

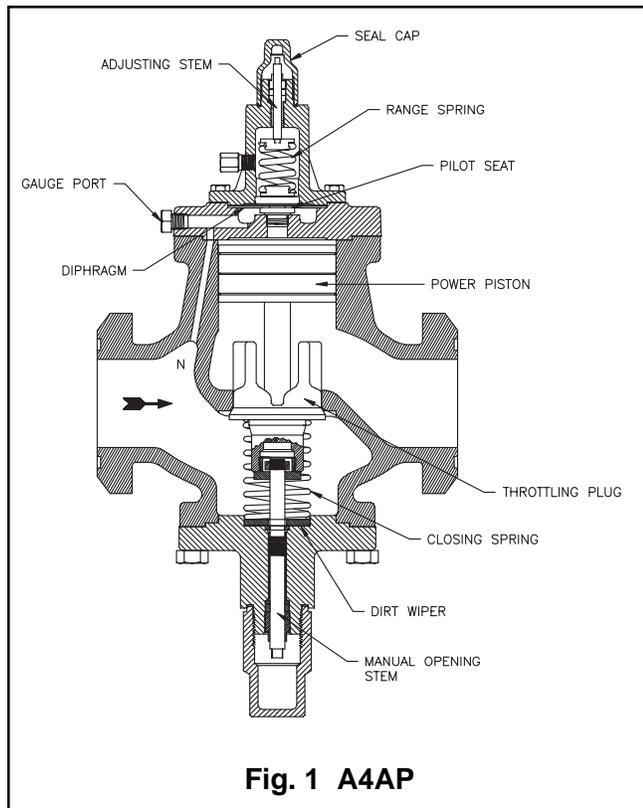
**PNEUMATICALLY COMPENSATED
INLET PRESSURE REGULATORS
TYPE A4AP-DN, A4A3P-DN
Port Size 3/4" - 4" (20 - 100 mm)
For Ammonia, R22, R134a, R404a, R507
Other Refrigerants and Oils**

FEATURES

- Pilot operated characterized Modulating Plug for precise control
- Suitable for all common refrigerants and oils
- 406 psig (28 bar) design pressure (PS)
- Flanges for threaded or welded steel pipe and copper tube (copper not for ammonia)
- Unique modular construction
- Interchangeable parts
- Easy to service
- Close coupled strainers, optional
- Stainless Steel Diaphragm
- Manual opening stem
- Complies with Pressure Equipment Directive 97/23/EC

Pressure Ranges:

- A: 0-150 psig (0-10 bar) Standard
- D: 75-280 psig (5-19 bar) A4AP only
- V: 20 in. hg-120 psig (500 mm hg- 8.3 bar)



**BULLETIN DN23-08B
Type A4AP-DN, A4A3P-DN**



**January 2007
Installation and Service Information**

Description

All A4 type regulators are pilot operated using upstream pressure for the opening force and require a minimum 2 psi (0.14 bar) pressure drop to fully open.

These valves are generally ordered with close coupled upstream strainer to prevent entrance of foreign material into the valve and the rest of the system.

Purpose:

These pneumatically compensated inlet pressure regulators modulate the flow of refrigerant gas or liquid to maintain a varying upstream (or inlet) pressure in response to a pneumatic signal received from a pneumatic controller. The regulator set-point will be directly varied, on a 1:1 basis (A4AP) or 3:1 basis (A4A3P), with value of the air pressure supplied to the bonnet. Thus a pneumatically compensated regulator, by responding to the varying output air signal from a pneumatic controller, can change the evaporator pressure and temperature up and down to match a varying load condition. A 1 psi increase in air pressure will increase the set point by 1 psi for the A4AP and 3 psi for the A4A3P. Generally, the pneumatic controller modulates the air pressure from 3 to 15 psig throughout its control range.

In addition to the standard "P" or "3P" version, other regulator variations can be combined along with the pneumatic variation to perform more than one control function. For example, A4ADP dual pressure regulator has the ability to revert to a high pressure setting via its high pressure pilot when the pilot solenoid is de-energized. The fluid temperature range for the A4 Series of Regulators is -50F to 220F (-45C to 105C).

