Immersion Heaters ROTKAPPE®

ROTKAPPE Immersion Heaters are most suitable for direct heating of nearly all process liquids and corresponding applications. Excellent chemical resistance is ensured by the use of different immersion tube materials and variable fitting options help you to meet the individual requirements of heating installations. A long life span with optimum reliability is assured by using high quality materials thereby ensuring fault-less operation of your system.

The ROTKAPPE immersion heater is constructed on a modular basis and consists of a tube, a long-life heating cartridge, a terminal casing and the lead.

The Immersion Heater Tube

We can offer you the optimum material for every application. The heated length (minimum immersion depth) is marked by a ring which is generally two-thirds of the tube length. The tube is not heated above this mark. The heated portion must always be covered with liquid even in the case of high liquid level fluctuation.

The Long-Life Heating Cartridge

Long-life heating cartridges are made from ceramic groove bodies with high electrical insulation values and good mechanical strength.

A high temperature resistance heating wire is fitted as a coil in order to achieve the best possible heat radiation from tube to liquid. The cartridges for immersion heaters are available in rated power voltages up to a maximum of 500 volts for one, two and three phase connections.

The Terminal Casing BC

The BC terminal casing for immersion heaters consists of high temperature stabilized PP. Problemfree use in most process liquids is ensured by good mechanical and thermal strength as well as wide ranging chemical resistance. The PVDF terminal casing (BC/L) is recommended in cases of extreme temperature (liquid temperature >80°C) or when subjected to strongly oxidizing chemicals (e.g. chrome electrolyte or HNO_3). The protective casing is IP 65 (jet-waterproof) according to EN 60529. Easy access to the terminal (after fitting) when connecting the lead is also ensured by unscrewing the cap with the mounting wrench SB.

The Lead

The PVC connecting lead is with a standard length of 1.6 m. Other lead lengths can be provided if desired.

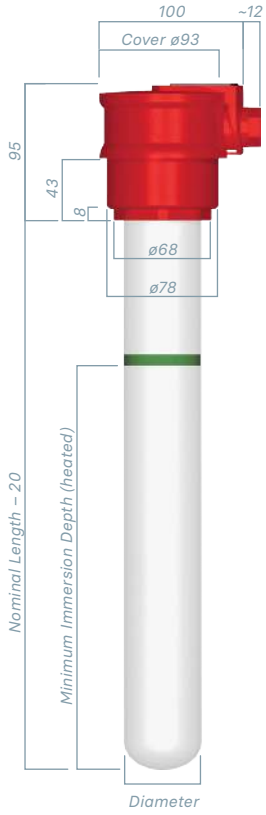
Electrical Safety

Immersion Heaters are classified as devices of protection class 1. All metal parts that are not protected from human contact are securely connected to earth. Using non-conductive tubes made of porcelain or glass, a “protective coil“ is also fitted to the heating cartridges in order to earth these tubes. The highest possible electrical safety is therefore ensured by using an earth leakage circuit breaker (ELCB).

ROTKAPPE immersion heaters type B-... carry the VDE label.

Please note that the user-side equipment of overtemperature and dry protection in plants and containers with electrical heating systems are required. This can be done with our float switches, level probes and corresponding electronics are optimally realised.

We will be pleased to advise you on these safety-related issues!



Immersion Heater ROTKAPPE

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Safety and Quality Heating

The chemicals in your treatment liquids demand the utmost chemical resistance of the materials used. When choosing the materials the physical processes (possible encrustment) and thermal limits (surface power density) have to be taken equally into consideration. The advantages and disadvantages of the individual materials are illustrated in the chemical resistance list. The following table gives an overview of the standard types available. The specific surface power density for the immersion heater tube is stated in W/cm² according to the minimum immersion depth and the rated power.

Standard Material Specifications

Type	Tube diameter [mm]	
PS	54	Special hard porcelain, glazed
TG	50	Technical glass (hydrolytic class 1, acid class 1, alkaline class 2 according to DIN 12111,12116 & 52322)
QS	52	Quartz glass (hydrolytic class 1, acid class 1, alkaline class 1, according to DIN 12111, 12116 & 52322)
FC	46,5	Fluoropolymer (PFA)-compound
KB	45	Stainless steel (material no. 316 TI)
TI	45	Titanium (material no. 3.7035)

ROTKAPPE Immersion Heater Overview

Nominal Length [mm]	Rated Power [kW]	Minimum Immersion Depth [mm]	Rated Voltage		Surface Power Density [W/cm²]					
			230 V~	400 V3~	PS	TG	QS	FC	KB	TI
315	0,40	225	x	-	1,6	-	-	-	1,9	1,9
315	0,63	225	x	-	2,5	-	-	-	3,0	3,0
400	0,63	275	x	x	1,9	2,0	-	2,2	2,3	2,3
400	1,00	275	x	x	3,0	3,2	-	-	3,6	3,6
500	0,80	360	x	x	1,6	1,7	1,7	1,8	1,9	1,9
500	1,00	360	x	x	2,0	2,2	2,1	2,3	2,4	2,4
500	1,40	360	x	x	2,8	3,0	2,9	-	3,4	3,4
630	1,25	460	x	x	1,9	2,0	2,0	2,2	2,3	2,3
630	1,60	460	x	x	2,4	2,6	2,5	-	2,9	2,9
630	2,00	460	x	x	3,0	3,2	3,1	-	3,6	3,6
800	1,00	560	x	x	1,2	1,3	1,2	1,4	1,4	1,4
800	1,60	560	x	x	1,9	2,1	2,0	2,2	2,3	2,3
800	2,00	560	x	x	2,4	2,6	2,5	-	2,9	2,9
800	2,50	560	x	x	3,0	3,2	3,1	-	3,6	3,6
1000	1,25	725	x	x	1,2	1,2	1,2	1,3	1,4	1,4
1000	1,60	725	x	x	1,5	1,6	1,5	1,7	1,8	1,8
1000	2,00	725	x	x	1,9	2,0	1,9	2,1	2,2	2,2
1000	2,50	725	x	x	2,3	2,5	2,4	-	2,8	2,8
1000	3,15	725	x	x	2,9	3,1	3,0	-	3,5	3,5
1000	3,50	725	x	x	3,2	3,5	3,4	-	3,9	3,9
1250	1,00	875	x	x	0,8	0,8	0,8	0,9	0,9	0,9
1250	1,60	875	x	x	1,2	1,3	1,3	1,4	1,4	1,4
1250	2,00	875	x	x	1,5	1,6	1,6	1,7	1,8	1,8
1250	2,50	875	x	x	1,9	2,0	2,0	2,2	2,3	2,3
1250	2,80	875	x	x	2,1	2,3	2,2	-	2,6	2,6
1250	3,50	875	x	x	2,6	2,8	2,7	-	3,2	3,2
1250	4,00	875	-	x	3,0	3,2	3,1	-	3,6	3,6
1600	2,00	1125	x	x	-	1,3	-	1,3	1,4	1,4
1600	3,15	1125	x	x	-	2,0	-	2,1	2,3	2,3
1600	3,50	1125	x	x	-	2,3	-	2,3	2,4	2,5
1600	4,00	1125	-	x	-	2,6	-	-	2,9	2,9
1600	4,50	1125	-	x	-	2,9	-	-	3,2	3,2
1600	6,00	1125	-	x	-	3,9	-	-	4,3	4,3
2000	4,00	1400	-	x	-	-	-	2,1	2,2	2,2
2000	4,50	1400	-	x	-	-	-	-	2,5	2,5
2000	5,00	1400	-	x	-	-	-	-	2,8	2,8
2000	6,00	1400	-	x	-	-	-	-	3,3	3,3
2500	4,50	1750	-	x	-	-	-	1,9	2,0	2,0
2500	6,30	1750	-	x	-	-	-	-	2,8	2,8
3150	5,00	2200	-	x	-	-	-	-	1,7	1,7
3150	7,00	2200	-	x	-	-	-	-	2,4	2,4

Accessories

- Mounting Sleeve EM
- Holding Sleeve HM
- Support HB
- Mounting Wrench SB
- Support THB
- Support SHB

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Safety Immersion Heaters ROTKAPPE® with Anti-Burn System

ROTKAPPE safety immersion heaters with Anti-Burn System minimise possible thermal damage to plants and tanks in the event of partial or complete loss of the liquid being heated.

The following „critical" situations in liquid solutions up to 100°C can be avoided by using a safety immersion heater with Anti-Burn System:

- Continuous operation of the heater with low fluid levels (due, for example, to evaporation of the fluid)
- Continuous operation of the heater with no fluid (due, for example, to a sudden, unexpected loss of fluid)
- Continuous operation of the heater when the transfer of heat from the heated immersion tube to the fluid is restricted (by, for example, heavy incrustation on the immersion tube)

ROTKAPPE safety immersion heaters with Anti-Burn System can be installed either vertically or horizontally in tanks and other plants. This flexibility simplifies the planning and installation of electrical immersion heaters to meet a wide range of requirements for such applications.

Please note that it is still necessary to install the normal overheating and dry-running protection devices in plants and tanks with electrical heating systems, even when using ROTKAPPE immersion heaters with Anti-Burn System.

The optimum solution to this can be found in our product range of float switches, conductive level probes and the related electronic controllers. We will gladly advise you in the solution of your safety problems.

1- or 2-phase connection

The integrated Anti-Burn System reacts to unpermissibly high immer-sion tube temperatures and switches off the heater. The heater remains off until the safety circuit is reset manually. This can be done only if the other safety devices are operating correctly and the tank and the heater are in good condition.

3- phase connection

The integrated Anti-Burn System is tripped if the immersion tube temperature becomes too high and switches off the heater with the aid of our differential current monitor DSW 3/2 and a power relay. The heater then remains switched off until the safety circuits in the immersion heater and on the differential current monitor are reset manually.

A prerequisite for this is that all other safety devices are functioning correctly and that the tank and the heater are in good condition.

The Anti-Burn System can be installed in all three-phase immersion heaters with rated voltages of up to 400 V and a current consumption of 1,8 to 16 A.

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Safety Immersion Heaters ROTKAPPE® with Anti-Burn System

The differential current monitor DSW 3/2 monitors the currents in the individual phases (L1, L2, L3) of a three-phase mains supply.

When the limit value set for power consumption imbalance is exceeded, the power contactor is switched off via the relay contact. The limit value recommended for power consumption imbalance is 5.0 %.

The effective process parameters (e.g. Phase current) are indicated on the display. If values exceed or fall below the set limits, the contact switches and the display shows the respective error message.

The DSW 3/2 differential current monitor reacts in the following situations:

- Overload protection (for current consumption monitoring)
- Current phase failure (if the temperature limiter in the immersion heater is activated)
- Current phase failure (if the heating coil fails or in case of cable breakage)

Technical data DSW 3/2

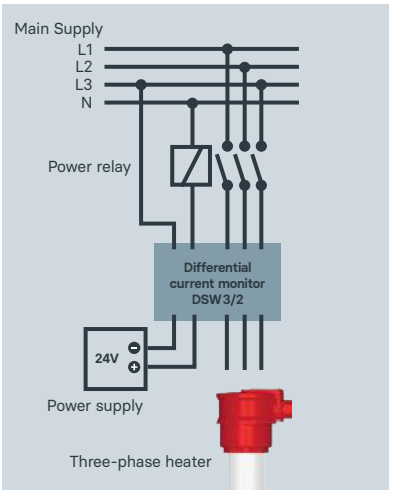
Dimensions	w = 45 mm, h = 86 mm, d = 80 mm
Mounting	on 35 mm rails (in accordance with EN 60715)
Ambient temperature	-25...60°C
Maximum humidity	10...95 % (no condensation)
Supply voltage	24 V DC ± 15 %
Power consumption	2,5 W at 24 V DC
Measuring inputs	3 x I with I_{MAX} = 16 A~
Output	Relay contact 230 V / 3 A~
Terminal cross-section	1,5 mm²...4 mm²

After phase failure, the DSW 3/2 differential current monitor can be reset directly via the control keys ▲▼. If the error is not resolved, the differential current monitor goes into alarm state again and the respective error message is displayed.

