

Self-operated Temperature Regulators

Temperature Regulator Type 9

with balanced¹⁾ three-way valve · flange connection



Application

Temperature regulator with either mixing or flow-diverting valve for heating or cooling installations, with control thermostats for **set points** from **-10 °C** to **+250 °C** · **Three-way valves** in **nominal sizes DN 15 to DN 150** · **Nominal pressures PN 16 to PN 40** and **temperatures** up to **350 °C**

Conversion of valve sizing coefficients:

$$C_v \text{ (in U.S. gallons/min)} = 1.17 \cdot K_{vs} \text{ (in m}^3/\text{h)}$$

$$K_{vs} \text{ (in m}^3/\text{h)} = 0.86 \cdot C_v \text{ (in U.S. gallons/min)}$$

Note

Typetested temperature regulators (TR), temperature limiters (TL), safety temperature monitors (STM) and safety temperature limiters (STL) are available.



The regulators consist of a balanced three-way valve and a control thermostat comprising a temperature sensor, a set point adjuster with an excess temperature safety device, a capillary tube and an operating element.

Special features

- Low-maintenance P regulators requiring no auxiliary energy
- Wide set point range and convenient set point adjustment
- Three-way valve with plug balancing¹⁾ by means of a stainless steel bellows, optionally available with a plug arrangement for mixing or diverting liquids
- Flow rate across the cross-sectional area AB is practically independent of the valve plug position
- Valve body optionally made of cast iron, cast steel or stainless cast steel
- Versions with double adapter and manual adjuster are available for attachment of a temperature limiter or a second thermostat. For details, see Data Sheet T 2036 EN.

Versions

Temperature Regulator with Type 9 Three-way Valve

DN 15 to DN 25 not pressure balanced · DN 32 to 150 pressure balanced · PN 16 to PN 40 · Types 2231 to 2235 Control Thermostats.

Three-way valve optionally available with plug arrangement for mixing or flow-diverting service. For more details on the application of the thermostats, refer to Information Sheet T 2010 EN.

Type 9/2231 (Fig. 1) · With Type 2231 Control Thermostat for liquids · Set points from **-10 to +150 °C** · Set point adjustment at the sensor.

Type 9/2232 (Fig. 2) · With Type 2232 Control Thermostat for liquids and steam · Set points from **-10 to +250 °C** · Separate set point adjustment.

Type 9/2233 · With Type 2233 Control Thermostat for liquids, air and other gases · Set points from **-10 to +150 °C** · Set point adjustment at the sensor.

Type 9/2234 · With Type 2234 Control Thermostat for liquids, air and other gases · Set points from **-10 to +250 °C** · Separate set point adjustment.

Type 9/2235 · With Type 2235 Control Thermostat for air-heated storage rooms, drying, climatic and heating cabinets · Set points from **-10 to +250 °C** · Separate set point adjustment and a sensor tube which can be installed by the user.

