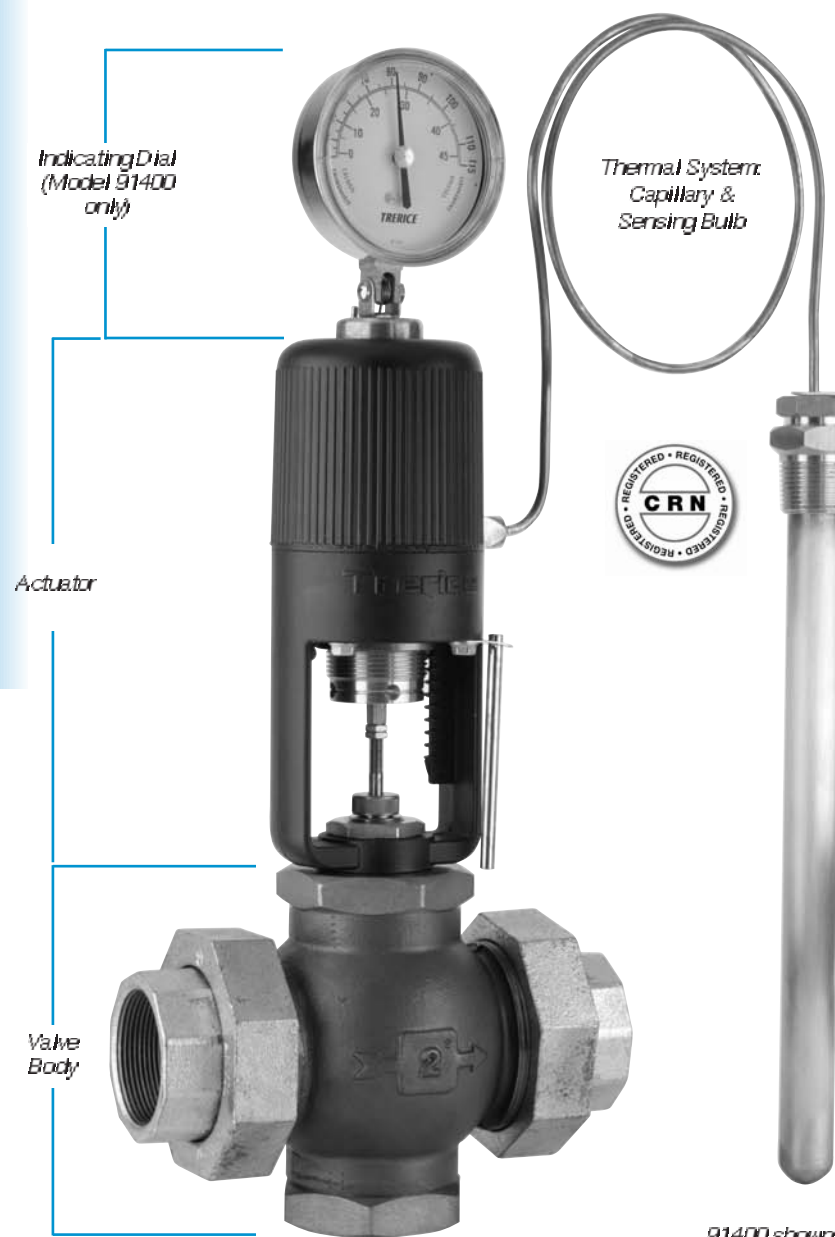


91000 Series Temperature Regulator

The "Self-Op" (Self-Operated Temperature Regulator)

TEMPERATURE REGULATORS



91400 shown

Self-Operating Design

Indicating, Non Indicating or Safety Models Available

Heavy Duty Die Cast Aluminum Housing

1/2" thru 6" Valve Sizes

Fully Enclosed Bellows

Internal Overrange protection

The **91000 Series** (Models 91000, 91400 & 91600) Self-Operating Temperature Regulator is the preferred choice of original equipment manufacturers, mechanical contractors and specifying engineers. These regulators require no external power source and are ideal for regulating the temperature of tanks, process streams and various types of industrial equipment. The Actuator is noted for its rugged die-cast aluminum housing, fully enclosed bellows assembly and internal over range protection.

Valve bodies for the **91000** are offered in single-seated, double-seated and 3-way designs and are available in Bronze, Cast-Iron, Cast-Steel and Stainless Steel construction.

The Model **91000** (without indicating dial) features a lower profile and should be specified where space constraints may be an issue.

The Model **91400** (with indicating dial) will allow the operator to verify the process temperature and to aid in temperature adjustment.

