

# Temperature Regulators

Temperature regulation to maximize  
steam system efficiency



**spirax**  
**/sarco®**

# Self acting regulators, the simplest and most

The rising cost of fuels heightens the need to control the production and use of heat more closely and effectively. To provide the right temperature for a process, to optimize energy usage, to provide comfort conditions, and for safety, automatic temperature control is necessary.

## Pilot Operated Temperature Regulators

The Spirax Sarco range of Pilot Operated Temperature Regulators have been developed for close control of process temperature applications where steam is the chosen energy fluid. An important feature in the Spirax Sarco pilot operated range of temperature regulators is the ability to interchange or combine two or more pilots on the same regulator body. This unique feature permits, for example, remote on/off control together with temperature control. These variations are available factory fitted but can easily be added on site.

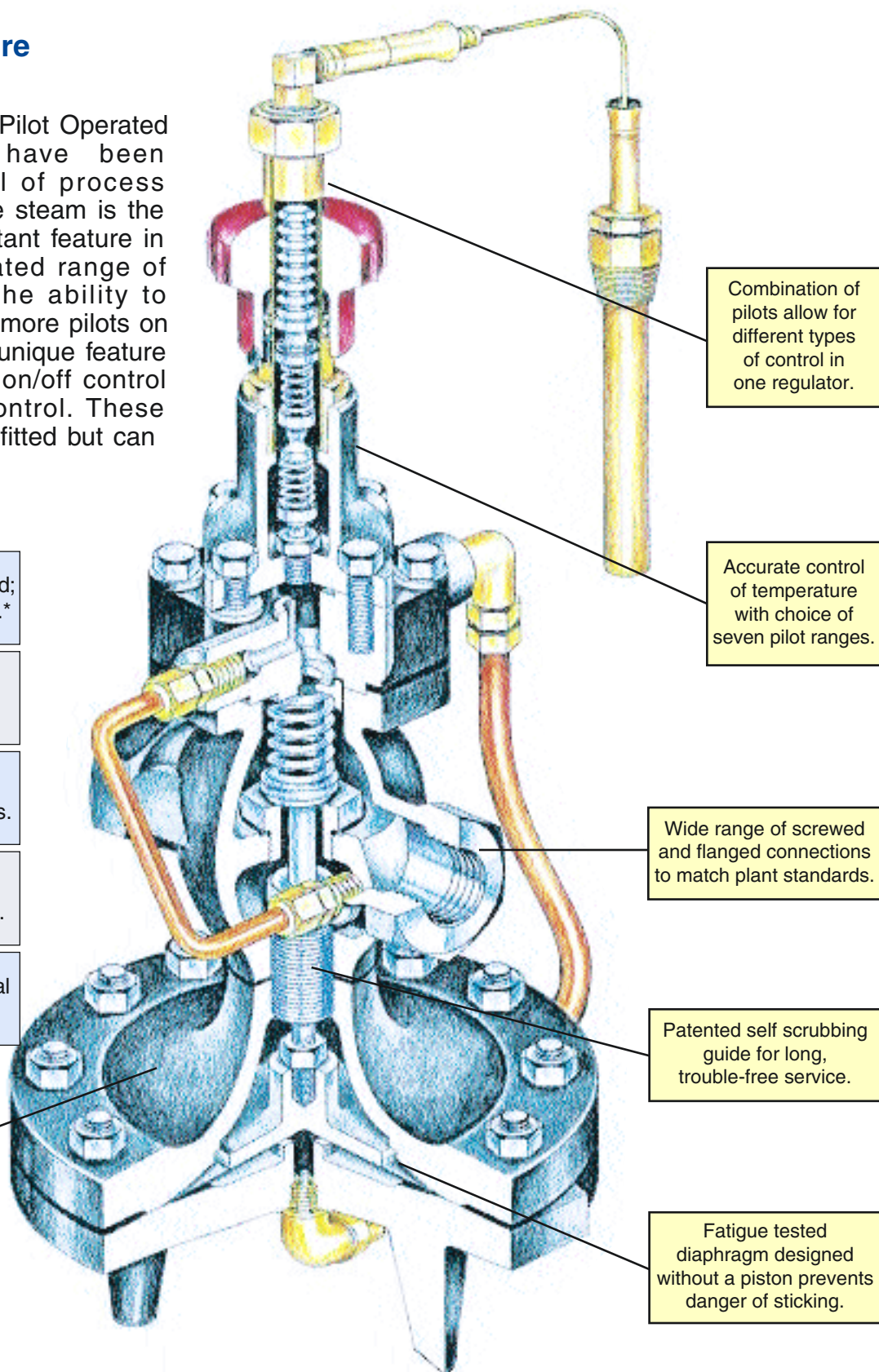
Spirax Sarco offers a complete line of Temperature Regulators. These regulators give stable, modulating control within close tolerances. Properly applied, Spirax Sarco temperature regulators provides the most reliable and precise control available today.

