

# What is a Temperature Regulator?

## Definition

The Self-Operating Temperature Regulator is a mechanically operated device designed to regulate system temperature by modulating the flow of a heating or cooling fluid in response to temperature changes.

## Principles of Operation

The Trerice "Self-Op" Temperature Regulator is a fully self-contained unit, requiring no external power source (i.e., compressed air or electricity). Regulation takes place when the sensing element (bulb) of the thermal system is exposed to changes in temperature. The thermal system is charged with a predetermined amount of vapor fill, which, when heated, will cause a bellows within the unit's actuator housing to expand. As the bellows expands, it compresses a return spring while simultaneously moving the valve stem downward to stroke the valve. When the process temperature decreases (or in the event of thermal system failure), the return spring will move the valve stem upward to the "out" position. The choice of valve action (stem In-To-Close or stem In-To-Open) will determine its system failure position.

## Selecting a Temperature Regulator

The Trerice "Self-Op" Temperature Regulator is recommended for controlling the flow on relatively stable systems, where small valve stroke modulations will correct temperature drift. Where sudden or large load changes, or rapid temperature changes occur, a pneumatically or electrically powered Trerice Control Valve should be specified. Please consult the Control Valve Section of this catalog.

**Trerice "Self-Op" Temperature Regulators are NOT intended for use in applications where the media comes in direct contact with the skin or body, such as showers, baths, lavatories or wash fountains.**

Trerice "Self-Op" Temperature Regulators should be carefully selected to meet the demands of the particular application. The information contained within this catalog is offered only as a guide to assist in making the proper selection. Selection of the proper temperature regulator is the sole responsibility of the user. Improper application may cause failure, resulting in possible personal injury or property damage.

## Actuator

The actuator consists of the following assemblies: housing, bellows and spring return, and thermal system. Three actuator models are available:

- **Model 91000** is non-indicating and direct acting.
- **Model 91400** is equipped with an integral dial thermometer to indicate sensing bulb temperature and is direct acting.
- **Model 91600** (Fail-Safe) is non-indicating and direct acting. It is specifically designed to cause the valve to move to the cooler position in case of thermal system failure.

