Instructions for Installing #11 Regulator

Double Seat - Balanced Valve - Bronze (Type DB) or Stainless Steel Trim (Type DS)

⚠ WARNING

Read this Manual BEFORE using this equipment.

Failure to read and follow all safety and use information can result in death, serious personal injury, property damage, or damage to the equipment.

Keep this Manual for future reference.

THINK SAFETY FIRST

Valve Description

The Powers #11 Double Seat Balanced Valve Regulator (Bronze or Stainless Steel trim) is a self-actuating control valve which automatically controls high temperature fluids at high pressures without the use of external power. Adjust the set point and the rugged self-operating #11 Regulator controls the flow of heating or cooling medium (water or steam) to maintain a constant temperature.

The instrument has a vapor pressure thermal system containing a thermally responsive fluid. This thermal system rapidly senses temperature changes at the bulb and accordingly positions the valve plug, to regulate the flow of the heating or cooling medium to maintain a desired temperature. The thermal system features a two-ply brass bellows with six reinforcing ribs on the bellows head and thick capillary tubing walls to ensure long operating life.

The Powers #11 DS and DB Regulators feature

- A double seated valve for handling high capacities
- A valve stem of highly polished corrosion resistant grade 316L stainless steel to decrease friction and reduce hysteresis
- An adjusting nut mounted on ball bearings and a set point adjusting rod to ease set point adjustments
- A set point reference scale to aid temperature adjustments

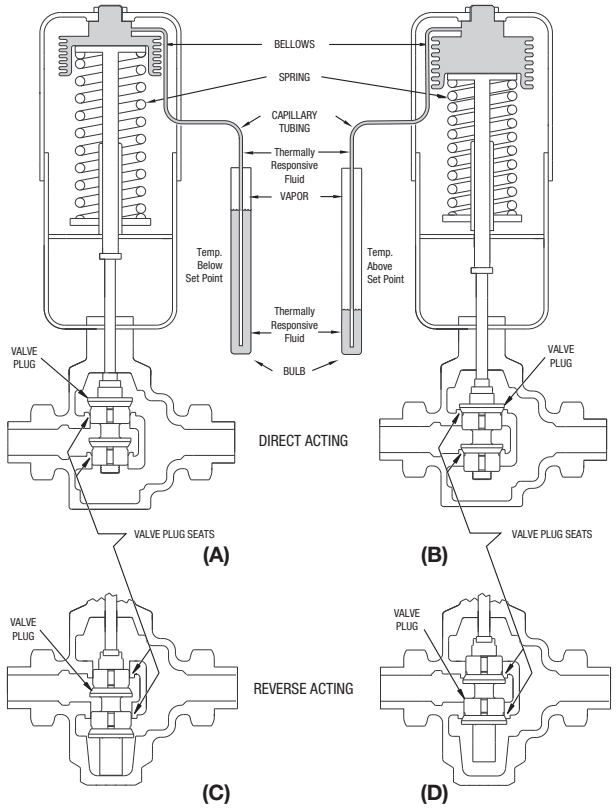
Operation

A bulb is connected to a bellows containing a thermally responsive fluid. The bulb is inserted into fluid you are trying to control (process fluid) to sense its temperature. The Regulator set point is adjusted to allow sufficient flow of heating or cooling medium (water or steam) through the valve to keep the process fluid at the desired temperature.

Direct Acting (heating application)

(A) When the temperature of the process fluid drops below the set point, the temperature of the thermally responsive fluid decreases, which decreases the vapor pressure in the bulb/bellows. The force of the resulting vapor pressure is less than the spring force, so the bellows contract and the spring extends, which raises the valve plug up from its seat. This increases the flow of the heating medium (water or steam), which raises the temperature of the process fluid.

(B) As the process fluid temperature increases toward or beyond the desired set point, the temperature of the thermally responsive fluid in the bulb increases, which causes the vapor pressure to increase. This expands the bellows, compresses the spring, and moves the valve plug down and closer to its seat, to reduce or stop the flow of the heating medium.



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POWERS™
A WATTS Brand

(C) When the temperature of the process fluid rises toward or above the set point, the temperature of the thermally responsive fluid increases, which increases vapor pressure in the bulb/bellows. The resulting force of the vapor pressure is greater than the spring force, so the spring contracts and the bellows expand to push the valve plug downward, away from its seat. This increases the flow of the cooling medium, which lowers the temperature of the process fluid.

(D) As the process fluid temperature decreases toward or below the desired set point, the temperature of the thermally responsive fluid decreases, causing the vapor pressure to decrease. This contracts the bellows and expands the spring to pull the valve plug up towards its seat, to reduce or stop the flow of the cooling medium.

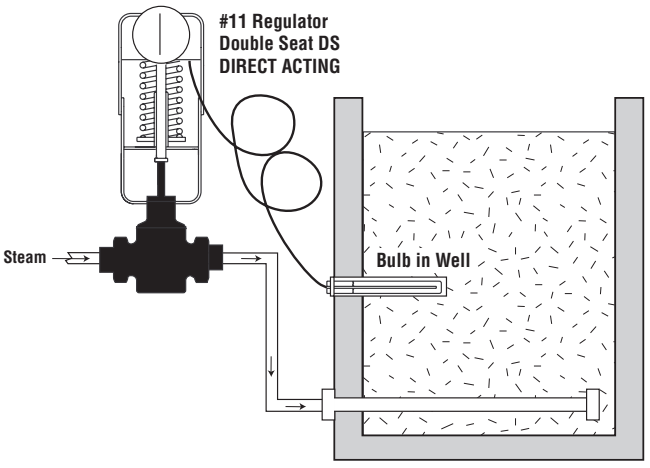
Specifications

		Valve Sizes:
		1/2" to 1-1/2" (NPT)
PHYSICAL SPECS	Valve Plug Travel	See Tables on page 13
	Effective Bellows Area	7.8 sq. in (50.3 cm2)
	Body Material	Bronze
	Body Rating	ANSI Class 250
	Connections	Double Female Union w/NPT Threads
	Style	Double Seat
	Maximum Body Temperature:	400°F (204°C)
OPERATING SPECS	Temperature Range	See order code on page 15
	Controlled Medium	Steam or Water
	Max. Differential Pressure	See Tables on page 4
	Max. Allowable Overheat Temp.	25°F (14°C) above temp. range
	Max. Well Safe Pressure	See Tables on page 11
	Max. Body Pressure	250psi (17/24 kPa)
	Shipping Weight	See Table on page 10
	Flow Characteristics	Linear
	Shutoff Class Rating	ANSI Class II
	Leakage	0.5% rated valve capacity

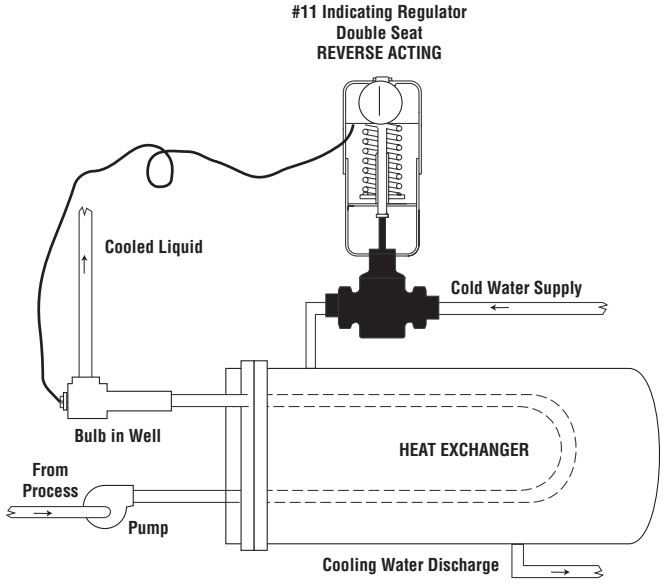
Applications

Powers #11 Balanced Valve Regulators are used to automatically control hot or cold fluids at pressures up to 125 psi. The self-actuated regulator can easily be installed in any convenient location. Among its applications are: hot water systems, fuel oil heaters, heat exchangers, air drying rooms, and many industrial processes. Below are two typical applications.