Important Note:

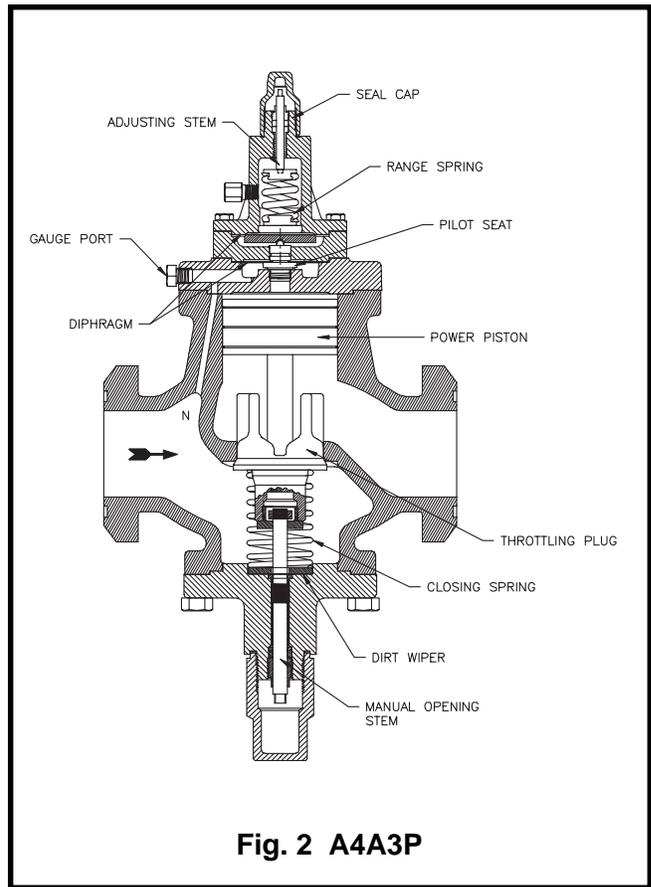
The control air supplied to the regulator must be clean, dry and oil free. To avoid the possibility of rust and of moisture from the compressed air freezing in the bonnet or in other parts of the control system, dehydrated air must be used whenever it may come in contact with temperatures below freezing. For applications where temperatures are below 32F (0C), the Type A4AR main valve with a remote pneumatic pilot should be used. Thus the pilot can be located in a nonrefrigerated space, connected to the main valve by a pair of 3/8" (9 mm) pilot control lines.

Principles of Operation (See Fig.1)

The principles of operation are the same as the basic A4A regulator except the set-point of the regulator is compensated or re-adjusted by the pneumatic pressure fed into the valve bonnet.

The inlet refrigerant pressure enters the space under the diaphragm through passage N. When the force created by the pressure exceeds the combined forces of the pneumatic pressure in the bonnet and the range spring force, 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 modulating plug to open and modulate to maintain the varying set-point as dictated by the pneumatic control pressure communicated to the valve bonnet. An increase in refrigerant inlet pressure, above the varying set-point pressure setting, lifts the diaphragm further, allowing more pressure on top of the power piston and opening the valve wider. A decrease in inlet refrigerant pressure, below the varying set-point pressure setting, causes the diaphragm to move closer to the pilot seat reducing the pressure on the top of the power 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 the bleed hole in the power piston and through the clearance between the piston and body bore. A minimum of 2 psi (0.14 bar) pressure difference across the valve is required to open fully. The A4AP/A4A3P Pressure Regulator therefore opens on a rise in the inlet pressure above the set-point and closes on a drop in inlet pressure below the

set-point. The inlet pressure 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 packing nut.

