

For Heating & Cooling

Model	<b>W91 (No Indicating Dial)</b> <b>W94 (Temperature Indicating Dial)</b>
Service	<b>Water, Steam, Other Liquids</b>
Sizes	<b>1/2" – 4"</b>
Connections	<b>Threaded, Union Ends, 125# FLG</b> <b>250# FLG (optional)</b>
Body Material	<b>1/2" – 2" Stainless Steel (Class IV)</b> <b>1/2" – 2" Bronze (Reverse-acting Class II)</b> <b>2 1/2" – 4" Cast Iron</b>
Seat Material	<b>Stainless Steel</b>
Max Inlet Pressure	<b>250 PSIG</b>



TEMPERATURE Regulators

## Typical Applications

The **W91 & W94** Self-Operating Temperature Regulators are the preferred choice of original equipment manufacturers, mechanical contractors and specifying engineers. They 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-temperature range protection.

### Model W91

**Non-Indicating** (without indicating dial) features a lower profile and should be specified where space constraints may be an issue.

### Model W94

**Temperature Indicating** (with indicating dial) will allow the operator to verify the process temperature and to aid in temperature adjustment.

## Features

- Self-Operating (no external power source required)
- Temperature Indicating & Non-Indicating models available
- Heavy Duty Die-Cast Aluminum Housing
- 1/2" thru 4" Valve Sizes
- Fully Enclosed Bellows
- Temperature Over-range protection spring to protect thermal system

## Model Code Configuration

Models	Temperature Range	Capillary Length	Sensing Bulb	Valve Body Selection
<b>W91</b> Non-Indicating	<b>01 – 14</b> Refer to Temperature Range Chart	<b>08</b> 8 Feet (standard) <b>12</b> 12 Feet <b>16</b> 16 Feet <b>20</b> 20 Feet <b>24</b> 24 Feet	<b>S15</b> Brass bulb (standard) <b>S16</b> Stainless bulb <b>SB15</b> 9" Brass bulb <b>SB16</b> 9" Stainless bulb	Refer to Valve Body Section <i>(Omit this selection if purchasing Actuator only)</i>
<b>W94</b> Indicating Dial				

Note: Thermowells are ordered separately. See Thermowell & Bulb Connections page.

## Specifications

- Dial Thermometer:** 3 1/2" dial, stainless steel case, swivel and angle adjustment (Model W94 only)
- Housing:** Die-cast aluminum, epoxy powder coated grey finish
- Bellows:** High-pressure brass, corrosion resistant, tin plated finish
- Temperature Over-range Protection:** Protects Thermal System from damage up to 100°F over high limit of range