The DSW 3/2 differential current monitor is an IO link device. It can therefore be used as an intelligent sensor / actuator for parameter data transfer to a PLC (via the IO link protocol).

Using a PLC and an IO link allows additional monitoring of the following parameters:

- Phase overcurrent monitor
- Phase undercurrent monitor
- Overcurrent and undercurrent monitor
- Current imbalance monitor
- 3-phase undercurrent detection
- Phase sequence detection (at inductive load)

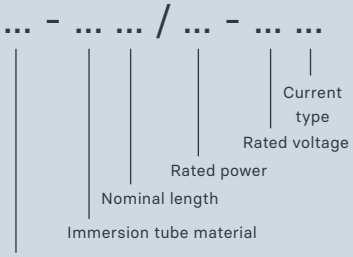


Block diagram for 3-phase-connection

Relation Heaters DSW 3/2

Immersion heaters with rated power [kW] for 400 V 3~	Max. number of heaters per DSW 3/2
1,6 / 2,0	5
2,5	4
3,15 / 3,5	3
4,0 / 5,0	2
6,3 / 7,0 / 8,0 / 10,0	1

Type designations



T = Safety ROTKAPPE immersion heater with Anti-Burn System, 1/2-phase

A = Safety ROTKAPPE immersion heater with Anti-Burn System, 3-phase

Example: T-PS630/1,6-230Ws:
Safety ROTKAPPE immersion heater with Anti-Burn System, porcelain tube, nominal tube length 630 mm; rated power 1.6 kW; rated voltage 230 V (single-phase).

Restriction note: The differential current monitor DSW 3/2 cannot be used in connection with control interventions with a phase angle control or for signal packages which change the sinus waves.

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Angular Immersion Heaters ROTKAPPE®

ROTKAPPE angular immersion heaters are the ideal method of direct heating for all containers with a low liquid level or high level fluctuation. The heating of the liquid from the container bottom is achieved by the horizontal heated immersion tube and this ensures optimum heat radiation as well as good heat distribution.

The rated power is determined by the length of the horizontal immersion tube. A relatively high heating performance is also possible because the entire tube length can be used for heating. The vertical, unheated immersion tube section can be adapted to the container depth.

Nearly every desired adaptation to the container size can be realized according to specific customer requirements. The compact type of construction saves space and as a result you can plan more cost effectively.

The table shows an overview of some standard types. The respecive specific surface power density for the immersion tubes is stated in W/cm² according to the heated horizontal immersion tube's nominal length and to the rated power.

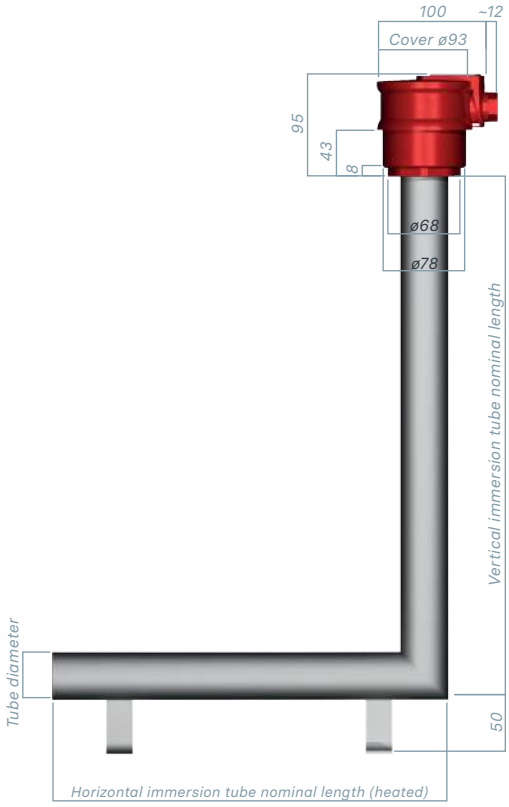
An adaptation to the maximum permissible surface power density of the process liquid can be easily done by variation of the rated power and the immersion tube length.

ROTKAPPE angular immersion heaters consist of the heated horizontal immersion tube, the long-life heating cartridge, the unheated vertical immersion tube, the terminal casing and the lead.

Angular Immersion Heater with HWB Support

The Immersion Heater Tube

The horizontal and the vertical immersion tubes are welded together. Good chemical resistance is ensured by using the various metal immersion tube materials. A long lifespan with optimum reliability is assured by using high quality materials, thereby ensuring faultless operation of your system. Angle shaped supports are welded onto the horizontal immersion tube in order to observe the minimum distance to the container bottom or fixing.



ROTKAPPE Angular Immersion Heater

The Long-life Heating Cartridge

Long-life heating cartridges are made from ceramic groove bodies with high electrical insulation values and good mechanical strength. A high temperature resistance heating wire is fitted as a coil in order to achieve the best possible heat radiation from tube to liquid. The cartridges for angular immersion heaters are available in rated voltages up to a maximum of 500 volts for one, two and three phase connections. The cartridges cannot be replaced by the user.

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Angular Immersion Heaters ROTKAPPE®

The Terminal Casing

The BC terminal casing for angular immersion heaters consists of high temperature stabilized PP. Problem-free use in most process liquids is ensured by good mechanical and thermal strength as well as wide ranging chemical resistance. The PVDF terminal casing (BC/L) is recommended in cases of extreme temperature (liquid temperature >80°C) or when subjected to strongly oxidizing chemicals (e.g. chrome electrolyte or HNO_3). The protective casing is IP 65 (jet-waterproof) according to EN 60529.

Easy access to the terminal (after fitting) when connecting the lead is also ensured by unscrewing the cap with the mounting wrench SB.

The Lead

The PVC connecting lead is with a standard length of 1.6 m. Other lead lengths can be provided if desired.

Safety Technology

Please note that the user is required to equip systems and containers with electrical heating systems with overtemperature and dry-boil protection. This can be optimally realised with our float switches, level sensors and corresponding electronics. We will be happy to advise you on these technical safety issues!

Angular Immersion Heater Overview

(Vertical immersion tube: any length, min. 200 mm)

Horiz. Immersion Tube [mm]	Rated Power [kW]	Rated Voltage		Surface Power Density [W/cm²]	
		230 V~	400 V3~	KB	TI
250	0,63	x	-	3,1	3,1
500	2,00	x	x	3,6	3,6
750	3,00	x	x	3,4	3,4
1000	4,00	-	x	3,2	3,2
1250	5,00	-	x	3,2	3,2
1500	6,00	-	x	3,1	3,1
1750	7,00	-	x	3,1	3,1
2000	8,00	-	x	3,1	3,1
2250	9,00	-	x	3,1	3,1
2500	10,00	-	x	3,0	3,0
2750	11,00	-	x	3,0	3,0

Accessories

Accessories

Standard supports are available for secure fixing of the angular immersion heater or a specific flange connection can be planned to suit your needs. We would be glad to advise you on the best possible fixing.

- Support HWB (PP)
- Support HWB/L (PVDF)
- Mounting Wrench SB

Angular Immersion Heater Materials

Type	Immersion tube diameter [mm]	
KB	45	Stainless Steel (Material No. 316 TI)
TI	45	Titanium (Material No. 3.7035)

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Small Immersion Heater ROTKAPPE®

ROTKAPPE Small Immersion Heaters are most suitable for direct heating of nearly all process liquids and corresponding applications. Excellent chemical resistance is ensured by the use of different immersion tube materials and variable fitting options help you to meet the individual requirements of heating installations. A long life span with optimum reliability is assured by using high quality materials thereby ensuring faultless operation of your system.

The small immersion heaters are used primarily in smaller plants and tanks for surface treatment and in the laboratory sector.

The ROTKAPPE small immersion heater is constructed on a modular basis and consists of a tube, a long-life heating cartridge, a terminal casing and a lead.

The Immersion Heater Tube

We can offer the optimum material for every application. The heated length (minimum immersion depth) is marked by a ring which is generally two-thirds of the tube length. The tube is not heated above this mark. The heated portion must always be covered with liquid even in the case of high liquid level fluctuation.

The Long-Life Heating Cartridge

Longlife heating cartridges are made from ceramic groove bodies with high electrical insulation values and good mechanical strength. A high temperature resistance heating wire is fitted as a coil in order to achieve the best possible heat radiation from tube to liquid. The cartridges for small immersion heaters are available in 230 volts for a single phase connection.

The Terminal Casing LC

The Terminal Casing LC for small immersion heaters is made from high temperature stabilized PP (LC) or PVDF (LC/L). The protective casing is IP 65 (jet-waterproof) according to EN 60529.

Access to the terminal (after fitting) when connecting the lead is also ensured by unscrewing the cap with the mounting wrench SL.

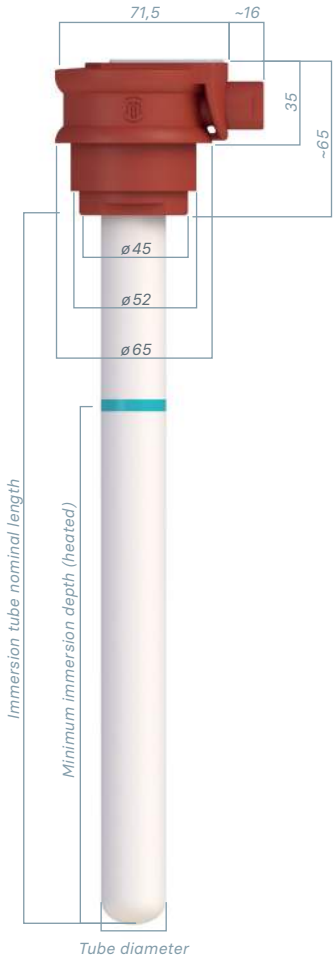
The support HL offers space-saving mounting at the rim of the tank.

The Lead

The PVC connecting lead is with a standard length of 1.6 m. Other lead lengths can be provided if desired.

Accessories

- Mounting Wrench SL
- Mounting Sleeve ML
- Support HL



Small Immersion Heater ROTKAPPE

Electrical Safety

The small immersion heaters are classified as “safety class 1” according to EN 60519. All metal parts that are not protected from human contact are securely connected to earth. Using non-conductive tubes made of porcelain or glass, a “protective coil“ is also fitted to the heating cartridges in order to earth these tubes. The highest possible electrical safety is therefore ensured by using an earth leakage circuit breaker (ELCB).

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Safety and Quality Heating

The treatment liquids demand the utmost of the chemical resistance of the materials used. When choosing the materials the physical processes (possible encrustment) and thermal limits (surface power density) have to be taken equally into consideration. The advantages and disadvantages of the individual materials are illustrated in the chemical resistance list. The following table gives an overview of the standard types available. The specific surface power density for the immersion heater tube is stated in W / cm² according to the minimum immersion depth and the rated power.

Immersion Tube Material Specifications

Type	Tube diameter [mm]	
PS	28	Special hard porcelain, glazed
TG	28	Technical glass (hydrolytic class 1, acid class 1, alkaline class 2 according to DIN 12111, 12116 und 52322)
KB	25	Stainless steel (material no. 316 TI)
TI	25,4	Titanium (material no. 3.7035)

ROTKAPPE Small Immersion Heater Tube Overview (Summary)

Nominal length [mm]	Rated power [kW]	Minimum immersion depth [mm]	Surface power density [W/cm²]			
			PS	TG	KB	TI
200	0,315	130	3,7	3,7	4,1	4,1
300	0,250	180	1,9	1,9	2,2	2,2
300	0,315	180	2,4	2,4	2,7	2,7
300	0,400	180	3,1	3,1	3,5	3,5
400	0,400	280	1,9	1,9	2,1	2,1
400	0,800	280	3,7	3,7	4,2	4,2
500	0,500	330	1,9	1,9	2,2	2,2
500	0,800	330	3,1	3,1	3,5	3,5
500	1,000	330	3,9	3,9	4,3	4,3
630	0,500	460	-	-	1,6	1,6
630	1,000	460	-	-	3,2	3,2
630	1,250	460	-	-	4,1	4,1
800	0,500	560	-	-	1,3	1,3
800	1,000	560	-	-	2,6	2,6
800	1,500	560	-	-	3,9	3,9
1000	1,000	725	,	,	2,0	2,0
1000	1,600	725	-	-	3,2	3,2

Accessories for Small Immersion Heaters with Terminal Casing LC

Mounting Wrench SL

For opening and closing the terminal cap LC and the lead screw fixing.

