

# Self-operated Temperature Regulators

## Type 4 Temperature Regulator

with balanced single-seated globe valve

ANSI version



### Application

Temperature regulator for heating installations with control thermostats for set points from **15 to 480 °F** (-10 to +250 °C) · Valve sizes **NPS ½ to 10** · Pressure rating **Class 125 to 300** · Suitable for temperatures up to **660 °F** (350 °C)  
The valve **closes** as the temperature rises.

### 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 globe valve and a control thermostat comprising a temperature sensor, set point adjuster with excess temperature protection, capillary tube and operating element.

### Special features

- Low-maintenance P regulators requiring no auxiliary energy
- Wide set point range and easy adjustment of the set point indicated on a dial
- Single-seated valves balanced by a bellows or a diaphragm (NPS 6 to 10)
- Suitable for liquids, gases and vapors, especially for heat transfer fluids such as water, oil and steam
- Valve body optionally made of cast iron, cast steel or cast stainless steel
- Versions with double adapter or manual override for attachment of a second control thermostat. For details, refer to Data Sheet T 2036 EN.

### Versions

**Type 4 Temperature Regulators** · Type 2114 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 · Types 2231 to 2235 Control Thermostats (Information Sheet T 2010 EN).

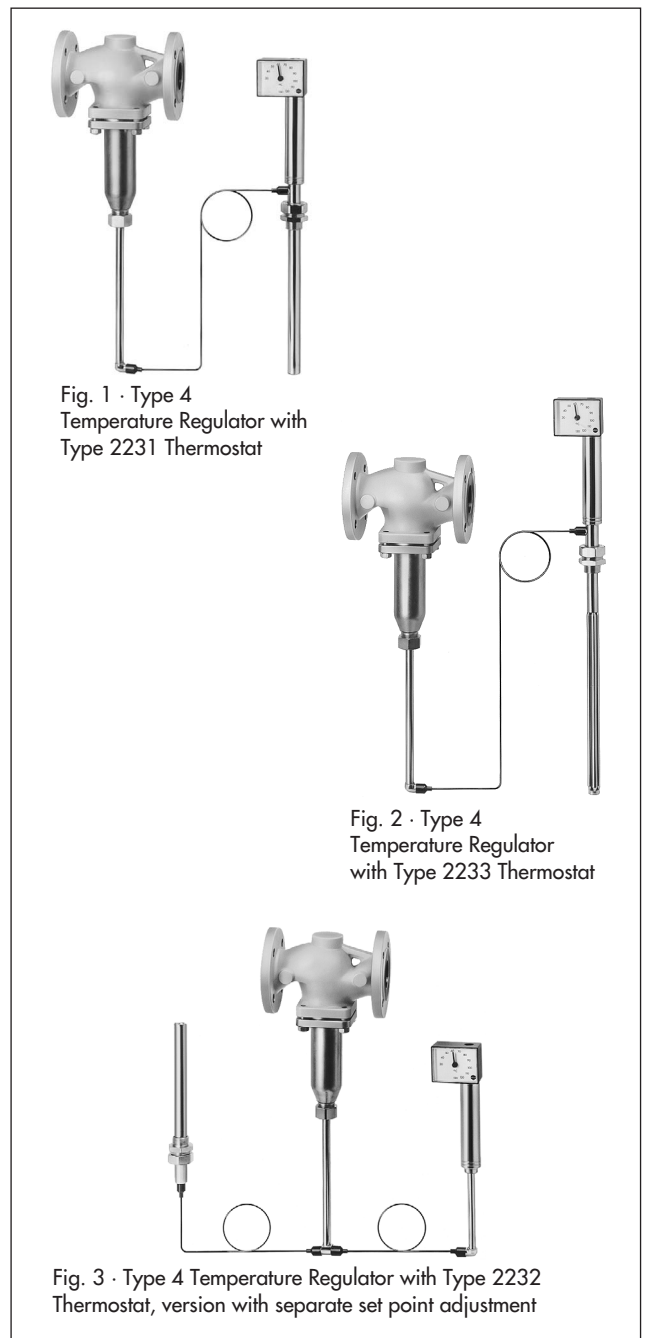
**Type 2114/2231** (Fig. 1) · With Type 2114 Valve and Type 2231 Control Thermostat for liquids · Set point adjustment at the sensor · Set points from 15 to 300 °F (-10 to +150 °C)

