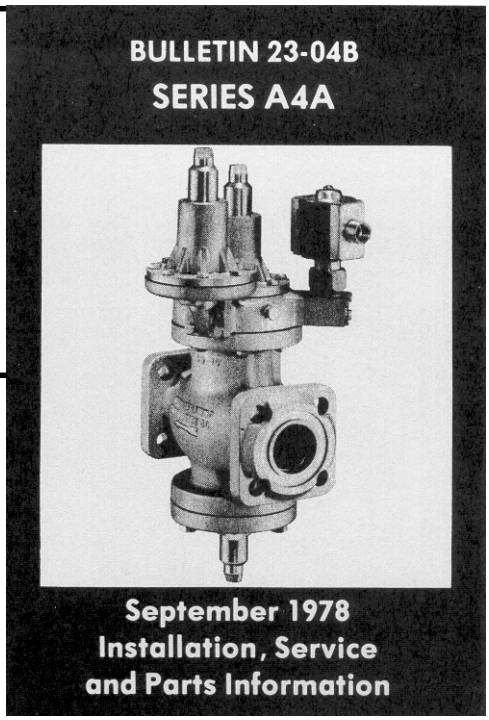
ADAPTOMODE®
PRESSURE REGULATORS
Series A4A
Port Size 20 mm - 100 mm (3/4" - 4")
FOR AMMONIA, R-12, R-22, R-502
OTHER REFRIGERANTS AND OIL



FEATURES
Unique Modular construction • Interchangeable parts • Many control variations are possible with the use of a few Modules and kits • All common variations have no external piping.

Pilot operated characterized V-Port for precise control • 21 kg/cm² (300 psig) maximum rated pressure (MRP) • Suitable for all common refrigerants and oil.

Flanges for threaded or welded iron pipe and copper tube • Easy to service • Close-coupled strainers.

INDEX **PAGES**

A4A Inlet Pressure Regulator 2, 3, 4
A4AE Inlet Pressure Regulator, Remote Sensing Connection ... 2, 3, 4
A4AK Reseating Relief Regulator 2, 3, 4
A4AL Differential Pressure Regulator 2, 3,4
A4AO Outlet Pressure Regulator 2, 3, 5
A4AOE Outlet Pressure Regulator, Remote Sensing Connection 2, 3, 5
A4AOS Outlet Pressure Regulator With Electric Shut-Off 5, 6, 7
A4AOM Electrically Compensated Outlet Pressure Regulator 5
A4AS Inlet Pressure Regulator With Electric Shut-Off 6, 7
A4AB Inlet Pressure Regulator With Electric Wide Open Variation 6, 8
A4AD Dual Inlet Pressure Regulator 6, 8
A4AM Electrically Compensated Inlet Pressure Regulator 2, 3, 9
A4AP Pneumatically Compensated Inlet Pressure Regulator With 1:1 Ratio 2, 3, 9
A4A3P Pneumatically Compensated Inlet Pressure Regulator With 3:1 Ratio 9, 10
A4AT Direct Acting Temperature Regulator 9, 10
A4AOT Reverse Acting Temperature Regulator 5, 10

INSTALLATION
All regulators are packed for maximum protection. Unpack carefully. Check the carton to make sure all flanges and other items are unpacked. Save the enclosed instructions for the installer and eventual user.

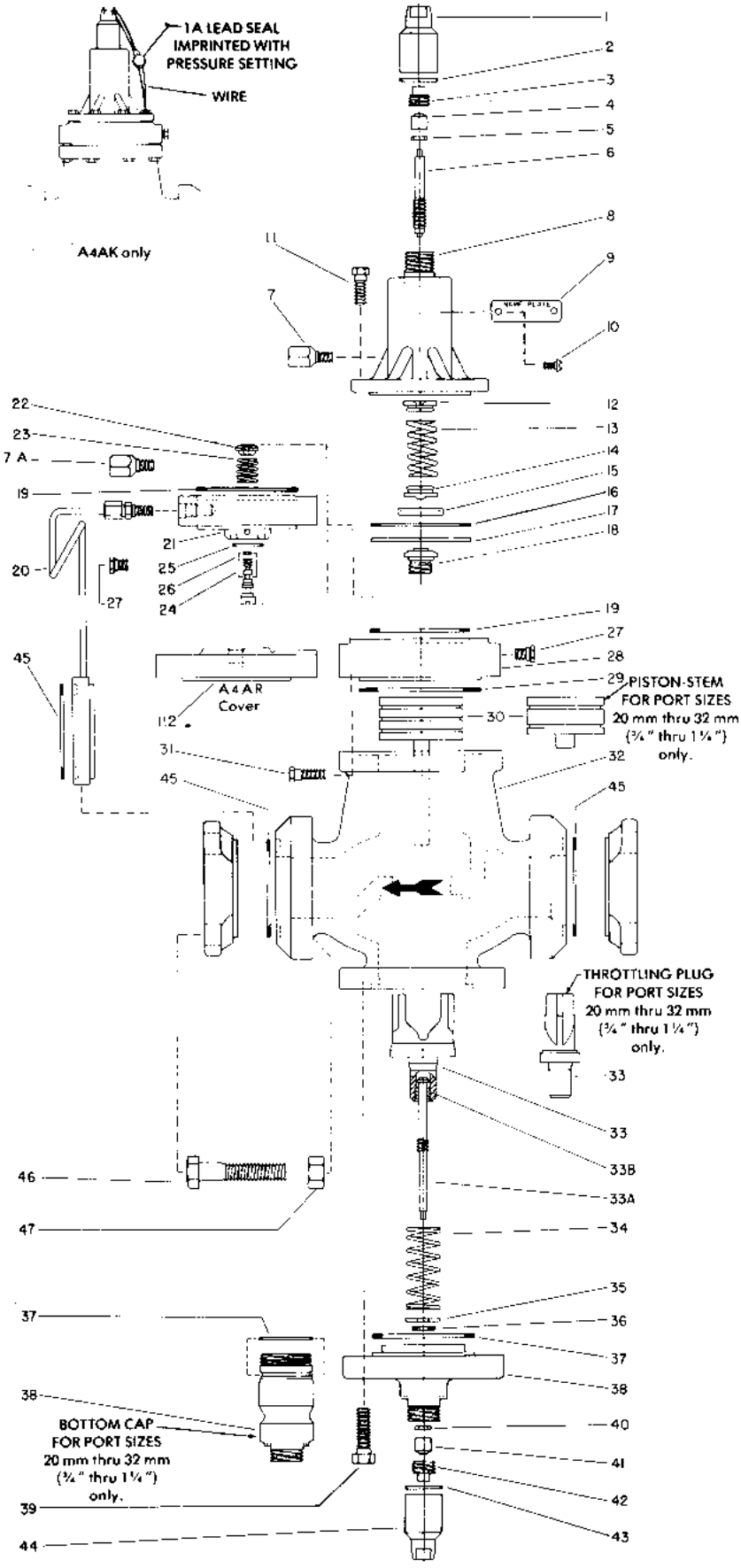
Do not remove the protective coverings from the inlet and outlet of the regulator until the regulator is ready to be installed. Protect the inside of the regulator from moisture, dirt and chips before and during installation. When welded or brazed flange connections are used, all slag, scale and loose particles should be removed from the flange interior before the regulator is installed between the flanges. It is advisable to install a close-coupled companion strainer (RSF) at the inlet of the regulator to help protect it from any foreign material in the system.

The A4A series of regulators will give optimum performance if mounted in a horizontal line in a vertical position with the manual opening stem on bottom. Where other positions are desired, the factory should be consulted; please give application and piping details. The regulator must be installed with the arrow on the valve body pointing in the direction of the fluid flow for the regulator to function properly. Backward flow through the regulator is uncontrolled and will vary with the valve model and the reverse pressure drop encountered.

Tighten the flange bolts and nuts evenly to provide proper seating of the flange gasket and to avoid damage to gaskets of flanges. (See Flange Bolt Torque Table, p. 12) Avoid using the regulator flange bolts to stretch or align pipe. Even the heavy duty semi-steel body of an A4A can be distorted, causing the precision parts to bind.

The regulator should be installed in a location where it is easily accessible for adjustment and maintenance. The location should be such that the regulator can not be easily damaged by material handling equipment. When it is necessary to insulate the regulator (and companion strainer), the insulation should be installed to provide access to the regulator (and companion strainer) for adjustment and maintenance. Proper indicating gauges should be installed to be easily visible to the operating engineer for system checking and adjusting purposes.

Where a modular pilot solenoid or electric motor is used, it must be connected to a circuit of the same voltage and frequency (Hz) as printed on the nameplate of the solenoid or motor. All wiring and power sources (such as transformers) must be adequate to supply full voltage to the coil or motor at all times. A Flange Ring-Tube Assembly is furnished with each Type A4AO (Outlet) and Type A4AL (Differential) Regulator for easy field connection of outlet pressure to the regulator.



A4A, A4AK, A4AL, A4AE, A4AO
FIG. 1

DISASSEMBLY & ASSEMBLY

Refer to the exploded view (Fig. 1) for parts discussed in this section.

Before disassembling or assembling any A4A type regulator, read the information in this bulletin and Bulletin RSB, Safety Procedures for Refrigerating Specialties Division Refrigeration Control Valves.

Before a regulator is removed from the line or disassembled in the line, make sure that all refrigerant has been removed from the regulator, including the bonnet where applicable, and the close-coupled strainer. 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 33A must be turned all the way out (counter-clockwise) to make sure the valve is open.

ALL A4A REGULATORS GENERAL PROCEDURE

The construction of the regulator and the method of disassembly are relatively simple, but some procedures must be followed to avoid damage. The following describes the procedure for the basic A4A; special instructions for other styles will be included in other appropriate sections.

Disassembly - Take care when removing Seal Caps 1 and 44 in case some refrigerant may be trapped inside. Back the Adjusting Stem 6 all the way out to remove any pressure from Range Spring 13 otherwise damage to Diaphragm 17 or Pilot Seat 18 may occur. Remove Bonnet 8 by carefully removing Cap Screws 11. Take care not to damage Diaphragm Follower 15. Remove Adapter 28 by removing Cap Screws 31. Turn the Manual Opening Stem 33A all the way in until the flats on the stem barely protrude from the stuffing box nut. Push Piston 30 down against the spring force. The piston should move freely down and be returned by the spring force. If the piston is jammed or sticky, remove Bottom Cap Assembly which includes Items 33 through 42 by removing Cap Screws 39 or unscrewing Bottom Cap, 20mm through 32mm (3/4" through 1-1/4"). Using a hard wood dowel rod inserted through the bottom of the valve, tap the piston upward and out. Thoroughly clean all parts. If jamming has taken place and the piston and bore are scored, remove all burrs by polishing the piston, bore and throttling plug with fine crocus cloth. Inspect the seating area of the Throttling Plug 33 for damage or erosion. If damaged it should be replaced. It would be advisable to replace the entire bottom cap assembly. Inspect all gaskets and "O" rings for damage and replace where necessary.

