

# Thermostatic expansion valves, TR 6

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Introduction



TR 6 thermostatic expansion valves have been designed and developed with features especially for use in applications such as:

- Residential air conditioning systems
- Split systems
- Roof top units
- Heat pumps
- Light commercial air conditioning systems
- Chillers

The hermetic tight design meets environmental demands for today and the future. The TR 6 program is available for R22 and R410A. The TR 6 can be used for all fluorinated refrigerants. Models for other refrigerants can be produced to order.

The TR design incorporates a hot-pressed brass body with the entire power element, including the capillary tube and bulb, fabricated from stainless steel. The valves are supplied as standard in straightway versions with fixed orifice and with external equalization. They can be delivered with or without internal check valve and with external superheat adjustment spindle for field retrofit. All valves are designed with balanced port which reduces the influence from varying condensing pressures.

The valves can be delivered with special connections and fittings both at the inlet and outlet and at the equalizer connection. The TR 6 can be delivered with a fixed setting in accordance with the customers' requirement for optimized unit performance.

Approvals

- UL listed, file SA7200

Features

- Compact size - hermetic design.
- Developed and designed for R22 and R410A.
- Rated capacities ranging up to:
  - R22: 6.7 TR / 23.6 kW
  - R410A: 7 TR / 24.5 kW
- A complete program with or without internal check valve.
- An internal check valve with low pressure drop at full flow.
- Non-adjustable TR 6 with customer specific factory setting.
- Laser-welded power element:
  - longer diaphragm life.
  - high pressure tolerance and working pressure.
- Stainless steel power element, capillary tube and bulb:
  - high corrosion resistance
  - high strength and vibration resistance
  - fast installation and good thermal contact and transmission
- Bleed function.
- With internal check valve for heat pump systems.
- With and without check valve.
- Customer specific engravement.

**Valve program**  
Standard versions

Refrigerants:  
R22 and R410A

Packing:  
Single or industrial pack

Operating range:  
+14°F to +59°F / -10°C to +15°C

Versions:  
All valves are in straightway versions.  
With or without internal check valve.

- Setting:
- Fixed setting:
    - Static superheat in accordance with customers' specifications.
  - Adjustable setting:
    - Factory static superheat of 7.2°F / 4°K.

Standard connections:  
3/8 in. ODF inlet x 1/2 in. ODF outlet x 1/4 in. ODF equalizer.

Capillary tube length: 20 in. / 0.5 m

Options on request

Refrigerants:  
Other refrigerants.

Options for Connections:  
Inlet/Outlet:  
3/8 in., 5/16 in., 1/2 in., 5/8 in. ODF, ODM, flare, and other threaded versions.

Range:  
Other temperature ranges.

- Equalizer:
- Cap tube size: 3/32 in., 1/8 in., 3/16 in., 1/4 in.
  - Length: 12 in. to 25 in.
  - Flare or solder ODF/ODM.

MOP:  
Special MOP charges.

- Capillary tube lengths:
- 31.5 in. / 0.8 m
  - 59 in. / 1.5 m

**Technical data**

- Max. operating temperature
- Thermostatic element:
    - R22: max. 212°F / 100°C
    - R410A: max. 167°F / 75°C
  - Valve body: 230°F / 110°C

Max. working pressure  
MWP 610 psig / PS = 42 bar

Max. test pressure  
680 psig / p' = 47 bar

**Identification**

Essential valve data is given on the power element.

- Main valve data example:
- TR 6** = Valve type
  - 3 TR** = Rated capacity  $Q_{nom}$  in Tons of Refrigeration
  - R22** = Refrigerant
  - 067L5748** = Code number
  - Unit cap** = Recommended Unit size
  - 1, 1.5, 2 TR** = Evaporating temperature range in °F
  - 40 / +86°F** = Evaporating temperature range in °F
  - PS 42 bar / MWP 610 psig** = Max. working pressure in bar and psig
  - 148** = Date marking week 14, year 2008)



