MAKING MODERN LIVING POSSIBLE

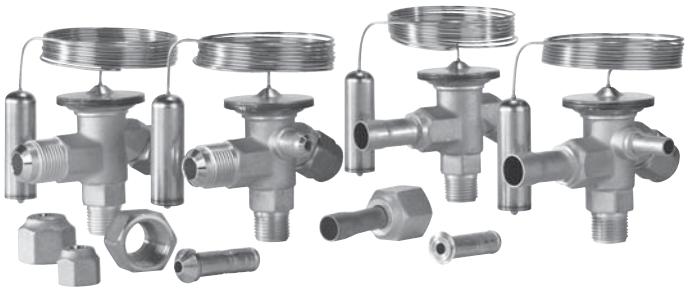
Thermostatic expansion valves
T 2 and TE 2

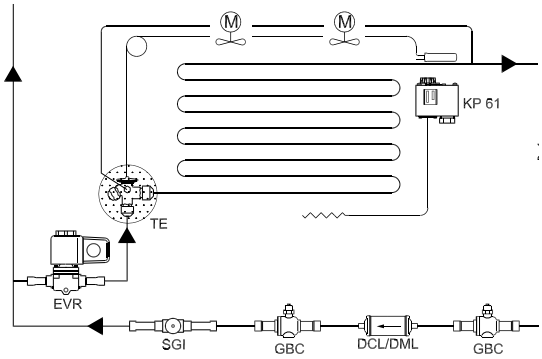
Technical brochure

Contents

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm
1 ft = 0.3 m
1 lb = 0.454 kg

Introduction





Thermostatic expansion valves, type T 2 and TE 2 regulate the flow of refrigerant liquid into evaporators.
Injection is controlled by the refrigerant superheat.
T 2 valves are especially suitable for liquid injection into "dry" evaporators where the superheat at the evaporator outlet is proportional to the evaporator load.
The valves are available in rated capacities up to 4.5 TR (R22) and can be used in a wide range of applications:

- Conventional refrigeration systems
- Heat pump systems
- Air conditioning systems
- Specialty refrigeration appliances
- Liquid chillers
- Ice machines
- Transport refrigeration

This leaflet contains data and code numbers for our standard product program.

Features

- Broad temperature range from – 75 to 50°F:
  Applicable for deep freezing, refrigeration and air conditioning.
- Interchangeable orifice assembly
  Easier stocking, capacity matching, and service.
- Rated capacities from 0.15 to 4.5 TR (R22)
- Available with Maximum Operating Pressure (MOP)
  Used to protect the compressor motor against excessive evaporator pressure.
- *Stainless steel bulb*
  For easy self-aligning during installation and efficient heat transfer from pipe to bulb.

Thermostatic charge options

Danfoss offers the following standard range of thermostatic charges:

Range N	– 40 to +50°F	without MOP
Range N	– 40 to +50°F,	MOP ~ 60°F
Range NM	– 40 to +25°F,	MOP ~ 32°F
Range NL	– 40 to + 5°F,	MOP ~ 15°F
Range B[1])	– 75 to –15°F	without MOP
Range B[1])	– 75 to –15°F,	MOP ~ –4°F

[1]) T 2/TE 2 valves for range B are not available for R134a

Regular valve options

Static superheat (SS) (R22, R134a, and R404A):
Valves without MOP: 9°F
Valves with MOP: 7°F

Static superheat (SS) for R507:
Valves without MOP: 11°F
Valves with MOP: 9°F

Capillary tube length
5 ft

Connection sizes
Inlet x outlet: 3/8 in. flare x 1/2 in. flare
3/8 in. flare x 1/2 in. ODF
3/8 in. ODF*) x 1/2 in. flare
3/8 in. ODF*) x 1/2 in. ODF
1/4 in. ODF*) x 1/2 in. flare
1/4 in. ODF*) x 1/2 in.ODF

*) Requires a solder adapter

External equalization:
1/4 in. flare (for all flare outlet bodies)
1/4 in. ODF (for all ODF outlet bodies)

Sizing

For optimum performance, it is important to select a T 2 or TE 2 valve according to system conditions and application. Selecting an incorrect valve will result in operational difficulties or poor system performance.
The following procedure will help you select the correct valve for your needs.

Example:
Refrigerant = R22

Evaporator capacity:
Q_e = 13,000 Btu (1.08 TR)

Evaporating temperature:
t_e = +40°F (equals p_e = 70 psig)

Condensing temperature:
t_c = +100°F (equals p_c = 195 psig)

Liquid refrigerant temperature:
t_l = +80°F

Step 1

Determine the pressure drop across the valve.
The pressure drop, Δp, is calculated by the formula:
$\Delta p = p_c - p_e - pdw$
where
p_c = condensing pressure
p_e = evaporating pressure, and
pdw = the sum of other pressure drops in the liquid line, evaporator and distributor.

The pressures p_c and p_e can be found by using the design condensing and evaporating temperatures at the saturated vapor point, then using a pressure-temperature chart or a Danfoss refrigerant slide to convert the temperatures to pressures.
In this example, the pressure drop across the valve will be:
$\Delta p = p_c - p_e - pdw = 195 - 70 - 0 = 125$ psi.

Step 2

Determine required valve capacity.
Use the design evaporator capacity, Q_e, to select the required valve size at a given evaporating temperature. If necessary, correct the evaporator capacity for subcooling. Subcooled liquid refrigerant entering the evaporator increases evaporator capacity, so that a smaller valve may be required.

In this example, the subcooling is:
$\Delta t_{sub} = t_c - t_l = 100 - 80 = 20$°F

From the subcooling correction factor table on page 9, we find the appropriate correction factor F_{sc} equals 0.94 for Δt_{sub} = 20°F.
Now determine the required valve capacity by multiplying the evaporator capacity by the correction factor for subcooling.

