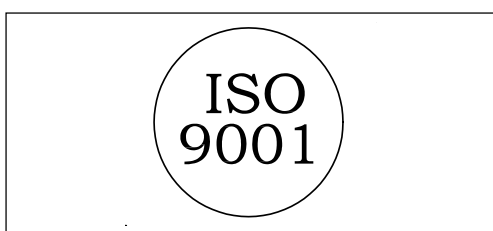


## Pressure controls and thermostats types KPI and KP

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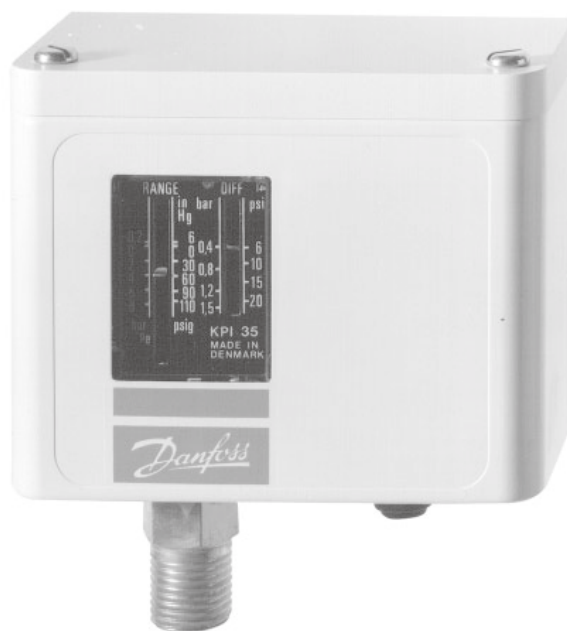
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ISO 9001 quality approval



Danfoss A/S is certified by BSI in accordance with international standard ISO 9001. This means that Danfoss fulfils the international standard in respect of product development, design, production and sale. BSI exercises continuous inspection to ensure that Danfoss observes the requirements of the standard and that Danfoss' own quality assurance system is maintained at the required level.

KP/KPI  
illustrated is KPI 35  
with top cover



**Introduction**

Danfoss KP/KPI pressure controls are used for regulating, monitoring and alarm systems in industry.  
 KP pressure controls are for gaseous media and air.  
 KPI pressure controls are suitable for plant in connection with liquid and gaseous media.

The pressure controls are fitted with a single-pole switch changeover (SPDT). The position of the switch depends on the setting of the pressure control and the pressure in the connector.

**Features**

- Wide regulating range
- Can be used for pumps and compressors
- Small dimensions.  
Space-saving – easy to install in panels
- Shock and impact resistant
- Ultra-short bounce times.  
Limits wear to an absolute minimum and increases reliability
- Electrical connection from front of unit.  
Makes rack mounting easier and also saves space
- Suitable for both alternating current and direct current
- Cable entry for 6-14 mm diameter cables
- Screwed cable entry makes rewiring easy.  
Standard screwed cable entry  
Pg 13.5 and Pg 16

**Definitions**

*Range setting*  
 The pressure range within which the unit will give a signal (contact changeover).

*Differential*  
 The difference between contact changeover on rising and falling pressure.  
 The differential is a condition for stable automatic plant operation.

*Automatic reset*  
 Units with automatic reset restart automatically after stop.  
 Min. reset units will restart after the pressure **has risen** by a value greater than that of the fixed differential.  
 Max. reset units will restart after the pressure **has fallen** by a value greater than that of the fixed differential

*Permissible operating pressure*  
 The highest permissible constant pressure or pressure variation the unit can be exposed to.

Ordering, IP 33/44 versions Pressure controls **type KP 35 and 36**

Setting range $p_e$ [bar]	Differential [bar]	Permissible operating pressure $p_B$ [bar]	Max. test pressure [bar]	Pressure connection	Contact Material	Code no.	Type
-0.2 → 7.5	0.7 → 4	17	22	G 1/4 A	Ag	<b>060-1133</b>	KP 35
					Au	<b>060-5047</b>	
2 → 14	0.7 → 4	17	22	G 1/4 A	Ag	<b>060-1108</b>	KP 36
					Au	<b>060-1137</b>	
4 → 12	0.5 → 1.6	17	22	G 1/4 A	Ag	<b>060-1221</b>	KP 36
					Au	<b>060-1144</b>	

Ordering, IP 33/44 versions Pressure controls **type KPI 35 - 38**

Setting range $p_e$ [bar]	Differential [bar]	Permissible operating pressure $p_B$ [bar]	Max. test pressure [bar]	Pressure connection	Contact Material	Code no.	Type
-0.2 → 8	0.4 → 1.5	18	18	G 1/4 A	Ag	<b>060-1217</b>	KPI 35
					Au	<b>060-3164</b>	
-0.2 → 8	0.5 → 2	18	18	G 1/4 A	Ag	<b>060-1219</b>	KPI 35
					Au	<b>060-3165</b>	
4 → 12	0.5 → 1.6	18	18	G 1/4 A	Ag	<b>060-1189</b>	KPI 36
					Au	<b>060-1138</b>	
2 → 12	0.5 → 1.6	18	18	G 1/4 A	Ag	<b>060-3169</b>	KPI 36
					Au	<b>060-3166</b>	
8 → 28	1.8 → 6	30	30	G 1/4 A	Ag	<b>060-5081</b>	KPI 38
					Au	<b>060-3167</b>	