¹⁾ DN 15 to 25: not pressure balanced

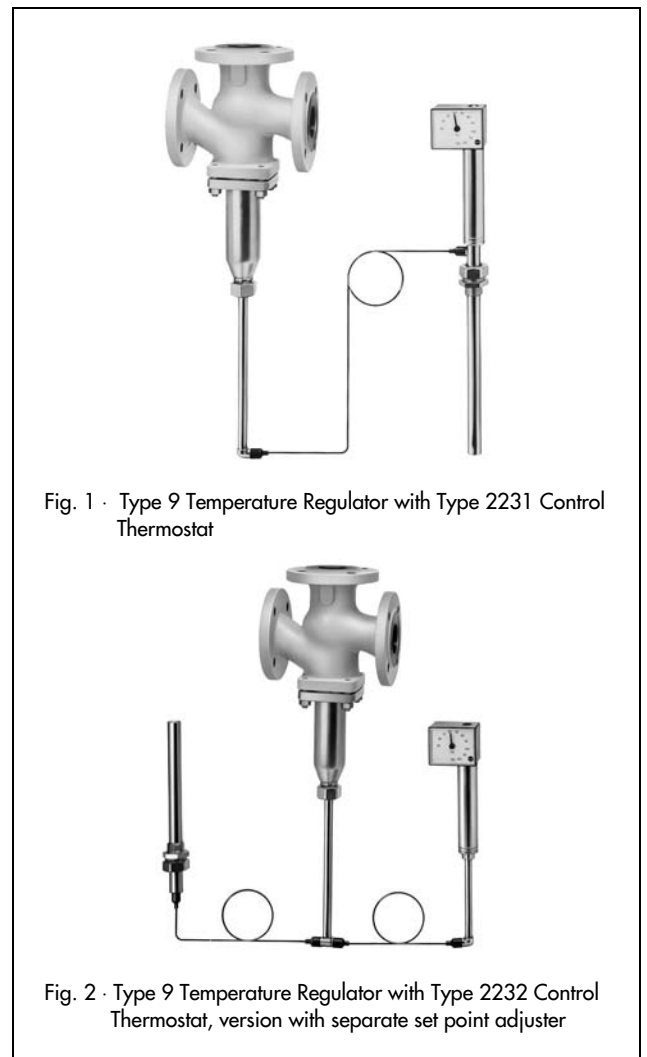


Fig. 1 · Type 9 Temperature Regulator with Type 2231 Control Thermostat

Fig. 2 · Type 9 Temperature Regulator with Type 2232 Control Thermostat, version with separate set point adjuster

Special version

- Longer capillary tube 5, 10, 15 m
- Capillary tube made of CrNiMo steel/Cu-plastic coated
- Sensor made from CrNiMo steel
- Valve made completely from stainless steel (min. material WN 1.4301)
- Version according to ANSI on request

Principle of operation (Figs. 3 and 4)

The regulators operate according to the liquid expansion principle. The temperature sensor (11), capillary tube (8) and operating element (7) are filled with an expansion liquid. The temperature-dependent change in volume of this liquid causes the operating element to move and, as a result, also the plug stem (5) of the control valve with the attached plug (3).

The position of the plug determines the flow rate of the heat transfer medium across the free area between the plug (3) and the seat (2). With a key (9), the set point can be adjusted to a value which is indicated on the dial (10).

With pressure balanced valves of nominal sizes DN 32 to 150, the pressure at port B acts through a hole in the plug stem (5) onto the outer surface of the balancing bellows¹⁾ (4.1), whereas the pressure at port A acts onto the inner bellows area which equalizes the forces acting onto the valve plugs (3).

In mixing valves (see Fig. 3 with plug arrangement I), the process media to be mixed flow through valve ports A and B. The combined flow is discharged from common port AB. The flow rate from A or B to common valve port AB depends on the free area of flow between the seats (2) and the plugs (3), i.e. on the position of the plug stem (5). When the temperature rises, port A opens and port B closes.

In flow-diverting valves, in contrast, the process medium flows through common valve port AB, and the partial flows are discharged from ports A or B. The flow rate from AB to A or B depends on the position of the plug stem. Flow-diverting valves are supplied with plug arrangement II (Fig. 4). In this case, port A closes and port B opens when the temperature rises.

¹⁾ Valve sizes DN 15 to 25 are without pressure balancing.

Three-way valve

- 1 Valve body
- 2 Seat (replaceable)
- 3 Plug
- 4 Bellows housing
- 4.1 Balancing bellows
- 5 Plug stem with spring
- 6 Nipple with coupling nut

Control thermostat

- 7 Operating element
- 8 Capillary tube
- 9 Key for set point adjustment
- 10 Set point dial
- 11 Temperature sensor (bulb sensor)