Required valve capacity
$Q_e \times F_{sc} = 1.08 \times 0.94 = 1.02$ TR

Step 3

Use the calculated valve capacity to select the corresponding orifice size from the capacity table for R22 as indicated below.

Note that the expansion valve capacity must be equal to or slightly more than the corrected evaporator capacity.
In this sizing example, orifice 02 will be suitable.

Capacities (R22)

Capacity in tons, range N: – 40 to + 50°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
Evaporating temperature + 40°F									
TX 2/ TEX 2	0X	0.12	0.14	0.15	0.16	0.17	0.18	0.18	0.19
	00	0.27	0.31	0.34	0.36	0.38	0.39	0.40	0.40
	01	0.65	0.75	0.82	0.87	0.92	0.96	0.98	1.00
	02	0.91	1.06	1.18	1.27	**1.36**	1.43	1.47	1.50
	03	1.62	1.90	2.11	2.27	2.43	2.54	2.62	2.67
	04	2.42	2.84	3.15	3.39	3.63	3.80	3.92	3.99
	05	3.06	3.59	3.98	4.29	4.58	4.79	4.94	5.03
	06	3.76	4.40	4.87	5.24	5.59	5.84	6.02	6.13

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Sizing (continued)

Step 4

Select a thermostatic charge.
Danfoss offers a universal wide range thermostatic charge.

Range N is suited for most applications in the normal temperature range.

Ranges NM, NL and B are available for special low temperature applications.

Step 5

Determine if external equalization is required.

Note! External equalization is always required if a distributor is used or if there is an appreciable difference in pressure from the valve outlet to the bulb location.

Finally, determine connection sizes, then find the valve´s code number from the tables on page 7.

Technical data

Maximum bulb temperature
212°F

Maximum valve body temperature
250°F
Short-lived peak 300°F

Maximum working pressure
MWP = 400 psig

Maximum test pressure
p' = 520 psig

Static superheat (SS) (R22, R134a, and R404A):
Valves without MOP: 9°F
Valves with MOP: 7°F

Static superheat (SS) for R507:
Valves without MOP: 11°F
Valves with MOP: 9°F

Standard refrigerants
R22, R134a and R404A/R507

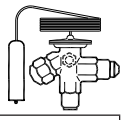
T 2 and TE 2 valves are continually evaluated for use with newer refrigerants.
For further information, please contact Danfoss.

MOP-points

Refrigerant	Range N – 40 → + 50°F	Range NM – 40 → + 25°F	Range NL – 40 → + 5°F	Range B – 75 → – 15°F
	MOP point for evaporating temperature t_e and evaporating pressure p_e [1])			
	t_e = + 60°F	t_e = + 32°F	t_e = + 15°F	t_e = – 4°F
R22	p_e = 100 psig	p_e = 60 psig	p_e = 35 psig	p_e = 20 psig
R134a	p_e = 55 psig	p_e = 30 psig	p_e = 15 psig	
R404A/R507	p_e = 120 psig	p_e = 75 psig	p_e = 50 psig	p_e = 30 psig

MOP valves
To avoid charge migration when using MOP valves, the bulb temperature must always be lower than the temperature of the thermostatic element.

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C



Ordering, Components with flare × flare connections

Thermostatic element and valve body with bulb strap (without orifice and filter)

Refrigerant	Valve type	Pressure equalization [1]	Capillary tube	Connection Inlet × outlet	Code no.					
					Range N −40 to +50°F		Range NM −40 to +25°F	Range NL −40 to +5°F	Range B −75 to −15°F	
			ft	in. × in.	Without MOP	With MOP	With MOP	With MOP	Without MOP	With MOP
R22	TX 2	Int.	5	$^3/_8 \times ^1/_2$	**068Z3206**	**068Z3208**	**068Z3224**	**068Z3226**	**068Z3207**	**068Z3228**
	TEX 2	Ext.	5	$^3/_8 \times ^1/_2$	**068Z3209**	**068Z3211**	**068Z3225**	**068Z3227**	**068Z3210**	**068Z3229**
R134a	TN 2	Int.	5	$^3/_8 \times ^1/_2$	**068Z3346**	**068Z3347**	**068Z3393**	**068Z3369**		
	TEN 2	Ext.	5	$^3/_8 \times ^1/_2$	**068Z3348**	**068Z3349**	**068Z3392**	**068Z3370**		
R404A/ R507	TS 2	Int.	5	$^3/_8 \times ^1/_2$	**068Z3400**	**068Z3402**	**068Z3406**	**068Z3408**	**068Z3401**	**068Z3410**
	TES 2	Ext.	5	$^3/_8 \times ^1/_2$	**068Z3403**	**068Z3405**	**068Z3407**	**068Z3409**	**068Z3404**	**068Z3411**

[1]) Externally equalized connections are ¼ in. flare.

Orifice assembly with filter

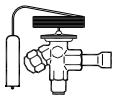
Rated capacity is based on:
Evaporating temperature
t_e = + 40°F for range N and
t_e = – 20°F for range B
Condensing temperature
t_c = + 90°F
Refrigerant liquid temperature ahead of valve t_l = + 80°F

Rated capacity in tons (TR)

Orifice no.	Range N: – 40 to + 50°F			Range B: – 75 to – 15 °F		Code no.
	R22	R134a	R404A/R507	R22	R404A/R507	
0X	0.15	0.11	0.11	0.15	0.11	**068-2002**
00	0.3	0.25	0.21	0.2	0.21	**068-2003**
01	0.7	0.5	0.45	0.3	0.45	**068-2010**
02	1.0	0.8	0.6	0.6	0.6	**068-2015**
03	1.5	1.3	1.2	0.8	1.0	**068-2006**
04	2.3	1.9	1.7	1.2	1.4	**068-2007**
05	3.0	2.5	2.2	1.5	1.7	**068-2008**
06	4.5	3.0	2.6	2.0	1.9	**068-2009**

