Data sheet

Thermostatic Expansion Valves
Type TR 6

Introduction
The TR 6 series is a hermetic tight design, 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 TR design incorporates a hot-pressed brass body with the entire power element, including the capillary tube and bulb, fabricated from stainless steel. 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.

Features

- Compact size - hermetic design
- Refrigerants & rated capacities ranging up to
  - R22: 6.7 TR / 23.6 kW
  - R410A: 7 TR / 24.5 kW
  - Others on request
- Laser-welded power element
  - Longer diaphragm life.
  - High pressure tolerance and working pressure.
- Stainless steel capillary tube
  - Tolerates more bending for easier installation and longer life.
  - High strength and vibration resistance.
- Stainless steel bulb
  - Self-aligning for fast and easy installation; secures with a single bulb strap/OEM strap
  - More contact surface for better heat transfer
- Balance port design
- A complete program with internal check valve with low pressure drop at full flow or without internal check valve.
- Adjustable or non-adjustable superheat, for customer specific factory setting.
- Bleed function available.
- Customer specific engraving.
- Solder and mechanical connections
- Straightway versions with fixed orifice and with external equalization.
- UL listed, file SA7200
### Thermostatic expansion valves, type TR 6

#### Valve program
**Standard versions**
- **Refrigerants:** R22 and R410A
- **Operating range:** +14 °F to +59 °F / -10 °C to +15 °C
- **Setting:**
  - Fixed setting: Static superheat in accordance with customers’ specifications.
  - Adjustable setting: Factory static superheat of 7.2 °F / 4 °C.
- **Max. working pressure:** MWP 630 psig / PS = 45.5 bar
- **Max. test pressure:** 680 psig / Pf = 47 bar
- **Standard connections:** 3/8 in. ODF inlet x 1/2 in. ODF outlet x 1/4 in flare nut 24.3 inch length
- **Capillary tube length:** 31.5 in / 0.8 m
- **Options on request**
  - Refrigerants: Other refrigerants.
  - Range: Other temperature ranges.
  - MOP: Special MOP charges.
  - Capillary tube lengths:
    - 20 in. / 0.5 m
    - 38.4 in / 0.975 m

#### Technical data
- **Max. operating temperature**
  - Thermostatic element:
    - R22: max. 212 °F / 100 °C
    - R410A: max. 212 °F / 100 °C
  - Valve body: 230 °F / 110 °C
- **Max. working pressure**
  - MWP 630 psig / PS = 45.5 bar
- **Max. test pressure**
  - 680 psig / Pf = 47 bar

#### Identification
- **Essential valve data is given on the power element.**
- **Main valve data example:**
  - TR6 = Valve type
  - R410A = Refrigerant
  - 6.70 TR = Rated capacity Qnom in Tons of Refrigeration
  - MWP 630 psig/
  - PS 45.5 bar = Max. working pressure in psig and bar
  - 067Uxxxx = Code number
  - BC1109D = Date making (BC=Mexico, week 11, year 2009, weekday D=Thursday)
  - +15/+60 °F = Evaporating temperature range in °F
  - -10/+15 °C = Evaporating temperature range in °C
Design and function

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

![Adjustable setting](image)

### Refrigerant Rated capacity

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>Rated capacity $Q_{\text{nom}}$</th>
<th>Orifice no.</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>R22</td>
<td>TR kW</td>
<td>Orifice no.</td>
<td>Inlet × Outlet</td>
</tr>
<tr>
<td>3.3</td>
<td>11.4</td>
<td>3</td>
<td>067LS855</td>
</tr>
<tr>
<td>4.5</td>
<td>15.8</td>
<td>4</td>
<td>067LS856</td>
</tr>
<tr>
<td>5.3</td>
<td>18.5</td>
<td>5</td>
<td>067LS857</td>
</tr>
<tr>
<td>5.6</td>
<td>19.6</td>
<td>6</td>
<td>067LS858</td>
</tr>
<tr>
<td>6.7</td>
<td>23.6</td>
<td>7</td>
<td>067LS859</td>
</tr>
<tr>
<td>R410A</td>
<td>TR kW</td>
<td>Orifice no.</td>
<td>Inlet × Outlet</td>
</tr>
<tr>
<td>3</td>
<td>10.5</td>
<td>3</td>
<td>067LS955</td>
</tr>
<tr>
<td>4</td>
<td>14.0</td>
<td>4</td>
<td>067LS956</td>
</tr>
<tr>
<td>5</td>
<td>17.5</td>
<td>5</td>
<td>067LS957</td>
</tr>
<tr>
<td>6</td>
<td>21.0</td>
<td>6</td>
<td>067LS958</td>
</tr>
<tr>
<td>7</td>
<td>24.5</td>
<td>7</td>
<td>067LS959</td>
</tr>
</tbody>
</table>

Pressure equalisation = ¼ in. ODF

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

2) Partnumbers consist of a valve, bulbstrap and the following connectors:
   1 Chatleff 3/8" female connector
   1 Aeroquip 5/8" female connector

### Check valve capacity

![Check valve capacity](image)

**Fig. 8** Internal check valve for orifice bypass in reverse flow (flow rate as a function of pressure differential)
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.

