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everything that counts

Temperature sensors
and accessories for heat and cooling measurement points

Applications

Temperature sensors are metrological components for heat or cold measuring points. They are used in pairs and measure the flow and return temperature of the heating or cooling system. The difference between the temperatures is used to measure energy consumption.

Features

- A wide range of platinum resistance temperature sensors (as cable or head sensors) in different lengths for direct or sensor pocket mounting.
- With Pt 100 or Pt 500 temperature sensors
- Type approvals according to 2004/22/EC and PTB K7.2 (cooling, combined heating and cooling)
- Matching accessories for direct mounting in the heating or cooling medium
- Customised sensor pocket in various sizes

Benefits

- Matching hot and cold measurement components from Aquametro ensuring high accuracy over long periods of time.
- Low inventory management with the same temperature sensors used for direct or sensor pocket measurement (DS/PSC)

DS/PSC Temperature sensors

Description
- Cable temperature sensors for direct (Direct Short) and pocket (Pocket Short Cable) mounting with Pt 100 and Pt 500, sensor diameter 5 mm, sensor length 45 mm
- Brass sensor pockets
- Ball valves for temperature sensors
- T-piece adapter
- Universally applicable for measuring heat or cold (Type approvals according to 2004/22/EC (MID) and PTB K7.2 (cooling))

Applications
- Recommended for piping up to DN 50 for direct and pocket mounting
- Interchangeable, e.g. for Aquametro meters for piping up to DN 50 mm
- For pipe widths of up to and including DN 25 (1" R), the temperature sensor should be fitted directly in the heating or cooling systems for new systems. In some countries (e.g. Germany), this is set out in the laws on verification, please check the relevant national regulations. For nominal pipe widths of DN 15 (1/2" R) to DN 25 (1" R), appropriate ball valves with temperature sensor sockets or T-piece adapters are available (see next page).

Note
- There must be mounting symmetrically of both temperature sensors, i.e. both sensors must be identically mounted, e.g. both in ball valves (and not one sensor in a pocket and the other directly mounted in the ball valve or T-piece).
- For direct installing of temperature sensors, only matching T-pieces are to be used. This ensures that no unnecessary measurement errors occur due to unequal immersion depths.

Technical data

Sensor type	Two-wire / four-wire connection, Pt 100 and Pt 500
Protective tube	Stainless steel
Temperature range	0 to 150 °C
Connector	Silicon
Matched pairs	at 10 °C, 65 °C, 120 °C
Tolerance class to IEC 751	Class B
Diameter of protective tube (1)	5 mm
Material of protective tube	1.4571
Length of sensor (2)	45 mm
Immersion depth with direct mounting $\approx$ 27.5 mm	
Connection wire terminals	Terminal sleeves to DIN 46 228 Part 4
Connection wire lengths (3)	approx. 2.5 m/10 m
Type approval	according to 2004/22/EC (MID) and PTB K7.2 (cooling)
Permissible range for ΔT	3...150 K

Part	Description	Quantity and packaging	Art. No.
DS/PSC 500/45/2.5 m Two-wire CE M/D cold	Pair of cable sensors Pt 500, sensor length 45 mm, connecting cable 2.5 m	Paired, bag-packed, with screw adapters 80205 for direct mounting and installation instructions	80579
DS/PSC 500/45/10 m Two-wire CE M/D cold	Pair of cable sensors PT 500, sensor length 45 mm, connecting cable 10 m	Paired, bag-packed, with screw adapters 80205 for direct mounting and installation instructions	80765
DS/PSC 100/45/2.5 m Two-wire CE M/D cold	Pair of cable sensors Pt 100, sensor length 45 mm, connecting cable 2.5 m	Paired, bag-packed, with screw adapters 80205 for direct mounting and installation instructions	80580
DS/PSC 100/45/10 m Four-wire CE M/D cold	Pair of cable sensors PT 500, sensor length 45 mm, connecting cable 10 m	Paired, bag-packed, with screw adapters 80205 for direct mounting and installation instructions	80764

