Thermostatic Expansion Valves

The same features and design principles found in thermostatic expansion valves for Refrigerants – 12, 22, 134a, and 502 are also incorporated in Sporlan thermostatic expansion valves for Ammonia. They have proven their value and acceptance in the Industry for over 65 years.

Refrigerant 717 (Ammonia) Applications

Thermostatic expansion valves for ammonia applications require special design considerations due to the erosive effects of ammonia vapor. For this type of application, Sporlan 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. The materials used in the manufacture of these valves are listed on pages 4 and 5.

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 TEV inlet at all times.
2. Maintain clean ammonia through effective filtration.
3. Reduce the velocity of the ammonia through the TEV 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 Sporlan **Catch-All® Filter-Drier**. This filter-drier is an effective scale trap when used on ammonia systems. For further information on the use of the **Catch-All Filter-Drier** with ammonia systems, refer to Bulletin 40-10 and page 15 of this bulletin.

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 20, 30, and 50 ton Type A valves. The discharge tube is the principle difference between ammonia TEVs and TEVs used with other refrigerants. Discharge tube sizes are listed in the Type D and A valve specifications on pages 4 and 5.

The discharge tube in the outlet passage must be removed when the TEV is combined with a Sporlan 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 TEV capacity. Refer to page 8 for further information on ammonia distributors.

The nominal 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, Z, 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 and Z 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.

THERMOSTATIC CHARGE	EVAPORATOR TEMPERATURE °F
C	40° to 0°
Z	0° to -20°

For applications at evaporator temperature below -20°F, consult Sporlan Valve Company, Washington, Missouri 63090.

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 Sporlan 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.

Type D – FPT Flange Connections

The Sporlan Type D valve is an externally adjustable valve with a gray cast iron body. It is available with either FPT or socket weld flange connections. The thermostatic element is replaceable, and all internal parts are serviceable. An optional XD-074 (1/2" FPT) external inlet strainer may be ordered with this valve. The nominal 1 and 2 ton Type D valves are identical, with the exception of their discharge tubes, as are the nominal 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. Refer to Sporlan Bulletin 20-10 for additional application information on this subject.

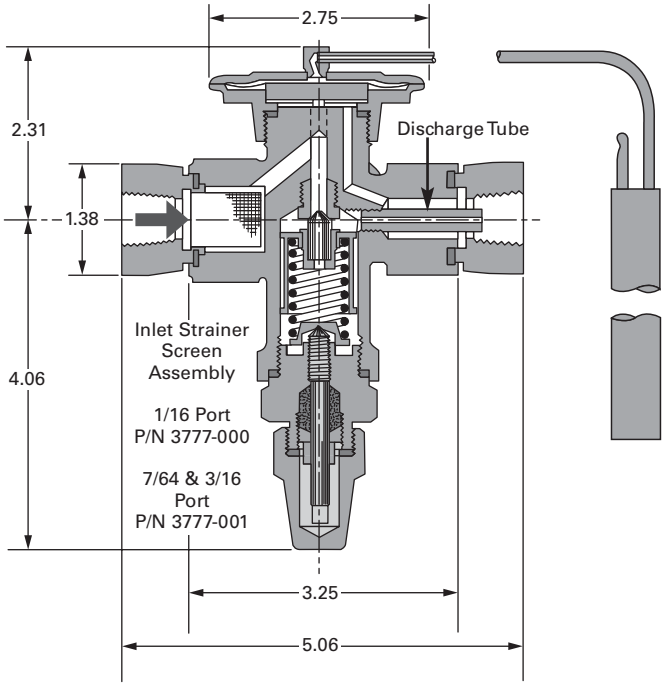
Note: The discharge tube must be removed when a refrigerant distributor is applied to the valve.

