Thermostats
type KP
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Technical leaflet  Thermostats, type KP

Introduction

KP thermostats are temperature-controlled electrical switches. All KP thermostats have a single pole double throw (SPDT) changeover switch. The position of the switch depends on the thermostat setting and the bulb temperature.

A KP thermostat can be directly connected to single-phase a.c. motors of up to about 2.7 hp, or installed in the control current circuit of d.c. motors and large a.c. motors.

Features

- Wide regulating range
- Can be used for deep freeze, refrigeration and air conditioning systems
- Welded bellows elements mean increased reliability
- Small dimensions
  Easy to install in refrigerated counters or cold rooms.
- Ultra-short bounce times
  Long operating life.
  Unnecessary cut-in and cut-out of control equipment is avoided.
- Standard versions with changeover switch
  Possible to obtain opposite switch function or to connect a signal.
- Electrical connection at the front of the unit
  Facilitates rack mounting.
  Saves space.
- Suitable for alternating and direct current
- No spade or lug terminals required
- Integral ½ NPSM swivel cable connector
  Allows direct attachment of ½ in. male pipe thread connector
- Extensive and wide range

Approvals

UL approval for USA and Canada, file E31024

Technical data

Ambient temperature
−40 → 150°F (175°F for maximum 2 hours).

Switch
Single pole changeover switch (SPDT).

Contact load
120 V a.c.: 16 FLA, 96 LRA
240 V a.c.: 8 FLA, 48 LRA
240 V d.c.: 12 W pilot duty

Cable entry
Integral ½ in. female NPSM swivel cable connector allows direct attachment of ½ in. male pipe thread

Enclosure
NEMA 2; IP 33 to IEC 529 (drip proof)
This grade of enclosure is obtained when the unit is mounted on a flat surface or bracket. The bracket must be fixed so that all unused holes are covered.
### Technical leaflet Thermostats, type KP

#### Regulating ranges

<table>
<thead>
<tr>
<th>Thermostat</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>KP 61</td>
<td>Vapour charge</td>
</tr>
<tr>
<td>KP 62</td>
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<tr>
<td>KP 63</td>
<td>KP 69</td>
</tr>
<tr>
<td>KP 71</td>
<td>KP 73</td>
</tr>
<tr>
<td>KP 98 OIL</td>
<td>KP 98 HT</td>
</tr>
</tbody>
</table>

#### Electrical wiring

**KP, single thermostats**

**KP 98, dual thermostat**

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## Technical leaflet

### Thermostats, type KP

#### Ordering

<table>
<thead>
<tr>
<th>Charge</th>
<th>Type</th>
<th>Bulb type</th>
<th>Regulation range °F</th>
<th>Differential Δt at lowest temperature setting °F</th>
<th>Differential Δt at highest temperature setting °F</th>
<th>Reset in</th>
<th>Reset ft</th>
<th>Code no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapour</td>
<td>1)</td>
<td>KP 61 B</td>
<td>20 → 55</td>
<td>8 → 40</td>
<td>2.2 → 13</td>
<td>auto. 80</td>
<td>6.5</td>
<td>060L200266</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KP 62 C</td>
<td>20 → 60</td>
<td>10 → 40</td>
<td>2.7 → 13</td>
<td>auto. 80</td>
<td>6.5</td>
<td>060L201566</td>
</tr>
<tr>
<td></td>
<td>2)</td>
<td>KP 71 E 2</td>
<td>25 → 70</td>
<td>4.5 → 18</td>
<td>4 → 18</td>
<td>auto. 80</td>
<td>6.5</td>
<td>060L201066</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KP 73 D</td>
<td>15 → 60</td>
<td>8 → 36</td>
<td>6.3 → 36</td>
<td>auto. 80</td>
<td>6.5</td>
<td>060L201766</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KP 73 E 1</td>
<td>0 → 80</td>
<td>10 → 35</td>
<td>10 → 35</td>
<td>auto. 80</td>
<td>6.5</td>
<td>060L202966</td>
</tr>
<tr>
<td></td>
<td>3)</td>
<td>KP 98 E 2</td>
<td>Oil: 140 to 250</td>
<td>Oil: fixed 25</td>
<td>Oil: fixed 25</td>
<td>man., max.</td>
<td>80</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E 2</td>
<td>HT: 210 to 350</td>
<td>HT: fixed 45</td>
<td>HT: fixed 45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adsorption</td>
<td>2)</td>
<td>KP 71 E 2</td>
<td>25 → 70</td>
<td>4.5 → 18</td>
<td>4 → 18</td>
<td>auto. 80</td>
<td>6.5</td>
<td>060L201066</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KP 73 D</td>
<td>15 → 60</td>
<td>8 → 36</td>
<td>6.3 → 36</td>
<td>auto. 80</td>
<td>6.5</td>
<td>060L201766</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KP 73 E 1</td>
<td>0 → 80</td>
<td>10 → 35</td>
<td>10 → 35</td>
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<td>060L202966</td>
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<td>E 2</td>
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<td></td>
<td></td>
<td>E 2</td>
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<td>HT: fixed 45</td>
<td>HT: fixed 45</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Bulb must be installed in colder position than thermostat housing and capillary tube.

