

# SOLENOID VALVES

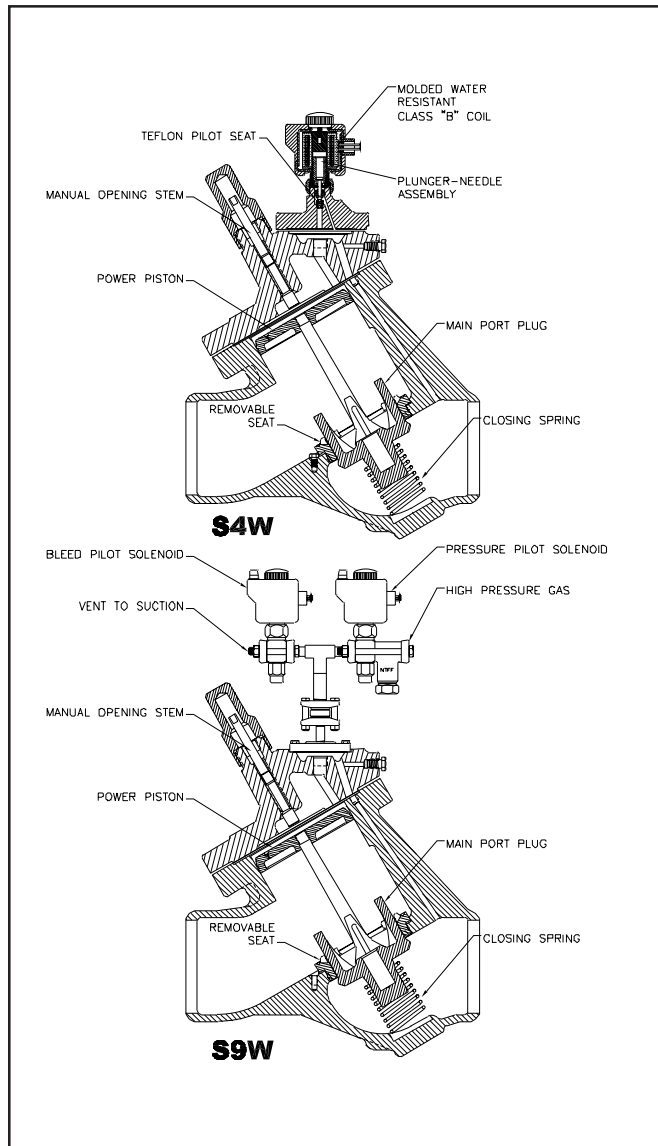
## Type S4W, S9W

Port Size: 125-200mm (5"-8")

FOR AMMONIA, R-12, R-22, R-502  
AND OTHER COMMON REFRIGERANTS

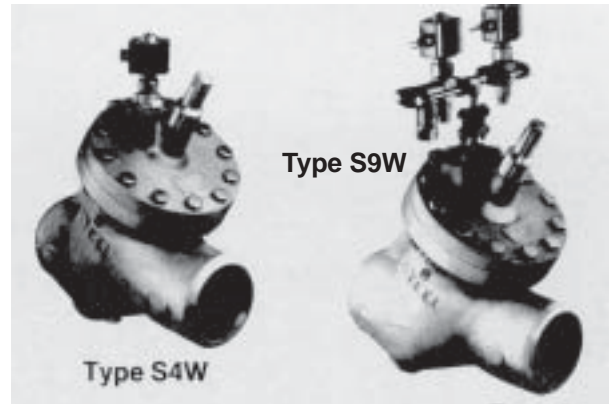
### FEATURES

- Cast Steel Body—Strong, Light Weight.
- Welds Directly In The Line—No Flanges.
- Removable Seat—Serviceable From Top Side.
- Pilot Operated
- Single Coil Size—Same As Most Other R/S Valves.
- Design Pressure (MRP): 27.6 bar (400 psig)
- Maximum Opening Pressure Difference (MOPD): 21 bar (300 psig)
- Manual Opening Stem
- PTFE Pilot Seat
- Streamlined Fluid Flow Pattern
- Pilot Solenoid Parts Are Same As Used With Most Other R/S Solenoids.