### User benefits

- External power source is not required; therefore, reducing installation costs.\*
- Improved process efficiency and product quality through accurate control of temperature.
- Reduced capital investment with temperature regulator combinations.
- Reduced stocking cost of spares due to interchangeable spare parts.
- Spirax Sarco's guarantee of technical support, knowledge and service.

\* Except for "E" version.

Body materials available in cast iron and steel to meet all plant requirements.

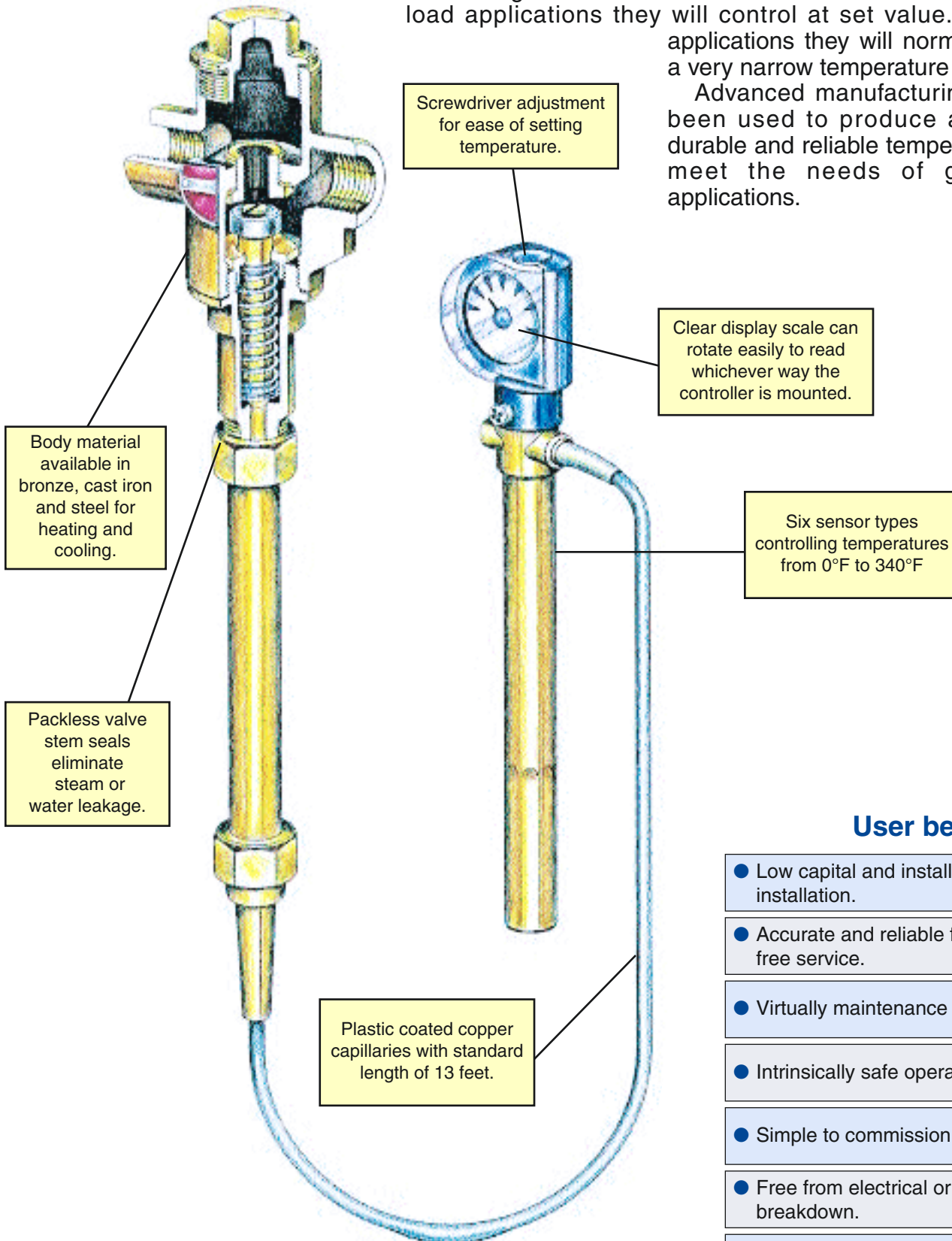


# Most reliable solution for controlling temperature

## Direct Operated Temperature Regulators

The Spirax Sarco Direct Operated Temperature Regulators are for use on steam and liquid applications. The regulators give stable, modulating control within close tolerances. On storage and constant load applications they will control at set value. On variable load applications they will normally operate within a very narrow temperature band.

