

## T 2134 EN

### Type 9 Temperature Regulator

Self-operated Temperature Regulators · ANSI version



#### Application

Temperature regulators with mixing or diverting valve designed for plants that are heated or cooled using liquids  
Control thermostats for set points from **15 to 480 °F / -10 to +250 °C** · Three-way valves in valve sizes **NPS ½ to 6 / DN 15 to 150**  
Pressure rating **Class 150 and 300** · Temperatures up to **660 °F / 350 °C**

#### Note

Typetested temperature regulators (TR), safety temperature monitors (STM) and safety temperature limiters (STL) 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 <sup>1)</sup> by a stainless steel bellows, optionally available with a plug arrangement to mix or divert liquids
- Flow rate across the port AB independent of the valve plug position
- Valve body optionally made of 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

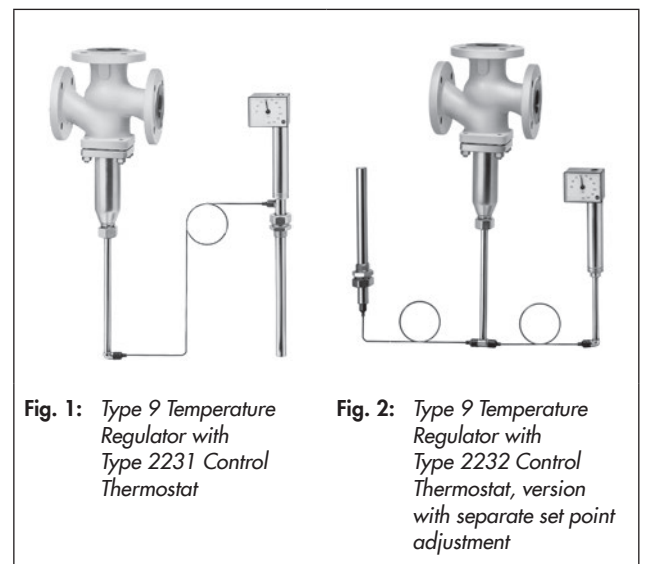
Type 2119 Valve NPS ½ to 1: unbalanced · NPS 1½ to 6: balanced · Class 150 and 300 · Type 2231 to 2235 Control Thermostat

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 · Set points from 15 to 300 °F (-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 15 to 480 °F (-10 to +250 °C) · Separate set point adjustment

<sup>1)</sup> NPS ½ to 1: not 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 adjustment

**Type 2119/2233** · With Type 2119 Valve and Type 2233 Control Thermostat · Suitable for liquids, air and other gases · Set points from 15 to 300 °F (-10 to +150 °C) · Set point adjustment at the sensor

**Type 2119/2234** · With Type 2119 Valve and Type 2234 Control Thermostat · Suitable for liquids, air and other gases · Set points from 15 to 480 °F (-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 15 to 480 °F (-10 to 250 °C) · Separate set point adjustment and a sensor tube to be installed on site

#### Special version

- 33 or 50 ft (10 or 15 m) capillary tube length
- Sensor of CrNiMo steel
- Capillary tube, copper with plastic coating
- Valve entirely of stainless steel (at least 1.4301)

## 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 (NPS 1½ to 6), the pressure at port B acts through a hole in the plug stem (5) onto the outer surface of the balancing bellows<sup>1)</sup> (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.

## Installation

### – Valve

The thermostat connection (6) must face downwards. Other mounting positions 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 2" (50 mm).

### – Temperature sensor

The temperature sensor can be installed in any position as required. 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.

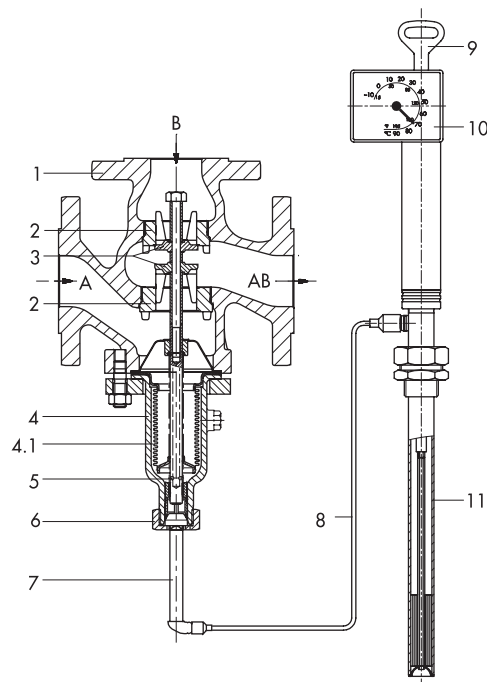


Fig. 3: Type 9 Temperature Regulator with three-way valve (NPS 2) and Type 2231 Control Thermostat, three-way valve with plug arrangement I (the arrows indicate mixing service)

