

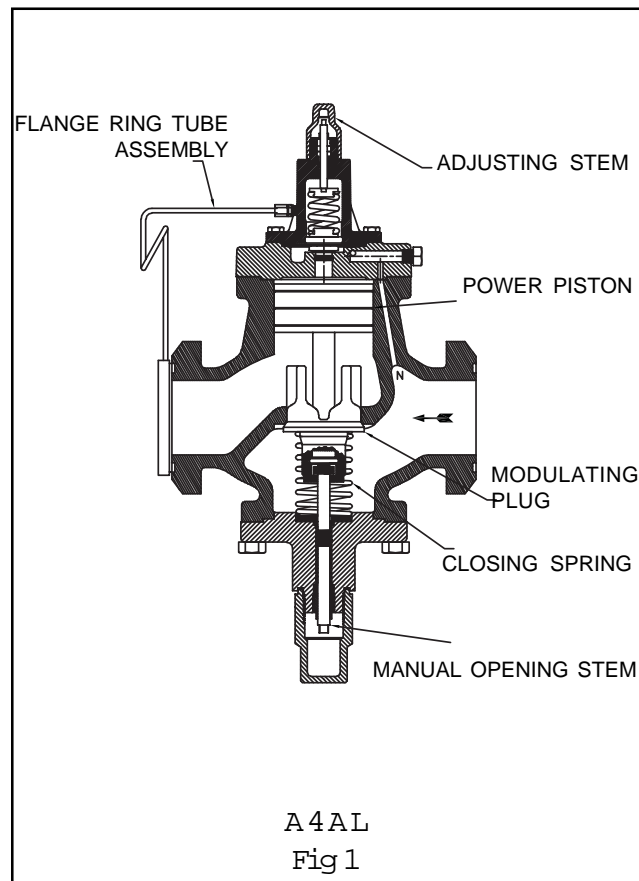
DIFFERENTIAL PRESSURE RELIEF REGULATOR TYPE A4AL

Port Size 3/4" - 4" (20-100mm)

For Ammonia, R-22, R134a, R404a, R507
and other common refrigerants.

FEATURES

- Pilot operated characterized Modulating Plug for precise control
- Suitable for all common refrigerants and oil
- 400 psig (27.6 bar) Design Pressure (MRP)
- 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
- Many control variations are possible with the use of a few modules and kits.
- Stainless Steel Diaphragm
- Manual Opening Stem



BULLETIN 23-10A Type A4AL



March 2002

Installation, Service and Parts Information

Description:

These compact, heavy duty, pilot operated, iron alloy (ASTM A126 Class B) Differential Pressure Regulators are suitable for Ammonia, R22, R134a, R404a, R507 and other common refrigerants and fluids approved for use in refrigeration systems.

All A4AL 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:

Modulates flow of refrigerant liquid or gas to maintain a constant set-for pressure differential between regulator inlet and regulator outlet.

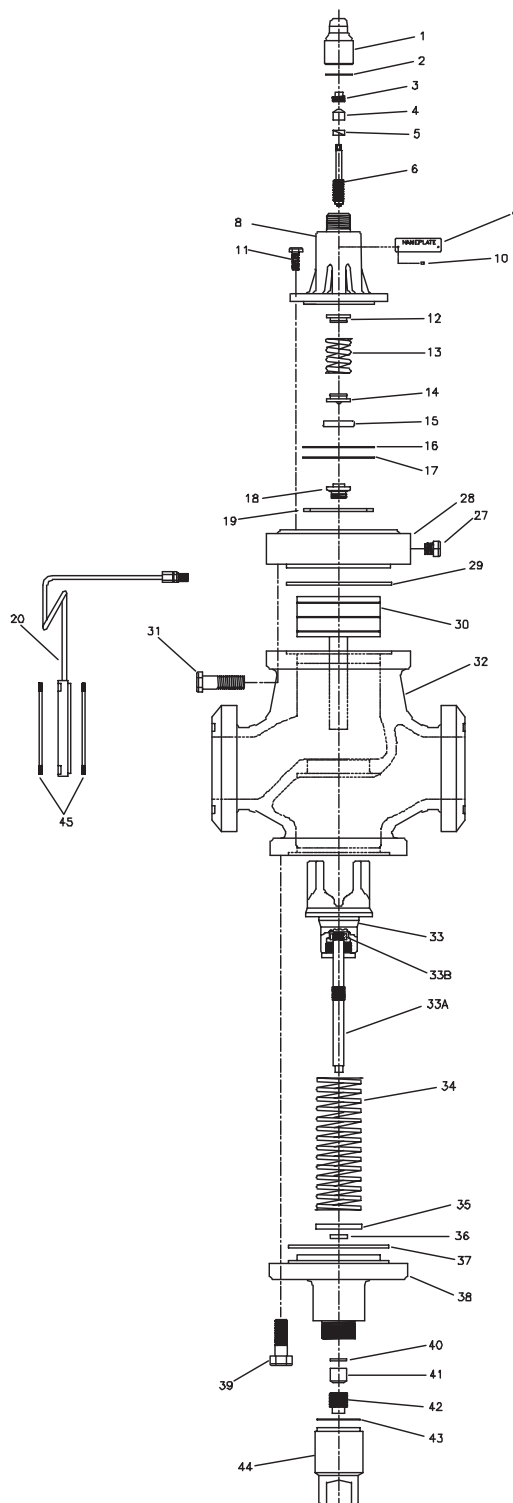
Regulator applications are as follows: As a relief valve from pump outlet to accumulator of a liquid recirculating pump system to prevent pump overload or dry pumping when evaporator liquid solenoid valves are closed. Differential pressure will not vary despite fluctuating accumulator pressures. As a gas or liquid pressure regulator whenever it is desired to maintain a set-for pressure difference between regulator inlet and outlet.