Material: Grivory GVN

Mounting Sleeve ML

Enables space-saving fitting in tank tops or tank cross-beams. Drill-hole diameter: 63 mm.

Material: EPDM

Support HL

A very simple method of safely fixing small immersion heaters is guaranteed by using this support. It is screwed firmly onto the tank rim and the terminal casing is a simple push-fit.

Material:
PP and PVDF (HL/L)

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Compact Heating Control System KHS

In accordance with EN 60519-1 any electrically heated container must be equipped with a thermostat and a level monitoring system. It is, however, often not possible to integrate all necessary components into a large control cabinet. Our solution – the Compact Heating Control System KHS.

All components necessary for the safe operation of the heating system are contained in a light grey, glass fibre reinforced polyester enclosure (protection type IP 65 in accordance with EN 60529). The control cabinet can be mounted with stainless steel mounting brackets onto a wall directly next to the container.

The enclosure can withstand a permanent temperature of up to 70°C (and a peak temperature of 150°C). It is also self-extinguishing, halogen-free and corrosion-resistant. It meets the safety class IK 10 in accordance with EN 62262, which protects it from external mechanical stress. Its rated insulation voltage is 1.000 V.

The main operating elements can be reached from the front without opening the heating control system:

- The heating control system can be safely switched on and off with the main red/yellow emergency switch. This switch ensures the disconnection of all poles.

Compact Heating Control System KHS

- the red LED warning light indicating the fill level (minimum level cut-out active)
- the thermostat MTR 1000, whose desired value can easily be set and adjusted with the buttons that can be accessed from the front of cabinet; the actual temperature value is indicated on the large LED display; the LED display also indicates the operating status of the heating systems.
- The door of the control cabinet can only be opened with a suitable key that has a two-point closure.

The following components can be found inside the heating control system:

- the line fuses and the power protection elements
- a FI-protection switch, which in the case of malfunction disconnects the heating systems quickly and safely
- the electronic level monitoring system ETS 100 that can be connected to a floating switch or a conductive level rod probe
- the clamping strips for the electrical connection

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Compact Heating Control System KHS

Compact Heating Control System KHS

The cables and sensors of the heating systems are inserted into the control cabinet via cable glands situated at its base and are tightly wired at the clamping strips. A temperature probe with a Pt100 sensor element must be connected for temperature control; a MTSu floating switch or alternatively a conductive NS 2 level rod probe must be connected for fluid level measurement.

A floating switch with an integrated temperature probe (MTSt) or a level rod probe with an integrated temperature probe (NT 2) can of course be connected in place of individual sensors. The connection of a separate temperature probe is in this case not necessary.

Unused cable seals are closed with blind plugs.

When connecting single-phase immersion heaters use safety immersion heaters with an anti-burn system to improve the safety of the whole system. These immersion heaters have a temperature monitor built-in at their heating insert, which safely disconnects them at inadmissibly high immersion pipe temperatures (e.g. complete heating liquid loss).

Technical Data

	KHS 230	KHS 400
Dimensions (h x w x d in mm)	515 x 415 x 230	515 x 415 x 230
Weight	12,6kg	13,9kg
Supply voltage	230V~, 50 / 60Hz or 400V 3~, 50 / 60Hz	400V3~, 50 / 60Hz
Rated maximum current	16A	40A
Max. total connected load	3,6kW / 230V~ or 10,5kW / 400V3~	27kW / 400V 3~
Heating connection	at supply voltage 230 V~	at supply voltage 400 V 3~
	max. 3 x 1,2 kW / 230V~	max. 3 x 9kW / 400V3~
	max. 2 x 1,6kW / 230V~	max. 2 x 9kW / 400V3~
	max. 1 x 3,5kW / 230V~	max. 1 x 9kW / 400V3~
	at supply voltage 400 V 3~	
	max. 3 x 3,5kW / 230V~	
	max. 2 x 3,5kW / 230V~	
	max. 1 x 3,5kW / 230V~	
	max. 1 x 10kW / 400V3~	
Ambient conditions	Condensation within the device must be avoided	
	Internal temperature max. 50°C	
	Rel. humidity max. 75%	
	Ambient temperature max. 35°C	

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Accessories for fitting of products with big terminal casing BC and BC/L

Terminal Casing BC

Material: PP

Terminal Casing BC/L

Material: PVDF

Mounting Sleeve EM

for space-saving fitting in supports or in tank cross-beams. Drill-hole diameter:

ø 87 mm to ø 90 mm.

Material: EPDM

Holding Sleeve HM

for fixing in tank cross-beams in cases of high liquid temperature (> 60°C) and exposure of the underside of the casing to highly concentrated steam. Drill-hole diameter ø 70 mm to ø 76 mm.

Material: EPDM

Support HB

for simple fixing to the tank rim (e.g. for immersion heaters with a max. nominal tube length of 800 mm).

Material: PP or PVDF (HB/L)

Support HWB

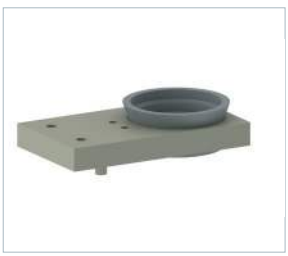
for fixing long probes and angular immersion heaters.

Material: PP or PVDF (HWB/L)

Support SHB

with integrated holding sleeve HM for fixing immersion heaters with nominal tube length > 800 mm.

Material of support: PP
Material of sleeve: EPDM



Support THB

with integrated holding sleeve HM for fixing immersion heaters with Anti-Burn-System.

Material of support: PP
Material of sleeve: EPDM

Set of Seals

O-rings / sealing inserts

Mounting Wrench SB

for opening and closing the terminal cap of big terminal casings BC, as well as dismantling the screw thread and the lead screw fixing.

Material: Grivory GVN

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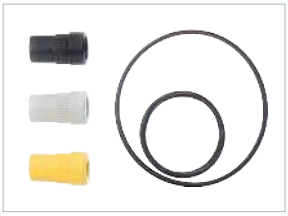
Accessories for fitting of products with small terminal casing LC and LC/L

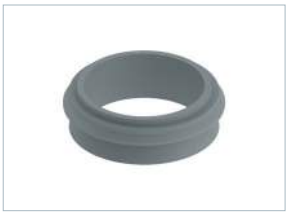
Terminal Casing LC
Material: PP

Terminal Casing LC/L
Material: PVDF

Set of Seals

O-rings / sealing inserts





Mounting Sleeve ML

enables space-saving fitting in container lid or tank cross-beams. Drill-hole diameter: ø63 mm.

Material: EPDM

Mounting Wrench SL

for opening and closing the terminal cap of small terminal casings LC and the lead screw fixing.

Material: Grivory GVN

Support HWL

for fixing long probes.

Material: PP or PVDF (HWL/L)

Support HL

is screwed firmly onto the tank rim and the terminal casing LC is a simple push-fit.

Material: PP or PVDF (HL/L)

Recommendations for Usage

As with all products with terminal casing care has to be taken, when installing them on the container rim, that the terminal casing does not submerge in the process liquid or is exposed to highly concentrated steam. Direct exposure of the underside of the casing to steam must be prevented by suitable installation measures (i.e. holding sleeve HM or a flange)

Service

Every process liquid puts specific demands on the materials of the products used. Please see our "Resistance List" showing the chemical resistance of the materials often used in the most common solutions. For efficient planning of heating your container or system we offer you our computer-aided calculation of the energy necessary for heating up the treatment liquids to the temperature you require and maintaining it. Take advantage of our service..

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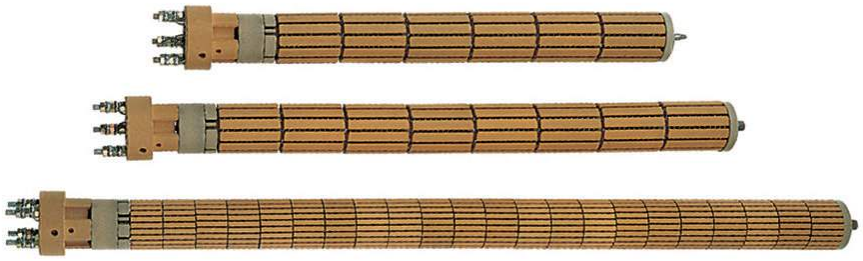
CALOR
Cartridge Heaters



CALOR cartridge heaters are especially suitable for direct heating of cleaning solutions and alkalines.

We adapt our products to customers´ individual and respective requirements in order to allow you as much freedom as possible when planning your system:

- Tubeless cartridge heaters with different diameters, installation lengths and heating performances specially tailored to your needs.
- Immersion tube cartridge heaters made from different materials with diverse fixing options such as flange or threaded nipple.

Cartridge Heater Specifications

The cartridge heaters consist of ceramic groove bodies with high electrical insulation values, good mechanical strength and excellent temperature fluctuation resistance. A high temperature heating wire is fitted as a coil in order to ensure good heat radiation and a long life span of the cartridge.

The unheated zone below the connection head can be designed individually and is at least 50 mm. However, we can also extend this unheated zone according to your wishes.

CALOR Cartridge Heater Overview

Nominal length [mm]	Installation length [mm]	Rated power [kW] at 230 V~			Rated power [kW] at 400 V3~		
		PHK 40	PHK 46	PHK 57	PHK 40	PHK 46	PHK 57
400	375	1,5	1,75	2,0	1,5	-	-
500	475	2,0	2,2	2,8	2,0	2,2	2,8
600	575	2,5	2,8	3,5	2,5	2,8	3,5
700	675	3,0	3,5	-	3,0	3,5	4,0
800	775	3,5	-	-	3,5	4,0	5,0
900	875	-	-	-	4,0	4,5	5,5
1000	975	-	-	-	4,5	5,0	6,0
1200	1175	-	-	-	5,0	5,5	7,5
1400	1375	-	-	-	6,0	7,5	8,5
1600	1575	-	-	-	7,0	8,5	10,0
1800	1775	-	-	-	8,0	9,5	11,0
2000	1975	-	-	-	9,0	11,0	12,0

The cartridges are available in every rated power voltage up to a maximum of 500 V. The connection can be one, two or three phase. The list above represents an overview of possible executions. Individual requirements regarding nominal length, rated voltage and rated power can be realized at any time due to the modular construction.

Immersion Tube Material Specifications

We can offer you different metallic materials with the most varied fixing methods according to your requirements or demands. The chemical resistance list illustrates our analysis of the respective materials. The surface power density of the immersion tube can be customized to suit your application. This individual custom design guarantees you the faultless operation of your system, a long life span and prevents damage to the heated liquid.

CALOR Cartridge Heater Tubes

Cartridge Heater	Tube materials with dimensions, tube diameter [mm] x wall thickness [mm]	
	Stainless steel n°. 316 TI	Titanium n°. 3.7035
PHK 40	44,5 x 1,5	44,5 x 0,9
PHK 46	52 x 1,5	-
PHK 57	-	-

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Safety and Quality Heating

Terminal casing BC 62 (PP) and BC 62/L (PVDF); protection IP 64

Terminal casing B (steel, zinc-plated); protection IP 64

Possible Fixings and Terminal Casings for Immersion Tubes

We have planned the widest variety of possible fixings for your application. The immersion tubes can be equipped without a flange, with a welded or screw-on flange, or a threaded nipple according to your particular application.