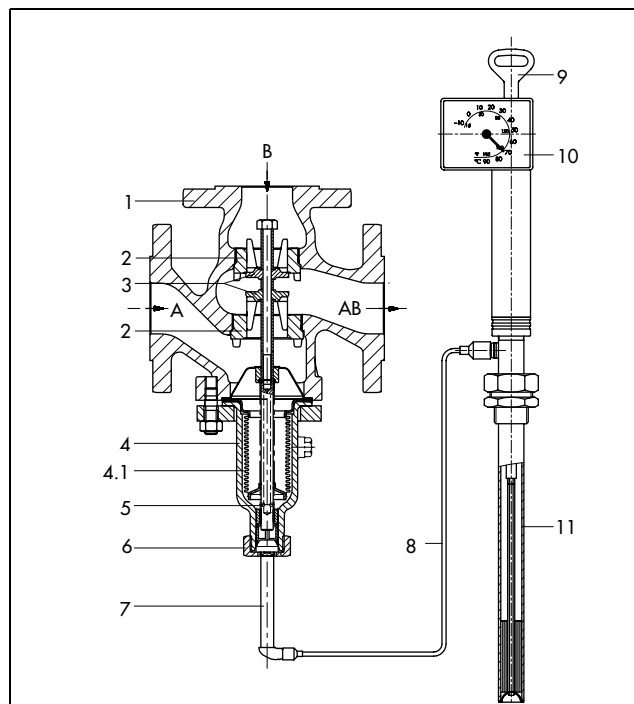


Fig. 3 · Temperature regulator with Type 9 Three-way Valve (DN 50) and Type 2231 Control Thermostat, three-way valve with plug arrangement I, arrows indicate mixing service

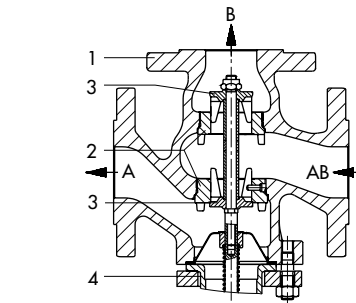
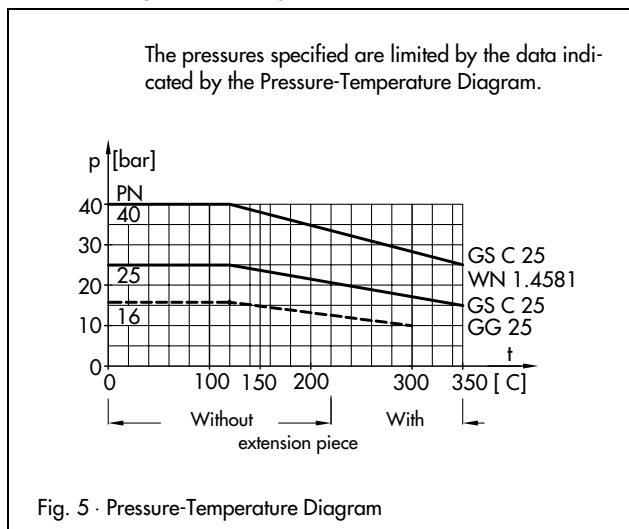


Fig. 4 · Type 9 Three-way Valve with plug arrangement II, arrows indicate flow-diverting service

Pressure-Temperature Diagram



Installation

- Install in horizontal pipelines with the thermostat connection vertically suspended. Match the direction of the medium flow as indicated by the arrow on the body.
- Install capillary tube so as to avoid exposure to large temperature fluctuations. Prevent mechanical damage. Minimum bending radius must be 50 mm.
- The bulb sensor may be installed in any desired position, however, make sure its entire length is immersed in the medium to be controlled. Install in a location where overheating or considerable idle times do not occur.
- Be sure to only combine the same kind of materials, for example stainless-steel heat exchangers should only be fitted with thermowells made of stainless steel WN 1.4571.

Table 1 · Technical data · All pressures in bar (gauge). The permissible pressures and differential pressures specified are limited by the data given in the Pressure-Temperature Diagram and the pressure ratings (according to DIN 2401).