Balanced valve regulators are well suited to heating applications where the steam inlet pressure is under 125 psig and good shutoff is not required.



Quench Tank Application (Heating)



Heat Exchanger Application (Cooling)

Sizing and Selection

Proper sizing of the Regulator is essential for correct system operation. An undersized Regulator will not allow sufficient flow at maximum load. An oversized Regulator may cycle and will not utilize the full valve stroke for efficient modulation of flow. This results in poor control and shortened valve life (quicker deterioration of valve plug and seat). For these reasons, the correct sizing of the Regulator for actual expected conditions is considered essential for good control.

NOTE: For best valve performance, select a bulb that contains your process set point in the upper third of its temperature range (see page 16).

Size the #11 Regulator for actual rather than maximum conditions. Do Not size according to piping conditions; piping systems are designed for different criteria than process controls. Refer to Powers document AE-1—"Valve Selection and Sizing"—for further recommendations.

Maximum Operating Pressure Differential (differential for fluid flow): In order for the process medium to flow, a pressure drop must exist across the valve. "Pressure differential" is the difference in valve pressure between the inlet and outlet under flow conditions. The greater the differential, the greater the flow at any given plug position.

Though the regulator should be sized for actual conditions, you need to know the available differential at maximum flow. For optimum control, take as much differential as possible across the valve.

Maximum Water Capacities

Use a pressure drop of at least 25% of inlet pressure when sizing valves for water applications.

⚠ CAUTION

Do not exceed maximum pressure differentials for given valve sizes. The maximum differential is the pressure the valve has against it at shutoff. Too large a differential can cause valve chatter and/or prevent shutoff.

Water Capacities --- GPM

VALVE SIZE	AVAILABLE SIZING PRESSURE DIFFERENTIAL --- PSI																Maximum ΔP - PSI	
	Cv	2	4	6	8	10	15	20	25	30	40	50	60	80	100	125	Bronze	SS
1"	13.5	19	27	33	38	43	52	60	68	74	85	95	105	121	135	151	50	150
1-1/4"	22	31	44	54	62	70	85	98	110	120	139	156	170	197	220	246	50	150
1-1/2"	28	40	56	69	79	89	108	125	140	153	177	198	217	250	280	313	50	150
2"	53	75	106	130	150	168	205	237	265	290	335	375	411	474	530	593	50	125

Water Capacities --- L/S

VALVE SIZE	AVAILABLE SIZING PRESSURE DIFFERENTIAL --- KPA																Maximum ΔP - kPa	
	7	15	30	45	60	75	100	125	150	200	250	350	450	550	650	750	Bronze	SS
1"	0.9	1.3	1.8	2.2	2.5	2.8	3.2	3.6	4	4.6	5.1	6.1	6.9	7.6	8.3	8.9	345	1034
1-1/4"	1.4	2	2.9	3.5	4.1	4.6	5.3	5.9	6.5	7.5	8.4	9.9	11	12	13	14	345	1034
1-1/2"	1.8	2.6	3.7	4.5	5.2	5.8	6.7	7.5	8.2	9.5	11	13	14	16	17	18	345	1034
2"	3.4	4.9	7	8.5	9.9	11	13	14	16	18	20	24	27	30	32	35	345	1034

Steam Capacities

Use a pressure drop of 50% of absolute inlet pressure (gauge pressure + 15 psi) for steam applications.

⚠ CAUTION

Caution: Do not exceed maximum pressure differentials for the given valve sizes. The maximum differential is the pressure the valve has against it at shutoff. Too large a differential can cause valve chatter and/or prevent shutoff.

Inlet Pressure - PSIG

	2		5				10					15				25					50			
VALVE SIZE	AVAILABLE SIZING PRESSURE DIFFERENTIAL --- PSI																							
	1	2	1	2	3	5	2	4	6	8	10	2	5	10	15	2	5	10	15	20	10	15	20	32.5
1"	161	225	176	245	296	372	276	382	457	516	563	304	468	630	732	353	547	747	881	958	980	1174	1326	1572
1-1/4"	263	366	286	400	483	606	450	623	746	841	917	495	762	1027	1192	575	891	1217	1436	1562	1596	1914	2161	2563
1-1/2"	335	466	364	509	614	771	573	792	949	1070	1167	630	970	1307	1517	732	1134	1549	1828	1987	2032	2436	2750	3261
2"	634	882	690	963	1163	1460	1084	1500	1796	2026	2209	1193	1836	2474	2872	1385	2147	2932	3459	3762	3846	4611	5206	6173

Inlet Pressure - PSIG

VALVE SIZE	75				100				125	150	175	200	Maximum ΔP - PSI	
	AVAILABLE SIZING PRESSURE DIFFERENTIAL --- PSI												Bronze	SS
Size	10	25	35	45	10	25	35	57.5	70	82.5	95	107.5	50	150
1"	1167	1761	2015	2187	1328	2027	2338	2801	110	120	139	156	50	150
1-1/4"	1902	2870	3284	3564	2164	3303	3811	4565	140	153	177	198	50	150
1-1/2"	2420	3653	4180	4535	2754	4203	4850	5809	265	290	335	375	50	125
2"	4581	6915	7912	8585	5213	7956	9181	10995	134408	158819	18231	20642	50	150

Always use Stainless Steel trim above 50 psg inlet pressure

Steam Capacities --- KG./HR.

Inlet Pressure - kPa

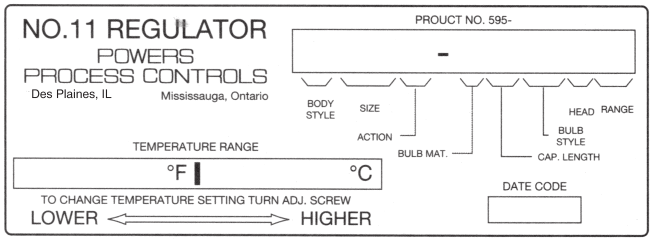
	15		30				70					15100				175					350			
VALVE SIZE	AVAILABLE SIZING PRESSURE DIFFERENTIAL --- PSI																							
	5	15	5	10	15	30	5	10	15	35	70	10	25	50	100	10	25	50	100	140	10	50	150	250
1"	63	107	67	94	114	156	77	108	131	194	258	117	181	248	324	137	214	296	397	448	176	385	627	753
1-1/4"	103	174	109	153	185	254	125	175	213	315	420	190	295	404	529	224	349	482	647	730	287	627	1021	1228
1-1/2"	131	221	139	194	236	323	159	223	271	401	534	242	375	514	673	285	444	613	823	930	365	799	1300	1562
2"	247	418	263	368	446	612	301	422	513	760	1012	459	711	972	1274	539	841	1161	1558	1760	692	1512	2460	2957

