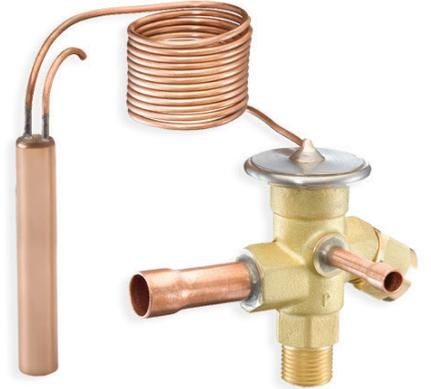


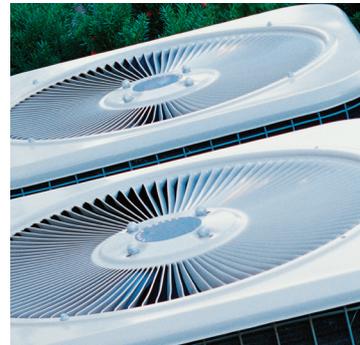


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J8 Thermostatic Expansion Valve

Products & Custom Solutions
 Bulletin 10-10-7, February 2018



ENGINEERING YOUR SUCCESS.

The J8 Thermostatic Expansion Valve

Introduction

The J8 Thermostatic Expansion Valves are designed to regulate refrigerant flow into evaporators as a response to sensed superheat value. They can be used in a wide range of AC and refrigeration applications.

Features

- Adjustable superheat
- 8 Replaceable orifice assemblies
- Temperature range from -40°C to +15°C
- Thermostatic charges with or without MOP (Maximum Operating Pressure)
- Solder ODF (with inlet connector) or Flare SAE fittings
- Stainless steel thermostatic element
- Copper sensing bulb
- EC compliant (PED & RoHS Compliant)

Technical Specifications

- Maximum bulb temperature: 100°C
- Maximum valve body temperature: 121°C
- Short-lived peak: 149°C
- Maximum working pressure MWP: 34 bar
- Maximum test pressure: 38 bar

J8 valves are supplied as three individual component parts that need to be ordered separately:

- Valve body & Thermostatic element assembly
- Cartridge & Filter assembly
- Inlet ODF adaptor (not mandatory)

Please refer to further sections for selection/ordering information.

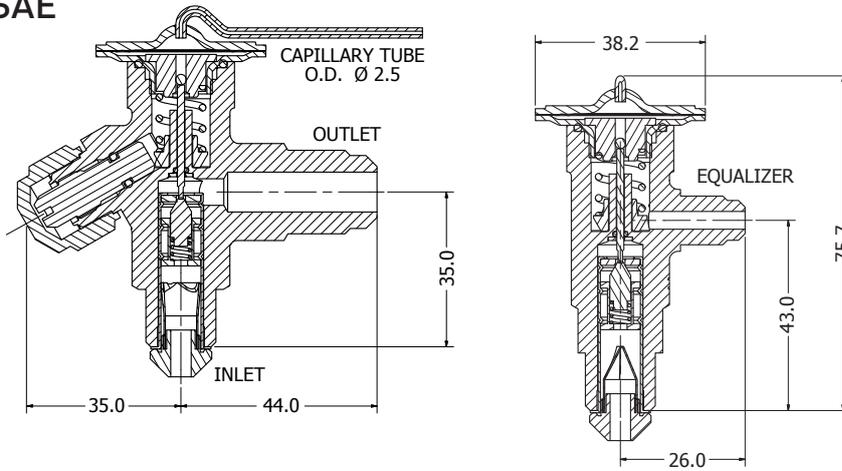
⚠ WARNING – USER RESPONSIBILITY

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

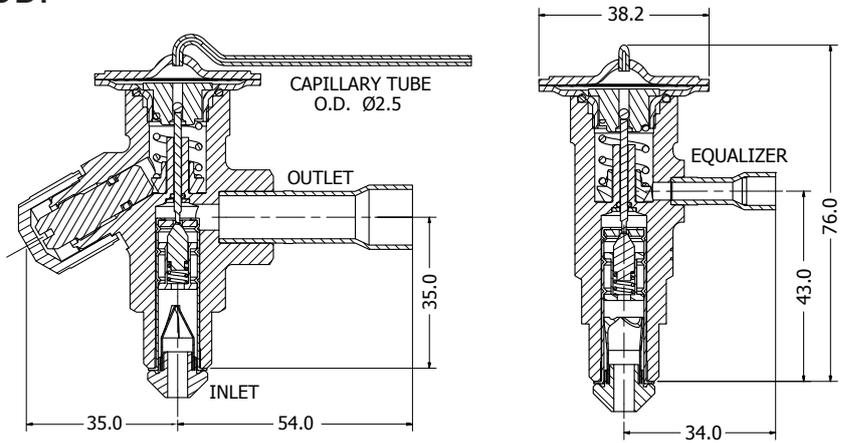
- This document and other information from Parker-Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.
- The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.
- To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