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm
1 ft = 0.3 m

Ordering, components with flare × solder connections



Thermostatic element and valve body with bulb strap(without orifice and filter)

Refrigerant	Valve type	Pressure equalization [1]	Capillary tube	Connection		Code no.				
				Inlet flare	Outlet ODF solder	Range N – 40 to + 50°F		Range NL – 40 to + 5°F	Range B – 75 to – 15°F	
			ft	in.	in.	without MOP	with MOP	with MOP	without MOP	with MOP
R22	TX 2	Int.	5	3/8	1/2	**068Z3281**	**068Z3287**		**068Z3357**	**068Z3319**
	TEX 2	Ext.	5	3/8	1/2	**068Z3284**	**068Z3290**		**068Z3359**	**068Z3320**
R134a	TN 2	Int.	5	3/8	1/2	**068Z3383**				
	TEN 2	Ext.	5	3/8	1/2	**068Z3385**	**068Z3389**			
R404A/R507	TS 2	Int.	5	3/8	1/2	**068Z3414**	**068Z3416**		**068Z3418**	**068Z3420**
	TES 2	Ext.	5	3/8	1/2	**068Z3415**	**068Z3417**	**068Z3430**	**068Z3419**	**068Z3421**

[1] Externally equalized connections are 1/4 in. ODF solder.

Orifice assembly with filter

Rated capacity is based on:
Evaporating temperature
t_e = + 40°F for range N and
t_e = – 20°F for range B
Condensing temperature
t_c = + 90°F
Refrigerant liquid temperature ahead of valve t_l = + 80°F

Rated capacity in tons (TR)

Orifice no.[1]	Range N: – 40 to + 50°F			Range B: – 75 to – 15°F		Code no.
	R22	R134a	R404A/R507	R22	R404A/R507	
0X	0.15	0.11	0.11	0.15	0.11	**068-2002**
00	0.3	0.25	0.21	0.2	0.21	**068-2003**
01	0.7	0.5	0.45	0.3	0.45	**068-2010**
02	1.0	0.8	0.6	0.6	0.6	**068-2015**
03	1.5	1.3	1.2	0.8	1.0	**068-2006**
04	2.3	1.9	1.7	1.2	1.4	**068-2007**
05	3.0	2.5	2.2	1.5	1.7	**068-2008**
06	4.5	3.0	2.6	2.0	1.9	**068-2009**

[1] These orifice assemblies cannot be used together with solder adapters. Please see adapter information below.

Solder adapter

The adapter is for use with thermostatic expansion valves type T 2 and TE 2 with flare × solder connections. When the adapter is correctly fitted it meets DIN 8964 sealing requirements.
The adapter offers the following advantages without unsoldering the valve from the system:

- The orifice assembly can be replaced.
- The filter can be cleaned or replaced.

When using the solder adapter, a special orifice assembly is required. Please use the following tables to select both the appropriate adapter and orifice asembly.

Solder adapter without orifice assembly and filter

Connection ODF solder	Code no.
1/4 in.	**068-2062**
3/8 in.	**068-2060**

Filter for solder adapter

Description	Code no.
Filter excl. orifice assembly	**068-0015**

Orifice assembly and filter for use with solder adapter

Orifice no.	Code no.
0X	**068-2089**
00	**068-2090**
01	**068-2091**
02	**068-2092**
03	**068-2093**
04	**068-2094**
05	**068-2095**
06	**068-2096**

Metric conversions
1 psi = 0.07 bar
5/9 (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm
1 ft = 0.3 m

Capacities (TR)

Range N: – 40°F to + 50°F

R22

Evaporating temperature + 50°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TX 2/ TEX 2	0X	0.12	0.14	0.15	0.16	0.17	0.18	0.19	0.19
	00	0.28	0.32	0.34	0.37	0.39	0.40	0.41	0.41
	01	0.70	0.81	0.88	0.94	1,00	1.03	1.06	1.07
	02	0.98	1.16	1.29	1.39	1.49	1.56	1.61	1.64
	03	1.75	2.06	2.30	2.48	2.65	2.77	2.86	2.91
	04	2.63	3.10	3.45	3.72	3.97	4.16	4.28	4.36
	05	3.33	3.92	4.35	4.69	5,00	5.23	5.39	5.48
	06	4.09	4.8	5.33	5.73	6.11	6.39	6.57	6.68

Evaporating temperature + 40°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TX 2/ TEX 2	0X	0.12	0.14	0.15	0.16	0.17	0.18	0.18	0.19
	00	0.27	0.31	0.34	0.36	0.38	0.39	0.40	0.40
	01	0.65	0.75	0.82	0.87	0.92	0.96	0.98	1.00
	02	0.91	1.06	1.18	1.27	1.36	1.43	1.47	1.50
	03	1.62	1.90	2.11	2.27	2.43	2.54	2.62	2.67
	04	2.42	2.84	3.15	3.39	3.63	3.80	3.92	3.99
	05	3.06	3.59	3.98	4.29	4.58	4.79	4.94	5.03
	06	3.76	4.40	4.87	5.24	5.59	5.84	6.02	6.13

Evaporating temperature + 20°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TX 2/ TEX 2	0X	0.12	0.13	0.15	0.16	0.17	0.17	0.18	0.18
	00	0.25	0.29	0.31	0.33	0.35	0.36	0.37	0.38
	01	0.54	0.62	0.68	0.72	0.77	0.8	0.83	0.84
	02	0.75	0.88	0.97	1.05	1.12	1.17	1.21	1.23
	03	1.35	1.57	1.74	1.87	1.99	2.09	2.15	2.20
	04	2,00	2.33	2.58	2.77	2.95	3.10	3.20	3.26
	05	2.54	2.96	3.26	3.50	3.74	3.91	4.04	4.12
	06	3.11	3.62	3.99	4.28	4.56	4.78	4.93	5.03