Advanced manufacturing technology has been used to produce a range of highly durable and reliable temperature regulators to meet the needs of general industry applications.



### User benefits

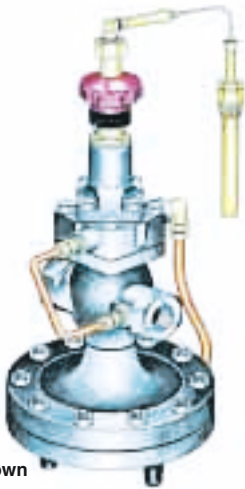
- Low capital and installation cost —one trade installation.
- Accurate and reliable for years of trouble free service.
- Virtually maintenance free.
- Intrinsically safe operation.
- Simple to commission.
- Free from electrical or pneumatic breakdown.
- No expensive safety checks.

# Self acting regulators

## 25T and 25TE

The Spirax Sarco 25-Series are a versatile family of self acting temperature regulators with control pilots and interchangeable main valves for most steam applications. Options include temperature control (25T), combined temperature control with electrical on/off override (25TE). Designed with the user in mind, the 25-Series offers versatility and simplicity. Seven pre-calibrated temperature ranges are interchangeable throughout the range. The 25-Series is available in sizes 1/2" to 6" with screwed and flanged connections. A typical application includes hot water storage where constant water temperatures must be maintained while providing protection against excess temperature.

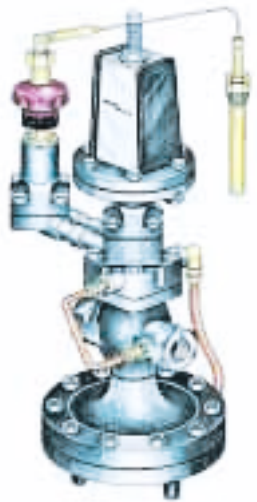
25T Model Shown



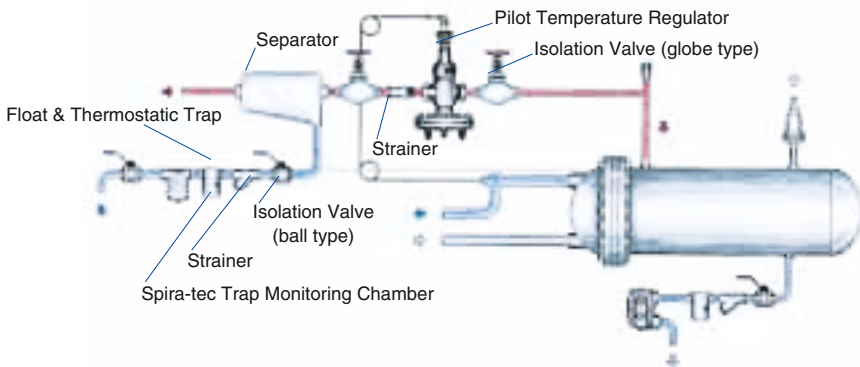
## 25 PT and 25 PTE

The ability to combine multiple pilots for dual control purposes provides a cost competitive solution. Options include combined pressure and temperature control (25PT) and pressure, temperature control with electrical on/off override (25PTE)

25PT Model Shown



### Typical temperature control station using a pilot operated regulator



### Typical temperature control station component overview

	Description	Model	Size	Connection
1	Isolation valves (globe type)	A3S, BSA3	1/2"-8"	Screwed & Flanged
2	Separator (target type)	Model S1, S2, S3, S4A	1/2"-8"	Screwed & Flanged
3	Strainer	Model IT, CT, Fig. 34	1/2"-8"	Screwed & Flanged
4	Temperature Regulator	See tables above	1/2"-6"	Screwed & Flanged
5	Spira-tec Trap Monitoring Chamber	Model ST17SG	1/2"-1"	Screwed
6	Float & Thermostatic Trap	Model FTI	1/2", 3/4"	Screwed
7	Isolation valves (ball type)	Model 10, 20	1/2"-6"	Screwed & Flanged

### Pilot operated temperature regulator C<sub>v</sub> values

Type	25T Series				
Size	1/2"	3/4"	1"	1 1/4"	1 1/2"
C <sub>v</sub>	3.48	6.5	10.5	14	20
Size	2"	2 1/2"	3"	4"	6"
C <sub>v</sub>	35	56	74	115	260

