ENGINEERING
TOMORROW

Data Sheet

# Thermostat
# Type **KP**

The KP Thermostats are single-pole, double-throw (SPDT) temperature-operated electric switches.

They can be connected directly to a single-phase AC motor of up to approx. 2 kW or installed in the control circuit of DC motors and large AC motors.

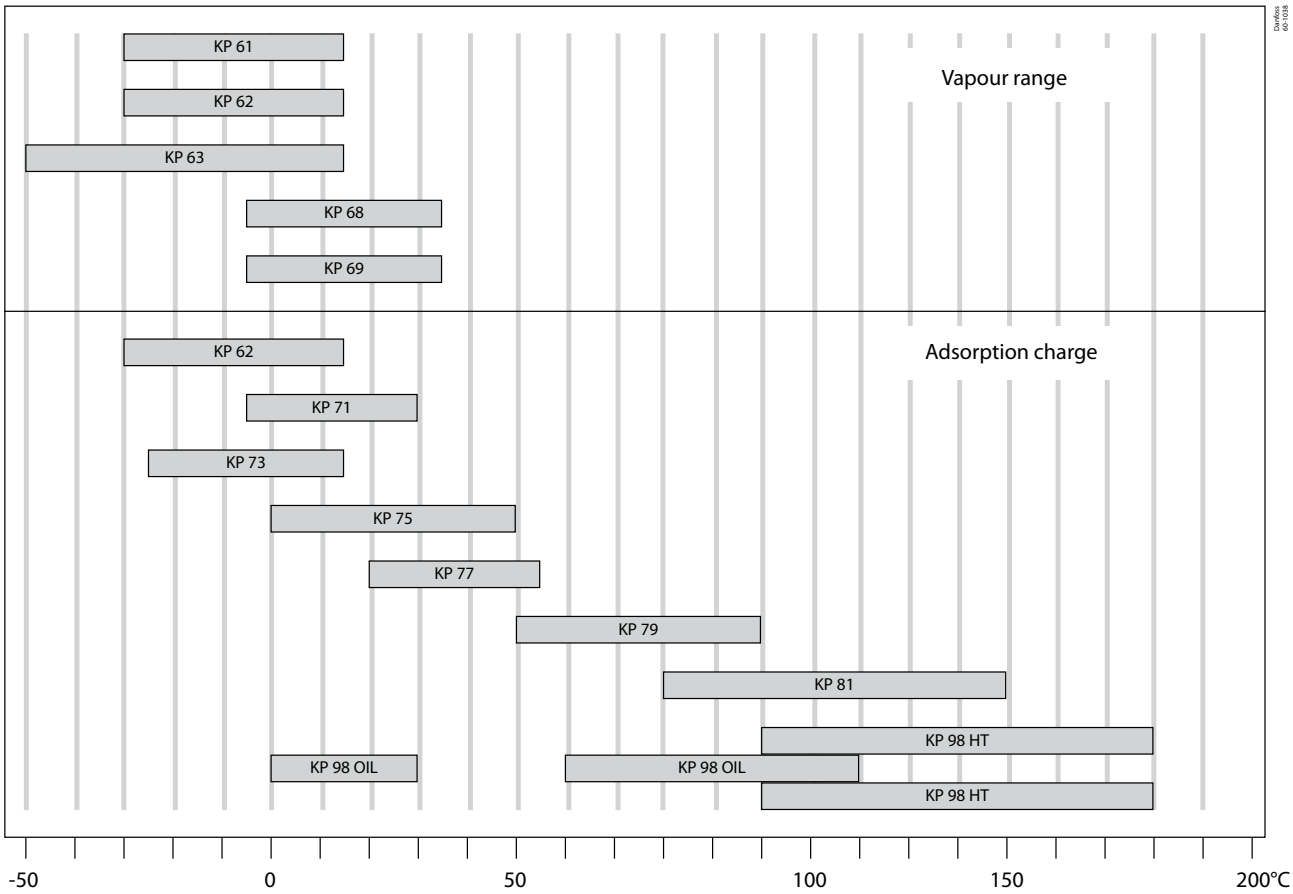
The KP Thermostats are used for regulation, but can also be seen in safety monitoring systems.

They are available with vapour charge or with adsorption charge. With vapour charge the differential is very small. The KP Thermostats with adsorption charge are widely used to give frost protection.