Assembly - When reassembling the valve, all internal parts should be clean, dry and lightly oiled with refrigerant oil, except “O” rings. Apply silicone grease to the “O” rings. Care must be taken especially when the parts are cold since moisture can condense on parts and cause rapid rusting. When replacing gaskets, they should be oiled very lightly with refrigerant oil before assembly. Install bottom cap assembly first and tighten in place. Carefully replace the piston; never try to force it in place. Align the Adapter Gasket 29 carefully with the proper holes in the adapter and valve body and fasten adapter in place. Before assembling the bonnet be sure the Adjusting Stem 6 is turned all the way out and that the Bonnet 8 and Diaphragm Follower 15 are properly aligned, otherwise damage

PARTS LIST #1 – COMMON PARTS – (Figure 1)															
Item	Description	Part No.	Qty.	Item	Description	Part No.	Qty.	Item	Description	Part No.	Qty.	Item	Description	Part No.	Qty.
1	Seal Cap	20-4005-00	1	8, 16	Bonnet	20-4044-11K	1	11	Screw Bonnet A4AO,			15	Diaphragm Follower	20-1092-00	1
	Seal Cap A4AK only	20-4005-01	1		Bonnet A4AP, A4AL,				A4A3P	90-1000-61	8	16	Bonnet Gasket	81-1001-35	1
1A	Wire & Seal A4AK only	93-1001-21	1		A4A3P	20-4044-12K	1	12	Spring Rest,				Bonnet Gasket A4AP &		
2	Gasket, Seal Cap	81-1000-12	1	9	Nameplate	20-4100-01	1		Upper Range A&V	40-1025-00	1		A4AL	81-1001-47	1
3	Nut, Stuffing Box	20-1080-00	1		Nameplate for field				Range D	20-4018-00	1	17	Diaphragm, Range		
4	Packing Ring	20-1077-00	1		conversion	20-4100-00	1	13	Spring, Range A & V	80-1001-15	1		A & V	20-1087-04	1
5	Packing Washer	20-1084-00	1	10	Screw, Name Plate	90-1000-23	2		Spring, Range D	80-1001-16	1		Diaphragm, Range D	20-1087-04	2
6	Adjusting Stem	20-4007-00	1	11	Screw Bonnet	90-1000-57	8	14	Spring Rest,			16,	Diaphragm Kit		
7	Fitting, Bonnet A4AL only	20-4110-00	1		Screw, Bonnet A4AK	90-1000-57	7		LowerRange A & V	40-1026-00	1	17,	Range A & V	21-0103-00K	1
7A	A4AOEonly	30-1017-00	1		Screw, Bonnet A4AK	20-4101-00	1		Range D	20-4017-00	1	19	Range D	21-0103-01K	1

PARTS LIST #2-BASIC REGULATORS-(Figure 1)																					
Item	Description	20 m. (3/4")	Qty	25 mm (1")	Qty	32 mm (1-1/4")	Qty	40 mm (1-5/8")	Qty	50 mm (2")	Qty	65 mm (2-1/2")	Qty	75 mm (3")	Qty	100mm (4")	Qty
1-6,8-17	Bonnet Assy. See Parts List #1																
18,16,	Pilot Seat Range A & D	20-0415-01K	1	20-0415-01K	1	20-0415-01 K	1	20-0415-01K	1	20-0415-01K	1	20-0415-02K	1	20-0415-02K	1	20-0415-02K	1
19 ①⑤	Range V (Vacuum Cartridge VC)	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1
19	Gasket, Adapter	81-1000-19	1	81-1000-19	1	81-1000-19	1	81-1000-19	1	81-1000-19	1	81-1000-19	1	81-1000-19	1	81-1000-19	1
20	Fig. Ring-tube Asmbly. A4AOT	20-0419-06	1	20-0419-06	1	20-0419-07	1	20-0419-08	1	20-0419-08	1	20-0419-09	1	20-0419-10	1	20-0419-11	1
20, 45	" " " " A4AO, A4AL	20-0419-00K	1	20-0419-00K	1	20-0419-01K	1	20-0419-02K	1	20-0419-02K	1	20-0419-03K	1	20-0419-04K	1	20-0419-05K	1
21-27, 19	A4AO Pilot Assembly	20-0989-00K	1	20-0989-00K	1	20-0989-00K	1	20-0989-00K	1	20-0989-00K	1	20-0989-01K	1	20-0989-01K	1	20-0989-01K	1
21	Adapter, A4AO	20-4046-11	1	20-4046-11	1	20-4046-11	1	20-4046-11	1	20-4046-11	1	20-4046-11	1	20-4046-11	1	20-4046-11	1
22	Spring Nut	20-4088-00	1	20-4088-00	1	20-4088-00	1	20-4088-00	1	20-4088-00	1	20-4088-00	1	20-4088-00	1	20-4088-00	1
23	Spring, Pilot Plug	80-1001-28	1	80-1001-28	1	80-1001-28	1	80-1001-28	1	80-1001-28	1	80-1001-28	1	80-1001-28	1	80-1001-28	1
24-26	Valve Plug Repair Kit	21-0104-02K	1	21-0104-02K	1	21-0104-02K	1	21-0104-02K	1	21-0104-02K	1	21-0104-03K	1	21-0104-03K	1	21-0104-03K	1
24	Pilot Plug	—		—		—		—		—		—		—		—	
25	"O" Ring, Seal	93-1001-15	1	93-1001-15	1	93-1001-15	1	93-1001-15	1	93-1001-15	1	93-1001-15	1	93-1001-15	1	93-1001-15	1
26	"O" Ring, Pilot Plug	93-1000-51	1	93-1000-51	1	93-1000-51	1	93-1000-51	1	93-1000-51	1	93-1000-51	1	93-1000-51	1	93-1000-51	1
27	Gauge Port Pipe Plug	92-1000-13	1	92-1000-13	1	92-1000-13	1	92-1000-13	1	92-1000-13	1	92-1000-13	1	92-1000-13	1	92-1000-13	1
28, 19, 29	Adapter, Body	20-1091-21K	1	20-1091-21K	1	20-1090-21K	1	20-1123-21K	1	20-1123-21K	1	20-1018-11K	1	20-1105-21K	1	20-1106-21K	1
29	Gasket, Adapter	81-1000-76	1	81-1000-76	1	81-1000-41	1	81-1000-22	1	81-1000-22	1	81-1001-02	1	81-1001-54	1	81-1000-34	1
	Gasket, Adapter A4AE Only	81-1000-75	1	81-1000-75	1	81-1000-40	1	81-1000-21	1	81-1000-21	1	81-1001-01	1	81-1001-53	1	81-1000-33	1
30, 29	Piston-Stem	20-4040-00K	1	20-4040-00K	1	20-4056-00K	1	20-4011-01K	1	20-4011-01K	1	20-0411-02K	1	20-0411-03K	1	20-0102-15K	1
31	Screw, Adapter	90-1000-60	8	90-1000-60	8	90-1000-58	8	90-1000-58	8	90-1000-58	8	90-1000-58	8	90-1001-18	6	90-1001-18	6
	Screw, Cover, A4AR	90-1000-60	8	90-1000-60	8	90-1000-58	8	90-1000-65	8	90-1000-65	8	90-1000-65	8	90-1001-17	6	90-1001-18	6
32, 45	Valve Body	20-4086-11K	1	20-4086-11K	1	20-1100-14K	1	20-1149-01K	1	20-1149-01K	1	20-1015-11K	1	20-1023-11K	1	20-1041-12K	1
33-33B	Throttling Plug Ass'y.	20-0410-00K	1	20-4010-01K	1	02-0410-02K	1	20-0410-03K	1	20-0410-04K	1	20-0410-05K	1	20-0410-06K	1	20-0410-13K	1
	A4AK	20-0412-00K	1	20-0412-01K	1	20-0412-02K	1	20-0410-03K	1	20-0410-04K	1	20-0410-05K	1	20-0410-06K	1	20-0410-13K	1
33	Throttling Plug	—		—		—		—		—		—		—		—	
33A	Manual Opening Stem	—		—		—		—		—		—		—		—	
33B	Stem Nut	—		—		—		—		—		—		—		—	
34	Spring, Closing	80-1001-32③	1	80-1001-32③	1	80-1001-33④	1	80-1001-35	1	80-1001-35	1	80-1001-36	1	80-1001-37	1	80-1000-35	1
35	Dirt Wiper Retainer	20-4067-00	1	20-4067-00	1	20-4067-00	1	20-4080-00	1	20-4080-00	1	20-4080-00	1	20-4085-00	1	20-4109-00	1
36	Dirt Wiper	20-4042-00	1	20-4042-00	1	20-4042-00	1	20-4042-00	1	20-4042-00	1	20-4042-00	1	20-4084-00	1	20-4084-00	1
37	Seal, Bottom Cap	93-1000-79	1	93-1000-79	1	93-1000-79	1	81-1000-15	1	81-1000-15	1	81-1000-15	1	81-1000-08	1	81-1000-17	1
38, 37	Bottom Cap	20-4043-00K	1	20-4043-00K	1	20-4050-11K	1	20-4050-11K	1	20-4050-11K	1	20-4050-11K	1	20-4048-11K	1	20-1113-00K	1
39	Screw, Bottom Cap	—		—		—		90-1000-81	6	90-1000-81	6	90-1000-81	6	90-1001-17	6	90-1001-17	6
40	Packing Washer	20-1084-00	1	20-1084-00	1	20-1084-00	1	20-1084-00	1	20-1084-00	1	20-1084-00	1	20-1114-00	1	20-1114-00	1
41	Packing Ring	20-1077-00	1	20-1077-00	1	20-1077-00	1	20-1077-00	1	20-1077-00	1	20-1077-00	1	20-1116-00	1	20-1116-00	1
42	Stuffing Box Nut	20-1080-00	1	20-1080-00	1	20-1080-00	1	20-1080-00	1	20-1080-00	1	20-1080-00	1	20-1129-00	1	20-1129-00	1
43	Gasket, Seal Cap	81-1000-12	1	81-1000-12	1	81-1000-12	1	81-1000-12	1	81-1000-12	1	81-1000-12	1	81-1000-20	1	81-1000-20	1
44	Seal Cap	20-4005-00	1	20-4005-00	1	20-4005-00	1	20-4005-00	1	20-4005-00	1	20-4005-00	1	20-1130-00	1	20-1130-00	1
45	Gasket, Flange②	81-1000-03	2	81-1000-03	2	81-1000-04	2	81-1000-05	2	81-1000-05	2	81-1000-05	2	81-1000-07	2	81-1000-09	2
46	Bolt, Flange	90-1001-14	4	90-1001-14	4	90-1001-11	8	90-1001-20	8	90-1001-20	8	90-1001-35	8	90-1001-35	8	90-1001-32	8
	Bolt, Flange (inlet)																
	A4AO, A4AL, A4AOT Only	90-1001-14	2	90-1001-14		90-1001-11	4	90-1001-20	4	90-1001-20	4	90-1001-35	4	90-1001-35	4	90-1001-32	4
	Bolt, Flange (outlet)																
	A4AO, A4AL, A4AOT Only	90-1001-20	2	90-1001-20	2	90-1001-14	4	90-1001-20	4	90-1001-20	4	90-1001-35	4	90-1001-35	4	90-1001-32	4
47	Nut, Flange	90-1000-02	4	90-1000-02	4	90-1000-02	8	90-1000-02	8	90-1000-02	8	90-1000-05	8	90-1000-05	8	90-1000-060	8
112, 29	Cover, A4AR	20-1010-12K	1	20-1010-12K	1	20-1001-01K	1	20-1003-01K	1	20-1003-01K	1	20-1019-12K	1	20-1005-13K	1	20-1006-12K	1

For flanges available, see Flange Table on page 12. Part numbers with "-K" suffix are Kits which include item numbers shown.

