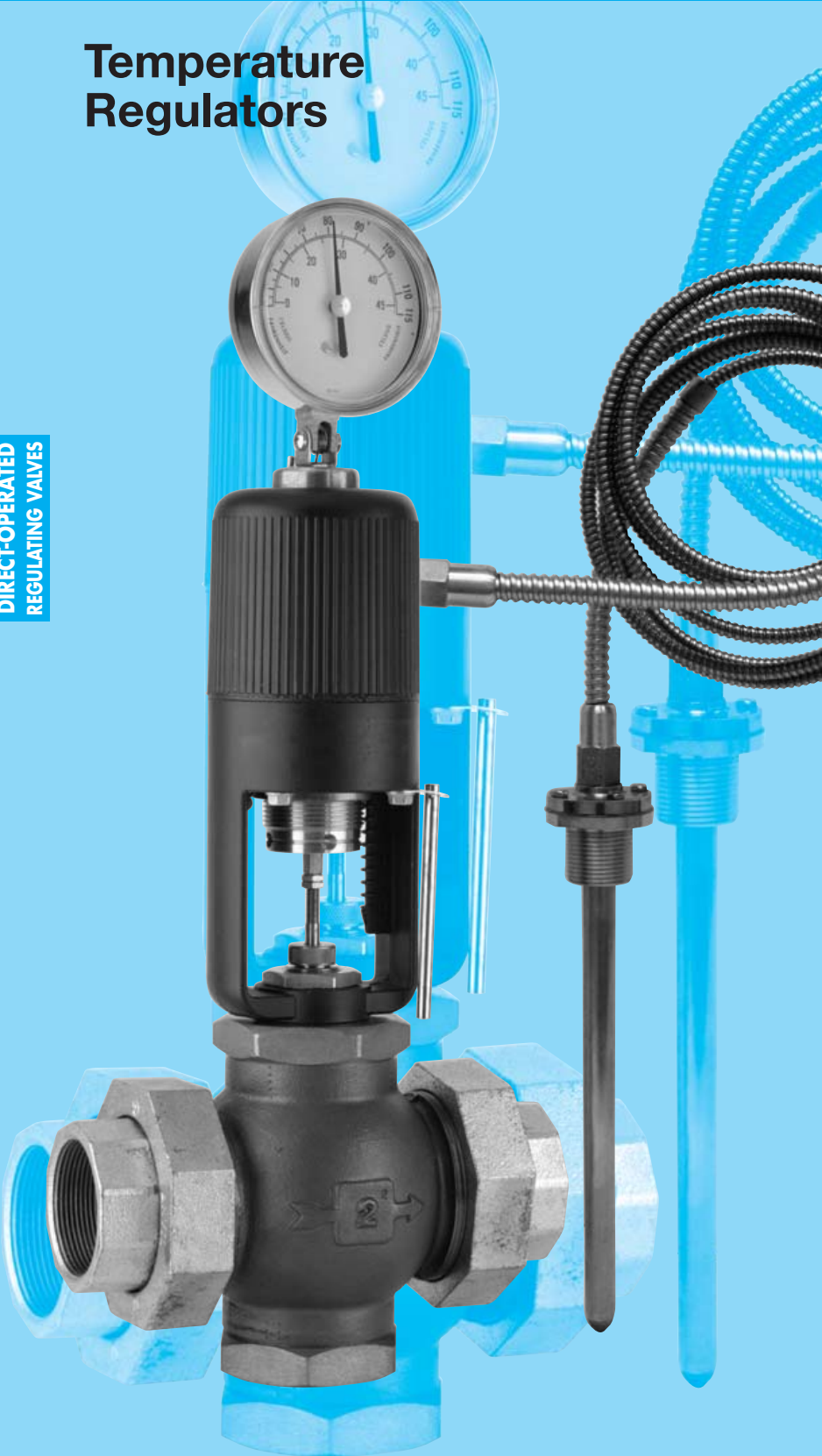


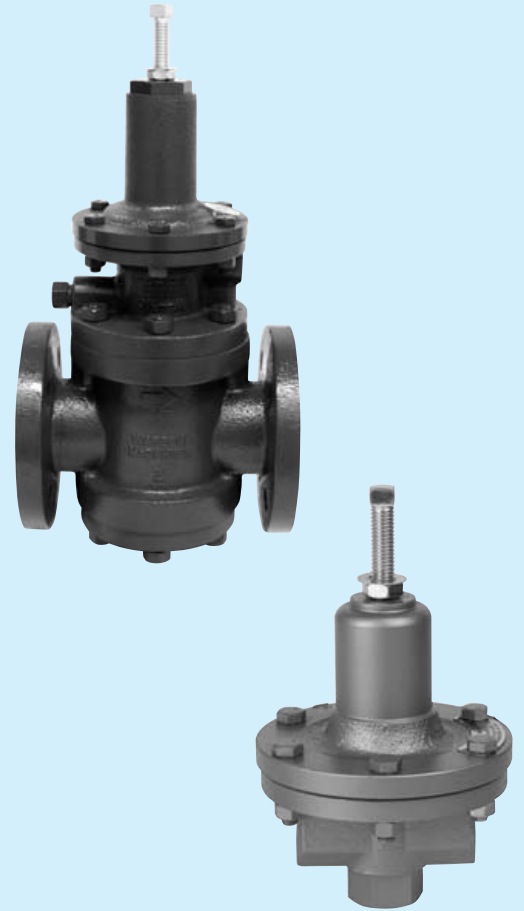
Direct-Operated Pressure & Temperature Regulating Valves

Temperature Regulators

DIRECT-OPERATED
REGULATING VALVES



Pressure Regulators




Relief Valves





Direct-Operated Pressure & Temperature Regulating Valves


Direct-Operated Regulators are used for controlling pressure and temperature in a variety of applications.

PRESSURE REGULATORS Page No.

 <p>Cast Iron 3/8" - 2"</p>	<h3>O Series</h3>	<p>Pressure Regulating Valve - STEAM, Water, Air, Oil, other Liquids & Gases</p> <p>The O Series, with Cast Iron body and Hardened Stainless internals, is our most popular and economical solution for reducing pressure in STEAM systems. It is also suitable for Air, Water, Oil as well as other Liquids and Gases.</p>	<p>154-155</p>
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 <p>Bronze, Cast Iron 1/2" - 4"</p>	<h3>B Series</h3>	<p>Pressure Regulating Valve - WATER, Air, Oil, other Liquids & Gases</p> <p>The B-Series is primarily used for reducing pressure in WATER systems. It is also suitable for Air, Oil, as well as other Liquids and Gases. The B-Series offers higher capacity than the O-Series.</p>	<p>156-157</p>
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 <p>Bronze, Cast Iron 1/2" - 4"</p>	<h3>455 Series</h3>	<p>Pressure Regulating Valve - STEAM, Air, Water & other Gases</p> <p>The 455 is ideally suited for reducing pressure in STEAM applications and requires only 5 PSIG minimum inlet pressure. Excellent for use in steam systems that contain large amounts of scale that may cause failure in pilot-operated regulators.</p> <p><i>With a slight modification to the internal mechanism, the 455 can be used for Liquid systems.</i></p>	<p>158-159</p>
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 <p>Ductile Iron 1/2" - 4"</p>	<h3>402 & 403 Series</h3>	<p>Pressure Regulating Valve - STEAM & Air</p> <p>The 402 & 403 are pilot-operated, piston-actuated, pressure regulators primarily used for reducing pressure in STEAM systems. This regulator can be equipped with an optional internal sensing line which simplifies installation. <i>The 403 Series has all stainless steel internals for high-pressure applications up to 450 PSIG.</i></p>	<p>160-161</p>
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**DIRECT-OPERATED
REGULATING VALVES**

BACK PRESSURE-RELIEF VALVES

 <p>Bronze 1/2" - 3"</p>	<h3>R Series & 10691 Series</h3>	<p>Relief & Back Pressure Valves - Water, Liquids & Air</p> <p>The R Series & 10691 Series are economically-priced Back Pressure Relief Valves for Liquid service. Relief Valves/Back Pressure Valves are used to maintain a specific back pressure or to protect systems from an over-pressure condition.</p>	<p>162-163</p>
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 <p>Bronze, Cast Iron 1/2" - 2"</p>	<h3>3040 Series</h3>	<p>Relief & Back Pressure Valves - Water, Liquids & Air</p> <p>The 3040 Back Pressure Relief Valve offers a much higher capacity than the R Series. Used for Liquid service. Relief Valves protect systems from over-pressurized conditions.</p>	<p>164-165</p>
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TEMPERATURE REGULATING VALVES

	<h3>W91 & W94 Series</h3>	<p>Self-Operating Temperature Regulating Valves - Heating/Cooling</p>	<p>166-183</p>
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The **W91/W94 Series** Temperature Regulating Valves are used for controlling temperatures in industrial and HVAC applications.

<p>W91/W94 Design & Operation</p> <p>Typical Applications</p> <p>How to Order</p> <p>Specifications & Options</p>	<p>166-170</p> <p>171</p> <p>172</p> <p>173-183</p>
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Bronze, Cast Iron
1/2" - 4"

REGULATORS

"O" Series

Pressure Regulating Valve

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Model	"O" Series
Service	Steam, Air, Water & Other Liquids
Sizes	3/8", 1/2", 3/4", 1", 1 1/4", 1 1/2", 2"
Connections	NPT
Body Material	Cast Iron
Seat & Disc	Hardened 420 Stainless Steel
Diaphragm	Phosphor Bronze - Steam Neoprene/Nylon (composition) - Water, Air & Oil (250°F max) Viton (optional) - Water, Air & Oil (300°F max)
Max. Inlet Pressure	250 PSIG
Min. Inlet Pressure	15 PSIG
Max. Diff. Pressure	125 PSI
Min. Diff. Pressure	15 PSI



DESIGN PRESSURE/TEMPERATURE RATING – PMA/TMA

NPT 250 PSIG @ 450°F

TYPICAL APPLICATIONS

The "O" Series Pressure Regulating Valves are used for reducing pressure in steam, air and water systems. Commonly used in heating and other process applications.

HOW TO SIZE/ORDER

From the Capacity chart, find the inlet pressure and required regulator outlet pressure. Follow across chart to nearest capacity of application service medium that meets or slightly exceeds demand requirements. Follow vertically up to determine appropriate size. When exact application values are not shown, interpolation between values is acceptable. From the Spring Ranges chart, select the ideal spring range that accommodates the required outlet set pressure, confirm that system pressure requirements can be accommodated by valve. Example:

Application: 200 lbs/hr of 100 PSIG Steam reduced to 30 PSIG
Size/Model: 1/2" "O" Series, 10-50 PSIG spring range

FEATURES & OPTIONS

- Hardened stainless steel seat and disc for extended service life (55 Rc)
- Neoprene & Nylon (composition) fiber diaphragm for water, oil and air service; 250°F maximum temperature
- Viton diaphragm for up to 300°F service for water, oil & air service
- Phosphor Bronze diaphragm for steam service; Neoprene for water, oil & air
- Double spring available for extended outlet pressure range
- Integral stainless steel strainer on 3/4" HC, 1", 1 1/4", 1 1/2" & 2"

PRESSURE-ADJUSTING SPRING RANGES – Spring No. & Color Code

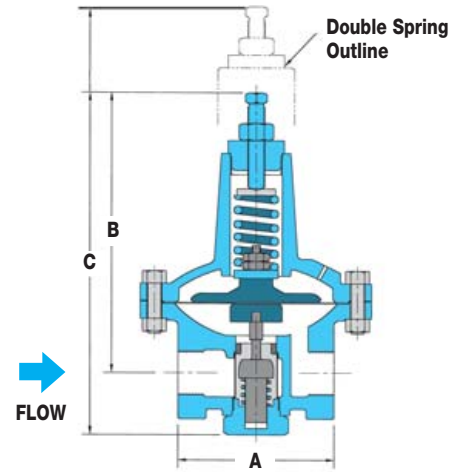
	Outlet Pressure	Size							
		3/8"	1/2"	3/4"	3/4" HC	1"	1 1/4"	1 1/2"	2"
Single Spring	0-10	13 blue/yellow	13 blue/yellow	13 blue/yellow	3 red	7 red/green	7 red/green	8 red/blue	8 red/blue
	10-30	–	–	–	4 green	8 red/blue	8 red/blue	9 red/yellow	9 red/yellow
	10-50	14 black/yellow	14 black/yellow	14 black/yellow	–	–	–	–	–
	30-50	–	–	–	5 blue	9 red/yellow	9 red/yellow	10 green/blue	10 green/blue
	40-85	–	–	–	6 yellow	10 green/blue	10 green/blue	11 green/yellow	11 green/yellow
	40-100	9 red/yellow	9 red/yellow	9 red/yellow	–	–	–	–	–
	100-200	10 green/blue	10 green/blue	10 green/blue	–	–	–	–	–
Double Spring	0-75	–	–	–	7, red/green 8, red/blue	8, red/blue 9, red/yellow	8, red/blue 9, red/yellow	8, red/blue 9, red/yellow	8, red/blue 9, red/yellow
	30-130	–	–	–	8, red/blue 9, red/yellow	9, red/yellow 10, green/blue	9, red/yellow 10, green/blue	9, red/yellow 10, green/blue	9, red/yellow 10, green/blue