Inlet Pressure - kPa

VALVE SIZE	500				100700				850	1000	1200	1400	Maximum ΔP - kPa	
	AVAILABLE SIZING PRESSURE DIFFERENTIAL --- PSI												Bronze	SS
	75	175	250	301	70	175	250	401	476	551	651	751		
1"	525	791	910	971	611	932	1084	1294	1537	1779	2102	2425	345	1034
1-1/4"	856	1289	1483	1583	995	1519	1767	2109	2504	2899	3425	3952	345	1034
1-1/2"	1089	1640	1887	2015	1267	1933	2249	2685	3187	3689	4359	5029	345	1034
2"	2061	3105	3573	3814	2398	3659	4257	5082	6033	6984	8252	9520	345	1034

Always use Stainless Steel trim above 350 kPa inlet pressure

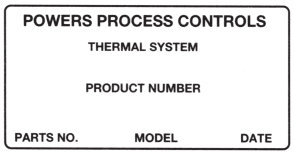
Product Identification



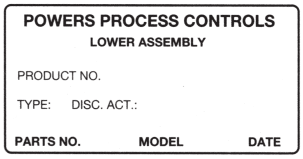
A red label should be on the front face of the thermal system. **Figure 1.**

This label contains information required to properly maintain, service and order parts for this product. If there is no label, look for a white label on the inside of the thermal system legs **(Figure 2A)** or the valve body vertical yoke **(Figure 2B).**

When replacing the original thermal assembly or valve body, secure the old red label onto the valve or thermal system or ink the number onto the body.



2A. Thermal System Label



2B. Valve Body Label

Installation

Tools Needed

- Straight slot screwdriver
- 3/8" open end wrench
- 13/16" open end wrench
- 5/16" open end wrench
- 7/16" open end wrench
- 1-3/8" open end wrench

Position Valve

1. To insure proper system operation, thoroughly flush all piping and valves to rid them of all scale, dirt and debris.
2. Select valve location with sufficient clearance to allow maintenance. Install valve in line. The direction of the arrows on the valve body must match the direction of the water or steam flow.

   For best results, we recommend installing the valve in a horizontal line, and in the upright position with bellows head above valve. The valve may also be installed in any position within 90° of upright.

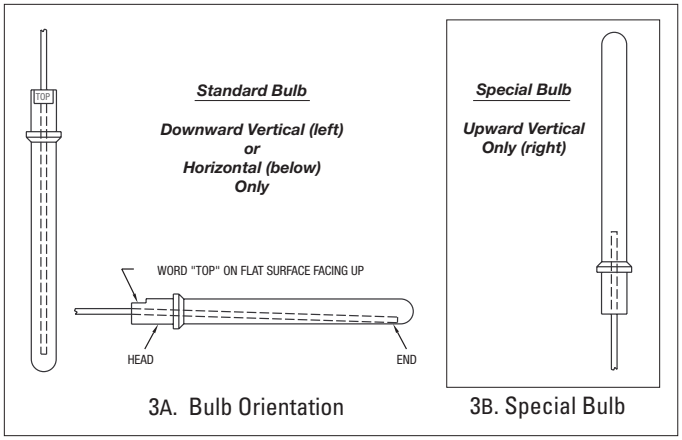
Install Bulb

3. **Figure 3a** shows proper bulb orientation. Figure 3b shows the special bulb needed for upwards vertical positioning.
4. **Figure 4**. For any position, fully immerse the bulb in the flow of the medium.

These instructions are for D style bulbs - for installation of other styles, refer to tag attached to bulb.

5. Without a well: Remove bushing from the bulb and screw it into the tank. Insert the thermostatic bulb through the bushing and tighten the union nut.

   With a well: Do not use bushing. Screw well into tank, insert bulb directly into well, and tighten union nut.

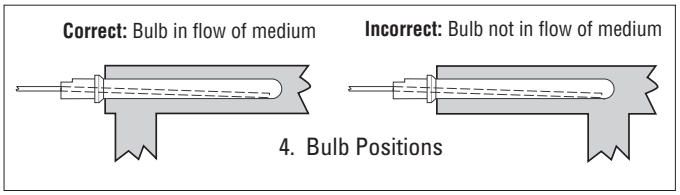


3A. Bulb Orientation

3B. Special Bulb

Adjust Capillary Tubing

6. Coil the extra capillary, and position away from regulator operation where it is subjected to room temperature only.



4. Bulb Positions

Adjust set point

All regulators are factory set to control near mid-range operating temperature.

⚠ WARNING

DO NOT kink, cut, sever or file the tubing. DO NOT disconnect tubing from bulb or bellows assembly. This can render the thermal system inoperable and result in severe process overheating.

7. When adjusting the set point, make certain the heating medium is flowing through the valve and is at the operating pressure of the system.
8. Figure 5. Make all set point temperature changes by inserting the temperature adjustment rod into one of the holes of the adjusting nut assembly. (Use the temperature adjustment setting scale only for reference)

To Raise the set point:

Turn rod left to right
(counterclockwise from top).

To Lower the set point:

Turn rod right to left
(clockwise from top).

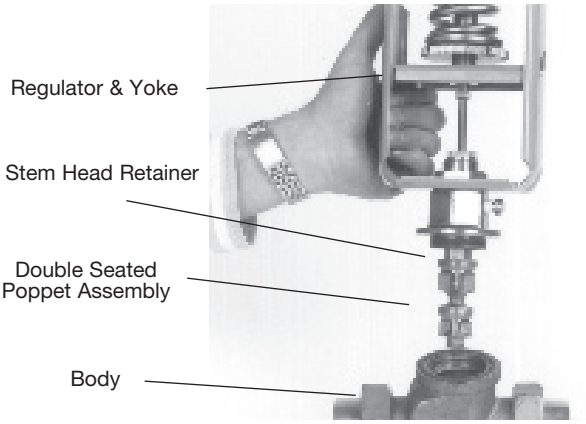
5. Adjusting Set Point

Maintenance

DA: To only replace the valve plug

1. Before disassembly, the bulb must be cooled 30°F (16°C) below the lowest point on the thermal system range, and flow through the valve must be stopped.
2. Figure 5. Relieve all pressure on the spring by turning adjusting nut assembly [31] fully right to left (clockwise from top).
3. Figure 6A. 1" to 2" valves: Use 1-3/8" wrench to loosen lock nut [11]. Then, use 1-3/8" wrench to unscrew bonnet [20] from valve body [26]. DO NOT ALLOW the regulator top to rotate.

   Lift up regulator top.



6A. (DA, 1" to 2") lift off regulator from valve body

5. Remove stem retainer [22] and replace poppet assembly [24]
6. 1” to 2” valves: Install a new gasket [21] between bonnet and valve body.
7. Replace bonnet and stem into valve body.
8. With valve plug firmly seated, screw stem extension [4] to the dimension shown in Figure 15 and tighten into place with hex nut [12].
9. Assemble in reverse order.

DA/RA: To fully disassemble regulator from valve

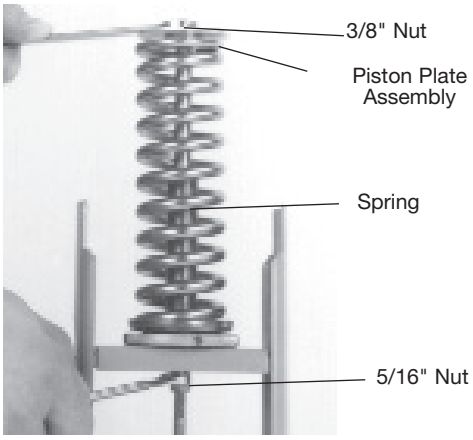
1. Before disassembly, the bulb must be cooled 30°F (16°C) below the lowest point on the thermal system range, and flow through the valve must be stopped.
2. **Figure 5**. Relieve all pressure on the spring by turning adjusting nut assembly [31] fully right to left (clockwise from top).
3. **Figure 7**. Remove housing bolts [6] and nuts [7] and temperature adjustment setting scale [8] and lift off thermal system [1] (housing, bellows, capillary, and bulb).
4. **Figure 8**. Using one 3/8" wrench and one 5/16" wrench, carefully loosen and remove piston plate assembly [2,3] from the stem extension [4].

