

Refrigerant Float Switch

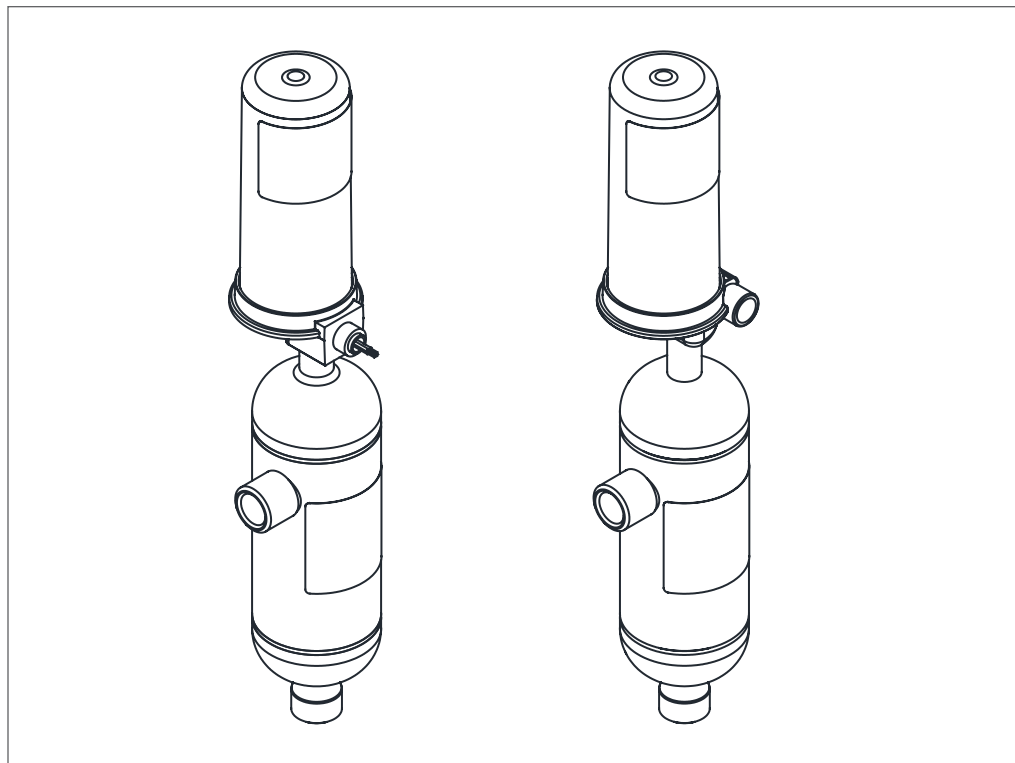
Product Bulletin 61-12 A

Type: LLSS



Purpose:

The LLSS refrigerant float switch provides an electrical switching action in response to change in the refrigerant level. LLSS float switches are used to control and monitor liquid levels in flooded surge drums, flooded shell and tube chillers, high and low pressure receivers, intercoolers, transfer vessels and various kinds of accumulators. The LLSS's most beneficial feature is its stainless steel construction, which allows it to withstand corrosive environments.



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- Suitable for ammonia, R-507, R-134a, and other common refrigerants
- Stainless steel float chamber assembly
- UV resistant and transparent switch housing with optional protective cover
- Magnetically actuated switch (single pole double throw)
- Hermetically sealed switch
- Complete assembly weighs 3.08 kg (6.8 lbs)
- Switch assemblies are compatible with Refrigeration Specialties liquid level models LL, LLS, and LLA
- Complies with Pressure Equipment Directive (PED) 2014/68/EU