Type 9 Three-way Valve		Nom. pressure ratings										
		PN 16 to PN 40										
Kvs values and max. perm. differential pressures Δp ¹⁾												
Connection	DN	15	20	25	32	40	50	65	80	100	125	150
Mixing valve	Kvs value	4	6.3	8	16	20	32	50	80	125	160	200
For p in B > p in A	Δp	10			16			10			8	
For p in A > p in B	Δp	2			3.5			3			2	
Flow-diverting valve	Kvs	4	6.3	8	16	20	32	40	64	100	125	160
	Δp	2			3.5			3			2	
Permissible valve temperature		See Fig. 5 · Pressure-Temperature Diagram										
Types 2231 to 2235 Thermostat		Size 150										
Set point range (each set point span 100 °C)		-10 to +90 °C, 20 to 120 °C or 50 to 150 °C For Types 2232, 2234, 2235 also 100 to 200 °C, 150 to 250 °C										
Perm. ambient temperature at the set point adjuster		-40 to +80 °C										
Perm. temperature at the sensor		100 °C above the adjusted set point										
Perm. pressure at the sensor	Types 2231/2232	Without thermowell: PN 40 · With thermowell: PN 40 (copper version: PN 16) or PN 63 With thermowell with flange: PN 40/DN 32 or PN 100/DN 40										
	Types 2233/2234	Without thermowell: PN 40 · With thermowell: PN 6 (external \varnothing 140) or PN 40/DN 32										
Length of capillary tube		3 m (special version: 5, 10 or 15 m)										

¹⁾ For liquids, the differential pressure corresponds to the pressure head of the pump

Table 2 · Materials (WN = Material Number acc. to DIN)

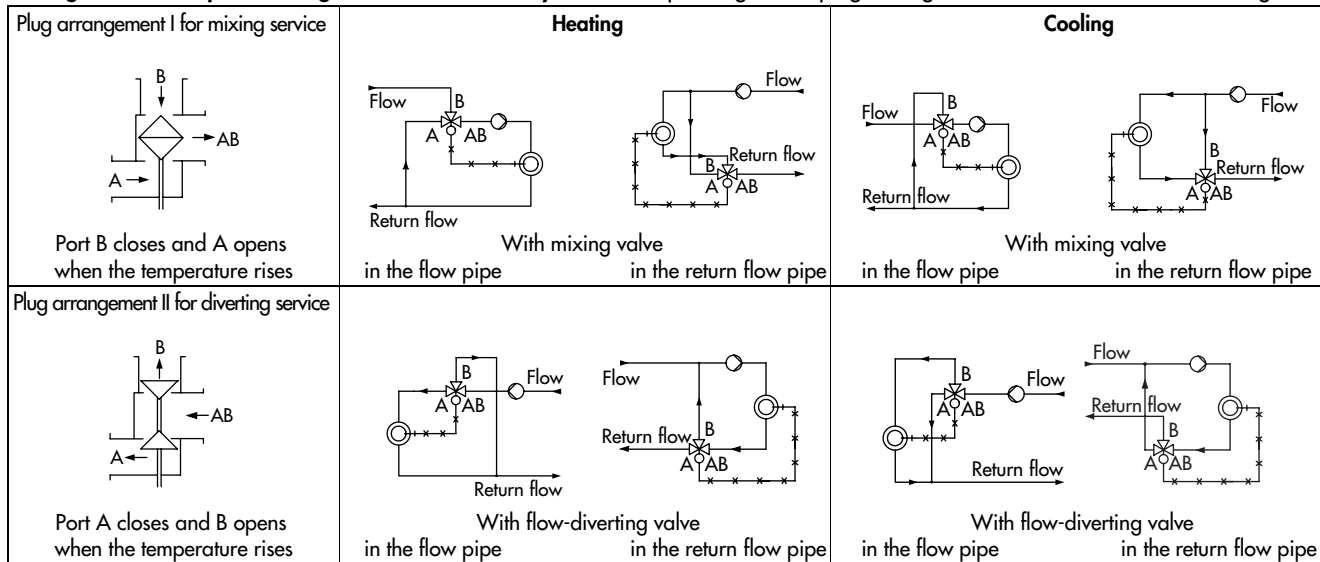
Type 9 Three-way Valve			
Connection	DN 15 to DN 150		Up to DN 100
Nominal pressure	PN 16		PN 25/40
Body	Cast iron GG 25 WN 0.6025		Cast steel GS C 25 WN 1.0619
Seat and plug	Steel WN 1.4006 (WN 1.4301 for DN 125 and 150)		Stainless cast steel WN 1.4571
Plug stem/spring	WN 1.4301/WN 1.4310		
Balancing bellows ¹⁾	WN 1.4571		
Bellows housing	St 35.8 (WN 1.0305)		WN 1.4571
Sealing ring	Graphite on metal core		
Extension piece/distance piece	Brass (special version: stainless steel WN 1.4301)		WN 1.4301
Types 2231, 2232, 2233, 2234 and 2235 Thermostat ²⁾			
	Standard version	Special version	
Operating element	Brass, nickel-plated		
Types 2231/2231	Bronze, nickel-plated	Stainless steel WN 1.4571	
Sensor Types 2233/2234	Copper, nickel-plated		
Type 2235	Copper		
Capillary tube	Copper, nickel-plated	Copper, plastic-coated	
Thermowell with threaded connection			
Immersion tube	Bronze, nickel-plated	Copper	WN 1.4571
Threaded nipple	Brass, nickel-plated	Copper	WN 1.4571
... with flanged connection			
Immersion tube	Steel	Plastic-coated or PTFE ³⁾	WN 1.4571
Flange	Steel		WN 1.4571