Fig. 1

Design and function

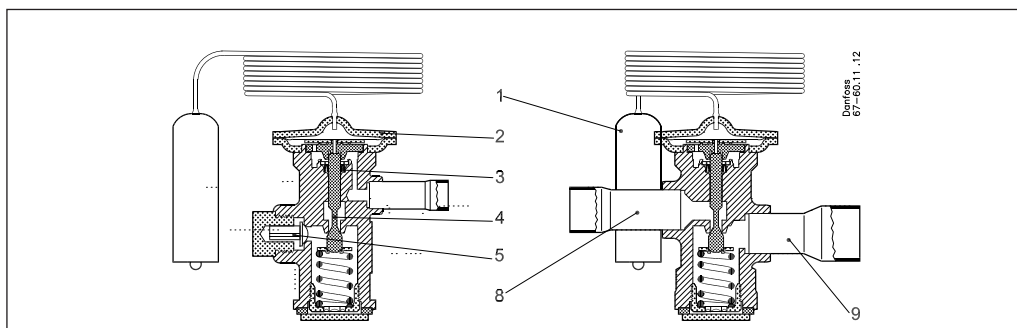


Fig. 2 TR 6 with fixed setting

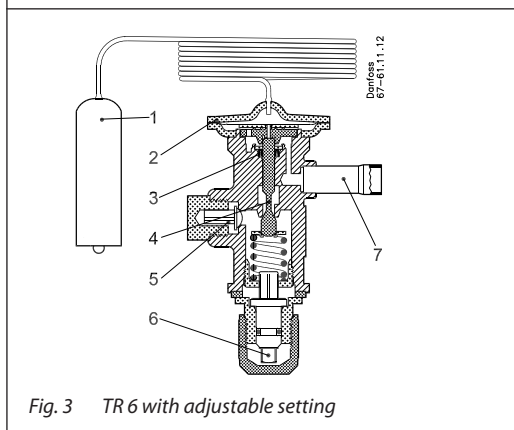


Fig. 3 TR 6 with adjustable setting

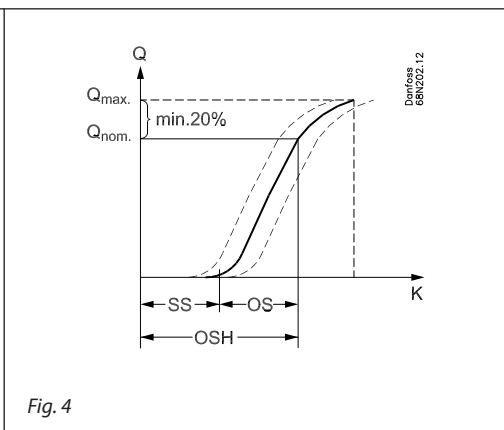


Fig. 4

- 1. Bulb
- 2. Thermostatic element
- 3. Push pin seal
- 4. Balanced port
- 5. Check valve
- 6. Setting spindle for adjustment of static superheat (SS)
- 7. Equalizer
- 8. Inlet connection
- 9. Outlet connection

The central push pin is sealed with a robust seal (pos. 3) that ensures maximum tightness and minimum friction through the lifetime of the valve.

The balanced port (pos. 4) ensures minimal superheat changes when condensing pressure varies. This feature makes the valve ideal for bi-flow operation.

Static superheat (SS) can be adjusted with the setting spindle (see fig. 3, pos. 6) . The standard superheat setting is 3.6°F / 2°K.

Terminology (fig.4)

- SS = Static superheat
- OS = Opening superheat
- OSH = SS + OS = Operating superheat

Example

Static superheat  
 SS = 3.6°F (2K) (factory setting)  
 or according to customer specification.

Opening superheat  
 OS = 7.2°F (4K)

The opening superheat is 7.2°F / 3.6°C, i.e. from the point the valve begins to open up to nominal capacity. Opening superheat (OS) is a fixed value and cannot be changed.

Operating superheat  
 OSH = SS + OS  
 OSH = 3.6°F + 7.2°F = 10.8°F (6°K)

OSH is the total superheat that can be measured on the system.