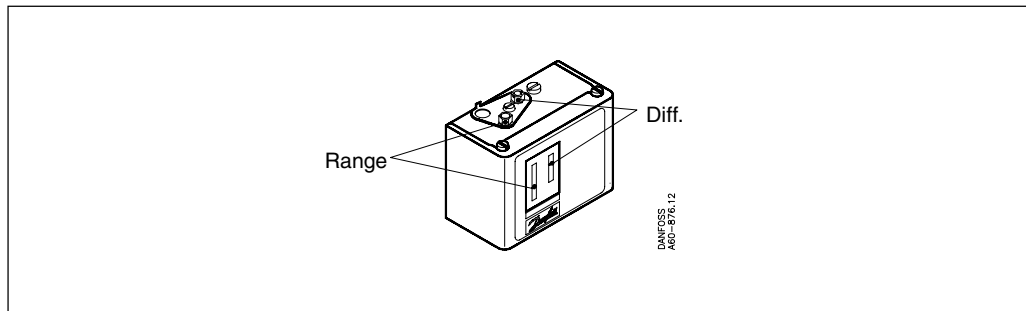
**Technical data**

Description		KP	KPI	
Ambient temperature °C		-40 °C - +65 °C (for short periods up to +80 °C)		
Media temperature °C		-40 °C - +100 °C		
Media		Gaseous media and air	Air, oil, fresh water	
Parts in contact with medium	Bellows	Tinbronze W. no. 2.1020 to DIN 17662	Tinbronze W. no. 2.1020 to DIN 17662	
	Pressure connector	Free-cutting steel W. no. 1.0719 to DIN 1651	Brass W. no. 2.0401 to DIN 17660	
Contact system		Single-pole changeover switch (SPDT) <div style="text-align: right;"> </div>		
Contact load, Ag contact set	<b>Alternating current:</b> AC-1: 16 A, 400 V AC-3: 16 A, 400 V AC-15: 10 A, 400V		<b>Alternating current:</b> AC-1: 10 A, 440 V AC-3: 6 A, 440 V AC-15: 4 A, 440V	
Contact material AgCdO	<b>Direct current:</b> DC-13: 12 W, 220 V		<b>Direct current:</b> DC-13: 12 W, 220 V	
Contact load, Au contact set	See information page 6			
Enclosure, IP 33 grade	Unit must be mounted on a flat surface/a flat fitting and all unused holes covered.			
Enclosure, IP 44 grade	Mounted as IP 33 plus fitting of top cover, code no. <b>060-1097</b>			
Cable connection	Entry for 6-14 mm diameter cables			
Mounted on back plate/wall bracket	Vibration proof in the range 0 - 1000 Hz, 4 g (1 g = 9.81 m/s <sup>2</sup> )			
Mounted on angle bracket	Not recommended in areas where vibrations occur			
Approvals	EN 60 947-4,5 RINA, Registro Italiano Navale MRS, Maritime Reg. of Shipping, Russia UL approved versions are available		EN 60 947-4,5	

**Setting**

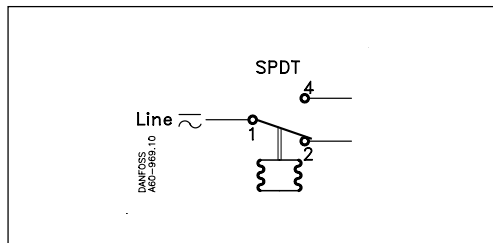
*KP/KPI pressure controls with automatic reset:*  
Set the upper limit pressure on the range

scale. Then set the lower limit pressure on the DIFF scale (the upper limit minus the differential).

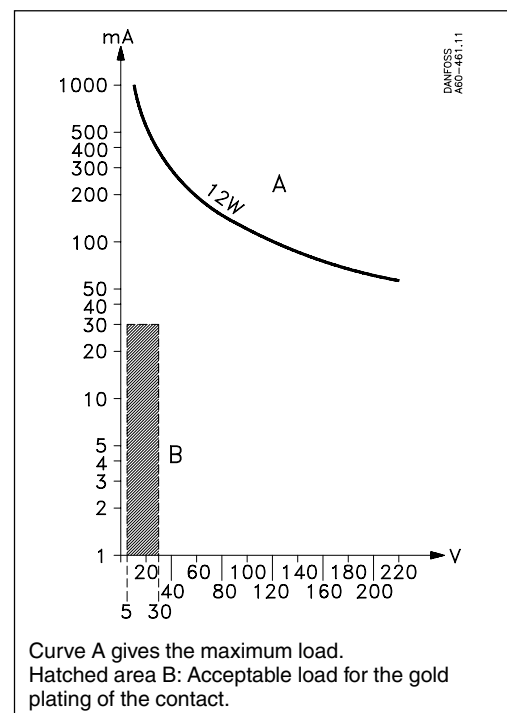


**Gold contacts**

*Contact system*  
Single-pole changeover switch (SPDT)  
Contact material: Gold-plated silver