Evaporating temperature 0°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TX 2/ TEX 2	0X	0.11	0.13	0.14	0.15	0.16	0.16	0.17	0.17
	00	0.23	0.26	0.28	0.30	0.32	0.33	0.34	0.35
	01	0.44	0.5	0.55	0.59	0.62	0.65	0.67	0.69
	02	0.62	0.71	0.78	0.84	0.89	0.93	0.96	0.98
	03	1.10	1.27	1.40	1.50	1.59	1.66	1.72	1.75
	04	1.62	1.87	2.06	2.20	2.35	2.46	2.54	2.6
	05	2.06	2.38	2.61	2.79	2.97	3.11	3.22	3.29
	06	2.52	2.91	3.19	3.41	3.63	3.80	3.93	4.01

Evaporating temperature – 20°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TX 2/ TEX 2	0X	0.10	0.12	0.13	0.14	0.15	0.15	0.16	0.16
	00	0.21	0.23	0.25	0.27	0.28	0.30	0.31	0.31
	01	0.35	0.40	0.44	0.47	0.49	0.52	0.54	0.55
	02	0.49	0.56	0.62	0.66	0.70	0.73	0.75	0.76
	03	0.88	1.01	1.10	1.18	1.25	1.30	1.34	1.37
	04	1.29	1.48	1.62	1.73	1.83	1.92	1.98	2.03
	05	1.64	1.88	2.05	2.19	2.33	2.43	2.52	2.58
	06	2.01	2.30	2.51	2.67	2.84	2.97	3.07	3.15

Evaporating temperature – 40°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TX 2/ TEX 2	0X	0.09	0.11	0.12	0.12	0.13	0.14	0.15	0.15
	00	0.18	0.20	0.22	0.24	0.25	0.26	0.27	0.28
	01	0.28	0.32	0.35	0.37	0.39	0.41	0.42	0.43
	02	0.39	0.45	0.48	0.51	0.54	0.57	0.58	0.59
	03	0.70	0.80	0.87	0.92	0.97	1.02	1.05	1.07
	04	1.02	1.16	1.27	1.35	1.43	1.49	1.55	1.58
	05	1.30	1.48	1.61	1.71	1.82	1.90	1.97	2.01
	06	1.59	1.81	1.97	2.09	2.22	2.32	2.40	2.46

Correction for subcooling Δt_{sub}

When subcooling Δt_{sub} ahead of the expansion valve is other than 10°F, adjust the evaporator capacity by multiplying by the appropriate correction factor found in the following table.

Refrigerant	0°F	10°F	20°F	30°F	40°F	50°F	60°F	70°F	80°F	90°F
R22	1.08	1.00	0.94	0.89	0.85	0.81	0.78	0.74	0.71	0.68

Metric conversions

1 psi = 0.07 bar

$^5/_9$ (t_1°F – 32) = t_2°C

1 ton = 3.5 kW

Capacities (TR) (continued)

Range B: –75°F to –15°F

R22

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
Evaporating temperature – 15°F									
TX 2/ TEX 2	00	0.21	0.24	0.26	0.27	0.29	0.31	0.32	0.32
	01	0.37	0.42	0.46	0.49	0.52	0.55	0.57	0.58
	02	0.52	0.60	0.65	0.70	0.74	0.77	0.80	0.81
	03	0.93	1.07	1.17	1.25	1.33	1.39	1.43	1.46
	04	1.37	1.57	1.72	1.84	1.95	2.04	2.11	2.16
	05	1.74	2,00	2.18	2.33	2.48	2.59	2.68	2.74
	06	2.13	2.44	2.66	2.84	3.02	3.16	3.27	3.35
Evaporating temperature – 30°F									
TX 2/ TEX 2	00	0.19	0.22	0.23	0.25	0.27	0.28	0.29	0.29
	01	0.32	0.36	0.39	0.41	0.44	0.46	0.48	0.49
	02	0.44	0.5	0.55	0.58	0.61	0.64	0.66	0.67
	03	0.79	0.9	0.98	1.04	1.1	1.15	1.19	1.21
	04	1.15	1.31	1.43	1.52	1.62	1.69	1.75	1.79
	05	1.46	1.67	1.82	1.94	2.05	2.15	2.22	2.27
	06	1.78	2.04	2.22	2.36	2.51	2.62	2.72	2.78
Evaporating temperature – 40°F									
TX 2/ TEX 2	00	0.18	0.2	0.22	0.24	0.25	0.26	0.27	0.28
	01	0.28	0.32	0.35	0.37	0.39	0.41	0.42	0.43
	02	0.39	0.45	0.48	0.51	0.54	0.57	0.58	0.59
	03	0.70	0.8	0.87	0.92	0.97	1.02	1.05	1.07
	04	1.02	1.16	1.27	1.35	1.43	1.49	1.55	1.58
	05	1.30	1.48	1.61	1.71	1.82	1.90	1.97	2.01
	06	1.59	1.81	1.97	2.09	2.22	2.32	2.40	2.46

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
Evaporating temperature – 50°F									
TX 2/ TEX 2	00	0.17	0.19	0.21	0.21	0.24	0.25	0.26	0.26
	01	0.25	0.29	0.31	0.33	0.35	0.37	0.38	0.39
	02	0.35	0.4	0.43	0.46	0.48	0.5	0.52	0.53
	03	0.63	0.71	0.77	0.82	0.87	0.9	0.93	0.95
	04	0.91	1.04	1.13	1.2	1.27	1.33	1.37	1.41
	05	1.16	1.32	1.43	1.52	1.61	1.69	1.75	1.79
	06	1.42	1.61	1.75	1.86	1.97	2.07	2.14	2.19
Evaporating temperature – 75°F									
TX 2/ TEX 2	00	0.16	0.17	0.18	0.19	0.21	0.22	0.22	0.23
	01	0.2	0.23	0.25	0.26	0.28	0.29	0.3	0.3
	02	0.28	0.31	0.34	0.36	0.38	0.39	0.4	0.41
	03	0.5	0.56	0.61	0.64	0.68	0.7	0.72	0.74
	04	0.72	0.81	0.88	0.93	0.99	1.03	1.07	1.1
	05	0.91	1.03	1.12	1.19	1.26	1.32	1.36	1.4
	06	1.11	1.26	1.37	1.45	1.54	1.61	1.67	1.72

Correction for subcooling Δt_{sub}

When subcooling Δt_{sub} ahead of the expansion valve is other than 10°F, adjust the evaporator capacity by multiplying by the appropriate correction factor found in the following table.