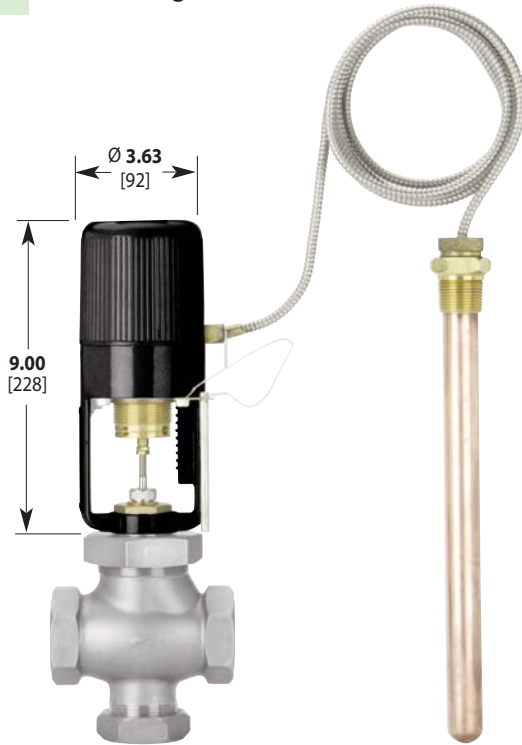
## Temperature Regulator Valve Action

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

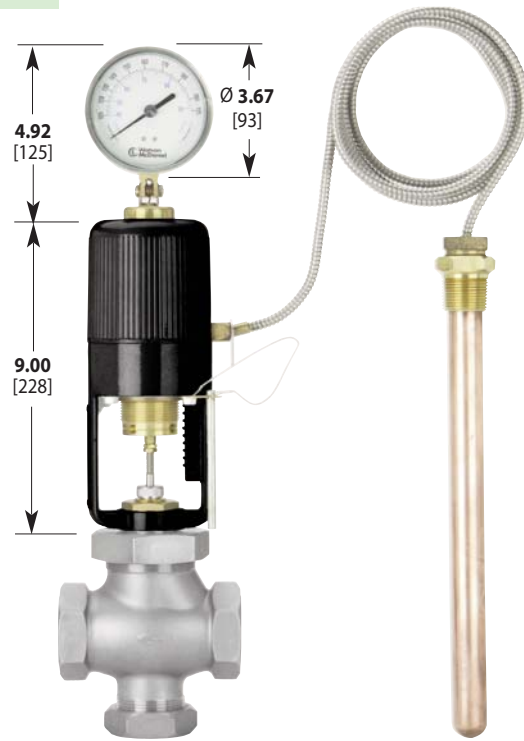
## How to write proper model number:

<b>Explanation of Model Number:</b>	<b>W91</b> Model	<b>06</b> Temp. Range	<b>08</b> Cap. Length	<b>S15</b> Bulb Type	<b>H13N</b> Valve Body
<b>Model Number:</b>	<b>W91-06-08-S15-H13N</b>				

**W91** Non-Indicating Actuator



**W94** Temperature Indicating Actuator



Dimensions: inches [mm]  
 Actuator Weight: 6 lbs.

**TEMPERATURE  
 Regulators**

**Description of Working Span**

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. Using the valve in the recommended working span improves temperature response time of the system.

**Temperature Range Chart**

W91 & W94 Actuators				
Range Code	Nominal Range		Recommended Working Span *	
01	20 to 70 °F	-10 to 20 °C	40 to 65 °F	5 to 20 °C
02	40 to 90 °F	5 to 30 °C	65 to 85 °F	20 to 30 °C
03	30 to 115 °F	0 to 45 °C	85 to 110 °F	30 to 45 °C
04	50 to 140 °F	10 to 60 °C	110 to 135 °F	45 to 60 °C
05	75 to 165 °F	25 to 70 °C	135 to 160 °F	60 to 70 °C
06	105 to 195 °F	40 to 90 °C	160 to 190 °F	70 to 90 °C
07	125 to 215 °F	55 to 100 °C	190 to 210 °F	90 to 100 °C
09	155 to 250 °F	70 to 120 °C	210 to 245 °F	100 to 120 °C
10	200 to 280 °F	95 to 135 °C	245 to 275 °F	120 to 135 °C
11	225 to 315 °F	110 to 155 °C	275 to 310 °F	135 to 155 °C
12	255 to 370 °F	125 to 185 °C	305 to 365 °F	155 to 185 °C
13	295 to 420 °F	145 to 215 °C	365 to 415 °F	185 to 215 °C
14	310 to 440 °F	155 to 225 °C	415 to 435 °F	215 to 225 °C

\*Note: The recommended working span typically falls within the upper third of the nominal range.

**Select range so that desired set temperature is within the Recommended Working Span**

**SENSING BULB & CAPILLARY Selection**

**Sensing Bulb Selection & Installation:**

The sensing bulb and capillary are available in Copper (best heat transfer properties) or Stainless Steel (for corrosive applications). Copper has better heat transfer properties than stainless steel and should always be chosen for better temperature control unless used in corrosive service. The length of the sensing bulb is dependent upon the capillary length required (see chart). Longer capillary lengths require a longer length sensing bulb to operate the regulator. For installation, the Union Hub is threaded into a tank or piping system. The bulb slides through the Union Hub and is held in place by the Union Nut which spins freely around the armored capillary and threads into the Union Hub. The angled surface of the sensing bulb forms a metal-to-metal seal on the inner edge of the Union Hub to prevent leakage of the process fluid.