Adjustment

Adjust the controller according to the manufacturers 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 proceed as follows: Install an accurate pressure gauge in the gauge port. Back the pressure adjusting stem out to its stop (counter clockwise). 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 (clockwise) until the pressure gauge shows a slight rise in the inlet pressure. At this point the adjusting stem may be turned in to raise the pressure further, or backed out to lower it: but the final adjustment should be made after the system has been operating for a period of time. This setting, without air pressure to the bonnet, represents the lowest inlet pressure the regulator will allow, thus providing a low limit feature. 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 (A4AP). In the case of the A4A3P, the inlet pressure will be increased 3 psi for every 1 psi pressure increase the controller applies to the top of the diaphragm. The A4A3P is available in Range A and V only. The A4AP is available in Range A, V and D.

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 valve model and the reverse pressure drop encountered. The regulator is not a check valve.

Tighten the flange bolts and nuts evenly to provide proper seating of the flange gasket and to avoid damage to gaskets or flanges. (See Bolt Torque Table). Avoid using the regulator flange bolts to stretch or align pipe. Even the heavy duty 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. Do not insulate the 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.

Disassembly and Assembly

Before disassembling any A4A type regulator, read the information in this bulletin and Bulletin RSBCV, 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 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 .

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 compression on Range Spring 13 otherwise damage to Diaphragm 17 or Pilot Seat 18 may occur. Disconnect air lines before removing bonnet. 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, 3/4" through 1-1/4" (20mm through 32mm). 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 modulating plug with fine crocus cloth. Inspect the seating area of the Modulating 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. Items which require several bolts to fasten must be tightened uniformly to provide proper alignment and seating. (See Bolt Torque Table). 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 the valve body and fasten adapter in place. Before assembling the bonnet be sure the adjusting Stem 6 is turned all the way out. Place Gasket 19, Diaphragms 17 and Gasket 16 in Adapter 28. The raised center of the diaphragm must be towards the bonnet. Stack Diaphragm Follower 15, Lower Spring Rest 14, Spring 13 and Upper Spring Rest 12 on top of diaphragm and carefully lower bonnet in place and tighten Screws 11 in place. Tighten Cap Screws 11 evenly. The ideal tightening torque is 11 ft. lbs. (1.5 kg-m). 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.

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.

Maintenance and Service

General Procedure:

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. Cotton bags are available for 1" - 4" (25mm-100mm) Type RSF Strainer to improve their ability to remove dirt during start-up. When the RSF close-coupled companion strainers are used, maintain according to instruction in Bulletin DN00-10. 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 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.

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.

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 RSBCV.

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 valves involved, or all other precautions will be meaningless. This includes reading and understanding pertinent Refrigerating Specialties Division Product Bulletins and Safety Bulletin RSBCV 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 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.

