Temperature Regulators

W91 • **Non-Indicating**
W94 • **Indicating - Dial Thermometer**

For **Heating** with Steam
for **Cooling** with Water
Mixing/Diverting for Liquids

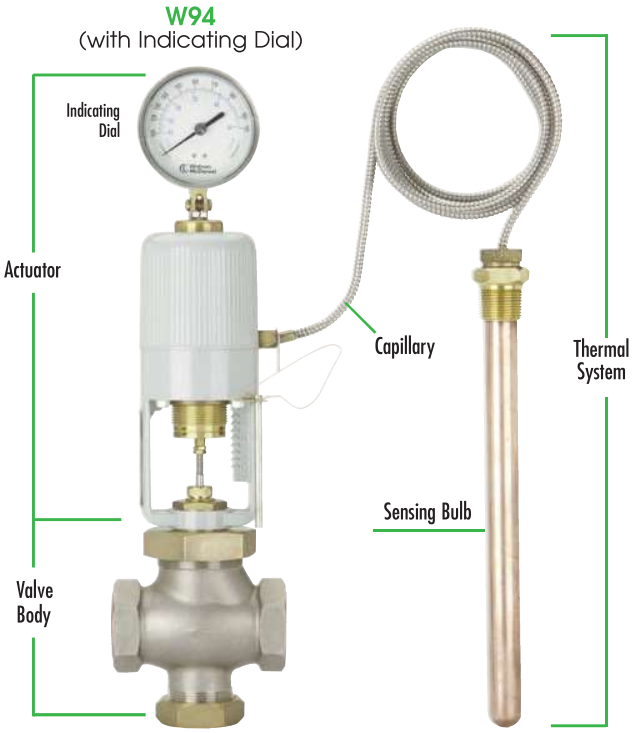
Description & Selection

The **W91/W94** 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; requires no external power source. They are recommended for controlling temperature 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-actuated Control Valve should be considered. Please consult the Control Valve Section of this catalog.

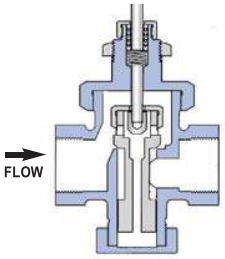
Principle of Operation

The **W91/W94** 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 the bellows within the unit's actuator housing to expand.

The valve action is either **In-To-Close for Heating** or **In-To-Open for Cooling**.



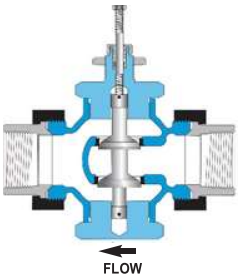
HEATING
Normally Open
(**in-to-close**)



Normally Open Valves are used for **HEATING**, so the valve stem closes (**in-to-close**) as the control signal (temperature) increases.

Single-Seated Balanced Valves are used for Heating Applications (normally steam) where tighter shut-off is required. Leakage rate is approximately 0.01% of the maximum capacity (Class IV shut-off).

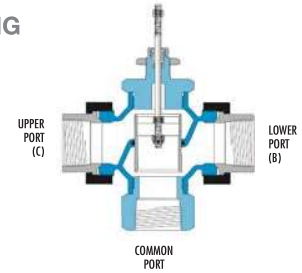
COOLING
Normally Closed
(**in-to-open**)



Normally Closed Valves are used for **COOLING**, so the valve stem opens (**in-to-open**) as the control signal (temperature) increases.

Double-Seated Balanced Valves are used for Cooling Applications where larger flow rates of water are frequently required, and a small leakage rate through the valve is normally acceptable. Leakage rate can be up to 0.5% of the maximum valve capacity (Class II shut-off).

MIXING & DIVERTING
3-Way Valves

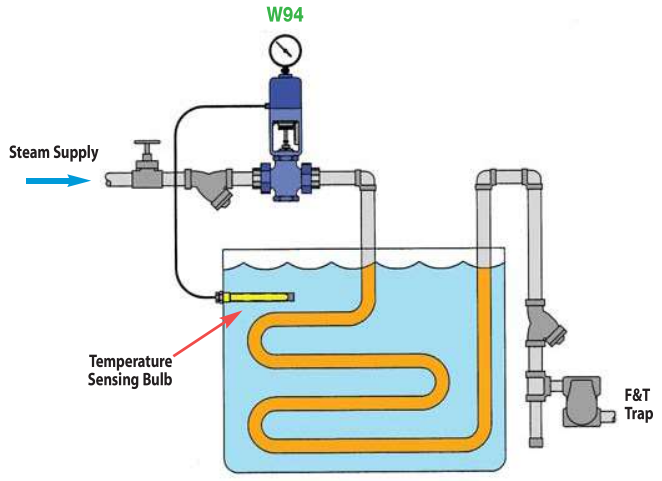


3-Way Valves are used for mixing two flows together, or for diverting a flow to or around a device (bypass). In order to produce consistent flow quantity for stable operation, the pressure drop across both flow paths (inlet to outlet) must be nearly equal. The Sleeve-Type (common port on the bottom) is most commonly used for diverting applications; however, due to its design, it can also be used for mixing applications (NOT for steam use). It is also suitable for water or glycol type service, up to a maximum temperature of 300°F. A higher temperature O-ring for use with other fluids, such as oil, or for temperatures up to 410°F, is available. Consult factory.