Refrigerant	0°F	10°F	20°F	30°F	40°F	50°F	60°F	70°F	80°F	90°F
R22	1.08	1.00	0.94	0.89	0.85	0.81	0.78	0.74	0.71	0.68

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Capacities (TR) (continued)

Range N: –40 → +50°F

R134a

Type	Orifice no.	Pressure drop across valve Δp psi				
		40	60	80	100	125
Evaporating temperature + 50°F						
TN 2/ TEN 2	0X	0.10	0.12	0.12	0.13	0.13
	00	0.22	0.25	0.26	0.27	0.28
	01	0.47	0.53	0.57	0.60	0.62
	02	0.66	0.76	0.82	0.87	0.90
	03	1.17	1.35	1.47	1.55	1.61
	04	1.74	2.01	2.18	2.30	2.39
	05	2.21	2.55	2.77	2.91	3.03
	06	2.71	3.12	3.38	3.56	3.69
Evaporating temperature + 40°F						
TN 2/ TEN 2	0X	0.10	0.11	0.12	0.13	0.13
	00	0.21	0.23	0.25	0.26	0.27
	01	0.43	0.48	0.52	0.54	0.56
	02	0.59	0.68	0.74	0.78	0.81
	03	1.06	1.22	1.33	1.40	1.45
	04	1.57	1.8	1.96	2.07	2.15
	05	1.99	2.29	2.49	2.62	2.72
	06	2.44	2.80	3.04	3.20	3.32
Evaporating temperature + 20°F						
TN 2/ TEN 2	0X	0.09	0.11	0.11	0.12	0.12
	00	0.19	0.21	0.22	0.23	0.24
	01	0.34	0.39	0.42	0.44	0.45
	02	0.47	0.54	0.59	0.62	0.64
	03	0.85	0.97	1.05	1.11	1.15
	04	1.25	1.42	1.54	1.62	1.69
	05	1.59	1.81	1.96	2.06	2.14
	06	1.94	2.21	2.39	2.52	2.64

Type	Orifice no.	Pressure drop across valve Δp psi				
		40	60	80	100	125
Evaporating temperature 0°F						
TN 2/ TEN 2	0X	0.08	0.10	0.10	0.11	0.11
	00	0.17	0.18	0.20	0.21	0.21
	01	0.27	0.30	0.32	0.34	0.35
	02	0.37	0.42	0.45	0.47	0.49
	03	0.66	0.75	0.81	0.85	0.88
	04	0.97	1.10	1.18	1.25	1.29
	05	1.23	1.39	1.51	1.58	1.64
	06	1.51	1.70	1.84	1.93	2,00
Evaporating temperature – 20°F						
TN 2/ TEN 2	0X	0.08	0.09	0.09	0.10	0.1
	00	0.15	0.16	0.17	0.18	0.18
	01	0.21	0.23	0.25	0.26	0.27
	02	0.29	0.32	0.35	0.36	0.37
	03	0.52	0.58	0.62	0.65	0.67
	04	0.75	0.84	0.90	0.95	0.98
	05	0.95	1.07	1.15	1.21	1.25
	06	1.16	1.31	1.41	1.48	1.53
Evaporating temperature – 40°F						
TN 2/ TEN 2	0X	0.07	0.08	0.80	0.09	0.09
	00	0.13	0.14	0.15	0.16	0.16
	01	0.17	0.19	0.20	0.21	0.22
	02	0.23	0.26	0.27	0.29	0.29
	03	0.41	0.46	0.49	0.51	0.53
	04	0.59	0.66	0.71	0.74	0.77
	05	0.76	0.84	0.91	0.95	0.98
	06	0.92	1.03	1.11	1.16	1.20

Correction for subcooling Δt_{sub}
When subcooling Δt_{sub} ahead of the expansion valve is other than 10°F, adjust the evaporator capacity by multiplying by the appropriate correction factor found in the following table.

Refrigerant	0°F	10°F	20°F	30°F	40°F	50°F	60°F	70°F	80°F	90°F
R134a	1.10	1.00	0.93	0.88	0.82	0.78	0.74	0.70	0.67	0.64

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Capacities (TR) (continued)

Range N: –40°F to +50°F

R404A and R507[1)]

Evaporating temperature + 50°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TS 2/ TES 2	0X	0.09	0.11	0.11	0.12	0.12	0.12	0.12	0.12
	00	0.20	0.22	0.23	0.24	0.25	0.25	0.26	0.26
	01	0.43	0.48	0.52	0.54	0.57	0.57	0.58	0.58
	02	0.59	0.69	0.75	0.80	0.83	0.85	0.86	0.87
	03	1.05	1.23	1.35	1.42	1.49	1.52	1.54	1.56
	04	1.56	1.83	2.00	2.11	2.20	2.27	2.29	2.31
	05	1.99	2.31	2.53	2.66	2.78	2.86	2.89	2.91
	06	2.43	2.84	3.10	3.25	3.39	3.49	3.52	3.54