**Features**

- Wide regulating range
- Can be used for deep freeze, refrigeration and air conditioning plant
- Welded bellows elements mean increased reliability
- Small dimensions. Easy to install in refrigerated counters or cold rooms
- Ultra-short bounce times. This gives long operating life, reduces wear to a minimum and increases reliability
- Standard versions with changeover switch. Possible to obtain opposite contact 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
- Cable entry of soft thermoplastic for cables from 6 to 14 mm diameter
- Extensive and wide range

## Portfolio overview



# Product specification

## Technical data

**Table 1: Technical data**

| Features | | Description |
|---|---|---|
| Ambient temperature | | -40 – 65 °C (80 °C for max. 2 hours) |
| Switch | | Single-pole, double-throw (SPDT) changeover switch |
| Contact load | Alternating current | AC1 =16 A, 400 V |
| | | AC3 = 16 A, 400 V |
| | Direct current | DC13: 12 W, 220 V control current |
| Wire dimensions | solid / stranded | 0.75 – 2.5 $mm^2$ |
| | flexible, without ferrules | 0.7 – 2.5 $mm^2$ |
| | flexible, with ferrules | 0.5 – 1.5 $mm^2$ |
| Tightening torque | | max. 2 Nm |
| Rated impulse voltage | | 4 kV |
| Pollution degree | | 3 |
| Short circuit protection, fuse | | 16 A |
| Insulation | | 400 V |
| Enclosure | | IP30 / IP44 |

### Cable connection

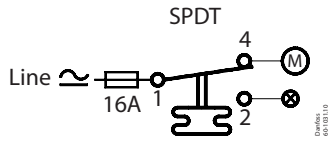
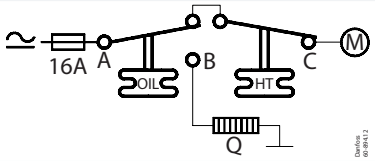
Cable entry for cables 6 – 14 mm dia. A Pg 13.5 screwed cable entry can be used for 6 – 14 mm dia. cables. With 8 – 16 mm cables a standard Pg 16 screwed cable entry can be used.

### Enclosure IP30 to EN 60529 / IEC 529

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.

## Contact systems

**Table 2: Contact systems**

| KP temperature control | KP 98 |
|---|---|
|  |  |





## Terminology

### Differential

The differential is the difference between the make and break temperatures. A differential is necessary for satisfactory automatic operation of the plant.

### 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 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.

Note that the differential depends on the range setting. Therefore, the differential scale must only be used as guideline.

If with low stop temperature settings the compressor will not stop, check whether the differential is set at too high a value!