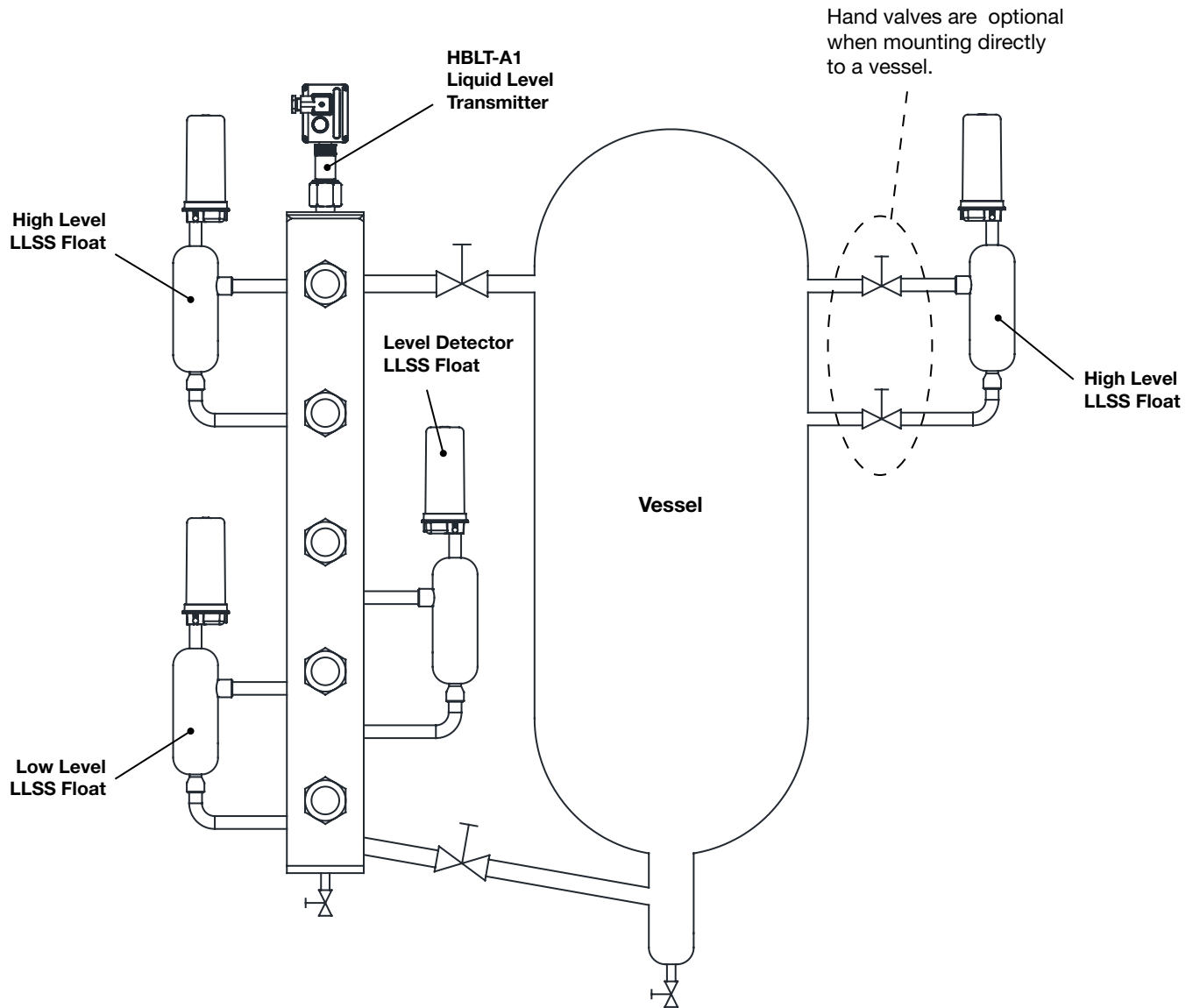
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Application Example

LLSS Float Chamber and Switch Assembly Mounting Example



Application

For control and detection of liquid levels in:

