REFRIGERANT FLOAT SWITCH
Type LL, LLC, LLS, LLSC, LLA, LLAC

Suitable For: Ammonia, R-22, R-507, R134A and Other Common Refrigerants

FEATURES
- Hermetically Sealed, Fused Switch Assembly
- Transparent Switch Housing
- Magnetically Actuated
- Mechanically Operated
- Single Stage Single Pole Double Throw Switch
- For All Common Refrigerants
- Float Controlled
- Rugged Construction
- Types LL, LLC, LLS, LLSC, LLA, LLAC, and U.L. Listed and CSA Certified
- Available with DIN Connector

DESCRIPTION
This float controlled switch, magnetically actuated, mechanically operated, and hermetically sealed switch assembly can maintain close control of liquid level. The rugged construction makes it relatively insensitive to disturbances of the refrigeration system or vibration of the attached pipe lines. The electrical switch, which is fused, and the operating mechanism are encapsulated within a transparent housing, which HERMETICALLY SEALS the moving parts and switch from ambient conditions and yet allows observation of the switching motion for determination of the liquid level. Type LLC, LLSC, LLAC are U.L. listed for outdoor service.

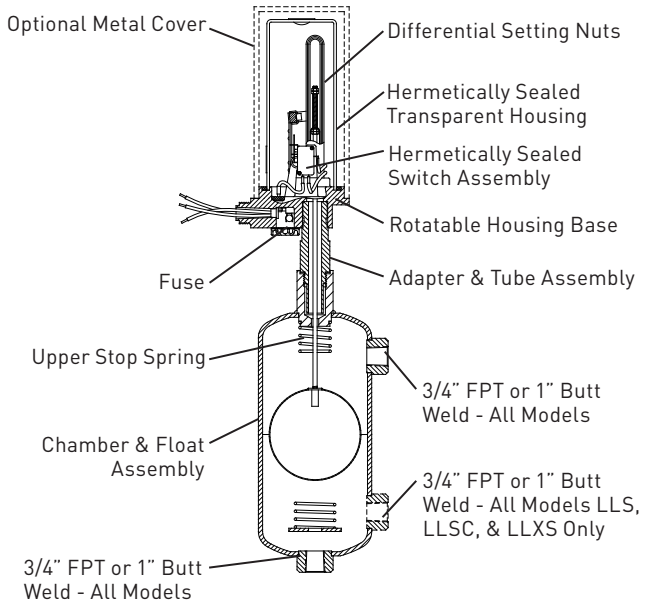


FIG. 1: Float Switch Cross-Section

Bulletin 61-10 J

November 2007
Installation, Service, and Parts Information

PURPOSE
The function of the Refrigerant Float Switch is to provide electrical switching action in response to a change in refrigerant liquid level.

This device can be used with all common refrigerant liquids with specific gravity of .57 to 1.7 in a temperature range of -45°C to +65°C (-50°F to +150°F). The temperature range for Types LLA, and LLAC is -75°C to +65°C (-100°F to +150°F). All types can be installed in ambient temperatures of -45°C to +50°C (-50°F to +120°F). The safe working pressure is 27.6 bar (400 psig).

It is used to control and monitor the liquid level in flooded surge drums, flooded shell and tube chillers, high and low pressure receivers, intercoolers, transfer vessels and various kinds of accumulators including liquid recirculating types.

In order to accomplish the above operations, the Float Switch is used to open and close solenoid valves to activate or deactivate electrical controls, to energize or de-energize magnetic starters for starting and stopping refrigerant liquid pumps and compressors and, as a safety device, to sound alarms and turn on lights when there is a danger of high or low liquid level.

INSTALLATION

The Refrigerant Float Switch is shipped from the factory with a plastic plug in the bottom inlet connection(s) and a metal clip in the upper side equalizing connection covered by a plastic plug. The forked portion of the clip slips over the float rod and supports the float ball and float rod in the upper position. This keeps the float ball from bouncing and possibly being damaged if dropped or otherwise mishandled in shipment. Also with the float rod in the upper position, the attraction sleeve is held in the magnetic field and the magnet is held securely against the enclosing tube, protecting the switch mechanism.