Outlet Connections
"D" flange

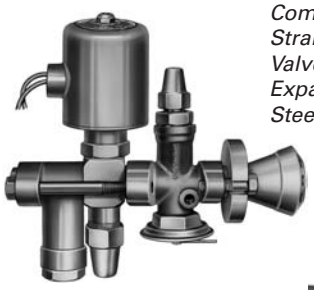
Distributors
1130, 1132, 1133, 1180 (aluminum)
1182 (aluminum)

SPECIFICATIONS – ELEMENT SIZE NO. 23, GASKET JOINT

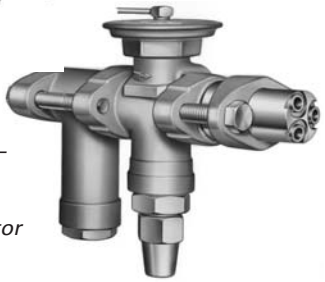
TYPE		NOMINAL CAPACITY Tons of Refrigeration	Port Size Inches	Discharge Tube Orifice Inches	Thermostatic Charges Available	**Bold** figures are standard and will be furnished unless otherwise specified.			Flange Ring Size OD X ID Inches	Net Weight – Lbs.	Shipping Weight – Lbs.
Internal Equalizer	External Equalizer 1/8" FPT					Std. Tubing Length – Ft.	CONNECTIONS – Inches FPT				
							INLET	OUTLET			
DA-1	DAE-1	1	1/16	1/32	C-Z-L	5	1/4, 3/8, or **1/2**		1.12 x 0.75	8	9
DA-2	DAE-2	2	1/16	1/16							
DA-5	DAE-5	5	7/64	5/64		**10**					
DA-10	DAE-10	10	3/16	7/64		15					
DA-15	DAE-15	15	3/16	5/32							



BULB SIZES – Inches	
CHARGES	REFRIGERANT 717 – Ammonia
C - Z - L	0.75 x 4.00



Compact combination of XD Strainer – MA5A3 Solenoid Valve – DA Thermostatic Expansion Valve & 1130 Steel Distributor



Types XD Strainer – DA Thermostatic Expansion Valve & 1132 Steel Distributor

MATERIALS & DETAILS OF CONSTRUCTION

VALVE TYPE	BODY	SEAT	PIN	PIN CARRIER	PUSHROD(S)	TYPE of JOINTS	CONNECTIONS	INLET STRAINER
D	Gray Iron Casting	Stainless Steel or Steel Alloy	Tungsten Carbide	Stainless Steel	Stainless Steel	Gasket	Pipe Flange, Socket Weld	Removable Strainer Screen

Type A – FPT Flange Connections

The Sporlan 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 (1/2" FPT) or 8006 (3/4" FPT) strainer may be ordered with this valve.

The nominal 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 75 and 100 ton Type A valves do not employ a discharge tube, nor are their outlets tapped to receive one.

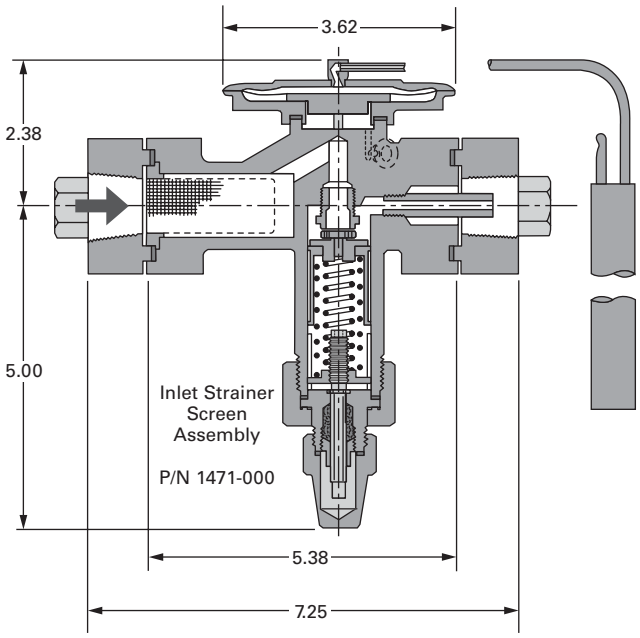
Refrigerant distributors that will mate directly to this valve are listed below. Refer to Sporlan Bulletin 20-10 for additional application information on this subject. Note: The discharge tube must be removed from the nominal 20, 30, and 50 ton Type A valves when a refrigerant distributor is applied.

