

## T 2025 EN

### Self-operated Temperature Regulators · Type 4 Temperature Regulator

With balanced single-seated globe valve · ANSI version



#### Application

Temperature regulator for heating installations · Control thermostats for set points from **15 to 480 °F (-10 to +250 °C)** · Valve sizes **NPS ½ to 10 (DN 15 to 150)** · Pressure rating **Class 125 to 300 (PN 16 to 40)** · Suitable for temperatures up to **660 °F (350 °C)**

The valve **closes** when the temperature **rises**.

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

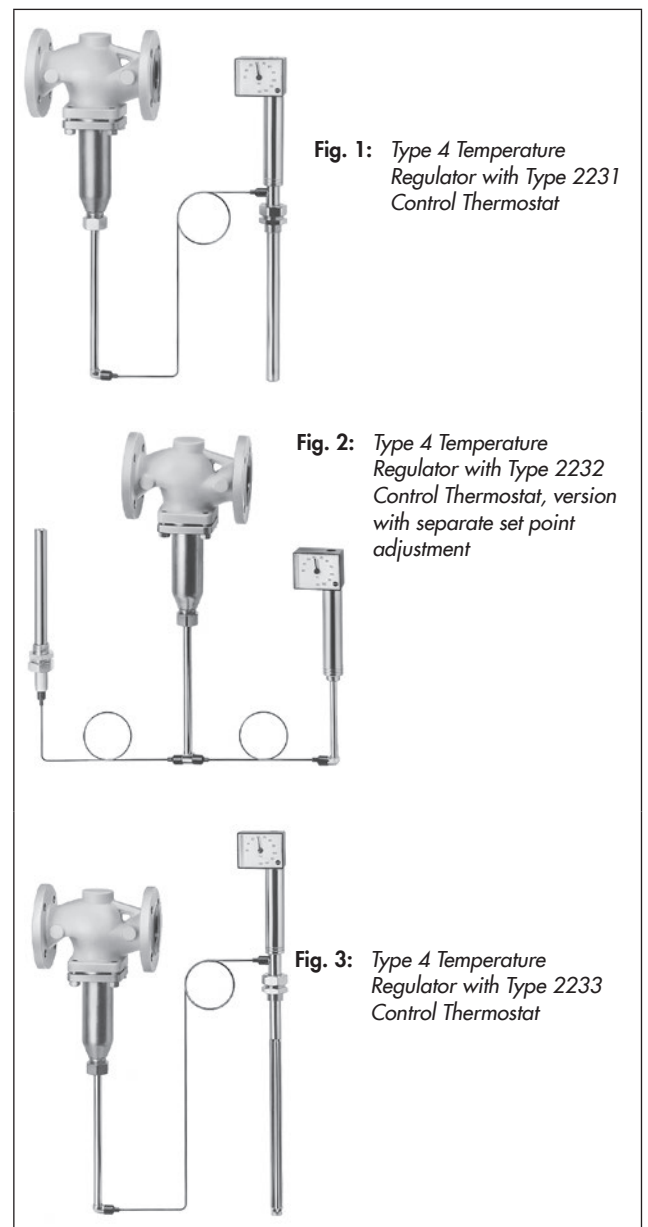
#### Special features

- Low-maintenance proportional regulators requiring no auxiliary energy
- Wide set point range and convenient set point adjustment with a dial
- Single-seated valves with a plug balanced by a stainless steel bellows or a balancing diaphragm (NPS 6 to 10)
- Suitable for liquids, gases, and vapors, especially for heat transfer media, such as water, oil and steam
- Valve body optionally available in cast iron, cast steel, or cast stainless steel
- Versions with double adapter for temperature limiters or attachment of a second control thermostat · Details ▶ T 2036

#### Versions

**Type 4 Temperature Regulator** · Type 2422 Valve with flanged connections and face-to-face dimensions according to ANSI · Balanced by a bellows (NPS ½ to 10), balanced by a diaphragm (NPS 6 to 10) · Class 125 to 300 · Type 2231 to 2235 Control Thermostat · Further details on the application of control thermostats can be found in Information Sheet ▶ T 2010.

