

HOT GAS BYPASS REGULATOR

Types A9, A9E, A9S and A9SE

Port 9mm (3/8") to 28mm (1-1/8")

FEATURES

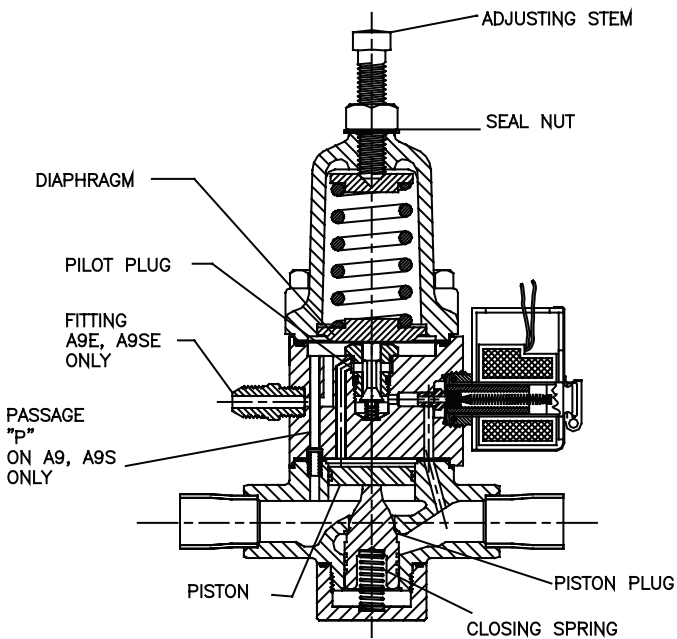
- Controls outlet pressure at sensing point
- Pilot operated for close regulation
- Few sizes cover entire capacity range
- External or internal equalizer
- Available with integral electric shut-off
- Tight seating - simple adjustment
- Sweat end design solders into line without disassembly
- Cleanable in line - Nominal capacities 1.3 to 24 tons
- CSA certified (A9S and A9SE types only)
- UL listed

SPECIFICATIONS

- 27.5 bar (400 psig) maximum rated pressure (MRP)
- Adjustment range: Range A = 250mm hg to 8.2 bar (10" hg to 120 psig); Range B = 5.5 to 15.1 bar (80 to 220 psig)
- Minimum pressure drop to open valve completely: 0.67 bar (10 psi)
- Maximum pressure change from valve closed to completely open: 0.34 bar (5 psi)
- Temperature range: -45°C to 93°C (-50°F to 200°F)

DESCRIPTION

These ductile iron bodied regulators with brazed copper couplings are used to modulate the flow of refrigerant gas to maintain a nearly constant outlet pressure at the sensing point. The regulators are pilot operated. The unique design allows the regulators to be soldered into the line without disassembly, yet allows disassembly of the valve for cleaning and maintenance without removing the regulator from line.



A9S, A9SE
Fig. 1

BULLETIN 25-95F

Type A9



May 2007

Installation, Service and Parts Information

WHEN YOU ORDER

Please give valve size and type, and pressure range. If internally equalized is required specify the Type A9, otherwise externally equalized A9E will be supplied as standard. Standard outlet pressure Range A, 10" hg vacuum to 120 psig will be furnished unless otherwise specified. Range B, 80 to 220 psig is available at no extra charge. Pilot electric shut-off is available: specify A9S or A9SE and coil voltage and cycles.

PURPOSE

The A9 Hot Gas Bypass Regulators modulate the flow of refrigerant gas to maintain a nearly constant pressure at the sensing point at the outlet or at a remote point (A9E) of the regulator. The regulator allows loading of the system to eliminate short cycling of the compressors, provide required humidity control, and proper oil return.

OTHER USES

- Booster suction control to prevent deep vacuum
- Air cooled condenser control
- Hot gas defrost control
- Liquid pressure control

INTERNALLY EQUALIZED

This regulator is normally furnished as A9E externally equalized. The pressure being controlled is that pressure at the external equalizer connection. In many applications where it is acceptable to control the pressure at the outlet of the regulator, an internally equalized regulator should be used. In this instance, the A9 should be ordered.

NOTE: A9E or A9SE can not be converted to A9 or A9S without replacing the #22 adapter.