### BULLETIN 30-05A

#### Types S4W, S9W



February 2003

### Installation, Service and Parts Information

### Description

These heavy duty, cast steel bodied (ASTM No. A352 Grade LCB), spring closing solenoid valves weld directly in the line and do not require flanges. They are for control of Ammonia, R-12, R-22 and R-502, other common refrigerants, certain oils and other fluids approved for use in refrigeration valves.

The Type S4W are pilot operated valves using upstream pressure for the moving force, and require a minimum 0.21 bar (3 psi) pressure drop to fully open. The Type S9W also are pilot operated valves but use an external source of higher pressure gas to operate the valve, and, therefore require no minimum pressure drop to open. The external gas pressure for the Type S9W must be at least 0.71 bar (10 psi) above valve internal upstream pressure for positive opening. Both valve types are normally closed.

It is advisable to install a strainer upstream of each S4W valve to prevent entrance of foreign material into the valve and the rest of the system. The Type RSW strainer can be welded directly to the Type S4W inlet. A strainer is not required upstream of a Type S9W valve.

### Purpose

TYPE S4W is suitable to stop or start flow in refrigerant hot gas, liquid or suction lines in a temperature range of -45° to 105°C (-50° to 220°F). If used in a liquid line, precautions should be taken to prevent hydraulic shock which is possible when flow of a substantial quantity of liquid is suddenly stopped.

TYPE S9W is most frequently used in a low temperature suction line in which pressure drops must be kept to a minimum. They can also be used in hot gas or liquid lines, provided there is always a refrigerant pressure available in the system for external pressure operation of the valve that is 0.71 bar (10 psi) above the valve upstream pressure. The fluid temperature range for the S9W is -45° to 105°C (-50° to 220°F).

The powerful opening and closing action of the S9W valve enables it to overcome viscous oil or minor dirt conditions which might jam a conventional solenoid valve when used on a very low temperature suction line.

### Principles of Operation

#### TYPE S4W

The valve in its closed position, with the solenoid coil de-energized and the plunger-needle and main port plug in the seated position is shown in the drawing at the left. Electrical energization of the solenoid coil forms a magnetic field, pulling up the plunger which strikes the needle, lifting it off its seat. Upward motion of the needle permits entrance of the fluid from the valve inlet M through Port N and down through the pilot port to the top of the power piston. This forces the piston downward and pushes the main port plug open, thereby permitting flow of the refrigerant through the valve. The closing spring meanwhile is held in a compressed position.

De-energization of the solenoid coil permits the spring-assisted needle to drop back into its seat, stopping the flow through the pilot port. Bleed-off, through the bleed hole in the piston, decreases the pressure above the piston and allows the closing spring to force the main port plug upward into a closed position to stop the flow. The pressure difference across the valve, acting upon the area of the valve seat, plus the force of the closing spring, holds the main port plug in a tightly closed position.

## TYPE S9W

For opening of the S9W main valve, the Pressure Pilot Solenoid Valve is electrically energized to open (Admitting high pressure gas to Chamber A at the top of the power piston); simultaneously, the Bleed Pilot Solenoid Valve is electrically de-energized (preventing escape of the high pressure gas entering Chamber A); thereby the pressure acting on the power piston forces the main valve wide open.

For closing of the S9W main valve, the reverse actions take place. The Pressure Solenoid is electrically de-energized to close (preventing further high pressure gas from reaching Chamber A at the top of the power piston); simultaneously, the Bleed Solenoid is electrically energized to

open (bleeding off pressure from Chamber A); thereby the main valve is caused to close by the force of the valve closing spring.