① Chrome plated Pilot Seat standard ② A4AO, A4AL, A4AOT only. Quantity is 3. ③ A4AK is 80-1001-48 ④ A4AK is 80-1001-49. ⑤ Not used with any A4AO or variations.

DISASSEMBLY& ASSEMBLY (cont.)

to the diaphragm and pilot seat may occur. Place Gasket 19 in the slot in the adapter and align Gasket 16 and Diaphragm 17 to the center of bonnet. The raised center of the diaphragm must be towards the bonnet. For range "D" use two diaphragms. Tighten Cap Screws 11 evenly. The ideal tightening torque is 1.5 kg-m (11 ft.-lbs.). Valve is now ready to be adjusted for normal operation.

If close-coupled strainer is used, it may be cleaned before putting the valve back in operation. The regulator must be tested for leaks with refrigerant gas or other appropriate gas before the system is put into operation.

A4A

After the General Procedure for disassembly, inspect the Pilot Seat 18 top seating surface for dirt, wear or damage. Remove seat from valve body and clean, lap on a flat plate or replace as necessary. Examine the diaphragm region which contacts the seat surface, look for dirt, heavy scratches or corrosion. If the diaphragm cannot be easily wiped clean, it should be replaced. Reassemble the regulator following the General Procedure.

A4AP, A4A3P and A4AL

Remove the sensing tube connection which is part of the Flange Ring tube Assembly 20 attached to the bonnet (A4AL) or the external pneumatic connection to the bonnet (A4AP or A4A3P). Disassemble following the General Procedure. Check the seat and diaphragm as for A4A. Check the parts inside the bonnet for dirt, moisture or corrosion, especially on the outside diameter of the diaphragm follower. If the source of dirt, moisture or corrosion cannot be eliminated, it may be advisable to install and maintain a filter-drier in the sensing line to the bonnet. Reassemble the regulator as described in the General Procedure and connect the sensing tube.

A4AK

For disassembly and assembly follow the General Procedure and the procedure for A4A. This regulator has a sealed wire connection to keep the seal cap from being removed. This wire must be removed before the regulator can be disassembled. **Please Note: Removal of the seal voids any Refrigerating Specialties Division factory responsibility for the regulator pressure set-point.**

A4AO and A4AOE

Remove the sensing tube connection which is part of the Flange Ring tube Assembly 20 (A4AO) or the external sensing connection to the adapter 7A (A4AOE). Disassemble following the General Procedure. Remove the A4AO adapter. Disassemble the Pilot Plug 24 and Spring 23 by inserting a screwdriver in the slot in the bottom of the pilot plug and turning the Spring Nut 22 with a wrench. Inspect the pilot plug and the matching surface on the Adapter 21 for dirt and damage. Clean, lap in place or replace as needed. Assemble new “O” Ring 26 to the pilot plug and carefully insert the assembly into the adapter. Reassemble the pilot plug, spring and spring nut. Replace “O” Ring 25. Reassemble regulator following the General Procedure.

A4A INLET PRESSURE REGULATOR

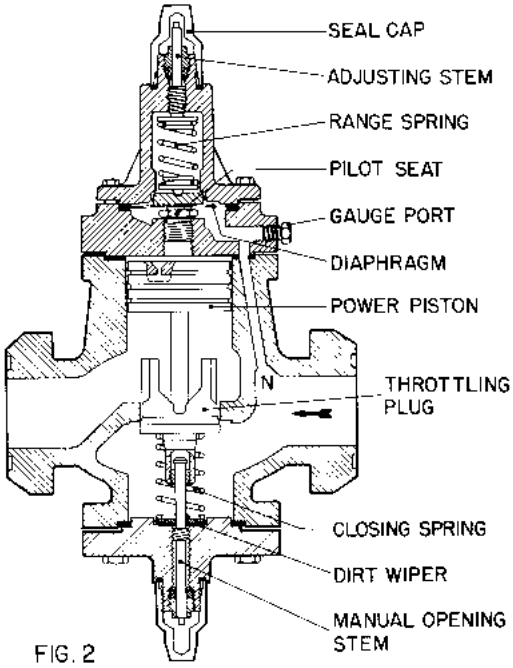
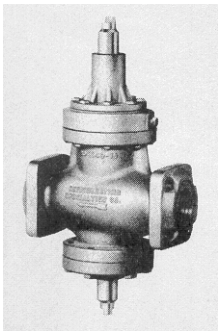


FIG. 2

OPERATION



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 the pilot seat allowing pressure to enter on top of the power piston. This causes the power piston to move downward forcing the throttling plug to open and modulate to maintain constant inlet pressure. Increase in inlet pressure lifts the diaphragm further, allowing more pressure on top of the power piston and opening the valve wider. Decrease in inlet pressure causes the diaphragm to move closer to the pilot seat reducing the pressure on top of the piston and causing the closing spring to reduce the valve opening. The pressure on top of the power piston is controlled by the flow through the pilot seat and the bleed off through a bleed hole in the power piston and through the clearance between the piston and the cylinder. A maximum of 0.14 bar (2 psi) pressure drop across the valve is required to open it fully.

The A4A Inlet Pressure regulator therefore opens on a rise in the inlet pressure above its set point and closes on a drop in inlet pressure below its set point. The inlet pressure set point is not appreciably affected by variations in the outlet pressure.

MANUAL OPENING STEM

All Type A4A Regulators are provided with a manual opening stem. To open the regulator manually, back the stem out (turn counter-clockwise) until it stops. To put the regulator into automatic operation, turn the stem in (clockwise) until only the flats on the stem protrude from the stuffing box nut.

ADJUSTMENT

Install an accurate pressure gauge in the gauge port. Back the adjusting stem all the way out to stop. This will reduce the set point to its lowest level and cause the valve to open wide. Start the system, and when suction pressure is about the desired pressure, turn the adjusting stem in until the pressure gauge shows a slight rise in the 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.

INLET PRESSURE SETTING RANGES

Set Point Ranges	Approx. Pressure Change per Turn of Adjusting Screw
A: 0 to 11 bar (0 to 150 psig)	1.8 bar (25 psi)
V: 500 mm hg to 8 bar (20 in hg to 120 psig)	1.8 bar (25 psi)
D: 5 to 20 bar (75 to 280 psig)	3.7 bar (53 psi)

A4AE INLET PRESSURE REGULATOR, REMOTE SENSING CONNECTION

This regulator allows control of upstream pressure at a point remote from the regulator inlet. The Adapter 28 is rotated one bolt hole to block the flow through passage N to under the diaphragm. The sensing pressure from the desired control point, upstream of the regulator, is connected to the gauge port leading to under the diaphragm. Thus the regulator will control the pressure at this point. The regulator operation and adjustment is the same as for A4A.

A4AK RESEATING RELIEF REGULATOR

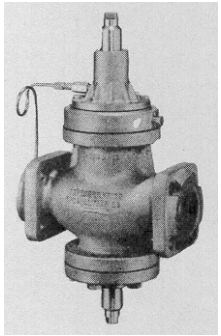
This regulator is adjusted at the factory for a given inlet pressure relief setting. The seal cap is wired to a bonnet cap screw and the wires are sealed with a lead seal. The relief pressure setting is stamped on the seal. **Breaking or removal of the seal voids the factory responsibility for the relief pressure setting of the regulator.**

The operation and other construction features are similar to A4A, except that sizes 20mm (3/4") through 32mm (1-1/4") use a teflon seat in the throttling plug.

Because of slight leakage tolerance, this regulator is not intended for use as a system relief regulator to the atmosphere, but rather to a lower pressure section of that system. Because of large diaphragm to seat area ratio, setting is affected only slightly by outlet pressure.

This regulator is often used as a defrost pressure relief regulator.

A4AL DIFFERENTIAL PRESSURE REGULATOR



When it is desired to control the differential pressure between the regulator inlet and outlet, this regulator is necessary. The outlet pressure is introduced through a sensing tube, which is part of the Flange Ring-tube Assembly 20, from the outlet of the regulator into the bonnet and to the top of the diaphragm, thus allowing the regulator to maintain a differential pressure between the inlet and outlet equivalent to the spring setting.

For adjustment, pressure gauges should be connected to the gauge port at the regulator inlet and also downstream of the regulator. With the system operating, back the adjusting stem all the way out to stop (counter-clockwise) to give minimum differential, which is about 0.14 bar (2 psi). Gradually turn the adjusting stem in (clockwise) until the desired differential pressure is reached, assuming the system is capable of achieving such a differential. Check the differential setting after the system has been in operation for a while and make any minor corrections necessary.