Application

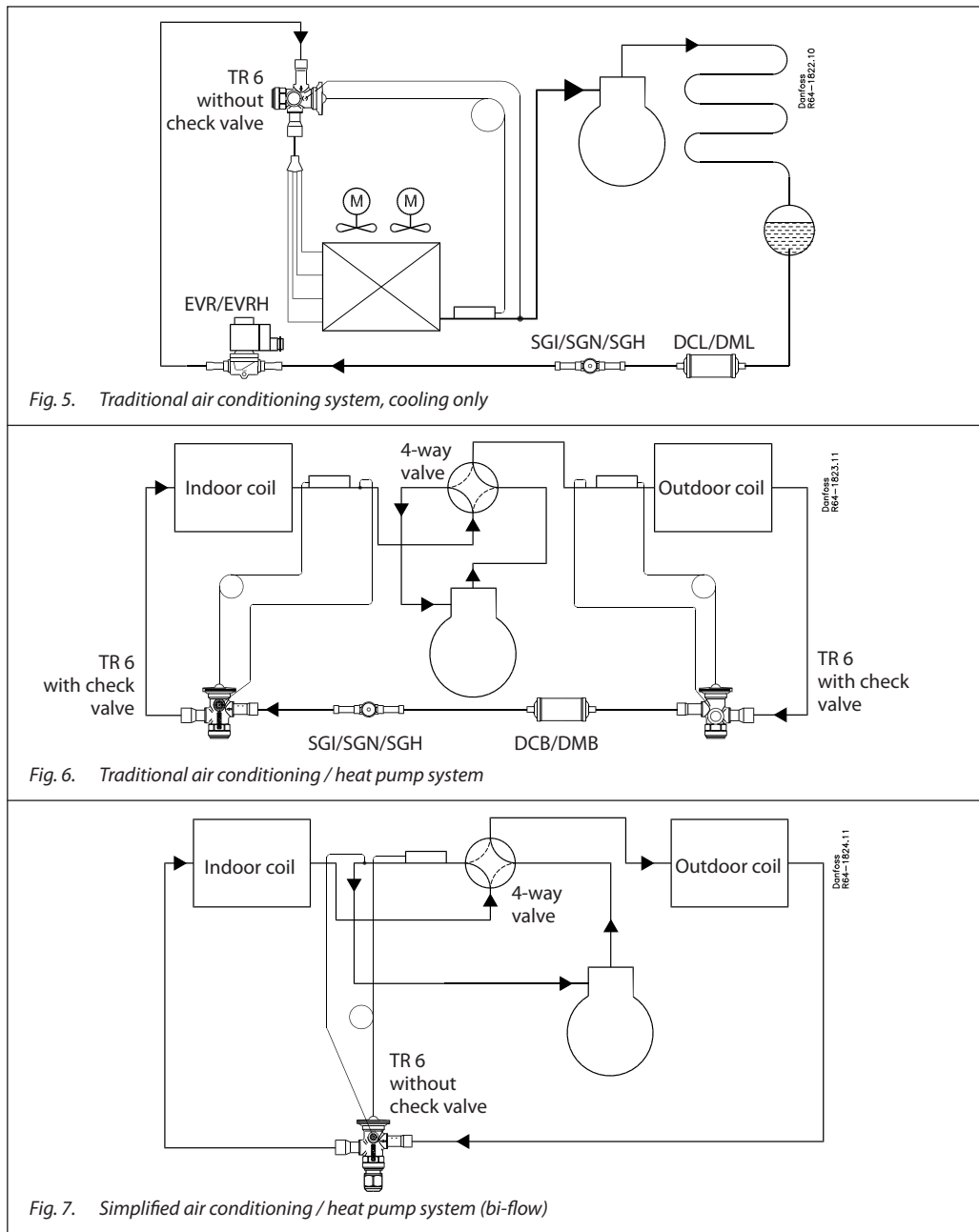


Fig. 5. Traditional air conditioning system, cooling only

Fig. 6. Traditional air conditioning / heat pump system

Fig. 7. Simplified air conditioning / heat pump system (bi-flow)

Fig. 5 illustrates the diagram of a traditional air conditioning system where the TR 6 is controlling liquid injection in one direction only.

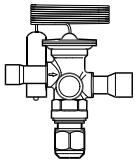
Fig. 6 illustrates a split air conditioning/heat pump system with cooling/heating mode and two thermostatic expansion valves, one for cooling mode and one for heating mode. The thermostatic expansion valves each has a built-in check valve, which has the function of preventing flow in one direction and allowing the flow in the opposite direction. It means that one thermostatic expansion valve is controlling liquid injection into the evaporator

and the other thermostatic expansion valve has an open check valve allowing the liquid refrigerant flow in the liquid line.