J8 Assembly

SAE



ODF



All dimensions in millimeters (mm).

Valve Nomenclature / Ordering Instructions

EXAMPLE

J8	E	F	N	W
Valve Type	<p>"E" specifies external equalizer. Omission of letter "E" indicates valve with internal equalizer. e.g. J8F-NW</p>	<p>Connection Type: (Inlet always supplied as 3/8" Flare, SAE)</p> <p>F = Flare, SAE</p> <p>M = Metric, ODF</p> <p>S = Standard, ODF (US Customary Units)</p>	<p>Parker Code – Refrigerant Element Label Color Code:</p> <p>J = R134a Blue R401A Pink</p> <p>S = R404A Orange R402A Sand R402B Olive R502 Purple R507 Teal</p> <p>N = R407C Lt. Brown</p>	<p>Thermostatic Charge</p> <p>See Charge Table for options.</p>

Thermostatic Charge Option

Charge	Application	Evaporator Temperature Range °C	MOP bar/ °C	Refrigerants
Z	Wide Range Charge	-40°C to 10°C	-	R-407A/C/F, R-134a, R-404A
W	Commercial Refrigeration	-23°C to 15°C	-	R-407A/C/F, R-134a, R-404A
X35	Pressure Limiting Low Temperature	-40°C to -18°C	2.4/-17	R-404A
X60	Pressure Limiting Wide Range	-40°C to 15°C	4.1/+17	R-134a
X100	Pressure Limiting Wide Range	-40°C to 15°C	6.9/+17	R-407A/C/F
X110	Pressure Limiting Wide Range	-40°C to 10°C	7.6/+12	R-404A

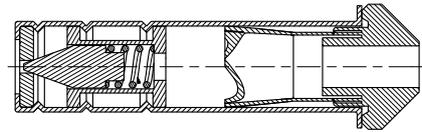
Valve Body & Thermostatic Element Assembly

