

T 2133 EN

Type 9 Temperature Regulator

Self-operated Temperature Regulators · With balanced three-way valve ¹⁾ · Flanged connections



Application

Temperature regulators with mixing or diverting valve designed for plants that are heated or cooled using liquids · Control thermostats for set points from **-10 to +250 °C** · Three-way valves **DN 15 to 150** · Nominal pressure **PN 16 to 40** · Suitable for temperatures up to **350 °C**

Note

Temperature regulators (TR), safety temperature monitors (STM), and safety temperature limiters (STL) tested according to DIN EN 14597 are available.

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

Special features

- Low-maintenance proportional regulators requiring no auxiliary energy
- Wide set point range and convenient set point adjustment
- Three-way valve with plug balanced ¹⁾ by a stainless steel bellows, optionally available with a plug arrangement to mix or divert liquids
- Flow rate across the port AB almost independent of the valve plug position
- Valve body optionally available in cast iron, cast steel, or cast stainless steel
- Versions with double adapter and manual adjuster for temperature limiters or attachment of a second control thermostat. See ▶ T 2036 for details.

Versions

Type 9 Temperature Regulator with three-way valve · With Type 2119 Valve · DN 15 to 25 (unbalanced) · DN 32 to 150 (balanced) · PN 16 to 40 · Type 2231 to 2235 Control Thermostat

Three-way valves with optional plug arrangements for either mixing or diverting service. Further details on the application of thermostats can be found in Information Sheet ▶ T 2010.

Type 2119/2231 (Fig. 1) · With Type 2119 Valve and Type 2231 Control Thermostat · Suitable for liquids and steam · Set points from **-10 to +150 °C** · Set point adjustment at the sensor

Type 2119/2232 (Fig. 2) · With Type 2119 Valve and Type 2232 Control Thermostat · Suitable for liquids and steam · Set points from **-10 to +250 °C** · Separate set point adjustment

Type 2119/2233 · With Type 2119 Valve and Type 2233 Control Thermostat · Suitable for liquids, air, and other gases · Set points from **-10 to +150 °C** · Set point adjustment at the sensor

¹⁾ DN 15 to 25 unbalanced

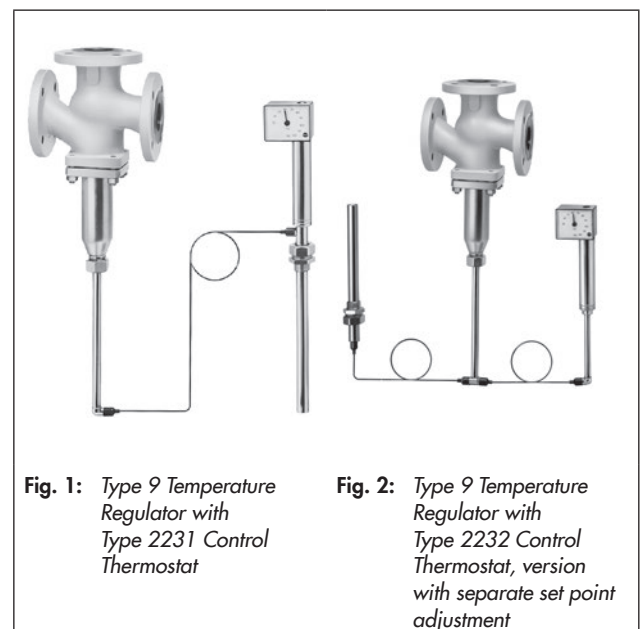


Fig. 1: Type 9 Temperature Regulator with Type 2231 Control Thermostat

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

Type 2119/2234 · With Type 2119 Valve and Type 2234 Control Thermostat · Suitable for liquids, air, and other gases · Set points from **-10 to +250 °C** · Separate set point adjustment

Type 2119/2235 · With Type 2119 Valve and Type 2235 Control Thermostat · Installation in air-heated storerooms as well as drying, climatic and heating cabinets · Set points from **-10 to +250 °C** · Separate set point adjustment and a sensor tube to be installed on site

Special version

- Capillary tube 5, 10 or 15 m
- Capillary tube made of CrNiMo steel or plastic-coated copper
- Sensor of CrNiMo steel
- Valve entirely of stainless steel (at least made of 1.4301)
- ANSI version on request (▶ T 2134)

Principle of operation (see Fig. 3 and Fig. 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 moves the plug stem (5) with the attached plug (3).

