Thermostats, type KP

REFRIGERATION AND
AIR CONDITIONING

Technical leaflet

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Introduction

KP thermostats are single-pole, double-throw (SPDT) temperature-operated electric switches. A KP thermostat can be connected directly to a single-phase alternating current motor of up to approx. 2 kW or installed in the control circuit of direct current motors and large alternating current motors.
KP thermostats are used for regulation, but can also be seen in safety monitoring systems. It is here that the electronic mechanism shows its superiority.
KP thermostats are available with vapour charge or with adsorption charge.
With vapour charge the differential is very small.
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

Approvals

CE-marked in accordance with EN 60947-4/-5 for sale in Europe.

GL, Germanischer Lloyd, Germany

DNV, Det Norske Veritas, Norway

UL approval for USA and Canada

RINA, Registro Italiano Navale, Italy

BV, Bureau Veritas, France

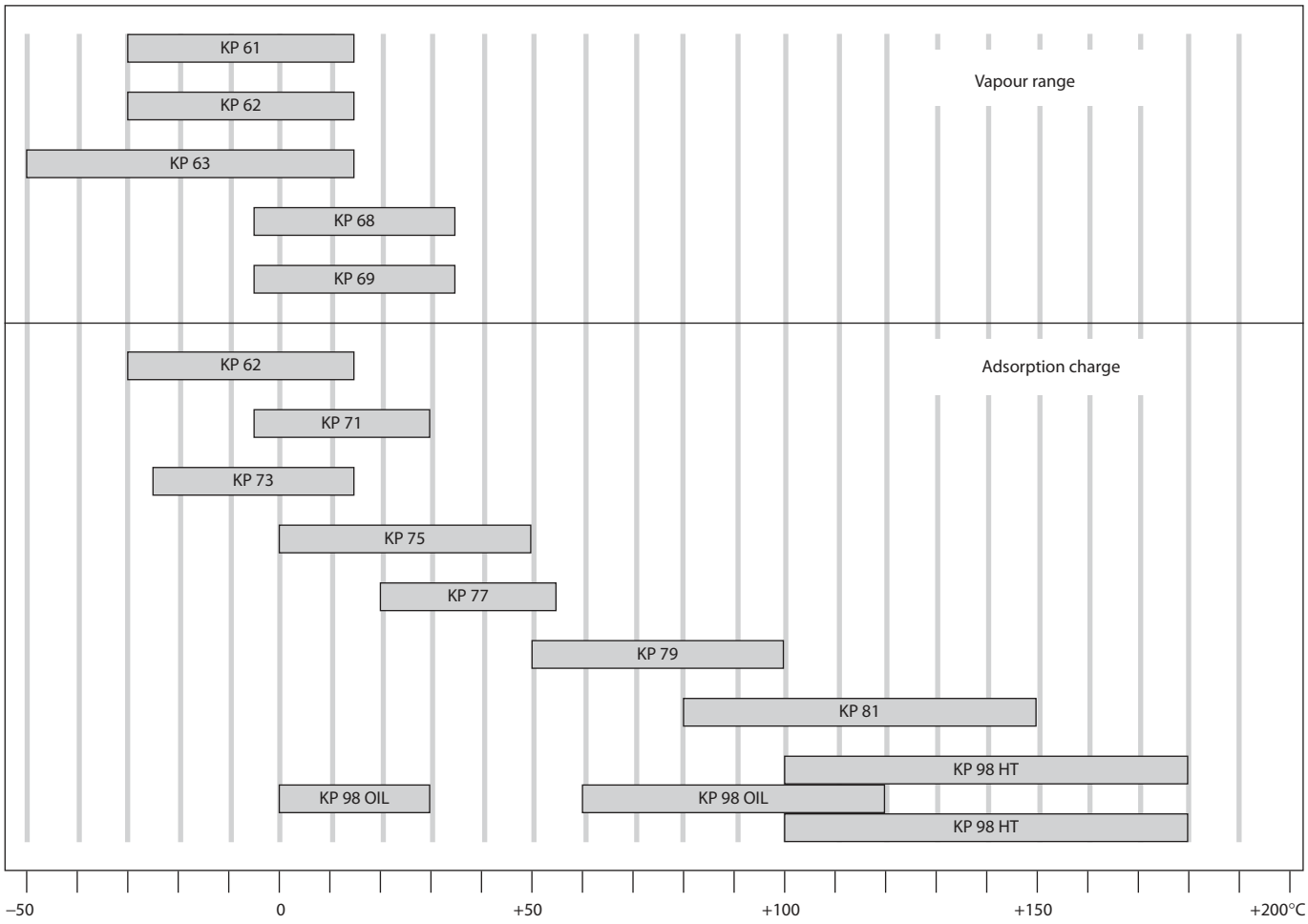
LR, Lloyd's Register, UK

RMRS, Russian Maritime Register of Shipping, Russia

CCC, China Compulsory Certificate

Note: Marine Approvals do not cover KP98 dual thermostat

Regulating range



Technical data

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
AC15: 10 A, 400 V
Max. starting current (L.R.): 112 A, 400 V
Direct current:
DC13: 12 W, 220 V control current

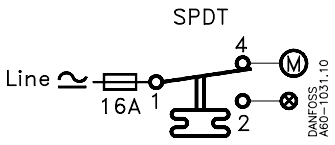