   Lift off spring [19].
5. **Figure 9**. Use 1-3/8" wrench to unscrew lock nut [11] and lift off the yoke and bridge assembly [9].

   Follow steps 1-5, To fully disassemble regulator from valve.

7. Remove Housing and Thermal System

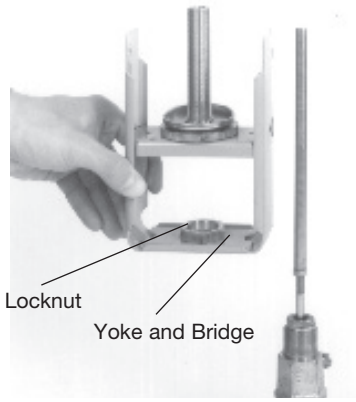
DA: To replace packing



8. Remove Piston Plate/Spring

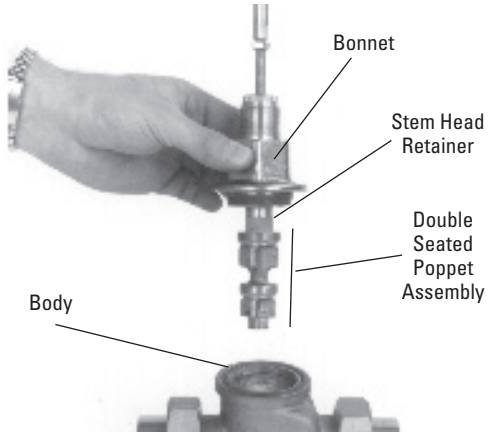
Maintenance, cont.

To replace packing



9. lift off yoke and bridge

6. Figure 10A.1" to 2": Loosen and remove bonnet [20] from valve body [26].



10A,. (DA, 1" to 2") remove bonnet from valve

7. Carefully pull out poppet [24] and stem assembly [30]. Check the stem. It must have a polished surface that is free of roughness and pitting. Replace any parts if necessary.
8. Figure 13. Remove packing gland [14], and all packing components [15a-15e].
9. Clean packing chamber, taking care not to scratch seating surfaces. Be sure chamber is free of dirt and grease.
10. 1" to 2" valves: Install a new gasket [21] between bonnet and valve body. Replace bonnet [20] and stem [30] into valve body.

    NOTE: You must replace the bonnet and stem before attempting to insert the packing. Otherwise, you may tear the packing rings.

11. For standard packing kits, install the parts as shown in Figure 13.

    Slide part(s) [15e], followed by [15d] and [15c] over the stem. Gently push them into the packing chamber.

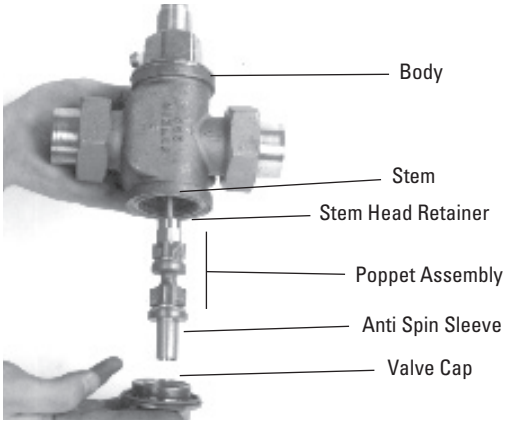
    NOTE: Some kits do not include all the listed packing parts (see page 12), but the order for part installation is the same.
12. For EP V-rings, lubricate the rings first.

    Slide each V-ring [15b] over the stem and carefully push it into the packing chamber.
13. Place the packing gland spacer [15a] on top of the bonnet.
14. Thread the packing gland assembly [14] into the bonnet. Tighten the gland assembly against the spacer.
15. With valve plug firmly seated (stem in full down position) screw stem extension [4] to the dimension shown in Figure 15 and tighten into place with hex nut [12].
16. Assemble the remaining parts in reverse order.

RA: To replace the valve plug / replace the packing

Follow steps 1-5, To fully disassemble regulator from valve.

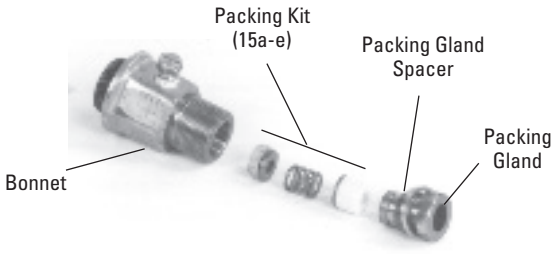
1. Figure 11. Use a 5/16" wrench on the flats of the stem extension [4] and a 7/16" wrench on the hex nut [12] to loosen and remove them.
2. Figure 12A. 1" to 2" valves: Loosen and remove valve cap.



12A. (RA, 1" to 2") remove valve cap

Check the stem. It must have a polished surface that is free of roughness and pitting. Replace any parts if necessary.

3. Unscrew plug from the stem retainer and replace.
4. Figure 13. Remove packing gland [14], and all packing components [15a-15e].



13. packing components

5. Clean packing chamber, taking care not to scratch seating surfaces. Be sure chamber is free of dirt and grease.
6. Insert plug and stem in valve body.

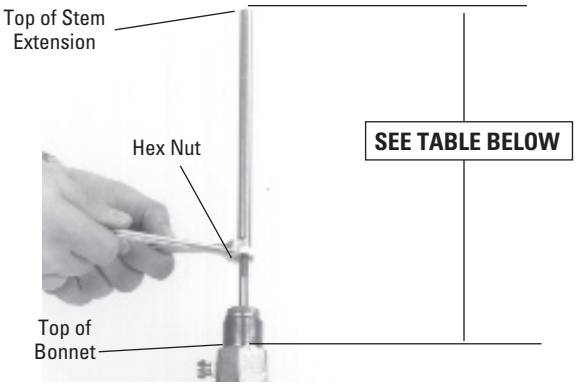
   NOTE: You must replace the plug and stem before attempting to insert the packing. Otherwise, you may tear the packing rings.
7. 1” to 2” valves: Screw valve cap into place and tighten.

   2-1/2” to 4" valves: Install a new gasket [21] between the bottom cap and body. Hold the bottom cap in place and secure with the four cap screws.
8. For standard packing kits, install the parts as shown in Figure 13.

   Slide part(s) [15e], followed by [15d] and [15c] over the stem. Gently push them into the packing chamber.

   NOTE: Some kits do not include all the listed packing parts (see page 12), but the order for part installation is the same.
9. For EP V-rings, lubricate the rings first.

   Slide each V-ring [15b] over the stem and carefully push it into the packing chamber.
10. Place the packing gland spacer [15a] on top of the bonnet.
11. Thread the packing gland assembly [14] into the bonnet. Tighten the gland assembly against the spacer.
12. **Figure 14.** With poppet firmly seated (see chart below for position), screw stem extension to the dimension given and tighten into place with hex nut.
13. Assemble in reverse order.