The position of the plug determines the flow rate of the heat transfer medium across the area released between the seat (2) and plug (3). The temperature set point is adjustable with a key (9) to a value which can be read off from the dial (10).

In the balanced valves (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 bellows ¹⁾ (4.1), whereas the pressure at port A acts onto the inner bellows area. This 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 enter at valve ports A and B. The combined flow exits the valve at port AB. The flow rate from A or B to AB is determined by the area released between the seats (2) and plugs (3), i.e. by the position of the plug stem (5). When the temperature rises, port A opens and port B closes.

In diverting valves, in contrast, the process medium enters at the valve port AB and the partial flows exit at ports A or B. The flow rate from AB to A or B is determined by the position of the plug stem. Diverting valves have the plug arrangement II (see Fig. 4). When the temperature rises, port A closes and port B opens.

¹⁾ Valves in DN 15 to 25 have unbalanced plugs

Three-way valve	Control thermostat
1 Valve body	7 Operating element
2 Seat (exchangeable)	8 Capillary tube
3 Plug	9 Set point adjustment key
4 Bottom section (bellows housing)	10 Set point dial
4.1 Balancing bellows	11 Temperature sensor (bulb sensor)
5 Plug stem with spring	
6 Thermostat connection (threaded nipple with coupling nut)	

Installation

Valve

The thermostat connection (6) must face downwards. Other mounting positions are available on request.

Make sure the direction of flow complies with the required service type, i.e. mixing or diverting service.

Capillary tube

The capillary tube must be run in such a way that the ambient temperature range cannot be exceeded, any deviations in temperature cannot occur and that the tube cannot be damaged. The smallest permissible bending radius is 50 mm.

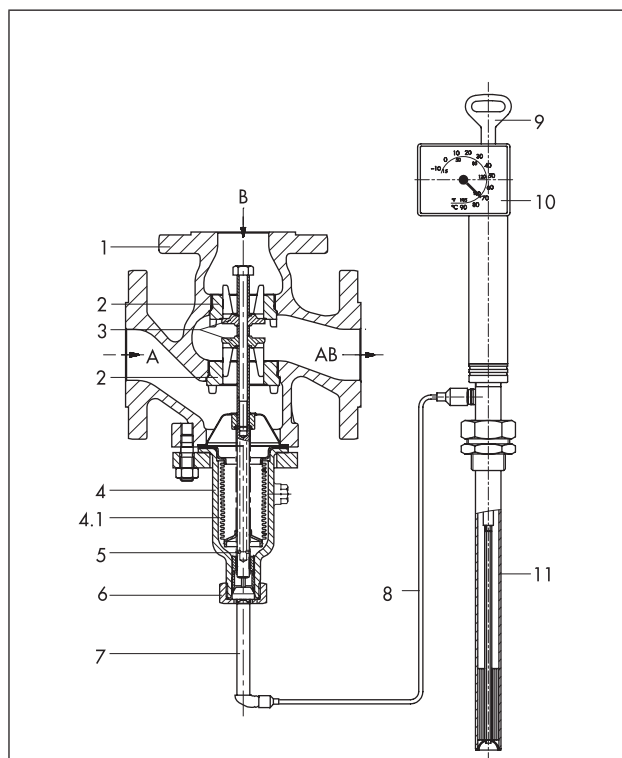


Fig. 3: Type 9 Temperature Regulator with three-way valve (DN 50) and Type 2231 Control Thermostat, three-way valve with plug arrangement I (the arrows indicate mixing service)

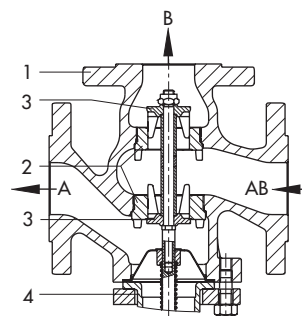


Fig. 4: Type 9 Temperature Regulator with three-way valve, with plug arrangement II (the arrows indicate diverting service)

Temperature sensor

The temperature sensor may be installed in any position. Its entire length must be immersed in the medium. It must be installed in a location where overheating or considerable idling times cannot occur.

Only the combination of the same kind of materials is permitted, e.g. a stainless steel heat exchanger with thermowells made of stainless steel 1.4571.

Table 1: Technical data · All pressures in bar (gauge). The listed permissible pressures and differential pressures are restricted by the specifications in the pressure-temperature diagram and the nominal pressure.