Introduction

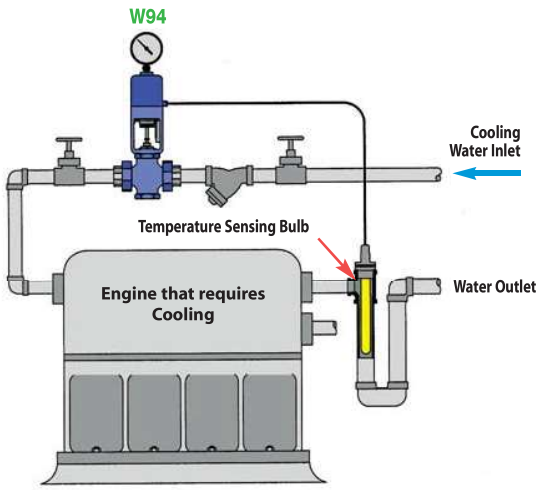
HEATING

Regulating Temperature of a Plating or Finishing Tank
Valve Body determines the action of the Regulator
For Heating: use **Normally Open** Valve Body (**in-to-close**)



COOLING

Using Water to Cool Engine
Valve Body determines the action of the Regulator
For Cooling: use **Normally Closed** Valve Body (**in-to-open**)



Components of a Self-Operated Temperature Regulator

Model W91 Actuator is Non-indicating (without temperature indicating dial).

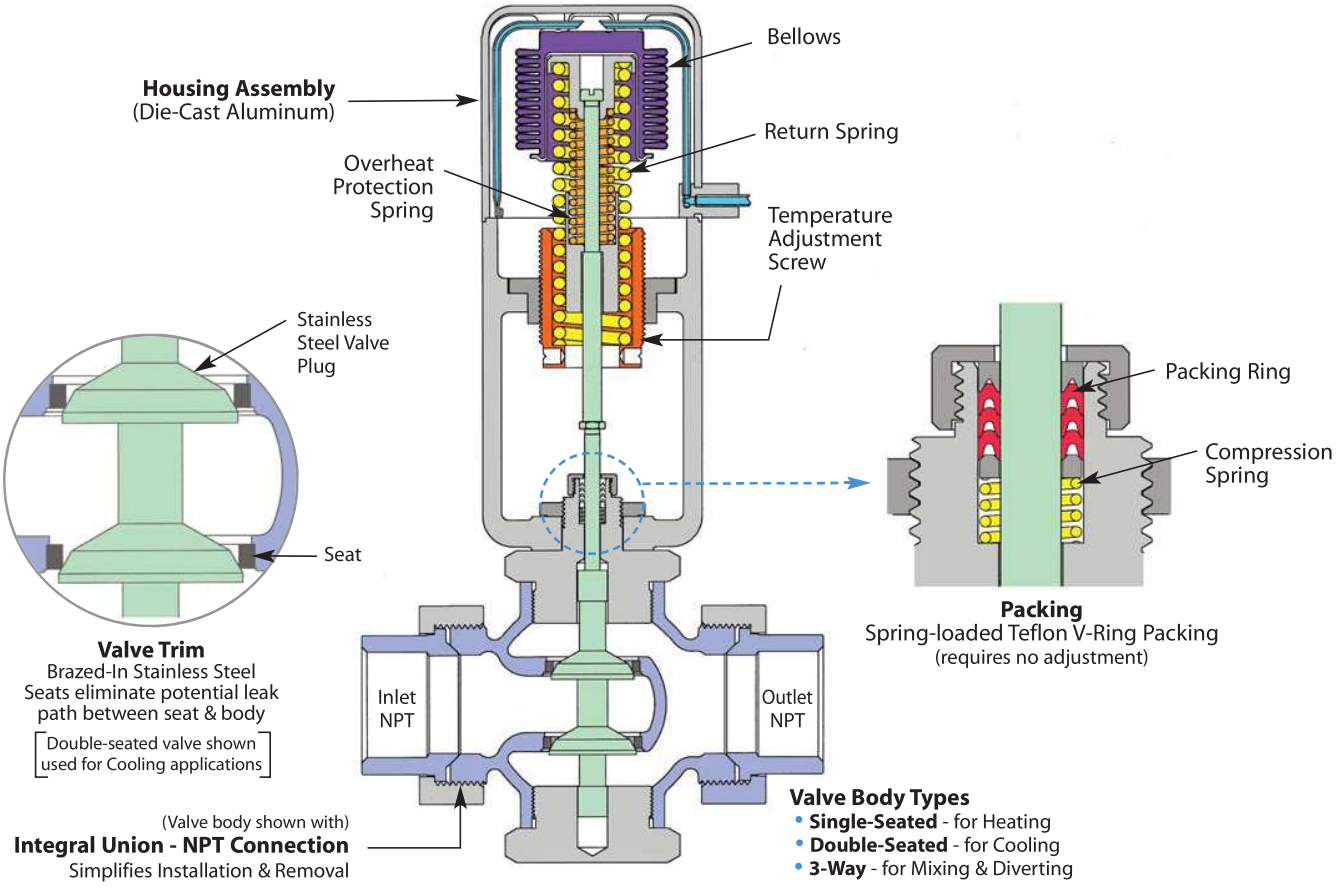
Model W94 Actuator is equipped with an integral dial thermometer to indicate sensing bulb temperature. The W94 displays the temperature at the sensing bulb. This allows for easy adjustment of the temperature set-point, as well as continuous monitoring of the application, without the installation of an additional thermometer.