**Thermowell Option (ordered separately)**

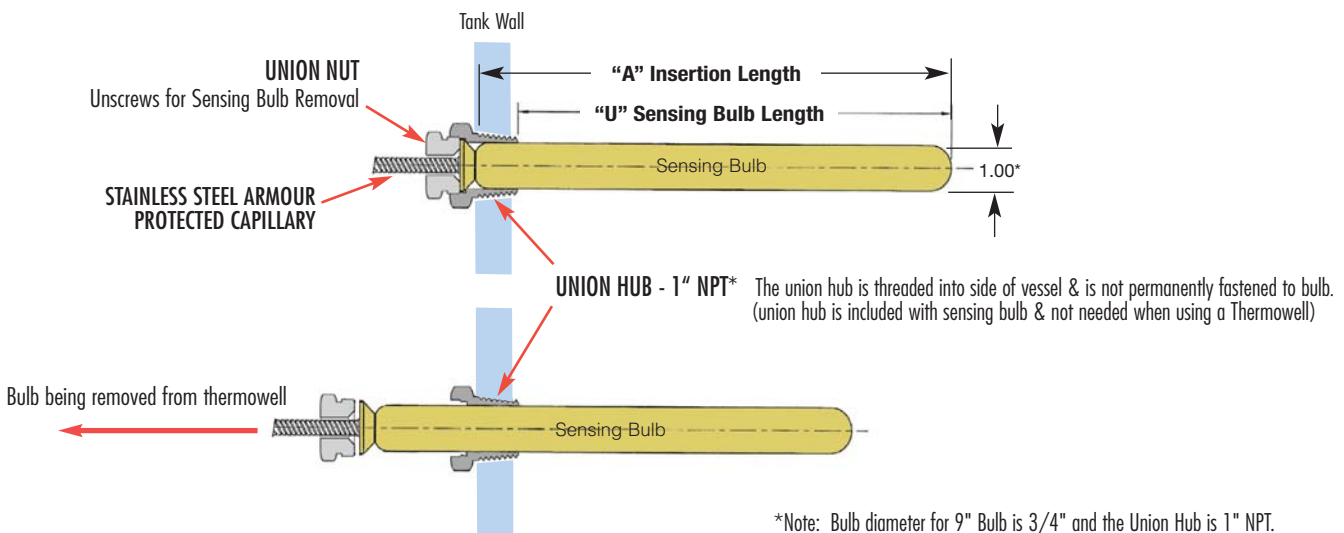
A thermowell isolates the sensing bulb from the process fluid. It can be used to remove the sensing bulb while the system is filled with fluid or to protect the sensing bulb from corrosive liquids or excessive system pressures (see following page).

TEMPERATURE Regulators

Sensing Bulb & Capillary						
ORDER CODE	Sensing Bulb Material	Capillary Tubing Material	Capillary Length in Ft.			
			8, 12, 16	20	24	
S15	Copper (Brass Union Hub) 13" Copper Bulb is standard	Copper with Stainless Steel Spiral Armour	A	13"	16"	20"
			U	12.25"	15.25"	19.25"
S16	Stainless Steel (Stainless Steel Union Hub)	Stainless Steel with Stainless Steel Spiral Armour	A	13"	16"	20"
			U	12.25"	15.25"	19.25"
SB15	Copper (Stainless Steel Union Hub) 9" Copper Bulb	Copper with Stainless Steel Spiral Armour	A	9"		
			U	8.25"		
SB16	Stainless Steel (Stainless Steel Union Hub) 9" Stainless Steel Bulb	Stainless Steel with Stainless Steel Spiral Armour	A	9"		
			U	8.25"		

For SDWA Compliance (Safe Drinking Water Act) of bulb and connection, use Suffix Code SDWA.  
Example Model Code: W91-05-12-SB15-H16N-SDWA

Other Options available. Consult Factory.



