ADAPTOMODE WELD-END PRESSURE REGULATORS

Types: A4W, A4WE, A4WS, A4WB, A4WD, A4WP, A4WOE, A4WR

Port Size 125-200mm (5"-8")
FOR AMMONIA, R12, R22, R502
AND OTHER COMMON REFRIGERANTS

FEATURES

- Cast Steel Body – Strong, Lightweight.
- Welds Directly in the Line – No Flanges.
- Removable Seat – Serviceable from Top Side.
- Streamlined Fluid Flow Pattern.
- Unique Modular Construction – Same Modules as A4A Series.
- Interchangeable Parts.
- Easy to Service.
- Pilot Operated Characterized Modulating Plug for Precise Control.
- Suitable for All Common Refrigerants and Oil.
- 27.6 bar (400 psig) Maximum Rated Pressure (MRP).
- Many Control Variations are Possible with the Use of a Few Modules and Kits.
- Stainless Steel Diaphragm.
- Chrome Plated Pilot Seat.
- Manual Opening Stem.

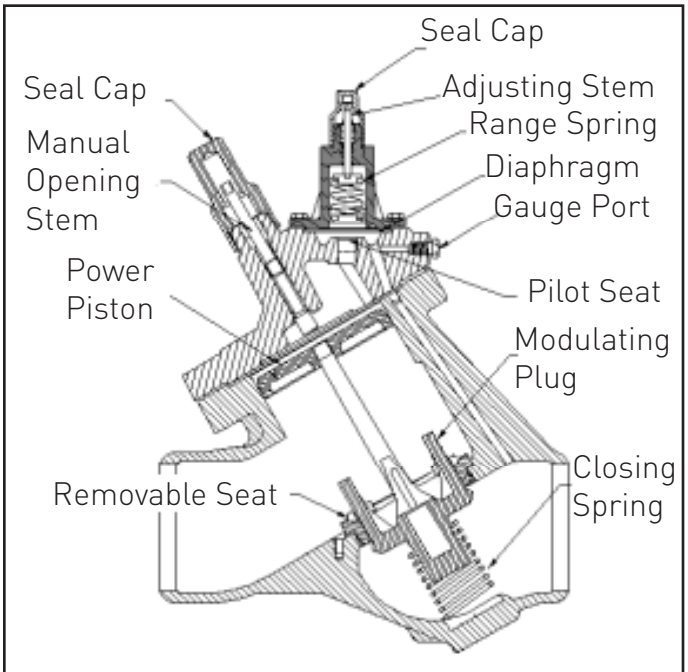


Fig. 1 - A4W, A4WE

BULLETIN 23-20D
A4W Series

August 2007
Installation, Service and Parts Information

Index

Description

These heavy duty, cast steel bodied (ASTIM No. A352 Grade LCB), pressure regulators weld directly in the line and do not require flanges.

They are used for control of Ammonia, R-12, R-22 and R-502, and other common refrigerants, certain oils and other fluids approved for use in refrigeration systems.

The A4W Series Regulators are pilot operated, using upstream pressure for the moving force, and require a minimum 0.14 bar (2 psi) pressure drop to fully open. The basic Type A4W is an Inlet Pressure Regulator which tends to open on a rise in upstream pressure above set-point and to close on a drop in pressure below set-point.

These valves can be ordered with the Type RSW Strainer to be welded directly to the inlet of any of the Type A4W Regulators or use a 13mm (1/2") Type RSF Strainer in only the pilot circuit of a Type A4WE or A4WR version of the regulator.

The A4W Series of regulators uses the same Modules as does the A4A Series to configure many possible variations.

Purpose
The purpose of the Type A4W Series of Pressure Regulators is to modulate the flow of refrigerant gas and/or liquid so as to maintain a constant set for pressure, regardless of load fluctuations. The regulators described in this bulletin control upstream (inlet) pressure except for the Type A4W0E, which controls downstream (outlet) pressure.

The fluid temperature range for the A4W Family of Regulators is -45° to 105°C (-50° to 220°F).

Principles of Operation (See Fig. 1)
The inlet pressure enters the space under the Diaphragm through passage N. When the force created by the pressure exceeds the force of the Range Spring, the Diaphragm is lifted off of the Pilot Seat, allowing pressure to enter on top of the Power Piston. This causes the Power Piston to move downward, forcing the Modulating Plug to open and modulate to maintain constant inlet pressure. (See pages 3 - 5 for principles of operation of other A4W Variations.) An increase in inlet pressure lifts the Diaphragm further, allowing more pressure on top of the Power Piston and opening the valve wider. A decrease in inlet pressure causes the Diaphragm to move closer to the Pilot Seat reducing the pressure on the top of the Power Piston and allowing the Closing Spring to reduce the valve opening.

The degree of valve opening is controlled by the amount of pressure on top of the Power Piston, which in turn is controlled by the flow through the Pilot Seat and the bleed off through the bleed hole in the Power Piston to the outlet of the valve. The volume of bleed flow from the top of the Piston to the valve outlet through the clearance between the Power Piston and the piston bore is very small because the Power Piston is fitted with a Seal Ring.

Manual Opening Stem
All Type **A4W Regulators are provided with a Manual Opening Stem** located at the top of the valve (refer to Fig. 1 for the location of the stem and other related parts). For access to the stem the Seal Cap on top of the regulator must be removed. Manual opening is accomplished by turning the stem clockwise until only the flats on the end of the stem protrude from the Packing Nut. To reset for automatic operation, turn the stem counter-clockwise as far as it goes.

CAUTIONS: 1.) The Seal Cap must be removed with care, as refrigerant may have been trapped inside the cap. 2.) BEFORE turning the stem, the Packing Nut should be loosened slightly, and 3.) AFTER turning the stem, the Packing Nut should be retightened. 4.) Always replace the Seal Cap when work with the regulator is completed.

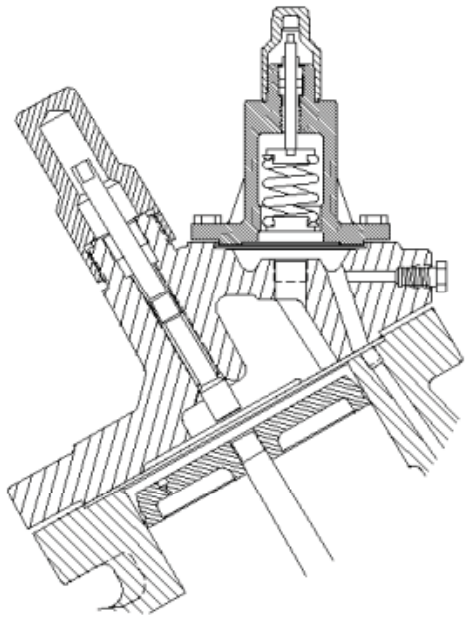


Fig. 2

Adjustment
INLET PRESSURE REGULATORS - A4W - (See Fig. 1) Install an accurate pressure gauge in the gauge port. Back the Adjusting Stem all of the way out to stop (counterclockwise). This will reduce the set-point to its lowest level and will cause the valve to OPEN wide. Start the system, and when the valve outlet pressure is approaching the desired inlet pressure, turn the Adjusting Stem in (clockwise) until the pressure gauge shows a slight rise in inlet pressure. At this point the Adjusting Stem may be turned in (clockwise) to raise the pressure further, or backed out (counterclockwise) to lower it, but the final adjustment should be made after the system has been operating for a period of time and has stabilized.

OUTLET PRESSURE REGULATORS - A4W0E - (See Figs. 2, 2A) Install an accurate pressure gauge at the gauge port in the A4W0E Adapter which is located next to the sensing tube that is connected to the valve outlet line. Back the Adjusting Stem all of the way out to stop (counterclockwise). This will reduce the set-point to its lowest level and cause the valve to CLOSE. Operate the system until the outlet pressure is lower than desired. Slowly turn the adjusting stem in (clockwise) until the desired outlet pressure is reached with the system stabilized.

PRESSURE SETTING RANGES

Inlet ranges available are A, V, and D
*Outlet pressure ranges available are V and D

Set-Point Ranges	Approx. Pressure Changes per Turn of Adjusting Screw	Factory Set Point (unless otherwise specified)
A: 0 to 10.3 bar (0 to 150 psig)	1.7 bar (25 psi)	2.8 bar (40 psig)
*V: 500mm hg to 8.3 bar (20 in hg to 120 psig)	1.7 bar (25 psi)	1.0 bar (15 psig)
*D: 5.2 to 19.3 bar (75 to 280 psig)	3.7 bar (53 psi)	9.7 bar (140 psig)

A Vacuum Range Regulator uses a Vacuum Cartridge instead of the standard Pilot Seat 44. Except for this one difference, a "V" Range Regulator is the same as an "A" Range Regulator as far as the Range Spring 49 and Diaphragm Kits are concerned. (See Figs. 7 and 8)

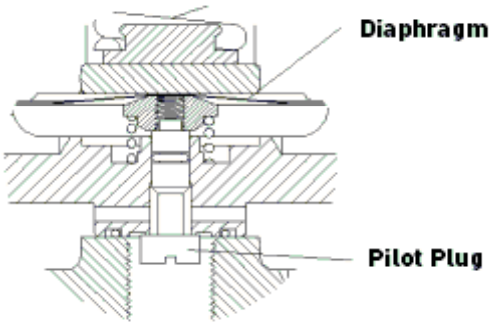


Fig. 2A - Outlet Pilot

Type A4WE (See Fig. 1)
Description
The Type A4WE is the same as a Type A4W except that the upstream or remote pressure must be field connected to the valve at the gauge connection through an external line. (The external line is not furnished with the regulator.) A Type A4W can be converted to an A4WE by removing the adaptor from the body; remove the alignment pin from passage 'N'; and rotate the Gasket 5 to block off the internal feed of upstream pressure. Re-assemble. (See Fig. 7)

Purpose
The Type A4WE is used when it is advantageous to use an external source of upstream pressure to the regulator. Whatever the source of pressure may be, it will be that pressure, as it exists when it reaches the regulator, that will be controlled. There is a small flow rate of fluid through the external line and care must be used to avoid a pressure drop by not under sizing the pipe or using too long a length. Normally a US 3/8" pipe size not exceeding 6m (20 ft.) in length will be adequate.

