

Data sheet

# Thermostat

## KP



The 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 temperature control 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 control equipment cut-in and cut-out 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  $\frac{1}{2}$  NPSM swivel cable connector  
Allows direct attachment of  $\frac{1}{2}$  in male pipe thread connector
- Extensive and wide range

### Approvals

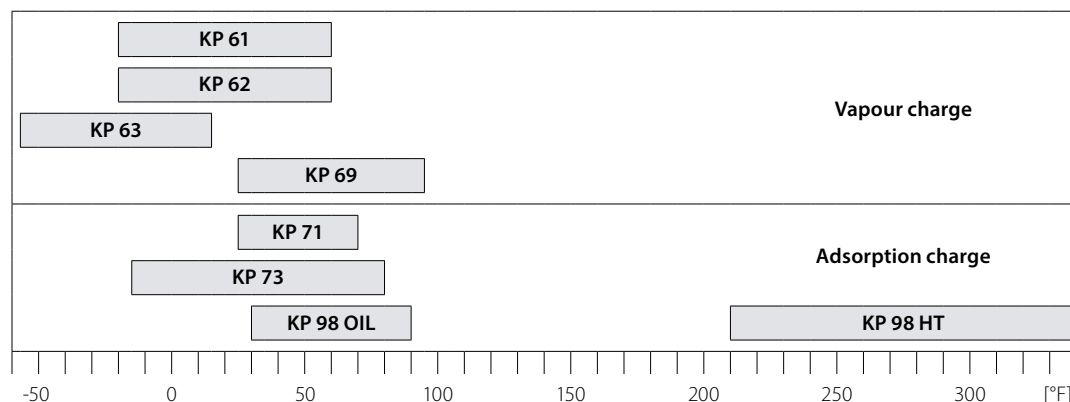
UL approval for USA and Canada, file E31024

## Data sheet | Thermostat, type KP

### Technical data

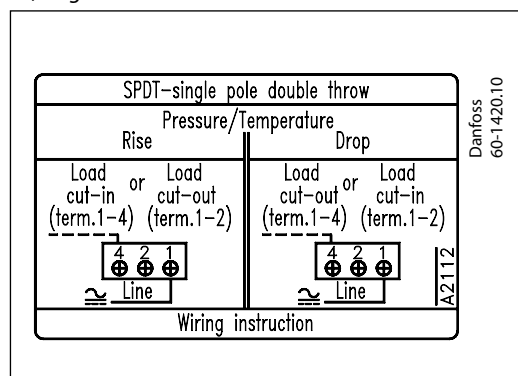
|                            |  |                 |
|----------------------------|--|-----------------|
| <b>Ambient temperature</b> | -40 – 150 °F (175 °F for maximum 2 hours)  |                 |
| <b>Switch</b>              | Single pole changeover switch (SPDT)   |                 |
| <b>Contact load</b>        | 120 V A.C.   | 16 FLA          |
|                            |  | 96 LRA          |
|                            | 240 V A.C.   | 8 FLA           |
|                            |  | 48 LRA          |
|                            | 240 V D.C.   | 12 W pilot duty |
| <b>Cable entry</b>         | Integral 1/2 in female NPSM swivel cable connector allows direct attachment of 1/2 in male pipe thread.  |                 |
| <b>Enclosure</b>           | ~NEMA 1; IP30 to IEC 529 (drip proof)<br>This grade of enclosure is obtained when the unit is mounted on a flat surface or bracket.<br>The bracket must be fixed so that all unused holes are covered. |                 |