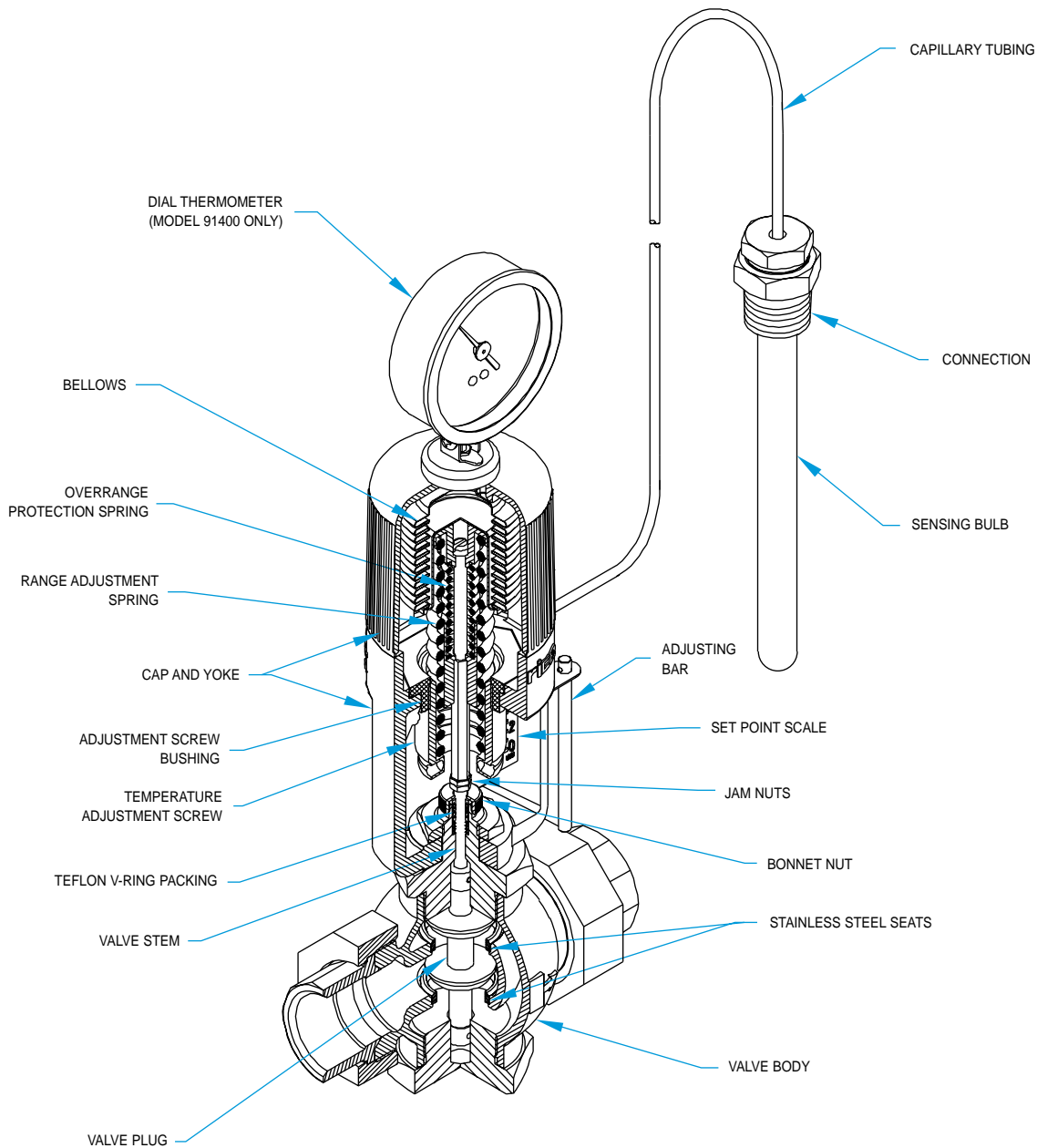
### Actuator: Direct Acting

Direct Acting actuators are designed to move the valve stem to the "in" position as the control signal (temperature) increases.

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## Housing Assembly

The housing consists of a cap and yoke constructed from precision die cast aluminum. This assembly ensures permanent alignment with the valve body, while protecting the bellows assembly. The yoke includes a set point scale used to reference the setting of the temperature adjustment screw. The entire housing is finished in a corrosion resistant, baked blue epoxy.

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## **Bellows and Spring Return Assembly**

The accordion type bellows is corrosion resistant to provide accurate response for the life of the regulator. An adjusting bar is provided to turn the brass temperature adjustment screw, which compresses or expands the range adjustment spring, thereby setting the control point of the unit.

## **Thermal System Assembly**

The thermal system (sensing bulb and capillary tubing) is available in copper (for best heat transfer) or 316 stainless steel (for corrosive applications), and can be ordered with a variety of protective coverings, including Teflon or stainless steel spiral armor. Capillary tubing lengths can be specified from 8 to 52 feet.

## **Integral Dial Thermometer**

The integral dial thermometer of the Model 91400 displays the temperature at the sensing bulb. This allows for easy adjustment of the temperature set point, as well as for continuous monitoring of the application, without the installation of an additional thermometer. The thermometer has a 3<sup>1</sup>/<sub>2</sub>" dialface and can be rotated and tilted for maximum readability.

## **Temperature Range**

Nominal ranges from 20°F (-10°C) through 440°F (225°C) are available. The nominal range defines the entire temperature range of the unit. The service conditions and the choice of valve style and action will determine the actual operating range (recommended working span) of the unit. The nominal range should be selected so the set point falls within the recommended working span for the specified valve style and action. Models 91000 and 91400 include an overrange protection spring, which allows the sensing bulb to be heated 100°F above the upper limit of the unit's nominal range for system cleaning or temporary situations.

## **Accuracy**

The Trerice "Self-Op" Temperature Regulator is a "set-and-forget" regulating device. Once the proper control point setting has been achieved, the unit requires virtually no adjustments and very little maintenance. Control point accuracy is dependent upon the sensing bulb location, load change size and speed, and valve size. The sensing bulb must be installed in an area within the process that is most representative of overall process conditions. Care should be taken not to locate the bulb in close proximity to the valve, as the regulator might respond to temperature changes before the process has had time to reach the control point. Where sudden or large load changes occur, a pneumatically or electrically powered Trerice Control Valve should be specified. Please consult the Control Valve Section of this catalog.

Valve sizing also plays a major part in regulator performance. A valve that is too small will not be able to provide the desired capacity during peak load conditions, while a valve that is too large may overshoot the control point and operate with the valve plug too close to the seat, resulting in undue wear of the plug and seat. As part of a well-designed system, a properly sized valve (operating in the 60-90% open position) can control to within 2° to 5°F.

### **Sensing Bulb Installation:**

Care must be taken to ensure that entire length of the sensing bulb is immersed into the medium at the sensing location. Partial immersion will result in faulty control. When the sensing bulb is installed into a pipeline, constant flow must be continued through the line, in order to maintain an active thermal signal to the bulb. Should a closed valve cause stoppage of flow to the bulb, a reduced bypass flow must be installed to maintain thermal signal.

The sensing bulb is designed to be installed in either a horizontal position or a vertical position with the tip down. If the tip must be installed upwards, please specify when ordering, as a special bulb construction is required.

