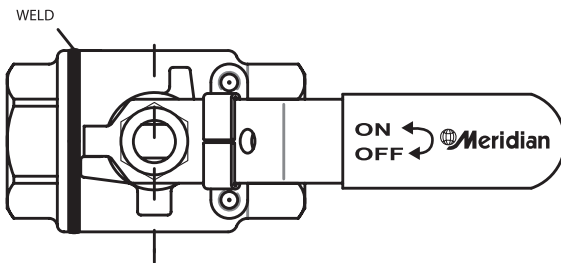
Size	A	B	C	D	E	W1	W2	F	Cv Factor
1/4"	11.6	27.5	55	50	96	12.7	28.5	1/4" NPT	6
3/8"	12.7	27.5	55	50	96	12.7	28.5	1/4" NPT	7
1/2"	15	32.5	65	53	96	12.7	28.5	1/2" NPT	10
3/4"	20	38.5	77	64	125	22.4	35	3/4" NPT	25
1"	25	44	88	66	125	22.4	35	1" NPT	35
1 1/4"	32	51	102	79	170	25.4	38.1	1 1/4" NPT	46
1 1/2"	38	55	110	83	170	25.4	38.1	1 1/2" NPT	80
2"	50	63	126	94	170	25.4	38.1	2" NPT	110
2 1/2"	65	81.5	161.5	130	250	N/A	58	2 1/2" NPT	310
3"	80	89	178	148	250	N/A	70	3" NPT	360



# Meridian™ Ball Valve

Model #: MAC2CF

## 2000 WOG 2-PIECE FULL BORE



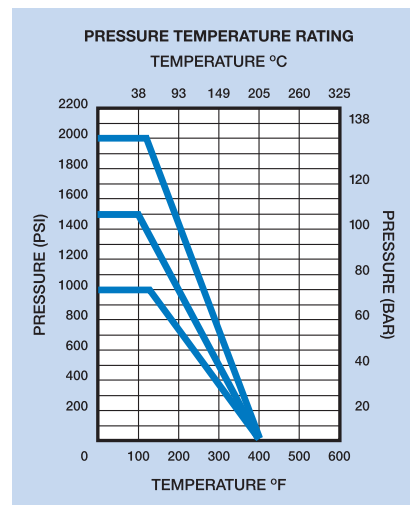
### FEATURES

- ASME B16.34 design
- Threaded ends conform to ASME B1.20.1 (NPT)
- Seal welded body
- Investment casting
- Blow-out proof stem
- 2000 psi (1/4" to 1") CL 800
- 1500 psi (1 1/4" to 2") CL 600
- 1000 psi (2 1/2" to 3") CL 400
- Glassfibre filled PTFE seats
- PTFE packing
- Latch lock handle
- Mounting pad
- Sour / NACE Service

ITEM	PARTS	MATERIAL
1	BODY	ASTM A216-WCB
2	END CAP	ASTM A216-WCB
3	BALL	ASTM A351-CF8M
4	STEM	ASTM A276-316
5	GLAND RING	AISI 304
6	BALL SEAT	R-PTFE
7	PACKING	PTFE
8	THRUST WASHER	PTFE
9	SPRING WASHER	AISI 304
10	NUT	AISI 304
11	HANDLE	AISI 304
12	HANDLE SLEEVE	PVC
13	LOCK DEVICE	AISI 304

DN	d	L	H	H1	W	Cv
8	11.6	60.5	53.6	10.5	102	10
10	12.8	60.5	53.6	10.5	102	10
15	15	62.5	57	10.5	102	12
20	20.2	77	62.1	13.5	124	35
25	25.6	90	80	15.7	165	60
32	32	100	83.7	15.7	165	100
40	38	118.2	99	17	188	150
50	50.8	138	106.9	17	188	250
65	65.5	167	141.9	27.5	250	400
80	80	193	152.8	27.5	250	600

NPS	d	L	H	H1	W	Cv
1/4"	0.46	2.38	2.11	0.41	4.02	10
3/8"	0.50	2.38	2.11	0.41	4.02	10
1/2"	0.59	2.46	2.24	0.41	4.02	12
3/4"	0.80	3.03	2.44	0.53	4.88	35
1"	1.01	3.54	3.15	0.62	6.50	60
1-1/4"	1.26	3.94	3.30	0.62	6.50	100
1-1/2"	1.50	4.65	3.90	0.67	7.40	150
2"	2	5.43	4.21	0.67	7.40	250
2-1/2"	2.58	6.57	5.59	1.08	9.84	400
3"	3.15	7.6	6.02	1.08	9.84	600



Canada's Valve Specialist

DUE TO CONTINUOUS DEVELOPMENT OF OUR PRODUCTS, WE RESERVE THE RIGHT TO MODIFY OUR PRODUCT DESIGN OR CONSTRUCTION WITHOUT PRIOR NOTICE.

## Carbon Steel

WGI Packer Series offers a compact valve at a very competitive price. The carbon steel valve comes with standard NACE MR0175 approved and carry a traceable number stamped on each valve.

## Specifications

### Sizes

1/8" to 1"

### Maximum Operating Pressure

6000 psi Tested at 10,000 psi

### Body & Bonnet Material

ASME - A175SN

### Stem Material

ASME - SA - 479

### Stem Packing

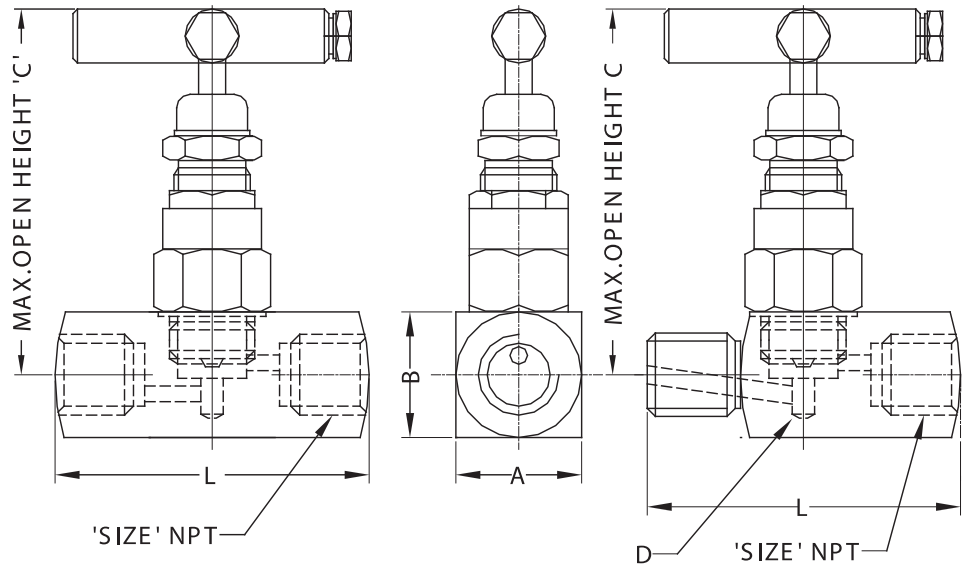
ASTM SA479

### Stem

Non Rotating Tip – 1/2" NPT and larger

### Temperature Rating

-40° to 500°F (-40 to 250°C)



### Dimensions: mm

Part No.	Size	Pattern	Ends	Material	A	B	C	L	D
WN1611PN	1/8"	G	FXF	CS NACE	22	22	62	54	3.2
WN1612PN	1/4"	G	FxF	CS NACE	22	22	74	54	3.2
WN1613PN	3/8"	G	FXF	CS NACE	28.5	28.5	85	68	3.2
WN1614PN	1/2"	G	FxF	CS NACE	28.5	28.5	85	76.2	3.2
WN1616PN	3/4"	G	FXF	CS NACE	35	35	89	68	6
WN1618PN	1"	G	FXF	CS NACE	45	45	91	76.2	6
WN1631PN	1/8"	G	MXF	CS NACE	22	22	62	54	3.2
WN1632PN	1/4"	G	MxF	CS NACE	22	22	62	54	3.2
WN1633PN	3/8"	G	MXF	CS NACE	28.5	28.5	85	76.2	3.2
WN1634PN	1/2"	G	MxF	CS NACE	28.5	28.5	85	76.2	3.2
WN1635PN	1/2" x 1/4"	G	MXF	CS NACE	28.5	28.5	85	76.2	3.2
WN1636PN	3/4"	G	MXF	CS NACE	35	35	89	76.2	6
WN1637PN	3/4" x 1/2"	G	MxF	CS NACE	30	30	78	76.2	4.2
WN1638PN	1"	G	MXF	CS NACE	45	45	112	90	6
WN1639PN	1" x 1/2"	G	MXF	CS NACE	45	45	112	90	9

'D' ORIFICE DIAMETER



## Stainless Steel

WGI Stainless Packer Series offers all the same features as the carbon steel series but give you the extra protection for any outdoor or extreme applications.