\*Note: Bulb diameter for 9" Bulb is 3/4" and the Union Hub is 1" NPT.  
For custom 3/4" Union Hub, consult factory.

**SENSING BULB inside OPTIONAL THERMOWELL**

**Thermowell Option (ordered separately)**

Thermowells isolate and protect the sensing bulb from the process fluid, and are available in either Brass (best heat transfer) or Stainless Steel (for corrosive applications). Thermowells allow for sensing bulb removal and replacement without having to drain liquid from the system. To maintain the best temperature control, always use a Copper Sensing bulb as opposed to a Stainless Steel sensing bulb. For corrosive applications, Stainless Steel thermowells (with a copper sensing bulb) can be used. Thermowells are also recommended for applications with excessive system pressures or extremely turbulent flow to protect the sensing bulb from damage.

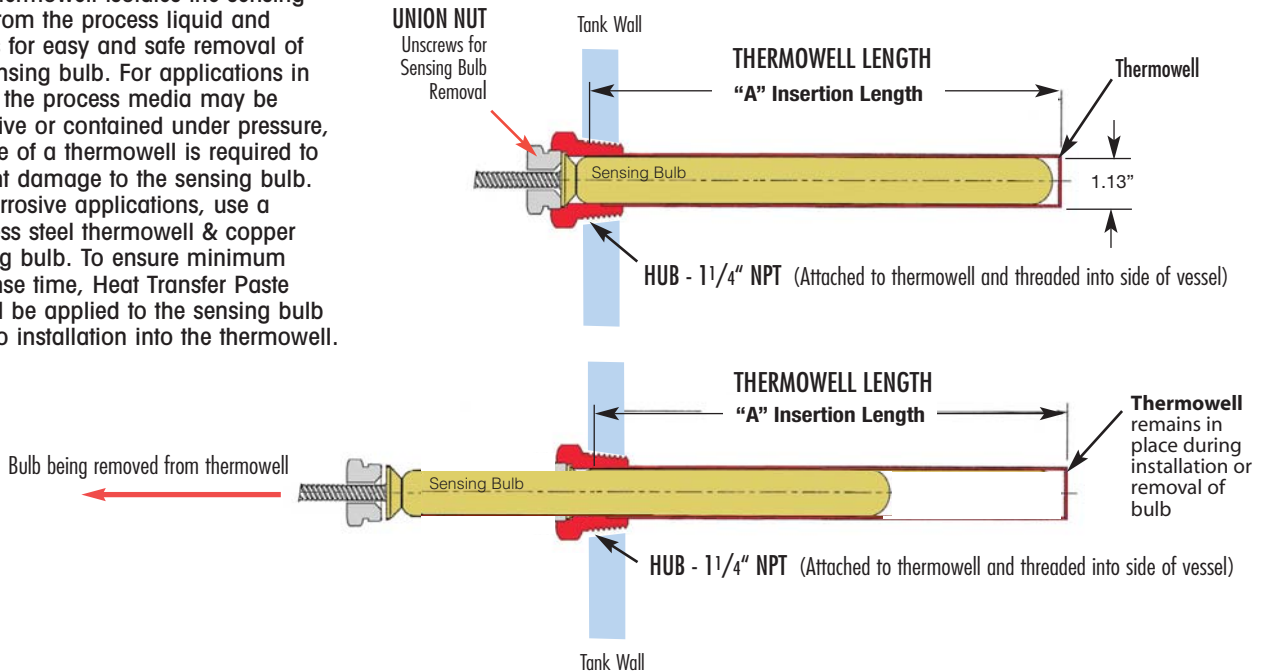
Thermowell Length must be selected based on the length of the sensing bulb. The sensing bulb length is based on the length of the Capillary used in the Thermal System. Longer capillary lengths require a longer sensing bulb to hold the additional actuator fluid inside the sensing bulb. Reference Sensing Bulb Chart for sensing bulb length.