ELECTRIC SHUT-OFF

For pump-down control the regulator must be electrically shut off. Specify A9S or A9SE "with pilot electric shut-off" and specify voltage and frequency. Alternately, a separate full size solenoid valve can be used upstream of the regulator for shut-off.

| Item No. | Description | Qty | Port Size | | | |
|--------------------------|-------------------------------------|--------|-----------|--------|--------|--------|
| | | | 3/8 | 5/8 | 7/8 | 1-1/8 |
| 1, 2, 3,15 | Spring Kit Range A | 1 | 202200 | | | |
| 1, 2, 3,15 | Spring Kit Range B | 1 | 202201 | | | |
| 3,15 | Follower Kit, Diaphragm | 1 | 200896 | | | |
| 4, 5, 6, 8,14,15 | Seat Kit Pilot, Range A | 1 | 200859 | | | |
| 9,11,15,16 | Gasket Kit | 1 | 202420 | | | |
| 10, 9 | Piston Kit | 1 | 200897 | | | |
| 12, 11 | Plug Kit | 1 | 200895 | 200894 | 200892 | 200893 |
| 14(2),15,16 | Diaphragm Kit Range A | 1 | 200860 | | | |
| 14(3),15,16 | Diaphragm Kit Range B | 1 | 200862 | | | |
| 19,15 | Bonnet Kit | 1 | 200907 | | | |
| 22, 9,16 | Adapter Kit A9E | 1 | 200889 | | | |
| 22, 9,16 | Adapter Kit A9 | 1 | 200890 | | | |
| 22, 9,16 | AdapterKitA9SE | 1 | 202401 | | | |
| 22, 9,16 | Adapter Kit A9S | 1 | 202402 | | | |
| 24 | Bolt Pkg (A9, A9E) | 4 | 202254 | | | |
| 24 | Bolt Pkg (A9S, A9SE) | 4 | 202255 | | | |
| 26, 11 | Cover Kit | 1 | 200891 | | | |
| 27 | Repair Kit, Solenoid | 1 | 202700 | | | |
| 39, 40, 41 | Coil and Housing Kit 120/60,110/50 | 1 | 202940 | | | |
| | Coil and Housing Kit 240/60, 220/50 | 1 | 202941 | | | |
| | Coil and Housing Kit 480/60, 440/50 | 1 | 202943 | | | |
| | Coil and Housing Kit 24/60 | 1 | 202944 | | | |
| | Coil and Housing Kit 240/50 | 1 | 202945 | | | |
| | Coil and Housing Kit 208/60 | 1 | 202942 | | | |
| | Coil and Housing Kit 120/6/60 | 1 | 202946 | | | |
| | Coil and Housing Kit 208/6/60 | 1 | 202947 | | | |
| | Coil and Housing Kit 240/6/60 | 1 | 202948 | | | |
| | Coil Assembly Q/D 240/60, 220/50 | 1 | 203730 | | | |
| Coil Assembly Q/D 240/50 | 1 | 203734 | | | | |

| BOLT TORQUE TABLE | | |
|---------------------|-----------|----------|
| Item | Port Size | Torque |
| 1/4-28" bonnet bolt | All | 72 in lb |

INSTALLATION

The regulator can be mounted in a horizontal or vertical line with the flow in the direction of the arrow on the valve body. The adjusting stem should not be located below the centerline of the valve. The valve should be installed in a manner that avoids trapping condensed refrigerant in the valve.

Protect the inside of the regulator from moisture, dirt and chips during installation. These regulators may be soldered into the line without disassembly. A wet cloth should be wrapped around the valve and the soldering flame should be directed away from the valve body.

PRINCIPLES OF OPERATION

Referring to figure 3, control pressure is transmitted through #7 Fitting to space A under #14 Diaphragm. When this pressure is lower than the setting of the #2 Spring, this spring force pushed against the #5 Pilot plug moving it off the #4 Pilot Seat and the inlet pressure is transmitted from area X through passage N, pilot seat,

and passage D to the chamber on top of #10 Piston. The difference in this pressure and the pressure in space M causes the Piston to move the #12 Piston Plug off the seat allowing flow from inlet space X to outlet space B, increasing the controlled pressure.