- **Type 2422/2231** (Fig. 1) · With Type 2422 Valve and Type 2231 Control Thermostat · Mainly suitable for liquids · Set points from 15 to 300 °F (-10 to +150 °C) · Set point adjustment at the sensor
- **Type 2422/2232** (Fig. 2) · With Type 2422 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
- **Type 2422/2233** (Fig. 3) · With Type 2422 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



**Fig. 1:** Type 4 Temperature Regulator with Type 2231 Control Thermostat

**Fig. 2:** Type 4 Temperature Regulator with Type 2232 Control Thermostat, version with separate set point adjustment

**Fig. 3:** Type 4 Temperature Regulator with Type 2233 Control Thermostat

- **Type 2422/2234** · With Type 2422 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 2422/2235** · With Type 2422 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 versions

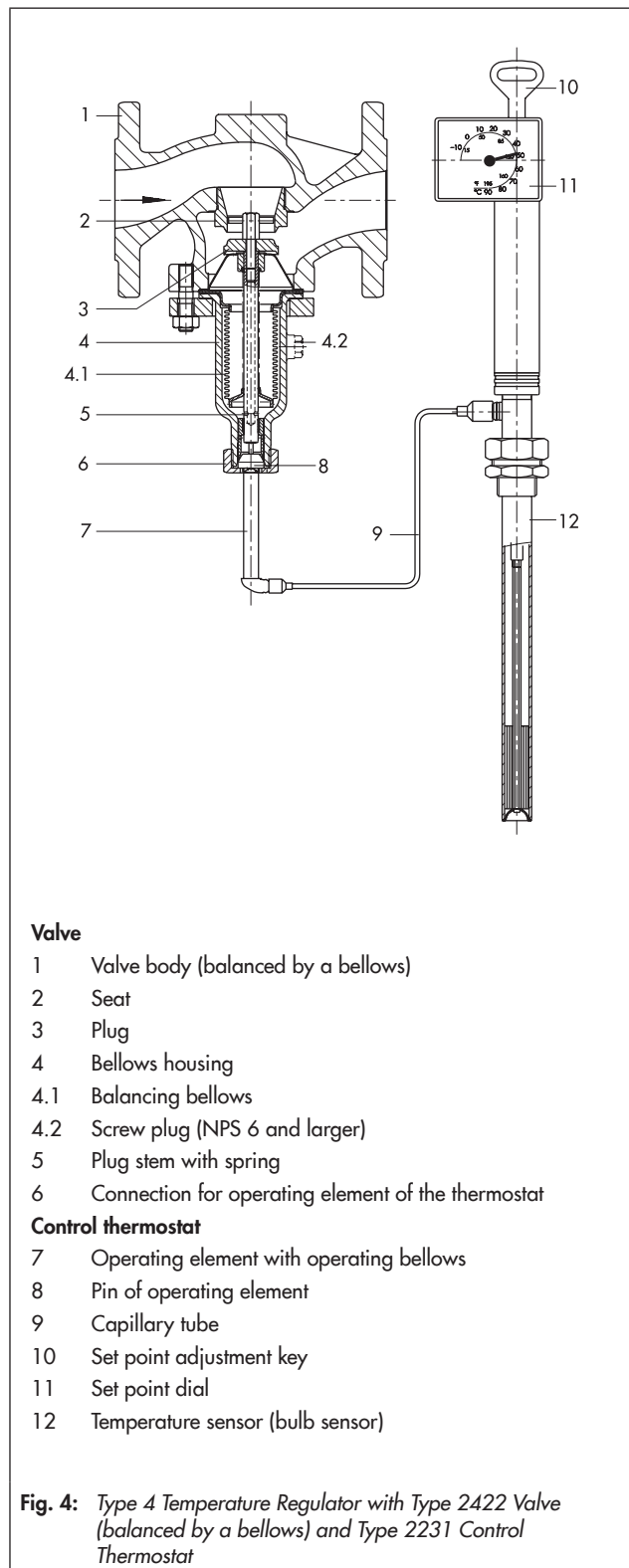
- 33 or 50 ft (10 or 15 m) capillary tube length
- Sensor of CrNiMo steel
- Capillary tube made of CrNiMo steel or plastic-coated copper
- Valve entirely of stainless steel
- Reduced  $C_v$  ( $K_{VS}$ ) coefficient
- Valve with flow divider ST 1 for noise reduction with steam and non-flammable gases
- Set point range 210 to 390 °F/300 to 480 °F (100 to 200 °C/150 to 250 °C)