Refrigerant	Connections			Capillary Tube Length cm	Evaporator Temperature Range °C	MOP bar / °C	Valve Type	Item Number	
	Inlet	Outlet	Equalizer						
R407A R407C R407F R448A R449A	3/8" SAE	1/2" SAE	1/4" SAE	150	-20°C to +10°C	-	J8EF-NW	600002	
					-40°C to +15°C	6.9 bar / +17°C	J8EF-NX100	600003	
			Internally Equalized	150	-20°C to +10°C	-	J8F-NW	600023	
					-40°C to +15°C	6.9 bar / +17°C	J8F-NX100	600024	
			12mm ODF	6mm ODF	150	-20°C to +10°C	-	J8EM-NW	600009
						-40°C to +15°C	6.9 bar / +17°C	J8EM-NX100	600010
		Internally Equalized	150	-20°C to +10°C	-	J8M-NW	600030		
				-40°C to +15°C	6.9 bar / +17°C	J8M-NX100	600031		
		1/2" ODF	1/4" ODF	150	-20°C to +10°C	-	J8ES-NW	600016	
					-40°C to +15°C	6.9 bar / +17°C	J8ES-NX100	600017	
		Internally Equalized	150	-20°C to +10°C	-	J8S-NW	600037		
				-40°C to +15°C	6.9 bar / +17°C	J8S-NX100	600038		
R134a	3/8" SAE	1/2" SAE	1/4" SAE	150	-20°C to +10°C	-	J8EF-JW	600000	
					-40°C to +15°C	4.1 bar / +17°C	J8EF-JX60	600001	
			Internally Equalized	150	-20°C to +10°C	-	J8F-JW	600021	
					-40°C to +15°C	4.1 bar / +17°C	J8F-JX60	600022	
			12mm ODF	6mm ODF	150	-20°C to +10°C	-	J8EM-JW	600007
						-40°C to +15°C	4.1 bar / +17°C	J8EM-JX60	600008
		Internally Equalized	150	-20°C to +10°C	-	J8M-JW	600028		
				-40°C to +15°C	4.1 bar / +17°C	J8M-JX60	600029		
		1/2" ODF	1/4" ODF	150	-20°C to +10°C	-	J8ES-JW	600014	
					-40°C to +15°C	4.1 bar / +17°C	J8ES-JX60	600015	
		Internally Equalized	150	-20°C to +10°C	-	J8S-JW	600035		
				-40°C to +15°C	4.1 bar / +17°C	J8S-JX60	600036		
R404A R507	3/8" SAE	1/2" SAE	1/4" SAE	150	-40°C to +10°C	-	J8EF-SZ	600062	
					-20°C to +10°C	-	J8EF-SW	600004	
					-40°C to +10°C	7.6 bar / +12°C	J8EF-SX110	600005	
					-40°C to -18°C	2.4 bar / -17°C	J8EF-SX35	600006	
					-40°C to +10°C	-	J8F-SZ	600063	
					-20°C to +10°C	-	J8F-SW	600025	
			Internally Equalized	150	-40°C to +10°C	7.6 bar / +12°C	J8F-SX110	600026	
					-40°C to -18°C	2.4 bar / -17°C	J8F-SX35	600027	
					-40°C to +10°C	-	J8EM-SZ	600064	
					-20°C to +10°C	-	J8EM-SW	600011	
					-40°C to +10°C	7.6 bar / +12°C	J8EM-SX110	600012	
					-40°C to -18°C	2.4 bar / -17°C	J8EM-SX35	600013	
		12mm ODF	6mm ODF	150	-40°C to +10°C	-	J8M-SZ	600065	
					-20°C to +10°C	-	J8M-SW	600032	
					-40°C to +10°C	7.6 bar / +12°C	J8M-SX110	600033	
					-40°C to -18°C	2.4 bar / -17°C	J8M-SX35	600034	
					-40°C to +10°C	-	J8ES-SZ	600066	
					-20°C to +10°C	-	J8ES-SW	600018	
		1/2" ODF	1/4" ODF	150	-40°C to +10°C	7.6 bar / +12°C	J8ES-SX110	600019	
					-40°C to -18°C	2.4 bar / -17°C	J8ES-SX35	600020	
					-40°C to +10°C	-	J8S-SZ	600067	
					-20°C to +10°C	-	J8S-SW	600039	
					-40°C to +10°C	7.6 bar / +12°C	J8S-SX110	600040	
					-40°C to -18°C	2.4 bar / -17°C	J8S-SX35	600041	

J8 Cartridge & Filter Assembly

Cartridge and Filter Assembly
Rated Capacities, kW¹

Item Number	Cartridge Type	Rated Capacities, kW ¹			
		R407C	R134a	R404A	R22
506032	C-0X	0.55	0.44	0.42	0.55
506033	C-00	1.2	1.0	0.77	1.1
506034	C-01	2.4	1.6	1.4	2.3
506035	C-02	3.8	2.6	2.1	3.5
506036	C-03	5.2	4.3	3.9	4.9
506037	C-04	9.0	7.0	6.3	8.4
506038	C-05	11.3	8.6	7.7	10.5
506039	C-06	15.0	9.5	8.2	14.0



- The cartridge orifice is stamped with the orifice size, ex. C-0X



- A metallic tag is provided with each individual cartridge and should be fixed on the cap tube as the orifice is installed in the valve body.

¹ The rated capacity is based on the following conditions:

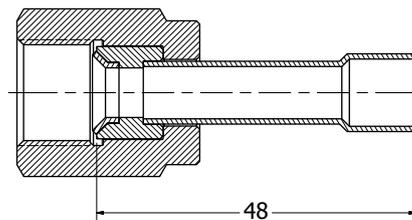
- Evaporating temperature, $T_e = +5^\circ\text{C}$
- Condensing temperature, $T_c = +32^\circ\text{C}$
- Refrigerant temperature ahead of valve, $T_1 = +28^\circ\text{C}$

Inlet ODF Adaptor

All J8 Thermostatic Expansion Valves feature 3/8"SAE inlet fitting. Solder inlet adaptors are available from Parker distributors.