Remove the plastic plugs from the chamber connections and the metal clip from the upper connection before installing.

CAUTION: Do not twist the metal clip as this may damage the float stem. Grasp the tab on the metal clip securely and pull straight out.

To learn more about the switch operation, insert a rigid slender rod through the bottom connection and up through the small opening in the baffle plate until the float ball is contacted. Note the position of the magnet and electrical switch at this time. One set of internal contacts is open and one set is closed. Gently raise the float ball and soon you will notice the magnet pull in against the enclosing tube. You will also notice that the actuating arm on the electrical switch has changed position. The internal contacts have now reversed themselves; the one set, which was open, is now closed, the other set is now open.

The desired level in the surge drum, accumulator, shell and tube evaporator, receiver, etc., should be established and located on the vessel or switch column (if supplied). The Refrigerant Float Switch should be located so that the level mark shown on the label is lined up with the desired liquid level in the vessel.

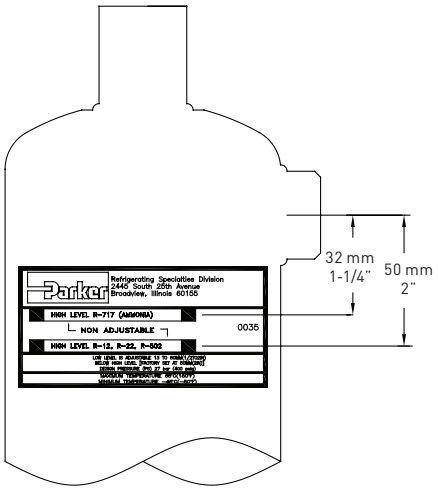


FIG. 2: Float Chamber

The gas equalizing connection located on the top side of the float chamber should normally be connected well above the liquid level in the vessel upon which it is mounted. The piping for making this connection should never be "trapped" as any liquid contained therein will cause the upper part of the float chamber to become gas-bound.

The liquid connection located at the bottom of the float chamber should be piped to the vessel at a location preferably lower than the float switch in such a manner that it will allow the pipe to be free draining thereby offering no obstructions to gravity flow. DO NOT TRAP THIS LINE as it would then become an ideal location for oil to accumulate and could cause false levels in the float chamber. It would be ideal if the piping on this liquid connection were arranged so that liquid could drain freely back into the vessel. Since this is not usually practical, level horizontal connections are normally used. Make both the liquid and gas equalizing pipe connections as short as possible.

If a Type LLS is used with both side connections for refrigerant, an oil drain can be connected in the bottom, if required.

MOUNTING INSTRUCTIONS

The Refrigerant Float Switch must always be mounted in a vertical position. The side of the float chamber can be used as a leveling surface and, with the use of a simple level, proper position can be obtained.

Where the Refrigerant Float Switch is mounted directly to the vessel (rather than on a float switch column), we recommend the installation of a hand globe valve in each of the piping connections to the float chamber. While not strictly necessary, these valves do provide access to the float chamber for cleaning or servicing without pumping out the vessel.