#### Principle of operation (Fig. 4)

The regulators operate according to the liquid expansion principle. The temperature sensor (12), capillary tube (9) and operating element (7) are filled with an expansion liquid. The temperature-dependent change in volume of this liquid causes the operating bellows in the operating element (7) 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 (10) to a value which can be read off from the dial (11).



#### Valve

- 1 Valve body (balanced by a bellows)
- 2 Seat
- 3 Plug
- 4 Bellows housing
- 4.1 Balancing bellows
- 4.2 Screw plug (NPS 6 and larger)
- 5 Plug stem with spring
- 6 Connection for operating element of the thermostat

#### Control thermostat

- 7 Operating element with operating bellows
- 8 Pin of operating element
- 9 Capillary tube
- 10 Set point adjustment key
- 11 Set point dial
- 12 Temperature sensor (bulb sensor)

**Fig. 4:** Type 4 Temperature Regulator with Type 2422 Valve (balanced by a bellows) and Type 2231 Control Thermostat

**Table 1:** Technical data · Type 2422 Valve · All pressures (gauge) in psi and bar

**Table 1.1:** Type 2422 Valve, balanced by a bellows

Valve size	NPS	½	¾	1	1½	2	2½	3	4	6	8	10
C <sub>V</sub> coefficients	US gal/min	5	7.5	9.4	23	37	60	94	145	330	490	590
K <sub>V5</sub> coefficients	m <sup>3</sup> /h	4	6.3	8	20	32	50	80	125	280	420	500
Leakage class according to ANSI/FCI 70-2		Metal seal: ≤0.05 % of C <sub>V</sub> /K <sub>V5</sub> Soft seal: ≤0.01 % of C <sub>V</sub> /K <sub>V5</sub>										
Max. perm. diff. pressure Δp	psi	360					290		230	175	145	
	bar	25					20		16	12	10	
Special version	C <sub>V</sub> coefficients	3; 5; 7.5		5	9.4	20	23	37	94	–	–	–
	K <sub>V5</sub> coefficients	2.5; 4; 6.3			8	16	20	32	80	–	–	–
Max. perm. diff. pressure Δp	psi	360					290		230	–		
	bar	25					20		16	–		
Permissible valve temperature		Max. 660 °F (max. 350 °C)										
Compliance		<b>CE · EAC</b>										

**Table 1.2:** Type 2422 Valve, balanced by a diaphragm <sup>1)</sup>

Valve size	NPS	6	8	10
C <sub>V</sub> coefficients	US gal/min	350	660	720
K <sub>V5</sub> coefficients in	m <sup>3</sup> /h	290	550	600
Leakage class according to ANSI/FCI 70-2		≤0.01 % of C <sub>V</sub> (K <sub>V5</sub> ) coefficient		
Max. perm. differential pressure Δp	psi	175		150
	bar	12		10
Permissible valve temperature		Max. 300 °F (max. 150 °C)		
Compliance		<b>CE · EAC</b>		

<sup>1)</sup> Only version with travel = 0.9" (22 mm)