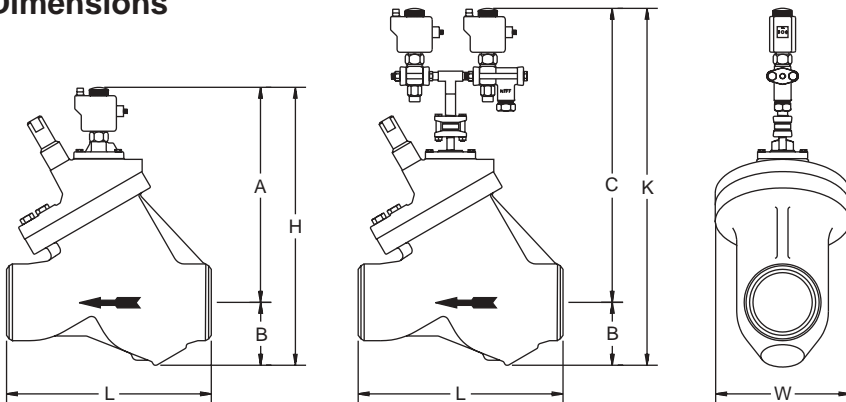
## Manual Opening Stem

The manual opening stems on the Types **S4W** and **S9W** are for the purpose of opening the valve without energizing the solenoid coil. Refer to the applicable cross-section drawing for location of the stem and other related parts. For access to each stem the seal cap on the top of the valve must be removed. This must be done with caution as refrigerant may have been trapped inside the seal cap. Manual opening is accomplished by turning the stem clockwise until only the flats on the end of the stem protrude from the packing nut. To reset for automatic operation turn the stem counterclockwise as far as it goes.

