Algas-SDI™

ISO 9001 Certified

...Innovative liquid vaporizing and gas mixing solutions

DFV

Packaged Natural Gas Replacement Systems
Models DFV2.5-5 through DFV14-8

Operations & Maintenance Manual

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FILE: MANUAL PN 52681 DFV REV 2-15-04 .DOC

ECLIPSE
Innovative Thermal Solutions

WARNING

Read the OPERATION MANUAL before operating this equipment.

NOTE: Algas-SDI reserves the right to use alternate manufacturers' components as vendor delivery applicability dictates. Literature contained in the Operation Manual has been supplied by vendors. Please check to be sure supplied data matches your configuration. Contact Algas-SDI if any questions exist.

This equipment uses LPG-a flammable fuel, or NH3-a toxic gas, (depending on the model), handled under pressure. Inherent hazards exist and a thorough understanding of the equipment is required to allow safe operation and maintenance.

Allow only a TRAINED and FULLY QUALIFIED PERSON to service this equipment.

Any time a component must be replaced, use the same type, model , etc. DO NOT SUBSTITUTE! The consequence from such actions are unpredictable and may lead to dire consequences. When components are replaced with components not approved for use in our FM/UL listed equipment, the FM/CSA listing becomes void for that unit.

DFV - Direct Fired Packaged Vaporizing / Mixing System Specifications Sheet

Refer to Nameplate on unit for the model and voltage information then look up specific information on the tables below.

☐ **PROPANE** ☐ **70 / 30 MIX**

Electrical Specification:

110V / 50-60Hz	Amps: 0.6	FUSE PN: 53096, 1-1/2 AMP
220V / 50-60Hz	Amps: 0.3	FUSE PN: 53096, 1-1/2 AMP

Mixer Specifications: * Venturi Stamping Information

Model / LPG-Air Mix	Capacity (Millions)		High Tank PSIG	Low Vapor PSIG	* Venturi Capacity (Millions)	* Motive Pressure	* Delivery Pressure PSIG
	BTU/Hr	Kcal/Hr					
DFV 2.5 - 5							
Propane	2.6	0.66	7	22	2.5	25	4 - 5
70/30	2.7	0.68	6	17	2.5	20	3 - 4
DFV 2.5 - 8							
Propane	2.8	0.71	11	85	2.5	72	8 - 9
70/30	2.6	0.66	9.5	86	2.5	73	6.5 - 7.5
DFV 7 - 5							
Propane	7.0	1.76	8	32	7	43	5 - 6
70/30	7.2	1.81	8	24	7	35	5 - 6
DFV 7 - 8							
Propane	7.0	1.76	11	66	7	70	8 - 9
70/30	7.0	1.76	9	50	7	54	6 - 7
DFV 14 - 5							
Propane	14.0	3.53	8	51	14	35	5 - 6
70/30	14.2	3.58	7	46	14	30	4 - 5
DFV 14 - 8							
Propane	14.0	3.53	11	76	14	74	8 - 9
70/30	14.2	3.58	9.5	60	14	58	6.5 - 7.5

Vaporizer Specifications:

DFV 2.5 1 Direct Fired 40/40 Vaporizer
DFV 7 1 Direct Fired 80/40 Vaporizer
DFV 14 2 Direct Fired 80/40 Vaporizer

Model	Capacity (Gal/Hr)	Operating Temperature (internal)	Pressure Vessel Rating	Heat Excahnge Surface Area (Sq. FT.)	Relief Valve Settting (PSIG)
40/40H	40	120 - 160 deg. F	MAWP 200 PSI @ 650 F	3.6	250
80/40H	80		MDMT -20F @ 200 PSI	7.2	

Algas-SDI Direct Fired Vaporizer is ***Factory Mutual Research (FM) Approved***.

Mixing capacity (BTU/Hr) is directly related to LPG motive pressure. All systems are pre-set at the factory within + 10% of rated motive pressure. Additional field adjustment may be required due to varying operating conditions.

Warranty Registration

To Register your new equipment: Visit Algas-SDI's web site at: algas-sdi.com, then click on the "Tech Support" button. Select online Registration or print out the Acrobat Warranty Registration.

OR

Fill out the Warranty Registration information on the last page of this manual. Then make a photo copy and mail to the address shown at the bottom.

Warranty, Copyrights and Approvals

WARRANTY

Algas-SDI International, LLC (ASDI) warrants that the equipment is free of defects in materials and workmanship under normal use and service. ASDI agrees to repair or replace, at our option, without charge f.o.b. factory, any part which has proven defective to the satisfaction of Algas-SDI International, LLC within one (1) year from the date of the original installation or within 18 months from the date of shipment, whichever is earlier. Equipment, which in the opinion of ASDI, has been damaged by improper installation or operation, or has been abused or tampered with in any way, will not be accepted for return under warranty.

Algas-SDI International, LLC will not accept back charges for work performed by others upon or in conjunction with ASDI equipment, unless prior authorization is given by means of an Algas-SDI International, LLC purchase order. Algas-SDI International, LLC will not be liable by reason of shutdown, non-operation or increased expense of operation of other equipment, or any other loss or damage of any nature, whether direct or consequential, arising from any cause whatsoever.

Algas-SDI International, LLC makes NO other warranty of any kind, whatsoever expressed or implied; and all warranties of merchantability and fitness for a particular purpose are hereby disclaimed by Algas-SDI International, LLC and excluded from these terms of sale. No person has any authority to bind Algas-SDI International, LLC to any representation or warranty other than this warranty.

COPYRIGHT

IMPORTANT WARRANTY NOTICE:

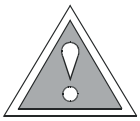
The Algas-SDI warranty period for equipment is 18 months after shipment from our facility or 12 months after installation. See our warranty statement at the beginning of this manual for the complete text. A warranty registration card has been provided with this manual so that you may register the date of installation for warranty purposes. If you do not return the warranty registration card, the warranty term will be 12 months after the equipment has been shipped to you, the end user. If you do not install it immediately, your warranty may expire earlier than necessary. The warranty registration also gives us information to contact you if we need to send you important information about the equipment later on.

Please register your equipment.

Symbols and Conventions

Special symbols are used to denote hazardous or important information. You should familiarize yourself with their meaning and take special notice of the indicated information.

Please read the following explanations thoroughly.



GENERAL WARNING OR CAUTION

Indicates hazards or unsafe practices which can result in damage to the equipment or cause personal injury. Use care and follow the instructions given.

FLAMMABLE GAS HAZARD

Indicates a potential hazard which can result in severe personal injury or death. Use extreme care and follow the instructions given.

ELECTRICAL DISCONNECT REQUIRED

Indicates a potentially dangerous situation which can result in severe personal injury or death or damage to equipment. Use great care and follow the instruction given.

ASDI CONTACT NUMBERS

If you have questions, need help with your equipment, or want information on other products, contact Algas-SDI at:

Telephone: 206.789.5410

Facsimile: 206.789.5414

Email: sales@algas-sdi.com

Internet: http://www.algas-sdi.com

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Introduction 1

The **DFV** Liquefied Petroleum Gas (LPG) vaporizing/mixing systems from Algas-SDI are self-contained units providing a mixture of LPG gas and air, which can replace natural gas. An accumulator tank enables the venturi to cycle on and off to meet the required load. Operation is quiet, reliable, and safe.

Description/Overview

The **DFV** compact LPG vaporizer/mixer systems are available in various propane models providing a gas/air mix from 2.5 to 14 million BTU at pressures from 5 to 8 PSIG depending on the model selected. The gas/air provided is compatible with natural gas systems and may be used as a direct replacement without adjustments to your burner systems.

This combination system uses the Algas-SDI Direct Fired vaporizer to vaporize the LPG and the Algas-SDI atmospheric venturi system. The gas is mixed with air and stored in the accumulator tank to provide uninterrupted flow of mixed gas from full flow to no flow, automatically.

Power requirements for the **DFV** are 110V/50-60Hz or 220V/50-60Hz.

A liquid pump, such as the Algas-SDI Stabilaire pump system, may be required to provide sufficient gas pressure for the mixing process. The required pressure for your system is indicated on the data sheet in **Appendix B** of this manual. If your supply tank will not provide the required pressure under all expected temperature conditions, a pump will be needed

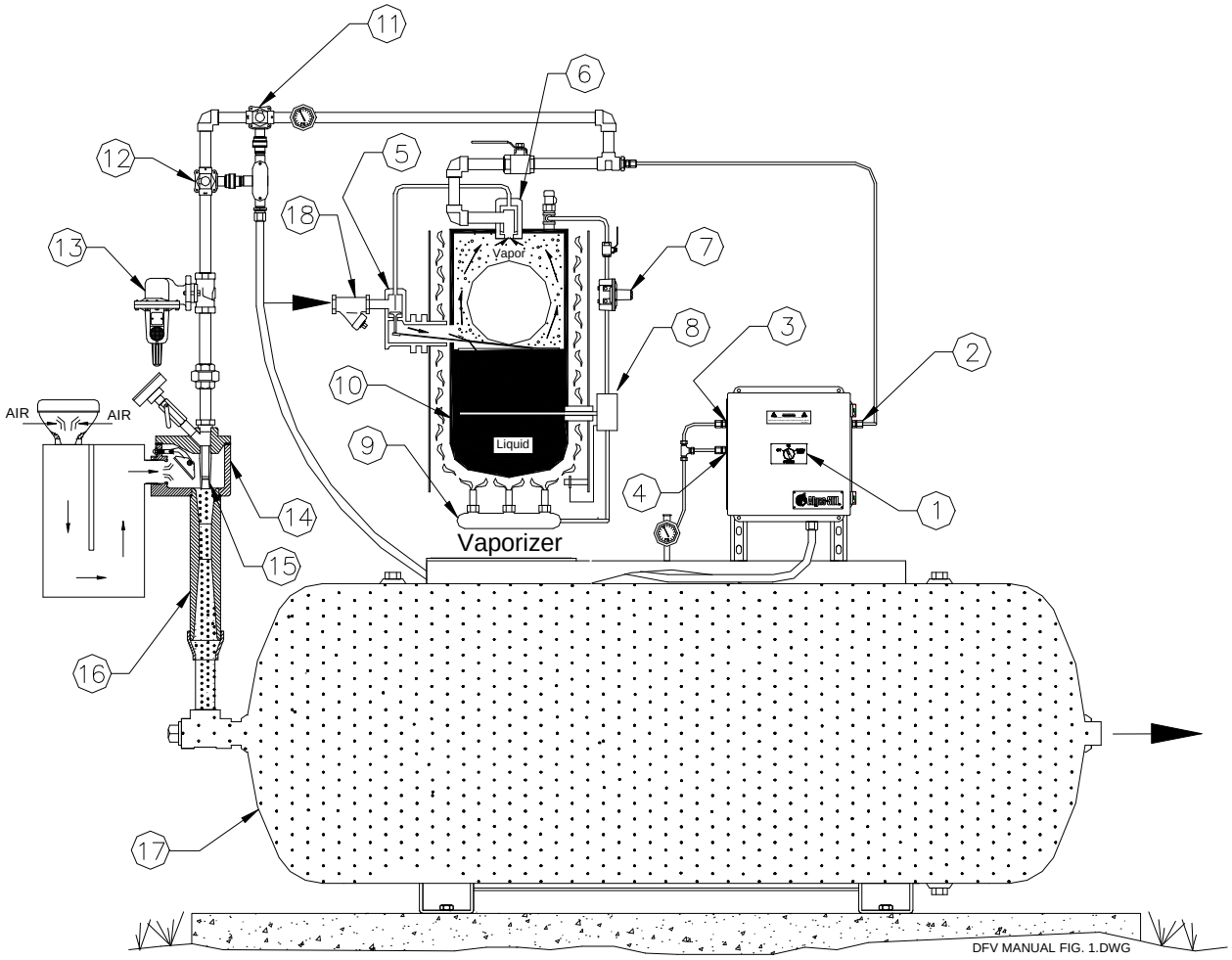
Direct Fire Vaporizer Operation

The Algas-SDI Direct Fired vaporizer applies an open flame directly to the heat exchange surface, which contacts the LPG liquid that is to be vaporized. The outlet LPG vapor temperature of the vaporizer can be set using the thermostat. This controls the burner(s) cycling on and off to accommodate the load requirement. The Liquid Inlet valve and the Capacity Control valve provide safety against liquid carry-over. Refer to the *Operation* section for details.

Mixer Operation

The pressure of the vaporized LPG from the vaporizer closes the low vapor switch and activates the venturi control circuit. The venturi solenoid opens, feeding LPG vapor through a pressure regulator and then through the venturi nozzle. The LPG creates a pressure lower than atmospheric pressure in the venturi housing as it exits the venturi nozzle. The air and the LPG streams are mixed and compressed in the diffuser section and pressurize the accumulator tank. When the pressure in the accumulator tank reaches a preset level, the venturi solenoid valve closes. As the mixed gas is used, the pressure decreases in the accumulator tank. Thus closing the venturi control switch and opening the solenoid valve to refill the tank.

Figure 1 – *DFV Vaporizer / Mixer System Typical Operation*



1. **OFF/0N/RESET SWITCH**
2. **LOW VAPOR PRESSURE SWITCH**
3. **HIGH TANK PRESSURE SWITCH**
4. **VENTURI PRESSURE CONTROL SWITCH (MIXED GAS)**
5. **INLET VALVE**
6. **CAPACITY CONTROL VALVE**
7. **BURNER SUPPLY REGULATOR**
8. **THERMOSTAT**
9. **BURNER**
10. **HEAT EXCHANGER**
11. **SAFETY SOLENOID VALVE**
12. **VENTURI VAPOR SOLENOID VALVE**
13. **VENTURI VAPOR PRESSURE REGULATOR**
14. **VENTURI HOUSING ASSEMBLY**
15. **VENTURI NOZZLE**
16. **DIFFUSER**
17. **ACCUMULATOR TANK**
18. **INLET STRAINER**

Installation 2

DFV System Installation Procedure

The **DFV** systems are normally installed outside of plant buildings on a concrete pad. Consult state, provincial, insurance carriers, and local authorities for installation requirements. ***Table 1*** provides information on installation distances.

Install the system on a level base and secure it through the four mounting holes. Use 1/2“, grade 5 “J” bolts embedded in a concrete pad at least 6’ x 10’ x 8” thick. Install a drain valve in the plugged opening at the bottom of the surge tank. Install a manual valve after the mixed gas outlet. *See* ***Figure 3*** for suggested installation

Clean all foreign materials from all pipe lines prior to making final connections. All joints require a pipe sealant approved for LPG. Test for leaks using an inert gas, such as compressed carbon dioxide or nitrogen, at approximately 100 psig (7 kg/cm^2). Check all connections using an appropriate leak detection solution or device.

Even very small leaks are unacceptable!
Eliminate all leaks prior to operation.

Table 1 – *Minimum Distance Requirements from Vaporizer*

Exposure	Minimum Distance From Vaporizer Required
Storage Tank	10 feet
Storage tank shutoff valves	15 feet
Point of transfer	15 feet
Nearest important building or group of buildings or line of adjoining property which maybe built upon (except buildings in which vaporizer is installed).	25 feet

** Reference NFPA58*

ELECTRICAL

The data sheet provides electrical power information and addition equipment specifications. Install the vaporizer and circuit breaker in accordance with applicable NFPA, NEC and local regulations. Appropriately ground the vaporizer as specified by local regulations.

LIQUID LINE

The liquid line from the storage tank to the vaporizer should be of sufficient size to supply the vaporizer at full capacity with a maximum pressure drop of less than the hydrostatic head pressure (*see NFPA 54*). Refer to ***Tables 2 & 3*** for line sizing information.

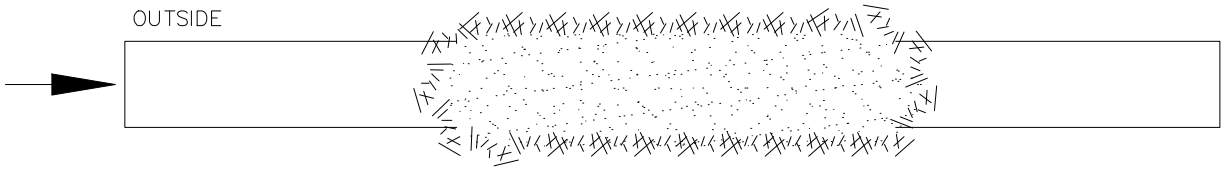
An adequately sized 60 mesh strainer (provided) must be installed at the liquid inlet to the vaporizer. Also install an isolation valve with hydrostatic relief on the inlet liquid line before the strainer

Connect the liquid LPG line to the vaporizer inlet. Back flow of liquid from the vaporizer toward the tank is part of the normal operation of the vaporizer. Do not install check valves in that line.

Pressure in the LPG storage tank depends on ambient temperature. Install an Algas-SDI Stabilaire liquid pump beneath the storage tank if the lowest ambient temperature will not provide enough pressure from the tank to supply your specific system. Refer to the data sheet provided in **Appendix B** of this manual to determine the pressure required for your specific system. The pump should be set up to supply LPG at a constant pressure, regardless of the flow rate.

Figure 2 – *Frost on the Liquid Line*

Frost.wmf



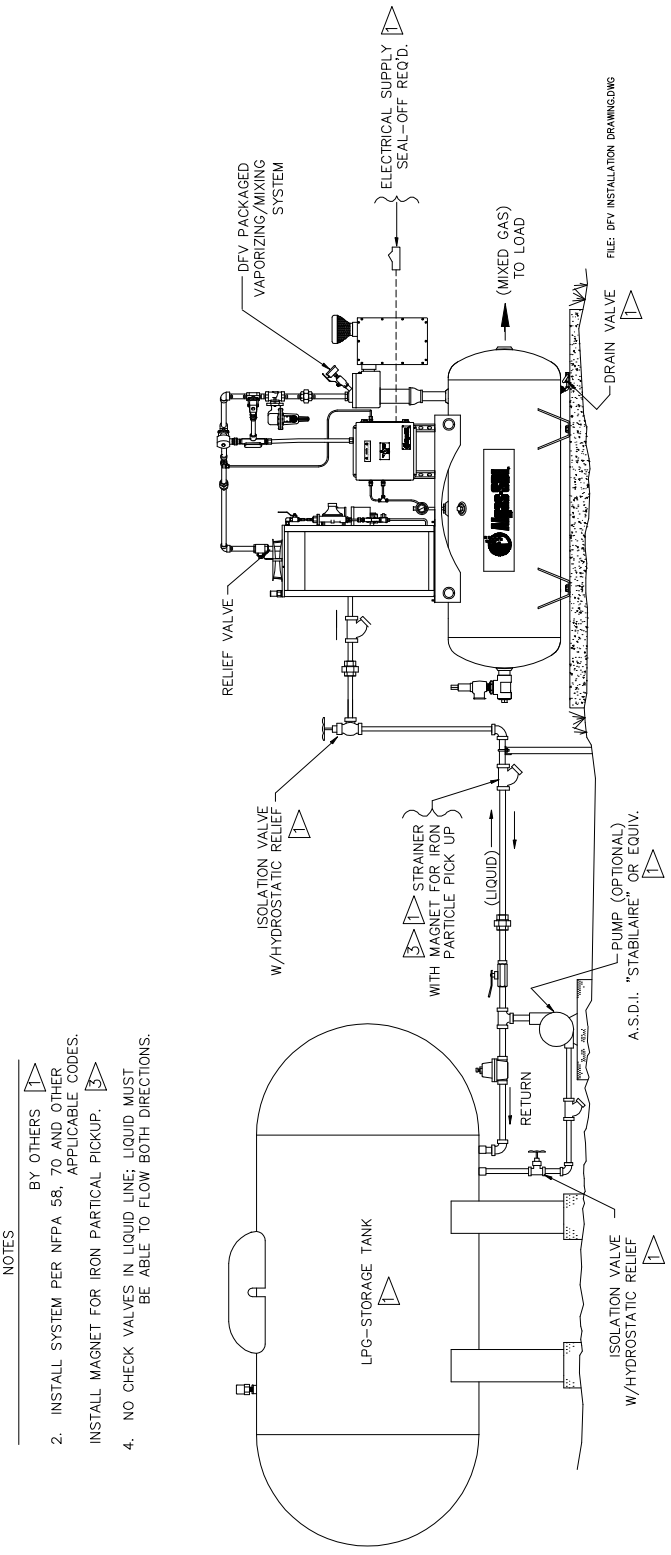
FROST ON INLET LINE - EXCESSIVE PRESSURE DROP.

NOTE

Frost on the liquid line indicates propane is vaporizing due to a restriction that causes a pressure drop. If the inlet pipe is too small, the LPG vaporizes before it enters the vaporizer causing a drastic drop in efficiency. Wrong size inlet pipes can reduce output as much as 50%. When referring to the line sizing chart, note that the pipe sizes recommended are minimum size. Restrictive valves or other devices may also cause a pressure drop in the liquid line resulting in a frosting of the line.

If pressure drop is excessive a liquid pump may be required.

Figure 3 – *DFV Installation Drawing*



BURNER SUPPLY LINE

The vaporizer burners are supplied with vapor from the outlet of the vaporizer where the least possibility of condensation will take place. However, in regions where there is a problem with a high content of heavy ends in the LP gas, a separate vapor supply line to the burner control on the vaporizer may be installed. If a separate burner supply line is used, the following is recommended:

1. Disconnect the ¼" line at the burner regulator.
2. Disconnect the ¼" line at the tee on top of the heat exchanger and plug it with ¼ NPT plug.
3. Install a first stage regulator as close to the tank vapor outlet as possible. A manual shut-off valve should be installed ahead of the regulator.
4. Connect the supply line from the first stage regulator to the burner regulator at the vaporizer. make sure that the supply is sized properly to handle maximum input rating of the vaporizer burner(s).
5. Adjust the burner regulator at the vaporizer so that the vapor pressure at the burner is 11" WC.

SAFETY RELIEF VALVE

Always install the raincap or similar device (if removed) to prevent water and other debris from entering the relief valve discharge port. If water enters, it may freeze and prevent the relief valve from proper discharge, creating a potentially hazardous situation

Table 2 – *LPG Liquid Line Sizing Chart (minimum pipe size)*

System Size	Distance in feet from storage to vaporizer							
	25	**50**	**75**	**100**	**150**	**200**	**300**	**400**
DFV 2.5	¾"	¾"	1"	1"	1"	1¼"	1¼"	1¼"
DFV 7.0	¾"	¾"	1"	1"	1"	1¼"	1¼"	1¼"
DFV 14.0	1"	1¼"	1¼"	1¼"	1¼"	1½"	1½"	1½"

* Add equivalent length of all values and fittings to the length of pipe.

Use this value from these tables to determine minimum pipe use.

Table 3 – *Equivalent Pipe Length of Various Valves and Fittings (length in feet)*

Size/Description	**½"**	**¾"**	**1"**	**1 ¼"**	**1 ½"**
Globe Valve	15.5	21	27	36	43
Gate Valve	0.6	0.8	1	1.4	1.6
Angle Valve	8	11	14	18	21
Elbow, 90	1.4	1.9	2.4	3.2	3.8
Elbow, 45	0.7	1	1.2	1.6	2
Elbow, 90 STR	2.3	3.1	4	5.3	6.3
Tee	2.7	3.7	4.8	6.4	7.5

Table 4 – *Liquid Temperature vs. Tank Pressure Chart*

Liquid Temperature		Propane Tank Gauge Pressure	
°F	**°C**	**PSI**	**Kpa**
-43.7	-41.6	0	0
-40	-39.6	1.4	9.6
-30	-36.8	3.4	23.6
-30	-34.1	5.6	38.9
-25	-31.3	8.1	55.6
-20	-28.6	10.7	73.7
-15	-25.8	13.6	93.5
-10	-23.1	16.7	114.9
-5	-20.3	20.0	136.1
0	-17.6	23.6	163.1
5	-14.8	27.5	189.9
10	-12.1	31.7	218.9
15	-9.3	36.2	249.9
20	-6.6	41.1	283.1
25	-3.8	46.2	318.7
30	-1.1	51.7	356.7
35	1.6	57.6	397.0
40	4.4	63.8	440.1
45	7.1	70.5	485.8
50	9.9	77.5	534.3
55	12.6	84.9	585.7
60	15.4	92.8	640.1
65	18.1	101.2	697.6
70	20.9	109.9	758.3
75	23.6	119.3	822.4
80	26.4	129.1	889.9
85	29.1	139.7	963.4
90	31.9	150.2	1035.7
95	34.6	161.6	1114.2
100	37.4	173.6	1196.6
105	40.1	186.1	1283.1
110	42.9	199.2	1373.7
115	45.6	213.0	1468.6
120	48.4	227.4	1567.9
125	51.1	242.5	1671.9
130	53.9	258.2	1780.5
135	56.6	274.7	1893.9

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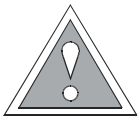
Operation and Startup

3

WARNING

Do not apply power to unit if LPG fumes are present. They may ignite!

Keep a fire extinguisher available in the immediate vicinity before re-applying power when the control cover is removed.



CAUTION

Piping may be hot!

DFV normal operating temperature is about 500-600°F [260-315°C] near the Direct Fire vaporizer exhaust stack. Piping may approach this temperature under some conditions.

FOR YOUR SAFETY — IF YOU SMELL GAS:

- **DO NOT TOUCH ANY ELECTRICAL SWITCHES.**
- **EXTINGUISH ANY OPEN FLAME.**
- **SHUT OFF GAS SUPPLY IMMEDIATELY.**
- **SHUT OFF POWER THROUGH A REMOTE DISC**

Vaporizer Operation & Startup

Refer to Direct Fired Vaporizer Manual for Operation, Startup, Maintenance, Troubleshooting, Spare parts and diagrams.

Mixer Operation & Start-Up

1. Complete installation and leak test.
2. Turn on the customer provided DISCONNECT for the equipment.
3. Turn the OFF/ON/RESET SWITCH to the OFF position.
4. Check for correct VOLTAGE to the system.
5. Manually close the MIXED GAS OUTLET VALVE, which is located at the outlet of the accumulator tank.
6. Manually close VENTURI ISOLATION VALVE(S), which is located after the outlet of the vaporizer

NOTE

Operating the unit in a "dry" condition will not damage this unit. It is not necessary to have LPG in the unit for testing or evaluation.

7. Drain the ACCUMULATOR TANK, check that no moisture or oils are present, re-close the valve.
8. Open all valves between the LPG storage tank and the vaporizer to allow liquid flow to the vaporizer. If a pump is required to achieve the necessary vapor pressure, start the pump and check the outlet pressure. Refer to the data sheet in Appendix B for required vapor pressure.
9. Start Vaporizer. Refer to Vaporizer Operation & Start-up section in the Direct Fired Manual for details.
10. Open the VENTURI ISOLATION VALVE(S).
11. Check the VAPOR PRESSURE GAUGE to verify the proper LPG vapor pressure.
12. Turn the OFF/ON/RESET SWITCH to the ON position. Then turn the switch to the RESET position to allow the venturi to start cycling.
13. The venturi will cycle, raising the pressure in the mixed gas accumulator to the preset level. The unit is now ready to supply mixed gas and opening the outlet shutoff valve will allow mixed gas to flow. The burner(s) and venturi(s) will cycle automatically to match flow conditions while the accumulator tank will insure continuous mixed gas supply.
14. Refer to BTU adjustment procedure in the maintenance section for proper method for setting the venturi trains. The pressure has been set initially at the factory; however, slight adjustments may be required due to altitude or vibrations from shipping.
15. The system is now ready for operation.
16. Refer to the Troubleshooting section for any problems.

Maintenance 4

The DFV packaged vaporizing/mixing system is designed for long term trouble-free operation. Considering the nature of system use, with heavy prolonged workloads, it is very important to provide scheduled maintenance.

The following maintenance schedule may be used as a guideline. This maintenance schedule includes items that must be serviced, the type of service to perform, and the frequency of service. However, this is only a suggested schedule. The conditions in your area and quality of the LP gas liquid may dictate a more stringent or more lax maintenance, but whatever your schedule, remember that maintenance is of paramount importance for trouble free operation.

ASDI provides a **RECOMMENDED SPARE PARTS** list located at the back of this manual and the Direct Fired manual for ordering ease when replacing components.

CAUTION

The equipment described in this manual is designed to operate with LP gas, a flammable fuel under pressure. The nature of the application involves inherent hazards that could result in injury. ONLY a trained and fully qualified person should service this equipment.

CAUTION

1. ***When servicing a component in the liquid or vapor line. BE SURE that the LP-gas supply to that component is shut off before it is removed or disassembled. The vaporizer must be completely blown down before performing service. Be sure that ALL sources of ignition are extinguished within 25 feet of the work area.***
2. ***When flaring the contents of the vaporizer, be sure that the burners are on to prevent freezing during the flaring operation.***

Table 5 – *Maintenance Schedule*

Item	1 Month	3 Months	6 Months	Annual
Pilot Burner Assembly	Inspect pilot assembly. The flame should envelope 3/8" to ½" of the thermocouple tip.			
Main Burner Assembly	Inspect for proper flame. Check that air supply openings are clear of debris, dirt or trash. If needed, clean each burner orifice.			Inspect for proper flame. Check that air supply openings are clear of debris, dirt or trash. If needed, clean each burner orifice.
Safety Relief Valves	Check all relief valves on vaporizer, accumulator tank, liquid, and vapor lines for signs of corrosion in outlet. Check all raincaps. Replace if damaged or missing.			
Enclosure	Check access door and inside enclosure for debris and combustible material. Check and, if needed, clean the inlet louvers and vent cap(s).			

Item	1 Month	3 Months	6 Months	Annual
Thermostat				Check the thermostat for proper operation *(see Start-up Procedure*). If the thermostat is not operating properly, it should be replaced (the thermostat cannot be serviced).
Thermocouple				The electrical output of the thermocouple should be checked with a millivolt meter. The thermocouple output should be between 13 and 30 millivolts. A lower than 13 millivolt reading indicates the thermocouple (P/N 46/4) should be replaced.
Liquid Inlet Valve				Disassemble and clean the valve. To service valve, use kit 3-0016
Capacity Control Valve				Disassemble and clean the valve. To service valve, use kit 3-0017. Use powdered graphite as lubricant around top of the piston with “O” ring. Use grease as lubricant on “O” ring.

Item	1 Month	3 Months	6 Months	Annual
Liquid LPG inlet strainer	Clean		Check as conditions require	Check as conditions require
Solenoid valve				Change the diaphragm and operating parts if the unit is being used regularly or if the valve makes unusual noises (i.e. buzzing, etc.) during operation. See the enclosed maintenance and operation sheet for ASCO 2-way valves replacement procedure. (**Appendix A**)
Electric wiring and connections			Check primary terminal lug tension	Visually inspect for corrosion, loose wires, heat buildup and charring
Low vapor pressure switch set points				Verify against the values on the data sheet
High tank pressure switch set points				Verify against the values on the data sheet
Venturi check valve assembly	Check for leaks		Check for wear and leakage	Check clevis assy., clevis pivot screw, valve arm & valve surface for wear. Replace if worn.
Motive pressure (pressure at the venturi) set point		Check setting		

NOTE

Before replacing thermostat, be sure thermocouple is delivering the proper voltage to the thermostat (13 to 30 millivolts).

Adjustment Procedures for System Operating and Safety Controls

All of the controls (except for the venturi regulator) are preset at the factory. However, vibration in transportation may alter the settings or it may be desirable to change the system delivery pressure (within the range of the installed venturi). Thus the control settings may need to be checked or readjusted. Any replaced controls will also require adjustment.

WARNING

Power to the control box must be turned off at a remote disconnect before the cover is removed. Check for propane leaks before applying power.

WARNING

DO NOT APPLY POWER IF LPG FUMES ARE PRESENT. THEY MAY IGNITE!

WARNING

DO NOT attempt to adjust the pressure switches with the power turned on.

WARNING

Always have a fire extinguisher handy when operating with the control enclosure open.

MOTIVE PRESSURE (Pressure at the Venturi)

SET PRESSURE OF THE VENTURI REGULATOR

The initial motive pressure for the venturi is stamped on the base of the venturi housing. This pressure is adjusted using the vapor pressure regulator on the LPG vapor train. The adjustments should be made with the system in operation, using a BTU METER while adjusting the motive pressure and monitoring BTU meter to attain a 1450 BTU/cu. ft. mix.

Table 6 – *Pressure Requirements & Settings*

Propane Pressure Requirement Data		
Mixed air/propane delivery pressure psig (kg/cm2)	**Inlet vapor pressure psig (kg/cm2)**	***Nozzle motive pressure psig (kg/cm2)**
5.0 (.35)	31.0-55.0 (2.18-3.87)	28.0-43.0 (1.97-3.02)
8.0 (.56)	74.0-85.0 (5.20-5.98)	70.0-74.0 (4.92-5.20)

SYSTEM DELIVERY PRESSURE

VENTURI PRESSURE CONTROL SWITCH (MIXED GAS / DELIVERY PRESSURE)

The Venturi Pressure Control Switch (Mixed Gas/Delivery) is wired normally closed and is set to open according to the set point on the data sheet. The Venturi Pressure Control Switch will cycle on and off as the tank pressure changes. The system delivery pressure is adjustable within the range of the installed venturi. The on/off and differential pressures are set by means of the Venturi Pressure Control Switch adjustment screw and the Venturi Pressure Control Switch differential pressure adjustment wheel.

