Thermostatic Expansion Valves (TXV)

Ammonia Applications Only

Thermostatic expansion valves for ammonia applications require special design considerations due to the erosive effects of ammonia vapor. For this type of application, Refrigerating Specialties has developed the types D and A thermostatic expansion valves. Like other components of ammonia systems, the types D and A valves are made from steel and steel alloys.

With ammonia systems, the formation of flash vapor at the expansion valve port causes valve seat erosion or wire drawing to occur. This effect is further aggravated by high velocity ammonia mixed with dirt or scale passing through the port of the expansion valve. Fortunately, seat erosion can be minimized and valve life extended if the following steps are taken:

1. Maintain vapor-free liquid at the TXV inlet at all times
2. Maintain clean ammonia through effective filtration
3. Reduce the velocity of the ammonia through the TXV port by reducing the pressure drop across the port

Step 1: can be accomplished through proper system design. Liquid line vapor is prevented by adequately sizing liquid lines and providing sufficient subcooling.

Step 2: can be assured with the use of a Parker Replaceable Core Dryer. This filter dryer is an effective scale trap when used on ammonia systems. For further information on the use of this dryer with ammonia systems, refer to page **152** of this catalog.

Step 3: can be accomplished with the use of a removable discharge tube or the nozzle of a refrigerant distributor. These components reduce the velocity and pressure drop at the expansion valve port by introducing a restriction or added pressure drop in the valve outlet passage.

The removable discharge tube is threaded into the outlet of the type D valves, and the nominal 70.3, 105 and 176 kW (20, 30 and 50 ton) type A valves. The discharge tube is the principle difference between ammonia TXVs and TXVs used with other refrigerants.

The discharge tube in the outlet passage must be removed when the TXV is combined with a R/S Ammonia Distributor and Nozzle. If the discharge tube is not removed from the valve, the combination of the discharge tube and distributor nozzle may create an excessive pressure drop resulting in a substantial loss of TXV capacity. Refer pages **147** - **150** for further information on ammonia distributors.

The nominal 264 and 352 kW (75 and 100 ton) type A valves do not employ a discharge tube since their valve outlets are designed to serve as a secondary orifice to reduce pressure drop across the valve port.

Thermostatic Charges for Ammonia Valves

Thermostatic charges C and L are available for the Type D thermostatic expansion valve. The type L thermostatic charge is the only charge available for the type A valve.

The types C thermostatic charges provide operating advantages for systems that cycle in response to a suction pressure switch or thermostat. These charges are also recommended for systems using a small capacity compressor. The table below lists the recommended temperature range for each charge.

Cold storage plants often have large centralized ammonia systems consisting of many evaporators connected to one or more large compressors. This makes for fairly stable suction pressures. The R/S type L charge responds more quickly to changes in bulb temperature, allowing for a quicker pull-down of the conditioned space temperature. Therefore, for large ammonia systems consisting of multiple evaporators, the Type L charge is recommended.

Thermostatic Charge	Evaporator Temperature
C	4°C to -18°C (40°F to 0°F)
L	-29°C to 4°C (-20°F to 40°F)

For applications at evaporator temperature below -29°C (-20°F) consult R/S

Cold storage plants often have large centralized ammonia systems consisting of many evaporators connected to one or more large compressors. This makes for fairly stable suction pressures. The R/S type L charge responds more quickly to changes in bulb temperature, allowing for a quicker pull-down of the conditioned space temperature. Therefore, for large ammonia systems consisting of multiple evaporators, the type L charge is recommended.

Thermostatic Expansion Valves (TXV)

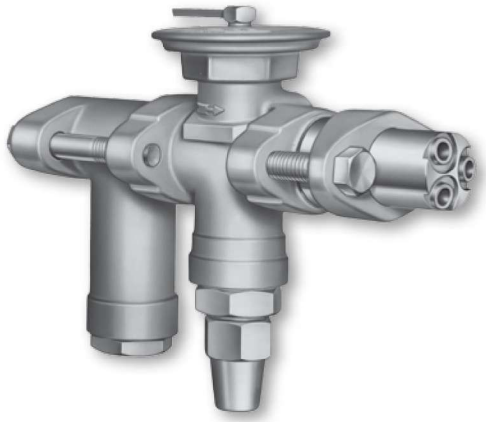
Type D - FPT Flange Connections

The type D valve is an externally adjustable valve with a gray cast iron body. It is supplied with FPT connections (½" SW available). The thermostatic element is replaceable, and all internal parts are serviceable. An optional XD-074 (½" FPT) external inlet strainer may be ordered with this valve. The nominal 3.52 and 7.03 kW (1 and 2 ton) type D valves are identical, with the exception of their discharge tubes, as are the nominal 35.2 and 52.7 kW (10 and 15 ton) valves. One of these valves can be converted to the other by exchanging the discharge tubes.