¹⁾ DN 15 to 25: without balancing bellows

²⁾ Type 2235 not available in stainless steel

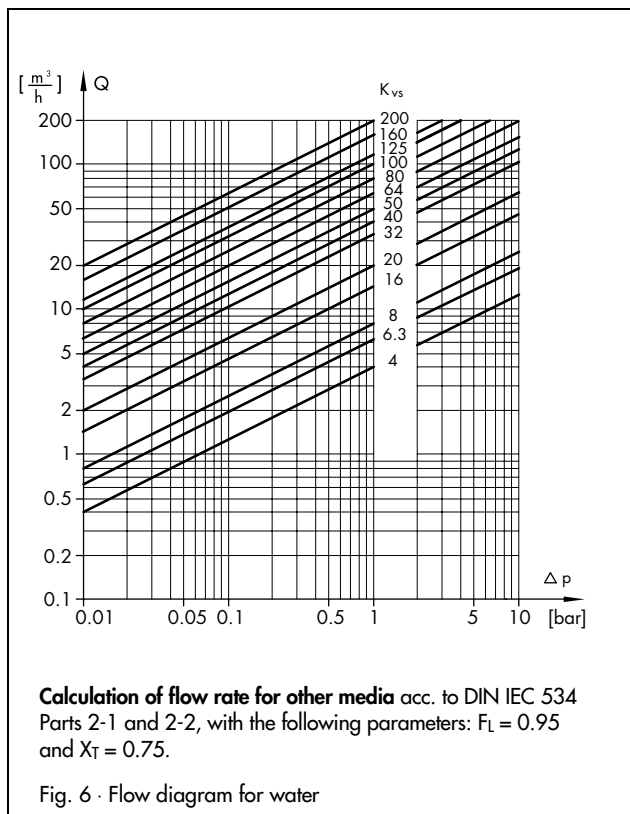
³⁾ Plastic coating - for temperatures up to 80 °C - - PVC or PPH coating. PTFE version · Immersion tube: PTFE · Flange: Steel with PTFE bushing.

Arrangement of temperature regulators with three-way valves - depending on the plug arrangement in the valve - schematic diagram



Flow diagram for water

The values shown apply to a fully open valve.



Ordering text

Temperature Regulator Type 9/..., DN ..., PN ..., mixing or flow-diverting valve, body material ..., with Thermostat Type ..., set point range ...°C, capillary tube ... m, optional special version ..., optional accessories ...

Typetested safety devices

The register number is available on request. Available are:

Temperature regulators (TR) with a Type 2231, 2232, 2233, 2234 or 2235 Thermostat and a Type 9 Three-way Valve, sizes DN 15 to DN 150, for which the max. operating pressure should not exceed the max. permissible differential pressure Δp specified in the "Technical data".

Sensor without thermowell: Applicable up to 40 bar

With thermowell: Only use SAMSON version G1, of bronze and WN 1.4571 up to 40 bar, of copper up to 16 bar.