**Table 2:** Technical data · Control thermostats

Type 2231 to 2235 Thermostat		Size 150	Size 250 <sup>1)</sup> (NPS 8/NPS 10)
Set point ranges (standard version)	ANSI	15 to 195 °F, 70 to 250 °F or 120 to 300 °F For Type 2232, Type 2234, Type 2235 also 210 to 390 °F or 300 to 480 °F	35 to 160 °F, 85 to 210 °F, 120 to 250 °F, 175 to 300 °F
	DIN	–10 to +90 °C, 20 to 120 °C or 50 to 150 °C For Type 2232, Type 2234, Type 2235 also 100 to 200 °C or 150 to 250 °C	0 to 70 °C, 30 to 100 °C, 50 to 120 °C, 80 to 150 °C
Perm. ambient temperature at the set point adjustment		–40 to +150 °F (–40 to +80 °C)	–5 to +175 °F (–20 to +80 °C)
Perm. temperature at the sensor		100 K above the adjusted set point	85 °F (30 °C) above set point
Perm. pressure at sensor of Type 2231, Type 2232, Type 2233, and Type 2234		Without/with thermowell: Class 300 <sup>2)</sup> · Thermowell with flange: Class 300 <sup>2)</sup>	
Capillary tube length	ANSI	16 ft (33 or 50 ft as special version)	
	DIN	5 m (10 or 15 m as special version)	
Compliance		<b>EAC</b>	

<sup>1)</sup> Type 2231 and Type 2232 only

<sup>2)</sup> Other pressure ratings for thermowell/flange on request

**Table 3: Materials · Material numbers according to ASTM and DIN EN****Table 3.1: Type 2422 Valve, balanced by a bellows**

Valve size	NPS 1 to 10	NPS ½ to 10	
Pressure rating	Class 125	Class 150 and 300	
Body	Cast iron A126B	Cast steel A216 WCB/WCC	Cast stainless steel A351 CF8M
Seat and plug <sup>1)</sup>	Up to NPS 4	Stainless steel 1.4006 or 1.4104	
	NPS 6 to 10	1.4301 · Plug with PTFE seal	
Plug stem/spring	1.4301/1.4310		
Metal bellows	1.4571		
Bellows housing	1.0425		1.4571
Gasket	Graphite on metal core		
Extension piece/separating piece	Brass (special version: stainless steel 1.4301)		1.4301

<sup>1)</sup> Special version 1.4409

**Table 3.2: Type 2422 Valve, balanced by a diaphragm**

Valve size	NPS 6 to 10		
Pressure rating	Class 125	Class 150 and 300	
Max. permissible temperature	450 °F · 230 °C	660 °F · 350 °C	
Body	Cast iron A126B	Cast steel A216 WCC	Cast stainless steel A351 CF8M
Seat	Red brass <sup>1)</sup>		
Plug (standard version)	Red brass <sup>1)</sup> · With EPDM soft seal, max. 300 °F (max. 150 °C)		
Pressure balancing	Balancing cases made of sheet steel DD11 EPDM balancing diaphragm, max. 300 °F (max. 150 °C)		
Gasket	Graphite on metal core		

<sup>1)</sup> Special version 1.4409

**Table 3.3: Type 2231, Type 2232, Type 2233, Type 2234, and Type 2235 Control Thermostats**

Control thermostat version	Standard version	Special version
Operating element	Nickel-plated brass	
Sensor	Type 2231 Type 2232	Nickel-plated bronze
	Type 2233 Type 2234	Nickel-plated copper
	Type 2235	Copper
Capillary tube	Nickel-plated copper	Plastic-coated copper or stainless steel 1.4571
<b>Thermowell</b>		
<b>1 NPT threaded connection</b>		
Thermowell	Nickel-plated bronze · Nickel-plated steel	Stainless steel 1.4571
Threaded nipple	Nickel-plated brass · Nickel-plated steel	
<b>Flanges</b>		
Thermowell	Steel	Stainless steel 1.4571
Flange	Steel	

## 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
- **Thermowell for flammable gases typetested by DVGW**, 1 NPT threaded connection, Class 600.
- **Mounting parts** for Types 2233 and 2234 · Clamps for wall mounting · Perforated cover for thermostat
- **Extension piece or separating piece** · 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 is made of stainless steel and has a bellows seal. It additionally acts as a separating piece.

