Did you know?

High pressure system protection in heat pump applications

According to EN378, different type/size of systems require different manner of protection against unallowable pressure by:

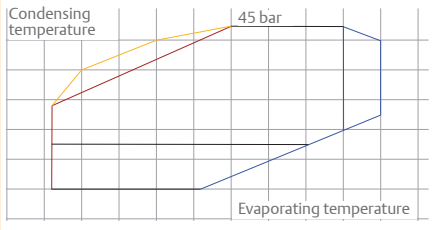
Safety limiting pressure switch	Safety limiting pressure switch plus pressure relief valve	Others

Each of the protection devices or combination are capable to protect the system against unallowable pressures and the permissible setting is defined by EN 378-2.

The capability of the narrower tolerances for cut-out set-point of protection devices is an important technical feature when they are applied in heat pumps and reversible chillers. It permits the highest condensing pressure (highest hot water temperature) close to maximum allowable operating pressure. In the following, examples are given for systems with different operating points or operating pressures:

Example Case 1: System with maximum allowable pressure PS:45 bar based on compressor operating envelope

(e.g reversible chiller)



Note: Compressor envelope only as illustration

		Safety pressure switch according EN 378 cut-out permitted: 41.4...45+0% bar					Factory pressure test for pressure switch > 1.1*PS			
	Compressor max. operating range									
Pressure (bar)	...	41.4	42	43	44	**PS= 45 bar**	46	47	48	49.5

Per Definition of EN 378:

- Single safety limiting pressure switch: Setting at ≤1.0*PS (≤45 bar)

Example Case 2: System with maximum allowable pressure PS:45 bar based on compressor operating envelope

For permitting higher operating pressure and producing higher condensing temperature for warm/hot water in heat pumps, the maximum allowable pressure PS must be increased to higher value than 45 bar. The system needs a pressure relief valve and an additional safety limiting pressure switch.

Per Definition EN 378:

- Pressure relief valve: setting at ≤1.0*PS (≤45 bar)
- Safety limiting pressure switch: setting at 0.9*PS (≤40.5 bar)

						Safety valve is closing below setting 45 bar and fully closed at 41.4 bar				Safety relief valve setting at 45+0% bar	Valve is fully open at 49.5 bar			
		Safety pressure switch according EN 378 cut-out permitted: 37.3 bar...40.5+0% bar				Factory pressure test for pressure switch > 1.1*PS								
	Compressor operation will stop at 40.5 bar					Compressor envelope up to 45 bar (not to operate)								
Pressure (bar)	...	37.3	38	39	40.5	41	42	43	44	**PS=45 bar**	46	47	48	49.5

Example Case 3: System with maximum allowable pressure PS:50 bar based on design pressure but maximum operating pressure at 45 bar

The system needs a pressure relief valve and an additional safety limiting pressure switch.

Per Definition EN 378:

- Pressure relief valve: setting at ≤1.0*PS (≤50 bar)
- Safety limiting pressure switch: setting at 0.9*PS (≤45 bar)

							Safety valve is closing below setting 50 bar and fully closed at 45 bar				Safety relief valve setting at 50 bar	Valve is fully open at 55 bar				
		Safety pressure switch according EN 378 cut-out permitted: 41.4...45+0% bar)					Factory pressure test for pressure switch > 1.1*PS									
	Compressor max. operating range															
Pressure (bar)	...	41.4	42	43	44	45	46	47	48	49	**PS=50 bar**	51	52	53	54	55

EMERSON offers controls such as electronic expansion valves, pressure switches to meet the new requirements in terms of design pressure at 50 bar and higher.

ALCO CONTROLS™

EMERSON™