Outlet Connections
"A" flange

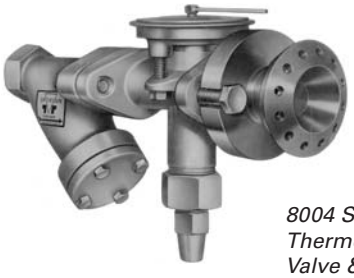
Distributors
1138, 1185 (aluminum)

SPECIFICATIONS – ELEMENT SIZE NO. 12, GASKET JOINT

TYPE		NOMINAL CAPACITY Tons of Refrigeration	Port Size Inches	Discharge Tube Orifice Inches	Thermostatic Charges Available	**Bold** figures are standard and will be furnished unless otherwise specified.			Flange Ring Size OD x ID Inches	Net Weight – Lbs.	Shipping Weight – Lbs.
Internal Equalizer	External Equalizer 1/8" FPT					Std. Tubing Length – Ft.	CONNECTIONS – Inches FPT				
							INLET	OUTLET			
AA-20	AAE-20	20	5/16	1/8	L Only	**10**	**1/2**, 3/4, or 1		1.75 x 1.25	10	11
AA-30	AAE-30	30	5/16	5/32							
AA-50	AAE-50	50	3/8	3/16		15	**3/4** or 1				
AA-75	AAE-75	75	3/8	–							
AA-100	AAE-100	100	7/16	–							



BULB SIZES – Inches	
CHARGE	REFRIGERANT
	717 – Ammonia
L - Only	0.88 OD x 6.00



8004 Strainer – AA Thermostatic Expansion Valve & 1185 Aluminum Distributor

MATERIALS & DETAILS OF CONSTRUCTION

VALVE TYPE	BODY	SEAT	PIN	PIN CARRIER	PUSHROD(S)	TYPE of JOINTS	CONNECTIONS	INLET STRAINER
A	Gray Iron Casting	Stainless Steel	20 & 30 Ton: Tungsten Carbide 50, 75, & 100 Ton: Stainless Steel	Stainless Steel	Stainless Steel	Gasket	Pipe Flange, Socket Weld	Removable Strainer Screen

Thermostatic Expansion Valve Capacities – Tons of Refrigeration

These ratings are based on vapor free 86°F liquid refrigerant entering the TEV, a maximum opening superheat of 7°F, and a standard factory air test setting.

AC and AL THERMOSTATIC CHARGES

VALVE TYPE	NOMINAL CAPACITY	PORT SIZE	DISCHARGE TUBE SIZE	EVAPORATOR TEMPERATURE °F											
				40°				20°				5°			
				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
D	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
D	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
D	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
D	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
A	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
A	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
A	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
A	100	7/16	–	96.4	108	118	127	93.8	103	111	119	84.5	92.6	100	107

AZ and AL THERMOSTATIC CHARGES

VALVE TYPE	NOMINAL CAPACITY	PORT SIZE	DISCHARGE TUBE SIZE	EVAPORATOR TEMPERATURE °F							
				-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
D	2	1/16	1/16	1.06	1.14	1.22	1.29	0.89	0.96	1.03	1.09
D	5	7/64	5/64	2.48	2.68	2.87	3.04	2.09	2.26	2.42	2.56
D	10	3/16	7/64	5.24	5.66	6.05	6.42	4.42	4.78	5.11	5.42
D	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
A	30	5/16	5/32	23.9	25.8	27.6	29.3	20.5	22.1	23.6	25.1
A	50	3/8	3/16	39.9	43.1	46.0	48.8	34.1	36.9	39.4	41.8
A	75	3/8	–	59.8	64.6	69.1	73.2	51.2	55.3	59.1	62.7
A	100	7/16	–	79.7	86.1	92.1	97.7	68.2	73.7	78.8	83.6