The fluid temperature range for the A4AL Series of Regulators is -50F to 220F (-45C to 105C).

A4AL PARTS KITS REFERENCE

ITEM	DESCRIPTION	PORT SIZE							
		3/4	1	1-1/4	1-5/8	2	2-1/2	3	4
1, 2	Cap Kit, Seal	202110	202110	202110	202110	202110	202110	202110	202110
3-5	Packing Kit, Stem	202100	202100	202100	202100	202100	202100	202100	202100
4-6	Stem Kit	202120	202120	202120	202120	202120	202120	202120	202120
3-5, 6, 12-16	Spring Stem Kit Rng A	202006	202006	202006	202006	202006	202006	202006	202006
	Spring Stem Kit Rng D	202007	202007	202007	202007	202007	202007	202007	202007
8	Bonnet Kit	***	***	***	***	***	***	***	***
12-14, 16	Spring Kit Rng A	202481	202481	202481	202481	202481	202481	202481	202481
	Spring Kit Rng D	202482	202482	202482	202482	202482	202482	202482	202482
16, 17, 19	Diaphragm Kit Rng A	200770	200770	200770	200770	200770	200770	200770	200770
	Diaphragm Kit Rng D	200771	200771	200771	200771	200771	200771	200771	200771
16-19	Seat Kit	202002	202002	202002	202002	202002	202003	202003	202003
27	Plug Pkg, Pipe	202552	202552	202552	202552	202552	202552	202552	202552
19, 28, 29	Adapter Kit	200703	200703	200700	200725	200725	200685	200713	200716
20, 45	Flange Ring Tube	200439	200439	200441	200443	200443	200445	200447	200449
29, 30	Piston Kit	200760	200760	200767	200389	200389	200391	200393	200227
34-37	Spring Kit, Closing	202300	202300	202301	202302	202302	202303	202304	202305
33-37, 40-42	Plug Kit, Full Capacity	202021	202022	202023	202024	202025	202026	202027	202028
	Plug Kit, 50% Capacity	202029	*	NA	NA	NA	NA	NA	NA
	Plug Kit, 35% Capacity	NA	NA	202031	202032	**	202033	202034	202035
	Plug Kit, 17% Capacity	202030	*	NA	NA	NA	NA	NA	
37, 38, 40, 41	Bottom Cover Kit	200761	200761	200761					
40-42	Packing Kit, Stem	202100	202100	202100	202100	202100	202100	202101	202101
43, 44	Cap Kit, Seal	202110	202110	202110	202110	202110	202110	202111	202111
33-38, 40-44	Bottom Kit, Full Cap	202010	202011	202012	202013	202014	202015	202016	202017
	Bottom Kit, 50% Cap	202347	*	NA	NA	NA	NA	NA	NA
	Bottom Kit, 17% Cap	202346	*	NA	NA	NA	NA	NA	NA
(All Seals)	Gasket / O-Ring Kit	202112	202112	202113	202114	202114	202115	202116	202117
11 (Qty 8)	Bolt Pkg, Bonnet	202246	202246	202246	202246	202246	202246	202246	202246
31 (Qty 8)	Bolt Pkg, Adapter	202248	202248	202249	202249	202249	202249	202250	202250
39 (Qty 6)	Bolt Pkg, Bottom Cap	NA	NA	NA	202251	202251	202251	202252	202252
(*)	All Plug Kits and Bottom Assembly Kits for 3/4" Port Size Valves can be used in the 1" Port Size Valves for reducing capacity.								
(**)	All Plug Kits and Bottom Assembly Kits for 1-5/8" Port Size Valves can be used in the 2" Port Size Valves for reducing capacity.								
(***)	See Industrial List Price Schedule for PK-1 Pneumatic Bonnet Kit.								