Accessories for DS/PSC temperature sensors

Direct mounting

Ball valve with CEN sensor holder (M10x1) for temperature sensor

Thread		Internal thread G 1/2", G 3/4" or G 1"			
Temperature sensor socket		M10x1 to EN 1434			
Material		Nickel-plated brass			
Maximum media temperature		150 °C			
Pressure rating		PN 16			
Dimensions	(G)	G 1/2"	G 3/4"	G 1"	
	(L)	72 mm	73 mm	84 mm	
	(B)	47 mm	53 mm	66 mm	

Part	Description	Quantity and packaging	Art. No.
KGH ISO 228 M10x1 IG 1/2"	Ball valve 1/2" for direct mounting of sensor	Loose with locking top	2505
KGH ISO 228 M10x1 IG 3/4"	Ball valve 3/4" for direct mounting of sensor	Loose with locking top	2504
KGH ISO 228 M10x1 IG 1"	Ball valve 1" for direct mounting of sensor	Loose with locking top	2507

T-piece adapter with CEN sensor holder (M10x1) for temperature sensor, mounting in the T-piece

Thread		External thread G 3/8", G 1/2", G 3/4" or G 1"			
Connection piece		M10x1 to EN 1434			
Material		Brass			
Dimensions	(G)	G 3/8"	G 1/2"	G 3/4"	G 1"
Width (AF)	(S)	20 mm	30 mm	32 mm	41 mm
	(L)	19 mm	16.5 mm	20 mm	20 mm
	(L1)	11 mm	11.5 mm	14 mm	14 mm
	(B)	Ø 5.7 mm (5.4 mm)			

Part	Description	Quantity and packaging	Art. No.
T-piece adapter G 3/8" / M10x1	Adapter for 3/8" T-piece for sensor mounting, M10x1	Loose without seal ring or locking top	19406
T-piece adapter G 1/2" / M10x1	Adapter for 1/2" T-piece for sensor mounting, M10x1	Loose, bag-packed with copper seal ring, without locking top	80072
T-piece adapter G 3/4" / M10x1	Adapter for 3/4" T-piece for sensor mounting, M10x1	Loose, bag-packed with copper seal ring, without locking top	80073
T-piece adapter G 1" / M10x1	Adapter for 1" T-piece for sensor mounting, M10x1	Loose, bag-packed with copper seal ring, without locking top	80074

Locking top M10x1

Connection piece	M10x1 to EN 1434
Material	Brass
Width (S)	12 mm

Part	Description	Quantity and packaging	Art. No.
Locking top set M10x1	Locking top for T-piece adapter (G3/8"...1")	Bag-packed	80207

Sensor pockets mounting

Note: For measuring points compliant to CE-MID, with nominal width of pipe 15, 20 and 25, directly immersed temperature sensors must be used.

Sensor pockets with CEN holder (M10x1) and straight protective tube

Face-to-face length (1)	40 mm and 60 mm
Process connection (2)	External thread G 1/2"
Width (AF) (3)	24 mm
Material	Brass
Maximum media temperature	130 °C
Pressure rating	PN 16
External diameter (4)	6.6 mm
Internal diameter of protective tube	5 mm
Sensor mounting	with synthetic threads

Part	Description	Quantity and packaging	Art. No.
SP-M 40, single	Brass sensor pocket immersion depth 40 mm, G 1/2"	Single, bag-packed, with copper seal ring compling unit and installation instructions	80490
SP-M 40, set	Brass sensor pocket immersion depth 40 mm, G 1/2"	Paired, bag-packed, with copper seal ring compling unit and installation instructions	80488
SP-M 60, single	Brass sensor pocket immersion depth 60 mm, G 1/2"	Single, bag-packed, with copper seal ring compling unit and installation instructions	80491
SP-M 60, set	Brass sensor pocket immersion depth 60 mm, G 1/2"	Paired, bag-packed, with copper seal ring compling unit and installation instructions	80489

Accessories for sensor pocket / direct mounting of DS/PSC sensors with CEN holders (M10x1)