Properties according to EN 60947:

Wire dimensions solid/stranded flexible, w/out ferrules flexible, with ferrules flexible, with ferrules	 0.75 - 2.5 mm² 0.7 - 2.5 mm² 0.5 - 1.5 mm²
Tightning torque Rated impulse voltage Pollution degree Short circuit protection, fuse Insulation IP	max. 2 NM 4 kV 3 10 Amp 400 V 30/44

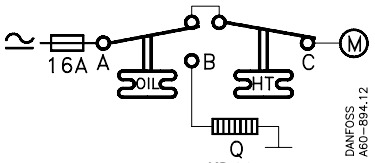
Cable connection
Cable entry for cables 6 → 14 mm dia.
A Pg 13.5 screwed cable entry can be used for 6 → 14 mm dia. cables.
With 8 → 16 mm cables a standard Pg 16 screwed cable entry can be used.

Enclosure
IP 30 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

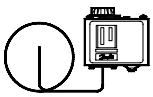


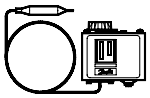
KP thermostats

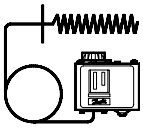


KP 98

Ordering





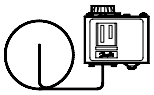
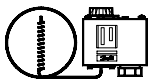
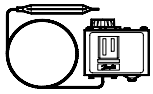
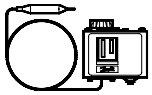
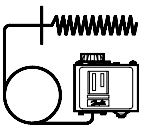


Charge	Type	Bulb type	Setting - range °C	Differential Δt Lowest temperature °C	Differential Δt Highest temperature °C	Reset	Max. bulb temp. °C	Capillary-tube length m	**Code no.**
Vapour [1]	KP 61	A	– 30 → 15	5.5 → 23	1.5 → 7	aut.	120	2	**060L110066**
	KP 61	A	– 30 → 15	5.5 → 23	1.5 → 7	aut.	120	5	**060L110166**
	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**
Adsorb-tion [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	