REGULATORS

"O" Series Pressure Regulating Valve

DIMENSIONS & WEIGHTS – inches/pounds

Size	A	B	C	C Double Spring	Weight (lbs)
3/8"	4 1/4	6 1/2	8	-	8
1/2"	3 5/8	6 1/2	8	-	8
3/4"	3 5/8	6 1/2	8	-	8
3/4" HC	3 5/8	8	10	12 1/2	15
1"	4 1/2	8 1/2	10 1/2	13	18
1 1/4"	4 1/2	8 1/2	10 1/2	13	18
1 1/2"	6 1/2	8 3/4	12	14 1/2	40
2"	6 1/2	8 3/4	12	14 1/2	40



CAPACITIES – Steam (lbs/hr); *Air (SCFM); *Water (GPM)

Inlet/Outlet Pressures (PSIG)

Inlet Press.	Outlet Press.	3/8", 1/2", 3/4"			3/4" HC **			1"			1 1/4"			1 1/2"			2"		
		Steam	Air	Water	Steam	Air	Water	Steam	Air	Water	Steam	Air	Water	Steam	Air	Water	Steam	Air	Water
15	2	46	26	6	92	51	11	130	73	16	145	81	18	180	100	22	199	111	25
	5	38	21	4	75	42	9	106	59	13	119	66	14	147	82	18	163	91	19
20	5	65	36	8	130	72	15	184	102	22	205	114	25	254	141	30	281	156	34
	10	61	34	6	123	69	13	174	97	18	194	109	20	241	134	25	266	149	27
30	15	45	25	4	90	51	9	128	72	13	143	80	14	177	99	18	196	109	19
	5	83	46	10	167	93	20	236	131	28	264	147	32	327	181	39	362	201	43
	10	83	46	10	167	93	18	236	131	25	264	147	28	327	181	35	362	201	39
50	20	71	40	6	142	79	13	201	112	18	225	126	20	278	155	25	308	172	27
	5	121	67	13	242	134	27	342	190	38	382	212	42	473	263	53	523	291	58
	25	121	67	10	242	134	20	342	190	28	382	212	32	473	263	39	523	291	43
100	40	87	49	6	174	97	13	247	138	18	276	154	20	341	191	25	377	211	27
	30	214	119	17	428	238	33	607	337	47	678	376	53	839	466	66	928	515	73
	50	214	119	14	428	238	28	607	337	40	678	376	45	839	466	55	928	515	61
125	70	195	109	11	275	154	18	390	218	25	436	244	28	540	301	35	597	333	39
	30	261	145	19	522	290	39	739	410	55	826	458	62	1021	567	76	1130	627	84
	50	261	145	17	522	290	35	739	410	49	826	458	55	1021	567	68	1130	627	75
150	70	261	145	15	522	290	30	739	410	42	826	458	47	1021	567	58	1130	627	64
	100	201	112	10	402	225	20	569	318	28	636	355	32	787	440	39	871	486	43
	30	307	171	22	615	341	44	871	484	62	974	540	69	1204	668	86	1332	740	95
200	50	307	171	20	615	341	40	871	484	57	974	540	63	1204	668	78	1332	740	87
	70	307	171	18	615	341	36	871	484	51	974	540	57	1204	668	70	1332	740	78
	100	298	166	14	596	333	28	844	471	40	943	527	45	1167	652	55	1291	721	61
250	120	239	133	11	478	267	22	677	378	31	756	422	35	935	523	43	1035	578	47
	30	401	222	26	802	445	52	1135	630	74	1269	705	83	1570	871	102	1737	964	113
	50	401	222	24	802	445	49	1135	630	69	1269	705	78	1570	871	96	1737	964	106
250	70	401	222	23	802	445	46	1135	630	65	1269	705	72	1570	871	89	1737	964	99
	100	401	222	20	802	445	40	1135	630	57	1269	705	63	1570	871	78	1737	964	87
	50	494	274	28	988	549	57	1400	777	80	1565	869	90	1935	1074	111	2141	1189	123
250	70	494	274	27	988	549	54	1400	777	76	1565	869	85	1935	1074	105	2141	1189	116
	125	494	274	22	988	549	45	1400	777	63	1565	869	71	1935	1074	88	2141	1189	97

* Air and water capacities are based on using elastomeric diaphragms.

** 3/4" HC is high-capacity version of standard 3/4" valve.

Note: For capacities of other gases multiply the air capacities by the following factors: Argon-0.85 CO₂-0.81 Helium-2.69 Nitrogen-1.02

DIRECT-OPERATED
REGULATING VALVES

REGULATORS

B Series

Pressure Regulating Valve

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DIRECT-OPERATED REGULATING VALVES

Model	B Series
Service	Water, Air, Oil, Other Gases & Liquids
Sizes	1/2", 3/4", 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 4"
Connections	NPT, 125# & 250# Flanged
Body Material	1/2"– 2 1/2" Bronze 3" & 4" Cast Iron
Disc	Neoprene (standard) - 200°F max Viton (optional) - 300°F max
Diaphragm	Neoprene/Nylon - 200°F max Viton (optional) - 300°F max
Max. Inlet Pressure	250 PSIG
Min. Inlet Pressure	10 PSIG
Max. Diff. Pressure	125 PSI
Min. Diff. Pressure	20% of Inlet Pressure

DESIGN PRESSURE/TEMPERATURE RATING – PMA/TMA

NPT	250 PSIG @ 400°F
125# FLG	125 PSIG @ 450°F
250# FLG	250 PSIG @ 450°F

TYPICAL APPLICATION

The **B Series** Pressure Regulating Valves are used for reducing pressure in air and water systems. These regulators are commonly found in industrial plants, apartment buildings, water supply systems, schools and underground water distribution systems.

FEATURES & OPTIONS

- Diaphragm, disc and cup packing available in Viton for 300°F service (optional)
- Balanced pressure regulator allows accurate control even when incoming pressure fluctuates
- Internally senses pressure – no external sensing line required
- Soft disc in Neoprene or Viton for Class-V shut-off rating

HOW TO SIZE/ORDER

From the Capacity chart, find the inlet pressure and required regulator outlet pressure. Follow across chart to nearest capacity of application service medium that meets or slightly exceeds demand requirements. Follow vertically up to determine appropriate size. When exact application values are not shown, interpolation between values is acceptable. From the Spring Ranges chart, select the ideal spring range that accommodates the required outlet set pressure. Confirm that system pressure requirements can be accommodated by valve. Example:

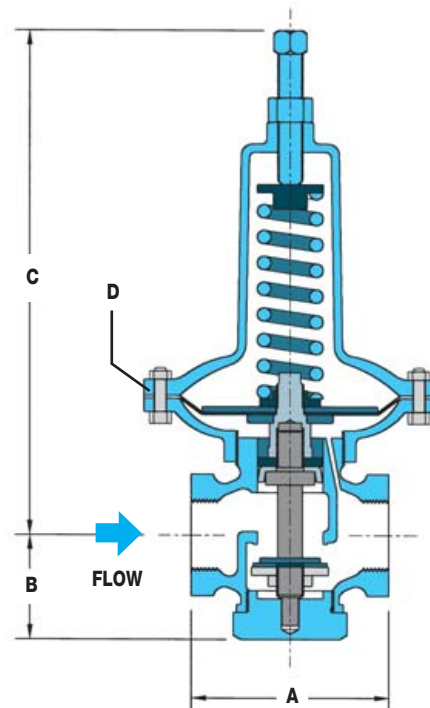
Application: 35 GPM of 70 PSIG Water reduced to 20 PSIG
Size/Model: 1" B-Series, 5-35 PSIG spring range



PRESSURE-ADJUSTING SPRING RANGES

Outlet Pressure (PSIG)	Spring No.
1-12	4*
5-35	3
20-70	2
40-125	1

* 1/2" – 1" only



REGULATORS

B Series

Pressure Regulating Valves

DIMENSIONS & WEIGHTS – inches/pounds

Size	Face-to-Face A			B	C	D Spring Case Dia. (in.)	Weight (lbs)
	NPT Threaded	125# Flanged	250# Flanged				
1/2", 3/4"	3 ³ / ₈			1 ⁷ / ₈	9	5	7
1"	3 ⁵ / ₈			2 ¹ / ₄	9 ¹ / ₂	5	8
1 ¹ / ₄ "	4 ¹ / ₄			2 ³ / ₈	10 ¹ / ₂	6 ³ / ₄	13
1 ¹ / ₂ "	4 ³ / ₄			2 ¹ / ₂	10 ³ / ₄	6 ³ / ₄	15
2"	5 ⁷ / ₈			3 ³ / ₈	11 ⁵ / ₈	6 ³ / ₄	20
2 ¹ / ₂ "	6 ¹ / ₂			4 ¹ / ₄	12 ³ / ₄	6 ³ / ₄	30
3"		10 ¹ / ₄	11	4 ¹ / ₂	21 ¹ / ₂	9 ¹ / ₄	125
4"		13	13 ⁵ / ₈	5 ³ / ₄	23	9 ¹ / ₄	182

DIRECT-OPERATED
REGULATING VALVES

CAPACITIES – Water (GPM); Air (SCFM)

Inlet/Outlet Pressures (PSIG)

Inlet Press.	Outlet Press.	1/2"		3/4"		1"		1 ¹ / ₄ "		1 ¹ / ₂ "		2"		2 ¹ / ₂ "		3"		4"	
		Water	Air	Water	Air	Water	Air	Water	Air	Water	Air	Water	Air	Water	Air	Water	Air	Water	Air
10	5	5.5	25	10	45	13	60	22	100	33	150	55	250	88	400	132	600	176	800
	20	9.8	48	18	86	23	114	39	190	59	285	98	475	156	760	234	1140	312	1520
20	10	8.0	43	14	77	19	102	32	170	48	255	80	425	128	680	192	1020	256	1360
	15	5.5	30	10	54	13	72	22	120	33	180	55	300	88	480	132	720	176	960
30	5	12.5	68	23	122	30	162	50	270	75	405	125	675	200	1080	300	1620	400	2160
	10	11.3	63	20	113	27	150	45	250	68	375	113	625	180	1000	270	1500	360	2000
50	20	8.0	48	14	86	19	114	32	190	48	285	80	475	128	760	192	1140	256	1520
	5	16.8	98	30	176	40	234	67	390	101	585	168	975	268	1560	402	2340	536	3120
50	25	12.5	88	23	158	30	210	50	350	75	525	125	875	200	1400	300	2100	400	2800
	40	8.0	63	14	113	19	150	32	250	48	375	80	625	128	1000	192	1500	256	2000
70	10	19.3	128	35	230	46	306	77	510	116	765	193	1275	308	2040	462	3060	616	4080
	30	15.8	125	28	225	38	300	63	500	95	750	158	1250	252	2000	378	3000	504	4000
100	50	11.3	95	20	171	27	228	45	380	68	570	113	950	180	1520	270	2280	360	3040
	30	21.0	175	38	315	50	420	84	700	126	1050	210	1750	336	2800	504	4200	672	5600
100	50	17.5	165	32	297	42	396	70	660	105	990	175	1650	280	2640	420	3960	560	5280
	70	13.8	135	25	243	33	324	55	540	83	810	138	1350	220	2160	330	3240	440	4320
125	30	24.3	213	44	383	58	510	97	850	146	1275	243	2125	388	3400	582	5100	776	6800
	50	21.5	213	39	383	52	510	86	850	129	1275	215	2125	344	3400	516	5100	688	6800
150	100	12.5	140	23	252	30	336	50	560	75	840	125	1400	200	2240	300	3360	400	4480
	30	27.5	250	50	450	66	600	110	1000	165	1500	275	2500	440	4000	660	6000	880	8000
150	50	25.0	250	45	450	60	600	100	1000	150	1500	250	2500	400	4000	600	6000	800	8000
	100	17.5	205	32	369	42	492	70	820	105	1230	175	2050	280	3280	420	4920	560	6560
200	125	12.5	153	23	275	30	366	50	610	75	915	125	1525	200	2440	3000	3660	400	4880
	70	28.5	325	51	585	68	780	114	1300	171	1950	285	3250	456	5200	684	7800	912	10400
250	100	25.0	263	45	473	60	630	100	1050	150	1575	250	2625	400	4200	600	6300	800	8400
	125	21.5	223	39	401	52	534	86	890	129	1335	215	2225	344	3560	516	5340	688	7120
250	100	30.8	403	55	725	74	966	123	1610	185	2415	308	4025	492	6440	738	9660	984	12880
	125	28.0	393	50	707	67	942	101	1570	168	2355	280	3925	448	6280	672	9420	896	12560

Note: For capacities of other gases multiply the air capacities by the following factors: Argon-0.85 CO₂-0.81 Helium-2.69 Nitrogen-1.0

REGULATORS

455 Series

Pressure Regulating Valve

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Model	455 Series
Service	Steam, Water, Air & Other Gases
Sizes	1/2", 3/4", 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 4"
Connections	NPT, 125# & 250# Flanges
Body Material	1/2" - 1 1/2" Bronze 2" - 4" Cast Iron
Seat & Disc	Stainless Steel
Diaphragm	Neoprene/Nylon
Max. Inlet Pressure	250 PSIG
Min. Inlet Pressure	5 PSIG
Max. Diff. Pressure	125 PSI
Min. Diff. Pressure	20% of Inlet Pressure



DESIGN PRESSURE/TEMPERATURE RATING – PMA/TMA

NPT	250 PSIG @ 400°F
125# FLG	125 PSIG @ 450°F
250# FLG	250 PSIG @ 450°F

PRESSURE-ADJUSTING SPRING RANGES

Size	Outlet Pressure (PSIG)	Spring No.	Spring Case Dia. (in.)
1/2" - 1 1/2"	1-6	5	6
	5-20	3	6
	15-45	2	6
	40-70	1	6
	60-125	1	5
2" - 4"	1-6	4	13
	5-20	4	9
	15-45	3	9
	40-70	3	7
	60-125	2	7

TYPICAL APPLICATIONS

The **455 Series** are balanced, Externally-Sensed Pressure Regulating Valves are used for reducing pressure in steam, air and water systems. Commonly used in heating and other process applications. Externally-sensed regulators are often more accurate than internally-sensed regulators because the sensing line is connected close to the process it is intending to control and is far enough away from the outlet of the regulator to not be affected by turbulence.