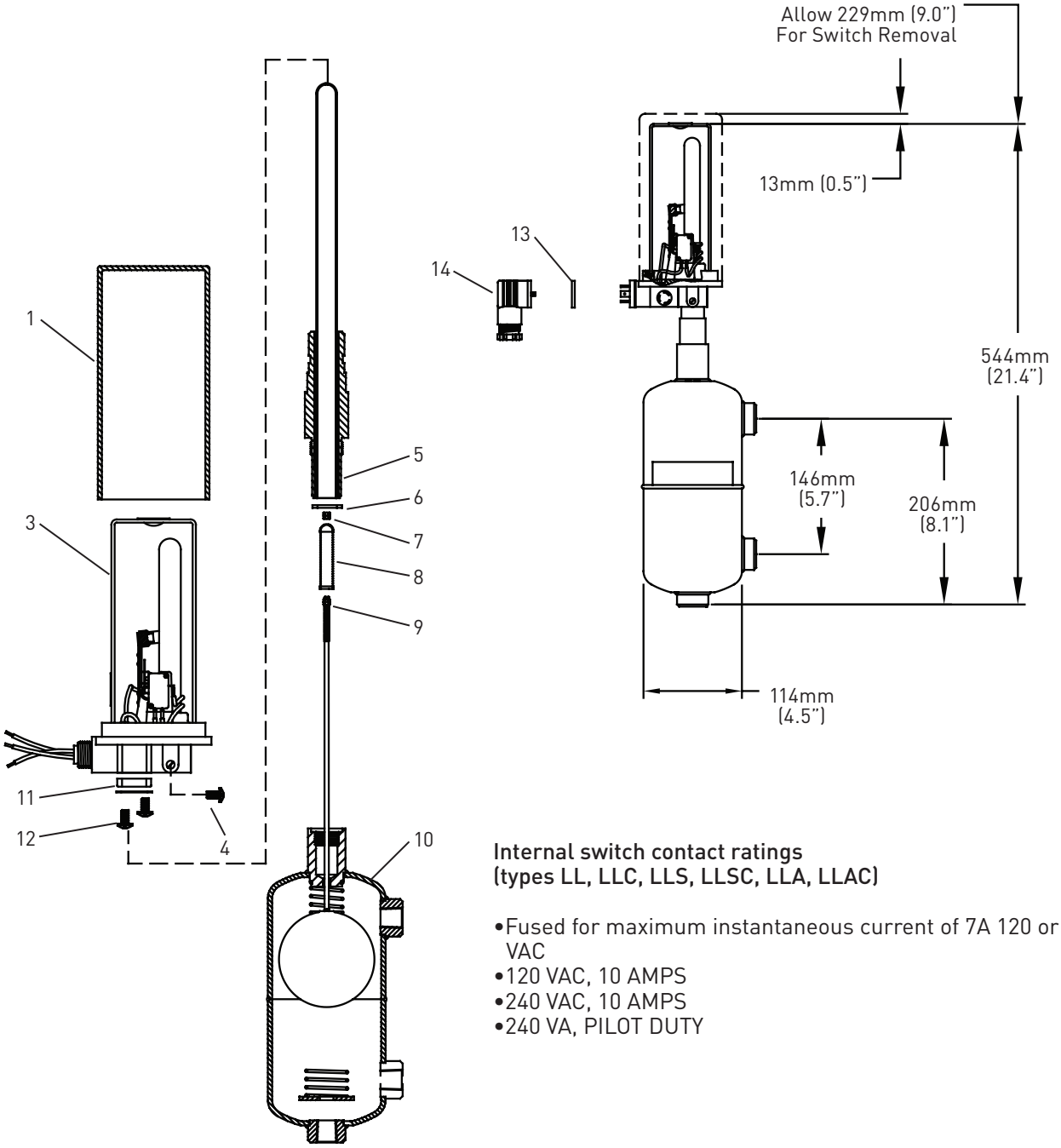
When installed in the horizontal pipe connections, it is recommended that the hand valves be positioned on their sides (with the stem horizontal) to offer as little restriction as possible to gravity flow.

For multiple float switch installation, where the float switches are mounted on a float switch column (sometimes called balance leg or gas bypass leg), and where it would be inconvenient and costly to install separate hand valves on each float switch, we recommend an upper and lower hand angle valve to be installled on the switch column. This will provide access to the float chambers without pumping out the system or the vessel. We recommend a 100mm (4") pipe to be used for the switch column.

It is important to remember that, on any type of float ball application, precaution must be taken, or at least considered, to keep the liquid in the float chamber as quiet as possible. Attention to this condition will assure a proper

REPAIR KITS LIST FOR THE REFRIGERANT FLOAT SWITCH

Item No.	Description	Qty	LL	LLC	LLS	LLSC	LLA	LLAC
1, 2	Cover	1	-----	202272	-----	202272	-----	202272
3, 4	Switch Assembly	1	050100	050100	050100	050100	050100	050100
5, 6	Adapter & Tube Kit	1	201243	201243	201243	201243	202356	202356
6	Gasket	5	202559	202559	202559	202559	202559	202559
5 - 10	Chamber & Float	1	201270	201270	201271	201271	050123	050123
3, 4	DIN Switch	1	204466	204466	204466	204466	204466	204466
11	Fuse Kit	-----	203486	203486	203486	203486	203486	203486
12	Cover Kit	-----	203485	203485	203485	203485	203485	203485
13 - 14	Connector Kit	-----	204135	204135	204135	204135	204135	204135