A4AO OUTLET REGULATOR

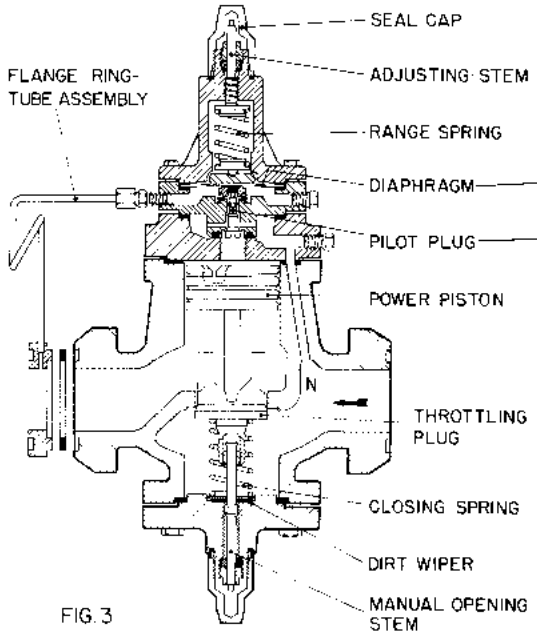


FIG. 3

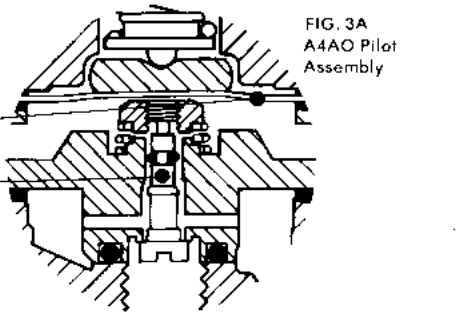
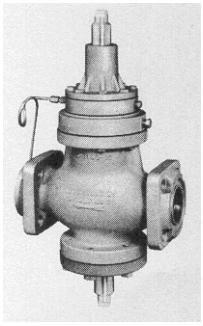


FIG. 3A
A4AO Pilot
Assembly

OPERATION



The outlet pressure is sensed under the diaphragm through the sensing tube, which is part of the Flange Ring-tube assembly. 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 pressure to enter on top of the piston. This causes the power piston to force the throttling plug to open to maintain constant outlet pressure. 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 throttling plug further. An increase in the outlet pressure will lift the diaphragm against the force of the range spring, allowing the pilot plug to start closing. The pressure on top of the power piston is decreased and the closing spring acts to reduce the opening of the throttling plug and the flow of fluid through the regulator. The pressure on top of the power piston is controlled by the flow through the pilot seat and the bleed through a bleed hole in the power piston and through the clearance between the piston and the cylinder. A maximum of 0.14 bar (2 psi) pressure drop across the regulator is required to open it fully.

ADJUSTMENT

Install a pressure gauge at the regulator gauge port in the A4AO Adapter next to the sensing tube. Back the adjusting stem all the way out to stop (counter-clockwise). 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 in the adjusting stem (clockwise) until the desired outlet pressure is reached.

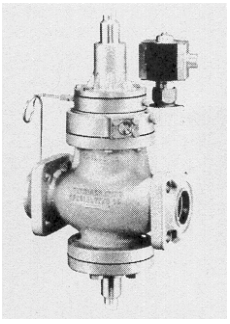
A4AO OUTLET PRESSURE SETTING RANGES

Set Point Ranges	Approx. Pressure Change per Turn of Adjusting Screw
V: 500 mm hg to 8 bar (20 in Hg to 120 psig)	1.8 bar (25 psi)
D: 5 to 20 bar (75 to 280 psig)	3.7 bar (53 psi)

A4AOE OUTLET PRESSURE REGULATOR, REMOTE SENSING CONNECTION

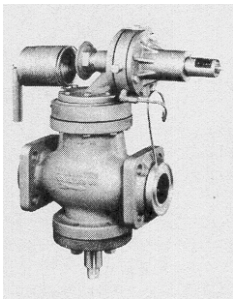
This regulator allows control of downstream pressure at a point remote from the outlet of the regulator. The pressure from the desired sensing point is connected directly to the A4AOE adapter at Fitting 7A in place of the Flange Ring-tube Assembly 20 shown for the A4AO. Thus the regulator will control the pressure at the sensing point. The regulator operation and adjustment is the same as for A4AO.

A4AOS OUTLET PRESSURE REGULATOR WITH ELECTRIC SHUT-OFF



The A4AOS Pressure Regulator controls outlet pressure when the modular solenoid pilot is energized, and closes when the solenoid pilot is de-energized regardless of the pressure setting or pressure in the regulator. The Modudapter® (Fig. 5) is used for this regulator. The pilot solenoid valve is mounted in the location shown for A4AS on page 7.

Adjustment - With the solenoid energized, proceed as with the A4AO.



A4AOT REVERSE ACTING TEMPERATURE REGULATOR

The A4AOT Regulator modulates flow in response to the temperature variations sensed by its thermal bulb. A special temperature pilot replaces the standard A4AO pilot. A drop in temperature will cause the valve to open; a rise will cause it to close. This valve responds only to temperature changes and is not a pressure regulator.

Operation - Temperature change of the controlled medium is sensed by the thermal bulb of the pilot. As the bulb is warmed, the charge in the thermal element expands. The resulting force is transmitted to the pilot plug by a push rod, causing the pilot to close. This in turn causes the main valve to close. A drop in the temperature at the thermal bulb causes the opposite to happen, thus allowing the main valve to open. Standard range is -30°C to +30°C (-20°F to 80°F). Also available 20°C to 60°C (60°F to 140°F). Maximum temperature to which thermal bulb can be exposed is 65°C (150°F).

The A4AOTS Regulator combines the Reverse Acting Temperature Regulator with Electric Shut-Off. It operates the same as the A4AOT when the solenoid pilot is energized, and closes when the solenoid pilot is de-energized regardless of the temperature setting or pressure in the regulator.

A4AOM ELECTRICALLY COMPENSATED OUTLET PRESSURE REGULATOR

This pressure regulator modulates the outlet pressure in accordance to load requirements as sensed by an electric thermostat or humidistat which varies an electric signal applied to a motor mounted on the regulator pilot. The motor operation is as described on Page 9 for A4AM, except the A4AOM operates as an outlet pressure regulator. Available in standard Range V or Range D.

The A4AOMS Regulator combines the Electrically Compensated Outlet Pressure Regulator with the Modular Solenoid Pilot to provide Electric Shut-off (see Page 7 for electric shut-off operation). It operates the same as the A4AOM when the solenoid pilot is energized and closes when the solenoid is de-energized regardless of the pressure setting or the pressure in the regulator.

PARTS LIST #3 BASIC MODULES (Figures 4, 5 and 6)

MODULAR PRESSURE PILOT

Item	Description	Part No.	Qty.
1-19	(Same as in Parts List 1 and 2)	——	—
48	Pilot Body	20-4020-11	1
49	Screw, Pressure Pilot	90-1001-77	4
50	"O" Ring	93-1000-58	2

A2D MODULAR PRESSURE PILOT KIT
(Includes items 1-19 and 48-50)

Kit Type	Range	For Port Sizes	Kit Part No.
A2D2	A	20 to 50 mm (3/4" to 2")	20-0997-00
A2D2	D	20 to 50 mm (3/4" to 2")	20-0997-01
A2D	A	65 & 100 mm (2-1/2" & 4")	20-0997-02
A2D	D	65 & 100 mm (2-1/2" & 4")	20-0997-03

Part Numbers with "-K" suffix are Kits which include items listed in table heading.

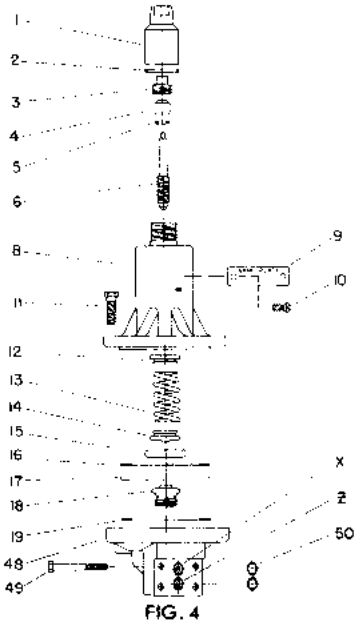


FIG. 4
MODULAR PRESSURE PILOT

MODUDAPTER® AND MODUPLATE

Item	Description	Part No.	Qty.
50	"O" Ring (Small)	93-1000-58	2
51	20 & 25 mm (3/4" & 1" Modudapter	20-4023-11	1
	32 mm (1-1/4") Modudapter	20-4026-11	1
	40 & 50 mm (1-5/8" & 2") Modudapter	20-4027-12	1
	65 mm (2-1/2") Modudapter	20-4028-11	1
	75 mm (3") Modudapter	20-4021-11	1
	100 mm (4") Modudapter	20-4105-11	1
52	Moduplate	20-4022-10	1
53	Screw, Moduplate	90-1001-70	4
54	"O" Ring (Large)	93-1001-17	1

MD MODUDAPTER® KITS
(Includes items 19, 27, 29, 31, same as in Parts List 2, and item 51)

Kit Type	For Port Sizes	Kit Part No.
MD25	20 & 25 mm (3/4" & 1")	20-0993-00
MD32	32 mm (1-1/4")	20-0993-01
MD50	40 & 50 mm (1-5/8" & 2")	20-0993-02
MD65	65 mm (2-1/2")	20-0993-03
MD75	75 mm (3")	20-0993-04
MD100	100 mm (4")	20-0993-10

MP MODUPLATE KIT
(Includes items 50, 52-54)

Kit Type	For Port Sizes	Kit Part No.
MP	20 to 100 mm (3/4" - 4")	20-0482-00K

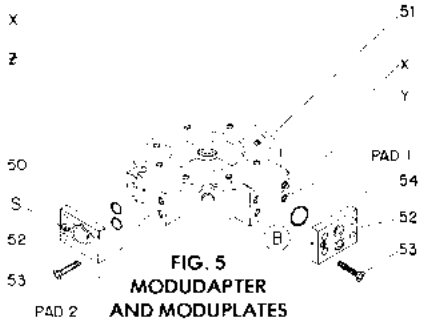


FIG. 5
MODUDAPTER
AND MODUPLATES

MODULAR SOLENOID PILOT

Item	Description	Part No.	Qty.
50	"O" Ring	93-1000-58	2
55	Screw, Coil Housing	90-1001-86	1
56	Solenoid Name Plate	30-1244-01	1
55-57, 59, 60	Coil Housing Assembly	30-0198-00K	1
58	Coil Assembly with Sleeves	30-0041- *	1
59	Screw, End Plate	90-1001-87	2
60	End Plate	30-1243-00	1
61, 62	Bonnet-Tube Assembly	30-0185-00K	1
61A	Tube Nut	——	—
61B	Solenoid Tube	——	—
62	Tube Gasket	81-1000-63	1
63, 62	Plunger-Needle Assembly	30-0158-00K	1
64, 62	Seat Assembly	30-0140-00K	1
65	Solenoid Pilot Body	20-4025-00	1
66	Screw, Solenoid Pilot	90-1001-78	4

S6A MODULAR SOLENOID PILOT KIT
(Includes items 50, 55-66)

Kit Type	For Port Sizes	Kit Part No.
S6A	20 to 100 mm (3/4" to 4")	*20-0998-00

*Must specify volts and frequency.