As the control pressure increases, the #14 Diaphragm moves against the force of #2 Spring, allowing the #5 Pilot Plug to start to close and reduce the flow to the top of #10 Piston. The pressure on top of the piston bleeds to the space M and the force of #13 Spring causes the #12 Piston Plug to move towards closed position, thus reducing the flow through the valve and maintaining the control pressure.

In case of the internally equalized A9 the control pressure is sensed at the valve outlet and transmitted through passage P.

When a solenoid shut-off feature is used, the passage N is open only when the solenoid is energized.

During operation, the Main Valve will assume an intermediate or throttling position with respect to the regulator setting. A properly sized A9E Hot Gas Bypass Regulator will control to within 1/2 to 5 pounds of the pressure setting depending on the system operating characteristics and the sizing of the regulator.

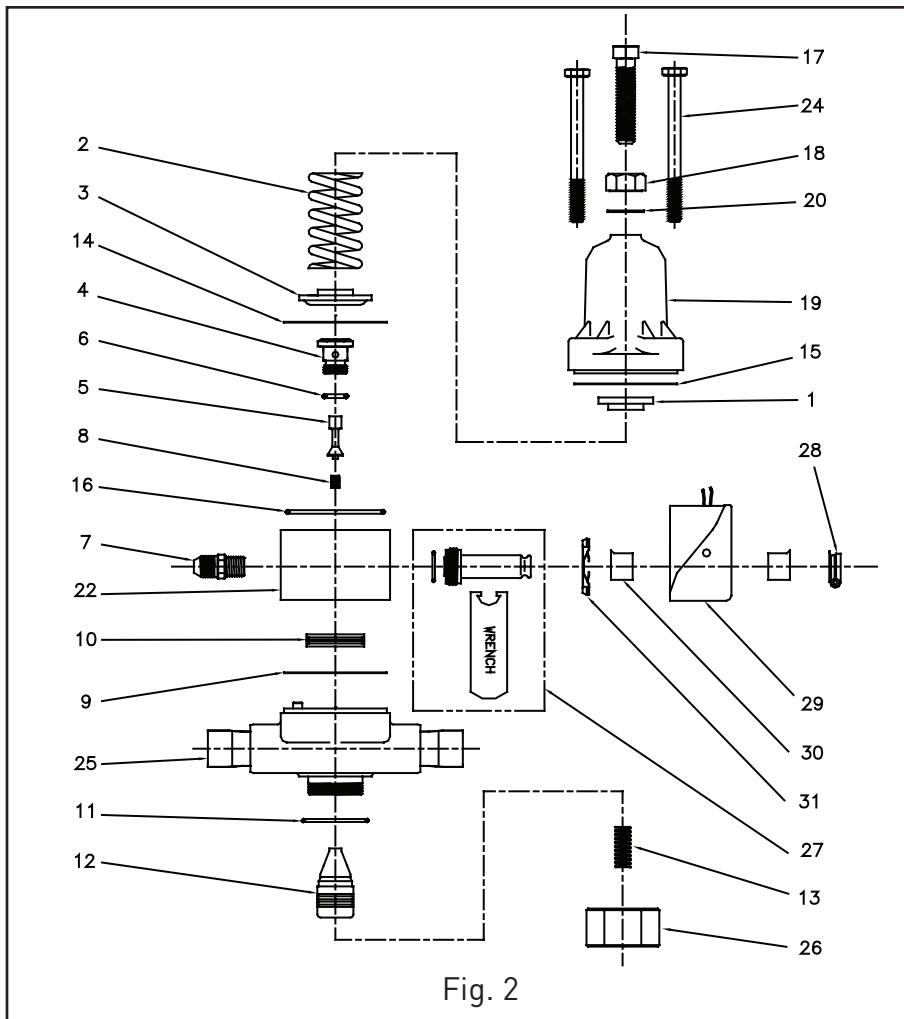


Fig. 2

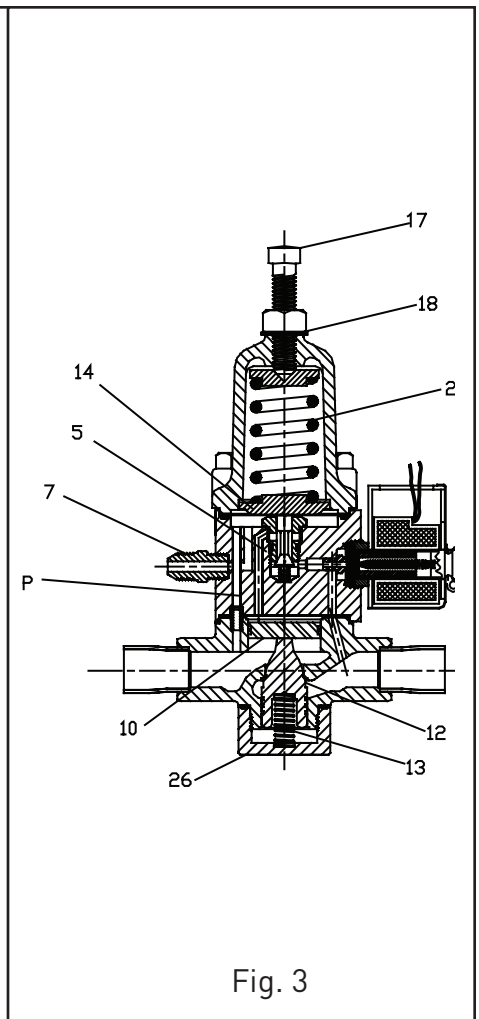


Fig. 3

ADJUSTMENT

Install an accurate pressure gauge at the control (sensing) point at the outlet side of the valve.

To adjust the valve, loosen #18 Seal Nut and turn the #17 Adjusting Stem clockwise to raise the pressure or counterclockwise to lower the pressure. For Range A one turn equals approximately 1.1 bar (16 psi), for Range B one turn equals approximately 1.7 bar (25 psi).

The regulator should be set under actual operating conditions. For hot gas bypass this condition occurs under minimal system load conditions. The regulator should be adjusted to maintain minimum desired suction pressure. Hot gas flow through the regulator can be detected by listening to the gas flow through the regulator or by feeling the outlet pipe for warmth. When it is not possible to simulate minimum load conditions, an approximate setting may be obtained by adjusting the valve until gas flow begins, observing the gauge reading, and then turning the adjusting stem counterclockwise for the required number of turns to obtain the desired minimum pressure. This setting should be checked and readjusted as needed under actual conditions.