The pressure as measured at the connection to the valve must be no less than the pressure at the valve inlet.

A 13mm (1/2") Type RSF strainer can be installed in the above line to protect the critical pilot circuit of the main valve and eliminate the space required for and the cost of a full line-size strainer. If this is done, it should be remembered that any pressure drop in this line caused by an overloaded strainer basket will affect the actual pressure at which the regulator will control. If this is the case, then the actual pressure at the main valve inlet will be higher than it should be by an amount equal to the pressure drop through the pilot circuit strainer.

Principles of Operation
The operation of the Type A4WE is the same as that described above for the A4W except that the upstream pressure being controlled is fed to the valve externally.

Adjustment
Follow the instructions above for the Type A4W Regulator.

Type A4WS (See Fig. 3)
Description
The Type A4WS is an inlet pressure regulator with a pilot electric shut off. The integrally mounted solenoid must be energized for the valve to function as a regulator. When de-energized the regulator is closed regardless of inlet pressure.

Purpose
The Type A4WS should be used where it is required at particular times to stop all flow through the regulator. The valve, however, is NOT a check valve and cannot prevent reverse flow of fluid if the outlet pressure exceeds the inlet pressure by more than 0.14 bar (2.0 psi). Typical uses include defrost applications as well as part of a temperature control system.

Principles of Operation
The operation of the A4WS is the same as that described for the A4W on page 2, except the inlet pressure from passage N must pass through the S6A Pilot Solenoid Valve before it can reach the diaphragm. Thus, the S6A Pilot Solenoid must be energized before the A4WS can begin to regulate, regardless of inlet pressure.

Adjustment
With the solenoid pilot electrically energized, proceed as described above for Inlet Pressure Regulators.

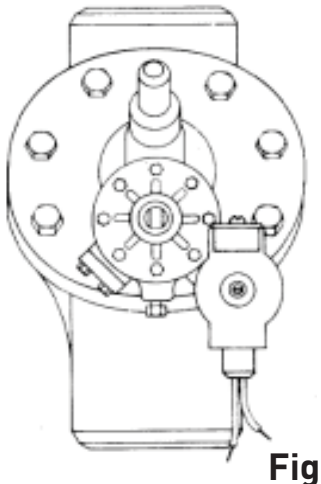


Fig. 3 - A4WS

Type A4WB (See Fig. 4)
Description
The Type A4WB is an Inlet Pressure Regulator with a Pilot Electric Wide-opening, or Bypass, variation. When the integrally mounted solenoid is energized the main valve is wide open thereby bypassing the regulator function, that is, not regulating. However, in the wide open mode the regulator will still require the 0.14 bar (2 psi) minimum pressure difference to be fully open. When the solenoid is de-energized the valve functions as an inlet pressure regulator.

Purpose
The Type A4WB frequently is used in the wide-open mode when maximum refrigeration capacity from an evaporator is required. During the defrost of the evaporator, the regulator pilot solenoid is de-energized, thus functioning as a defrost relief regulator or for high pressure limit protection. Also, this regulator can be used in the wide open mode for evaporator pump out prior to defrost.

When used in a discharge pressure line, it can, when de-energized, hold back enough pressure for some heat reclaim or defrosting function and then, when energized, allow the discharge pressure to decrease to a lower level.

Principles of Operation
The operation of the A4WB is the same as that described for the A4W on page 2, when operating as a regulator (Pilot Solenoid De-energized). When the solenoid is energized the upstream pressure from passage N bypasses the underside of the diaphragm and is fed directly to the top of the piston, whereby, provided a 0.14 bar (2 psi) pressure difference exists across the main valve, the Modulating Plug will be held wide open.

Adjustment
With the solenoid pilot electrically de-energized, proceed as described above for Inlet Pressure Regulators.

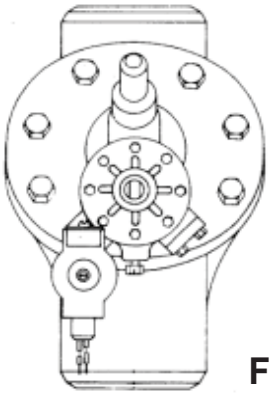


Fig. 4 - A4WB

Type A4WD (See Fig. 5)
Description
The Type A4WD is a Dual Inlet Pressure Regulator capable of regulating two different pressure set-points. When the integrally mounted S6A Pilot Solenoid is energized, the regulator is controlling the lower of the two set-points, which must be adjusted on the pressure pilot over the center of the main valve. When the solenoid is de-energized, the regulator is controlling the higher of the two set-points, which must be adjusted on the bolt-on (outboard) pressure pilot.

Purpose
The Type A4WD uses are similar to those for the A4WB except that, instead of operating in a wide-open position when the pilot solenoid is energized, the regulator is controlling at some preset level.

Typical uses include capacity control of an evaporator at two different pressure levels to regulate temperature, or evaporator pressure control combined with defrost or wash down pressure relief.

Principles of Operation
The operation of the A4WD is similar to that described for the A4W on page 2. When the Pilot Solenoid is energized, upstream pressure from passage N is made available to both diaphragms. Since the path of least resistance will be through the pilot having the lower set-point (lower range spring force), that pilot will control.

When the Pilot Solenoid is de-energized, the upstream pressure from passage N can flow only to the high pressure pilot, which will then control the regulator.

Adjustment
Electrically de-energize the solenoid pilot and adjust the modular (bolt-on) pressure pilot for the desired high pressure setting following the adjusting procedure as described above.

Energize the solenoid pilot and adjust the integral pressure pilot for the desired low pressure setting following the same procedure. The modular (bolt-on) pilot MUST be adjusted for a set-point HIGHER than the integral pilot or the regulator will always be controlling at the lower set-point whether the pilot solenoid is energized or de-energized.

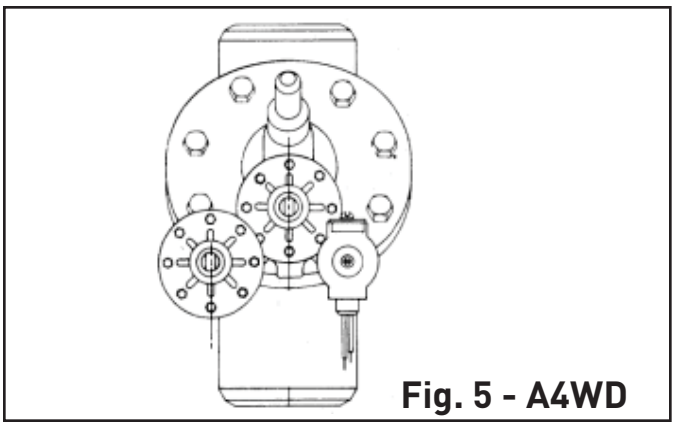


Fig. 5 - A4WD

Type A4WP

Description

The Type A4WP is an Inlet Pressure Regulator whose setpoint can be compensated by a remote pressure. Typically the remote pressure would be a pneumatic signal from a thermostat or controller, but it can also be a refrigerant pressure. The remote pressure is fed into the bonnet of the regulator where it is capable of changing the set-point on a 1:1 basis. That is, a 0.07 bar (1.0 psi) change in the remote pressure will create a 0.07 bar (1.0 psi) change in the set-point of the regulator.

Although not specifically described in this bulletin, the A4WP is also available with any of the "S", "B", "D" and "OE" features mentioned elsewhere.

Purpose

The Type A4WP can be used to vary an evaporator or condenser pressure to match a changing load condition. A pneumatic thermostat-controller modulates the air pressure applied to the top of the diaphragm as the temperature at the thermostat changes. Whether used as part of a cooling system to control evaporator pressure, or as part of a Heat Reclaim system to control condensing pressure, a rise in temperature at the thermostat must cause a decrease in controlled air pressure. (Normally this is known as a "Reverse Acting" thermostat-controller.) The decrease in air pressure will lower the regulator set-point and produce a lower inlet pressure and lower evaporator or condenser temperature. Conversely, a drop in temperature at the thermostat must cause an increase in air pressure, with a resultant increase in evaporator or condenser temperature. Usually, the controller modulates the air pressure from 0.21 to 1.0 bar (3 to 15 psig) throughout its control range.

The A4WP can be used as a Differential Pressure Regulator if the regulator outlet pressure is connected to the bonnet.