2) Bulb can be placed warmer or colder than thermostat housing.

3) Factory setting cut-in: 60°F cut-out: 25°F

### Thermostat bulb types

<table>
<thead>
<tr>
<th>Letter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Straight capillary tube&lt;br&gt; Sensing length: 15 in. of 80 in</td>
</tr>
<tr>
<td>B</td>
<td>Dia. 3/8 in. x 2 3/4 in. remote air coil</td>
</tr>
<tr>
<td>C</td>
<td>Dia. 1 9/16 in. x 1 in. air coil (integral with thermostat)</td>
</tr>
<tr>
<td>D</td>
<td>Dia. 3/8 in. x 3 3/8 in. double contact remote bulb&lt;br&gt;Note! Cannot be used in sensor (bulb) pocket</td>
</tr>
<tr>
<td>E</td>
<td>E1: Dia. 1/4 in. x 3 3/4 in. remote bulb&lt;br&gt;E2: Dia. 3/8 in. x 4 1/2 in. remote bulb</td>
</tr>
</tbody>
</table>

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The switch in the KP has a snap-action function and the bellows move only when the cutin or cut-out value is reached.

The design of the KP thermostat provides the following advantages:
- high contact load
- ultra-short bounce time
- vibration resistance up to 4 g in the range 0-1000 Hz
- long mechanical and electrical life.
Design Function
(continued)

1. Temperature setting spindle, OIL
2. Main arm
3. Main spiral
5. Temperature setting spindle, HT
7. Main spring
9. Bellows
10. Capillary tube, OIL
11. Capillary tube, HT
12. Switch
13. Terminals
14. Earth terminal
15. Cable entry
16. Tumbler
17. Sensor (bulb)
18. Locking plate

Dual thermostat KP 98 is used as a protection against too high a discharge gas temperature and to ensure a suitable oil temperature in the compressor.

To avoid the temperature of the hot gas exceeding the maximum permissible value during extreme operating conditions (low evaporating pressure, high condensing pressure, high suction vapour superheat) a KP 98 thermostat can be used on the high temperature side (HT). If the temperature of the hot gas becomes too high the refrigerant will break down and the compressor discharge valve will become damaged.

The risk is greatest in refrigeration systems that operate on a high compression ratio (e.g. in systems with NH₃ or R 22) and in applications with hot gas bypass.

This unit has two separate thermostat functions. The HT sensor that controls the discharge gas temperature is fitted on the discharge tube immediately after the compressor.

For larger compressors, the sensor can be built into the discharge tube.

The OIL sensor that controls the oil temperature is located in the compressor oil sump.

KP 98 is available for protection against low oil temperature. Compressor manufactures recommend fitting a heating element in the crankcase to prevent refrigerant boiling out of the oil during start. KP 98 is the correct thermostat for controlling this heating element.

Why a heating element?
During standstill, refrigerant is dissolved in the crankcase oil. If the oil is cold and the standstill period is long, a large amount of refrigerant can dissolve in the oil.

This leads to two problems:
1. When the compressor is started, the refrigerant will boil off, causing a high risk of liquid hammer and consequent compressor damage.
2. The oil loses its lubricating capability when it is thinned with refrigerant.

