

Did you know?

Change in power rating of thermo-expansion and solenoid valves when converting to HFO and HFO blends

Converting to HFO/HFO blends does not simply involve changing the cooling agent. In addition to the temperature slide, significant power rating changes may occur in hermo-expansion and solenoid valves. This is particularly notable for output-regulated and multi-level compressors and composite systems.

A power rating increase of up to +55% can be expected when converting form R404A to R448A/ R449A. However, power rating decreases are also possible in the valves when systems are converted from R134a to R450A, R513A or R1234ze cooling agents. These power rating changes often require the replacement of the valve orifice or the complete valve. The table below presents the changes in power rating in thermostatic expansion and solenoid valves at different operating points.

Refrigerant conversion	Condensation temperature °C														
	30 °C					40 °C					50 °C				
	Evaporating temperature °C														
	-40	-30	-20	-10	0	-40	-30	-20	-10	0	-40	-30	-20	-10	0
Changes in power rating in thermo - expansion and solenoid valves with cooling agent conversion															
R404A > R448A	42%	41%	40%	40%	41%	50%	47%	45%	44%	43%	63%	58%	55%	52%	50%
R404A > R449A	38%	37%	36%	36%	38%	45%	43%	41%	40%	40%	57%	53%	50%	48%	46%
R404A > R452A	5%	5%	5%	7%	8%	6%	6%	6%	7%	8%	7%	7%	7%	8%	8%
R134a > R450A	-	-14%	-13%	-12%	-12%	-	-14%	-13%	-13	-12%	-	-15%	-14%	-13%	-13%
R134a > R513A	-	-11%	-10%	-10%	-9%	-	-13%	-11%	-1	-10%	-	-16%	-15%	-14%	-12%
R134a > R1234ze	-	-24%	-24%	-23%	-22%	-	-25%	-23%	-23	-22%	-	-25%	-24%	-23%	-22%

Thermo-Expansion valve

Overload fluctuations (hunting) are created if the cooling agent conversion creates an excessive power rating in the installed valve. The evaporator capacity is not fully utilized and liquid cooling agent may enter the compressor, etc. If the power rating of the installed valve decreases following the cooling agent conversion, the evaporation temperature may be lower than expected. The consequences are as follows: Increased overload and suction gas temperature, increased compressor operating time and insufficient compressor cooling.

Solenoid valve

Pilot-operated solenoid valves generally require a minimum pressure loss of 0.05 bar in order to remain open. If this value is not attained, the valve will close, resulting in potential operating disturbances and pulsations in the system. This minimum pressure loss may not be attained in the case of oversizing of the solenoid valve, which can also occur with a change to the refrigerant.

Example: System conversion from cooling agent R404A to R449A, To = -10°C; Tc = 40°C; TFL = 39°C; Qo = 15 kW

Status 2 (red) is displayed if the cooling agent is replaced. The valves are oversized.

Normal operating conditions are restored when the orifice and solenoid valves have been replaced.

Thermo-Expansion valve calculation			
Cooling agent	R404A	R449A	R449A
Status	1	2	3
Qo	15 kW		
To	-10 °C		
Tc	40 °C		
TFL	39 °C		
Valve	Seria T		
Orifice	X22440-B5B	X22440-B5B	X22440-B4B
Capacity	16.2 kW	22.4 kW	17.5 kW
Rating	93%	67%	86%

Solenoid valve calculation			
Cooling agent	R404A	R449A	R449A
Status	1	2	3
Qo	15 kW		
To	-10 °C		
Tc	40 °C		
TFL	39 °C		
Valve	240RA8	240RA8	200RB4
Pressure Drop	0,07 bar	< 0,05 bar	0,14 bar