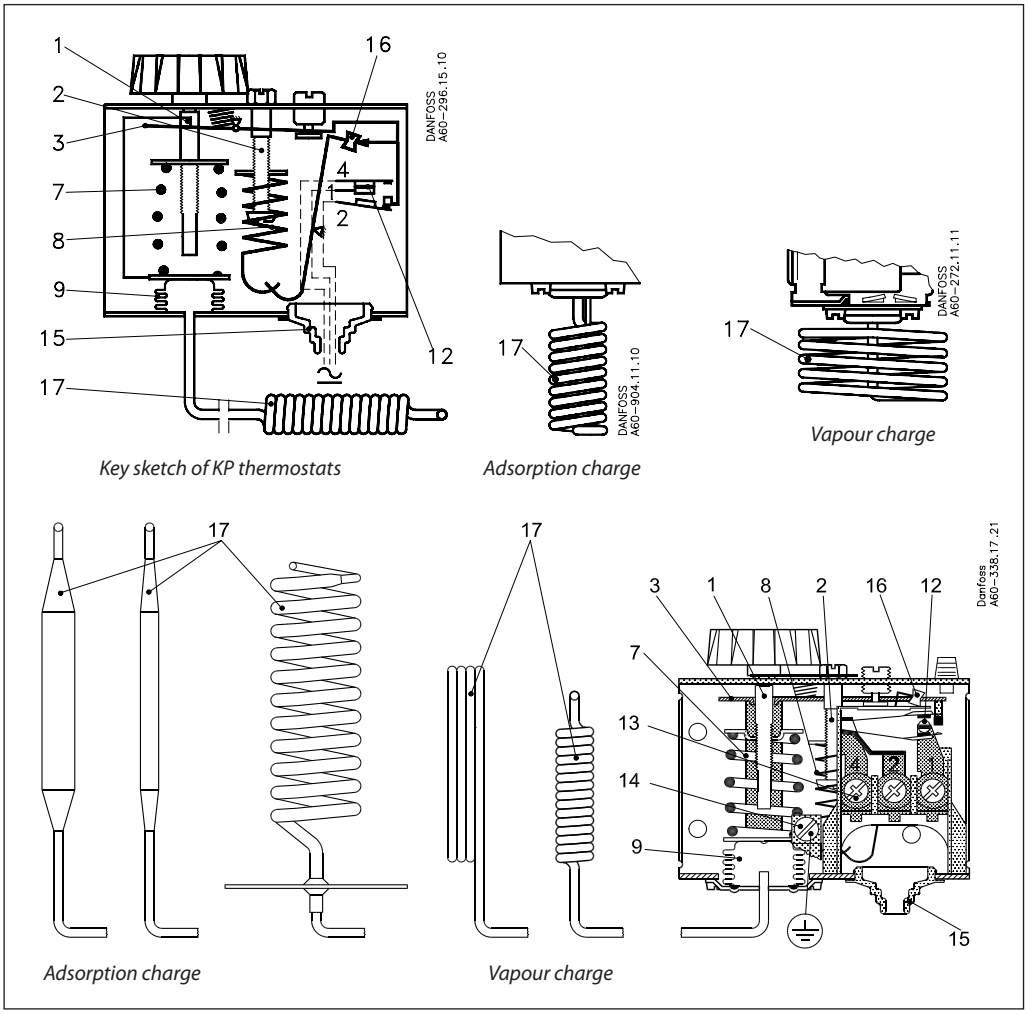
[1]) Bulb must always be placed colder than the thermostat housing and capillary tube. The thermostat will then regulate independent of ambient temperature.
[2]) Bulb can be placed warmer or colder than thermostat housing and capillary tube, but variations from +20°C ambient temperature will influence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

Ordering
(continued)

Thermostat bulb types

A		Straight capillary tube
B		∅ 9.5 × 70 mm remote air coil
C		C1: ∅ 40 × 30 mm air coil C2: ∅ 25 × 67 mm air coil (integral with thermostat)
D		D1: ∅ 10 × 85 mm double contact remote bulb D2: ∅ 16 × 170 mm double contact remote bulb Note! Cannot be used in sensor (bulb) pocket
E		E1: ∅ 6.4 × 95 mm remote bulb E2: ∅ 9.5 × 115 mm remote bulb E3: ∅ 9.5 × 85 mm remote bulb
F		∅ 25 × 125 mm remote duct coil