We would recommend a central terminal casing for several immersion heater tubes in a row. If single immersion tubes (or tubes fitted further apart) are planned, then an individual casing has to be chosen for each immersion tube.

There is the choice of either the polypropylene (PP) BC 62 terminal casing or the polyvinylidenfluoride (PVDF) BC 62/L. The casing can be easily and quickly fitted by using the mounting wrench. Alternatively the zinc-plated steel B terminal casing can be used specially for high temperatures.

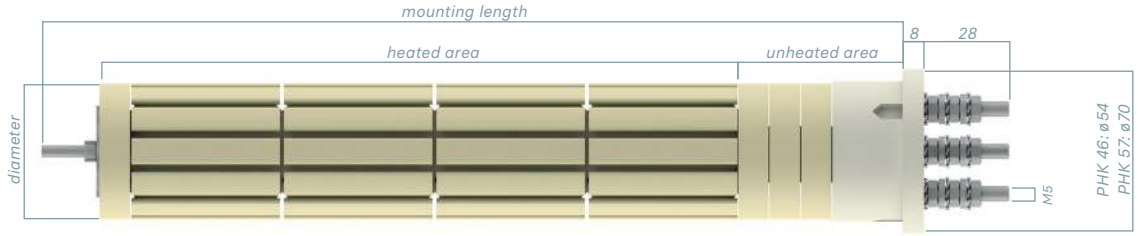
Fixing Types and Terminal Casings

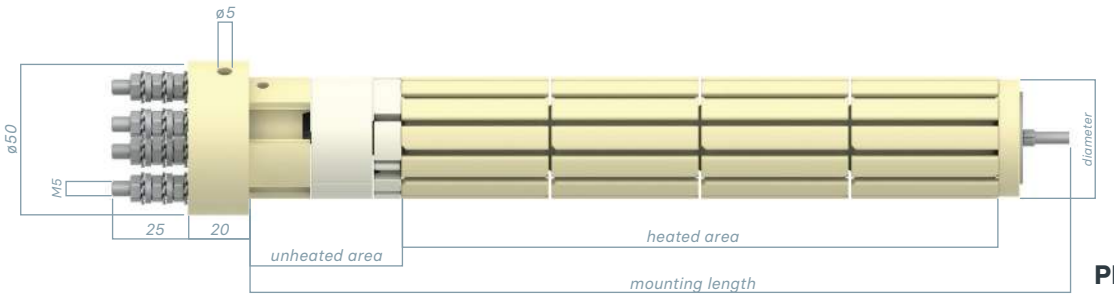
	Tube material	
	Stainless steel	Titanium
Fixing types		
without fixing flange	K	T
with welded flange	K 1	T 1
with screw-on flange	K 2	T 2
with threaded nipple G 2"	K 3	-
Terminal casing		
without casing	-OA	-OA
with terminal casing BC	-BC	-BC
with terminal casing B	-B	-B

Electrical Safety

The cartridge heaters are classified as safety class 1 according to EN 60519-1. All metal parts (immersion heater tubes) that are not protected from human contact are securely connected to earth.

PHK 46/57





PHK 40

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Heating register

The heating register is suited for direct heating in plants and tanks according to the customer's requirements.
A heating register can consist of one or more heating elements. These heating elements are made of one or two heated horizontal tubes.

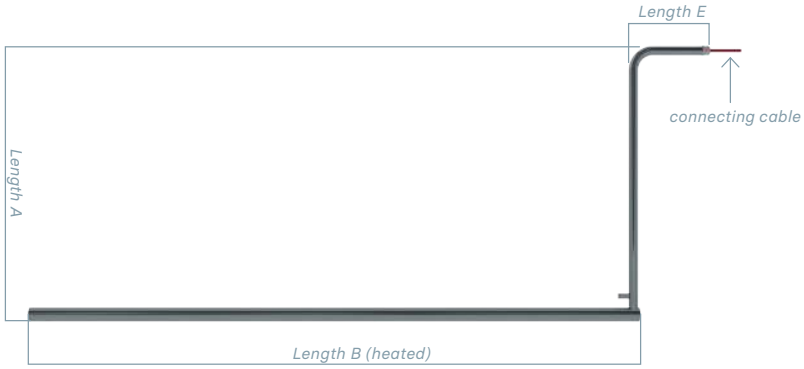
In addition, the heat registers are characterized by a high power density. Through this a large heating capacity in relation to the required volume can be provided.

The dimensions of the heating elements can be easily adapted to the available space in the tank (wall or bottom).

Single heating element

Double heating element wall mounting

Heating register consisting of 3 heating elements in the tank with brackets and a maximum total power of 60 kW



Available materials are stainless steel AISI 316Ti or steel S355J2H. The 6 mm² connection cable is sheathed with silicone and is supplied in the length required by the customer.

The compact arrangement is on-site via holder in the tank. The individual heating elements can be easily removed for cleaning and maintenance.

Lengths up to 3500 mm with a max. power up to 20 kW can be realized. The design is adapted to the respective process conditions and plant specifications.

The heat registers have a high heating capacity. Therefore the wiring and installation efforts required are lower compared to other heating concepts.

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PFA Rod Heaters GALMAFORM®

The PFA rod heaters GALMAFORM are electric heaters for direct heat transfer designed for the use in plants and tanks with a minimum physical size. They have excellent resistance to aggressive process liquids. The very high chemical resistance is achieved by a special coating with PFA (perfluoralkoxy-polymer).

The surface layer made of fluoro-polymer prevents, among other things, encrustation and fouling for effortless cleaning and easy maintenance.

The rod heaters GALMAFORM can be used to heat autocatalytic (electroless) electrolytes, since they are electrically non-conductive and therefore metal reduction is prevented.

The individual shape of the rods allows for a variety of installation options. As the contact box and the cable can also be immersed in the process liquid, you can adjust the maximum immersion depth to your specific requirements. The use of high-quality materials guarantees a long operating life-time with optimum reliability and failure-free operation.

Construction

The rod heaters are based on a PFA-coated stainless steel tubular heater with an electrical connection at one end. The contact box and the PFA cable are welded together with a gas-tight seam to allow for complete immersion.

The heated length of the rod (mini-mum immersion depth) is indicated by a permanent ring-shaped marker. The rod is not heated above this mark.

Even in applications where the liquid level is subject to abrupt or drastic rise or fall the heated length of the rod must always be immersed!

The distance pieces AW 12 set the necessary distance between the rod heater and the wall of the tank. The support UH is designed for secure mounting of the rod heater on the edge of the tank.

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PFA Rod Heaters GALMAFORM®

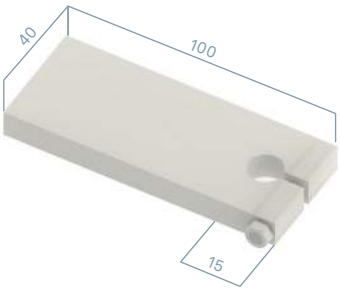
Due to the individual shape of the rod heaters different types of installation are possible. The various bending shapes of the rods are individually planned and implemented for you. Alternatively, you can bend the rods to the desired shape yourself, matching them to the installation conditions.

The available space can be optimally used by means of the various installation possibilities:

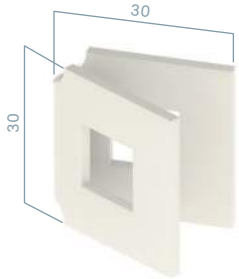
- on the tank wall
- on the floor of the tank
- hanging freely in the tank

Electrical safety

In accordance with EN 60519-1, the heaters are classified as devices of protection class I. All metal parts are connected to the neutral conductor. If used together with an earth leakage circuit breaker (ELCB), the maximum possible electrical safety is ensured.



Support UH, material PVDF



Distance piece AW 12, material PTFE, pure white

Technical data

	U-FP 25200-2	U-FP 25200-6	U-FP 14090-2
Rod coating	PFA-Compound	PFA-Compound	PFA-Compound
Electrical conductivity of coating	no	no	no
Rated power	2.000 W	2.000 W	900 W
Surface loading	2,4 W/cm²	2,4 W/cm²	2,2 W/cm²
Rated voltage	230 V ~	230 V ~	230 V ~
Nominal length	2.500 mm	2.500 mm	1.350 mm
Heated length	2.350 mm	2.350 mm	1.200 mm
Cable length	2 m	6 m	2 m
Rod diameter	ø 12 mm	ø 12 mm	ø 12 mm
Minimum bending radius	30 mm	30 mm	30 mm

Accessories

Support	UH	UH	UH
Distance piece	AW 12	AW 12	AW 12

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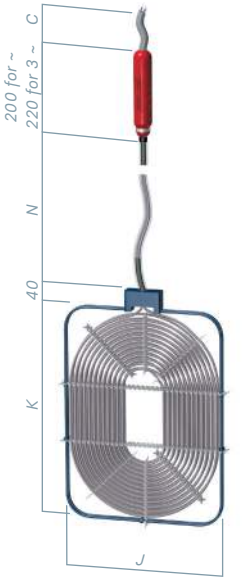
GALMATHERM®
Heaters

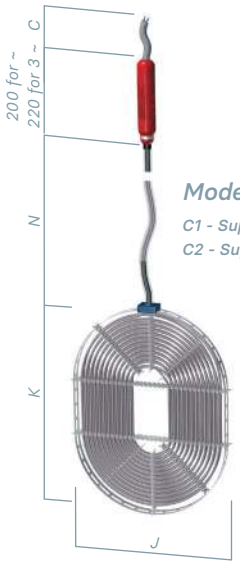
GALMATHERM heaters are designed specifically for use as direct electric heaters in plants and tanks where space is at a premium and high heating capacities and excellent resistance to aggressive process liquids are required. The very good chemical resistance of the heating cable is achieved by the use of a special sheath made of FEP or PFA. The surface power density is only 1 W/cm².

The PFA sheath should be selected for particularly critical operating conditions in extremely aggressive process liquids (such as mixed-acid chrome electrolyte) and for very high liquid temperatures (max. 100°C). The wide range of different shapes and designs provides simple solutions to even difficult installation problems. Small dimensions, combined with relatively high heating powers, permit space-saving installation. The use of high-quality materials guarantees a long operating lifetime with optimum reliability and thus ensures problemfree operation of the plant.



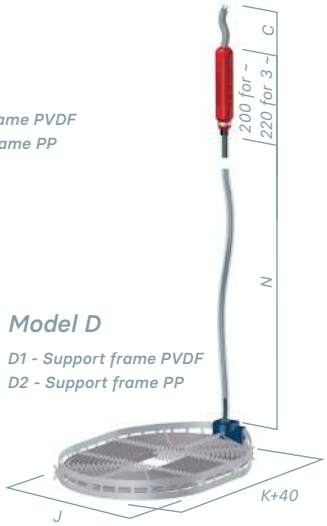
Model A

A1 - Support frame PVDF
A2 - Support frame PP



Model C

C1 - Support frame PVDF
C2 - Support frame PP



Model D

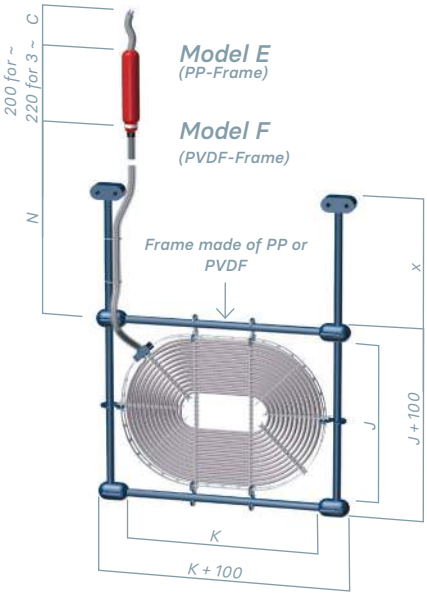
D1 - Support frame PVDF
D2 - Support frame PP

Construction

These heaters consist of a metal heating wire in a FEP/PFA sheath, wound on a flexible PP or PVDF support frame. The mounting elements and the spacers which prevent direct contact between the windings of the heating cable and between the windings and the tank, are also made of PP or PVDF. The mechanical strength can be improved by mounting the heater in a steel frame with PP/PVDF sheath (Model A) or in a robust PP/PVDF frame (Models E/F).