The thermometer has a 3 1/2" diameter dial face and can be rotated and tilted for maximum readability.

The **Sensing Bulb and Capillary** are available in either Copper (for best heat transfer) or Stainless Steel (for corrosive applications). The capillary tubing is protected by stainless steel flexible armor to resist damage during handling and installation. The sensing bulb is also available with an optional Teflon or Kynar coating; used for special corrosive applications such as plating tanks where stainless steel may not be acceptable.

Capillary lengths up to 24 feet are considered standard; non-standard lengths up to 52 feet are available. Longer capillary lengths require longer bulb length to contain the additional actuating fluid required (see selection chart).

Valve Body
Single-seated balanced valves are used on heating applications (most commonly steam) where tight shut-off is required. Double-seated valves are used on cooling applications because of the high flow rates often required. The balanced double-seated design also allows the temperature actuator to operate with higher differential pressures than would be possible using single-seated non-balanced valves. 3-way valves are used for mixing and diverting applications.



Actuator 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 grey epoxy.

Actuator Bellows & 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.

Valve Body & Connection Type

W91/W94 Temperature Regulators available with NPT connection, Integral Union (with NPT connection) and Flanged.

Valve Trim

Valve Trim is composed of the plug and seat(s). Single and double-seated valves employ a stainless steel, tapered plug for enhanced modulation. The valve plug is both top and bottom guided to ensure positive seating alignment. 3-Way valves use a stainless steel sleeve and brass seating surface to change flow direction within the body.

Packing

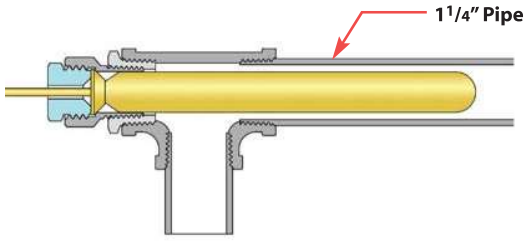
Valves feature a self-energizing (spring-loaded) Teflon V-Ring packing, which reduces leakage around the valve stem. V-Ring packing is spring loaded to maintain proper compression and does not require manual adjustment.

Sensing Bulb

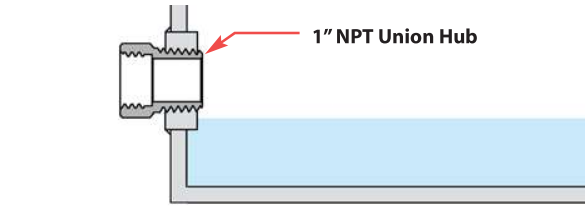
Sensing Bulb Installation

Care must be taken to ensure that the entire length of the sensing bulb is immersed into the medium at the sensing location. Partial immersion of sensing bulb in the process fluid can result in faulty control.

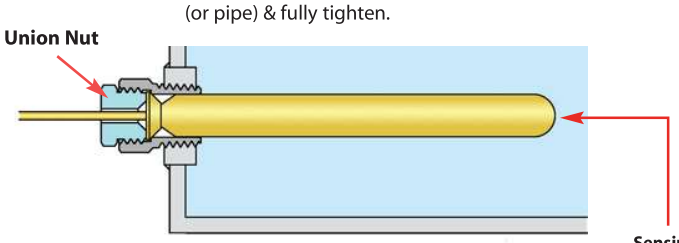
The sensing bulb is designed to be installed in either a horizontal or vertical orientation (with the tip down). If the tip must be installed upwards, please specify when ordering, as a special bulb construction is required. The sensing bulb material is available in either copper (best heat transfer) or stainless steel (corrosion resistant) and must be compatible with the process fluid, or an optional thermowell can be used for complete isolation of the sensing bulb from the process fluid.