Process connection	M10x1
Mounting set for DS/PSC sensor (1)	Direct sensor mounting or in sensor pocket SP-M 40
Coupling parts for SP-M 60 (2)	Mounting in sensor pocket SP-M 60 only

Part	Description	Quantity and packaging	Art. No.
Mounting set for DS/PSC sensors	Mounting components for direct mounting or in sensor pocket SP-M 40	1 pair of threaded coupling units (brown), 2 O-rings (4.3 x 2.4), tools and installation instructions	80205
Coupling for SP-M 60 (grey)	Mounting components for direct mounting or in sensor pocket SP-M 60	One threaded coupling unit (grey), folding	20040

Special versions: sensor pockets

Face-to-face length (3)	33 mm
Process connection (4)	External thread G 3/8"
Width (AF)	A = 17 mm, B = 14 mm and C = 22 mm
Material	Brass
Maximum media temperature	130 °C
Pressure rating	PN 16
External diameter (1)	6.6 mm
Internal diameter of protective tube (2)	5 mm
Sensor mounting	with cap nut

Part	Description	Quantity and packaging	Art. No.
ATH-33	Brass sensor pocket, immersion depth 33 mm, G 3/8"	Single, loose	81568

Direct mounting: for AMTRON® E-30 and ULTRASONIC E only

Process connection (1)	M10x1
Width (AF)	(2) = 12 mm, (3) = 24 mm
Material	Brass
Maximum media temperature	130 °C
Pressure rating	PN 16
Sensor mounting	with O-ring

Part	Description	Quantity and packaging	Art. No.
MG Mounting set for ball valve AMTRON® E-30/ULTRASONIC E CEN	Mounting set, brass	Single, bag-packed with installation instructions	81598
MG 1/2" Mounting set for T-piece AMTRON® E-30/ULTRASONIC E CEN	Mounting set, brass, with T-piece adapter 1/2"	Single, bag-packed with installation instructions	81599

PLC temperature sensors

Description

- Cable temperature sensor for pocket mounting (Pocket Long Cable), types Pt 100 and Pt 500, sensor diameter 6 mm, sensor lengths 105 mm, 140 mm, 175 mm and 230 mm
- Special versions for high absolute temperatures up to 180 °C
- Universally applicable for metering heat or cold (Type approvals according to 2004/22/EC (MID) and PTB K7.2 (cooling))

Applications

- For facilities with pipe diameters from approx. DN 50 upwards
- Good thermal properties with low heat radiation
- Two-wire connection but can be converted to four-wire using a sealed VD-30 distributor box
- Mounting with SP-E sensor pockets (see accessories for PLC and PLH temperature sensors)

Technical data

Sensor type	Two-wire / four-wire connection, Pt 100 and Pt 500
Protective tube	Stainless steel
Temperature range	0 to 150 °C (180 °C)
Connector	Silicon
Matched pairs (standard 150 °C)	at 10 °C, 65 °C, 120 °C
Matched pairs (for 180 °C)	at 10 °C, 80 °C, 150 °C
Tolerance class to 751	Class B
Diameter of protective tube (1)	6 mm
Material of protective tube	1.4571
Length of sensor (2)	105, 140, 175 and 230 mm
Connection wire terminals	Terminal sleeves to DIN 46 228 Part 4
Connection wire lengths (4)	2.5 m / 10 m
Size of tag to sensor end (3)	15 mm
Type approval	according to 2004/22/EC (MID) and PTB K7.2 (cooling)
Permissible range for ΔT	3...150 K (180 K)

PLC - Pt 500 sensor

| Part	Description	Quantity and packaging	Art. No.
PLC 500/105/2.5 m 2-wire CE M/D cold	Pair of cable sensors Pt 500, sensor length 105 mm, connecting cable 2.5 m	Paired, bag-packed	80581
PLC 500/140/2.5 m 2-wire CE M/D cold	Pair of cable sensors Pt 500, sensor length 140 mm, connecting cable 2.5 m	Paired, bag-packed	80582
PLC 500/175/2.5 m 2-wire CE M/D cold	Pair of cable sensors Pt 500, sensor length 175 mm, connecting cable 2.5 m	Paired, bag-packed	80583
PLC 500/230/2.5 m CE M/D cold	Pair of cable sensors Pt 500, sensor length 230 mm, connecting cable 2.5 m	Paired, bag-packed	80584

