

HP Switch Setting

This guide covers how you decide what the high pressure (HP) switch setting should be, and how you check and adjust them.

When used as a safety device the HP switch shuts off the compressor if the condensing pressure increases to the set pressure. HP switches are also used to control head pressure by cycling condenser fans. This guide just covers the use of HP switches as safety devices, although the method of setting the switches is the same.

HP switches as safety devices

Under EN378¹ HP switches are required on all systems except those which fall into hazard category SEP² and have a refrigerant charge of less than 10 kg.

HP switches are available as:

- Automatically resetting versions (also called pressure limiters or PSH) and
- Manual reset versions (also called pressure cut outs or PZH).

The latter should be used on systems with a refrigerant charge greater than 100 kg and / or with an individual compressor size greater than 25 l/s displacement (90 m³/h, a four cylinder reciprocating compressor typically is this size).

You should refer to EN378 for specific guidance on whether an HP switch is required and what type it should be – the above guidance is general and will be relevant for most but not all system types.

Faults which cause high pressure trips

The following faults will cause a system to run with excessively high condensing pressures and potentially trip on the HP switch:

- Condenser fan (or pump) failure;
- Blocked or damaged condenser on the air side;
- Air (or other non-condensable gas) in the system;
- High air on (or water) temperature, for example caused by air recirculation;
- Too much refrigerant;
- Closed discharge valve or damaged pipe work between compressor discharge and receiver.

¹ EN378-2:2008 Refrigerating systems and heat pumps – Safety and environmental requirements, Part 2 Design, construction, testing, marking and documentation.

² Sound Engineering Practice (the lowest hazard category) as defined in EN378-2:2008 Annex B.

Setting the switch

Most pressure switches have an adjustable cut out pressure and a non-adjustable differential and hence cut in pressure.

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

- Forcing the condensing pressure to the required set pressure by either blocking the condenser air flow or switching off condenser fans. Care must be taken when doing this to ensure the pressure does not rise above the required set pressure, so the pressure must be monitored carefully;
- Following the above process but using nitrogen and a gauge manifold to control the pressures to cut out the switch. You should ensure the change-over contacts on the switch are wired correctly for the required function, i.e. break on rise, make on fall;
- Following the above process using a controls pump to achieve the pressures, in conjunction with the gauge manifold.

The set pressures

EN378 provides guidance on the HP switch set pressures. To calculate the set pressure you need to determine the maximum allowable pressure of the system (PS).

PS depends on the maximum ambient temperature and the type of condenser. For the UK we usually use a 32°C maximum ambient. PS is found using the condensing temperatures listed in the table below for this ambient. The equivalent pressures for common refrigerants are also listed. For zeotropic blends the pressure of the saturated liquid (also called the bubble point) is used.

Condenser type	Maximum condensing temperature	PS for R134a	PS for R404A	PS for R407C	PS for R410A
Air cooled	55°C	13.9	24.8	23.5	33.0
Water cooled	8°C above the maximum leaving water temperature	Pressures dependent on water temperature			
Evaporative cooled	43°C	10.0	18.5	17.6	24.8

In warmer climates higher maximum ambient temperatures are used, so the maximum condensing temperature and hence PS is higher.

The set pressure of the HP switch depends on whether there is a pressure relief valve (PRV) fitted:

For systems without a PRV

The HP switch set pressure should be no higher than PS.

For systems with a PRV

The HP switch set pressure should be no higher than 0.9 x PS.

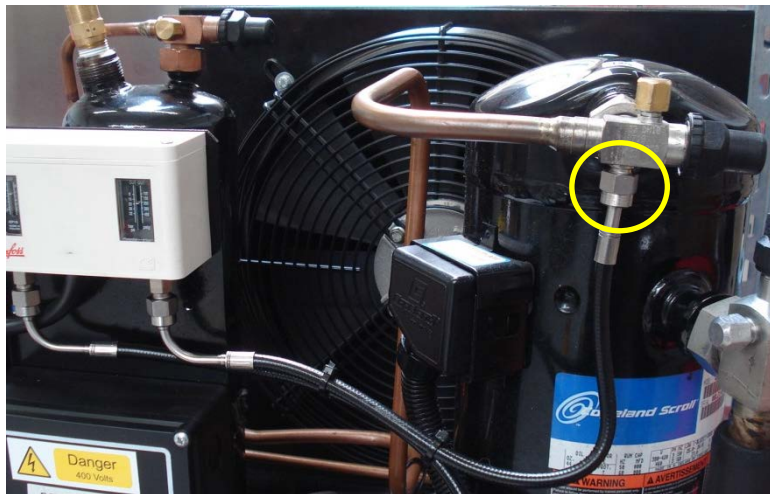
0.9 is the same as 90%.

Example, for an R404A system with a PRV the maximum set pressure for the HP switch is:

$$0.9 \times 24.8 \text{ bar g} = 22.3 \text{ bar g.}$$

Connection to the system

HP switches which are used as safety devices should not be able to be isolated from the compressor – there should be no shut off valves (isolation valves) between compressor discharge and the HP switch.



If the HP switch is connected to a shut off valve (Rotolock or service valve), it should be to a valve with two gauge ports, and it must be connected to the front seat port, as circled in the example valve in the photo.

The pipe work connecting the HP switch to the system should have an internal diameter of at least 4 mm. The pipe work should be connected and routed so that liquid, oil or dirt cannot collect in it, and should be protected against discharge gas pulsations.

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

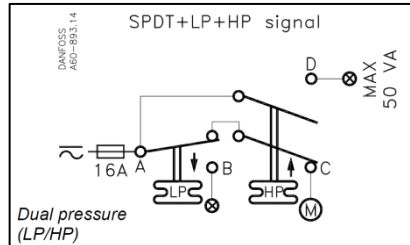
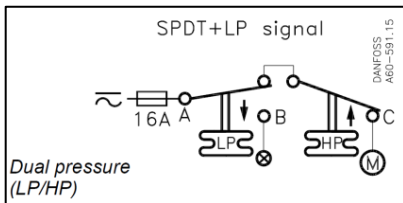
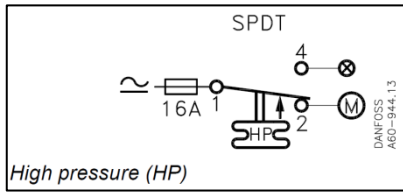
LP and HP (high pressure) switches can be supplied within one unit – a dual pressure switch. The photo shows an example of an adjustable type, with the LP function on the left and the HP on the right hand side of the switch.



Electrical Connections

The diagrams show how typical switches are wired.

The switches are shown in the made position (M is the compressor).



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

Disclaimer

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