To adjust the switch, use a 1/4“ open end wrench. Turn the main adjustment screw counterclockwise to lower the setpoint or clockwise to raise the setpoint. Turn the adjusting screw until the “ON” setpoint is reached, then set the differential adjustment wheel for a deadband "OFF" of .75 to 1 psi. A typical setting is between E and F. *See Section 5: Troubleshooting* for replacing the Venturi Pressure Control Switch.

Table 7 – *System Delivery Pressure Set points*

System Delivery Pressure Set points				
DFV 2.5 - DFV 14.0				
Delivery Pressure	**Venturi “ON” (psig)**	**Venturi “OFF” (psig)**	**Deadband**	**Deadband Position**
#5	5	5 ¾ - 6	.75 - 1	E - F
#8	8	8 ¾ - 9	.75 - 1	E - F

HIGH TANK PRESSURE SWITCH

The High Tank Pressure Switch is wired normally closed and is set to open according to the set point on the data sheet. The high tank pressure switch is a safety that opens due to high tank pressure. When this occurs it is an indication that there is a component failure. See Troubleshooting Section to resolve the problem. The pressure switch is located in the control box. To set, turn the adjusting wheel to approximate the setting shown on the indicator scale on the switch. The set points for the high tank pressure switch in the control box are as follows.

Table 8 – *High Tank Pressure Switch Set points*

High Tank Pressure Switch Set points	
Mixed air/propane delivery pressure	**High tank pressure switch**
5 psig	8 psig
8 psig	11 psig

LOW VAPOR PRESSURE SWITCH

The Low Vapor Pressure Switch is wired normally open and is set according to the set point on the data sheet. The Low Vapor Pressure Switch opens when there is in adequate pressure to operate the venturi. With the system operating, slowly throttle the vaporizer LPG vapor outlet valve. This reduces the LPG vapor pressure being sent to the mixer. Observe the LPG vapor pressure gauge and note the pressure at which the low vapor pressure switch opens and disables the venturi solenoid valve.

To set the low vapor pressure switch, turn the adjusting wheel to the approximate setting shown on the indicator scale on the switch body. Refer to the data sheet for set point information. Repeat the process to verify the setpoint. Note the low vapor pressure switch only disables the venturi solenoid valve and does not shut off the DFV.

Venturi Check Valve Replacement Instruction

If the venturi check valve leaks or the pivot mechanism operates poorly, the venturi check valve assembly must be replaced. Follow the procedure below to replace the venturi check valve and pivot arm.

NOTE

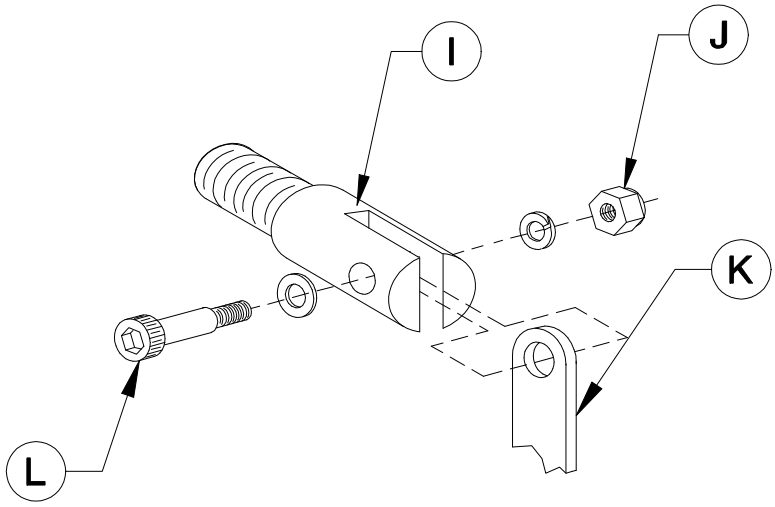
As with all components containing materials subject to deterioration, the venturi check valves should routinely be checked and replaced as necessary. A minimum annual inspection should be conducted. IF REPLACEMENT VENTURI CHECK VALVE IS NOT ASSEMBLED, follow below instructions

This instruction set is to be used for the Venturi Check Valve Kit- P/N - 40490.

1. After the existing check valve (A) has been removed, examine the machined seating surface (F) on the venturi housing (D) to be sure the surface is clean and without flaws.

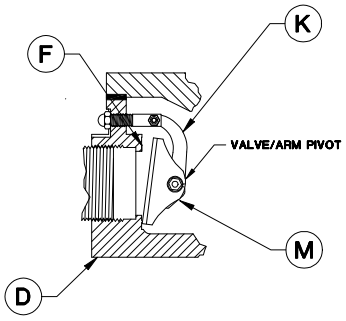
2. Screw the clevis (I) into the housing, using Permatex NO. 2 or equivalent on the threads, until 3- 3 ½ threads are exposed outside of the housing (D). Do not use a screwdriver or other prying device to install the clevis. Clean any excess Peratex from clevis slot.

3. Insert the check valve arm (K) into the slot of the clevis and connect the two pieces with the clevis/arm pivot screw (L) through the aligned holes. Be sure that the lock washer and a flat washer are inserted on the lock nut end (with the flat washers are inserted on either side of the clevis. Tighten the lock nut (J), allowing for free swing of the arm.

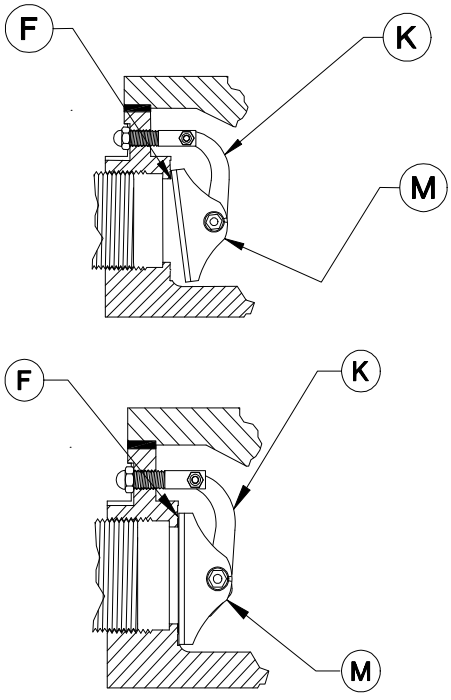


Check for proper clevis installation as follows:

- With the arm (K) raised, rotate the valve (M) around the valve/arm pivot so that the edge of the valve nearest the clevis is lowered without allowing the valve (M) to turn around the valve/arm pivot; only the lower part of the valve should contact the seating surface (F).

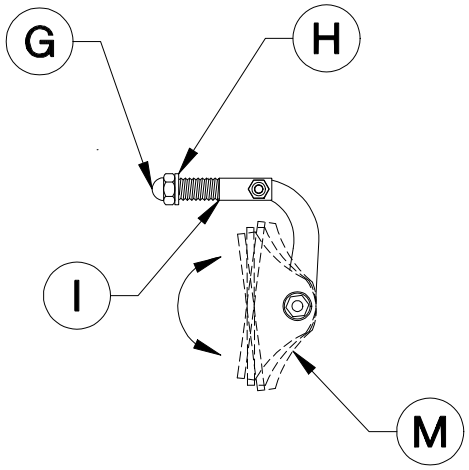


With the valve (M) rotated to the other extreme position around the valve/arm pivot, lowering the arm (K) should cause only the upper part of the valve (M) to contact the seating surface (F).



- Lower the arm (K) a third time, allowing free rotation of the valve (A). The valve (M) should be able to contact the seating surface (F) uniformly all around.

■ If the valve does not contact the seat as described above, reposition the clevis (I) in the housing (D). At least three threads must be exposed for proper installation of the acorn nut (G)



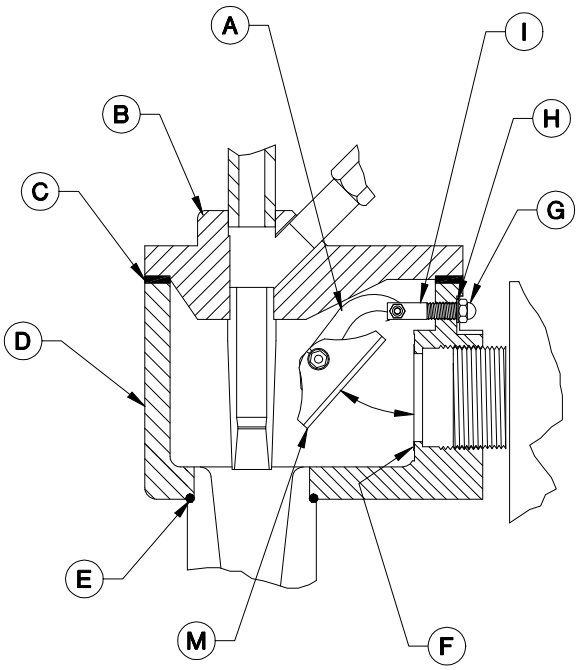
5. Place sealing washer (H) on to clevis (I) then tighten the acorn nut (G) onto the clevis (I) outside the housing (D), making sure that when the nut is tight , the valve is centered. Do not use any tools on the clevis inside the housing, or on the arm or valve. It may be helpful to start with the valve offset to the side and allow it it to rotate to its centered position while tightening the acorn nut.

6. Tighten the lock nut (J) on the clevis/arm pivot screw until the arm is tight in the clevis. Then slowly loosen the lock nut just until the arm can swing freely. Check that the valve is centered and clears the housing on both sides.

7. Install the venturi housing lid (B), using a new gasket (C). Apply white Lithium grease to gasket & threads.

8. Apply pressure to the unit and check for leaks around the lid and around the check valve. Initially a small leak may occur around the check valve, but after a few cycles the leak should correct itself. If it persists, remove the lid and re-check the seating surfaces and the alignment.

Figure 5 –*Venturi Check Valve Assembly*



Venturi Check Valve.dxf

A. Flapper Arm Assembly
B. Housing Lid
C. Housing Gasket
D. Housing
E. Diffuse/Housing “O” Ring
F. Seating Surface
G. Acorn Nut
H. Sealing Washer
I. Clevis
J. Lock Nut
K. Flapper Arm
L. Pivot Screw
M. Flapper

LEAK CHECK PROCEDURE FOR VENTURI CHECK VALVES

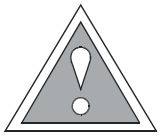
Remove silencer from venturi.

Build up pressure in the surge tank to the system operating pressure, shut off the system, close the inlet valve, and disconnect all power.

Use either a gas detector or a soapy solution applied to the check valve and seat to determine if there is a leak.

If there is a slight leak from the venturi check valve, tapping the valve open quickly with the handle of a screwdriver **(DO NOT USE THE BLADE SIDE)** or a suitable tool may dislodge a small particle on the lip of the valve. Otherwise the venturi must be disassembled to adjust the check valve pivot arm as outlined in the previous procedure.

When assembling the silencer into the venturi housing, use an anti-seize compound on the threads.



WARNING

LPG is heavier than air and LPG vapor either mixed with or without air will "pool" in low areas without ventilation or wind. Check potential pooling areas with a gas detector if gas is suspected.

BTU ADJUSTMENT PROCEDURE

The BTU adjustment procedure must be done on initial start-up to assure proper mixed gas BTU value.

Connect your BTU analyzer to the surge tank test port.

With your system running, establish a load such that the venturi is on 50% of the time and off 50% of the time. Adjust the venturi regulator until the venturi motive pressure is at the pressure stamped on the venturi housing or the pressure called out on your data sheet. This is a starting point for adjusting the BTU value of your mixed gas.

Monitor your BTU instrument and set the venturi regulator until you have the appropriate mix of propane/air (in most cases 1450 BTU's per cubic foot, or 1.30 specific gravity).

Due to the physical properties of the venturi's, as the motive pressure increases, the LPG flow increases accordingly. If the motive pressure is set too high, it may overdraw the vaporizer. A general rule is, do not exceed the motive pressure stamped on the venturi housing by more than 5 PSIG.

Increase the system load and verify the mixed gas BTU value.

Disconnect your test equipment and return the system to operation

Troubleshooting 5

VAPORIZER

There are 4 troubleshooting trees provided for the Direct Fire Vaporizer.
TREE #1 - Pilot will not light.
TREE #2 - Pilot lights but will not hold.
TREE #3 - Main Burner will not light.
TREE #4 - Vapor Pressure Drops.

PILOT

The pilot flame is adjusted at the factory to provide a non-blowing blue flame. If the flame is not adequate or the pilot does not stay lit, check the pilot burner to see if it is clear of any obstructions.

Flame should envelope 3/8" to ½" of the thermocouple tip. If the burner is too low, the thermocouple will not generate sufficient voltage to hold the main burner's valve open. If the pilot flame is too small, clean the pilot burner orifice, or replace the pilot.

MAIN BURNTER WILL NOT IGNITE

Check the pilot burner as per 1 above.

Check burner regulator. Disconnect tube from outlet side of regulator and check output pressure.

If pilot burner and burner regulator check out OK, the problem is in the thermostat. Replace thermostat (the main burner will not come on unless the temperature in the heat exchanger falls below 120° F).

DROP IN VAPOR PRESSURE

Check burner; check pilot as per 1 and 2 above.

If vapor pressure drops, but main burner(s) is working, vapor demand exceeds vaporizer capacity. Cut down on vapor demand.

Check liquid excess flow valve and shut off valve; make sure they are open.

Close liquid inlet valve upstream of strainer. Bleed down system and clean strainer filter.

MIXER

No Reaction when switch turned to ON or RESET

Be sure wiring is correct. Refer to the Wiring Schematic for proper installation. Replace switch if defective.

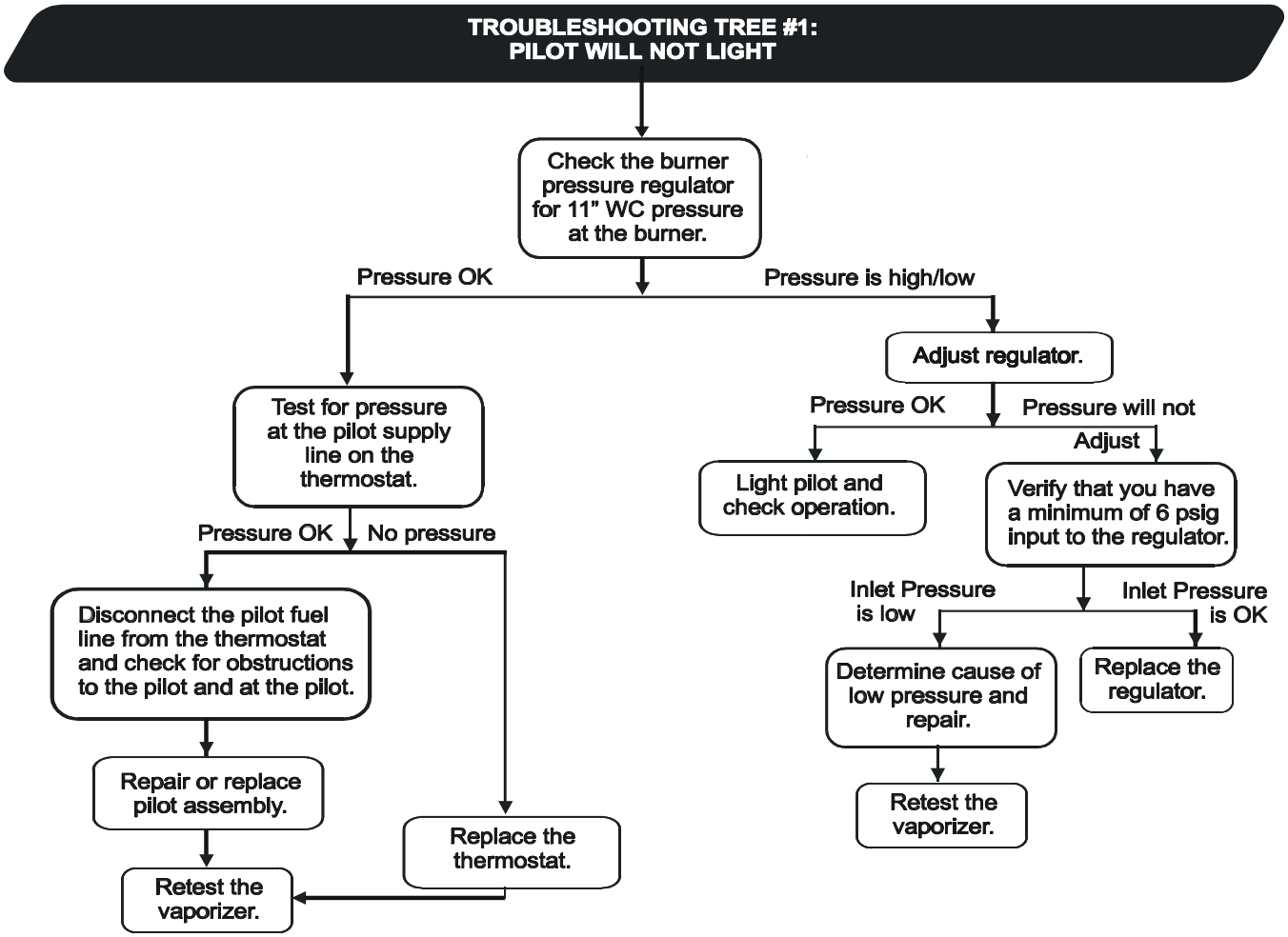
Vaporizer operates, but Venturi does not Open

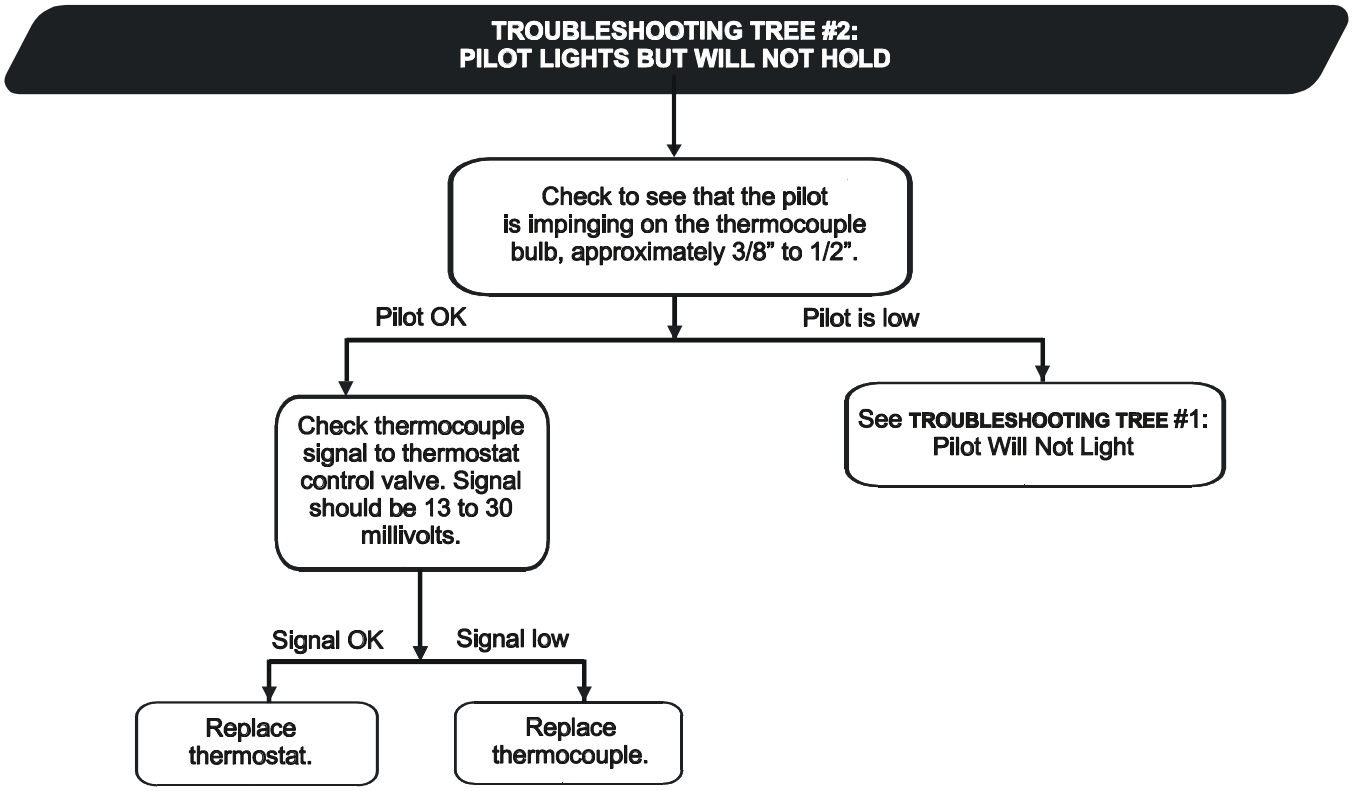
Hold the **OFF/ON/RESET** switch in the RESET position to energize the relay.

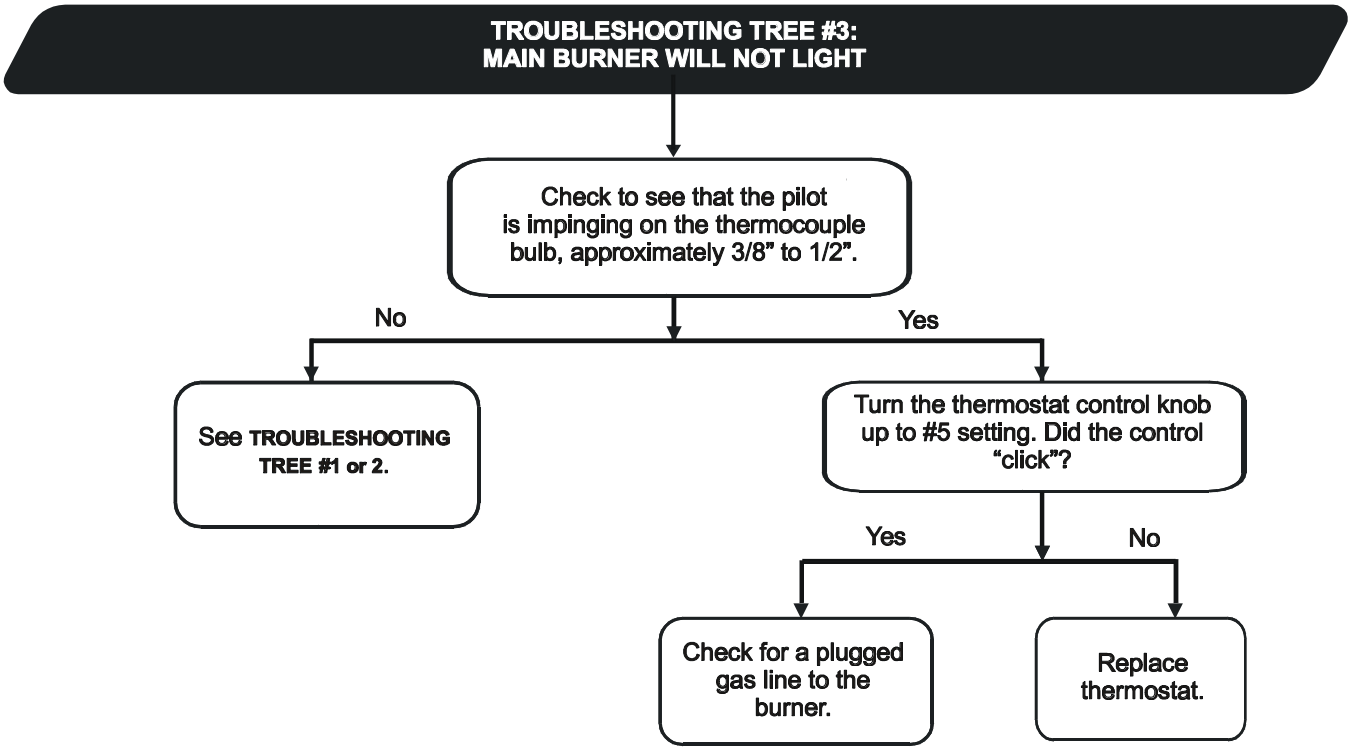
If the solenoid valves still do not open, check the continuity of the solenoid circuit. Replace wire or solenoid valve is continuity is open. Check the wiring as well. The pressure switches may need adjustment or replacement. Refer to the *Testing Individual Components* section for details.

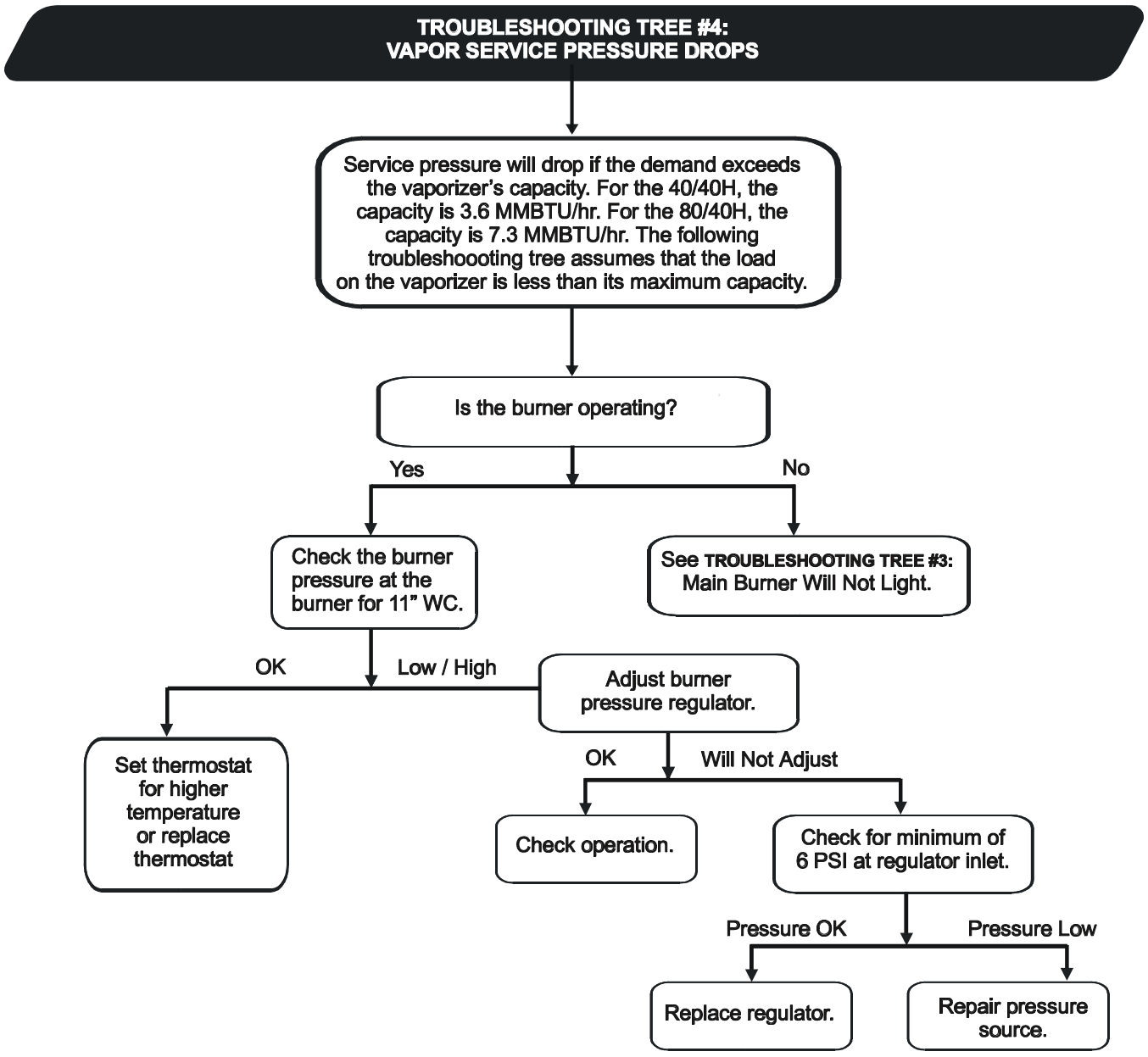
DFV Cycles Once and Shuts Down

Check the mixed gas pressure. Adjust the **VENTURI PRESSURE CONTROL SWITCH** if the pressure is too high. Refer to the *Testing Individual Components* section for details.




TROUBLESHOOTING TREE #2:
PILOT LIGHTS BUT WILL NOT HOLD
Check to see that the pilot is impinging on the thermocouple bulb, approximately 3/8" to 1/2".
Pilot OK
Pilot is low
Check thermocouple signal to thermostat control valve. Signal should be 13 to 30 millivolts.
See TROUBLESHOOTING TREE #1: Pilot Will Not Light
Signal OK
Signal low
Replace thermostat.
Replace thermocouple.


TROUBLESHOOTING TREE #3:
MAIN BURNER WILL NOT LIGHT
Check to see that the pilot is impinging on the thermocouple bulb, approximately 3/8" to 1/2".
No
Yes
See TROUBLESHOOTING TREE #1 or 2.
Turn the thermostat control knob up to #5 setting. Did the control "click"?
Yes
No
Check for a plugged gas line to the burner.
Replace thermostat.


TROUBLESHOOTING TREE #4:
VAPOR SERVICE PRESSURE DROPS
Service pressure will drop if the demand exceeds the vaporizer's capacity. For the 40/40H, the capacity is 3.6 MMBTU/hr. For the 80/40H, the capacity is 7.3 MMBTU/hr. The following troubleshoooting tree assumes that the load on the vaporizer is less than its maximum capacity.
Is the burner operating?
Yes
No
Check the burner pressure at the burner for 11" WC.
See TROUBLESHOOTING TREE #3: Main Burner Will Not Light.
OK
Low / High
Adjust burner pressure regulator.
Set thermostat for higher temperature or replace thermostat
OK
Will Not Adjust
Check operation.
Check for minimum of 6 PSI at regulator inlet.
Pressure OK
Pressure Low
Replace regulator.
Repair pressure source.

Testing Individual Components

NOTE

See ADJUSTMENT PROCEDURES FOR SYSTEM OPERATING AND SAFETY CONTROLS section. Venturi Pressure Control Switch, earlier in this manual for additional information.

HIGH TANK PRESSURE SAFETY SWITCH

Shuts off the unit when the **MIXED GAS** pressure is too high due to a malfunction in the control system. *See the data sheet* for pressure setting. The pressure is adjusted by turning the adjustment dial on the switch.

Accuracy of the High Tank Pressure safety switch can be checked with an external regulator and calibrated pressure.

REPLACING THE HIGH TANK PRESSURE SAFETY SWITCH

- Turn power off at the disconnect, bleed the system to 0 pressure.
- Remove the wires to the switch.
- Remove the switch with an open end wrench.
- Install a new switch.
- Turn power on, open isolation valve, and bring system up to operating pressure.
- Carefully check carefully for leaks at all connections.
- Refer to the adjustment procedure section for setting the switch.

LOW VAPOR SAFETY SWITCH

Disables the venturi when the vapor pressure is too low to properly operate the venturi. Once there is adequate vapor pressure the venturi will resume operation as needed. *See the data sheet* for pressure setting. The pressure is adjusted by turning the adjustment dial on the switch.

Accuracy of the low vapor safety switch can be checked with an external regulator and calibrated pressure gauge or by removing the switch and testing it with a known pressure.

REPLACING THE LOW VAPOR SAFETY SWITCH

- Turn off the power at the disconnect, bleed the system to 0 pressure.
- Remove the wires to the switch.
- Remove the switch with an open end wrench.
- Install a new switch.
- Turn power on, open isolation valve and bring system up to operating pressure.
- Refer to the adjustment procedures section for setting the switch

VENTURI PRESSURE CONTROL SWITCH (MIXED GAS / DELIVERY PRESSURE)

The Venturi Pressure Control Switch maintains tank pressure by cycling on and off as required by the load.

Accuracy of the Venturi Pressure Control switch can be checked with an external regulator and calibrated pressure.

REPLACING THE VENTURI PRESSURE CONTROL SWITCH (MIXED GAS / DELIVERY PRESSURE)

- Turn off the power at the disconnect, close the inlet hand valve and bleed the system to 0 pressure.
- Remove the wires to the switch.
- Remove the switch with an open end wrench.
- Install a new switch.
- Turn power on, open isolation valve and bring system up to operating pressure.
- Verify operation with external pressure gauges.
- Refer to the adjustment procedures section for setting the switch.