Type 2119 Three-way Valve													
Nominal pressure		PN 16 to 40											
K _{V5} coefficients and max. permissible differential pressures Δp in bar													
Connection		DN	15	20	25	32	40	50	65	80	100	125	150
Mixing valve		K _{V5} coefficient	4	6.3	8	16	20	32	50	80	125	160	200
When p in B > p in A		Δp	10			16			10			8	
When p in A > p in B		Δp	5			3.5			3			2	
Diverting valve (when AB to A or B)		K _{V5} coefficient	4	6.3	8	16	20	32	40	64	100	125	160
		Δp	4			3.5			3			2	
Permissible temperature of the valve		220 °C/350 °C · See pressure-temperature diagram in ► T 2010											
Compliance													
Type 2231 to 2235 Thermostat													
		Size 150											
Set point range (set point span 100 K)		-10 to +90 °C, 20 to 120 °C or 50 to 150 °C · For Types 2232, 2234 and 2235 also 100 to 200 °C, 150 to 250 °C											
Perm. ambient temperature at the set point adjustment		-40 to +80 °C											
Permissible temperature at sensor		100 K above the adjusted set point											
Permissible pressure at sensor		Type 2231/2232	Without/with thermowell: PN 40 · Thermowell with flange: PN 40										
		Type 2233/2234	Without thermowell: PN 40 · With flange on request										
Capillary tube length		3 m (5, 10 or 15 m as special version)											

Table 2: Materials · Material numbers according to DIN EN

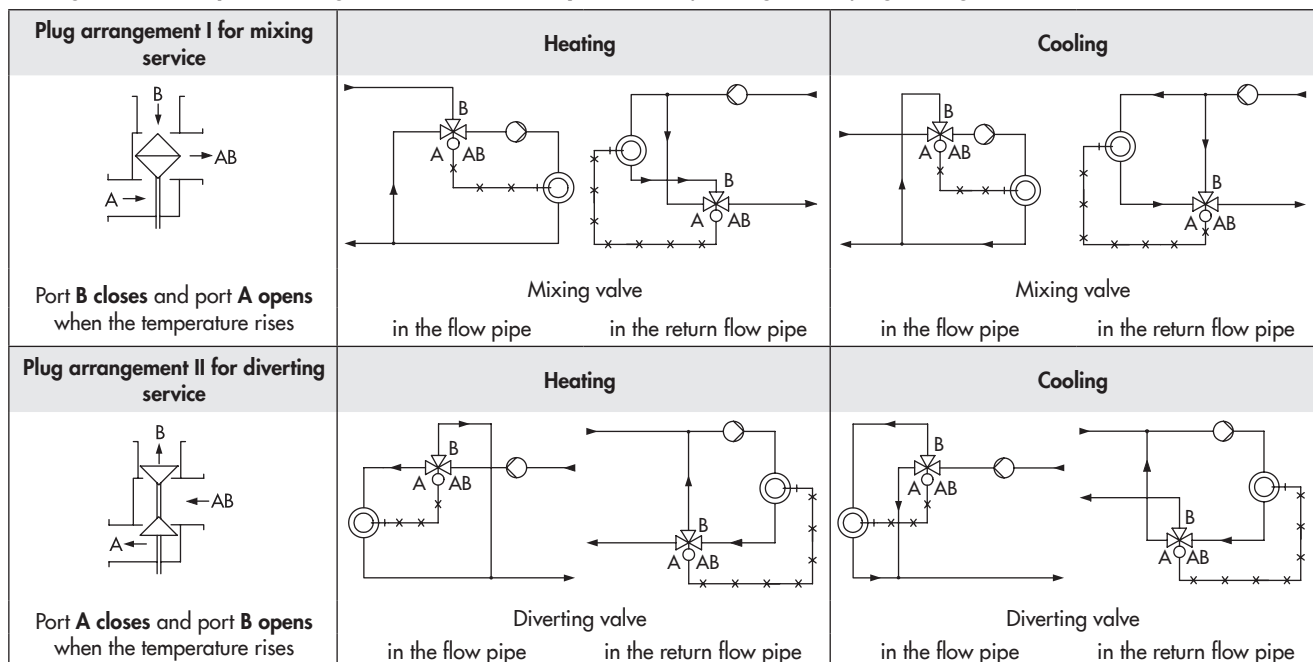
Type 2119 Three-way Valve		
Nominal size	DN 15 to 150	
Nominal pressure	PN 16	PN 25/40
Body	Cast iron EN-JL1040	Cast steel 1.0619
Seat and plug	Steel 1.4006 (1.4301 for DN 125 and 150)	
Plug stem/spring	1.4301/1.4310	
Balancing bellows ¹⁾	1.4571	
Bellows housing	1.0425	1.4571
Gasket	Graphite on metal core	
Extension piece/separating piece	Brass (special version: stainless steel 1.4301)	
Types 2231, 2232, 2233, 2234 and 2235 Thermostat ²⁾		
	Standard version	Special version
Operating element	Nickel-plated brass	
Sensor	Type 2231/2232	Bronze
	Type 2233/2234	Copper
	Type 2235	Copper
Capillary tube	Nickel-plated copper	Plastic-coated copper or stainless steel 1.4571
Thermowell		
G 1 threaded connection		
Thermowell	Thermowell	Bronze, steel, copper ³⁾
	Threaded nipple	Brass
Flanges	Thermowell	Steel
	Flange	Steel