## Repair Kits for Type S4W and S9W Solenoid Valves

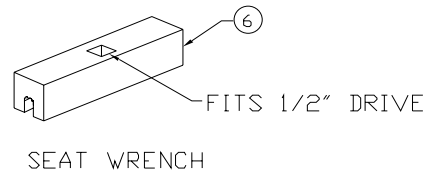
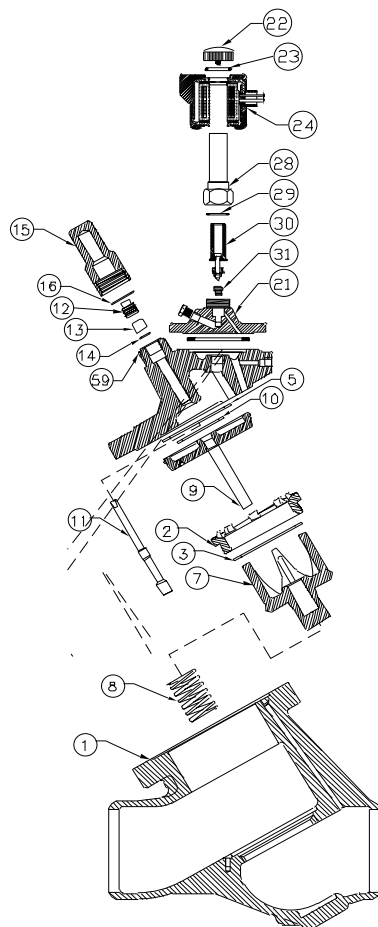
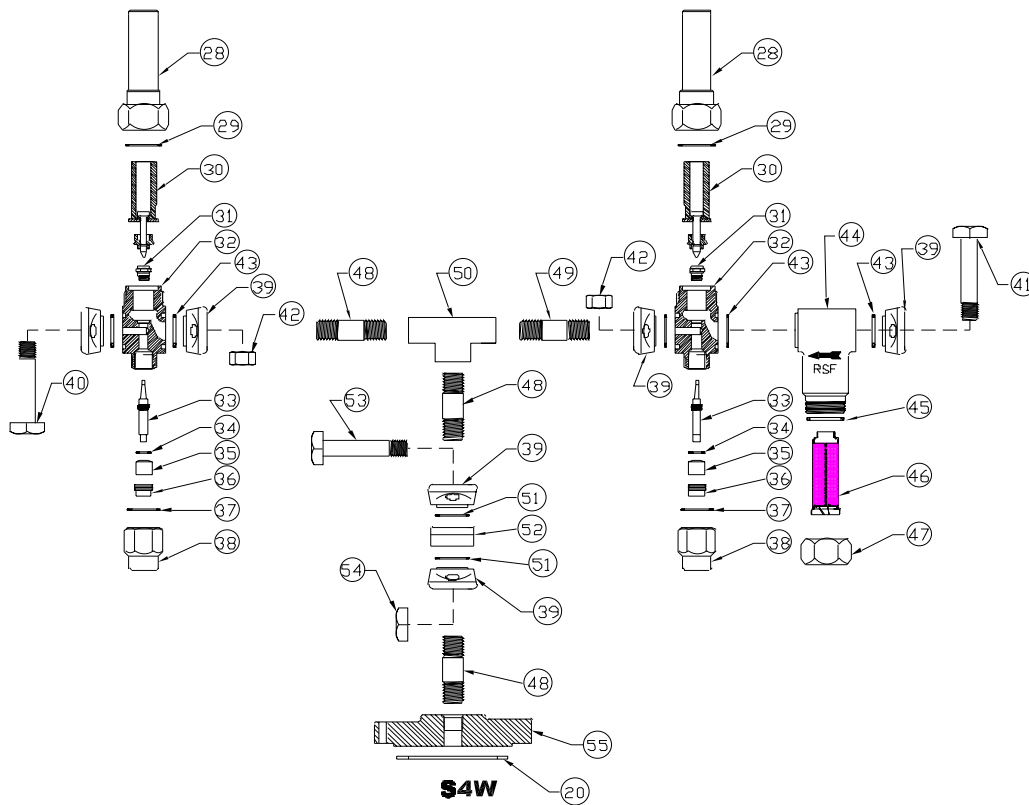
Item	Description	125mm (5")	Qty S4W S9W	150mm (6")	Qty S4W S9W	200mm (8")	Qty S4W S9W	Item	Description	125mm (5")	Qty S4W S9W	150mm (6")	Qty S4W S9W	200mm (8")	Qty S4W S9W
1	Body, Valve	Not available separately	1	Not available separately	1	Not available separately	1	32	Body, S6N (Includes Name Plate)	Not available separately	2	Not available separately	2	Not available separately	2
2	Seat, Valve	Only with Kit	1	Only with Kit	1	Only with Kit	1	33	Stem, Manual Opening	Only with Kit	2	Only with Kit	2	Only with Kit	2
3	O-Ring, Seat	Only with Kit	1	Only with Kit	1	Only with Kit	1	34	Washer	Only with Kit	2	Only with Kit	2	Only with Kit	2
4	Screw, Retaining	Only with Kit	1	Only with Kit	1	Only with Kit	1	35	Packing, Stem	Only with Kit	2	Only with Kit	2	Only with Kit	2
5	Gasket (Adapter to Body)	Only with Kit	1	Only with Kit	1	Only with Kit	1	36	Nut, Packing	Only with Kit	2	Only with Kit	2	Only with Kit	2
6	Wrench, Seat	Only with Kit	1	Only with Kit	1	Only with Kit	1	33-36	Stem Kit, Opening	201631	2	201631	2	201631	2
2-6	Seat Kit	201534	1	201535	1	201536	1	37	Gasket	Only with Kit	2	Only with Kit	2	Only with Kit	2
7	Plug, Modulating	Only with Kit	1	Only with Kit	1	Only with Kit	1	38	Seal Cap	Only with Kit	2	Only with Kit	2	Only with Kit	2
8	Spring, Compression	Only with Kit	1	Only with Kit	1	Only with Kit	1	37-38	Seal Cap Kit	201145	2	201145	2	201145	2
2-8	Plug Kit - S4W	201537	1	201538	1	201539	1	39	Flange Kit (2 Figs. only)	200001	3	200001	3	200001	3
2-8	Plug Kit - S9W	201691	1	201692	1	201693	1	40	Bolt	Only with Kit	2	Only with Kit	2	Only with Kit	2
9	Piston Stem Assembly	Only with Kit	1	Only with Kit	1	Only with Kit	1	41	Bolt	Only with Kit	2	Only with Kit	2	Only with Kit	2
10	Ring, Seal	Only with Kit	1	Only with Kit	1	Only with Kit	1	42	Nut	Only with Kit	4	Only with Kit	4	Only with Kit	4
5,9,10	Piston Kit - S4W	201540	1	201541	1	201542	1	43	Gasket	Only with Kit	5	Only with Kit	5	Only with Kit	5
5,9a,10	Piston Kit - S9W	201543	1	201544	1	201545	1	40-43	Bolt Kit (S6N without Strainer)	201290	1	201290	1	201290	1
11	Stem, Manual Opening	Only with Kit	1	Only with Kit	1	Only with Kit	1	40-43	Bolt Kit (S6N with Strainer)	201287	1	201287	1	201287	1
12	Nut, Packing	Only with Kit	1	Only with Kit	1	Only with Kit	1	29,37,43	Gasket Kit	201632	2	201632	2	201632	2