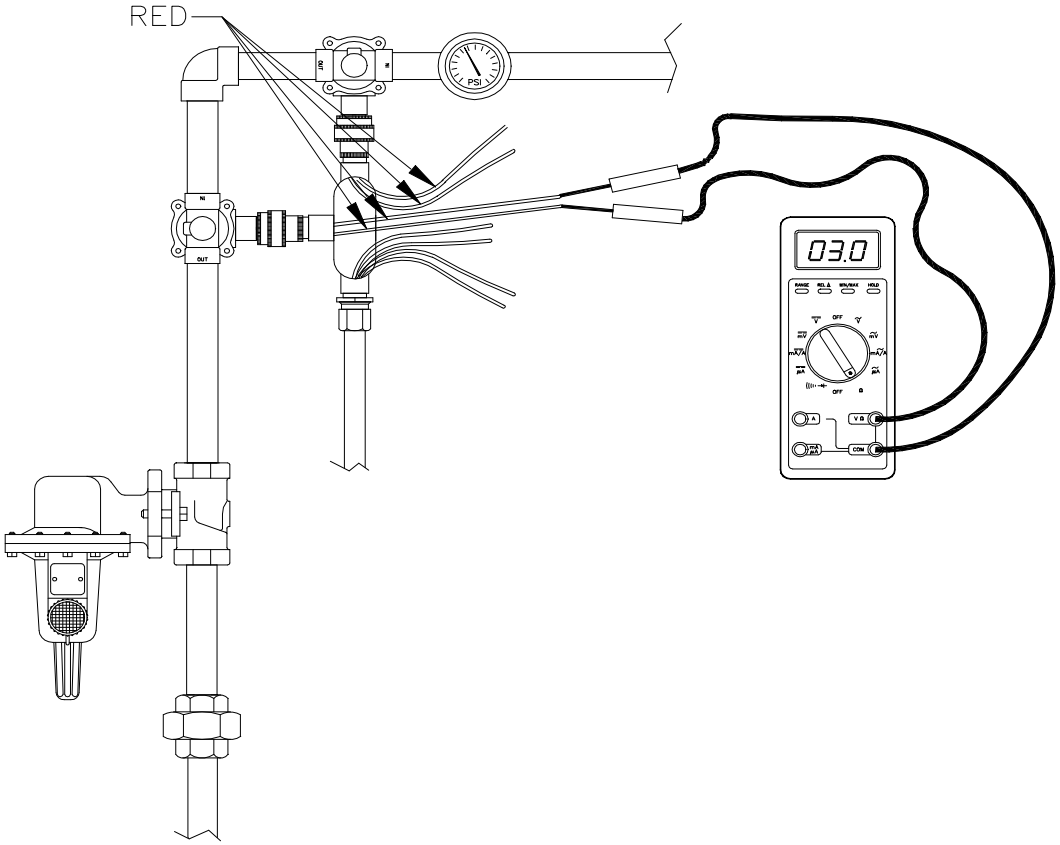
Solenoid Valve Electrical Test

WARNING

Shut off power at the electrical disconnect before proceeding.

Remove the cover of the conduit tee near the solenoid valves. Disconnect the wires and measure each of the solenoid lead wires. You should measure approximately 3 ohms on the multimeter. If the measured resistance is incorrect, change the solenoid coil.

Figure 6 – *Solenoid Valve Electrical Test.*



APPENDIX A

COMPONENT INFORMATION

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Table 12 – DFV Packaged Vaporizing/Mixing System Recommended Spare Parts and Accessories

DFV Replacement Parts		
Components	**Description**	**Qty.**
35539 – DFV – ALL	SWITCH, PRESSURE, VENTURI CONTROL (MIXED GAS), 0-20 PSI	1
36081 – DFV2.5–5# DFV—7–5# DFV–14–5#	SWITCH, PRESSURE HIGH TANK (MIXED GAS), 4–12 PSI	1
36082 – DFV2.5–8# DFV—7–8# DFV–14–8#	SWITCH, PRESSURE HIGH TANK (MIXED GAS), 8–25 PSI	1
36118 – DFV2.5–5# DFV—7–5#	SWITCH, PRESSURE, LOW VAPOR, 20-50 PSI	1
36106 – DFV2.5–8# DFV—7–8# DFV–14–8#	SWITCH, PRESSURE, LOW VAPOR, 40–120 PSI	1
31304	RELIEF VALVE (SURGE TANK)	1
36113 - DFV – 110VAC	VALVE, SOLENOID, ¾" (SAFETY AND VENTURI CONTROL)	2
36112 - DFV – 220VAC	VALVE, SOLENOID, ¾" (SAFETY AND VENTURI CONTROL)	2
40287	REPAIR KIT, SOLENOID VALVE	2
50330 - DFV – 110VAC	LAMP, 110V	1
53124 - DFV – 220VAC	LAMP, 220V	1
51476 - DFV – 110VAC	CONTROL RELAY, 110V	1
53017 - DFV – 220VAC	CONTROL RELAY, 220V	1
37009 - DFV2.5 DFV—7	ELECTRONIC IGNITOR 117V / 220V	1
37009 - DFV–14	ELECTRONIC IGNITOR 117V / 220V	2
53096 - DFV – ALL	FUSE, 1-1/2 AMP SLO-BLO	1
33950 – DFV2.5–5# 33951 – DFV—7–5# 33952 – DFV–14–5# 33953 – DFV2.5–8# 33953 – DFV—7–8# 32070 – DFV–14–8#	REGULATOR, 627	1
20122	GASKET, VENTURI HOUSING	1
31051	O-RING (DIFFUSER)	1
40490	VENTURI CHECK VALVE REBUILD KIT	1
36080	SILENCER	1
31016	AIR INLET SCREEN	1
30638	GAUGE, PRESSURE, 0-100 PSI	1
30641	GAUGE, PRESSURE, 0-300 PSI	1
52681	MANUAL, DFV	1
52642	MANUAL, DIRECT FIRED	1

Installation & Maintenance Instructions

ASCO® TRIVPOINT® Pressure Switches

Miniature–Size, Fixed Deadband Pressure Switches With Field Adjustable Set Points

H–SERIES

Form No. P7079R4

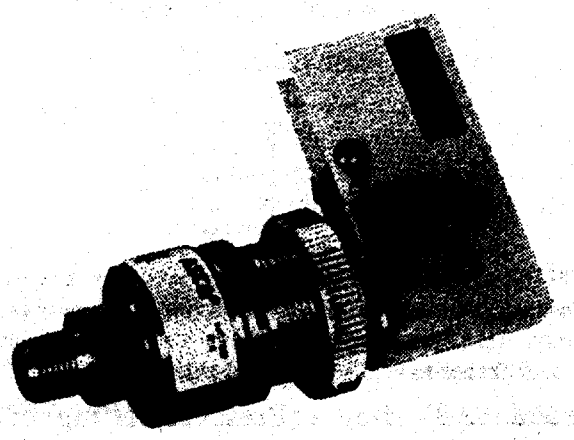
DESCRIPTION

The H–Series are miniature size pressure switches having field adjustable set points, fixed deadbands, and diaphragm/piston sensors. These pressure switches are designed to provide long life and maintain set point accuracy. Materials wetted by the fluid include brass or stainless steel pressure connections. Internal elastomers are made of Buna N, ethylene propylene, fluorosilicone, or VITON* depending upon service requirements.

H–Series pressure switches are available with:

- Open–Frame construction
- Type 1 –General Purpose Enclosure
- Types 3, 3S, and 4–Raintight/Watertight Enclosure

NOTE: H–Series, Suffix *L* pressure switches are limited to Open–Frame Construction.



H–Series, Suffix *L* Pressure Switch

OPERATION

The pressure switch controls electrical circuits in response to changes in pressure. The set and reset points are adjustable over the full range of the switch. As the deadband (on–off differential) is adjusted, both set point on increasing pressure and set point on decreasing pressure are changed. The difference between these points is fixed and is not adjustable. Pressure setting adjustments are made by turning the adjustment wheel at the center of the switch.
On H–Series, Suffix S pressure switches, the snap switch has an adjustment knob to vary the deadband range. To increase deadband range, turn knob counterclockwise; to decrease range, turn knob clockwise.

NOTE: The maximum proof pressure for H–Series pressure switches is 250 psig. Proof pressure is the pressure which a device can be subjected to for extended periods of time without changes in its operating characteristics.

*DuPont's Registered Trademark

INSTALLATION

Check the nameplate for correct catalog number, electrical rating, and pressure range. Never apply incompatible fluids or exceed pressure rating of the switch.

IMPORTANT: All internal adjustments have been made at the factory. Any adjustment, alteration, or repair to the parts of the switch other than stated herein voids all warranties.

Temperature Limitations

Ambient Temperature

- Standard & Suffix *L* Switch: – 4° F to +140° F
- Suffix *U* Switch: – 4° F to +122° F

Check catalog number on nameplate to determine fluid temperature limitations. The seventh (7th) digit in the catalog indicates diaphragm material and fluid temperature limitations. See chart provided.

Seventh (7th) Digit in Catalog Number	Diaphragm Material	Fluid Temperature Limitations
1	Buna N	–4° F to +180° F
2	VITON*	–4° F to +250° F
6	Ethylene Propylene	–4° F to +250° F
7	Fluorosilicone	–40° F to +250° F

EXAMPLE: For Catalog Number HB46A278, the seventh digit of the catalog number is 7. This indicates that the diaphragm material is Fluorosilicone and the fluid temperature limitations are – 40° F to +250° F.

Positioning

The pressure switch may be mounted in any position.

Mounting

For mounting bracket (optional feature) or mounting dimensions of general purpose enclosure see Figures 1, 2, and 3.

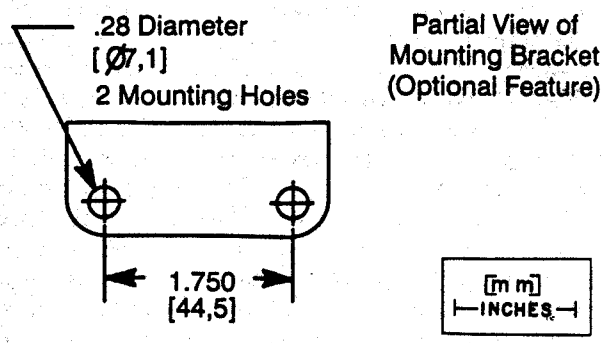


Figure 1. Optional mounting bracket.

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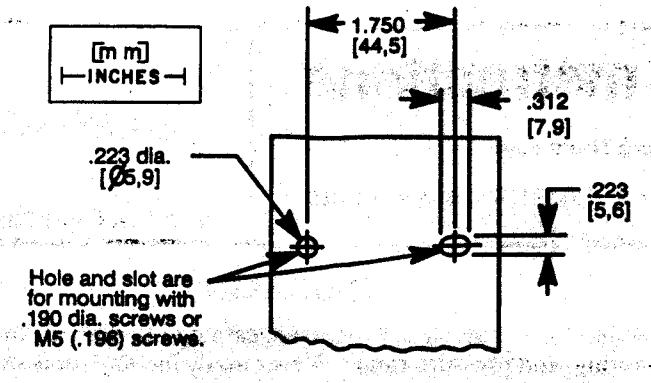


Figure 2. General purpose enclosure.

Piping/Tubing

Adequate support of piping and proper mounting of pressure switch should be made to avoid excessive shock or vibration. To minimize the effect of vibration on a switch, mount perpendicular to vibration. Connect piping or tubing at base of pressure switch.

⚠ CAUTION: Do not use 1/2" pipe thread on pressure switch body as a pressure connection. This thread is provided for mounting the pressure switch in a panel enclosure or mounting bracket through a 7/8" diameter hole.

⚠ CAUTION: Pressure switches with the seventh (7th) digit in the catalog number being a six (6) are provided with ethylene propylene diaphragm material which can be attacked by oils and greases. Wipe the pipe threads clean of cutting oils.

Apply pipe compound sparingly to male pipe threads only. If applied to internal threads, the compound may enter the sensor and cause operational difficulty. Avoid pipe strain on pressure switch by properly supporting and aligning piping. When tightening pipe, do not use the pressure switch as a lever. Locate wrenches applied to pressure switch body on wrenching flats only.

⚠ CAUTION: For steam service, install a condensate loop, (pigtail or steam siphon tube) between the steam line and the pressure switch.

Wiring

Wiring must comply with local codes and the National Electric Code. Use No. 14 AWG copper wire rated for 60° C minimum. Switch is marked *NO* for normally open, *NC* for normally closed, and *C* for common. H–Series, Suffix *L* switches are provided with 1/4" spade terminal connections. The general purpose switch enclosure is provided with two 7/8" diameter knockouts to accommodate 1/2" electrical hub or connector. For extra support, leave switch housing assembled when driving out 7/8" diameter knockout. It is recommended that flexible conduit be used. If rigid conduit is used, do not consider it or use it as a means of supporting (mounting) the pressure switch. The raintight/watertight enclosure has a 1/2" conduit hub. When replacing housing cover, torque screws in a crisscross manner to 10 in–lbs [1,1 Nm] to ensure even gasket compression.

⚠ CAUTION: Electrical load must be within range stated on nameplate. Failure to stay within the electrical range of the switch rating may result in damage or premature failure of the electrical switch.

⚠ CAUTION: Do not overtighten screw type terminal connections. When connections are made, be sure there is no stress on the wire leads. Excess of either condition may cause malfunction of switch.

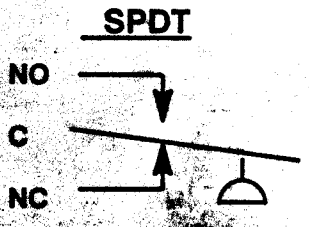
Electrical Ratings

Standard & Suffix *L* Switches

15 amps resistive, 125 volts AC
10 amps resistive, 250 volts AC
1/8 HP, 125 volts AC
1/4 HP, 250 volts AC
1/2 amp resistive, 125 volts DC
1/4 amp resistive, 250 volts DC

Suffix *U* Switch

5 amps resistive, 125 and 250 volts AC
1/8 HP, 125 volts AC
1/4 HP, 250 volts AC
1/2 amp resistive, 125 volts DC
1/4 amp resistive, 250 volts DC



IMPORTANT: H–Series pressure switches are available with optional snap switches which have different electrical ratings than listed above. Check nameplate on housing cover or frame to verify electrical ratings.

Set Point Adjustment (Pressure Setting) of Fixed Deadband Pressure Switch

When making adjustment (pressure setting) a pressure gauge within suitable range is required. If electrical hookup (to line of final application) to the switch is not desirable, a battery powered test lamp or Ohmmeter may be used. The markings on the pressure switch calibration scale (in PSIG or BAR) are for an approximate pressure setting. The adjustment wheel in center of the pressure switch is turned clockwise or counterclockwise to change pressure setting. For an exact pressure setting proceed as follows:

To Adjust Set Point On *Increasing Pressure*

1. If the pressure switch is in the line of final application when set point adjustment is made, be sure switch can be test operated without affecting other equipment.
2. Turn adjustment wheel clockwise until indicator is full down (toward pressure connection) or well beyond desired pressure setting (set point).
3. Follow the steps in the chart below to make the pressure setting.

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Adjustment Procedure	Normally Closed		Normally Open	
	Switch Terminal	Status of Test Lamp	Switch Terminal	Status of Test Lamp
1. Starting with zero pressure, connect test lamp to common	NC	On (Closed Circuit)	NO	Off (Open Circuit)
2. Apply desired set point pressure. Then turn adjustment wheel counterclockwise until switch operates.	NC	Off (Open Circuit)	NO	On (Closed Circuit)
3. Lower pressure until switch returns on decreasing pressure	NC	On (Closed Circuit)	NO	Off (Open Circuit)

4. For exact pressure setting, cycle pressure switch and make fine adjustments with wheel.
5. After setting has been made, make permanent electrical connections.

⚠ WARNING: To prevent the possibility of personal injury or property damage, be sure electrical power is off when making permanent electrical connections.

To Adjust Set Point On *Decreasing Pressure*

1. If the pressure switch is in the line of final application when set point adjustment is made, be sure switch can be test operated without affecting other equipment.
2. Turn adjustment wheel counterclockwise until indicator is full up (toward snap switch).
3. Follow the steps in the chart below to make the pressure settings.

Adjustment Procedure	Normally Closed		Normally Open	
	Switch Terminal	Status of Test Lamp	Switch Terminal	Status of Test Lamp
1. Starting with initial pressure above desired pressure (set point), connect test lamp to common.	NC	Off (Open Circuit)	NO	On (Closed Circuit)
2. Decrease pressure to desired set point pressure. Then turn adjustment wheel clockwise until switch operates.	NC	On (Closed Circuit)	NO	Off (Closed Circuit)
3. Raise pressure until switch returns on increasing pressure.	NC	Off (Open Circuit)	NO	On (Closed Circuit)

4. For exact pressure setting, cycle pressure switch and make fine adjustments with wheel.
5. After setting has been made make permanent electrical connections.

⚠ WARNING: To prevent the possibility of personal injury or property damage, be sure electrical power is off when making permanent electrical connections.

Testing of Installation

If the adjustment of the switch has been made outside of the line of final application, the switch should be re-tested when installed in the line of final application. Follow adjustment instructions. Be sure switch can be test operated without affecting other equipment.

MAINTENANCE

⚠ WARNING: To prevent the possibility of personal injury or property damage, turn off electrical power, depressurize switch and vent fluid to a safe area before removal or inspection.

IMPORTANT: Pressure switch is not field repairable. In case of damage, replace the entire pressure switch. Address all service inquiries to Automatic Switch Company, 50–60 Hanover Road, Florham Park, New Jersey 07932, Valve Service Department.

Preventive Maintenance

- While in service, operate the fixed deadband pressure switch periodically (cycle between two set points) to ensure proper operation. If necessary, electrical wiring and pipe connections should be made so that switch can be test operated without affecting other equipment.
- Periodic inspection of the pressure switch, external surfaces only, should be carried out. Switch should be kept clean and free from paint, foreign matter, corrosion, icing, or freeing conditions.
- Keep the medium entering the pressure switch as free from dirt and foreign material as possible.

Causes of Improper Operation

- **Incorrect Electrical Connection:** Check leads to switch. Be sure they are properly connected. Switch is marked *NO* for normally open, *NC* for normally closed, and *C* for common.
- **Faulty Control Circuit:** Check the electrical power supply to switch. Check for loose or blown fuses, open-circuited or grounded wires, loose connections at switch. See nameplate for electrical rating and range.
- **Incorrect Pressure:** Check pressure in system with suitable pressure gauge. Pressure must be within range specified on nameplate.
- **Incorrect Adjustment:** Check pressure scale to see approximate setting. Refer to section on "Set Point Adjustment of Fixed Deadband Pressure Switch".
- **External Leakage or Snap Switch Failure:** Replace pressure switch, see *ORDERING INFORMATION*.
- **Excessive Vibration or Surges Causing Switch to Operate Undesirably:** Check for pressure fluctuations in system and install pressure surge suppressor. Check switch mounting and be sure there is no excessive vibration.

If the operation of the pressure switch cannot be corrected by the above means, it should be replaced.

FOR SERVICE, REPLACEMENT OR INFORMATION

Consult Factory or Authorized Factory Representative or Distributors

ORDERING INFORMATION

When Ordering, Specify Catalog Number, Fluid, and Pressure Range.

Torque Chart

Part Name	Torque Value Inch–Pounds	Torque Value Newton–Meters
Cover screws	10	1,1

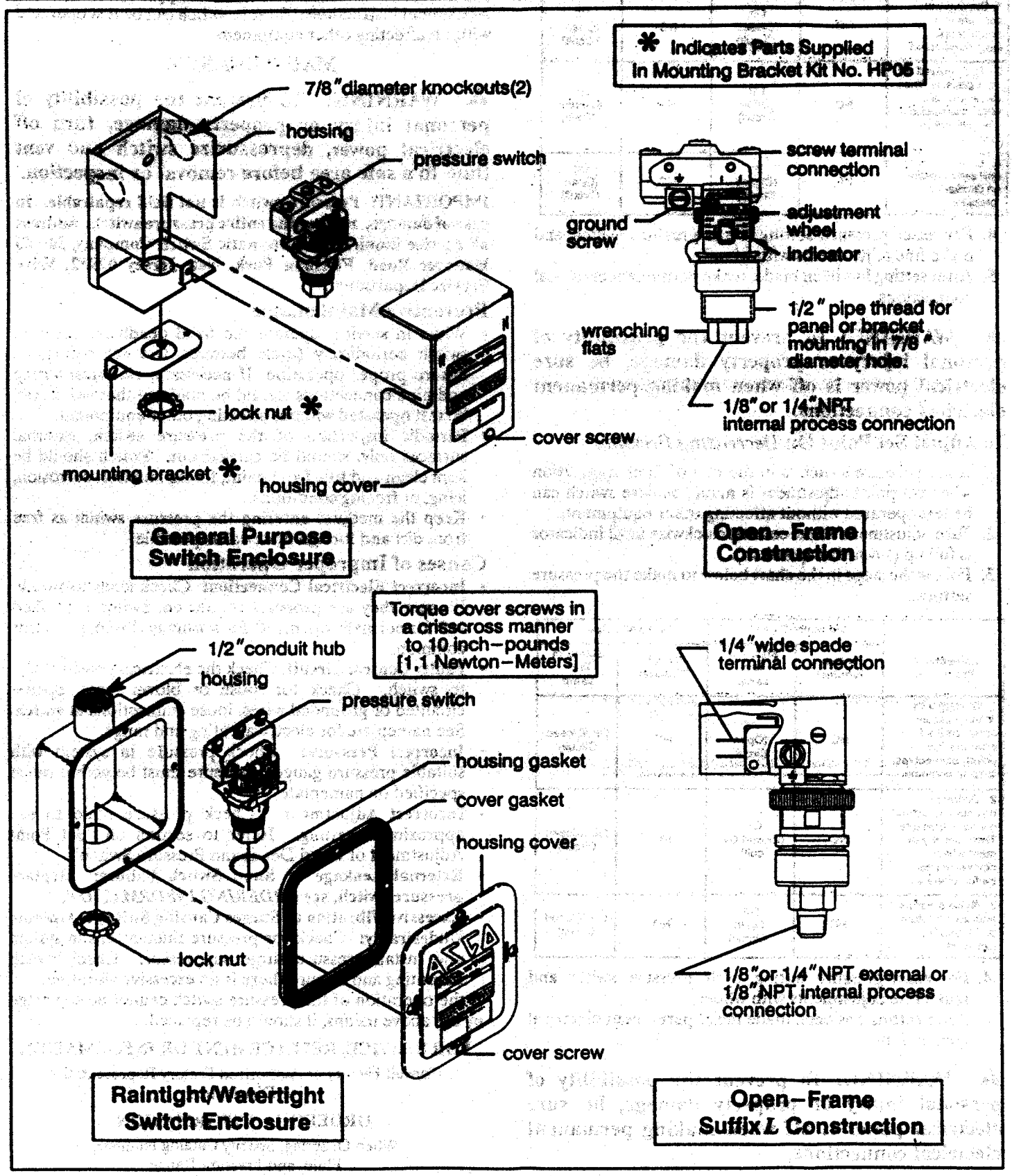

Figure 3. H–Series pressure switches.

INSTALLATION AND MAINTENANCE INSTRUCTIONS

2-WAY INTERNAL PILOT OPERATED SOLENOID VALVES HUNG DIAPHRAGM – 3/8, 1/2 AND 3/4 N.P.T. NORMALLY CLOSED OPERATION

BULLETINS
8210
8211

ASCO

Form No. V-5825

DESCRIPTION

Bulletin 8210's are 2-way, normally closed, internal pilot operated solenoid valves. Valve body and bonnet are of brass construction. Standard valves have a General Purpose, NEMA Type 1 Solenoid Enclosure.

Bulletin 8211's are the same as Bulletin 8210's except the solenoids are equipped with an enclosure which is designed to meet NEMA Type 4 Watertight, NEMA Type 7 (C or D) Hazardous Locations - Class I, Group C or D, and NEMA Type 9 (E, F or G) Hazardous Locations - Class II, Group E, F or G. The explosion-proof/watertight solenoid enclosure is shown on a separate sheet of Installation and Maintenance Instructions, Form No. V-5380.

Bulletin 8210 and 8211 valves with suffix 'HW' in the catalog number are specifically designed for hot water service.

OPERATION

Normally Closed: Valve is closed when solenoid is de-energized and opens when solenoid is energized.

MANUAL OPERATOR (Optional)

Valves with suffix 'MO' in catalog number are provided with a manual operator which allows manual operation when desired or during an interruption of electrical power. To operate valve manually, push in knurled cap and rotate clockwise 180°. Disengage manual operator by rotating knurled cap counterclockwise 180° before operating electrically.

MANUAL OPERATOR LOCATION (Refer to Figure 3)

Manual operator (when shipped from factory) will be located over the valve outlet. Manual operator may be relocated at 90° increments by rotating valve bonnet. Remove bonnet screws (4) and rotate valve bonnet with solenoid to desired position. Replace bonnet screws (4) and torque in a crisscross manner to 110 ± 10 inch pounds.

If valve is installed in system and is operational, proceed in the following manner:

WARNING: Depressurize valve and turn off electrical power supply.

1. Remove retaining cap or clip and slip the entire solenoid enclosure off the solenoid base sub-assembly. CAUTION: When metal retaining clip disengages, it will spring upwards.
2. Remove bonnet screws (4) and rotate valve bonnet to desired position.
3. Replace bonnet screws (4) and torque in a crisscross manner to 110 ± 10 inch pounds.
4. Replace solenoid enclosure and retaining clip or cap.

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage and service.

TEMPERATURE LIMITATIONS

For maximum valve ambient and fluid temperatures refer to chart. The temperature limitations listed are for UL applications. For non UL applications, higher ambient and fluid temperature limitations are available. Consult factory. Check catalog number on nameplate to determine maximum temperatures.

Construction	Coil Class	Catalog Number Prefix	Maximum Ambient Temp. °F.	Maximum Fluid Temp. °F.
A-C Construction (Alternating Current)	A	None or DA	77	180
	F	DF or FT	122	180
	H	HT	140	180
D-C Construction (Direct Current)	A, F or H	None, FT or HT	77	150
Catalog Numbers Suffixed 'HW' A-C Construction (Alternating Current)	A	None or DA	77	210
	F	DF or FT	77	210
	H	HT	122	210

POSITIONING/MOUNTING

Valve may be mounted in any position. For mounting bracket (optional feature) dimensions, refer to Figure 1.

PIPING

Connect piping to valve according to markings on valve body. Apply pipe compound sparingly to male pipe threads only; if applied to valve threads, it may enter the valve and cause operational difficulty. Pipe strain should be avoided by proper support and alignment of piping. When tightening the pipe do not use valve as a lever. Wrenches applied to valve body or piping are to be located as close as possible to connection point. **IMPORTANT: Valves with suffix 'HW' in the catalog number have a special diaphragm material which is specifically compounded for hot water service. This material can be attacked by oil and grease. Wipe the pipe threads clean of cutting oils and use teflon tape to seal pipe joints.**

IMPORTANT: For the protection of the solenoid valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Periodic cleaning is required depending on the service conditions. See Bulletins 8600, 8601 and 8602 for strainers.

WIRING

Wiring must comply with Local and National Electrical Codes. Housings for all solenoids are provided with connections for 1/2 inch conduit. The general purpose solenoid enclosure may be rotated to facilitate wiring by removing the retaining cap or clip. CAUTION: When metal retaining clip disengages it will spring upwards. Rotate to desired position. Replace retaining cap or clip before operating.

NOTE: Alternating Current (A-C) and Direct Current (D-C) Solenoids are built differently. To convert from one to the other, it is necessary to change the complete solenoid including the solenoid base sub-assembly and core assembly.

SOLENOID TEMPERATURE

Standard catalog valves are supplied with coils designed for continuous duty service. When the solenoid is energized for a long period, the solenoid enclosure becomes hot and can be touched with the hand for only an instant. This is a safe operating temperature. Any excessive heating will be indicated by the smoke and odor of burning coil insulation.

MAINTENANCE

WARNING: Turn off electrical power and depressurize valve before making repairs. It is not necessary to remove valve from pipe line for repairs.

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ASCO Valves
FLORHAM PARK, NEW JERSEY 07932

CLEANING

A periodic cleaning of all solenoid valves is desirable. The time between cleanings will vary, depending on media and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive leakage or noise will indicate that cleaning is required.

PREVENTIVE MAINTENANCE

1. Keep the medium flowing through the valve as free from dirt and foreign material as possible.
2. While in service, operate valve at least once a month to insure proper opening and closing.
3. Periodic inspection (depending on media and service conditions) of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any parts that are worn or damaged.

IMPROPER OPERATION

1. **Faulty Control Circuit:** Check electrical system by energizing solenoid. A metallic click signifies the solenoid is operating. Absence of the click indicates loss of power supply. Check for loose or blown-out fuses, open circuited or grounded coil, broken lead wires or splice connections.
2. **Burned-Out Coil:** Check for open circuited coil. Replace coil if necessary.
3. **Low Voltage:** Check voltage across coil leads. Voltage must be at least 85% of nameplate rating.
4. **Incorrect Pressure:** Check valve pressure. Pressure to the valve must be within range specified on nameplate.
5. **Excessive Leakage:** Disassemble valve and clean all parts. Replace worn or damaged parts with a complete Spare Parts Kit for best results.

COIL REPLACEMENT (Refer to Figure 2)

Turn off electrical power supply and disconnect coil leads. Proceed in the following manner:

1. Remove retaining cap or clip, nameplate and cover. CAUTION: When metal retaining clip disengages, it will spring upwards.
2. Remove spring washer, insulating washer and coil. Insulating washers are omitted when a molded coil is used.
3. Reassemble in reverse order of disassembly paying careful attention to exploded view provided for identification and placement of parts.

CAUTION: Solenoid must be fully reassembled as the housing and internal parts are part of and complete the magnetic circuit. Place insulating washer at each end of coil if required.

VALVE DISASSEMBLY (Refer to Figures 2 and 3)

Depressurize valve and turn off electrical power supply. Proceed in the following manner:

1. Remove retaining cap or clip and slip the entire solenoid enclosure off the solenoid base sub-assembly. CAUTION: When metal retaining clip disengages, it will spring upwards.
2. Unscrew solenoid base sub-assembly and remove bonnet gasket.
3. Remove valve bonnet screws (4) and valve bonnet.
4. For normal maintenance, it is not necessary to disassemble the manual operator (optional feature) unless external leakage is evident. To disassemble remove stem pin, manual operator stem, stem spring and stem gasket.
5. Remove core spring, core/diaphragm sub-assembly and body gasket. CAUTION: Do not damage or distort hanger spring between core/diaphragm sub-assembly.
6. All parts are now accessible for cleaning or replacement. Replace worn or damaged parts with a complete Spare Parts Kit for best results.

VALVE REASSEMBLY

1. Reassemble in reverse order of disassembly paying careful attention to exploded views provided for identification and placement of parts.
2. Replace body gasket and core/diaphragm sub-assembly. Locate the bleed hole in core/diaphragm sub-assembly approximately 45° from the valve outlet.
3. Replace core spring with wide end in core first; closed end protrudes from top of core.
4. If removed, replace manual operator stem, stem spring, stem gasket and stem pin.
5. Replace valve bonnet and bonnet screws (4). Torque bonnet screws (4) in a crisscross manner to 110 ± 10 inch pounds.
6. Replace bonnet gasket and solenoid base sub-assembly. Put solenoid base sub-assembly to 175 ± 25 inch pounds.
7. Replace solenoid enclosure and retaining cap or clip.
8. After maintenance, operate the valve a few times to be sure of proper opening and closing.

SPARE PARTS KITS

Spare Parts Kits and Coils are available for ASCO valves.
Parts marked with an asterisk (*) are supplied in Spare Parts Kits.

ORDERING INFORMATION FOR SPARE PARTS KITS
When Ordering Spare Parts Kits or Coils Specify Valve Catalog Number, Serial Number and Voltage.

