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
## Valve program

**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 °K.

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

**Packing:**
- Single or industrial pack

**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

## 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

**Options for Connections:**
- Inlet/Outlet:
  - Inlet: ¼ in. ODM, ½ in. ODF, ½ in. ODF, chatleff, aeroquip
  - Outlet: ¼ in. ODF, ½ in ODF, ½ in ODF, chatleff, aeroquip, flare

**Equalizer:**
- Cu capillary tube size: Ø 1/8 in.
- ¼ in. Flare Nut with l = 9.5, 16.9 or 24.3 in.
- Solder ¼ in ODM with l = 16.9 or 24.3 in.
- Solder ¼ in ODF with l = 31.7 or 39.1 in.

## 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
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- PS 45.5 bar = Max. working pressure in psig and bar
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Fig. 1
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.

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
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**

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**R22 and R410A**

Range: $N = 14\,^\circ F \rightarrow 59\,^\circ F$ (–10 °C → +15 °C)

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>Rated capacity $Q_{\text{nom}}$</th>
<th>Orifice no.</th>
<th>Connection</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>TR</td>
<td>kW</td>
<td></td>
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<tr>
<td>R22</td>
<td>3.3</td>
<td>11.4</td>
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<td></td>
<td>4.5</td>
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</tr>
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<td></td>
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<td>19.6</td>
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</tr>
<tr>
<td></td>
<td>6.7</td>
<td>23.6</td>
<td>7</td>
</tr>
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<td>R410A</td>
<td>3</td>
<td>10.5</td>
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<tr>
<td></td>
<td>4</td>
<td>14.0</td>
<td>4</td>
</tr>
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<td></td>
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<td>6</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>24.5</td>
<td>7</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 $\frac{3}{4}$" female connector
   1 Aeroquip $\frac{5}{8}$" female connector

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### Check valve capacity

![Check valve capacity graph](image)

*Fig. 8 Internal check valve for orifice bypass in reverse flow (flow rate as a function of pressure differential)*
### Data sheet Thermostatic expansion valves, type TR 6

#### Capacity US units

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

| Type   | Orifice no. | Pressure drop across valve Δ psi 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 | Pressure drop across valve Δ psi 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 |
|--------|-------------|--------------------------------------|----|-----|-----|-----|-----|-----|-----|--------------------------------------|----|-----|-----|-----|-----|-----|-----|-----|
| 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 | 2.57 | 2.57 | 2.53 | 2.88 | 3.17/3.11                           | 3.39 | 3.41 | 3.41 | 3.38 | 3.33 |
|        | 5           | 2.67/2.94                            | 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 |
|        | 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 |

**Evaporating temperature 0°F**

<table>
<thead>
<tr>
<th>Type</th>
<th>Orifice no.</th>
<th>Pressure drop across valve Δ psi</th>
<th>7.2°F</th>
<th>11.5°F</th>
<th>15.8°F</th>
<th>20.5°F</th>
<th>25°F</th>
<th>30°F</th>
<th>35°F</th>
<th>40°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR 6</td>
<td>3</td>
<td>2.61/3.01</td>
<td>3.27</td>
<td>3.36</td>
<td>3.35</td>
<td>3.32</td>
<td>3.28</td>
<td>3.22</td>
<td>2.56</td>
<td>2.96</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>3.78/4.36</td>
<td>4.51</td>
<td>4.55</td>
<td>4.54</td>
<td>4.49</td>
<td>4.43</td>
<td>4.34</td>
<td>3.70</td>
<td>4.28</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>4.55/5.13</td>
<td>5.28</td>
<td>5.33</td>
<td>5.33</td>
<td>5.27</td>
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<td>4.45</td>
<td>5.16</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>4.91/5.42</td>
<td>5.59</td>
<td>5.64</td>
<td>5.63</td>
<td>5.56</td>
<td>5.47</td>
<td>5.36</td>
<td>4.81</td>
<td>5.57</td>
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<td></td>
<td>7</td>
<td>6.00/6.53</td>
<td>6.73</td>
<td>6.79</td>
<td>6.76</td>
<td>6.67</td>
<td>6.55</td>
<td>6.40</td>
<td>6.07</td>
<td>7.03</td>
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</table>

**Evaporating temperature 40°F**

<table>
<thead>
<tr>
<th>Type</th>
<th>Orifice no.</th>
<th>Pressure drop across valve Δ psi</th>
<th>7.2°F</th>
<th>11.5°F</th>
<th>15.8°F</th>
<th>20.5°F</th>
<th>25°F</th>
<th>30°F</th>
<th>35°F</th>
<th>40°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR 6</td>
<td>3</td>
<td>5.18/5.71</td>
<td>6.03</td>
<td>6.21</td>
<td>6.31</td>
<td>6.34</td>
<td>6.32</td>
<td>6.27</td>
<td>6.98</td>
<td>7.72</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>7.61/8.34</td>
<td>8.74</td>
<td>8.96</td>
<td>9.05</td>
<td>9.05</td>
<td>8.98</td>
<td>8.87</td>
<td>10.08</td>
<td>11.08</td>
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**Evaporating temperature 50°F**