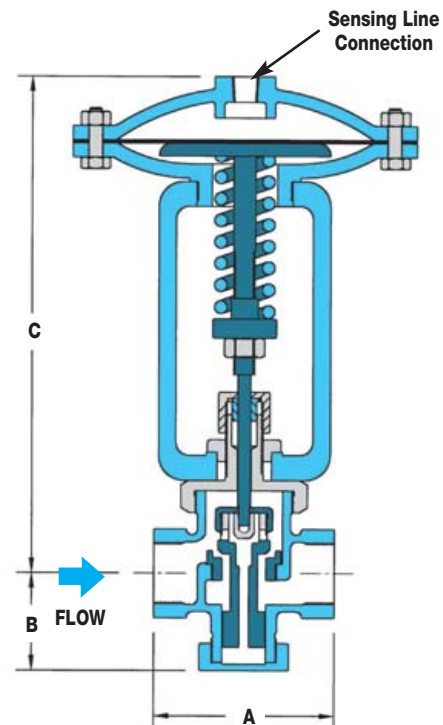
HOW TO SIZE/ORDER

From the Capacity chart, find the inlet pressure and required regulator outlet pressure. Follow across chart to nearest capacity of application service medium that meets or slightly exceeds demand requirements. Follow vertically up to determine appropriate size. When exact application values are not shown, interpolation between values is acceptable. From the Spring Ranges chart, select the ideal spring range that accommodates the required outlet set pressure. Confirm that system pressure requirements can be accommodated by valve. Example:

Application: 1000 lbs/hr of 20 PSIG Steam reduced to 5 PSIG
Size/Model: 1 1/2" **455-Series, 1-6 PSIG spring range**

FEATURES

- Operates with minimum inlet pressures of 5 PSIG
- Stainless steel internals
- Excellent for use in steam systems that contain large amounts of scale and other contamination
- Balance valve for more precise control of downstream pressure



REGULATORS

455 Series

Pressure Regulating Valve

DIMENSIONS & WEIGHTS – inches/pounds

Size	Face-to-Face A			B	C	Sensing Line Connection NPT	Weight (lbs)
	NPT Threaded	125# Flanged	250# Flanged				
1/2"	4 1/4			2 3/8	10 1/4	1/4"	15
3/4"	4 1/4			2 3/8	10 1/4	1/4"	15
1"	4 1/8			2 3/8	10 1/4	1/4"	15
1 1/4"	5			3 1/8	10 3/4	1/4"	18
1 1/2"	5 1/4			3 3/8	11	1/4"	20
2"	9 1/2	10 3/8	10 7/8	5 3/4	18 1/2	3/8"	75
2 1/2"		10 5/8	11 1/4	6 1/4	18 3/4	3/8"	95
3"		10 7/8	11 5/8	7 1/8	19 1/4	3/8"	135
4"		12 1/2	13 1/8	8 1/4	20	3/8"	158

DIRECT-OPERATED
REGULATING VALVES

CAPACITIES – Steam (lbs/hr); Water (GPM)

Inlet/Outlet Pressures (PSIG)

Inlet Press.	Outlet Press.	1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"	
		Steam	Water	Steam	Water	Steam	Water	Steam	Water	Steam	Water	Steam	Water	Steam	Water	Steam	Water	Steam	Water
5	2	53	4.3	95	7.8	191	15.6	276	22.5	403	33.0	572	47.0	890	73.0	1166	95.0	1484	121
	10	95	7.1	171	12.7	342	25.0	494	37.0	722	54.0	1026	76.0	1596	119	2090	156	2660	198
20	5	73	5.6	131	10.1	263	20.0	380	29.0	555	42.0	788	60.0	1226	94.0	1606	123	2044	157
	0-5	157	9.7	283	17.4	565	35.0	816	50.0	1193	75.0	1696	105	2638	163	3454	213	4396	271
30	10	125	7.9	225	14.2	450	28.0	650	41.0	950	60.0	1350	85.0	2100	133	2750	174	3500	221
	0-10	200	11.2	360	20.1	720	40.0	1040	58.0	1520	85.0	2160	121	3360	188	4400	246	5600	313
50	20	145	7.9	261	14.2	522	28.0	754	41.0	1102	60.0	1566	85.0	2436	133	3190	174	4060	221
	25	107	5.6	193	10.1	385	20.0	556	29.0	813	42.0	1156	60.0	1798	94.0	2354	123	2996	157
	0-20	295	13.7	531	24.6	1062	49.0	1534	71.0	2242	104	3186	148	4956	230	6490	301	8260	383
75	30	245	11.2	441	20.1	882	40.0	1274	58.0	1862	85.0	2646	121	4116	188	5390	247	6860	313
	40	185	7.9	333	14.2	666	28.0	962	41.0	1406	60.0	1998	85.0	3108	133	4070	174	5180	221
	0-30	402	16.8	724	30.2	1447	60.0	2090	87.0	3055	127	4342	181	6754	282	8844	369	11256	470
100	50	327	12.5	589	22.5	1177	45.0	1700	65.0	2485	95.0	3532	135	5494	210	7194	275	9156	350
	60	255	9.7	459	17.4	918	35.0	1326	50.0	1938	74.0	2754	105	4284	163	5610	213	7140	271
	0-50	522	17.7	940	31.8	1879	64.0	2714	92.0	3967	134	5638	191	8770	297	11484	389	14616	495
125	60	455	15.8	819	28.5	1638	57.0	2366	82.0	3458	120	4914	171	7644	266	10010	348	12740	443
	80	325	11.2	585	20.1	1170	40.0	1690	58.0	2470	85.0	3510	121	5460	188	7150	246	9100	313
	0-60	635	20.2	1143	36.3	2286	73.0	3302	105	4826	153	6858	218	10668	339	13970	443	17780	564
150	70	575	18.5	1035	33.4	2070	67.0	2990	96.0	4370	141	6210	200	9660	311	12650	408	16100	519
	100	420	12.5	756	22.5	1512	45.0	2184	65.0	3192	95.0	4536	135	7056	210	9240	275	11760	350
	0-70	750	22.4	1350	40.2	2700	80.0	3900	116	5700	170	8100	241	12600	376	16500	492	21000	626
200	100	612	17.7	1102	31.8	2203	64.0	3182	92.0	4651	134	6610	191	10282	297	13464	389	17136	495
	125	435	12.5	783	22.5	1566	45.0	2262	65.0	3306	95	4698	135	7308	210	9570	275	12180	350
	0-100	977	25.0	1759	45.0	3517	90.0	5080	130	7425	190	10552	270	16414	420	21494	550	27356	700
250	125	850	21.7	1530	39.0	3060	78.0	4420	113	6460	165	9180	234	14280	364	18700	476	23800	606
0-125	1180	28.0	2124	50.3	4248	101	6136	145	8968	212	12744	302	19824	470	25960	615	33040	783	

Note: Air in SCFM (Standard Cubic Feet per Minute) = Steam (lbs/hr) x 0.36

REGULATORS

402 & 403 Series

Pressure Regulating Valve

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Model	402	403
Service	Steam & Air	
Sizes	1/2", 3/4", 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 4"	
Connections	NPT, 150# & 300# Flanged	
Body Material	Ductile Iron	
Seat & Disc	Hardened 420 Stainless Steel (55 Rc)	
Max. Inlet Pressure	250 PSIG	450 PSIG
Min. Inlet Pressure	20 PSIG	20 PSIG
Max. Diff. Pressure	150 PSI	250 PSI
Min. Diff. Pressure	15% of Inlet Pressure (10 PSI min)	



402/403
Flanged

DESIGN PRESSURE/TEMPERATURE RATING – PMA/TMA

NPT	450 PSIG @ 650°F
150# FLG	150 PSIG @ 566°F
300# FLG	450 PSIG @ 650°F

TYPICAL APPLICATIONS

The **402** and **403** Series Internally Pilot-Operated Pressure Regulating Valves are used for pressure reduction on steam mains and other process equipment. Pilot-operated regulators will maintain a constant and accurate downstream pressure regardless of fluctuations in supply pressure or usage. These regulators can be supplied with an internal sensing option eliminating the external sensing line.

FEATURES & OPTIONS

- Internal pilot minimizes outlet pressure fluctuations. Outlet pressure remains constant even when load varies
- Internal Sensing option (If requested the regulator can be modified to internally sense pressure eliminating the need for an external sensing line)
- Ductile Iron body to handle increased pressure and temperature
- Hardened stainless steel seat and disc (55 Rc)
- 403 Series regulators use stainless steel wear parts for a higher operating pressure rating (PMO of 450 PSIG)

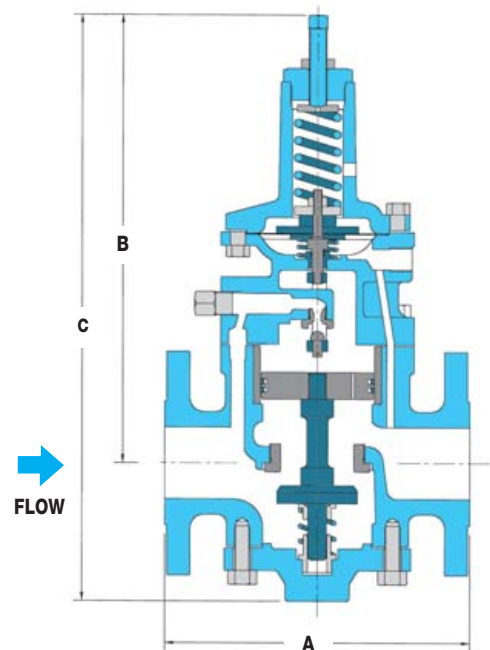
HOW TO SIZE/ORDER

From the Capacity chart, find the inlet pressure and required regulator outlet pressure. Follow across chart to nearest capacity of application service medium that meets or slightly exceeds demand requirements. Follow vertically up to determine appropriate size. When exact application values are not shown, interpolation between values is acceptable. From the Spring Ranges chart, select the ideal spring range that accommodates the required outlet set pressure. Select valve model suitable for system pressure requirements. Specify Internal or External (Remote) sensing. Example:

Application: 12,500 lbs/hr of 300 PSIG Steam reduced to 125 PSIG
Size/Model: 2" 403 Series Valve, 100-200 PSIG spring range,
Specify internal or external sensing

PRESSURE-ADJUSTING SPRING RANGES

Springs	Outlet Pressure (PSIG)	Spring No.	Identifying Colors
Single	0-10	13	blue/yellow
	10-50	14	black/yellow
	40-100	9	red/yellow
	100-200	10	green/blue
	200-280	special	bellville washers
Double	30-125	14	black/yellow
		9	red/yellow
	50-200	9	red/yellow
		10	green/blue



402 & 403 Series Pressure Regulating Valve

DIMENSIONS & WEIGHTS – inches/pounds

Size	Face-to-Face A			Centerline to Top B		Overall Height C		Weight (lbs)
	NPT Threaded	150# Flanged	300# Flanged	Single Spring	Double Spring	Single Spring	Double Spring	
1/2"	4 ¹ / ₂			12	14 ³ / ₈	14 ³ / ₈	16 ³ / ₄	19
3/4"	4 ¹ / ₂			12	14 ³ / ₈	14 ³ / ₈	16 ³ / ₄	19
1"	4 ¹ / ₂			12	14 ³ / ₈	14 ³ / ₈	16 ³ / ₄	19
1 1/4"	8 ³ / ₁₆			12 ³ / ₄	15 ¹ / ₈	16 ¹ / ₈	18 ¹ / ₂	36
1 1/2"	8 ³ / ₁₆			12 ³ / ₄	15 ¹ / ₈	16 ¹ / ₈	18 ¹ / ₂	36
2"	8 ³ / ₄	8 ¹ / ₄	8 ³ / ₄	13	15 ³ / ₈	17 ¹ / ₈	19 ¹ / ₂	50
2 1/2"		9 ¹ / ₈	9 ³ / ₄	13 ³ / ₄	16 ¹ / ₈	18 ¹ / ₄	20 ⁵ / ₈	70
3"		9 ³ / ₄	10 ¹ / ₂	14 ³ / ₄	16 ¹ / ₈	19 ³ / ₄	22 ¹ / ₈	82
4"		13 ¹ / ₂	14	16	18 ³ / ₈	24	26 ³ / ₈	170

DIRECT-OPERATED
REGULATING VALVES

CAPACITIES – Steam (lbs/hr); Air (SCFM)

Inlet/Outlet Pressures (PSIG)