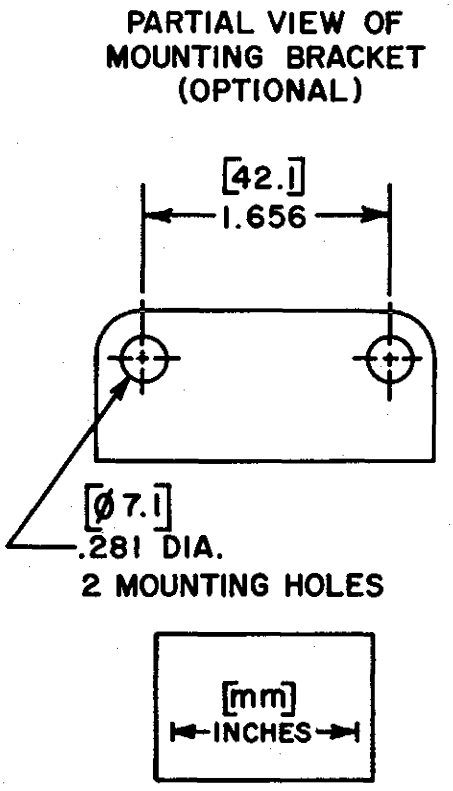

Figure 1. Dimensions For Mounting Bracket (Optional Feature)

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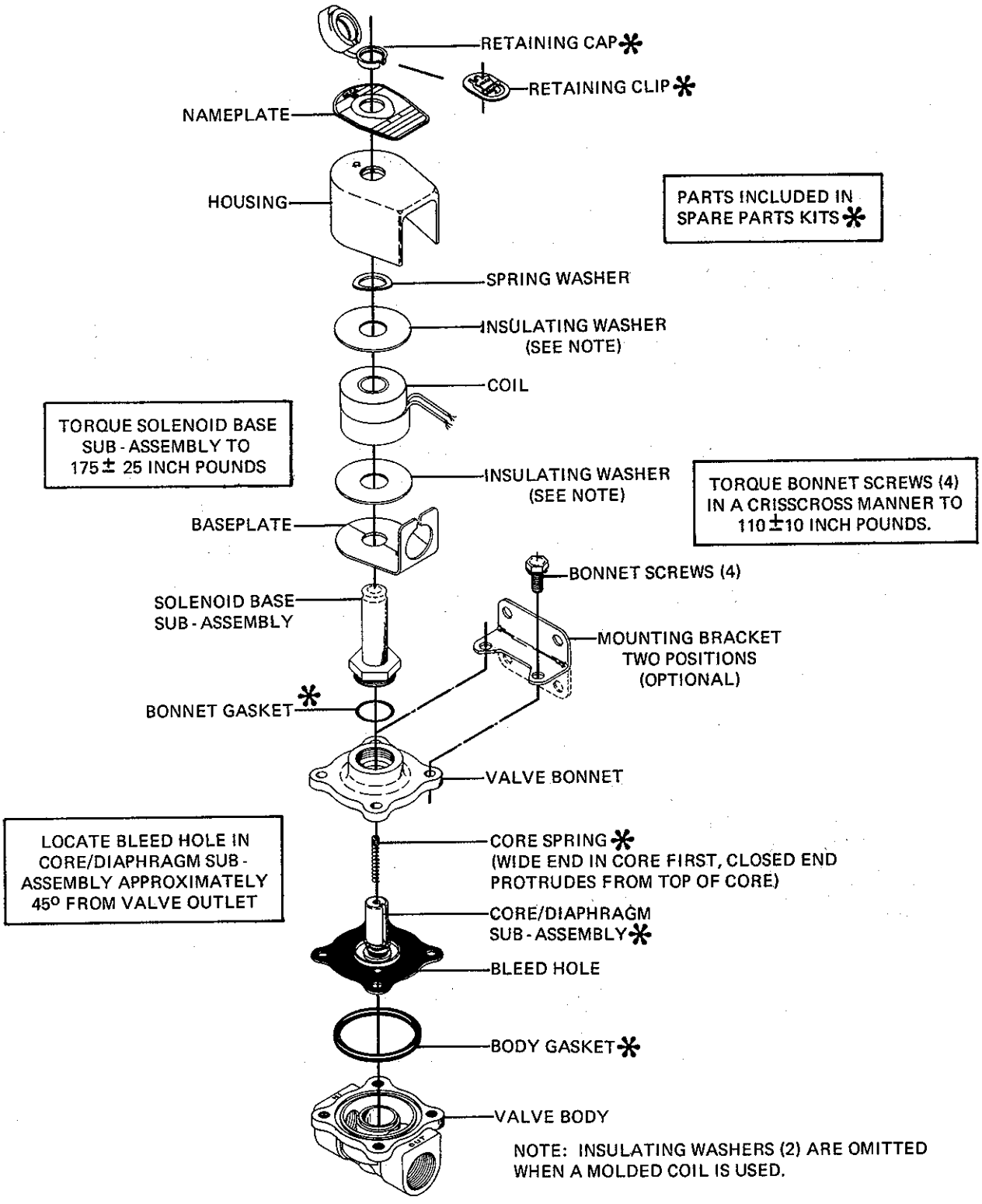

Bulletin 8210 — 3/8, 1/2 & 3/4 N.P.T. — A-C Construction
General purpose solenoid enclosure shown.
For explosion-proof/watertight solenoid enclosure used on Bulletin 8211, see Form No. V-5380.

Figure 2.

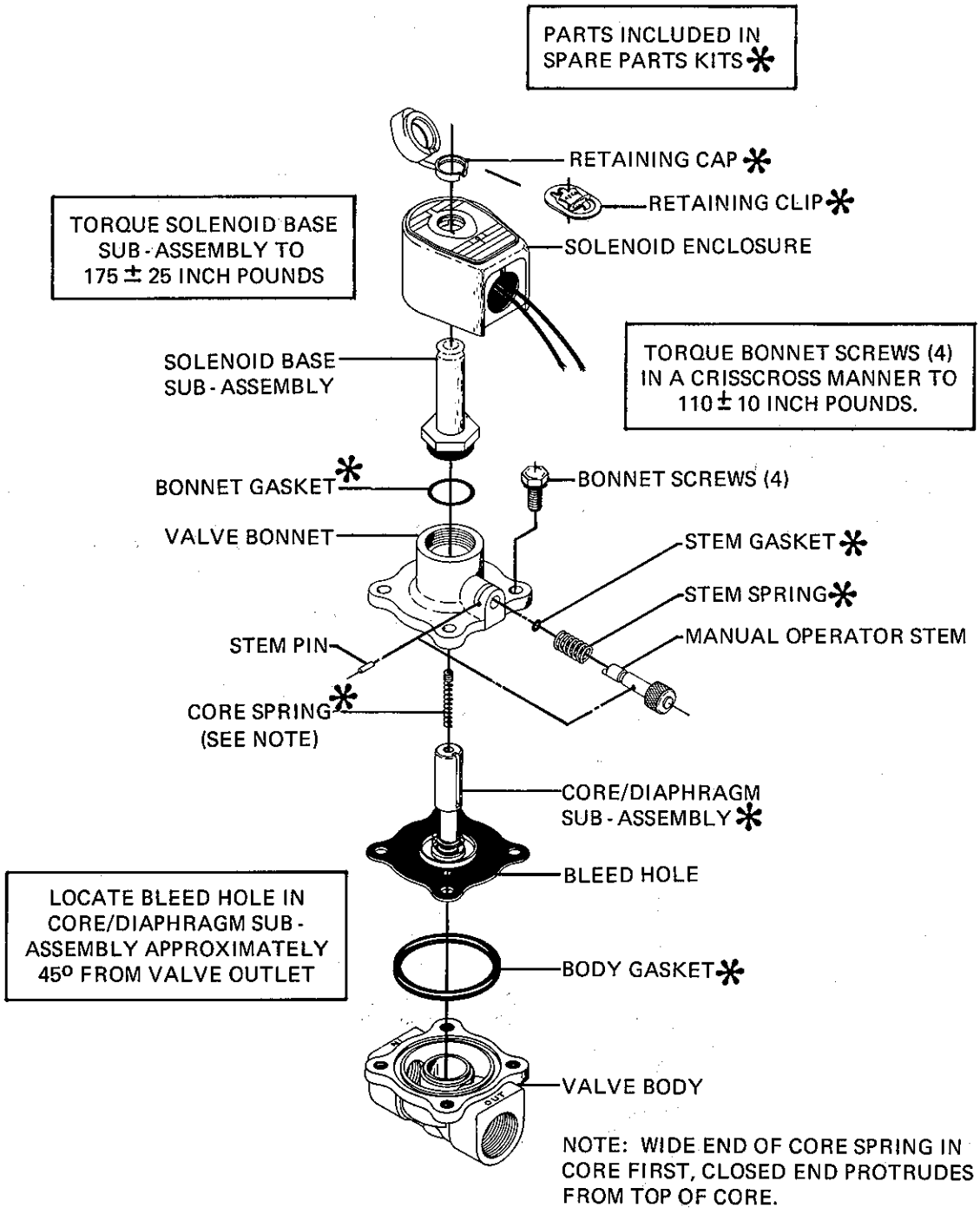

Figure 3. **Bulletin 8210 — Manual Operator**
General purpose solenoid enclosure shown.
For explosion-proof/watertight solenoid enclosure used on Bulletin 8211, see Form No. V-5380.

ASCO Valves
Automatic Switch Co. FLORHAM PARK, NEW JERSEY 07932 Form No. V-5825 PRINTED IN U.S.A. 1975

Installation & Maintenance Instructions

ASCO Red-Hat II®

OPEN–FRAME, GENERAL PURPOSE, WATERTIGHT/EXPLOSIONPROOF SOLENOIDS

SERIES
8003G
8202G
Form No.V6584R8

— SERVICE NOTICE —

ASCO® solenoid valves with design change letter "G" or "H" in the catalog number (ex. 8210G 1) have an epoxy encapsulated ASCO® Red Hat II® solenoid. This solenoid replaces some of the solenoids with metal enclosures and open–frame constructions. Follow these installation and maintenance instructions if your valve or operator uses this solenoid.

See separate instructions for basic valve.

DESCRIPTION

Catalog numbers 8003G and 8202G are epoxy encapsulated pull–type solenoids. The green solenoid with lead wires and 1/2″ conduit connection is designed to meet Enclosure Type 1–General Purpose, Type 2–Dripproof, Types 3 and 3S–Raintight, and Types 4 and 4X–Watertight. The black solenoid on catalog numbers prefixed "EF" or "EV" is designed to meet Enclosure Types 3 and 3S–Raintight, Types 4 and 4X–Watertight, Types 6 and 6P–Submersible, Type 7 (A, B, C & D) Explosionproof Class I, Division 1 Groups A, B, C, & D and Type 9 (E, F, & G)–Dust–Ignitionproof Class II, Division 1 Groups E, F & G. The Class II, Groups F & G Dust Locations designation is not applicable for solenoids or solenoid valves used for steam service or when a class "H" solenoid is used. See *Temperature Limitations* section for solenoid identification and nameplate/retainer for service. When installed just as a solenoid and not attached to an ASCO valve, the core has a 0.250–28 UNF–2B tapped hole, 0.38 or 0.63 minimum full thread.

NOTE: Catalog number prefix "EV" denotes stainless steel construction.

Catalog numbers 8202G1, 8202G3, 8202G5 and 8202G7 are epoxy encapsulated push–type, reverse–acting solenoids having the same enclosure types as previously stated for Catalog numbers 8003G1 and 8003G2.

Series 8003G and 8202G solenoids are available in:

- **Open–Frame Construction:** The green solenoid may be supplied with 1/4″ spade, screw or DIN terminals. (Refer to Figure 4)
- **Panel Mounted Construction:** These solenoids are specifically designed to be panel mounted by the customer through a panel having a .062 to .093 maximum wall thickness. Refer to Figure 1 and section on *Installation of Panel Mounted Solenoid.*

Optional Features For Type 1 – General Purpose Construction Only

- **Junction Box:** This junction box construction meets Enclosure Types 2,3,3S,4, and 4X. Only solenoids with 1/4″ spade or screw terminals may have a junction box. The junction box provides a 1/2″ conduit connection, grounding and spade or screw terminal connections within the junction box (See Figure 5).
- **DIN Plug Connector Kit No.K236034:** Use this kit only for solenoids with DIN terminals. The DIN plug connector kit provides a two pole with grounding contact DIN Type 43650 construction (See Figure 6).

OPERATION

Series 8003G – When the solenoid is energized, the core is drawn into the solenoid base sub–assembly. **IMPORTANT: When the solenoid is de–energized, the initial return force for the core, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force for AC construction is 11 ounces, and 5 ounces for DC construction.**

Series 8202G – When the solenoid is energized, the disc holder assembly seats against the orifice. When the solenoid is de–energized , the disc holder assembly returns. **IMPORTANT: Initial return force for the disc or disc holder assembly, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force is 1 pound, 5 ounces.**

INSTALLATION

Check nameplate for correct catalog number, service, and wattage. Check front of solenoid for voltage and frequency.

⚠ WARNING: Electrical hazard from the accessibility of live parts. To prevent the possibility of death, serious injury or property damage, install the open – frame solenoid in an enclosure.

FOR BLACK ENCLOSURE TYPES 7 AND 9 ONLY

⚠ CAUTION: To prevent fire or explosion, do not install solenoid and/or valve where ignition temperature of hazardous atmosphere is less than 165° C. On valves used for steam service or when a class "H" solenoid is used, do not install in hazardous atmosphere where ignition temperature is less than 180°C. See nameplate/retainer for service.

NOTE: These solenoids have an internal non–resetable thermal fuse to limit solenoid temperature in the event that extraordinary conditions occur which could cause excessive temperatures. These conditions include high input voltage, a jammed core, excessive ambient temperature or a shorted solenoid, etc. This unique feature is a standard feature only in solenoids with black explosionproof/dust–ignitionproof enclosures (Types 7 & 9).

⚠ CAUTION: To protect the solenoid valve or operator, install a strainer or filter, suitable for the service involved in the inlet side as close to the valve or operator as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601, and 8602 for strainers.

Temperature Limitations

For maximum valve ambient temperatures, refer to chart. The temperature limitations listed, only indicate maximum application temperatures for field wiring rated at 90°C. Check catalog number prefix and watt rating on nameplate to determine maximum ambient temperature. See valve installation and maintenance instructions for maximum fluid temperature. NOTE: For steam service, refer to *Wiring* section, *Junction Box* for temperature rating of supply wires.

Temperature Limitations For Series 8003G or 8202G Solenoids for use on Valves Rated at 10.1, 11.6, 17.1, or 22.6 Watts

Watt Rating	Catalog Number Coil Prefix	Class of Insulation	Maximum † Ambient Temp.
10.1 & 17.1	None, FB, KF, KP SC, SD, SF, & SP,	F	125°F (51.7°C)
10.1 & 17.1	HB, HT, KB, KH, SS, ST, SU,	H	140°F (60°C)
11.6 & 22.6	None, FB,KF, KP, SC, SD, SF, & SP.	F	104°F (40°C)
11.6 & 22.6	HP, HT, KB, KH, SS, ST, SU, & SV	H	104°F (40°C)

† Minimum ambient temperature –40° F (–40° C).

Positioning

This solenoid is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub–assembly area.

Wiring

Wiring must comply with local codes and the National Electrical Code. All solenoids supplied with lead wires are provided with a grounding wire which is green or green with yellow stripes and a 1/2″ conduit connection. To

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facilitate wiring, the solenoid may be rotated 360°. For the watertight and explosionproof solenoid, electrical fittings must be approved for use in the approved hazardous locations.

⚠ CAUTION: Cryogenic Applications — Solenoid lead wire insulation should not be subjected to cryogenic temperatures. Adequate lead wire protection and routing must be provided.

Additional Wiring Instructions For Optional Features:

- **Open−Frame solenoid with 1/4″ spade terminals.**

For solenoids supplied with screw terminal connections use #12−18 AWG stranded copper wire rated at 90°C or greater. Torque terminal block screws to 10 ± 2 in−lbs [1,0 ± 1,2 Nm]. A tapped hole is provided in the solenoid for grounding, use a #10−32 machine screw. Torque grounding screw to 15 − 20 in−lbs [1,7 − 2,3 Nm]. On solenoids with screw terminals, the socket head screw holding the terminal block to the solenoid is the grounding screw. Torque the screw to 15 − 20 in−lbs [1,7 − 2,3 Nm] with a 5/32″ hex key wrench.

- **Junction Box**

The junction box is used with spade or screw terminal solenoids only and is provided with a grounding screw and a 1/2″ conduit connection. Connect #12−18 AWG standard copper wire only to the screw terminals. Within the junction box use field wire that is rated 90°C or greater for connections. For steam service use 105°C rated wire up to 50 psi or use 125°C rated wire above 50 psi. After electrical hookup, replace cover gasket, cover, and screws. Tighten screws evenly in a crisscross manner.

- **DIN Plug Connector Kit No.K236034**

1. The open−frame solenoid is provided with DIN terminals to accommodate the plug connector kit.
2. Remove center screw from plug connector. Using a small screwdriver, pry terminal block from connector cover.
3. Use #12−18 AWG stranded copper wire rated at 90°C or greater for connections. Strip wire leads back approximately 1/4″ for installation in socket terminals. The use of wire−end sleeves is also recommended for these socket terminals. Maximum length of wire−end sleeves to be approximately 1/4″. Tinning of the ends of the lead wires is not recommended.
4. Thread wire through gland nut, gland gasket, washer and connector cover.

NOTE: Connector housing may be rotated in 90° increments from position shown for alternate positioning of cable entry.

5. Check DIN connector terminal block for electrical markings. Then make electrical hookup to terminal block according to markings on it. Snap terminal block into connector cover and install center screw.
6. Position connector gasket on solenoid and install plug connector. Torque center screw to 5 ± 1 in−lbs [0,6 ± 1,1 Nm].

NOTE: Alternating current (AC) and direct current (DC) solenoids are built differently. To convert from one to the other, it may be necessary to change the complete solenoid including the core and solenoid base sub−assembly, not just the solenoid. Consult ASCO.

Installation of Solenoid

Solenoids may be assembled as a complete unit. Tightening is accomplished by means of a hex flange at the base of the solenoid.

Installation of Panel Mounted Solenoid (See Figure 1)

1. Disassemble solenoid following instruction under *Solenoid Replacement* then proceed.
2. Install solenoid base sub−assembly through customer panel.
3. Position spring washer on opposite side of panel over solenoid base sub−assembly.
4. Replace solenoid, nameplate/retainer and red cap.
5. Make electrical hookup, see *Wiring* section.

Solenoid Temperature

Standard solenoids are designed for continuous duty service. When the solenoid is energized for a long period, the solenoid becomes hot and can be touched by hand only for an instant. This is a safe operating temperature.

MAINTENANCE

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize solenoid operator and/or valve, and vent fluid to a safe area before servicing.

Cleaning

All solenoid operators and valves should be cleaned periodically. The time between cleaning will vary depending on medium and service conditions. In general, if the voltage to the solenoid is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. Clean strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep the medium flowing through the solenoid operator or valve as free from dirt and foreign material as possible.
- While in service, the solenoid operator or valve should be operated at least once a month to insure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any worn or damaged parts.

Causes of Improper Operation

- **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic *click* signifies that the solenoid is operating. Absence of the *click* indicates loss of power supply. Check for loose or blown fuses, open−circuited or grounded solenoid, broken lead wires or splice connections.
- **Burned−Out Solenoid:** Check for open−circuited solenoid. Replace if necessary. Check supply voltage; it must be the same as specified on nameplate/retainer and marked on the solenoid. Check ambient temperature and check that the core is not jammed.
- **Low Voltage:** Check voltage across the solenoid leads. Voltage must be at least 85% of rated voltage.

Solenoid Replacement

1. Disconnect conduit, coil leads, and grounding wire.

NOTE: Any optional parts attached to the old solenoid must be reinstalled on the new solenoid. For 3−way construction, piping or tubing must be removed from pipe adapter.

2. Disassemble solenoids with optional features as follows:

- **Spade or Screw Terminals**

Remove terminal connections, grounding screw, grounding wire, and terminal block (screw terminal type only).

NOTE: For screw terminals, the socket head screw holding the terminal block serves as a grounding screw.

- **Junction Box**

Remove conduit and socket head screw (use 5/32″ hex key wrench) from center of junction box. Disconnect junction box from solenoid.

- **DIN Plug Connector**

Remove center screw from DIN plug connector. Disconnect DIN plug connector from adapter. Remove socket head screw (use 5/32″ hex key wrench), DIN terminal adapter, and gasket from solenoid.

3. Snap off red cap from top of solenoid base sub−assembly. For 3−way construction with pipe adapter (Figure 3), remove pipe adapter, nameplate and solenoid. Omit steps 4 and 5.
4. Push down on solenoid. Then using a suitable screwdriver, insert blade between solenoid and nameplate/retainer. Pry up slightly and push to remove.

NOTE: Series 8202G solenoids have a spacer between the nameplate/retainer and solenoid.

5. Remove solenoid from solenoid base sub−assembly.
6. Reassemble in reverse order of disassembly. Use exploded views for identification and placement of parts.
7. Torque pipe adapter to 90 inch−pounds maximum [10,2 Nm maximum]. Then make up piping or tubing to pipe adapter on solenoid.

Disassembly and Reassembly of Solenoids

1. Remove solenoid, see *Solenoid Replacement*.
2. Remove spring washer from solenoid base sub−assembly. For 3−way construction, remove plugnut gasket.
3. Unscrew solenoid base sub−assembly from valve body.
4. Remove internal solenoid parts for cleaning or replacement. Use exploded views for identification and placement of parts.
5. If the solenoid is part of a valve, refer to basic valve installation and maintenance instructions for further disassembly.
6. Torque solenoid base sub−assembly and adapter to 175±25 in−lbs [19,8±2,8 Nm].

ORDERING INFORMATION FOR ASCO SOLENOIDS

When Ordering Solenoids for ASCO Solenoid Operators or Valves, order the number stamped on the solenoid. Also specify voltage and frequency.

Torque Chart

Part Name	Torque Value Inch—Pounds	Torque Value Newton—Meters
solenoid base sub—assembly & adapter	175 ± 25	19,8 ± 2,8
pipe adapter	90 maximum	10,2 maximum

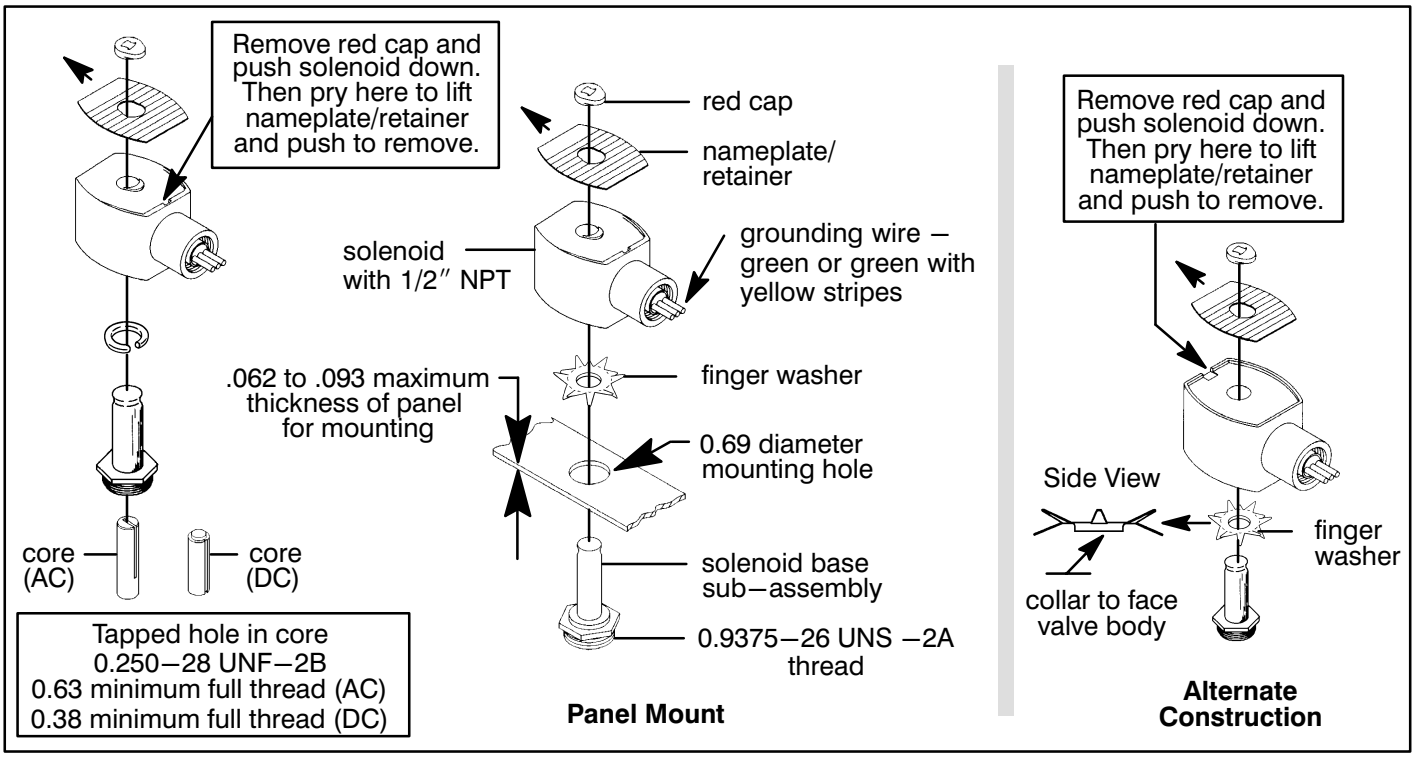

Figure 1. Series 8003G solenoids

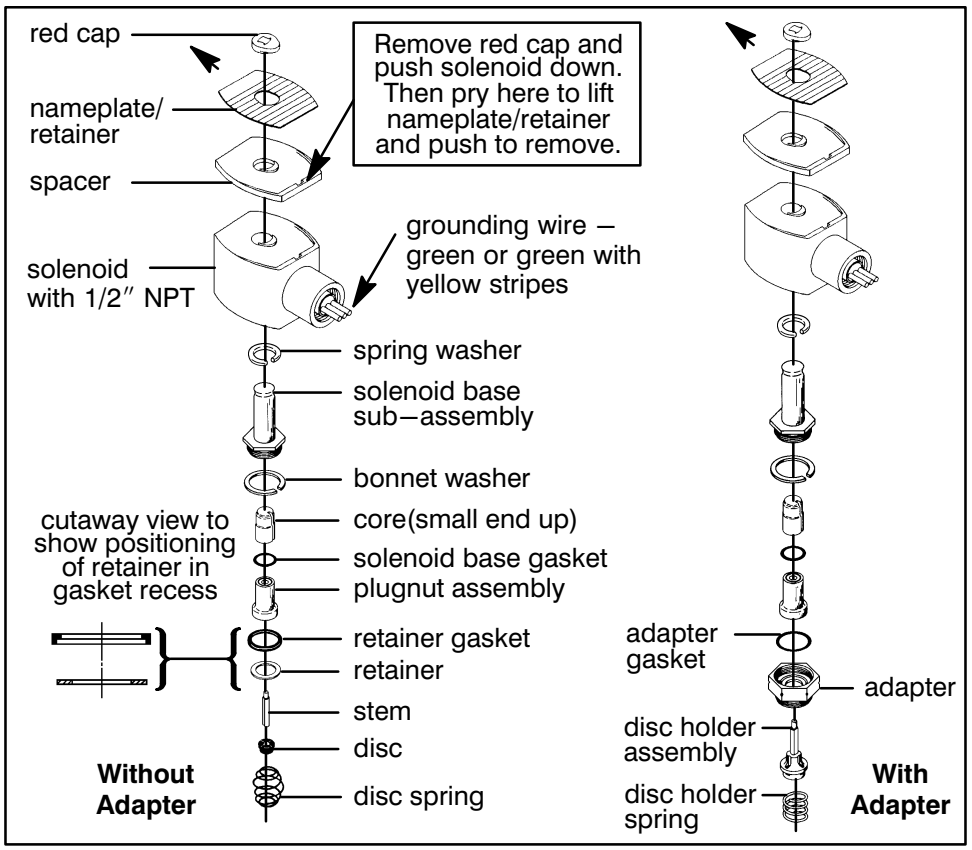

Figure 2. Series 8202G solenoids

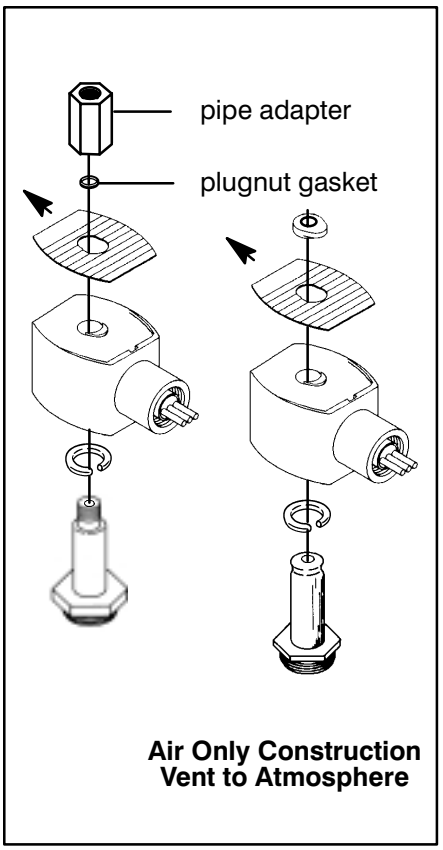

Figure 3. 3—Way Construction

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Torque Chart

Part Name	Torque Value in Inch—Pounds	Torque Value in Newton—Meters
terminal block screws	10 ± 2	1,1 ± 0,2
socket head screw	15 — 20	1,7 — 2,3
center screw	5 ± 1	0,6 ± 0,1

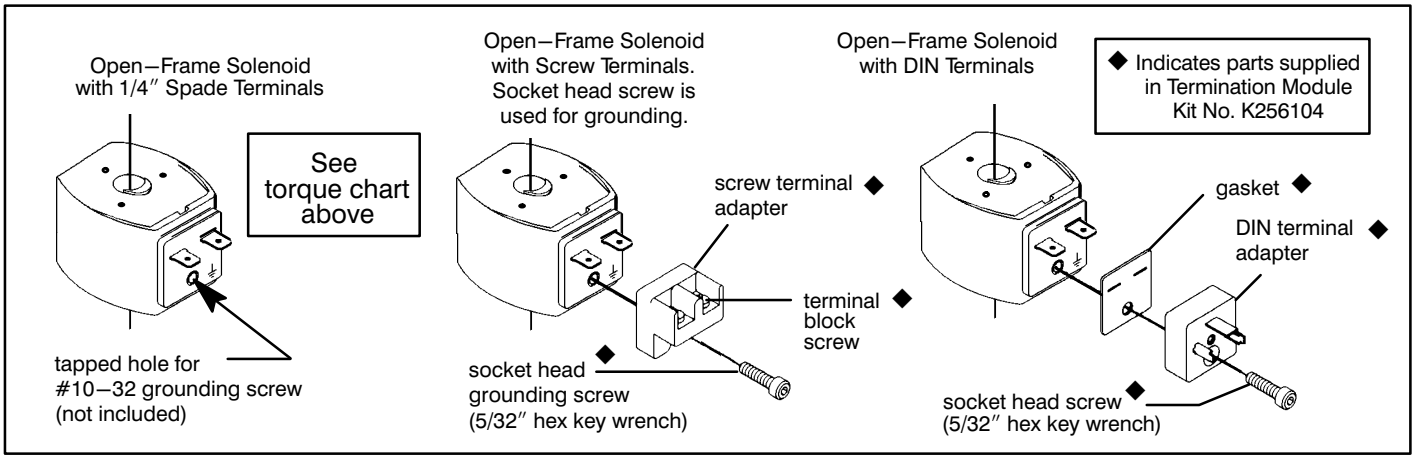

Figure 4. Open—frame solenoids

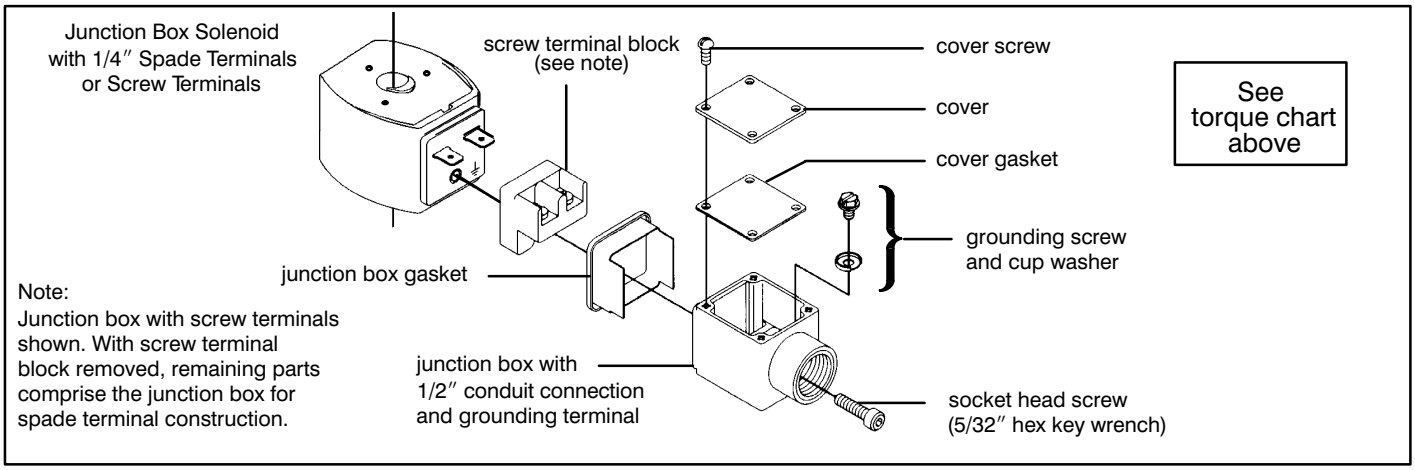

Figure 5. Junction box (optional feature)

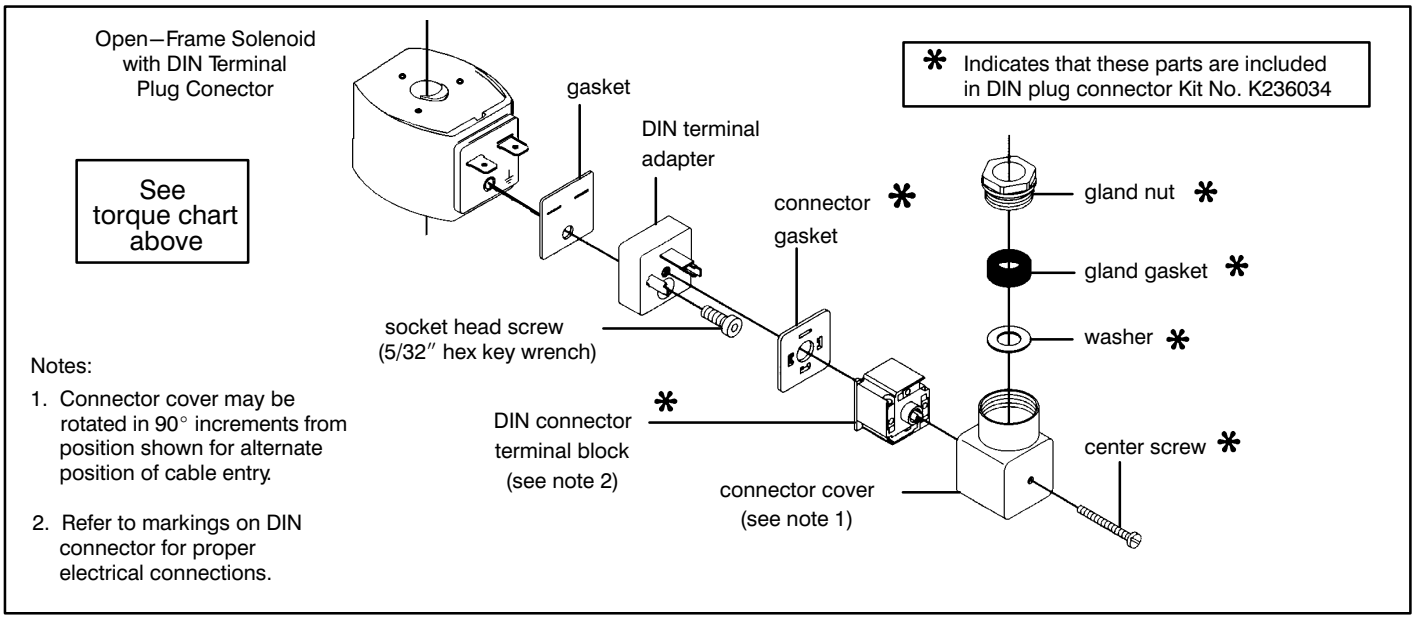

Figure 6. DIN plug connector kit No. K236034 (optional feature)

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627 Series Pressure Reducing Regulators

Introduction

Scope of Manual

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

Figure 1. Typical 627 Series Self-Operated Pressure Reducing Regulator

Description

The 627 Series self-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 (see the AVAILABLE CONFIGURATIONS specification in table 1).