Principles of Operation

The Type A4WP operation is the same as the A4W described above except that the set-point is changed (compensated) on a 1:1 basis by the pressure that is fed into the bonnet.

If the A4WP is part of a pneumatically operated control system, the air must be clean, dry and oil free. To avoid the possibility of moisture from compressed air freezing in the bonnet or in other parts of the control system, a dehydrated air system must be used whenever it may come in contact with sub-freezing temperatures. This is particularly true if the regulator is controlling suction gas flow at temperatures below freezing.

Adjustment

If the A4WP is part of a pneumatically operated control system. the controller must be adjusted according to the manufacturers instructions to obtain the optimum system performance. To adjust the pressure regulator. disconnect the air line and follow the instructions, above listed for the Type A4W. This setting represents the lowest inlet pressure the regulator will allow, thus providing a low limit feature to the regulator. Next, connect the air line. From this point the regulator's set-point will be increased on a 1:1 ratio with the air pressure increase.

If the A4WP is compensated by a remote refrigerant pressure, the setpoint of the regulator (the inlet pressure it will be controlling) will be equal to the sum of the remote pressure and the pressure equivalent to that made by the range spring adjustment. If the remote pressure is the regulator outlet pressure, then the valve will control an inlet pressure equal to the outlet pressure plus the Range Spring setting. Or, said another way, the Regulator will be a Differential Pressure Regulator because the set-point will be the difference in pressure across the regulator.

Type A4WOE (See Fig. 2-2,2A)

Description

The Type A4WOE is an Outlet Pressure Regulator with an external, field installed connection to the downstream (outlet) pipe of the regulator. This connection is not furnished with the regulator. The regulator will tend to open on a drop in outlet pressure below set-point and will tend to close on a rise in outlet pressure above set-point.

Although not described in this bulletin, the A4WOE is also available in combination with the "S", "B", "D" and "P" features described elsewhere.

Purpose

The Type A4WOE will modulate flow of refrigerant fluid to maintain a constant downstream pressure as set-for, despite fluctuations in load. However, once closed, the regulator can do nothing further to reduce downstream pressure. This reduction must come from system capacity. The regulator cannot maintain set-for pressure if uncontrolled blanch lines feed into the main pipeline downstream of the A4WOE Regulator.

Typical applications are as a hold back or crankcase pressure regulator to prevent pressure rise in a suction main, or to prevent too low a plant suction pressure by putting an artificial load on the main from a higher pressure source.

Principles of Operation

The outlet pressure is sensed under the Diaphragm through the external tube which has been installed in the field to the outlet pipe downstream of the main valve. When the force created by the outlet pressure acting under the Diaphragm is less than the force of the Range Spring, the pilot is open, allowing upstream pressure from passage N to flow to the top of the Piston. This causes the Piston to force the Modulating Plug to open to maintain a constant outlet pressure. A decrease in the outlet pressure allows the Range Spring to open the pilot further, allowing more pressure on top of the piston and opening the Modulating Plug further.

An increase in outlet pressure will lift the Diaphragm against the force of the Range Spring, allowing the Pilot Plug to start to close. The pressure on top of the Piston is decreased and the Closing Spring acts to reduce the opening of the Modulating Plug and the flow of fluid through the regulator.

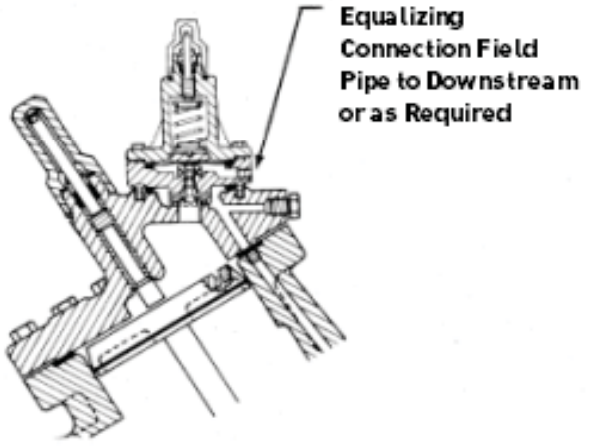


Fig. 2-2 - A4WOE

The pressure on top of the Piston is controlled by the flow through the Pilot Plug and the bleed through the bleed hole in the Piston. Due to the Seal Ring fitted to the Piston, the amount of bleed to the outlet of the valve, as a result of blow-by of the Piston, is very small. A minimum pressure drop of 0.14 bar (2 psi) across the valve is required to open it fully.

The Type A4W0E Outlet Pressure Regulator opens on a drop in outlet pressure below set-point and closes on a rise in outlet pressure above its set-point. The outlet pressure set-point is not appreciably affected by variations in the inlet pressure.

Adjustment

See Outlet Pressure Regulator Adjustment on page 2.

Type A4WR (See Fig. 6)

Description

The Type A4WR is a main valve only intended for pilot operation by one or more remote piloting devices, such as Type S6N Solenoid Valve, Type A2B (inlet) or Type A2B04E (outlet) Pilot Regulators. The valve is complete with a Manual Opening Stem but has no integrally mounted pilot devices to provide any type of control function. A plain Cover with a 3/8" FPT connection is in the position otherwise occupied by the pilot devices. The

Type A4WR uses upstream pressure which is externally fed to the A4WR through pipes (not included with valve) field installed to provide the moving force for the valve operation. A minimum 0.14 bar (2 psi) pressure drop is required to fully open the valve. The upstream pressure must be fed from a connection field installed in the main valve inlet pipe. There is no connection on the valve body for this purpose.

A small flow of refrigerant passes through the line connected to the upstream side of the valve so care must be used not to create a pressure drop by under sizing the pipe or using too great a length. Normally standard 3/8" US pipe size no longer than 6m (20 ft.) will be adequate. Consult the factory if a greater length is required.

Purpose

The Type A4WR should be used where there is an advantage to install all of the control modules at some remote location. Frequently this is done to make adjustment and servicing easier, or to fit a large valve in a space that would be too small for a complete valve.

Principles of Operation

Since the Type A4WR is a main valve only and may be used with an assortment of remote devices: the reader is referred to the most recent editions of the bulletins describing each of those devices. The most common of these are: Type S6N Solenoid Valve - Bulletin 30-90; Type A2B and Type A2B04E Regulators - Bulletin 21-02.

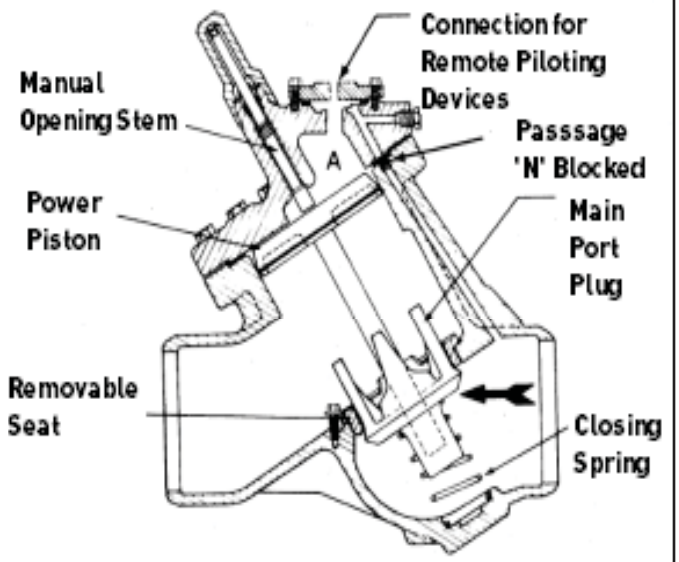


Fig. 6 - A4WR

Adjustment

See the appropriate bulletin as listed above under "Principles of Operation".

Installation

It is necessary that all installation personnel read and become familiar with the Refrigerating Specialties Division's Refrigeration Safety Bulletin (RSB) before installing any valves.

All valves are packed for the maximum protection during storage and shipment Read the literature packed with the valve and save it for reference after installation.

Do not remove the protective covers from the inlet and outlet of the valve until ready to install, as they protect the interior from dirt and other foreign matter.

Select a location for installation where the valve will be easily accessible for adjustment and maintenance and where a pressure gauge installed on the regulator can be seen. Avoid locations where the valve may be damaged by personnel, traffic, material handling or other equipment.

Before installing the valve, check to see that all chips, scale, dirt, moisture and other foreign material are removed from the connecting pipes. Be sure the arrow on the A4W valve body is pointing in the direction of fluid flow for the regulator to function properly. Backward flow through the regulator is uncontrolled and will vary with the reverse pressure drop encountered. The regulator is NOT a check valve. Remove the protective covers from the valve. It is not necessary to disassemble or to manually open the valve before welding in place.

The A4W family of regulators will give optimum performance if mounted in a horizontal line in a vertical position with the Manual Opening Stem on the top. This is particularly true for regulators with an electrical feature, such as the "B", "S" or "D" variations. Where other positions are desired, the factory should be consulted; please give valve type, application and piping details.

After installation, check the valve and the welded joints for external leaks with refrigerant or other appropriate gas before putting the system into operation

If pilot solenoid valves are a part of the regulator, connect the solenoid lead wires to an electrical supply source the same as indicated on the valve coil. The power source must be capable of supplying full, constant voltage. The wires to which the solenoid leads are connected must be of the proper gauge.