**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.

## Design and function

**Figure 1: Key sketch of KP thermostat**

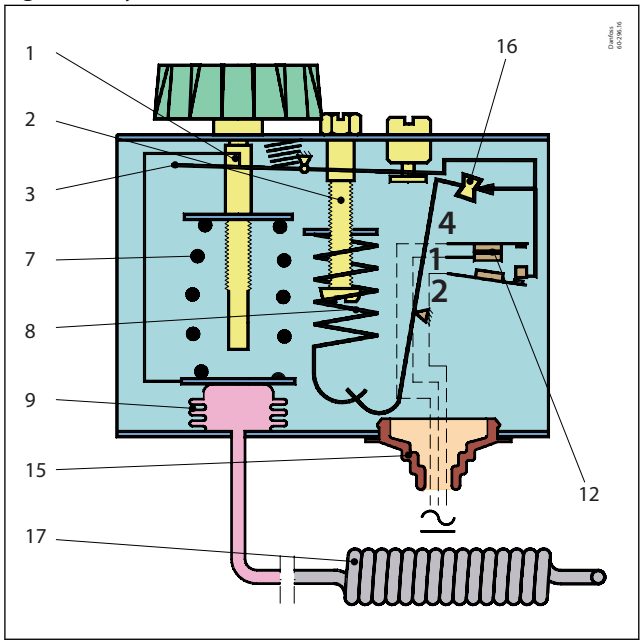



**Figure 2: KP thermostat**

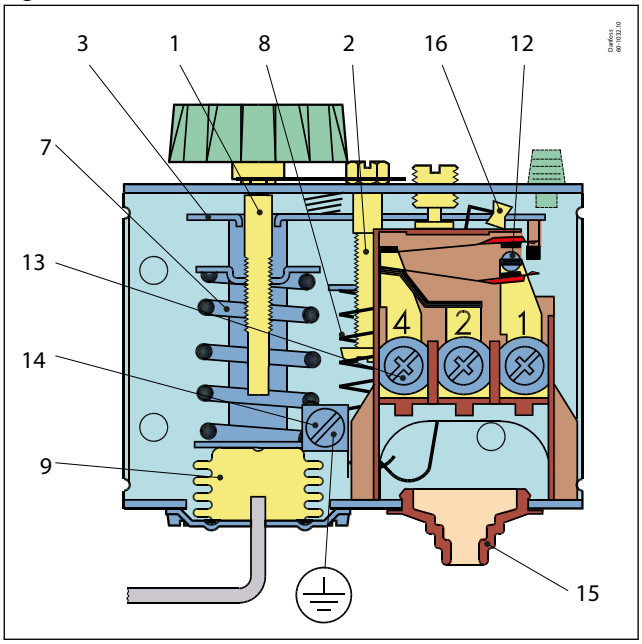


**Figure 3: Adsorption charge**

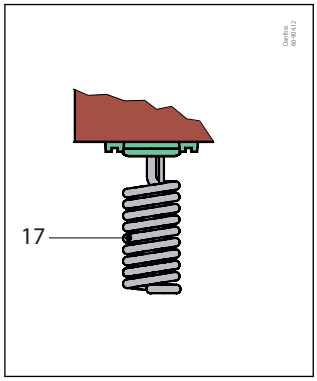



**Figure 4: Vapour charge**

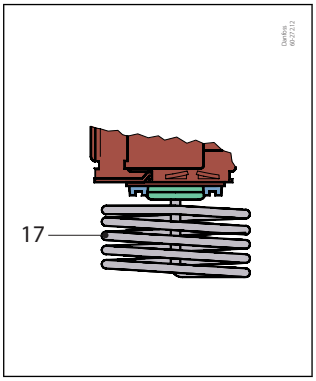



**Figure 5: Adsorption charge**

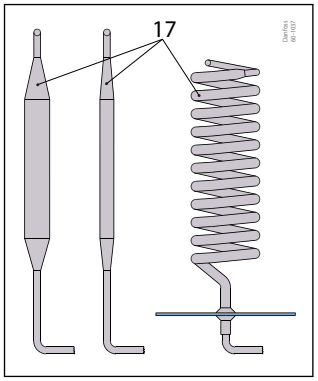
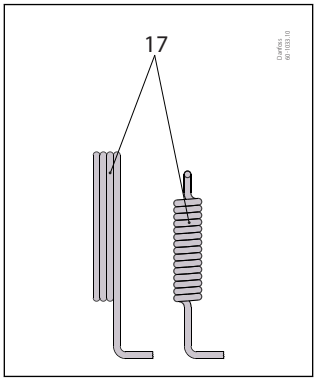



**Figure 6: Vapour charge**




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

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 thermostats affords 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

**Figure 7: KP thermostat, dual type**

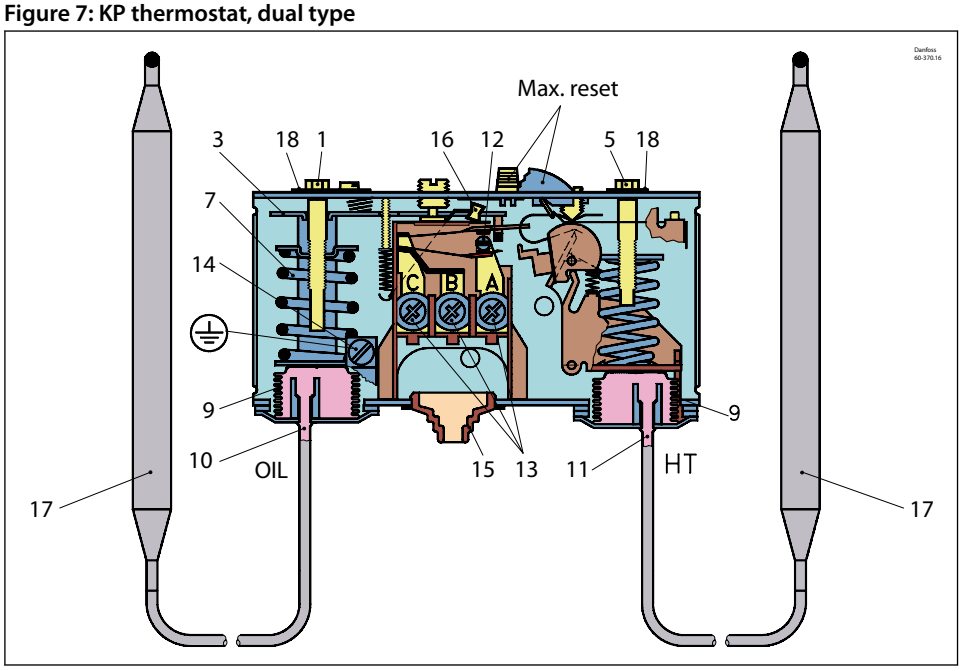
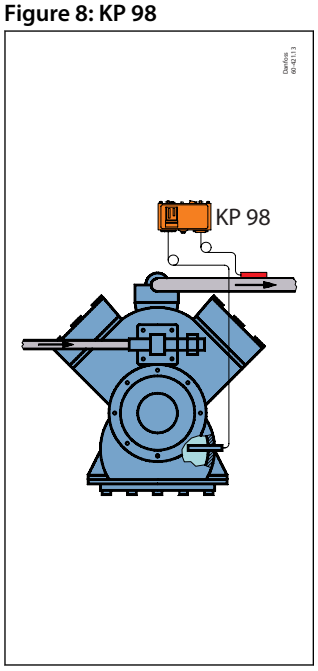