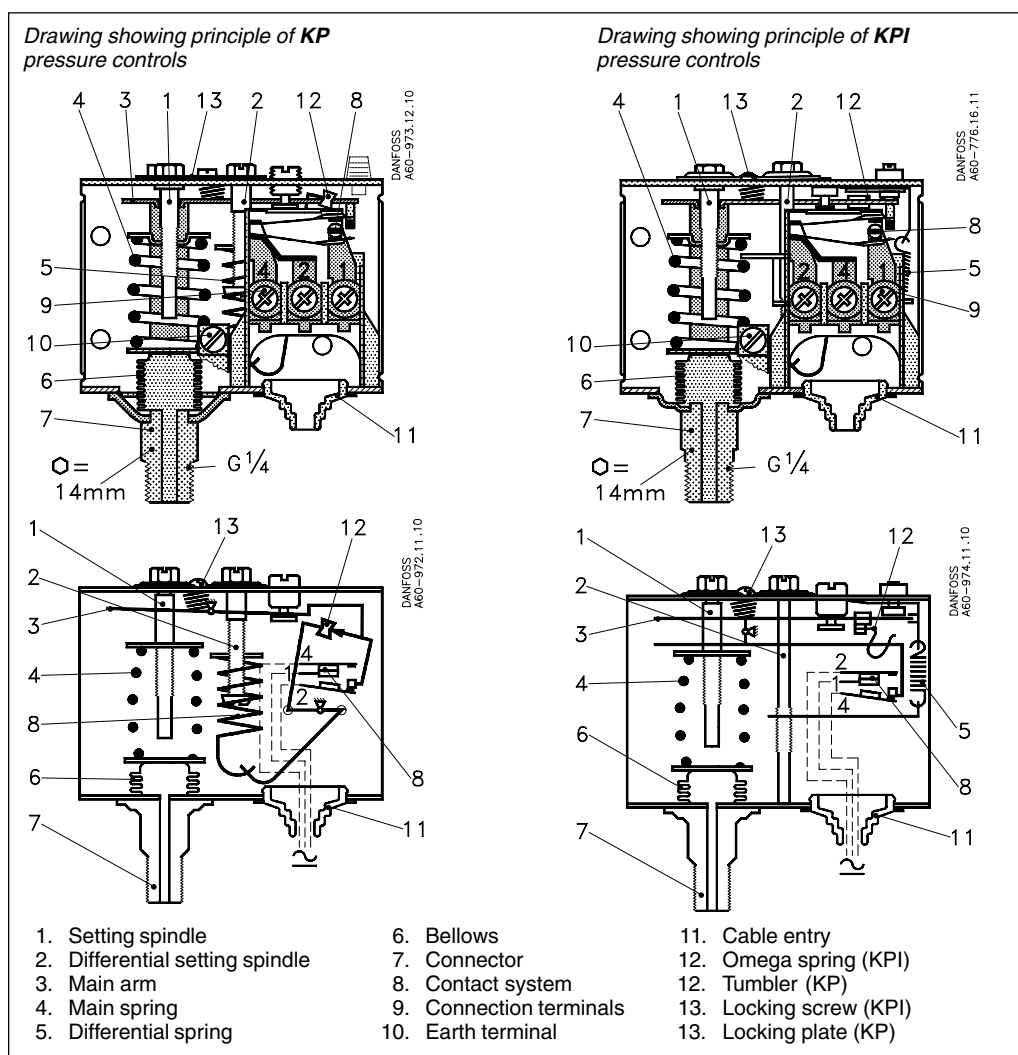


*Contact load*  
Alternating current:  
Ohmic load: AC-1: 10 A, 440 V  
Inductive load: AC-3: 6 A, 440 V  
AC-15: 4 A, 440 V  
Direct current: DC-1312 W, 220 V,



Curve A gives the maximum load.  
Hatched area B: Acceptable load for the gold plating of the contact.

Design and function



KP features

The contact system in KP pressure controls has a snap function. This means that the bellows is active only when the cut-in or cut-out value is reached. The bellows is connected to the pressure of the controlled plant via the connector (7).

The design of KP pressure controls gives the following advantages:

- High contact load
- Ultra-short bounce times
- Vibration-proof in the range 0-1000 Hz, 4 g (1 g = 9.81 m/s<sup>2</sup>)
- Long operating life
- High pulsation protection
- Small dimensions – Easy to mount in panels

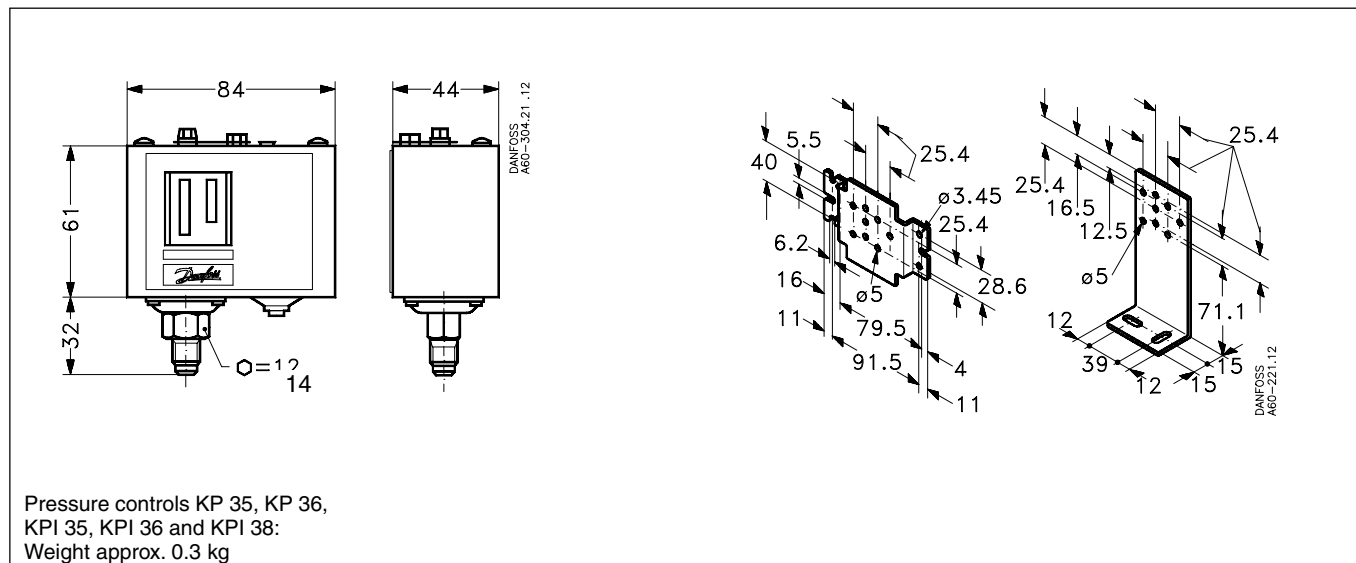
KPI features

Danfoss KPI pressure controls are designed so that the bellows moves in the same proportion as the pressure change. To ensure a snap function on contact change-over, an omega spring is located between bellows and contact system.

The design of KPI pressure controls gives the following advantages:

- High contact load
- Ultra-short bounce times
- Vibration-proof in the range 0-1000 Hz, 4 g (1 g = 9.81 m/s<sup>2</sup>)
- Long operating life
- Can be used for both liquids and gases
- Small dimensions – Easy to mount in panels

Dimensions and weights



Accessories for KP/KPI pressure controls

Part	Symbol	Description	Total	Code no.
Brackets with mounting screws and washers		Wall bracket	10	<b>060-1055</b>
		Angle bracket	10	<b>060-1056</b>
		4-off screws M4x5 + 4-off washers	1	<b>060-1054</b>
Screwed cable entry		Screwed cable entry Pg 13.5 with special nut. For 6-14 mm cables. A standard Pg 16 screwed cable entry can be used for 8-16 mm cables.	5	<b>060-1059</b>
Sealing screw		For sealing the setting on KP	20	<b>060-1057</b>
Top cover		If a bracket is mounted on the backplate of the housing, the KP/KPI pressure control will have an IP 44 grade of enclosure. The cover covers the setting spindles.	10	<b>060-1097</b>
Protective cap		Protective cap for KP/KPI pressure controls. To protect the unit against rain and humidity. Grade of enclosure: IP 44 Material: Polyethylene Max. ambient temperature: 65 °C Min. ambient temperature: -40 °C	7	<b>060-0031</b>





**Introduction**

Danfoss dual pressure switch KP 44 is designed for use as a pump guard to control and protect supply water pumps. The KP 44 pump guard combines the function of a pressure switch and a flow monitoring device.