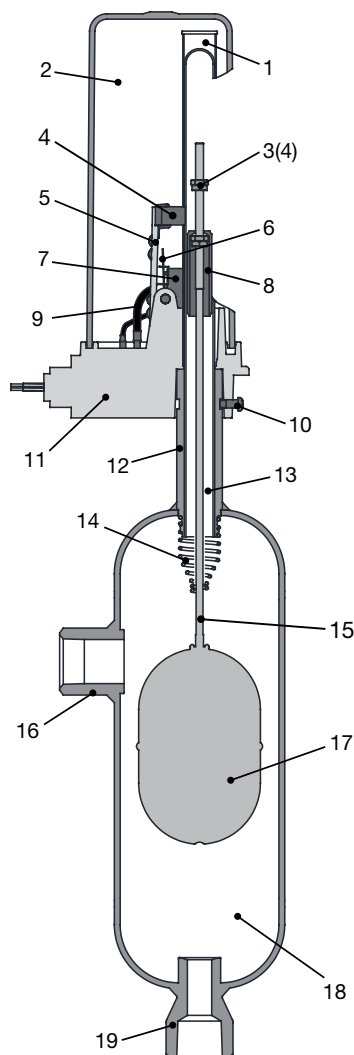
- Flooded surge drums
- Flooded shell and tube chillers
- High and low pressure receivers
- Inter coolers
- Transfer vessels
- High/Low level safety switch

Technical Data

Tank Liquid Temperature -75°C to 65°C (-100°F to 150°F)
 Ambient Temperature -45°C to 50°C (-50°F to 120°F)
 Maximum Float Chamber Rated Pressure 31 bar (450 psi)
 Connections
 Float Chamber 3/4" -14 NPT or 1" BW
 Switches 1/2" NPT
 Specific Gravity Range 0.55 to 1.70
 Electrical Connections 4-pole Q/D or Ledged

Leaded Switch Lead Length 610 mm (24")
 Supply Voltage 10A 120 VAC, 10 A 240 VAC, or 1/2 A 125 VDC
 Approvals /Certificates
 Float Chamber CE0035, PED
 Leaded Switch No certificate
 QD Connector, DIN Switch IP65
 Weight 3.08 kg (6.8 lbs)

Material List



Item	Description	Material
1	Tube, Base Assembly	ASTM B-135, Brass Tubing
2	Housing, Molded	UV Stabilized Clear Polycarbonate
3	Nut, Differential Setting	18-8 Stainless Steel
4	Magnet	Alnico 5
5	Bracket, Lever (Magnet)	Brass, Zinc Plated
6	Actuator, Lever (Magnet)	304 Stainless Steel
7	Switch	—
8	Metallic Sleeve Attractor	
9	Wire Assembly	18 AWG Red, Black and Gray 12 AWG Green
10	Thumb Screw, #8-32 3/8" LG	Nylon 6/6
11	Base, Molded	UV Stabilized Black Polycarbonate
12	Adapter	304L Stainless Steel
13	Tube	304L Stainless Steel
14	Spring	ASTM A-313 Stainless Steel
15	Stem, Threaded Rod	ASTM A-582 Stainless Steel
16	Side Fitting, Tank	304L Stainless Steel
17	Float Ball	304 Stainless Steel
18	Tank/Chamber	ASTM A-269 Stainless Steel
19	Bottom Fitting, Tank	304L Stainless Steel
—	Cover, Switch	6061-T6 Aluminum
—	Gasket, QD Connector	GDM 3-21 EPDM
—	Wire Leads, Leaded & QD Switch	18 AWG

Function and Design

The LLSS refrigerant float switch is a mechanical float device which identifies a particular level of refrigerant in a vessel; as shown in the application example, on page 2, three separate LLSS float switches are being utilized to identify a low, high and intermediate liquid refrigerant levels. These examples are only a few of many applications of how the LLSS float switch can be applied to monitor or control refrigerant liquid levels.

The float switch can be used to open and close solenoid valves, to activate or de-activate 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 high, low or unwanted liquid level.