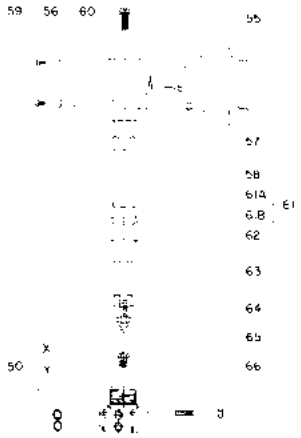


FIG. 6
MODULAR SOLENOID PILOT

BASIC MODULES

DISASSEMBLY AND ASSEMBLY

Refer to the exploded views (Fig. 4, 5 and 6) for parts discussed in this section. Before disassembling or assembling any modules, refer to page 2 of this bulletin and to Bulletin RSB, Safety Procedures for Refrigerating Specialties Division Refrigeration Control Valves. Before disassembly, make sure all refrigerant has been removed from the regulator.

MODUDAPTER® (Fig. 5).

This Adapter 51 is used in place of standard Adapter 28 in Fig. 1, page 2 to allow the use of the modular pilots and is fastened to the Valve Body 32 with Cap Screws 31. To convert an A4A or A4AO Regulator to one with any of the Modular Variations follow the General Procedure for the A4A (pages 1 and 2) and replace the Adapter 28 with the Modudapter. Make sure this Modudapter gauge port is directly lined up with the inlet of the regulator and that Path X is lined up with Passage N in the regulator body (see Fig. 7, page 7). Make sure that the hole in Gasket 29 is lined up with Path X and Passage N. Protect the surfaces of Pads 1 and 2 at all times since these surfaces determine the sealing tightness of the "O" rings.

When the Modudapter is field installed the completely assembled regulator should be leak tested before the system is put into operation.

A2D MODULAR PRESSURE PILOT (Fig. 4 and Fig. 10)

This pressure pilot is used where a dual pressure regulator is desired and is mounted on Pad 2. Follow the disassembly and assembly procedure for the A4A pilot (pages 2 and 3). When mounting the pilot, place the "O" Rings 50 into the proper grooves and tighten the Cap Screws 49 evenly. The ideal tightening torque is 1.1 kg-m (8 ft.-lbs.).

S6A MODULAR SOLENOID PILOT (Fig. 6 and Fig. 12)

This solenoid pilot may be mounted either on Pad 1 or 2, depending on the function desired (see pages 7 and 8). Before working on any solenoid pilot, make sure the coil is de-energized and will remain so.

Disassembly - Remove Coil Housing Screw 55 and pull entire Coil and Housing Assembly, 56 through 60, upward and off of Bonnet-Tube Assembly 61. Carefully remove Bonnet-Tube Assembly. Lift out Plunger-Needle Assembly 63, avoid damaging the needle. Remove Seat Assembly 64 by using a 7/16" (11 mm) wrench. Inspect all parts, clean or replace as needed.

Assembly - Reinstall the Seat Assembly and tighten (no gasket needed). Carefully insert the Plunger Needle Assembly. Replace the Gasket 62 and re-install Bonnet-Tube Assembly. Replace entire Coil and Housing Assembly and tighten Coil Housing Screw. *Make sure the solenoid coil is of the proper voltage and frequency (Hz).*

When mounting the solenoid pilot, place the "O" Rings 50 into the proper grooves and tighten the Cap Screws 66 evenly. The ideal tightening torque is 1.1 kg-m (8 ft.-lbs.).

MODUPLATE (Fig. 5 and Fig. 11)

See pages 7 and 8 showing the use of this plate. Protect the "O" ring surfaces at all times. When mounting the Moduplate, place "O" Rings 50 (or "O" Ring 54) into the proper grooves and tighten the Cap Screws 53 evenly to avoid distortion and assure proper sealing. The ideal tightening torque is 1.1 kg-m (8 ft.-lbs.).

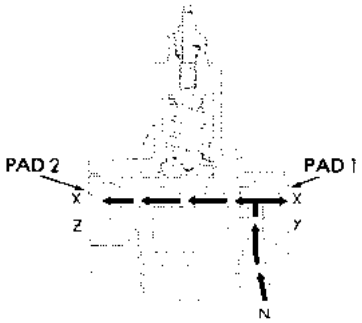


FIG. 7 FLOW PATH X

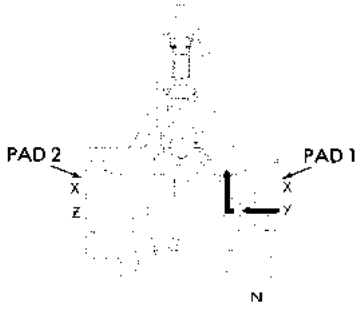


FIG. 8 FLOW PATH Y

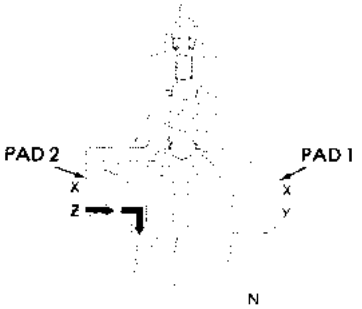


FIG. 9 FLOW PATH Z

MODULE OPERATION

MODUDAPTER (Fig. 5)

The Modudapter uses internal flow paths to eliminate most of the external pilot piping necessary for various regulator functions. These flow paths serve to connect the ports in the two mounting Pads 1 and 2 used for modular pilots.

Flow Path X (Fig. 7) connects directly from Pad 1 to Pad 2 and to the flow Path N from the inlet of the regulator.

Flow Path Y (Fig. 8) connects from Pad 1 to under the diaphragm.

Flow Path Z (Fig. 9) connects from Pad 2 to top of the piston.

The Modudapter is used in place of the regular A4A Adapter for mounting solenoid pilot and pressure pilot for electric shut-off, electric wide-opening or dual pressure variations (see Figs. 13 to 18).

A2D MODULAR PRESSURE PILOT (Fig. 10)

This pilot is used in addition to the integral pilot where a regulator with two pressure settings is required (Fig. 17 and 18 A4AD) and is mounted on Pad 2. Internal construction shown in Fig. 4.

S6A MODULAR SOLENOID PILOT (Fig. 12)

Depending on the functional requirement, this pilot may be mounted either on Pad 1 (for A4AS or A4AD) or Pad 2 (for A4AB). See Figures 13 to 18.

Operation-When the solenoid coil is energized, it forms a magnetic field which pulls the plunger upward striking the needle and lifting it off its seat. This allows flow through the solenoid pilot. When the coil is de-energized, the plunger-needle assembly moves toward the seat and the needle closes to stop the flow through the pilot.

MODUPLATE (Fig. 11)

This plate is used to direct the flow or stop the flow through the flow paths in the Modudapter. When mounted on Pad 2 with the “S” side out, it blocks flow from Path X to Path Z (see Fig. 13 and 14 A4AS). When mounted on Pad 1 with the “B” side out, it allows flow from Path X to Path Y (see Fig. 15 and 16 A4AB).

VARIATIONS-INLET PRESSURE REGULATORS

These regulators use the Adaptomode modules to provide electric shut-off, electric wide-opening and dual pressure variations.

A4AS INLET RESSURE REGULATOR WITH ELECTRIC SHUT-OFF VARIATION

The A4AS Pressure Regulator controls inlet (evaporator) pressure when the solenoid pilot is energized and closes when the solenoid pilot is de-energized, regardless of the pressure setting or inlet pressure. The S6A Modular Solenoid Pilot (Fig. 12) is mounted on Pad 1 of the Modudapter and the Moduplate (Fig. 11) is mounted on Pad 2 with side “S” exposed. The Moduplate acts to stop the flow from Path X to Path Z. See Modudapter flow paths above.

Operation-When the solenoid pilot is electrically energized, the operation is similar to A4A. The inlet pressure is transmitted through Passage N to Path X, through the open solenoid pilot to Path Y. Path Y transmits the pressure to the underside of the diaphragm (see Fig. 13) and the pilot will operate as described for A4A (see page 4). When the solenoid pilot is de-energized, flow to Path Y is closed and pressure can no longer reach the area under the diaphragm and the top of the power piston. This pressure on top of the piston will equalize through the piston bleed hole and the closing spring will close the throttling plug, thus shutting off the flow through the regulator (see Fig. 14).

Adjustment-With the solenoid pilot electrically energized, proceed as with the A4A (see page 4).

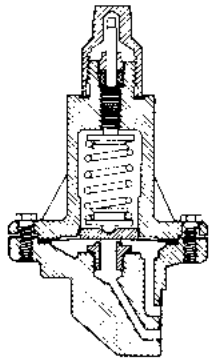
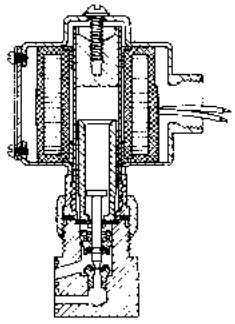

FIG. 10 A2D MODULAR PRESSURE PILOT



FIG. 11 MODUPLATE


FIG. 12 S6A MODULAR SOLENOID PILOT

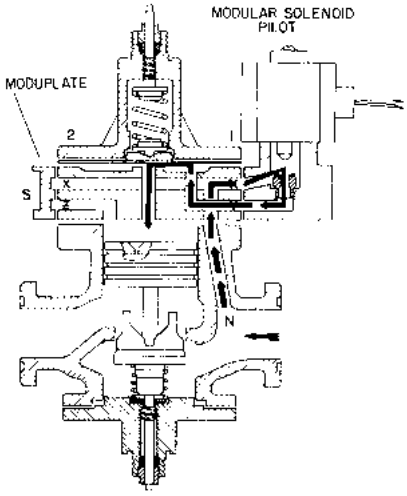


FIG. 13 A4AS SOLENOID ENERGIZED VALVE REGULATES

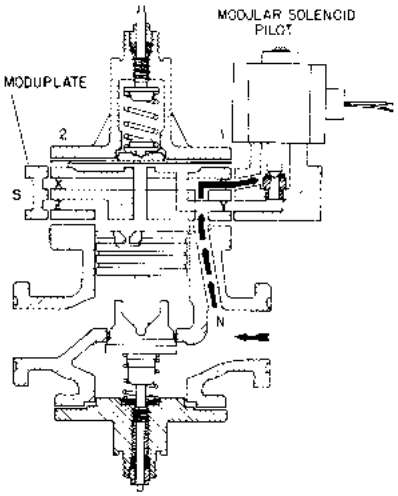


FIG. 14 A4AS SOLENOID DE-ENERGIZED VALVE CLOSED

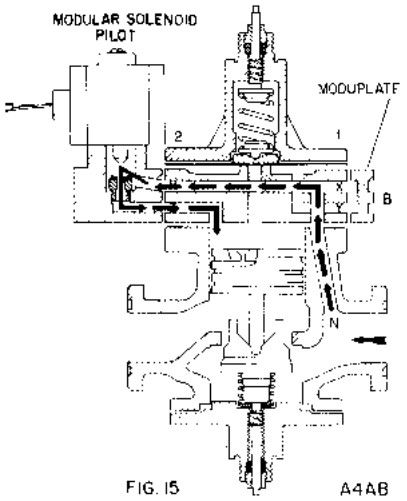


FIG. 15 A4AB

SOLENOID ENERGIZED
VALVE WIDE OPEN

A4AB INLET PRESSURE REGULATOR WITH ELECTRIC WIDE-OPENING VARIATION

The A4AB Pressure Regulator controls the inlet (evaporator) pressure when the solenoid pilot is de-energized and opens wide when the solenoid pilot is electrically energized regardless of the regulator setting. The S6A Modular Solenoid Pilot (Fig. 12) is mounted on Pad 2 of the Modudapter and the Moduplate (Fig. 11) is mounted on Pad 1 with the "B" side exposed. The Moduplate acts to channel the flow from Path X to Path Y. See Modudapter flow paths on page 7.