**Type 2114/2232** (Fig. 2) · With Type 2114 Valve and Type 2232 Control Thermostat for liquids and steam · Separate set point adjustment · Set points from 15 to 480 °F (-10 to +250 °C)

**Type 2114/2233** · With Type 2114 Valve and Type 2233 Control Thermostat for liquids, air and gases · Set points from 15 to 300 °F (-10 to +150 °C), set point adjustment at the sensor

**Type 2114/2234** · With Type 2114 Valve and Type 2234 Control Thermostat for liquids, air and gases · Separate set point adjustment · Set points from 15 to 480 °F (-10 to +250 °C)

**Type 2114/2235** · With Type 2114 Valve and Type 2235 Control Thermostat for air-heated storerooms as well as drying, climatic, and heating cabinets · Separate set point adjustment and a sensor tube to be installed on site · Set points from 15 to 480 °F (-10 to +250 °C)



### Special version

- Capillary tube of either 16, 33 or 50 ft (5 m, 10 m or 15 m)
- Sensor made of CrNiMo steel
- Capillary tube made of CrNiMo steel or plastic-coated copper
- Valve made completely of stainless steel
- Reduced  $C_v$  ( $K_{vs}$ ) coefficient
- Valve with flow divider I for noise reduction when handling steam and non-flammable gases
- Set point range from 210 to 390 °F (100 to 200 °C)/300 to 480 °F (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 expanding liquid. The temperature-dependent change in volume of this liquid causes the 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.

The set point is adjustable with a key (10); the adjusted value can be read off the dial (11).

### Valve

- 1 Valve body
- 2 Seat (exchangeable)
- 3 Plug
- 4 Bellows housing
- 4.1 Balancing bellows
- 4.2 Vent screw (NPS 6 and larger)
- 5 Plug stem with spring
- 6 Connection for operating element (coupling nut)

### Control thermostat

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

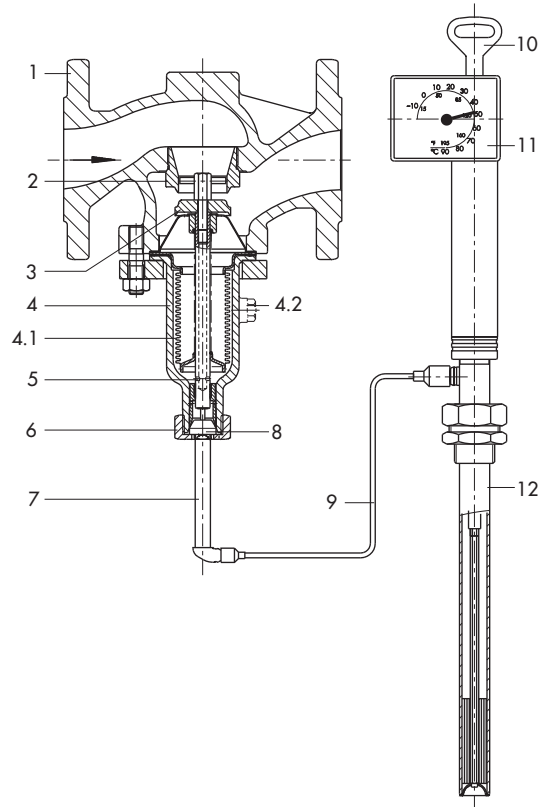


Fig. 4 · Type 4 Temperature Regulator with Type 2231 Thermostat (Type 2114 Valve balanced by a bellows)

Table 1 · Technical data of valve · All pressures in bar and psi (gauge)