### Regulating ranges

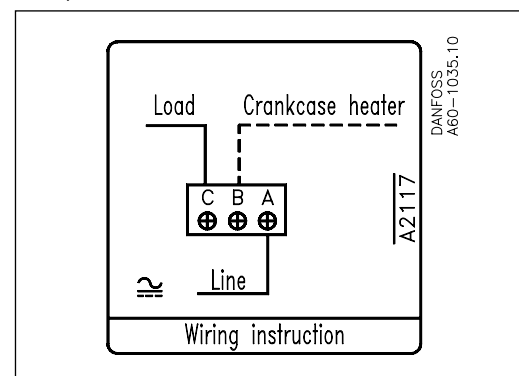


### Electrical wiring

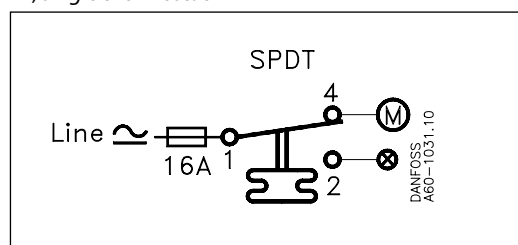
*KP, single thermostat*



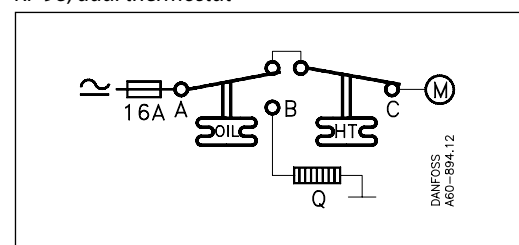
*KP 98, dual thermostat*



*KP, single thermostat*



*KP 98, dual thermostat*



## Data sheet | Thermostat, type KP

### Ordering

| Charge                   | Type  | Bulb type | Regulation range<br>[°F]        | Differential $\Delta t$               |  | Reset         | [in]     | [ft]       | Code no.                 |
|--------------------------|-------|-----------|---------------------------------|---------------------------------------|--|---------------|----------|------------|--------------------------|
|                          |       |           |                                 | at lowest temperature setting<br>[°F] | at highest temperature setting<br>[°F] |               |          |            |                          |
| Vapour <sup>1)</sup>     | KP 61 | B         | -20 – 55                        | 8 – 40                                | 2.2 – 13                               | Auto          | 80       | 6.5        | 060L200266               |
|                          | KP 62 | C         | -20 – 60                        | 10 – 40                               | 2.7 – 13                               | Auto          | –        | –          | 060L201566               |
| Adsorption <sup>2)</sup> | KP 71 | E2        | 25 – 70                         | 4.5 – 18                              | 4 – 18                                 | Auto          | 80       | 6.5        | 060L201066               |
|                          | KP 73 | D         | -15 – 60                        | 8 – 36                                | 6.3 – 36                               | Auto          | 80       | 6.5        | 060L201766               |
|                          | KP 73 | E1        | 0 – 80                          | 10 – 35                               | 10 – 35                                | Auto          | 80       | 6.5        | 060L202966 <sup>3)</sup> |
|                          | KP 98 | E2        | Oil: 140 – 250<br>HT: 210 – 350 | Oil: fixed 25<br>HT: fixed 45         | Oil: fixed 22<br>HT: fixed 45          | Manual (Max.) | 40<br>80 | 3.2<br>6.5 | 060L202466               |

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

<sup>2)</sup> Bulb can be placed warmer or colder than thermostat housing.

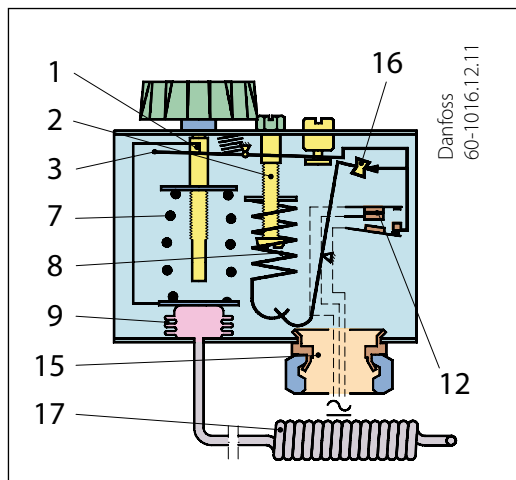
<sup>3)</sup> Factory setting:  
cut-in: 60 °F  
cut-out: 25 °F