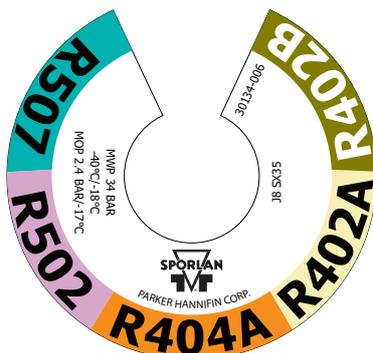
Solder inlet adaptors allow the installation of the J8 TEV and easy access of cartridge orifice & filter assembly. Parker Solder Inlet Adaptors have been designed to be used with flare orifice filter.

Item	Description
A-6M	Solder Inlet Adaptor 3/8" SAE to 6mm ODF
A-10M	Solder Inlet Adaptor 3/8" SAE to 10mm ODF
A-2	Solder Inlet Adaptor 3/8" SAE to 1/4" ODF
A-3	Solder Inlet Adaptor 3/8" SAE to 3/8" ODF



All dimensions in millimeters (mm).

Identification



The main information about the valve is provided on the element label:

- Element J8 SX35
- Refrigerant
- Maximum Working Pressure (MWP) = 34 bar
- Evaporating temperature range in $^\circ\text{C} = -40^\circ\text{C}/-18^\circ\text{C}$
- Maximum Operating Pressure (MOP) point in bar & $^\circ\text{C} = \text{MOP } 2.4 \text{ bar}/-17^\circ\text{C}$

Selection Procedure

The following procedure should be used when selecting a Parker TEV:

1. Determine the liquid temperature of the refrigerant entering the valve.

The TEV capacity tables on pages 7-9 are based on a liquid temperature of 100°F (38°C) for R-134a, R-404A, R407A, R-407C, R407F, R448A, R449A, and R507. For other liquid temperatures, apply the correction factor given in the tables for each refrigerant. See selection example.

2. Determine pressure drop across valve.

The pressure drop correction factors are based on standard liquid temperature and pressure drop. The standard pressure drop is dependent on the evaporator temperature. To determine the pressure drop, subtract the saturated pressure equivalent to evaporator temperature from the condensing pressure. The condensing pressure used in this calculation should be the minimum operating condensing pressure of the system. From this value, subtract all other pressure losses to obtain the net pressure drop across the valve. Use this value to determine the pressure drop correction factor. See selection example. Be sure to consider all of the following possible sources of pressure drop:

1. Friction losses through refrigeration lines including the evaporator and condenser.
2. Pressure drop across liquid line accessories such as a solenoid valve and filter-drier.
3. Static pressure loss (gain) due to the vertical lift (drop) of the liquid line.
4. Pressure drop across a refrigerant distributor if used.

3. Select cartridge from the capacity tables.

Select a cartridge based on the design evaporating temperature. If possible, the valve capacity should be equal or slightly exceed the design rating of the system. Be sure to apply the appropriate correction factor for liquid temperature choose proper pressure drop. Once the desired valve capacity has been located, determine the proper cartridge from the table's left column. On multiple evaporator systems, select each valve on the basis of individual evaporator capacity. See selection example.

4. Determine if an external equalizer is required.

The amount of pressure drop between the valve outlet and bulb location will determine if an external equalizer is required. Internally equalized models should be limited to single circuit evaporators having a pressure drop no greater than the equivalent of 1°C saturated temperature change.

5. Select body type.

Select the body type according to the style connections desired. Refer to page 4.

6. Select the Thermostatic Charge.

Select the charge according to the design evaporating temperature from the Table on page 4.

Selection Example – Refrigerant R-404A

Application: Refrigeration	
Design evaporator temperature	-10°C
Design condenser temperature	38°C
Refrigerant liquid temperature	28°C
Design system capacity	7 kW
Available pressure drop across TEV:	
Condensing pressure - bar	16.3
Evaporating pressure - bar	3.3
	13
Liquid line and accessories loss - bar	0.58
Distributor and tubes loss - bar ①	2.06
	10.36
Refrigerant liquid correction factor	1.10

Use the following formula to calculate cartridge capacity:
 Cartridge Capacity = Cartridge rating x CF liquid temperature

Cartridge C-04 has capacity of: 7.4 x 1.10 = 8.1kW at -10°C evaporating temperature and 28°C liquid temperature.