When it is necessary to insulate the regulator (and companion strainer), the insulation should be installed to allow access to the regulator (and companion strainer) for adjustment and maintenance. Do not insulate a solenoid coil and coil housing. Proper indicating gauges should be installed to be easily visible to the operating engineer for system checking and adjusting purposes.

Electrical (For A4WS, A4WB and A4WD)

The Refrigerating Specialties Division molded, water resistant Class "B" solenoid coil is designed for long life and powerful opening force. The standard coil housing meets NEMA 3R and 4 requirements. This sealed construction can withstand direct contact with moisture and ice. The coil housing far exceeds the requirements of NEMA Standard ICS, 1-110.57 salt spray test for rust resistance.

By definition, Class "B" coil construction will permit coil internal temperatures, as measured by the resistance method, as high as 130 deg. C (266 deg. F). Final coil temperatures are a function of both fluid and ambient temperatures. The higher fluid temperatures require lower ambient temperatures so the maximum coil temperature is not exceeded. **Conversely, low fluid temperatures permit higher ambient temperatures.**

The molded Class "B" coil is available, from Refrigerating Specialties Div. stock, with most standard voltages. However, coils are available for other voltages and frequencies, as well as for direct current. Coils are also available as transformer type with a 6 volt secondary winding for use with the Refrigerating Specialties Division Pilot Light Assembly. (See current copy of Bulletin 60-10, "Pilot Light Assembly and Solenoid Transformer Coil".)

The solenoid coil must be connected to electrical lines with volts and Hertz the same as stamped on the coil. The supply circuits must be properly sized to give adequate voltage at the coil leads even when other electrical equipment is operating. The coil is designed to

operate with line voltage from 85% to 110% of rated coil voltage. Operating with a line voltage above or below these limits may result in coil burn-out. Also, operating with line voltages below the limit will definitely result in lowering the valve's maximum opening pressure differential. Power consumption during normal operation will be 33 watts or less. Note that no coil should ever be energized when it is not securely mounted on the solenoid tube.

Inrush and running current is listed below:

Standard Coil Volts/Hertz	Inrush Current (Amps)	Running Current (Amps)	Fuse Size (Amps)
120/60 (Blue leads)	1.18	0.46	1
208/60 (Blue & Red leads	063	0.26	1
240/60 (Red leads)	0.60	0.23	1
440/60 (Yellow & Red leads)	0.39	0.13	1
115/50 (Yellow & Blue leads)	1.22	0.21	1
230/50 (Yellow leads)	0.65	0.26	1
Other	(Contact Factory)		

(On transformer coil, the 6 volt leads are always black.)

Disassembly and Assembly
General Procedure (See Figs. 7, 8, 9, and 10)

Before disassembling any A4W type regulator, read the information in this bulletin and Bulletin RSB (Safety Procedures for Refrigerating Specialties Division Refrigeration Control Valves).

Before a regulator is disassembled in the line, make sure that all refrigerant has been removed from the regulator, including the Bonnet (where applicable), the close coupled Strainer (if used) and the adjacent pipes at the inlet and outlet of the valve. The regulator must be isolated from the rest of the system in a safe manner. When pumping down to remove the refrigerant, the Manual Opening Stem 11 must be turned in (clockwise) to make sure that the valve is open.

All service or disassembly work is done from only the top side of all A4W Regulators. The construction of the regulator and the method of disassembly are relatively simple, but some procedures must be followedto avoid damage or injury. The following describes the procedure for the basic A4W: special instructions for other types are included in the appropriate sections.

See Fig. 9 for S6A Pilot Solenoid Valve and Fig. 10 for A2D Pilot Regulator Valve. See also Bulletin 23-06 for additional information about the S6A Pilot Solenoid and the A2D Pilot Regulator Valves.

Disassembly (See Figs. 7, 8 , 9 and 10)

Take care when removing Seal Caps 15 and 57 in case some refrigerant may be trapped inside. Back the Adjusting Stem 52 all of the way out (counterclockwise) to remove any pressure from the Range Spring 49, otherwise damage to diaphragm 45 or Pilot Seat 44 may occur. Remove Bonnet 51 by carefully removing Cap Screws 58. Take care not to damage Diaphragm Follower 47.

Turn the Manual Opening Stem 11 all the way out (counterclockwise) to stop. If for a 125 or 150mm (5" or 6") Regulator, remove the Adapter Cover 22 by carefully removing Bolts 17 and Nuts 18. If for a 200mm (8") Regulator, remove the Adapter Cover by carefully removing Bolts 17. (Note: The Studs 19 found on the two smaller sizes are not used on the 200mm (8") size.) Carefully lift the Adapter Cover away from the Body 1 by first breaking the gasket seal by inserting a flat tipped screw driver between the two parts and prying them apart, then lift the Adapter Cover off of the Body 1. On the 125 and 150mm (5" and 6") valves, the two Studs 19 will be retained in the Adapter Cover.

The Manual Opening Stem 11 can be removed from the Adapter Cover 22 as follows: Remove Packing Nut 12 by turning it out (counterclockwise) from the Adapter Cover. Slide the Packing Nut over the Manual Opening Stem and then turn the Manual Opening Stem in (clockwise) until the threads on the stem disengage from the Adapter Cover. Remove the Manual Opening Stem from the bottom side of the casting.

Push the Power Piston 9 down against the Closing Spring 8 force. The Piston should move freely down and be returned by the spring force. If the Piston is jammed or sticky, insert a US 1/4"-20 machine screw into the tapped hole in the center-top of the Piston and use this screw as a means of lifting the Piston from place. (It may be helpful to know that the coil housing screw on a standard Refrigerating Specialties solenoid valve is a 1/4-20 screw that can be used for this purpose.)

If the Piston 9 cannot be removed as suggested above then use the following procedure: Obtain a flat steel bar approximately 10mm x 50mm (3/8" x 2") x 50 (2") longer than the diameter of the piston bore. Drill a hole in the center of the flat face that will clear the 1/4"-20 screw. Obtain a 1/4-20 machine screw with a thread the full length of the bolt that is at least 100mm (4") long and a 1/4" hex nut. Place the bar across the top of the body bore, thread the nut on to the machine screw and put the screw through the clearance hole in the bar and thread it into the hole in the top of the Piston. Snug the nut down against the bar and then, by further tightening of the nut, pull the piston out of the body.

Examine the Seal Ring 10 for unusual wear and or tears. The Seal Ring should appear as is illustrated in Fig. 11 which shows a cross-section of the edge of the Piston 9 and the manner in which the Seal Ring fits in the piston groove. Look at the bottom end of the piston stem for signs of hammering or peening that could be caused by an oversized regulator chattering as it attempts to control a load far less than its capacity. If either the Seal Ring or the Piston is damaged, they should be replaced and the cause of the damage determined and eliminated.

The Valve Seat 2 on all A4W Regulators is removable. A US 3/8"-16 hex head Locking Screw 4 is used to hold the seat in position and this must be removed using a 9/16 socket wrench. A Seat Wrench 6 is used to remove the Valve Seat. (Each valve size has its own size Seat Wrench.) Position the prongs of the Modulating Plug so that it is possible to place the wrench over opposite projections on the top of the seat. Then, using a standard US 1/2" drive bar, turn the seat counterclockwise until it comes free. The main valve Modulating Plug 7 and the Closing Spring 8 can now be removed. Examine the seating faces of the Valve Seat and the Modulating Plug for uneven wear, nicks or non-uniform surfaces to determine if either or both should be replaced. If it is necessary to replace either part, determine and eliminate the cause of the wear that necessitated the replacement.

Assembly (See Figs. 7, 8, 9 and 10) To assemble the Modulating Plug 7 and the Valve Seat 2 it is necessary to have the appropriate size Seat Wrench 6 (each valve size has its own Seat Wrench) and a new Seat O-Ring 3. Insert the Closing Compression Spring 8 into the matching recess in the bottom of the Valve Body 1 so that it is in position to receive the bottom extension of the Modulating Plug. Next insert the O-ring into position on the Valve Seat and lightly lubricate with silicone grease. Put the Modulating Plug through the Valve Seat and by grasping the prongs of the Modulating Plug place both into the Valve Body so that the Modulating Plug engages the Closing Spring and the Valve Seat threads line up with the matching threads in the Body. Using the Seat Wrench tighten the seat in place to the torque listed in the table below. Finally, replace the Retaining Screw 4 and tighten with a 9/16" socket wrench to the torque listed in the table below.

To replace the Seal Ring 10 on the Power Piston 9 install in place by starting the new ring over the top of the Piston. Gradually engage the ring into the slot, rotating the force on the ring as it is pushed into place. The Seal Ring must be installed as shown in Fig. 11 with the open edge of the ring pointing up.

Before installing the Power Piston 9 in the body bore be sure that the bleed hole in the top of the piston is clear. Insert the Piston into the Body 1 so that the top of the Piston is parallel with the top of the Valve Body and, with an even force, push the Piston into the Body. There is no fasteningbetween the Piston and the Modulating Plug 7; the Piston Stem only slides into the receptacle in the center of the Modulating Plug. The Piston should not bind and must move up and down easily.