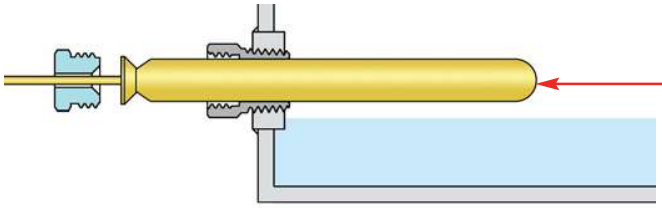
Installed in Pipe Line:
Drawing shows Sensing Bulb installed in a 1" NPT pipe fitting. 1 1/4" is minimum pipe size for adequate clearance around sensing bulb.



First insert threaded Union Hub into side of tank (or pipe) & fully tighten.



Sensing Bulb is inserted through union hub and is in direct contact with fluid.



Liquid level must be lowered below sensing bulb insertion point for installation or removal.

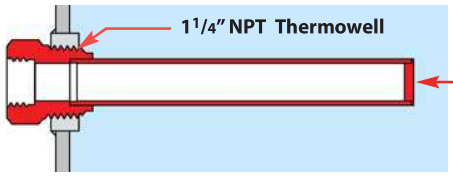
Sensing Bulb with Thermowell

Thermowell (isolates sensing bulb from process fluid)

Thermowells isolate the sensing bulb from the process fluid. For applications in which the process media may be corrosive or contained under excessive pressure, the use of a thermowell is required to prevent damage to the sensing bulb. A thermowell also allows the removal of the sensing bulb without having to drain liquid from the system. Thermowells are available in either brass (best heat transfer) or stainless steel (for corrosive applications). The 1 1/4" NPT hub of the thermowell can be installed into the side of a tank or female pipe connection, depending on the application. Three different length thermowells are available to match sensing bulb lengths.

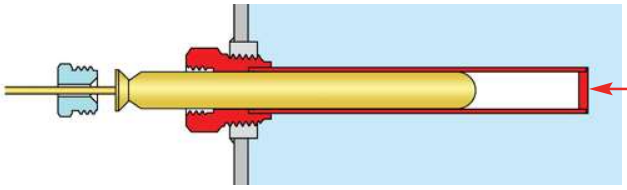
To ensure minimum response time, Heat Transfer Paste (supplied with thermowell) should be applied to the sensing bulb prior to installation.

Thermowell remains installed into tank or pipeline; therefore, liquid does not require draining when replacing sensing bulb.



Thermowell threaded into tank wall

Sensing Bulb Inserted into Thermowell



Removing Sensing Bulb from Thermowell

Typical Applications for Temperature Regulators for Heating & Cooling

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 choice of valve style and action will determine the actual operating range (recommended working span) of the unit. Using the valve in the recommended working span improves temperature response time of the system. The nominal range should be selected so that the set-point falls within the recommended working span for the specified valve style and action. They include an over-range 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 W91/W94 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 Control Valve should be specified. Consult the Control Valves 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.

Size

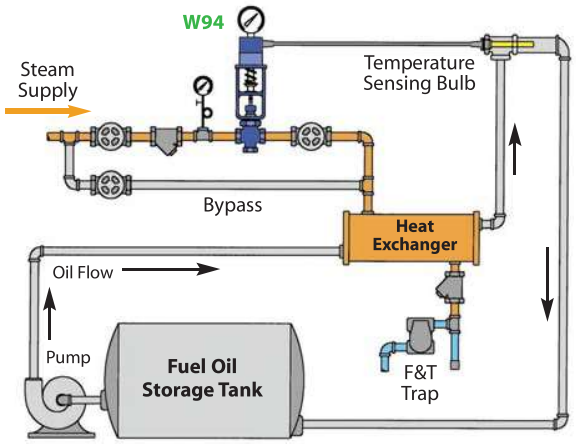
The proper sizing of a regulating valve is one of the most important factors in its selection. A valve that is too small will not be able to provide the desired capacity during peak load conditions, while a valve that is too large may overshoot the control-point and operate with the valve plug too close to the seat, resulting in premature wear of the plug and seat. The valve coefficient (Cv) is used to determine the maximum capacity of a valve. From this value, a valve body with the appropriate port size can be selected. Port sizes from 1/8" through 4" and connection sizes from 1/2" through 4" are available. Consult the Valve Selection section of this catalog.