Refrigerant distributors that will mate directly to this valve are listed below.

Note: The discharge tube must be removed when a refrigerant distributor is applied to the valve.

Type D Thermostatic Expansion Valve with XD Strainer and 1132 Steel Distributor



Specifications

Maximum Rated Pressure (MRP) ..... 27.6 barg (400 psig)
Outlet Connections ..... "D" flange

Distributors

1130, 1132, 1133, 1180 (aluminum)
1182 (aluminum)

Specifications - Element Size No. 23, Gasket Joint

Type		Normal Capacity		Port Size (Inches)	Discharge Tube Orifice (inches)	Thermostatic Charges Available	Std. Tubing (Length - Ft.)	Connections FPT & SW		Flange Ring Size OD X ID (Inches)	Maximum Design Pressure		Net Weight		Shipping Weight	
Internal Equalizer	External Equalizer ⅛" FPT	kw	tons					Inlet (inches)	Outlet (inches)		bar	psi	kg	lbs	kg	lbs
DA-1	DAE-1	3.52	1	1/16	1/32	C L Y764 Y779 Y1201	**10*** 20	¼", ⅜", or ½*		1.12 x 0.75	29.3	425	3.6	8	4.1	9
DA-2	DAE-2	7.03	2	1/16	1/16											
DA-5	DAE-5	17.6	5	7/64	5/64											
DA-10	DAE-10	35.2	10	3/16	7/64											
DA-15	DAE-15	52.7	15	3/16	5/32											

Bold* figures are standard and will be furnished unless other wise specified.

Material & Details of Construction

Valve Type	Body	Seat	Pin	Pin Carrier	Pushrod(s)	Type of Joints	Connection	Inlet Strainer
D	Gray Iron Casting	Stainless Steel or Steel Alloy	Tungsten Carbide	Stainless Steel	Stainless Steel	Gasket	FPT (1/2" SW only)	Removable Strainer Screen

Note: The DA to a DAE do not use the same body and are not inter changeable.
Discharge tubes are only interchangeable when thermostatic expansion valves (TXV) have the same port size.

Thermostatic Expansion Valves (TXV)

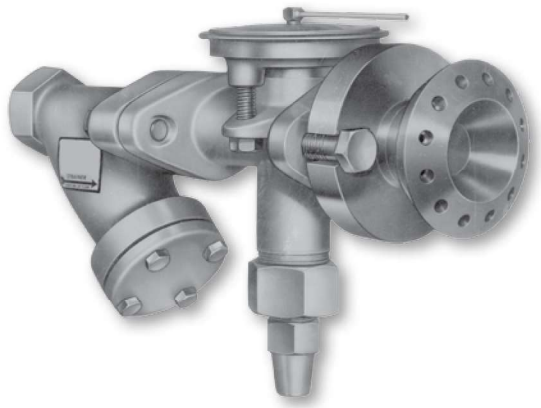
Type A - FPT Flange Connections

The type A valve is an externally adjustable valve with a gray cast iron body and either FPT or socket weld flange connections. The thermostatic element is replaceable. An optional 8004 (½" FPT) or 8006 (¾" FPT) strainer may be ordered with this valve.

The nominal 70.3 and 105 kW (20 and 30 ton) type A valves are identical with the exception of their discharge tubes. One of these valves can be converted to the other by exchanging their discharge tubes. The nominal 264 and 352 kW (75 and 100 ton) type A valves do not employ a discharge tube, nor are their outlets tapped to receive one.

Refrigerant distributors that will mate directly to this valve are listed below. Note: The discharge tube must be removed from the nominal 70.3, 105 and 176 kW (20, 30 and 50 ton) type A valves when a refrigerant distributor is applied.