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## Valve

Trerice "Self-Op" Temperature Regulators are available with a wide variety of globe valves in various styles, materials, connections and sizes.

## Style

Trerice Regulator Valves are offered in single seated, double seated and three-way designs.

- **Single Seated Valves** are designed for applications where tighter shut off is required. However, this design is unbalanced and limited in the pressure that it will shut-off against. The leakage rate is approximately 0.1% of the maximum capacity.
- **Double Seated Valves** are nearly pressure balanced and, therefore, are able to close the valve plug against higher operating pressures. However, since temperature fluctuations may cause expansion and contraction across the seats, tight shut-off is not always possible. The leakage rate is approximately 0.5% of the maximum capacity. Double seated valves have a faster flow response and greater capacity than single seated valves, and are recommended when tight shut-off is not required.
- **3-Way Valves** are used for mixing two flows together, or for diverting a flow to or around a device (bypass). In order to produce consistent flow quantity for stable operation, the pressure drop across both flow paths (inlet to outlet) must be nearly equal.

The valve is not considered a shut-off valve. A pressure surge may force a single seated valve plug open. The Trerice Temperature Regulator is a balanced equilibrium system at the set point and provides no power to tightly seat the valve plug. A separate power driven or hand actuated valve is required to ensure tight shut-off when necessary.

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## Action

Trerice Single and Double Seated Valves are available as stem In-To-Close (Normally Open) for heating applications, or stem In-To-Open (Normally Closed) for cooling applications. The action of bronze bodied valves is field reversible. Trerice 3-Way Valves can be plumbed for either mixing or diverting service.

### Temperature Regulator Valve Action

Application	Stem Action	Normal (Fail*) Position
Heating	In-To-Close	Normally Open
Cooling	In-To-Open	Normally Closed

*\*91000 and 91400 only. 91600 is designed to fail in the cooler position.*

## Body Material and Connection

Trerice "Self-Op" Temperature Regulators are available with bronze, cast-iron, cast steel and stainless steel valve bodies. Union, flanged and threaded connection styles are available.

## Trim

Valve trim is composed of the stem and plug assembly, and the seats within the ports. Trerice single and double seated bronze bodied valves employ a stainless steel, tapered plug for enhanced modulation, as well as permanently brazed-in stainless steel seats for smooth performance throughout the life of the valve. The valve plug is both top and bottom guided to ensure positive seating alignment. Trerice 3-Way valves use a stainless steel sleeve and brass seating surface to change flow direction within the body.

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## Packing

Trerice valves feature a self-energizing Teflon V-Ring packing, which reduces leakage around the valve stem. V-Ring packing is spring loaded to maintain proper compression and does not require manual adjustment.

## Size

The proper sizing of a regulating valve is one of the most important factors in its selection. A valve that is too small will not be able to provide the desired capacity during peak load conditions, while a valve that is too large may overshoot the control point and operate with the valve plug too close to the seat, resulting in undue wear of the plug and seat. The valve coefficient ( $C_v$ ) is mathematically determined through an evaluation of the system service conditions (operating pressures and flow). From this evaluation, a valve body with the appropriate port size can be selected. Port sizes from 1/8" through 6" and connection sizes from 1/2" through 6" are available. Please consult the Valve Selection Section of this catalog.

### Valve Coefficient ( $C_v$ )

The rated valve coefficient is used to describe the relative flow capacity of the valve based on standard test conditions. Please refer to the Valve Selection Section for detailed information.

## Temperature Regulator Valve Availability

Body Material	Connection	Style	Size											
			1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	
Bronze	Iron Unions	Single	✓*	✓	✓	✓	✓	✓						
		Double		✓	✓	✓	✓	✓						
		3-Way	✓	✓	✓	✓	✓	✓						
Cast-Iron	Class 125 Flanged	Double							✓	✓	✓	✓	✓	
		3-Way							✓	✓	✓			
Cast-Steel	Threaded	Single		✓*	✓*									
Stainless Steel	Threaded	Single	✓	✓	✓		✓	✓						
		3-Way	✓	✓	✓		✓	✓						

\*Reduced port sizes are available.

## Thermowell

For applications in which the process media may be corrosive or contained under pressure, the use of a thermowell is required to prevent damage to the sensing bulb. A thermowell will also facilitate the removal of the sensing bulb and thermal system from the operating process. Thermowells are available in a variety of connection styles, materials and lengths.

## Pipeline Strainer

A Trerice Series 1100 Pipeline Strainer should always be installed upstream of a Trerice Regulator. This Y-Type strainer employs a stainless steel screen to remove debris from the line, which will prevent jamming of the valve and extend its life.

To ensure minimum response time, Trerice Heat Transfer Paste should be applied to the sensing portion of the bulb before installation.

1 oz. tube: Item No. 107-0001

# Notes