13	Packing, Stem	Only with Kit	1	Only with Kit	1	Only with Kit	1	28-38,43	Pilot Valve Assembly	100990	2	100990	2	100990	2
14	Washer, Packing	Only with Kit	1	Only with Kit	1	Only with Kit	1	44	Body, Strainer	Not available separately	1	Not available separately	1	Not available separately	1
5,11-14	Stem Kit, Opening	201546	1	201547	1	201548	1	45	Gasket	Only with Kit	1	Only with Kit	1	Only with Kit	1
15	Seal Cap	Only with Kit	1	Only with Kit	1	Only with Kit	1	46	Basket	Only with Kit	1	Only with Kit	1	Only with Kit	1
16	Gasket	Only with Kit	1	Only with Kit	1	Only with Kit	1	47	Cap	Only with Kit	1	Only with Kit	1	Only with Kit	1
15-16	Cap Kit, Seal	201549	1	201550	1	201551	1	45-47	Basket, Kit	200136	1	200136	1	200136	1
17	Bolt, Hex Head	Only with Kit	6	Only with Kit	10	Only with Kit	16	48	Pipe Nipple	302014	3	302014	3	302014	3
18	Nuts	Only with Kit	6	Only with Kit	12	Only with Kit	16	49	Pipe Nipple with Orifice	200999	1	200999	1	200999	1
19	Studs	Only with Kit	2	Only with Kit	2	Only with Kit	2	50	Tee	302083	1	302083	1	302083	1
5,17-19	Bolt Kit	201552	1	201553	1	201554	1	51	Gasket	Only with Kit	2	Only with Kit	2	Only with Kit	2
20	Gasket (Bonnet)	Only with Kit	1	Only with Kit	1	Only with Kit	1	52	Screen Assembly	Only with Kit	1	Only with Kit	1	Only with Kit	1
3,5,10,16-20	Gasket Kit	201558	1	201559	1	201560	1	51-52	Screen Assembly Kit	200912	1	200912	1	200912	1
21	Adapter, S4W	301244	1	301244	1	301244	1	52	Bolt	Only with Kit	2	Only with Kit	2	Only with Kit	2
22	Knob	Only with Kit	1	Only with Kit	1	Only with Kit	1	54	Nut	Only with Kit	2	Only with Kit	2	Only with Kit	2
23	O-Ring	Only with Kit	1	Only with Kit	1	Only with Kit	1	53-54	Bolt Kit	201672	1	201672	1	201672	1
22,23	Knob Kit	205237	1	205237	1	205237	1	55	Cover Top	202545	1	202545	1	202545	1
24	Coil Assembly, S4W	See Part No. Page 4	1	See Part No. Page 4	1	See Part No. Page 4	1	56	O-Ring	Only with Kit	1	Only with Kit	1	Only with Kit	1
28	Tube Assembly	Only with Kit	1	Only with Kit	1	Only with Kit	1	57	Insert Seal	Only with Kit	1	Only with Kit	1	Only with Kit	1
29	Gasket	Only with Kit	1	Only with Kit	1	Only with Kit	1	56-57,20	Insert Seal Kit	202333	1	202333	1	202333	1
28-29	Tube Kit	201036	1	201036	1	201036	1	58	Plug, Pipe	302011	1	302011	1	302011	1
30	Plunger Needle Assembly	Only with Kit	1	Only with Kit	1	Only with Kit	1	5-13-20	Adapter Cover	202861	1	202484	1	203099	1
31	Seal Assembly	Only with Kit	1	Only with Kit	1	Only with Kit	1	58-59							
29-31	Plunger Seat Kit	201630	1	201630	1	201630	1								