	Stem Setting Dimension (See Above)
Valve Action	Valve Size
	1"- 2"
DA (Stem DOWN)	10-1/8" (+1/32, -0) [257mm (+.79, -0)]
RA (Stem UP)	10-11/32" (+0,-1/32) [263mm (+0, -.79)]

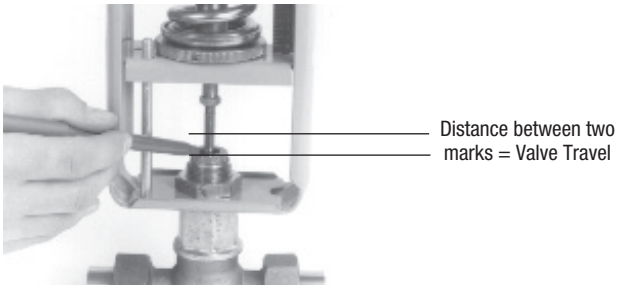
14. Stem extension dimensions

Testing the Thermal System

If the valve is not responding to temperature change, test the thermal system.

1. Stop the flow of fluid through the line.
2. **DA:** Raise the temperature of the bulb above the set point temperature by placing it in a container of hot water. This will cause the plug to fully seat.

   RA: Raise the temperature of the bulb above the set point temperature by placing it in a container of hot water. This will cause the plug to fully open.
3. **Figure 15.** With the valve plug in the desired position, use a felt tip pen to mark the position of the packing gland assembly on the stem.



13. valve travel measurement

4. **DA:** Place the bulb in a pan of cool water. Cool the bulb 30°F (16°C) below set point so the valve is fully open.

   RA: Place the bulb in a pan of cool water. Cool the bulb to or beyond the set point so the valve plug is seated.
5. Use the pen to mark the new position of the packing gland assembly on the stem.
6. The distance between the marks is the valve plug travel. This should correspond with the Travel value in the Valve Dimensions table on page 14. No movement or only partial movement indicates the thermal system is defective and should be replaced with a new system.

⚠ WARNING

Failure of the #11's thermal system will cause a heating valve to full open and a cooling valve to full close. If either of these valve states results in an unsafe process condition, a high-limit shutdown device, such as a Powers Aqua Sentry, should be used.

Preventive Maintenance

⚠ WARNING

Failure of the thermal system will result in a constant rise in temperature (or constant high temperature) of the fluid which you are trying to control.

Once every three months, inspect the Regulator as follows:

1. Visually check for leaks from the valve body joints, piping-to-valve connections, packing and stem areas
2. Visually check for excessive corrosion on the regulator, including the bellows, capillary, bulb, thermal system legs, bridge, and yoke. Also check for excessive corrosion on the valve body.
3. Perform the instructions in **Testing the Thermal System** Less than full valve travel may indicate a leak in the bellows, capillary, or bulb, or other problems. This may result in excessive temperature in the process.
4. Test the temperature adjusting nut assembly for freedom of movement (see **Adjust Set Point** for instructions).
5. Remove bulb from the process fluid and check for excessive corrosion, or erosion that may weaken the bulb and/or cause thermal system failure.

Troubleshooting

• Erratic temperature control (valve cycles too hot/cold)

1. Valve sized incorrectly. Verify valve selection.
2. Regulator is controlling at incorrect set point. Refer to Adjust Set Point.
3. Bulb is poorly positioned and/or oriented, and will not control the actual temperature of the heating/cooling medium. Refer to Install Bulb.
4. Incorrect type of bulb is being used. See Table on page 15.
5. The valve stem is sticking. Lubricate the stem.
6. The valve stem is bent. Refer to Maintenance for disassembly instructions and replace.
7. Packing gland assembly too tight. Loosen packing gland nut.
8. Faulty or incorrect steam traps. Replace with correct steam trap.
9. Very wet steam. Install a high pressure steam trap just ahead of the valve to drain off condensate that collects in the steam line.

• Regulator does not shut off

1. Pressure differential is greater than allowable pressure drop. Refer to Water Capacities and Steam Capacities tables.
2. Plug and/or seat is worn. Refer to Maintenance. Replace seat and/or valve body plug.
3. Foreign material between the plug and seat. Refer to Maintenance. Clean.
4. Bulb is poorly positioned and/or oriented, and will not control the actual temperature of the heating/cooling medium. Refer to Install Bulb.
5. Incorrect type of bulb is being used. See Table on page 15.
6. Valve sized incorrectly, causing wire drawing and leakage. Refer to Sizing Information.
7. Packing gland assembly is too tight, locking valve stem. Loosen packing gland assembly and lubricate if desired.
8. Bent valve stem; need to replace. Refer to Maintenance for disassembly instructions.
9. Thermal system failure. Refer to Testing the Thermal System.
10. Temperature adjusting nut assembly raised too high. Refer to Adjust Set Point.

• Regulator controlling at too low a temperature

1. Temperature adjusting nut assembly raised too high. Refer to Adjust Set Point.
2. Pressure differential is greater than allowable pressure drop. Refer to Water Capacities and Steam Capacities tables.

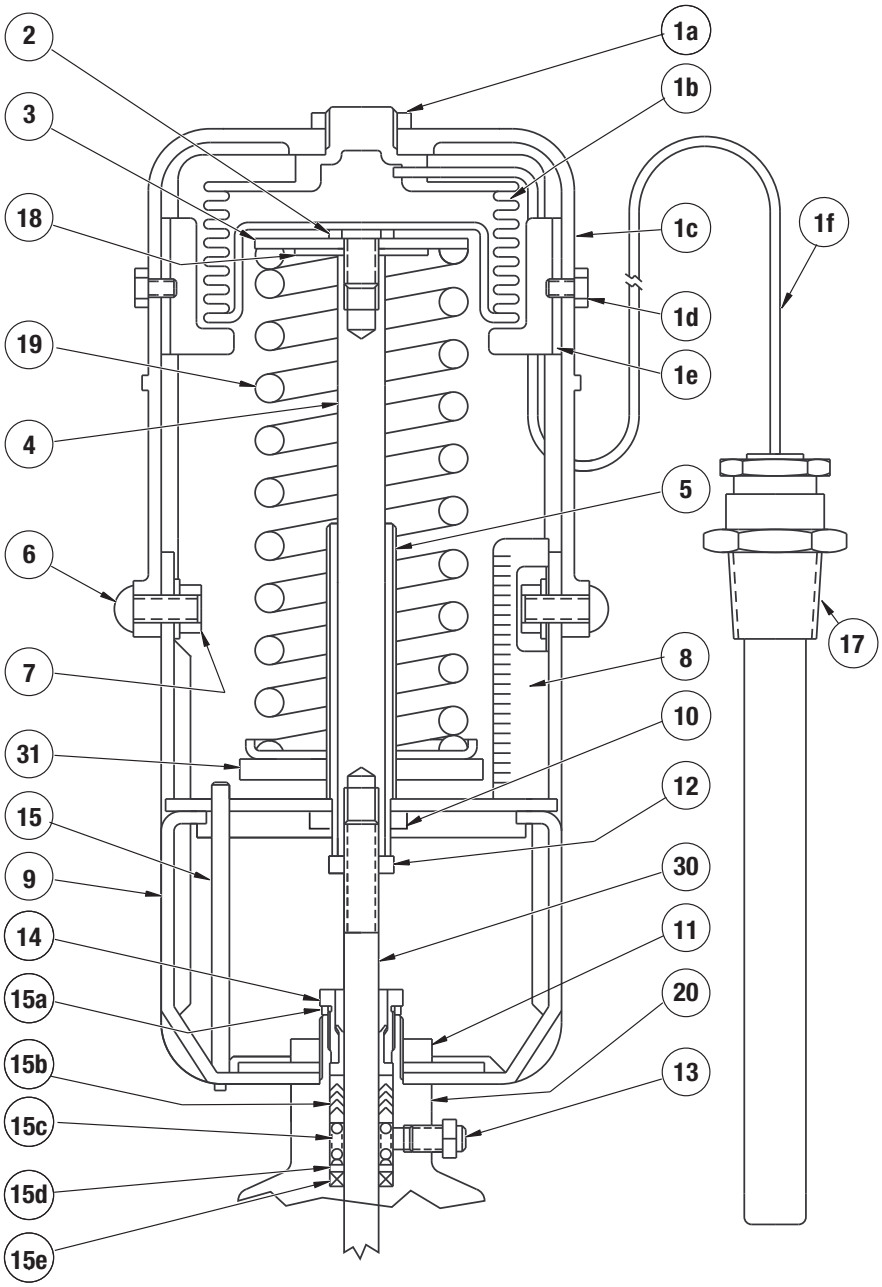
• Valve "chatters"

1. Regulator installed with the flow of the control medium in reverse of arrow direction on valve body.
2. Pressure differential too high, refer Water Capacities and Steam Capacities tables for correct range.
3. Trapped condensate in line. Install a steam trap just ahead of the regulator to drain off condensate that collects in the steam line.