Design
Function



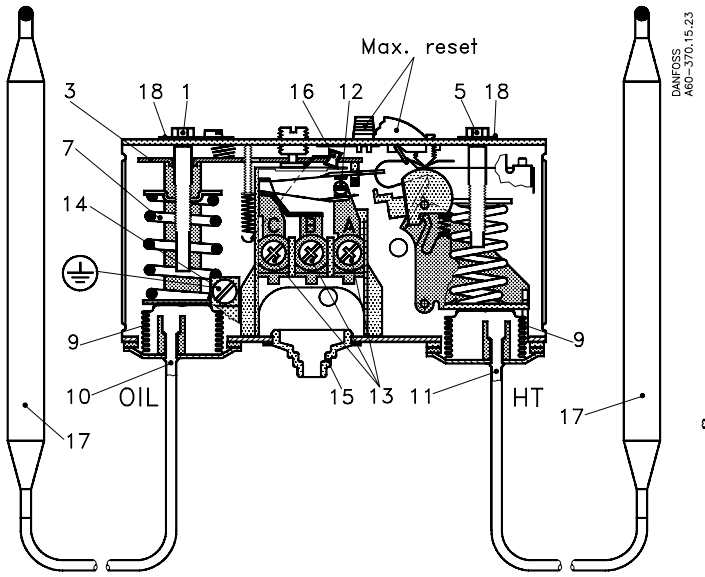
1. Temperature setting spindle
2. Differential setting spindle
3. Main arm
7. Main spring
8. Differential spring
9. Bellows
12. Switch
13. Terminals
14. Earth terminal
15. Cable entry
16. Tumbler
17. Sensor

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 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.

Design
Function
(continued)



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 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 NH_3 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.

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

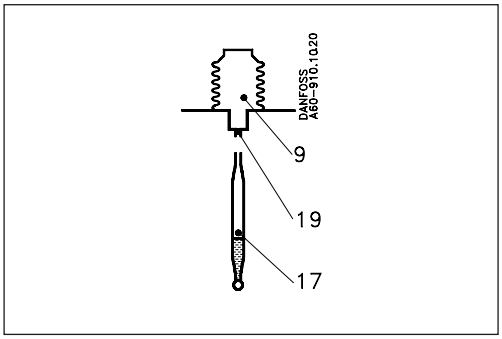
Thermostats with automatic reset
Set the upper activating temperature on the range scale.
Set the differential on the "DIFF" scale.
The temperature setting on the range scale will then correspond to the temperature at which the refrigeration compressor will be started on rising temperature. The compressor 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.

Charges

1. Vapour charge



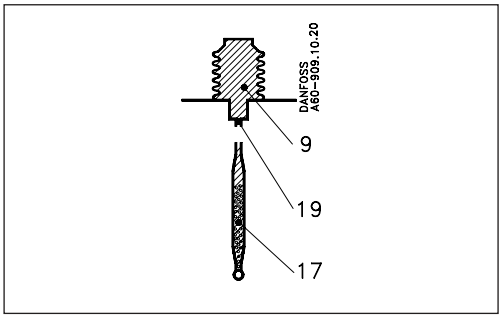
9. Bellows element
17. Sensor (bulb)
19. Capillary tube

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

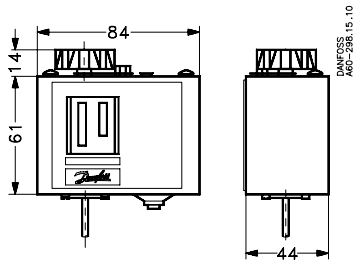


9. Bellows element
17. Sensor (bulb)
19. Capillary tube

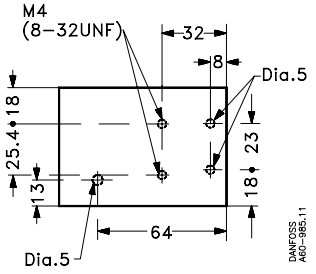
In this case the charge consists partly of a superheated gas and partly of a solid having a large adsorption surface.
The solid is concentrated in the sensor (17) and it is therefore always the sensor that is the temperature-controlling part of the thermostatic element.
The sensor can be placed warmer or colder than thermostat housing and capillary tube, but variations from +20°C ambient temperature will influence the scale accuracy.