PLC - Pt 100 sensor Two - wire connection

Part	Description	Quantity and Packaging	Art. No.
PLC 100/105/2.5 m 2-wire CE M/D cold	Pair of cable sensors Pt 100, Longueur de sonde 105 mm, connecting cable 2.5 m	Paired, bag-packed	80585
PLC 100/140/2.5 m 2-wire CE M/D cold	Pair of cable sensors Pt 100, sensor length 140 mm, connecting cable 2.5 m	Paired, bag-packed	80548
PLC 100/175/2.5 m 2-wire CE M/D cold	Pair of cable sensors Pt 100, sensor length 175 mm, connecting cable 2.5 m	Paired, bag-packed	80549
PLC 100/230/2.5 m 2-wire CE M/D cold	Pair of cable sensors Pt 100, sensor length 230 mm, connecting cable 2.5 m	Paired, bag-packed	80586

PLC - Pt 100 sensor Four - wire connection

Part	Description	Quantity and Packaging	Art. No.
PLC 100/105/10 m 4-wire CE M/D cold	Pair of cable sensors Pt 100, Longueur de sonde 105 mm, connecting cable 10 m	Paired, bag-packed	94645
PLC 100/140/10 m 4-wire CE M/D cold	Pair of cable sensors Pt 100, sensor length 140 mm, connecting cable 10 m	Paired, bag-packed	94646
PLC 100/175/10 m 4-wire CE M/D cold	Pair of cable sensors Pt 100, sensor length 175 mm, connecting cable 10 m	Paired, bag-packed	94647
PLC 100/230/10 m 4-wire CE M/D cold	Pair of cable sensors Pt 100, sensor length 230 mm, connecting cable 10 m	Paired, bag-packed	94648

For special applications

PLC 180 °C	Order for special applications	180413

PLH temperature sensors
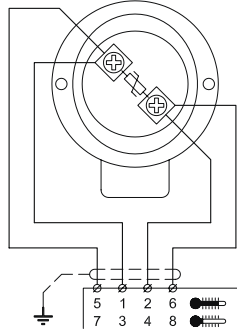
Description

- Head sensor for pocket mounting (Pocket Long Head), types Pt 100, sensor diameter 6 mm, sensor lengths 105 mm, 140 mm, 175 mm and 230 mm
- Special versions for low temperature differences (e.g. for cooling measurements) and high absolute temperatures up to 180 °C
- Maximum connection cable length to CALEC® ST and AMTRON® X-50: 15 m.
  Maximum connection cable length to CALEC® energy master: 100 m

Applications

- For facilities with pipe diameters from approx. DN 50 upwards
- Good thermal properties with low heat loss
- Two-wire connection but can be converted to four-wire by connecting directly to the sensor head
- Mounting with SP-E sensor pockets (see. accessories for PLC and PLH temperature sensors)
- Ohmic resistance of connection cable to computer has no influence on temperature measurement

Technical data

Sensor type	Two-wire connection Pt 100 and Pt 500
Protective tube	Stainless steel
Temperature range	0 to 150 °C (180 °C)
Connector	Metal, version PL
Matched pairs (standard 150 °C)	at 10 °C, 65 °C, 120 °C
Matched pairs (for cooling applicat.)	at (0 °C), 10 °C, 30 °C, 50 °C
Matched pairs (180 °C)	at 10 °C, 80 °C, 180 °C
Tolerance class to IEC 751	Class B
Diameter of protective tube (1)	6 mm
Material of protective tube	1.4571
Length of sensor (2)	105, 140, 175 and 230 mm
Height of sensor head (3)	44.5 mm
Connection head (4)	33 mm
Type approval	EN 1434 for Switzerland and Germany, 2004/22/EC (MID)
Permissible range for ΔT	3...150 K
Verification	On demand for Switzerland and Germany