If the Manual Opening Stem 11 has been removed, it must be re-installed before the Adapter Cover 22 is installed. Insert the Opening Stem into the opening on the bottom of the Adapter Cover and push it through the Stem Packing 13 until it is ready to engage with the threads in the casting. Grasp the Stem at its top end and pull while, at the same time, turning it counterclockwise (when viewed from the top of the Stem) to begin to engage the threads, and, then, complete the turning with a wrench until the bottom of the stem is about flush with the bottom of the Adapter Cover. Install the Packing Nut 12 at the top of the Stem.

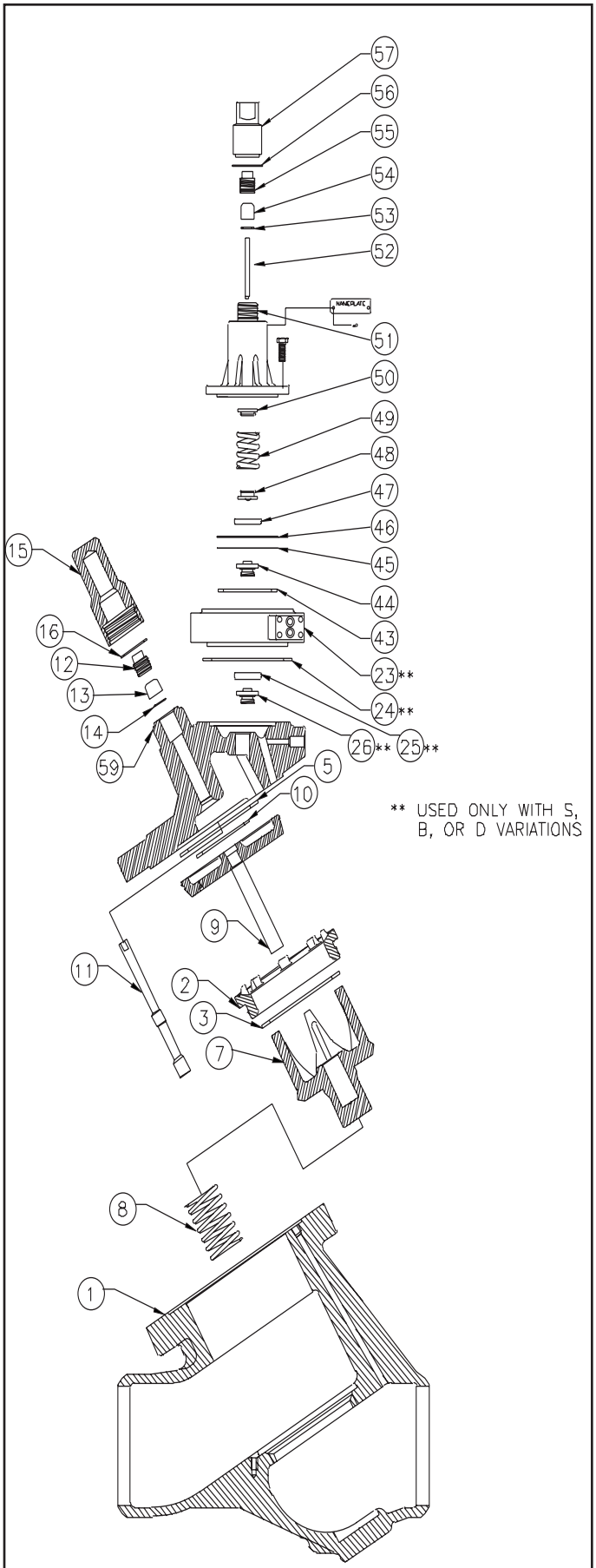


Fig. 7-1

Clean the sealing surfaces where the Adapter-to-Body Gasket 5 is to beinstalled and insert a new Gasket in position, making sure to line up the hole in the Gasket with the passage "N" hole (see Fig. 1) in the Valve Body 1. The gasket should have a very light film of refrigerant oil applied to both surfaces before inserting in place.

Position the Adapter Cover 22 so the extension of passage N in the Adapter lines up with the matching hole in the Valve Body 1. Insert the bolts (and nuts) and tighten to the torques listed in the table below. These should be tightened in a pattern that provides a uniform pull-down of the Adapter Cover to the Valve Body.

Inspect the top surface of the Pilot Seat 44 to be sure that it is smooth and unblemished. This is essential for reliable performance and for a tight shut-off. If the surface is not good replace the Pilot Seat with a new part. There is no gasket or O-ring under the Pilot Seat. Tighten the seat to the torque listed in the table below.

Inspect the Diaphragm 45 surfaces to be sure they are clean and free from scratches, bends or cracks. If range "A" or "V", there is only one Diaphragm: if range "D", there will be two Diaphragms. Replace any Diaphragms that are defective.

Two Diaphragm Gaskets 43 and 46 are a part of each installation. A thick, black gasket goes under the Diaphragm 45 against the Valve Body. and a thin, black gasket goes on top of the Diaphragm. The Diaphragm(s) is installed bowed toward the Diaphragm Follower 47 and Range Spring 49. That is, the center of the Diaphragm is higher than its perimeter.

Before installing the Bonnet 51 be sure that the Adjusting Stem 52 is backed out far enough so that when the assembly of Range Spring 49. Spring Rests 48 and 50, Diaphragm Follower 47 and Bonnet are put in place, there will be no compression of the Spring. Place the Diaphragm 45 and both Diaphragm Gaskets 43 and 46 in place on top of the Adapter Cover 22 as described above. Assemble the Range Spring, Range Spring Rests and Diaphragm Follower into the Bonnet in the sequence shown in Figs. 1 or 9. This assembly procedure is most convenient if done in the mechanics hands and not in place on the top of the valve. These parts can be held in place within the Bonnet as the assembly is positioned on top of the Adapter at one edge and then slid over to its proper location. There is no specific orientation for the Bonnet. Insert the Cap Screws 58 and tighten to the torque listed in the table below. Tighten in a manner that provides a uniform pull-down of the Bonnet.

Check the assembled valve for leaks to atmosphere. Check the position of the Manual Opening Stem 11 to be as desired. Set the Range Adjusting Stem 52 to control the pressure as required. Tighten Stem Packing Nuts 12 and 55 and install Seal Caps 15 and 57.

TABLE OF TORQUES FOR A4W FASTENERS AND VALVE SEATS

	Item No.	Metric Units mkg (All sizes)	U.S. Units ft/lbs (All sizes)
Valve Seat	(2)	13.8	100
Retaining Screw	(4)	2.1	15
Bonnet Cap Screws	(58)	1.5	11
Adapter Cover Nuts	(18)	14.5	105
Pilot Seat	(44)	2.8	20
A2D Body Bolt	(60)	0.83 -1.1	6 - 8
S6A Body Bolt	(42)	0.83 -1.1	6 - 8

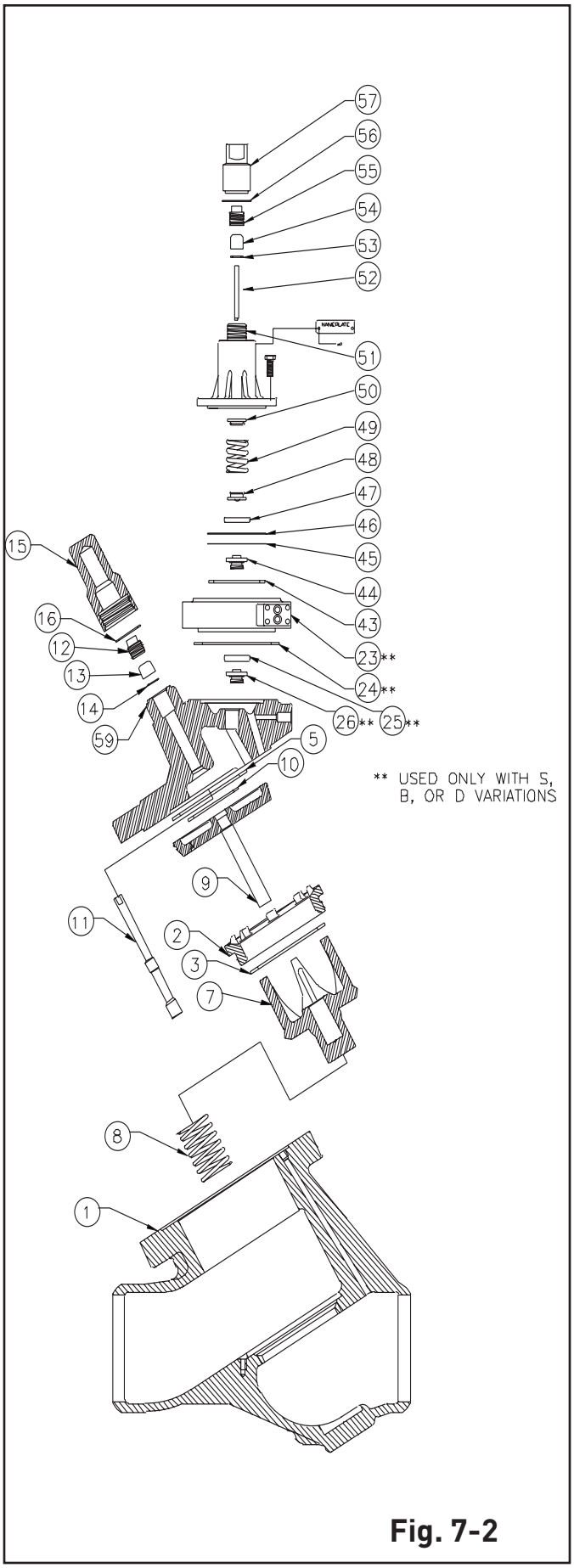


Fig. 7-2

Maintenance and Service

Dirt in the system is the greatest single cause of regulator malfunction. All screens or filters must be cleaned or replaced when they become dirty. At start up, or when changes or additions are made, it is especially important that these items are cleaned or changed frequently. When the RSW companion strainer or 13mm (1/2") pilot circuit strainer is used, maintain according to instructions in Bulletin 00-10. Moisture in halocarbon systems, in particular, can cause corrosion or form ice, causing the Piston to freeze in position. Filter-driers should be used and maintained for halocarbon systems.