It consists of a stainless steel welded chamber containing a float with a limit switch mounted on top. The chamber has a float-rod assembly with a metallic attractor located on the upper end of the float rod. The electrical switch and operating mechanism are encapsulated within a hermetically sealed UV resistant transparent housing.

The neck at the top of the chamber and the metallic attractor sleeve provide a means for guiding the float rod. This design

feature virtually eliminates 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 inlet connections. The 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. This upper spring eliminates possible damage brought about by an abrupt inflow surge.

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Principles of Operation

As the refrigerant level rises, the liquid fills the chamber causing the float ball to rise. The bottom set of lock nuts prevent the attractor from sliding down pushing it upwards. When the attractor comes in line with the magnet located inside the switch assembly, which is on a lever that operates a snap action switch, the attractor forces the magnet towards the tube turning an electrical circuit on or off.

The upper end of the float rod contain the top pair of lock nuts. The differential setting is determined by the distance separating the top and bottom pair of lock nuts. The differential is factory set at 50 mm (2") as shown in Figure 1.

With a decrease in liquid level, the attractor 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 top nuts push the attractor downward out of the magnet's range. The snap action switch returns to its natural position turning an electrical circuit on or off.

Black Wire (N.O.) - Contacts close with the rise of the liquid level
 Red Wire (N.C.) - Contacts open with the rise of the liquid level

See Figures 4 & 5 for wiring diagram.

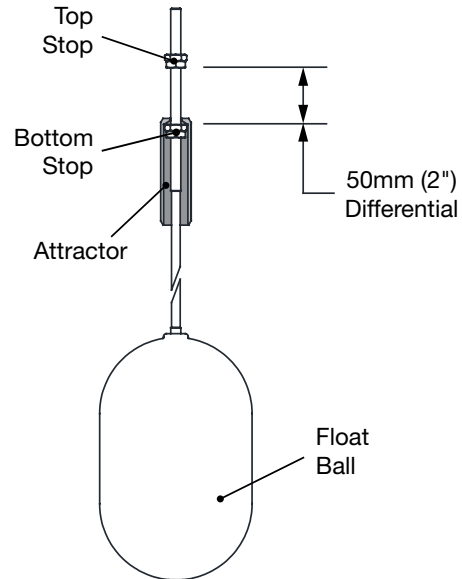


Figure 1: Float Ball Assembly

Level Applications

A level column or vessel could have multiple liquid level switches for a number of different functions, as shown in Figure 2. Below is a list of some common applications, along with the proper wiring method.

- **Low Level Alarm**
 This switch turns on an alarm to alert of a low refrigerant level. Wired in the N.C. position.
- **Pump Cut-Out**
 The switch is mounted below the low level alarm level switch and is used to turn off the liquid pump in order to prevent cavitation. Wired in the N.C. position.
- **Level Control**
 This switch maintains a desired refrigerant level in the vessel by turning on and off a liquid feed solenoid valve. Wired in the N.O. position.
- **High Level Alarm**
 This switch turns on an alarm to alert of a high refrigerant level. Wired in the N.O. position.
- **Compressor Cut-Off**
 The switch is mounted above the high level alarm level switch and is used to turn off the compressor in order to prevent liquid refrigerant from entering the compressor. Wired in the N.O. position.