The lefthand pressure bellows controls the pump pressure. The righthand bellows cuts out the pump if the pump suction pressure is too low. In this way the pump is protected from running dry and consequent bearing damage.

**Features**

- Wide regulating range
- Can be used for pumps and compressors
- Small dimensions. Space-saving – easy to install in panels
- Ultra-short bounce times. Limits wear to an absolute minimum and increases reliability
- Electrical connection from front of unit. Makes rack mounting easier and also saves space
- Suitable for both alternating current and direct current
- Cable entry for 6-14 mm diameter cables
- Screwed cable entry makes rewiring easy. Standard screwed cable entry Pg 13.5 and Pg 16
- Efficient protection of water pumps in case of water supply fails.

**Definitions**

*Range setting*  
The pressure range within which the unit will give a signal (contact changeover).

*Differential*  
The difference between contact changeover on rising and falling pressure. The differential is a condition for stable automatic plant operation.

*Automatic reset*  
Units with automatic reset restart automatically after stop.

Min. reset units will restart after the pressure **has risen** by a value greater than that of the fixed differential.

Max. reset units will restart after the pressure **has fallen** by a value greater than that of the fixed differential

*Permissible operating pressure*  
The highest permissible constant pressure or pressure variation the unit can be exposed to.

Ordering

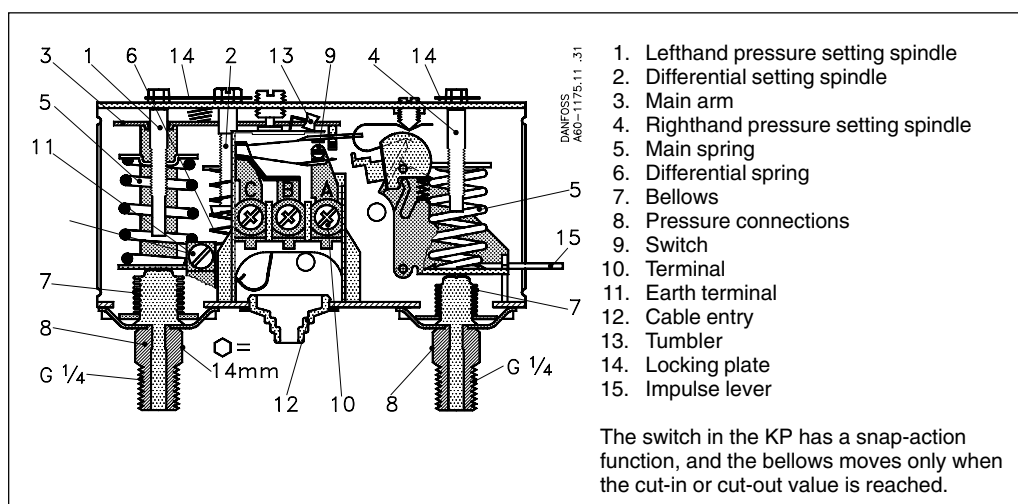
Pressure control type KP 44, IP 22

Pressure range		Differential		Permissible operating pressure $p_B$	Max. test pressure	Pressure connection	Contact Material	Code no.
Control [bar]	Safety [bar]	Control [bar]	Safety [bar]					
2 - 12	0.5 - 6	0.7 - 4.0	1.0	LP/HP: 17	22	2 × G 1/4 A	Ag	<b>060-0013</b>

Technical data

Ambient temperature °C	-40 °C - +65 °C (for short periods up to +80 °C)	
Media temperature °C	Max +100 °C	
Media	Fresh water	
Parts in contact with medium	Bellows	Tinbronze W. no. 2.1020 to DIN 17662
	Pressure connector	Free-cutting steel W. no. 1.0719 to DIN 1651
Contact material AgCdO	<b>Alternating current:</b> AC-1: 16 A, 400 V AC-3: 16 A, 400 V AC-15: 10 A, 400V	
Contact load, Ag contact set	<b>Direct current:</b> DC-13: 12 W, 220 V	
Approvals	EN 60 947-4,-5	
Cable connection	Entry for 6-14 mm diameter cables	
Mounted on backplate or wall bracket	Vibration-proof in the range 0 - 1000 Hz, 4 g (1 g = 9.81 m/s <sup>2</sup> )	
Mounting on angle bracket	Not recommended for areas where vibration occurs	

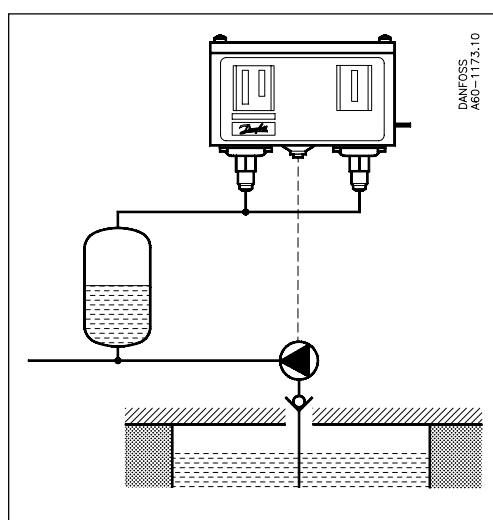
Design and function



**Water supply from reservoir or well**

If water is running short in the well or reservoir, the pump will no longer be able to increase the pressure to the cut-out value. Consequently the pump will keep running - perhaps without water. However, the KP 44 pump guard will stop the pump as soon as the righthand bellows pressure drops below the safety cut-out setting.

The pump can be started again by lifting the impulse lever. The pump will continue to operate when the impulse lever is released, provided that the righthand bellows pressure is higher than the safety cut-out setting plus a fixed differential of 1 bar. If this is not the case, the pump will cut-out again indicating insufficient water supply.