Specifications

Table 1 gives some general specifications for the 627 Series regulators. The nameplates (figure 2) gives detailed information for a particular regulator as it comes from the factory.

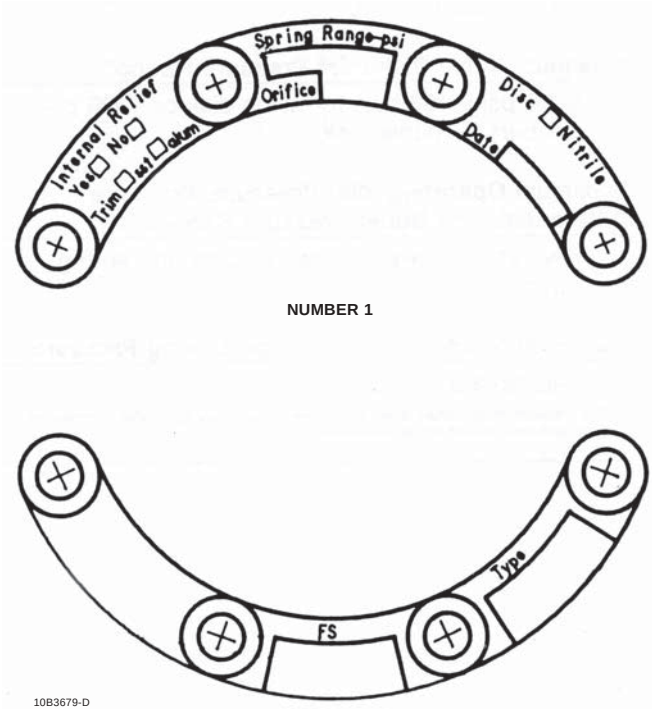


Figure 2. Nameplates

D101328X012

Table 1. Specifications

Available Constructions

Type 627: Self-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 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-inch NPT downstream control line connection (figure 9)

Type 627MR: Type 627M with internal relief (figure 10)

Type 627H: Type 627 with a diaphragm limiter to deliver a higher outlet pressure (figure 11)

Type 627HM: Type 627H with a stem seal between the body outlet pressure and diaphragm case. Pressure is measured under the diaphragm through two 1/4-inch NPT downstream control line connections (figure 12)

Body Sizes

3/4, 1, or 2-inch

End Connection Styles

3/4, 1, or 2-inch body sizes: NPT

1 or 2-inch body sizes: ANSI Class 300 or 600 RF flanged

Maximum Inlet Pressure(1) (Body Rating)

2000 psig (138 bar) for NPT steel, 1480 psig (102 bar) for RF flanged steel, or 1000 psig (69 bar) for ductile iron

Maximum Valve Disk Inlet Pressure Rating(1)

2000 psig (138 bar) for nylon disk or 1000 psig (69 bar) for nitrile disk

Maximum Operating Inlet Pressure, Pressure Differential, and Outlet Pressure Ranges(1)

See table 2 for pressures by port and spring range

Maximum Spring and Diaphragm Casing Pressure(1)

See table 3

Maximum Body Outlet Pressure(1) (Type 627M, 627MR, and 627HM Only)

2000 psig (138 bar) for screwed steel, 1480 psig (102 bar) for RF flanged steel, or 1000 psig (69 bar) for ductile iron. (Type 627 and 627R are limited by maximum diaphragm casing pressure)

Port Diameters

See table 2

Internal Relief Performance

Type 627R: See table 4

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

Temperature Capabilities(1)

-20 to 180°F (-29 to 82°C)

Pressure Registration

Type 627, 627H or 627R: Internal

Type 627M, 627HM or 627MR: External through 1/4-inch 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 627R and 627MR (see figures 8 and 9)

Spring Case Vent Connection

3/4-inch NPT female with removable screened vent assembly

Control Line Connection (Type 627M, 627HM or 627MR Only)

1/4-inch NPT female

Approximate Weight

Ductile Iron or Steel Casings: 10 pounds (4,5 kg)

Aluminum Casings: 6.3 pounds (2.8 kg)

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

Table 2. Maximum Inlet Pressures, Differential Pressures, and Outlet Pressure Ranges

TYPE NUMBER	OUTLET PRESSURE RANGE, SPRING PART NUMBER, AND COLOR	ORIFICE SIZE, INCHES (mm)	MAXIMUM INLET PRESSURE, PSIG (bar)	MAXIMUM DIFFERENTIAL PRESSURE, PSID (bar)
627 and 627M[3]	5[2] to 20 psig (0,34 to 1,4 bar) 10B3076X012 Yellow	3/32 (2,4) 1/8 (3,2) 3/16 (4,8) 1/4 (6,4) 3/8 (9,5) 1/2 (12,7)	2000 (138)[1] 1000 (69)[1] 750 (51,7) 500 (34,5) 300 (20,7) 250 (17,2)	2000 (138)[1] 1000 (69)[1] 750 (51,7) 500 (34,5) 300 (20,7) 250 (17,2)
	15 to 40 psig (1,0 to 2,8 bar) 10B3077X012 Green	3/32 (2,4) 1/8 (3,2) 3/16 (4,8) 1/4 (6,4) 3/8 (9,5) 1/2 (12,7)	2000 (138)[1] 1500 (103)[1] 1000 (69)[1] 750 (51,7) 500 (34,5) 300 (20,7)	2000 (138)[1] 1500 (103)[1] 1000 (69)[1] 750 (51,7) 500 (34,5) 300 (20,7)
	35 to 80 psig (2,4 to 5,5 bar) 10B3078X012 Blue	3/32 (2,4) 1/8 (3,2) 3/16 (4,8) 1/4 (6,4) 3/8 (9,5) 1/2 (12,7)	2000 (138)[1] 2000 (138)[1] 1750 (121)[1] 1500 (103)[1] 1000 (69)[1] 750 (51,7)	2000 (138)[1] 2000 (138)[1] 1750 (121)[1] 1500 (103)[1] 1000 (69)[1] 750 (51,7)
	70 to 150 psig (4,8 to 10,3 bar) 10B3079X012 Red	3/32 (2,4) 1/8 (3,2) 3/16 (4,8) 1/4 (6,4) 3/8 (9,5) 1/2 (12,7)	2000 (138)[1] 2000 (138)[1] 2000 (138)[1] 1750 (121)[1] 1250 (86,2)[1] 750 (51,7)	2000 (138)[1] 2000 (138)[1] 2000 (138)[1] 1750 (121)[1] 1250 (86,2)[1] 750 (51,7)
627R and 627MR	5[2] to 20 psig (0,34 to 1,4 bar) 10B3076X012 Yellow	3/32 (2,4) 1/8 (3,2) 3/16 (4,8) 1/4 (6,4) 3/8 (9,5) 1/2 (12,7)	2000 (138)[1] 1000 (69)[1] 750 (51,7) 500 (34,5) 300 (20,7) 200 (13,8)	2000 (138)[1] 1000 (69)[1] 750 (51,7) 500 (34,5) 300 (20,7) 200 (13,8)
	15 to 40 psig (1,0 to 2,8 bar) 10B3077X012 Green	3/32 (2,4) 1/8 (3,2) 3/16 (4,8) 1/4 (6,4) 3/8 (9,5) 1/2 (12,7)	2000 (138)[1] 1500 (103)[1] 1000 (69)[1] 750 (51,7) 300 (20,7) 200 (13,8)	2000 (138)[1] 1500 (103)[1] 1000 (69)[1] 750 (51,7) 300 (20,7) 200 (13,8)
	35 to 80 psig (2,4 to 5,5 bar) 10B3078X012 Blue	3/32 (2,4) 1/8 (3,2) 3/16 (4,8) 1/4 (6,4) 3/8 (9,5) 1/2 (12,7)	2000 (138)[1] 1750 (121)[1] 1000 (69)[1] 750 (51,7) 300 (20,7) 200 (13,8)	2000 (138)[1] 1750 (121)[1] 1000 (69)[1] 750 (51,7) 300 (20,7) 200 (13,8)
	70 to 150 psig (4,8 to 10,3 bar) 10B3079X012 Red	3/32 (2,4) 1/8 (3,2) 3/16 (4,8) 1/4 (6,4) 3/8 (9,5) 1/2 (12,7)	2000 (138)[1] 1000 (69)[1] 500 (34,5) 300 (20,7) 200 (13,8) 200 (13,8)	2000 (138)[1] 1000 (69)[1] 500 (34,5) 300 (20,7) 200 (13,8) 200 (13,8)
627H and 627MH[3]	140 to 250 psig (9,7 to 17,2 bar) 10B3078X012 Blue	3/32 (2,4) 1/8 (3,2) 3/16 (4,8) 1/4 (6,4) 3/8 (9,5) 1/2 (12,7)	2000 (138)[1] 2000 (138)[1] 1750 (121)[1] 1500 (103)[1] 1000 (69)[1] 750 (51,7)	2000 (138)[1] 2000 (138)[1] 1750 (121)[1] 1000 (69)[1] 500 (34,5) 250 (17,2)
	240 to 500 psig (16,5 to 34,5 bar) 10B3079X012 Red	3/32 (2,4) 1/8 (3,2) 3/16 (4,8) 1/4 (6,4) 3/8 (9,5) 1/2 (12,7)	2000 (138)[1] 2000 (138)[1] 1750 (121)[1] 1500 (103)[1] 1000 (69)[1] 750 (51,7)	2000 (138)[1] 2000 (138)[1] 1750 (121)[1] 1000 (69)[1] 500 (34,5) 250 (17,2)

1. For inlet pressure in excess of 1000 psig (69 bar), refer to the maximum body and disk pressure ratings in the specification table.
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 627MH should have a 3/8-inch (9,5 mm) or larger orifice when used as a wide-open monitor.

Table 3. Maximum Spring and Diaphragm Casing Pressure(1)

MAXIMUM PRESSURE DESCRIPTION	SPRING AND DIAPHRAGM CASING STYLE	TYPE 627, PSIG (bar)	TYPE 627R, PSIG (bar)	TYPE 627M, PSIG (bar)	TYPE 627MR, PSIG (bar)	TYPE 627H AND 627HM, 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
	Die cast aluminum	250 (17,2)	250 (17,2)	250 (17,2)	Not Available	Not Available
	Steel	250 (17,2)	250 (17,2)	250 (17,2)	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)	465 (32)	465 (32)	465 (32)	Not Available
	Steel	1500 (103)	1500 (103)	1500 (103)	1500 (103)	1500 (103)
Maximum diaphragm casing overpressure (above setpoint) to prevent damage to internal parts	All styles	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 Fisher Sales Representative.

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 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 those limits. The Type 627R or 627MR regulator with internal relief will provide downstream overpressure protection within the limits given in 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.

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 12. Ensure that the operating temperature capabilities listed in table 1 are not exceeded.

Like most regulators, 627 Series regulators have outlet pressure ratings that are lower than their inlet pressure ratings. A pressure relieving or pressure limiting device must be provided by the user for the Type 627, 627H, 627M, and 627HM regulators if the inlet pressure can exceed the outlet pressure rating, since these regulators do not have internal relief.

Type 627R regulators provide internal relief which limits the total outlet pressure buildup over setpoint. Use table 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.

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.

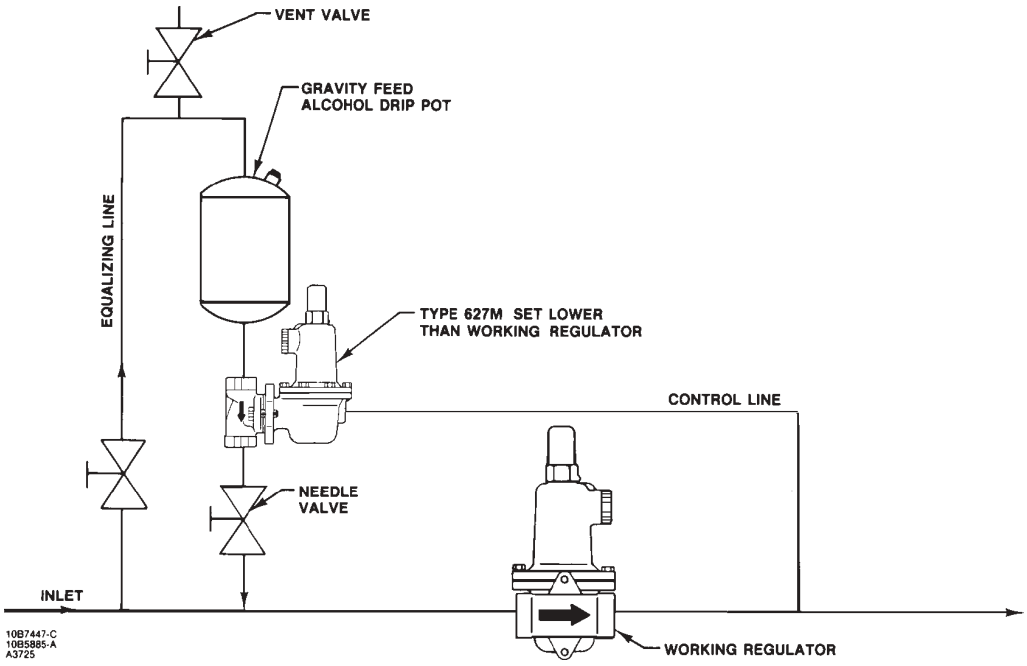


Figure 3. Schematic of De-Icer System

WARNING

A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gasmay accumulate and cause personal injury, death, or property damage due to fire or explosion. Vent a regulator in hazardousgas service toa 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 diaphragmspring case (key 29) so it will not collectmoisture or debris into the screened vent. If the regulator requires repositioning, refer to the body area maintenance procedures and/or the diaphragm case area maintenance procedures in the Maintenance section to reposition the screened vent for the application.

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 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 unstability or cycling of the regulator.

Remote Vent Line Installation

All 627 series regulators have a vent assembly installed in the 3/4-inch 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. The vent line should be as short as possible with a 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

Table 4. Type 627R Internal Relief Performance[1]

OUTLET PRESSURE RANGE, SPRING PART NUMBER, AND COLOR	OUTLET PRESSURE SETTING, PSIG (bar)	MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE, PSIG (bar)	MAXIMUM INLET PRESSURE TO KEEP MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE FROM BEING EXCEEDED, PSIG (bar)[2]					
			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 (12,7)
5[3] to 20 psig (0,34 to 1,4 bar) 10B3076X012 Yellow	10 (0,69)	60 (4,1)	1250 (86,2)	740 (51,1)	320 (22,1)	190 (13,1)	95 (6,56)	75 (5,18)
		100 (6,9)	2000 (138)	1500 (103)	620 (42,7)	390 (26,9)	180 (12,4)	130 (8,97)
		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 (8,97)
		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 (5,52)	65 (4,49)
		100 (6,9)	2000 (138)	1300 (89,6)	600 (41,4)	360 (24,8)	170 (11,7)	120 (8,28)
		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 (8,97)	80 (5,5)	65 (4,49)
		100 (6,9)	2000 (138)	1300 (89,6)	590 (40,7)	350 (24,1)	170 (11,7)	120 (8,28)
		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 (4,83)	65 (4,49)
		100 (6,9)	2000 (138)	1200 (82,7)	550 (37,9)	330 (22,8)	160 (11,0)	120 (8,28)
		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 (9,66)	110 (7,59)
		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 (8,28)	108 (7,45)
		125 (8,6)	2000 (138)	1300 (89,6)	560 (38,6)	340 (23,4)	180 (12,4)	140 (9,66)
		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)

form with in this regulator. The formation of ice decreases the size of the port opening, 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 627Mor 627HMregulator moves off its seat ring, permitting alcohol to flow into the main gas line. The alcohol carried to the main regulator by the flow stream prevents additional ice from forming on the seat ring. When normal flow resumes, and as pressure in the downstream system is restored, the Type 627M or 627HM regulator shuts off.

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

Table 4. Type 627R Internal Relief Performance[1] (continued)

OUTLET PRESSURE RANGE, SPRING PART NUMBER, AND COLOR	OUTLET PRESSURE SETTING, PSIG (bar)	MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE, PSIG (bar)	MAXIMUM INLET PRESSURE TO KEEP MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE FROM BEING EXCEEDED, PSIG (bar)[2]					
			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 (12,7)
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 (9,66)
		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 (9,66)
		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 (31,1)	270 (18,6)	190 (13,1)	140 (9,66)	130 (8,97)
		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)
	80 (5,5)	150 (10,3)	800 (55,2)	500 (34,5)	300 (20,7)	200 (13,8)	160 (11,0)	150 (10,3)
		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)
70 to 150 psig (4,8 to 10,3 bar) 10B3079X012 Red	70 (4,8)	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)
		250 (17,2)	2000 (138)	2000 (138)	1100 (75,8)	680 (46,9)	360 (24,8)	290 (20,0)
	80 (5,5)	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)
		250 (17,2)	2000 (138)	1600 (110)	770 (53,1)	520 (35,9)	320 (22,1)	270 (18,6)
	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)	250 (17,2)	1200 (82,7)	260 (17,9)	260 (17,9)	260 (17,9)	260 (17,9)	260 (17,9)

1. The internal relief performance values are obtained by removing the disk assembly.
2. For inlet pressures in excess of 1000 psig (69 bar), refer to the maximum body and disk pressure ratings in the specifications table.
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 6 gives the maximum inlet pressure for normal regulator operation.

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 shutoff valve.
2. Slowly open the downstream shutoff 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 (figure 2). 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 tables 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.

Table 5. Maximum Torque Values

KEY NUMBER(1)	DESCRIPTION	MAXIMUM TORQUE, FOOT-POUNDS (N•m)
2	Seat ring	25 (34)
3	Cap screw (w/ aluminum diaphragm casing)	16 (22)
	Cap screw (w/ ductile iron or steel diaphragm casing)	25 (34)
18	Lever cap screw	7 (9)
22	Diaphragm connector nut	17 (23)
26	Guide retainer (for Type 627R and 627MR only)	3 (4)
37	Spring case cap screw (w/ aluminum or ductile iron diaphragm casing)	7 (9)
	Spring case cap screw (w/ steel diaphragm casing)	35 (47)
46	Diaphragm cap screw (w/Type 627 or 627M)	7 (9)
	Diaphragm cap screw (w/Type 627H or 627MH)	14 (19)

1. Refer to figures 7 through 10 for key number locations.

Note

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

Refer to figures 7 through 12 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 shutoff valve.

2. Close the nearest downstream shutoff valve.

3. Open the vent valve between the regulator and the downstream shutoff valve nearest to it.

4. For a Type 627, 627H, or 627R regulator, the regulator will open to release pressure between the upstream shutoff 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 shutoff 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 5.

Due to normal wear, damage from external sources, or debris in the air or gas line, regulator parts such as the disk assembly, seat ring, and diaphragm must 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 seat ring and disk assembly is accelerated with high pressure drops and with large amounts of impurities in the flow stream. Instructions are given below for replacing the disk assembly, seat ring, diaphragm, and O-rings. These procedures may also be used for disassembly required for inspection and replacement of other parts.

Problem Indication for Type 627R 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 seat ring.

If the disk assembly and seat ring are not damaged, refer to the diaphragm and spring case area maintenance procedures in this section.

The disk assembly and seat ring 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, seat ring, diaphragm casing O-ring and stem assembly. All pressure must be released from the diaphragm casing before the performing these steps.

While using the following procedures, refer to figures 7 through 12 for key number locations.

Replacing the Disk Assembly or Seat Ring

1. To inspect and replace the disk assembly (key 9) or seat ring (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 seat ring (key 2). If removed, coat the threads of the replacement seat ring with lubricant (key 38) and torque to 25 foot-pounds (34 N•m).

3. Inspect the disk assembly 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.

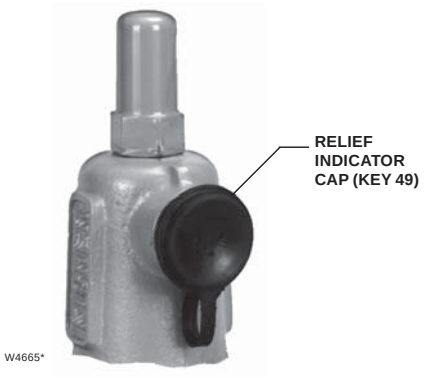


Figure 4. Relief Indicator

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 Type 627, 627H, and 627R regulators, or steps 9 through 19 for Type 627M, 627HM, and 627MR regulators.

Perform steps 4 through 8 for Type 627, 627H, and 627R Regulators only:

4. ForType 627, 627H, and627R regulators (figure 5), 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, or 11) and replace it if necessary.

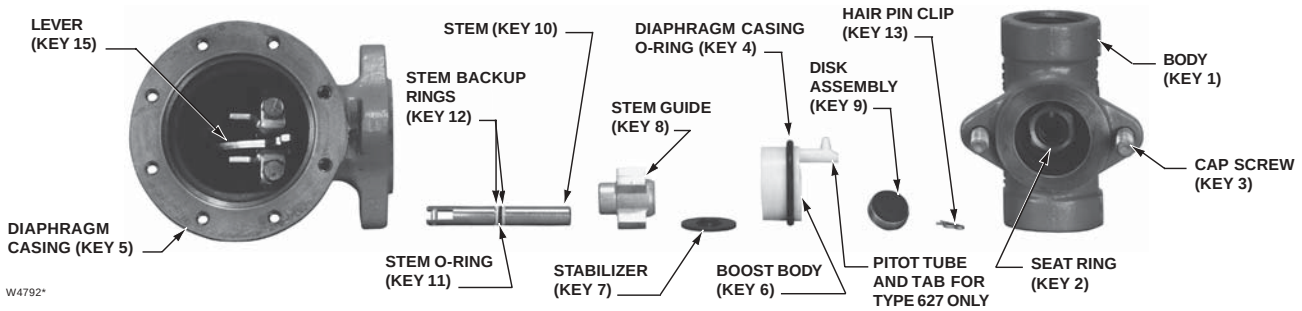
7. Apply lubricant (key 42) to a replacement diaphragm casing O-ring (key 4, figure 7, 8, or 11) and install it onto the boost body (key 6). Skip to step 14.

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 11). Skip to step 14.

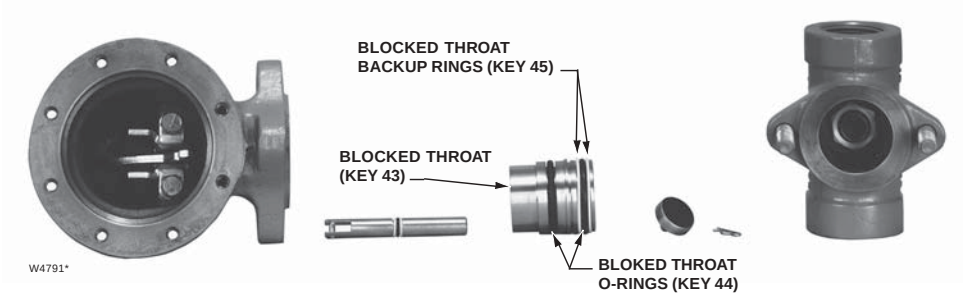
Perform steps 9 through 19 for Type 627M, 627HM, and 627MR Regulators only:

9. For Type 627M, 627HM, and 627MR regulators (figure 5), 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.



Type 627 and 627R



Type 627M amd 627MR

Figure 5. Stem Assemblies

11. Inspect and, if necessary, replace the blocked throat O-rings (key 44, figure 5) and backup rings (key 45, figure 5).

12. Apply lubricant (key 42) to replacement blocked throat O-rings (key 44) and backup rings (key 45).

13. Apply lubricant (key 42) to the replacement stem O-ring (key 11) and stem backup rings (key 12) and install them on the stem (key 10).

14. For assembly, insert the stem (key 10) into the diaphragm casing (key 5) and hook it on the lever (key 15).

15. Insert parts into the diaphragm casing (key 5) that were removed in steps 5 and 6 or step 10 (see figure 5).

16. Install the 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).

17. Position the diaphragm casing plus attached parts in relation to the body (key 1) so that they are correct for the application.

18. Secure the diaphragm casing to the body with the cap screws (key 3, figure 5). For an aluminum diaphragm casing (key 5), 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).

19. 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.

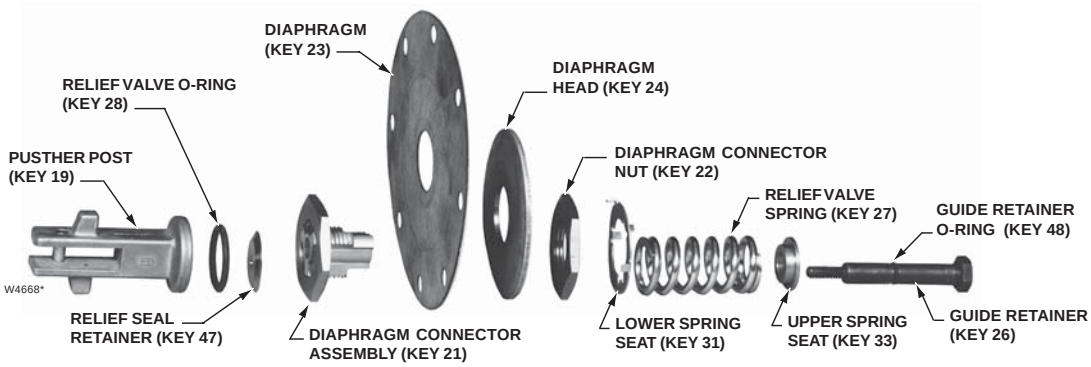
Diaphragm and Spring Case Area Maintenance Procedures

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.

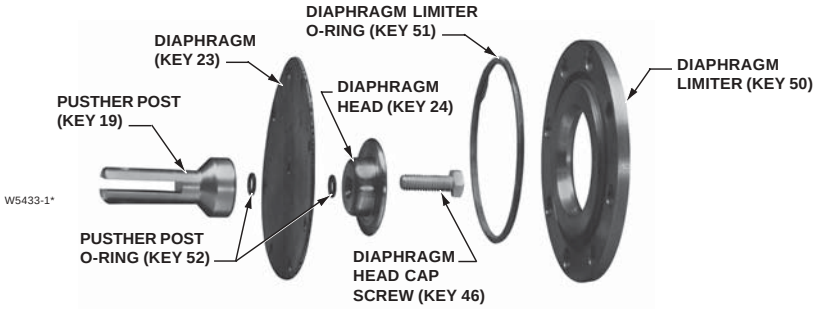
While using the following procedures, refer to figures 7 through 12 for key number locations.

1. Remove the adjusting screw cap (key 36), loosen the lock nut, 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.



Type 627, 627R, 627M, or 627MR



Type 627H amd 627HM

Figure 6. Diaphragm Assemblies

3. Remove the diaphragm limiter and O-ring (keys 50 and 51, 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 N•m).

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

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

6. For Type 627, 627H, 627M, and 627HM regulators (figures 5 & 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 627Monly), and diaphragm head (key 24). On the Type 627H or 627HM, remove the diaphragm cap screw 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 and torque the diaphragm head cap screw (key 46) to 7 foot-pounds (9 N•m) for the Type 627 or 627M. On the Type 627H or 627HM torque the diaphragm head cap screw to 14 foot-pounds (18 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 Type 627R and 627MR Regulators only:

12. For Type 627R 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).

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 (32 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 lubricate (key 42). 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 N•m).

18. Hook the pusher post (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 (key 38) 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 (key 39) over the screw holes, insert the spring case cap screws (key 37), and finger tighten.

23. Screw in the adjustment screw 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 N•m) of torque.

25. If necessary, refer to the installation and/or the startup and adjustment procedures.

26. Install the adjusting screw cap (key 34) after regulator adjustment.

Parts Ordering

When corresponding with your Fisher sales office or sales representative about this regulator, always reference the type number which is found on the nameplate (key 39, figures 7 through 12).

When ordering replacement parts, reference the key number of each needed part as found in the following parts list.

Parts List

Key	Description	Part Number
	Type 627 Parts Kit with aluminum/nitrile trim (includes keys 4, 9, 11, 12, and 23)	R627X000A12
	Type 627 Parts Kit with stainless steel/nitrile trim (includes keys 4, 9, 11, 12, and 23)	R627X000S12
	Type 627R Parts Kit with aluminum/nitrile trim (includes keys 4, 9, 11, 12, 23, 28, and 48)	R627RX00A12
	Type 627R Parts Kit with stainless steel/nitrile trim (includes keys 4, 9, 11, 12, 23, 28, and 48)	R627RX00S12
1	Body	
	Ductile iron	
	1000 psig (69 bar) max inlet pressure	
	3/4-inch NPT size	30B3046X012
	1-inch NPT size	30B3048X012
	2-inch NPT size	30B3096X012
	Steel	
	2000 psig (138 bar) max inlet pressure	
	3/4-inch NPT size	30B3050X012
	1-inch NPT size	30B3051X012
	2-inch NPT size	30B7452X012
	Steel, ANSI Class 600 RF flanged	
	1480 psig (102 bar) max inlet pressure	
	1-inch size	40B6754X012
	2-inch size	40B6756X012
2*	Seat ring	
	Aluminum	
	3/32-inch (2.4 mm) port diameter	0R044109022
	1/8-inch (3.2 mm) port diameter	1A936709012
	3/16-inch (4.8 mm) port diameter	00991209012
	1/4-inch (6.4 mm) port diameter	0B042009012
	3/8-inch (9.5 mm) port diameter	0B042209012
	1/2-inch (12.7 mm) port diameter	1A928809012
	303 Stainless steel	
	3/32-inch (2.4 mm) port diameter	0R044135032
	1/8-inch (3.2 mm) port diameter	1A936735032
	3/16-inch (4.8 mm) port diameter	00991235032
	1/4-inch (6.4 mm) port diameter	0B042035032
	3/8-inch (9.5 mm) port diameter	0B042235032
	1/2-inch (12.7 mm) port diameter	1A928835032

*Recommended spare part.