### Sensor overview table

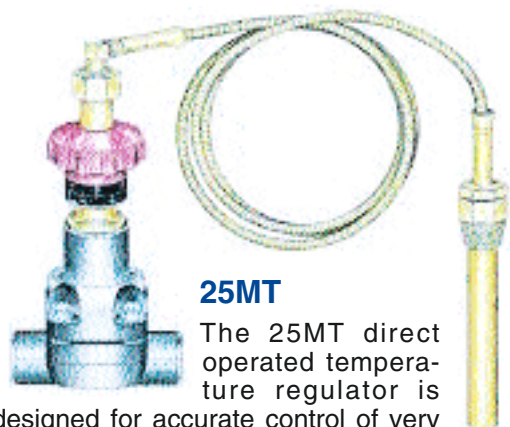
Sensor Type	Valve Type	Temperature Range	Materials	Capillary Length	TIS#
T1	25 Series, MT Series	30-320°F in 60°F steps	Plain copper	8 ft. and 15 ft.	1.1123
T2	25 Series, MT Series	30-320°F in 60°F steps	Copper with 3/4" NPT union	8 ft. and 15 ft.	1.1123
T3	25 Series, MT Series	30-320°F in 60°F steps	Copper teflon coated	8 ft. teflon coat	1.1123
T4	25 Series, MT Series	30-320°F in 60°F steps	Copper with flanged connection	8 ft. and 15 ft.	1.1123
T5	25 Series, MT Series	30-320°F in 60°F steps	Copper with brass well	8 ft. and 15 ft.	1.1123
T6	25 Series, MT Series	30-320°F in 60°F steps	Copper with stainless steel well	8 ft. and 15 ft.	1.1123
T7	25 Series, MT Series	30-320°F in 60°F steps	T1 thermostat bulb with Brass 18" extension well	8 ft. and 15 ft.	1.1123
T8	25 Series, MT Series	30-320°F in 60°F steps	T1 thermostat bulb with stainless steel, 18" extension well	8 ft. and 15 ft.	1.1123
T9	25 Series, MT Series	30-320°F in 60°F steps	T1 thermostat bulb with wall mounting bracket	8 ft. and 15 ft.	1.1123
T10	25 Series, MT Series	30-320°F in 60°F steps	Bulb in stainless steel	8 ft. stainless steel	1.1123
T11	25 Series, MT Series	30-320°F in 60°F steps	Bulb in stainless steel with union connection 3/4" NPT	8 ft. stainless steel	1.1123
T12	25 Series, MT Series	30-320°F in 60°F steps	Blub in plain copper with union connection at 90° offset	8 ft. brass armored	1.1123
HL10	B, K, N & S Series	32°F to 212°F	Brass. Optional wells in brass, steel or stainless steel	6.5 ft.	1.1000
121, 122 & 123	B, K, N & S Series	5°F to 320°F in 60°F or 120°F steps	Brass. Optional wells in brass, steel or stainless steel	13 ft.	1.900

# - A range of solutions

## Pilot and direct operated temperature regulator overview

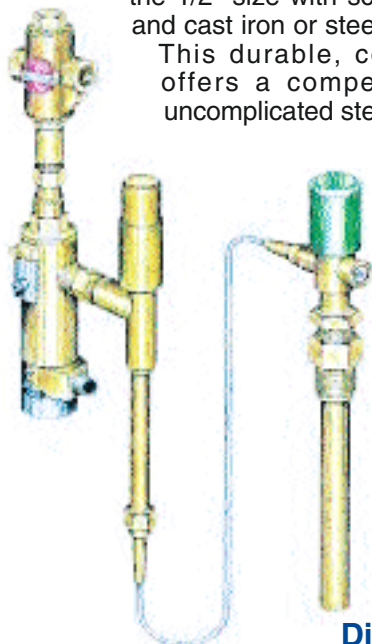
Product Type	Connections				Body Material				Max. Operating Conditions		TIS #
	NPT	ANSI 125	ANSI 150	ANSI 300	Cast Iron	Cast Steel	Stainless Steel	Yellow Metal	°F	psig	
25T, 25PT 25TE*	1/2"-2"	2 1/2"-6"	2 1/2"-6"	2"-6"	Yes	Yes	—	—	CI = 0-450 CS = 0-600	250 300	1.1116(1) 3.018
25MT	1/2"	—	—	—	Yes	Yes	—	—	CI = 0-450 CS = 0-600	250 300	1.1125
T44	1/2"-1"	—	—	—	—	—	—	Yes	250	125	1.1113
BX BXRA	1/2"	—	—	—	—	—	—	Yes	BX = 0-450 BXRA = 0-425	250 150	1.800
SB/SBRA	1/2"-1"	—	—	—	—	—	—	Yes	Consult TIS		1.801
KA/KB/KC	1"-2"	—	—	—	—	—	—	Yes	Consult TIS		1.803
KX/KY	1"-2"	—	—	—	—	—	—	Ye	Consult TIS		1.804
TW	3/4"-1 1/2"	—	—	—	—	—	—	Yes	392	50	1.809
KA43/KB43/KC43	1"-2"	—	—	Yes	—	Yes	—	—	Consult TIS		1.808
BM/BMRA	1/2"	—	—	Yes	—	Yes	—	—	0-450	BM=250 BMRA=150	1.807