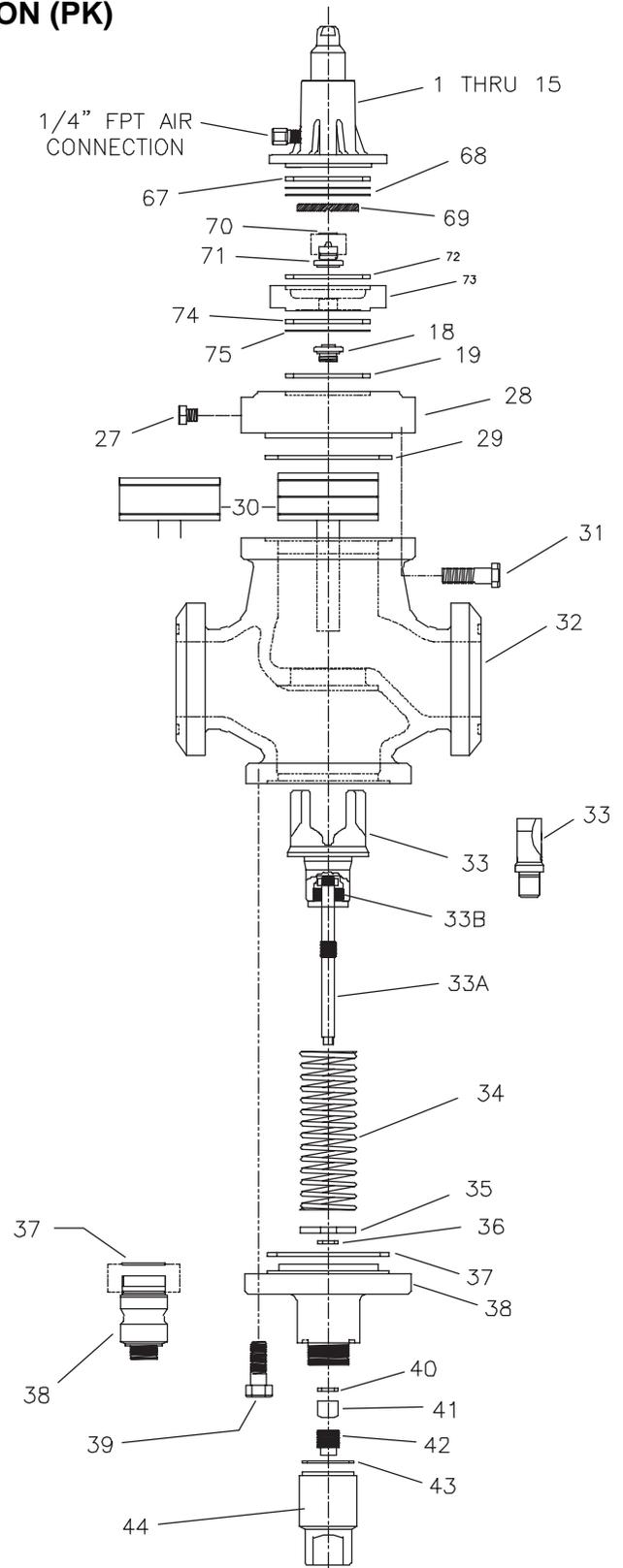
For the protection of people and products, all refrigerant must be removed from the section to be worked on before a valve, strainer, or other device is opened or removed.

Flanges with ODS connections are not suitable for ammonia service.

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
	Modulating plug leaking due to excess dirt or damaged	Clean or replace. If used on liquid, check for erosion due to excessive flash gas by subcooling or by reducing pressure drop across valve by providing restriction at valve outlet.
Regulator does not open	Pressure Regulator Diaphragm ruptured or badly deformed	Replace. Make sure 2 diaphragms are installed.
	Diaphragm follower stuck, damaged or frozen	Clean or replace. Install follower carefully
	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, damaged.	Clean or replace. Clean strainer
	Diaphragm follower has dirt on the outside diameter or outside diameter is damaged.	Clean or replace
	Regulator too far oversized.	Check load. Replace with smaller regulator or investigate use of Reduced Capacity Plug Kit.
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.

**For replacement parts and prices, consult
PARTS KITS LIST PRICE SCHEDULE INDUSTRIAL
AND FLO-CON (PK)**

Item	Description
1	Seal Cap
2	Gasket, Seal Cap
3	Nut, Stuffing Box
4	Packing Ring
5	Packing Washer
6	Adjusting Stem
8	Bonnet
9	Nameplate
10	Screw, Name Plate
11	Screw, Bonnet
12	Spring Rest, Upper
13	Spring, Range
14	Spring Rest, Lower
15	Diaphragm Follower
16	Gasket, Bonnet
17	Diaphragm
18	Seat, Pilot
19	Gasket, Adapter
27	Gauge Port Pipe Plug
28	Adapter, Body
29	Gasket, Body
30	Piston-Stem
31	Screw, Body
32	Body
33	Throttling Plug Asm
34	Spring, Closing
35	Dirt Wiper Retainer
36	Dirt Wiper
37	Seal, Bottom Cap
38	Bottom Cap
39	Screw, Bottom Cap
40	Packing Washer
41	Packing Ring
42	Stuffing Box Nut
43	Gasket, Seal Cap
44	Seal Cap
45	Gasket, Flange
46	Bolt, Flange
47	Nut, Flange
67	Bonnet Gasket
68	Diaphragm
69	Diaphragm Actuator Upper
70	O-Ring
71	Diaphragm Actuator Lower
72	Gasket, Adapter
73	Adapter, 3P
74	Gasket, 3P
75	Diaphragm