Key	Description	Part Number
2*	Seat ring (continued)	
	316 Stainless steel, NACE(1) construction only	
	3/32-inch (2.4 mm) port diameter	0R0441X0012
	1/8-inch (3.2 mm) port diameter	1A9367X0022
	3/16-inch (4.8 mm) port diameter	009912X0012
	1/4-inch (6.4 mm) port diameter	0B0420X0012
	3/8-inch (9.5 mm) port diameter	0B0422X0012
	1/2-inch (12.7 mm) port diameter	1A9288X0012
3	Cap Screw (not shown), (2 req'd)	
	Type 627 and 627R w/aluminum diaphragm case, pl steel	18A1087X012
	All Types w/ductile iron diaphragm case, pl steel	1C403824052
	or steel diaphragm case, pl steel	1C403024052
4*	Diaphragm Case O-Ring (Type 627, 627H, or 627R only), nitrile	17A2325X022
5	Diaphragm Case	
	For Type 627 or 627R	
	Aluminum w/o 1/8-inch gauge tap	40B3084X012
	Aluminum with 1/8-inch gauge tap for Type 627 only	11B5380X012
	Ductile iron w/o 1/8-inch gauge tap	30B3053X012
	Ductile iron with 1/8-inch gauge tap for Type 627 only	31B0641X012
	Steel	30B3104X012
	For Type 627M or 627MR	
	Ductile iron	39A5987X012
	Steel	30B8734X012
	For Type 627H, steel	30B3104X012
	For Type 627HM, steel	30B8734X012
6	Boost Body (not for Type 627M, 627HM, or 627MR), Delrin(2)	
	For Type 627 or 627H	30B3056X012
	For Type 627R	30B3057X012
7	Stabilizer (for Type 627, 627H, and 627R only), nitrile	10B3060X012
8	Stem Guide (for Type 627, 627H, and 627R only), powdered metal	20B3061X012
9*	Disk Assembly (for all port diameters)	
	Aluminum holder and nitrile disk	1C4248X0212
	303 Stainless steel holder and nitrile disk	1C4248X0202
	Aluminum holder and nylon disk	1C4248X00A2
	303 Stainless steel holder and nylon disk	1C4248X0062
	NACE construction only	
	Aluminum holder and nitrile disk	1C4248X0212
	316 Stainless steel holder and nitrile disk	1C4248X0252
	Aluminum holder and nylon disk	1C4248X00A2
	316 Stainless steel holder and nylon disk	1C4248X0262
10	Stem	
	303 stainless steel	10B3059X012
	316 stainless steel (NACE)	10B3059X022
11*	Stem O-Ring, nitrile	1D687506992
12	Stem Backup Ring, TFE (2 required)	1K786806992
13	Hair Pin Clip, stainless steel	10B3058X012
14	Drive Pin, plated steel	1A953228982
15	Lever, plated steel	20B3063X012
16	Lever Retainer, plated steel	30B3097X012
17	Lever Pin	
	Stainless steel	10B3083X012
	316 stainless steel (NACE)	10B3083X022
18	Lever Cap Screw (2 required)	
	Plated steel	10B7454X012
	316 stainless steel (NACE)	10B7454X022
19	Pusher Post, aluminum	
	For Type 627 or 627M	10B3098 X012
	For Type 627R or 627MR	10B3098 X022
	For Type 627H or 627HM, 416 stainless steel	10B3098 X032
21	Diaphragm Connector (for Type 627R or 627MR only), stainless steel	10B6758X012
22	Diaphragm Connector Nut (for Type 627R or 627MR only), stainless steel	10B7449X012
23*	Diaphragm, nitrile	
	For Type 627 or 627M w/aluminum or ductile iron diaphragm case	10B3069X012

Key	Description	Part Number
23*	Diaphragm, nitrile (continued)	
	For Type 627 or 627M w/steel diaphragm case	10B8735X012
	For Type 627R or 627MR w/aluminum or ductile iron diaphragm case	10B3068X012
	For Type 627R or 627MR w/steel diaphragm case	10B8736X012
	For Type 627H or 627HM w/steel diaphragm case (diaphragm is neoprene with nylon fabric)	12B0178X012
24	Diaphragm Head, plated steel	
	For Type 627 or 627M, plated steel	1D666428982
	For Type 627R or 627MR, plated steel	10B3071X012
	For Type 627H or 627HM, 416 stainless steel	12B0175X012
25	Relief Spring Seat (for Type 627R or 627MR only), steel	10B7446X012
26	Guide Retainer (for Type 627R or 627MR only), stainless steel	10B7450X012
27	Relief Spring (for Type 627R or 627MR only), plated steel	10B6757X012
28*	Relief Seal O-Ring (for Type 627R or 627MR only), nitrile	1J108506992
29	Spring Case	
	For Type 627 or 627R	
	Aluminum	40B3086X012
	Ductile iron	30B3055X012
	Steel	30B3102X012
	For Type 627M or 627MR	
	Ductile iron	30B3055X012
	Steel	30B3102X012
	For Type 627H or 627HM	
	Steel	30B3102X012
30	Screened Vent Assembly, plastic	10B3093X012
31	Lower Spring Seat, plated steel	
	For Type 627 or 627M	1D666625072
	For Type 627R or 627MR	20B3073X012
32	Control Spring, pl steel	
	5 to 20 psig (0.34 to 1.4 bar), yellow	10B3076X012
	15 to 40 psig (1.0 to 2.8 bar), green	10B3077X012
	35 to 80 psig (2.4 to 5.5 bar), blue	10B3078X012
	70 to 150 psig (4.8 to 10.3 bar), red	10B3079X012
	140 to 250 psig range (9.6 to 17.2 bar), blue, used in a Type 627H or 627HM	10B3078X012
	240 to 500 psig range (16.5 to 34.5 bar), red, used in a Type 627H or 627HM	10B3079X012
33	Upper Spring Seat, plated steel	1D667125072
34	Locknut, plated steel	1D667728982
35	Adjusting Screw, pl steel	
	For Type 627 or 627M	10B3081X012
	For Type 627H or 627HM	10B3081X012
	For Type 627R or 627MR	10B3080X012
36	Adjusting Screw Cap, plastic	20B3082X012
37	Spring Case Cap Screw, pl steel (8 required)	
	For aluminum or ductile iron diaphragm case	1A391724052
	For steel diaphragm case	10B8737X012
	For Type 627H/HM, steel diaphragm case	1A346424052
39	Nameplate	----------
43	Blocked Throat (for Type 627M, 627HM or 627MR only), stainless steel	10B3085X012
44	Blocked Throat O-Ring (for Type 627M, 627HM, or 627MR only), nitrile (2 required)	1E264306992
45	Blocked Throat Backup Ring (for Type 627M, 627HM, or 627MR only), TFE (2 required)	10B3106X012
46	Diaphragm Head Cap Screw, steel	
	For Type 627 or 627M	1K920724052
	For Type 627H or 627HM	1C379124052
47	Relief Seal Retainer (for Type 627R or 627MR only), stainless steel	10B7445X012
48*	Guide Retainer O-Ring (for Type 627R or 627MR only), nitrile	1D682506992
49	Relief Indicator (for Type 627R or 627MR only), rubber (not shown)	30B3100X012
50	Diaphragm Limiter	22B0176X012
51*	Diaphragm Limiter O-Ring	1K877606992
52*	Pusher Post O-Ring (2 required)	1C853806992

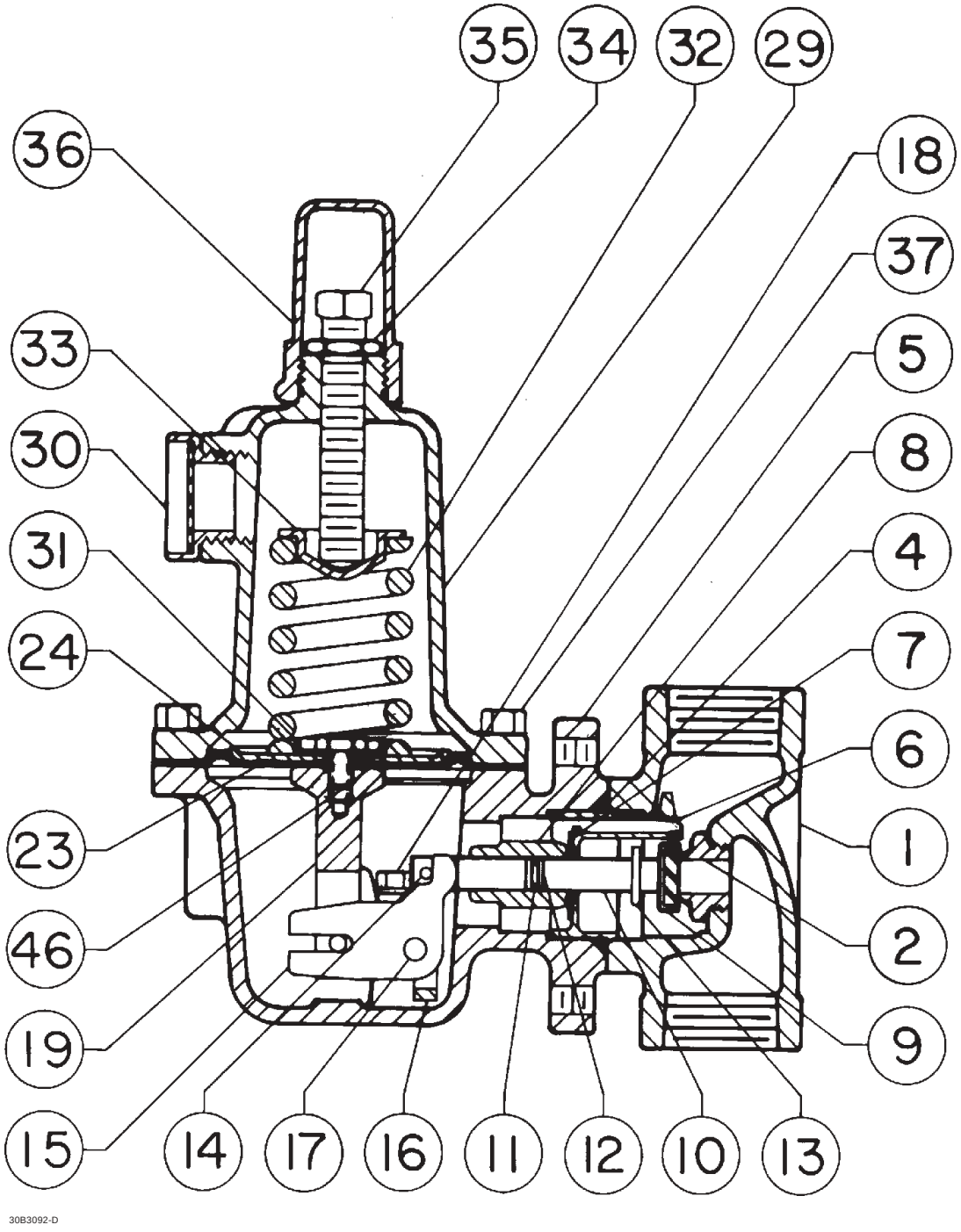


Figure 7. Type 627 Regulator Components

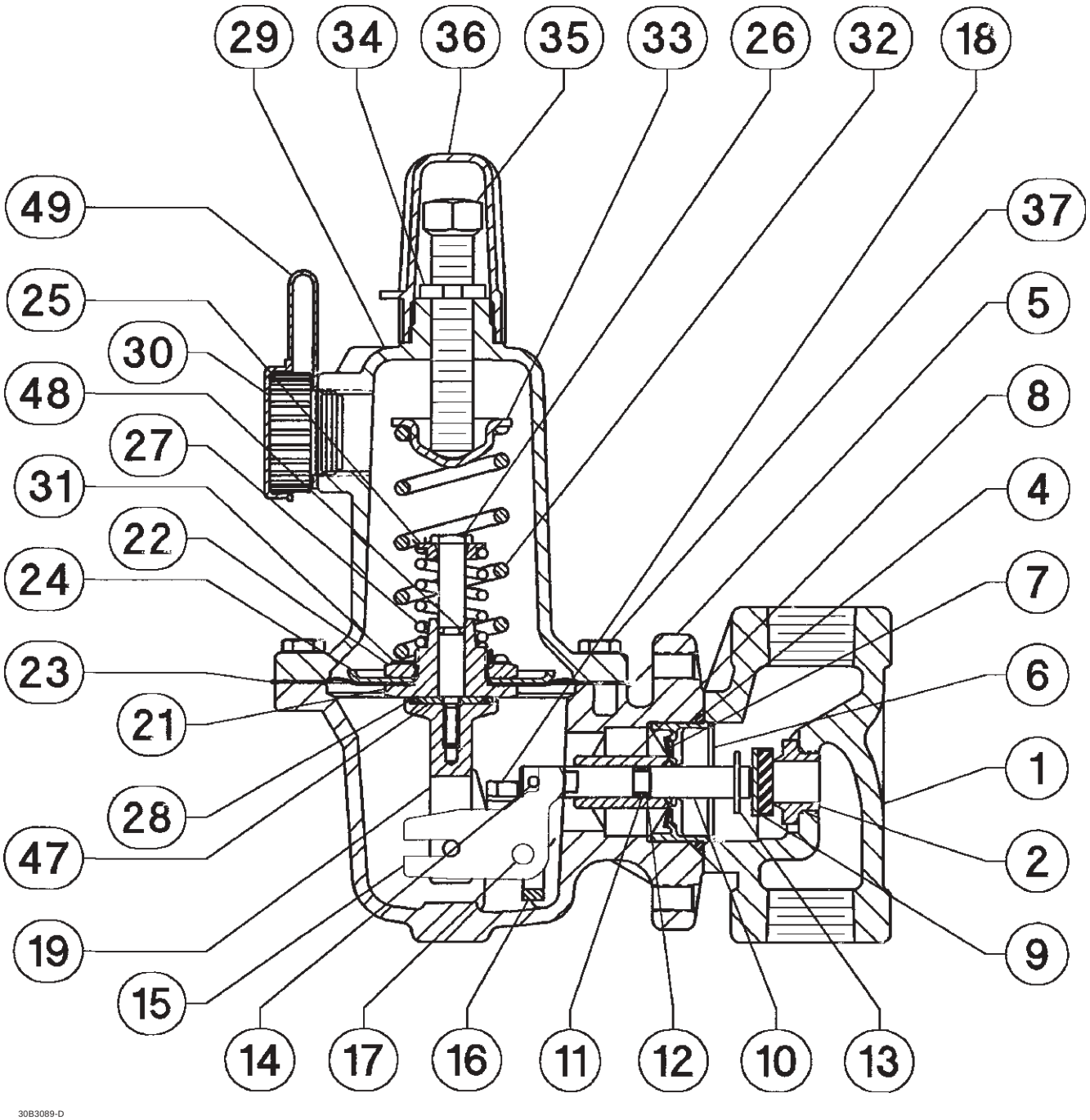


Figure 8. Type 627R Regulator Components

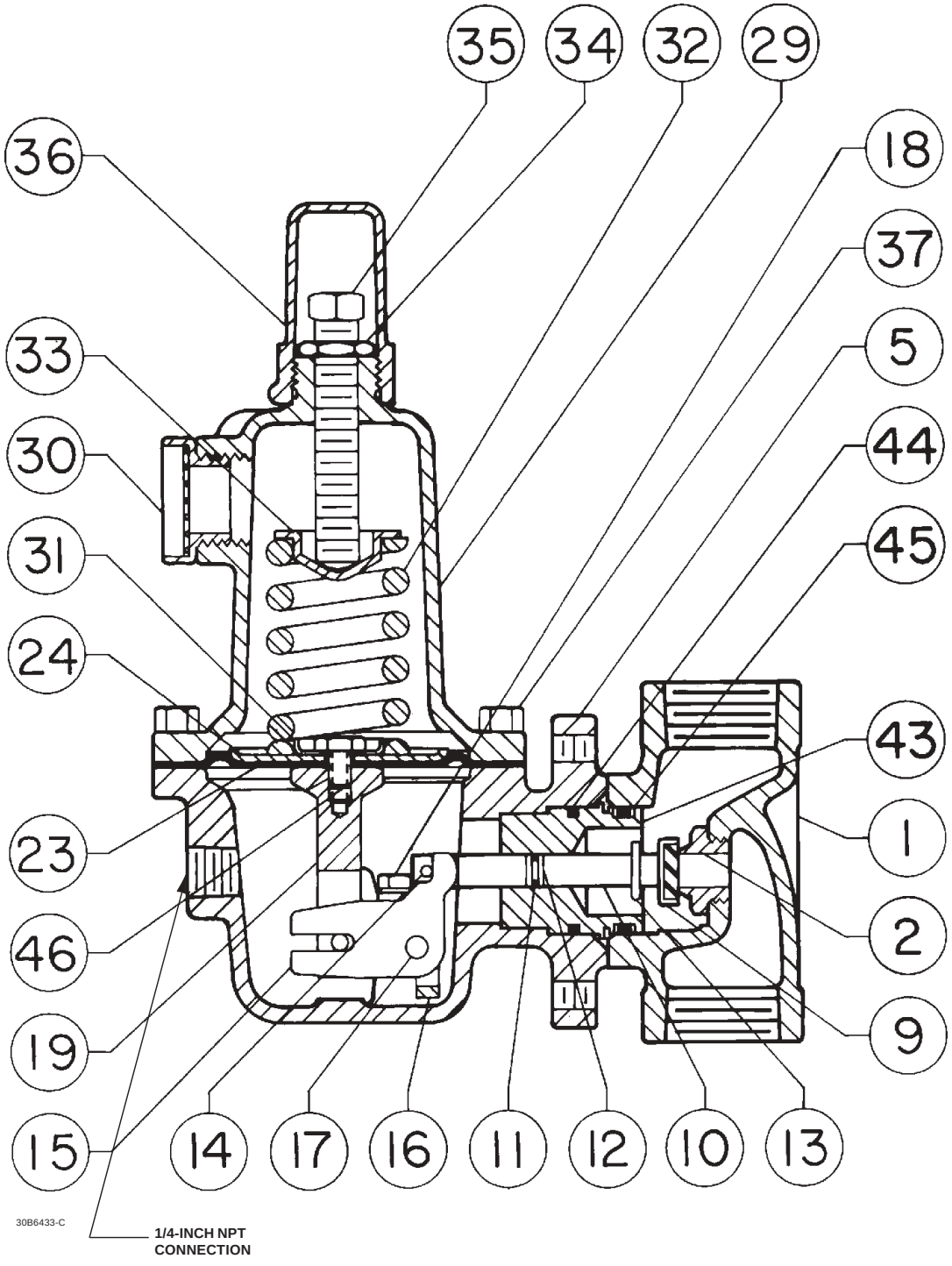


Figure 9. Type 627M Regulator Components

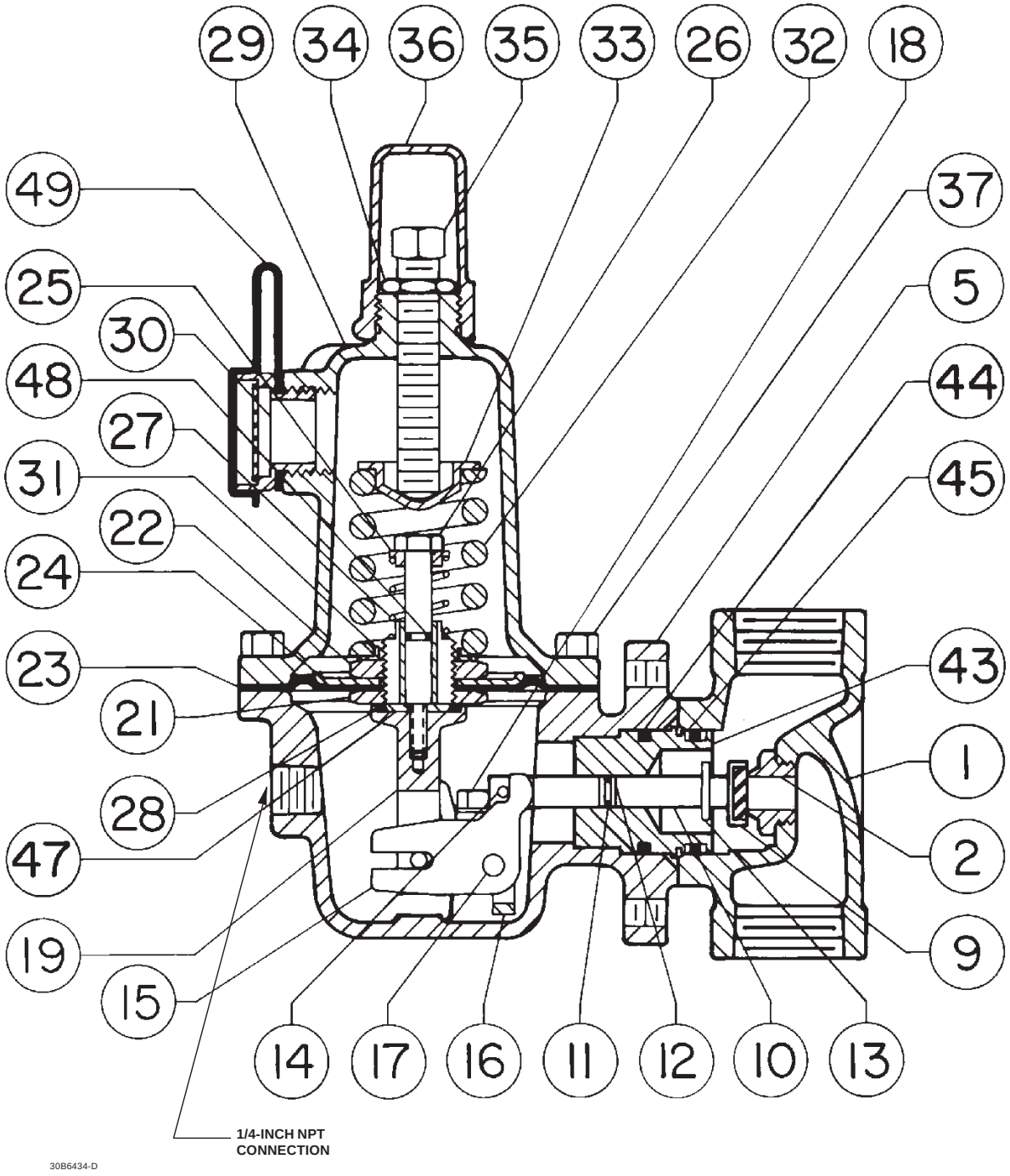


Figure 10. Type 627MR Regulator Components

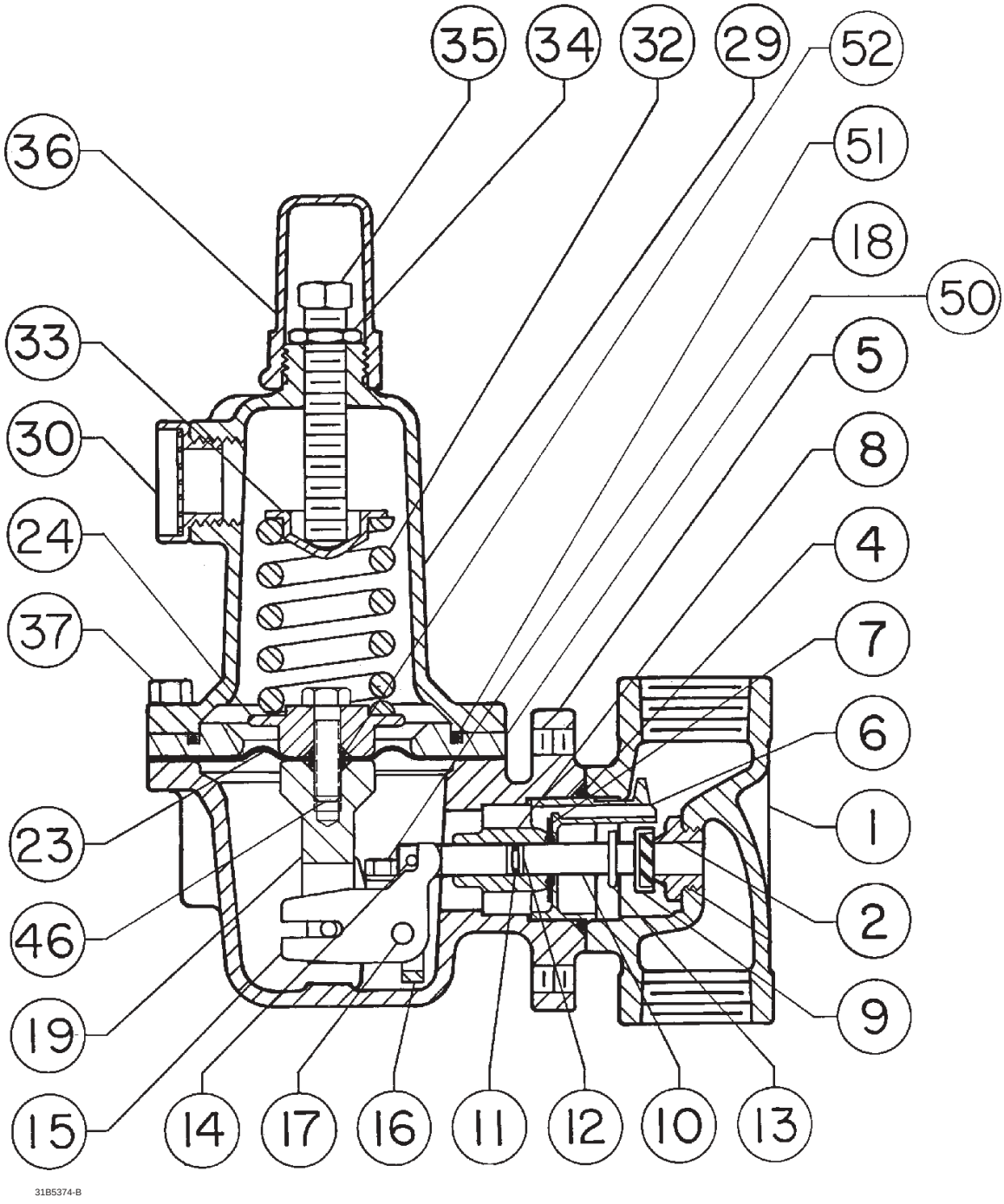


Figure 11. Type 627H Regulator Components

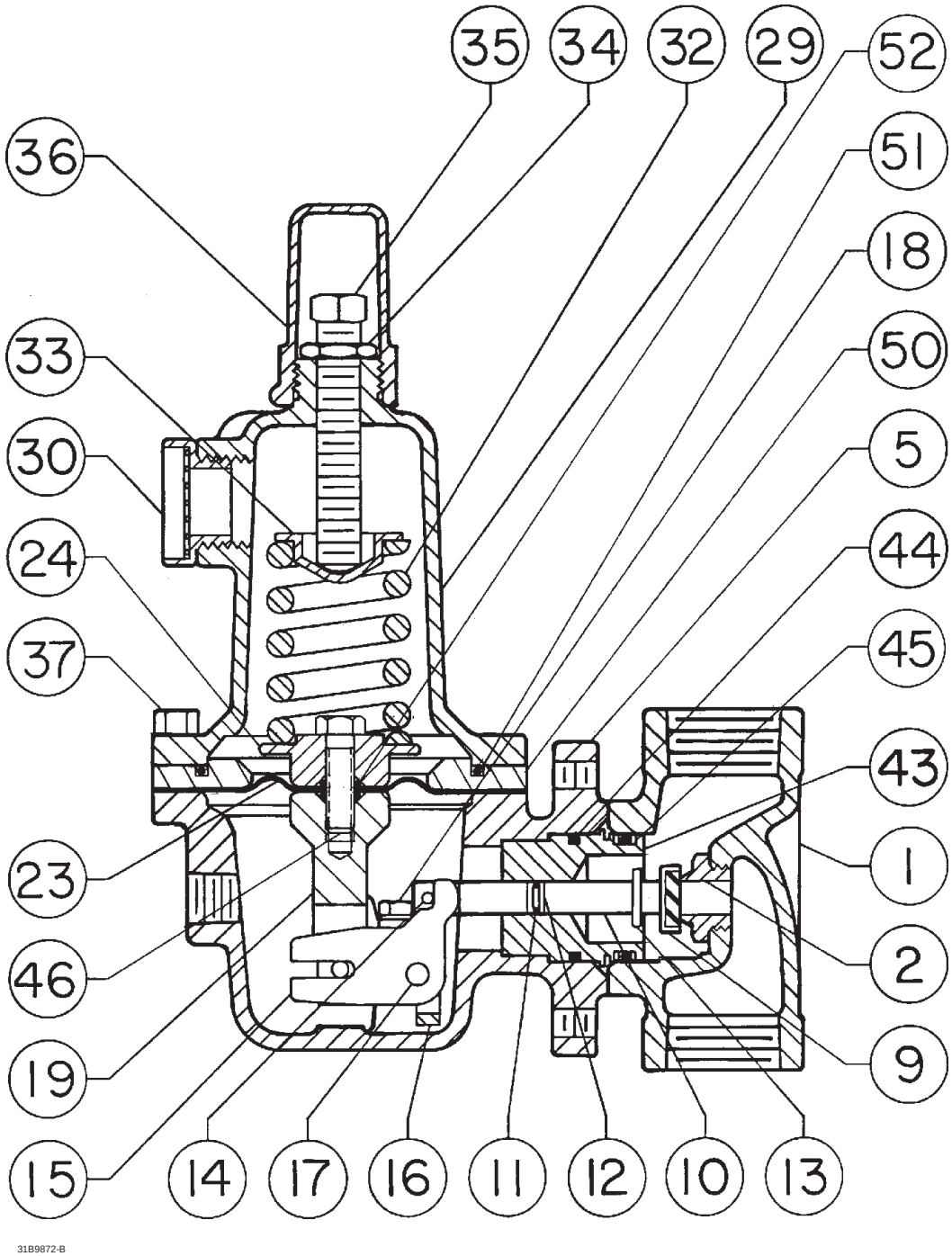


Figure 12. Type 627HM Regulator Components

January 2001

Errata Sheet
for

627 Series
Form 5252, July 1989

This errata sheet includes information covering the Type 627LB extended body regulator. This new body style is available on all 627 Series configurations and will be an addition to key 1 in the Parts List. The pressure ratings on the Type 627LB bodies will be identical to the existing specifications stated in the current 627 Series Instruction Manual. Each bullet on this errata sheet refers to a section of the 627 Series Instruction Manual (form 5252) where this infornation needs to be added.

• Add the following to the Available Constructions section of Table 1. Specifications on page 2.

Type 627LB: A 627 Series construction with an extended NPT screwed body. Note: The pressure ratings and capacities for a Type 627LB depend on the 627 Series construction. See the above listed constructions for ratings and specifications.

• Add the following to the Parts List on page 12.

Key	Description	Part Number
1	Body	
	Type 627LB - Ductile iron	
	1000 psig (69 bar) max inlet pressure	
	3/4-inch NPT screwed body	39B2450X012
	1-inch NPT screwed body	39B2451X012
	2-inch NPT screwed body	39B0414X012
	Type 627LB - Steel	
	2000 psig (138 bar) max inlet pressure	
	3/4-inch NPT screwed body	39B0411X012
	1-inch NPT screwed body	39B0412X012
	2-inch NPT screwed body	39B0415X012

• Add the following figure to the end of page 18.

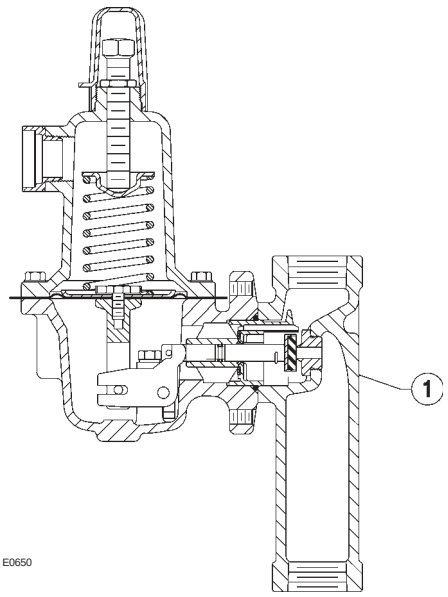


Figure 13. Type 627LB Regulator Body

For information, contact Fisher Controls:
Marshalltown, Iowa 50158 USA
28320 Gallardon, France
Sao Paulo 05424 Brazil
Singapore 128461

Printed in U.S.A.