\*Maximum operating condition for PT is limited to 450°F, TE is limited to 392°F.



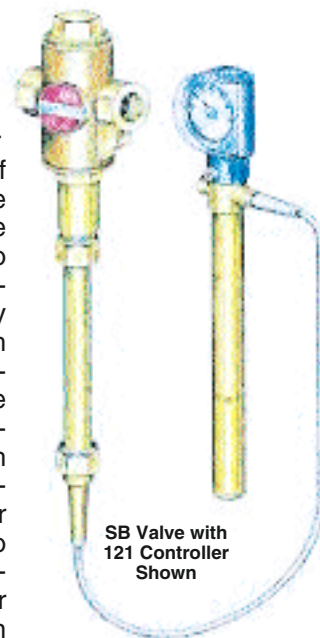
### 25MT

The 25MT direct operated temperature regulator is designed for accurate control of very light loads. The 25MT is available in the 1/2" size with screwed connections, and cast iron or steel body construction. This durable, compact regulator offers a competitive solution to uncomplicated steam applications.



### B, K, N and S Valve Range with 100 Series Controllers

These simple, versatile direct operating temperature regulators are designed for customers where reliability and ease of use are important. These regulators give stable, modulating control within close tolerances. Because the Spirax Sarco controllers operate through liquid expansion within friction free bellows, they have a long maintenance free life with repeatable performance. "Set and forget" is the normal method of using these regulators. Even where temperature settings must vary, operators find them quick and simple to operate. The uncomplicated construction and small number of components makes this range easy to understand so installation is straight forward. The complete range for heating or cooling is available in bronze, cast iron or steel construction with threaded or flanged connections.



SB Valve with 121 Controller Shown

### HL10-130 High Limit Cut Out

The HL10-130 regulator is a self-acting safeguard against overheating. Even the best temperature controls can fail often through no fault of their own. Whatever the cause, the effect of failure can be serious and may lead to injury or even loss of life. The Spirax Sarco HL10-130 automatically shuts off heat at its source in the event of a temperature overrun. The type 130 control system is the sensing device and features self-acting operation and fail safe even if capillary is damaged. The HL10 snaps the isolation valve shut if the preset high limit temperature is exceeded. The HL10 features manual reset, visual red indicator and micro switch facility for remote audio/visual indicator.

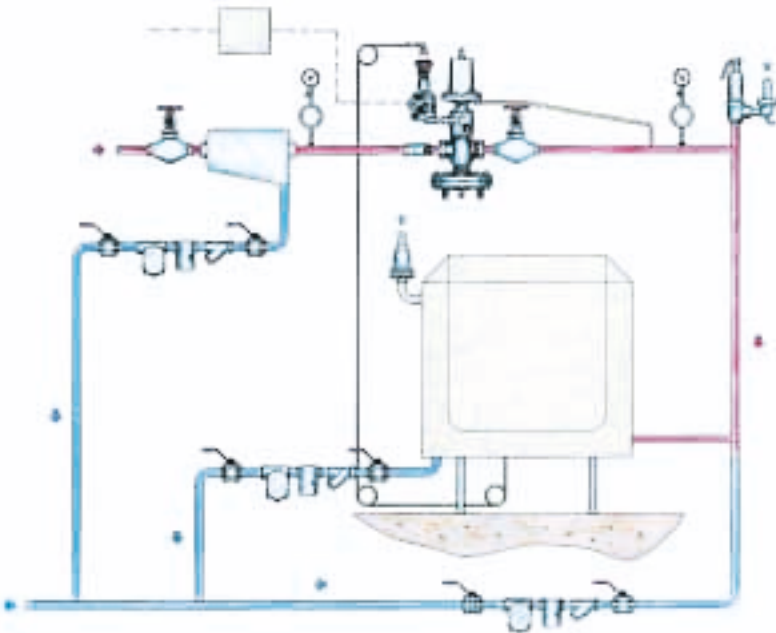
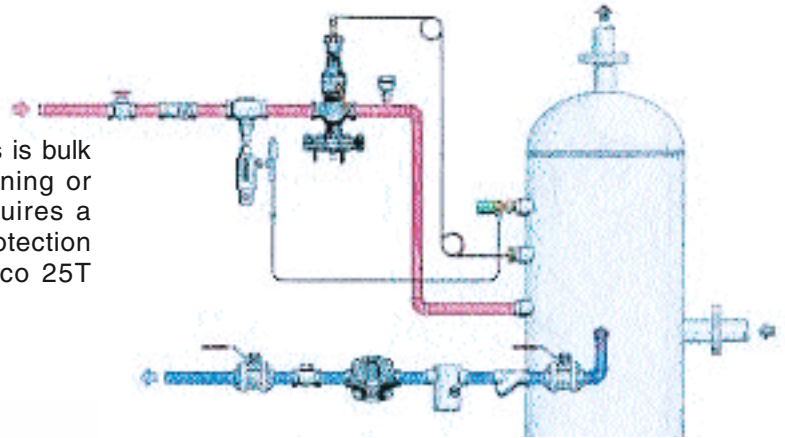
### Direct operated temperature regulator C<sub>v</sub> values