A4A3P

Fig. 3

Warranty

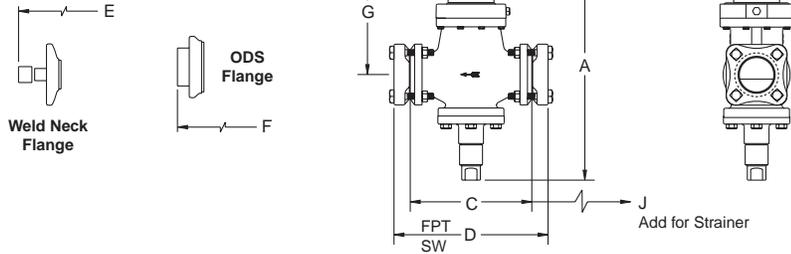
All Refrigerating Specialties products are warranted against defects in workmanship and materials for a period of one year from date of shipment from originating factory. This warranty is in force only when products are properly installed, field assembled, maintained, and operated in use and service as specifically stated in Refrigerating Specialties Catalogs or Bulletins for normal refrigeration applications, unless otherwise approved in writing by Refrigerating Specialties Company. 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.

PRESSURE CONTAINING COMPONENTS A4A DN LINE: 3/4" & 1"				
	COMPONENT DESCRIPTION	MATERIAL	Kv	VOLUME
3/4 & 1IN	BODY, A4A DN	ASTM A-126 CLASS B	6.2	
	ADAPTER, A4A DN	ASTM A-126 CLASS B	&	
20 & 25 MM	COVER BOTTOM, A4A/S4A	BARSTOCK ASTM 1213 CR	8.6	
	BONNET A4W	ASTM A-126 CLASS B		
	BODY, S6A (REGULAR MATL)	DUCTILE IRON ASTM A536		
	TUBE SOLENOID, S6	SS TUBING 304		
	SLEEVE, SOLENOID TUBE	AISI 1117 CRS BARSTOCK		
	BODY, A2D DN	ASTM A-126 CLASS B		
PRESSURE CONTAINING COMPONENTS A4A DN LINE: 1-1/4 TO 4				
	COMPONENT DESCRIPTION	MATERIAL	Kv	VOLUME
1-1/4 IN	BODY, A4A DN	DUCTILE IRON GGG 40.3	15	0.57 L
	ADAPTER, A4A DN	DUCTILE IRON GGG 40.3		
32 MM	COVER BOTTOM, A4A/S4A	BARSTOCK ASTM 1213 CRS		
	BONNET A4W	DUCTILE IRON GGG 40.6		
1-5/8 IN	BODY, 2 A4A DN	DUCTILE IRON GGG 40.3	28.6	1.61 L
	ADAPTER, 2 A4A DN	DUCTILE IRON GGG 40.3		
40 MM	COVER BOTTOM, A4A/S4A 1-5/8 to 2-1/2	DUCTILE IRON GGG 40.3		
	BONNET A4W	DUCTILE IRON GGG 40.3		
2 IN	BODY, 2 A4A DN	DUCTILE IRON GGG 40.3	42.4	1.61 L
	ADAPTER, 2 A4A DN	DUCTILE IRON GGG 40.3		
50 MM	COVER BOTTOM, A4A/S4A 1-5/8 to 2-1/2	DUCTILE IRON GGG 40.3		
	BONNET A4W	DUCTILE IRON GGG 40.3		
2-1/2 IN	BODY, 2-1/2 A4A DN	DUCTILE IRON GGG 40.3	60	3.19 L
	ADAPTER, 3 A4A DN	DUCTILE IRON GGG 40.3		
65 MM	COVER BOTTOM, 3 A4A/S4A	DUCTILE IRON GGG 40.3		
	BONNET A4W	DUCTILE IRON GGG 40.3		
3 IN	BODY, 3 A4A DN	DUCTILE IRON GGG 40.3	86	3.91 L
	ADAPTER, 3 A4A DN	DUCTILE IRON GGG 40.3		
75 MM	COVER BOTTOM, 3 A4A/S4A	DUCTILE IRON GGG 40.4		
	BONNET A4W	DUCTILE IRON GGG 40.3		
4 IN	BODY, 4 A4A DN	DUCTILE IRON GGG 40.3	116	6.5 L
	ADAPTER, 4 A4A DN	DUCTILE IRON GGG 40.3		
100 MM	COVER BOTTOM, 4 A4A/S4A	DUCTILE IRON GGG 40.4		
	BONNET A4W	DUCTILE IRON GGG 40.3		