The Model **91600** Fail-Safe Actuator is designed to cause the valve to fail in the safe control position (open in a cooling application, closed in a heating application) should accidental damage to the thermal system occur, resulting in loss of the pressure charge.

For optimal performance, the service conditions (medium, flow, temperature, inlet and outlet pressures) of the application must be considered when selecting a valve. Please refer to the Valve Selection Section of this catalog. For applications where the process media may be corrosive or contained under pressure, the use of a thermowell is required to prevent damage to the regulator bulb and facilitate its removal from the process. Improper application may cause failure of the valve, resulting in possible personal injury or property damage.

For replacement or service parts please see Accessories and Replacement Parts in the Regulators and Control Valves section of the list price sheet.

HOW TO ORDER

Sample Order Number: **91400 R06 08 B01 W01 - A26**

Models	Range	Capillary Length	Thermal System	Thermowell*	Valve Body Selection
91000 Non-Indicating	Refer to Standard Ranges (page 176)	08 8 Feet	Refer to Thermal System Selection Chart (pages 178-179)	W01 - Brass	For 91000/91400 Models
91400 Indicating Dial		12 12 Feet		W02 - Steel	(refer to pages 180-187)
91600 Fail Safe		16 16 Feet		W04 - 316SS <i>(Omit if not required)</i>	For 91600 Models (refer to page 188) <i>(Omit this selection if purchasing Actuator only)</i>
		20 20 Feet			

* Thermowell sized to fit bulb as specified.

Other Capillary Lengths available: Specify in 4 Foot increments (52' maximum)

91000 Series

Temperature Regulator

TEMPERATURE REGULATORS

Specifications

Actuator Models

91000	(Non-Indicating)
91400	(Indicating Dial)
91600	(Fail-Safe)

Power Requirements

Fully self-contained –
no external power required

Dial Thermometer

3 1/2" dial, stainless steel case,
swivel and angle adjustment
(Model 91400 only)

Housing

Die cast aluminum, epoxy powder
coated blue finish

Set Point Scale

Integral to housing

Bellows

High pressure brass, corrosion
resistant, tin plated finish

Adjustment Screw

Brass

Adjustment Screw Bushing

Lubricant impregnated
sintered bronze

Range Adjustment Spring

Cadmium Plated

Overrange Protection

Upper range limit +100°F for
temporary situations
(not available for Model 91600)

Approximate Shipping Weight

Actuator

91000: 6.0 lbs [2.70 kg]
91400: 6.6 lbs [2.97 kg]
91600: 9.5 lbs [4.32 kg]

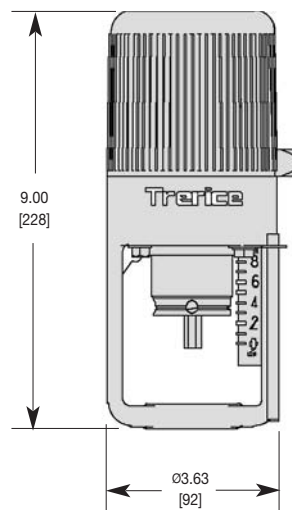
Valve

See Valve Selection tables

All dimensions are nominal. Dimensions in [] are in millimeters.

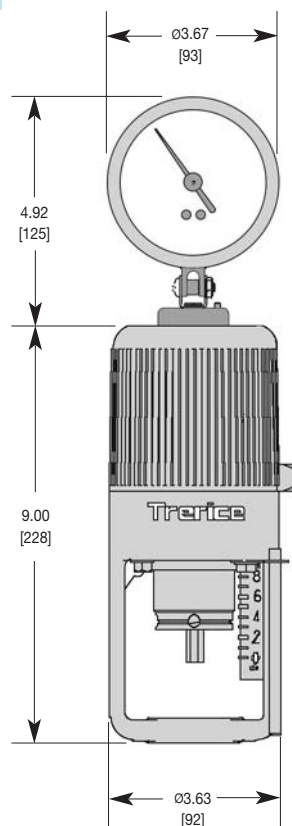
91000

Non-Indicating Actuator



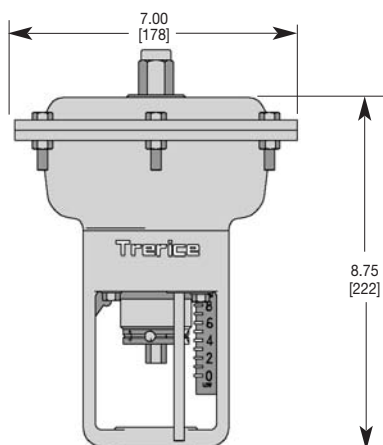
91400

Indicating Actuator



91600

Fail-Safe Actuator



Temperature Ranges

The “Self-Op” Temperature Regulator (91000, 91400, & 91600 Models)