### Thermostat bulb types

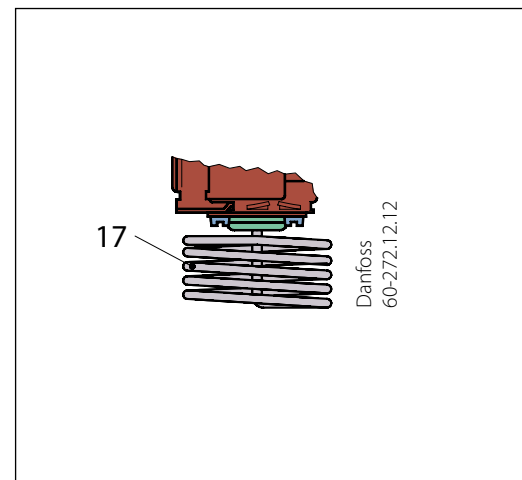
|   |  |   |
|---|--|---|
| A |  | Straight capillary tube<br>Sensing lengths:<br>15 in or 80 in                                     |
| B |  | Dia. 3/8 in x 2 3/4 in remote air coil  |
| C |  | Dia. 1 9/16 in x 1 in air coil (integral with thermostat)   |
| D |  | Dia. 3/8 in x 3 3/8 in double contact remote bulb<br>Note! Cannot be used in sensor (bulb) pocket |
| E |  | E1: Dia. 1/4 in x 3 3/4 in remote bulb<br>E2: Dia. 3/8 in x 4 1/2 in remote bulb                  |

**Design / Function**

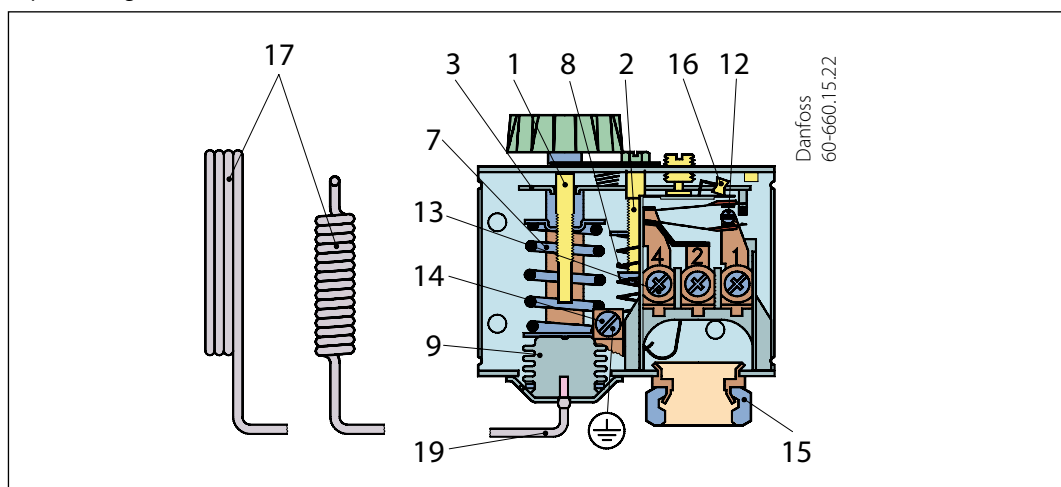
Key sketch of KP thermostat



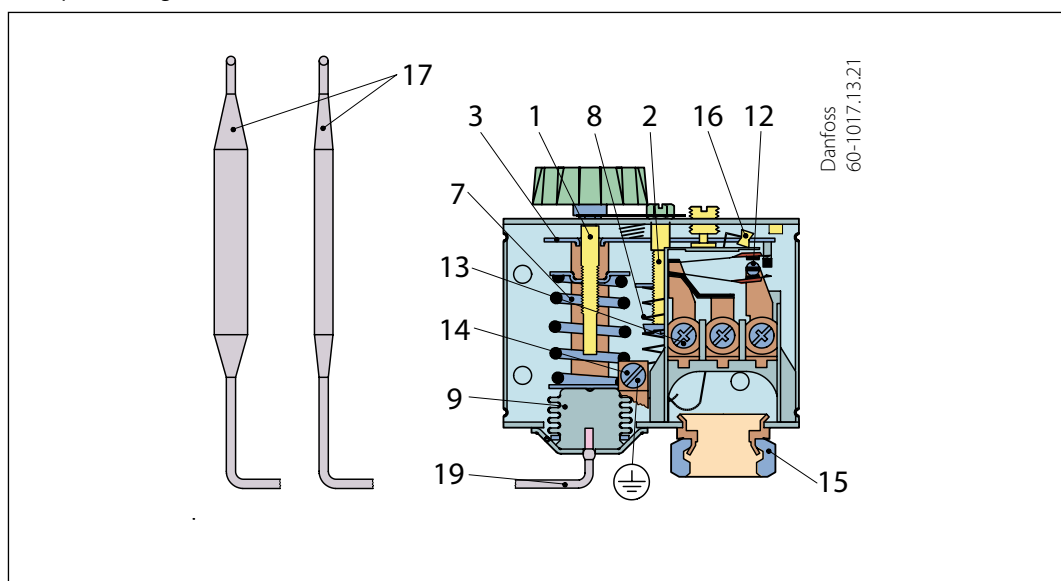
Vapour charge



Vapour charge



Adsorption charge



- 1. Temperature setting spindle
- 2. Differential setting spindle
- 3. Main arm
- 7. Main spring
- 8. Differential spring
- 9. Bellows
- 12. Switch
- 13. Terminals
- 14. Earth terminal
- 15. Cable entry
- 16. Tumbler
- 17. Sensor
- 19. Capillary tube