Close-Off

Temperature Regulators are not considered shut-off valves. A pressure surge may force a single-seated valve plug open. The W91/W94 Temperature Regulator is a balanced equilibrium system and may not provide the force necessary to tightly seat the valve plug. A separate power-driven or hand-actuated valve is required to ensure tight shut-off when necessary.

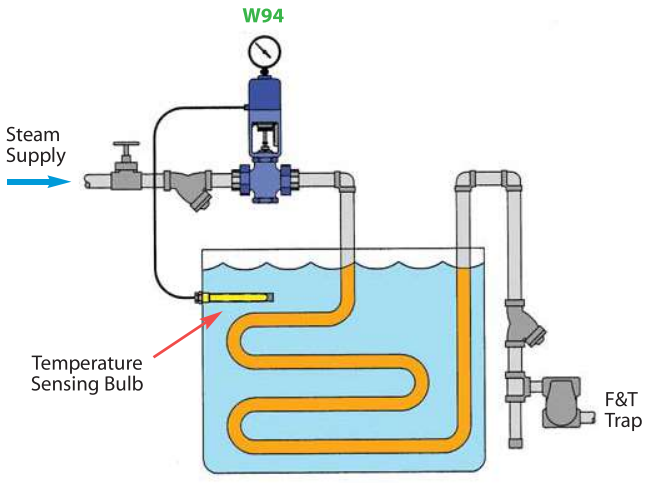
W94 Heating Fuel Oil to Proper Temperature

When the Sensing Bulb is mounted remotely from the actual point of heating (as shown) the Circulation Pump MUST continue to run so that the sensing bulb can sample the product temperature in the heat exchanger. Without product circulation, the temperature control valve will never shut off and the oil will be overheated



W94 Elevating Temperature of a Plating or Finishing Tank

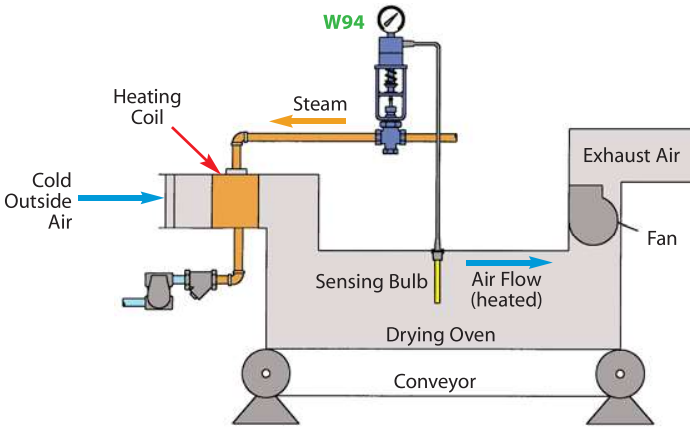
Sensing bulb should be properly placed inside tank for best temperature consistency. An optional Thermowell (Stainless Steel or Brass) may slightly reduce temperature sensitivity. However, it will isolate sensing bulb and allow for its removal without draining the tank.



Introduction

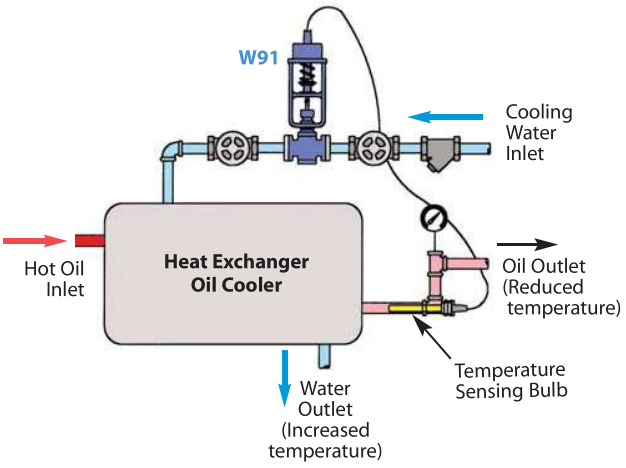
Typical Applications for Temperature Regulators for Heating & Cooling

W94 Used in a Drying Oven Application



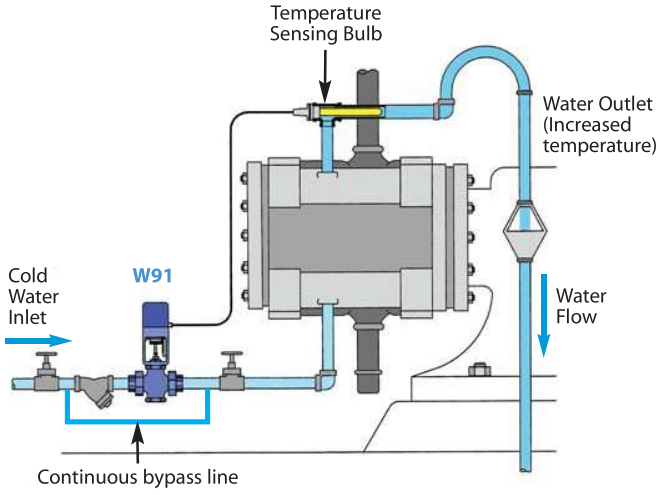
W94 Valve used to regulate the temperature of the air flow through an air heating duct. The sensing bulb is installed toward the end of the heating duct and will sense the temperature of the air flowing past the heating coils. When air temperature is below the set point, the valve will open to allow more steam through to the coils to heat the air passing through the duct. Once the desired air temperature is achieved, the valve will begin to modulate closed to maintain the air temperature.