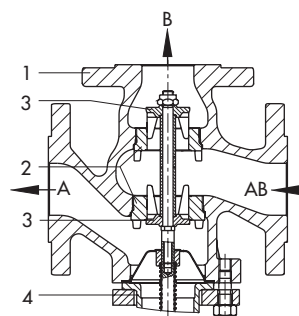


Fig. 4: Type 9 Temperature Regulator with three-way valve, with plug arrangement II (the arrows indicate diverting service)

### Three-way valve


- 1 Valve body
- 2 Seat (exchangeable)
- 3 Plug
- 4 Bottom section (bellows housing)
- 4.1 Balancing bellows
- 5 Plug stem with spring
- 6 Thermostat connection (threaded nipple with coupling nut)

### Control thermostat

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

<sup>1)</sup> Valves in NPS ½ to 1 have unbalanced plugs

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

Type 2119 Three-way Valve												
Pressure rating					Class 150 and 300							
K <sub>VS</sub> coefficients and max. permissible differential pressures Δp in bar												
Connection		NPS	½	¾	1	1 ½	2	2 ½	3	4	6	
Mixing valve	C <sub>V</sub> in gal/min		5	7.5	9.4	23	37	60	94	145	230	
	K <sub>VS</sub> coefficient in m <sup>3</sup> /h		4	6.3	8	20	32	50	80	125	200	
	When p in B > p in A	Δp in psi		145			230		145			120
		Δp in bar		10			16		10			8
When p in A > p in B	Δp in psi		75			50		45			30	
	Δp in bar		5			3.5		3			2	
Diverting valve (when AB to A or B)	C <sub>V</sub> in gal/min		5	7.5	9.4	23	37	50	77	117	185	
	K <sub>VS</sub> coefficient in m <sup>3</sup> /h		4	6.3	8	16	32	40	64	100	160	
	Δp in psi		60			50		45			30	
		Δp in bar		4			3.5		3			2
Permissible temperature of the valve			430 °F/660 °F (220 °C/350 °C) · See pressure-temperature diagram in ► T 2010									
Conformity												
Type 2231 to 2235 Thermostat												
Size 150												
Set point range (set point span 100 K)			15 to 195 °F, 70 to 250 °F or 120 to 300 °F · For Types 2232, 2234 and 2235 also 210 to 390 °F, 300 to 480 °F									
			-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 +140 °F/-40 to +80 °C									
Perm. temperature at the sensor			100 K above the adjusted set point									
Perm. pressure at sensor			Type 2231/2232		Without/with thermowell: Class 300 · Thermowell with flange: Class 150/300							
			Type 2233/2234		Without thermowell: Class 300 · With flange on request							
Capillary tube length			16 ft (33 or 50 ft as special version/5 m (10 or 15 m as special version)									

**Table 2: Materials** · Material numbers according to DIN EN

Type 2119 Three-way Valve			
Valve size	NPS ½ to 6		Up to NPS 4
Pressure rating	Class 150 and 300		
Body	Cast steel A216 WCC		Cast stainless steel A351 CF8M
Seat and plug	Steel 1.4006 (1.4301 in NPS 6)		1.4571
Plug stem/spring	1.4301/1.4310		
Balancing bellows <sup>1)</sup>	1.4571		
Bellows housing	1.0425		1.4571
Seat ring	Graphite on metal core		
Extension piece/separating piece	Brass (special version: stainless steel 1.4301)		1.4301
Types 2231, 2232, 2233, 2234 and 2235 Thermostat <sup>2)</sup>			
Version	Standard version		Special version
Operating element	Nickel-plated brass		
Sensor	Type 2231/2232	Bronze	CrNiMoTi steel
	Type 2233/2234	Copper	
	Type 2235	Copper	-
Capillary tube	Copper		Plastic-coated copper
Thermowell			
With threaded connection (1 NPT)	Thermowell	Bronze, steel, copper <sup>4)</sup>	
	Threaded nipple	Brass · Steel	
With flanges <sup>3)</sup>	Thermowell	Steel	
	Threaded nipple	Steel	