PLH - Pt 100 sensor

Part	Description	Quantity and packaging	Art. No.
PLH 100/105 CE M	Pair of head sensors Pt 100, sensor length 105 mm	Paired, bag-packed	80360
PLH 100/140 CE M	Pair of head sensors Pt 100, sensor length 140 mm	Paired, bag-packed	80361
PLH 100/175 CE M	Pair of head sensors Pt 100, sensor length 175 mm	Paired, bag-packed	80362
PLH 100/230 CE M	Pair of head sensors Pt 100, sensor length 230 mm	Paired, bag-packed	80363

Cold applications (special testing points in the temperature range from 0 to 50 °C, no approval in accordance with PTB K7.2)

Part	Description	Quantity and packaging	Art. No.
PLH 100/140 verified / cold	Pair of head sensors Pt 100, sensor length 140 mm for cold applications	Paired, bag-packed	80085
PLH 100/175 verified / cold	Pair of head sensors Pt 100, sensor length 175 mm for cold applications	Paired, bag-packed	80086

For special applications

PLH 180 °C	Order for special application	180412

Accessories for PLC and PLH temperature sensors
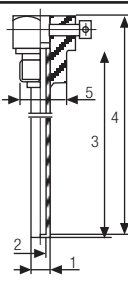
Description
- Stainless steel sensor pockets, face-to-face lengths 85 mm, 120 mm, 155 mm and 210 mm for PN 40
- Enhanced sensor wells for higher flow rates (EV)
- Steel or stainless steel welded sleeve
- Distributor box VD-30 converting from two- to four-wire connections
- Extension cable for distributor box

Note
The face-to-face sensor pocket length for PLC and PLH sensors must be 20 mm shorter than the length of the sensor itself. This is shown in the table below

SP-E (SP-EV) sensor pocket
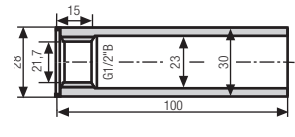
External diameter (1)	8 mm
Internal diameter of protective tube (2)	6 mm
Material of protective tube	1.4571
With sealing screw	
Maximum media temperature	180 °C
Pressure rating	PN 40
Thread (5)	G 1/2"
Length (4)	98, 133, 168 and 223 mm
Face-to-face length (3)	85, 120, 155 and 210 mm

Product range

| Part	Description	Quantity and packaging	Permissible flow velocity*	Art. No.
SP-E 85 / 105	Stainless steel sensor pocket G1/2", face-to-face length 85 mm, PN 40, for sensor PLxxx/105	Single, with copper seal ring, bag-packed	5.0 m/s	80059
SP-E 120 / 140	Stainless steel sensor pocket G1/2", face-to-face length 120 mm, PN 40, for sensor PLxxx/140	Single, with copper seal ring, bag-packed	3.1 m/s	80060
SP-EV 120 / 140	Stainless steel sensor pocket G1/2", reinforced face-to-face length 120 mm PN 40, for sensor PLxxx/140	Single, with copper seal ring, bag-packed	5.4 m/s	80790
SP-E 155 / 175	Stainless steel sensor pocket G1/2", face-to-face length 155 mm, PN 40, for sensor PLxxx/175	Single, with copper seal ring, bag-packed	2.5m/s	80062
SP-EV 155 / 175	Stainless steel sensor pocket G1/2", reinforced face-to-face length 155 mm PN 40, for sensor PLxxx/175	Single, with copper seal ring, bag-packed	4.5m/s	80791
SP-E 210 / 230	Stainless steel sensor pocket G1/2", face-to-face length 210 mm, PN 40, for sensor PLxxx/230	Single, with copper seal ring, bag-packed	1.7 m/s	80064
SP-EV 210 / 230	Stainless steel sensor pocket G1/2", reinforced face-to-face length 210 mm PN 40, for sensor PLxxx/230	Single, with copper seal ring, bag-packed	2.9 m/s	80077

* The specified values are calculated for reference only with certain specified conditions. The information is only valid for laminar flows. Additional local factors influencing such as turbulence, pressure surges, pulsations or vibrations caused by external motors, pumps, valves, etc., can lead to increased stress and damage the protprotective tube. These factors have to be considered by the user.