W91 Used to Reduce Oil Temperature In a Heat Exchanger



W91 Cooling valve controlling the flow of water through a heat exchanger to maintain the temperature of oil that is gaining heat by some process. The valve automatically shuts off when not required, greatly reducing cooling water usage. The source of the cooling water may be a well or city water supply and it can be circulated or dumped to drain. A 3-way valve may be used on cold water chiller systems so flow can be diverted from going through the heat exchanger when not required.

W91 Used to Control Water Flow to Air Compressor for Cooling Purposes



When the Sensing Bulb is mounted remotely from the actual point of Cooling (as shown), the water MUST continue to flow so that the sensing bulb can sample the product temperature of the unit being cooled. Without continuous water flow, the temperature control valve will never turn on, causing the unit to overheat. The bypass line provides a minimum continuous flow when temperature set point is achieved and the valve is closed.

W91/W94 Series

For Heating & Cooling

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

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

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:

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

Model Code Configuration

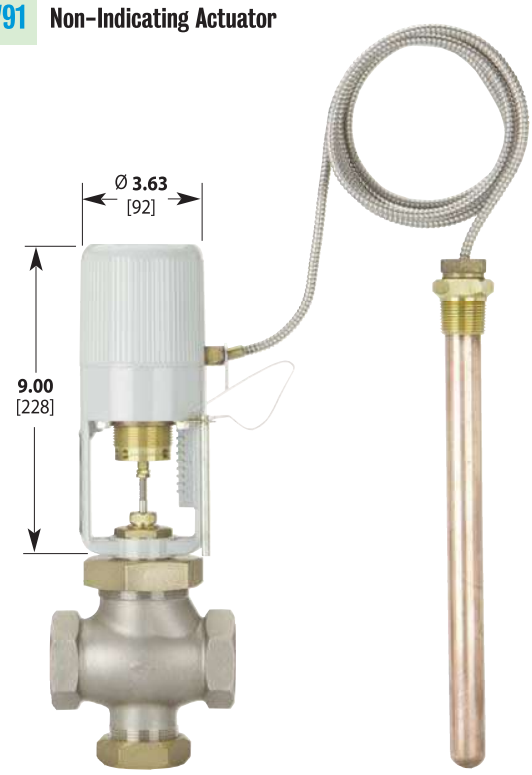
Models		Temperature Range		Capillary Length		Sensing Bulb		Valve Body Selection
W91	Non-Indicating	**01 – 14**	Refer to Temperature Range Chart	**08**	8 Feet (standard)	**S15**	Brass bulb (standard)	Refer to Valve Body Section
W94	Indicating Dial			**12**	12 Feet			
				16	16 Feet			*(Omit this selection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

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

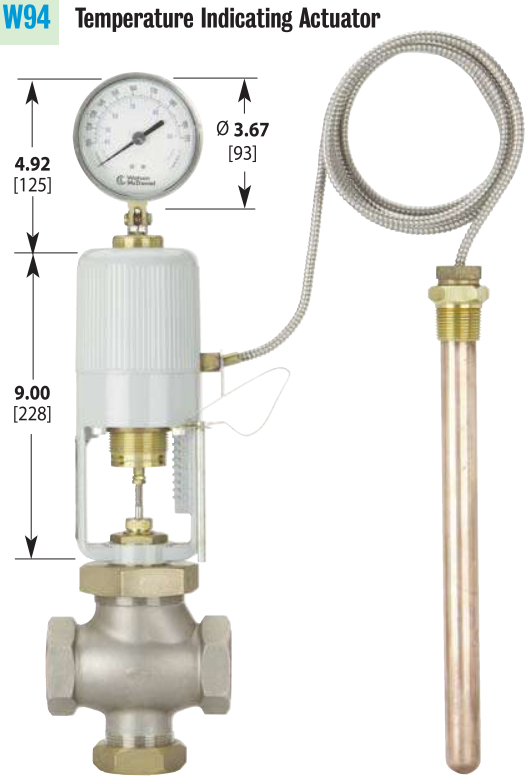
Temperature Range Selection

For Heating & Cooling

W91 Non-Indicating Actuator



W94 Temperature Indicating Actuator



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

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.