**A4AP
A4A3P**



OVERALL VALVE DIMENSIONS																			
Port Size		20mm & 25mm (3/4 & 1")		32mm (1-1/4")		40mm & 50mm (1-5/8 & 2")		65mm (2-1/2")		75mm (3")		100mm (4")							
DIMENSION		mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches						
A	A4P, A4L	392	15.4	410	15.6	464	16.2	483	19.0	597	23.5	653	25.7						
	A43P	414	16.3	432	17.0	485	19.1	505	19.9	620	24.4	676	26.6						
C		164	6.2	203	8.0	251	9.9	252	9.9	311	12.2	359	14.1						
G	A4P, A4L	244	9.6	248	9.8	287	11.3	302	11.9	324	12.8	361	14.2						
	A43P	266	10.5	270	10.7	308	12.2	324	12.8	347	13.7	384	15.1						
H		117	4.6	117	4.6	140	5.5	159	6.2	176	7.0	222	8.8						
J		98	3.9	178	7.0	251	9.9	314	12.4	314	12.4	363	14.3						
OVERALL LENGTH DIMENSIONS WITH FLANGES																			
*Add 13mm (0.5") to D, E & F Dimensions for A4L Variation																			
D*	FPT & SW FOR PIPE SIZES	3/4"	216	8.5	1-1/4"	256	10.1	1-1/2"	307	12.1	2-1/2"	331	13.0	3"	389	15.3	4"	450	17.7
		1"	216	8.5	1-1/2"	256	10.1	2"	307	12.1									
		1-1/4"	216	8.5															
E*	WN FOR FOR PIPE SIZES	3/4"	254	10.0	1-1/4"	300	11.8	1-1/2"	364	14.3	2-1/2"	401	15.8	3"	478	18.8	4"	571	22.5
		1"	261	10.3	1-1/2"	304	12.0	2"	371	14.6									
		1-1/4"	261	10.3															
F*	ODS FOR TUBE SIZES	7/8"	239	9.4	1-3/8"	269	10.6	1-5/8"	358	14.1	2-5/8"	348	13.7	3-1/8"	414	16.3	4-1/8"	503	19.8
		1-1/8"	239	9.4	1-5/8"	279	11.0	2-1/8"	338	13.3									
		1-3/8"	231	9.1	2-1/8"	305	12.0	2-5/8"	358	14.1									
		1-5/8"	239	9.4															

BOLT TORQUE TABLE		
ITEM	PORT SIZE	TORQUE
7/16" Flange Bolt	1/2"	28 ft lb
5/8" Flange Bolt	3/4" - 2"	85 ft lb
3/4" Flange Bolt	2-1/2" - 3"	105 ft lb
7/8" Flange Bolt	4"	150 ft lb
5/16"-18 Bonnet Bolt	3/4" - 4"	15 ft lb
5/16"-18 Adapter Bolt	3/4" - 2"	15 ft lb
5/8"-11 Adapter Bolt	3" - 4"	75 ft lb
Bottom Cap	3/4"- 1-1/4"	150 ft lb
1/2"-13 Bottom Cap Bolt	1-5/8" - 2-1/2"	50 ft lb
5/8"-11 Bottom Cap Bolt	3"-4"	75 ft lb