**Design / Function**  
(continued)

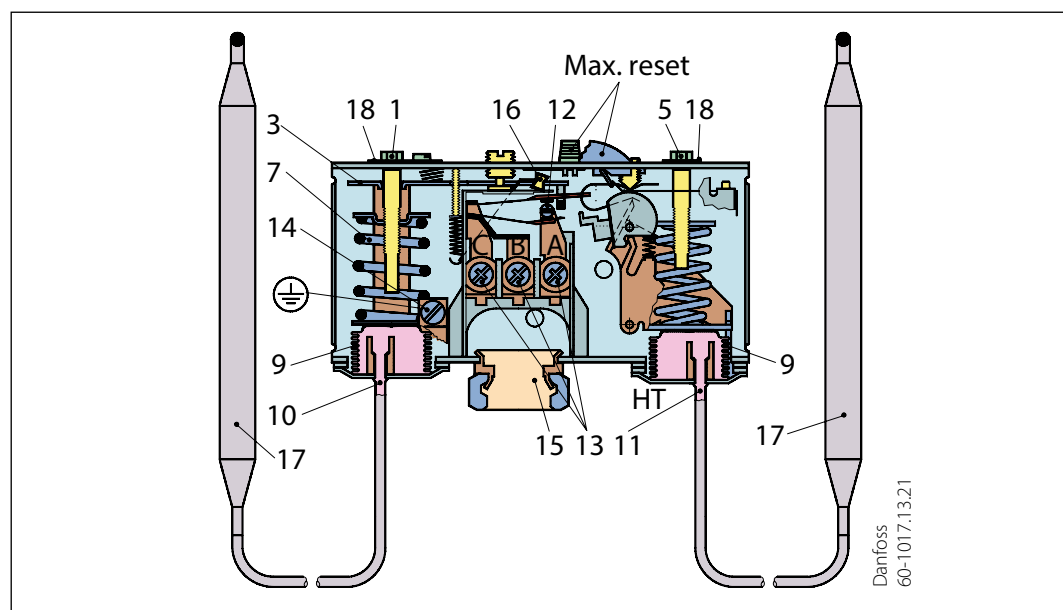
The switch in the KP has a snap-action function and the bellows move only when the cut-in or cut-out value is reached.

*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.

*KP 98, dual thermostat*

1. Temperature setting spindle (OIL)
3. Main arm
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 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 NH<sub>3</sub> 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 manufacturers 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 being dissolved in the oil.

## 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.

### *Reset*

#### 1. Manual reset:

Units with manual reset can only be restarted after the reset button has been activated.  
On min. reset units the set value is equal to the cut-out value for falling temperature.  
On max. reset units the set value is equal to the cut-out value for rising temperature.

#### 2. Automatic reset:

These units are automatically reset after operational stop.

## 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 a 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*

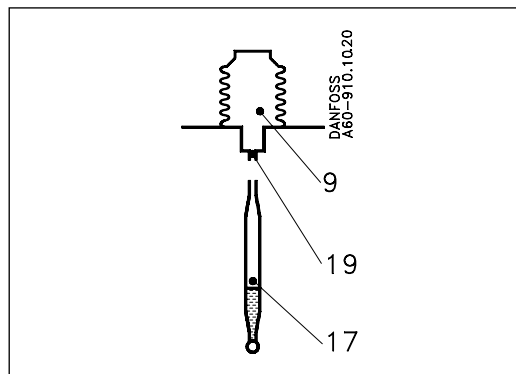
Set the stop temperature on the range scale.

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



9. Bellows element  
17. Sensor (bulb)  
19. Capillary tube

#### Note:

When the sensor is coldest, the ambient temperature has no effect on regulating accuracy.

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.