¹⁾ DN 15 to 25: without balancing bellows

²⁾ Type 2235 not available in stainless steel version

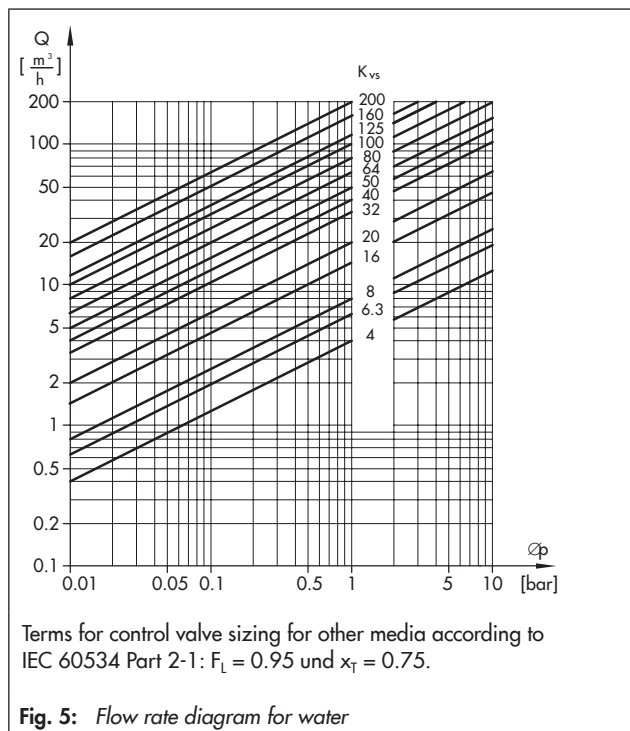
³⁾ Only for nominal pressure PN 16

Arrangement of temperature regulators with three-way valves (depending on the plug arrangement in valve) - Schematics



Flow rate diagram for water

The specifications apply to a fully open valve



Typetested safety devices

The register number is available on request.

The following versions are available:

Temperature regulators (TR) with a Type 2231, 2232, 2233, 2234 or Type 2235 Thermostat and a Type 2119 Three-way Valve in sizes DN 15 to 150, for which the maximum operating pressure must not exceed the maximum permissible differential pressure Δp specified in the technical data.

Sensors **without thermowell**: applicable up to 40 bar

Sensors **with thermowell**: only use SAMSON G 1 version made of bronze, steel or stainless steel up to 40 bar, copper up to 16 bar.

Thermowell for flammable gases **typetested by DVGW**, G 1 threaded connection, PN 100.

Further details on the selection application of typetested equipment can be found in Information Sheet ► T 2040.

Additionally, the following are available:

Safety temperature monitors (STM) and **safety temperature limiters (STL)**. Details in Data Sheets ► T 2043 and ► T 2046.