A protective plate made of PP or PVDF (Models Q/R) protects the heater against mechanical damage.

The unheated connection cable leaving the heater is also sheathed in as far as the connection sleeve and is secured in a PP expandable braided sleeving. This part of the heater can be immersed in the process liquid and carries markings for the minimum and maximum immersion depth. Even in applications with extreme level variations, the liquid level must remain within this range! From the PVC connection sleeve (degree of protection IP 64 to EN 60529), a connection cable leads to the switchgear cabinet. The connection sleeve may not be immersed in the liquid, nor may it be directly exposed to vapours.



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Flat Heater GALMATHERM (Type P30 / P40)

Rated power [kW]	Dimensions J x K [mm] for rated voltage		Type designation for rated voltage	
	230 V~	400 V3~	230 V~	400 V3~
1,0	150 x 605	-	P 3003102	-
1,0	170 x 520	-	P 3004102	-
1,0	185 x 365	-	P 3005102	-
1,0	205 x 335	-	P 3006102	-
1,0	220 x 290	-	P 3007102	-
1,0	240 x 250	-	P 3008102	-
1,0	165 x 395	-	P 4003102	-
1,0	185 x 305	-	P 4004102	-
1,0	205 x 255	-	P 4005102	-
1,0	225 x 230	-	P 4006102	-
1,5	165 x 680	170 x 680	P 3004152	P 3004155
1,5	205 x 425	205 x 475	P 3006152	P 3006155
1,5	220 x 355	225 x 440	P 3007152	P 3007155
1,5	240 x 315	240 x 360	P 3008152	P 3008155
1,5	260 x 285	280 x 340	P 3010152	P 3010155
1,5	185 x 375	185 x 380	P 4004152	P 4004155
1,5	205 x 345	205 x 375	P 4005152	P 4005155
1,5	225 x 275	225 x 325	P 4006152	P 4006155
1,5	245 x 245	245 x 275	P 4007152	P 4007155
1,5	245 x 245	270 x 270	P 4008152	P 4008155
2,0	170 x 765	-	P 3004202	-
2,0	185 x 635	-	P 3005202	-
2,0	205 x 565	-	P 3006202	-
2,0	220 x 475	-	P 3007202	-
2,0	240 x 420	-	P 3008202	-
2,0	260 x 380	-	P 3009202	-
2,0	275 x 340	-	P 3010202	-
2,0	295 x 315	-	P 3011202	-
2,0	185 x 515	-	P 4004202	-
2,0	210 x 420	-	P 4005202	-
2,0	225 x 350	-	P 4006202	-
2,0	245 x 305	-	P 4007202	-
2,0	265 x 275	-	P 4008202	-
3,0	205 x 925	205 x 905	P 3006302	P 3006305
3,0	225 x 790	225 x 910	P 3007302	P 3007305
3,0	240 x 690	240 x 700	P 3008302	P 3008305
3,0	260 x 620	260 x 705	P 3009302	P 3009305
3,0	275 x 555	275 x 580	P 3010302	P 3010305
3,0	295 x 510	295 x 575	P 3011302	P 3011305
3,0	315 x 460	315 x 490	P 3012302	P 3012305
3,0	330 x 440	330 x 465	P 3013302	P 3013305
3,0	345 x 410	350 x 450	P 3014302	P 3014305
3,0	365 x 390	370 x 410	P 3015302	P 3015305
3,0	370 x 385	380 x 395	P 3016302	P 3016305
3,0	205 x 685	205 x 735	P 4005302	P 4005305
3,0	225 x 575	230 x 615	P 4006302	P 4006305
3,0	245 x 500	250 x 545	P 4007302	P 4007305
3,0	265 x 445	265 x 470	P 4008302	P 4008305
3,0	285 x 400	285 x 420	P 4009302	P 4009305
3,0	325 x 340	325 x 360	P 4011302	P 4011305
3,0	340 x 340	340 x 340	P 4012302	P 4012305
4,0	225 x 880	-	P 3007402	-
4,0	260 x 700	-	P 3009402	-
4,0	315 x 545	-	P 3012402	-
4,0	330 x 515	-	P 3013402	-
4,0	350 x 475	-	P 3014402	-
4,0	385 x 435	-	P 3016402	-
4,0	405 x 420	-	P 3017402	-
4,0	205 x 810	-	P 4005402	-
4,0	225 x 685	-	P 4006402	-
4,0	245 x 595	-	P 4007402	-
4,0	285 x 475	-	P 4009402	-
4,0	310 x 435	-	P 4010402	-
4,0	325 x 400	-	P 4011402	-
4,0	345 x 375	-	P 4012402	-

Rated power [kW]	Dimensions J x K [mm] for rated voltage	Type designation for rated voltage
	400 V3~	400 V3~
4,5	240 x 905	P 3008455
4,5	275 x 750	P 3010455
4,5	295 x 730	P 3011455
4,5	315 x 625	P 3012455
4,5	350 x 535	P 3014455
4,5	370 x 520	P 3015455
4,5	385 x 505	P 3016455
4,5	405 x 460	P 3017455
4,5	420 x 440	P 3018455
4,5	265 x 595	P 4008455
4,5	285 x 535	P 4009455
4,5	305 x 480	P 4010455
4,5	325 x 445	P 4011455
4,5	345 x 425	P 4012455
4,5	365 x 395	P 4013455
4,5	380 x 380	P 4014455
6,0	275 x 990	P 3010605
6,0	295 x 855	P 3011605
6,0	310 x 825	P 3012605
6,0	350 x 720	P 3014605
6,0	365 x 645	P 3015605
6,0	385 x 635	P 3016605
6,0	405 x 625	P 3017605
6,0	420 x 570	P 3018605
6,0	440 x 550	P 3019605
6,0	455 x 545	P 3020605
6,0	475 x 540	P 3021605
6,0	265 x 785	P 4008605
6,0	305 x 635	P 4010605
6,0	325 x 585	P 4011605
6,0	350 x 550	P 4012605
6,0	365 x 505	P 4013605
6,0	390 x 470	P 4014605
6,0	405 x 455	P 4015605
6,0	425 x 425	P 4016605
9,0	400 x 975	P 3017905
9,0	435 x 870	P 3019905
9,0	475 x 800	P 3021905
9,0	490 x 790	P 3022905
9,0	525 x 720	P 3024905
9,0	545 x 705	P 3025905
9,0	565 x 695	P 3026905
9,0	600 x 675	P 3028905
9,0	345 x 890	P 4012905
9,0	385 x 775	P 4014905
9,0	405 x 730	P 4015905
9,0	425 x 685	P 4016905
9,0	445 x 655	P 4017905
9,0	465 x 625	P 4018905
9,0	505 x 575	P 4020905
9,0	525 x 565	P 4021905

Rated power [kW]	Dimensions J x K [mm] for rated voltage	Type designation for rated voltage
	400 V3~	400 V3~
12,0	430 x 1075	P 3018125
12,0	440 x 1070	P 3019125
12,0	510 x 885	P 3023125
12,0	585 x 785	P 3027125
12,0	385 x 915	P 4014125
12,0	405 x 860	P 4015125
12,0	425 x 800	P 4016125
12,0	465 x 740	P 4018125
12,0	485 x 705	P 4019125
12,0	505 x 680	P 4020125
12,0	545 x 625	P 4022125
12,0	585 x 595	P 4024125
15,0	430 x 1245	P 3018135
15,0	445 x 1235	P 3019135
15,0	465 x 1140	P 3020135
15,0	485 x 1125	P 3021135
15,0	500 x 1045	P 3022135
15,0	520 x 1030	P 3023135
15,0	540 x 1035	P 3024135
15,0	555 x 950	P 3025135
15,0	575 x 940	P 3026135
15,0	595 x 925	P 3027135
15,0	375 x 1125	P 4013135
15,0	395 x 1055	P 4014135
15,0	415 x 1000	P 4015135
15,0	435 x 940	P 4016135
15,0	455 x 890	P 4017135
15,0	475 x 850	P 4018135
15,0	495 x 810	P 4019135
15,0	515 x 780	P 4020135
15,0	535 x 750	P 4021135
15,0	555 x 725	P 4022135
15,0	575 x 700	P 4023135
15,0	595 x 690	P 4024135
15,0	615 x 660	P 4025135
15,0	635 x 640	P 4026135

Legend:

Type:

J = unheated connection cable N on the short side J

K = unheated connection cable N on the long side K

Sheath material:

F = Fluorinated ethylene propylene (FEP)

P = Perfluoralkoxy (PFA)

Type designation	Sheath heater cable								Model
	Type		Length of unheated connection cable N			Length of connection cable C			
P.....	J or K	F or P	0 = 1 m	1 = 1,5 m	2 = 2 m	0 = 1 m	1 = 1,5 m	2 = 2 m	A1, A2, C1, C2, D1, D2, E, F, M1, M2, Q, R
			3 = 2,5 m	4 = 3 m	5 = 3,5 m	3 = 2,5 m	4 = 3 m	5 = 3,5 m	
			6 = 4 m	7 = 4,5 m	8 = 5 m	6 = 4 m	7 = 4,5 m	8 = 5 m	
Example:	J	F	2			0			E

P4010402JF20E: Flat heater, 4 kW, dimensions J x K for 230 V~ (310 x 435 mm), connection cable N on short side J, FEP sheath, 2 m connection cable N, 1 m connection cable C, PP frame without protective plate.

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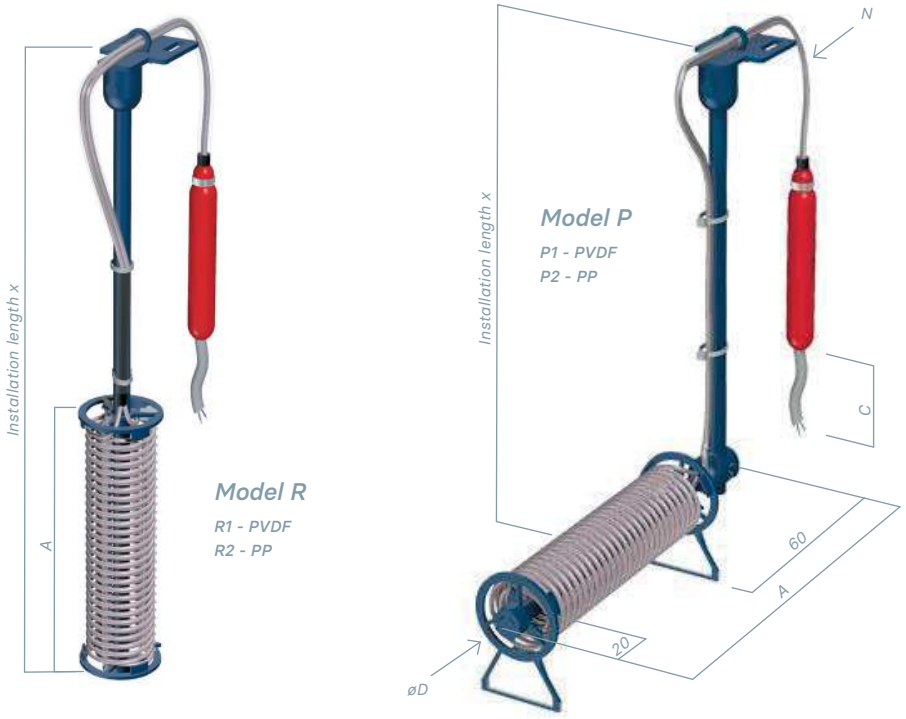
Cylindrical Heaters GALMATHERM®

GALMATHERM Cylindrical Heaters (Type C85 / C12)

The heater model P is an alternative to the ROTKAPPE angular heaters made of metal for heating very aggressive liquids. Since the horizontal part of the heater is heated, the contents of the tank are heated from the bottom, thus ensuring good heat transfer and distribution even at low or widely varying liquid levels. This cylindrical model permits the use of high power even in restricted spaces. Also, you can choose the type of the coating of the heating cable (FEP or PFA) and the lengths of the immersed, unheated connection cable N and of the external PVC connection cable C to meet your requirements.