KUNKLE PRESSURE RELIEF VALVES

Installation and Operating Instructions

Pre-Installation Handling

This pressure relief valve is designed to protect equipment from overpressure. The valve should be handled with care, not subjected to heavy shock loads, and protected to prevent dirt from getting inside. It should be installed correctly. Failure to do so could result in property damage or serious injury to personnel.

Installation

1. Mount the valve in a vertical position so that the valve body is self draining. If a body drain port is provided, make sure it is open when required by the ASME code. Do not plug any bonnet vent openings. The inlet piping should be as short as possible, with no elbows, and equal to or greater than the size of the pressure relief valve inlet connection. This will help to limit the inlet pressure drop to 3% or less when the valve is relieving.

2. When discharge piping is connected to valve outlet, make sure it is self draining if a body drain port is not used. The valve should not be connected to any discharge pipe that contains pressure before the valve opens or to any pipe where the pressure build-up is greater than 10% of the set pressure when the valve is open and relieving.

   Discharge piping, other than a short tailpipe, must be supported. For steam service, a drip pan elbow or flexible connection between the valve and the pipe should be used to prevent excessive pipe stress, due to thermal expansion, from being imposed on the valve body.

3. For threaded valves, apply a small amount of pipe thread sealing compound to external threads only. Do not put any sealing compound on the first thread or on any internal threads. To do so may cause the sealing compound to enter the valve and cause seat leakage.

   Use the wrench flats provided to tighten the valve to the connecting pipe. Do not use the valve body or bonnet and do not over-tighten. To do so may cause valve leakage.

4. For flanged valves, use new gaskets and tighten the mounting studs evenly.

Operation

1. Maintain a system operating pressure at least 5 psig or 10% below the set pressure of the valve, whichever is greater. Operating too close to the valve set pressure will cause seat leakage and will shorten the time between valve maintenance.

2. Do not use the safety valve as a control valve to regulate system operating pressure. Excessive operation will cause the seat to leak and will require more frequent valve maintenance.

3. ASME Section I and VIII valves equipped with lift levers are designed to be operated only when the system pressure is 75% of set pressure or greater. ASME Section IV valves may be operated at any set pressure. When hand operating the valve, hold it open long enough to purge any foreign matter from the seat area. If a cable or wire is attached to the lift lever for remote actuation, make sure the direction of pull is the same as it would be if the lever were pulled directly by hand.

Maintenance

Maintenance should be performed on a regular basis. An initial inspection interval of 12 months is recommended. Depending on the service conditions and the condition of the e valve, the inspection interval may be decreased or increased. Use only Kunkle parts for repair. Depending o the local jurisdictional requirements where the valve is installed, repairs may have to be made by a repair facility holding a VR stamp

Kunkle
An Anderson, Greenwood Company
Phone: 828-669-55151281 Old US 70, Black Mountain, NC 28711 Fax: 828-669-0586

Safety Warning — LP-Gas Pressure Relief Valves

Purpose

In its continuing quest for safety, Engineered Controls International, Inc. is publishing safety warning bulletins explaining the hazards associated with the use, misuse and aging of *ECII®/ RegO® Products*. LP-Gas dealer managers and service personnel must realize that the failure to exercise the utmost care and attention in the installation, inspection and maintenance of these products can result in personal injury and property damage.

The National Fire Protection Association Pamphlet #58 "Storage and Handling of Liquefied Petroleum Gases" states: "In the interests of safety, all persons employed in handling LP-Gases shall be trained in proper handling and operating procedures." *ECII®* Warning Bulletins are useful in training new employees and reminding older employees of potential hazards.

This Warning Bulletin should be provided to all purchasers of ECII® / RegO® Products and all personnel using or servicing these products. Additional copies are available from Engineered Controls International, Inc. and your Authorized *ECII®/ RegO® Products* Distributor.

⚠WARNING

What You Must Do:

- Read This Entire Warning
- Install Properly
- Inspect Regularly
- Replace In 10 Years or Less

Scope

This bulletin applies to pressure relief valves installed on stationary, portable and cargo containers and piping systems utilized with these containers. This bulletin is not intended to be an exhaustive treatment of this subject and does not cover all safety practices that should be followed in the installation and maintenance of LP-Gas systems. Each LP-Gas employee should be provided with a copy of NPGA Safety Pamphlet 306 "LP-Gas Regulator and Valve Inspection and Maintenance" as well as the NPGA "LP-Gas Training Guidebooks" relating to this subject.

Warnings should be as brief as possible. If there is a simple warning, it is:

Inspect pressure relief valves regularly. Replace unsafe or suspect valves immediately. Use common sense.

Install Properly

Consult NFPA Pamphlet #58 and/or any applicable regulations governing the application and use of pressure relief valves. Make sure you are thoroughly trained before you attempt any valve installation, inspection or maintenance.

Proper installation is essential to the safe operation of pressure relief valves. When installing *ECII®/ RegO®* pressure relief valves, consult warning # 8545-500 which accompanies each valve. Check for damage and proper operation after valve installation. Check that the valve is clean and free of foreign material.

Pipeaways and deflectors may be required by local codes, laws and regulations depending on the installation. Use only *ECII®/ RegO®* adapters on *ECII®/ RegO®* relief valves. Adapters not designed specifically for piping away *ECII®/ RegO®* relief valves, such as those with 90° turns or reduced internal diameters, will decrease flow dramatically. These should never be used as they can cause the relief valve to chatter and eventually destroy itself.

The addition of deflectors, pipeaway adapters and piping will restrict the flow. To properly protect any container, the total system flow must be sufficient to relieve pressure at the pressure setting of the relief valve in accordance with all applicable codes.

Inspect Regularly

A pressure relief valve discharges when some extraordinary circumstance causes an over pressure condition in the container. If a pressure relief valve is known to have discharged, the relief valve, as well as the entire system, should be immediately and thoroughly inspected to determine the reason for the discharge. In the case of discharge due to fire, the valve should be removed from service and replaced.

Relief valves should be inspected each time the container is filled but no less than once a year. If there is any doubt about the condition of the valve, it must be replaced.

Eye protection must be worn when performing inspection on relief valves under pressure. Never look directly into a relief valve under pressure or place any part of your body where the relief valve discharge could impact it. In some cases a flashlight and a small mirror are suggested to assist when making visual inspections.

To Properly Inspect A Pressure Relief Valve, Check For:

1. A rain cap. Check protective cap located in valve or at end of pipeaway for a secure fit. Protective caps help protect the relief valve against possible malfunction caused by rain, sleet, snow, ice, sand, dirt , pebbles, insects, other debris and contamination. REPLACE DAMAGED OR MISSING CAPS AT ONCE AND KEEP A CAP IN PLACE AT ALL TIMES.
2. Open weep holes. Dirt, ice, paint and other foreign particles can prevent proper drainage from the valve body. IF THE WEEP HOLES CANNOT BE CLEARED, REPLACE THE VALVE.
3. Deterioration and corrosion on relief valve spring. Exposure to high concentrations of water, salt, industrial pollutants, chemicals and roadway contaminants could cause metal parts to fail. IF THE COATING ON THE RELIEF VALVE SPRING IS CRACKED OR CHIPPED, REPLACE THE VALVE.
4. Physical damage. Ice accumulations and improper installation could cause mechanical damage. IF THERE ARE ANY INDICATIONS OF DAMAGE, REPLACE THE VALVE.
5. Tampering or readjustment. Pressure relief valves are factory set to discharge at specified pressures. IF THERE ARE ANY INDICATIONS OF TAMPERING OR READJUSTMENT, REPLACE THE VALVE.
6. Seat leakage. Check for leaks in the seating area using a non-corrosive leak detection solution. REPLACE THE VALVE IF THERE IS ANY INDICATION OF LEAKAGE. Never force a relief valve closed and continue to leave it in service. This could result in damage to the valve and possible rupture of the container or piping on which the valve is installed.
7. Corrosion and contamination. REPLACE THE VALVE IF THERE ARE ANY SIGNS OF CORROSION OR CONTAMINATION ON THE VALVE.
8. Moisture, foreign particles or contaminants in the valve. Foreign material such as paint, tar or ice in relief valve parts can impair the proper functioning of the valves. Grease placed in the valve body may harden over time or collect contaminants, thereby impairing the proper operation of the relief valve. DO NOT PLACE GREASE IN THE VALVE BODY, REPLACE THE VALVE IF THERE ARE ANY INDICATIONS OF MOISTURE OR FOREIGN MATTER IN THE VALVE.
9. Corrosion or leakage at container connection. Check container to valve connection with a non-corrosive leak detection solution. REPLACE THE VALVE IF THERE IS ANY INDICATION OF CORROSION OR LEAKAGE AT THE CONNECTION BETWEEN THE VALVE AND CONTAINER.

CAUTION: Never plug the outlet of a pressure relief valve. Any device used to stop the flow of a properly operating pressure relief valve that is venting an overfilled or overpressurized container - raises serious safety concerns!

Replace Pressure Relief Valves In 10 Years Or Less

The safe useful life of pressure relief valves can vary greatly depending on the environment in which they live.

Relief valves are required to function under widely varying conditions. Corrosion, aging of the resilient seat disc and friction all proceed at different rates depending upon the nature of the specific environment and application. Gas impurities, product misuse and improper installations can shorten the safe life of a relief valve.

Predicting the safe useful life of a relief valve obviously is not an exact science. The conditions to which the valve is subjected will vary widely and will determine its useful life. In matters of this kind, only basic guidelines can be suggested. For example, the Compressed Gas Association Pamphlet S-1.1 Pressure Relief Device Standards — Cylinders, section 9.1.1 requires all cylinders used in industrial motor fuel service to have the cylinder's pressure relief valves replaced by new or unused relief valves within twelve years of the date of manufacture of cylinder and within each ten years thereafter. *The LP-Gas dealer must observe and determine the safe useful life of relief valves in his territory.* The valve manufacturer can only make recommendations for the continuing safety of the industry.

WARNING: Under normal conditions, the useful safe service life of a pressure relief valve is 10 years from the original date of manufacture. However, the safe useful life of the valve may be shortened and replacement required in less than 10 years depending on the environment in which the valve lives. Inspection and maintenance of pressure relief valves is very important. Failure to properly inspect and maintain pressure relief valves could result in personal injuries or property damage.

For Additional Information Read:

1. CGA Pamphlet S-1.1 Pressure Relief Standards — Cylinders, Section 9.1.1.
2. *ECII*® Catalog L-500.
3. *ECII*® Warning # 8545-500.
4. NPGA Safety Pamphlet 306 "LP-Gas Regulator and Valve Inspection and Maintenance" and "LP-Gas Training Guidebooks".
5. NFPA # 58, "Storage and Handling of Liquefied Petroleum Gases".
6. NFPA # 59, "LP-Gases at Utility Gas Plants".
7. ANSI K61.1 Safety Requirements for Storage and Handling of Anhydrous Ammonia.

Requirements for Pressure Relief Valves

Every container used for storing or hauling LP-Gas and anhydrous ammonia must be protected by a pressure relief valve. These valves must guard against the development of hazardous conditions which might be created by any of the following:

- Hydrostatic pressures due to overfilling or the trapping of liquid between two points.
- High pressures resulting from exposure of the container to excessive external heat.
- High pressures due to the use of incorrect fuel.
- High pressures due to improper purging of the container.

Consult NFPA Pamphlet #58 for LP-Gas and ANSI #K61.1 for anhydrous ammonia, and/or any applicable regulations governing the application and use of pressure relief valves.

Operation of Pressure Relief Valves

Pressure relief valves are set and sealed by the manufacturer to function at a specific "start-to-discharge" pressure in accordance with regulations. This set pressure, marked on the relief valve, depends on the design requirement of the container to be protected by the relief valve. If the container pressure reaches the start-to-discharge pressure, the relief valve will open a slight amount as the seat disc begins to move slightly away from the seat. If the pressure continues to rise despite the initial discharge through the relief valve, the seat disc will move to a full open position with a sudden "pop". This sharp popping sound is from which the term "pop-action" is derived.

Whether the relief valve opens a slight amount or pops wide open, it will start to close if the pressure in the container diminishes. After the pressure has decreased sufficiently, the relief valve spring will force the seat disc against the seat tightly enough to prevent any further escape of product. The pressure at which the valve closes tightly is referred to as the "re-seal" or "blow-down" pressure. Generally, the re-seal pressure will be lower than the start-to-discharge pressure.The re-seal pressure can be, and in most cases is, adversely affected by the presence of dirt, rust, scale or other foreign particles lodging between the seat and disc. They interfere with the proper mating of the seat and disc and the pressure in the container will usually have to decrease to a lower pressure before the spring force embeds foreign particles into the resilient seat disc material and seals leak-tight. The degree by which the presence of dirt decreases the re-seal pressure, is, of course, dependent on the size of the interfering particles.

Once particles have been trapped between the disc and seat, the start-to-discharge pressure is also affected. For example, the pressure relief valve will start-to-discharge at some pressure lower than its original start-to-discharge pressure. Again, the pressure at which the valve will start to discharge is dependent on the size of the foreign particles.

In the case of a pressure relief valve that has opened very slightly due to a pressure beyond its start-to-discharge setting, the chances of foreign material lodging between the seat and disc is negligible although the possibility is always present. If the relief valve continues to leak at pressures below its start-to-discharge setting it must be replaced.

Relief valves which have "popped" wide open must also be checked for foreign material lodged between the seat and disc, as well as for proper reseating of the seat and disc. Continued leakage at pressures below the start-to-discharge setting indicate the relief valve must be replaced.

The pressure at which a pressure relief valve will start to discharge should never be judged by the reading of the pressure gauge normally furnished on the container.

The reasons for this are two-fold:

- If the relief valve is called upon to open, the resulting discharge produces an increased vaporization of the product in the container with the result that the liquid cools to a certain extent and the vapor pressure drops. A reading taken at this time would obviously not indicate what the pressure was when the relief valve opened.
- The pressure gauges usually on most containers provide somewhat approximate readings and are not intended to provide an indication of pressure sufficiently accurate to judge the setting of the relief valve.

Repair and Testing

RegO® Pressure Relief Valves are tested and listed by Underwriters Laboratories, Inc., in accordance with NFPA Pamphlet #58. Construction and performance of RegO® Pressure Relief Valves are constantly checked at the factory by U.L. inspectors. Therefore, testing of RegO® Pressure Relief Valves in the field is not necessary.

Never attempt to repair or change the setting of RegO® Pressure Relief Valves. Any changes in settings or repairs in the field will void the UL® listing and may create a serious hazard.

While the functioning of a pressure relief valve appears to be relatively simple, the assembly and test procedure used to manufacture these RegO® products is rather complex. Highly specialized test fixtures and specially trained personnel are necessary to attain proper relief valve settings. These fixtures and personnel are available only at the factory.

Any pressure relief valve which shows evidence of leakage, other improper operation or is suspect as to its performance must be replaced immediately using approved procedures.

Pipe-Away Adapters

Pipe-away adapters are available for most RegO® Pressure Relief Valves, where it is required or desirable to pipe the discharge above or away from the container. Each adapter is designed to sever if excessive stress is applied to the vent piping – thus leaving the relief valve fully operative.

Weep hole deflectors are available on larger relief valves. These deflectors provide protection against flame impinging on adjacent containers which could occur from ignition of LP-Gas escaping through the relief valve drain hole when the valve is discharging.

Selection of RegO® Pressure Relief Valves For ASME Containers

The rate of discharge required for a given container is determined by the calculation of the surface area of the container as shown in "Chart A" for LP-Gas and "Chart B" for anhydrous ammonia. See page D9.

Setting - The set pressure of a pressure relief valve depends upon the design pressure of the container. Refer to NFPA Pamphlet #58 for more information.

Selection of RegO® Pressure Relief Valves for DOT Containers

To determine the proper relief valve required for a given DOT container, refer to the information shown with each pressure relief valve

in the catalog. This information will give the maximum size (pounds water capacity) DOT container for which the relief valve has been approved.

Setting - The standard relief valve setting for use on DOT cylinders is 375 PSIG.

Ordering RegO® Pressure Relief Valves

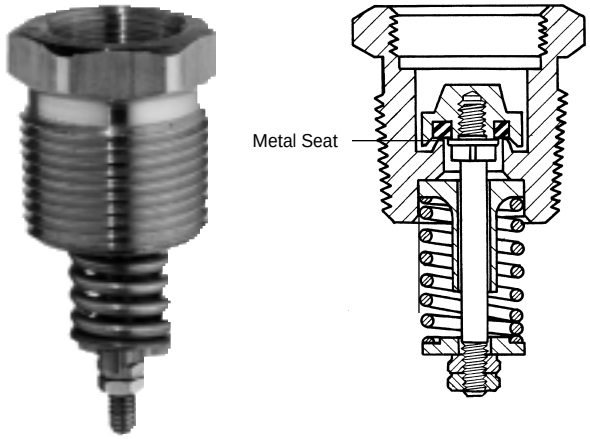
When ordering RegO® Pressure Relief Valves, be sure you are certain that it will sufficiently protect the container as specified in the forewording information, NFPA Pamphlet #58 and any other applicable standards or specifications.

All adapters, protective caps and deflectors must be ordered separately, unless specified otherwise.

Part Number Explanation

Products carrying an “A” or “AA” prefix contain no brass parts and are suitable for NH_3. Hydrostatic relief valves carrying an “SS” prefix are of stainless steel construction and are suitable for use with NH_3. The products are also suitable for use with LP-Gas service except relief valves carrying an “AA” prefix. These are of partial aluminum construction and are listed by U.L. for NH_3 service only.

Safety Information — Relief Valves Don’t Last Forever



RegO® Relief Valve for lift truck containers

The internal spring is protected from external contamination but the other external parts must be protected with a cap. Circular rubber seat disc ring seats on brass shoulder approximately 3⁄64" wide.

This article was prepared by the engineers of RegO® products, after technical consultation with valve manufacturers and other industry sources. Its purpose is to alert and remind the LP-Gas industry of the importance of proper maintenance of pressure relief valves. It applies most particularly to separate relief valves with emphasis on lift truck and motor fuel containers where the hazards of contamination are greatest.

Since the beginning of our industry, manufacturers of equipment and distributors of LP-Gas have worked diligently to provide a safe environment for employees and consumers. The history of the industry testifies to the success of their efforts.

But the industry is now entering its sixth decade and equipment installed years ago is failing because of age. Every year, additional equipment will fail unless it is replaced. Pressure relief valves are no exception. The valve manufacturers and LP-Gas dealers are naturally concerned about this situation.

Causes of Relief Valve Failure

A relief valve is designed to have a safe useful life of many years, but that life will vary greatly depending on the environment in which it “lives.” To attempt to estimate the safe useful life of a relief valve and the effect of environment on its performance, a brief discussion of the materials used and the nature of its performance should be helpful.

Relief valve bodies are generally made of brass or steel. Springs are made from various spring wires which are plated or painted, or made of stainless steel. Valve seat discs are made of synthetic rubber compounds which will remain serviceable in an atmosphere of LP-Gas. Relief valve stems, guides, etc. are generally made from brass or stainless steel.

Relief valves, over the years, may not function properly in several ways:

- They may leak at pressures below the set pressure.
- They may open and fail to properly reseat.
- They may open at higher than the set pressure.

These failures to function properly are due primarily to four “environmental” conditions:

1. Corrosion of metal parts (particularly springs) which result in the component parts failing to perform.
2. Deterioration of the synthetic rubber seat disc material.
3. Clogging or “cementing” of the movable relief valve components so that their movement is restricted.
4. Debris on the valve seat after the relief valve opens, effectively preventing the valve from reseating.

Corrosion is caused by water, corrosive atmospheres of salt and industrial pollutants, chemicals, and roadway contaminants. High concentrations can attack the metal parts vigorously. No suitable metals are totally resistant to such corrosion.

Synthetic rubber and seat disc materials can also be attacked by impurities in the gas and corrosive atmospheres, particularly those with sulphur dioxide. There are no suitable rubber materials which resist all contaminants.

“Cementing” of relief valve parts has been caused by normal industrial atmospheres containing particles of dirt, iron oxide, metal chips, etc. combined with water, oil, or grease. Ice collecting in recessed valves could cause relief valves to fail to open. Paint and tar in relief valves also cause failure to function properly.

Debris on valve seats which prevents reseating can occur whenever the valve collects material in the relief valve opening which is not blown out when the relief valve opens.

Inspection of Relief Valves

Unfortunately many of the above problems may not be easily observed because of the compact nature of some relief valve designs.

A casual visual inspection of a relief valve may not necessarily disclose a potential hazard. On the other hand, a visual inspection will often disclose leakage, corrosion, damage, plugging and contamination.

If additional light is required, a flashlight should be used.

If there is any doubt about the condition of the valve, or if there is a suspicion that the valve has not been protected by a cap for some time, it should be replaced before refilling the container.

Eye protection must be used when examining relief valves under pressure.

Smaller Relief Valves

The industry's requirement for a small full-flow safety relief valve challenged design engineers some years ago:

- The valve must be leakproof before operating and must reseat leakproof each time after each operation. The only known satisfactory seat disc materials to accomplish this have been special synthetic rubber compounds.
- Valve discharge settings are relatively high and require high spring loads to keep the valve closed.
- Because of the small interior diameter of the valve, the round metal seating area is small.

All of these parameters may result in the development of a significant indentation in the rubber seat disc after some years. The seat disc may have a tendency to cling to the metal seat. This may result in the relief valve not opening at the set pressure as the seat disc ages.

Test have been conducted on small LP-Gas relief valves of all the U.S. valve manufacturers. Valves over 10 years old were removed from service and tested to determine at what pressure the valves discharged. In many of the valves, the pressure required to open the valve exceeded the set pressure.

Because of the critical importance of proper functioning of relief valves, common sense and basic safety practice dictate that small relief valves should be replaced in about 10 years.

Some larger relief valves on bulk storage tanks can be replaced with rebuilt valves obtained from the manufacturers. Small relief valves cannot be rebuilt economically, thus, new valves are required. Most LP-Gas dealers find it impractical and costly to test relief valves and field repairing of relief valves is not sanctioned by the manufacturers, Underwriter's Laboratories, or ASME.

Use of Protective Caps

Many of the problems that cause inoperative relief valves could be prevented if proper protective caps were kept in place *at all times.*

Collection of debris would be prevented. Contamination caused by corrosive atmospheres would be reduced. Water collection in the valves would be eliminated. Relief valves protected with caps from the time of installation in the container would obviously have a much longer safe useful life, but they still should be replaced at some time because of the gradual deterioration of the rubber seat disc due to age alone.

NFPA 58 requires that protective caps must be kept in place as a protective cover on some relief valves. This is a mandatory requirement on several types of relief valves. The fact that use of caps may make inspection more time consuming should not be viewed as a reason for either not using the caps, or not making required periodic inspections.

In the event a relief valve has been used without the required cap, the relief valve should be thoroughly inspected and the required cap placed on the relief valve. If damage is noted to the relief valve, it should be replaced and the replacement valve should be capped.

Relief valves with pipe-away adapters or deflectors used on lift truck containers have been found choked with debris. Inspection of relief valves with deflectors can only be accomplished by removing the deflector.

Similarly, larger relief valves with vent stacks have been found choked with debris and water. Valves have failed because springs rusted through. The weep hole was plugged. It was obvious that the relief valves had not been inspected in many years. These conditions must be alleviated by periodic inspections and replacement of relief valves as needed.

Summary Recommendations

Predicting the safe useful life of a relief valve is obviously not an exact science. The conditions to which the valve is subjected will vary widely and will largely control its life. In matters of this kind, only basic guidelines can be suggested. The LP-Gas dealer must observe and determine the safe useful life of relief valves in his territory. The valve manufacturers can only make recommendations for the continuing safety of the industry:

1. Make sure proper protective caps are in place at all times. Do not release a container for service or fill a container unless it has a protective cap in place.
2. Replace relief valves periodically, at least every 10 years. Every relief valve has the month and year of manufacture stamped on the valve. This is most particularly true of small *separate* relief valves.
3. Carefully inspect valves each time before the container is filled. Replace valves showing any signs of contamination, corrosion, damage, plugging, leakage, or any other problem. Eye protection must be used when examining relief valves under pressure.

Chart A — Minimum Required Rate of Discharge for LP-Gas Pressure Relief Valves Used on ASME Containers

From NFPA Pamphlet #58, Appendix D (1986).

Minimum required rate of discharge in cubic feet per minute of air at 120% of the maximum permitted start-to-discharge pressure for pressure relief valves to be used on containers other than those constructed in accordance with Interstate Commerce Commission specification.

Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air
20 or less	626	85	2050	150	3260	230	4630	360	6690	850	13540	1500	21570
25	751	90	2150	155	3350	240	4800	370	6840	900	14190	1550	22160
30	872	95	2240	160	3440	250	4960	380	7000	950	14830	1600	22740
35	990	100	2340	165	3530	260	5130	390	7150	1000	15470	1650	23320
40	1100	105	2440	170	3620	270	5290	400	7300	1050	16100	1700	23900
45	1220	110	2530	175	3700	280	5450	450	8040	1100	16720	1750	24470
50	1330	115	2630	180	3790	290	5610	500	8760	1150	17350	1800	25050
55	1430	120	2720	185	3880	300	5760	550	9470	1200	17960	1850	25620
60	1540	125	2810	190	3960	310	5920	600	10170	1250	18570	1900	26180
65	1640	130	2900	195	4050	320	6080	650	10860	1300	19180	1950	26750
70	1750	135	2990	200	4130	330	6230	700	11550	1350	19780	2000	27310
75	1850	140	3080	210	4300	340	6390	750	12220	1400	20380		
80	1950	145	3170	220	4470	350	6540	800	12880	1450	20980		

Surface area =Total outside surface area of container in square feet.

When the surface area is not stamped on the name plate or when the marking is not legible, the area can be calculated by using one of the following formulas:

1. Cylindrical container with hemispherical heads. Area (in sq. ft.) = overall length (ft.) x outside diameter (ft.) x 3.1416.
2. Cylindrical container with semi-ellipsoidal heads. Area (in sq. ft.) = [overall length (ft.) + .3 outside diameter (ft.)] x outside diameter (ft.) x 3.1416.
3. Spherical container. Area (in sq. ft.) = outside diameter (ft.) squared x 3.1416.

Flow Rate CFM Air = Required flow capacity in cubic feet per minute of air at standard conditions, 60ºF. and atmospheric pressure (14.7 psia).

The rate of discharge may be interpolated for intermediate values of surface area. For containers with total outside surface area greater than 2000 square feet, the required flow rate can be calculated using the formula, Flow Rate in CFM Air = 53.632 $A^{0.82}$. Where A = total outside surface area of the container in square feet.

Valves not marked "Air" have flow rate marking in cubic feet per minute of liquefied petroleum gas. These can be converted to ratings in cubic feet per minute of air by multiplying the liquefied petroleum gas ratings by the factors listed below. Air flow ratings can be converted to ratings in cubic feet per minute of liquefied petroleum gas by dividing the air ratings by the factors listed below.

Air Conversion Factors

Container Type	100	125	150	175	200
Air Conversion Factor	1.162	1.142	1.113	1.078	1.010

Chart B — Minimum Required Rate of Discharge for Anhydrous Ammonia Pressure Relief Valves Used on ASME Containers

From ANSI K61.1-1981, Appendix A (1981).

Minimum required rate of discharge in cubic feet per minute of air at 120% of the maximum permitted start-to-discharge pressure for pressure relief valves to be used on containers other than those constructed in accordance with United States Department of Transportation cylinder specifications.

Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air
20	258	95	925	170	1500	290	2320	600	4200	1350	8160	2100	11720
25	310	100	965	175	1530	300	2380	650	4480	1400	8410	2150	11950
30	360	105	1010	180	1570	310	2450	700	4760	1450	8650	2200	12180
35	408	110	1050	185	1600	320	2510	750	5040	1500	8900	2250	12400
40	455	115	1090	190	1640	330	2570	800	5300	1550	9140	2300	12630
45	501	120	1120	195	1670	340	2640	850	5590	1600	9380	2350	12850
50	547	125	1160	200	1710	350	2700	900	5850	1650	9620	2400	13080
55	591	130	1200	210	1780	360	2760	950	6120	1700	9860	2450	13300
60	635	135	1240	220	1850	370	2830	1000	6380	1750	10090	2500	13520
65	678	140	1280	230	1920	380	2890	1050	6640	1800	10330		
70	720	145	1310	240	1980	390	2950	1100	6900	1850	10560		
75	762	150	1350	250	2050	400	3010	1150	7160	1900	10800		
80	804	155	1390	260	2120	450	3320	1200	7410	1950	11030		
85	845	160	1420	270	2180	500	3620	1250	7660	2000	11260		
90	885	165	1460	280	2250	550	3910	1300	7910	2050	11490		

Surface area = Total outside surface area of container in square feet.

When the surface area is not stamped on the name plate or when the marking is not legible, the area can be calculated by using one of the following formulas:

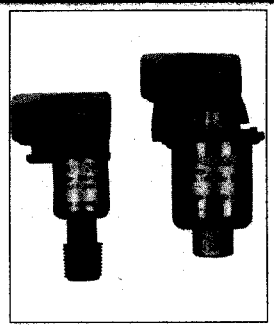
1. Cylindrical container with hemispherical heads. Area (in sq. ft.) = overall length (ft.) x outside diameter (ft.) x 3.146.
2. Cylindrical container with other than hemispherical heads. Area (in sq. ft.) = [overall length (ft.) + .3 outside diameter (ft.)] x outside diameter (ft.) x 3.1416.
3. Spherical container. Area (in sq. ft.) = outside diameter (ft.) squared x 3.1416.

Flow Rate CFM Air = Required flow capacity in cubic feet per minute of air at standard conditions, 60°F. and atmospheric pressure (14.7 psia).

The rate of discharge may be interpolated for intermediate values of surface area. For containers with total outside surface area greater than 2,500 square feet, the required flow rate can be calculated using the formula, Flow Rate in CFM Air = 22.11 $A^{0.82}$ where A = outside surface area of the container in square feet.

Conversion Factor

ft^2 x 0.092 903 = m^2
CFM x 0.028 317 = m^3/min
ft x 0.304 8 = m



54 Series Pressure Switches

Types

Enclosed: J54, J54A, H54,
Skeleton: J54S, J54AS, H54S,

UNITED ELECTRIC CONTROLS

Installation and Maintenance Instructions

Please read all instructional literature carefully and thoroughly before starting. Refer to the final page for the listing of Recommended Practices, Liabilities and Warrantees.

GENERAL

As the pressure changes, a diaphragm, bellows or piston sensor actuates one or two snap acting switches. The 54 Series offers two types of adjustments: internal hex adjustment on the "J" types or a calibrated adjustment dial on "H" types.

Part I - Installation

Tools Needed
Flatblade screwdriver
Adjustable wrench to 1 1/8"

LOCATE SWITCH WHERE VIBRATION, SHOCK, AND AMBIENT TEMPERATURE FLUCTUATIONS ARE MINIMAL. TO AVOID DAMAGE TO CONTROL, ALWAYS HOLD THE WRENCH ON THE WRENCH FLATS OR HEX PORTION OF THE PRESSURE CONNECTION WHEN TIGHTENING.

The control can be mounted in any position.

Enclosed Versions J54, J54A and H54

Remove cover first by removing the one captive screw located on the front of the cover.

Pipe Mounting
Mount the control directly to the line via the NPT pressure connection.

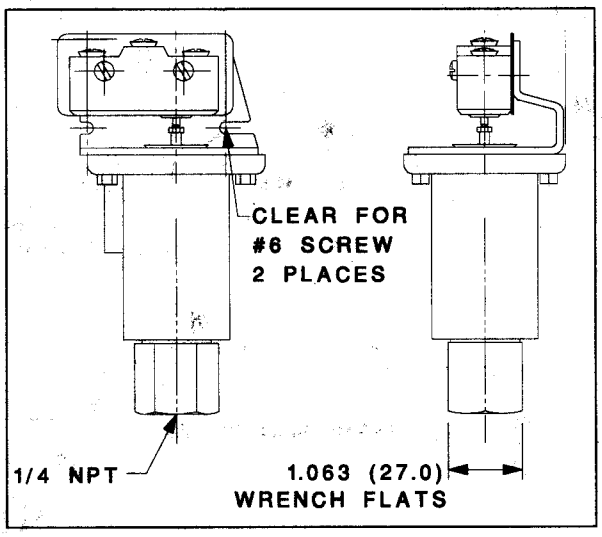
Vertical Surface Mount
Two holes for #10 screws are provided in the bracket plate.

Conduit Connection
A 7/8" diameter hole has been provided in the bracket plate for mounting a 1/2" NPT conduit fitting.