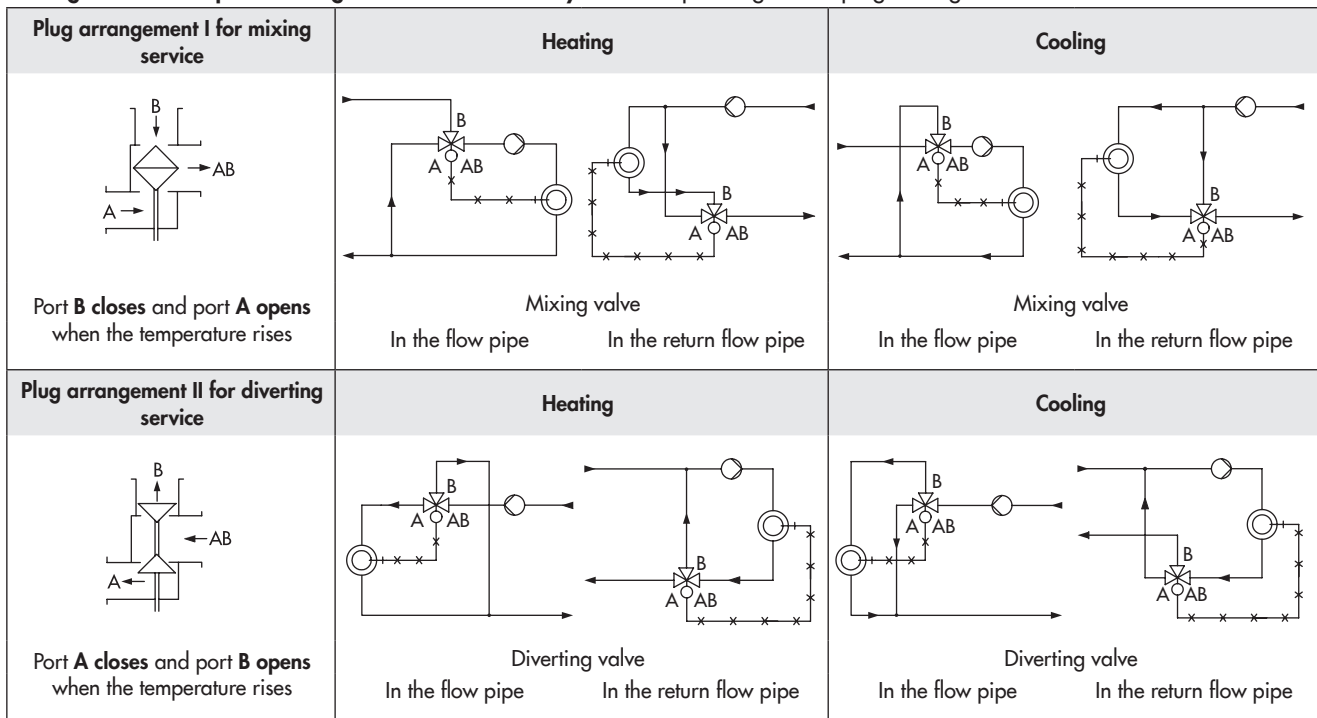
<sup>1)</sup> NPS ½ to 1: without balancing bellows

<sup>2)</sup> Type 2235 not available in stainless steel version

<sup>3)</sup> On request

<sup>4)</sup> Class 125 only

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



### 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 NPS ½ to 6, for which the maximum operating pressure must not exceed the maximum permissible differential pressure  $\Delta p$  specified in the technical data.

Sensors without thermowell: applicable up to 600 psi (40 bar)

Sensors with thermowell: only use SAMSON 1 NPT version made of bronze or stainless steel 1.4571 up to 600 psi (40 bar).

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.

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

**Table 3: Dynamic behavior of SAMSON thermostats**

Principle of operation	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	– <sup>1)</sup>
	2234	15 s	– <sup>1)</sup>
	2235	10 s	– <sup>1)</sup>
Adsorption	2213	70 s	120 s
	2212	– <sup>1)</sup>	40 s