Inlet Press.	Outlet Press.	1/2", 3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"	
		Steam	Air	Steam	Air	Steam	Air	Steam	Air	Steam	Air	Steam	Air	Steam	Air	Steam	Air
20	0-10	175	60	425	145	600	204	850	289	1300	442	2750	935	3850	1309	4900	1666
	0-10	270	88	655	213	924	300	1309	425	2002	650	4235	1375	5929	1925	7546	2450
30	20	203	67	493	162	696	228	986	323	1508	494	3190	1045	4466	1463	5684	1862
	0-20	385	130	935	315	1320	444	1870	629	2860	962	6050	2035	8470	2849	10780	3626
50	30	343	116	833	281	1176	396	1666	561	2548	858	5390	1815	7546	2541	9604	3234
	0-50	690	231	1675	561	2364	792	3349	1122	5122	1716	10835	3630	15169	5082	19306	6468
100	60	637	214	1547	519	2184	732	3094	1037	4732	1586	10010	3355	14014	4697	17836	5978
	80	455	151	1105	366	1560	516	2210	731	3380	1118	7150	2365	10010	3311	12740	4214
125	0-60	865	287	2100	697	2964	984	4199	1394	6422	2132	13585	4510	19019	6314	24206	8036
	70	805	270	1955	655	2760	924	3910	1309	5980	2002	12650	4235	17710	5929	22540	7546
150	100	588	196	1428	476	2016	672	2856	952	4368	1456	9240	3080	12936	4312	16464	5488
	0-70	1019	343	2474	833	3492	1176	4947	1666	7566	2548	16005	5390	22407	7546	28518	9604
200	100	858	287	2083	697	2940	984	4165	1394	6370	2132	13475	4510	18865	6314	24010	8036
	125	609	214	1479	519	2088	732	2958	1037	4524	1586	9570	3355	13398	4697	17052	5978
250	0-100	1337	445	3247	1080	4584	1524	6494	2159	9932	3302	21010	6985	29414	9779	37436	12446
	150	1001	333	2431	808	3432	1140	4862	1615	7436	2470	15730	5225	22022	7315	28028	9310
300	175	739	245	1794	595	2532	840	3587	1190	5486	1820	11605	3850	16247	5390	20678	6860
	0-125	1652	550	4012	1335	5664	1884	8024	2669	12272	4082	25960	8635	36344	12089	46256	15386
400	175	1358	452	3298	1097	4656	1548	6596	2193	10088	3354	21340	7095	29876	9933	38024	12642
	200	1138	378	2763	918	3900	1296	5525	1836	8450	2808	17875	5940	25025	8316	31850	10584
450	0-150	2016	665	4896	1615	6912	2280	9792	3230	14976	4940	31680	10450	44352	14630	56448	18620
	200	2016	665	4896	1615	6912	2280	9792	3230	14976	4940	31680	10450	44352	14630	56448	18620
500	250	1250	417	3035	1012	4284	1428	6069	2023	9282	3094	19635	6545	27489	9163	34986	11662
	0-200	2657	875	6452	2125	9108	3000	12903	4250	19734	6500	41745	13750	58443	19250	74382	24500
600	280	2146	711	5211	1726	7356	2436	10421	3451	15938	5278	33715	11165	47201	15631	60074	19894
	0-225	2975	984	7225	2389	10200	3372	14450	4777	22100	7306	46750	15455	65450	21637	83300	27538
700	280	2975	984	7225	2389	10200	3372	14450	4777	22100	7306	46750	15455	65450	21637	83300	27538

Note: For capacities of other gases multiply the air capacities by the following factors: Argon-0.85 CO₂-0.81 Helium-2.69 Nitrogen-1.02

BACK PRESSURE-RELIEF VALVES

R Series & 10691

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Relief & Back-Pressure Regulating Valves

Model	R Series & *10691 Series
Service	Liquids
Sizes	1/2", 3/4", 1", 1 1/4", 1 1/2", 2", 3"
Connections	NPT
Body & Seat Material	Body: Bronze Seat: Bronze or EPDM*
Valve Material	Stainless Steel (1/2" - 1 1/2") Bronze (2" - 3")
Max. Inlet Pressure	300 PSIG

* For tight shut-off, use Model 10691 with EPDM soft seat. Available in 1/2", 3/4" & 1" sizes only.



Series 10691
Relief Valve has Soft EPDM Seat for tight shut-off in sizes 1/2", 3/4" & 1"

DESIGN PRESSURE/TEMPERATURE RATING – PMA/TMA

NPT 300 PSIG @ 180°F

PRESSURE-ADJUSTING SPRING RANGES

Relief Pressure (PSIG)	Spring No. – Color
1-6 (R only)	4, yellow*
5-35	3, silver
25-100	2, blue
75-300	1, red

*1/2" - 1 1/2" only

DIRECT-OPERATED REGULATING VALVES

TYPICAL APPLICATIONS

The **R Series & 10691 Series** Back Pressure Relief Valves are used in the following applications:

- Water pump bypass for irrigation, sprinkler systems on golf courses, fountains and fire protection systems
- Fuel oil pump bypass on commercial systems or large residential systems

Caution: Not to be used as an emergency or safety relief valve.

FEATURES & OPTIONS

- **Four Springs** – easily interchanged to cover pressures from 1 to 300 PSIG
- **Heavy-duty bronze valve body**
- **10691 Series has EPDM Seat** for tight shut-off (1/2" - 1")

PRESSURE ADJUSTMENT

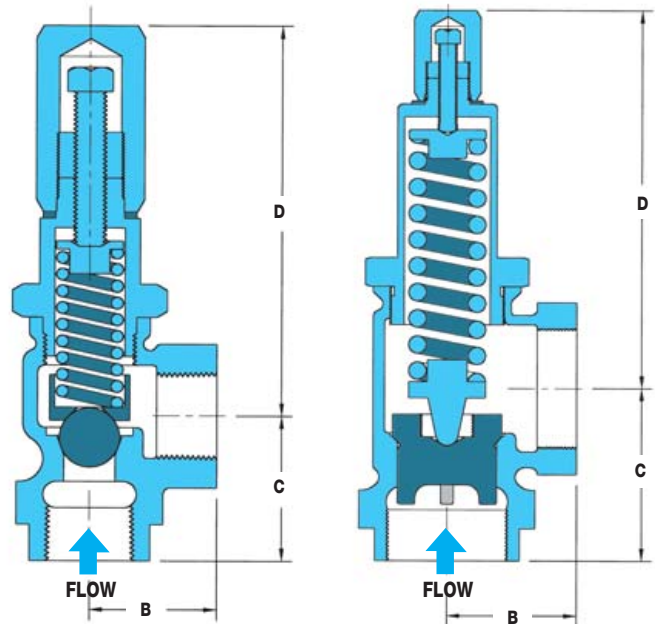
To adjust set pressure of valve, remove top cap, loosen lock nut and adjust pressure with steel setting screw. Rotating the screw clockwise increases the compression on the spring thereby increasing the set pressure. Rotating the screw counter-clockwise lowers the set pressure. Tighten the lock nut and replace top cap and gasket when desired set pressure is reached.

HOW TO SIZE/ORDER

- Specify:
- Regulator: **R-Series** or **10691**
 - Size based on capacity chart
 - Spring range or relief pressure

Examples: **1" R-Series – 5-35 PSIG relief pressure range**
1" R-Series – 20 PSIG (factory set)

Note: Units are not factory set unless specified.



1/2" thru 1 1/2"

2" & 3"

DIMENSIONS & WEIGHTS – inches/pounds

Size	B	C	D	Weight (lbs)
1/2"	1 1/8	1 1/2	3 5/8	1.5
3/4"	1 3/8	1 3/4	5 1/2	2
1"	1 5/8	2 1/4	6	3
1 1/4"	1 7/8	2 3/8	6	6
1 1/2"	2 3/16	2 5/8	6 7/8	8
2"	2 1/2	2 5/16	8 3/4	10
3"	3 7/8	4 1/8	10 7/8	25

Note: Model 10691 available only in sizes 1/2" thru 1".

BACK PRESSURE-RELIEF VALVES

R Series & 10691

Relief & Back-Pressure Regulating Valves

CAPACITIES – Water (GPM)

At 10% Over Set Pressure								
Spring Range (PSIG)	Set Pressure (PSIG)	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"
1-6	3	1.2	2.2	3.2	4.3	5.4	-	-
5-35	10	0.3	0.4	0.4	0.5	0.5	0.6	0.7
5-35	20	0.6	0.7	0.8	1.0	1.1	1.3	1.6
25-100	50	1.0	1.3	1.6	1.8	2.2	2.6	3.2
25-100	75	1.4	1.9	2.3	2.8	3.4	4.0	5.0
75-300	100	1.9	2.5	3.2	3.8	4.6	5.4	6.9
75-300	200	3.4	4.4	5.8	6.9	8.2	9.7	12.3

At 20% Over Set Pressure								
Spring Range (PSIG)	Set Pressure (PSIG)	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"
1-6	3	2.2	3.4	4.6	5.8	7.1	-	-
5-35	10	0.6	0.8	1.1	1.3	1.4	1.8	2.2
5-35	20	1.4	1.9	2.4	3.0	3.4	4.1	4.8
25-100	50	1.8	2.0	3.1	3.8	4.4	5.4	6.4
25-100	75	2.3	3.2	4.0	4.8	5.6	6.9	8.1
75-300	100	3.6	4.2	5.0	6.3	7.0	7.3	8.9
75-300	200	6.5	7.6	9.0	11.2	12.4	13.1	16.0

DIRECT-OPERATED REGULATING VALVES

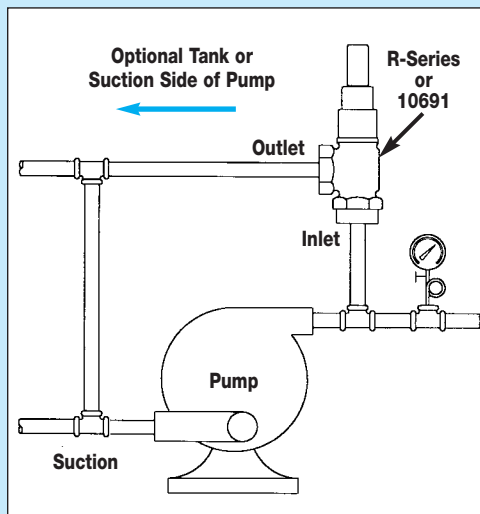
The R Series Relief Valve water capacities at both 10% and 20% over "Set Pressure" are tabulated in the above table. Enter the chart at the desired "Set Pressure" in the gray column and read the capacity in GPM to determine proper Valve Size. Select a spring with a relief range that includes the "Set Pressure" required. **Example: A 1" valve set at 50 PSIG will pass 3.1 GPM if the system pressure exceeds the set point by 20%.**

HOW IT WORKS

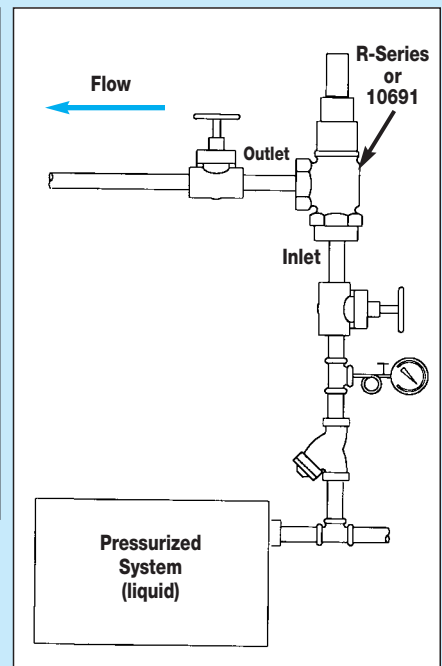
The Relief Valve is actuated by the system pressure on the inlet side of the valve. Valve loading is provided by a spring. The adjustment is done by removing the cap and rotating the screw clockwise or counter-clockwise.

Spring load balances against the opening force of the upstream (or relief) pressure. Valve will open at the slightest increase in pressure above the spring set point, and will close when the excess pressure has been relieved.

The higher the system pressure is above the relief set point pressure, the more flow the valve will pass. It is therefore typical to specify the maximum capacity of a back pressure relief valve at 10% & 20% over set pressure.



A Relief Valve allows water to recirculate through the pump even when the discharge valve on the pump is completely closed. As a rule, a minimum of 20% of the pump capacity must recirculate to prevent overheating of the pumped liquid.



BACK PRESSURE RELIEF VALVES

3040 Series

Relief & Back Pressure Regulating Valve

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Model	3040 Series
Service	Water, Oil, other Liquids, Air
Sizes	1/2", 3/4", 1", 1 1/4", 1 1/2", 2"
Connections	NPT, 125# & 250# Flanged
Body Material	Bronze - 1/2" - 1 1/2" Threaded Cast Iron - 2" Threaded Cast Iron - 2" Flanged
Disc Material	Buna-N/Teflon - 200°F max Viton (optional) - 300°F max
Diaphragm	Neoprene/Nylon - 200°F max Viton (optional) - 300°F max
Max. Inlet Pressure	250 PSIG



DESIGN PRESSURE/TEMPERATURE RATING – PMA/TMA

NPT	300 PSIG @ 200°F
125# FLG	125 PSIG @ 200°F
250# FLG	250 PSIG @ 200°F

TYPICAL APPLICATIONS

The **3040 Series** Back Pressure Valves relieve upstream pressure in a variety of processes. Automatically maintains desired maximum pressure in a vessel or system by relieving excess pressure into lower pressure return line or to atmosphere. Ideally suited for use as pump bypass control valve by maintaining constant pump discharge pressures. Used as a continuously operating valve for protection against overpressure conditions.