Type	BX/BXRA	SB/SBRA		BM	All K Series								TW	T44			25MT	
Size	1/2"	1/2"	3/4"	1"	1/2"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	3/4"	1"	1-1/2"	1/2"	3/4"	1"	1/2"
C <sub>v</sub>	1.92	3	4.5	7.9	1.92	3.36	5.4	11.4	19.2	27.6	39.6	5.4	10.5	24	3	7		.49

# Typical applications for self acting temperature regulators

## Bulk water storage

One popular application for self acting pilot regulators is bulk water storage when used for process vessel cleaning or hospital showers and baths. This application requires a constant hot water temperature while providing protection against excessive temperatures. The Spirax Sarco 25T combined with an HL10-130 provides these functions.

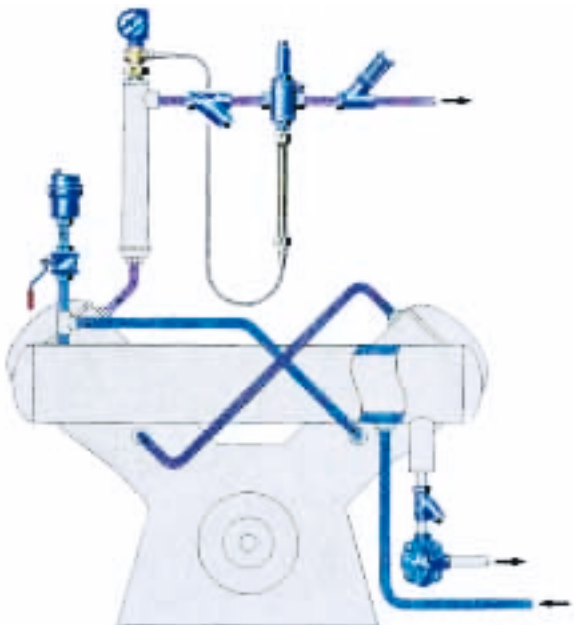
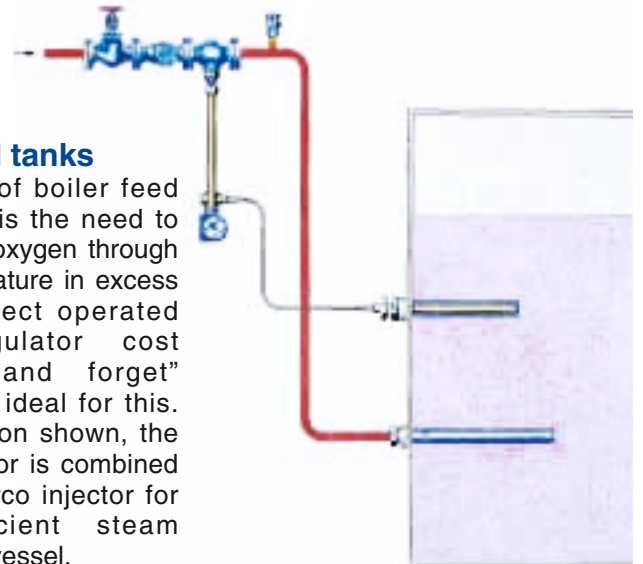


## Controlling a batch process vessel

In this example, a combination of pressure limiting, temperature control, and on/off switching is used in a 25PTE Series valve. This displays the versatility of self acting pilot regulators in fixing the maximum steam pressure and temperature limit to avoid excessive vessel wall temperatures, then controlling temperature within this limit for heat up and run conditions. The on/off solenoid is used to begin and end the heat cycle, plus shut down the steam on safety alarms.