Before deciding to disassemble a regulator for servicing, the following investigations should be made:

Check the Manual Opening Stem; it should be turned out (counterclockwise) for automatic operation.

Check the regulator setting to make sure it is properly adjusted. Turn Adjusting Screw slowly to see if the regulator responds. Check regulator pressure range; if wrong, range spring must be changed or a Vacuum Cartridge installed.

Check other system components for proper operation.

Check hand valves in the system to make sure they are open or closed as required and the system is receiving liquid or vapor as the case may be.

Before disassembly of Regulator, make certain that all refrigerant has been removed (pumped out) from the regulator and its corresponding Strainer where one is used. Read Safety Bulletin RSB.

TROUBLE SHOOTING SUGGESTIONS

SYMPTOM	PROBABLE REASON	CORRECTION
Regulator does not shut off flow.	Diaphragm or Pilot Seat dirty, damaged or frozen.	Clean or replace. Clean strainer.
	Diaphragm follower stuck or damaged.	Clean or replace. Install follower carefully.
	Piston jammed with excess dirt.	Remove Piston and clean dirt from Seal Ring and groove. Clean bore with crocus cloth. Clean valve and strainer.
	Modulating plug leaking due to excess dirt or damage.	Clean or replace Modulating Plug and or Valve Seat.
	Diaphragm and Pilot Seat eroded due to flash gas.	Replace. Reduce flash gas by reducing amount of liquid in suction line. For example, reduce rate of liquid overfeed.
Regulator does not open.	Diaphragm ruptured or badly deformed.	Replace. If Range D make sure two diaphragms are installed.
	Diaphragm Follower stuck, damaged or frozen.	Clean or replace. Install follower carefully.
	Piston Seal Ring worn or torn.	Replace Seal Ring. Check for reason.
Regulator Operation erratic.	Diaphragm or Pilot Seat dirty or damaged.	Clean or replace. Clean strainer.
	Diaphragm Follower has dirt on the outside diameter or outside diameter is damaged.	Clean or replace.
	Other system components, line controllers, thermostats, etc., erratic.	Adjust, repair or replace.
	Regulator too far oversized.	Check load. Replace with smaller regulator. If load has wide variation, consider using two smaller regulators in parallel. Check with factory.
Pressure drop across regulator too high.	Inlet or outlet restricted.	Check for restriction. Clean strainer.
	Regulator too small.	Replace with properly sized regulator.
	High pressure drop causes high rate of expansion gas at regulator outlet.	Increase pipe size at the outlet of the regulator.
	Regulator does not open all of the way.	Check Piston Seal Ring for wear. Replace and determine cause for wear.

Parts Kits Which Are Exclusive to Each Port Size Type A4W Regulator

Item No.	Description and Contents	PORT SIZE Parts Kit Number and Part Quantities 125mm (5")	150mm (6")	200mm (8")
	Seat Kit, Main Valve	**201534**	**201535**	**201536**
2	Seat, Valve	1	1	1
3	O-Ring	1	1	1
4	Screw, Hex Head	1	1	1
5	Gasket	1	1	1
6	Wrench, Seat	1	1	1
	Plug Kit, Modulating	**201537**	**201538**	**201539**
7	Plug, Modulating	1	1	1
8	Spring	1	1	1
H	Seat Kit, Main Valve (See Above)	1	1	1
	Piston Kit	**201540**	**201541**	**201542**
9	Piston Stem	1	1	1
10	Ring, Seal	1	1	1
5	Gasket	1	1	1
	Stem Kit, Opening	**201546**	**201547**	**201548**
11	Stem, Manual Opening	1	1	1
12	Nut, Packing	1	1	1
13	Packing, Stem	1	1	1
14	Washer, Flat	1	1	1
5	Gasket	1	1	1

Item No.	Description and Contents	PORT SIZE Parts Kit Number and Part Quantities 125mm (5")	150mm (6")	200mm (8")
	Cap Kit, Seal	**201549**	**201550**	**201551**
15	Seal Cap	1	1	1
16	O-Ring	1	1	1
	Bolt Kit	**201552**	**201553**	**201554**
17	Bolt, Hex Head	6	10	16
18	Nut	8	12	16
19	Stud	2	2	0
5	Gasket	1	1	1
	Gasket Kit	**201558**	**201559**	**201560**
3	O-Ring	1	1	1
5	Gasket	1	1	1
16	O-Ring	1	1	1
45	Gasket	1	1	1
10	Ring, Seal	1	1	1
	Adapter/Cover Kit	**202861**	**202484**	**203099**
59	Adapter/Cover	1	1	1
5	Gasket	1	1	1
43	Gasket	1	1	1
21	Plug, Pipe	1	1	1
13	Packing	1	1	1

Parts Kits Which Are Common To All A4W Port Sizes (including A4W, A4WE, A4WS, A4WB, A4WD, A4WP, A4W0E and A4WR)

Item No.	Description and Contents	Qty.	Kit No.
	Stem Kit, Adjusting		**202120**
52	Stem, Adjusting	1	
53	Washer, Flat	1	
54	Packing, Stem	1	
	Spring Stem Kit, Range A & V		**202006**
55	Nut, Packing	1	
*	Stem Kit, Adjusting (202120)	1	
50	Plate, Spring, Upper	1	
48	Plate, Spring, Lower	1	
49	Spring. Comp.	1	
47	Follower, Diaphragm	1	
	Spring Stem Kit, Range D		**202007**
55	Nut, Packing	1	
*	Stem Kit, Adjusting (202120)	1	
50	Plate, Spring, Upper	1	
48	Plate, Spring, Lower	1	
49	Spring, Comp.	1	
47	Follower, Diaphragm	1	
	Bonnet/Spring Kit, Range A & V (A4W0nly)		**202008**
*	Spring Stem Kit (202006)	1	
57	Seal Cap	1	
56	Gasket	1	
51	Bonnet	1	
58	Screw, Hex Head**	8	
48	Gasket	1	
	**Not for S, B or D Variations		
	Bonnet, Spring Kit, Range D (AM Only)		**202009**
	Spring Stem Kit (202007)	1	
57	Seal Cap	1	
56	Gasket	1	
51	Bonnet	1	
58	Screw, Hex Head**	8	
46	Gasket	1	
	**Not for S, B or D Variations		
	Seal Cap Kit		**202110**
57	Seal Cap	1	
56	Gasket	1	
	Packing Kit, Opening Stem		**202101**
12	Nut, Packing	1	
13	Packing, Stem	1	
14	Washer, Flat	1	
	Spring Kit, Range A & V		**202481**
50	Plate, Spring, Upper	1	
48	Plate, Spring, Lower	1	
49	Spring, Comp.	1	
46	Gasket	1	
	Spring Kit, Range D		**202482**
50	Plate, Spring, Upper	1	
48	Plate, Spring, Lower	1	
49	Spring, Comp.	1	
46	Gasket	1	
	Diaphragm Kit, Range A & V		**200770**
45	Diaphragm	1	
46	Gasket	1	
43	Gasket	1	
	Diaphragm Kit, Range D		**200771**
45	Diaphragm	2	
46	Gasket	1	
43	Gasket	1	
	Pilot Seat Kit, Range A & D (Not A4W0E)		**200411**
44	Pilot Seat	1	
43	Gasket	1	
46	Gasket	1	
	Seat Kit, Pilot, Range A (Not A4W0E)		**202001**
44	Seat, Pilot	1	
*	Diaphragm Kit (200770)	1	
	Seat Kit, Pilot, Range V (Not A4W0E)		**202004**
44	Seat, Pilot	1	
*	Diaphragm Kit (200770)	1	
	Seat Kit, Pilot, Range D (Not A4W0E)		**202003**
44	Seat, Pilot	1	
*	Diaphragm Kit (200771)	1	
	Bolt Package, A4W Bonnet**		**202246**
58	Bolts, 5/16"-18 x 7/8" Lg	8	
**	Not for S, B or D Variations		