CAUTION: Not to be used as an emergency or safety relief valve.

FEATURES & OPTIONS

- Soft Seat for tight shut-off
- Easy maintenance
- Self-contained
- Fast response
- Accurate control
- Optional Viton trim for 300°F service

PRESSURE ADJUSTMENT

Rotating the adjustment screw clockwise increases the compression on the spring, thereby increasing the set pressure. Rotating the adjustment screw counter-clockwise, lowers the set pressure. Tighten lock nut after adjustment.

HOW TO SIZE/ORDER

- Specify:
- Regulator **3040 Series**
 - Size based on capacity chart
 - Spring range or relief pressure

Example: **2" 3040 Series – 5-35 PSIG spring range**

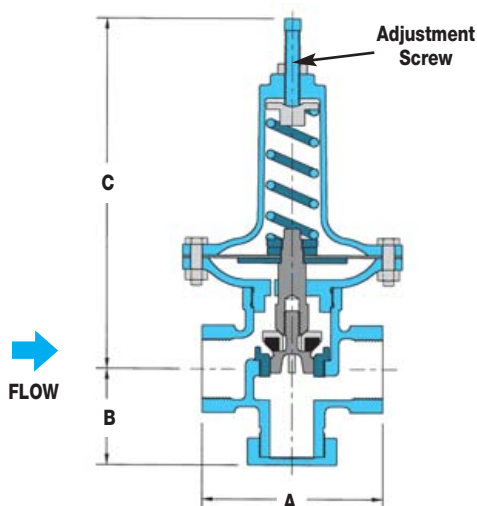
PRESSURE-ADJUSTING SPRING RANGES

Relief Pressure (PSIG)	Spring No.
1-12	4*
5-35	3
20-70	2
40-125	1

* 1/2" - 1" only

DIMENSIONS & WEIGHTS – inches/pounds

Size	Face-to-Face A			B	C	Weight (lbs)
	NPT Threaded	125# Flanged	250# Flanged			
1/2"	4 ¹ / ₈			2 ⁵ / ₁₆	9	10
3/4"	4 ¹ / ₈			2 ⁵ / ₁₆	9	10
1"	4 ¹ / ₈			2 ⁵ / ₁₆	9	10
1 1/4"	4 ¹³ / ₁₆			3 ¹ / ₄	12 ³ / ₄	15
1 1/2"	5 ³ / ₁₆			3 ¹ / ₂	13 ¹ / ₄	17
2"	9 ¹ / ₂	10 ³ / ₈	10 ⁷ / ₈	5 ¹ / ₂	16 ³ / ₄	45



BACK PRESSURE RELIEF VALVES

3040 Series

Relief & Back Pressure Regulating Valve

CAPACITIES – Water (GPM)

		At 10% Over Set Pressure					
Spring Range (PSIG)	Set Pressure (PSIG)	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
1-12	5	4.0	8.0	10.0	–	–	–
5-35	10	5.7	11.4	14.3	29	43	71
5-35	20	8.1	16.2	20.3	41	61	101
20-70	50	12.7	25.4	31.8	64	95	159
40-125	75	15.6	31.2	39.0	78	117	195
40-125	100	18.0	36.0	45.0	90	135	225
40-125	125	20	40	50	100	150	250

		At 20% Over Set Pressure					
Spring Range (PSIG)	Set Pressure (PSIG)	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
1-12	5	4.4	8.8	11.2	–	–	–
5-35	10	6.3	12.5	16.0	32	47	79
5-35	20	8.9	17.8	22.7	45	67	113
20-70	50	14.0	27.	35.6	71	105	177
40-125	75	17.2	34.3	43.7	87	129	217
40-125	100	19.8	39.6	50.4	101	149	250
40-125	125	22	44	56	112	166	278

CAPACITIES – Air (SCFM)

		At 10% Over Set Pressure					
1/2"	3/4"	1"	1 1/4"	1 1/2"	2"		
31	55	111	–	–	–		
39	70	141	203	297	422		
56	100	201	290	424	603		
106	191	381	551	805	1144		
148	266	532	768	1123	1596		
190	341	682	986	1441	2047		
231	416	833	1203	1758	2499		

		At 20% Over Set Pressure					
1/2"	3/4"	1"	1 1/4"	1 1/2"	2"		
32	57	113	–	–	–		
41	73	146	211	308	438		
59	106	212	306	447	635		
114	204	409	591	863	1226		
159	287	573	828	1210	1719		
205	369	737	1065	1556	2212		
250	451	901	1302	1903	2704		

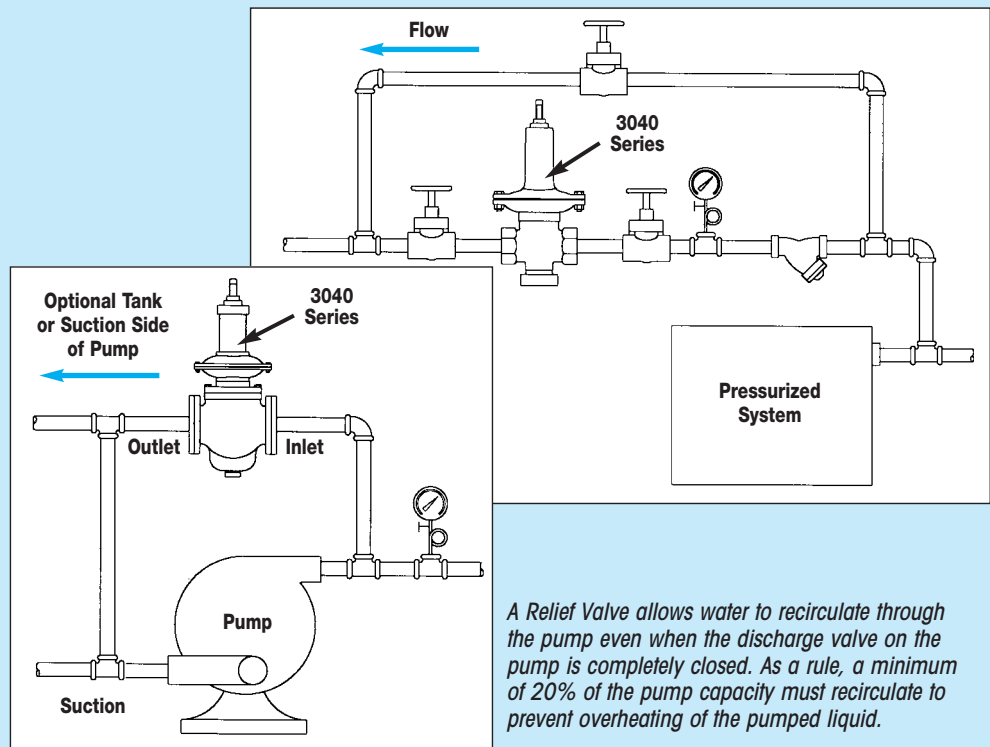
The 3040 Series Relief Valve water and air capacities at both 10% and 20% over "Set Pressure" are tabulated in the above tables. Enter the chart at the desired "Set Pressure" in the gray column and read the capacity in GPM or SCFM to determine proper Valve Size. Select a spring with a relief range that includes the "Set Pressure" required. Example: A 1" valve set at 50 PSIG will pass 35.6 GPM water or 409 SCFM air if the system pressure exceeds the set point by 20%.

HOW IT WORKS

The 3040 Series Back Pressure Valve senses upstream pressure acting on the underside of the diaphragm through a port in the bottom diaphragm case.

An increase in the upstream pressure above the set point will compress the spring and allow the valve to open. The spring will close the valve as the upstream pressure decreases to the set point.

The higher the system pressurizes above the relief set point pressure, the more flow the valve will pass. It is therefore typical to specify the maximum capacity of a back pressure relief valve at 10% & 20% over set pressure.



A Relief Valve allows water to recirculate through the pump even when the discharge valve on the pump is completely closed. As a rule, a minimum of 20% of the pump capacity must recirculate to prevent overheating of the pumped liquid.

DIRECT-OPERATED
REGULATING VALVES

TEMPERATURE REGULATORS

W91/W94 Series

Self-Operated Temperature Regulators

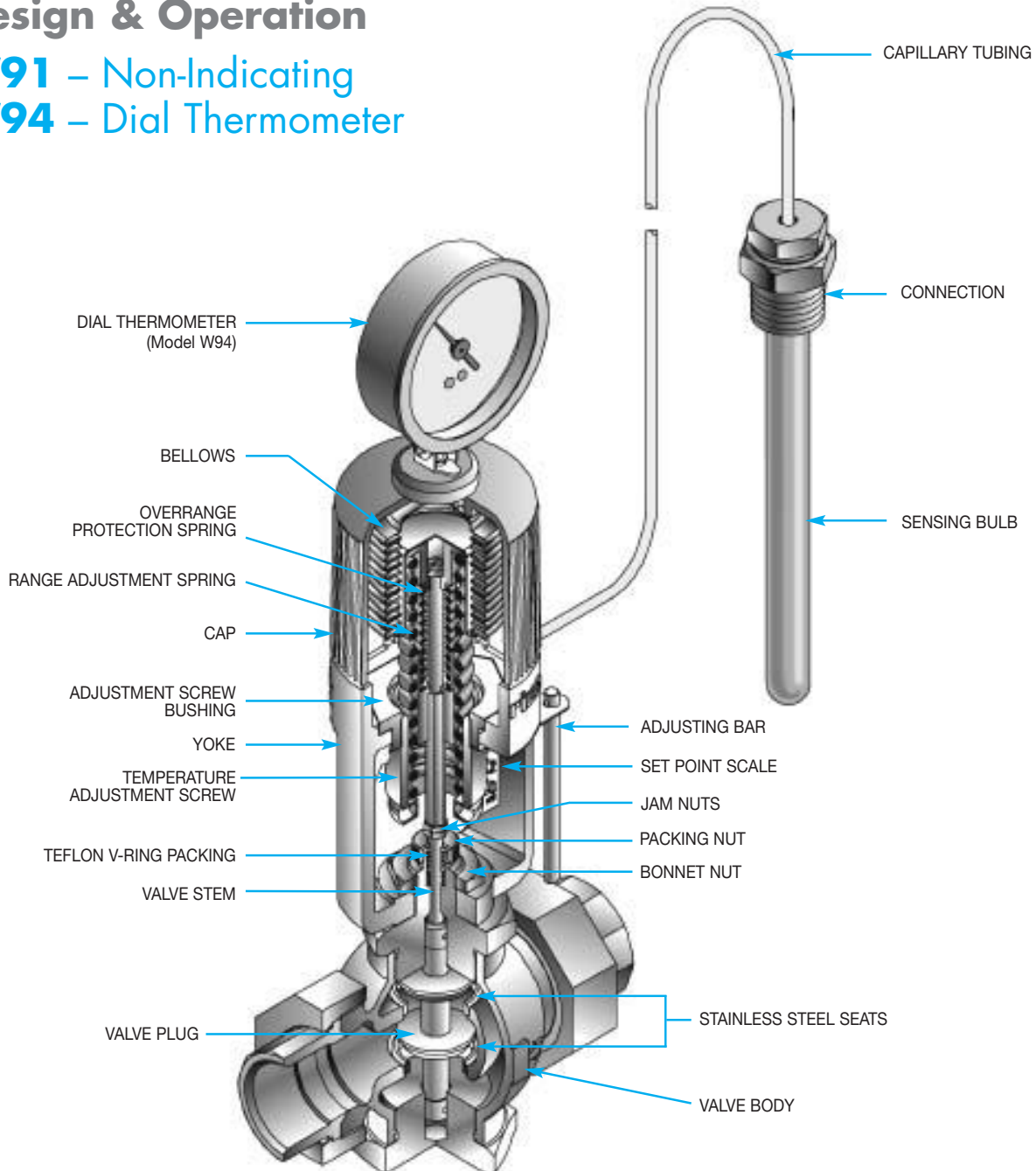
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Design & Operation

W91 – Non-Indicating

W94 – Dial Thermometer

DIRECT-OPERATED
REGULATING VALVES



Housing Assembly

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

TEMPERATURE REGULATORS

W91/W94 Series Self-Operated Temperature Regulators

Design & Operation

Description

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.

Principles 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 a bellows within the unit's actuator housing to expand. As the bellows expands, it compresses a return spring while simultaneously moving the valve stem downward to stroke the valve. When the process temperature decreases (or in the event of thermal system failure), the return spring will move the valve stem upward to the "out" position. The choice of valve action (stem **In-To-Close for Heating** or stem **In-To-Open for Cooling**) will determine the system failure position.

Direct-Acting – HEATING

Direct-Acting actuators are designed to move the valve stem closed (**in-to-close**) as the control signal (temperature) increases.

Reverse-Acting – COOLING

Reverse-Acting actuators are designed to move the valve stem open (**in-to-open**) as the control signal (temperature) increases.

Selecting a Temperature Regulator

The **W91/W94** Temperature Regulator is recommended for controlling the flow on relatively stable systems, where small valve stroke modulations will correct temperature drift. Where sudden or large load changes, or rapid temperature changes occur, a pneumatically or electrically powered Control Valve should be specified. Please consult the Control Valves section of this catalog.