Thermostatic charge (from table on page 4): **SZ**

Selection:

- ① An externally equalized valve must be used on evaporators employing a refrigerant distributor due to the pressure drop created by the distributor. In addition, an externally equalized valve should always be used with air conditioning thermostatic charges to reduce the possibility of thermostatic charge migration.

Selection Tables

R404A/R507 (kW)

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
	Evaporating Temperature +10°C							
C-0X	0.31	0.39	0.44	0.46	0.47	0.47	0.46	0.45
C-00	0.74	0.90	1.0	1.0	1.1	1.1	1.0	1.0
C-01	1.5	1.9	2.1	2.2	2.3	2.3	2.2	2.1
C-02	2.3	3.0	3.4	3.6	3.7	3.7	3.7	3.6
C-03	3.9	5.1	5.6	6.0	6.2	6.3	6.2	6.0
C-04	6.5	8.5	9.5	10.2	10.5	10.5	10.3	10.1
C-05	7.9	10.2	11.4	12.2	12.5	12.6	12.3	12.0
C-06	8.7	11.3	12.6	13.4	13.8	13.8	13.6	13.2

Table A

Correction Factor, (CF) Liquid Temperature

TEV corrected capacity = Required Evaporator Capacity / Correction Factor, (CF), for Subcooling.

Subcooling	4°K	10°K	15°K	20°K	25°K	30°K	35°K	40°K	45°K	50°K
Correction Factor	1.00	1.08	1.14	1.21	1.27	1.33	1.39	1.45	1.51	1.57

Table B

Design Evaporating Temperature

Liquid Temperature

The valve capacity should equal or slightly exceed the tonnage rating of the system.

Selection Tables

R407A/R407C/R407F/R448A/R449A (kW)

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature +10°C								
C-0X	0.44	0.55	0.62	0.67	0.69	0.70	0.69	0.70
C-00	1.0	1.2	1.3	1.4	1.5	1.5	1.5	1.5
C-01	2.1	2.6	3.0	3.1	3.2	3.2	3.3	3.2
C-02	3.1	4.1	4.8	5.2	5.4	5.5	5.6	5.6
C-03	5.2	6.9	8.0	8.6	9.1	9.2	9.3	9.3
C-04	8.8	11.6	13.4	14.6	15.2	15.4	15.6	15.6
C-05	10.6	14.0	16.0	17.4	18.3	18.5	18.7	18.7
C-06	11.8	15.5	17.7	19.1	20.1	20.3	20.5	20.5

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature 0°C								
C-0X	0.44	0.55	0.62	0.66	0.69	0.70	0.70	0.69
C-00	0.96	1.1	1.3	1.4	1.4	1.5	1.5	1.4
C-01	1.8	2.3	2.5	2.7	2.8	2.8	2.9	2.9
C-02	2.7	3.5	4.1	4.3	4.6	4.7	4.8	4.8
C-03	4.5	5.9	6.7	7.4	7.7	7.8	7.9	7.9
C-04	7.5	9.9	11.2	12.2	12.8	13.0	13.2	13.3
C-05	9.2	11.9	13.6	14.7	15.5	15.8	15.9	15.9
C-06	10.1	13.1	14.9	16.2	17.0	17.3	17.5	17.5

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature -10°C								
C-0X	0.42	0.53	0.59	0.63	0.66	0.68	0.68	0.67
C-00	0.90	1.1	1.2	1.3	1.3	1.4	1.4	1.3
C-01	1.5	1.8	2.1	2.3	2.3	2.3	2.4	2.4
C-02	2.3	3.0	3.3	3.6	3.8	3.9	4.0	3.9
C-03	3.8	4.9	5.6	6.0	6.4	6.6	6.7	6.5
C-04	6.3	8.2	9.2	10.0	10.6	10.8	11.0	10.9
C-05	7.7	9.8	11.1	12.0	12.8	13.0	13.2	13.1
C-06	8.6	10.8	12.2	13.2	14.0	14.3	14.5	14.4