Internal switch contact ratings
(types LL, LLC, LLS, LLSC, LLA, LLAC)

- Fused for maximum instantaneous current of 7A 120 or 240 VAC
- 120 VAC, 10 AMPS
- 240 VAC, 10 AMPS
- 240 VA, PILOT DUTY

FIG. 3: Hermetic Float Chamber Assembly and Parts List

response of the float switch to the rise and fall of the liquid level in the vessel being controlled.

In low temperature systems, where the vessel and float switches are located in a non-refrigerated room, it is quite important that the gas equalizing piping connection on the top of the float chamber be generously sized in an effort to continuously release any gas which is formed and to prevent a depression of the liquid level in the float chamber due to a slight pressure build-up on top of the liquid.

In addition, when installed in non-refrigerated rooms, both the liquid and gas equalizing lines and float chamber (as well as the main vessel) must be insulated to minimize the "boiling" action and provide a quiet liquid level for the float ball.

LIQUID LEVEL DIFFERENTIAL ADJUSTMENT (FIG. 4)
The upper end of the float rod contains two pairs of lock nuts. The differential setting is determined by the distance separating these two pairs of lock nuts. When these pairs of nuts are located at their maximum distance apart, the greatest differential will be realized. A decrease in differential setting is made by loosening the upper pair (differential setting nuts), moving them toward the lower attraction sleeve stop nuts, then setting and locking them at the required spot. The differential is factory set at **50mm (2")** and can be adjusted down to **13mm (1/2")**, if necessary.

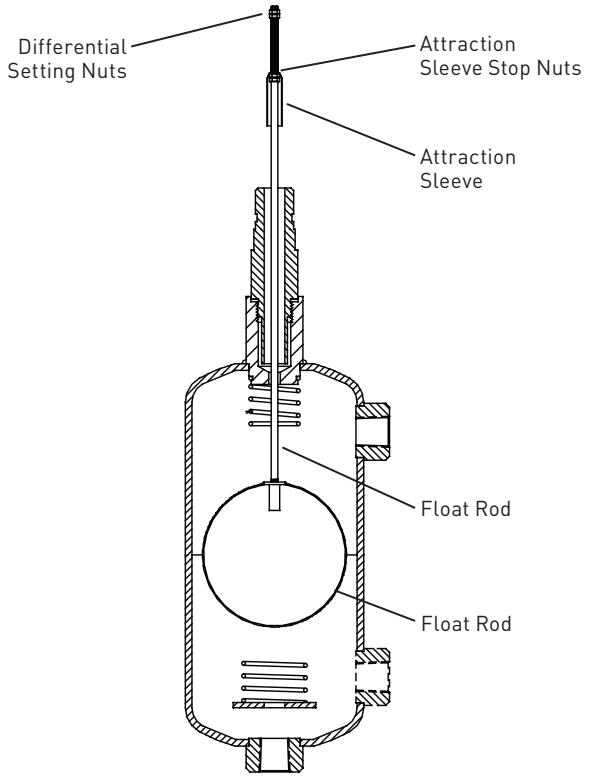


FIG. 4: Level Adjustment Diagram

CAUTION: In order to make this adjustment, which is very seldom necessary and then only on special applications, the chamber, adapter and tube assembly must be pumped-out to atmospheric pressure and isolated from the main vessel of liquid.

The lower pair (attraction sleeve stop nuts) are factory locked in position and determine the *maximum liquid level* in the float chamber. They move the attraction sleeve upward with a rise in liquid level and also perform the function of stopping the attraction sleeve as it drops out of the magnetic field when the liquid level falls; *the position of these lower attraction sleeve nuts should never be changed.* When shipped, the upper pair (differential setting nuts) is factory located near the upper end of the float rod and in this location achieves the *maximum liquid level differential,* which is 50mm (2").