**Figure 8: KP 98**



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

Dual thermostat KP 98 is used to provide protection against excessively 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 NH3 or R22) 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.

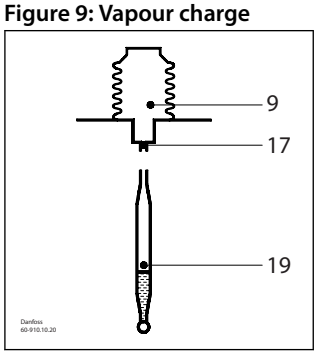
For larger compressors, the sensor can be built into the discharge line.

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

## Charges

### 1. Vapour charge

**Figure 9: Vapour charge**




| | |
|---|---|
| **9** | Bellows element |
| **17** | Sensor (bulb) |
| **19** | Capillary tube |

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.

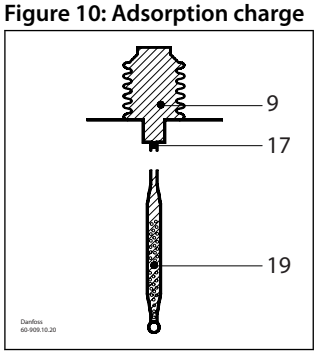
This principle can be utilized in thermostats for low temperature, etc. where evaporation must be able to take place from the free liquid surface in the sensor (within the operating range of the thermostat), and where at the same time, the bellows must be protected against deformation when kept at normal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

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

### 2. Adsorption charge

**Figure 10: 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 20 °C ambient temperature will influence the scale accuracy.