• Constant rise in process fluid temperature

1. **DA (Heating Valve):** A constant rise in temperature may indicate the thermal system is leaking charge and/or the valve has failed in a partially or fully open position. This would allow a constant flow of heating medium, which would overheat the fluid which you are trying to control.
2. **RA (Cooling Valve):** A constant rise in temperature may indicate the thermal system is leaking charge, and or the valve has failed in a partially or fully closed position. This would slow or stop the flow of cooling medium which would overheat the fluid which you are trying to control.

Parts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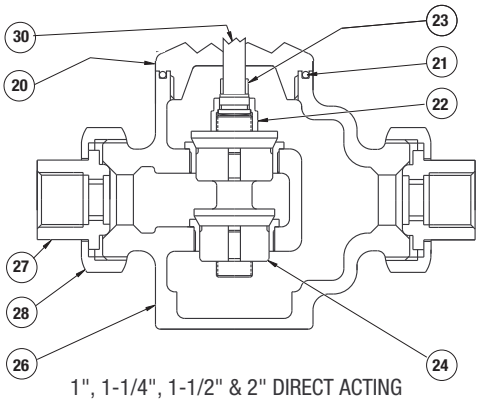
Parts

REGULATOR PARTS		DIRECT & REVERSE ACTING					
Item	Description	1"	1-1/4"	1-1/2"	2"	Qty	Material
1a-f	Thermal System	Refer to Order Code				1	
1a	Locknut	(Included in Thermal System)				1	Brass
1b	Thermal Motor/Bellows	(Included in Thermal System)				2	
1c	Housing	(Included in Thermal System)				1	Aluminum
1d	Screw	(Included in Thermal System)				2	Al & Steel
1e	Bellows Stop	(Included in Thermal System)				2	Zn plated Steel
1f	Bulb/Capillary Assembly	(Included in Thermal System)				1	Cu
2	Piston Plate Retaining Screw	590 816				1	SS
3	Piston Plate Washer	590 815				1	Zn plated Steel
4	Stem Extension	590808B				1	Brass
5**	Spring Adjustment Screw	590 807				1	Brass
6	Screw	030546J				2	Zn plated Steel
7	Hex Nut 5/16 - 18	041225K				2	Cd plated Steel
8	Temp. Adj. Setting Scale	590 813				1	Aluminum
**	Lower Housing Assembly	590 859				1	
9**	Yoke and Bridge Assembly	Not sold as individual Part				1	
10**	Nut, hex	041167J				1	Zn plated Steel
11	Nut, hex	041 125				1	Brass
12	Locknut	628 008				1	Brass
13	Pipe Plug	403 007				1	Brass
13	Stem Lubricator Kit	590184A				1	
14	Packing Gland Assembly	590 763				1	Brass
15a-e	Packing Kits	Refer to Accessory Kits on page 16				1	
15a	Packing Spacer	(Included in Packing Kit)				1	
15b	Packing Set	(Included in Packing Kit)				1	
15c	Packing Spring	(Included in Packing Kit)				1	
15d	Packing Washer	(Included in Packing Kit)				1	
15e	Packing Ring	(Included in Packing Kit)				1	
16	Temp. Adj. Rod	590 820				1	Cd plated Steel
17	1" Tank Fitting	705 005				1	Brass
17	1-1/4" Tank Fitting	705 006				1	Bronze
18	Spring Guide Washer	590 814	595 503			1	Steel
19	Spring	590 821	–			1	Zn plated Steel
19	Spring, inner	–	595 501			1	Zn plated Steel
19	Spring, outer	–	595 502			1	Zn plated Steel
31**	Temp. Adj. Nut Assembly	590 829				1	

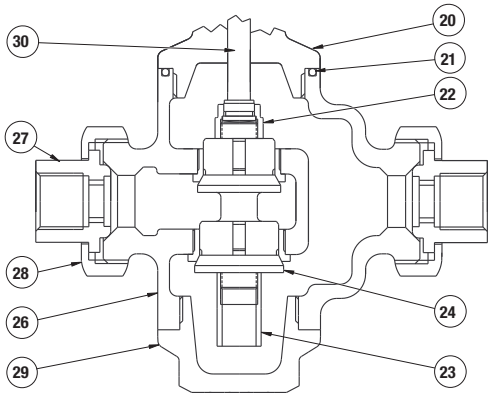
Parts

VALVE PARTS		DIRECT ACTING					
ITEM	DESCRIPTION	1"	1-1/4"	1-1/2"	2"	QTY	MATERIAL
20-30	Valve Assembly	Refer to Order Code				1	
20	Bonnet	594 499	594 499	594 468	594 456	1	Brass
21	O-ring	084 008	084 008	084 009	084 010	1	Silicone
	Gasket (non asbestos)	—	—	—	—	1	Gasketing
	Gasket (non asbestos)	—	—	—	—	2	Material*
22	Stem Head Retainer	603 012	603 012	603 012	—	1	Brass
	Stem Head Retainer	—	—	—	612 100	1	416 SS
23	Spacer Bushing (DB)	609019C	609 019	609019A	609019C	1	Brass
	Spacer Bushing (DS)	609019C	609019C	609019C	609019A	1	Brass
23	Valve Stop Sleeve (DB)	—	—	—	—	1	Brass
	Valve Stop Sleeve (DS)	—	—	—	—	1	Brass
24	Poppet Assy (DB)	603 003	604 003	605 003	594 354	1	(See Specs)
	Poppet Assy (DS)	591 948	591 949	591 950	591 951	1	(See Specs)
26	Body/Seat Assy (DB)	594 509	594 494	594 482	594 461	1	(See Specs)
	Body/Seat Assy (DS)	594 511	594 496	594 483	594 463	1	(See Specs)
27	Union Tail Piece	609 003	610 003	611 003	—	2	Brass
	Union Tail Piece	—	—	—	590 233	2	Bronze
28	Union Nut	609 004	610 004	611 004	590 234	2	Bronze
28	Screw	—	—	—	—	4	SS
	Screw	—	—	—	—	8	SS
29	Valve Cap	—	—	—	—	1	(See Specs)
29a	Blind Cap	—	—	—	—	1	Iron
29b	Top Cap	—	—	—	—	1	Iron
30	Stem Assembly	594816E	594816E	594816E	594817A	1	