### Specifications

#### Sizes

1/8" to 1"

#### Maximum Operating Pressure

6000 psi Tested at 10,000 psi

#### Body & Bonnet Material

ASME - SA - 479

#### Stem Material

ASME - SA-479

#### Stem Packing

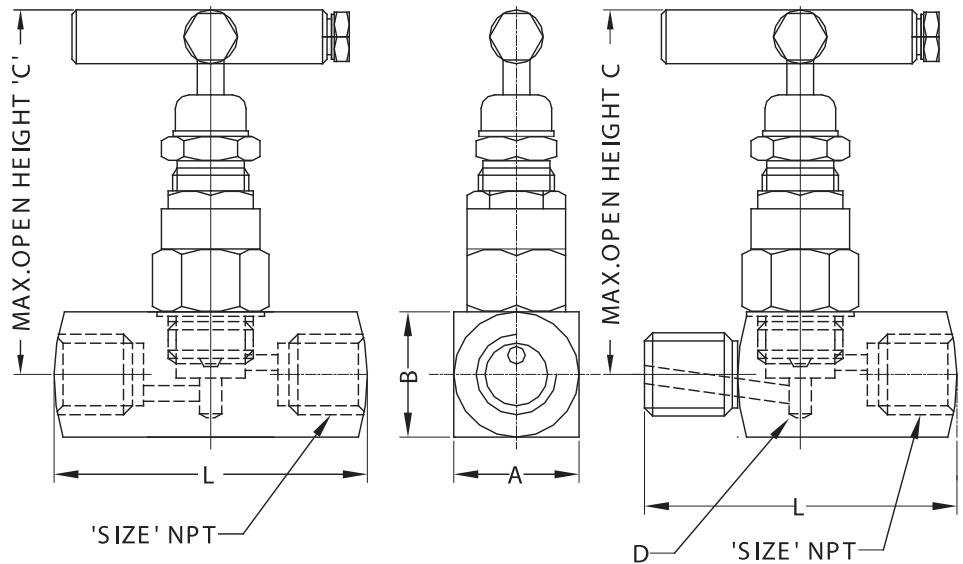
PTFE Teflon®

#### Stem

Non Rotating TIP – 1/2" NPT and larger

#### Temperature Rating

-40° to 500°F (-40 to 250°C)



'D' ORIFICE DIAMETER

### Dimensions: mm

Part No.	Size	Pattern	Ends	Material	A	B	C	L	D
WN1411PN	1/8"	G	FXF	CS NACE	22	22	62	54	3.2
WN1412PN	1/4"	G	FxF	CS NACE	22	22	74	54	3.2
WN1413PN	3/8"	G	FXF	CS NACE	28.5	28.5	85	68	3.2
WN1414PN	1/2"	G	FxF	CS NACE	28.5	28.5	85	76.2	3.2
WN1416PN	3/4"	G	FXF	CS NACE	35	35	89	68	6
WN1418PN	1"	G	FXF	CS NACE	45	45	91	76.2	6
WN1431PN	1/8"	G	MXF	CS NACE	22	22	62	54	3.2
WN1432PN	1/4"	G	MxF	CS NACE	22	22	62	54	3.2
WN1433PN	3/8"	G	MXF	CS NACE	28.5	28.5	85	76.2	3.2
WN1434PN	1/2"	G	MxF	CS NACE	28.5	28.5	85	76.2	3.2
WN1435PN	1/2" x 1/4"	G	MXF	CS NACE	28.5	28.5	85	76.2	3.2
WN1436PN	3/4"	G	MXF	CS NACE	35	35	89	76.2	6
WN1437PN	3/4" x 1/2"	G	MxF	CS NACE	30	30	78	76.2	4.2
WN1438PN	1"	G	MXF	CS NACE	45	45	112	90	6
WN1439PN	1" x 1/2"	G	MXF	CS NACE	45	45	112	90	9

WGI mini series offers a compact size with both hard and soft seat options. For any application where size and price are important.

## Specifications

### Sizes

1/8" & 1/4" NPT

### Maximum Operating Pressure

6000 psi

### Body & Bonnet Material

ASTM - A - 105 / ASTM - A - 479

### Stem Material

ASTM - A - 105

### Stem Packing

PTFE Teflon®

### Stem

Rotating

### Seat Material (WN06 & WN04 Series)

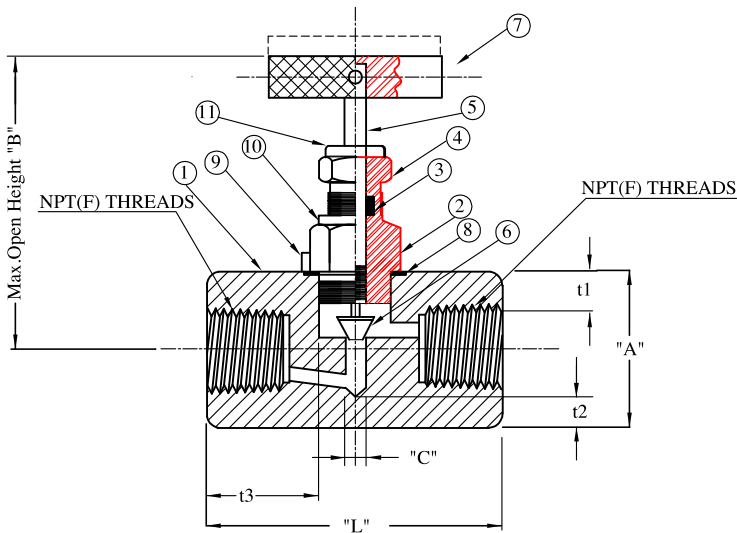
PTFE Teflon®

### Temperature Rating

-40° to 500°F (-40 to 250°C)



## WGI Miniature Needle Valves F X F - Hard Seat



No.	Description	QTY.	Material
1	Body	1	C.S-ASTM A105/ SS316-ASTM A479
2	Gland Body	1	C.S-ASTM A105/ SS316-ASTM A479
3	Gland Seal	1	PTFE/GRAFOIL
4	Hex Nut	1	C.S-ASTM A105/ SS316-ASTM A479
5	Spindle	1	SS316-ASTM A479
6	Tip	1	SS316-ASTM A479
7	Handle	1	C.S-ASTM A105/ SS316-ASTM A479
8	Washer	1	C.S-ASTM A105/ SS316-ASTM A479
9	Lock Pin	1	C.S-ASTM A105/ SS316-ASTM A479
10	Identification Ring	1	Aluminum
11	Dust cap	1	AL./PLASTIC