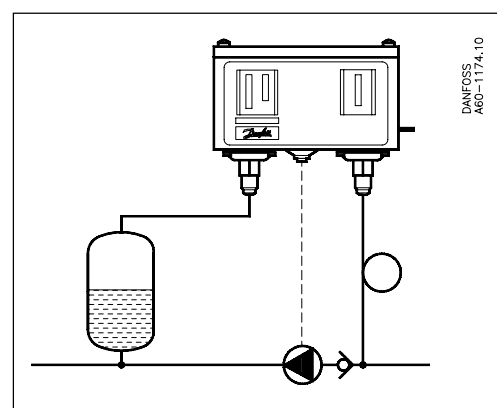
In a hydrophore system where water is pumped from a well or an open tank, both bellows are connected to a pressure outlet on the air side in the pump pressure line, if possible.

**Pressurized water supply direct to pump**

When water supply fails on the inlet side, the pump will no longer be able to boost the pressure to the cut-out value. Consequently the pump will keep running - perhaps without water.

However, the KP 44 pump guard will stop the pump as soon as the pressure in the pump suction line drops below the safety cut-out setting. The pump will automatically start again when the pump suction pressure has reached the level of 1 bar above the safety cut-out setting.

Automatic start-up will only take place if the righthand bellows is connected to the pump suction line. Air pockets should be avoided to prevent the pump from starting up on air pressure rise, without the presence of water.



In a booster system receiving pressurized water the righthand bellows is connected - to the low pressure side of the pump for automatic start-up. - to the high pressure side of the pump for manual start-up.

The lefthand bellows is always connected to the high pressure side of the pump.

**Pressure settings**

*Safety cut-out setting*

The righthand bellows will automatically cut-out the pump at the safety cut-out setpoint. Automatic start-up, if any, will take place when the pressure has reached the level of 1 bar above the setpoint. Manual cut-in is made by lifting the impulse lever and releasing it again when the pressure has increased by min. 1 bar.

The safety cut-out setpoint is normally determined by the static pressure (the water column). However, in order to avoid disturbing signal interaction, care should be taken to ensure that the safety cut-out setting is at least 1.5 bar lower than the control pressure cut-in setting. See table with pressure setting examples below.

Required tap water pressure	≥ 2.3 bar	≥ 4.0 bar	≥ 5.0 bar	≥ 8.0 bar
Control pressure cut-out setting	3.0 bar	5.0 bar	8.0 bar	12 bar
Differential	0.7 bar	1.0 bar	3.0 bar	4.0 bar
Control pressure cut-in setting	2.3 bar	4.0 bar	5.0 bar	8.0 bar
Max. safety cut-out setting	0.8 bar	2.5 bar	3.5 bar	6.0* bar

\* 6.0 bar is the normal max. setpoint

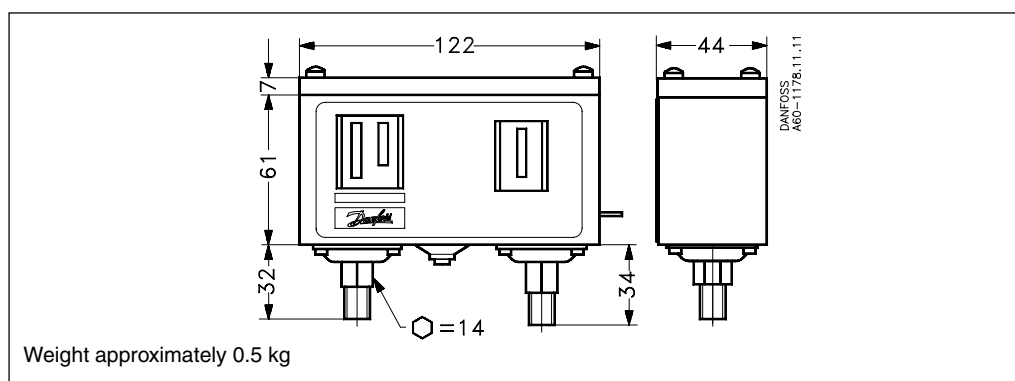
*Control pressure settings*

Control pressure cut-out setpoint is set on the lefthand pressure setting scale. The differen-

tial is set between 0.7 and 4 bar.

The control pressure cut-in setting will be the cut-out control pressure less the differential.

**Dimensions and weight**



**Accessories for KP 44 pressure controls**

Part	Symbol	Description	Total	Code no.
Brackets with mounting screws and washers		Wall bracket	10	<b>060-1055</b>
		Angle bracket	10	<b>060-1056</b>
		4-off screws M4×5 + 4-off washers	1	<b>060-1054</b>
Screwed cable entry		Screwed cable entry Pg 13.5 with special nut. For 6-14 mm cables. A standard Pg 16 screwed cable entry can be used for 8-16 mm cables.	5	<b>060-1059</b>
Sealing screw		For sealing the setting	20	<b>060-1057</b>



**Introduction**

Danfoss KP thermostats are used for regulating, monitoring and alarm systems in industry. KP thermostats are temperature-operated electric circuit breakers. The thermostats are fitted with a single-pole switch (SPDT)

The position of the switch depends on the thermostat setting and sensor temperature. A KP thermostat can be connected and switch to single-phase alternating current motors of up to about 2 kW.

**Features**

- Wide regulating range
- Small dimensions  
Space-saving - easy to install in panels
- Ultra-short bounce time.  
Limits wear to an absolute minimum and increases reliability.
- Electrical connection at front of unit.  
Makes rack mounting easier and also saves space
- Suitable for both alternating current and direct current
- Cable entry for 6-14 mm diameter cables
- Screwed cable entry makes rewiring easy
- Standard screwed cable entry Pg 13.5 and Pg 16

**Definitions**

*Differential*  
The difference between cut-in and cut-out temperature. The differential is a condition for stable automatic plant operation.

*Mechanical differential (intrinsic differential)*  
The differential set on the differential spindle of the unit.

*Working differential (thermal differential)*  
The differential on which the plant operates. The working differential is the sum of the mechanical differential and the differential arising from the time constant.