Item No.	Description and Contents	Qty.	Kit No.
	Plug Kit, Pilot, A4W0E		**200778**
64	Plug, Pilot	1	
65	O-Ring	1	
66	O-Ring	1	
62	Nut, Retainer	1	
43	Gasket	1	
63	Spring	1	
	Outlet Regulator Kit		**200517**
61	Adapter (A4W0E)	1	
*	Plug Kit, Pilot, A4W0E (200778)	1	
68	Screw, Hex Head	8	
21	Plug, Pipe	1	
	Bolt Package, A4W0E Bonnet		**202247**
68	Bolts, 5/16"- 18 x 1-3/4" Lg.	8	
	Cover Kit, A4W0E		
69	Cover	1	
70	Gasket	1	
	- S, B or D Variations-		
	Adapter Kit, Series		**200564**
23	Adapter	1	
24	Gasket	2	
25	O-Ring	1	
26	Insert, Seal	1	
21	Plug, Pipe	1	
68	Screw	8	
	Adapter Kit, Seal		**202333**
24	Gasket	1	
25	O-Ring	1	
26	Insert, Seal	1	
	Spacer Kit, Adapt. A2D		**202122**
	Spacer, Adapter (not shown)	1	
72	Screw, Hex Hd	4	
30	O-Ring	4	
	Spacer Kit, Adapt. S6A		**202123**
	Spacer, Adapter (not shown)	1	
72	Screw, Hex Hd	4	
30	O-Ring	4	
	Tube Kit		**201036**
37A	Nut. Solenoid Tube	1	
37B	Tube Assembly, Solenoid	1	
38	Gasket	1	
	Bolt/O-Ring Kit		**201574**
30	O-Ring	2	
42	Bolt	4	
	Plunger Kit, Needle (AC Only)		**201019**
38	Gasket	1	
39	Plunger Needle Assembly	1	
	Plunger Kit, Needle (DC Only)		**201021**
38	Gasket	1	
39	Plunger Needle Assembly	1	
	Plunger Seat Kit (AC Only)		**201630**
38	Gasket	1	
39	Plunger Needle Assembly	1	
40	Seat Assembly	1	
	Bolts, A4WD, S, B Bonnet		**202247**
68	Bolts, 5/16"-18 x 1-3/4" Lg.	8	
71	Body, A2D (Not available as a part)		
	Bolt/O-Ring Kit, A2B Pilot		**201572**
72	Bolts	4	
30	C-Rings	2	
	- Packages -		
	Gasket Package/Seal Cap		**202408**
56	Gasket	12	
	Gasket Package/Solenoid Kit		**202078**
38	Gasket	12	
	Stem Packing Package		**202478**
54	Packing	25	
	Plug Package 1/4" NPT		**202552**
21	Plug	5	
	O-Ring Package		
30	'B'-Side, Moduplates; and S6A/A2D/Spacers	12	**202424**
	'S'-Side, Moduplate (Not illustrated)	6	**202425**

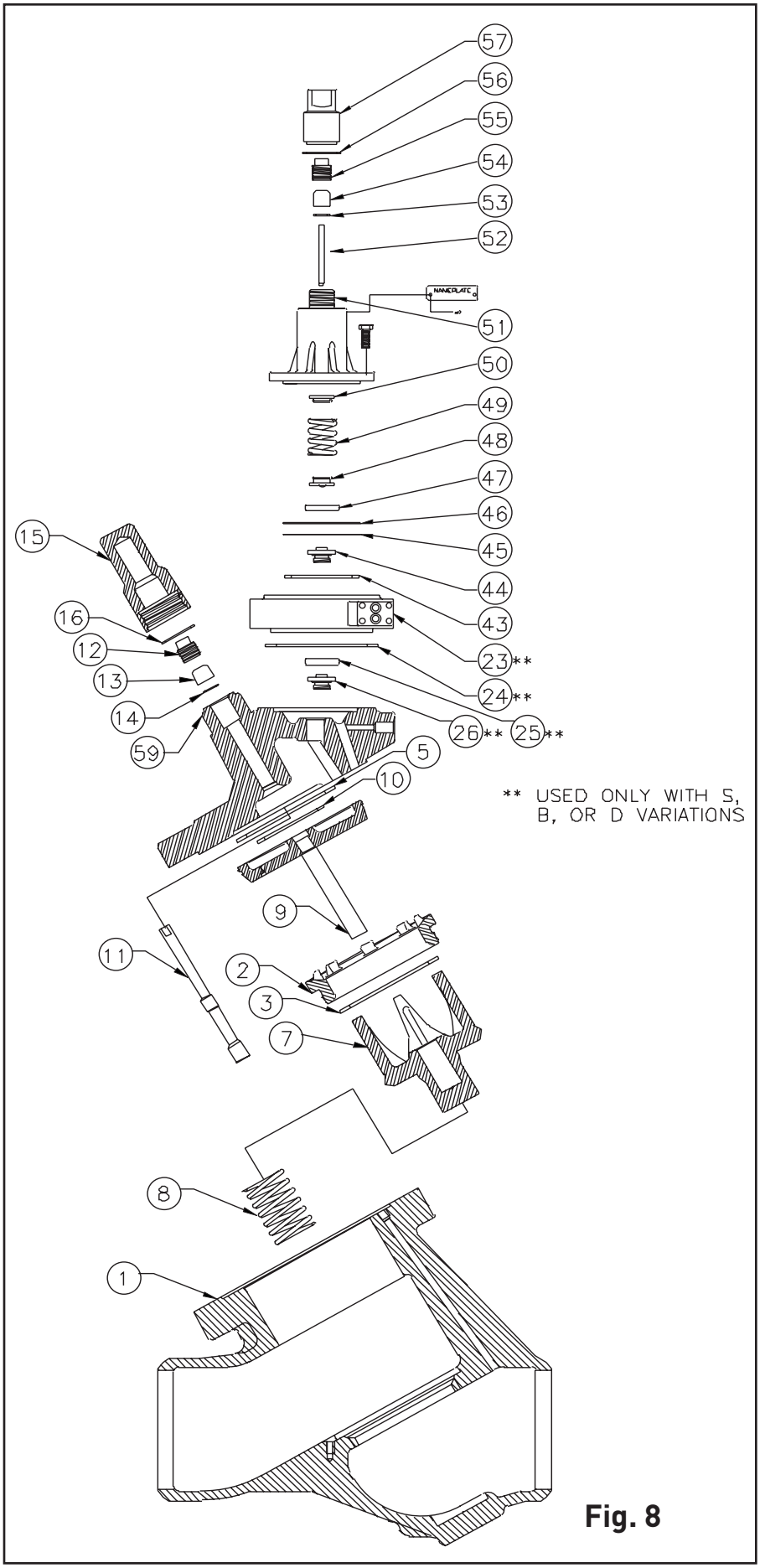


Fig. 8

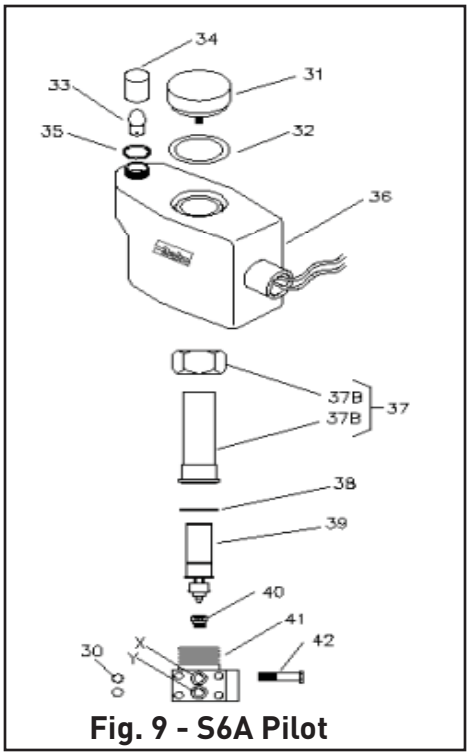


Fig. 9 - S6A Pilot

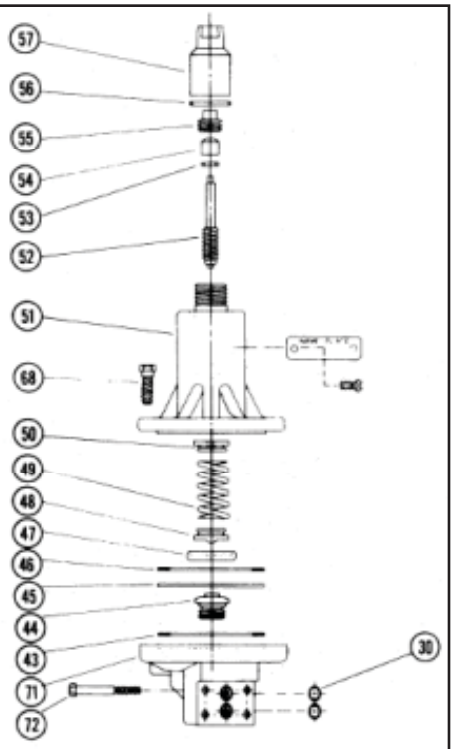


Fig. 10 - A2D Pilot

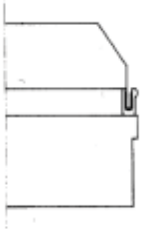
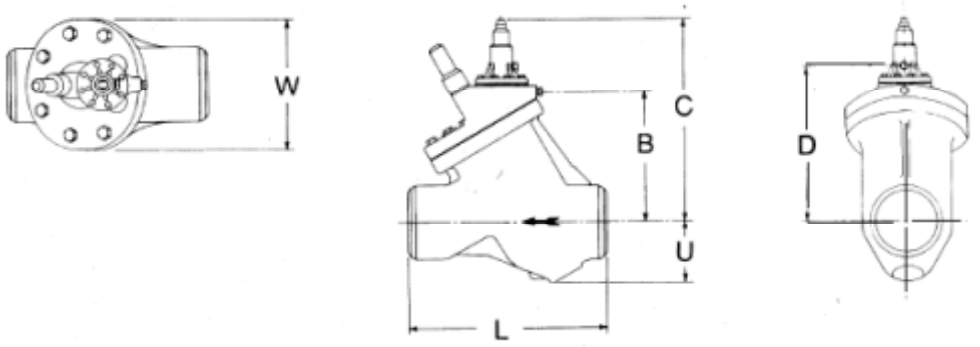