Type A Thermostatic Expansion Valve with Y Strainer and 1185 Steel Distributor



Specifications

Maximum Rated Pressure (MRP) ..... 27.6 barg (400 psig)
Outlet Connections ..... "A" flange

Distributors

1138, 1185 (aluminum)

Specifications - Element Size No. 12, Gasket Joint

Type		Normal Capacity		Port Size (Inches)	Discharge Tube Orifice (Inches)	Thermostatic Charges Available	Std. Tubing (Length - Ft.)	Connections FPT & SW		Flange Ring Size OD X ID (Inches)	Maximum Design Pressure		Net Weight		Shipping Weight	
Internal Equalizer	External Equalizer ⅛" FPT	kw	tons					Inlet (inches)	Outlet (inches)		bar	psi	kg	lbs	kg	lbs
AA-20	AAE-20	70.3	20	5/16	1/8	L Y1182 Y830 Y832 Y1199	**10'** 20	½*, ¾, or 1		1.75 x 1.25	27.6	400	4.5	10	5.0	11
AA-30	AAE-30	105	30	5/16	5/32											
AA-50	AAE-50	176	50	3/8	3/16											
AA-75	AAE-75	264	75	3/8	—			¾*, or 1								
AA-100	AAE-100	352	100	7/16	—											

Bold* figures are standard and will be furnished unless other wise specified.

Material & Details of Construction

Valve Type	Body	Seat	Pin	Pin Carrier	Pushrod(s)	Type of Joints	Connection	Inlet Strainer
A	Gray Iron Casting	Stainless Steel or Steel Alloy	20 & 30 Ton: Tungsten Carbide 50, 75, & 100 Ton: Stainless Steel	Stainless Steel	Stainless Steel	Gasket	FPT or SW	Removable Strainer Screen

Note: The AA to a AAE do not use the same body and are not inter changeable.
Discharge tubes are only interchangeable when thermostatic expansion valves (TXV) have the same port size.

Thermostatic Expansion Valves (TXV) Capacities

These ratings are based on vapor free 30ºC (86ºF) liquid refrigerant entering the TXV, a maximum opening superheat of 7ºF, and a standard factory air test setting.

AC and AL Thermostatic Charges 717 Capacities (KW)

Valve Type	Nominal Capacity	Port Size (inches)	Discharge Tube Size (inches)	Evaporator Temperature (ºC)											
				4º				-7º				-15º			
				Pressure Drop Across Valve (bar)											
				5.5	6.9	8.3	9.7	6.9	8.3	9.7	11	6.9	8.3	9.7	11
D	3.52	1/16	1/32	3.80	4.25	4.64	5.03	3.59	3.94	4.25	4.54	2.99	3.27	3.52	3.76
	7.03	1/16	1/16	7.59	8.47	9.28	10.06	7.21	7.88	8.51	9.11	5.94	6.50	7.03	7.52
	17.6	7/64	5/64	19.0	21.2	23.2	25.1	18.0	19.7	21.3	22.7	14.9	16.3	17.6	18.8
	35.2	3/16	7/64	38.0	42.5	46.4	50.3	35.9	39.4	42.5	45.4	29.7	32.6	35.2	37.6
	52.7	3/16	5/32	57.0	63.6	69.6	75.2	54.1	59.1	64.0	68.2	44.7	48.9	52.7	56.3
A	70.3	5/16	1/8	67.9	75.9	83.0	89.7	66.1	72.4	78.1	83.3	59.4	65.0	70.3	75.2
	105	5/16	5/32	102	114	124	134	98.8	108	117	125	89.3	97.7	105	113
	176	3/8	3/16	169	190	207	224	165	181	195	208	149	163	176	188
	264	3/8	—	254	284	311	336	248	271	293	313	223	244	264	282
	352	7/16	—	339	380	415	447	330	362	390	418	297	326	352	376

AC and AL Thermostatic Charges 717 Capacities (TONS)