## Dimensions



Dimension		125mm (5")	150mm (6")	200mm (8")
A	mm	451	527	584
	inch	17.75	20.75	23.00
B	mm	114	152	197
	inch	4.50	6.00	7.75
C	mm	597	673	730
	inch	23.50	26.50	28.75
H	mm	565	679	781
	inch	22.25	26.75	30.75
K	mm	711	825	927
	inch	28.00	32.50	36.50
L	mm	381	483	622
	inch	15.00	19.00	24.50
W	mm	267	318	381
	inch	10.50	12.50	15.00

**\$9W**



## Installation

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

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

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

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

Before installing the valve, check to see that all chips, scale, dirt and other foreign material are removed from the pipes; also be sure the arrow on the S4W valve body is pointing in the flow direction. (See paragraph below concerning Type S9W). Remove the protective covers from the valve.

Type S4W valve must be mounted in a horizontal pipeline with the solenoid at the top and in a vertical position as shown on page 1.

Type S9W valve can be mounted in any position except upside down. The remote pilot solenoids, however, must be mounted in a vertical position with the solenoid at the top as shown on page 1.

There are some applications in which an S9W in a horizontal line will function better if installed lying on its side. For example, in a liquid overfeed suction line. The internal partitions of the valve body that separate the inlet side from the outlet side, create a higher wall (or dam) which will tend to block flow of liquid refrigerant and/or oil, if the valve is in an upright position, than if on its side. Especially in low temperature suction lines, where the velocities tend to be slower, an S9W lying on its side will offer less resistance to flow than one in an upright position, because the valve inlet throat will not be choked with as much liquid.

The Type S9W Main Valve Body should normally be installed with the arrow on the body pointing in the direction of normal fluid flow through the valve. However, when installed in gravity liquid or gas legs between a flooded evaporator and its surge drum, as part of a defrost control system, the arrow should always point from the evaporator to the surge drum.

The Pilot Solenoid Valve assembly may be located anywhere within approximately 8 meters (25 feet) of the Main Valve Body, provided pipe connections are extended to the Main Valve Body as well as to condenser gas and compressor suction lines. The standard Pilot Solenoid Valve assembly is built for installation on top of the Main Valve Body; therefore, remote or altered location of the Pilot Solenoid Valve assembly requires slight revisions in the field to the 3/8" pilot valve assembly piping.

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

If the valve is to be insulated, be sure to allow access to the manual opening stem and strainer. Do not insulate the coil and coil housing.

Connect the solenoid lead wires to an electrical supply source as indicated on the valve coil. The power source must be capable of supplying full, constant voltage. The wires, to which the solenoid leads are connected, must be of the proper gauge.

## Electrical

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

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

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

The solenoid coil must be connected to electrical lines with volts and Hertz same as stamped on coil. The supply circuits must be properly sized to give adequate voltage at the coil leads even when other electrical equipment is operating. The coil is designed to operate with line voltage from 85% to 110% of rated coil voltage. Operating with a line voltage above or below these limits may result in coil burnout. Also, operating with line voltage below the limit will definitely result in lowering the valve opening 10 pressure differential. Power consumption during normal operation will be 33 watts or less.

Inrush and running current is listed below:

Standard Coil Volts/Hertz	Inrush Current (Amps)	Running Current (Amps)	Fuse Size (Amps)
120/60 (Blue leads)	1.18	0.46	1
208/60 (Blue & Red leads)	0.63	0.26	1
240/60 (Red leads)	0.60	0.23	1
440/60 (Yellow & Red leads)	0.39	0.13	1
115/50 (Yellow & Blue leads)	1.22	0.21	1
230/50 (Yellow leads)	0.65	0.26	1
Other	(Contact Factory)		
On transformer coil the 6 volt leads are always black.			

**Caution:** Do not connect the solenoid lead wires to the loadside circuit of a motor or other high current device. Doing this may cause the solenoid and motor or other device to become energized simultaneously and produce a voltage drop, resulting in the valve's failure to open. A more desirable condition would be to connect the solenoid on a separate circuit or to install a time delay on the heavy load solenoid valve circuit. This would prevent energization of the solenoid until the circuit's full power is restored.

## Warranty

All Refrigerating Specialties Products are warranted against defect 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, repaired in the field; damaged in transit, or have suffered accidents, misuse, or abuse. Products disabled by dirt, or other foreign substances will not be considered defective.

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

## SAFE OPERATION (see also Bulletin RSBCV)

People doing any work on a refrigeration system must be qualified and completely familiar with the system and the Refrigerating Specialties Division 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 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 for S9W pilot solenoids with ODS connections **are not suitable** for ammonia service.