Type 2114 Valve · Balanced by a bellows												
Valve size	NPS	½	¾	1	1½	2	2½	3	4	6	8	10
$C_v$ coefficients	US gal/min	5	7.5	9.4	23	37	60	94	145	330	490	590
$K_{vs}$ coefficients	m³/h	4	6.3	8	20	32	50	80	125	280	420	500
Leakage rate acc. to ANSI/FCI 70-2		Metal-seated plug: ≤0.05 % of $C_v$ ( $K_{vs}$ ) coefficient · Soft-seated plug: ≤0.01 % of $C_v$ ( $K_{vs}$ ) coefficient										
Max. permissible differential pressure $\Delta p$	psi	360						290		175	145	
	bar	25						20		12	10	
Special version												
Flow coefficients	$C_v$	3 · 5 · 7.5	5	9.4	20	23	37	60	-	-	-	
	$K_{vs}$	2.5 · 4 · 6.3	8	16	20	32	50	-	-	-		
Max. permissible differential pressure $\Delta p$	psi	360					290		230	-		
	bar	25					20		16	-		
Permissible valve temperature		Max. 660 °F (max. 350 °C)										
Type 2114 Valve · Balanced by a diaphragm <sup>1)</sup>												
Valve size	NPS	6			8			10				
$C_v$ coefficients	US gal/min	350			660			720				
$K_{vs}$ coefficients	m³/h	290			550			600				
Leakage rate acc. to ANSI/FCI 70-2		≤0.01 % of $C_v$ ( $K_{vs}$ ) coefficient										
Max. permissible differential pressure $\Delta p$	psi	175			150							
	bar	12			10							
Permissible valve temperature		Max. 300 °F (max. 150 °C)										

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

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

Types 2231 to 2235 Thermostats		Size 150	Size 250 <sup>1)</sup> (NPS 8/10)
Set point ranges	ANSI	15 to 195 °F, 70 to 250 °F or 120 to 300 °F For Types 2232, 2234, 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 Types 2232, 2234, 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
Permissible ambient temperature at the set point adjustment head		-40 to +150 °F (-40 to +80 °C)	-5 to +175 °C (-20 to +80 °C)
Permissible temperature at the sensor		100 K above the adjusted set point	85 °F (30 °C) above set point
Permissible pressure at the sensor of Types 2231, 2232, 2233, 2234		With/without thermowell: Class 300 <sup>2)</sup> · Version with flange: Class 300 <sup>2)</sup>	
Length of the capillary tube	ANSI	10 ft (special version: 16 ft, 33 ft or 50 ft)	
	DIN	3 m (special version: 5 m, 10 m or 15 m)	

<sup>1)</sup> Only Types 2231 and 2232

<sup>2)</sup> Other pressure ratings for thermowells and flanges on request

**Table 3 · Materials · Material numbers according to ASTM and DIN EN**

Type 2114 Valve · Balanced by a bellows			
Valve size	NPS 1 to 10		NPS ½ to 10
Pressure rating	Class 125		Class 150 and 300
Valve body	Cast iron A126B	Cast steel A216 WCB/WCC	Cast stainless steel A351 CF8M
Seat and plug <sup>3)</sup>	Up to NPS 4	Stainless steel 1.4006 or 1.4104	
	NPS 6 to 10	Steel 1.4301 · Plug with PTFE seal	1.4571
Plug stem/spring	1.4301/1.4310		
Balancing bellows	1.4571		
Bellows housing	Steel 1.0425		1.4571
Body gasket	Graphite on metal core		
Extension piece/separating piece	Brass (version free of non-ferrous metal: stainless steel 1.4301)		1.4301
Type 2114 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	
Valve body	Cast iron A126B	Cast steel A216 WCC	Cast stainless steel A351 CF8M
Seat	Red brass <sup>1)</sup>		
Plug	Red brass <sup>1)</sup> with EPDM soft seal, max. 300 °F (150 °C)		
Pressure balancing	Balancing cases of sheet steel DD11 · EPDM balancing diaphragm, max. 300 °F (150 °C)		
Flat gasket	Graphite on metal core		

Types 2231, 2232, 2233, 2234 and 2235 Control Thermostats		Standard version	Special version
Operating element		Nickel-plated brass	
Sensor	Type 2231	Nickel-plated bronze	Stainless steel 1.4571
	Type 2232		
	Type 2233	Copper	-
	Type 2234		
Type 2235			
Capillary tube		Nickel-plated copper	Plastic-coated copper or stainless steel 1.4571
Thermowell			
Threaded connection 1 NPT			
Immersion tube		Nickel-plated bronze · Nickel-plated steel	Stainless steel 1.4571
Threaded nipple		Nickel-plated brass · Nickel-plated steel	
Flanged connection			
Immersion tube		Steel	Stainless steel 1.4571
Flange		Steel	

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

## Accessories

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

**Thermowell typetested by DVGW** for flammable gases, threaded connection 1 NPT, Class 600

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

To protect the operating element against impermissible operating conditions, an **extension piece** or **separating piece** is mounted between the valve and 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).