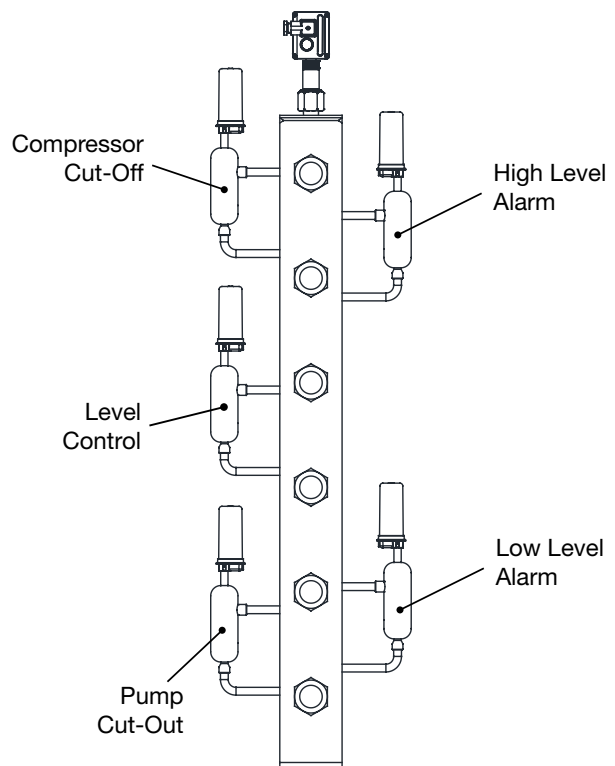


Figure 2: Multiple Liquid Level Functions

Installation Instructions

The refrigerant float switch is shipped from the factory with a plastic plug in the bottom and side float tank connections. The bottom plug pushes the float ball and float rod into the upper position. This keeps the float ball from bouncing and possibly being damaged in shipment. Unpack carefully and check the carton to make sure all items are unpacked.

Do not remove the plastic plugs from the float tank connections until it is ready to be installed. This will protect the inside of the switch tank from dirt and chips before and during installation.

Pipe Column/Vessel Installation

The position and orientation of the column must be appropriate to the specific application and installation criteria. We recommend a 100 mm (4") diameter pipe column in a vertical position. In any case, it must be in a serviceable location and out of the way of any possible damage by material handling vehicles such as lift trucks.

For multiple float switch installation, where the float switches are mounted on a 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 installed on the switch column. This will provide access to the float chambers without pumping out the system or the vessel.

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 the horizontal pipe connections, it is recommended that the hand valves be positioned on their sides (with the stem horizontal) to avoid liquid trapping as explained later in this section.

It is important to remember that, on any type of float switch application, precaution must be taken to keep the liquid in the float chamber as quiet as possible. Attention to this condition will assure a proper 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 tank 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 tank must be insulated to minimize the "boiling" action and provide a quiet liquid level for the float ball. The desired high 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).

Float Switch Installation

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 the proper position can be obtained.

The refrigerant float switch should be located so that the level mark shown on the nameplate is lined up with the desired high liquid level in the vessel, based on the fluid temperature and specific gravity, as shown in Figure 3. The low level will be 50 mm (2") below the high level (metallic attractor sleeve travel distance).

Remove the switch from the stainless steel body before welding. This grade of stainless steel is a poor conductor of heat and conventional weld processes (stick, MIG, and TIG) do not create enough heat that transfers to the valve's internal parts that could be affected.

Contractors need to follow a WPS (Welding Procedure Specification) for all welding. Welding procedures for all steel pipe and fittings need to conform to all requirements of the ASME (Section B31.5 and IX), API, and other applicable piping codes. For welding the 304L stainless steel float chamber assembly to carbon steel pipe, E309L and ER309L-15,-16, or -17 filler metal is a common choice. Contractors can develop their own standards and have them qualified based on the equipment they use and the environment they may encounter.