Dimensions and weights

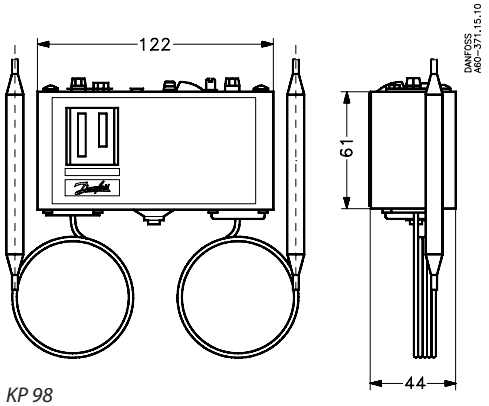
Weight
KP 61-81: approx. 0.4 kg
KP 98: approx. 0.6 kg



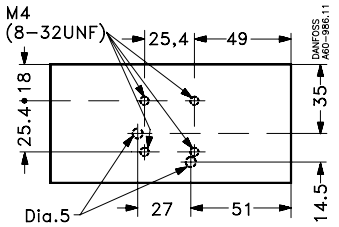
KP 61-81



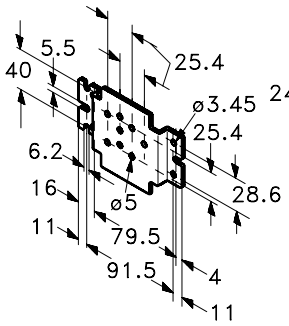
Mounting holes (back of KP)



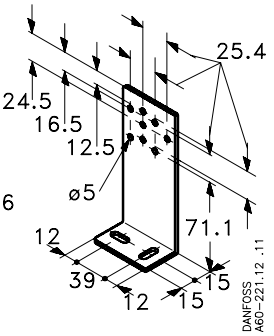
KP 98



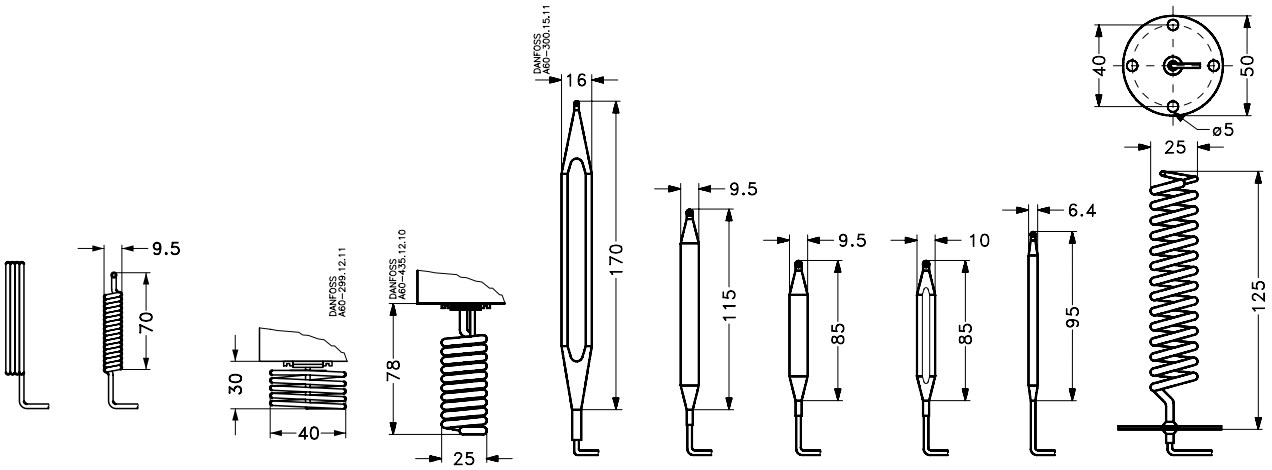
Mounting holes (back of KP)



Wall bracket



Angle bracket



A:
KP 61,
KP 63

B:
KP 61,
KP 63,
KP 69

C1:
KP 62,
KP 68

C2:
KP 62

D2:
KP 73

E2:
KP 71

E3:
KP 77
KP 73
KP 75
KP 77
KP 98

D1:
KP 73
KP 79
KP 81

E1:
KP 73

F:
KP 75