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature -20°C								
C-0X	–	0.50	0.56	0.59	0.62	0.63	0.65	0.63
C-00	–	1.0	1.1	1.2	1.2	1.3	1.3	1.2
C-01	–	1.5	1.7	1.8	2.0	2.0	2.0	2.0
C-02	–	2.4	2.7	2.9	3.1	3.1	3.2	3.1
C-03	–	4.0	4.5	4.9	5.1	5.2	5.3	5.2
C-04	–	6.6	7.5	8.1	8.5	8.6	8.8	8.7
C-05	–	8.1	9.1	9.8	10.2	10.5	10.6	10.5
C-06	–	8.8	10.0	10.7	11.3	11.4	11.7	11.6

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature -30°C								
C-0X	–	0.45	0.50	0.54	0.56	0.58	0.58	0.58
C-00	–	0.89	1.0	1.1	1.1	1.2	1.1	1.1
C-01	–	1.3	1.4	1.5	1.6	1.5	1.6	1.6
C-02	–	1.9	2.2	2.7	2.5	2.5	2.5	2.5
C-03	–	3.3	3.7	3.9	4.0	4.1	4.2	4.2
C-04	–	5.3	6.1	6.4	6.7	6.8	7.0	6.9
C-05	–	6.5	7.3	7.7	8.1	8.3	8.4	8.4
C-06	–	7.2	8.0	8.6	8.9	9.1	9.3	9.2

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature -40°C								
C-0X	–	–	0.46	0.48	0.51	0.53	0.53	0.54
C-00	–	–	0.88	0.92	1.0	1.0	1.0	1.0
C-01	–	–	1.2	1.3	1.2	1.3	1.3	1.4
C-02	–	–	1.7	1.9	1.9	1.9	2.0	1.9
C-03	–	–	2.9	3.1	3.2	3.3	3.3	3.3
C-04	–	–	4.8	5.0	5.2	5.3	5.4	5.4
C-05	–	–	5.8	6.2	6.3	6.6	6.6	6.6
C-06	–	–	6.4	6.8	7.0	7.2	7.3	7.3

Correction Factor, (CF) Liquid Temperature

TEV corrected capacity = Required Evaporator Capacity / Correction Factor, (CF), for Subcooling.

Subcooling	4°K	10°K	15°K	20°K	25°K	30°K	35°K	40°K	45°K	50°K
Correction Factor	1.00	1.08	1.14	1.21	1.27	1.33	1.39	1.45	1.51	1.57

Selection Tables

R134a/R513A (kW)

Orifice Number	Pressure Drop Across the Valve (bar)				
	2	4	6	8	10
Evaporating Temperature +10°C					
C-0X	0.37	0.47	0.52	0.55	0.56
C-00	0.78	0.95	1.0	1.1	1.1
C-01	1.4	1.7	1.9	2.0	2.0
C-02	2.0	2.6	3.0	3.1	3.2
C-03	3.4	4.4	5.0	5.2	5.4
C-04	5.7	7.3	8.2	8.7	9.0
C-05	6.9	8.9	9.9	10.8	10.9
C-06	7.6	9.7	10.9	11.5	11.9

Orifice Number	Pressure Drop Across the Valve (bar)				
	2	4	6	8	10
Evaporating Temperature 0°C					
C-0X	0.36	0.46	0.51	0.52	0.54
C-00	0.72	0.86	0.95	1.0	1.0
C-01	1.2	1.4	1.5	1.6	1.6
C-02	1.7	2.2	2.4	2.6	2.6
C-03	2.8	3.7	4.1	4.3	4.4
C-04	4.7	6.0	6.7	7.1	7.3
C-05	5.7	7.3	8.1	8.6	8.8
C-06	6.3	8.0	9.0	9.5	9.7

Orifice Number	Pressure Drop Across the Valve (bar)				
	2	4	6	8	10
Evaporating Temperature -10°C					
C-0X	0.33	0.42	0.47	0.48	0.48
C-00	0.65	0.77	0.85	0.89	0.90
C-01	0.90	1.2	1.3	1.4	1.4
C-02	1.4	1.8	2.0	2.1	2.1
C-03	2.3	2.9	3.3	3.5	3.6
C-04	3.8	4.8	5.3	5.7	5.9
C-05	4.6	5.8	6.5	6.9	7.1
C-06	5.1	6.4	7.2	7.6	7.7