Standard Ranges

91000 & 91400 Actuators				
Range Code	Nominal Range	Recommended Working Span		Dial Thermometer Range (Model 91400 only)
		Single Seat, In-To-Close Valves Double Seat, In-To-Close Valves Double Seat, In-To-Open Valves All 3-Way Valves	Single Seat In-To-Open Valves	
R01*	20° to 70°F & -10° to 20°C	40° to 65°F & 5° to 20°C	N/A	30° to 115°F & C
R02*	40° to 90°F & 5° to 30°C	65° to 85°F & 20° to 30°C	N/A	50° to 140°F & C
R03	30° to 115°F & 0° to 45°C	85° to 110°F & 30° to 45°C	50° to 80°F & 10° to 25°C	30° to 115°F & C
R04	50° to 140°F & 10° to 60°C	110° to 135°F & 45° to 60°C	80° to 105°F & 25° to 45°C	50° to 140°F & C
R05	75° to 165°F & 25° to 70°C	135° to 160°F & 60° to 70°C	105° to 130°F & 40° to 50°C	75° to 165°F & C
R06	105° to 195°F & 40° to 90°C	160° to 190°F & 70° to 90°C	130° to 155°F & 50° to 65°C	105° to 195°F & C
R07	125° to 215°F & 55° to 100°C	190° to 210°F & 90° to 100°C	155° to 180°F & 65° to 80°C	125° to 215°F & C
R09	155° to 250°F & 70° to 120°C	210° to 245°F & 100° to 120°C	180° to 215°F & 80° to 100°C	155° to 250°F & C
R10	200° to 280°F & 95° to 135°C	245° to 275°F & 120° to 135°C	215° to 245°F & 100° to 120°C	200° to 280°F & C
R11	225° to 315°F & 110° to 155°C	275° to 310°F & 135° to 155°C	245° to 280°F & 120° to 140°C	225° to 315°F & C
R12	255° to 370°F & 125° to 185°C	305° to 365°F & 155° to 185°C	275° to 335°F & 135° to 165°C	255° to 370°F & C
R13	295° to 420°F & 145° to 215°C	365° to 415°F & 185° to 215°C	335° to 385°F & 165° to 195°C	295° to 420°F & C
R14	310° to 440°F & 155° to 225°C	415° to 435°F & 215° to 225°C	385° to 405°F & 195° to 205°C	310° to 440°F & C

*Not recommended for single seated valves.

The recommended working span typically falls within the upper third of the nominal range. Single Seat In-To-Close, all Double Seat, and all 3-Way valves have a recommended working span in this part of the nominal range. However, due to differing thrust requirements, Single Seat In-To-Open valves have a recommended working span in the middle one-third of the nominal range.

Standard Ranges

91600 Fail-Safe Actuators	
Range Code	Nominal Range and Recommended Working Span
R81	40° to 65°F & 5° to 20°C
R82	55° to 80°F & 15° to 25°C
R83	65° to 90°F & 20° to 30°C
R84	80° to 110°F & 25° to 40°C
R85	90° to 115°F & 30° to 45°C
R86	110° to 140°F & 40° to 60°C
R89	140° to 175°F & 60° to 80°C
R90	170° to 195°F & 80° to 90°C
R91	190° to 210°F & 85° to 100°C
R92	205° to 225°F & 95° to 105°C
R93	215° to 250°F & 100° to 120°C
R94	230° to 265°F & 110° to 130°C
R95	245° to 280°F & 120° to 135°C
R96	270° to 300°F & 135° to 150°C

Thermowells

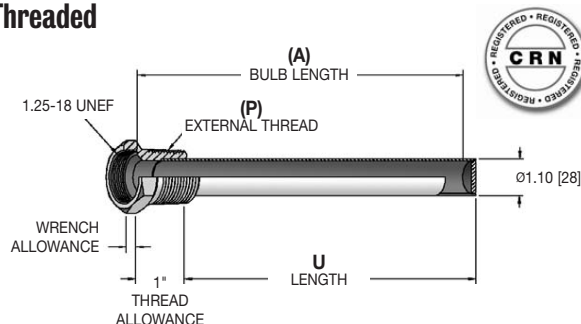
for Temperature Regulator (91000, 91400, & 91600 Models)

If Thermowells are to be purchased as a separate item, or if a Special Thermowell is required, please refer to this page. If a complete Temperature Regulator is purchased, the proper Thermowell to match the sensing bulb ordered will be supplied. Please note sensing bulb size is affected by capillary length. Indicate W01 for Brass, W02 for Steel or W04 for 316SS.