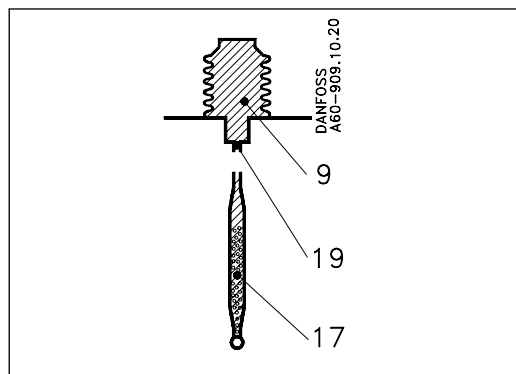
The charge is pressure-limited; a further increase in pressure after evaporation of all the liquid in the sensor (17) will only result in a small pressure increase in the element.

This principle can be utilized in thermostats for low temperature, etc. where evaporation must be able to take place from the free liquid surface in the sensor (within the operating range of the thermostat), and where at the same time, the bellows must be protected against deformation when kept at normal ambient temperatures.

Since the pressure in the element depends on the temperature at the free liquid surface, the thermostat must always be placed so that the sensor is colder than the rest of the thermostatic element.

The evaporated liquid will recondense at the coldest point, i.e. the sensor. Thus, as intended, the sensor becomes the temperature-controlling part of the system.

### 2. Adsorption charge



9. Bellows element  
17. Sensor (bulb)  
19. Capillary tube

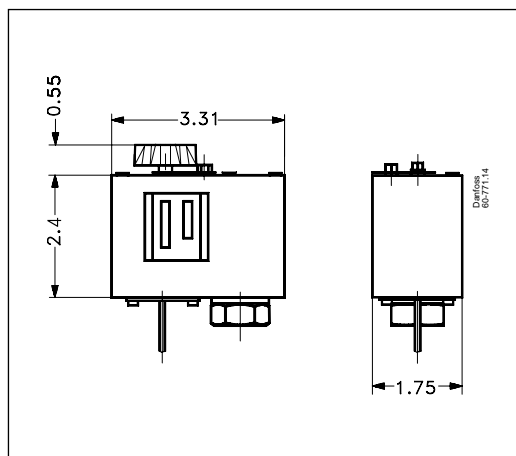
In this case the charge consists partly of a superheated gas and partly of a solid having a large adsorption surface.

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.

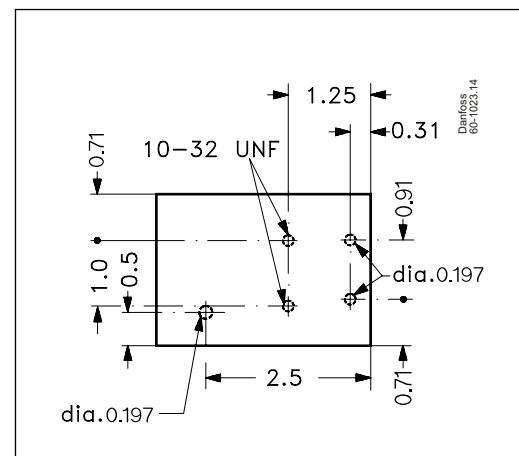
The sensor can be placed warmer or colder than thermostat housing and capillary tube, but variations from 70 °F ambient temperature will influence the scale accuracy.