Fig. 7 illustrates a similar system as the previous one, but this time it is a packed unit with a short distance between the evaporator and the condenser, the bi-flow feature of the TR 6 thermostatic expansion valve can be used. The two thermostatic expansion valves have, therefore, been replaced by one TR 6 bi-flow valve controlling liquid injection in both directions. The normal flow direction marked with an arrow should be used for the primary function, i.e. cooling or heating.

**Ordering**

Adjustable setting



Range N = 14°F → 59°F (-10°C → +15°C)

**R22 and R410A**

Refrigerant	Rated capacity $Q_{nom}^{1)}$		Orifice no.	Connection <sup>2)</sup> 3/8 in. x 1/2 in. x 1/4 in. equalizer with flare nut ODF Inlet x Outlet
	TR	kW		
R22	3.3	11.4	3	<b>067L5855</b>
	4.5	15.8	4	<b>067L5856</b>
	5.3	18.5	5	<b>067L5857</b>
	5.6	19.6	6	<b>067L5858</b>
	6.7	23.6	7	<b>067L5859</b>
R410A	3	10.5	3	<b>067L5955</b>
	4	14.0	4	<b>067L5956</b>
	5	17.5	5	<b>067L5957</b>
	6	21.0	6	<b>067L5958</b>
	7	24.5	7	<b>067L5959</b>

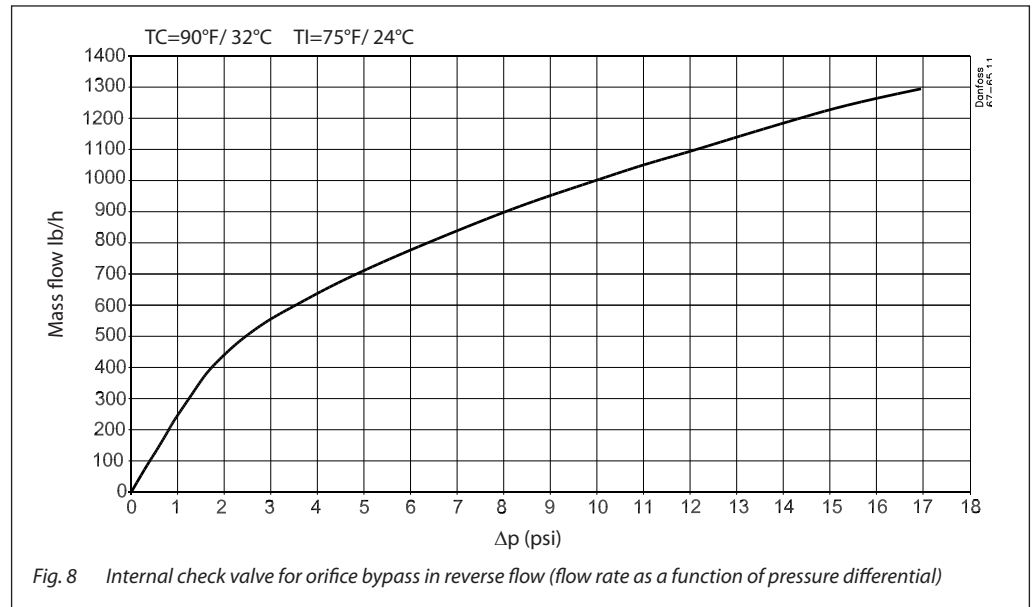
Pressure equalisation = 1/4 in. ODF

1) The rated capacity is based on: Evaporating temperature,  $t_e = 41^\circ\text{F} / 5^\circ\text{C}$ , Liquid temperature,  $t_l = 82^\circ\text{F} / 28^\circ\text{C}$ , Condensing temperature,  $t_c = 90^\circ\text{F} / 32^\circ\text{C}$ , Opening superheat, OS = max.  $7.2^\circ\text{F} / 4\text{K}$

2) Partnumbers consist of a valve, bulbstrap and the following connectors:

- 1 Chatleff 3/8" female connector
- 1 Aeroquip 3/8" female connector

**Check valve capacity**



## Capacity

## US units

Capacity in TR for MAH +14/+59°F at 7.2°F static superheat SS

**R22**

Type	Orifice no.	Pressure drop across valve $\Delta$ psi								Pressure drop across valve $\Delta$ psi							
		50	75	100	125	150	175	200	225	50	75	100	125	150	175	200	225
<b>Evaporating temperature 0°F</b>										<b>Evaporating temperature 20°F</b>							
TR 6	3	1.48	1.63	1.72	1.77	1.80	1.81	1.81	1.79	1.99	2.21	2.32	2.39	2.42	2.43	2.41	2.39
	4	2.17	2.38	2.50	2.56	2.59	2.59	2.57	2.53	2.88	3.17	3.31	3.39	3.41	3.41	3.38	3.33
	5	2.67	2.91	3.05	3.11	3.14	3.13	3.10	3.05	3.49	3.83	3.99	4.07	4.10	4.08	4.03	3.97
	6	2.85	3.11	3.24	3.30	3.32	3.30	3.26	3.21	3.72	4.07	4.24	4.32	4.33	4.31	4.25	4.18
	7	3.49	3.79	3.93	3.98	3.98	3.94	3.87	3.79	4.55	4.95	5.14	5.21	5.21	5.16	5.08	4.97
<b>Evaporating temperature 40°F</b>										<b>Evaporating temperature 50°F</b>							
TR 6	3	2.61	3.01	3.27	3.36	3.35	3.32	3.28	3.22	2.56	2.96	3.24	3.41	3.54	3.63	3.69	3.72
	4	3.78	4.36	4.51	4.55	4.54	4.49	4.43	4.34	3.70	4.28	4.68	4.94	5.12	5.24	5.12	4.99
	5	4.55	5.13	5.28	5.33	5.33	5.27	5.19	5.09	4.45	5.16	5.64	5.95	6.14	6.02	5.89	5.75
	6	4.91	5.42	5.59	5.64	5.63	5.56	5.47	5.36	4.81	5.57	6.09	6.42	6.45	6.33	6.20	6.05
	7	6.00	6.53	6.73	6.79	6.76	6.67	6.55	6.40	6.07	7.03	7.68	7.81	7.72	7.58	7.42	7.23

## SI units

Capacity in kW for MAH -10°C/+15°C at 4°K static superheat SS

**R22**

Type	Orifice no.	Pressure drop across valve $\Delta$ bar								Pressure drop across valve $\Delta$ bar							
		3.5	5.2	6.9	8.6	10.3	12.1	13.8	15.5	3.5	5.2	6.9	8.6	10.3	12.1	13.8	15.5
<b>Evaporating temperature -17.8°C</b>										<b>Evaporating temperature -6.7°C</b>							
TR 6	3	5.18	5.71	6.03	6.21	6.31	6.34	6.32	6.27	6.98	7.72	8.13	8.36	8.47	8.49	8.45	8.36
	4	7.61	8.34	8.74	8.96	9.05	9.05	8.98	8.87	10.08	11.08	11.60	11.86	11.95	11.92	11.82	11.65
	5	9.34	10.20	10.67	10.90	10.98	10.95	10.85	10.69	12.22	13.39	13.98	14.26	14.34	14.28	14.12	13.89
	6	9.98	10.87	11.34	11.56	11.62	11.56	11.42	11.23	13.03	14.25	14.85	15.11	15.17	15.08	14.89	14.62
	7	12.23	13.25	13.75	13.94	13.93	13.79	13.55	13.25	15.92	17.34	18.00	18.25	18.25	18.06	17.77	17.39
<b>Evaporating temperature 4.4°C</b>										<b>Evaporating temperature 10°C</b>							
TR 6	3	9.14	10.55	11.44	11.75	11.73	11.63	11.47	11.27	8.95	10.36	11.33	11.95	12.39	12.71	12.91	13.03
	4	13.22	15.27	15.78	15.92	15.89	15.73	15.50	15.20	12.95	14.99	16.39	17.28	17.92	18.35	17.91	17.45
	5	15.93	17.94	18.49	18.67	18.64	18.46	18.18	17.82	15.59	18.05	19.74	20.81	21.49	21.07	20.63	20.14
	6	17.19	18.97	19.55	19.73	19.69	19.47	19.15	18.76	16.84	19.49	21.31	22.46	22.58	22.16	21.70	21.17
	7	21.00	22.85	23.57	23.77	23.67	23.36	22.93	22.41	21.25	24.60	26.89	27.33	27.02	26.54	25.96	25.31

**Correction for subcooling  $\Delta t_{sub}$**   
 The evaporator capacity used must be corrected if subcooling deviates from 7.2°F/ 4°K. The corrected capacity can be obtained by multiplying the evaporator capacity by the correction factor given below.