## Dimensions [mm] and weights [kg]

**Figure 11: KP 61 – 81**

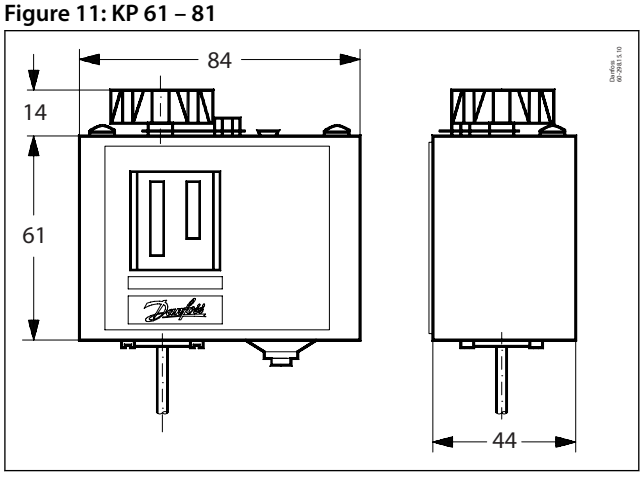



**Figure 12: Mounting holes (back of KP)**

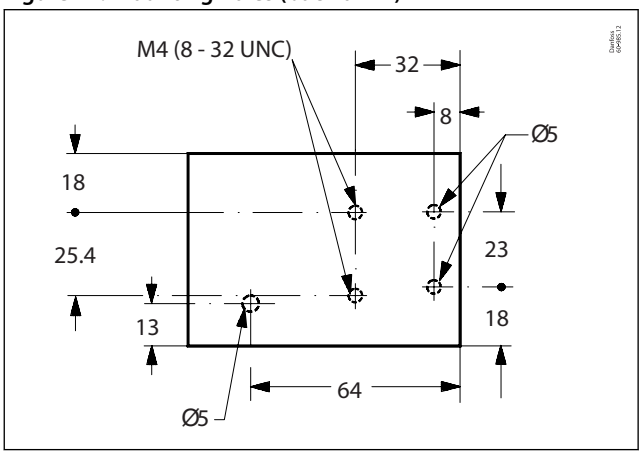



**Figure 13: KP 98**

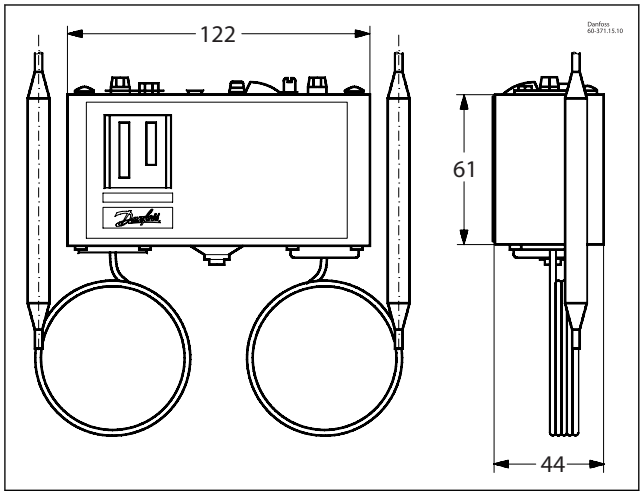



**Figure 14: Mounting holes (back of KP)**

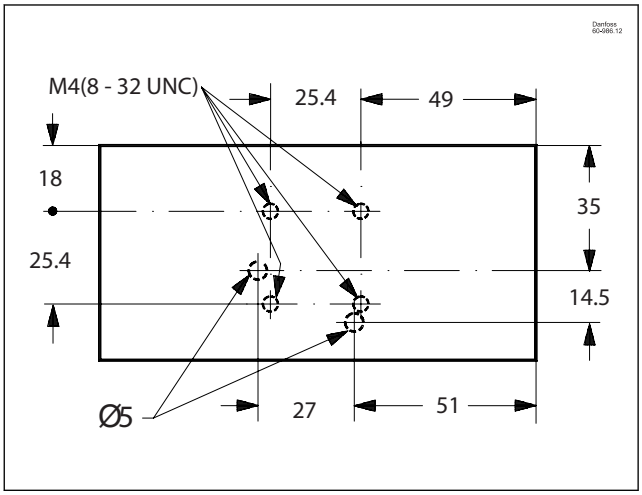