With a decrease in liquid level, the attraction sleeve does not immediately follow the float movement but is held in place by the magnet until the liquid level differential has been reached and the differential setting nuts have pulled it down out of the magnetic field. With a drop in the liquid level, the liquid level differential is determined by the total change in height of the liquid required to pull the attraction sleeve out of the magnetic field.

PRINCIPLES OF OPERATION (FIG. 3, ITEM NO. 3)
When the float chamber is empty, the float ball will be supported by the float stop spring and lower baffle plate. In this position, the differential setting nuts will have pulled the attraction sleeve out of the magnetic field allowing the carriage lever and magnet to move away from the enclosing tube. With the carriage lever and magnet *in this position*, the electrical switch will have one set of contacts open (N.O.-electrical circuit open) and the other set of contacts closed (N.C.-electrical circuit closed).

The electrical switch has single pole double throw contacts rated for 10 amps. The switch circuit is protected by a style 3AG fuse on the common leg rated at 7 amps. The 3 leads from the switch are connected to isolated terminal pins incorporated into the hermetic enclosure. A second set of wires connected to the opposite side of the terminal pins lead to the exterior of the switch base thereby ensuring the integrity of the hermetic seal. The wires are color coded and individually tagged as follows (in addition each wire is marked as shown in parenthesis):

Gray Wire - Common lead (C)

Red Wire - Normally closed circuits (N.C.)

Makes a closed electrical circuit (with magnet and carriage lever away from the enclosing tube) when connected to Gray Wire and the liquid level is low.

Black Wire - Normally Open (N.O.)

Makes an open electrical circuit (with magnet and carriage lever away from enclosing tube) when connected to Gray Wire and the liquid level is low.

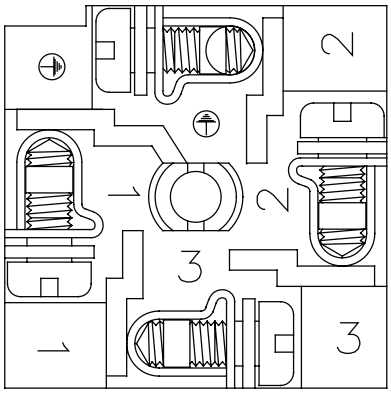


FIG. 5: Quick Connect/Disconnect Electrical Switch Connector Diagram

TERMINAL TABLE

Terminal	Wire Color	Type
1	Gray	C
2	Red	N.C.
3	Black	N.O.
G	Green	Ground

As liquid refrigerant enters the chamber through the bottom inlet connection, the float will start to rise as it is buoyed-up by the liquid. As the float and its rigidly attached float rod begin to move upward, the attraction sleeve stop nuts will contact the attraction sleeve and move it upward.

As the liquid level continues to rise in the float chamber, the float and float rod will continue to move upward until the attraction sleeve stop nuts have moved the attraction sleeve into the magnetic field (Fig 6). With the float in this position, the liquid is up to the high level marked on the label. A magnetic force is exerted and the magnet, with its carriage lever, is pulled against the enclosing tube. With the magnet in this position, the force of the carriage lever actuates the rigidly held electrical switch and the two sets of contacts will be reversed; the normally closed circuit ***will open*** and the normally open circuit will ***close*** **.**

The neck at the top of the chamber and the attraction sleeve provide a guiding means for the float rod and keep the float ball from contacting any surface of the chamber. This design feature virtually eliminates any internal sludge or oil formation on the chamber side walls from affecting the float's freedom of movement.

If a violent surging action should take place in the main vessel, the resultant rapid change in liquid level might be reflected in the float chamber, although at a much slower rate due to the baffle plate covering the bottom inlet connection.

A rather sudden increase in liquid level could possibly raise the float and float rod up past the normal operating liquid level and cause the float ball to contact the upper stop spring. The upward movement of the float and float rod would now be stopped. This upper spring eliminates possible stem damage brought about by this abrupt inflow surge.