Orifice Number	Pressure Drop Across the Valve (bar)				
	2	4	6	8	10
Evaporating Temperature -20°C					
C-0X	0.31	0.39	0.43	0.45	0.46
C-00	0.58	0.68	0.76	0.79	0.80
C-01	0.73	0.90	1.0	1.1	1.1
C-02	1.1	1.4	1.5	1.6	1.7
C-03	1.9	2.3	2.6	2.7	2.8
C-04	3.0	3.8	4.2	4.5	4.6
C-05	3.7	4.6	5.1	5.4	5.5
C-06	4.1	5.0	5.6	5.9	6.1

Orifice Number	Pressure Drop Across the Valve (bar)				
	2	4	6	8	10
Evaporating Temperature -30°C					
C-0X	0.28	0.35	0.39	0.41	0.42
C-00	0.53	0.61	0.67	0.70	0.70
C-01	0.59	0.72	0.79	0.84	0.86
C-02	0.90	1.1	1.2	1.3	1.3
C-03	1.5	1.9	2.1	2.2	2.2
C-04	2.4	3.0	3.4	3.5	3.6
C-05	3.0	3.6	4.0	4.2	4.3
C-06	3.2	4.0	4.4	4.7	4.8

Orifice Number	Pressure Drop Across the Valve (bar)				
	2	4	6	8	10
Evaporating Temperature -40°C					
C-0X	0.25	0.31	0.35	0.36	0.37
C-00	0.48	0.55	0.59	0.62	0.63
C-01	0.49	0.59	0.65	0.68	0.69
C-02	0.74	0.89	1.0	1.0	1.0
C-03	1.2	1.5	1.7	1.8	1.8
C-04	2.0	2.4	2.7	2.8	2.8
C-05	2.4	2.9	3.2	3.5	3.5
C-06	2.7	3.2	3.6	3.8	3.9

Correction Factor, (CF) Liquid Temperature

TEV corrected capacity = Required Evaporator Capacity / Correction Factor, (CF), for Subcooling.

Subcooling	4°K	10°K	15°K	20°K	25°K	30°K	35°K	40°K	45°K	50°K
Correction Factor	1.00	1.08	1.13	1.19	1.25	1.31	1.37	1.42	1.48	1.54

Selection Tables

R404A/R507 (kW)

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature +10°C								
C-0X	0.31	0.39	0.44	0.46	0.47	0.47	0.46	0.45
C-00	0.74	0.90	1.0	1.0	1.1	1.1	1.0	1.0
C-01	1.5	1.9	2.1	2.2	2.3	2.3	2.2	2.1
C-02	2.3	3.0	3.4	3.6	3.7	3.7	3.7	3.6
C-03	3.9	5.1	5.6	6.0	6.2	6.3	6.2	6.0
C-04	6.5	8.5	9.5	10.2	10.5	10.5	10.3	10.1
C-05	7.9	10.2	11.4	12.2	12.5	12.6	12.3	12.0
C-06	8.7	11.3	12.6	13.4	13.8	13.8	13.6	13.2

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature 0°C								
C-0X	0.33	0.41	0.45	0.46	0.47	0.47	0.47	0.45
C-00	0.75	0.88	1.0	1.0	1.0	1.0	1.0	1.0
C-01	1.4	1.7	1.8	1.9	2.0	2.0	2.0	1.9
C-02	2.1	2.6	3.0	3.1	3.2	3.3	3.2	3.1
C-03	3.5	4.4	5.0	5.2	5.4	5.4	5.3	5.2
C-04	5.8	7.4	8.3	8.7	9.0	9.0	8.9	8.7
C-05	7.0	8.9	10.0	10.5	10.8	10.9	10.8	10.4
C-06	7.7	9.8	11.0	11.6	11.9	12.0	11.8	11.4

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature -10°C								
C-0X	0.33	0.41	0.44	0.46	0.46	0.46	0.45	0.45
C-00	0.72	0.84	0.90	0.92	1.0	1.0	0.94	0.91
C-01	1.2	1.4	1.5	1.6	1.6	1.7	1.6	1.6
C-02	1.8	2.2	2.5	2.6	2.7	2.7	2.7	2.6
C-03	2.9	3.7	4.2	4.4	4.5	4.5	4.5	4.4
C-04	4.9	6.3	6.9	7.3	7.4	7.5	7.4	7.2
C-05	5.9	7.6	8.4	8.8	9.0	9.1	9.0	8.7
C-06	6.6	8.4	9.3	9.7	9.9	10.0	9.9	9.6