Temperature limiters (TL) with a thermostat and three-way valve as specified above and a double adapter DoL (see Data Sheet T 2036 EN).

For further details on the selection and application of typetested devices, see Information Sheet T 2040 EN.

Safety temperature monitors (STM) and safety temperature limiters (STL) are also available. For details, see Data Sheets T 2043 EN and T 2046 EN.

Accessories

Extension piece and/or distance piece. For mounting between the three-way valve and the operating element when the operating conditions affect the reliability of the operating element.

The **extension piece** is required for temperatures exceeding 220 °C (see Fig. 5 · Pressure-Temperature Diagram).

The **distance piece** is used for the stainless steel version to isolate the non-ferrous metal parts of the operating element from the medium flowing through the valve. In addition, it prevents medium leakage when the thermostat is exchanged.

For Types 2231 and 2232 Control Thermostat: Thermowells with threaded connection or flange.

For Types 2233 and 2234 Control Thermostat: Clamps and cover for wall mounting.

Table 3 · Dimensions in mm and weights

Type 9 Three-way Valve		DN	15	20	25	32	40	50	65	80	100	125	150
Length L			130	150	160	180	200	230	290	310	350	400	480
H2			70	80	85	100	105	120	130	140	150	200	210
H1	Up to 220 °C (without extension piece)		235			240		245	320		355	395	500
	Up to 350 °C (with extension piece)		375			380		385	460		495	535	640
H	Up to 220 °C (without extension piece)		525			530		535	610		645	685	790
	Up to 350 °C (with extension piece)		665			670		675	750		785	825	930
Weight (body PN 16) ¹⁾		approx. kg	6	7	8.5	15	17	19	32	50	71	On request	
Thermostat		Type	2231		2232		2233		2234		2235		
Immersion depth T			290		235		430		460		3460		
Weight		approx. kg	3.2		4.0		3.4		3.7		3.6		