Skeleton Versions J54S, J54AS H54S

Pipe Mounting
Mount the control directly to the line via the NPT pressure connection.

Vertical Surface Mount
Two openings for #6 screws are provided in the rear of the bracket plate.



Mounting for skeleton versions (J54S shown)

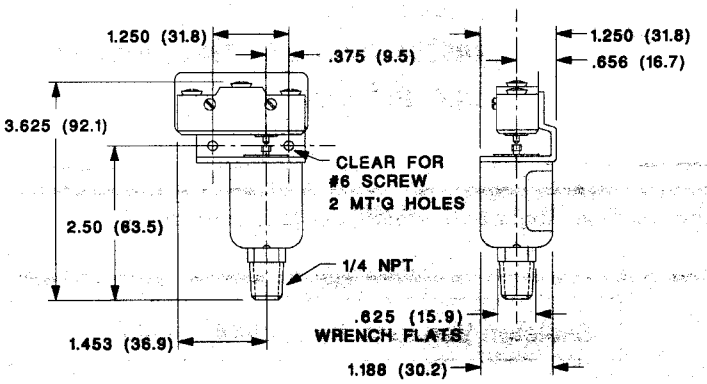
ALL LIVE SUPPLY CIRCUITS MUST BE DISCONNECTED BEFORE WIRING THE CONTROL. WIRE IN ACCORDANCE WITH NATIONAL AND LOCAL WIRING CODES. MAXIMUM RECOMMENDED WIRE SIZE IS #14AWG.

Bring wires up to the terminals from the rear, so that wires lay along insulator.

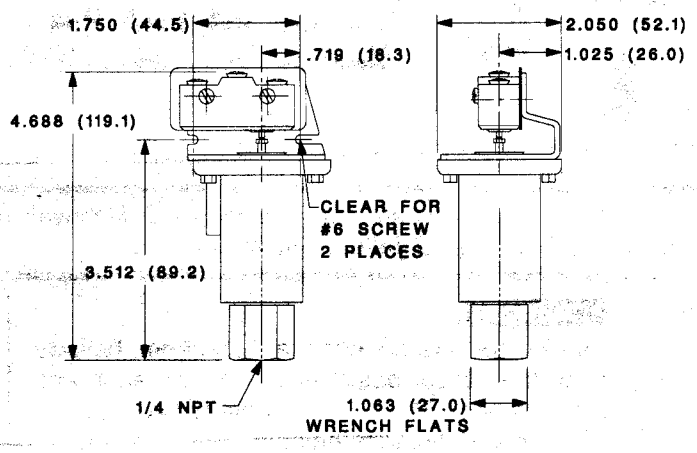
Part II - Adjustments

Tools Needed
1/4" open end wrench
Flatblade screwdriver

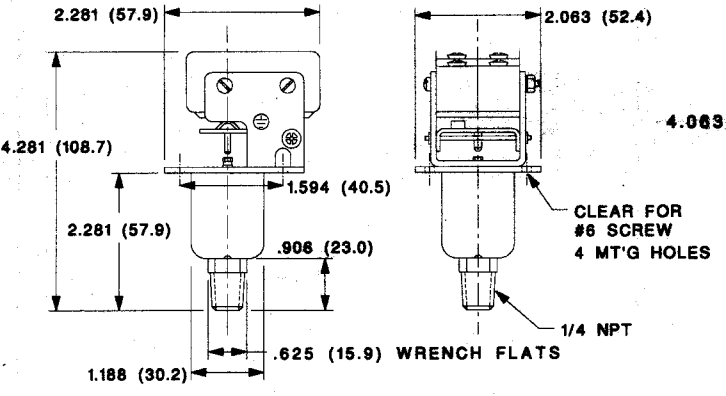
Dimensions



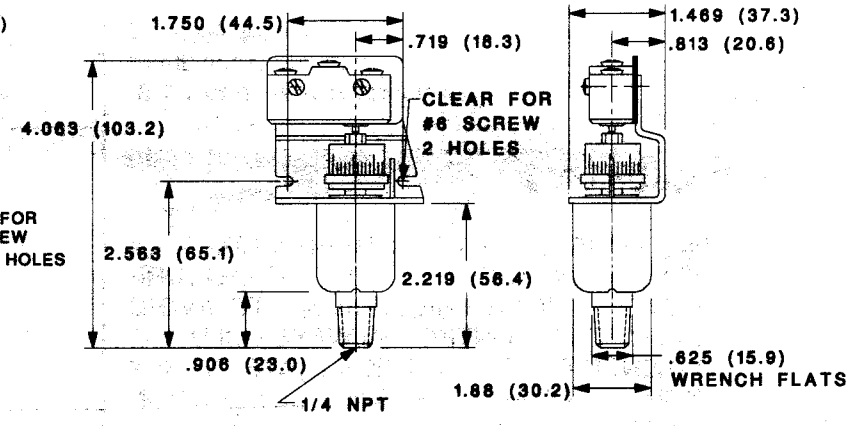
Type J54S models 22 - 28



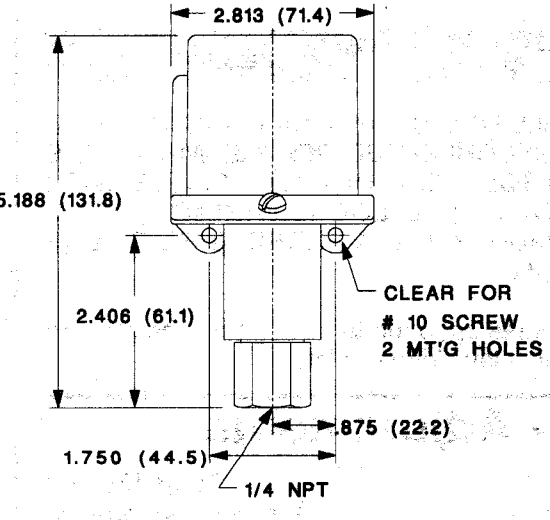
Type J54S models 610 - 614



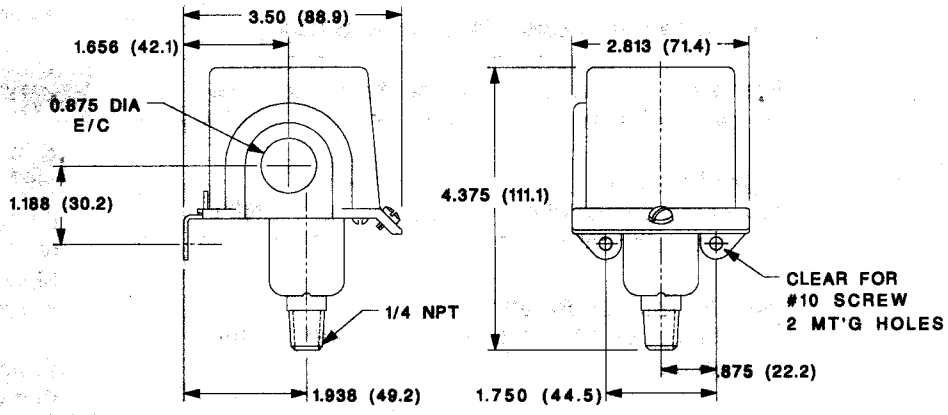
Type J54AS models 22 - 28



Type H54S models 22 - 28



Type J54 models 610 - 614



Type H54, J54 and J54A models 22 - 28

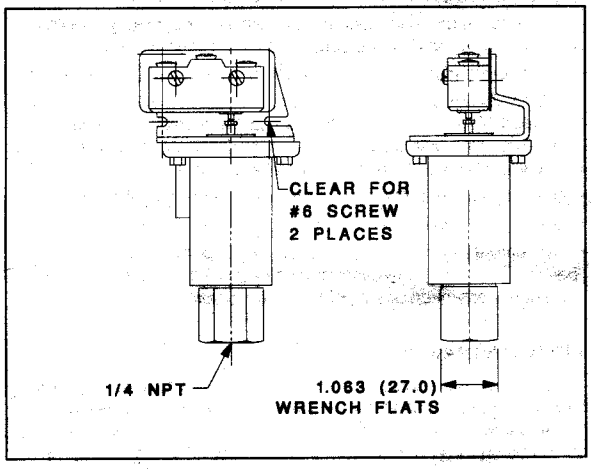
Uncalibrated Single Switch Versions J54, J54S

Mount control onto a calibrated pressure source (vacuum source for model 22). Secure. Use pipe sealant or teflon tape to ensure tight vacuum seal.

USING THE SENSOR HOUSING OR BRACKET TO TIGHTEN THE FITTING TO THE SOURCE WILL RESULT IN DAMAGE TO THE CONTROL.

Using a 1/4" open end wrench, turn main adjustment screw counterclockwise (out of sensor plunger) to lower set point or clockwise (into sensor plunger) to raise set point.

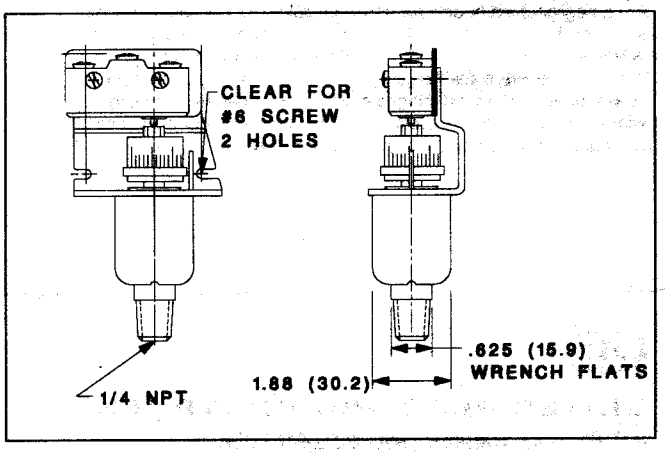
ALWAYS RECHECK SET POINTS AFTER ANY ADJUSTMENTS ARE MADE.



Type J54S, models 610-614

Calibrating Single Switch Versions H54, H54S

Turn the calibrated reference dial to desired set point by aligning setting on dial with dowel pin.



Type H54S, models 22-28

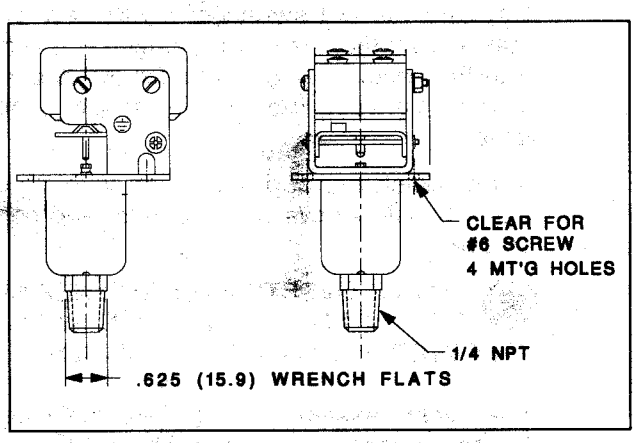
Calibrating All Dual Switch Versions J54A, J54AS

Mount control via an NPT pressure connection onto a calibrated pressure source (vacuum source for model 22). Secure fitting to source tight enough to prevent leaks. Use teflon tape to secure firmly. Apply tightening torque to the fitting only.

USING THE SENSOR HOUSING OR BRACKET TO TIGHTEN THE FITTING TO THE SOURCE WILL RESULT IN DAMAGE TO THE CONTROL.

High Set of Range

Using a 1/4" open end wrench, turn main adjustment screw counterclockwise (out of sensor plunger) to lower set point or clockwise (into sensor plunger) to raise set point. Turning the 1/4" hex screw clockwise until "high set" switch transfers at the target pressure point provides a pressure rise set point.



Type J54AS, models 22-28

Low Set of Range

Using a 1/4" open end wrench, turn "low set" microswitch screw counterclockwise (out of sensor plunger) to lower set point or clockwise (into sensor plunger) to raise set point. Turn screw until both "high set" and "low set" switches transfer together on or near the target pressure on rise.

Turn the "low set" switch adjustment screw clockwise (into sensor plunger) until the "low set" switch transfers at the desired pressure on fall (unless required otherwise).

Raise the pressure source to the "high set" pressure valve to check the set point pressure. Adjust the 1/4" hex screw accordingly if further fine adjustments are needed. Lower pressure to check the set point of the "low set". Fine adjust if necessary.

ALWAYS RECHECK SET POINTS AFTER ANY ADJUSTMENTS ARE MADE.

Manual Reset, Option 1530 or suffix "G"
A snap-acting switch with this option will remain tripped until pressure changes and the reset button is manually depressed, which resets the switch.

Part III - Replacements

Tools Needed

Flatblade screwdriver

DISCONNECT ALL LIVE ELECTRICAL SUPPLY TO THE CONTROL BEFORE PERFORMING ANY DISASSEMBLY.

Remove the cover if an enclosed type. Disconnect wires from switch terminals. Label each wire to ensure proper reconnections. Remove the two hex nuts and pull out the long screws. Remove the switch(es) and insulators. Note the position of switch plunger relative to sensor plunger or lever of dual switch.

Replace the old switch(es) with new ones, making sure that the switch plunger(s) is aligned with the sensor plunger, and the insulators are located between the switch(es) and bracket plate.

Align switch(es) and insulators with bracket plate. Install screws with hex nuts and tighten securely.

DO NOT OVERTIGHTEN THE HEX NUTS OR SWITCH ACTUATION WILL BE AFFECTED. RECONNECT THE WIRES.

The sensor assembly is not field replaceable. Do not attempt any disassembly of these parts. If any questions, consult the UE factory.

RECOMMENDED PRACTICES

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE pressure and temperature units. Before installing a unit, the Installation and Maintenance instructions provided with unit must be read and understood.

- To avoid damaging unit, proof pressure and max temperature limits stated in literature and on nameplates must never be exceeded, even by surges in the system. Operation of the unit up to proof pressure or max temperature is acceptable on a limited basis (i.e.start-up, testing) but continuous operation must be restricted to the designated adjustable range. Excessive cycling at proof pressure or maximum temperature limits could reduce sensor life.
- A back-up unit is necessary for applications where damage to the primary unit could endanger life, limb or property. A high or low limit switch is necessary for applications where dangerous runaway condition could result.
- The adjustable range must be selected so that incorrect, inadvertent or malicious setting at any range point can not result in an unsafe system condition.
- Install unit where shock, vibration and ambient temperature fluctuations will not damage unit or affect operation. Orient unit so that moisture does not enter the enclosure via the electrical connection.
- Unit must not be altered or modified after shipment. Consult UE if modification is necessary.
- Monitor operation to observe warning signs of possible damage to unit, such as drift in set point. Check unit immediately.
- Preventative maintenance/periodic testing is necessary for critical applications where damage could endanger property/ personnel.
- For all applications, a factory set unit should be tested before use.

Electrical ratings stated in literature and on nameplate must not be exceeded. Overload on a switch can cause possible damage on the first cycle. Wire unit according to local and national electrical codes, using wire size recommended in installation sheet.

- Use only factory authorized replacement parts and procedures.
- Do not mount unit in ambient temp. exceeding published limits.
- For remote mounted temperature units, capillary lengths beyond 10 feet can increase chance of error, and may require re-calibration of set point and indication.

LIMIT WARRANTY

UE warrants that the product thereby purchased is, upon delivery, free from defects in material and workmanship and that any such product which is found to be defective in such workmanship or material will be repaired or replaced by UE (F.O.B. UE); provided, however, that this warranty applies only to equipment found to be so defective within a period of 12 months after installation by buyer but not to exceed 18 months after delivery by the seller. Except for the limited warranty of repair and replacement stated above, UE disclaims all warranties whatsoever with respect to the product, including all implied warranties of merchantability or fitness for any particular purpose.

LIABILITY LIMITATION

The sole and exclusive remedy of buyer for any liability or seller for any claim, including incurred in connection with (I) breach of any warranty whatsoever expressed or implied, (II) a breach of contract, (III) a negligent act or acts (or negligent failure to act) committed by seller, or (IV) an act for which strict liability will be imputed to seller, is limited to the limited warranty or repair and replacement stated herein. In no event shall the seller be liable for any special, indirect, consequential or other damages or like general nature, including, without limitation, loss of profits or production, or loss or expenses of any nature, incurred by the buyer or any third party.

UE
UNITED ELECTRIC CONTROLS
P.O. Box 9143, Watertown, MA 02272-9143 USA
617 926-1000 Fax 617 926-2568

APPENDIX B

DRAWINGS & TECHNICAL INFORMATION

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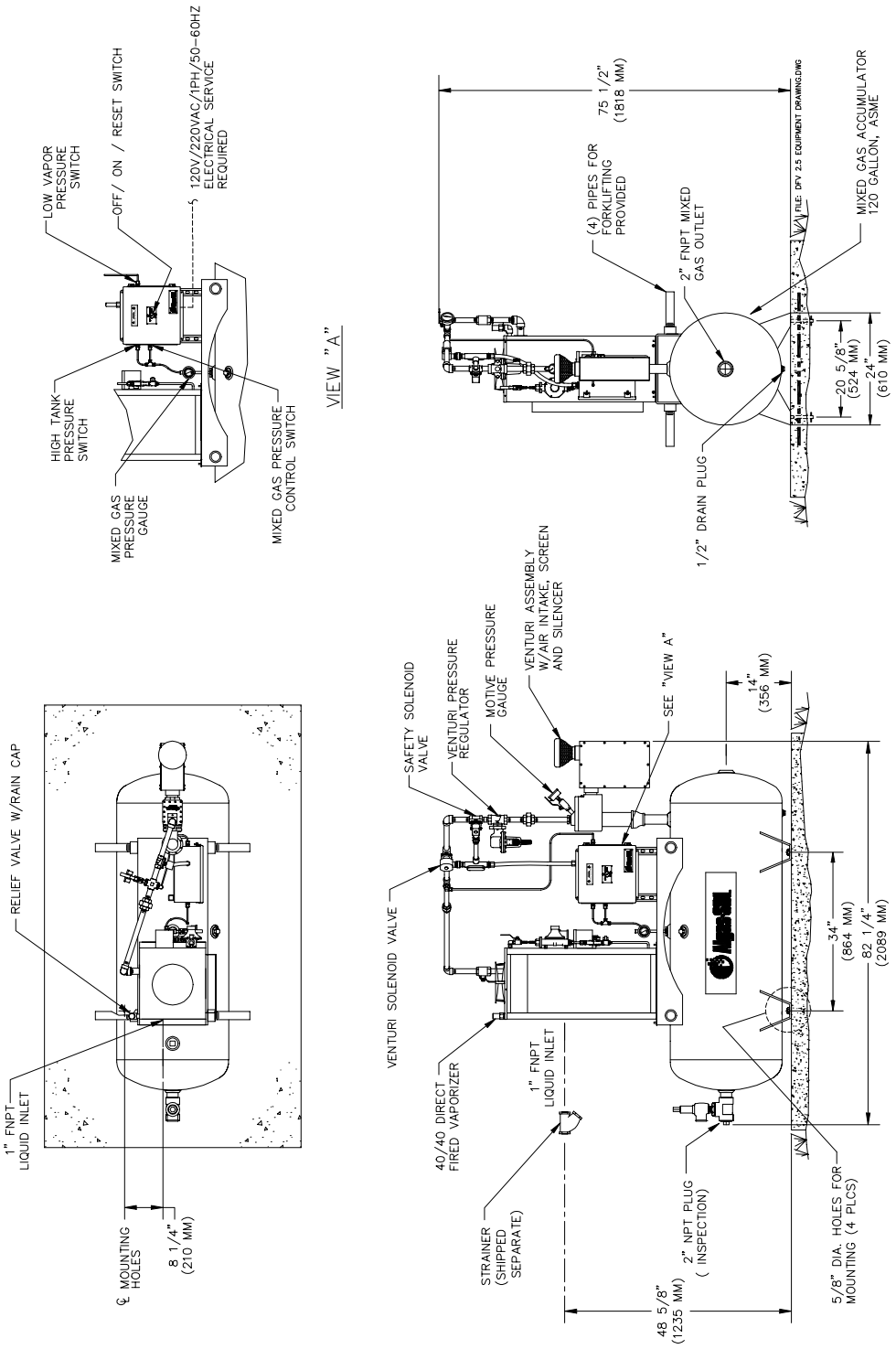
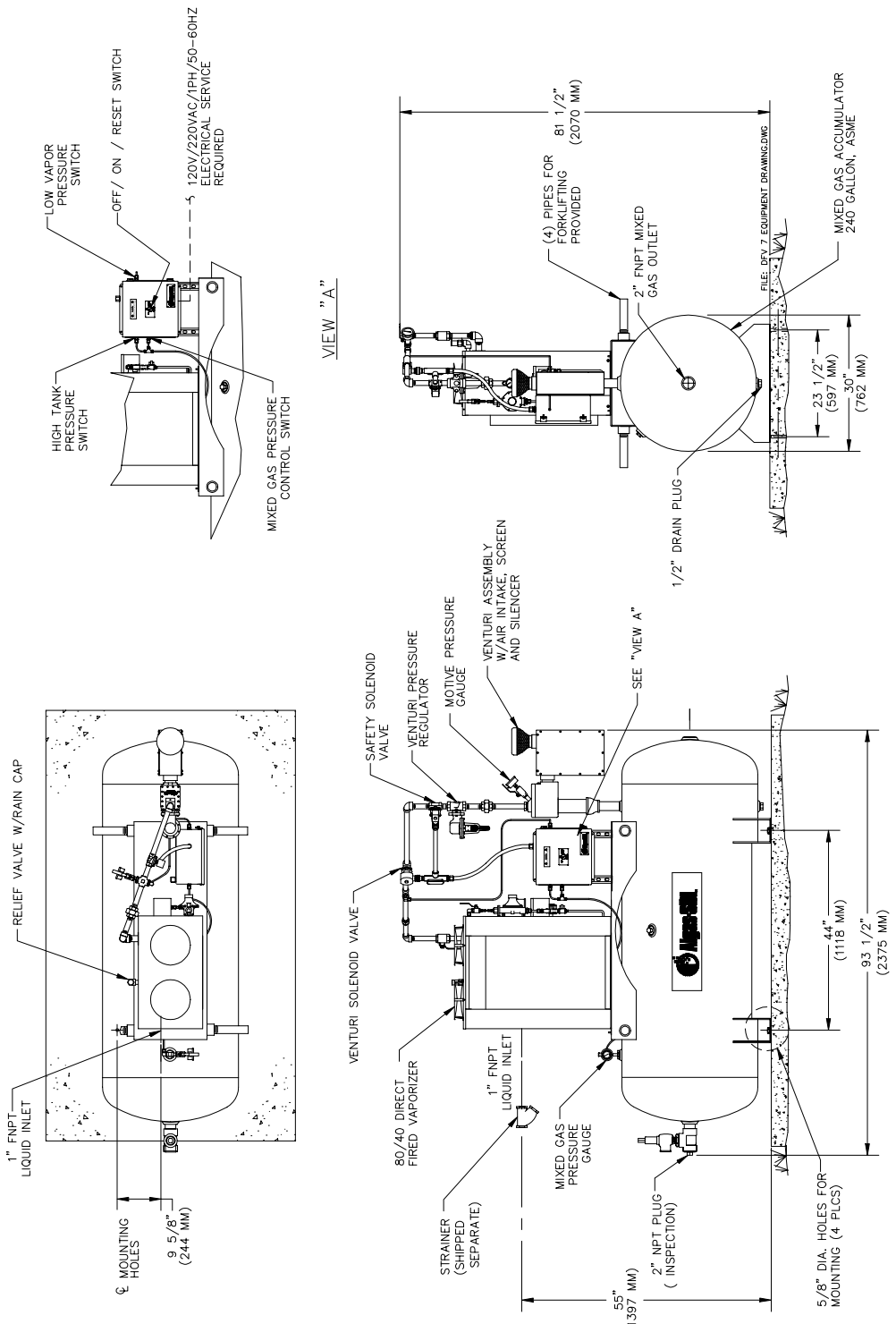
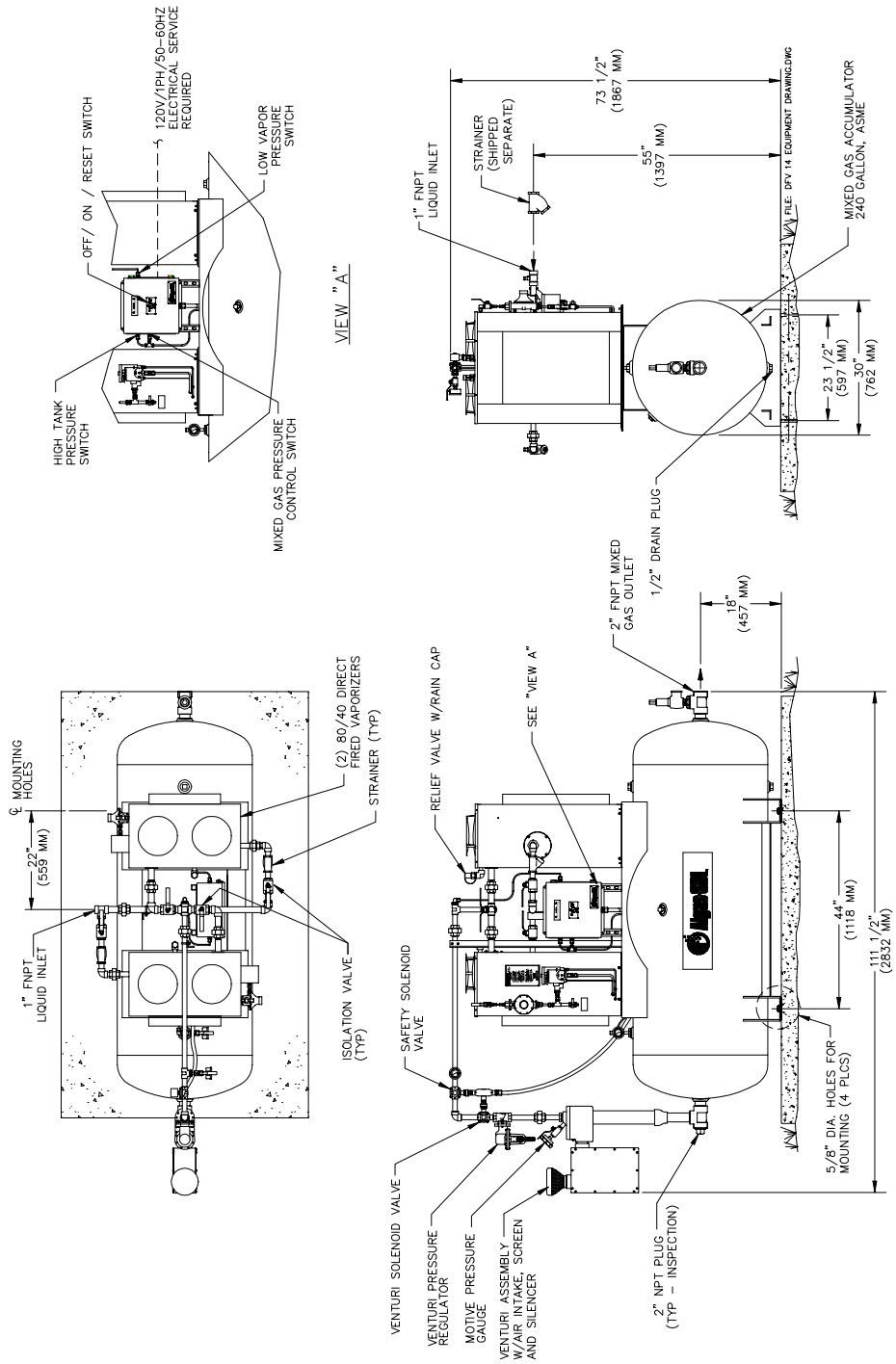
DFV 2.5 Equipment Drawing



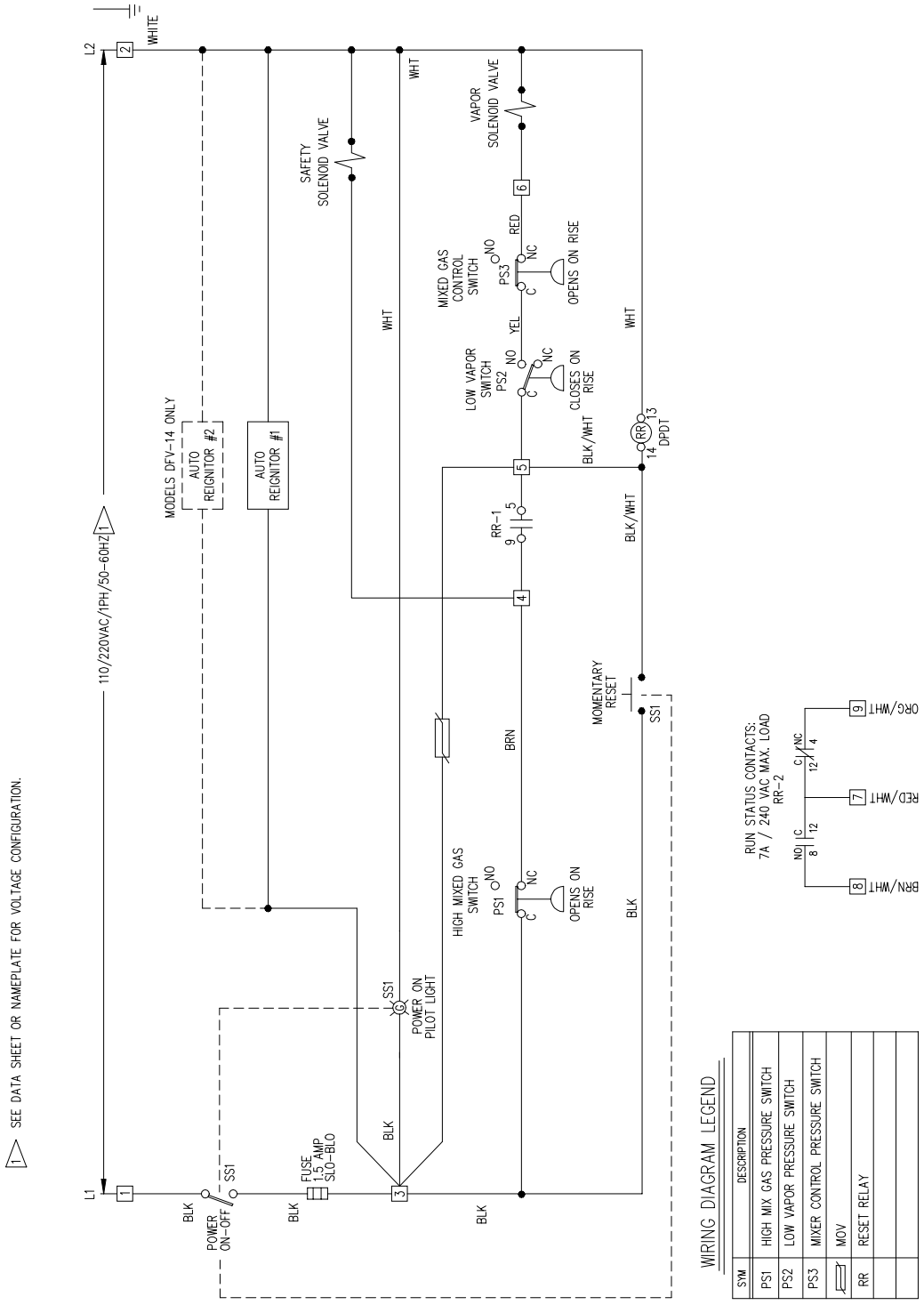
DFV 7 Equipment Drawing



DFV 14 Equipment Drawing



DFV Electrical Schematic



Algas-SDI™

ISO 9001 Certified

...Innovative liquid vaporizing and gas mixing solutions

WARRANTY REGISTRATION

Please copy the information from the data sheet supplied with your manual.

Type of Equipment: _____ Serial Number: _____

ASDI Sales Order #: _____ Order Date: _____

Purchased By: _____

_____

_____

To help us provide better service to you, please fill out this warranty registration form and retur n it to us. Keep a copy for your records.

This will register your recent purchase and aide us in tracking the performance of your equipment. Please help us with a small amount of information about your company and about how you are using the equipment. Contact us via phone, fax, or email if you have a question, problem, or concern about your equipment. Please have the type of equipment and serial number available so we can give you accurate information.

End Customer/Company Name: _____

Address: _____ Tel: _____

City: _____ State: _____ Zip: _____ Fax: _____

Name of individual to contact for follow up information: _____

When was the equipment put in service?_____/_____/_____

Usage - Circle one:	Base Load	Standby System		
	Peak Shaving	Other please specify: _____		
Application - Circle one:	**Agriculture:**	Poultry	Livestock	Grain drying
	Commercial:	Restaurant	Hospital	School
	Industrial :	Construction	Automotive	Glass/ceramics
	Other:	Please specify: _____		

Note: If you have more than one piece of our equipment, fill out one warranty sheet and staple the others to it, we'll do the rest.

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