In combinations with Type 2212 Safety Temperature Limiter or Type 2213 Safety Temperature Monitor, an extension piece is required for temperatures over 300 °F (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
- **Type 2231 and Type 2232 Sensor** · Thermowells with threaded connection
- **Type 2233 and Type 2234 Sensors** · Clamps and perforated cover for wall mounting

## 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 2422 Valve in NPS ½ to 10 (Type 2234 and Type 2235 only up to NPS 6/DN 150), 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), test pressure max. 870 psi (60 bar)  
Sensors with thermowell: only use SAMSON 1 NPT version made of bronze or steel 1.4571 up to Class 300.
- **Thermowell for flammable gases typetested by DVGW**, 1 NPT threaded connection, Class 600.

- **Safety temperature monitors (STM) and safety temperature limiters (STL)**: details can be found in Data Sheets ▶ T 2043 and ▶ T 2046.

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

## 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.

**Table 4:** Time constants of SAMSON thermostats

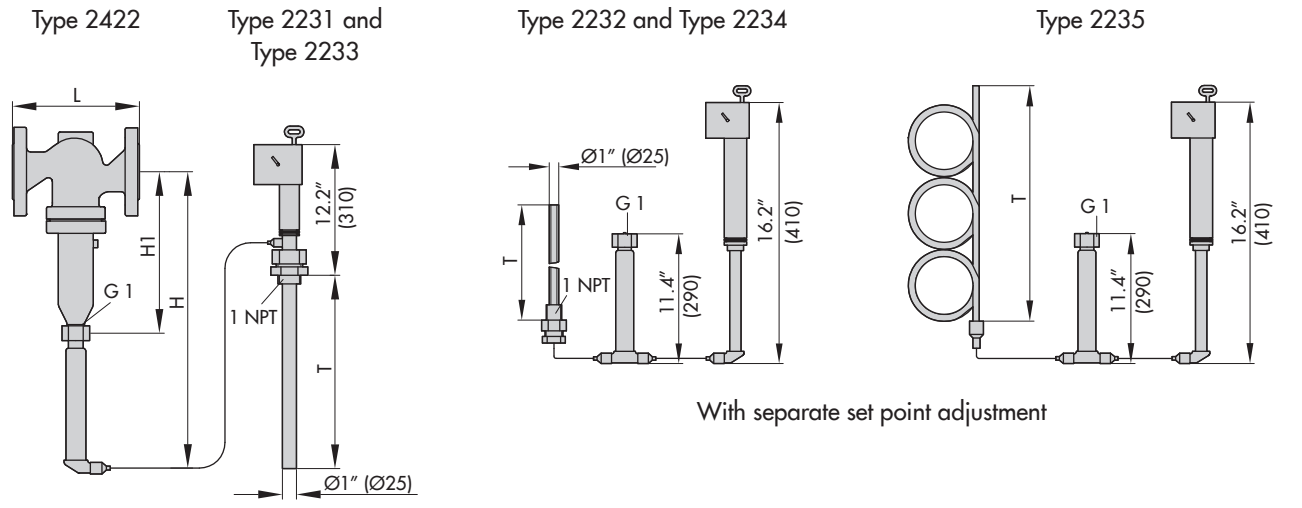
Functional principle	Control thermostat	Time constant [s]	
		Without thermowell	With thermowell
Liquid expansion	Type 2231	70	120
	Type 2232	65	110
	Type 2233	25	– <sup>1)</sup>
	Type 2234	15	– <sup>1)</sup>
	Type 2235	10	– <sup>1)</sup>
	Type 2213	70	120
Adsorption	Type 2212	– <sup>1)</sup>	40

<sup>1)</sup> Not permissible

## Installation

- **Valves**  
Install the valves in horizontal pipelines. The operating element must be suspended to hang downward. The direction of flow must match the direction indicated by the arrow on the body.
- **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 approx. 2" (50 mm).
- **Temperature sensor**  
The temperature sensor can be installed in any position as required. The entire temperature sensor must be immersed in the process 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).