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.

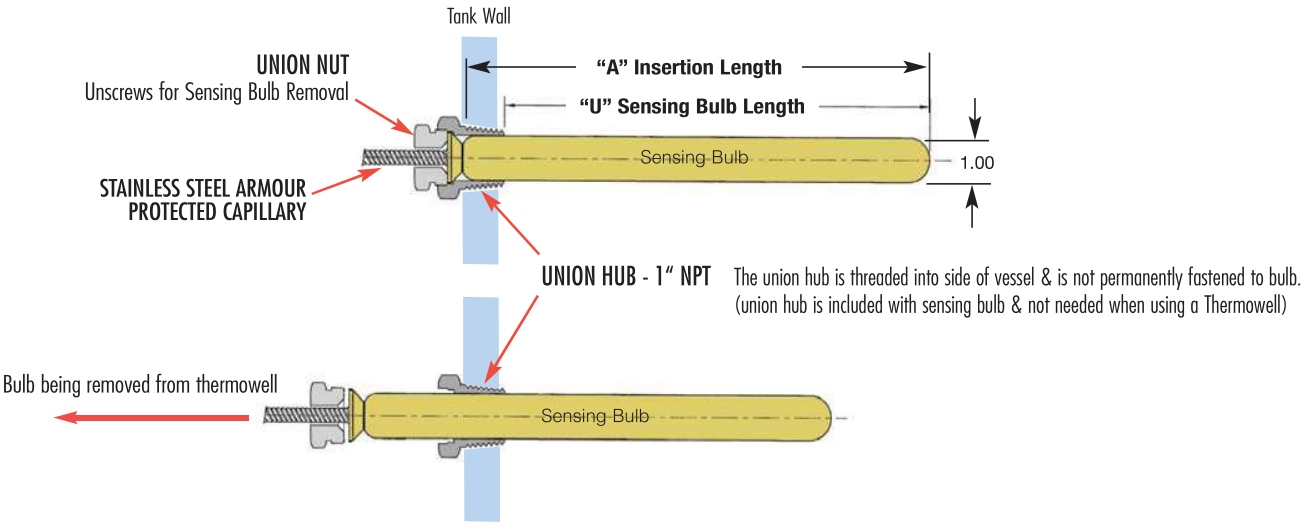
Thermowell Option **(ordered separately)**

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).

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)	**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"

Other Options available. Consult Factory.



HEATING

CAPACITIES — Steam (lbs/hr) — SINGLE-SEATED VALVES

Inlet Pressure (PSIG)	Size & Valve Body Number								
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
	H12	H13	H14	H15	H16	H17	H18	H19	H20
1	91	180	309	454	640	946	1357	1949	3129
3	103	203	348	512	722	1066	1530	2197	3527
5	115	226	387	570	803	1187	1703	2445	3926
10	144	283	486	715	1007	1488	2135	3066	4922
15	173	341	584	859	1211	1789	2568	3686	5919
20	202	398	682	1004	1415	2090	3000	4307	6915
25	231	455	780	1149	1618	2392	3432	4928	7912
30	260	513	879	1294	1822	2693	3864	5548	8908
40	319	627	1075	1583	2230	3295	4729	6790	10,901
50	377	742	1272	1872	2638	3898	5593	8031	12,894
60	435	857	1468	2162	3045	4500	6458	9272	14,887
70	493	971	1665	2451	3453	5102	7322	10,513	16,880
80	552	1086	1861	2740	3861	5705	8187	11,755	18,873
90	610	1200	2058	3030	4268	6307	9051	12,996	20,866
100	668	1315	2255	3319	4676	6910	9916	14,237	22,859
125	814	1602	2746	4043	5695	8416	12,077	17,340	27,841
150	959	1888	3237	4766	6714	9922	14,238	20,443	32,823
175	1105	2175	3729	5490	7734				
200	1250	2462	4220	6213	8753				
250	1542	3035							

Notes: 1) For reduced-port 1/2" valves, consult factory. 2) All steam capacities based on Critical Drop (Choked Flow).

Note:

Verify that Maximum Close-Off Pressure for 2" - 4" models does not exceed max rating for selected Valve Body Number and Type (refer to Valve Body Number in chart).

Note: When used with water, add **W** to the Valve Body Number.