<sup>1)</sup> Not permissible

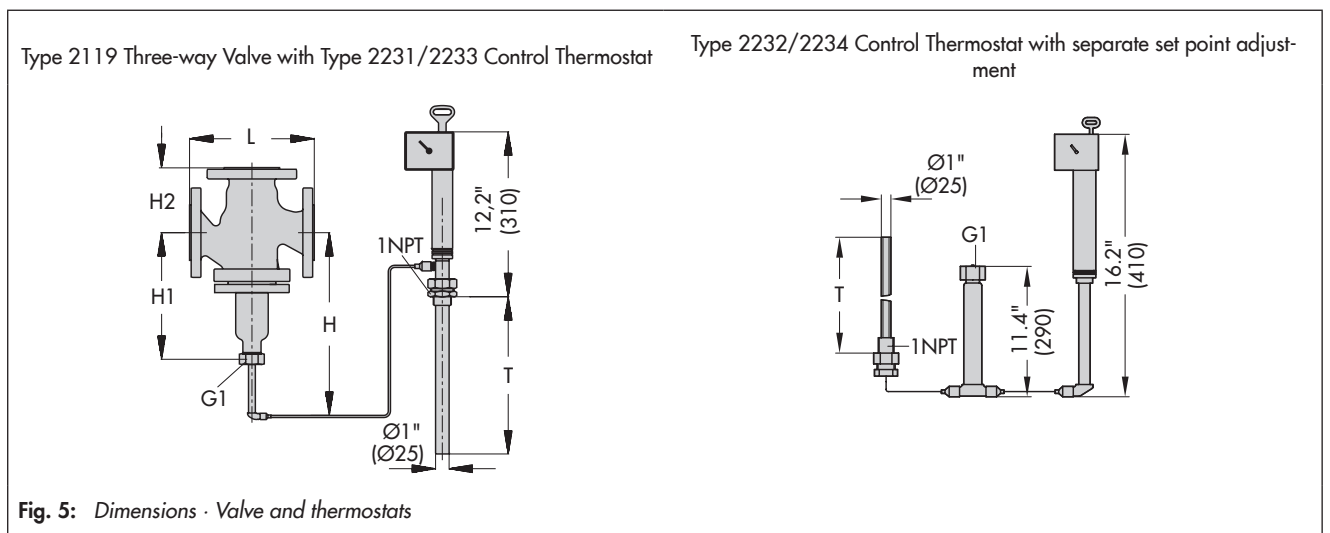
**Table 4: Dimensions and weights**

Type 2119 Three-way Valve		NPS	½	¾	1	1½	2	2½	3	4	6
L	Class 150	inch	7.25			8.75	10	10.9	11.75	13.9	17.75
		mm	184			222	254	276	298	352	451
	Class 300	inch	7.5	7.6	7.75	9.25	10.5	11.5	12.5	14.5	18.6
		mm	191	194	197	235	267	292	318	368	473
H2	Class 150	inch	3.6			4.4	5	5.4	5.9	6.9	8.9
		mm	92			111	127	138	149	176	225
	Class 300	inch	3.8	3.8	3.9	4.6	5.3	5.8	6.3	7.2	9.3
		mm	95.5	97	98.5	117.5	133.5	146	159	184	236.5
H1	Up to 430 °F Up to 220 °C Without extension piece	inch	9.25			9.5	9.7	12.6		14	19.7
		mm	235			240	245	320		355	500
	Up to 660 °F Up to 350 °C With extension piece	inch	14.8			15	15.5	18.1		19.5	25.2
		mm	375			380	385	460		495	640
H	Up to 430 °F Up to 220 °C Without extension piece	inch	20.7			20.9	21.1	24		25.4	31.1
		mm	525			530	535	610		645	790
	Up to 660 °F Up to 350 °C With extension piece	inch	26.2			26.4	26.6	29.5		30.9	36.6
		mm	665			670	675	750		785	930
Weight <sup>1)</sup>	ap-prox. lb	13	15.5	17.5	33	37.5	68	82	108	On re-quest	
	kg (ap-prox.)	6	7	8.5	15	17	31	37	49		

Thermostat	Type	2231	2232	2233	2234	2235
Immersion depth T		11.4" (290 mm) <sup>2)</sup>	9.25" (235 mm) <sup>2)</sup>	16.9" (430 mm)	18.1" (460 mm)	136.2" (3460 mm)
Weight, approx.		7 lb (3.2 kg)	8.8 lb (4.0 kg)	7.5 lb (3.4 kg)	8.1 lb (3.7 kg)	7.9 lb (3.6 kg)