Actuator

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

- **Model W91** is non-indicating.
- **Model W94** is equipped with an integral dial thermometer to indicate sensing bulb temperature.

TEMPERATURE REGULATORS

W91/W94 Series

Self-Operated Temperature Regulators

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Design & Operation

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.

Thermal System Assembly

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

Integral Dial Thermometer

The integral dial thermometer (Model **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" dialface and can be rotated and tilted for maximum readability.

Temperature Range

Nominal ranges from 20°F (-10°C) through 440°F (225°C) are available. The nominal range defines the entire temperature range of the unit. The service conditions and choice of valve style and action will determine the actual operating range (recommended working span) of the unit. The nominal range should be selected so that the set point falls within the recommended working span for the specified valve style and action. Models **W91/W94** include an overrange protection spring, which allows the sensing bulb to be heated 100°F above the upper limit of the unit's nominal range for system cleaning or temporary situations.

Accuracy

The **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. Please consult the Control Valves section of this catalog.

Sensing Bulb Installation:

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

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

TEMPERATURE REGULATORS

W91/W94 Series

Self-Operated Temperature Regulators

Design & Operation

Accuracy (continued)

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.

Valve

W91/W94 Temperature Regulators are available with a wide variety of globe valves in various styles, materials, connections and sizes.

Style

W91/W94 Regulator Valves are offered in single-seated, double-seated and three-way designs:

- **Single-Seated Balanced Valves** are designed for heating applications where tighter shut-off is required. The leakage rate is approximately 0.1% of the maximum capacity.
- **Double-Seated Balanced Valves** are designed for cooling applications where a slight amount of leakage is normally acceptable. Since temperature fluctuations may cause expansion and contraction across the seats, tight shut-off is not always possible. The leakage rate can be up to approximately 0.5% of the maximum capacity.
- **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.

3-Way Valves are of the Sleeve-Type (common port on the bottom). This type is most commonly used for diverting applications; however, due to its design it can also be used for mixing applications. The Sleeve-Type design is constructed with an O-ring around the sleeve. This O-ring is suitable for water or glycol type service, up to a maximum 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.

Thermowell

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

CAUTION:
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 at the set point and provides no power to tightly seat the valve plug. A separate power driven or hand actuated valve is required to ensure tight shut-off when necessary.

CAUTION:
3-Way Valves are not designed for use in steam applications.

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

DIRECT-OPERATED
REGULATING VALVES

TEMPERATURE REGULATORS

W91/W94 Series

Self-Operated Temperature Regulators

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Design & Operation

Action

Single-Seated Valves are available as stem In-To-Close (Normally Open) for Heating applications. Double-Seated Valves are available as stem In-To-Open (Normally Closed) for Cooling applications. 3-Way Valves can be plumbed for either mixing or diverting service.

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

Body & Material and Connection

W91/W94 Temperature Regulators are available with bronze and cast iron valve bodies with Union, Flanged and Threaded connections.

Trim

Valve trim is composed of the stem and plug assembly, and the seats within the ports. Single and double-seated bronze bodied 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 Teflon V-Ring packing, which reduces leakage around the valve stem. V-Ring packing is spring loaded to maintain proper compression and does not require manual adjustment.

Size

The proper sizing of a regulating valve is one of the most important factors in its selection. A valve that is too small will not be able to provide the desired capacity during peak load conditions, while a valve that is too large may overshoot the control point and operate with the valve plug too close to the seat, resulting in undue wear of the plug and seat. The valve coefficient (C_v) is 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. Please consult the Valve Selection section of this catalog.

Valve Coefficient (C_v):

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

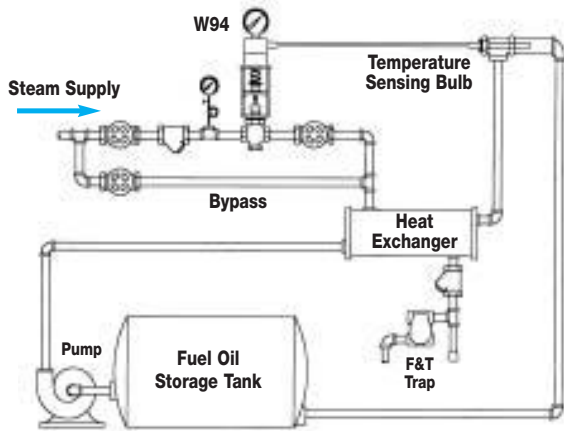
TEMPERATURE REGULATORS

W91/W94 Series

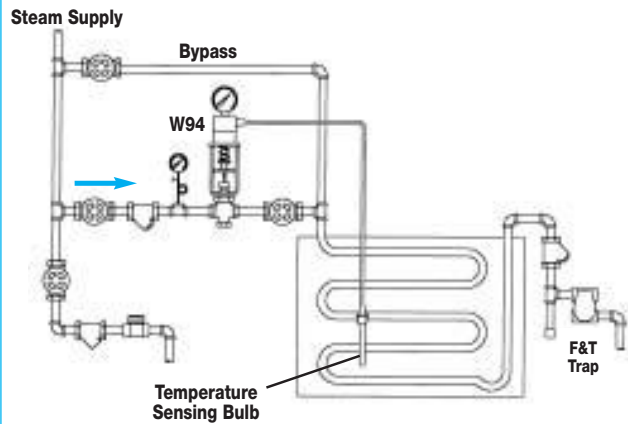
Self-Operated Temperature Regulators

Typical Applications for Temperature Regulators

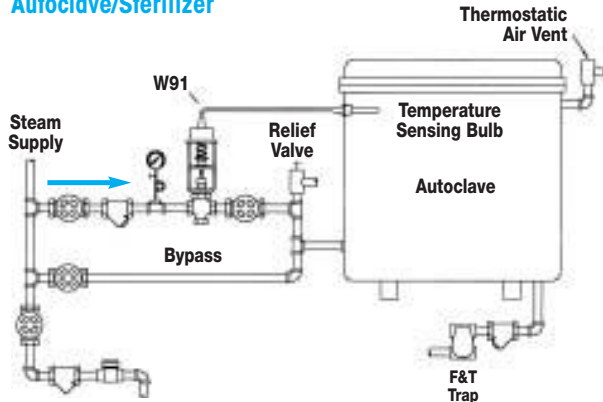
W94 Heating Fuel Oil To Proper Temperature



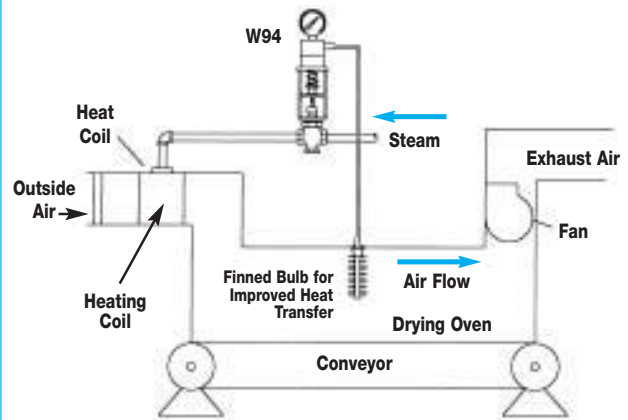
W94 Elevating Temperature Of A Plating Or Finishing Tank



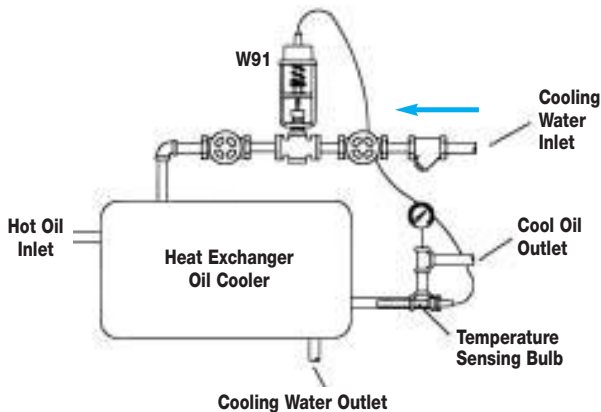
W91 Used for Regulating Steam Flow In An Autoclave/Sterilizer



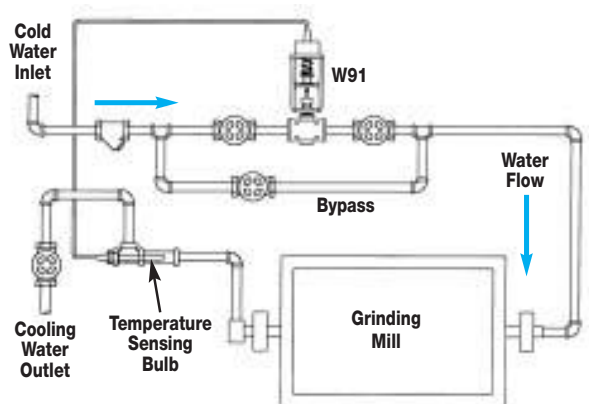
W94 Used In A Drying Oven Application



W91 Used to Reduce Oil Temperature In A Heat Exchanger



W91 Used To Control Water Flow In A Grinding Mill For Temperature Reduction



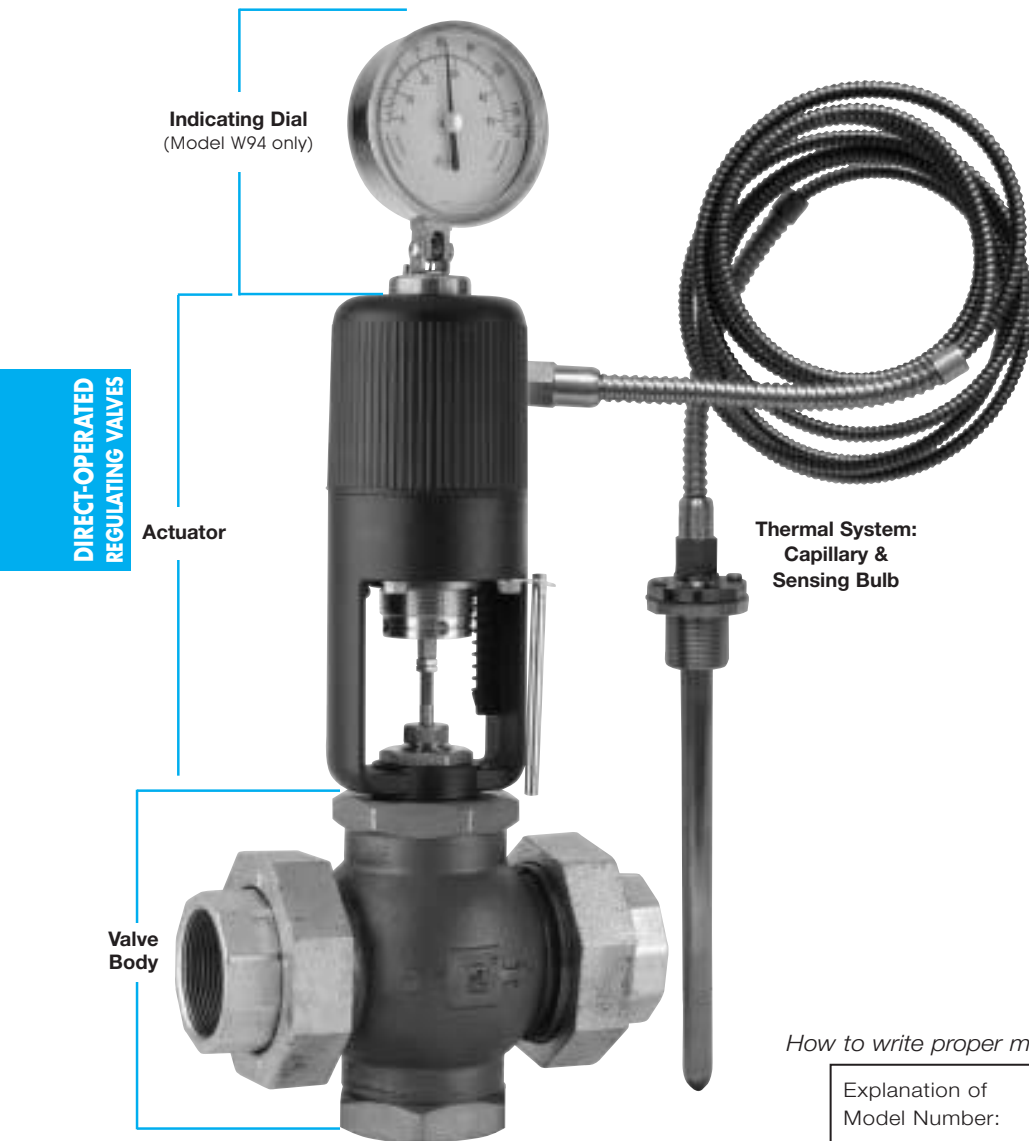
DIRECT-OPERATED
REGULATING VALVES

TEMPERATURE REGULATORS

W91/W94 Series

Self-Operated Temperature Regulators

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- ▶ Self-Operating Design
- ▶ Indicating & Non-Indicating Models Available
- ▶ Heavy Duty Die Cast Aluminum Housing
- ▶ 1/2" thru 4" Valve Sizes
- ▶ Fully Enclosed Bellows
- ▶ Internal Overrange protection

The **W91 & W94** Self-Operating Temperature Regulators are 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 overrange protection.