Welded sleeve

External diameter	30 mm
Pressure rating	PN 40
Thread	Internal thread G 1/2"
Length	100 mm
Material of protective tube	Steel / stainless steel

Part	Description	Quantity and packaging	Art. No.
SWM-11	Steel welded sleeve for the face-to-face length of the sensor pocket	Single, with copper seal ring, bag-packed	81551
SWM-12	Stainless steel welded sleeve for the face-to-face length of the sensor pocket	Single, with copper seal ring, bag-packed	81552

Connection box (VD-30), extension cable (10x0.5 mm)

Note: Not permitted in Germany for systems which are used for custody transfer
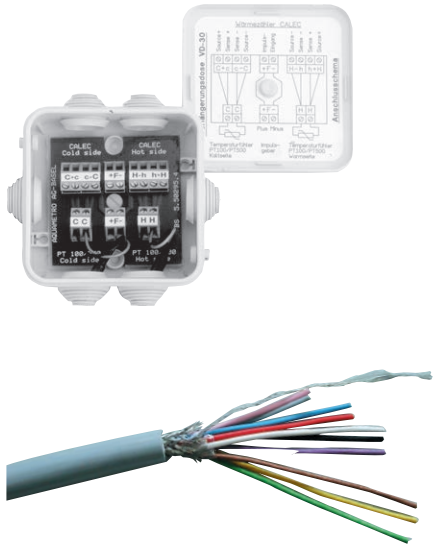
Description

Temperatur sensor cables can be extended by 4 wires by means of the connexion box VD-30, avoiding the measurement errors other wise created by additional resistance of a 2 wire extension.
Please comply with relevant national approval regulations on usability.

Features of VD-30:
- Converts 2-wire cable sensors systems (measurement of resistance) to 4-wire systems (measurement of voltage loss)
- Negligible cable resistance for smaller cable diameters
- Appropriate extension of cable sensors (PLC and DS/PSC)
- Optional connection for a passive pulse transmitter
- Clear installation
- Optional access protection with lead seal

Extension cable recommanded
- 10-core, flexible, 0.5 mm^2
- Screened
- Cable designation LiYCY

Part	Description	Quantity and packaging	Art. No.
VD-30	Distributor box for temperature sensor and pulse transmitter	Single, bag-packed with installation instructions	93331
Cable 10x0.5 mm screened	Cable for cable sensor and pulse transmitter extension with VD-30	per meter	20042
Cable 4x0.5 mm screened	LiYCY, for the wiring of the head sensors PLH	per meter	95423
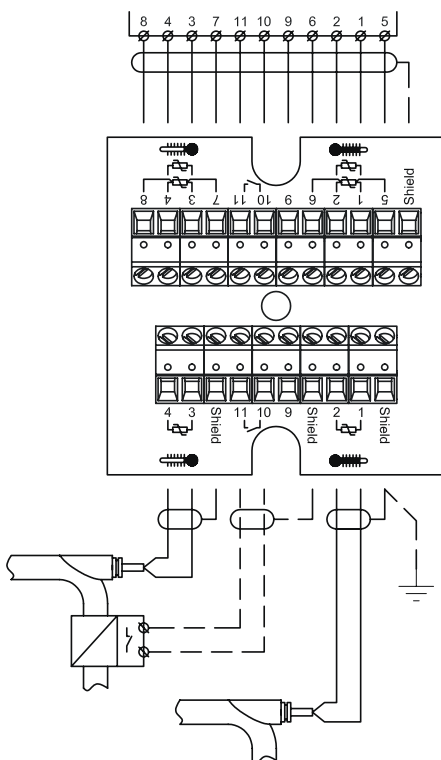
Recommendations for installation

Mechanical considerations

The location of the installation point of the temperature sensors and the flow sensor in the heating/cooling circuit is determined by the measurement itself. The two temperature measurement points form the limits for which the energy flow is calculated. (The supplier, for example, bears all pipe losses, which occur upstream, and the consumer all those downstream from the temperature measurement points.)