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
20	Flg Ring-tube Asm
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



A4AL
Fig 2

Principles of Operation

This is a pilot operated regulator whose main valve is opened by a power piston in response to the inlet fluid pressure received from below the regulator diaphragm. 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 pressure.

After the regulator is set for the desired pressure differential, the pressure at the inlet of the regulator will rise and fall, pound for pound, with the rise and fall of pressure at the regulator outlet, always maintaining the set-for differential pressure across the regulator. If the difference between inlet pressure and outlet pressure of the regulator is less than the set-for pressure, the regulator will remain tightly closed.

Manual Opening Stem:

All Type A4AL Regulators are provided with a manual opening stem. To open the regulator manually, back the stem out (turn counterclockwise) 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

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 (counterclockwise) to give minimum differential, which is about 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.

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 A4AL 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 dam-

aged 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 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 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 instruction 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 Dia-

phragm 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), Diaphragm (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. When the RSF close-coupled companion strainers are used, maintain according to instruction in Bulletin 00-10. Moisture in halocarbon systems in particular can cause corrosion or form ice, causing the piston to freeze in position. Filter-driers should be used and maintained for halocarbon systems.

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

Check the manual opening stem; it should be turned 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 RSB.

Safe Operation (See also Bulletin RSB)

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 RSB prior to installation or servicing work.

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

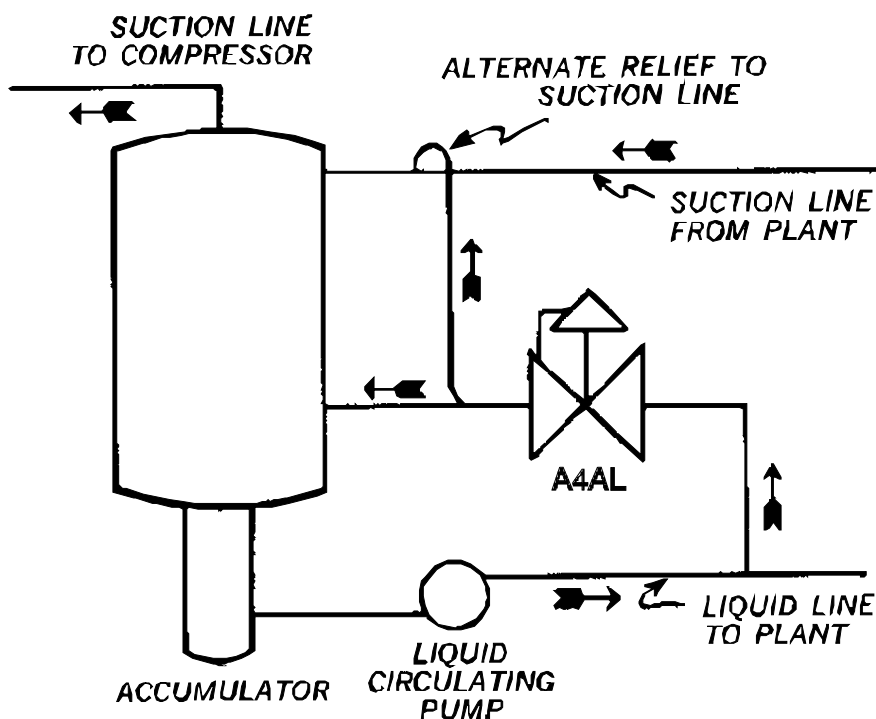
Avoid all piping or control arrangements which might produce thermal or pressure shock. For the protection of people and products, all refrigerant must be removed from the section to be worked on before a valve, strainer, or other device is opened or removed. Flanges with ODS connections are not suitable for ammonia service.