**Dimensional drawings: Type 2422 Valve · Balanced by a bellows · With connection for Type 2231 to Type 2235 Thermostat**



**Table 5:** Dimensions and weights · Type 2422 Valve

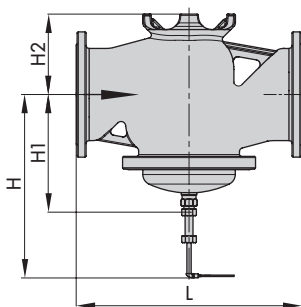
**Table 5.1:** Type 2422 Valve, balanced by a bellows

Valve size	NPS	1/2	3/4	1	1 1/2	2	2 1/2	3	4	6	8 <sup>1)</sup>	10 <sup>1)</sup>	
Length L	Class 125	inch	–	–	7.25	8.75	10	10.9	11.75	13.9	17.75	21.4	26.5
		mm	–	–	184	222	254	276	298	352	451	543	673
	Class 150	inch	7.25	7.25	7.25	8.75	10	10.9	11.75	13.9	17.75	21.4	26.5
		mm	184	184	184	222	254	276	298	352	451	543	673
	Class 300	inch	7.5	7.6	7.75	9.25	10.5	11.5	12.5	14.5	18.6	22.4	27.9
		mm	191	194	197	235	267	292	318	368	473	568	708
HI	W/o ext. piece <sup>1)</sup>	8.9" (225 mm)					11.8" (300 mm)		14" (355 mm)	23.2" (590 mm)	28.7" (730 mm)		
	With ext. piece <sup>1)</sup>	14.4" (365 mm)					17.3" (440 mm)		19.5" (495 mm)	28.7" (730 mm)	34.3" (870 mm)		
H	W/o ext. piece <sup>1)</sup>	20.3" (515 mm)					23.2" (590 mm)		25.4" (645 mm)	34.6" (880 mm)	40.2" (1020 mm)		
	With ext. piece <sup>1)</sup>	25.8" (655 mm)					28.7" (730 mm)		30.9" (785 mm)	40.2" (1020 mm)	45.7" (1160 mm)		
Weight <sup>2)</sup> (approx.)	lbs (kg)	12.5 (5.5)	12.23 (6)	15.4 (7)	30.9 (14)	37.5 (17)	62 (28)	73 (33)	90 (41)	254 (115)	562 (255)	661 (300)	

Type ... Thermostat		2231	2231 Size 250	2232	2233	2234	2235
Immersion depth T	inch (mm)	11.4 (290) <sup>3)</sup>	38.6 (980)	9.25 (235) <sup>3)</sup>	17 (430)	18.1 (460)	136.2 (3460)
Weight, approx.	lbs (kg)	7.1 (3.2)	14.3 (6.5)	9 (4)	7.5 (3.4)	8.2 (3.7)	8 (3.6)

- <sup>1)</sup> Only with Type 2231 Thermostat
- <sup>2)</sup> Class 150 +10 %; Class 300 +15 %
- <sup>3)</sup> Larger immersion depths on request