Valve Type	Nominal Capacity	Port Size (inches)	Discharge Tube Size (inches)	Evaporator Temperature (ºF)											
				40º				20º				5º			
				Pressure Drop Across Valve (psi)											
				80	100	120	140	100	120	140	160	100	120	140	160
D	1	1/16	1/32	1.08	1.21	1.32	1.43	1.02	1.12	1.21	1.29	0.85	0.93	1.00	1.07
	2	1/16	1/16	2.16	2.41	2.64	2.86	2.05	2.24	2.42	2.59	1.69	1.85	2.00	2.14
	5	7/64	5/64	5.40	6.03	6.61	7.14	5.12	5.61	6.05	6.47	4.23	4.63	5.00	5.35
	10	3/16	7/64	10.8	12.1	13.2	14.3	10.2	11.2	12.1	12.9	8.45	9.26	10.0	10.7
	15	3/16	5/32	16.2	18.1	19.8	21.4	15.4	16.8	18.2	19.4	12.7	13.9	15.0	16.0
A	20	5/16	1/8	19.3	21.6	23.6	25.5	18.8	20.6	22.2	23.7	16.9	18.5	20.0	21.4
	30	5/16	5/32	28.9	32.3	35.4	38.2	28.1	30.8	33.3	35.6	25.4	27.8	30.0	32.1
	50	3/8	3/16	48.2	53.9	59.0	63.7	46.9	51.4	55.5	59.3	42.3	46.3	50.0	53.5
	75	3/8	—	72.3	80.8	88.5	95.6	70.4	77.1	83.3	89.0	63.4	69.4	75.0	80.2
	100	7/16	—	96.4	108	118	127	93.8	103	111	119	84.5	92.6	100	107

Correction Factor (CF) Liquid Temperature Entering TXV

Refrigerant	-18°C (0°F)	-12°C (10°F)	-7°C (20°F)	-1°C (30°F)	4°C (40°f)	10°C (50°F)	16°C (60°F)	21°C (70°F)	27°C (80°F)	30°C (86°C)	32°C (90°F)	38°C (100°F)
717	1.27	1.24	1.20	1.17	1.14	1.11	1.08	1.05	1.02	1.00	0.99	0.96

EXAMPLE:
Actual capacity of nominal 35.2 kW (10 ton) valve at -7°C (20°F) evaporator, 11 bar (160 psi) pressure drop and 16°C (60°F) liquid temperature

45.4 bar x 1.08 = 49.0 bar
(12.9 tons x 1.08 = 13.9 tons)

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an average evaporator temperature of -18ºC (0ºF). However, they may be used for any evaporator temperature from -29ºC to 4ºC (-20ºF to 40ºF) since the variation in the actual factors across this range is insignificant.

Thermostatic Expansion Valves (TXV) Capacities

These ratings are based on vapor free 30ºC (86ºF) liquid refrigerant entering the TXV, a maximum opening superheat of 7ºF, and a standard factory air test setting.

AZ and AL Thermostatic Charges 717 Capacities (KW)

Valve Type	Nominal Capacity	Port Size (inches)	Discharge Tube Size (inches)	Evaporator Temperature (ºC)							
				4°				-7°			
				Pressure Drop Across Valve (bar)							
				8.3	9.7	11.0	12.4	8.3	9.7	11.0	12.4
D	3.52	1/16	1/32	2.14	2.32	2.50	2.64	1.83	1.97	2.11	2.22
	7.03	1/16	1/16	3.73	4.01	4.29	4.54	3.13	3.38	3.62	3.83
	17.6	7/64	5/64	8.72	9.42	10.1	10.7	7.35	7.95	8.51	9.00
	35.2	3/16	7/64	18.4	19.9	21.3	22.6	15.5	16.8	18.0	19.1
	52.7	3/16	5/32	25.6	27.6	29.5	31.3	21.6	23.3	24.9	26.4
A	70.3	5/16	1/8	55.9	60.5	64.7	68.6	47.8	51.7	55.6	58.7
	105	5/16	5/32	84.0	90.7	97.0	103	72.1	77.7	83.0	88.3
	176	3/8	3/16	140	152	162	172	120	130	139	147
	264	3/8	—	210	227	243	257	180	194	208	220
	352	7/16	—	280	303	324	344	240	259	277	294

AZ and AL Thermostatic Charges 717 Capacities (TONS)