*Reset*

**1. Manual reset.**  
Resets only when the reset button is pressed.  
Min. reset units will restart after the temperature at the thermostat sensor **has risen** by a value greater than that of the fixed differential.  
Max. reset units will restart after the temperature at the thermostat sensor **has fallen** by a value greater than that of the fixed differential

**2. Automatic reset.**  
Units with automatic reset restart automatically after stop.

Ordering

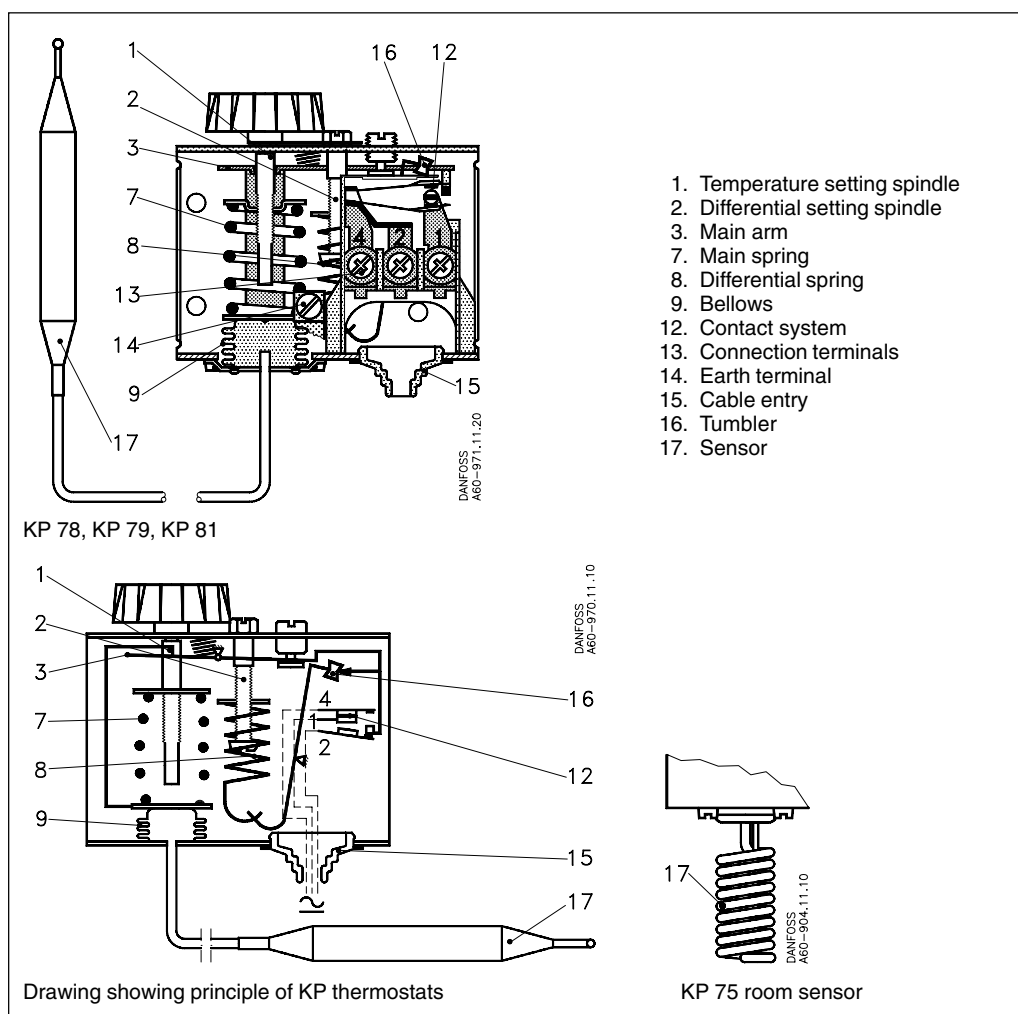
Thermostats type KP 75 - KP 81

Setting range [°C]	Differential [°C]	Max. sensor temperature [°C]	Capillary tube length m	Contact Material	Code no.	Type
0 → 40	3 → 10	80	Room sensor	Ag	<b>060L1212</b>	KP 75
				Au	<b>060L1171</b>	
30 → 90	5 → 15	150	2	Ag	<b>060L1184</b>	KP 78
				Au	<b>060L1213</b>	
50 → 100	5 → 15	150	2	Ag	<b>060L1126</b>	KP 79
				Au	<b>060L1214</b>	
50 → 100	5 → 15	150	5	Ag	<b>060L1169</b>	KP 79
				Au	<b>060L1220</b>	
80 → 150	7 → 20	200	2	Ag	<b>060L1125</b>	KP 81
				Au	<b>060L1215</b>	
80 → 150	7 → 20	200	3	Ag	<b>060L1183</b>	KP 81
				Au	<b>060L1216</b>	
80 → 150	7 → 20	200	5	Ag	<b>060L1170</b>	KP 81
				Au	<b>060L1217</b>	
80 → 150	8 (Max. reset)	200	2	Ag	<b>060L1155</b>	KP 81 (max. reset)
				Au	<b>060L1218</b>	

Technical data

Ambient temperature °C	-40 °C - +65 °C (for short periods up to +80 °C)
Sensor material	Tinned copper Cu/Sn5
Contact system	<p>Single-pole changeover switch (SPDT)</p>
Contact load, Ag contact set	<b>Alternating current</b> AC-1: 16 A, 400 V AC-3: 16 A, 400 V AC-15: 10 A, 400 V
Contact material AgCdO	<b>Direct current:</b> DC-13: 12 W, 220V
Contact load, Au contact set	See information page 16
Enclosure, IP 33 grade	Unit must be mounted on a flat surface/a flat fitting and all unused holes covered.
Enclosure, IP 44 grade	Mounted as IP 33 plus fitting of top cover, code no. <b>060-1097</b>
Approvals	EN 60 947-4,-5 RINA, Registro Italiano Navale MRS, Maritime Reg. of Shipping, Russia Bureau Veritas Germanischer Lloyd, Germany DNV, Det norske Veritas, Norway Polski Rejestr Statkow, Poland UL approved version are available
Cable connection	Entry for 6-14 mm diameter cables
Mounted on backplate or wall bracket	Vibration-proof in the range 0 - 1000 Hz, 4 g (1 g = 9.81 m/s <sup>2</sup> )
Mounted on angle bracket	Not recommended for areas where vibration occurs

Design and function



The contact system in KP thermostats has a snap function. This means that the bellows is active only when the cut-in or cut-out value is reached.