Example:
H17N becomes **HW17N**

Note: Verify that Maximum Close-Off Pressure for 2" - 4" models does not exceed max rating for selected Valve Body Number and Type (refer to Valve Body Number chart on previous page)

CAPACITIES — Water (GPM) — SINGLE-SEATED VALVES

Pressure (PSI△P)	Size & Valve Body Number								
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
	HW12	HW13	HW14	HW15	HW16	HW17	HW18	HW19	HW20
1	3.2	6.3	11	16	22	33	48	68	110
3	5.5	11	19	28	39	57	82	118	190
5	7.2	14	24	36	50	74	106	152	245
10	10	20	34	50	71	105	150	216	346
15	12	24	42	62	87	128	184	264	424
20	14	28	48	71	100	148	212	305	490
25	16	32	54	80	112	166	238	341	548
30	18	35	59	87	123	181	260	374	600
40	20	40	68	101	142	209	300	431	693
50	23	45	76	112	158	234	336	482	774
60	25	49	84	123	174	256	368	528	848
70	27	53	90	133	187	277	397	571	916
80	29	56	97	142	200	296	425	610	979
90	30	60	102	151	213	314	451	647	1039
100	32	63	108	159	224	331	475	682	1095
125	36	70	121	178	250	370	531	762	1224
150	39	77	132	195	274	405	582	835	1341
175	42	83	143	210	296				
200	45	89	153	225	317				
250	51	100							

HEATING

Steam Required for Heating Water

Steam flow required through a temperature regulator (lbs/hr) to heat a specified number of gallons of water per hour (gal/hr)

TABLE 1- Steam Flow Required in Pounds Per Hour (lbs/hr)

Temp Increase (˚F)	*Gallons of Water per Hour To Be Heated*												Temp Increase (˚F)
	25	50	100	200	300	500	700	1000	2000	4000	10,000	20,000	
5°	1	2	4	8	12	21	29	41	83	166	415	830	5°
10°	2	4	8	16	25	41	58	83	166	332	830	1660	10°
15°	3	6	12	25	37	62	87	124	249	498	1245	2490	15°
20°	4	8	17	33	50	83	116	166	332	664	1660	3320	20°
25°	5	10	20	42	62	104	145	207	415	830	2075	4150	25°
30°	6	12	25	50	75	124	174	249	498	996	2490	4980	30°
40°	8	16	33	66	100	166	232	332	664	1328	3320	6640	40°
50°	10	21	42	83	124	207	290	415	830	1660	4150	8300	50°
60°	12	25	50	100	149	249	348	498	996	1992	4980	9960	60°
70°	15	29	58	116	174	290	407	581	1162	2324	5810	11,620	70°
80°	17	33	67	133	199	332	465	664	1328	2656	6640	13,280	80°
90°	19	38	75	149	224	373	523	747	1494	2988	7470	14,940	90°
100°	21	42	83	166	249	415	581	830	1660	3320	8300	16,600	100°
115°	24	48	95	191	286	477	668	955	1909	3818	9544	19,088	115°
130°	27	54	108	216	324	539	755	1079	2158	4316	10,790	21,580	130°
145°	30	60	120	241	361	601	842	1200	2400	4812	12,030	24,060	145°
160°	33	66	133	266	398	664	929	1328	2656	5312	13,280	26,560	160°
175°	36	72	145	290	436	726	1017	1452	2900	5810	14,524	29,048	175°
200°	41	83	166	332	498	830	1162	1660	3320	6640	16,600	33,200	200°
225°	47	94	187	374	560	934	1307	1867	3735	7470	18,680	37,360	225°
250°	52	104	207	415	622	1037	1452	2075	4150	8300	20,750	41,500	250°

HEATING WATER: The amount of steam required to heat water can be found using chart above.
Example: **To heat 1000 gallons per hour of water from 40˚F to 140˚F (Temp. increase 100˚F) requires 830 lbs/hr of steam.**

HEATING FUEL OIL: The amount of steam required to heat fuel oil is half of that to heat water. Use half the value found in chart above.
Example: **To heat 1000 gallons per hour of fuel oil from 40˚F to 140˚F (Temp. increase 100˚F) requires 415 lbs/hr of steam.**

Capacity Formulas for Steam Loads

When Heat Load or Heat Transfer Rate (E) is Known	Capacity of steam required (lbs/hr)	=	$\frac{E \text{ (Btu/hr)}}{1000}$
When Square Feet Equivalent Direct Radiation (EDR) is Known	Capacity of steam required (lbs/hr)	=	$\frac{\text{Sq. ft. of EDR}}{4}$
When Heating Water with Steam	Capacity of steam required (lbs/hr)	=	$\frac{\text{GPM x Temp Rise (°F)}}{2}$
When Heating Fuel Oil with Steam	Capacity of steam required (lbs/hr)	=	$\frac{\text{GPM x Temp Rise (°F)}}{4}$
When Heating Air with Steam Coils	Capacity of steam required (lbs/hr)	=	$\frac{\text{CFM x Temp Rise (°F)}}{900}$

Note: Above formulas based on steam containing approximately 1000 Btu's of Latent Heat per pound.