To avoid these problems a heating element controlled by a KP 98 should be fitted in the crankcase to keep the oil warm. This prevents dangerous amounts of refrigerant from being dissolved in the oil.
**Technical leaflet**

**Thermostats, type KP**

**Terminology**

- **Differential**
  The differential is the difference between the make and break temperatures. A differential is necessary for satisfactory automatic operation of the system.

- **Mechanical differential (intrinsic differential)**
  The mechanical differential is the differential set by the differential spindle.

- **Operating differential (thermal differential)**
  The operating differential is the differential the plant operates on. Operating differential is the sum of the mechanical differential and the differential produced by the thermal time constant.

**Setting**

- **Thermostats with automatic reset**
  Set the upper activating temperature on the range scale.
  Set the differential on the “DIFF” scale.
  The temperature setting on the range scale will then correspond to the temperature at which the refrigeration compressor will be started on rising temperature. The compressor will be stopped when the temperature has fallen in relation to the differential setting.
  Please note that the differential depends on the range setting. Therefore, the differential scale must only be used as guideline.
  If the compressor will not stop at low stop temperature settings, check whether the differential is set at too high a value!
  The thermostat will automatically reset and the compressor will start once the temperature rises above the range scale setting.

- **Thermostats with minimum reset**
  Set the stop temperature on the range scale.
  The differential is a fixed setting.
  The compressor can be restarted by pressing the “Reset button” after the temperature on the thermostat sensor has risen by a value equal to the fixed differential setting.

- **Thermostats with maximum reset**
  Set the stop temperature on the range scale.
  The differential is a fixed setting.
  The compressor can be restarted by pressing the “Reset button” after the temperature on the thermostat sensor has fallen to a value equal to the fixed differential setting.

**Charges**

1. **Vapour charge**
   ![Diagram of Vapour Charge]

   Here the interdependence between the pressure and temperature of saturated vapour is utilized, i.e. the element is charged with saturated vapour plus a small amount of liquid.
   The charge is pressure-limited; a further increase in pressure after evaporation of all the liquid in the sensor (17) will only result in a small pressure increase in the element.

   **Note:** When the sensor is coldest, the ambient temperature has no effect on regulating accuracy.
2. Adsorption charge

In this case the charge consists partly of a superheated gas and partly of a solid having a large adsorption surface.

The solid is concentrated in the sensor (17) and it is therefore always the sensor that is the temperature-controlling part of the thermostatic element.

The sensor can be placed warmer or colder than thermostat housing and capillary tube, but variations from +70°F ambient temperature will influence the scale accuracy.

Dimensions and weights

- KP 61 to 73: approx. 0.9 lbs
- KP 98: approx. 1.3 lbs

Charges (continued)

Dimensions and weights
Accessories

For
KP pressure controls
KP thermostats
MP differential pressure controls

Bracket (universal hole pattern)
Angle bracket, code no. 060-105366

Seal screw (KP only)
For use when sealing the setting, code no. 060-105766

Bulb clamp
Screw and nut included
Length = 3 in., code no. 017-420366

Clamping band
Screws and nuts included
Length = 15 in., code no. 017-420466

Bulb holder kit, code no. 017-420166
1 Bulb holder (1pc.)
2 Clamp (4 pcs.)

Setting nut
For KP pressure controls and thermostats, code no. 060-106366 (10 pcs.)

Copper damping coil
with 1/4 in. female flare nuts both ends.
For KP pressure controls and MP differential pressure controls.

<table>
<thead>
<tr>
<th>Capillary tube length in.</th>
<th>Code no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>060-007066</td>
</tr>
<tr>
<td>36</td>
<td>060-007166</td>
</tr>
<tr>
<td>54</td>
<td>060-007266</td>
</tr>
<tr>
<td>88</td>
<td>060-007666</td>
</tr>
</tbody>
</table>

ISO 9001 quality approval

Refrigeration and Air Conditioning Controls, part of the Danfoss concern, is certified in accordance with international standard ISO 9001. This means that Danfoss fulfills the international standard in respect of product development, design, production and sale.