Dimensions · Type 2119 Three-way Valve with thermostat

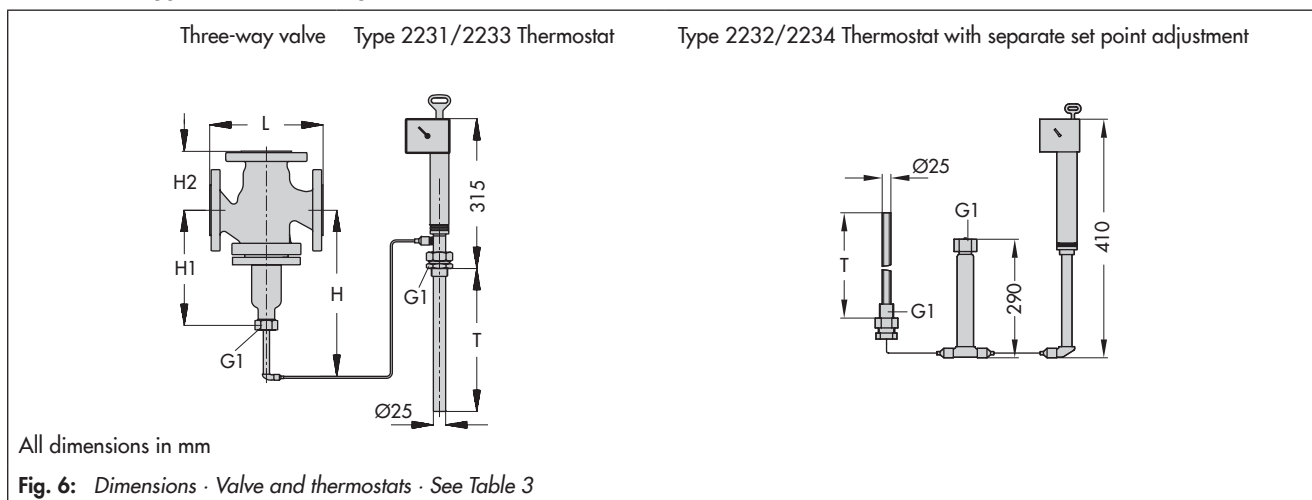


Table 3: Dimensions in mm and weights

Type 2119 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 (PN 16 body) ¹⁾ , approx.		kg	6	7	8.5	15	17	19	32	50	71	100	120
Thermostat		Type	2231		2232		2233		2234		2235		
Immersion depth T			290 ²⁾		235 ²⁾		430		460		3460		
Weight, approx.		kg	3.2		4.0		3.4		3.7		3.6		

¹⁾ +1.5 % for PN 25/40

²⁾ Larger immersion depths on request

Dynamic behavior of the thermostats

The dynamics of the regulator are mainly determined by the response of the sensor with its characteristic time constant.

Table 4 lists the response times of SAMSON sensors operating according to different principles measured in water.

Ordering text

Type 9 Temperature Regulator/....,

DN ..., PN ...

Mixing or diverting valve, body material ...,

With Type ... Thermostat, set point range ...°C

Capillary tube ... m

Optionally, special version ...

Optionally, accessories ...

Table 4: Dynamic behavior of SAMSON thermostats

Functional principle	Control thermostat Type	Time constant [s]	
		Without Thermowell	With Thermowell
Liquid expansion	2231	70 s	120 s
	2232	65 s	110 s
	2233	25 s	– ¹⁾
	2234	15 s	– ¹⁾
	2235	10 s	– ¹⁾
Adsorption	2213	70 s	120 s
	2212	– ¹⁾	40 s