Evaporating temperature 0°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TS 2/ TES 2	0X	0.08	0.09	0.10	0.10	0.10	0.10	0.11	0.10
	00	0.16	0.18	0.19	0.20	0.21	0.21	0.21	0.21
	01	0.27	0.30	0.33	0.34	0.36	0.36	0.36	0.36
	02	0.36	0.41	0.45	0.47	0.49	0.51	0.50	0.50
	03	0.64	0.74	0.81	0.85	0.90	0.90	0.91	0.89
	04	0.93	1.08	1.19	1.24	1.31	1.33	1.35	1.32
	05	1.19	1.38	1.50	1.58	1.67	1.71	1.71	1.68
	06	1.45	1.68	1.84	1.93	2.04	2.08	2.09	2.06

Evaporating temperature + 40°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TS 2/ TES 2	0X	0.08	0.11	0.11	0.12	0.12	0.12	0.12	0.12
	00	0.19	0.21	0.22	0.24	0.24	0.24	0.24	0.25
	01	0.39	0.45	0.48	0.50	0.52	0.53	0.53	0.53
	02	0.54	0.63	0.70	0.73	0.76	0.77	0.78	0.78
	03	0.97	1.12	1.24	1.29	1.36	1.40	1.40	1.41
	04	1.43	1.66	1.83	1.93	2.01	2.06	2.07	2.08
	05	1.82	2.11	2.31	2.43	2.54	2.61	2.62	2.63
	06	2.23	2.59	2.84	2.97	3.10	3.17	3.19	3.20

Evaporating temperature – 20°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TS 2/ TES 2	0X	0.07	0.08	0.09	0.09	0.11	0.11	0.10	0.10
	00	0.13	0.16	0.17	0.17	0.19	0.19	0.18	0.18
	01	0.20	0.24	0.26	0.27	0.28	0.29	0.29	0.29
	02	0.28	0.32	0.35	0.37	0.39	0.39	0.40	0.38
	03	0.49	0.57	0.63	0.66	0.69	0.70	0.71	0.69
	04	0.72	0.83	0.92	0.97	1.01	1.04	1.04	1.02
	05	0.92	1.06	1.17	1.23	1.29	1.32	1.33	1.31
	06	1.12	1.30	1.43	1.51	1.58	1.62	1.63	1.59

Evaporating temperature + 20°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TS 2/ TES 2	0X	0.09	0.10	0.11	0.11	0.11	0.11	0.11	0.11
	00	0.17	0.20	0.21	0.22	0.22	0.23	0.23	0.22
	01	0.33	0.37	0.41	0.42	0.44	0.45	0.45	0.44
	02	0.45	0.52	0.58	0.60	0.63	0.64	0.64	0.63
	03	0.81	0.94	1.02	1.08	1.12	1.14	1.15	1.13
	04	1.18	1.38	1.51	1.59	1.66	1.70	1.70	1.68
	05	1.50	1.75	1.91	2.01	2.09	2.15	2.15	2.13
	06	1.84	2.13	2.34	2.46	2.56	2.62	2.62	2.60

Evaporating temperature – 40°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TS 2/ TES 2	0X	0.07	0.07	0.08	0.08	0.09	0.10	0.08	0.08
	00	0.12	0.14	0.15	0.15	0.15	0.16	0.16	0.16
	01	0.16	0.18	0.20	0.21	0.21	0.23	0.22	0.22
	02	0.21	0.24	0.27	0.28	0.30	0.30	0.29	0.29
	03	0.38	0.44	0.48	0.50	0.52	0.54	0.53	0.52
	04	0.55	0.63	0.70	0.74	0.77	0.79	0.80	0.78
	05	0.70	0.81	0.89	0.94	0.98	1.01	1.00	0.98
	06	0.86	0.99	1.09	1.15	1.20	1.24	1.23	1.21

[1)] The capacities for R507 deviate less than ± 2% from the capacities for R404A.

Correction for subcooling Δt_{sub}

When subcooling Δt_{sub} ahead of the expansion valve is other than 10°F, adjust the evaporator capacity by multiplying by the appropriate correction factor found in the following table.

Refrigerant	0°F	10°F	20°F	30°F	40°F	50°F	60°F	70°F	80°F	90°F
R404A/R507	1.18	1.00	0.89	0.81	0.74	0.68	0.63	0.60	0.56	0.53

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Capacities (TR) (continued)
Range B: – 75°F to – 15°F

R404A and R507[1)]

Evaporating temperature – 15°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TS 2/ TES 2	00	0.17	0.19	0.20	0.20	0.21	0.21	0.21	0.21
	01	0.29	0.34	0.36	0.37	0.37	0.38	0.38	0.37
	02	0.40	0.47	0.49	0.53	0.53	0.54	0.53	0.53
	03	0.72	0.84	0.89	0.93	0.96	0.96	0.96	0.95
	04	1.06	1.22	1.31	1.38	1.40	1.42	1.42	1.40
	05	1.35	1.56	1.67	1.74	1.79	1.80	1.80	1.79
	06	1.66	1.91	2.04	2.13	2.18	2.19	2.19	2.18

Evaporating temperature – 30°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TS 2/ TES 2	00	0.16	0.17	0.18	0.19	0.19	0.19	0.18	0.19
	01	0.24	0.28	0.29	0.30	0.31	0.31	0.32	0.31
	02	0.34	0.38	0.41	0.43	0.44	0.43	0.43	0.42
	03	0.60	0.69	0.74	0.77	0.78	0.78	0.78	0.77
	04	0.88	1.01	1.07	1.12	1.14	1.15	1.14	1.13
	05	1.12	1.27	1.37	1.43	1.46	1.46	1.46	1.44
	06	1.38	1.56	1.67	1.74	1.78	1.79	1.79	1.77