**Note:**  
 Insufficient subcooling can produce flash gas.

**Correction factor for subcooling  $\Delta t_{sub}$** 

Correction factor	$\Delta t_{sub}$							
	4°K	10°K	15°K	20°K	25°K	30°K	35°K	40°K
	7.2°F	18°F	27°F	36°F	45°F	55°F	63°F	72°F
R22	1.00	1.06	1.11	1.15	1.20	1.24	1.29	1.33



Capacity (cont.)

US units

Capacity in TR for MAH +14/+59°F at 7.2°F static superheat SS

R410A

Type	Orifice no.	Pressure drop across valve Δ psi								Pressure drop across valve Δ psi							
		50	75	100	125	150	175	200	225	50	75	100	125	150	175	200	225
		<b>Evaporating temperature 0°F</b>								<b>Evaporating temperature 20°F</b>							
TR 6	3	1.48	1.67	1.79	1.86	1.90	1.93	1.94	1.94	1.87	2.13	2.30	2.40	2.46	2.50	2.51	2.51
	4	2.20	2.47	2.63	2.72	2.78	2.81	2.81	2.80	2.74	3.12	3.36	3.49	3.56	3.60	3.61	3.59
	5	2.71	3.05	3.23	3.34	3.41	3.43	3.43	3.41	3.36	3.82	4.10	4.25	4.33	4.37	4.37	4.35
	6	2.91	3.25	3.45	3.56	3.62	3.65	3.64	3.61	3.59	4.08	4.37	4.53	4.61	4.65	4.64	4.61
	7	3.58	3.99	4.22	4.34	4.40	4.41	4.39	4.34	4.42	5.00	5.34	5.52	5.61	5.64	5.62	5.56
		<b>Evaporating temperature 40°F</b>								<b>Evaporating temperature 50°F</b>							
TR 6	3	2.30	2.63	2.86	3.01	3.09	3.14	3.15	3.15	2.53	2.90	3.15	3.32	3.43	3.48	3.49	3.48
	4	3.33	3.80	4.11	4.31	4.41	4.46	4.47	4.44	3.63	4.15	4.49	4.71	4.85	4.90	4.90	4.87
	5	4.03	4.59	4.96	5.20	5.31	5.36	5.36	5.32	4.36	4.97	5.37	5.63	5.79	5.84	5.84	5.80
	6	4.31	4.90	5.29	5.54	5.65	5.70	5.69	5.65	4.66	5.31	5.73	6.00	6.16	6.21	6.21	6.16
	7	5.29	6.01	6.47	6.77	6.89	6.93	6.91	6.85	5.73	6.51	7.02	7.34	7.53	7.57	7.55	7.48

SI units

Capacity in kW for MAH -10°C/+15°C at 4°K static superheat SS

R410A

Type	Orifice no.	Pressure drop across valve Δ bar								Pressure drop across valve Δ bar							
		3.5	5.2	6.9	8.6	10.3	12.1	13.8	15.5	3.5	5.2	6.9	8.6	10.3	12.1	13.8	15.5
		<b>Evaporating temperature -17.8°C</b>								<b>Evaporating temperature -6.7°C</b>							
TR 6	3	5.19	5.86	6.25	6.50	6.66	6.76	6.79	6.79	6.53	7.47	8.06	8.40	8.62	8.74	8.79	8.78
	4	7.69	8.65	9.19	9.53	9.73	9.83	9.85	9.80	9.60	10.93	11.75	12.20	12.47	12.60	12.63	12.57
	5	9.50	10.66	11.31	11.70	11.92	12.02	12.02	11.95	11.76	13.37	14.34	14.87	15.16	15.30	15.31	15.22
	6	10.17	11.39	12.07	12.47	12.68	12.77	12.74	12.65	12.58	14.28	15.30	15.84	16.13	16.26	16.24	16.13
	7	12.53	13.98	14.76	15.19	15.40	15.44	15.36	15.20	15.46	17.51	18.70	19.32	19.63	19.73	19.66	19.47
		<b>Evaporating temperature 4.4°C</b>								<b>Evaporating temperature 10°C</b>							
TR 6	3	8.04	9.22	10.01	10.55	10.82	10.98	11.03	11.01	8.86	10.16	11.03	11.62	12.01	12.17	12.22	12.19
	4	11.64	13.30	14.38	15.10	15.44	15.61	15.63	15.55	12.71	14.52	15.70	16.48	16.97	17.14	17.16	17.05
	5	14.10	16.07	17.35	18.19	18.57	18.75	18.75	18.63	15.26	17.40	18.79	19.70	20.25	20.44	20.43	20.29
	6	15.07	17.16	18.51	19.38	19.77	19.94	19.92	19.77	16.31	18.58	20.05	20.99	21.57	21.74	21.72	21.55
	7	18.52	21.05	22.66	23.68	24.11	24.27	24.20	23.98	20.05	22.80	24.56	25.68	26.34	26.51	26.44	26.19