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<th>Type</th>
<th>Orifice no.</th>
<th>Pressure drop across valve Δ psi</th>
<th>7.2°F</th>
<th>11.5°F</th>
<th>15.8°F</th>
<th>20.5°F</th>
<th>25°F</th>
<th>30°F</th>
<th>35°F</th>
<th>40°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR 6</td>
<td>3</td>
<td>9.34/10.55</td>
<td>11.44</td>
<td>11.75</td>
<td>11.73</td>
<td>11.63</td>
<td>11.47</td>
<td>11.27</td>
<td>8.95</td>
<td>10.36</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>13.22/15.27</td>
<td>15.78</td>
<td>15.92</td>
<td>15.89</td>
<td>15.73</td>
<td>15.50</td>
<td>15.20</td>
<td>12.95</td>
<td>14.99</td>
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<tr>
<td></td>
<td>5</td>
<td>15.93/17.94</td>
<td>18.49</td>
<td>18.67</td>
<td>18.64</td>
<td>18.46</td>
<td>18.18</td>
<td>17.82</td>
<td>15.59</td>
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<td>6</td>
<td>17.19/19.55</td>
<td>19.73</td>
<td>19.69</td>
<td>19.47</td>
<td>19.15</td>
<td>18.76</td>
<td>18.46</td>
<td>16.84</td>
<td>19.49</td>
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<tr>
<td></td>
<td>7</td>
<td>21.00/22.85</td>
<td>23.57</td>
<td>23.77</td>
<td>23.67</td>
<td>23.36</td>
<td>22.93</td>
<td>22.41</td>
<td>21.25</td>
<td>24.60</td>
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**Evaporating temperature 60°F**

<table>
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<tr>
<th>Type</th>
<th>Orifice no.</th>
<th>Pressure drop across valve Δ psi</th>
<th>7.2°F</th>
<th>11.5°F</th>
<th>15.8°F</th>
<th>20.5°F</th>
<th>25°F</th>
<th>30°F</th>
<th>35°F</th>
<th>40°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR 6</td>
<td>3</td>
<td>1.00/1.06</td>
<td>1.11</td>
<td>1.15</td>
<td>1.20</td>
<td>1.24</td>
<td>1.29</td>
<td>1.33</td>
<td>1.00</td>
<td>1.06</td>
</tr>
</tbody>
</table>

**Correction for subcooling Δt_{sub}**

The evaporator capacity used must be corrected if subcooling deviates from 7.2°F/ 4.0K.

The corrected capacity can be obtained by multiplying the evaporator capacity by the correction factor given below.

**Correction factor for subcooling Δt_{sub}**

<table>
<thead>
<tr>
<th>Correction factor</th>
<th>Δt_{sub}</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 °K</td>
<td>10 °K</td>
</tr>
<tr>
<td>7.2 °F</td>
<td>18 °F</td>
</tr>
<tr>
<td>R22</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Correction 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.

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

<table>
<thead>
<tr>
<th>Correction factor</th>
<th>( \Delta t_{\text{sub}} )</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 \( t_e = 40^\circ F \)
Condensing temperature \( t_c = 118^\circ F \)
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 \( \Delta t_{\text{sub}} = t_c - t_l = 18^\circ F \)
Evaporator capacity \( = 4.0 \text{ TR} \)
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**

<table>
<thead>
<tr>
<th>Type</th>
<th>Orifice no.</th>
<th>Pressure drop across valve ( \Delta p ) psi</th>
<th>Pressure drop across valve ( \Delta p ) psi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50 75 100 125 150 175 200 225</td>
<td>50 75 100 125 150 175 200 225</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evaporating temperature 0°F</td>
<td>Evaporating temperature 20°F</td>
<td>Evaporating temperature 40°F</td>
</tr>
<tr>
<td>TR 6</td>
<td>3 1.48 1.63 1.72 1.77 1.80 1.81 1.81 1.79</td>
<td>1.99 2.21 2.32 2.39 2.42 2.43 2.41 2.39</td>
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<tr>
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<td>4 2.17 2.38 2.50 2.56 2.59 2.59 2.57 2.53</td>
<td>2.88 3.17 3.31 3.39 3.41 3.41 3.38 3.33</td>
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</tr>
<tr>
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<td>5 2.67 2.91 3.05 3.11 3.14 3.13 3.10 3.05</td>
<td>3.49 3.83 3.99 4.07 4.10 4.08 4.03 3.97</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 3.49 3.79 3.93 3.98 3.98 3.94 3.87 3.79</td>
<td>4.55 4.95 5.14 5.21 5.21 5.16 5.08 4.97</td>
<td></td>
</tr>
<tr>
<td>TR 6</td>
<td>3 2.61 3.01 3.27 3.36 3.35 3.32 3.28 3.22</td>
<td>2.56 2.96 3.24 3.41 3.54 3.63 3.69 3.72</td>
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</tr>
<tr>
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<td>3.70 4.28 4.68 4.94 5.12 5.24 5.12 4.99</td>
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<td>7 6.00 6.53 6.73 6.79 6.76 6.67 6.55 6.40</td>
<td>6.07 7.03 7.68 7.81 7.72 7.58 7.42 7.23</td>
<td></td>
</tr>
</tbody>
</table>
Dimensions and weights

Fixed setting

All dimensions in inches

Fig. 10

Weight

0.57 lbs

Adjustable setting

All dimensions in inches

Fig. 11

Weight

0.67 lbs