**THERMOWELLS - Model Numbers & Lengths**

Bulb Code	Capillary Length (ft.)	Bulb Length Required (U)	Thermowell Length (ft.)	Connection Size NPT	Model #	Stainless Steel Model #
S15 or SB16	8', 12' or 16'	12.25"	13.0"	1 1/4"	W536S2	W536S6
Special	20'	15.25"	16.0"	1 1/4"	W536SE2	W536SE6
Special	24'	19.25"	20.0"	1 1/4"	W536WE2	W536WE6
SB15 or SB16	8', 12' or 16'	8.25"	9.0"	1"	W535M2	W535M6

- Notes: 1) Thermowell Length chosen is based on the Sensing Bulb Length and the Capillary Length used in the Thermal System. (See chart)  
 2) To ensure minimum response time, Heat Transfer Paste (supplied with Thermowell) should be applied to sensing bulb prior to installation.  
 3) "U" dimension is Sensing Bulb Length.

The Thermowell isolates the sensing bulb from the process liquid and allows for easy and safe removal of the sensing bulb. 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. For corrosive applications, use a stainless steel thermowell & copper sensing bulb. To ensure minimum response time, Heat Transfer Paste should be applied to the sensing bulb prior to installation into the thermowell.



\*Note: Bulb diameter for 9" Bulb is 3/4" and the Union Hub is 1" NPT.  
 For custom 3/4" Union Hub, consult factory.



## COOLING

Model Codes in Chart are for complete Temperature Regulators.  
This includes the Valve Body and Thermal Actuator with standard copper bulb and 8 ft. capillary.



		<b>W91</b>	
		Non-Indicating Type Actuator with valve body	
		<b>X</b> = Temperature Range	
		<b>08</b> = Capillary Length 8 ft.	
		<b>S15</b> = Copper Bulb	
Connection			PMO (PSI)
3/4" NPT	with Integral Union	<b>W91-X-08S15-C13U</b>	250
1" NPT	with Integral Union	<b>W91-X-08S15-C14U</b>	250
1 1/4" NPT	with Integral Union	<b>W91-X-08S15-C15U</b>	250
1 1/2" NPT	with Integral Union	<b>W91-X-08S15-C16U</b>	250
2" NPT	with Integral Union	<b>W91-X-08S15-C17U</b>	250
2 1/2"	125# FLG	<b>W91-X-08S15-C18F125</b>	65
3"	125# FLG	<b>W91-X-08S15-C19F125</b>	50
4"	125# FLG	<b>W91-X-08S15-C20F125</b>	40

		<b>W94</b>		
		Indicating Type Actuator with valve body		
		<b>X</b> = Temperature Range		
		<b>08</b> = Capillary Length 8 ft.		
		<b>S15</b> = Copper Bulb		
			PMO (PSI)	Weight
		<b>W94-X-08S15-C13U</b>	250	12
		<b>W94-X-08S15-C14U</b>	250	13
		<b>W94-X-08S15-C15U</b>	250	17
		<b>W94-X-08S15-C16U</b>	250	18
		<b>W94-X-08S15-C17U</b>	250	24
		<b>W94-X-08S15-C18F125</b>	65	55
		<b>W94-X-08S15-C19F125</b>	50	80
		<b>W94-X-08S15-C20F125</b>	40	105

TEMPERATURE Regulators

### Model Configuration Chart

Note: Thermowells for Models W91/W94 are ordered separately.