### Dimensions: mm

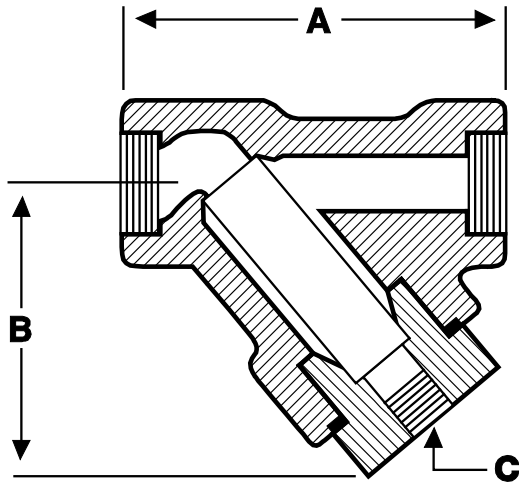
Part No.	Size NPT	Ends	Material	A	B	C	L	t2	t3
WN 0511	1/8"X1/8"	F X F	C.S-ASTM A105	22.0	62.0	3.2	48.26	6.25	17.80
WN 0311	1/8"X1/8"	F X F	SS316-ASTM A479	22.0	62.0	3.2	48.26	6.25	17.80
WN 0512	1/4"X1/4"	F X F	C.S-ASTM A105	22.0	62.0	3.2	48.26	6.25	17.80
WN 0312	1/4"X1/4"	F X F	SS316-ASTM A479	22.0	62.0	3.2	48.26	6.25	17.80

Pressure rating 6000 PSI  
Temperature Rating 100°F

# ALTA

**MODEL YS 3000  
CLASS 3000 CARBON STEEL  
SCREWED / SOCKET WELD  
"Y" STRAINER**

**DRAWING A 101**



DESCRIPTION	MATERIAL
BODY	ASTM A105 N
CAP	ASTM A105 N
GASKET	SPIRAL WOUND SS
SCREEN	304 SS 1/32 PERF

TEMPERATURE		WORKING PRESSURE	
C	F	kPa	P.S.I.
-29 to 38	-20 to 100	20670	3000
95	200	18844	2735
150	300	18292	2655
200	400	17672	2565
260	500	16708	2425

**ALL STRAINERS ARE INDIVIDUALLY HYDROSTATICALLY TESTED TO ANSI B16.5**

SIZE		DIMENSIONS						NET WEIGHT	
		A		B		C			
mm	in.	mm	in.	mm	in.	mm	in.	Kg.	Lbs
15	1/2	79	3 1/8	83	3 1/4	10	3/8	.9	2
20	3/4	95	3 3/4	85	3 3/8	10	3/8	1.4	3
25	1	117	4 5/8	89	3 1/2	15	1/2	1.8	4

## FEATURES

**BODY HAS A MACHINED SEAT TO HOLD SCREEN SECURELY.**

**CAP HAS A MACHINED SCREEN HOLDER TO ALIGN SCREEN DURING INSTALLATION AND TO RETAIN SEDIMENT WHEN CAP IS REMOVED.**

**BODY IS MACHINED TO HOLD CAP GASKET IN A BLOW-OUT PROOF DESIGN.**



## 6.0 Process Coils

### 6.1 Travel Sheet

**TRAVEL SHEET - HEATER COILS**

Authorized Inspector to be given Travel Sheet prior to construction so that he can indicate hold points.

C.R.N.	SERIAL #	DATE FUNCTION COMPLETED & INSPECTOR'S INITIALS		
Y6789.2	C3964A.CB			
ITEM	COMMENTS	Q.C.	A.I.	3RD PARTY
Travel Sheet Accepted Calculations in File		DS Mar 28/18	WJH APR 06 2018 R. WJH APR 13 2018	
Material checked against Bill of Materials		DS Mar 28/18	WJH APR 06 2018	
Heat #'s Recorded Mill Test Checked		DS Apr 6/18		
Impact Tests		N/A		
Welder's I.D. checked, WPS Checked,	L	DS Mar 29/18	WJH APR 06 2018 WJH APR 06 2018	NO ID
Welder Qualified, Weld Sizes Checked		DS Apr 4/18	WJH APR 06 2018 WJH APR 06 2018	R Apr 11/18
Radiographs		DS Apr 5/18	WJH APR 06 2018	R Apr 11/18
Other N.D.E.		N/A		
External Prior to P.W.H.T.		DS Apr 5/18	WJH APR 06 2018	
Hydrostatic Test	2160 psig	DS Apr 11/18	W H APR 11/18	R Apr 11/18
Final External Inspection		N/A		
P.W.H.T. Chart Checked		DS Apr 11/18	R APR 13 2018	
Nameplates Stamping		DS Apr 13/18	R APR 13 2018	
Data Reports (AB-28)		DS Apr 13/18	H APR 13 2018	
Release of Approved Drawings	C-3964-A4 Rev 1	DS Mar 8/18		

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



6.2 AB 28



the pressure equipment safety authority

# MANUFACTURER'S DATA REPORT FOR INDIRECT FIRED HEATER COILS

AB-28 2016-03

PARTIAL

A# 672696

Manufactured By: Rushton Gas & Oil Equipment Ltd. 2331-121 Ave NE Edmonton, AB T6S 1B2

Manufactured For: HAMMERHEAD RESOURCES INC. Watermark Tower Suite 810, 530-8th Avenue SW Calgary. AB T2P 3S8

Ultimate Owner: HAMMERHEAD RESOURCES INC. Watermark Tower Suite 810, 530-8th Avenue SW Calgary. AB T2P 3S8

Location of Installation: LSD: 01-16-65-03 W6M

Manufacturer's Serial No.	Construction Drawing No.	CODE: ASME B31.3		Year Built
C3964A.CB	C-3964-A4 Rev 1	Edition	2016	2018

### CONSTRUCTION

Coil ID/Purpose	Design Pressure	Design Temp	Design Minimum Temp	Corrosion Allowance	Registered Drawing No.	CRN
a PROCESS HEATING COIL 1 to 6	1440 PSIG	250°F	-20°F	0.125"	C-3964-A4 REV B	Y6789.2
b						
c						
d						
e						

### COIL

	Tubes			End Closures				Openings		
	Mat'l Spec.	Diameter	Thickness	Return Bend		Flanges		Mat'l Spec.	Size/Type	Rating
				Mat'l Spec.	Thickness	Mat'l Spec.	Rating			
a	SA-106B	NPS 4	0.337"	SA-234-WPB	0.337"	SA-105N RFWN	CL 900	N/A	N/A	N/A
b										
c										
d										
e										

### HEADERS/MANIFOLDS

	Purpose	Size	Shell		Ends			Openings		
			Mat'l Spec.	Thickness	Mat'l Spec.	Thickness	No	Mat'l Spec.	Size/Type	Rating
f	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
g	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

### TEST PRESSURE, NDE, POSTWELD HEAT TREATMENT AND SIZE

	Hydrostatic Test Pressure	Radiography (100% or % Random)	Other NDE (MT) (PT) (UT)	Postweld Heat Treatment		Overall Length	Heating Surface	Volume
				Temp.	Time			
a	2160 PSIG	100%	N/A	1150°F	60 MINS	76.67 ft EACH	90.25 sq.ft. EACH	6.12 cu.ft. EACH
b								
c								
d								
e								
f								
g								

IMPACT TESTING: Impact Test exempt per table 323.2.2A

REMARKS: PSV installed by others.

### CERTIFICATE OF COMPLIANCE

We certify that the statements in this report are correct and that all details of design, material, construction, and workmanship of this coil bundle are in accordance with the above Provincial Registered Design.