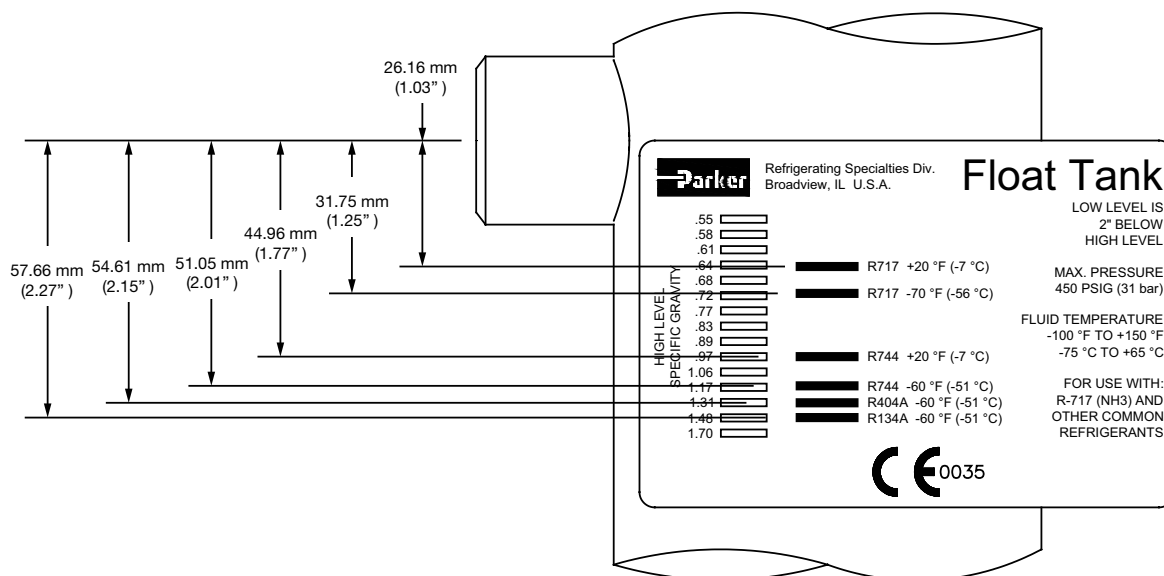


Figure 3: Float Chamber Nameplate with Refrigerant Level Location Examples

Note: When welding carbon steel to stainless steel the welded joint should be painted to prevent galvanic corrosion.

The gas equalizing connection located on the top side of the float tank 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.

Before putting LLSS switches into service, all pipe connections should be tested for leaks at pressure levels called for in appropriate codes.

Electrical/Nameplate Information

The electrical switch is a single pole double throw contact. For both the leaded and QD connector switches, the wires are color coded as shown in Table 1.

Function	QD/DIN	Leaded	
	Terminal Pin	Gauge	Color
COM	1	18 AWG	Gray
N.C.	2	18 AWG	Red ^[1]
N.O.	3	18 AWG	Black ^[2]
Ground	G	18 AWG	Green

1. Makes a closed electrical circuit (with magnet and lever away from the enclosing tube) between the red and gray wire when the liquid level is low.
2. Makes an open electrical circuit (with magnet and lever away from enclosing tube) between the black and gray wire and the liquid level is low.

Table 3: Electrical Contact Information

The internal switch contact ratings are:

- 120 VAC, 10 Amps
- 240 VAC, 10 Amps
- 125 VDC, 1/2 Amps

In order to connect the wires to the QD connector the terminal must be gently pried with a small screw driver or flat blade. Strip the wire insulation 1/8” from end and attach wires to screws using the color codes shown in the terminal section in Table 1.

A low sensitivity, intrinsically safe, relay can be used with the liquid level float switch in hazardous environments. When the intrinsically safe relay installation is in accordance with manufactures guidelines these switch terminals are suitable for connection to Class I; Division 1,2; Groups A, B, C & D and Class II; Division 1, 2; Groups E, F, G and Class III, as defined by Article 500 of the National Electric Code.

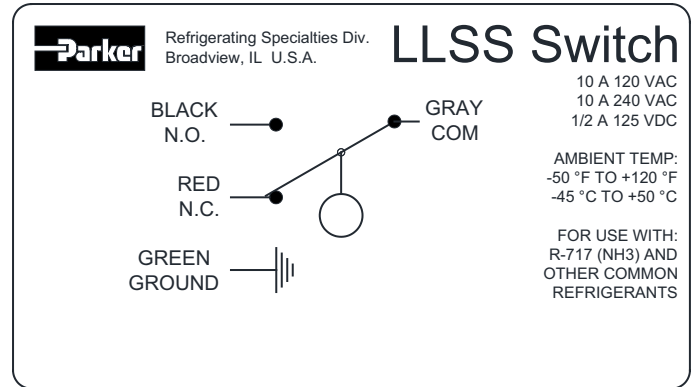


Figure 4: Label and Wiring Diagram (Leaded Float Switch)