**Figure 15: Wall bracket**

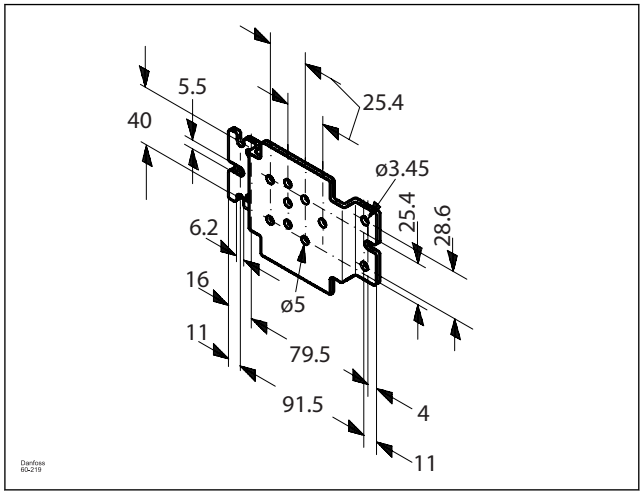



**Figure 16: Angle bracket**

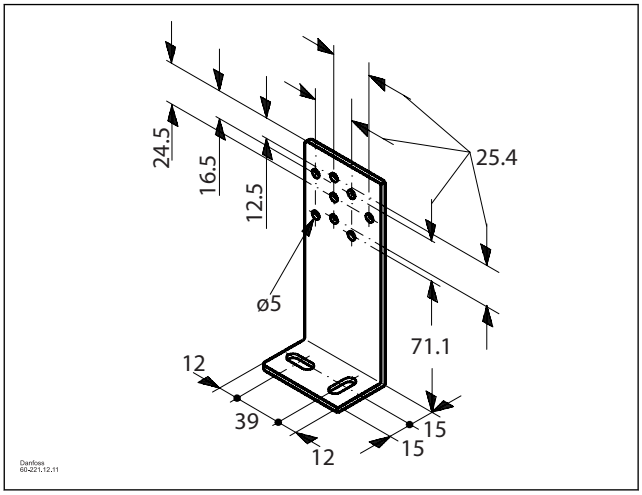



**Figure 17: Thermostat sensor types A, B and C**

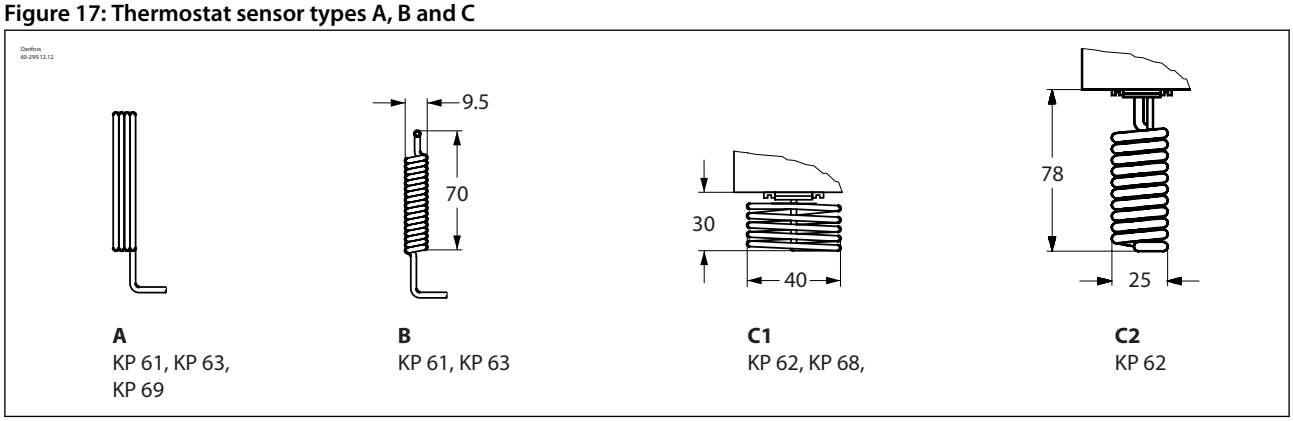
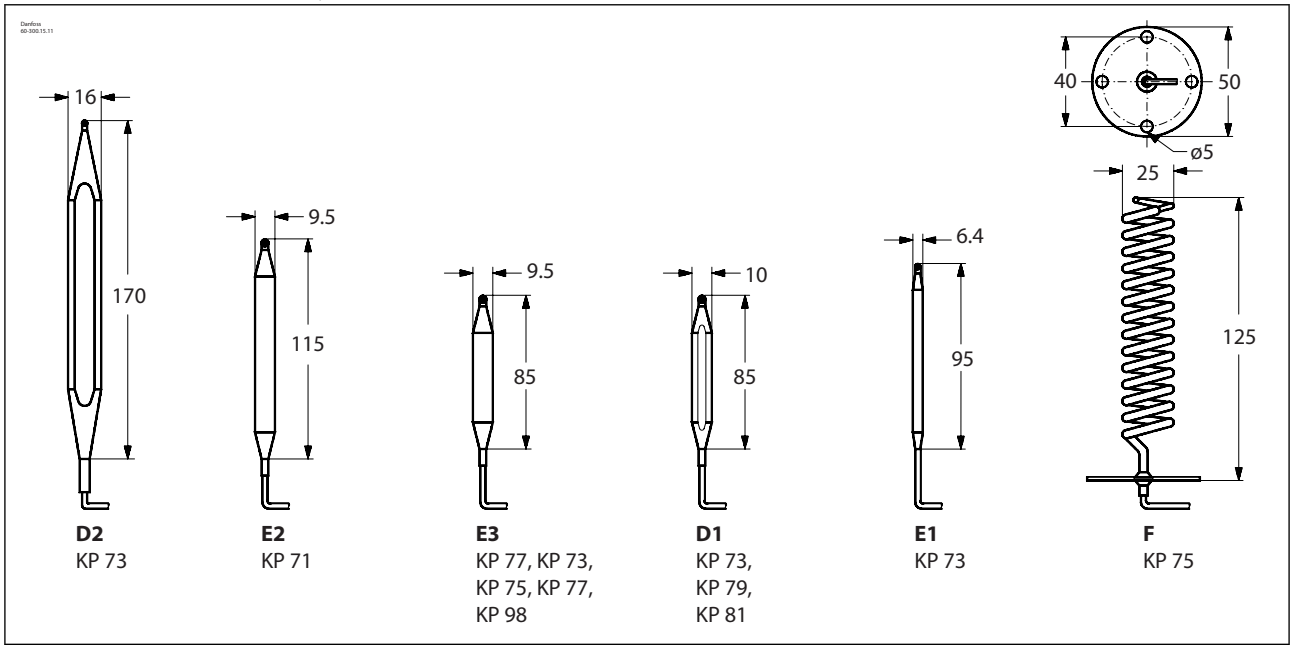