Both sensors for differential temperature measurement must be installed in an identical way. This also applies to the pipe diameter and the thermal insulation of the sensor surroundings. The aim is to ensure the same flow rates and thermal conditions for both measurement points. If, for example, one of the sensors is installed in non-insulated pipe, then the second should/must also be installed in non-insulated pipe (principle of equality).

The sensors should be preferably installed so that the first 10 mm of the one upstream (active measuring length) is in the middle third of the pipe cross-section.

Adjusting the face-to-face length is done with welded sleeves. These also ensure that the sensor locking screw is still accessible after attaching the insulation. Welded sleeves are made to a standard length of 100 mm. They must be adjusted to the pipe in both length and position.

Sensor pockets and head sensors must be installed so that there is sufficient room to replace them. (The sensors or measuring inserts must be in a position to be removed easily without the use of force).

The type of sensors used must be suitable for the temperature, pressure and flow speed of the application. Sensors, especially those with long immersion lengths, may be subject to considerable forces created by the flow.

The standard sensors today ensure maximum heat transfer with the sensor fitting snugly in the sensor pocket. Any dirt in the immersion tube will prevent the sensor from being properly seated in the pocket, and thus falsifying the results. The pockets are therefore mounted either from the side or from below. This is especially important for cooling systems as otherwise condensation or ice can build up in the pocket.

Immersion lengths for Aquametro for sensor pockets and temperature sensors

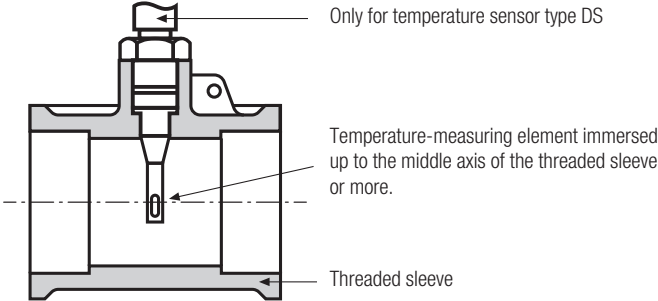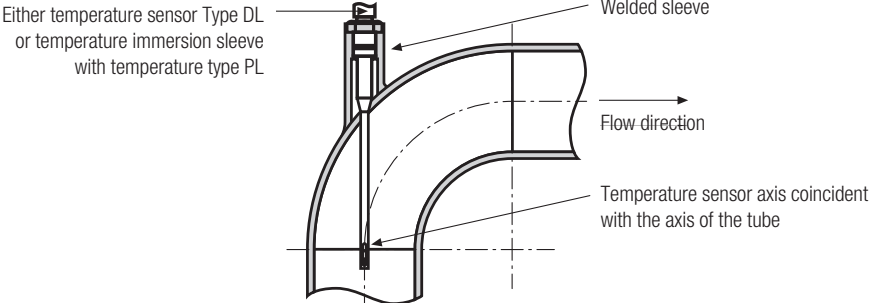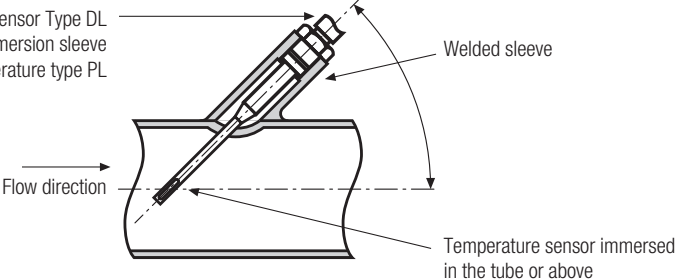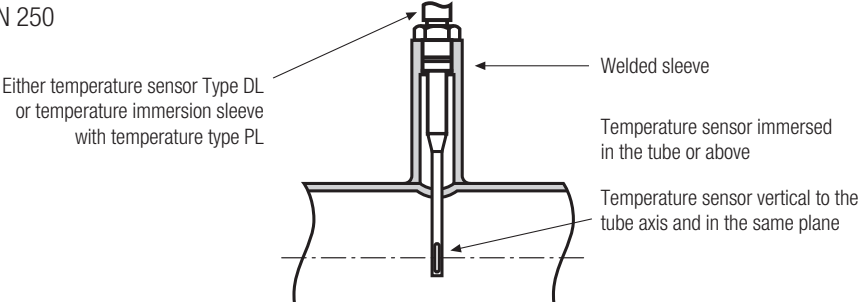### Recommendations for heating systems
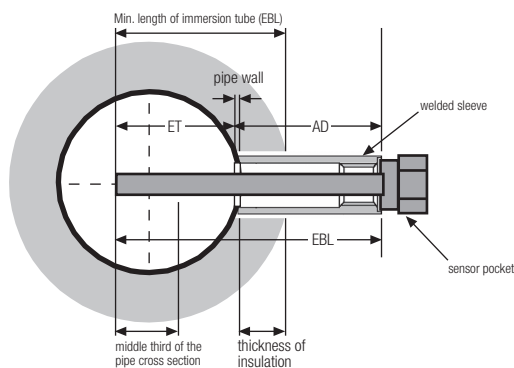
Insulation in the heating loops, heating plant regulations (Example: Germany)