**Dimensions [in]  
and weights [lbs]**

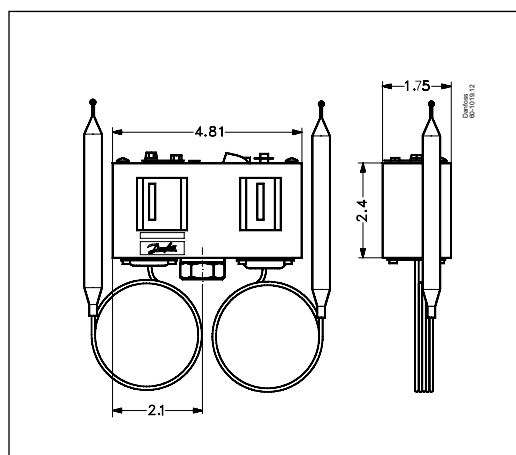
*KP 61 – KP 73*



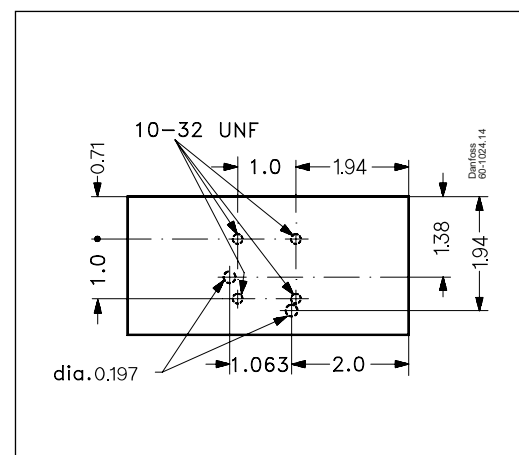
*KP 61 – KP 73 rear side*



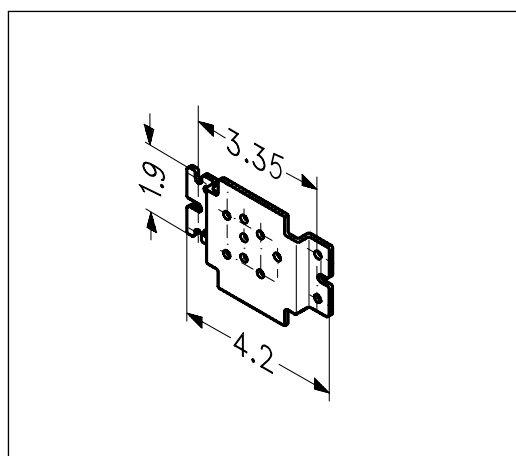
*KP 98*



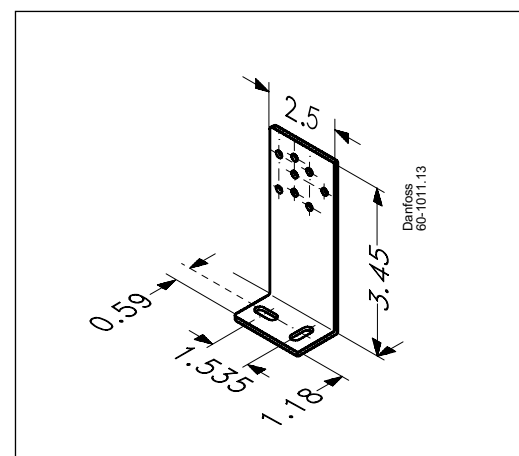
*KP 98 rear side*



*Wall bracket*



*Angle bracket*



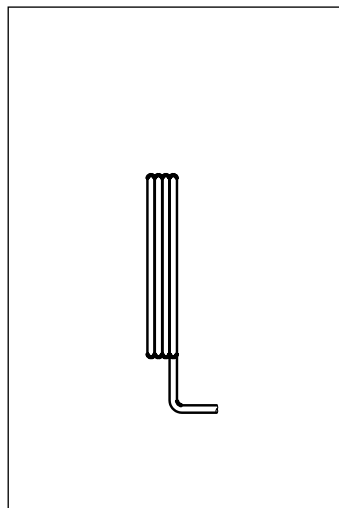
Net weights:  
KP 61 – KP 73: approx. 0.9 lbs  
KP 98: approx. 1.3 lbs