SERVICE POINTERS

1. Failure to regulate: (a) #10 Piston may be jammed due to excessive dirt. This is the most likely cause of any regulator difficulties even when the regulator is preceded by a filter. Remove #24 Bolts. Remove #22 Adaptor. Push down on #10 Piston against the returning #13 Plug Spring Force. If jammed or sticky, remove #26 Bottom Cap and push up #12 Piston Plug from the bottom with the blunt end of a wood pencil or similar tool #10 Piston should now pop free from #25 Body. Remove #12 Piston Plug by pushing from top to eject from the bottom. Clean all removed parts thoroughly. If jamming has occurred, remove all burrs from

#10 Piston, #12 Piston Plug and Cylinder Wall with fine crocus cloth. Reassemble the regulator with a light coating of refrigeration oil on all parts. (b) #5 Pilot Plug may be dirty or eroded (inspect and replace if necessary). Remove #5 Pilot Plug by removing #4 Pilot Seat with a 5,18" socket. (c) #14 Diaphragm may be broken or eroded (inspect and replace if necessary). (d) #14 Diaphragm may not be receiving downstream pressure. In the case of an A9E external equalized regulator, the pipe leading to a downstream source may be blocked by dirt or a closed valve. In the case of an A9 internally equalized regulator, passage P may be blocked by dirt.

2. Failure to open: (a) #10 Piston or #12 Piston Plug may be jammed due to excessive dirt. This is the most likely cause of not opening; to correct, see 1 (a) above. (b) #17 adjusting stem may be turned out so far that a lower downstream pressure may be required to open the regulator than can be created by the system. (Turn in the #17 adjusting stem.) (c) #2 Diaphragm Range Spring may be the improper range for the pressure setting desired. This most likely to occur when range B regulator is supplied. To correct, change #2 Spring. (d) In case of regulator with electric shut-off the solenoid may not be energized or coil may be burned out. Check electrical circuit to make sure the solenoid is energized and drawing current. Replace #29 Coil if necessary.