Models	Temperature Range = <b>X</b>	Capillary Length	Sensing Bulb	Valve Body Selection
<b>W91</b> Non-Indicating <b>W94</b> Indicating Dial	<b>01 - 14</b> (Refer to Temperature Range Chart)	<b>08</b> 8 Feet (std) <b>12</b> 12 Feet <b>16</b> 16 Feet <b>20</b> 20 Feet <b>24</b> 24 Feet	<b>S15</b> Copper Bulb (std) (with Brass Union Hub) <b>S16</b> Stainless Steel Bulb (with SS Union Hub) <b>SB15</b> 9" Brass Bulb <b>SB16</b> 9" Stainless Steel Bulb	Included in Model Code in above chart.
<b>W91</b>	<b>05</b> (75 - 165°F)	<b>12</b>	<b>S15</b>	<b>C15U</b> (1 1/4" NPT)

Single-Seated COOLING for Valves for Tight Shut-Off (Class IV)			
Size Code	Max Operating Pressure	Model Code	Cv Flow Factor
1/2"	125	<b>W91-X-08S15-CSS12U</b>	2.4
3/4"	125	<b>W91-X-08S15-CSS13U</b>	2.8
1"	100	<b>W91-X-08S15-CSS14U</b>	5.5
1 1/4"	70	<b>W91-X-08S15-CSS15U</b>	9.5
1 1/2"	70	<b>W91-X-08S15-CSS16U</b>	14.0
2"	40	<b>W91-X-08S15-CSS17U</b>	25.0

Example Model Code configured: **W91-05-12-S15-C15U**  
(W91, 75-165 °F Temp. Range, 12 ft. Capillary, Copper Sensing Bulb, 1 1/4" NPT Valve Body)

Range Code	Nominal Temperature Range *	
<b>01</b>	20 - 70°F	10 - 20°C
<b>02</b>	40 - 90°F	5 - 30°C
<b>03</b>	30 - 115°F	0 - 45°C
<b>04</b>	50 - 140°F	10 - 60°C
<b>05</b>	75 - 165°F	25 - 70°C
<b>06</b>	105 - 195°F	40 - 90°C
<b>07</b>	125 - 215°F	55 - 100°C
<b>09</b>	155 - 250°F	70 - 120°C
<b>10</b>	200 - 280°F	95 - 135°C
<b>11</b>	225 - 315°F	110 - 155°C
<b>12</b>	255 - 370°F	125 - 185°C
<b>13</b>	295 - 420°F	145 - 215°C
<b>14</b>	310 - 440°F	155 - 225°C

Select range so that desired set temperature is within the Recommended Working Span

\* The recommended working span typically falls within the upper third of the nominal range.

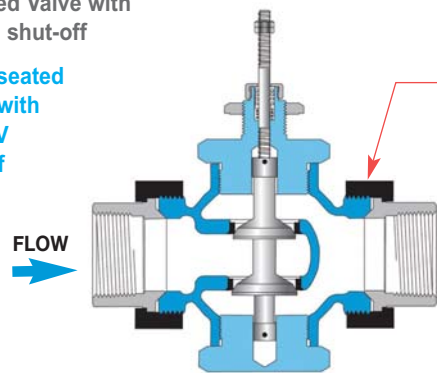
Valve bodies used for COOLING have designation **C**  
(Example: **C15U**)

#### Normally Closed

(IN-TO-OPEN)