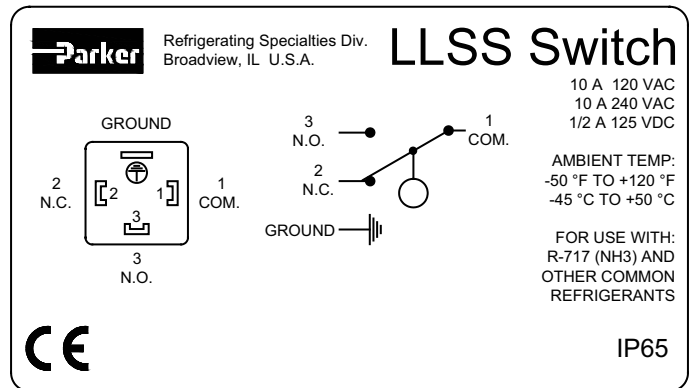


Figure 5: Label and Wiring Diagram (QD Float Switch)

Service Pointer

Manually Actuating Float Switch

The 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) remove the switch from the tank assembly by unscrewing the retaining screw, lift the switch assembly off the enclosing tube and insert a lone rigid slender metal rod or screw driver into the opening where the enclosing tube resided. The rod or screw driver will activate the switch.

⚠ Caution

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

Replacement of Switch Assembly

The switch assembly can be replaced without pumping down the float chamber. Disconnect the electrical connection at the

float switch and slide the switch assembly up from the float rod enclosing tube. In the case of a QD connector the base set screw must be removed before pulling the connector off the float switch. The new switch assembly can then be replaced in the reverse order.