¹⁾ +1.5% for PN 25/40

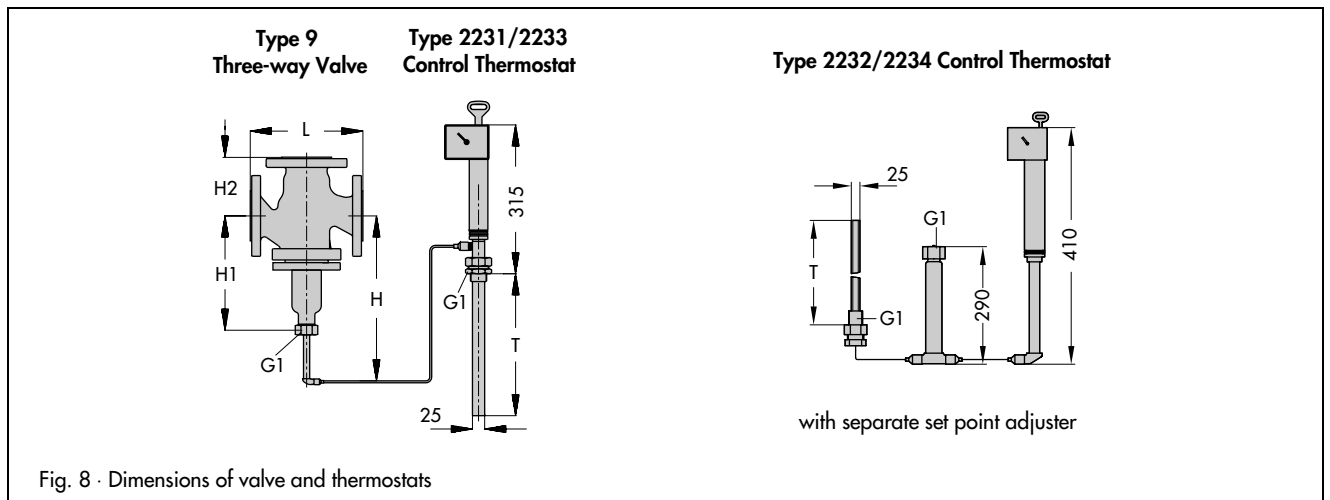


Fig. 8 · Dimensions of valve and thermostats

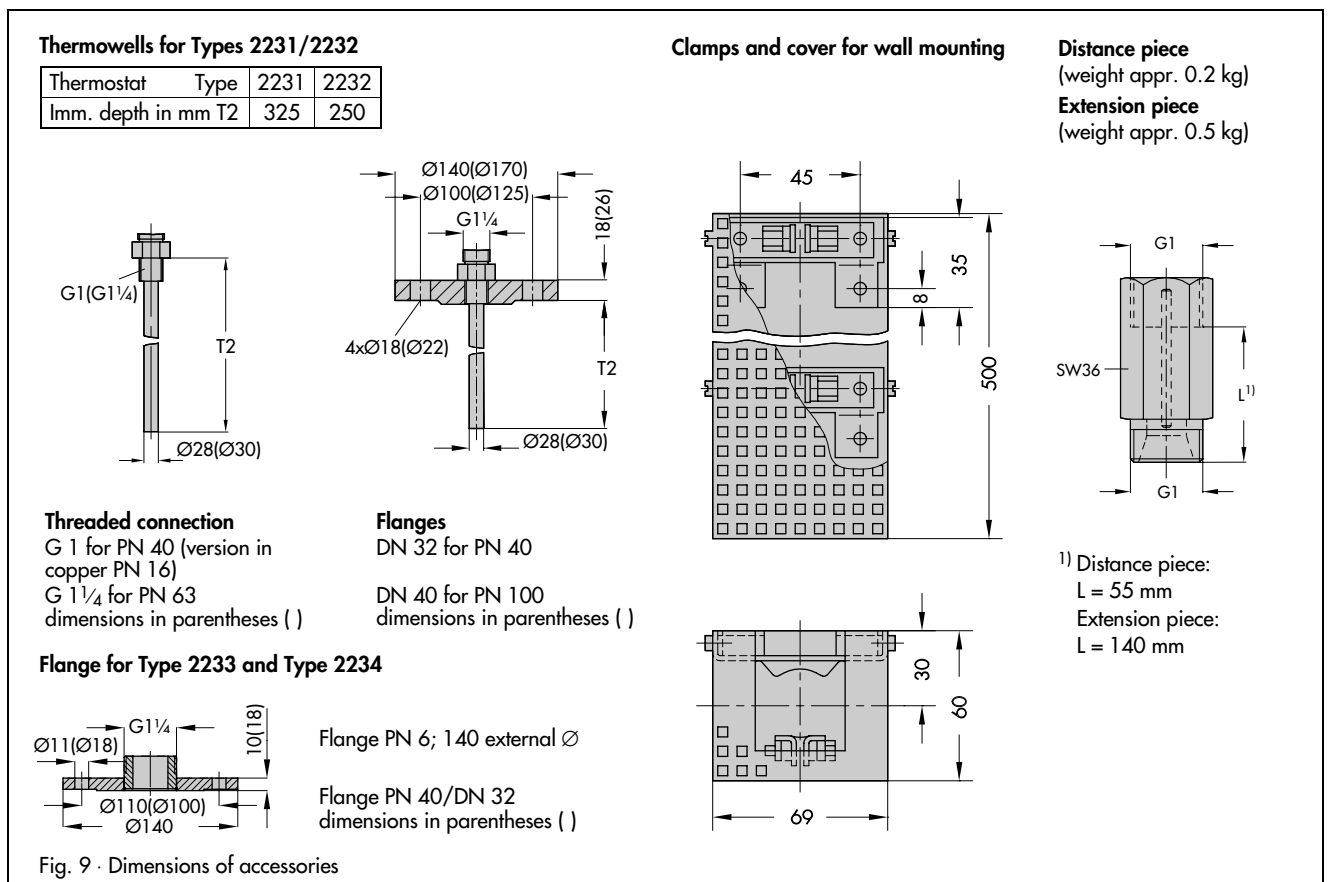


Fig. 9 · Dimensions of accessories

Specifications subject to change without notice.



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