Double-seated  
Balanced Valve with  
Class II shut-off

Single-seated  
option with  
Class IV  
shut-off



3/4" - 2" NPT with Integral Union for Easy Removal from the piping system

## COOLING

# Direct-Operated Regulators Double-Seated Valve Bodies

# W91/W94 Series

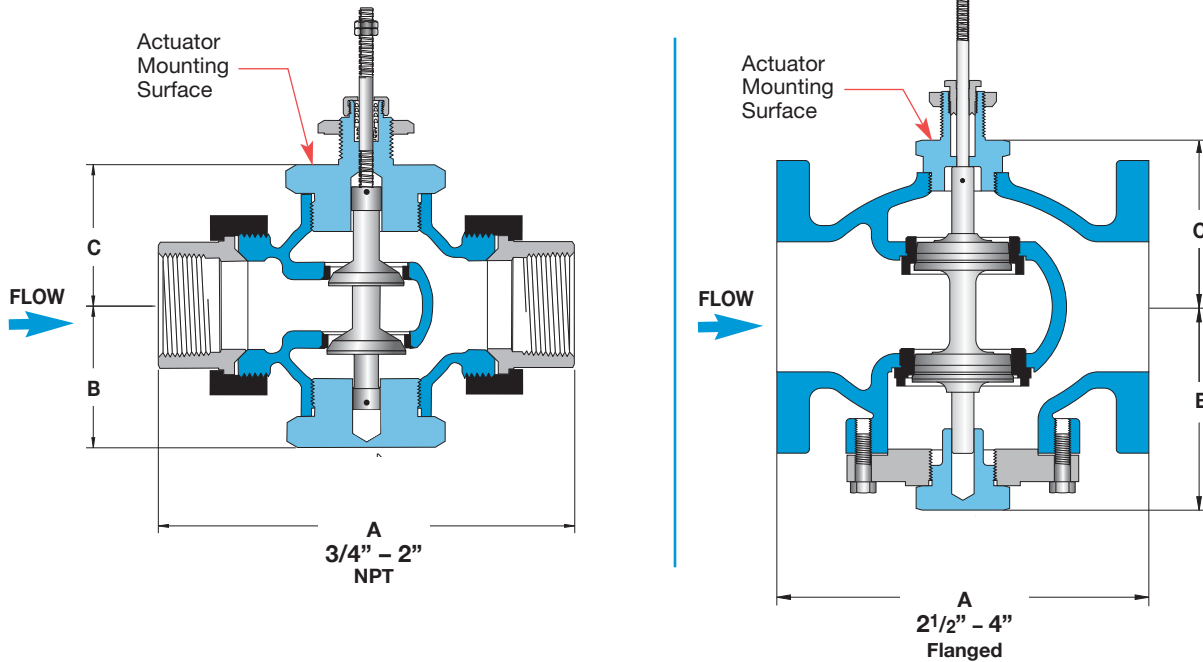
for Temperature Regulators

Double Seat • 3/4" – 4"  
**COOLING**

NORMALLY CLOSED

Stem In-To-Open  
for Cooling

Dimensions in inches [mm]



TEMPERATURE  
Regulators

## Valve Body Specifications

Body Material*	Trim Material	Connection	Pressure & Temperature Rating
3/4" - 2" Bronze*	Stainless Steel	Threaded with Malleable Iron Union Ends	250 PSI @ 410°F (210°C)
2 1/2" - 4" Cast Iron	Stainless Steel	125# Flanged	125 PSI @ 350°F (149°C)

\* Note: Single-seat option 1/2" to 2" is Stainless Steel.

## Valve Body Selection – Threaded

Valve Body Number (In-To-Open Cooling)	Size		Capacity C <sub>v</sub>	Maximum Close-Off Pressure (PSI ΔP)	Dimensions*			Approximate Shipping Wt. (lbs) [kg]
	Connection (NPT)	Nominal Port			A	B	C	
C13U	3/4	3/4"	8	250	5.6 [142]	2.3 [58]	2.3 [58]	5.0 lbs [2.25 kg]
C14U	1	1"	12	250	6.0 [152]	2.3 [58]	2.3 [58]	6.1 lbs [2.75 kg]
C15U	1 1/4	1 1/4"	21	250	7.2 [183]	2.6 [66]	2.6 [66]	10.1 lbs [4.55 kg]
C16U	1 1/2	1 1/2"	30	250	7.7 [196]	2.6 [66]	2.6 [66]	11.1 lbs [5.00 kg]
C17U	2	2"	47	250	8.6 [218]	3.1 [79]	3.1 [79]	17.0 lbs [7.65 kg]

\*Note: Dimensions are for standard double-seated bodies. Consult factory for single-seat body option dimensions.