**Figure 18: Thermostat sensor types D, E and F**




## Net weight

- KP 61 - 81: approx. 0.4 kg
- KP 98: approx. 0.6 kg

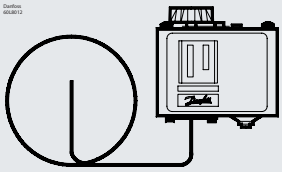
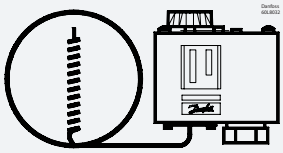
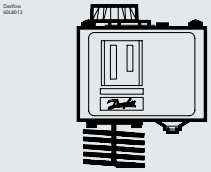
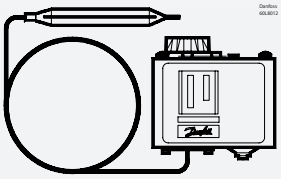
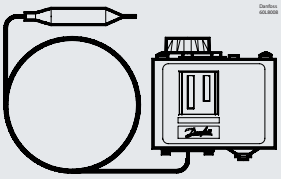
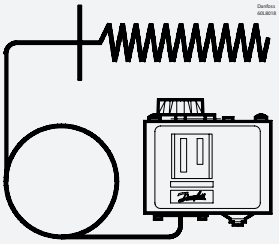
## Ordering

**Table 3: Standard thermostat type KP**

| Charge | Type | Bulb type | Regulating range | Differential Δt | | Reset | Max. bulb temp. | Capillary tube length | Code no. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Lowest temperature | Highest temperature | | | | |
| | | | [°C] | [°C] | [°C] | | [°C] | [m] | |
| Vapour[1] | KP 61 | A | -30 – 15 | 5.5 – 23 | 1.5 – 7 | aut. | 120 | 2 | 060L110066 |
| | KP 61 | A | -30 – 15 | 5.5 – 23 | 1.5 – 7 | aut. | 120 | 5 | 060L110166 |
| | KP 61 | B | -30 – 13 | 4.5 – 23 | 1.2 – 7 | aut. | 120 | 2 | 060L110266 |
| | KP 61 | B | -30 – 15 | 5.5 – 23 | 1.5 – 7 | aut. | 120 | 2 | 060L110366 [3] |
| | KP 61 | B | -30 – 15 | 5.5 – 23 | 1.5 – 7 | aut. | 120 | 2 | 060L112866 [3] [4] |
| | KP 61 | A | -30 – 15 | Fixed 6 | Fixed 2 | min. | 120 | 5 | 060L110466 |
| | KP 61 | B | -30 – 15 | Fixed 6 | Fixed 2 | min. | 120 | 2 | 060L110566 |
| | KP 62 | C 1 | -30 – 15 | 6.0 – 23 | 1.5 – 7 | aut. | 120 | – | 060L110666 |
| | KP 63 | A | -50 – 10 | 10.0 – 70 | 2.7 – 8 | aut. | 120 | 2 | 060L110766 |
| | KP 63 | B | -50 – 10 | 10.0 – 70 | 2.7 – 8 | aut. | 120 | 2 | 060L110866 |
| | KP 68 | C 1 | -5 – 35 | 4.5 – 25 | 1.8 – 7 | aut. | 120 | – | 060L111166 |
| | KP 69 | B | -5 – 35 | 4.5 – 25 | 1.8 – 7 | aut. | 120 | 2 | 060L111266 |
| Adsorbtion [2] | KP 62 | C 2 | -30 – 15 | 5.0 – 20 | 2.0 – 8 | aut. | 80 | – | 060L111066[3] [4] |
| | KP 71 | E 2 | -5 – 20 | 3.0 – 10 | 2.2 –9 | aut. | 80 | 2 | 060L111366 |
| | KP 71 | E 2 | -5 – 20 | Fixed 3 | Fixed 3 | min. | 80 | 2 | 060L111566 |
| | KP 73 | E 1 | -25 – 15 | 12.0 – 70 | 8.0 – 25 | aut. | 80 | 2 | 060L111766 |
| | KP 73 | D 1 | -25 – 15 | 4.0 – 10 | 3.5 – 9 | aut. | 80 | 2 | 060L111866[3] |
| | KP 73 | D 1 | -25 – 15 | Fixed 3.5 | Fixed 3.5 | min. | 80 | 2 | 060L113866 |
| | KP 73 | D 2 | -20 – 15 | 4.0 – 15 | 2.0 – 13 | aut. | 55 | 3 | 060L114066 |
| | KP 73 | D 1 | -25 – 15 | 3.5 – 20 | 3.25 – 18 | aut. | 80 | 2 | 060L114366 |
| | KP 75 | F | 0 – 35 | 3.5 – 16 | 2.5 – 12 | aut. | 110 | 2 | 060L112066 |
| | KP 75 | E 2 | 0 – 35 | 3.5 – 16 | 2.5 – 12 | aut. | 110 | 2 | 060L113766 |
| | KP 77 | E 3 | 20 – 60 | 3.5 – 10 | 3.5 – 10 | aut. | 130 | 2 | 060L112166 |
| | KP 77 | E 3 | 20 – 60 | 3.5 – 10 | 3.5 – 10 | aut. | 130 | 3 | 060L112266 |
| | KP 77 | E 2 | 20 – 60 | 3.5 – 10 | 3.5 – 10 | aut. | 130 | 5 | 060L116866 |
| | KP 79 | E 3 | 50 – 100 | 5.0 – 15 | 5.0 – 15 | aut. | 150 | 2 | 060L112666 |
| | KP 81 | E 3 | 80 – 150 | 7.0 – 20 | 7.0 – 20 | aut. | 200 | 2 | 060L112566 |
| | KP 81 | E 3 | 80 – 150 | Fixed 8 | Fixed 8 | max. | 200 | 2 | 060L115566 |
| | KP 98 | E 2 | OIL: 60 – 120 | OIL: Fixed 14 | OIL: Fixed 14 | max. | 150 | 1 | 060L113166 |
| | | E 2 | HT: 100 – 180 | HT: Fixed 25 | HT: Fixed 25 | max. | 250 | 2 | |