- ▶ Model **W91** (without indicating dial) features a lower profile and should be specified where space constraints may be an issue.
- ▶ Model **W94** (with indicating dial) will allow the operator to verify the process temperature and to aid in temperature adjustment.

Thermowells:

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

How to write proper model number:

Explanation of Model Number:	W91	06	08	S15	175-13
	model	temp. range	cap. length	bulb type	valve body
Model Number:	W910608S15175-13				

HOW TO ORDER

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

Note: Thermowells are ordered separately.
See page 175 for model numbers & lengths.

TEMPERATURE REGULATORS

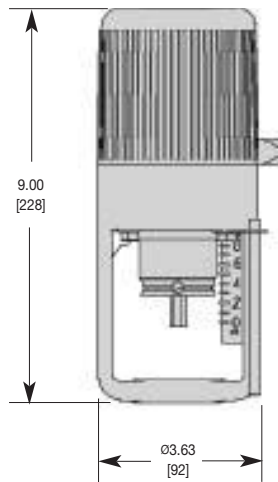
W91/W94 Series

Self-Operated Temperature Regulators

Model	W91/W94
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

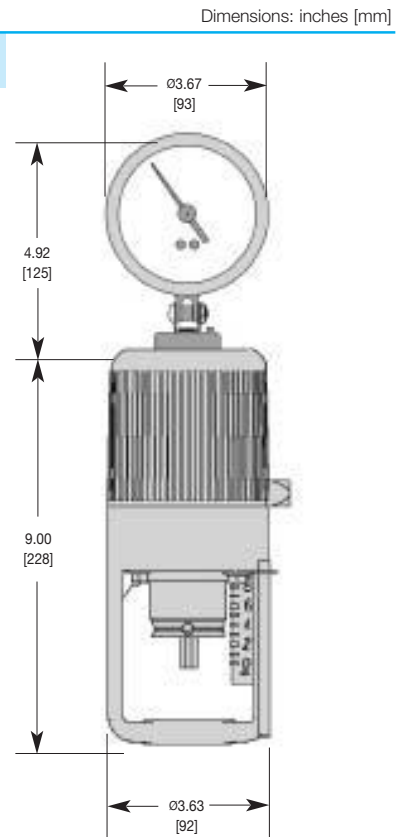
W91

Non-Indicating Actuator



W94

Indicating Actuator



DIRECT-OPERATED
REGULATING VALVES

Specifications

Actuator Models

W91 - Non-Indicating
W94 - Indicating Dial

Dial Thermometer

3 1/2" dial, stainless steel case, swivel and angle adjustment (Model W94 only)

Housing

Die cast aluminum, epoxy powder coated blue finish

Bellows

High pressure brass, corrosion resistant, tin plated finish

Overrange Protection

Upper range limit +100°F for temporary situations

Approximate Shipping Weight

Actuator

W91 6.0 lbs [2.7 kg]
W94 6.6 lbs [3.0 kg]

Valve

See Valve Selection tables

TEMPERATURE REGULATORS

W91/W94 Series

Self-Operated Temperature Regulators

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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
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

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

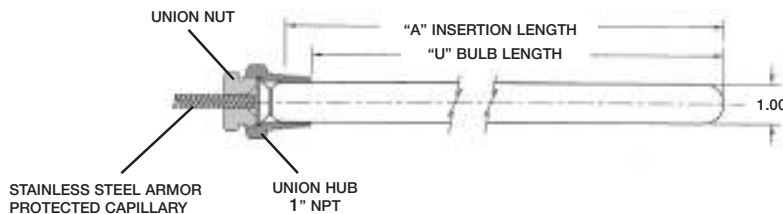
Bulb & Capillary Style

ORDER CODE	Connection Style & Material	Bulb Material	Capillary Tubing Material	Capillary Length in Ft.			
				8, 12, 16	20	24	
S15	Brass Union Hub	Copper	Copper with Stainless Steel Spiral Armor	A	13"	16"	20"
				U	12.25"	15.25"	19.25"
S16	Stainless Steel Union Hub	Stainless Steel	Stainless Steel with Stainless Steel Spiral Armor	A	13"	16"	20"
				U	12.25"	15.25"	19.25"

Other Options available. Consult Factory.

Bulb Installation: (refer to diagram below)

The 1" NPT Union Hub is not physically attached to the bulb. The 1" NPT Union Hub is threaded into a tank or vessel. The bulb slides thru the 1" NPT Union Hub and is held in place and sealed with the Union Nut, which freely turns on the stainless steel armor protected capillary. When using a Thermowell, the 1" NPT Union Hub is discarded and the Union Nut threads into the Thermowell.



DIRECT-OPERATED REGULATING VALVES

TEMPERATURE REGULATORS

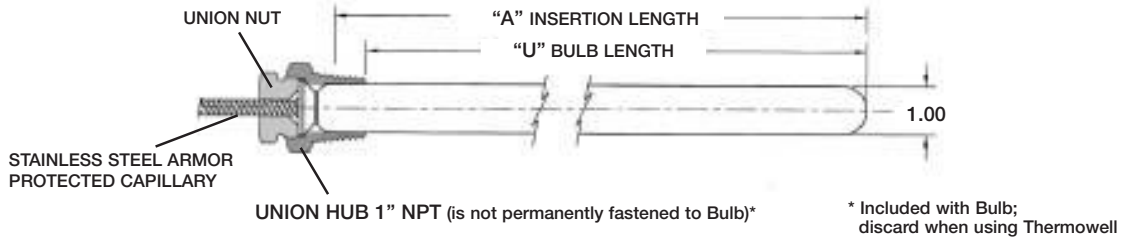
W91/W94 Series

Self-Operated Temperature Regulators

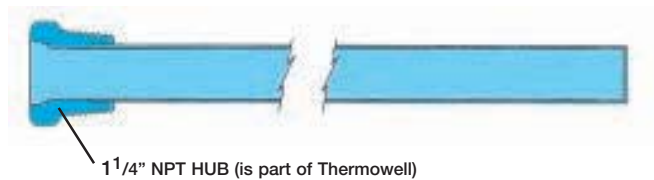
Thermowell Selection

Dimensions (inches)

BULB

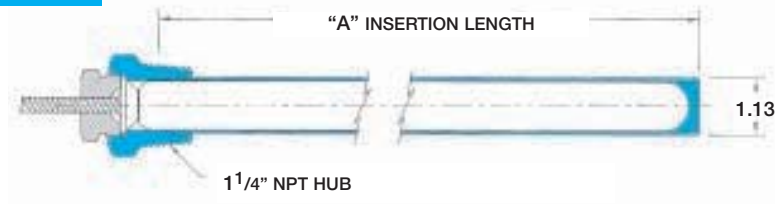


THERMOWELL



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

BULB inside THERMOWELL



For applications in which the process media may be corrosive or contained under pressure, the use of a thermowell is required to prevent damage to the sensing bulb. A thermowell will also facilitate the removal of the sensing bulb and thermal system from the operating process. Because the sensing bulb is isolated from the fluid, this allows the sensing bulb to be removed without having to drain the liquid below the bulb insertion point.

THERMOWELLS - Model Numbers & Lengths

Brass Model No.	Stainless Steel Model No.	Nominal Length	"A" INSERTION LENGTH (in.)		Capillary Length in Feet
			BULB	THERMOWELL	
536-S2	536-S6	13"	12.25	13.00	8, 12 or 16
536-SE2	536-SE6	16"	15.25	16.00	20
536-WE2	536-WE6	20"	19.25	20.00	24

- Notes:
- 1) Other connections and lengths may be available, consult factory.
 - 2) External pressure rating on Brass is 500 PSI max.
 - 3) External pressure rating on 316 SS is 1000 PSI max.

DIRECT-OPERATED REGULATING VALVES

TEMPERATURE REGULATORS

W91/W94 Series

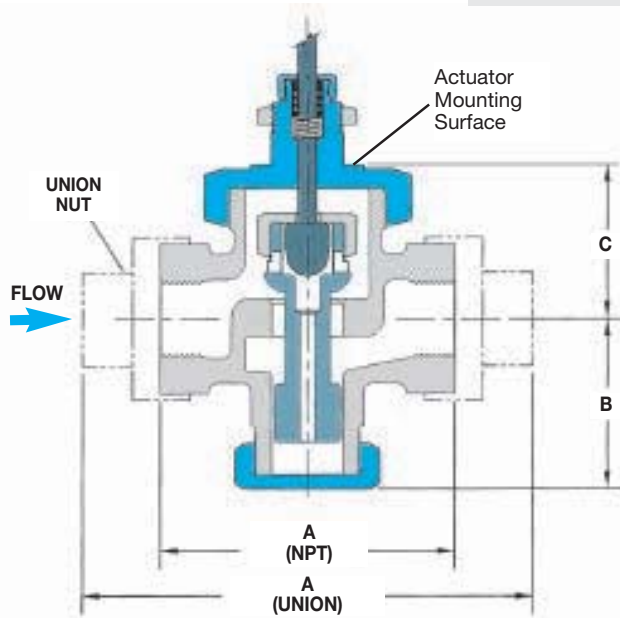
Single Seated Valve Bodies

HEATING

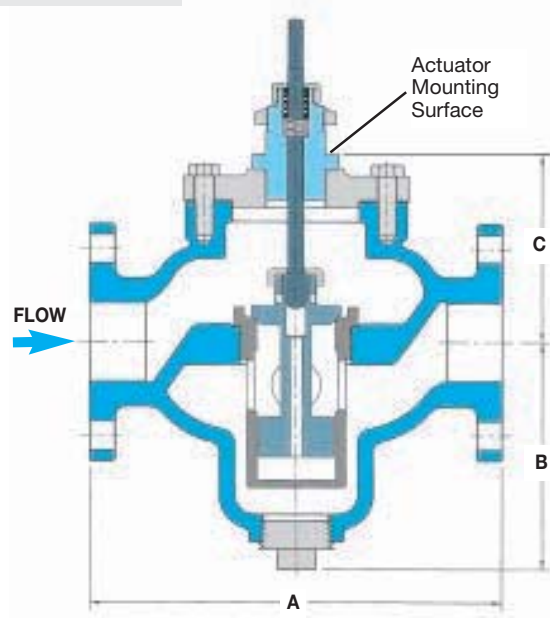
Single Seat • 1/2" – 4"

Dimensions in inches

Stem In-To-Close for Heating



THREADED & UNION



FLANGED

DIRECT-OPERATED
REGULATING VALVES

Specifications

Body Material	Trim Material	Connection	Pressure & Temperature Rating
1/2" - 1 1/2" Bronze/Stainless	Stainless Steel	Threaded or Malleable Iron Union Ends	125 PSI @ 450°F
2" Cast Iron	Stainless Steel	Threaded	250 PSI @ 450°F
2" - 4" Cast Iron	Stainless Steel	125# Flanged	125 PSI @ 450°F
		250# Flanged	250 PSI @ 450°F

Valve Body Selection

Valve Body Number (In-To-Close Heating)		Size Connection	Capacity Cv	Maximum Close-Off Pressure (PSI ΔP)	Dimensions						Approx. Ship. Wt. (lbs) [kg]	
NPT	Union				A Threaded	A 125# FLG	A 250# FLG	A Union	B	C		
175-12-N	175-12-U	1/2"	3.2	250	4.125	x	x	6.50	2.375	2.12	14 [6.35]	
175-13-N	175-13-U	3/4"	6.3	250	4.125	x	x	6.50	2.375	2.12	14 [6.35]	
175-14-N	175-14-U	1"	10.8	200	4.125	x	x	7.00	2.375	2.12	14 [6.35]	
175-15-N	175-15-U	1 1/4"	15.9	200	4.81	x	x	7.50	3.25	2.50	17 [7.7]	
175-16-N	175-16-U	1 1/2"	22.4	200	5.19	x	x	8.00	3.50	2.69	18 [8.2]	
175-17-N		2"	33.1	150	9.50	x	x	x	5.75	4.75	50 [22.7]	
FLANGED				Valve Type								
125#	250#			Standard	Special							
175-17-125	175-17-250	2"	33.1	150	-	x	10.375	10.875	x	5.75	4.75	80 [36.3]
175-18-125	175-18-250	2 1/2"	47.5	65	150	x	10.625	11.25	x	7.00	5.00	96 [43.6]
175-19-125	175-19-250	3"	68.2	50	150	x	10.875	11.625	x	8.00	5.75	110 [49.9]
175-20-125	175-20-250	4"	109.5	40	150	x	10.50	13.125	x	8.75	6.50	160 [72.6]

Note: For 2 1/2" - 4" sizes, consult factory for proper actuators.

TEMPERATURE REGULATORS

W91/W94 Series

Capacity Chart for Single Seated Valves

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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"
	175-12	175-13	175-14	175-15	175-16	175-17	175-18	175-19	175-20
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							

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)

DIRECT-OPERATED REGULATING VALVES

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

CAPACITIES – Water (GPM)				SINGLE SEATED VALVES					
Pressure (PSI ΔP)	Size & Valve Body Number								
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
	175W-12	175W-13	175W-14	175W-15	175W-16	175W-17	175W-18	175W-19	175W-20
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							

Note: When 175 Type Single Seated Valves are used with water, add **W** to the Valve Body Number.