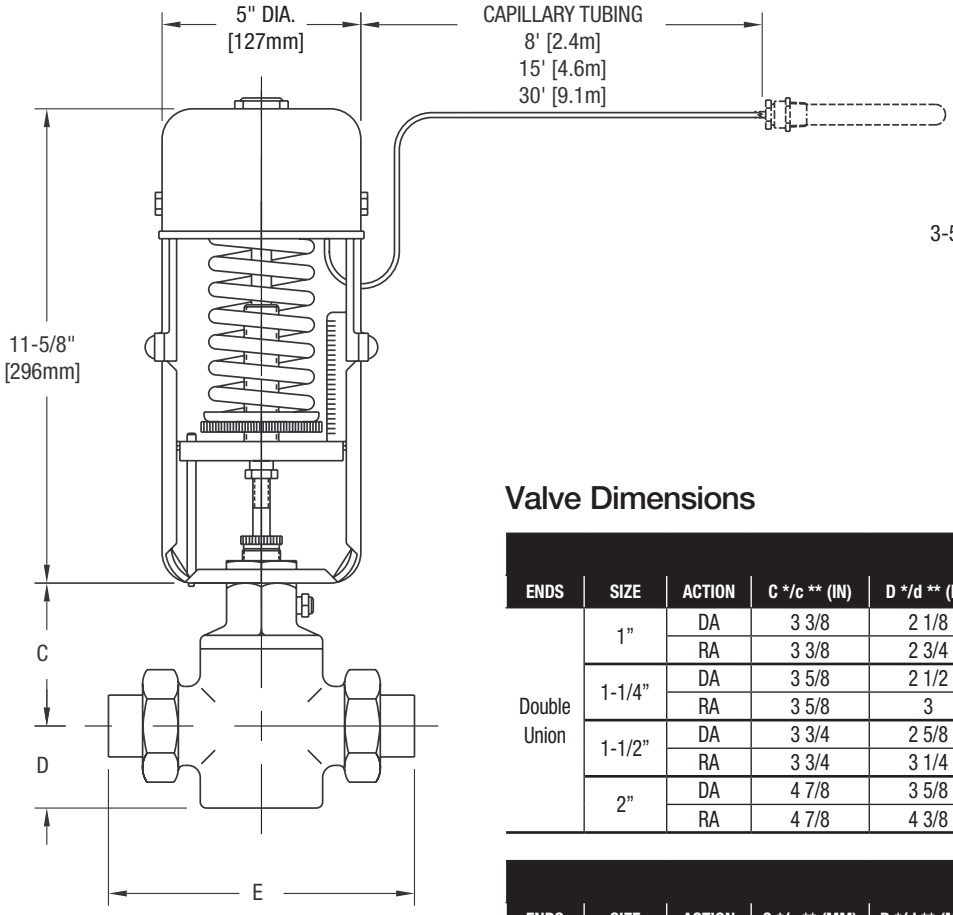
1", 1-1/4", 1-1/2" & 2" DIRECT ACTING

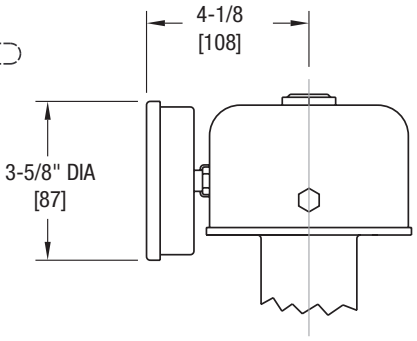
VALVE PARTS		REVERSE ACTING					
ITEM	DESCRIPTION	1"	1-1/4"	1-1/2"	2"	QTY	MATERIAL
20-30	Valve Assembly	Refer to Order Code				1	
20	Bonnet	594 499	594 499	594 468	594 456	1	Brass
21	O-ring	084 008	084 008	084 009	084 010	2	Silicone
21	Gasket	—	—	—	—	2	*
22	Stem Head Retainer	603 012	603 012	603 012	—	1	Brass
	Stem Head Retainer	—	—	—	612 100	1	416 SS
23	Valve Stop Sleeve (DB)	601 090	601 091	601 093	590 328	1	Brass
	Valve Stop Sleeve (DS)	601 090	601 091	601 092	590 329	1	Brass
23a	Anti- Spin Sleeve (DB)	—	—	—	—	1	Zn pltd Steel
	Anti- Spin Sleeve (DS)	—	—	—	—	1	SS
23b	Dowel Pin	—	—	—	—	1	Cd pltd Steel
23c	Screw (1/4-20-x 1/4)	—	—	—	—	1	Steel
24	Poppet Assy (DB)	603 003	604 003	605 003	594 354	1	
	Poppet Assy (DS)	591 948	591 949	591 950	591 951	1	
26	Body/Seat Assy (DB)	594 510	594 495	594 482	594 462	1	
	Body/Seat Assy (DS)	594 512	594 497	594 485	594 464	1	
27	Union Tail Piece	609 003	610 003	611 003	—	2	Brass
	Union Tail Piece	—	—	—	590 233	2	Bronze
28	Union Nut	609 004	610 004	611 004	590 234	2	Bronze
28	Screw	—	—	—	—	4	SS
	Screw	—	—	—	—	8	SS
29	Valve Cap	591 781	591 781	594 472	594 466	1	Brass
29a	Blind Cap	—	—	—	—	1	Iron
29b	Top Cap	—	—	—	—	1	Iron
30	Stem Assembly	594816E	594816E	594816E	594817A	1	



1", 1-1/4", 1-1/2" & 2" REVERSE ACTING

Dimensions





Optional Indicating Style Head

Valve Dimensions

ENDS	SIZE	ACTION	C */c ** (IN)	D */d ** (IN)	E (IN)	TRAVEL (IN)	ACTUAL WEIGHT (LBS.) NON INDIC.	ACTUAL WEIGHT (LBS.) INDICATING
Double Union	1"	DA	3 3/8	2 1/8	6 3/4	3/16	22	24
		RA	3 3/8	2 3/4	6 3/4	1/4	22	24
	1-1/4"	DA	3 5/8	2 1/2	7	1/4	24	26
		RA	3 5/8	3	7	1/4	24	26
	1-1/2"	DA	3 3/4	2 5/8	8	1/4	26	28
		RA	3 3/4	3 1/4	8	1/4	26	28
	2"	DA	4 7/8	3 5/8	9 5/8	3/8	36	39
		RA	4 7/8	4 3/8	9 5/8	5/16	36	39

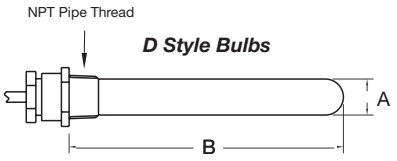
ENDS	SIZE	ACTION	C */c ** (MM)	D */d ** (MM)	E (MM)	TRAVEL (MM)	ACTUAL WEIGHT (KG.) NON INDIC.	ACTUAL WEIGHT (KG.) INDICATING
Double Union	1"	DA	86	54	171	5	10	11
		RA	86	70	171	6	10	11
	1-1/4"	DA	92	64	178	6	11	12
		RA	92	76	178	6	11	12
	1-1/2"	DA	95	67	203	6	12	13
		RA	95	83	203	6	12	13
	2"	DA	124	92	244	10	16	18
		RA	124	111	244	8	16	18