[1] Bulb must always be placed colder than the thermostat housing and capillary tube. The thermostat will then regulate independent of ambient temperature.
[2] Bulb can be placed warmer or colder than thermostat housing and capillary tube, but variations from 20 °C ambient temperature will influence the scale accuracy.
[3] With manual switch, not isolating switch.
[4] Panel mounting model with top plate.

**Table 4: Thermostat bulb types**

| Thermostat bulb types | | Description |
|---|---|---|
| A |  | Straight capillary tube |
| B |  | ø9.5 × 70 mm remote air coil |
| C |  | C1: ø40 × 30 mm air coil<br>C2: ø25 × 67 mm air coil<br>(integral with thermostat) |
| D |  | D1: ø10 × 85 mm double contact remote bulb<br>D2: ø16 × 170 mm double contact remote bulb<br>**NOTE:**<br>Cannot be used in sensor (bulb) pocket |
| E |  | E1: ø6.4 × 95 mm remote bulb<br>E2: ø9.5 × 115 mm remote bulb<br>E3: ø9.5 × 85 mm remote bulb |
| F |  | ø25 × 125 mm remote duct coil |

## Certificates, declarations, and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

Some approvals may change over time. You can check the most current status at danfoss.com or contact your local Danfoss representative if you have any questions.

**Table 5: Certificates, declarations, and approvals**

| Document name | Document type | Document topic | Approval authority |
|---|---|---|---|
| 060-9638.AA | Manufacturers Declaration | China RoHS | Danfoss |
| 060-9650.AD | EU Declaration | LVD/RoHS | Danfoss |
| BV 02281-J0 BV | Marine - Safety Certificate | | BV |
| BV SMS.W.II-2179-B.0 | Marine - Manufacturing Permission | | BV |
| CCC 2003010305069849 | Electrical - Safety Certificate | | CCC |
| DNV GL TAA000026F | Marine - Safety Certificate | | DNV GL |
| LR 17-20046 | Marine - Safety Certificate | | LR |
| RINA ELE-086320XG-001 | Marine - Safety Certificate | | RINA |
| UL E31024 | Electrical - Safety Certificate | | UL |

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