Date Apr 13/18 Signed [Signature] For Rushton Gas & Oil Equipment Ltd.  
(Representative) (Manufacturer)

### CERTIFICATE OF SHOP INSPECTION

I, the undersigned, a duly authorized boiler and pressure vessel inspector employed by Alberta Boilers Safety Association (ABSA) of Alberta have inspected the above Heater Coils and state that, to the best of my knowledge and belief, the constructed is in accordance with the Alberta Safety Codes Act and Regulations. By signing this certificate, neither the inspector nor his or her employer makes any warranty, expressed or implied, concerning the vessel described in this manufacturer's data report. Furthermore, neither the inspector nor his or her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date APR 13 2018 Signed Monica Parker  
NB 14446 AB-422 D00006748 [Signature]



## 6.3 Registration AB



March 28, 2018

**Attention:** Rick Crook  
RUSHTON GAS & OIL EQUIPMENT (1991) LTD  
2331 121 AVENUE NE  
EDMONTON, AB T6S 1B2

**Email:** RCrook@rushton.ca

The design submission, tracking number 2018-01555, originally received on March 09, 2018 was surveyed and accepted for registration as follows:

**CRN :** Y6789.2

**Accepted on:** March 28, 2018

**Reg Type:** NEW DESIGN

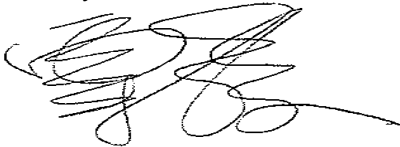
**Drawing No. :** C-3964-A4 Rev B

<b>Description</b>	<b>MAWP</b>	<b>Design Temperature</b>	<b>MDMT</b>
Internal Pressure	10735kPa	121 °C	-29 °C

An invoice covering survey and registration fees will be forwarded from our Revenue Accounts.

If you have any question don't hesitate to contact me by phone at (780) 433-0281 or fax (780) 437-7787 or e-mail su@absa.ca.

Sincerely,



SU, YI  
DOP Cert. No. D00008398



## 6.4 Name Plate

CONST

W

CERTIFIED BY



HT

**RUSHTON**

RT 100%

EDMONTON ALBERTA

MAWP 1440 Psig

AT 250 °F

— Psig

AT — °F

MDMT -20 °F

AT 1440 Psig

JOB# C3964A

S/N C3964A.CB

YR BT 2018

CRN V6789.2

**A#**

Ⓐ 672696

MIN HD —

NOM SH 0.337

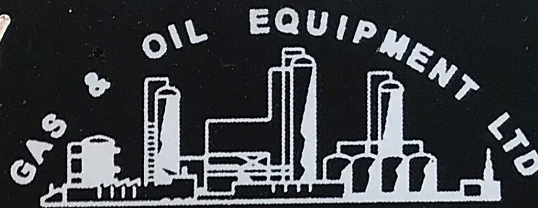
CA 0.125

57 ✓

CONST

W

CERTIFIED BY



RUSHTON

EDMONTON ALBERTA

HT

RT

100%

MAWP

1440 Psig

AT

250

°F

- Psig

AT

-

°F

MDMT

- 20 °F

AT

1440

Psig

JOB#

C3964A

S/N

C3964A.CB

YR BT

2018

CRN

Y6789.2

A#

Ⓐ 672696

MIN HD

-

NOM SH

0.337

CA

0.125



## 6.5 Radiographic Report

# ALL CAN INSPECTION SERVICES (2011) INC.

Report # H1611

9323-37 Avenue, NW, Edmonton, Albert T6E 5N4  
 SHOP: 780-462-1072 OFFICE: 780-462-9797 FAX: 780-462-4664  
 EMAIL: shop@allcaninspection.com www.allcaninspection.com

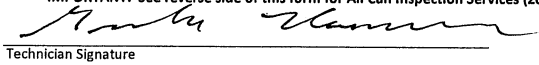

PAGE 1 OF 1

Client:	<b>Rushton Gas &amp; Oil</b>	Client Job #	<b>C3964ACB</b>	<b>CODES</b> 1. ASME B31.3 N/S 2. ASME B31.3 S/C 3. ASME Sec. VIII Div 1 UW51 4. ASME Sec. VIII Div. 1 UW52 5. CSA Z662 6. CSA Z662 (Sour) 7. API 650 8. Shot to Z662, Interp. B31.3N
Address:	2331-121 Ave. NE, Ed. Alta T6S 1B2	P.O. #		
Contact:	Name: Dion	Date:	<b>Mar 1/18</b>	
	Phone: 780-475-8801			
Work Location:	Fab Shop - Edmonton	Work Description:		

NDE NO:	Size & thickness Plus Code Max. reinforcement	Material	Code	IQI	Technique Number	Source Side of Object to Film Distance		Number of Exposures	Welder ID	LF - Lack of Fusion IP - Incomplete Penetration IC - Internal Concavity BT - Burn Through TI - Tungsten Inclusion IU: Internal Undercut EU: External Undercut EP - Excessive Penetration P - Porosity S - Slag HL - High-Low C - Crack AB - Arc Burn HB - Hollow Bead	Severity	Accept	Reject
						Inches	Inches						
										<b>Severity: 1 = Slight, 2 = Medium, 3 = Severe (Reject)</b> Discontinuity			
X1	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X2	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X3	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X4	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X5	4" s80	P1	1	2	RT-3	0.462	4.163	3	L	P @ 5"	1	√	
X6	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X7	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X8	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X9	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X10	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X11	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X12	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X13	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X14	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X15	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X16	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X17	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	
X18	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			√	

RT Technician: <u>Gordon Thomas</u>	CGSB Level: <u>2</u>	Reg. #: <u>6</u>	SNT-TC-1A Level: <u>III</u>	SNT-TC-1A No: <u>6</u>
RT Assistant #1: <u>Ken Brunlees</u>	CEDO #: <u>15425</u>		SNT-TC-1A Level: <u>II</u>	SNT-TC-1A No: <u>15425</u>
RT Assistant #2: _____	CEDO #: _____		SNT-TC-1A Level: _____	SNT-TC-1A No: _____

**IMPORTANT: See reverse side of this form for All Can Inspection Services (2011) Inc. LIMITED LIABILITY POLICY**

Technician Signature:  Date: Mar 1/18  
 Client Representative Signature:  Evaluation Date: Mar 1/18

The above interpretation is a technical opinion, not a guarantee.  
 Client signature indicates acceptance of the report and results.  
 Clock tape marker and start arrow marked on weldment.  
 It is the customer's responsibility to map welds on drawings.

Film Make / Brand: <u>AGFA</u>	Film Class / Type: <u>1-D5</u>
Screens: <u>Lead</u>	Front: <u>0.010"</u> Back: <u>0.010"</u> One (no.) film per screen: _____
Film Density in H & D: <u>Min. 2.0</u> <u>Max. 4.0</u>	
Penetrometer (IQI hole type) designation: <u>N/A</u>	Recommended Max. U.G.: <u>0.20"</u>
Source Isotope: <u>IRIDIUM-192(Gamma)</u>	Wall Viewing: <u>Single</u>
Effective Focal Spot Size: <u>0.146 inches</u>	Processing: <u>Automatic</u>

## RADIOGRAPHIC EXAMINATION REPORT



# ALL CAN INSPECTION SERVICES (2011) INC.

Report # H1859

9323-37 Avenue, NW, Edmonton, Albert T6E 5N4  
 SHOP: 780-462-1072 OFFICE: 780-462-9797 FAX: 780-462-4664  
 EMAIL: shop@allcaninspection.com www.allcaninspection.com

Client:	<b>Rushton Gas &amp; Oil</b>	Client Job #	<b>C3964ACB</b>	<b>CODES</b> 1. ASME B31.3 N/S 2. ASME B31.3 S/C 3. ASME Sec. VIII Div. 1 UW51 4. ASME Sec. VIII Div. 1 UW52 5. CSA Z662 6. CSA Z662 (Sour) 7. API 650 8. Shot to Z662, Interp. B31.3N
Address:	2331-121 Ave. NE, Ed. Alta T6S 1B2	P.O. #		
Contact:	Name: Dion	Date:	<b>Mar 16/18</b>	
	Phone: 780-475-8801			
Work Location:	Fab Shop - Edmonton	Work Description:		