Operation-When the solenoid pilot is de-energized the operation is similar to A4A. The inlet pressure is transmitted through Passage N to Path X and through the Moduplate to Path Y. Path Y transmits the pressure to the underside of the diaphragm (see Fig. 16) and the pilot will operate as described for A4A (see page 4). When the solenoid pilot is electrically energized the pressure is transmitted through Path X to the solenoid pilot and through the open solenoid pilot to Path Z. Path Z transmits the pressure directly to the top of the piston causing it to open the throttling plug, allowing flow through the regulator (see Fig. 15).

Adjustment-With the solenoid pilot de-energized, proceed as with the A4A. (See page 4.)

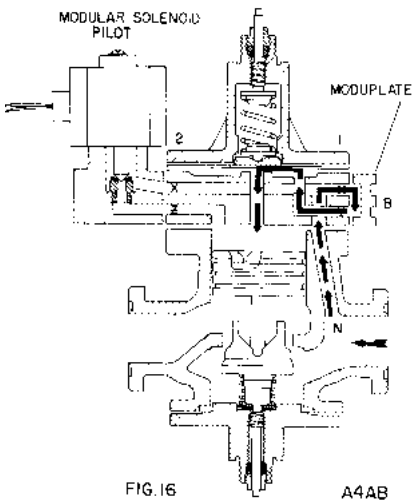


FIG. 16 A4AB

SOLENOID DE-ENERGIZED
VALVE REGULATES INLET
PRESSURE

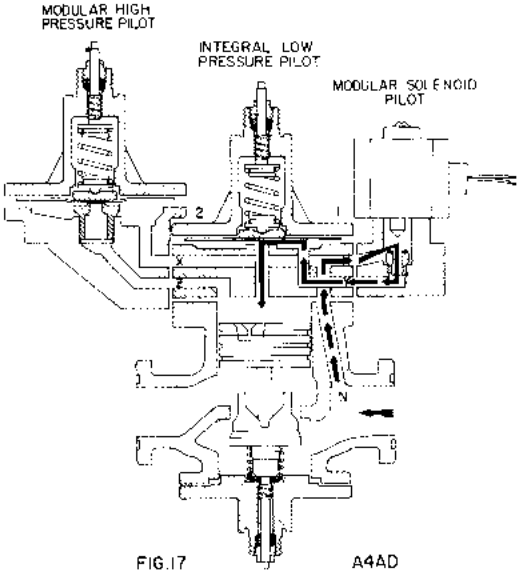


FIG. 17 A4AD

SOLENOID ENERGIZED
LOW PRESSURE PILOT
CONTROLS VALVE

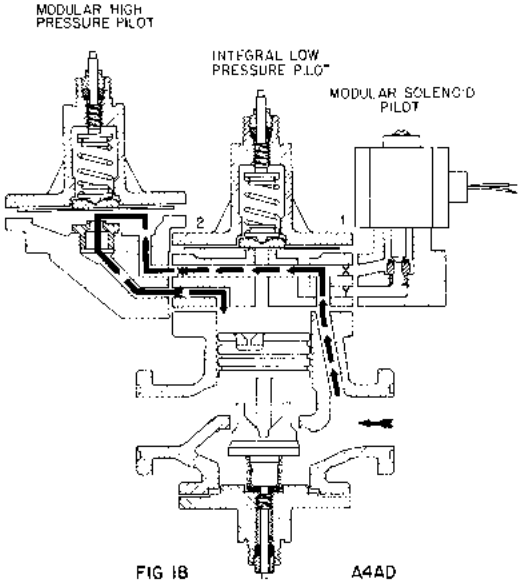


FIG 18 A4AD

SOLENOID DE-ENERGIZED
HIGH PRESSURE PILOT
CONTROLS VALVE

A4AD DUAL INLET PRESSURE REGULATOR

The A4AD Pressure Regulator controls the inlet (evaporator) pressure at either of two pre-set pressures. When the solenoid pilot is energized, the A4AD controls at the lower pressure setting; when it is de-energized, the regulator controls at the higher pressure setting.

The S6A Modular Solenoid Pilot (Fig. 12) is mounted on Pad 1 of the Modudapter; the A2D Modular Pressure Pilot (Fig. 10) is mounted on Pad 2.

The 20 to 32 mm (3/4" to 1-1/4") A4AD Regulator gauge connections require the addition of a 1/4" NPT nipple and coupling to make a 50 mm (2") extension to allow installation of a gauge valve or gauge.

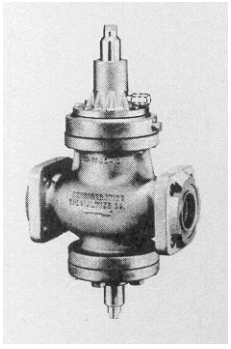
Operation - When the solenoid pilot is de-energized, the Path Y is closed off from Path X and the inlet pressure from Passage N cannot enter the space under the diaphragm of the integral (low pressure) pilot. The inlet pressure is transmitted to the space under the diaphragm of the modular pressure pilot (high pressure) through Path X, and the pilot operates as described for A4A (see page 4). The pressure is transmitted to the top of the piston through Path Z (see Fig. 18) and the regulator operates like an A4A. See Modudapter flow paths on page 7. When the solenoid pilot is electrically energized, the inlet pressure from Passage N is transmitted through Path X through the open solenoid pilot to Path Y. Path Y transmits the pressure under the diaphragm of the integral pressure pilot (low pressure) which will operate the regulator like an A4A (see Fig. 17). The modular pressure pilot is inactive because of its higher pressure setting. Note: On the older A4CD design the pilot locations were reversed, the integral pilot was the high pressure pilot.

Adjustment-De-energize the solenoid pilot and adjust the modular pressure pilot for the desired high pressure setting following the A4A adjusting procedure (see page 4). Energize the solenoid pilot and adjust the integral pressure pilot for the desired low pressure setting following the A4A adjusting procedure (see page 4).

COMPENSATED TYPE INLET PRESSURE REGULATORS

These pressure regulators modulate the inlet (evaporator) pressure in accordance to load requirements as sensed by pneumatic or electric thermostat or humidistat. When supplied with Range D, they also may be used to control condensing pressures: for example, as part of a Heat Reclaim system. In addition to standard versions described, these regulators may be combined with any of the multi-function features by using the modular construction. (See A4AS, A4AB and A4AD.)

A4AP PNEUMATICALLY COMPENSATED INLET PRESSURE REGULATOR



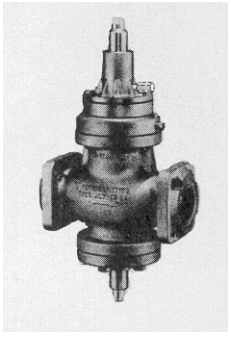
The A4AP Pressure Regulator modulates the inlet (evaporator or condenser) pressure in response to a pneumatic signal applied on top of the pilot diaphragm. The air must be clean, dry and oil free. To avoid the possibility of moisture from the compressed air freezing in the bonnet or in other parts of the control system, dehydrated air supply must be used whenever it may come in contact with temperatures below freezing.

Operation-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. 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. Normally, the controller modulates the air pressure from 3 to 15 psig throughout its control range.

Adjustment-Adjust the controller according to manufacturer's instructions and set it for the desired sensitivity. This sensitivity setting depends on the amount of regulator inlet pressure change necessary to counteract the load change to keep the temperature at the thermostat within the desired limits.

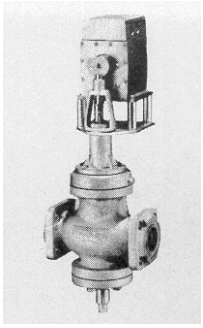
To adjust the pressure regulator, disconnect the air line and, following the procedure described for A4A, adjust the regulator for the lowest inlet pressure desired. This setting represents the lowest inlet pressure the regulator will allow, thus providing a low limit feature to the regulator. Connect the air line. From this point, the inlet pressure will be increased 1 psi for every 1 psi pressure increase the controller applies to the top of the diaphragm. Note that the controller can only increase the inlet pressure (regulator set-point) from the minimum regulator pressure setting. Available in Ranges A, D and V**.**

A4A3P PNEUMATICALLY COMPENSATED INLET PRESSURE REGULATOR



Operation-The A4A3P Pressure Regulator operates like the A4AP Regulator except that it uses a unique multiplier module to cause a 3 psi change in the inlet pressure for every 1 psi change in the air pressure the controller applies to the top of the diaphragm. This causes faster response and provides a potential pressure rise above the low setting 3 times as great as the A4AP Regulator. Example: 45 psi instead of 15 psi.

Adjustment - Same as the A4AP Regulator. Available in Ranges A and V only.



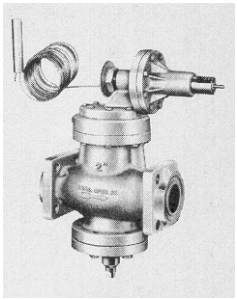
A4AM ELECTRICALLY COMPENSATED INLET PRESSURE REGULATOR

The A4AM Pressure Regulator modulates the inlet (evaporator) pressure in response to an electric signal applied to a motor mounted on the regulator pilot. When supplied with Range D, they also may be used to control condensing pressures. For example, as part of a Heat Reclaim system. When the regulator is used in a location where excessive moisture or corrosive or explosive atmosphere exists, or in low temperature applications where ice could accumulate on the valve stem, the A4AMR with remote pilot can be used. The cover should be kept on the motor at all times to protect it from dust and mechanical damage. No lubrication of the motor is needed.