Example:
175-17-N becomes 175W-17-N

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)

TEMPERATURE REGULATORS

W91/W94 Series

Steam Required for Heating Water

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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°

DIRECT-OPERATED REGULATING VALVES

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 BTU Load is Known	Capacity of steam required (lbs/hr)	= $\frac{\text{BTU}}{1000}$
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)	= $\frac{\text{GPM} \times \text{Temp Rise } ^\circ\text{F}}{2}$
When Heating Fuel Oil with Steam	Capacity of steam required (lbs/hr)	= $\frac{\text{GPM} \times \text{Temp Rise } ^\circ\text{F}}{4}$
When Heating Air with Steam Coils	Capacity of steam required (lbs/hr)	= $\frac{\text{CFM} \times \text{Temp Rise } ^\circ\text{F}}{900}$

TEMPERATURE REGULATORS

W91/W94 Series

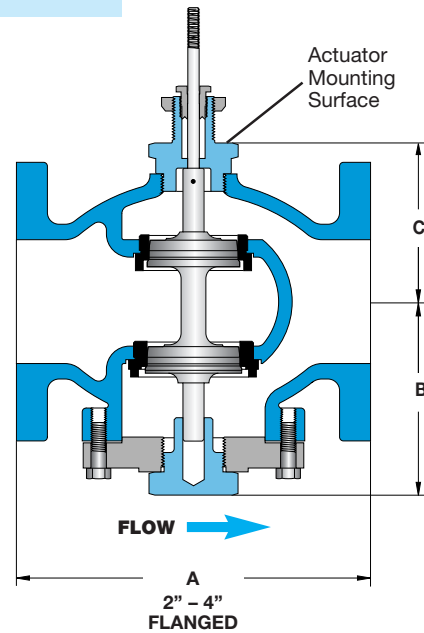
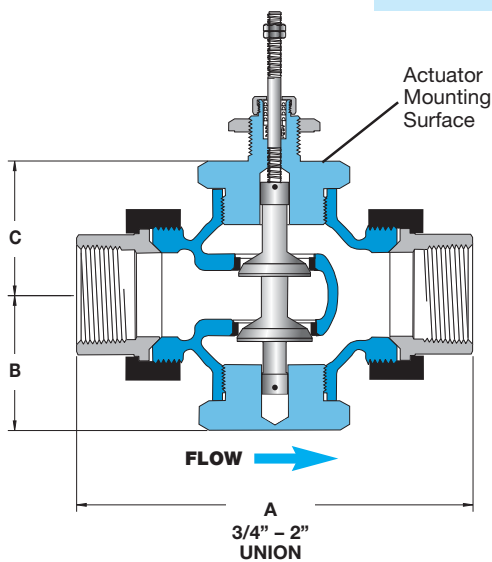
Double Seated Valve Bodies

COOLING

Dimensions in inches [mm]

Double Seat • 3/4" – 4"

Stem In-To-Open
for Cooling



DIRECT-OPERATED
REGULATING VALVES

Specifications

Body Material	Trim Material	Trim Style 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)

Valve Body Selection – Threaded

Valve Body Number (In-To-Open Cooling)	Size		Capacity C _v	Maximum Close-Off Pressure (PSI ΔP)	Dimensions			Approximate Shipping Wt. (lbs) [kg]
	Connection (NPT)	Nominal Port			A	B	C	
A24	3/4	3/4"	8	250	5.6 [142]	2.3 [58]	2.3 [58]	5.0 lbs [2.25 kg]
A33	1	1"	12	250	6.0 [152]	2.3 [58]	2.3 [58]	6.1 lbs [2.75 kg]
A44	1 1/4	1 1/4"	21	250	7.2 [183]	2.6 [66]	2.6 [66]	10.1 lbs [4.55 kg]
A55	1 1/2	1 1/2"	30	250	7.7 [196]	2.6 [66]	2.6 [66]	11.1 lbs [5.00 kg]
A66	2	2"	47	250	8.6 [218]	3.1 [79]	3.1 [79]	17.0 lbs [7.65 kg]

Valve Body Selection – Flanged

Valve Body Number (In-To-Open Cooling)	Size		Capacity C _v	Maximum Close-Off Pressure (PSI ΔP)	Dimensions			Approximate Shipping Wt. (lbs) [kg]
	Connection	Nominal Port			A	B	C	
B74	2 1/2"	2 1/2"	69	65	7.8 [198]	4.8 [122]	5.4 [137]	45 lbs [20 kg]
B79	3"	3"	90	50	9.0 [229]	5.0 [127]	5.6 [142]	70 lbs [32 kg]
B84	4"	4"	196	40	11.4 [290]	6.3 [160]	6.5 [165]	100 lbs [45 kg]

TEMPERATURE REGULATORS

W91/W94 Series

Capacity Chart for Double Seated Valves

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COOLING

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"
	A24 ITO Cv = 8	A33 ITO Cv = 12	A44 ITO Cv = 21	A55 ITO Cv = 30	A66 ITO Cv = 47	B74 ITO Cv = 69	B79 ITO Cv = 90	B84 ITO 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			

ITO = In-to-Open

DIRECT-OPERATED
REGULATING VALVES

TEMPERATURE REGULATORS

W91/W94 Series

BRONZE

3-Way Valve Bodies

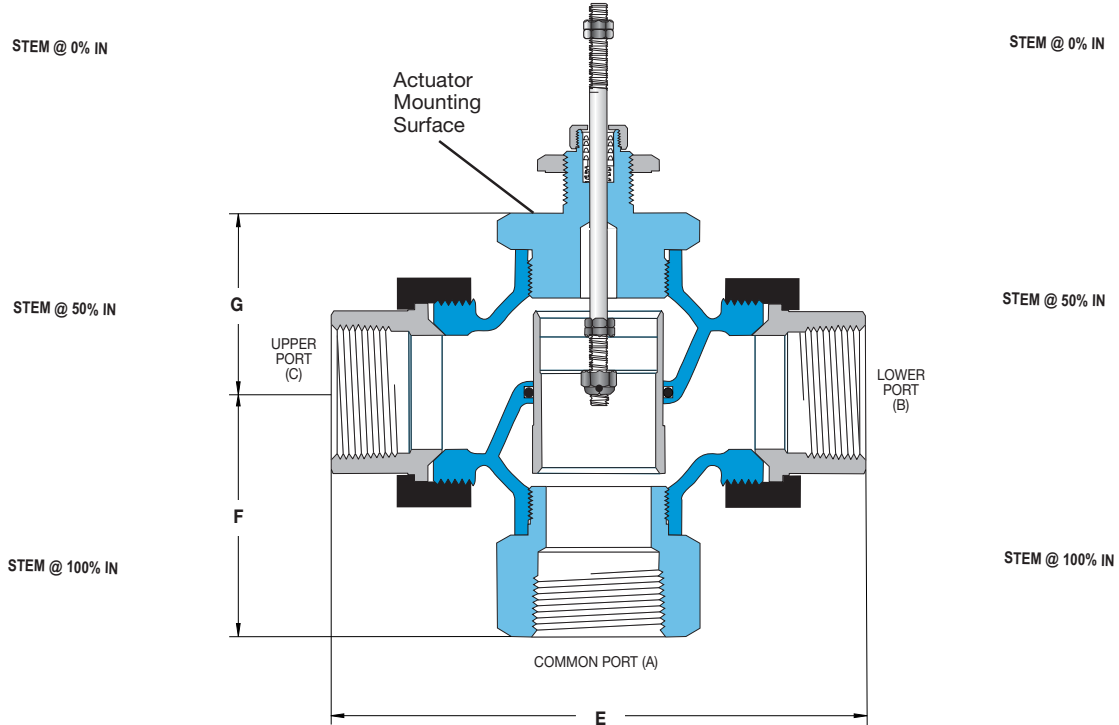
Dimensions in inches [mm]

3-Way • 1/2" – 2"

for Mixing or Diverting

MIXING FLOW DIAGRAM

DIVERTING FLOW DIAGRAM



DIRECT-OPERATED
REGULATING VALVES

CAUTION: 3-Way Valves are not designed for use in steam applications. To properly control the mixing of two flows, inlet pressures at ports B and C should be as equal as possible.

Specifications

Body Material	Trim Material	Connection	Pressure & Temperature Rating
Bronze	Bronze	Threaded with Malleable Iron Union Ends	250 PSI @ 300°F (149°C)

Valve Body Selection

Valve Body Number	Size		Capacity C _v	Maximum Close-Off Pressure (PSI ΔP)	Dimensions			Approximate Shipping Wt.
	Connection (NPT)	Nominal Port			E	F	G	
A18	1/2"	1/2"	2.8	250	4.8 [122]	1.8 [46]	1.8 [46]	2.9 lbs [1.31 kg]
A25	3/4"	3/4"	5.6	250	5.6 [142]	2.3 [58]	2.3 [58]	4.7 lbs [2.12 kg]
A34	1"	1"	8.4	250	6.0 [152]	2.3 [58]	2.3 [58]	5.7 lbs [2.57 kg]
A45	1 1/4"	1 1/4"	15	250	7.2 [183]	2.8 [71]	2.6 [66]	9.5 lbs [4.28 kg]
A56	1 1/2"	1 1/2"	21	250	7.7 [196]	3.5 [89]	2.6 [66]	11.1 lbs [5.00 kg]
A67	2"	2"	33	250	8.6 [218]	4.1 [104]	3.1 [79]	16.7 lbs [7.55 kg]

TEMPERATURE REGULATORS

W91/W94 Series

3-Way Valve Bodies

CAST IRON

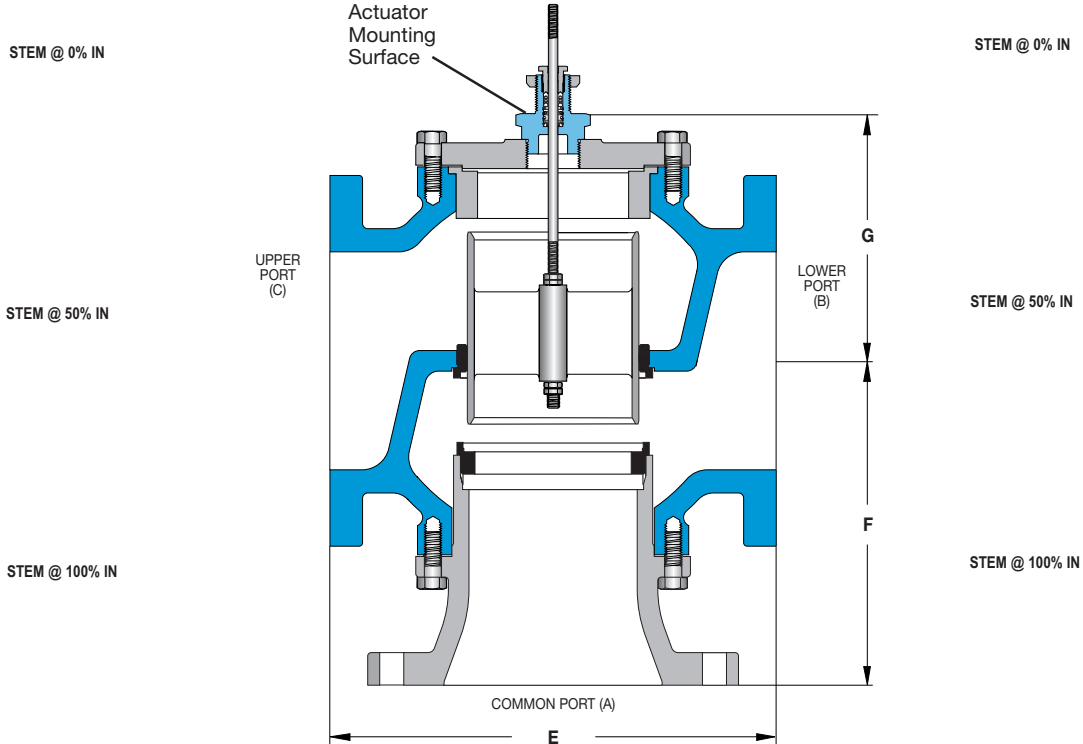
3-Way • 2 1/2" – 4"

Dimensions in inches [mm]

for Mixing or Diverting

MIXING FLOW DIAGRAM

DIVERTING FLOW DIAGRAM



DIRECT-OPERATED
REGULATING VALVES

CAUTION: 3-Way Valves are not designed for use in steam applications. To properly control the mixing of two flows, inlet pressures at ports B and C should be as equal as possible.

Specifications

Body Material	Trim Material	Connection	Pressure & Temperature Rating
Cast Iron	Bronze	125# Flanged	125 PSI @ 300°F (149°C)

Valve Body Selection

Valve Body Number	Size		Capacity C _v	Maximum Close-Off Pressure (PSI ΔP)	Dimensions			Approximate Shipping Wt.
	Connection	Nominal Port			E	F	G	
B75	2 1/2"	2 1/2"	58	125	9.0 [229]	7.1 [180]	5.2 [132]	62 lbs [28 kg]
B80	3"	3"	72	125	10.0 [254]	8.0 [203]	6.0 [152]	80 lbs [36 kg]
B85	4"	4"	102	125	13.0 [330]	10.0 [254]	6.9 [175]	140 lbs [64 kg]

TEMPERATURE REGULATORS

W91/W94 Series

Capacity Chart for 3-Way Valves

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.

DIRECT-OPERATED
REGULATING VALVES