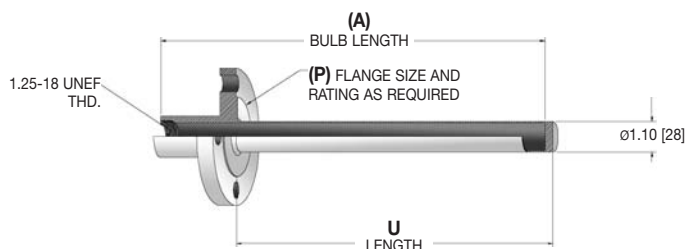
Thermowell to fit Standard Bulb

All dimensions are nominal. Dimensions in [] are in millimeters.

Threaded



Flanged



Pressure Rating (psi)

Material	Operating Temperature		
	70°F	300°F	500°F
Carbon Steel	780	780	600
316 Stainless Steel	750	690	600
Brass	350 psi @ 150°F, 280 @ 350°F		

Lengths

(A) BULB LENGTH	U Length
13"	12.25 [311]
16"	15.25 [387]
20"	19.25 [489]
24"	23.25 [591]

Maximum pressure and temperature ratings are limited by the choice of flange. Please see ANSI/ASME B16.5-2003 for more information.

HOW TO ORDER

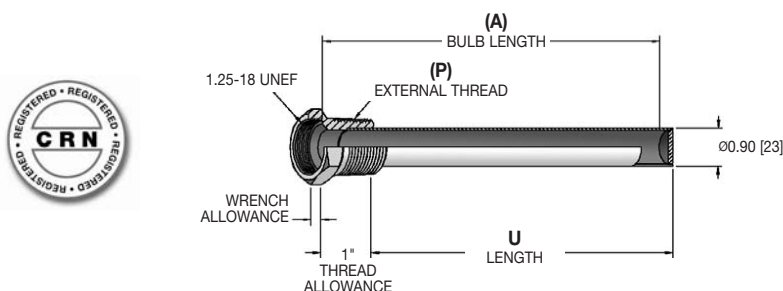
Sample Order Number: **53-6S6**

Thermowell Style	(P) External Connection	(A) Bulb Length	Material
53 - Temperature Regulator	6 1 1/4 NPT	S 13" Bulb	2 Brass (500 psi max.)
	71 1 1/2" 150# RFF *	Se 16" Bulb	3 Steel (500 psi max.)
	81 2" 150# RFF *	We 20" Bulb	6 316SS (1000 psi max.)
	181 3" 150# RFF *	Wk 24" Bulb	

* Not available in Brass.

Other connections and lengths may be available, consult factory.

Thermowell to fit Special "Small" Bulb



Lengths

(A) Bulb Length	Thermowell U Length
9"	8.25 [210]
12"	11.25 [286]

Pressure Rating (psi)

Material	Operating Temperature		
	70°F	300°F	500°F
Carbon Steel	850	850	680
316 Stainless Steel	850	780	730
Brass	480 psi @ 150°F, 400 @ 350°F		

HOW TO ORDER

Sample Order Number: **53-5M2**

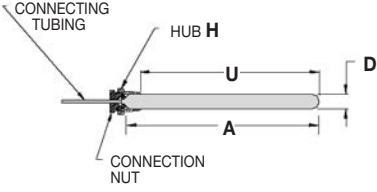
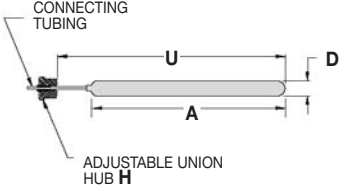
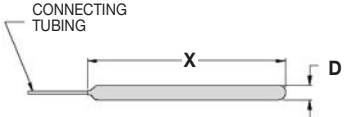
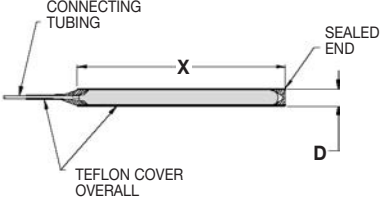
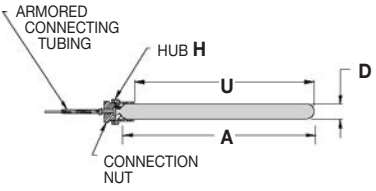
Thermowell Style	(P) External Thread	(A) Bulb Length	Material
53 - Temperature Regulator	5 1 NPT	M 9" Bulb	2 Brass (500 psi max.)
		R 12" Bulb	3 Steel (500 psi max.)
			6 316SS (1000 psi max.)