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

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.

<table>
<thead>
<tr>
<th>Correction factor</th>
<th>$\Delta t_{\text{sub}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4°F</td>
</tr>
<tr>
<td>R22</td>
<td>1.00</td>
</tr>
</tbody>
</table>

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

**Thermostatic expansion valves, type TR 6**

**Capacity (cont.)**

**US units**

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Onifice no.</th>
<th>50 psi</th>
<th>75 psi</th>
<th>100 psi</th>
<th>125 psi</th>
<th>150 psi</th>
<th>175 psi</th>
<th>200 psi</th>
<th>225 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR 6</td>
<td>3</td>
<td>1.48</td>
<td>1.67</td>
<td>1.79</td>
<td>1.86</td>
<td>1.90</td>
<td>1.93</td>
<td>1.94</td>
<td>1.94</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2.20</td>
<td>2.47</td>
<td>2.63</td>
<td>2.72</td>
<td>2.78</td>
<td>2.81</td>
<td>2.81</td>
<td>2.80</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2.71</td>
<td>3.05</td>
<td>3.23</td>
<td>3.34</td>
<td>3.41</td>
<td>3.43</td>
<td>3.43</td>
<td>3.41</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>2.91</td>
<td>3.25</td>
<td>3.45</td>
<td>3.56</td>
<td>3.62</td>
<td>3.65</td>
<td>3.64</td>
<td>3.61</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>3.58</td>
<td>3.99</td>
<td>4.22</td>
<td>4.34</td>
<td>4.40</td>
<td>4.41</td>
<td>4.39</td>
<td>4.34</td>
</tr>
</tbody>
</table>

**Pressure drop across valve D psi**

**Evaporating temperature 0°F**

**Evaporating temperature 20°F**

**Evaporating temperature 40°F**

**Evaporating temperature 50°F**

**SI units**

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Onifice no.</th>
<th>3.5 bar</th>
<th>5.2 bar</th>
<th>6.9 bar</th>
<th>8.6 bar</th>
<th>10.3 bar</th>
<th>12.1 bar</th>
<th>13.8 bar</th>
<th>15.5 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR 6</td>
<td>3</td>
<td>5.19</td>
<td>5.86</td>
<td>6.25</td>
<td>6.50</td>
<td>6.66</td>
<td>6.76</td>
<td>6.79</td>
<td>6.79</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>9.50</td>
<td>10.66</td>
<td>11.31</td>
<td>11.70</td>
<td>11.92</td>
<td>12.02</td>
<td>12.02</td>
<td>11.95</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>12.53</td>
<td>13.98</td>
<td>14.76</td>
<td>15.19</td>
<td>15.40</td>
<td>15.44</td>
<td>15.36</td>
<td>15.20</td>
</tr>
</tbody>
</table>

**Pressure drop across valve D bar**

**Evaporating temperature −17.8°C**

**Evaporating temperature −6.7°C**

**Evaporating temperature 4.4°C**

**Evaporating temperature 10°C**

**Correction for subcooling Δt<sub>sub</sub>**

The evaporator capacity used must be corrected if subcooling deviates from 7.2 °F / 4 °C. The corrected capacity can be obtained by multiplying the evaporator capacity by the correction factor given below.

**Correction factor for subcooling Δt<sub>sub</sub>**

<table>
<thead>
<tr>
<th>Correction factor</th>
<th>Δt&lt;sub&gt;sub&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 °K</td>
</tr>
<tr>
<td>R410A</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Note:** Insufficient subcooling can produce flash gas.
**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: \( \Delta p_L + \Delta p_D = 27 \) psi  
Pressure drop in valve: \( \Delta p = 256 - 79 - 27 = 150 \) psi  
Subcooling: \( \Delta t_{sub} = t_c - t_l = 18 ^\circ\text{F} \)  
Evaporator capacity: \( 4.0 \) TR  
Correction factor from table: \( 1.06 \)  
The corrected evaporator capacity then becomes: \( 4.0 \times 1.06 = 4.24 \) 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Orifice no.</th>
<th>Pressure drop across valve ( \Delta ) psi @ 0°F</th>
<th>Pressure drop across valve ( \Delta ) psi @ 20°F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TR 6</td>
<td>3</td>
<td>1.48</td>
<td>1.63</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2.17</td>
<td>2.38</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2.67</td>
<td>2.91</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>3.49</td>
<td>3.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TR 6</td>
<td>3</td>
<td>2.61</td>
<td>3.01</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>3.78</td>
<td>4.36</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>4.55</td>
<td>5.13</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>4.91</td>
<td>5.42</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>6.00</td>
<td>6.53</td>
</tr>
</tbody>
</table>
Dimensions and weights

Fixed setting

![Fixed setting diagram](image1)

All dimensions in inches

Fig. 10

Weight

0.57 lbs

Adjustable setting

![Adjustable setting diagram](image2)

All dimensions in inches

Fig. 11

Weight

0.67 lbs