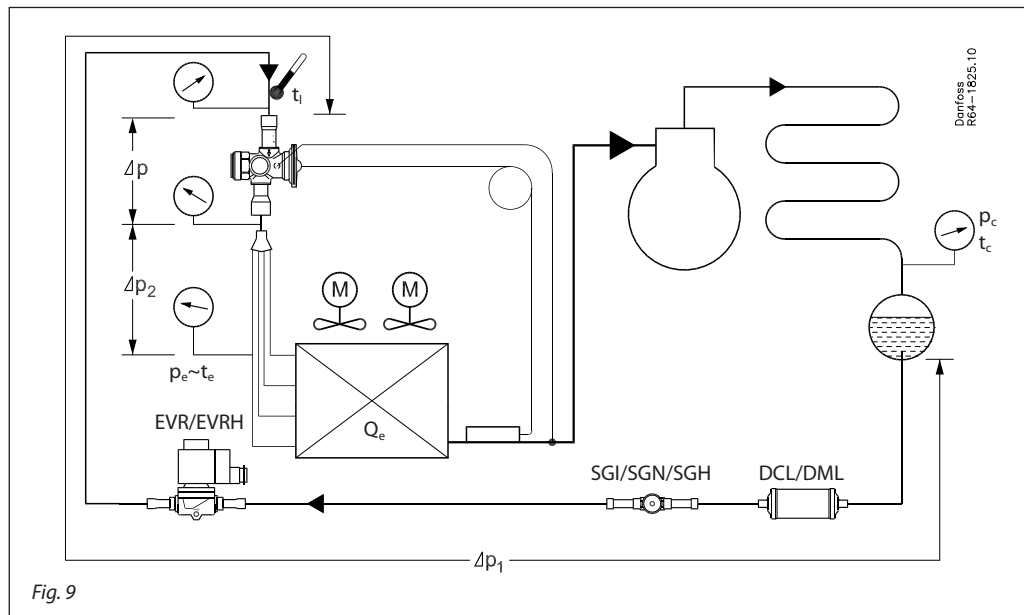
**Correction for subcooling  $\Delta t_{sub}$**   
 The evaporator capacity used must be corrected if subcooling deviates from 7.2°F/ 4°K. The corrected capacity can be obtained by multiplying the evaporator capacity by the correction factor given below.

**Note:**  
 Insufficient subcooling can produce flash gas.

Correction factor for subcooling  $\Delta t_{sub}$

Correction factor	$\Delta t_{sub}$							
	4°K	10°K	15°K	20°K	25°K	30°K	35°K	40°K
	7.2°F	18°F	27°F	36°F	45°F	55°F	63°F	72°F
R410A	1.00	1.08	1.14	1.20	1.26	1.31	1.37	1.43

Sizing



*Example:*  
 Refrigerant R22  
 Evaporating temperature  $t_e = 40^\circ\text{F}$   
 Condensing temperature  $t_c = 118^\circ\text{F}$   
 Pressure drop in liquid line, drier and distributor system  $\Delta p_2 + \Delta p_1 = 27 \text{ psi}$   
 Pressure drop in valve  $\Delta p = 256 - 79 - 27 = 150 \text{ psi}$   
 Subcooling  $\Delta t_{\text{sub}} = t_c - t_l = 18^\circ\text{F}$   
 Evaporator capacity = 4.0 TR  
 Correction factor from table = 1.06

The corrected evaporator capacity then becomes  $4.0 \times 1.06 = 4.24 \text{ TR}$

As the selected valve must be equal to or slightly larger than the corrected evaporator capacity of 4.24 TR, the TR 6 with orifice 4 having a table capacity of 5.4 TR would be a suitable choice.