3. Failure to close: (a) #10 Piston or #12 Piston Plug may be jammed due to excessive dirt. This the most likely cause of not closing, to correct, see 1 (a). (b) #17 adjusting stem may be turned in so far that a higher pressure is opening the regulator than is desired in the system. (Turn out #17 adjusting stem until the regulator closes at the desired pressure.) (c) #2 Diaphragm Range Spring may be the improper range for the pressure desired. (Change #2 Diaphragm Spring.) (d) #5 Pilot Plug may be dirty or eroded (inspect and replace if necessary); see 1 (b). (e) #14

Diaphragm may be broken or eroded (inspect and replace if necessary); see 1 (c), (f) In case of regulator with solenoid shut-off the regulator should close when the solenoid coil is de-energized. Check electrical circuit to make sure no power is applied to the solenoid coil. Remove solenoid tube and check seat for damage. Replace internal parts using #27 Solenoid Repair Kit if necessary.

4. Hunting: Under light load conditions, a system may hunt. Unless the hunting is adversely affecting temperatures or bothering the performance of the equipment, the hunting itself should be ignored. If very serious, the matter should be looked into further.

The Hot Gas Bypass Regulators is sometimes blamed if the system seems to hunt. The A9E regulator was especially designed with a characterized plug to give controlled flow over its entire hot gas flow range. For this reason, we suggest that the other elements and control valves in the system be critically examined if there appears to be intolerable hunting.

The following action is recommended: (a) If bypass with liquid injection is used, refer to BYG Bulletin for correct TXV size. (b) Examine TXV's; are they operating below 50% of capacity? If so, use one of the methods recommended by TXV manufacturers for this type operation. (c) Increase superheat of TXV liquid injection valve by adjusting, or installing new charge. (d) Wrap bulb to dampen action of TXV liquid injection valve. (e) Check location of entrance of external equalizer connection to suction line in relation to TXV liquid injection bulb location. (f) If hot gas side inlet type of distributor is used, determine whether it is properly selected. (g) If "T" is used between main TXV and distributor for hot gas input, limit bypass tonnage to one-third of capacity of distributor. (h) Check with TXV manufacturer for proper TXV charge. (i) Determine if the A9E used for the job is oversized for the actual maximum load conditions, if so, use a smaller capacity plug. Piston plugs #12 are interchangeable on all sizes of A9 type regulators.

ELECTRICAL

The Refrigerating Specialties Division molded water resistant Class "H" 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. By definition, Class "H" coil construction will permit coil temperatures, as measured by resistance method, as high as 185°C (386°F). Final coil temperatures are a function of both fluid and ambient temperatures.

A solenoid coil should never be energized except when mounted on its corresponding solenoid tube.

The molded Class "H" coil is available from 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 Model PLT-2. See Bulletin No. 60-20.

The solenoid coil must be connected to electrical lines with volts and Hertz same as marked on 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 burnout. Also, operating with line voltage below the limit will definitely result in lowering the valves maximum opening pressure differential. Power consumption during normal operation will be 11 watts or less. On transformer coils the 6 volt leads are always black.

SAFE OPERATION (See Bulletin RSBCV)

People doing any work on a refrigeration system must be qualified and completely familiar with the system and the valves involved, or all other precautions will be meaningless. This includes reading and understanding pertinent product bulletins and the current Bulletin RSB prior to installation or servicing work.

WARRANTY

All Refrigerating Specialties Products are warranted against defect in workmanship and materials for a period of one year from date of shipment from the factory. This warranty is in force only when products are properly installed, 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.

| | DIM A | | DIM B | |
|-------|--------|-----|--------|----|
| | inches | mm | inches | mm |
| 3/8 | 5.25 | 133 | 0.5 | 13 |
| 5/8 | 5.25 | 133 | 0.5 | 13 |
| 7/8 | 6.19 | 157 | 0.75 | 19 |
| 1-1/8 | 6.87 | 175 | 0.94 | 24 |