**Dimensional drawing: Type 2422 Valve · Balanced by a diaphragm · With connection for Types 2231 to 2235 Thermostat**



**Table 5.2:** Type 2422 Valve, balanced by a diaphragm

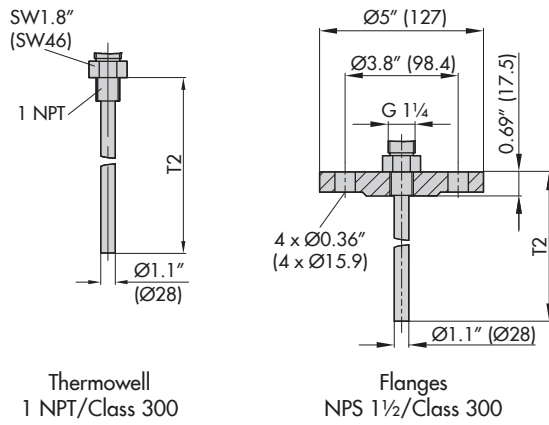
Valve size	NPS	6	8	10
Length L	Class 125/150	17.75" (451 mm)	21.4" (543 mm)	26.5" (673 mm)
	Class 300	18.6" (473 mm)	22.4" (568 mm)	27.9" (708 mm)
Height H (approx.)		23.6" (600 mm)	26.4" (670 mm)	
Height H2 (approx.)		6.9" (175 mm)	10.2" (260 mm)	
Weight	kg	159 lb (72 kg)	478 lb (217 kg)	500 lb (227 kg)

<sup>1)</sup> +10 % for A216 WCC/Class 150 and stainless steel A351 CF8M

**Thermowells for Type 2231 and Type 2232**

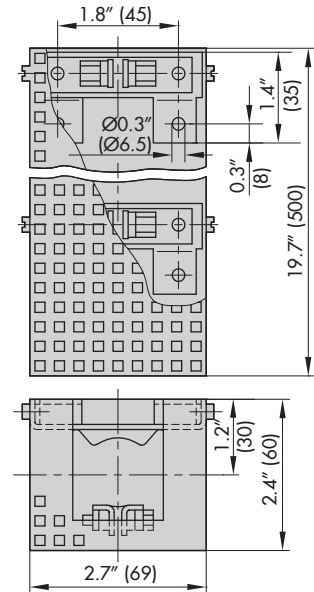
**Table 6:** Thermowells for Type 2231 and Type 2232

Control thermostat		Type 2231	Type 2232
Immersion depth T2	in	12.6	9.7
Length L1	mm	321	246



**Mounting parts for Type 2233 and Type 2234**

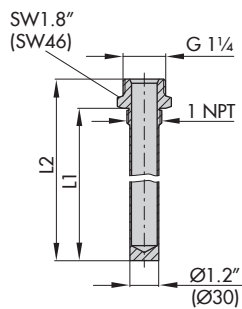
Clamps and perforated cover for wall mounting



**Thermowells for Type 2231 and Type 2232**

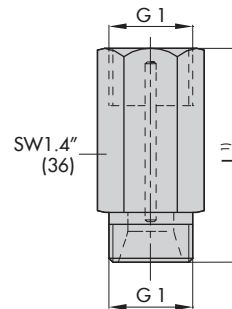
**Table 7:** Thermowells for flammable gases (Class 600)

Control thermostat		Type 2231	Type 2232
Length L1	in	12.4	10
	mm	314	254
Length L2	in	13.4	11
	mm	340	280



Thermowells for flammable gases  
1 NPT/Class 600

**Extension piece/separating piece**



Extension piece (standard)		
L (approx.)	in	5.5
	mm	140
Weight, approx.	lb	1.1
	kg	0.5
With bellows seal (special version)		
L (approx.)	in	7.1
	mm	180
Weight, approx.	lb	1.3
	kg	0.6
Separating piece with seals		
L (approx.)	in	2.1
	mm	55
Weight, approx.	lb	0.4
	kg	0.2

<sup>1)</sup> Add the dimension L to H and H1 when these accessories are used.

**Ordering text**

Type 4 Temperature Regulator

NPS ... (DN ...)

Class ..., body material ...

With Type ... Thermostat,

Set point range ... °F (°C), capillary tube length ... ft (m)

Optionally, special version ...

Optionally, accessories ...