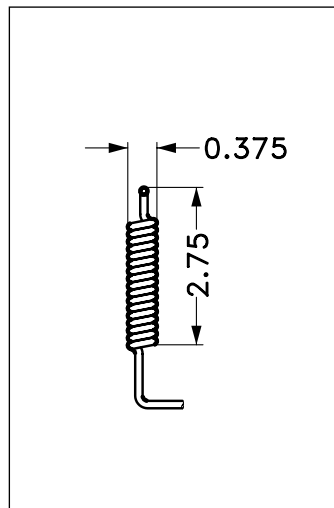
**Data sheet | Thermostat, type KP**

**Dimensions [in]  
and weights [lbs]**  
(continued)

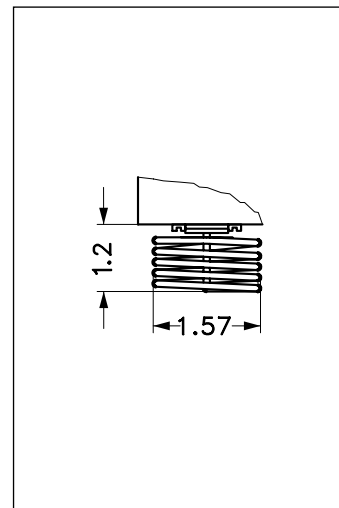
KP 63



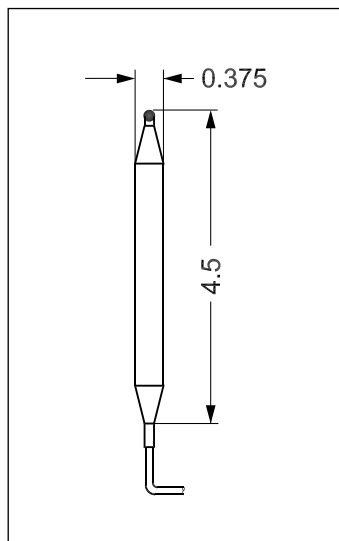
KP 61, KP 79



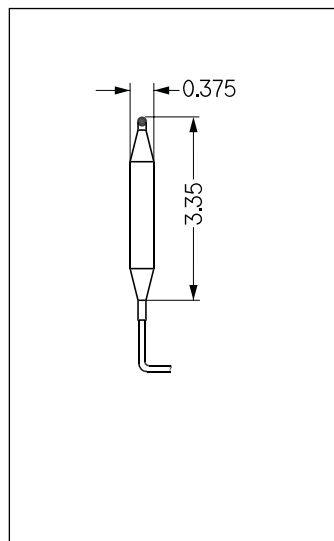
KP 62



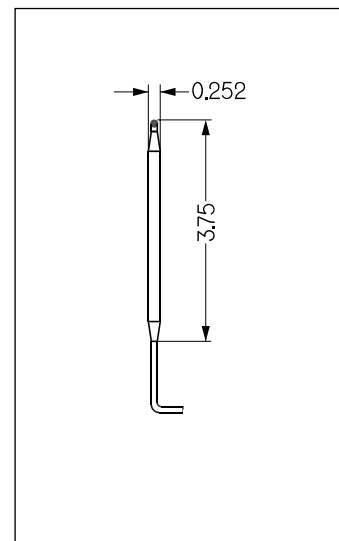
KP 75, KP 98



KP 73


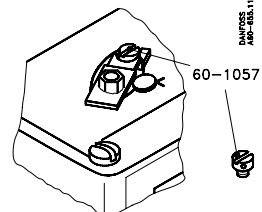
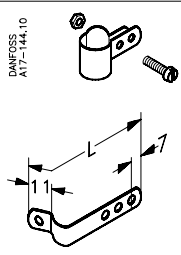
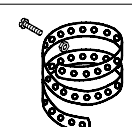
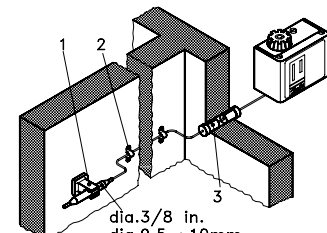
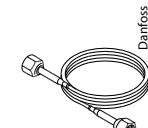


KP 73



*Net weights:  
KP 61 – KP 73: approx. 0.9 lbs  
KP 98: approx. 1.3 lbs*

## Accessories

| Part  | Description                                 | Code no.          |
|---|---|-------------------|
| <b>Bracket<br/>(universal hole pattern)</b>    | Angle bracket                               | <b>060-105366</b> |
| <b>Seal screw (KP only)</b>    | For use when sealing the setting            | <b>060-105766</b> |
| <b>Bulb clamp</b>   | Screw and nut included<br>Lengths = 3 in    | <b>017-420366</b> |
| <b>Clamping band</b>   | Screws and nuts included<br>Lengths = 15 in | <b>017-420466</b> |
| <b>Bulb holder kit</b>   | 1 Bulb holder (1pc.)<br>2 Clamp (4 pcs.)    | <b>017-420166</b> |
| <b>Copper damping coil</b>  <p>with 1/4 in female flare nuts both ends.<br/>For KP pressure switch and MP differential pressure switch</p> | <b>Capillary tube lengths [in]</b>          |                   |
|   | 18  | <b>060-007066</b> |
|   | 36  | <b>060-007166</b> |
|   | 54  | <b>060-007266</b> |

For  
KP pressure switches  
KP thermostats  
MP differential pressure  
switches

## 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 fulfils the international standard in respect of product development, design, production and sale.