US units

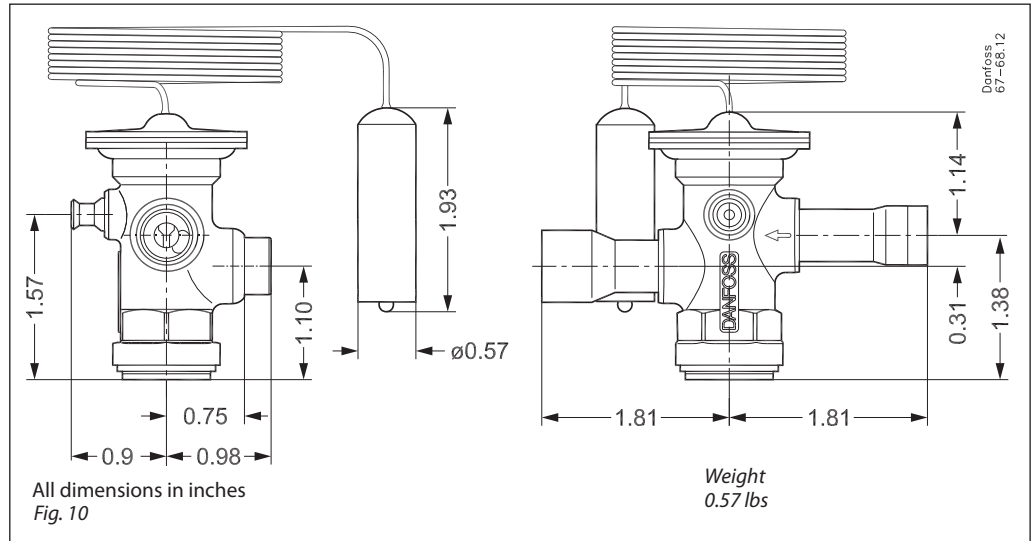
Capacity in TR for MAH +14/+59°F at 7.2°F static superheat SS

**R22**

Type	Orifice no.	Pressure drop across valve $\Delta p$ psi								Pressure drop across valve $\Delta p$ psi							
		50	75	100	125	150	175	200	225	50	75	100	125	150	175	200	225
<b>Evaporating temperature 0°F</b>										<b>Evaporating temperature 20°F</b>							
TR 6	3	1.48	1.63	1.72	1.77	1.80	1.81	1.81	1.79	1.99	2.21	2.32	2.39	2.42	2.43	2.41	2.39
	4	2.17	2.38	2.50	2.56	2.59	2.59	2.57	2.53	2.88	3.17	3.31	3.39	3.41	3.41	3.38	3.33
	5	2.67	2.91	3.05	3.11	3.14	3.13	3.10	3.05	3.49	3.83	3.99	4.07	4.10	4.08	4.03	3.97
	6	2.85	3.11	3.24	3.30	3.32	3.30	3.26	3.21	3.72	4.07	4.24	4.32	4.33	4.31	4.25	4.18
	7	3.49	3.79	3.93	3.98	3.98	3.94	3.87	3.79	4.55	4.95	5.14	5.21	5.21	5.16	5.08	4.97
<b>Evaporating temperature 40°F</b>										<b>Evaporating temperature 50°F</b>							
TR 6	3	2.61	3.01	3.27	3.36	3.35	3.32	3.28	3.22	2.56	2.96	3.24	3.41	3.54	3.63	3.69	3.72
	4	3.78	4.36	4.51	4.55	4.54	4.49	4.43	4.34	3.70	4.28	4.68	4.94	5.12	5.24	5.12	4.99
	5	4.55	5.13	5.28	5.33	5.33	5.27	5.19	5.09	4.45	5.16	5.64	5.95	6.14	6.02	5.89	5.75
	6	4.91	5.42	5.59	5.64	5.63	5.56	5.47	5.36	4.81	5.57	6.09	6.42	6.45	6.33	6.20	6.05
	7	6.00	6.53	6.73	6.79	6.76	6.67	6.55	6.40	6.07	7.03	7.68	7.81	7.72	7.58	7.42	7.23

Dimensions and weights

Fixed setting



Adjustable setting