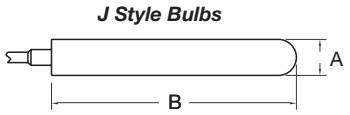
*DA **RA

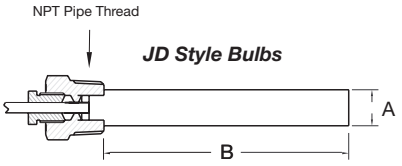
Bulb Dimensions

					MAX. PRESSURE - PSI	
BULB	**SIZE**	**MATERIAL**	**A (IN)**	**B (IN)**	**SHOCK**	**NON-SHOCK**
D Fixed Union (& V-Vertical Fixed Union)	1 x 9	Copper	15/16	8	175	250
		347 Stainless	15/16	8 1/16	500	725
	1 x 20	Copper	15/16	19 7/8	175	250
		347 Stainless	15/16	19 13/16	500	725
J Plain Bulb*	1 x 9	347 Stainless	15/16	8 3/4	–	–
	1 x 20	347 Stainless	15/16	20 1/2	–	–
JD Adjustable	1 x 9	347 Stainless	15/16	8 3/4	500	725
	1 x 20	347 Stainless	15/16	20 1/2	500	725

					MAX. PRESSURE - PSI	
BULB	**SIZE**	**MATERIAL**	**A (IN)**	**B (IN)**	**SHOCK**	**NON-SHOCK**
D Fixed Union (& V-Vertical Fixed Union)	1 x 9	Copper	24	203	4445	6350
		347 Stainless	24	205	12700	18415
	1 x 20	Copper	24	505	4445	6350
		347 Stainless	24	503	12700	18415
J Plain Bulb*	1 x 9	347 Stainless	24	222	–	–
		Teflon Coated	24	222	–	–
	1 x 20	347 Stainless	24	521	–	–
JD Adjustable	1 x 9	347 Stainless	24	222	12700	18415
	1 x 20	347 Stainless	24	521	12700	18415







Well Dimensions

								WELL PRESSURE - PSI	
BULB SIZE	**WELL KIT #**	**WELL MATERIAL**	**F (IN)**	**G (IN)**	**H (IN)**	**J (IN)**	**K (IN)**	**SHOCK**	**NON-SHOCK**
1 x 9	709 193	Chrome Plated Copper	15/16	13/16	9 1/16	1	1.11	175	250
	808 478	316L Stainless Steel	1 1/16	13/16	8 11/16	1 1/64	1.11	450	675
1 x 20	709 075	Chrome Plated Copper	15/16	13/16	21 1/16	1	1.11	175	250
	808 475	316L Stainless Steel	1 1/16	13/16	20 3/8	1 1/64	1.11	450	675

								WELL PRESSURE - kPa	
BULB SIZE	**WELL KIT #**	**WELL MATERIAL**	**F (MM)**	**G (MM)**	**H (MM)**	**J (MM)**	**K (MM)**	**SHOCK**	**NON-SHOCK**
1 x 9	709 193	Chrome Plated Copper	24	21	230	25	28	1207	1724
	808 478	316L Stainless Steel	27	21	221	26	28	3103	4654
1 x 20	709-075	Chrome Plated Copper	24	21	533	25	28	1207	1724
	808-475	316L Stainless Steel	27	21	518	26	28	3103	4654

Accessories

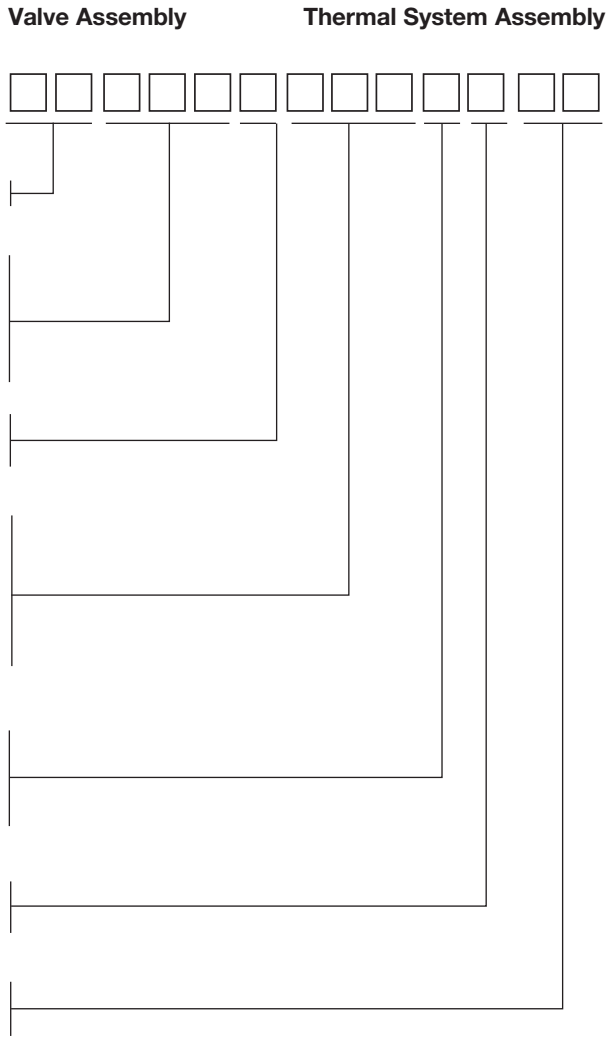
KIT#	MATERIAL	VALVE SIZE	STEM SIZE	USAGE	PARTS	LUBRICANT
591 927	Teflon V-ring	1/2" – 2"	1/4"	Effective from 200°F-400°F S team: 50 - 200 psi	15A, 15B, 15C, 15D, 15E	None
594 220	EP V-ring	1/2" – 2"	1/4"	Effective from 0°F-300°F Steam: 50psi maximum Water: up to maximum PSI valve rating	15A, 15B, 15C, 15D, 15E	Silicone required for installation (optional for service)
594 289	TFE Split Ring	1/2" – 2"	1/4"	For replacement only Effective from 40°F-366°F	15B, 15D	Silicone **Part #087 126**

Temperature Ranges/Bulb Sizes

For ordering thermal systems, refer to order code, the Powers #11 Product Specification Brochure, or call Powers.

BULB SIZE	BULB TEMP. RANGE		ORDER CODE
	SINGLE OR DOUBLE SEAT VALVES 1/2" TO 2"		
	HEATING DA	COOLINNG RA	
1" x 20"	10–70°F (-12–21°C)	0-60°F (-18-16C)	01
	55–115°F (13–46°C)	45-105°F (7-41°C)	02
	80–145°F (29–63°C)	70-130°F (21-54°C)	03
		90-150°F (32-66°C)	04
1" x 9"	110–170°F (43–77°C)	110-150°F (43-66°C)	05
	130–190°F (54–88°C)	-	06
	140–200°F (60–93°C)	120-180°F (49-82°C)	07
	170–230°F (77–110°C)	150-210°F (66-99°C)	08
	200–250°F (93–121°C)	185-245°F (85-118°C)	09
	230–290°F (110–143°C)	220-280°F (104-138°C)	10
	270–330°F (132–166°C)	255-315°F (124-157°C)	11

Order Code



Valves Type

Double Seat Bronze Trim . . . . . DB
Double Seat Stainless Trim . . . . . DS

Valve Sizes

1" 100
1-1/4" 125
1-1/2" 150
2" 200

Applications

Heating . . . . . H
Cooling C

Bulb/Capillary Material & Length

Copper 8' C08
Copper 15' C15
Copper 30' C30
Stainless Steel 8' S08
Stainless Steel 15' S15
Stainless Steel 30' S30

Bulb Size

Fixed Union . . . . . D
No Pipe Fittings (N/A Copper) . . . . . J
Adj. Union (N/A in H head) . . . . . A
Fixed Union (D Type) Vertical V

Head Assembly

Non-indicating . . . . . N
Indicating I

Range/Bulb Size . . . . . #
See chart on page 15
Select Range with Set Point in
UPPER THIRD for best performance.

POWERS™

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