## Boiler feed tanks

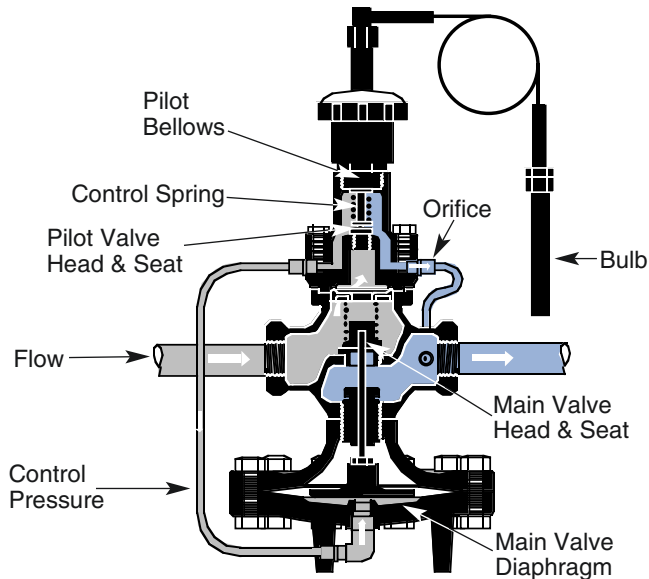
An essential part of boiler feed water conditioning is the need to drive out dissolved oxygen through heating to a temperature in excess of 180°F. The direct operated temperature regulator cost effective, "set and forget" characteristics are ideal for this. Within the application shown, the temperature regulator is combined with the Spirax Sarco injector for silent and efficient steam penetration into the vessel.



## Air compressor cooling

Air compressors call for modulating temperature control valves which will start up in the closed state and provide a minimum bleed through the jacketed air receiver for sensing purposes. As the water temperature increases, the control valve will open to allow cold water into the jacketed air receiver.

# How self acting temperature regulators work



## How the 25T pilot regulator works

The Spirax Sarco pilot operated temperature regulator works by converting the process temperature to a force which is balanced by the control spring. This modulates a small valve head over a seat (the pilot). The flow through this seat is directed in turn to the main valve diaphragm, where it modulates the main valve.

In order to achieve the most stable operating condition, the sensing bulb must be immersed entirely in the sensed medium. This allows the liquid in the bulb to expand through the capillary tubing into the bellows and throttles the pilot valve. This settles the pilot valve, allowing constant flow across the main diaphragm.

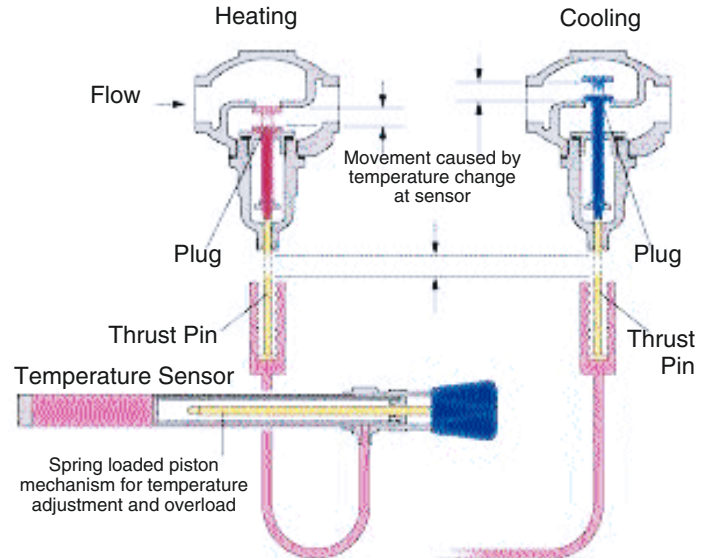
When process temperature rises, the pilot valve closes, and pressure is released from the main valve diaphragm through the control orifice to close the main valve. Any variations in temperature will immediately be sensed on the bulb, which will act to adjust the position of the pilot and main valve, ensuring a constant process temperature.