Valve Type	Nominal Capacity	Port Size (inches)	Discharge Tube Size (inches)	Evaporator Temperature (ºF)							
				-10°				-20°			
				Pressure Drop Across Valve (psi)							
				120	140	160	180	120	140	160	180
D	1	1/16	1/32	0.61	0.66	0.71	0.75	0.52	0.56	0.60	0.63
	2	1/16	1/16	1.06	1.14	1.22	1.29	0.89	0.96	1.03	1.09
	5	7/64	5/64	2.48	2.68	2.87	3.04	2.09	2.26	2.42	2.56
	10	3/16	7/64	5.24	5.66	6.05	6.42	4.42	4.78	5.11	5.42
	15	3/16	5/32	7.27	7.85	8.39	8.90	6.13	6.62	7.08	7.51
A	20	5/16	1/8	15.9	17.2	18.4	19.5	13.6	14.7	15.8	16.7
	30	5/16	5/32	23.9	25.8	27.6	29.3	20.5	22.1	23.6	25.1
	50	3/8	3/16	39.9	43.1	46.0	48.8	34.1	36.9	39.4	41.8
	75	3/8	—	59.8	64.6	69.1	73.2	51.2	55.3	59.1	62.7
	100	7/16	—	79.7	86.1	92.1	97.7	68.2	73.7	78.8	83.6

Correction Factor (CF) Liquid Temperature Entering TXV

Refrigerant	-18ºC (0ºF)	-12ºC (10ºF)	-7ºC (20ºF)	-1ºC (30ºF)	4ºC (40ºf)	10ºC (50ºF)	16ºC (60ºF)	21ºC (70ºF)	27ºC (80ºF)	30ºC (86ºC)	32ºC (90ºF)	38ºC (100ºF)
717	1.27	1.24	1.20	1.17	1.14	1.11	1.08	1.05	1.02	1.00	0.99	0.96

EXAMPLE:
Actual capacity of nominal 35.2 kW (10 ton) valve at -23°C (-10°F) evaporator, 11 bar (160 psi) pressure drop and 16°C (60°F) liquid temperature

21.3 bar x 1.08 = 23.0 bar
(6.05 tons x 1.08 = 6.53 tons)

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an average evaporator temperature of -18ºC (0ºF). However, they may be used for any evaporator temperature from -29ºC to 4ºC (-20ºF to 40ºF) since the variation in the actual factors across this range is insignificant.

Oil Cooling Thermostatic Charges

Estimated Bulb Temperature Control Range (°C)

Equalizer Pressure	Type D Valve Charges (°C)			Type A Valve Charges (°C)			
bar	Y764	Y779	Y1201	Y1182	Y830	Y832	Y1199
2.8	31 - 39	47 - 56	73 - 82	27 - 35	31 - 39	47 - 56	73 - 82
3.4	36 - 44	52 - 60	79 - 87	32 - 39	36 - 44	52 - 60	79 - 87
4.1	41 - 48	57 - 64	84 - 92	37 - 43	41 - 48	57 - 64	84 - 92
4.8	45 - 52	62 - 69	89 - 96	41 - 47	45 - 52	62 - 69	89 - 96
5.5	49 - 56	66 - 73	94 - 100	45 - 51	49 - 56	66 - 73	94 - 100

Estimated Bulb Temperature Control Range (°F)

Equalizer Pressure	Type D Valve Charges (°F)			Type A Valve Charges (°F)			
psi	Y764	Y779	Y1201	Y1182	Y830	Y832	Y1199
40	87 - 103	116 - 132	163 - 180	81 - 95	87 - 103	116 - 132	163 - 180
50	96 - 111	126 - 140	174 - 189	90 - 103	96 - 111	126 - 140	174 - 189
60	105 - 119	135 - 148	184 - 197	98 - 110	105 - 119	135 - 148	184 - 197
70	113 - 126	144 - 156	193 - 205	106 - 117	113 - 126	144 - 156	193 - 205
80	120 - 133	151 - 163	201 - 212	113 - 123	120 - 133	151 - 163	201 - 212

- Use 40°F evaporating temperature ratings
- Liquid temperature entering TXV
- Pressure drop across TXV
- Cooling load (compressor manufacturer)

Thermostatic Expansion Valves Selection Procedure

The following procedure should be used when selecting a R717 Ammonia TXV:

1. Determine the pressure drop across the valve

Subtract the evaporating pressure 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. 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; and (3) static pressure loss (gain) due to the vertical lift (drop) of the liquid line, see Table 1.