¹⁾ Not permissible

Dimensions of accessories

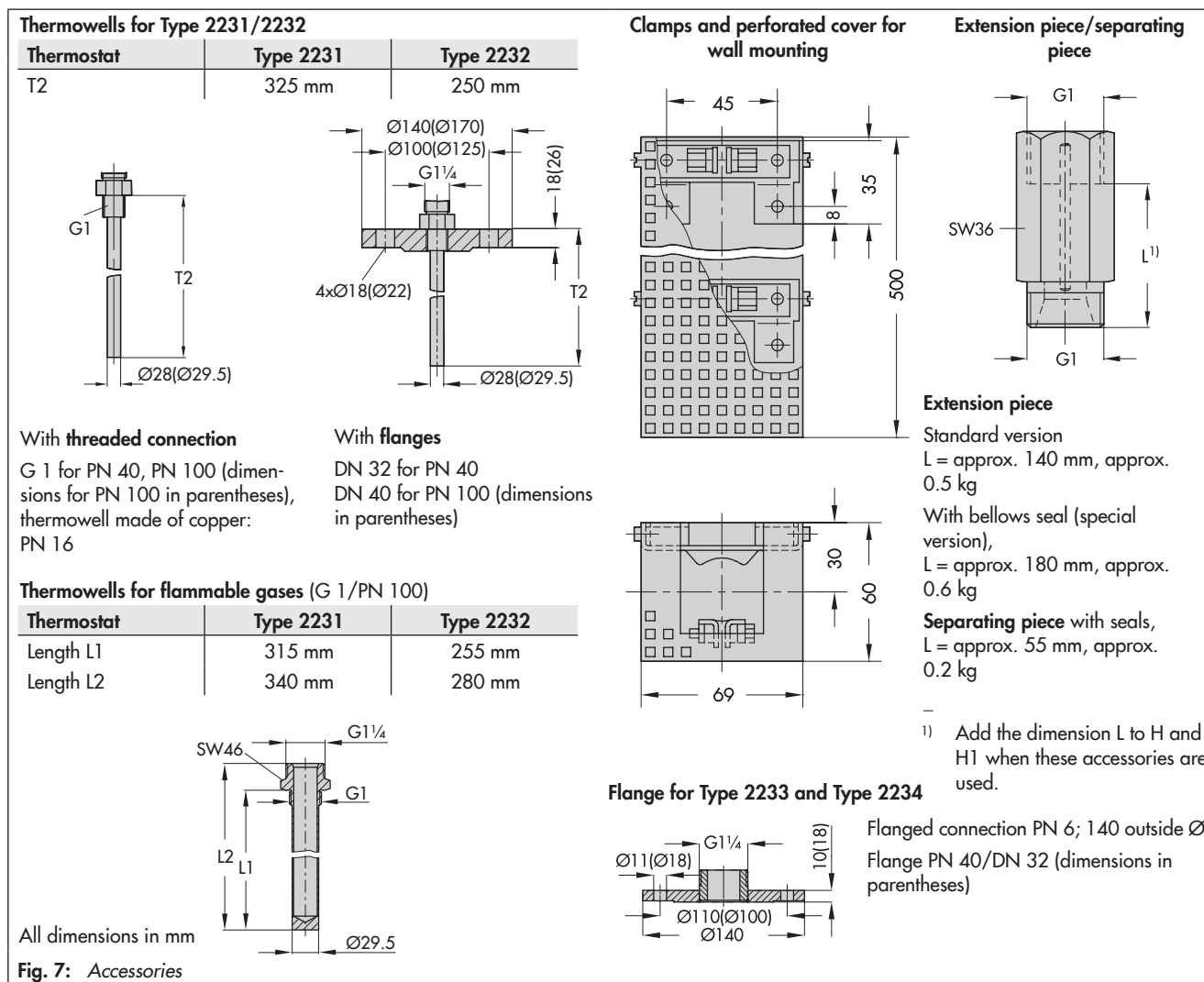


Fig. 7: Accessories

Accessories

Thermowells with threaded or flanged connections for Types 2231 and 2232 Bulb Sensors · G 1 threaded connection, made of bronze, steel, or CrNiMo steel (PN 40) or made of copper (PN 16) · Flanged connection, DN 32, PN 40, with thermowell made of CrNiMo steel/steel · Thermowell made of PTFE, PN 6 (flange PN 40).

Thermowell for flammable gases **typetested by DVGW**, G 1 threaded connection, PN 100.

Mounting parts for Types 2233 and 2234 · Clamps for wall mounting · Perforated cover for thermostat

To protect the operating element from inadmissible operating conditions, an **extension piece** or **separating piece** must be installed between the valve and the operating element.

An **extension piece** is needed for temperatures over 220 °C. The standard version does not have sealing. The special version of the extension piece for DN 15 to 100 is made of stainless steel and has a bellows seal. It additionally acts as a separating piece.

In combinations with valves made of cast iron or spheroidal graphite iron together with Type 2212 Safety Temperature Limiter or Type 2213 Safety Temperature Monitor, an extension piece is required for temperatures over 150 °C.

Separating piece made of brass (for water and steam) or CrNi steel (for water and oil). A separating piece must be used when a seal between thermostat and valve is required. Separating pieces made of CrNi steel must be used when all wetted parts are to be free of non-ferrous metals. In addition, it prevents the medium from leaking while the thermostat is being replaced.

Do2 double adapter for second thermostat · **DoS** with electric signal transmitter

Manual adjuster Ma with travel indicator · **MaS** with electric signal transmitter

Reversing device for DN 65 to 100 (item no. 1180-8098). Installed between thermostat connection and operating element with capillary tube. This allows the operating direction to be reversed when the regulator is installed incorrectly in the pipeline.