A **separating piece** is 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.

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

**Manual override** Ma with travel indication · MaS with electric signal transmitter

**Type 2231 and Type 2232 Bulb Sensors:** Thermowell with threaded connection

**Type 2233 and Type 2234 Bulb 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<sup>1)</sup>, or Type 2235<sup>1)</sup> Thermostat and a Type 2114 Valve in sizes NPS ½ to 10, for which the max. operating pressure must not exceed the max. permissible differential pressure  $\Delta p$  specified in the technical data.

**Sensors without thermowell:** applicable up to 600 psi (40 bar), max. test pressure 870 psi (60 bar)

**Sensors with thermowell:** only use SAMSON 1 NPT version made of bronze or stainless steel 1.4571 up to Class 300

**Thermowells typetested by DVGW** for flammable gases, 1 NPT threaded connection, Class 600.

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

Additionally, the following versions are available:

**Safety temperature monitors (STM)** and **safety temperature limiters (STL)**. For details, refer to Data Sheets T 2043 EN and T 2046 EN.

<sup>1)</sup> Types 2234 and 2235 Thermostats only up to NPS 6 (DN 150)

## Dynamic behavior of the thermostat

The dynamics of the regulator mainly depends on the dynamic behavior of the associated sensor with its characteristic time constant.

Table 4 lists the time constants of SAMSON thermostats operating according to different functional principles when measuring in water.

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

Functional principle	Type ... Control Thermostat	Time constant in seconds	
		Without thermowell	With thermowell
Liquid expansion	2231	70	120
	2232	65	110
	2233	25	-1)
	2234	15	-1)
	2235	10	-1)
Adsorption	2213	-1)	40

<sup>1)</sup> Not permissible

## Installation

### • Valve

The valves are to be installed in horizontal pipelines with the operating element vertically suspended. The process medium must flow through the valve in the direction indicated by the arrow on the body.



### • Temperature sensor

The bulb sensor can be installed in any desired position.

Its entire length must be immersed in the process medium. Choose a place of installation where neither overheating nor considerable idle times occur.

Only use the same kind of materials together, for example thermowells made of stainless steel 1.4571 can be installed in stainless steel heat exchangers.

### • Capillary tube

The capillary tube must be installed such that it is not exposed to large temperature fluctuations and cannot be damaged. The smallest possible bending radius is approx. 2" (50 mm).