NDE No:	Size & thickness Plus Code Max. reinforcement	Material	Code	IQI	Technique Number	Source Side of Object to Film Distance		Number of Exposures	Welder ID	LF - Lack of Fusion IP - Incomplete Penetration IC - Internal Concavity BT - Burn Through TI - Tungsten Inclusion IU: Internal Undercut EU: External Undercut EP - Excessive Penetration P - Porosity S - Slag HL - High-Low C - Crack AB - Arc Burn HB - Hollow Bead	Severity	Accept	Reject
						Inches	Inches						
										Severity: 1 = Slight, 2 = Medium, 3 = Severe (Reject)			
										Discontinuity			
X24	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			✓	
X25	4" s80	P1	1	2	RT-3	0.462	4.163	3	L	P @ 15"	1	✓	
X26	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			✓	
X27	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			✓	
X28	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			✓	
X29	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			✓	
X30	4" s80	P1	1	2	RT-3	0.462	4.163	3	L	(P @ 8 1/2" (OK)) LF @ 3-5"	3		X
X31	4" s80	P1	1	2	RT-3	0.462	4.163	3	L	IU & HL @ 7-9"	1	✓	
X32	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			✓	
X33	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			✓	
X34	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			✓	
X35	4" s80	P1	1	2	RT-3	0.462	4.163	3	L	P @ 0"	1	✓	
X36	4" s80	P1	1	2	RT-3	0.462	4.163	3	L			✓	

RT Technician: <u>Gordon Thomas</u>	CGSB Level: <u>2</u>	Reg. #: <u>6</u>	SNT-TC-1A Level: <u>III</u>	SNT-TC-1A No: <u>6</u>
RT Assistant # 1 <u>Shannon Berg</u>	CEDO #: <u>17583</u>		SNT-TC-1A Level: <u>I</u>	SNT-TC-1A No: <u>17583</u>
RT Assistant # 2 _____	CEDO #: _____		SNT-TC-1A Level: _____	SNT-TC-1A No: _____

IMPORTANT: See reverse side of this form for All Can Inspection Services (2011) Inc. LIMITED LIABILITY POLICY	
Technician Signature: Date: <u>Mar 16/18</u>	Film Make / Brand: <u>AGFA</u> Film Class / Type: <u>1-D5</u> Screens Lead: Front <u>0.010"</u> Back <u>0.010"</u> One (no.) film per screen Film Density in H & D: Min. <u>2.0</u> Max. <u>4.0</u> Penetrometer (IQI hole type) designation: <u>N/A</u> Recommended Max. U.G.: <u>0.20"</u>
Client Representative Signature: Evaluation Date: <u>Mar-16-18</u>	Source Isotope: <u>IRIDIUM-192(Gamma)</u> Wall Viewing: <u>Single</u> Effective Focal Spot Size: <u>0.146 inches</u> Processing: <u>Automatic</u>
The above interpretation is a technical opinion, not a guarantee. Client signature indicates acceptance of the report and results. Clock tape marker and start arrow marked on weldment. It is the customer's responsibility to map welds on drawings.	

## RADIOGRAPHIC EXAMINATION REPORT





# ALL CAN INSPECTION SERVICES (2011) INC.

Report # H2118

9323-37 Avenue, NW, Edmonton, Albert T6E 5N4  
 SHOP: 780-462-1072 OFFICE: 780-462-9797 FAX: 780-462-4664  
 EMAIL: shop@allcaninspection.com www.allcaninspection.com

Client:	<b>Rushton Gas &amp; Oil</b>	Client Job #	<b>C3964A.CB</b>	<b>CODES</b>
Address:	2331-121 Ave. NE, Ed. Alta T6S 1B2	P.O. #		1. ASME B31.3 N/S
Contact:	Name: Dion	Date:	<b>April 5/18</b>	2. ASME B31.3 S/C
	Phone: 780-475-8801			3. ASME Sec. VIII Div 1 UW51
Work Location:	Fab Shop - Edmonton	Work Description:		4. ASME Sec. VIII Div. 1 UW52
				5. CSA Z662
				6. CSA Z662 (Sour)
				7. API 650
				8. Shot to Z662, Interp. B31.3N

NDE No:	Size & thickness Plus Code Max. reinforcement	Material	Code	IQI	Technique Number	Source Side of Object to Film Distance	Source to Object Distance	Number of Exposures	Welder ID	LF - Lack of Fusion IP - Incomplete Penetration IC - Internal Concavity BT - Burn Through TI - Tungsten Inclusion IU: Internal Undercut EU: External Undercut		EP - Excessive Penetration P - Porosity S - Slag HL - High-Low C - Crack AB - Arc Burn HB - Hollow Bead		Severity	Accept	Reject	
										Severity: 1 = Slight, 2 = Medium, 3 = Severe (Reject)		1-3	v				x
										1-8	See Back						
X37	4" s80	P1	1	2	RT-3	0.462	4.163	3	L								
X38	4" s80	P1	1	2	RT-3	0.462	4.163	3	L		P @ 7"		1				
X39	4" s80	P1	1	2	RT-3	0.462	4.163	3	L		P @ 0"		1				
X40	4" s80	P1	1	2	RT-3	0.462	4.163	3	L		P @ 8"		2				
X41	4" s80	P1	1	2	RT-3	0.462	4.163	3	L								
X42	4" s80	P1	1	2	RT-3	0.462	4.163	3	L								
X43	4" s80	P1	1	2	RT-3	0.462	4.163	3	L								
X44	4" s80	P1	1	2	RT-3	0.462	4.163	3	L		P @ 7 1/2"		1				
X45	4" s80	P1	1	2	RT-3	0.462	4.163	3	L		P @ 9"		2				
X46	4" s80	P1	1	2	RT-3	0.462	4.163	3	L								
X47	4" s80	P1	1	2	RT-3	0.462	4.163	3	L		P @ 8"		1				
X48	4" s80	P1	1	2	RT-3	0.462	4.163	3	L		IU @ 0"		1				

RT Technician: <u>Gordon Thomas</u>	CGSB Level: <u>2</u>	Reg. #: <u>6</u>	SNT-TC-1A Level: <u>III</u>	SNT-TC-1A No: <u>6</u>
RT Assistant # 1: <u>Shannon Berg</u>	CEO #: <u>17583</u>		SNT-TC-1A Level: <u>I</u>	SNT-TC-1A No: <u>17583</u>
RT Assistant # 2: _____	CEO #: _____		SNT-TC-1A Level: _____	SNT-TC-1A No: _____

<b>IMPORTANT: See reverse side of this form for All Can Inspection Services (2011) Inc. LIMITED LIABILITY POLICY</b>			
Technician Signature: <u><i>[Signature]</i></u> Date: <u>April 5/18</u>	Film Make / Brand: <u>AGFA</u>	Film Class / Type: <u>1-D5</u>	
Client Representative Signature: <u><i>[Signature]</i></u> Evaluation Date: <u>April 5/18</u>	Screens Lead: <u>Front 0.010" Back 0.010"</u> One (no.) film per screen	Film Density in H & D: <u>Min. 2.0 Max. 4.0</u>	
Penetrometer (IQI hole type) designation: <u>N/A</u>		Recommended Max. U.G.: <u>0.20"</u>	
Source Isotope: <u>IRIDIUM-192(Gamma)</u>		Wall Viewing: <u>Single</u>	
Effective Focal Spot Size: <u>0.146 inches</u>		Processing: <u>Automatic</u>	

The above interpretation is a technical opinion, not a guarantee.  
 Client signature indicates acceptance of the report and results.  
 Clock tape marker and start arrow marked on weldment.  
 It is the customer's responsibility to map welds on drawings.

