coolconcerns
Training | Consultancy | Technical Support

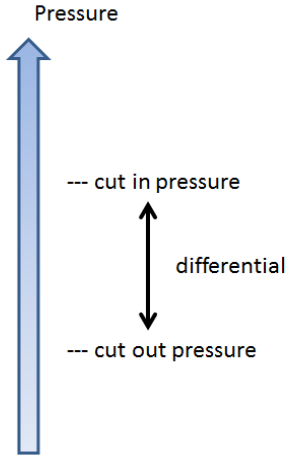
Setting LP Switches

This guide covers how you decide what the low pressure (LP) switch setting should be, and how you check and adjust the switch. The use of LP switches for the following applications are covered in this guide:

- Protection of the compressor due to abnormal system operation.
- To control a pump down.

The LP switch functions as follows:

- It switches off the compressor on a fall in suction pressure.
- It switches on the compressor on a rise in suction pressure.



The cut in pressure and the differential are adjusted on the LP switch. The cut out pressure depends on both the cut in pressure and the differential:

Cut out pressure = cut in pressure - differential

The photo, left, clearly shows the LP switch scales, with the cur in pressure scale on the left and the differential scale on the right.

LP switches usually reset automatically. When used to control a pump down the switch must be an automatic reset type.

Setting the switch

The order that you set the two adjustable scales is important:

1. Set and check the cut in pressure (it helps if the differential is set to a nominal 0.5 bar during this step);
2. Set the differential and check the cut out pressure.

The scales on the pressure switch are indicative – they should only be used as a guide to the set pressures. The actual cut in and cut out pressures should be checked with a gauge manifold by one of the following methods:

- Pumping down the system (in order to get the system to cut out) and slowly allowing liquid back into the low side of the system to raise the low side pressure and check the cut in pressure. Once the cut in pressure is correctly set the differential should be set to achieve the required cut out pressure. The system should be pumped down again to check this pressure;

- Following the above process but using a cylinder of nitrogen, a suitable regulator and a gauge manifold to control the pressures to cut in the switch and then release the pressure to check the cut out of the switch. You should ensure the change-over contacts on the switch are wired correctly for the required function, i.e. break on fall, make on rise;

- Following the above process using a controls pump to achieve the pressures, in conjunction with the gauge manifold.

LP switch as a protection device

Systems will operate with lower than design evaporating pressures if the following faults occur:

- Shortage of refrigerant, for example due to leakage;
- Blocked evaporator, e.g. by ice due to insufficient defrost;
- Failed evaporator fan motor(s);
- Blocked liquid line filter drier;
- Blocked or damaged liquid line solenoid valve;
- Blocked or damaged expansion device;
- Thermostat failure.

The cut out pressure should be below the normal evaporating pressure (low pressure) of the system, and is usually set to avoid the system operating at a pressure below atmospheric pressure. This avoids air and moisture being drawn into the system in the event of a leak, and problems associated with some compressors operating with very low crankcase pressures.

Typical evaporating pressures are shown in the table at the end of this guide.

The cut in pressure should be below the lowest standstill pressure of the system. For many systems this will be the refrigerant saturation pressure equivalent to the lowest cooled space temperature. For example, for an R404A frozen food system, with a cooled space temperature of -20^{O}C, the minimum low side standstill pressure would be 2.1 bar g. It is suggested that the cut in pressure is set to 1.5 bar g.

Where the compressor, condenser and receiver are located outside, it is possible that the minimum standstill pressure is a function of the ambient temperature. In this case the refrigerant saturation pressure at the lowest ambient temperature should be used. For example, for a condensing unit running on R404A to chill food, with the unit in an ambient of -10^{O}C, the minimum low side standstill pressure would be 3.5 bar g. It is suggested that the cut in pressure is set to 3.0 bar g.

The differential should not be so low that is causes cycling of the compressor due to increase in pressure in the low side. It is recommended that the differential is at least 0.5 bar.

LP to control pump down

Many systems are designed to pump the refrigerant into the receiver when the cooled space temperature has been achieved or the system goes on defrost. This prevents liquid accumulating in either the evaporator or the compressor during the off cycle, potentially damaging the compressor when it starts. It also prevents high pressures in the evaporator during defrost. The pump down operation is as follows:

1. Either the thermostat or the defrost time clock closes the liquid line solenoid valve;
2. The compressor carries on running, pumping the refrigerant out of the liquid line and evaporator, into the receiver;
3. The LP switch cuts out the compressor when the low side pressure reduces to the cut out pressure.

When cooling is required again:

1. The thermostat or the defrost time clock opens the liquid line solenoid valve;
2. Liquid refrigerant flows into the evaporator;
3. The LP switch switches on the compressor when the cut in pressure is reached.

The cut out pressure is usually set at approximately 0.1 bar g to avoid the system operating at a pressure below atmospheric pressure.

The cut in pressure and the minimum differential should be the same as those recommended for LP switches used as protection devices.

Non-adjustable pressure switches

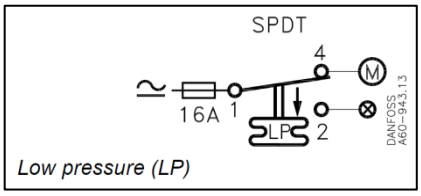
Pressure switches which are pre-set and non-adjustable are also available, and are usually used as protection devices. An example is shown in the photo.

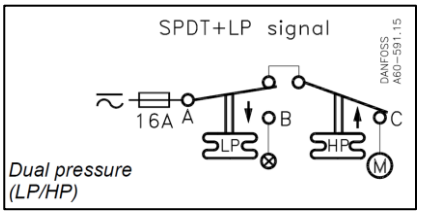
Dual pressure switches

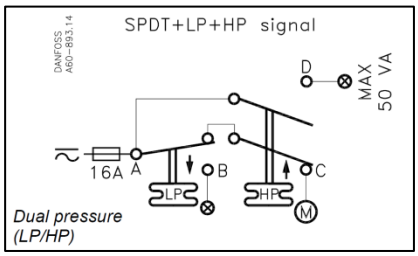
LP and HP (high pressure) switches can be supplied within one unit – a dual pressure switch. The photo shows an example of an adjustable type, with the LP function on the left and the HP on the right hand side of the switch.

Electrical Connections

The diagrams show how typical switches are wired. The switches are shown in the made position (M is the compressor).







Typical evaporating pressures

Application	Refrigerant	Typical evaporating temperature	Typical evaporating pressure
Chilled food at +6^{O}C	R134a	-6^{O}C	1.3 bar g
	R404A	-6^{O}C	4.1 bar g
Chilled food at +1^{O}C	R134a	-11^{O}C	0.9 bar g
	R404A	-11^{O}C	3.3 bar g
Frozen food at -18^{O}C	R404A	-30^{O}C	1.1 bar g
Frozen food at -23^{O}C	R404A	-35^{O}C	0.7 bar g

With thanks to Danfoss for the photos used in this document.

Disclaimer