## Dimensions and weights

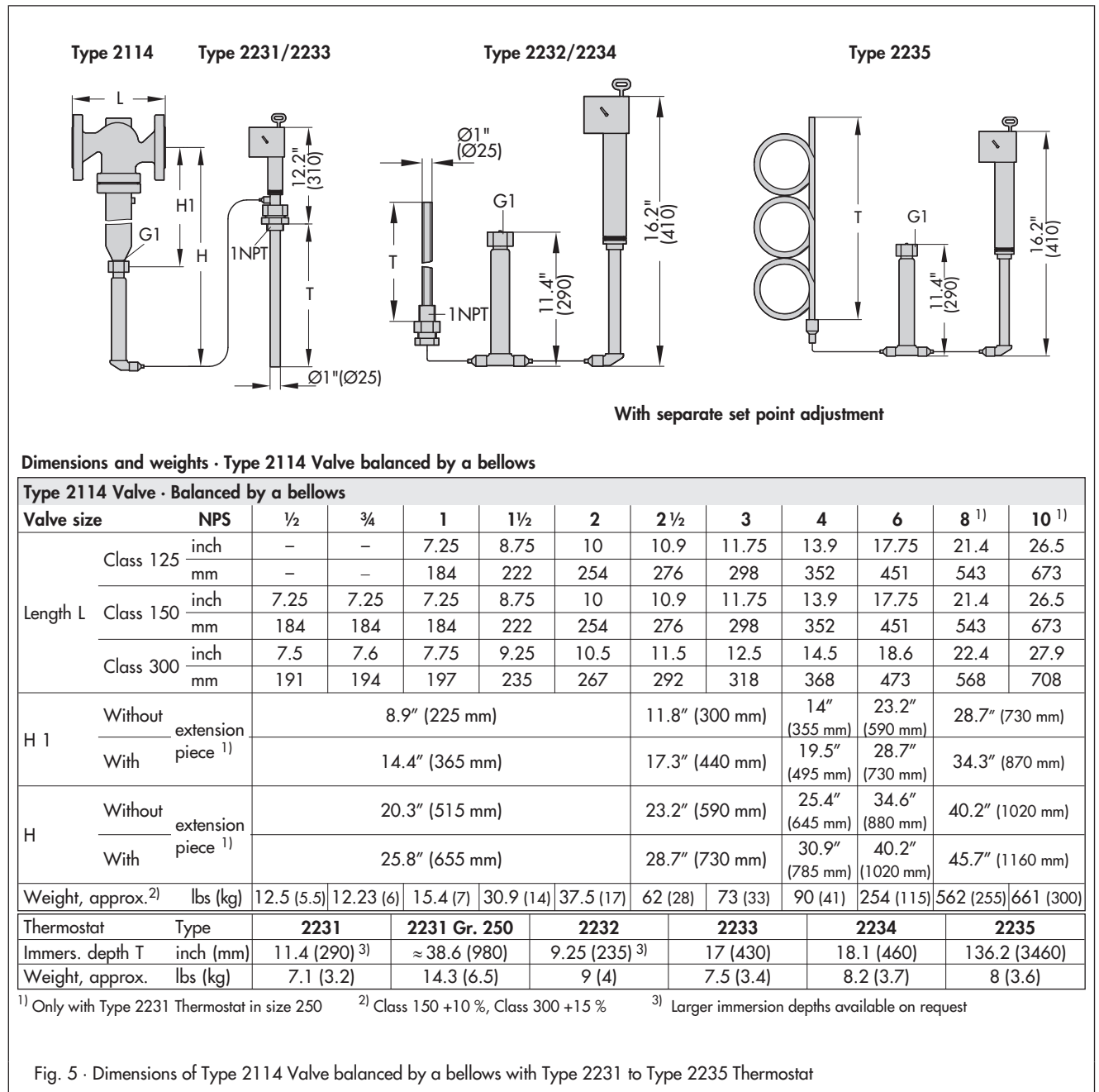


Fig. 5 · Dimensions of Type 2114 Valve balanced by a bellows with Type 2231 to Type 2235 Thermostat