Selection of the proper thermowell is the sole responsibility of the user. Pressure limitations must be considered. Improper application may cause failure of the thermowell, resulting in possible personal injury or property damage.

Thermal System Selection

Temperature Regulator (91000, 91400, & 91600 Models)

TEMPERATURE REGULATORS

Bulb and Capillary Style	Order Code	Connection Style & Material	Bulb Material	Capillary Tubing Material
Union Connection 	B01	Brass Union Hub	Copper	Copper
	B10	Stainless Steel Union Hub	Stainless Steel	Stainless Steel
Adjustable Union Connection 	B02	Brass Union Hub	Copper	Copper
		Adjustable over entire capillary length		
	B04	Stainless Steel Union Hub	Stainless Steel	Stainless Steel
		Adjustable over entire capillary length		
Plain Bulb 	B05	None	Copper	Copper
	B06	None	Stainless Steel	Stainless Steel
Teflon Covered Bulb 	B08	None	Copper with Teflon Covering	Copper with Teflon Covering
		450°F (232°C) Maximum Temperature		
	B07	None	Stainless Steel with Teflon Covering	Stainless Steel with Teflon Covering
		450°F (232°C) Maximum Temperature		
Union Connection with Spiral Armor 	B15	Brass Union Hub	Copper	Copper with Stainless Steel Spiral Armor
	B16	Stainless Steel Union Hub	Stainless Steel	Stainless Steel with Stainless Steel Spiral Armor

Bulb Pressure Limits: Copper = 250 psi, Stainless Steel = 500 psi

Bulb Dimensions & Minimum Insertion Lengths

Standard Bulb

Special "Small" Bulb

Dim.	91000 / 91400 Capillary Length					91000 / 91400		91600
	8 to 16 Feet	20 Feet	24 to 36 Feet	40 to 52 Feet	8 Feet*	Order Code	All	
A	13"	16"	20"	24"	16"	SB01	9"	12"
U	12.25"	15.25"	19.25"	23.25"	15.25"		8.25"	11.25"
D	1"	1"	1"	1"	1"		3/4"	3/4"
H	1 NPT	1 NPT	1 NPT	1 NPT	1 NPT		3/4 NPT	3/4 NPT
A	13"	16"	20"	24"	16"	SB10	9"	12"
U	12.25"	15.25"	19.25"	23.25"	15.25"		8.25"	11.25"
D	1"	1"	1"	1"	1"		3/4"	3/4"
H	1 NPT	1 NPT	1 NPT	1 NPT	1 NPT		3/4 NPT	3/4 NPT
A	13"	16"	20"	24"	16"	Note: This bulb is available for applications where space considerations exist, and may only be used when the temperature of the actuator housing will always remain lower than that of the sensing bulb. If the temperature of the actuator housing rises above the sensing bulb temperature, the unit will not operate properly. The temperature of the actuator housing is dependent upon both the surrounding environment and the temperature of the flow medium and may easily reach 150°F on steam service. This bulb is only available on union connected thermal systems. Always use the Standard Bulb unless special requirements exist and full details of the application are known, consult factory.		
U	12.25"	15.25"	19.25"	23.25"	15.25"			
D	1"	1"	1"	1"	1"			
H	1 NPT	1 NPT	1 NPT	1 NPT	1 NPT			
X	13"	16"	20"	24"	16"			
D	1"	1"	1"	1"	1"			
X	13"	16"	20"	24"	16"			
D	1"	1"	1"	1"	1"			
X	15"	18"	22"	26"	18"			
D	1.16"	1.16"	1.16"	1.16"	1.16"			
X	15"	18"	22"	26"	18"			
D	1.16"	1.16"	1.16"	1.16"	1.16"			
A	13"	16"	20"	24"	16"	SB15	9"	12"
U	12.25"	15.25"	19.25"	23.25"	15.25"		8.25"	11.25"
D	1"	1"	1"	1"	1"		3/4"	3/4"
H	1 NPT	1 NPT	1 NPT	1 NPT	1 NPT		3/4 NPT	3/4 NPT
A	13"	16"	20"	24"	16"	SB16	9"	12"
U	12.25"	15.25"	19.25"	23.25"	15.25"		8.25"	11.25"
D	1"	1"	1"	1"	1"		3/4"	3/4"
H	1 NPT	1 NPT	1 NPT	1 NPT	1 NPT		3/4 NPT	3/4 NPT

*On Model 91600, Minimum Insertion Length increases by 1" for each additional 4 ft. capillary increment.