Evaporating temperature – 40°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TS 2/ TES 2	00	0.12	0.14	0.15	0.15	0.15	0.16	0.16	0.16
	01	0.16	0.18	0.20	0.21	0.21	0.23	0.22	0.22
	02	0.21	0.24	0.27	0.28	0.30	0.30	0.29	0.29
	03	0.38	0.44	0.48	0.50	0.52	0.54	0.53	0.52
	04	0.55	0.63	0.70	0.74	0.77	0.79	0.80	0.78
	05	0.70	0.81	0.89	0.94	0.98	1.01	1.00	0.98
	06	0.86	0.99	1.09	1.15	1.20	1.24	1.23	1.21

Evaporating temperature – 50°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TS 2/ TES 2	00	0.14	0.15	0.16	0.16	0.17	0.16	0.16	0.16
	01	0.19	0.21	0.23	0.24	0.24	0.24	0.23	0.23
	02	0.25	0.29	0.30	0.32	0.32	0.32	0.32	0.31
	03	0.47	0.52	0.56	0.57	0.59	0.59	0.58	0.57
	04	0.67	0.76	0.81	0.84	0.86	0.87	0.86	0.84
	05	0.86	0.96	1.03	1.07	1.10	1.10	1.09	1.07
	06	1.05	1.19	1.26	1.30	1.34	1.35	1.34	1.31

Evaporating temperature – 75°F

Valve type	Orifice no.	Pressure drop across valve Δp psi							
		40	60	80	100	125	150	175	200
TS 2/ TES 2	00	0.12	0.13	0.14	0.14	0.13	0.13	0.13	0.13
	01	0.14	0.16	0.17	0.17	0.18	0.17	0.17	0.17
	02	0.19	0.21	0.22	0.23	0.23	0.22	0.22	0.22
	03	0.34	0.38	0.40	0.41	0.41	0.41	0.40	0.40
	04	0.49	0.54	0.58	0.60	0.61	0.61	0.60	0.58
	05	0.63	0.69	0.74	0.76	0.77	0.78	0.77	0.75
	06	0.75	0.84	0.90	0.94	0.95	0.95	0.94	0.92

[1)] The capacities for R507 deviate less than ± 2% from the capacities for R404A.

Correction for subcooling Δt_{sub}
When subcooling Δt_{sub} ahead of the expansion valve is other than 10°F, adjust the evaporator capacity by multiplying by the appropriate correction factor found in the following table.

Refrigerant	0°F	10°F	20°F	30°F	40°F	50°F	60°F	70°F	80°F	90°F
R404A/R507	1.18	1.00	0.89	0.81	0.74	0.68	0.63	0.60	0.56	0.53

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

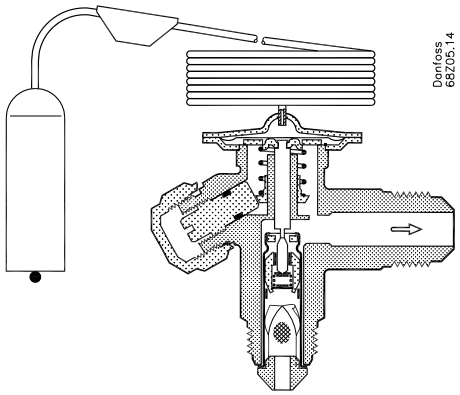
Design

T 2 and TE 2 valves consist of four main components:

1. Thermostatic element
2. Orifice assembly
3. Valve body with connections
4. Superheat setting spindle

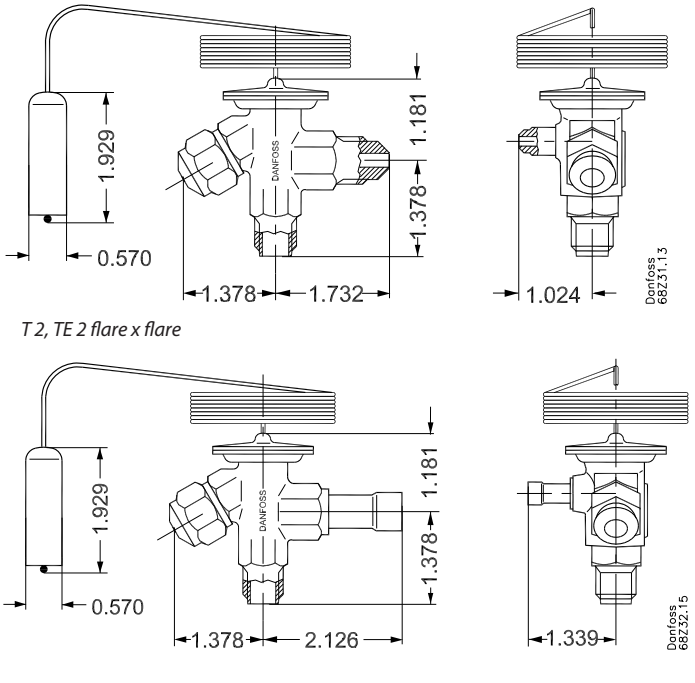
For a given valve type and refrigerant, the associated orifice is suitable for all versions of the valve body and in all evaporating temperature ranges.

The valves are equipped with internal or external pressure equlization.
Where a liquid distributor is used, always use a valve with external equalization.
The double- contact bulb give fast and precise reaction of temperature changes in the evaporator. The bulb design makes mounting quick and easy.
The valves are able to withstand the effects that normally occur with hot gas defrosting.
To insure long operating life, the valve cone and valve seat are made of a steel alloy with particulaly good wear qualities.



1. Thermostatic element
2. Interchangeable orifice assembly
3. Valve body
4. Superheat adjustment spindle

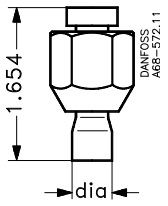
Dimensions and weights



T 2, TE 2 flare x flare

T 2, TE 2 flare x solder

Weight 1.1 lbs.



Solder adapter for T 2 and TE 2

dia. = 1/4 in. or 3/8 in.
Weight = 0.11 lbs.