## RADIOGRAPHIC EXAMINATION REPORT



## 6.6 PWHT

# HEAT TREATMENT INSTRUCTIONS



## INSTRUCTIONS FOR MAXIMUM THICKNESS OF 0-1"

JOB #	SERIAL #	VESSEL	IMPACT COUPON	MNWX BLIND	CB	# OF SPOOLS	DIM L x W x H	TOTAL W.T.
<del>C3954</del>	<del>C3954A.FKOD</del>	<del>✓</del>					<del>34' x 9'-8 1/2" x 14'</del>	<del>24,000#</del>
<del>C3954</del>	<del>C3954A.SP</del>					<b>19</b>	<del>18' x 3'-6"</del>	<del>1,200#</del>
C3964	C3964A.CB					✓	20' x 7'-6"	8,000#
<del>C3552</del>	<del>2464-&gt; 2488.FGS</del>	<del>✓</del>	<del>25</del>				<del>2' 4" x 1'</del>	<del>1,750#</del>

TYPE OF HEAT TREATMENT: PRESSURE VESSEL STRESS RELIEF P-No. 1

**HEATING**

Temperature to be raised from 800°F to **1150°F** at a maximum rate of **400°F** per hour.

NOTE: THIS VALUE MUST NEVER EXCEED 400°F PER HOUR.

[Calculated rate = 400 degrees F/hr. Divided by the maximum metal thickness of the shell or head plate in inches]

**HOLDING**

Temperature to be held at a minimum of **1150°F** for **60** minutes.

[Holding time to be determined by Table UCS-56 for Nominal Thickness as specified in UW-40(f)]

**COOLING**

Temperature to be lowered from **1150°F** to 800°F at a maximum rate of **500°F** per hour.

NOTE: THIS VALUE MUST NEVER EXCEED 500°F PER HOUR.

[Calculated rate = 500 degrees F/hr. Divided by the maximum metal thickness of the shell or head plate in inches]

From 800°F items may be cooled in still air.

FOR APRIL 06/18 PWHT

**Additional requirements:**

- ◆ Job number and description required on heat treatment charts along with the operator's signature & date.
- ◆ Reporting of thermocouple attachment method and location, and verification of furnace thermocouple calibration is required.
- ◆ A sufficient number of thermocouples shall be located to control and maintain uniform distribution of temperature on all vessels and parts. Thermocouples shall be directly attached to the item or provision shall be made for thermocouple placement at bottom, centre and top of the furnace charge in accordance with the ASME Code.
- ◆ During the heating period, there shall not be a greater variation in temperature throughout the portion of the vessel being heated than 250°F within any 15 ft. interval of length. An adequate number of thermocouples must be used to ensure this Code requirement is met. This limitation is also applicable to the temperature variations between the different thicknesses of various vessel components.
- ◆ During the holding period, there shall not be a greater difference than 150°F between the highest and lowest temperature throughout the portion of the vessel being heat treated, except where the range is further limited by these instructions.
- ◆ If Capacitor Discharge welding is used to attach thermocouples an ASME Code Section IX Welding Procedure Specification is required (WPS qualification is not required), and the energy output must be limited to 125 Watt-Seconds. No other welding is permitted on vessels or parts. [0.5 X Capacitance in farads X Voltage<sup>2</sup> = W-Sec.]
- ◆ The method of thermocouple removal shall not damage the heat treated item.

Quality Control Inspector Signature: Date: **March 23, 2018**

Engineering Manager Signature: Date: **29/03/2010**

Thermocouple Attachment Method: **Flask Weld** Location(s): **TOP MIDDLE BOTTOM**

Furnace Heat Number: **F 67-180 416**

Furnace Operator Signature: Date: **Apr 9/18**



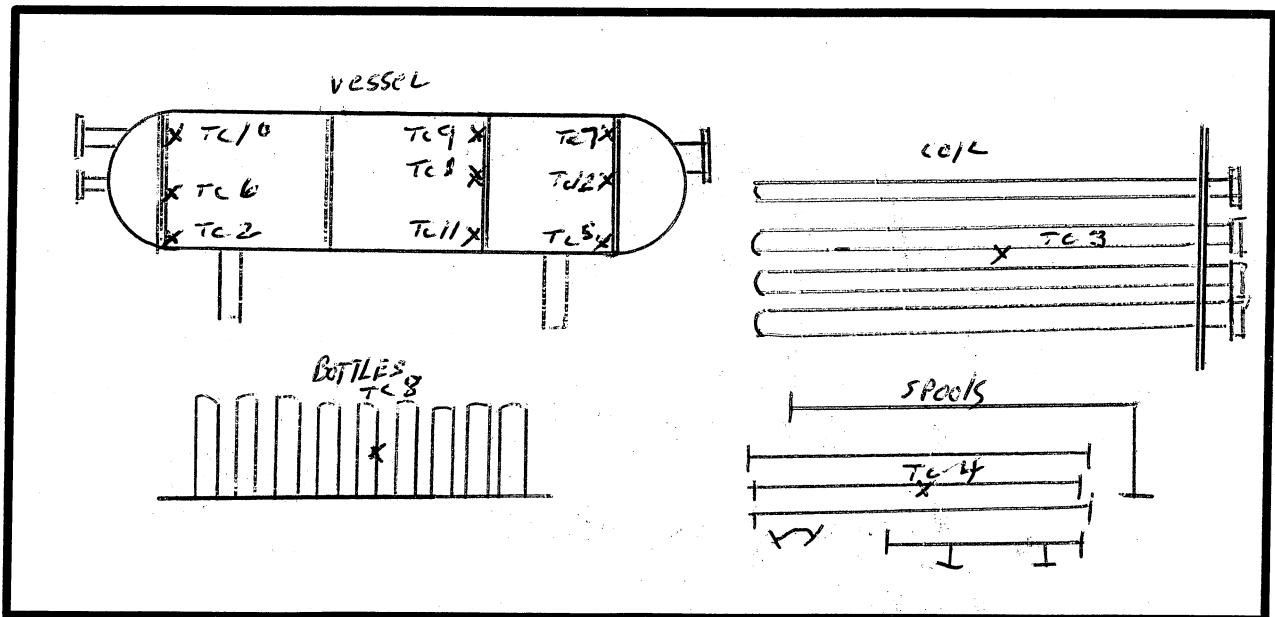
# THERMOCOUPLE PLACEMENT PER CUSTOMER SPECIFICATIONS

CLIENT: RUSH TOWN

DATE: APRIL 9 / 18 CHART NO. FL67180 416

MATERIAL DESCRIPTION: 1-VESSEL, 1-COIL, 25 SCRUBBER BOTTLES  
19 SPOOLS SERIAL C3954  
Job Nos C3954, C3964, C3552

THERMOCOUPLE LOCATION: TOP MIDDLE BOTTOM.  
TC #S 1-12.



### Client Heat Specifications:

Ambient to 800 °F / °C at moderate rate  
 Raise from 500 °F / °C to 1150 °F / °C at 400 °F / °C / HR  
 Soak at 1150 °F / °C for 1 Hours — Mins  
 Cool from 1150 °F / °C to 800 °F / °C at 500 °F / °C / HR  
 Cool from 800 °F / °C to ambient in enclosed furnace.