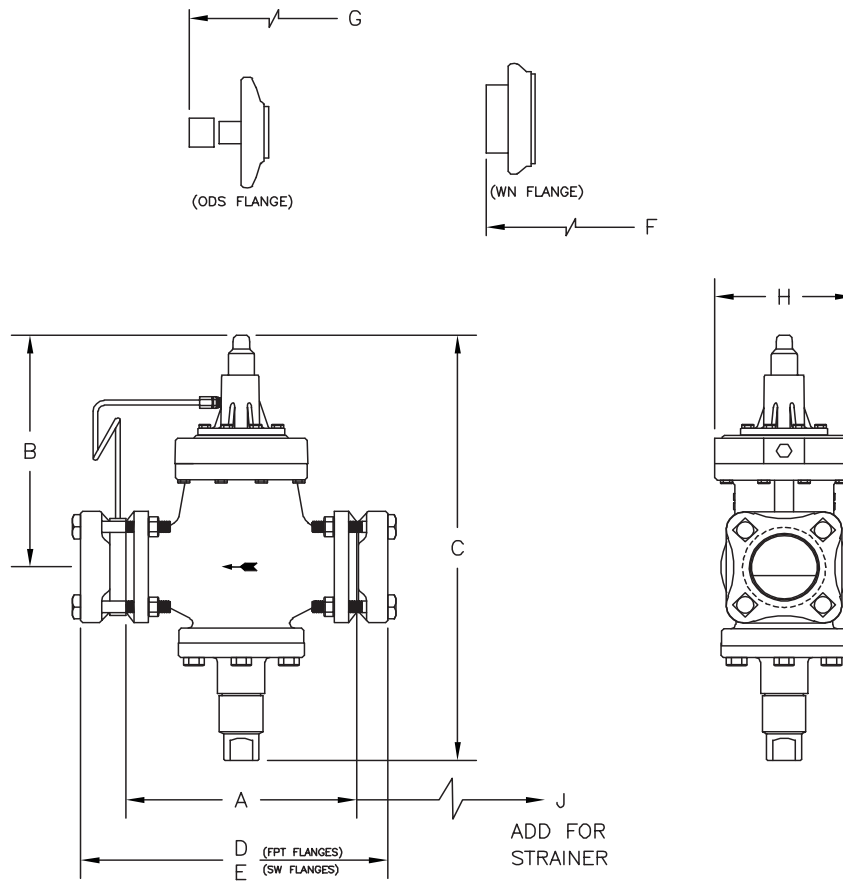
Warranty

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.

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"	11 ft lb
5/16"-18 Adapter Bolt	3/4" - 2"	11 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





A4AL VALVE DIMENSION TABLE													
PORT SIZE		20 & 25 MM		32 MM		40 & 50 MM		65 MM		75 MM		100 MM	
		3/4 & 1		1-1/4		1-5/8 & 2		2-1/2		3		4	
DIMENSION		MM	INCH	MM	INCH	MM	INCH	MM	INCH	MM	INCH	MM	INCH
A	(ALL)	164	6.2	203	8.0	251	9.9	252	9.9	311	12.2	359	14.1
B	(ALL)	244	9.3	248	9.6	287	11.3	302	11.9	324	12.8	361	14.2
C	(ALL)	392	15.6	410	16.4	464	18.6	483	19.2	597	23.5	563	25.7
D	FPT	3/4	229	9.0	1-1/4	269	10.6	1-1/2	318	12.5	2-1/2	343	13.5
	PIPE	1	229	9.0	1-1/2	269	10.6	2	318	12.5			
	SIZE	1-1/4	229	9.0									
E	SW	3/4	229	9.0	1-1/4	269	10.6	1-1/2	318	12.5	2-1/2	343	13.5
	PIPE	1	229	9.0	1-1/2	269	10.6	2	318	12.5			
	SIZE	1-1/4	229	9.0									
F	WN	3/4	267	10.5	1-1/4	312	12.3	1-1/2	376	14.8	2-1/2	414	16.3
	PIPE	1	274	10.8	1-1/2	318	12.5	2	384	15.1			
	SIZE	1-1/4	274	10.8									
G	ODS	1-1/8	300	11.8	1-3/8	338	13.3	1-5/8	427	16.8	2-5/8	445	17.5
	TUBE	1-3/8	297	11.7	1-5/8	339	13.8	2-1/8	417	16.4	3-1/8	480	18.9
	SIZE	1-5/8	313	12.3	2-1/8	384	15.1	2-5/8	442	17.4			
H	(ALL)		117	4.6		117	4.8		140	5.5		159	6.3
J	(ALL)		98	3.9		178	7.0		251	9.9		314	12.4