GALMATHERM cylindrical heaters (Type C85 / C12)

Rated power [kW]	øD [mm]	Model R Dimensions A [mm] for rated voltage		Model P Dimensions A [mm] for rated voltage		Type designation for rated voltage	
		230 V~	400 V3~	230 V~	400 V3~	230 V~	400 V3~
1,0	85	280	-	320	-	C8500102	-
1,5	85	330	465	370	505	C8500152	C8500155
2,0	85	410	-	450	-	C8500202	-
3,0	85	640	775	680	815	C8500302	C8500305
4,0	85	750	-	790	-	C8500402	-
4,5	85	-	920	-	960	-	C8500455
6,0	85	-	1160	-	1200	-	C8500605
9,0	125	-	1160	-	1200	-	C1200905
12,0	125	-	1340	-	1380	-	C1200125

Type designation	Coating heating cable	Length of unheated connection cable N			Length of connection cable C			Model
C	F or P	0 = 1 m	1 = 1,5 m	2 = 2 m	0 = 1 m	1 = 1,5 m	2 = 2 m	R1, R2, P1, P2
		3 = 2,5 m	4 = 3 m	5 = 3,5 m	3 = 2,5 m	4 = 3 m	5 = 3,5 m	
		6 = 4 m	7 = 4,5 m	8 = 5 m	6 = 4 m	7 = 4,5 m	8 = 5 m	
Example:	F		6			1		P1

C8500302OF61P1: cylindrical heater, 3 kW, dimensions for 230 V~ (øD = 85 mm, A = 680 mm), FEP coating, 4 m unheated connection cable N,1.5 m connection cable C, Model P 1 (PVDF)

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Detecting liquid levels with conductive Level Rod-Probes

Liquid levels in process and storage tanks need to be measured and monitored, since unwanted variations in these levels (due to evaporation or removal of the process liquids) must be corrected. In this respect, there are two different general tasks:

- control of the level in order to permit automatic execution of process operations (such as dosing of liquids)
- monitoring of the level in order to prevent possible damage (dry-running, heating without sufficient liquid) to the devices (pumps, heaters) installed in the tanks or to prevent an overflow of the process liquid from the tanks.

You can assure the safe control and monitoring of the liquid level in your tank by using level rod-probes. Since these are purely passive devices, suitable electronic controllers are needed. Level rod-probes operate on the conductive principle, which means that they can be used only in electrically conductive liquids (conductivity >4 µS). Encrustation and contamination in the tank normally have no effect on the function of the probes.

Possible deposits of encrustation between the tips of the probe can be avoided by ensuring that the difference between the probe-rod lengths is at least 60 mm.

The levels of non-conductive or poorly conducting liquids, in which level rod-probes cannot be used, can be controlled and monitored by our float switches.

The level rod-probes are available in many different versions:

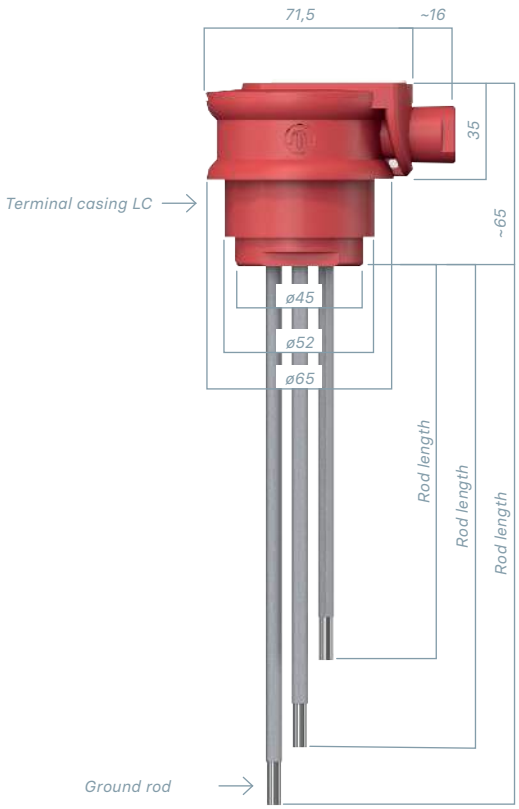
- with two to five rods for detection of one to four different levels

and

- with or without an integrated temperature sensor.

A suitable electronic controller applies a low alternating voltage to the probe rods. A current then flows from the electrically conductive tips of the rods and through the conductive liquid to the reference electrode, called the ground rod. The electrical circuit is closed. If the liquid level drops below the tip of a probe rod, the related electrical circuit is opened. The electronic controller detects the two states “current” and “no current”.

The ground rod must be at least as long as the longest rod. An additional ground rod must be provided for level rod probes coated with PTFE-Compound, if the distance between the tips of the minimum and maximum rods is more than 1000 mm.



Level rod-probes NS with terminal casing LC

In metallic, electrically conductive tanks, no ground rod is needed if the ground terminal is connected directly to the tank.

In order to prevent the rods from touching each other, PTFE spacers are fitted on probes with rod lengths of 300 mm or more.

The level rod-probes are available with the small terminal casing LC (material PP) or LC/L (material PVDF) and the large terminal casing BC (material PP) or BC/L (material PVDF).

Level rod-probes with terminal casing BC can be mounted onto the edge of the tank by the supports HB (PP) or HB/L (PVDF) or on a cross-beam by means of the mounting sleeve EM or the holding sleeve HM.

Level rod-probes with terminal casing LC are mounted onto the edge of the tank by the supports HL (PP) or HL/L (PVDF), or on crossbeams by means of the holding sleeve ML.

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Controlling and monitoring with safety and quality

In order to ensure optimal chemical and thermal resistance, the level rod-probes are made from a variety of materials.

Specifications of the standard materials

Code letter	Probe rod material	Coating	Temp. Sensor material (in case of NT)	Max. liquid temperature
K	PTFE-Compound	PTFE, pure-white	PFA	100°C
B	Stainless steel (Mat. No. 316 TI)	PTFE, pure-white	PFA	90°C
T	Titanium (Mat. No. 3.7035)	PTFE, pure-white	PFA	90°C

Overview of available level rod-probes

The switching points are determined by the various lengths of the probe rods and can be changed by the customer by cutting the rods to the desired length (not possible in the case of PTFE probe rods).

Number of levels to be detected	1	2	3	4
Number of probe rods	2	3	4	5
Level rod-probes type	NS2	NS3	NS4	NS5
Level rod-probes with integrated Temperature sensor Pt100	NT2	NT3	-	-

BC Version

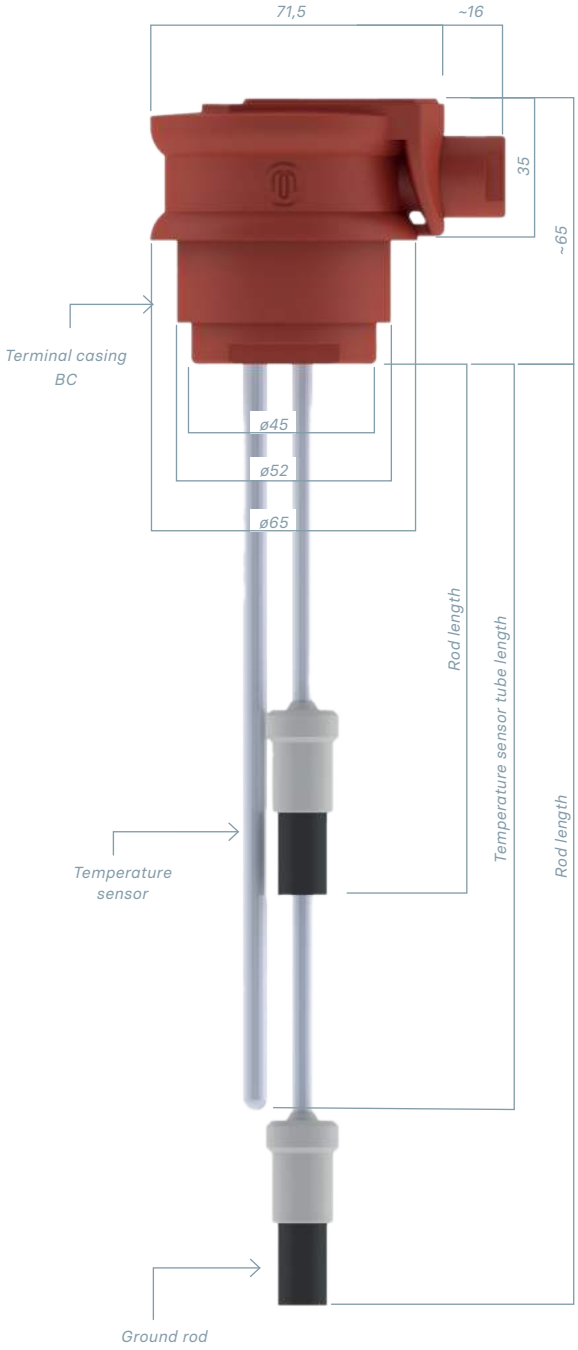
The terminal casing BC made of PP permits the connection of the cable and has the degree of protection IP 65 (jet waterproof) in accordance with EN 60529. In cases of high temperatures (liquid temperature 80°C) or strongly oxidizing chemicals (such as chrome electrolyte or HNO_3 solutions), the PVDF terminal casing BC/L should be used.

LC Version

The small terminal casing LC made of PP or LC/L made of PVDF permits the cable connection and has the degree of protection IP 65 (jet waterproof) in accordance with EN 60529.

Cable connection

The covers of the terminal casings can be unscrewed by using the mounting wrench for access to the cable terminals.



Level rod-probes NT with terminal casing LC

Selection table for control and monitoring electronics

	Level rod-probe types					
	NS2	**NS3**	**NS4**	**NS5**	**NT2**	**NT3**
Monitoring devices						
Level monitor	ETS100	ETS200	-	ETS410	ETS100	ETS200
Temperature limiter	-	-	-	-	ETB100	ETB100
Control devices						
Level controller	-	ENR200	ENR300	-	-	ENR200
Temperature controller	-	-		-	MTR	MTR

Level rod-probes used together with suitable electronic controllers ensure the safe control and monitoring of important process parameters.

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Measuring Temperatures with Temperature Sensors TF...

Particularly in surface treatment, the precise measurement and control of temperatures is of decisive importance for the subsequent quality of the treated items. To keep the temperature of the liquid in storage tanks within the desired range, also prevents negative effects on the process liquids, such as freezing, crystallisation and excessive viscosity.

The following functions need to be implemented:

- Control of the temperature in order to automate process steps (such as keeping the desired process temperature)
- Monitoring of the temperature in order to avoid possible damage to the process, the process liquid (e.g. damage by excessive temperatures) and the tank (e.g. thermal damage)

With the aid of temperature sensors and suitable electronic units, you can control and monitor the temperature of liquids easily and cheaply.