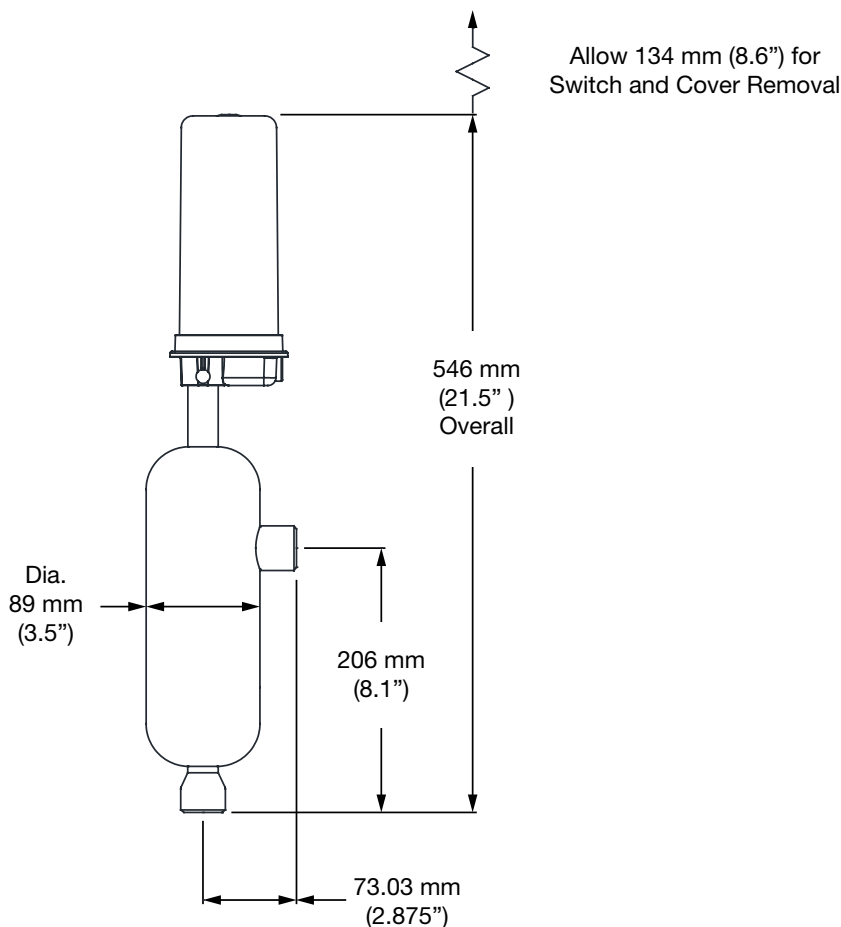
Failure to Open or Close

Before replacing the assembly check the external wiring to be sure that the trouble is not somewhere other than the float switch. For QD connector float switches also check the terminal connections using Table 1 for reference.

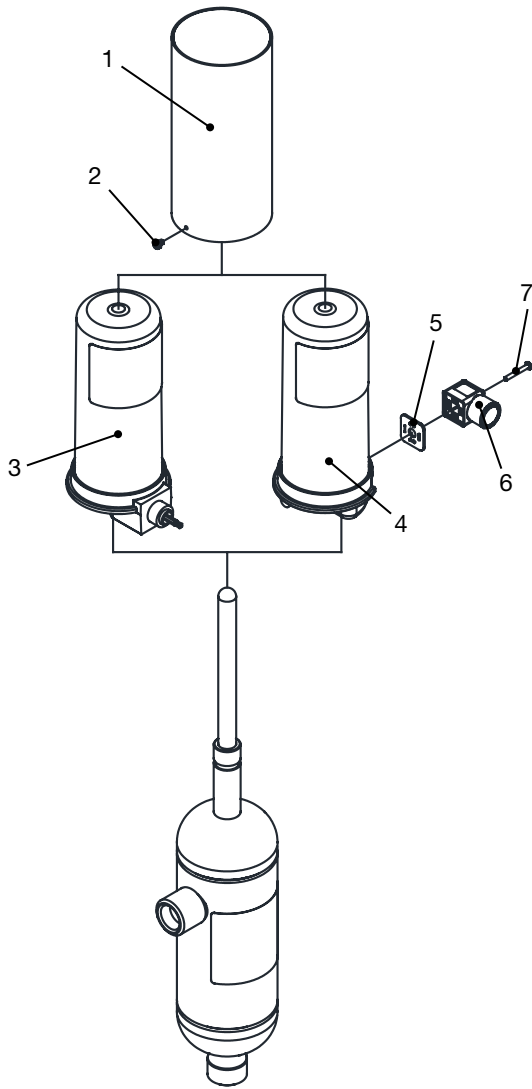
Switch Current Limitations

The electrical specifications of the switch are listed in the electrical section of this bulletin. Continual switching of overloaded contacts will 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 to fail. Good wiring practice will dictate using a properly sized fuse in the control circuit to protect the wiring as well as added protection for the switch.

Dimensional Information



Parts Kit Reference



Item	Description	Kit Description	Kit
1	Cover, Switch	Cover Switch	208642
2	Retaining Screw		
3	Leaded, Switch	Leaded, Switch Assembly (No Certification)	210221
4	DIN, Switch	DIN, Switch Assembly (CE Certification)	210220
5	Gasket, Q/D Connector		
6	Connector, Leaded		
7	Screw, M3 x .05 Dia.	Q/D Connector	208645
5	Gasket, Q/D Connector		
6	Q/D Connector		
7	Screw, M3 x 0.05 Dia.		

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 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 with ODS connections are not suitable for ammonia service.

Warranty

All Refrigerating Specialties products are under warranty against defects in workmanship and materials for a period of one year from date of shipment from 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 the 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, 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, expressed or implied, written including any warranty of merchantability, or 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 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.