Operation - The motor will respond to a signal from a suitable potentiometer type of controller, for example, a thermostat. When the temperature at the sensing element changes, the thermostat changes the resistance in the electric circuit. The motor responds immediately to the signal and rotates to rebalance the circuit. This rotation is transmitted through a cam to the valve stem and range spring to change the set-point by changing the spring pressure. Whether used as part of a cooling system to control evaporator pressure, or as part of a Heat Reclaim system to control condensing pressure, an increase in temperature at the thermostat must decrease the spring pressure and lower the inlet pressure and the evaporator or condenser temperature. Normally, the cam rotation is 160° and one minute of time is required for the full rotation. A motor with 240° cam rotation and 1.5 minutes rotation time is available.

Adjustment - Adjust the controller sensitivity to the desired point according to the manufacturer's directions. Open the regulator manually (manual opening stem backed out) and run the system until the temperature at the sensing element reaches the desired level. Adjust the controller (thermostat) setting to a reading which will cause the cam of the motor to rotate and stop in center cam position. Put the regulator back into automatic operation by turning the manual opening stem in. Loosen the pressure adjusting screw lock nut and turn the adjusting screw until the desired inlet pressure for this temperature and load condition is reached. Turning the adjusting screw in will lower the pressure, turning it out will raise the pressure. If after several hours of operation the temperature is not as desired, re-adjust the pressure adjusting screw slightly. Once the desired setting is reached, make sure the lock nut is tightened. The valve will now modulate in response to load variations to maintain constant temperature.

Available in Ranges A, V and D. Honeywell motor has 160° cam rotation which is equivalent to a change in set-point of 4.2 bar (60 psi) for Ranges A or V, or 7.5 bar (106 psi) for Range D; Penn motor has 240° cam rotation which changes set-point 6.3 bar (90 psi) for Ranges A or V, or 11.2 bar (159 psi) for Range D.



A4AT DIRECT ACTING TEMPERATURE REGULATOR

The A4AT Regulator modulates flow in response to the temperature variation sensed by its thermal bulb. A special temperature pilot replaces the standard A4A pressure pilot. A rise in temperature will cause the valve to open; a drop will cause it to close. This valve responds only to temperature changes and is not a pressure regulator.

Operation - Temperature changes of the cooled medium are sensed by the thermal bulb of the pilot. As the bulb is warmed the charge in the thermal element expands, creating an increase in pressure on the element diaphragm. The resulting force pushes a push pin against the pilot diaphragm, lifting it off the seat, allowing inlet pressure to reach the top of the piston of the main regulator, causing the main valve to open. A drop in the temperature at the thermal bulb causes the opposite to happen, closing the main valve.

Adjustment - In addition to the pressure gauge at the inlet, a thermometer is needed in the cooled medium. Set the regulator pilot to the desired temperature by turning the adjusting stem. The temperature scale is only approximate and minor adjustments will be necessary after the system has been in operation for a while to obtain the desired temperature setting. Standard Range is -30°C to +30°C (-20°F to 80°F). Also available: 20°C to 60°C (60°F to 140°F). Maximum temperature to which thermal bulb can be exposed is 65°C (150°F).

BONNET ASSEMBLIES AND KITS

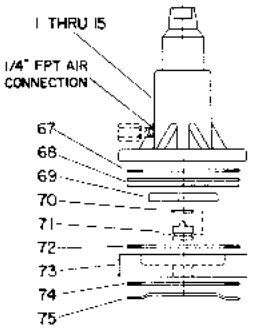


FIG. 19
A4A3P PNEUMATIC BONNET

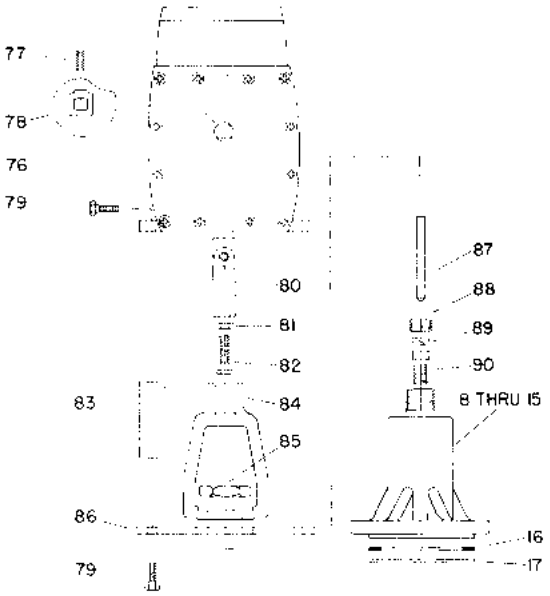


FIG. 20
A4AM MOTOR BONNET

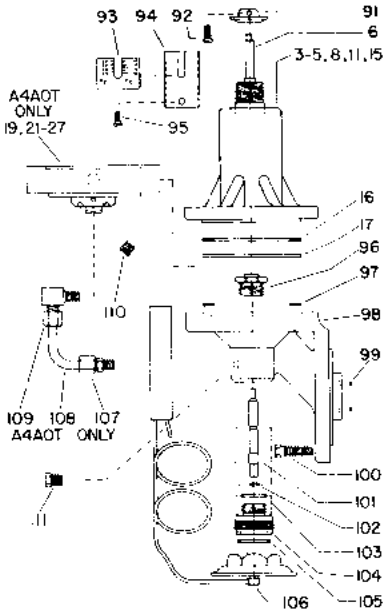


FIG. 21
A4AT, A4AOT TEMPERATURE BONNET

A4A3P PNEUMATIC BONNET (Fig. 19)

Item	Description	Part No.	Qty.
1 thru 15	Bonnet Assy. See Parts List 1, Page 3		
67	Bonnet Gasket	81-1001-62	1
68	Diaphragm	20-4032-00	2
69	Diaphragm Actuator (upper)	20-4030-00	1
70	"O" Ring	93-1000-75	1
71	Diaphragm Actuator (lower)	20-4031-00	1
72	Gasket, Adapter	81-1001-63	1
73,72,74	Adapter, 3P	20-4036-00K	1
74	Gasket, 3P	81-1001-61	1
75	Diaphragm	20-1087-05	1
19,67,68, 72,74,75	Diaphragm Kit	21-0103-04K	1

PK3 PNEUMATIC BONNET KIT (3:1 Ratio)

Converts to 3:1 Pneumatic Compensation (3P) Variation any A4A, A4AO or A2 Series Regulator, Range A. Includes items 2, 4, 7, 8, 11 and 19 (same as in Parts Lists 1 and 2) and items 67-75.

Kit Type	Range	For Port Sizes	Kit Part No.
PK-3	*A	20 to 100 mm (3/4" to 4")	20-0485-00K

*Combine with Vacuum Cartridge Kit VC for vacuum range.

A4AM MOTOR BONNET (Fig. 20)

Item	Description	Part No.	Qty.
8-12, 14, 16	Bonnet Assy.— See Parts List 1, Page 3		
13	Spring, Range A and D	80-1001-15	1
15	Diaphragm Follower, Range A	20-1092-00	1
	Diaphragm Follower, Range D	20-1092-01	1
17	Diaphragm, Range A	20-1087-04	1
	Diaphragm, Range D	20-1087-04	3
76	Motor (Honeywell M944A)	83-1000-44	1
	Motor (Penn M80JAA-2)	83-1000-78	1
77	Cam Lock Screw	90-1001-80	1
78	Motor Cam	20-4087-11	1
79	Motor Mounting Screw	90-1001-70	8
80	Cam Follower Assembly (includes bearing)	20-0416-00	1
81	Lock Nut	90-1000-00	1
82	Pressure Adjusting Screw	90-1000-61	1
83	Mounting Post (Honeywell)	20-1174-00	4
	Mounting Post (Penn)	20-1174-01	4
84	Guide Post	20-4037-00	1
85	Guide Post Locknut	20-4038-00	1
86	Mounting Plate	20-4093-00	1
87	Actuating Stem	20-4006-00	1
88	Stuffing Box Nut	20-1080-00	1
89	Packing Ring	20-4092-00	1
90	Stem Insert	20-4035-00	1

MB MOTOR BONNET KIT

Converts to Electric Compensation (M) Variation any A4A or A2 Series Regulator, Range A. (Not for A4AO) Includes items 8 and 11-17 (same as in Parts List 1), and items 76-90.

Kit Type	Range	For Port Sizes	Kit Part No.
MBH	A	20 to 100 mm (3/4" - 4") with Honeywell Motor	83-1000-44K
MBP	A	20 to 100 mm (3/4" - 4") with Penn Motor	83-1000-78K

Order transformer as a separate item; specify primary voltage.

Part Numbers with "-K" suffix are kits which include item numbers shown.

A4AT, A4AOT TEMPERATURE BONNET (Fig. 21) Low range: —30° to 30°C (—20° to 80°F); High range: 20° to 60°C (60° to 140°F)

Item	Description	Part No.	Qty.
3-5, 8-11, 15	Bonnet Assy.— See Parts List 1, Page 3		
6	Adjusting Stem	20-4007-01	1
12	Spring Rest, Upper		
	Low Temp. Range	40-1025-00	1
	High Temp. Range	20-4018-00	1
13	Spring		
	Low Temp. Range	80-1001-15	1
	High Temp. Range	80-1001-16	1
14	Spring Rest, Lower		
	Low Temp. Range	40-1026-00	1
	High Temp. Range	20-4017-00	1
16	Gasket, Bonnet	81-1001-58	1
17	Diaphragm		
	Low Temp. Range	20-1087-04	1
	High Temp. Range	20-1087-04	2
20	Flange Ring—Tube Assembly: See Parts List 1, Page 3.		
91	Indicator Ring	41-1024-01	1
92	Indicator Screw	90-1001-60	1
93	Indicator Tag		
	Low Temp. Range	82-1000-58	1
	High Temp. Range	82-1000-59	1
94	Indicator Collar	20-4001-00	1
95	Collar Screw	90-1000-30	1
96	Pilot Seat		
	3/4" through 2"	20-0415-01	1
	2-1/2" and 4"	20-0415-02	1
97	Gasket	81-1000-19	1
98	Pilot Body	20-4019-11	1
99	"O" Ring	93-1001-15	1
100	Cap Screw	90-1000-57	8
101	Push Pin	20-4004-00	1
102	"O" Ring	93-1000-51	1
103	"O" Ring	93-1001-02	1
104	Thermo-Adapter	20-4003-00	1
105	"O" Ring	93-1001-03	1
106	Thermal Element	83-1000-79	1
107	Tube Fitting	92-1001-46	1
107-109	Tubing Kit (A4AOT only)	20-4098-15K	1
109	Tube Fitting	92-1001-48	1
110	Set Screw (A4AOT only)	90-1000-37	1
111	Pipe Plug (A4A only)	92-1001-21	1

TB TEMPERATURE BONNET KIT

Converts to Temperature Operated (T) Variation any A4A Regulator, Range —30° to 30°C (—20° to 80°F). Includes items 3-5, 8, 11, 12-17 (same as in Parts List 1 and 2), and items 91-106

Kit Type	Range	For Port Sizes	Kit Part No.
TB 50	—30° to 30°C (—20° to 80°F)	20 to 50 mm (3/4" to 2")	20-0995-00K
TB 100	—30° to 30°C (—20° to 80°F)	65 to 100 mm (2-1/2" to 4")	20-0995-01K

MAINTENANCE AND SERVICE

GENERALPROCEDURE:

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 it is especially important that these items are cleaned or changed frequently. When the RSF close-coupled companion strainers are used, maintain according to instructions in Bulletin 00-10D. 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 in for automatic operation.