Our temperature sensors are available in the following versions:

- with rigid immersion tubes made of various materials
- with flexible tube made of PFA

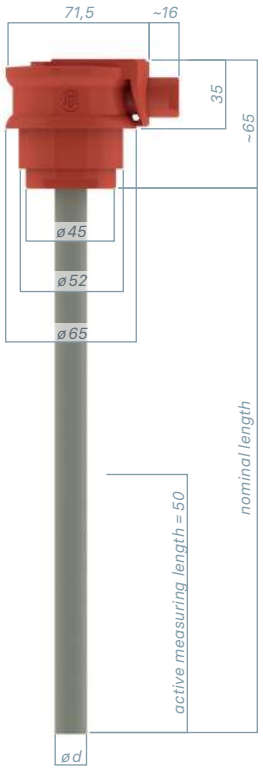
All versions can be equipped with one or two Pt100 elements.

The function of the temperature sensor results from the integrated Pt100 sensor element. The temperature is determined from the temperature-dependent change in the electrical resistance of the Pt100 element. At 0°C, the element has a resistance of exactly 100 Ω. As the temperature increases, the resistance of the element changes in direct proportion to the temperature change.

A suitable electronic unit generates a low, constant current through the Pt100 element and measures the resulting voltage across the element. The resistance of the element, and thus its temperature, can then be determined with the aid of Ohm's Law (R = U/I).

The connection between the electronic unit and the Pt100 element can be made with 2, 3 or 4 wires. We provide 4-wire connections because these permit compensation for the resistance of the connecting wires.

Particularly in the case of long wires, the measurement result can be significantly distorted by the wire resistance. Therefore, the connection of temperature sensors to electronics should not exceed 50 m and should be executed generally with 3 or 4 wires. For longer lengths, it is possible to interpose a temperature transmitter with a standard output signal of 4...20 mA.



Temperature sensor with terminal casing LC

Temperature sensors with a flexible protective tube made of PFA (ø 6 mm) with a standard length of 1.6 m (other lengths possible) are extremely resistant to chemicals and the maximum operating temperature is 200°C. They are also suitable for use in cleanroom applications (physiologically benign) and can be mounted to the measuring point in plants and tanks where space is limited. The Pt100 sensor element, with an active measuring length of 50 mm, is mounted to the end of the protective tube.

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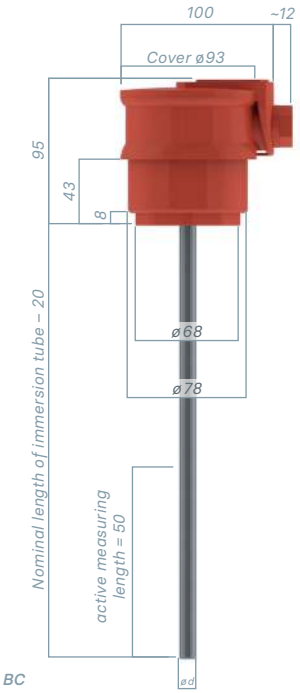
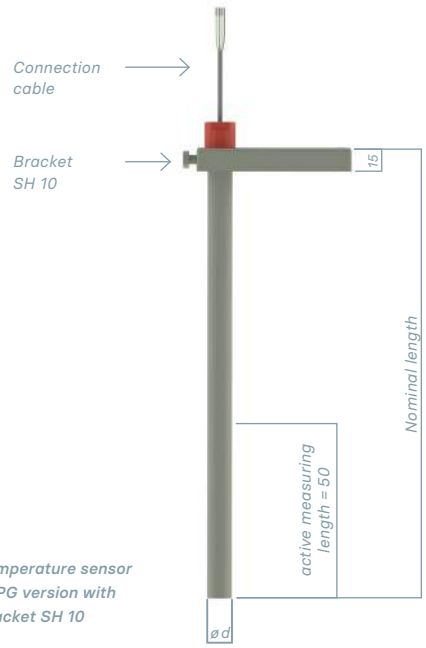
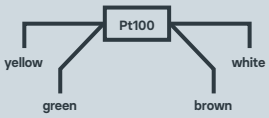


Temperature sensor with terminal casing BC



Temperature sensor in PG version with bracket SH 10



sensor element: Pt100
DIN EN 60751

SOG Version

The stranded conductors of the Pt100 element are led out openly at the end of the protective tube.

SMG 00 Version

The terminal casing MG 00 (degree of protection: IP 64) at the end of the protective tube permits easy connection of a cable.

Temperature sensors with rigid immersion tubes are available with tubes made from various materials in standard lengths of 300, 500 and 800 mm. Other lengths are possible. We can offer two different terminal casings LC and BC. The Pt100 elements can be replaced by the user.

Specifications of the standard materials

Immersion tube material	Code letter	ø d	Max. operating temp. (°C)
Stainless steel (Material No. 316 TI)	B	11	100
Polypropylene (PP)	F	16	90
Polytetrafluorethylene (PTFE)	G	12	100
Polyvinyledene fluoride (PVDF)	L	16	100
Perfluoralkoxy (PFA)	M	6 (flexible tube)	200

PG Version

In the case of temperature sensors without a terminal casing the permanently connected cable (standard length 1.6 m) is led out of the rigid immersion tube via a cable gland (degree of protection IP 64). Other cable lengths are available. The bracket SH 10 is attached to the immersion tube and permits adjustment to any desired height of the immersion tube and easy mounting of the temperature sensor to the tank rim.

LC Version

Temperature sensor with rigid immersion tube. The small terminal casing LC made of PP or LC/L made of PVDF permits connection of a cable and has the degree of protection IP 65 (jet-waterproof) to EN 60529.

BC Version

Temperature sensor with rigid immersion tube. The terminal casing BC (ø93 mm) made of PP permits connection of a cable and has the degree of protection IP 65 (jet-waterproof) to EN 60529. In the case of extremely high temperatures (liquid temperature > 80°C) or possible exposure to strongly oxidant chemicals (such as chrome electrolyte or HNO_3 solutions), the terminal casing BC/L made of PVDF should be used.

Connection of the cable

The cover can be unscrewed with the mounting wrench to provide access to the terminals for connection of the cable.

Terminal casing MG 00

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Float Switches MTS...
made of PP, PVDF or Stainless Steel

The measurement of the liquid level is necessary in process containers, storage tanks and galvanising lines, since unwanted variations in these levels (due to evaporation or removal of the liquids) must be corrected. In this respect, a distinction must be made between two general tasks:

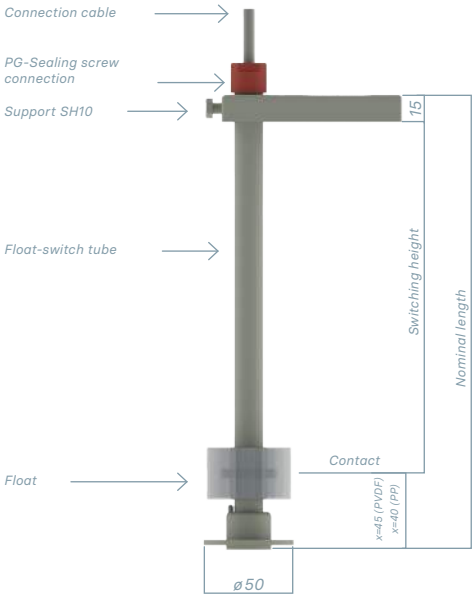
- Controlling of the level to control procedures automatically (such as dosing of liquids).
- Monitoring of the level in order to prevent possible damage (dry-running, heating without sufficient liquid) to the devices (pumps, heaters) installed in the tanks or to prevent an overflow of the process liquid from the tanks.

Float switches in connection with our electronics ETS/ENR offer a simple and economical solution for the controlling and monitoring of liquid levels.

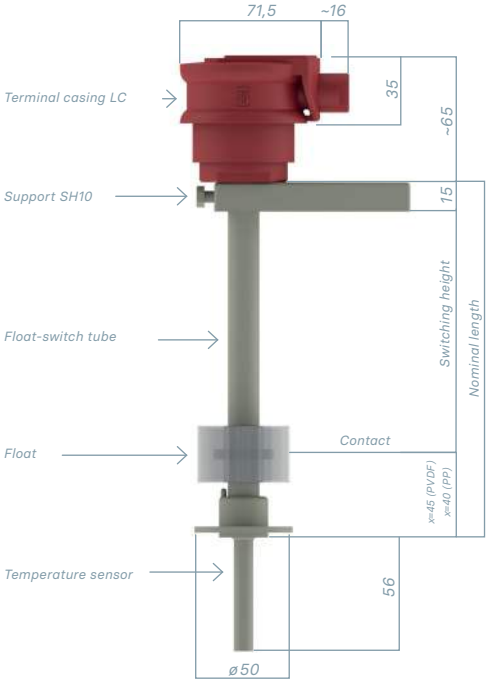
Alternatively, a switching voltage up to 25V AC/DC from a control system (for example from a PLC) can be connected directly to the float switches.

The function of a float switch is based on the moving float and can be guaranteed only in liquids which do not form encrustation. Dirt in the tank (such as chips, adhesive substances) can also block the movement of the float.

In such cases, where a float switch cannot be used, we recommend the use of our level rod-probes, providing the liquid is electrically conductive.



Float switch with one contact, version PG/ plastics



Float switch with one contact and integrated temperature sensor, version LC / plastics

The float switches are available in various versions:

- with one switch contact
- with two switch contacts
- with three switch contacts
- with four switch contacts

All switch contacts are changeover contacts.

As an option, the float switches made of plastic (PP or PVDF) with the terminal casing LC or LC/L with one, two and three switching contacts are also available with integrated temperature sensor (Pt100 in 3-wire-connection).

Function

A magnet inside the moving float actuates a reed contact mounted in a fixed position within the tube of the float switch.

In order to ensure optimal chemical and thermal resistance, the float switches are made of polypropylene (PP), polyvinyliden fluoride (PVDF) and stainless steel (AISI 316Ti). They are available without a terminal casing (version PG) and directly connected cable (length of 1.6 m) or with the terminal casing LC (material PP) or LC/L (material PVDF). The versions with LC terminal casings permit easy connection of the cables.

The stepless height adjustment of the float rod and the easy attachment of the float switch to the container edge is made possible in the plastic version via the holder attached to the float rod.

Further mounting options are available on request (e.g. threaded nipples or flanges).

The holder of stainless steel level switches is welded and has to be specified with the order.

PG version

On float switches without a terminal casing and with a permanently connected cable 1.6 m long (other cable lengths to order), the cable enters the tube of the float switch via a cable gland. Degree of protection IP 64 (splash-proof) according to EN 60529.

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Controlling and Monitoring with Safety and Quality

LC version

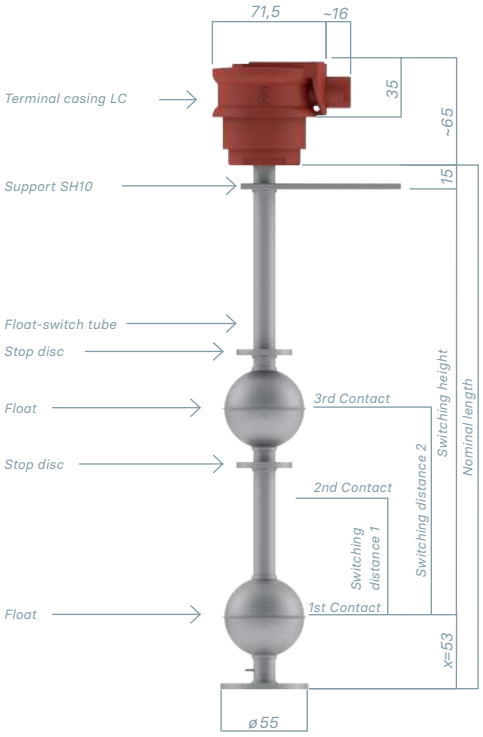
The small terminal casing LC made of PP or LC/L made of PVDF permits cable connection and has the degree of protection IP65 (jet-waterproof) in accordance with EN60529. If the level switch is exposed to high temperatures (liquid temperature >80°C) or in contact with strong oxidizing chemicals (e.g. chrome electrolytes or HNO_3) the PVDF terminal casing LC/L should be used.