The design of KP thermostats gives the following advantages:

- High contact load
- Ultra-short bounce times. Limits wear to an absolute minimum and increases reliability.
- Vibration-proof in the range 0-1000 Hz, 4 g (1 g = 9.81 m/s<sup>2</sup>)
- Long operating life

Setting

*Thermostats with automatic reset*  
 Set the upper limit temperature on the range scale. Then set the differential on the DIFF scale.  
 The temperature set on the range scale is also the temperature at which contact changeover re-occurs on rising temperature.  
 The contacts changeover when the temperature has fallen to a value lower than that set on the DIFF scale.  
 If at lower settings the plant will not start/stop, the reason might be that the differential has been set too high.

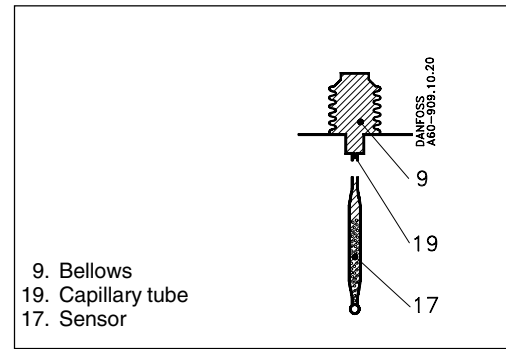
*Thermostats with minimum reset*  
 Set the temperature on the range scale. The differential setting is fixed.  
 Min. reset units will restart after the temperature at the thermostat sensor **has risen** by a value greater than that of the fixed differential.

*Thermostats with maximum reset*  
 Set the stop temperature on the range scale. The differential setting is fixed.  
 Max. reset units will restart after the temperature at the thermostat sensor **has fallen** by a value greater than that of the fixed differential

**Charges**

*Absorption charge*

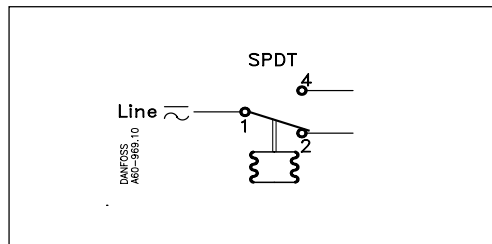
The charge consists partly of a superheated gas and partly of a solid substance with a large absorption surface. The solid substance is concentrated in the sensor (17), and consequently it is always the sensor that comprises the temperature-regulating part of the thermostatic element. The sensor can be placed both warmer or colder than the thermostat housing and capillary tube. However, placing it in an ambient temperature higher or lower than +20 °C can affect the accuracy of the scale.