## How to order

When ordering a Spirax Sarco 25T temperature regulator, include all of the following:

- Valve size by nominal pipe/flange size
- Body material of cast iron or cast steel
- Type of sensor - 25T for thermostatic regulation
- Style of thermostatic bulb
- Length of capillary tubing
- Temperature adjustment range
- Maximum steam supply pressure. Specify low pressure pilot when inlet pressure for flanged sizes is 15 psig or below.
- Intended application

**For example:** Spirax Sarco 1" Cast Iron Temperature Regulator, Type 25T-2 with 8 feet of tubing, temperature range of 120° to 180°F, 75 psig steam, for storage water heater.



## How direct operated temperature regulators work

A change in temperature at the sensor will cause the liquid filling to expand or contract. If the liquid expands it will apply a force on the thrust pin which, in turn, will cause the valve plug to move. As the liquid contracts, the force on the valve plug reduces and a spring reverses its direction of travel.

For heating applications, the valves will normally be open and will close against a rise in temperature.

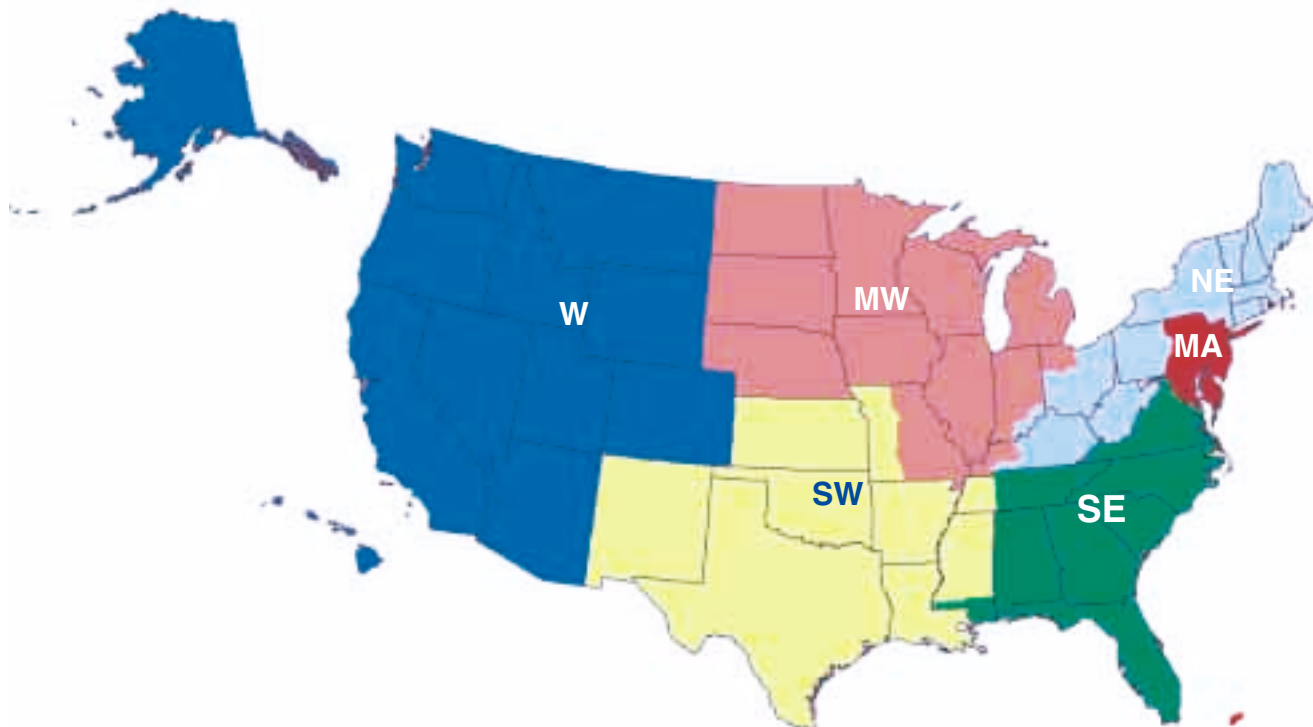
For cooling applications, the valves will normally be closed and will open against a rise in temperature.

## How to order

When ordering a Spirax Sarco 121 temperature regulator, include all of the following:

- Valve size by nominal pipe/flange size
- Body material of cast iron or cast steel
- Type of sensor - 121 for thermostatic regulation
- Style of thermostatic bulb or union nut
- Length of capillary tubing
- Temperature adjustment range
- Maximum steam supply pressure
- Intended application

**For example:** Spirax Sarco 1" Cast Iron Screwed Regulator with 121 Regulator having temperature set value of 180°F, 13 ft. capillary, and bulb with 3/4" NPT union nut.



**For more information on Spirax Sarco, contact your Regional Hub Office below, or call 1-800-883-4411 and you will be connected to the location nearest you.**

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