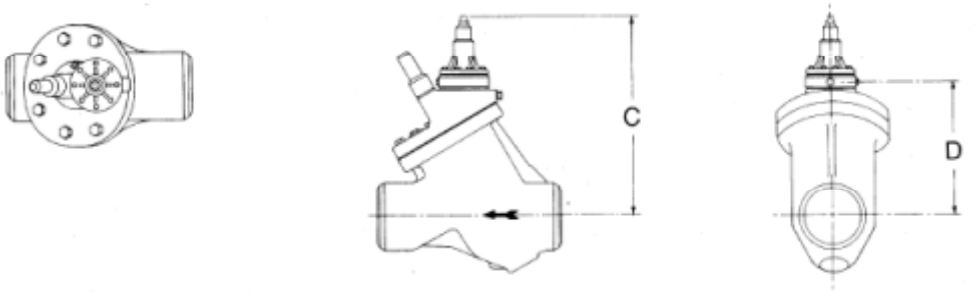
Fig. 11 - Section Through Piston

Fig. 12

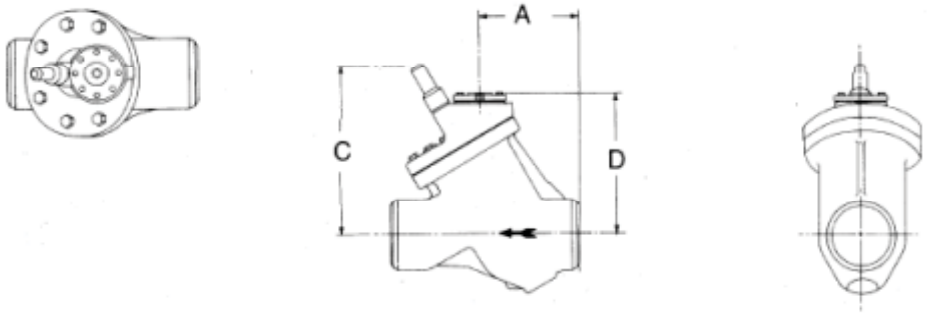
A4W
A4WE
A4WP
A4WL



A4W0E

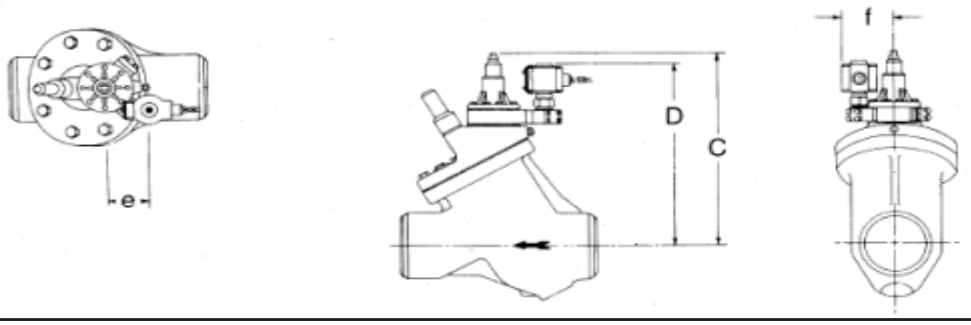


A4WR



A4WB
A4WS

For All Sizes
"e" is 75mm - 3.0 in.
"f" is 100mm -4.0 in.
"g" is 140mm - 5.5 in.



A4WD

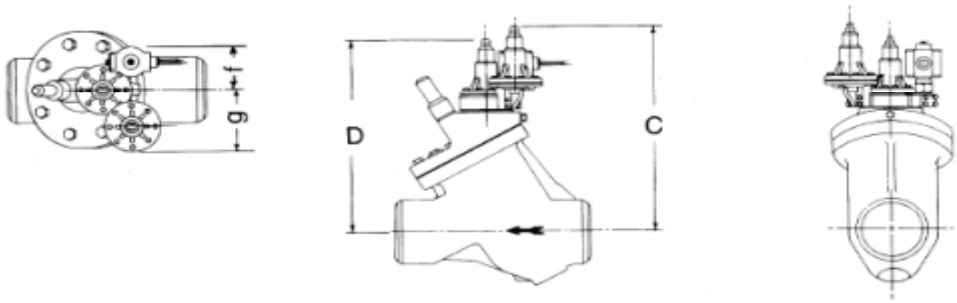


TABLE OF DIMENSIONS

VALVE SIZE	VALVE VARIATION		DIMENSION U	L	W_1	A	B	C	D
mm 125 In. 5	Common to All	mm In.	114 4.5	381 15.0	267 10.5	190 7.5	273 10.75		
	A4W, A4WE	mm In.						438* 17.25*	
	A4WP, A4WL	mm In.						438* 17.25*	318 12.5
	A4WOE	mm In.						463* 18.25*	305 12.0
	A4WR	mm In.						414** 16.25**	305 12.0
	A4WB, A4WS	mm In.						476* 18.75*	451 ** 17.75**
	A4WD	mm In.						502* 19.75*	476** 18.75**
mm 150 In. 6	Common to All	mm In.	152 6.0	483 19.0	318 12.5	254 10.0	349 13.75		
	A4W, A4WE	mm In.						514* 20.25*	
	A4WP, A4WL	mm In.						514* 20.25*	394 15.5
	A4WOE	mm In.						539* 21.25*	381 15.0
	A4WR	mm In.						489** 19.25**	381 15.0
	A4WB, A4WS	mm In.						552* 21.75*	527** 20.75**
	A4WD	mm In.						578* 22.75*	552** 21.75**
mm 200 In. 8	Common to All	mm In.	197 7.75	622 24.5	381 15.0	356 14.0	406 16.0		
	A4W, A4WE	mm In.						572* 22.5*	
	A4WP, A4WL	mm In.						572* 22.5*	451 17.75
	A4WOE	mm In.						597* 23.5*	438 17.25
	A4WR	mm In.						546** 21.5**	438 17.25

NOTES:

1 Valve body is wider than adapter for 125mm (5") A4W; Adapter wider than body for 150mm (6") & 200mm (8") A4W

* Allow 75mm (3") overhead clearance for access to adjusting stem.

** Allow 100mm (4") overhead clearance for coil or seal cap removal.

Warranty

All Refrigerating Specialties Products are warranted against defect in workmanship and materials for a period of one year from date of shipment from factory. This warranty is in force only when products are properly installed, field assembled, maintained and operated in use and service as specifically stated in Refrigerating Specialties Catalogs or Bulletins for normal refrigeration applications, unless otherwise approved in writing by Refrigerating Specialties Division. Defective products, or parts thereof, returned to the factory with transportation charges prepaid and found to be defective by factory inspection will be replaced or repaired at Refrigerating Specialties' option, free of charge, F.O.B. factory. Warranty does not cover products which have been altered or repaired in the field; damaged in transit, or have suffered accidents, misuse, or abuse. Products disabled by dirt or other foreign substances will not be considered defective.

THE EXPRESS WARRANTY SET FORTH ABOVE CONSTITUTES THE ONLY WARRANTY APPLICABLE TO REFRIGERATING SPECIALTIES PRODUCTS, AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No employee, agent, dealer or other person is authorized to give any warranties on behalf of Refrigerating Specialties, nor to assume, for Refrigerating Specialties, any other liability in connection with any of its products.

Safe Operation (See also Bulletin RSBCV)

People doing any work on a refrigeration system must be qualified and completely familiar with the system and the Refrigerating Specialties Division Products involved, or all other precautions will be meaningless. This includes reading and understanding pertinent Refrigerating Specialties Division Product Bulletins, and Safety Bulletin RSB prior to installation or servicing work.

Where cold refrigerant liquid lines are used, it is necessary that certain precautions be taken to avoid damage which could result from liquid expansion. Temperature increase in a piping section full of solid liquid will cause high pressure due to the expanding liquid which can possibly rupture a gasket, pipe or valve. All hand valves isolating such sections should be marked, warning against accidental closing, and must not be closed until the liquid is removed. Check valves must never be installed upstream of solenoid valves, or regulators with electric shut-off, nor should hand valves upstream of solenoid valves or downstream of check valves be closed until the liquid has been removed. It is advisable to properly install relief devices in any section where liquid expansion could take place.

Avoid all piping or control arrangements which might produce thermal or pressure shock.

For the protection of people and products, all refrigerant must be removed from the section to be worked on before a valve, strainer, or other device is opened or removed.

Flanges with ODS connections are not suitable for ammonia service.

⚠ WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.