Pipe cross-section (mm)	Thickness of insulation (ID)
up to DN 20	20 mm
DN 20 to DN 35	30 mm
DN 40 to DN 100	same ID as width
DN 100 upwards	100 mm

Note: For measuring points compliant to CE-MID, with nominal width of pipe 15, 20 and 25, directly immersed temperature sensors must be used.

Nominal width of pipe DN	15	20	25	32	40	50	65	80	100	125	150	200	250	300
Thickness of insulation (mm)	20	20	30	30	40	50	65	80	100	100	100	100	100	100
Immersion depth ET (mm)	10	15	20	25	30	38	45	60	70	83	95	120	145	170
Face-to-face length EBL (mm)	30	35	50	55	70	88	110	140	170	183	195	220	245	270
	External length for sensor pockets in relation to immersion depth													
3/8" / ATH-33	23	18	13											
1/2" / SP-M 40	30	25	20											
1/2" / SP-M 60		45	40											
1/2" / SP-E 85/105				60	55	47	40	25	15					
1/2" / SP-E 120/140				90	82	75	60	50	37	25				
1/2" / SP-E 155/175					117	110	95	85	72	60	35	10		
1/2" / SP-E 210/230						165	150	140	127	115	90	65	40	

Recommendations for installtion of EN 1434-2

Installation Type of the temperature sensor	Tube size		
In threaded sleeve	DN 15 DN 20 DN 25		Only for temperature sensor type DS Temperature-measuring element immersed up to the middle axis of the threaded sleeve or more. Threaded sleeve
In tube sheed	≤ DN 50	Either temperature sensor Type DL or temperature immersion sleeve with temperature type PL	Welded sleeve Flow direction Temperature sensor axis coincident with the axis of the tube
Diagonally to the flow direction	≤ DN 50	Either temperature sensor Type DL or temperature immersion sleeve with temperature type PL Flow direction	Welded sleeve Temperature sensor immersed in the tube or above
Vertical to the flow direction	DN 65 to DN 250	Either temperature sensor Type DL or temperature immersion sleeve with temperature type PL	Welded sleeve Temperature sensor immersed in the tube or above Temperature sensor vertical to the tube axis and in the same plane

Recommendations for cooling systems

Remarks
• Larger insulation thickness
• Condensate run-out: mounting from below

With PLC sensor

seal to insulate the
sensor cable

With PLH sensor

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