REFRIGERANT	LIQUID TEMPERATURE ENTERING TEV °F											
	0°	10°	20°	30°	40°	50°	60°	70°	80°	86°	90°	100°
	CORRECTION FACTOR, CF LIQUID TEMPERATURE											
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 10 ton valve at -10°F evaporator, 160 psi pressure drop and 60°F liquid temperature = 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 0°F. However, they may be used for any evaporator temperature from -20°F to 40°F since the variation in the actual factors across this range is insignificant.

Selection Procedure

The following procedure should be used when selecting a Refrigerant 717 Ammonia TEV:

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.

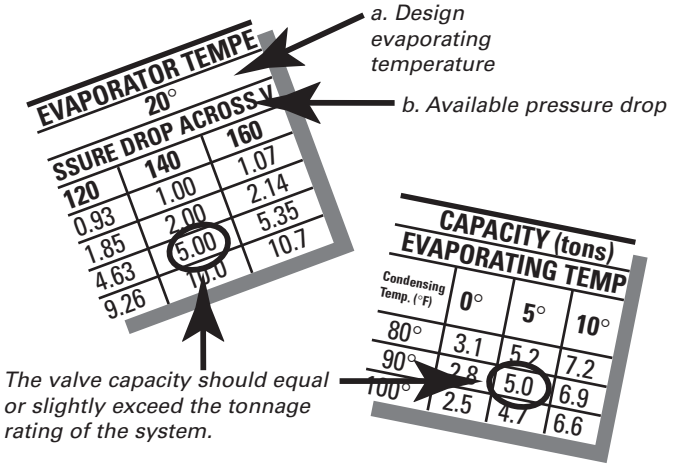
Table 1

REFRIGERANT	VERTICAL LIFT – FEET				
	20	40	60	80	100
	STATIC PRESSURE LOSS – psi				
717 Ammonia	5	10	15	20	25

It is not necessary to subtract the pressure drop across the refrigerant distributor when determining the pressure drop across a Sporlan Type D or Type A valve with a nominal rating of 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. Sporlan distributors are normally selected to provide a 40 psi pressure drop at design load conditions for ammonia applications. Removing the discharge tube from the valve will compensate for this pressure drop. Refer to Bulletin 20-10 for further information on refrigerant distributors.

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

The R-717 Ammonia TEV rating tables on page 6 are based on a liquid temperature of 86°F. For other liquid temperatures, apply the correction factor given in the table.



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 °F			
	40	20	0	-20
	PRESSURE DROP – psi			
717 Ammonia	3	2	1.5	1.0

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 Sporlan 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 3. Refer to Bulletin 10-9 for a complete discussion of Sporlan Selective Thermostatic Charges.

Selection Example:

Refrigerant 717
Application: Refrigeration, single evaporator system

Design evaporator temperature	5°F
Design condenser temperature	90°F
Refrigerant liquid temperature	80°F
Design evaporator capacity	5 tons
Available pressure drop across TEV	
Condensing pressure (psig)	166
Evaporator pressure (psig)	-19
	147
Liquid line and accessories loss (psi)	-7
Distributor and tubes loss (psi) ①	0
	140
Refrigerant liquid correction factor	1.02

The DAE-5 has a valve capacity of: 5.00 x 1.02 = 5.10 tons at 5°F evaporator temperature, 140 psi pressure drop, and 80°F liquid temperature.

Thermostatic charge, see page 3: 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 TEV since the valve's discharge tube will be removed. Refer to step 1 of the selection procedure.