# R&R Stress Relieving Service Ltd.

2103 – 6<sup>th</sup> Street, Nisku AB T9E 7X8

780-955-7559 \* [www.rrstress.com](http://www.rrstress.com)

## CERTIFICATE OF CALIBRATION AND CONFORMANCE

CERTIFIED BY:	R&R Stress Relieving Service
TEST NUMBER:	RR0227-E
DATE:	February 27, 2018
DATE DUE:	Aug 27, 2018
MANUFACTURER:	Chino
MODEL NO.	AH-3725 N00
SERIAL NO.	AH-029A073
RECORDER NUMBER	IR-183

**This instrument has been calibrated and is within the manufacturers specifications.**

---

---

### REFERENCE STANDARDS

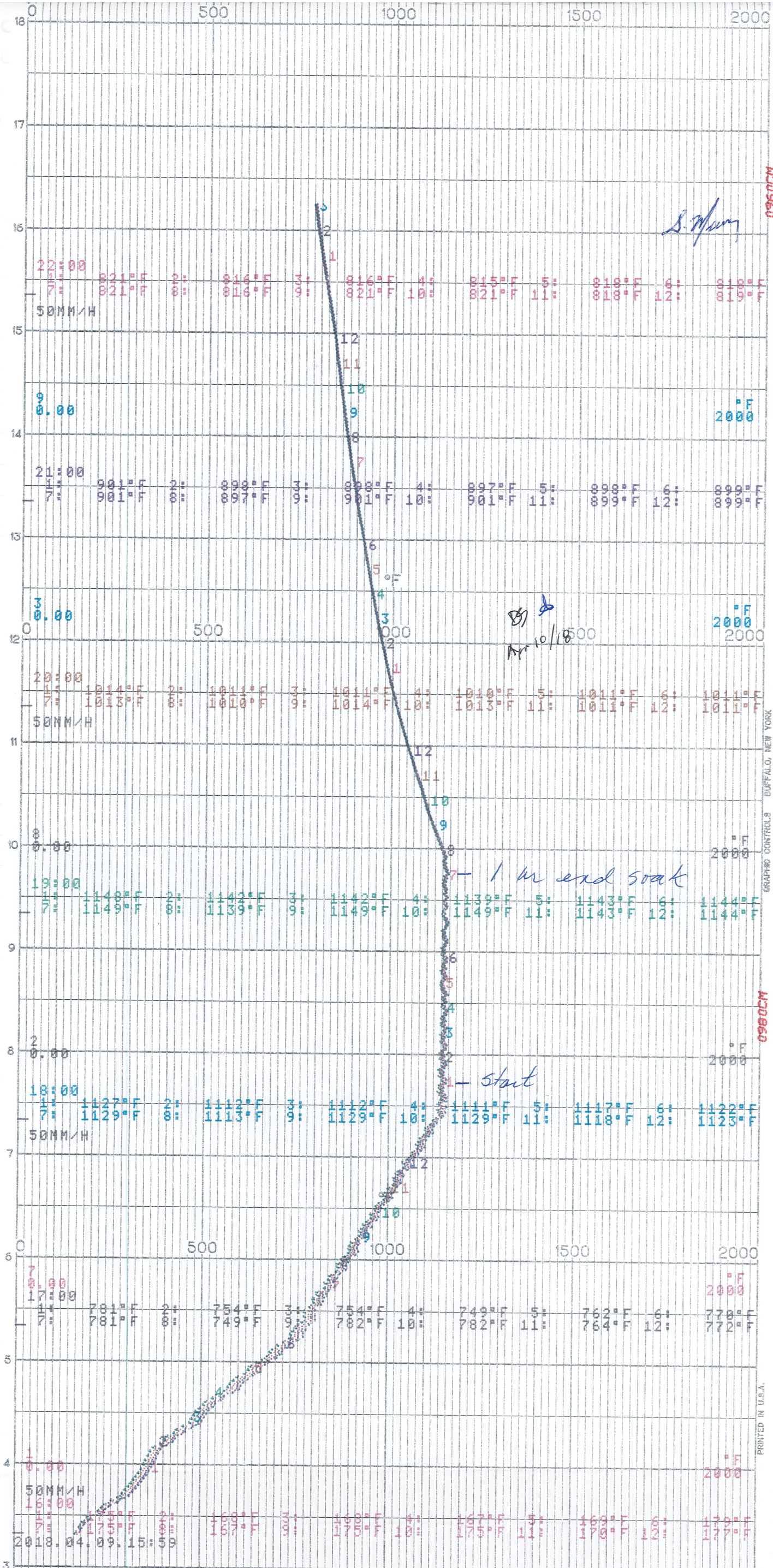
**DIGIMITE 311600; SERIAL NO. 48430-5522; CERTIFICATION DATE: December 13, 2016**  
**OMEGA CL3512A; SERIAL NO. 09001074; ASSET NO. A-55304; CERTIFICATION DATE: November 27, 2017**

R&R Stress Relieving Service Ltd. certifies that the above listed instrument meets or exceeds all specification as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the National Institute of Standards and Technology (NIST), or to the NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques. This calibration complies with NIL-STD-45662A and ANSI/NCSL Z540.3-2006.

---

---

  
Steve Pierson



0960CM  
 GRAPHIC CONTROLS  
 BUFFALO, NEW YORK  
 0960CM  
 PRINTED IN U.S.A.

**CLIENT:** Rushton Gas & Oil  
**PO No.:** 27711  
**DATE:** April 9, 2018  
**CHART No.:** F67-180416  
**REORDER No.:** IR-183  
**CHART SPEED:** 50 mm/hr  
**OPERATOR:** S. Murray

**DESCRIPTION:**  
**Job No.:** C3954  
**(1) Vessel:** C3964A, FK0B  
**Job No.:** C3954  
**(1) Spools:** C3954A-SP  
**Job No.:** 3964  
**(1) Coil:** C3964A, CB  
**Job No.:** 3552  
**(25) Scrubber Bottles,**  
**2464-2488-FGS**



R&R Stress Relieving Service



## 7.0 Reports

### 7.1 Hydro / Pneumatic Test Report & Calibration Certificates



## HYDRO TEST REPORT

Date: Apr 11/18

Name of Customer: Hammerhead Resources Inc

Address: L.S.D# 01-16-65-03 WGM

**Hydro Test For The Following Equipment:**

Type of Equipment Being Tested: Line Heater

Temperature: 15°C


Test Media: Water

Gauge Numbers: R11, R12


**ize of Piping:**

O.D. - in.	Material	Service	Pressure Tested - psi	Duration
1"	106B, 105N	Pre-Heat Coil	428	1HR

Rushton Job #: C-3964

QCI: 

Per: Rushton Gas & Oil Equipment (1991) Ltd.

rd Party Insp: Jason Rubike 

Per: HHR / CEL



Doc. No: C-3964-LL		Rev. No: 3		STORED ENERGY LESS THAN 1677 KJ		HYDRO / PNEUMATIC TEST REPORT					Date: 04/13/2018
Service: SWEET											
Test Gauge S/N	Recorder S/N	YES / NO	Volume	Test Press. PSI	Test Medium	Pipe Mat'l Spec & Grade	Line #	Pipe NPS & Schedule	Rushton QC Sign Off	3rd Party Sign Off	Date
R11, R12	N/A	N/A	N/A	428 (2951)	WATER	SA-106B	001	1" / 1/4" SCH 80 (TE)	DS	R	Apr 26/18
R5, R6	N/A	Yes	N/A	72 (496)	AIR	SA-106B	002	1 1/2" / 1" / 1/2" / 1/4" SCH 80 (TE) 1 1/2"x1" SCH 80 SWAGE (TE)	DS	R	Apr 26/18
R5, R6	N/A	Yes	N/A	72 (496)	AIR	SA-106B	003	1/4" SCH 80 (TE)	DS	R	Apr 26/18
R5, R6	N/A	Yes	N/A	30 (207)	AIR	SA-106B	004	1/4" SCH 80 (TE)	DS	R	Apr 26/18
N/A	N/A	Yes	N/A	72 (496)	AIR	316SS		3/8" DIA. (0.035" W.T.)	DS	R	Apr 26/18



**CPW VALVE & INSTRUMENT LTD.**  
 MANUFACTURER OF  
 CPW HYDRO-POISE OIL FILLED PRESSURE GAUGES  
 #100 7503 Girard Road EDMONTON, ALBERTA, T6B 2H2  
 PH: 780-451-6888 FAX: 780-451-6878



## DEADWEIGHT CERTIFICATION REPORT

**CUSTOMER NAME:** Rushton Gas & Oil

**P.O #** 55074-5010

**SERIAL #:** PI/5994

**MANUFACTURER:** CPW

**DIAL SIZE:** 4 1/2"

**PRESSURE RANGE:** 0-200 D/S

**SUB DIVISIONS:** 2 PSI

**CONNECTION:** 1/2"

**INSPECTOR:** Mark Duker

**AMBIENT TEMPERATURE:** 21C

**MODEL:** 901

**TESTING DEVICE:** CE IS33-36/3000PSI  
 S/N 2262-738262

**TEST MEDIUM:** Air

**MAXIMUM ERROR:** .42 PSI

**DATE:** April 4, 2017

**LOCATION TESTED:** 100 7503 Girard Road  
 EDMONTON, AB  
 T6B 2H2

CRYSTAL ENGINEERING IS33-36/3000PSI S/N 2262-738262

The crystal Engineering tester was calibrated to meet or exceed Deadweight tester accuracy of 0.1% of the reading traceable to N.I.S.T under report No. 61912