**Gold contacts**

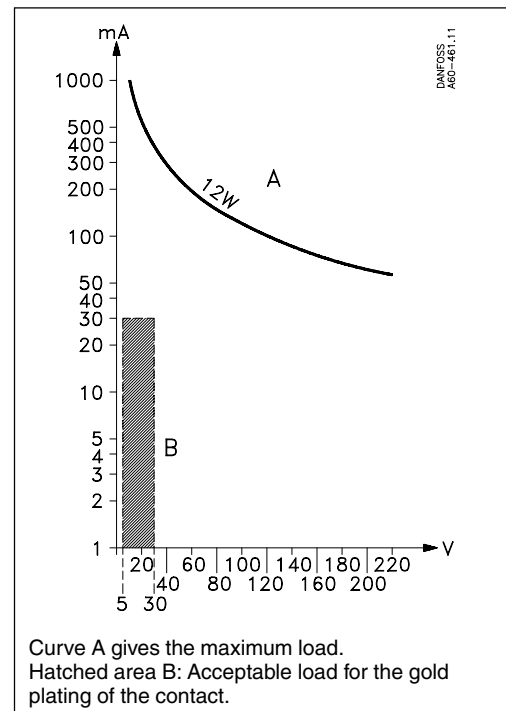
*Contact system*

Single-pole changeover switch (SPDT)  
Contact material: Gold-plated silver



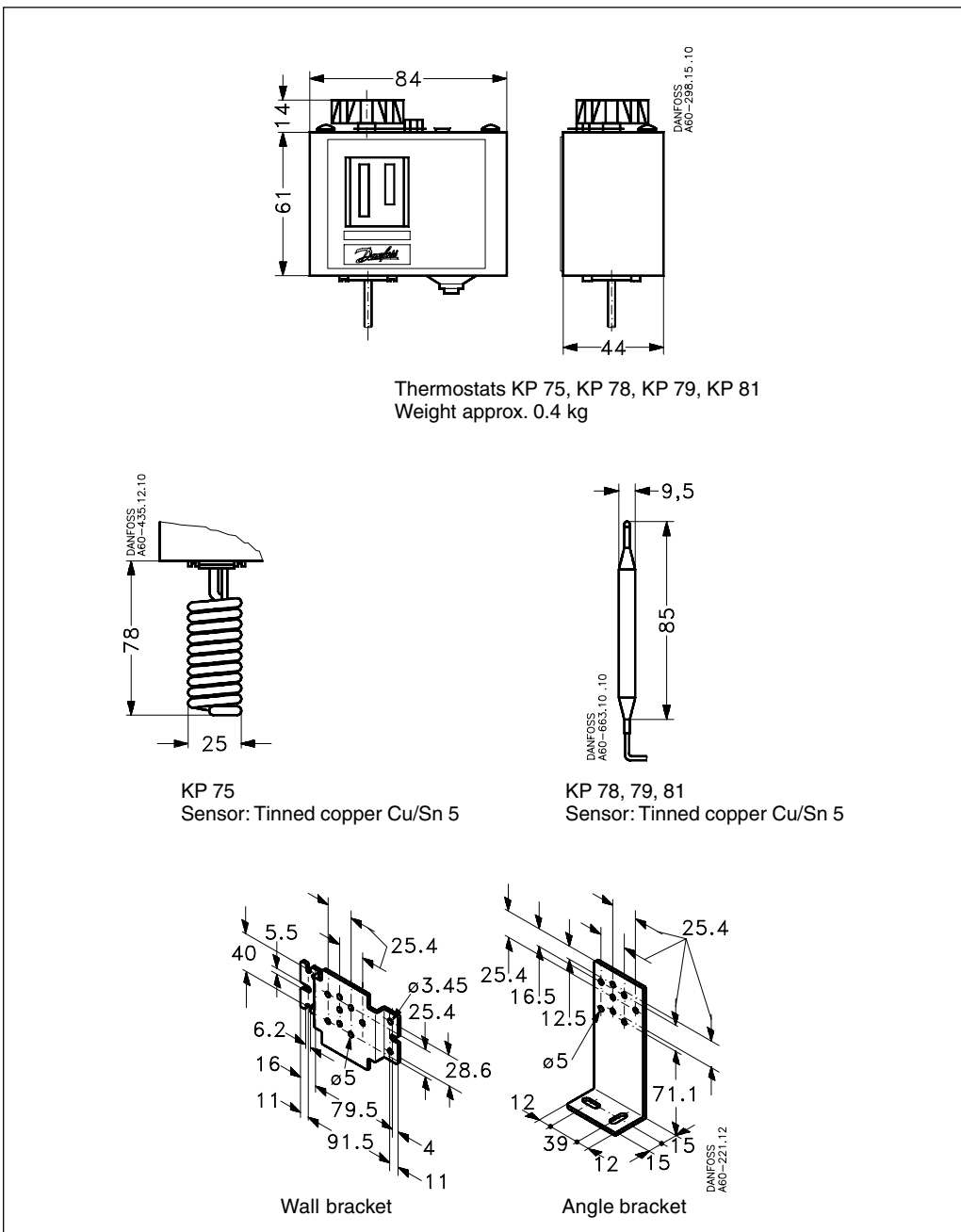
*Contact load*

Alternating current:  
Ohmic load: AC-1: 10 A, 440 V  
Inductive load: AC-3: 6 A, 440 V  
AC-15: 4 A, 440 V  
Direct current: DC-13: 12 W, 220 V





Dimensions and weight



Accessories for KP thermostats

Part	Symbol	Description	Total	Code no.
Brackets with mounting screws and washers		Wall bracket for KP	10	060-1055
		Angle bracket for KP	10	060-1056
		4-off screws M4x5 + 4-off washers	1	060-1054
Capillary tube gland		Oil-resistant rubber gasket for max. 110 °C and 90 bar	5	017-4220
Sensor holder		For thermostats with Ø9.5 mm sensors	1	017-4157
		Rubber plug for wall entry Ø13x20 mm	1 set	017-5392
		Sensor holder for wall mounting with four capillary tub clips and 9-off 12 mm pins	20	017-4201
Knob			20	060-1063
Screwed cable entry		Pg 13.5 with special nut. For 6-14 mm diameter cables. A standard Pg 16 cable entry can be used for 8-16 mm diameter cables.	5	060-1059
Sealing screw		For sealing the setting on KP	20	060-1057
Top cover		If a bracket is mounted on the backplate of the housing, the KP thermostats will have an IP 44 grade of enclosure. The cover covers the setting spindles.	10	060-1097
Protective cap		Protective cap for KP thermostats. To protect the unit against rain and humidity. Grade of enclosure: IP 44 Material: Polyethylene Max. ambient temperature: 65 °C Min. ambient temperature: -40 °C	7	060-0031
Sensor pocket	<p>bar</p> <p>200 150 100 80 60 40 30 20</p> <p>—40 0 20 60 100 140 180 220 240 280 °C</p> <p>Permissible pressure of sensor pipe medium</p> <p>Brass</p> <p>Stainless steel</p> <p>DANFOSS A/P-524, 14</p> <p>DANFOSS A/P-414, 12</p>	For all KP thermostats with cylindrical remote sensor. Sensor pocket, gasket and union for screwing into G 1/2 connectors welded onto tubes, containers, etc.		
		Int. diameter 9.6 mm, insert depth 112 mm (brass). Ext. diameter 11 mm	1	017-4370
		Int. diameter 9.6 mm, insert depth 112 mm (st. 18/8). Ext. diameter 11 mm	1	017-4369
		Int. diameter 9.6 mm, insert depth 465 mm (brass). Ext. diameter 11 mm	1	017-4216
		Media temperature for sensor: 250 °C This temperature can be increased by applying a different gasket material		
Heat-conductive aluminium paste	<p>Tube</p> <p>Tin</p>	For KP and RT thermostats with sensor mounted in a sensor pocket. Temperature range: -20 - +150 °C (short-lived +220 °C)		
		Tube with 5 g aluminium paste	1	041E0110
		Tin with 750 g aluminium paste	1	041E0111

**IP 33/44 enclosure**

IP 33 grade of enclosure is obtained by mounting the unit on a flat surface or a flat fitting and then covering all unused holes. IP 44 grade of enclosure is obtained by mounting the unit as for IP 33 grade of

enclosure and then fitting a top cover, code no. **060-1097**. Alternatively the unit can be mounted in a polyethylene protective cap, type no. **060-0031**.

**IP testing**

An IP grade of enclosure certification is obtained when the product has been submitted to an IP test. The IP classification contains two digits, the first IP digit denoting

the degree of enclosure against foreign bodies, the second digit denoting the degree of watertightness. The corresponding tests are as follows:

IP 1st digit	Foreign body Test	IP 2nd digit	Watertightness Test <sup>1)</sup>
0	No test	0	No test
1	A ball of Ø50 mm cannot enter	1	Vertically falling drops, dripping water
2	A ball of Ø12.5 mm and a test probe of Ø12 mm, L = 80 mm, cannot be inserted	2	Vertically (±15°) falling drops
3	A rod of Ø2.5 mm cannot enter	3	Water sprays ±60° from vertical
4	A wire of Ø1 mm cannot enter	4	Water sprays from all directions
5	As 4 + Dust in amounts that might cause damage cannot enter	5	Water jets from all directions, 12 l/min
6	As 4 + Dust cannot enter	6	Water jets from all directions, 100 l/min
		7	Immersion in 1 m water
		8	Subject to agreement

<sup>1)</sup> After all these tests, water in amounts that might cause damage must not have entered the enclosure and not have collected in electrically conductive parts or cable entries.

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