Line connection

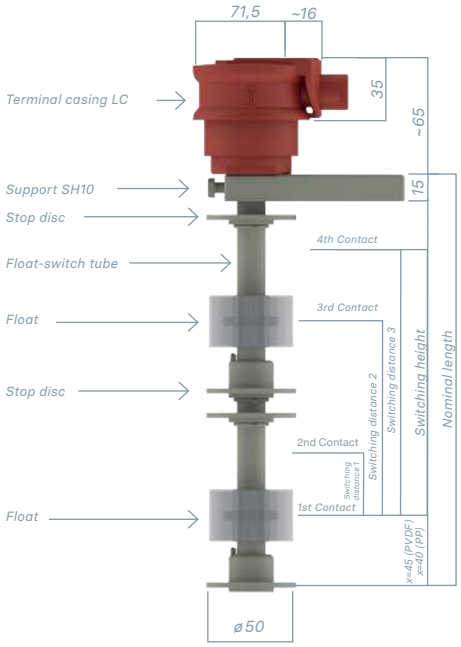
The terminal block for connecting the cable is accessible with the mounting wrench after unscrewing the cover.

Switching points

The switching points are set in the factory and cannot be changed. For this reason, you must precisely specify the first switching point and the distances from this to any further contacts when ordering the float switches.



Float switch made of stainless steel with 3 contacts, LC version



Float switch with 4 contacts, LC version / plastics

Technical Data

	MTSu/MTSt	MTS2u/MTS2t	MTS3u/MTS3t	MTS4u	MTSu	MTS2u	MTS3u	MTS4u
Material	PP /PVDF	PP /PVDF	PP /PVDF	PP /PVDF	Stainless steel	Stainless steel	Stainless steel	Stainless steel
Number of contacts	1 Changeover	2 Changeover	3 Changeover	4 Changeover	1 Changeover	2 Changeover	3 Changeover	4 Changeover
Integrated temp. sensor	opt. Pt100*	opt. Pt100*	opt. Pt100*	no	no	no	no	no
Switching current	0,25A	0,25A	0,25A	0,25A	0,25A	0,25A	0,25A	0,25A
Switching voltage	25V AC/ DC	25V AC/ DC	25V AC/ DC	25V AC/ DC	25V AC/ DC	25V AC/ DC	25V AC/ DC	25V AC/ DC
Switching power	5VA / 5W	5VA / 5W	5VA / 5W	5VA / 5W	5VA / 5W	5VA / 5W	5VA / 5W	5VA / 5W
Switching delay	none	none	none	none	none	none	none	none
Switching hysteresis	5mm	5mm	5mm	5mm	5mm	5mm	5mm	5mm
Min. distance between contact 1 and 2	-	20mm	20mm	20mm	-	20mm	20mm	20mm
Min. distance between contact 1 and 3	-	-	95mm	95mm	-	-	100mm	100mm
Min. distance between contact 1 and 4	-	-	-	120mm	-	-	-	120mm
Min. nominal length LC, LC/L	100mm	125mm	200mm	230mm	125mm	160mm	220mm	260mm
Min. nominal length PG	120mm	145mm	220mm	250mm	145mm	180mm	240mm	280mm
Versions	PG, LC, LC/L	PG, LC, LC/L	PG, LC, LC/L	PG, LC, LC/L	PG, LC, LC/L	PG, LC, LC/L	PG, LC, LC/L	PG, LC, LC/L
Max. nominal length	3000mm	3000mm	3000mm	3000mm	3000mm	3000mm	3000mm	3000mm
	Maximum operating temperature PP=90°C/ PVDF=100°C				Maximum operating temperature stainless steel=100°C			

Selection Table for Control and Monitoring Electronics

Monitoring Devices	MTSu/MTSt	MTS2u/MTS2t	MTS3u/MTS3t	MTS4u
Levelmonitor	ETS 100	ETS 200	ETS 410	ETS 410
Temperature limiter	ETB 200**	ETB 200**	ETB 200**	-

Control Devices	MTSu/MTSt	MTS2u/MTS2t	MTS3u/MTS3t	MTS4u
Level controller	-	ENR300	ENR300	ENR300
Temperature controller	MTR1000**	MTR1000**	MTR1000**	-

* only in combination with LC or LC/L version

**only in combination with integrated temperature probe

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Level electronics ETS/ENR for control of liquid levels

Level electronics in combination with float switches or level rod probes permit the control and monitoring of the liquid level.

The ETS/ENR level electronics are based on the principle of conductive level measurement and have been developed specifically for process liquids in the general metal finishing industry and for electroplating.

The sensitivity can be set in stages according to the conductivity of the process liquid. All level electronics have been tested in accordance with EN 61326 for electromagnetic compatibility and offer functional safety according to SIL 2 in line with EN 61508.

EMC Electromagnetic Compatibility

SIL 2 Suitable for Safety Applications IEC 61508 / IEC 61511

Level monitoring

For monitoring the liquid level as a MIN or MAX switching contact, the device **ETS 100** is used. On exceeding the set maximum level or undershooting the defined minimum level, the contact switches. If the level of the process liquid returns to the “permitted” range, the contact is switched back.

The **ETS 200** device can be used to monitor two separate liquid levels in one tank independently.

Level control

The **ENR 300** level controller is equipped with a switching relay output for the MIN/MAX control. For monitoring a further minimum or maximum level, there is another switching contact available.

The **ETS 410** level electronics have four separate signal inputs and four relay outputs. This means that four independent levels can be detected in one tank and evaluated, for in-stance via a PLC.

The dielectric strength of the signal inputs is 50 V DC. If a higher dielectric strength is required (e.g. in pulseplating processes), the electronic ballast device EVG 200 can be used with an dielectric strength of 200 V DC and has to be connected to each signal inputs of the corresponding level electronics.

The level electronics and the electronic ballast device are designed for control cabinets with top-hat rail mounting for close mounting.

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Controlling and monitoring of liquid levels

Technical data

	ETS 100	ETS 200	ETS 410	ENR 300
No. of level switching points	1	2	4	3
Contacts (potential-free)	1 Changeover switch	2 Changeover switches	4 Changeover switches	2 Changeover switches
Switching status display	1 LED	2 LED	4 LED	2 LED
Voltage	20...230 V AC / DC	20...230 V AC / DC	20...230 V AC / DC	20...230 V AC / DC
Switching voltage	< 250 V AC	< 250 V AC	< 60 V DC	< 250 V DC
Switching current	≤ 5 A	≤ 5 A	≤ 2 A	≤ 5 A
Test function	yes	yes	yes	yes

Input	
Switching delay	3s
Output voltage / current	0,1...6 V~ / < 5 mA~
Trigger sensitivity	0,05...100 kΩ (10 µS ... 2 x 10^4 µS) adjustable with 16 stages
Dielectric strength	50 V DC

Mechanical construction	
Casing material	Polyamid PA 6.6
Flammability class housing	V0 (UL94)
Mounting	on 35 mm mounting rail (acc. to EN 50022)
Dimensions	w = 22,5 mm, h = 111 mm, d = 115 mm
Index of protection	IP 20 (acc. to EN 60529)

Climatic stress	
Ambient temperature	-20...60°C
Transport and storage temp.	-40...70°C
Max. humidity	< 75 % (no dew)

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ETB 200 temperature limiter with TF 24 temperature sensor

The ETB 200 temperature limiter monitors the temperature of process liquids in systems to a set limit value. If this value is exceeded, the integrated relay (AC 230/2A with fuse) switches to a safe operating state and the backlighting of the LC display changes from white to red.

The operating state of the temperature limiter is easy to determine based on the colour of the display. If the monitored temperature falls below the set limit value, in accordance with DIN EN 14597 for temperature limiters, the reset must be carried out manually on the device. An external release button can be connected as an option.

A further switching relay is available in addition to the main relay. This can be used as an advance alarm across an adjustable temperature, before the limit value is reached. Using the active analogue output (0/4...20 mA or 0/2...10 V DC), the measured temperature can be queried and evaluated via a PLC, for example.

Installing the device in the switch cabinet is especially simple thanks to the power consumption of 5 VA and the integrated wide-range power supply with a supply voltage of 20...250 V AC/DC.

The temperature limiter is installed in the switch cabinet on a top hat rail. The wiring is carried out using screw terminals with a max. cross-section of 2.5 mm². The permissible ambient temperature is –10...+55°C. The slimline polyamide housing measuring 22.5 x111x115mm (W x H x D) has protection rating IP 20.

The limiter temperature can be easily set via the switch on the front and is displayed on the clear, alphanumeric LC display. The maximum measuring range is -100...600°C (0.2% accuracy relative to the size of the measuring range), whereby the temperature sensor being connected covers a temperature usage range of -20...200°C.

The temperature sensor approved by TÜV in compliance with DIN EN 14597, in combination with our certified TF 24-160/SMG00-M temperature sensor, represents a standardscompliant temperature limitation system. The electronics

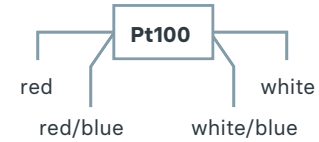
Temperature limiter ETB 200

have been tested for electromagnetic compatibility in accordance with EN 61326 and provide functional safety conforming to SIL 2 in accordance with EN 61508.

The Pt100 sensor element in 4-conductor technology is located in a flexible protective tube made from the fluoropolymer PFA with a diameter of 6 mm and a nominal length of 1.6 m.

The small MG 00 plastic housing (protection rating IP 64) at the end of the PFA protective tube permits problem-free connection of a line. The maximum usage temperature of the temperature sensor is 200°C.

Temperature sensor with flexible protective tube



Sensor element: Pt100-Sensor
DIN EN 60751

EMC Electromagnetic Compatibility

SIL 2 Suitable for Safety Applications IEC 61508 / IEC 61511

Type name	Article number
ETB 200	3496000001
TF 24-160/SMG00-M	3932440001

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Controlling Temperatures with the Electronic Temperature Controllers MTR

Electronic Temperature Controller MTR

The temperature controllers MTR 1000 / 1020 / 2000 are designed specially for the rough operating conditions in surface treatment plants; their front panel is covered with a sheet of polyethylene, which is insensitive to chemicals.

The relatively small dimensions permit installation on control panels or, with the aid of a casing, close to the tank, even when space is at a premium. Easy operation and the clear, 7-segment-LED display guarantee problem-free use. The cables are connected with the aid of plug-in terminals.

The parameters of the temperature controller are easily set with the buttons on the front panel. Amongst other things, the following parameters can be set: hysteresis of the switching contact, correction of the actual value, setpoint limiting, alarm limit value.

In order to ensure the best possible safety, the connected temperature sensor is monitored for breakage or a short-circuit of the sensor element. In the case of a fault, the heater is switched off.

The controller MTR 1000 has a logic input. This input can be used to switch to a lower temperature at night.

The MTR 1020 with an operating voltage of 24 V (DC) is perfectly suit-able for the use in control cabinets or large switchboards.

MTR 1000 with casing

	MTR 1000	MTR 1020	MTR 2000
Number of setpoints	1	1	2
Output contacts	1 changeover	1 changeover	2 changeovers
Operating voltage	230V~	16...36V (DC)	230V~
Max. switched voltage	250V~	250V~	250V~
Max. switched current	10A	10A	8A + 8A
Max. switched power	2kW	2kW	1,5kW + 1,5kW

Technical data

Front dimensions	84 x 42 mm
Installation depth	approx. 85 mm
Panel cut-out	67,5 x 31,5 mm
Degree of protection (front)	IP 65 (to EN 60529)
Degree of protection (rear)	IP 00 (to EN 60529)
Ambient temperature	0...55°C
Max. relative humidity	0...75 % (no condensation)
Supply voltage	230 V~ (+ 10 % / - 15 %) bei 50...60 Hz
Power consumption	max. 4 VA
Measuring input	Pt 100 with 3-wire-connection
Measuring range	- 60,0...400°C
Measuring accuracy	0,5 K ± 0,5 % of measuring range

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