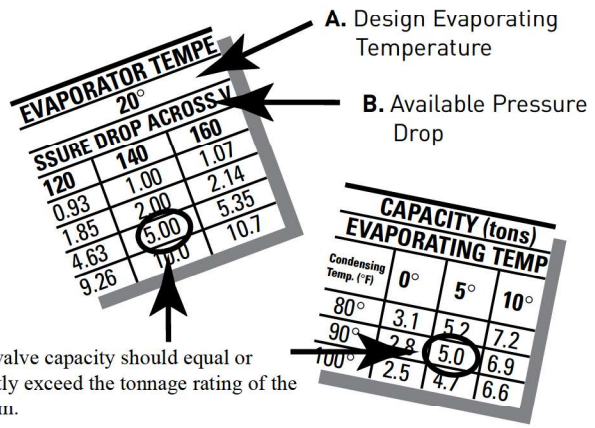
Table 1

Refrigerant	Vertical Lift				
	6.1 m (20 ft)	12.2 m (40 ft)	18.3 m (60 ft)	24.4 m (80 ft)	30.5 m (100 ft)
	Static Pressure Loss				
717 Ammonia	0.34 bar (5 psi)	0.69 bar (10 psi)	1.03 bar (15 psi)	1.38 bar (20 psi)	1.72 bar (25 psi)

It is not necessary to subtract the pressure drop across the refrigerant distributor when determining the pressure drop across a R/S Type D or type A valve with a nominal rating of 176 kW (50 tons) or less. These valves employ a discharge tube in the valve outlet passageway, and it should be removed when a distributor is connected to the valve. R/S distributors are normally selected to provide a 2.76 bar (40 psi) pressure drop at design load conditions for ammonia applications. Removing the discharge tube from the valve will compensate for this pressure drop.

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

The R-717 Ammonia TXV rating tables on page **143** are based on a liquid temperature of 30°C (86°F). For other liquid temperatures, apply the correction factor given in the table.



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

3. Select valve from the rating tables

Select a valve based on the design evaporating temperature and the available pressure drop across the valve. If possible, the valve rating should equal or slightly exceed the design rating of the system. Be sure to apply the appropriate liquid temperature correction factor to the valve ratings shown in the tables. Once the desired valve rating has been located, determine the nominal capacity of the valve from the second column of the table. On multiple evaporator systems, select each valve on the basis of individual evaporator capacity.

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. The recommendations given in Table 1 are suitable for most field installed systems. Use an externally equalized valve when pressure drop between the valve outlet and bulb location exceeds values shown in Table 2. An externally equalized valve must be used on evaporators, which employ a refrigerant distributor.

Table 2

Refrigerant	Evaporator Temperature			
	4°C (40 °F)	-7°C (20 °F)	-18°C (0 °F)	-29°C (-20 °F)
	Pressure Drop (psi)			
717 Ammonia	0.21 bar (3 psi)	0.14 bar (2 psi)	0.10 bar (1.5 psi)	0.07 bar (1.0 psi)

When the thermostatic expansion valve is equipped with an external equalizer, it must be connected. Do not cap off the equalizer connection, as it will prevent the valve from operating properly.

5. Select the R/S Selective Thermostatic Charge

Select the charge according to the design evaporator temperature and the valve application. The subject of R-717 thermostatic charges is discussed on page **140**.

Selection Example: Refrigerant 717
Application: Refrigeration, single evaporator system
Design evaporator temperature ..... -15°C (5°F)
Design condenser temperature ..... 32°C (90°F)
Refrigerant liquid temperature ..... 27°C (80°F)
Design evaporator capacity ..... 17.6 kW (5 tons)

Available pressure drop across TXV
Condensing pressure ..... 11.4 barg (166 psig)
Evaporator pressure ..... 1.31 barg (19 psig)
Pressure Drop ..... 10.1 bar (147 psi)

Liquid line and accessories loss ..... 0.48 bar (7 psi)
① Distributor and tubes loss ..... 0 bar (0 psi)
Total Pressure Drop ..... 9.65 bar (140 psi)

Refrigerant liquid correction factor 1.02

The DAE-5 has a valve capacity of: 17.6 x 1.02 = 17.93 kW (5.00 x 1.02 = 5.10 tons) at -15°C (5°F) evaporator temperature, 9.65 bar (140 psi) pressure drop, and 27°C (80°F) liquid temperature.

Thermostatic charge, see page **140**: C

Selection: DAE-5-C

① An externally equalized valve must be used on evaporators employing a refrigerant distributor due to the pressure drop created by the distributor. Pressure drop due to the distributor is not used in the calculation to determine pressure drop across the TXV since the valve's discharge tube will be removed. Refer to step 1 of the selection procedure.