## Valve Body Selection – Flanged

Valve Body Number (In-To-Open Cooling)	Size		Capacity C <sub>v</sub>	Maximum Close-Off Pressure (PSI ΔP)	Dimensions			Approximate Shipping Wt. (lbs) [kg]
	Connection	Nominal Port			A	B	C	
C18F125	2 1/2"	2 1/2"	69	65	7.8 [198]	4.8 [122]	5.4 [137]	45 lbs [20 kg]
C19F125	3"	3"	90	50	9.0 [229]	5.0 [127]	5.6 [142]	70 lbs [32 kg]
C20F125	4"	4"	196	40	11.4 [290]	6.3 [160]	6.5 [165]	100 lbs [45 kg]



for Temperature Regulators

Capacity Charts

**COOLING** Double-Seated Valve Bodies

CAPACITIES – Water (GPM)		DOUBLE-SEATED VALVES						
Pressure Drop (PSI ΔP)	Size, Valve Body Number & Coefficient (Cv)							
	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
	C13U Cv = 8	C14U Cv = 12	C15U Cv = 21	C16U Cv = 30	C17U Cv = 47	C18F125 Cv = 69	C19F125 Cv = 90	C20F125 Cv = 196
1	8	12	21	30	47	69	90	196
3	14	21	36	52	81	120	156	339
5	18	27	47	67	105	154	201	438
10	25	38	66	95	149	218	285	620
15	31	46	81	116	182	267	349	759
20	36	54	94	134	210	309	402	877
25	40	60	105	150	235	345	450	980
30	44	66	115	164	257	378	493	1074
40	51	76	133	190	297	436	569	1240
50	57	85	148	212	332	488	636	
60	62	93	163	232	364			
70	67	100	176	251	393			
80	72	107	188	268	420			
90	76	114	199	285	446			
100	80	120	210	300	470			
125	89	134	235	335	525			
150	98	147	257	367	576			
175	106	159	278	397	622			
200	113	170	297	424	665			
225	120	180	315	450	705			
250	126	190	332	474	743			

Note: Double-seated valves have In-to-Open (ITO) stem action for cooling applications.

**MIXING & DIVERTING** 3-Way Valve Bodies

CAPACITIES – Water (GPM)		3-WAY VALVES							
Pressure Drop (PSI ΔP)	Size, Valve Body Number & Coefficient (Cv)								
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
	A18 Cv = 2.8	A25 Cv = 5.6	A34 Cv = 8.4	A45 Cv = 15	A56 Cv = 21	A67 Cv = 33	B75 Cv = 58	B80 Cv = 72	B85 Cv = 102
1	2.8	5.6	8.4	15	21	33	58	72	102
3	4.8	10	15	26	36	57	100	125	177
5	6.3	13	19	34	47	74	130	161	228
10	8.9	18	27	47	66	104	183	228	323
15	11	22	33	58	81	128	225	279	395
20	13	25	38	67	94	148	259	322	456
25	14	28	42	75	105	165	290	360	510
30	15	31	46	82	115	181	318	394	559
40	18	35	53	95	133	209	367	455	645
50	20	40	59	106	148	233	410	509	721
60	22	43	65	116	163	256	449	558	790
70	23	47	70	125	176	276	485	602	853
80	25	50	75	134	188	295	519	644	912
90	27	53	80	142	199	313	550	683	968
100	28	56	84	150	210	330	580	720	1020
125	31	63	94	168	235	369	648	805	1140
150	34	69	103	184	257	404			
175	37	74	111	198	278	437			
200	40	79	119	212	297	467			
225	42	84	126	225	315	495			
250	44	89	133	237	332	522			

Note: Oil service or high temperature service requires special O-ring.

TEMPERATURE Regulators