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature -20°C								
C-0X	–	0.39	0.42	0.44	0.43	0.44	0.43	0.42
C-00	–	0.77	0.83	0.85	0.87	0.87	0.87	0.84
C-01	–	1.2	1.4	1.4	1.4	1.4	1.4	1.4
C-02	–	1.9	2.0	2.1	2.2	2.2	2.2	2.1
C-03	–	3.1	3.5	3.6	3.7	3.7	3.7	3.6
C-04	–	5.1	5.7	5.9	6.1	6.1	6.0	5.9
C-05	–	6.2	6.9	7.2	7.3	7.3	7.2	7.1
C-06	–	6.8	7.6	7.9	8.0	8.0	7.9	7.7

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature -30°C								
C-0X	–	–	0.39	0.41	0.40	0.41	0.40	0.39
C-00	–	–	0.74	0.77	0.77	0.77	0.76	0.74
C-01	–	–	1.1	1.1	1.1	1.1	1.1	1.1
C-02	–	–	1.6	1.7	1.7	1.7	1.7	1.6
C-03	–	–	2.7	2.8	2.9	2.9	2.8	2.7
C-04	–	–	4.5	4.7	4.7	4.7	4.7	4.6
C-05	–	–	5.5	5.7	5.7	5.7	5.7	5.5
C-06	–	–	6.0	6.2	6.3	6.3	6.2	6.1

Orifice Number	Pressure Drop Across the Valve (bar)							
	2	4	6	8	10	12	14	16
Evaporating Temperature -40°C								
C-0X	–	–	0.35	0.36	0.36	0.36	0.35	0.35
C-00	–	–	0.66	0.67	0.68	0.67	0.66	0.65
C-01	–	–	0.83	0.86	0.87	0.86	0.85	0.82
C-02	–	–	1.3	1.3	1.3	1.3	1.3	1.2
C-03	–	–	2.2	2.2	2.2	2.2	2.2	2.1
C-04	–	–	3.5	3.7	3.7	3.7	3.6	3.5
C-05	–	–	4.3	4.4	4.5	4.4	4.4	4.2
C-06	–	–	4.7	4.9	5.0	4.9	4.8	4.7

Correction Factor, (CF) Liquid Temperature

TEV corrected capacity = Required Evaporator Capacity / Correction Factor, (CF), for Subcooling.

Subcooling	4°K	10°K	15°K	20°K	25°K	30°K	35°K	40°K	45°K	50°K
Correction Factor	1.00	1.10	1.20	1.29	1.37	1.46	1.54	1.63	1.70	1.78

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WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

7. **Contingencies.** Seller shall not be liable for any default or delay in performance if caused by circumstances beyond the reasonable control of Seller.

8. **User Responsibility.** The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

9. **Loss to Buyer's Property.** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

10. **Special Tooling.** A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

11. **Buyer's Obligation; Rights of Seller.** To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest. Seller shall have a security interest in, and lien upon, any property of Buyer in Seller's possession as security for the payment of any amounts owed to Seller by Buyer.

12. **Improper use and Indemnity.** Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

13. **Cancellations and Changes.** Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

14. **Limitation on Assignment.** Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

15. **Entire Agreement.** This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive

expression of the terms of the agreement. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

16. **Waiver and Severability.** Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

17. **Termination.** This agreement may be terminated by Seller for any reason and at any time by giving Buyer thirty (30) days written notice of termination. In addition, Seller may by written notice immediately terminate this agreement for the following: (a) Buyer commits a breach of any provision of this agreement (b) the appointment of a trustee, receiver or custodian for all or any part of Buyer's property (c) the filing of a petition for relief in bankruptcy of the other Party on its own behalf, or by a third party (d) an assignment for the benefit of creditors, or (e) the dissolution or liquidation of the Buyer.

18. **Governing Law.** This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement. Disputes between the parties shall not be settled by arbitration unless, after a dispute has arisen, both parties expressly agree in writing to arbitrate the dispute.

19. **Indemnity for Infringement of Intellectual Property Rights.** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

20. **Taxes.** Unless otherwise indicated, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of Products.

21. **Equal Opportunity Clause.** For the performance of government contracts and where dollar value of the Products exceed \$10,000, the equal employment opportunity clauses in Executive Order 11246, VEVRAA, and 41 C.F.R. §§ 60-1.4(a), 60-741.5(a), and 60-250.4, are hereby incorporated.



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