<sup>1)</sup> +10 % for Class 300

<sup>2)</sup> Larger immersion depths on request



**Fig. 5: Dimensions · Valve and thermostats**

## Accessories

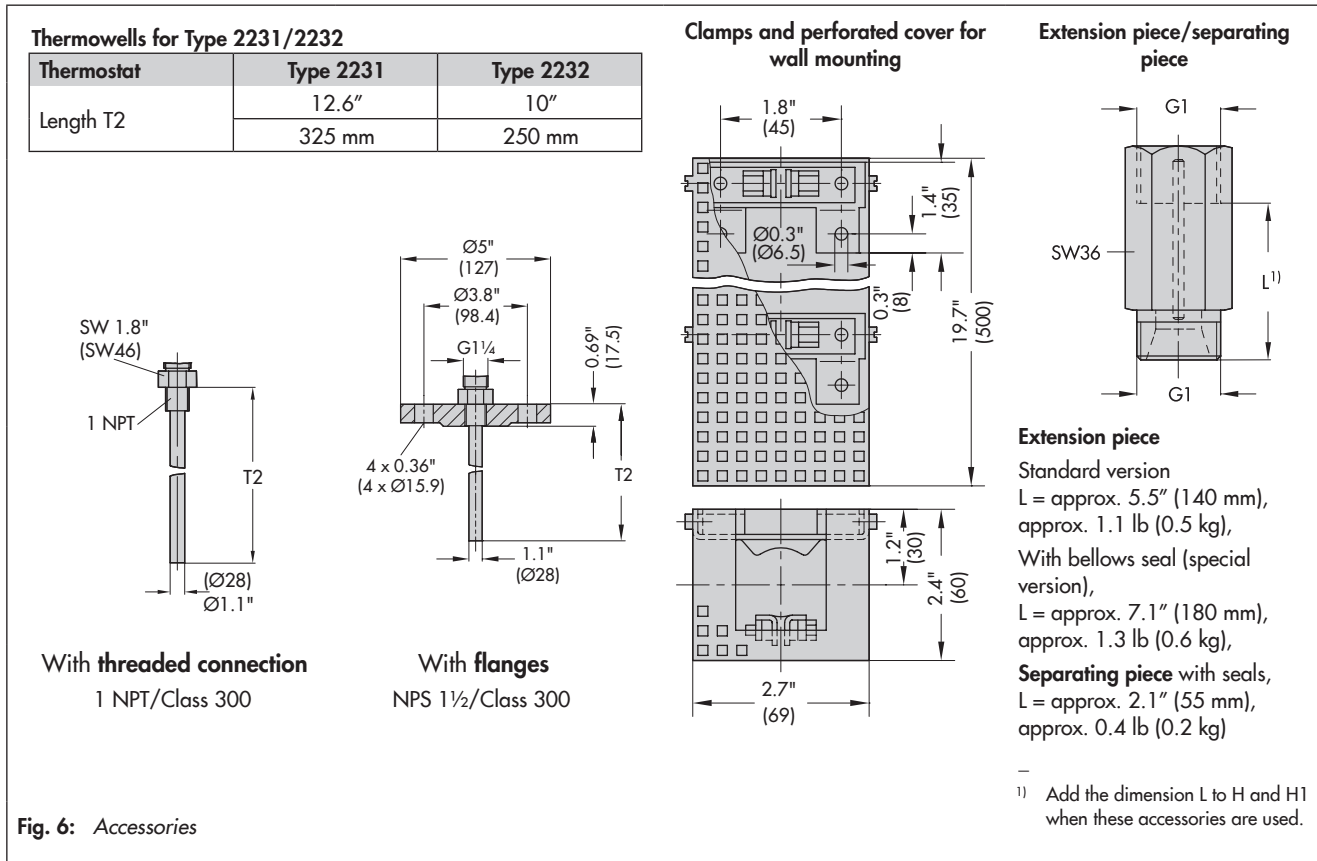


Fig. 6: Accessories

## Accessories

**Thermowells** with threaded or flanged connections for Types 2231 and 2232 Bulb Sensors · 1 NPT threaded connection, Class 300, made of bronze/steel or CrNiMo steel  
NPS 1½ flanged connection, Class 300, with thermowell made of CrNiMo steel/steel

**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 430 °F (220 °C). The standard version does not have sealing. The special version of the extension piece for NPS ½ to 4 is made of stainless steel and has a bellows seal. It additionally acts as a separating piece.

**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 NPS 2½ to 4 (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.

## Ordering text

### Type 9/... Temperature Regulator

NPS ...,

Mixing or diverting valve,

Body material ..., Class ...,

With Type ... Thermostat,

Set point range ... °F (°C),

Capillary tube ... ft (m),

Optionally, special version ...

Optionally, accessories ...