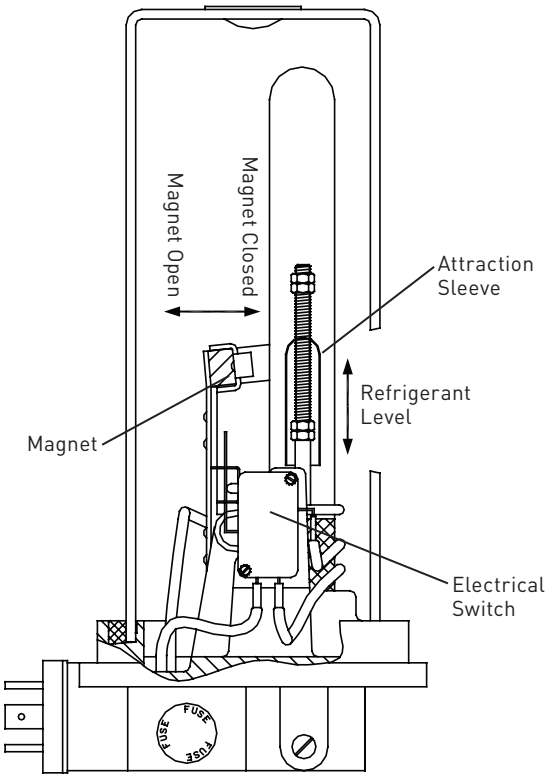


FIG. 6: Quick Connect/Disconnet Magnet and Sleeve

SERVICE POINTERS

CAUTION: Before doing any service work, always be sure to disconnect the power to the switch assembly.

1. **Replacement of Switch Assembly:** The Hermetic Float Switch Assembly (Fig. 4, Item No. 3), can be replaced without pumping down the float chamber. It is necessary only to disconnect the electrical leads in the junction box at or near the float switch, loosen the base set screw and slide the Switch Assembly up from the Float Rod Enclosing Tube. The new Switch Assembly can then be replaced in a similar manner.

2. **Failure to Open or Close:** The Hermetic Float Switch Assembly is a sealed unit. Before replacing the assembly as described in paragraph No. 1 above, external wiring should be checked to be sure that the trouble is not somewhere other than the float switch. If the wiring is found to be in good condition, the fuse in the base of the switch assembly should be checked to be sure it is

in working condition. If the fuse needs to be replaced, be sure the power is disconnected to the switch before any repairs are made. To replace the fuse, remove the gasket and cover over the fuse compartment in the base of the switch. Carefully remove the fuse so as not to crack the glass insulator and discard the old fuse. Simply slip in a new fuse in the fuse holder clips to install the replacement. Then place the gasket and cover back on the switch base over the new fuse.

3. **Switch Current Limitations:** The electrical capacities of the switch are listed on page 3. Continual switching of overloaded contacts will, of course, eventually burn or pit them to a point where they will no longer perform their function. Gross overloading can weld the contacts together so that they will not open. Errors in field wiring which place a dead short across the contacts will cause the switch fuse to fail. Good wiring practice will dictate using a properly sized fuse in the control circuit to protect the load as well as added protection for the switch.

4. **Low Temperature Ambients:** If it is necessary to install a Switch Assembly in an ambient temperature below -20°C (0°F), caution should be used when flexing the plastic insulated wire leads. At very low temperatures -40°C (-40°F) the leads are stiff, and undue bending may crack the insulation.

FLOAT SWITCH ACTUATOR

The HERMETICALLY SEALED, tamper-proof construction of the R/S Refrigerant Float Switch necessitates an external means of actuating the switch since manual contact is not possible. When operation of the switch is desired without changing the liquid level (or to check electrical circuitry before the system is charged), R/S can supply a powerful permanent magnet to actuate the switch externally. Specify Q63 magnet.

The external magnetic actuator can be used to attract or repel the switch's permanent magnet mounted on magnet carriage lever. To accomplish the operation, apply the float switch actuator to the hermetically sealed transparent enclosure in a location opposite the switch permanent magnet. It may be necessary to reverse the actuator once to obtain the proper action desired.

SAFE OPERATION (SEE 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 that could result from liquid expansion. Temperature increase in a piping section full of solid liquid will cause high pressure due to the expanding liquid that 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 close 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 that 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 (1) 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 Division. Defective products or parts of 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 that have been altered or repaired in the field, damaged in transit as a result of 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. In no event is Refrigerating Specialties responsible for any consequential damages of any nature whatsoever. No employee, agent, dealer or other person is authorized neither to give any warranties

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