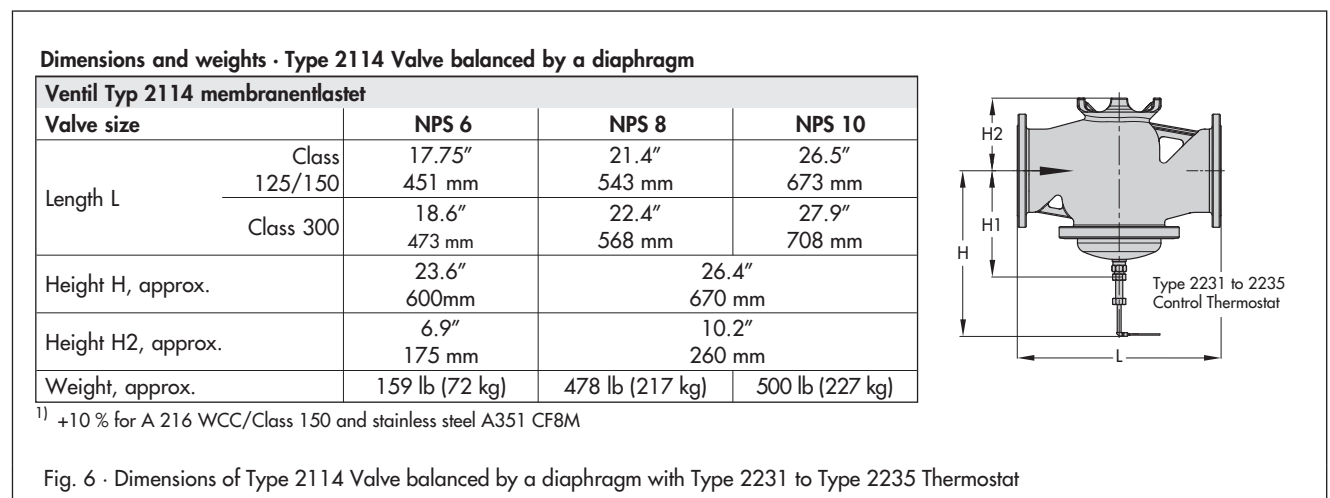


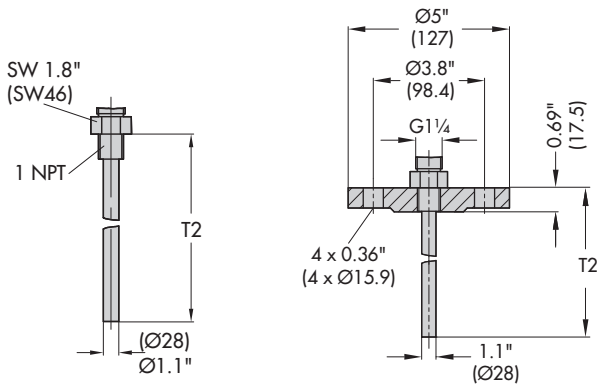
Fig. 6 · Dimensions of Type 2114 Valve balanced by a diaphragm with Type 2231 to Type 2235 Thermostat

Thermowells for Type 2231/2232

Mounting parts for Type 2233/2234

Thermowells for Type 2231/2232 · Dimensions

Control Thermostat Type ...	2231	2232
Immersion depth T2	12.6"	9.7"
	321 mm	246 mm



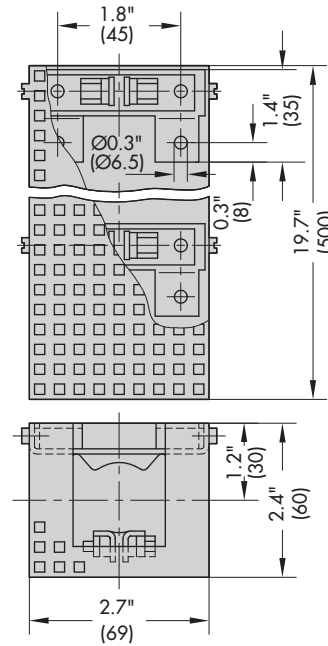
Thermowell with threaded connection  
1 NPT/Class 300

Flanged connection  
NPS 1 1/2/Class 300

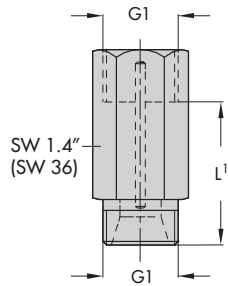
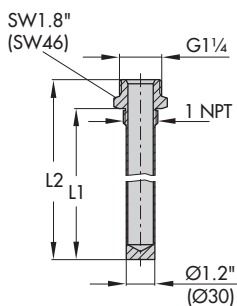
Thermowells for flammable gases, 1 NPT/Class 600

Control thermostat	Type 2231	Type 2232
Length L1	inch	12.4
	mm	314
Length L2	inch	13.4
	mm	340

Clamps and perforated cover for wall mounting



Extension piece/separating piece



**Extension piece:**  
Standard version  
L = approx. 5.5" (140 mm),  
approx. 1.1 lb (0.5 kg)  
Special version (with bellows seal)  
L = approx. 7.1" (180 mm),  
approx. 1.3 lb (0.6 kg)  
**Separating piece:**  
with seals  
L = approx. 2.1" (55 mm),  
approx. 0.4 lb (0.2 kg)

<sup>1)</sup> When accessories are used, the H and H1 increase by the dimension L

Fig. 8 · Dimensions of accessories

Ordering text

Type 4/... Temperature Regulator

NPS ..., Class...

Body material ...

Balanced by a bellows/diaphragm

With Thermostat Type ...

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

If required, special version ..., accessories ...

Specifications subject to change without notice.