<u>READING</u> <u>NO.</u>	<u>CE IS33-36/3000</u> <u>PSI</u>	<u>GAUGE READING</u> <u>PSI</u>
1	20.05	20
2	59.84	60
3	99.58	100
4	140.05	140
5	180.19	180
6	200.30	200



**CPW VALVE & INSTRUMENT LTD.**  
 MANUFACTURER OF  
 CPW HYDRO-POISE OIL FILLED PRESSURE GAUGES  
 #100 7503 Girard Road EDMONTON, ALBERTA, T6B 2H2  
 PH: 780-451-6888 FAX: 780-451-6878



## DEADWEIGHT CERTIFICATION REPORT

**CUSTOMER NAME: Rushton Gas & Oil**

**P.O # 55074-5010**

**SERIAL #: PI/5995**

**MANUFACTURER: CPW**

**AMBIENT TEMPERATURE: 21C**

**MODEL: 901**

**TESTING DEVICE: CE IS33-36/3000PSI  
 S/N 2262-738262**

**DIAL SIZE: 4 1/2"**

**PRESSURE RANGE: 0-200 D/S**

**SUB DIVISIONS: 2 PSI**

**CONNECTION: 1/2"**

**INSPECTOR: Mark Dukes**

**TEST MEDIUM: Air**

**MAXIMUM ERROR: .35 PSI**

**DATE: April 4, 2017**

**LOCATION TESTED: 100 7503 Girard Road  
 EDMONTON, AB  
 T6B 2H2**

**CRYSTAL ENGINEERING IS33-36/3000PSI S/N 2262-738262**

The crystal Engineering tester was calibrated to meet or exceed Deadweight tester accuracy of 0.1% of the reading traceable to N.I.S.T under report No. 61912

<u>READING</u> <u>NO.</u>	<u>CE IS33-36/3000</u> <u>PSI</u>	<u>GAUGE READING</u> <u>PSI</u>
1	20.15	20
2	60.04	60
3	99.94	100
4	140.34	140
5	180.35	180
6	200.28	200



**CPW VALVE & INSTRUMENT LTD.**  
MANUFACTURER OF  
CPW HYDRO-POISE OIL FILLED PRESSURE GAUGES  
#100 7503 Girard Road EDMONTON, ALBERTA, T6B 2H2  
PH: 780-451-6888 FAX: 780-451-6878



**DEADWEIGHT CERTIFICATION REPORT**

**CUSTOMER NAME: Rushton Gas & Oil**

**P.O # 55334-5010**

**SERIAL #: PI/6187**

**MANUFACTURER: CPW**

**DIAL SIZE: 4 1/2"**

**PRESSURE RANGE: 0-1000 D/S**

**SUB DIVISIONS: 10 PSI**

**CONNECTION: 1/2"**

**INSPECTOR: Mark Dukes**

**AMBIENT TEMPERATURE: 21C**

**MODEL: 901**

**TESTING DEVICE: CE IS33-36/3000PSI  
S/N 2262-738262**

**TEST MEDIUM: Air**

**MAXIMUM ERROR: 2.87 PSI**

**DATE: November 7, 2017**

**LOCATION TESTED: 100 7503 Girard Road  
EDMONTON, AB  
T6B 2H2**

**CRYSTAL ENGINEERING IS33-36/3000PSI S/N 2262-738262**

The crystal Engineering tester was calibrated to meet or exceed Deadweight tester accuracy of 0.1% of the reading traceable to N.I.S.T under report No. 61912

<u>READING</u> <u>NO.</u>	<u>CE IS33-36/3000</u> <u>PSI</u>	<u>GAUGE READING</u> <u>PSI</u>
1	98.31	100
2	297.13	300
3	498.45	500
4	698.70	700
5	899.78	900
6	998.52	1000



**CPW VALVE & INSTRUMENT LTD.**

MANUFACTURER OF

CPW HYDRO-POISE OIL FILLED PRESSURE GAUGES  
#100 7503 Girard Road EDMONTON, ALBERTA, T6B 2H2  
PH: 780-451-6888 FAX: 780-451-6878



**DEADWEIGHT CERTIFICATION REPORT**

**CUSTOMER NAME: Rushton Gas & Oil**

**P.O # 55334-5010**

**SERIAL #: PI/6188**

**MANUFACTURER: CPW**

**AMBIENT TEMPERATURE: 21C**

**MODEL: 901**

**TESTING DEVICE: CE IS33-36/3000PSI  
S/N 2262-738262**

**DIAL SIZE: 4 1/2"**

**PRESSURE RANGE: 0-1000 D/S**

**SUB DIVISIONS: 10 PSI**

**CONNECTION: 1/2"**

**INSPECTOR: Mark Dukes**

**TEST MEDIUM: Air**

**MAXIMUM ERROR: 2.91 PSI**

**DATE: November 7, 2017**

**LOCATION TESTED: 100 7503 Girard Road  
EDMONTON, AB  
T6B 2H2**

**CRYSTAL ENGINEERING IS33-36/3000PSI S/N 2262-738262**

The crystal engineering tester was calibrated to meet or exceed Deadweight tester accuracy of 0.1% of the reading traceable to N.I.S.T under report No. 61912

<u>READING</u> <u>NO.</u>	<u>CE IS33-36/3000</u> <u>PSI</u>	<u>GAUGE READING</u> <u>PSI</u>
1	98.48	100
2	297.18	300
3	497.09	500
4	698.53	700
5	899.55	900
6	998.70	1000



## 7.2 Electrical Permit

Inspection Date: (Y/M/D) 2018/04/24 Permit #: EDM2018-007244

---

Contractor/Applicant Name: PRONGHORN CONTROLS

---

Location of Project Address: 2331 - 121 AVENUE NE  
 Municipal Legal Description: Plan 7520635 Blk 4 Lot 7

---

Project Description: Wiring, Other: Install BMS controller. Wire devices to BMS controller.

Stages of Inspection:  Annual Mid-Term  Annual Final  Rough-In  Final

Work on this site is:  Completed  in Progress Outcome: Complete - Observations Noted

**Deficiencies, Observations and Unsafe Conditions**

**Observation** Final Wiring Checks - Acceptable

**Comments:** FINAL INSTALLATION OF CONDUIT AND DEVICES FOR BMS CONTROLLER FOR BURNER UNIT ONLY ON 'B' IS ACCEPTABLE. TIGI LABEL# 14762

NOTE TO CONTRACTOR:  
 1. INSTALL BOND CONDUCTORS AS DISCUSSED ON SITE. BOLTS ON BURNER ARE NOT A SUITABLE BOND.

Observation  Deficiency  Unsafe Condition

No Entry to Site: Please contact undersigned at the City of Edmonton to arrange for site inspection within 30 days.

---

Compliance Monitoring has been completed on this site and meets the intent of the Alberta Safety Codes Act.

---

REIMER, COLIN \_\_\_\_\_  
 S.C.O.'s Name (print or type) Safety Codes Officer - Signature Safety Codes Officer - Designation #

The personal information on this form is collected under the authority of Section 33(c) of the Alberta Freedom of Information and Protection of Privacy Act, Section 642 of the Municipal Government Act and/or Section 63 of the Safety Codes Act. The information will be used to process your application(s) and your name and address of where the development/use is being proposed may be included on reports that are available to the public. If you have any questions on the collection and use of this information, please contact the City of Edmonton Call Centre at 311.