Check the regulator setting to make sure it is properly adjusted. Turn adjusting screw slowly to see if regulator responds. Check regulator pressure range; if wrong, range spring must be replaced.

Check other system components for proper operation. Make sure that the regulator receives the proper electrical signal where modular pilot solenoids or motors are used.

Check hand valves in the system to make sure they are open or closed as required and the system is receiving liquid or gas as the case may be. Check modular pilot solenoid or motor voltage and frequency (Hz). Make sure they are same as the power supply.

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

SOLENOID COILS AND COIL HOUSING

The solenoid coils and coil housing, identified and described on pages 6 and 7 for the Type S6A Solenoid Pilot, are an improved design which provide a higher MOPD and a cooler coil resulting in longer life. The new coil and its heavily plated, rust resisting housing are interchangeable with the obsolete coil and cast iron housing as follows: The new coil, which has its 30-0041-XX Series Part Number stamped on the side, can be used in both the old and new coil housing; the old coil which has its 30-0030-XX Series Part Number stamped on one end, can be used in the old, cast iron housing only. There is no bottom marking on the new coil; either end may be positioned up. The color coding of lead wires for various voltages and frequencies has not been changed. The fuses used with the old coils are suitable for the new coils; the new coil power consumption is 30 Watts instead of 37.

The S6A pilot solenoid valve is also available with a coil using a quick electrical connector or plug, permitting easy wiring connection with an exposed rubber covered cable instead of a rigid or flexible conduit and enclosed wiring. This type of coil cannot be used with the old, cast iron housing.

The new coils and new housing described above for the S6A valve are also used with Solenoid valve Types S4, S5, S6N, S7, S8 and S9.

SERVICE POINTERS (Check General Procedure)

SYMPTOM	PROBABLE REASON	CORRECTION
Regulator does not shut off flow.	Diaphragm or 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 and polish piston and bore with crocus cloth. Clean valve and strainer.
	Throttling plug leaking due to excess dirt or damage.	Clean or replace. If used on liquid, check for erosion due to excessive flash gas. Reduce flash gas by subcooling or by reducing pressure drop across valve by providing restriction at valve outlet.
	A4AO Pilot Plug sticking.	Check for dirt, corrosion or damage. Clean or replace. Check mating bore and seat in adapter.
	A4AO Diaphragm ruptured or badly deformed.	Replace. If Range “D” make sure has 2 diaphragms.
	A4AB Modular Solenoid Pilot seat leaking.	Check seat and needle. Replace as needed.
	Diaphragm and seat eroded due to flash gas.	Replace. Reduce flash gas by subcooling or by reducing pressure drop across regulator by providing restriction at valve outlet.
	Modular Solenoid Pilot not closing.	Check power at leads, make sure coil is de-energized.
Regulator does not open.	A4A (inlet) Pressure Regulator Diaphragm ruptured or badly deformed,	Replace. If Range D make sure has 2 diaphragms.
	Diaphragm follower stuck, damaged or frozen.	Clean or replace. Install follower carefully.
	A4AO Pilot Plug sticking.	Check for dirt, corrosion or damage. Clean or replace. Check mating bore and seat in the adapter.
	A4AS Modular Solenoid Pilot not opening.	Pressure drop across valve too high: over 21 bar (300 psig). Lower pressure drop. Improper power supply. Correct. Replace solenoid coil.
	Piston worn, too much clearance.	Replace piston. Check for reason. If used on liquid, check for flash gas.
Regulator operation erratic.	Diaphragm or seat dirty or damaged.	Clean or replace. Clean strainer.
	A4AO Pilot Plug sticking.	Check for dirt, corrosion or damage. Clean or replace. Check mating bore and seat in the adapter.
	Diaphragm follower has dirt on the outside diameter or outside diameter is damaged.	Clean or replace.
	A4AP or A4A3P has moisture in the pneumatic line causing the diaphragm follower to freeze in position.	Clean or replace follower. Use filter-drier in the pneumatic line. May be necessary to use remote pilot in above freezing ambient.
	Other system components, line controllers, thermostats, etc., erratic.	Adjust, repair or replace.
	Regulator too far oversized.	Check load. Replace with smaller regulator.
Pressure drop across regulator too high.	Inlet or outlet restricted.	Check for restriction. Clean strainer.
	Regulator too small.	Replace with proper size regulator.
	Large amount of flash gas in liquid line.	Reduce flash gas by subcooling. Reduce line restriction by increasing line size, particularly at the regulator outlet. Replace with larger regulator.
	High pressure drop causes high rate of expansion of gas at regulator outlet.	Increase pipe size at the outlet of the regulator.
	Regulator does not open all the way.	Check piston for wear. Replace, if needed.

FLANGE TABLE

VALVE SIZE		① FPT FLANGES		WELDING FLANGES								④ ODS FLANGES				
		Nom Pipe Size	Part No.	Nominal Pipe Size		Sock Weld Socket I.D.		Weld Neck O.D.		Part No.		Tubing O.D.		Fitting I.D.		Part No.
mm	Inches	Inches		Inches	② NW No.	Inches	mm	Inches	mm	Socket Weld	Weld Neck	Inches	③ mm	Inches	mm	
		1/2	00-1179-00	1/2	15	0.860	21.84	—	—	00-1180-00	N.A.	7/8	22.22	0.877	22.27	30-0108-13
20	3/4	3/4	00-1181-00	3/4	20	1.070	27.81	1.050	26.67	00-1114-00	00-1182-00	1-1/8	28.57	1.130	28.70	30-0108-10
and	and	1	00-1031-00	1	25	1.365	34.67	1.315	33.40	00-1033-00	00-1098-00	1-3/8	34.92	1.380	35.05	30-0108-11
25	1	1-1/4	00-1117-00	1-1/4	32	1.705	43.31	1.660	42.16	00-1118-00	00-1155-00	1-5/8	41.27	1.631	41.43	30-0108-12
		1-1/4	00-1094-00	1-1/4	32	1.705	43.31	1.660	42.16	00-1035-00	00-1100-00	1-3/8	34.92	1.380	35.05	30-0109-10
32	1-1/4	1-1/2	00-1120-00	1-1/2	40	1.930	49.02	1.900	48.26	00-1121-00	00-1161-00	1-5/8	41.27	1.631	41.43	30-0109-11
												2-1/8	53.97	2.131	54.13	30-0109-12
40	1-5/8	1-1/2	00-1038-00	1-1/2	40	1.930	49.02	1.900	48.26	00-1040-00	00-1103-00	1-5/8	41.27	1.631	41.43	30-0110-10
and	and	2	00-1042-00	2	50	2.445	62.10	2.375	60.33	00-1044-00	00-1074-00	2-1/8	53.97	2.131	54.13	30-0110-11
50	2											2-5/8	66.67	2.631	66.83	30-0110-12
65	2-1/2	2-1/2	00-1047-00	2-1/2	65	2.945	—	2.875	73.03	00-1070-00	00-1049-00	2-5/8	66.67	2.631	66.83	30-0111-10
												3-1/8	79.37	3.131	79.53	30-0111-11
75	3	3	00-1053-00	3	80	3.575	90.81	3.500	88.90	00-1071-00	00-1055-00	3-1/8	79.37	3.131	79.53	30-0112-10
												3-5/8	92.07	3.631	92.23	30-0112-11
100	4	4	00-1057-00	4	100	4.575	116.20	4.500	114.30	00-1104-00	00-1059-00	4-1/8	104.77	4.132	104.95	30-0113-10

① FPT: Internal NPT (USA Standard Taper Pipe Thread).
② NW: Metric equivalent nominal size for steel tubing.
③ Metric copper tubing used for refrigeration.
④ ODS connections to fit copper tubing of given outside diameter. (Not for use with ammonia)

Definitions:
ODS - Outside Diameter Sweat
I.D. - Inside Diameter
O.D. - Outside Diameter
N.A. - Not Available

Flange Bolt Torque Requirements

Bolt Diameter	Valve Port Size	Torque
11 mm (7/16")	13mm (1/2 ")	3.9 mkg (28 ft lb)
16m m (5/8")	20-50mm (3/4 "- 2")	11.8 mkg (85 ft lb)
19m m (3/4")	65-75mm (2-1/2 "- 3")	14.5 mkg (105 ft lb)
22mm (7/8")	100mm (4")	22.1 mkg (150 ft lb)

SAFE OPERATION (See Bulletin RSB for further information.)

The personnel doing any work on a refrigeration system must be qualified and completely familiar with the system, or all other precautions will be meaningless.

Where cold liquid lines are used, it is important that certain precautions are taken to avoid damage due to liquid expansion. Temperature increase in a section full of solid liquid can cause high pressures due to the expanding liquid and possibly rupture a gasket, pipe or valve. All hand valves in such locations 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 install relief devices in any section where liquid expansion could take place.

For the protection of personnel and products, all refrigerant should be removed from the section to be worked on before a valve, strainer or other device is opened. Special care should be taken when pumping out a strainer, liquid may be trapped in the strainer and considerable time may be required to remove it.

Strainer inspection is of utmost importance, especially the first few hours, days or weeks after the start-up. The strainers should be opened and any dirt removed. Strainer inspection and cleaning should be continued until dirt accumulation ceases. Later, any time a valve is opened for service or maintenance, its companion strainer should also be inspected and cleaned.

WARRANTY

All Refrigerating Specialties products are warranted against defects in workmanship and materials for a period of one year from date of shipment from originating 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, accidents, misuse, or abuse. Products disabled by dirt or other foreign substances will not be considered defective.

The express warranty above constitutes the only warranty of Refrigerating Specialties products, and is in lieu of all other warranties, expressed or implied, written or oral, **including any warranty of merchantability or warranty of fitness for a particular purpose and in no event is Refrigerating Specialties responsible for any consequential damages of any nature whatsoever.** 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.

FACTORY REPAIR AND REBUILDING

For the convenience of our customers, we have a standard factory repair and re-building service. Repairable returned Regulators are disassembled, cleaned, sandblasted, worn parts replaced, reassembled, and re-painted. For quickest service, it is advisable that this be done during the off peak season.