Metric conversions
1 in. = 25.4 mm
1 lb = 0.454 kg

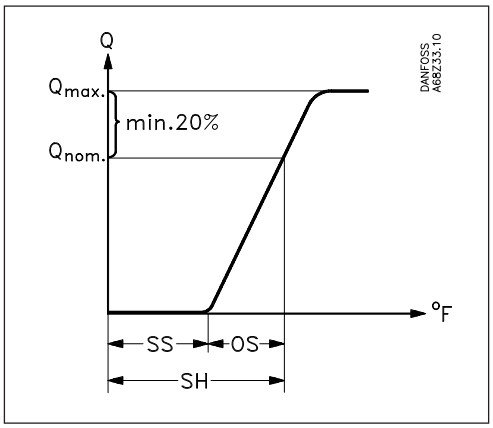
T 2/TE 2 operation and function

Superheat
Superheat is the controlling parameter of the valve. Superheat, measured at the evaporator outlet, is defined as the difference between actual bulb temperature and the evaporating temperature at the saturation point. In other words, vapor is said to be superheated if its temperature is higher than the saturation temperature corresponding to its pressure.
In order to prevent liquid refrigerant from entering the compressor, a certain minimum superheat must be maintained. Liquid entering the compressor causes serious damage.
When discussing superheat, the following terms are used with respect to valve operation:

Static Superheat
Static superheat, SS, is the superheat above which the valve will begin to open.

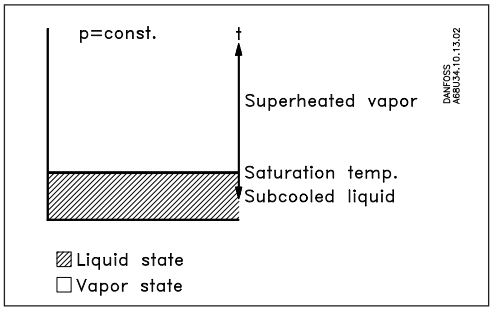
Opening Superheat
The opening superheat, OS, is the amount of superheat above the static superheat, SS, required to produce a given valve capacity.

Operating superheat
The operating superheat, SH, is the sum of the static superheat, SS, and the opening superheat, OS.

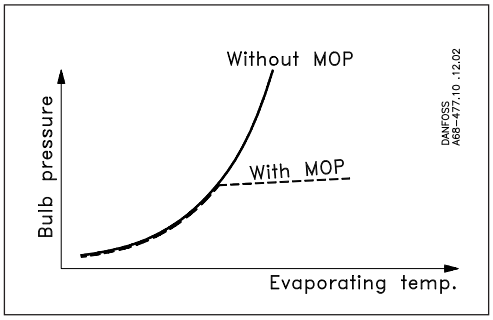


Subcooling Δt_{sub}
Subcooling is defined as the difference between the liquid refrigerant temperature and its saturation temperature. Depending on system design, subcooling may be necessary to prevent flash gas from forming in the liquid line. If flash gas forms in the liquid line, the capacity of the expansion valve will be greatly reduced.

Superheat-subcooling relationship



*MOP - **M**aximum **O**perating **P**ressure*
MOP function protects the compressor motor against overload during start-up.
MOP is the evaporating pressure at which the expansion valve will throttle liquid injection into the evaporator and thus prevent the evaporating pressure from rising.
MOP valves are primarily used in low temperature applications with a single evaporator and a single compressor. MOP occurs when the sensor reaches a predetermined maximum value.
Above MOP any increase in sensor temperature results in only minimal additional opening of the expansion valve.
An MOP charge is also known as a *pressure limiting charge*.



Note!
The MOP point will change if the factory superheat setting of the expansion valve is changed.
If the superheat setting increases, the MOP point is reduced and vice versa, if the MOP point increases, the superheat setting is reduced.

Identification

Main valve data is indicated on the valve element (fig. 1), and on the bottom of the orifice assembly (fig. 2).

Example valve body

TES2	= Type (E = external equalization)
068ZXXXX	= Code number
R404A - R507	= Refrigerant
MOP 120 / +15°C	= **MOP-point in psig / °C**
–40 / +10°C	= Evaporating temperature range in °C
–**40** / **+50°F**	= Evaporating temperature range in °F
PB 34 bar/ **MWP 500 psig**	= Max. working pressure in bar/psig
4503A	= Date marking (week **45**, year 200**3**, weekday **A** = Monday)

Orifice assembly for T 2 and TE 2 (Fig. 2)
The orifice assembly is marked with the orifice size (06) and week stamp + last number in the year (174). The valve strainer is also shown in the figure.
The orifice assembly number is also given on the lid of its plastic container.

Capillary tube label for T 2 and TE 2 (Fig. 3)
The label gives the orifice size (04) and consists of the lid of the orifice assembly plastic container. It can easily be fastened around the expansion valve capillary tube to clearly identify the valve size.

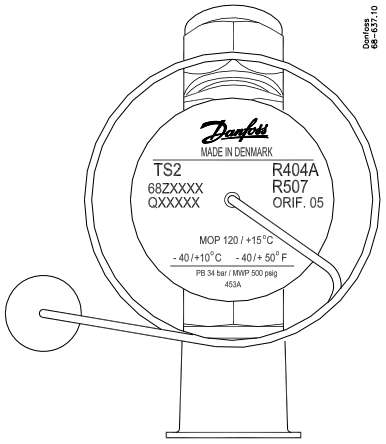


Fig. 1 Power element

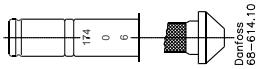


Fig. 2 Orifice assembly and filter for T 2 and TE 2

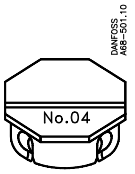


Fig. 3 Capillary tube label for T 2 and TE 2

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm