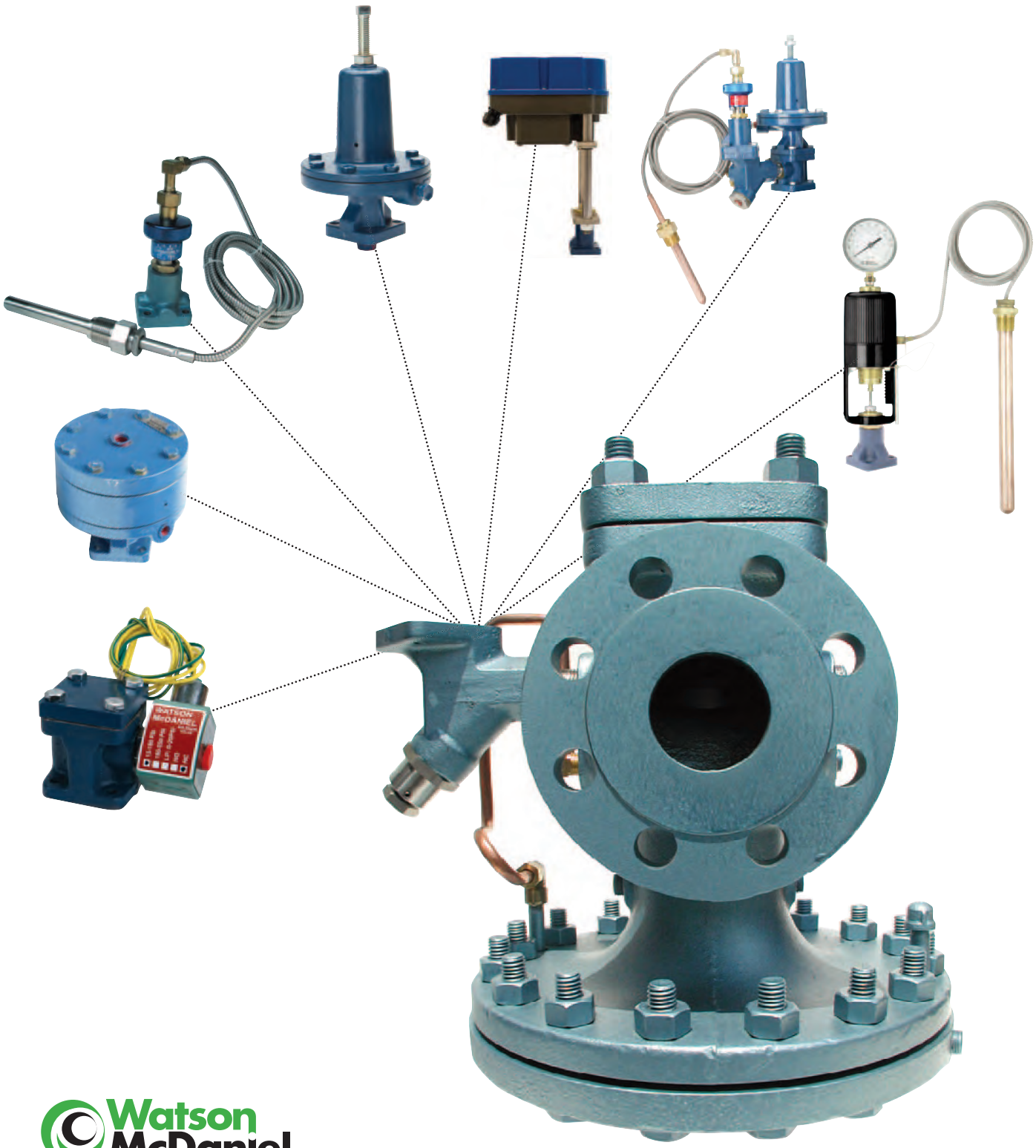
Pilot-Operated Regulating Valves



Watson McDaniel

HD Regulating Valve & Pilots

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HD Main Valve
Ductile Iron

Most Common HD Pilots

PP & PP5
PRESSURE
Spring-Loaded

PT
TEMPERATURE
Liquid Filled

PA
PRESSURE
Air-Loaded

PS
On/Off
(Solenoid)

HD Main Valve is used in conjunction with the appropriate Pilot(s) to control Steam Pressure or Process Temperature

Other HD Pilots

PTRP
TEMPERATURE

PTR & PTL
TEMPERATURE
Controllers

PBP
BACK PRESSURE

PDP
DIFFERENTIAL PRESSURE

TSP
TRIP-STOP PRESSURE

EP
ELECTRONIC CONTROL

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PA-Pressure Pilot (Air-Loaded)	Air-loaded Pressure Pilot can be used instead of spring-loaded PP pilots for pressure regulation in remote installations. Also used in conjuction with PTR & PTL temperature controllers.	234
PS-Solenoid Pilot	Solenoid Pilot can be used in conjunction with any of the listed pilots for electrical on/off control of HD Regulators.	238
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HD Regulator with PP-**PRESSURE** Pilot

HD Regulator with PT-**TEMPERATURE** Pilot

HD Regulator with PP-**PRESSURE** Pilot & PT-**TEMPERATURE** Pilot

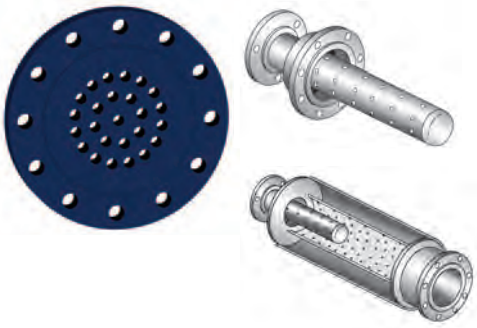
HD Regulator with PTRP- **TEMPERATURE** Pilot

HSP & HSP-SS Series Pressure Regulators • Cast Steel • Stainless Steel 250

The Watson McDaniel HSP Pilot-Operated Pressure Regulating Valve is constructed of Cast Carbon Steel for higher pressure and temperature ratings when compared to ductile iron. The HSP-SS is constructed of Stainless Steel for increased corrosion resistance.

Available with other pilots such as Temperature, Electric, Back Pressure, Trip-Stop, etc.

Accessories for Pilot-Operated Regulators 254-257



Noise Attenuators for HD & HSP Regulators: Reduces noise in pressure reducing applications 254

Insulation Blankets for HD & HSP Regulators. Protects personnel and reduces noise. 257

Capacity Charts for HD, HSP & HSP-SS Pilot-Operated Regulators 258

DL Series Pressure Regulators • Ductile Iron • Cast Steel • Stainless Steel 260

The Watson McDaniel DL Series Dome-Loaded Regulator is used mainly to Reduce Steam Pressure. No pilot is needed as it can be direct-loaded with air or inert gas for simple and accurate control of downstream steam pressure.

Available in Ductile Iron, Carbon Steel, or Stainless Steel as well as other options for steam pressure control.

Introduction

The **HD-Series Pilot-Operated Regulators** are used on steam applications for pressure reduction or controlling product temperature (when steam is used in heating applications). The Pilot-operated regulators are more accurate and available in higher capacity than Direct-Operated regulators. The HD Series regulators use a pilot valve (several types and styles including Pressure, Temperature, ON-OFF solenoid, etc) to control the operation of the Main Valve. The HD series has a Ductile Iron Body; Pilot and Main-Valve are selected separately.

The **HSP Pressure Regulator** has a Cast Carbon Steel body; standard is with pressure pilot. Other pilots available; Consult factory.

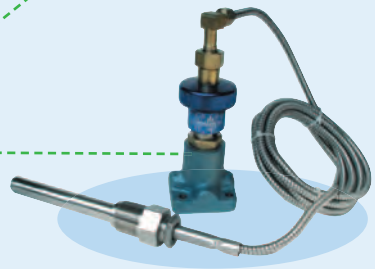
1) Select HD Main Valve

The HD Series Pilot-Operated Regulating Valves are used for controlling pressure and temperature in industrial and HVAC steam applications.

2) Select HD Pilot(s)

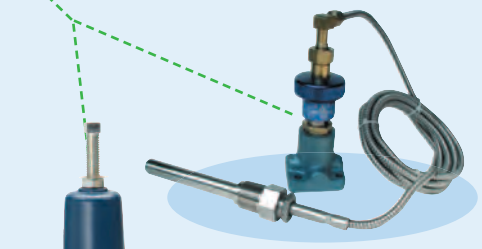
Model: **PP**

For Pressure Control
- HD Main Valve *with*
- PP Pressure Pilot



Model: **PT**

For Temperature Control
- HD Main Valve *with*
- PT Temperature Pilot



Model: **PT**

Model: **PP**

For Combination Pressure & Temperature Control
- HD Main Valve *with*
- PT Pressure Pilot &
- PP Temperature Pilot

Typical Applications

- **Pressure** Regulating
- **Temperature** Regulating
- **Pressure-Temperature** Control
- **Back Pressure** Control
- **Differential Pressure** Control

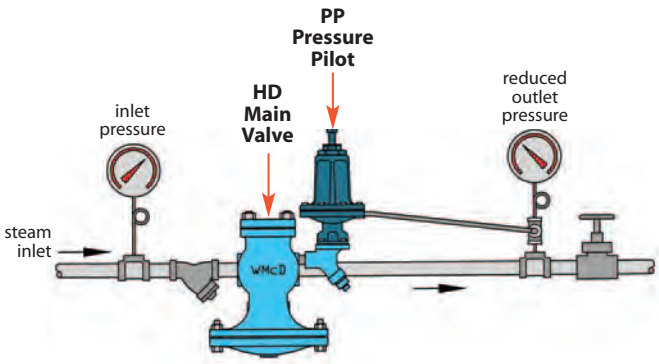
Combination Pilots

The HD-Series Steam regulating valve can be used with up to three pilots simultaneously to control the operation of the valve. An example is when steam is used to heat water in a Heat Exchanger. The Temperature Pilot will maintain precise control of outlet water temperature by controlling the amount of steam flow through the valve while a Pressure Pilot limits the maximum outlet steam pressure of the regulator to the Heat exchanger. A third pilot (Solenoid pilot) can be added to electrically activate or de-activate the system.

HD Main Valve
with
PP-Pressure Pilot

Reducing Pressure

Several choices of pilot valves can be used for pressure reduction on steam applications. The opening of the pressure pilot controls the operation of the Main Valve. The PP & PP5 are referred to as spring loaded pressure pilots because an adjustable control spring is used to apply the opening force to the pilot valve. Pressure adjustment screw is located on top of pressure pilot. The PA pilot is referred to as an Air Loaded pressure pilot because Air Pressure is used to apply the opening force to the pilot valve. The PA pilot allows for convenient and remote adjustment of steam pressure using a small air regulator.

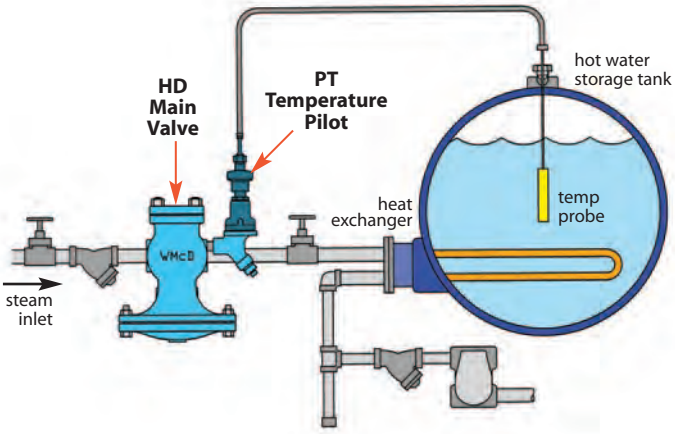


HD Main Valve
with
PT-Temperature Pilot

Controlling Temperature

When steam is used on heating applications, several choices of pilots are available. The PT pilot (most common) is referred to as a "solid liquid fill" and contains a temperature probe connected by a length of capillary tubing to a bellows in the pilot valve. When the temperature bulb is heated the liquid inside the probe expands the bellows and closes off the pilot valve. PTRP pilot operates in a similar fashion except this style is referred to as a vapor tension unit.

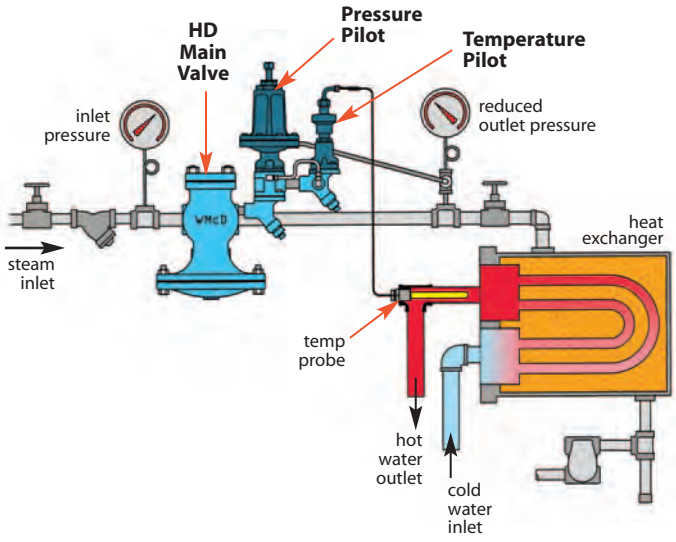
The PTL temperature controller uses a bi-metal element to sense temperature and deliver an appropriate air signal to a PA air pilot that controls the operation of the HD main valve.



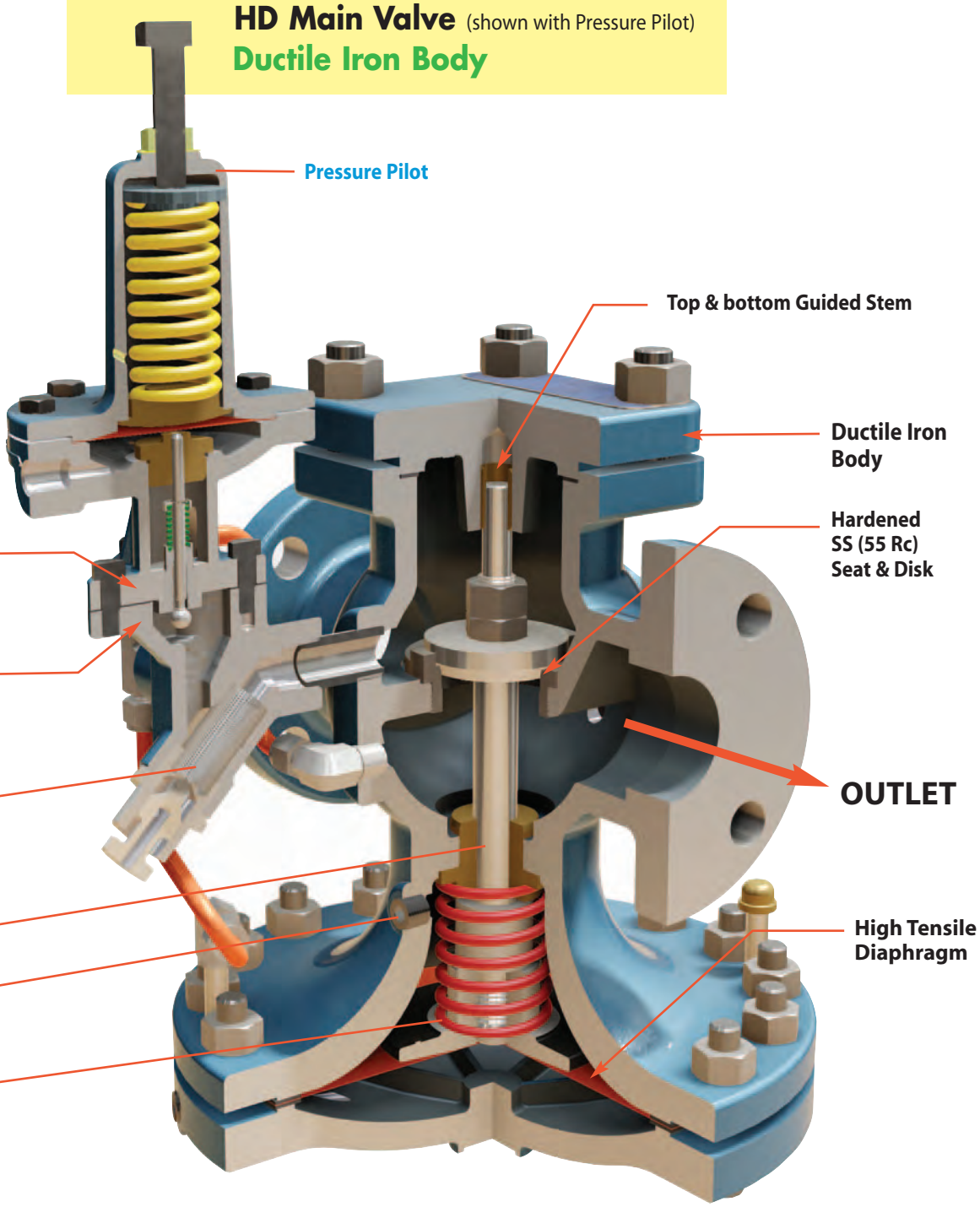
HD Main Valve
with
PP-Pressure Pilot
and
PT-Temperature Pilot

Controlling Temperature & Limiting Pressure to a Maximum Value

The PT & PP Pilot combination is used when it's required to control **temperature** while limiting **downstream pressure** to a maximum value. When the PT & PP Pilot combination is used, the downstream pressure is limited to a maximum setting by the pressure pilot, while the temperature pilot maintains the correct temperature of the process.



HD Main Valve (shown with Pressure Pilot)
Ductile Iron Body



Features of the HD Regulating Valve

- No external power source is required.
- Pressure & temperature pilots can be used in combination, eliminating the need for a separate pressure and temperature regulator.
- Ductile iron body for higher pressure ranges and increased safety when compared to cast iron.
- Full port strainer and blowdown valve on pilot adapter for ultimate protection against dirt and scale.
- Hardened stainless steel trim (55 Rc) for extended life even in the most demanding applications.
- The innovative design allows the pilot to be mounted on either side of the regulator and is easily field-reversible without having to rebend tubing.
- Tubing and pilot adapter is pre-mounted on main valve. The control pilot requires only four bolts to complete the installation.

Introduction

PP & PP5
PRESSURE
Pilot
Spring-Loaded

PA
PRESSURE
Pilot
Air-Loaded

PBP
BACK
PRESSURE
Pilot

PDP
DIFFERENTIAL
PRESSURE
Pilot

PT
TEMPERATURE
Pilot
Liquid Filled

PTRP
TEMPERATURE
Pilot
Vapor Tension

EP
ELECTRONIC
CONTROL

PS
ON/OFF
(Solenoid)

TSP
TRIP-STOP
PRESSURE

PRESSURE | **TEMPERATURE** | **OPEN/CLOSED**

Pilot-Operated REGULATORS

Typical Configurations

The **HD Series Pilot-Operated Regulating Valve** was designed for extremely accurate control of temperature and pressure in steam service applications. The HD-Series is made of Ductile Iron for extended pressure and temperature ratings when compared to cast iron. Several different control pilots can be mounted to the valve to control pressure, temperature, or a combination of both. When two or more pilots are used together (both a pressure and a temperature pilot) an additional pilot adapter for the second pilot is required (must indicate when ordering). The most common pilots are the PP-Pilot for pressure reducing, and the PT-Pilot for temperature control. **The Standard Main Valve** is used for an inlet steam pressure range of 15-300 PSI. The **Low-pressure Main Valve** contains a different main valve spring and is available for an inlet pressure range of 5-20 PSI. The Main Valve and Pilot are purchased separately.

Pressure Control

When controlling pressure, there are several options you can use for a pilot. The **PP**-Pilot and the **PP5**-Pilot are both **spring-adjusted** pressure pilots. The **PP**-Pilot is used on general-purpose pressure reducing applications and the **PP5**-Pilot is used when higher accuracy is required. The **PA**-Pilot is air controlled and allows for easier and remote adjustment of steam pressure.

Temperature Control

Several choices of pilot valves can be used for temperature control when steam is used on heating applications. The **PT** style pilot (most common) is referred to as a "solid liquid fill" and contains a temperature probe connected by a length of capillary tubing to a bellows in the pilot valve. When the temperature bulb is heated the liquid inside the probe expands the bellows and closes off the pilot valve. **PTRP** pilot operates in a similar fashion except this style is referred to as a vapor tension unit.

The **PTL** temperature controller uses a bi-metal element to sense temperature and deliver an appropriate air signal to a **PA** air pilot that controls the operation of the HD main valve.

Temperature-Pressure Control

The **PP** & **PT**-Pilot combination is used when it is desirable to control both the **pressure** and **temperature** of a system with only one regulating valve. The unique features of this modular valve allow this to be accomplished quite easily. When the **PP** & **PT**-Pilot combination is used, the downstream pressure is limited to a maximum setting by the pressure pilot, while the temperature pilot maintains the correct temperature.

On-Off Operation

Electrical **On-off control** of the regulator is possible by using the **PS**-Solenoid Pilot or **EP** Electric Pilot. The **PS**-Pilot allows the regulator to be shut off or turned on **electrically**. Normally the regulator is equipped with either a **PP**-Pressure Pilot or **PT**-Temperature Pilot in addition to the **PS**-Solenoid Pilot. The **EP** Electric Pilot can be used for a variety of applications including pressure control, on-off, as well as slow system start-up.

Trip-Stop Pressure

The **TSP-Trip Stop** Pilot is used to prevent over pressurization of downstream steam piping systems.

Back Pressure

When controlling the back pressure in a steam system, the **BP**-Pilot is used in conjunction with the **HD-Series** Regulator. This controls the pressure on the upstream side of the regulator.

Differential Pressure

The **PDP**-Pilot is used when trying to balance two different media sources that are being blended.

Stainless Diaphragm Option

The HD regulator is supplied standard with a high tensile strength Phosphor Bronze diaphragm which has been determined thru experience and testing to be the absolute best diaphragm material choice for steam applications. Stainless Steel diaphragms are offered as an option because certain industry specifications have been written requiring stainless steel. Note: Stainless steel is prone to work hardening and will not last as long as phosphor bronze; only use if required by the specification to do so.

Stainless Tubing Option

Copper tubing is supplied as standard. Copper tubing offers excellent corrosion resistance and is easy to bend and manipulate and normally outlasts the life span of the valve. Stainless Steel tubing is offered as an option.

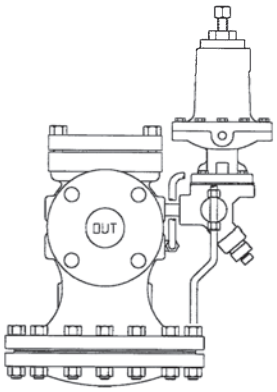
Reduced port trim Option:

Regulators should be sized to meet the application not to fit the pipe size. Over sizing a regulator may cause overshoot which leads to erratic pressure or temperature control often referred to as "hunting." A valve with reduced port trim has a reduced seat and disc size for a given pipe size, (refer to capacity charts).

Low pressure (differential and inlet) Option:

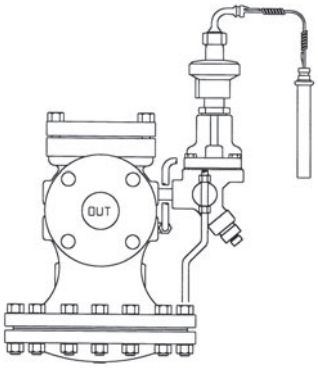
Regulators require a minimum Inlet pressure as well as a minimum pressure drop across the valve to operate properly. The HD Standard Main valve requires a minimum inlet pressure of 15 PSIG and minimum differential pressure of 10 PSI. The Low Pressure Main valve requires 5 PSIG minimum inlet pressure and 3 PSI minimum differential pressure. Low pressure main valve uses a EPDM diaphragm.

HD Main Valve
with
PP-Pressure Pilot
Spring-Loaded



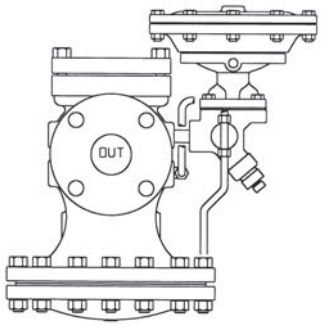
Shown with **PP** Pressure control Pilot. Spring-loaded pressure pilots are the most typical method of controlling downstream pressure in Steam Systems. Adjustment screw on top of pilot controls downstream steam pressure.

HD Main Valve
with
PT-Temperature Pilot



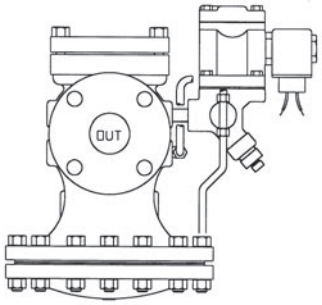
Shown with Temperature control Pilot: The **PT** Temperature Pilot will control the flow of steam flowing through the HD valve based on the temperature of the sensing bulb. The liquid-filled sensing Bulb is available in standard 8 ft and 15 ft capillary lengths. Other lengths available.

HD Main Valve
with
PA-Pressure Pilot
Air-Loaded



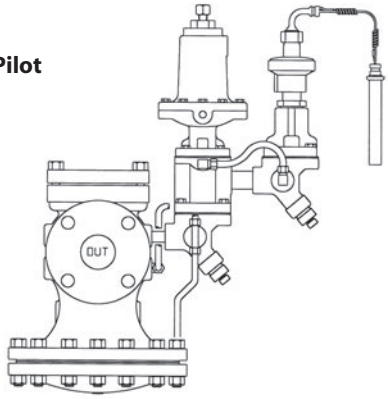
Shown with Air-loaded pressure control pilot. Air-loaded pressure pilots are used to reduce and control pressure in steam systems. They are used as an alternative to the more common spring-loaded pilot. The **PA** Air-loaded pressure pilot allows for remote adjustment of the valve using a small air regulator to alter the air pressure to the top of the pilot.

HD Main Valve
with
PS On/Off Control
Solenoid Pilot



Shown with **PS** ON-OFF(solenoid Pilot) control pilot: The **PS** ON-OFF (solenoid) Pilot allows for the HD valve to be opened and closed using an electrical switch to activate a small solenoid valve. The **PS** Pilot can be used for system automation or as a safety shut down device. The ON-OFF pilot is most often used in conjunction with a Pressure or Temperature control pilot.

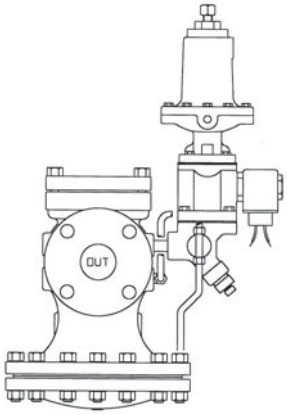
HD Main Valve
with
- **PT-Temperature Pilot**
- **PP-Pressure Pilot**



The **PT** Temperature Pilot will maintain the proper flow of steam through the main valve to keep the process it's controlling at the proper temperature. The **PP** pressure Pilot will LIMIT the downstream pressure to a maximum value. This combination of Pilots is very convenient when the Steam Pressure in the supply line is greater than the maximum pressure allowed to the process heat exchanger. This eliminates using a separate Pressure reducing valve prior to the temperature control valve.

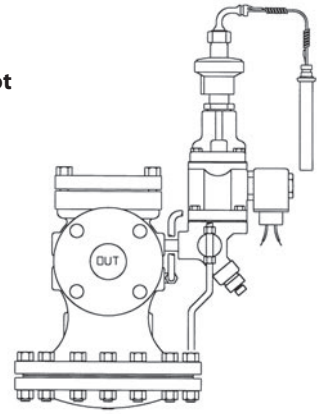
NOTE: When two or more pilots are used on the same valve: An additional Pilot Adapter for Second Pilot is required: Use part number: **BADAPTER**

HD Main Valve
with
- **PP-Pressure Pilot**
- **PS1 On/Off Control Solenoid Pilot**



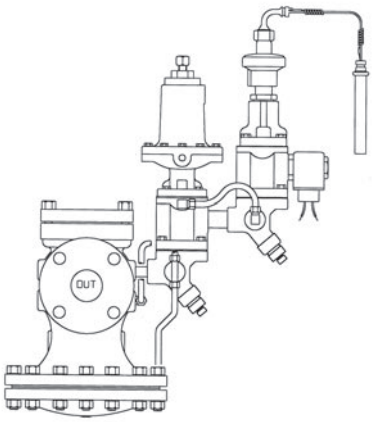
The **PP** Pressure Pilot will maintain the desired downstream set pressure as long as the **PS** ON-OFF (solenoid) Pilot is in the ON position. Available in either Normally-ON or Normally-OFF configuration; an electrical signal turns valve OFF or ON.

HD Main Valve
with
- **PT-Temperature Pilot**
- **PS1 On/Off Control Solenoid Pilot**



The **PT** Temperature Pilot will maintain the proper flow of steam through the main valve to keep the process it's controlling at the proper temperature as long as the **PS** ON-OFF (solenoid) Pilot is in the ON position. Available in either Normally-ON or Normally-OFF configuration; an electrical signal turns valve OFF or ON.

HD Main Valve
with
- **PP-Pressure Pilot**
- **PT-Temperature Pilot**
- **PS1 On/Off Control Solenoid Pilot**



The **PT** Temperature Pilot will maintain the proper flow of steam through the main valve to keep the process it's controlling at the proper temperature as long as the **PS** ON-OFF (solenoid) Pilot is in the ON position. The **PP** Pressure Pilot will LIMIT the downstream pressure to a maximum value.

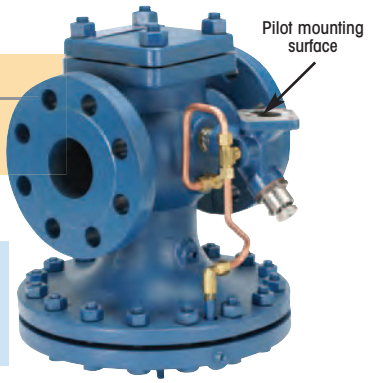
NOTE: When two or more pilots are used on the same valve: An additional Pilot Adapter for Second Pilot is required: Use part number: **BADAPTER**

HD Main Valve • Ductile Iron

Main Valve	**HD-Series**
Sizes	**1/2" – 6"**
Connections	**NPT: 1/2" - 2"** **FLG: 1" - 6"**
Body Material	**Ductile Iron**
PMO Max. Operating Pressure	**300 PSIG**
Design Pressure/ Temperature Ratings TMA/PMA	NPT 450 PSIG @ 650° F 150# FLG 150 PSIG @ 566° F 300# FLG 450 PSIG @ 650° F

STANDARD Main Valve Spring:
Inlet Pressure: **15-300 PSIG**
Example Model Code: **HD-12-N**

LOW-PRESSURE Main Valve Spring:
Inlet Pressure: **5-20 PSIG**
Example Model Code: **HD-12-N-LP**



Model Code Configuration Chart

Models		Code	Size	Code	Connection Type		Options	(Suffix)
HD	Full Port	**12**	1/2"	**N**	NPT	(1/2"–2")	**SSD**	SS Diaphragm
HDR	Reduced Port	**13**	3/4"	**BSP**	BSPT	(1/2"–2")	**SSXT**	SS External Tubing
		14	1"	**F150**	150# FLG	(1" – 6")	**LP**	Low Pressure (LP Spring, EPDM Diaphragm, & By-Pass Tubing)
		15	1 1/4"	**F300**	300# FLG	(1" – 6")		
		16	1 1/2"					
		17	2"				**LDP**	Low-Differential Pressure (LDP Spring & Bronze Diaphragm)
		18	2 1/2"					
		19	3"					Note: For more than one Option, combine suffixes. **Example: SSD-SSXT**
		20	4"					
		22	6"					

Model Codes below are for HD Main Valve ONLY. Control Pilot must be ordered separately. When two or more pilots are used on the same valve, a pilot adapter must be ordered also. Use Part Number BADAPTER.

ANSI/FCI 70-3 Class IV Shut-off

Size/Connection	STANDARD Inlet Pressure 15 - 300 PSI	LOW-PRESSURE Inlet Pressure 5 - 20 PSI	Weight lbs
1/2" NPT	HD-12-N	HD-12-N-LP	24
3/4" NPT	HD-13-N	HD-13-N-LP	24
1" NPT	HD-14-N	HD-14-N-LP	30
1" 150# FLG	HD-14-F150	HD-14-F150-LP	31
1" 300# FLG	HD-14-F300	HD-14-F300-LP	34
1 1/4" NPT	HD-15-N	HD-15-N-LP	50
1 1/2" NPT	HD-16-N	HD-16-N-LP	51
1 1/2" 150# FLG	HD-16-F150	HD-16-F150-LP	54
1 1/2" 300# FLG	HD-16-F300	HD-16-F300-LP	60
2" NPT	HD-17-N	HD-17-N-LP	72
2" 150# FLG	HD-17-F150	HD-17-F150-LP	80
2" 300# FLG	HD-17-F300	HD-17-F300-LP	82
2 1/2" 150# FLG	HD-18-F150	HD-18-F150-LP	105
2 1/2" 300# FLG	HD-18-F300	HD-18-F300-LP	109
3" 150# FLG	HD-19-F150	HD-19-F150-LP	150
3" 300# FLG	HD-19-F300	HD-19-F300-LP	158
4" 150# FLG	HD-20-F150	HD-20-F150-LP	230
4" 300# FLG	HD-20-F300	HD-20-F300-LP	250
6" 150# FLG	HD-22-F150	HD-22-F150-LP	450
6" 300# FLG	HD-22-F300	HD-22-F300-LP	472

Ordering Instructions:

NOTE: When two or more pilots are used on the same valve: An additional Pilot Adapter for Second Pilot is required: (Not required for Solenoid Pilot)

Use part number: (**BADAPTER**)

Options & Adders:	Code
Low Pressure Main Valve:	**LP**
Reduced Port Valves:	**HDR**
Stainless Steel Diaphragm:	**SSD**
Stainless Steel External Tubing:	**SSXT**
Required for secondary Pilot: (Not required for Solenoid Pilot)	**BADAPTER**
*Low-Differential Valves:	**LDP**

*Special Low-Differential Main Valve available when Inlet pressure is 25 PSIG or above, and differential pressure requirement is 10 PSI or less; Consult factory.

By-Pass Tubing (pre-installed)
See Parts Section for Kit #

Use for improved control when excessive system condensate is possible (included on LP valves)

Low-Pressure Main Valve not available with SS Diaphragms

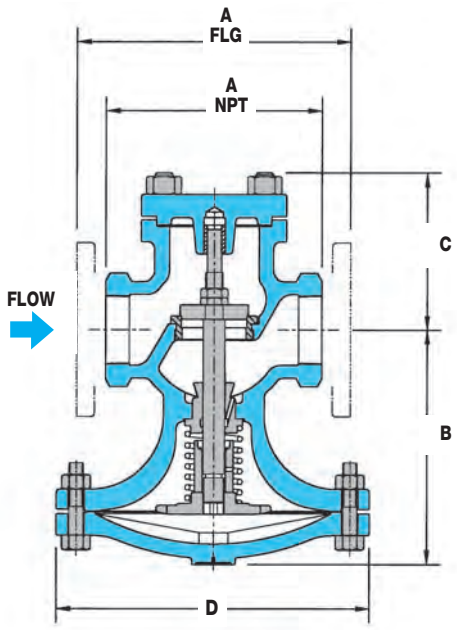
Example Model Codes for Main Valve:

1) **HD-15-N**
(HD Series Valve with 1 1/4" Threaded, NPT connections)

2) **HDR-16-F150**
(HD Series Valve, Reduced Port with 1 1/2" 150# Flanged connections)

3) **HD-20-F300-SSXT**
(HD Series Valve with 4" 300# Flanged connections & SS External tubing)

HD Main Valve • Ductile Iron



HD-Series DIMENSIONS – *inches*

	(A) Face-To-Face						Weight (lbs)		
Size	NPT	150#	300#	B	C	D	NPT	150#	300#
1/2"	4 3/8			5 5/8	3 3/8	6 3/4	24		
3/4"	4 3/8			5 5/8	3 3/8	6 3/4	24		
1"	5 3/8	5 1/2	6	6 1/4	3 1/2	7 1/8	30	31	34
1 1/4"	6 1/2			7 3/8	4 7/8	8 7/8	50		
1 1/2"	7 1/4	6 7/8	7 3/8	7 3/8	4 7/8	8 7/8	51	54	60
2"	7 1/2	8 1/2	9	8 1/4	5 3/8	10 7/8	72	80	82
2 1/2"		9 3/8	10	9	5 3/4	11 3/4		105	109
3"		10	10 3/4	8 7/8	6 3/4	13 1/4		150	158
4"		11 7/8	12 1/2	11	7 1/2	14 3/4		230	250
6"		15 1/8	16	14 1/2	10	19 3/4		450	472

Note: 150# flanges are flat face.
300# flanges are raised face.

Option: Stainless diaphragms and external tubing - consult factory

Standard pilot mounting is on the right side of the regulator when looking into the outlet port (as shown). Pilot mounting on HD regulators are field-reversible.

OPERATING PRESSURES

Inlet Pressure Range: (for Main Valve):
15-300 PSIG (Standard Main Valve)
5-20 PSIG (Low-Pressure Main Valve)

Minimum Differential Pressure (for Main Valve):*
10 PSI (Standard Main Valve)
3 PSI (Low-Pressure Main Valve)

** Not required for Temperature Pilot applications*

MATERIALS

Body	**Ductile Iron**
Cover	**Ductile Iron**
Gasket	Grafoil/Garlock
Cover Screws	Steel
Pilot Adapter	**Cast Steel**
Screen	Stainless Steel
Tubing	Copper
Valve Seat	Hardened SST (55Rc)
Valve Disc	Hardened SST (55Rc)
Diaphragm	Phosphor Bronze (standard) EPDM (Low Pressure Main Valve)

Ordering Instructions: HD Series Regulator with a Pilot

Model Code for Main Valve:	HD-19-F150	HD Series Valve with 3" 150# Flanges
Model Code for Pilot:	PP-B	Pressure Pilot, 20-100 PSIG (Blue spring color)

HD Valve with Pressure Pilot

Model Code for Main Valve: **HD-17-F150**
(2" HD Series Valve with 150# Flanges)

Model Code for Pilot: **PP-B**
(Pressure Pilot with 20-100 PSIG Range)

HD Valve with Temperature Pilot

Model Code for Main Valve: **HD-17-F150**
(2" HD Series Valve with 150# Flanges)

Model Code for Pilot: **PTU-14-8**
(Temperature Pilot (100-160° F) with 8 Ft. Capillary)

HD Valve with Pressure & Temperature Pilots

* If 2 Pilots are used on the same valve, a Secondary Pilot Adapter is required.

Model Code for Main Valve: **HD-17-F150**
(2" HD Series Valve with 150# Flanges)

Model Code for Pilot: **PP-B**
(Pressure Pilot with 20-100 PSIG Range)

Model Code for Pilot: **PTU-14-8**
(Temperature Pilot (100-160° F) with 8 Ft. Capillary)

Model Code for Secondary Pilot Adapter*: **BADAPTER**

PP & PP5 Pilots
HD Series

Pressure Regulating with PP & PP5 Spring-loaded Pilot

Pressure Pilot	(Standard: 1.0 psig accuracy)	**PP**
	(High-accuracy: 0.5 psig accuracy)	**PP5**
Pilot Body Material		**Cast Steel**
Max Inlet Pressure		**300 PSIG**
Reduced Outlet Pressure Range		**3-200 PSIG**
Inlet Pressure Range		
(with **HD** Standard main valve)		**15-300 PSIG**
(with **HD** Low-Pressure (LP) main valve)		**5-20 PSIG**
Minimum Differential Pressure		
(with **HD** Standard main valve)		**10 PSI**
(with **HD** Low-Pressure (LP) main valve)		**3 PSI**

Typical Applications

The **PP & PP5 Pressure Pilots** are used with the HD Regulator to control steam pressure in steam mains or for process equipment. Pilot-operated regulators maintain constant downstream pressure even when the inlet pressure to the valve fluctuates or steam usage varies. The PP-Pressure Pilot is adequate for controlling pressure in most industrial applications. For increased accuracy use the PP5 Pilot.

PP-Pressure Pilot (Standard) **1.0 PSIG accuracy**
PP5-Pressure Pilot (Special Applications) **0.5 PSIG accuracy**

Features

- The **PP**-Pilot can maintain downstream pressure to ±1 PSIG
- **PP5**-Pilot can maintain downstream pressure to ±0.5 PSIG
- Choices of three overlapping pressure ranges
- Pilot is easily installed on pilot adapter using four bolts, no tubing connections are required
- Full port strainer and blowdown valve on pilot adapter for protection of pilot from dirt and scale
- Solid floating diaphragm is more failure resistant
- Watson McDaniel's pilots can be used with other manufacturers' regulators

Options

- Pressure pilot can be used with temperature pilot to eliminate the need for two separate regulators
- Solenoid pilot can be added for remote on/off control of regulator

Example: **PP-B Pilot at 20-100 PSIG**

Reduced Pressure Range **PSI**	Model **Code**	Spring **Color**	Weight **lbs**
PP-Pressure Pilot (for Standard Industrial Applications) 1.0 PSIG accuracy			
3-25	**PP-Y**	Yellow	10
20-100	**PP-B**	Blue	10
80-200	**PP-R**	Red	10
PP5-Pressure Pilot (Special Applications) 0.5 PSIG accuracy			
1-10	**PP5-Y***	Yellow	25
10-25	**PP5-B***	Blue	25

* A Spacer (model # BAP-SPACE) is required when using PP5 Pressure Pilots on a 3" & 4" HD Main Valve.

HD Main Valve
with
PP-Pressure Pilot

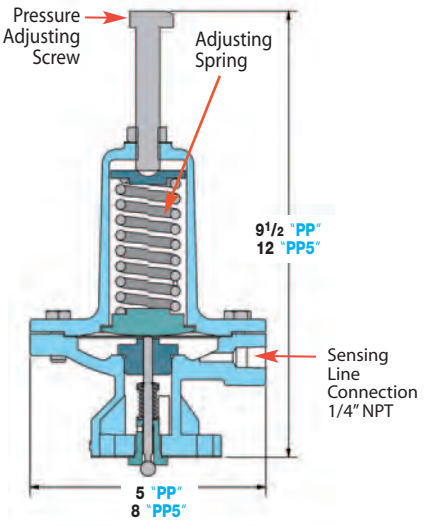
Model Code for Main Valve: **HD-17-F150**
(2" HD Series Valve with 150# Flanges)

Model Code for Pilot: **PP-B**
(Pressure Pilot with 20-100 PSIG Range)

MATERIALS for PP Pressure Pilot	
PP Pilot Body	**WCB 216 Cast Steel**
PP5 Pilot Body	**WCB 216 Cast Steel**
Head & Seat Gasket	302 SS
Diaphragm	Phosphor Bronze
Head & Seat Assembly	Hardened SST (55 Rc)

MATERIALS for HD Main Valve	
Body	**Ductile Iron**
Cover	**Ductile Iron**
Gasket	Grafoil/Garlock
Cover Screws	Steel
Pilot Adapter	**Cast Steel**
Screen	Stainless Steel
Tubing	Copper
Valve Seat	Hardened SST (55 Rc)
Valve Disc	Hardened SST (55 Rc)
Diaphragm	Phosphor Bronze

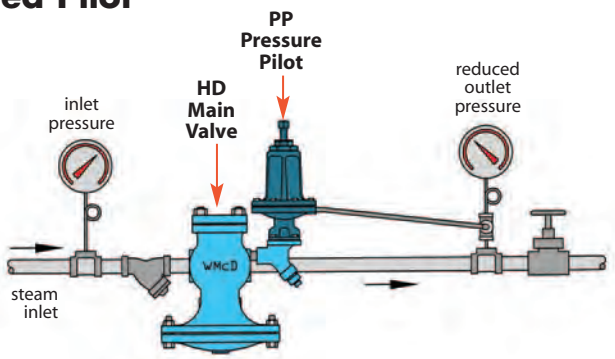
Units: inches

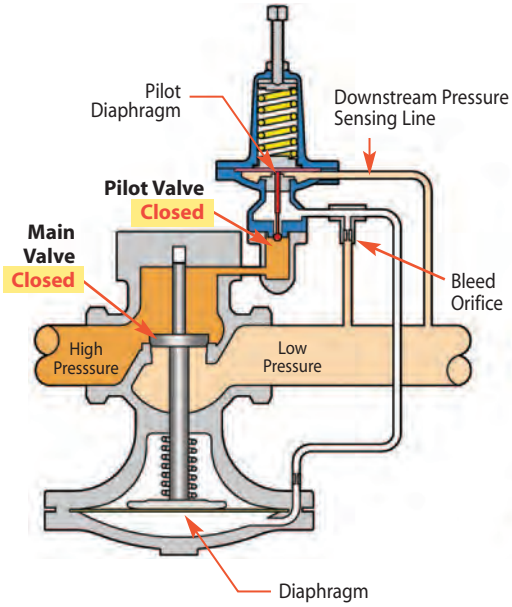


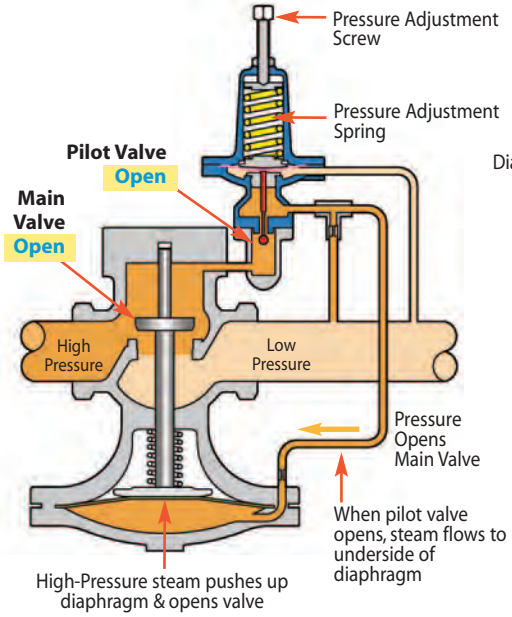
Pressure Regulating with PP & PP5 Spring-loaded Pilot

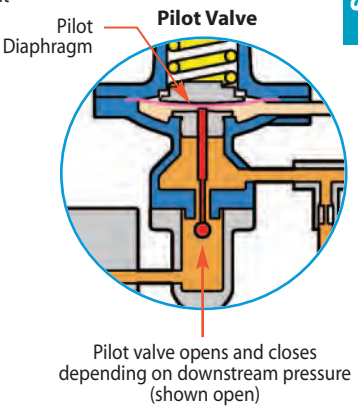
Reducing Pressure

The **PP**-Pilot and the **PP5**-Pilot are both **spring-adjusted** pressure pilots. The **PP**-Pilot is used on typical general-purpose pressure reducing applications. The **PP5**-Pilot is used when higher accuracy is required and is capable of maintaining a control pressure window of less than 1 PSI.



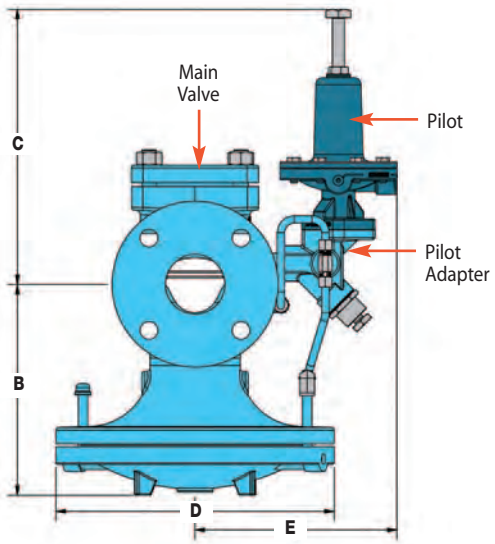






How it Works

The Pressure Pilot controls the operation of the HD Regulator. The sensing line connects the pressure pilot to the downstream side of the regulator. Pressure in the sensing line applies an upward force to the pilot diaphragm to compress the adjustment spring. When system pressure equals set point, the diaphragm moves upwards against the force of the adjusting spring, closing pilot valve. When the pilot valve is shut, steam cannot pass thru to the underside of the regulator diaphragm, closing the regulator. When the steam pressure falls below its set point, the pilot valve opens allowing steam to lift the main valve diaphragm which opens up the regulating valve.



DIMENSIONS HD-Series – *inches*

Size	Face-To-Face NPT	Face-To-Face 150#	Face-To-Face 300#	B	C*	D	E**	Weight (lbs) NPT	Weight (lbs) FLG
1/2"	4 3/8	-	-	5 5/8	11 7/8	6 3/4	7 3/4	18	-
3/4"	4 3/8	-	-	5 5/8	11 7/8	6 3/4	7 3/4	18	-
1"	5 3/8	5 1/2	6	6 1/4	11 7/8	7 1/8	7 3/4	23	35
1 1/4"	6 1/2	-	-	7 3/8	11 7/8	8 7/8	8 1/4	43	-
1 1/2"	7 1/4	6 7/8	7 3/8	7 3/8	11 7/8	8 7/8	8 1/4	43	60
2"	7 1/2	8 1/2	9	8 1/4	11 7/8	10 7/8	8 1/2	65	85
2 1/2"	-	9 3/8	10	9	11 7/8	11 3/4	8 1/2	-	105
3"	-	10	10 3/4	8 7/8	11 7/8	13 1/4	9 1/2	-	145
4"	-	11 7/8	12 1/2	11	11 7/8	14 3/4	10 1/2	-	235
6"	-	15 1/8	16	14 1/2	12 1/2	19 3/4	11 3/4	-	470

For PP5 Pilot: * *For sizes 1/2" to 1 1/2" add 2 1/2" to "C" dimension; For sizes 2" to 6" add 5" to "C" dimension.*
** *Add 1 1/2" to "E" dimension for all sizes.*

Back Pressure Regulating with **PBP Back-Pressure Pilot**

Back Pressure Pilot	**PBP**
Pilot Body Material	**Cast Steel**
Max Inlet Pressure	**300 PSIG**
Reduced Outlet Pressure Range	**10-200 PSIG**
Inlet Pressure Range (when used with **HD** Standard main valve)	**15-300 PSIG**
Inlet Pressure Range (when used with **HD-LP** Low-Pressure main valve)	**5-20 PSIG**

Minimum Differential Pressure:
10 PSI (Standard Main Valve)
3 PSI (Low Pressure Main Valve)

Typical Applications

The **PBP-Back Pressure Pilot**, used with the **HD** regulator, maintains upstream pressure in steam systems. These regulators are commonly used to supply flash steam to low pressure mains.

Features

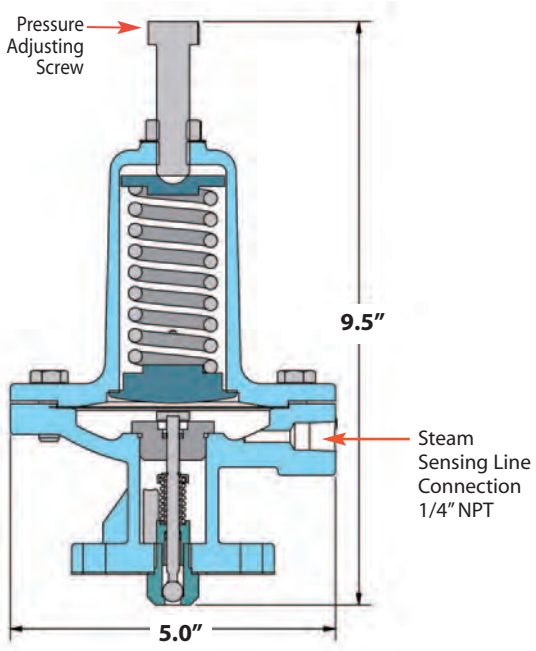
- The PBP-Pilot can maintain upstream pressure to ±1 PSIG
- Choices of three overlapping pressure ranges
- Pilot is easily installed using four bolts. No tubing connection required
- Full port strainer and blowdown valve on pilot adapter for protection of pilot from dirt and scale
- Solid floating (no penetration hole) pilot diaphragm resists failure
- Watson McDaniel's pilots can be used with other manufacturers' regulators

Option

- Can be used with solenoid pilot for on/off control

Reduced Pressure Range **PSI**	Model **Code**	Spring **Color**	Weight **lbs**
10-25	**PBP-Y**	Yellow	10
20-100	**PBP-B**	Blue	10
80-200	**PBP-R**	Red	10

Units: inches



OPERATING PRESSURES

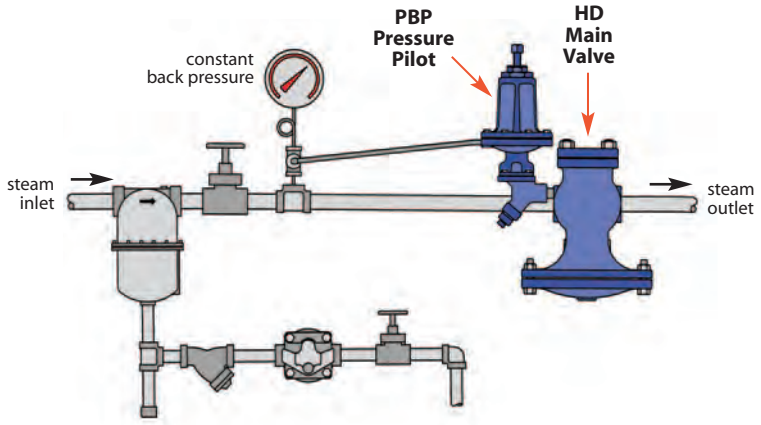
Inlet Pressure Range:
15-300 PSIG (Standard Main Valve)
5-20 PSIG (Low Pressure Main Valve)

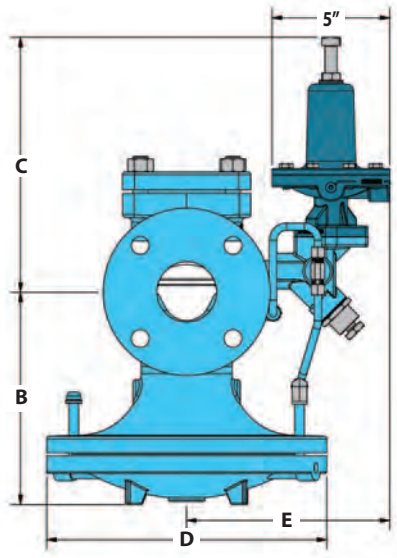
Minimum Differential Pressure:
10 PSI (Standard Main Valve)
3 PSI (Low Pressure Main Valve)

Back Pressure **Regulating** with **PBP Back-Pressure Pilot**

Back Pressure

The **PBP** Back-Pressure Pilots are used with HD Regulators to maintain upstream pressures in steam systems. When the upstream pressure reaches the pilot set point, the regulator opens. The HD Regulator with a PBP Back-Pressure Pilot is commonly used to supply steam to low-pressure mains. The PBP Back-Pressure Pilot maintains a constant back-pressure on the inlet side of the regulator. Should not be used in place of a safety relief valve.





DIMENSIONS HD-Series – *inches*

Size	Face-To-Face NPT	Face-To-Face 150#	Face-To-Face 300#	B	C*	D	E**	Weight (lbs) NPT	Weight (lbs) FLG
1/2″	4 3/8			5 5/8	11 7/8	6 3/4	7 3/4	18	
3/4″	4 3/8			5 5/8	11 7/8	6 3/4	7 3/4	18	
1″	5 3/8	5 1/2	6	6 1/4	11 7/8	7 1/8	7 3/4	23	35
1 1/4″	6 1/2			7 3/8	11 7/8	8 7/8	8 1/4	43	
1 1/2″	7 1/4	6 7/8	7 3/8	7 3/8	11 7/8	8 7/8	8 1/4	43	60
2″	7 1/2	8 1/2	9	8 1/4	11 7/8	10 7/8	8 1/2	65	85
2 1/2″		9 3/8	10	9	11 7/8	11 3/4	8 1/2		105
3″		10	10 3/4	8 7/8	11 7/8	13 1/4	9 1/2		145
4″		11 7/8	12 1/2	11	11 7/8	14 3/4	10 1/2		235
6″		15 1/8	16	14 1/2	12 1/2	19 3/4	11 3/4		470

MATERIALS for PBP Back-Pressure Pilot

Pilot Body & Cover	**Cast Steel**
Head & Seat Gasket	302 SS
Diaphragm	Phosphor Bronze
Head & Seat Assembly	Hardened SST (55 Rc)

MATERIALS for HD Main Valve

Body	**Ductile Iron**
Cover	**Ductile Iron**
Gasket	Grafoil/Garlock
Cover Screws	Steel
Pilot Adapter	**Cast Steel**
Screen	Stainless Steel
Tubing	Copper
Valve Seat	Hardened SST (55 Rc)
Valve Disc	Hardened SST (55 Rc)
Diaphragm	Phosphor Bronze

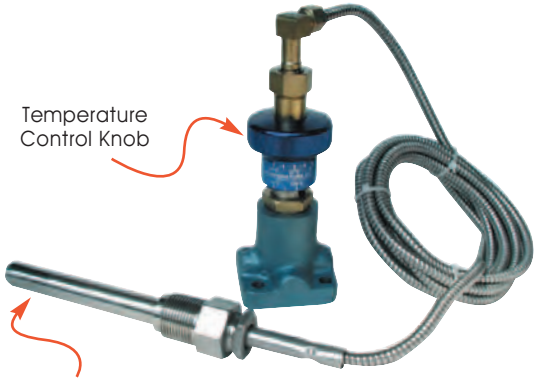
HD Main Valve with **PBP-Pressure Pilot**

Model Code for Main Valve: **HD-17-F150**
(2″ HD Series Valve with 150# Flanges)

Model Code for Pilot: **PBP-B**
(Back-Pressure Pilot with 20-100 PSIG Range)

Temperature Regulating with PT Temperature Pilot

Temperature Pilot	**PT**
Pilot Body Material	**Cast Steel**
Max Inlet Pressure	**300 PSIG**
Temperature Control Range	**60-300˚F**
Steam Inlet Pressure Range (Standard) (when Standard Temperature Pilot is used with **HD** Standard main valve)	**15-300 PSIG**
Steam Inlet Pressure Range (Low) (when Low-Pressure Temperature Pilot is used with **HD-LP** Low-Pressure main valve)	**5-20 PSIG**



Typical Applications

The PT-Temperature Pilots are used with the HD regulator to control temperature in various processes and systems. Some examples are: oil heaters, ovens, process heaters, vats, dryers and jacketed kettles. Thermostatic sensing bulb comes with standard 8-ft. or 15-ft. capillary lengths. Temperature adjustment is accomplished by rotating an adjustment knob to the desired temperature setting.

The **HD** Regulator can be used with both the **PP-Pressure Pilot** and **PT-Temperature Pilot** simultaneously to limit pressure and control temperature in process applications.

Using both the temperature and pressure pilots on the same regulator eliminates the need for two separate regulators to control temperature and pressure.

Features

- Temperature adjustment made simple and easy by rotating an adjustment knob to the desired temperature setting
- Thermostatic sensing bulb comes with an 8-ft. or 15-ft. length capillary
- Capillary is armor-protected to resist damage
- Overheat protection bellows is incorporated into sensing bulb; 200˚F overheat protection up to 350˚F
- Full port strainer and blowdown valve on pilot adapter for protection of pilot from dirt and scale

Options

- Temperature Pilot can be combined with Pressure and Solenoid pilots
- Capillary lengths up to 25-ft. maximum
- Thermowells* for isolating sensing bulb from process liquid are available in brass or 316 stainless steel
- Extended length wells available for increased insertion depth of sensing bulb
- 316 Stainless Steel Sensing Bulb

LOW PRESSURE PT Pilot (pressures under 15 PSIG)
Use Code **LP**: Low pressure Temperature Pilot is required for steam pressure under 15 PSI. (Range 5 - 20)
PILOT: Example Model Code: **PTU-12-8-LP**

LOW PRESSURE HD Main Valve (pressures under 15 PSIG)
Use Code **LP**: A Low Pressure Main Valve must be used in conjuction with a Low Pressure Temperature Pilot for steam pressure under 15 PSIG (Range 5 - 20)
MAIN VALVE: Example Model Code: **HD-13-N-LP**

Options & Adders:

Code **LP** - Low Pressure Pilot

Code **20**	20 ft. Capillary Length
Code **25**	25 ft. Capillary Length

Example: **PTU-29-8** (with standard 8 ft capillary) is changed to 20 ft of capillary. Model code becomes **PTU-29-20**

Code **SSBBAC** - *SS bulb, bushing & 8 ft. armored capillary

*Note: The standard sensing bulb is copper. A 316 SS Bulb and bushing with 8 ft. armoured capillary is available for corrosive applications or to meet SWDA requirements. Use code **SSBBAC**

For Temperature Pilot Temperature Ranges	
60 - 120°F	(16 - 49°C)
100 - 160°F	(38 - 71°C)
120 - 180°F	(49 - 82°C)
160 - 220°F	(71 - 104°C)
200 - 260°F	(93 - 127°C)
240 - 300°F	(116 - 149°C)

Model Codels for Individual Thermowells for PT & PTU Pilots

Model Code	Description of Thermowell
WELL-TU-BR	Brass Thermowell for PTU pilot
WELL-TU-SS	Stainless steel Thermowell for PTU pilot
WELL-T-BR-EXT	Extended brass Thermowell for PT pilot
WELL-T-SS-EXT	Extended stainless steel Thermowell for PT pilot

*** Thermowells:**
Wells isolate sensing bulb from the process liquid and are available in Brass or Stainless Steel. When placed on the side of a tank or vessel, the sensing bulb can be removed without having to drain the process fluid.

Temperature Regulating with PT Temperature Pilot

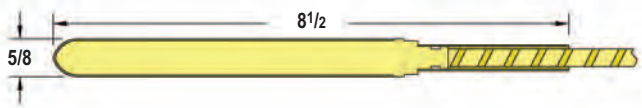
PT Pilots with 8 Ft. Capillary & Sensing Bulbs

Bulb Type	Temperature Range	Pilot Model Code
PT	60˚F-120˚F	PT-12-8
	100˚F-160˚F	PT-14-8
	120˚F-180˚F	PT-29-8
	160˚F-220˚F	PT-30-8
	200˚F-260˚F	PT-31-8
	240˚F-300˚F	PT-32-8
PTU	60˚F-120˚F	PTU-12-8
	100˚F-160˚F	PTU-14-8
	120˚F-180˚F	PTU-29-8
	160˚F-220˚F	PTU-30-8
	200˚F-260˚F	PTU-31-8
	240˚F-300˚F	PTU-32-8
PTUBW Brass Well	60˚F-120˚F	PTUBW-12-8
	100˚F-160˚F	PTUBW-14-8
	120˚F-180˚F	PTUBW-29-8
	160˚F-220˚F	PTUBW-30-8
	200˚F-260˚F	PTUBW-31-8
	240˚F-300˚F	PTUBW-32-8
PTUSW SS Well	60˚F-120˚F	PTUSW-12-8
	100˚F-160˚F	PTUSW-14-8
	120˚F-180˚F	PTUSW-29-8
	160˚F-220˚F	PTUSW-30-8
	200˚F-260˚F	PTUSW-31-8
	240˚F-300˚F	PTUSW-32-8
PTBW Brass Well	60˚F-120˚F	PTBW-12-8
	100˚F-160˚F	PTBW-14-8
	120˚F-180˚F	PTBW-29-8
	160˚F-220˚F	PTBW-30-8
	200˚F-260˚F	PTBW-31-8
	240˚F-300˚F	PTBW-32-8
PTSW SS Well	60˚F-120˚F	PTSW-12-8
	100˚F-160˚F	PTSW-14-8
	120˚F-180˚F	PTSW-29-8
	160˚F-220˚F	PTSW-30-8
	200˚F-260˚F	PTSW-31-8
	240˚F-300˚F	PTSW-32-8

All Sensing Bulbs are Copper

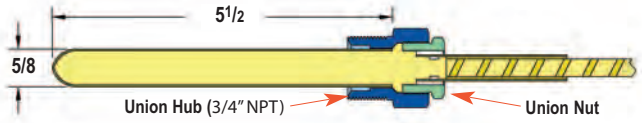
Dimension (inches)

PT



Plain copper sensing bulb that is directly immersed into the fluid. Normally the PT bulb type is lowered down vertically into the top of a tank or vat to a desired vertical insertion depth.

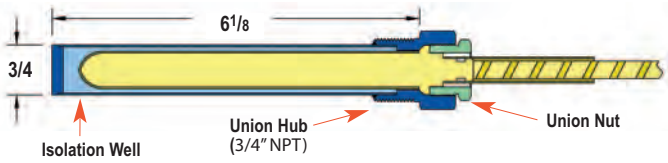
PTU



Copper sensing bulb with Union connection allowing it to be screwed into the side of a tank or pipe. The sensing bulb is in direct contact with the process fluid. Sensing bulb can be removed by unscrewing union nut (union hub remains in place).

PTUBW & PTUSW (PTU style copper sensing bulb with Thermowell)

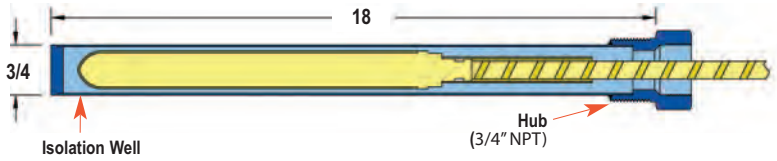
PTUBW: Brass Well
PTUSW: 316L SS Well



The Isolation Well, which isolates the copper sensing bulb from the process fluid, is available in either Brass or 316L Stainless Steel. Sensing bulb can be removed by unscrewing union nut. Union Hub & Isolation Well remain in place which allows the removal of the sensing bulb without having to drain the tank. Stainless Steel Isolation Wells are used to protect the copper sensing bulb from corrosive fluids. Brass wells have better heat transfer.

PTBW & PTSW (PT style copper sensing bulb with Extended Length Thermowell)

PTBW: Brass Well
PTSW: 316L SS Well



For deeper & variable insertion depths into tanks or vats; up to 18" deep. The extended length Isolation Well isolates the copper sensing bulb from the liquid and allows the copper sensing bulb insertion depth to be adjusted to a depth of up to 18". They are available in either Brass or 316L Stainless Steel. Isolation Well remains in place which allows the removal of the sensing bulb without having to drain the tank.

Example Model Codes:

PT-14-15	**PT** Plain Sensing Bulb (no threaded connection), 100-160 °F, 15 Ft. Capillary Length
PTUBW-30-8	**PTUBW** Sensing Bulb with Threaded Union Connection & Brass Well, 160-220 °F, 8 Ft. Capillary Length
PTBW-31-20-LP	**PTBW** Plain Sensing Bulb with Extended Brass Well, 200-260 °F, 20 Ft. Capillary Length with Low Pressure Option

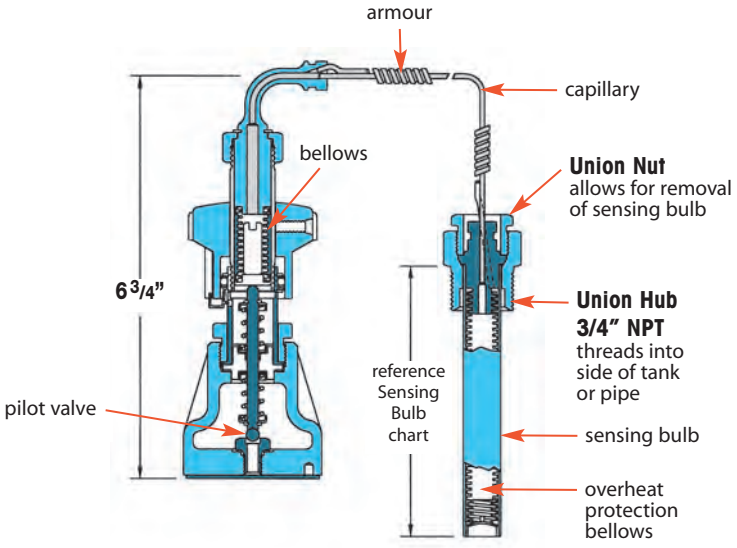
Model Code Configuration for Temperature Pilot

Example Model: PTBW-31-8-LP

Bulb Type		Code	Temperature Range	Code	Capillary Length	Code	Options (Suffix)
PT	Plain Sensing Bulb (no threaded connection)	12	60°F - 120°F	8	8 Feet	LP	Low Pressure (required under 15 PSI)
PTU	Sensing Bulb with Threaded Union Connection	14	100°F - 160°F	15	15 Feet	SSBBAC	SS bulb, bushing & armored capillary
PTUBW	Sensing Bulb with Threaded Union Connection & Brass Well	29	120°F - 180°F	20	20 Feet		
PTUSW	Sensing Bulb with Threaded Union Connection & 316L SS Well	30	160°F - 220°F	25	25 Feet		
PTBW	Plain Sensing Bulb with Extended Length Brass Well	31	200°F - 260°F				
PTSW	Plain Sensing Bulb with Extended Length 316L SS Well	32	240°F - 300°F				

Temperature Regulating with **PT Temperature Pilot**

PT Pilot Dimensions



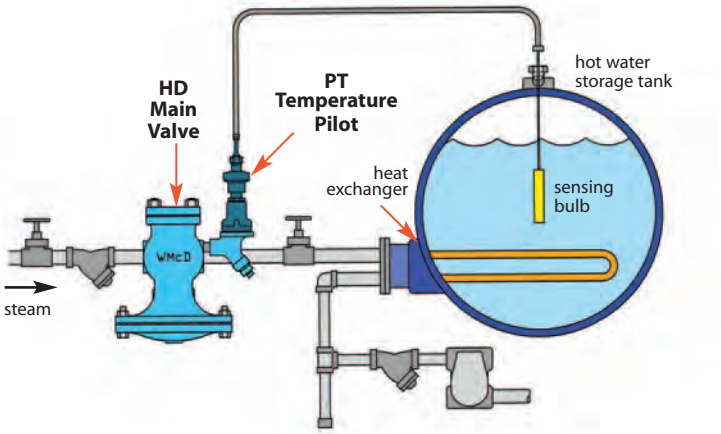
Controlling Temperature of a large Tank of Water using PT-Temperature Pilot

HD Main Valve
with
PT-Temperature Pilot

Controlling Temperature

PT-pilot is used for temperature control when steam is used on heating applications. The PT style pilot is a "solid liquid fill" design made up of a temperature probe connected by a length of capillary tubing to a bellows in the pilot valve. When the temperature bulb is heated the liquid inside the probe expands the bellows and closes off the pilot valve. The opening and closing of the pilot controls the flow of steam thru the main valve; which maintains system temperature. PT-pilot controls temperature through a range of 60-300˚F.

An overheat protection bellows is incorporated into sensing bulb.

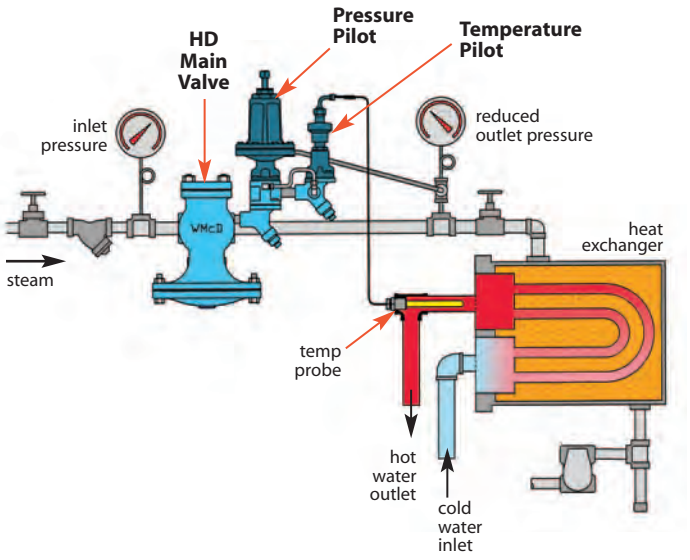


Controlling Temperature and Limiting Pressure using PT-Temperature Pilot & PP-Pressure Pilot

HD Main Valve
with
- **PP-Pressure Pilot**
- **PT-Temperature Pilot**

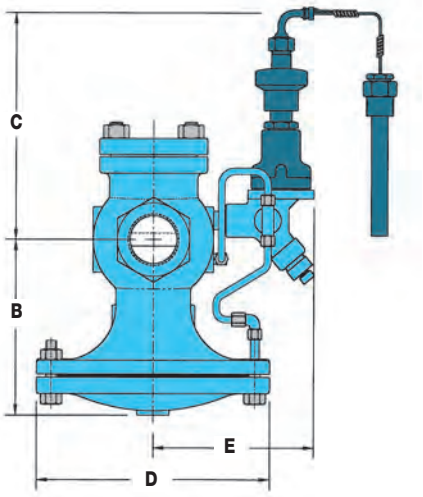
Controlling Temperature & Limiting Pressure to a Maximum Value

The **PT** & **PP** Pilots combination is used when it's required to control **temperature** while limiting **downstream pressure** to a maximum value. When the **PT** & **PP** Pilots combination is used, the downstream pressure is limited to a maximum setting by the pressure pilot, while the temperature pilot maintains the correct temperature of the process. This eliminates the need for a separate pressure reducing valve.

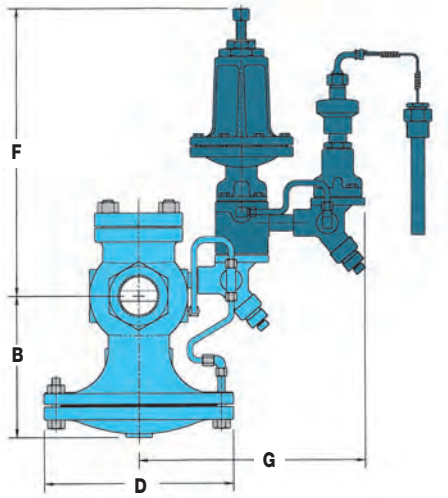


Temperature Regulating with PT Temperature Pilot

HD Valve with **Temperature Pilot**



HD Valve with **Temperature & Pressure Pilot**



DIMENSIONS HD-Series – *inches*

Size	Face-To-Face NPT	Face-To-Face 150#	Face-To-Face 300#	B	C	D	E	F	G	Weight (lbs) NPT	Weight (lbs) FLG
1/2"	4 3/8	–	–	5 5/8	9 1/4	6 3/4	6 1/2	14 1/2	10 1/4	18	–
3/4"	4 3/8	–	–	5 5/8	9 1/4	6 3/4	6 1/2	14 1/2	10 1/4	18	–
1"	5 3/8	5 1/2	6	6 1/4	9 1/4	7 1/8	8 1/4	14 1/2	10 1/4	23	35
1 1/4"	6 1/2	–	–	7 3/8	9 1/4	8 7/8	7 1/4	14 1/2	10 3/4	43	–
1 1/2"	7 1/4	6 7/8	7 3/8	7 3/8	9 1/4	8 7/8	7 1/4	14 1/2	10 3/4	43	60
2"	7 1/2	8 1/2	9	8 1/4	9 1/4	10 7/8	7 1/2	14 1/2	11 1/4	65	85
2 1/2"	–	9 3/8	10	9	9 1/4	11 3/4	7 3/4	14 1/2	11 1/4	–	105
3"	–	10	10 3/4	8 7/8	9 1/4	13 1/4	8 1/2	14 1/2	12	–	145
4"	–	11 7/8	12 1/2	11	9 1/4	6 1/2	9 1/2	14 1/2	13	–	235
6"	–	15 1/8	16	14 1/2	9 3/4	19 3/4	10 3/4	15	14 1/4	–	470

For Pressure Pilot

Pressure Ranges	Model
3-25 PSIG	PP-Y
20-100 PSIG	PP-B
80-200 PSIG	PP-R

HD Main Valve with PT-Temperature Pilot

Model Code for Main Valve: **HD-17-F150**
(2" HD Series Valve with 150# Flanges)

Model Code for Pilot: **PTU-14-8**
(Temperature Pilot (100-160° F) with 8 Ft. Capillary)

HD Main Valve with
- **PP-Pressure Pilot**
- **PT-Temperature Pilot**

Model Code for Main Valve: **HD-17-F150**
(2" HD Series Valve with 150# Flanges)

Model Code for Pilot: **PP-B**
(Pressure Pilot with 20-100 PSIG Range)

Model Code for Pilot: **PTU-14-8**
(Temperature Pilot (100-160° F) with 8 Ft. Capillary)

Model Code for Secondary Pilot Adapter*: **BADAPTER**

* If 2 Pilots are used on the same valve, a Secondary Pilot Adapter is required.

MATERIALS for PT Temperature Pilot

Pilot Body	**Cast Steel**
Bellows	Phosphor Bronze
Head & Seat Assembly	Hardened SST (55 Rc)

MATERIALS for PP Pressure Pilot

Pilot Body & Cover	**Ductile Iron or Cast Steel**
Head & Seat Gasket	302 SS
Diaphragm	Phosphor Bronze
Head & Seat Assembly	Hardened SST (55 Rc)

MATERIALS for HD Main Valve

Body	**Ductile Iron**
Cover	**Ductile Iron**
Gasket	Grafoil/Garlock
Cover Screws	Steel
Pilot Adapter	**Cast Steel**
Screen	Stainless Steel
Tubing	Copper
Valve Seat	Hardened SST (55 Rc)
Valve Disc	Hardened SST (55 Rc)
Diaphragm	Phosphor Bronze

PA Series Pilots
HD Series

Pressure Control with PA Air-Loaded Pilot

Pressure Pilot (Air)	**PA**
Pilot Body Material	**Cast Steel/Ductile Iron**
Max Inlet Pressure	**300 PSIG**
Reduced Outlet Pressure Range	**3-200 PSIG**
Inlet Pressure Range (when used with **HD** Standard main valve)	**15-300 PSIG**
Inlet Pressure Range (when used with **HD-LP** Low-Pressure main valve)	**5-20 PSIG**

Minimum Differential Pressure:
10 PSI (Standard Main Valve)
3 PSI (Low Pressure Main Valve)

Note: Temperature Range: 0-350˚F when used with PTL & PTR temperature controllers

Model PA1
(Pilot shown)

HD Main Valve with PA4 Pilot

MAXIMUM CONTROL AIR PRESSURE ON AIR PILOT IS 125 PSIG

PRESSURE ADJUSTING RANGES

Model	Pressure Ranges	Description
PA1	**3-125 PSIG**	**1:1** ratio of steam pressure to control air pressure
PA4	**3-200 PSIG**	**4:1** ratio of steam pressure to control air pressure
PA6	**20-200 PSIG**	**6:1** ratio of steam pressure to control air pressure

The larger Diaphragm area of the **PA4** & **PA6** Air Pilots allow the use of lower control air pressure to regulate higher pressure steam.

Typical Applications

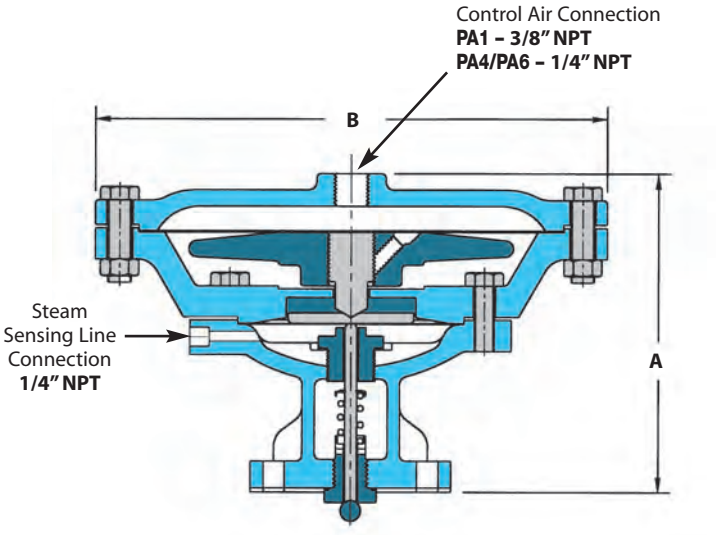
The **PA** Air-Loaded **Pressure Pilot** is used with the **HD** Regulator to control steam pressure on steam mains and process equipment. The principal advantage the **PA-Air Pilot** has over standard spring-loaded pilots is that pressure adjustments to the regulator can be made from a remote location. A regulator that is located in a difficult to reach or inaccessible location can be adjusted by a remote control panel board. The **PA-Air Pilot** can also be used in conjunction with the **PTL** or **PTR** pneumatic temperature controllers for controlling temperature in process applications.

How it Works

When air pressure is applied to the upper chamber of the air pilot it exerts a downward force on the air pilot's diaphragm. This force controls the outlet pressure of the steam through the regulating valve. The control process is similar to a spring loaded pressure pilot except that the air pressure takes the place of the spring. There are three separate models of air pilots that make up the complete range depending on the steam pressure that needs to be controlled and the control air pressure available. See Pressure Adjusting Ranges chart.

Features

- Pressure adjustments to the regulator can be done from a remote location using an air signal
- Air-operated pilot ensures instant response and extremely accurate control
- Full port strainer and blowdown valve on pilot adapter for protection of pilot from dirt and scale
- Controls pressure settings within ±1 PSIG

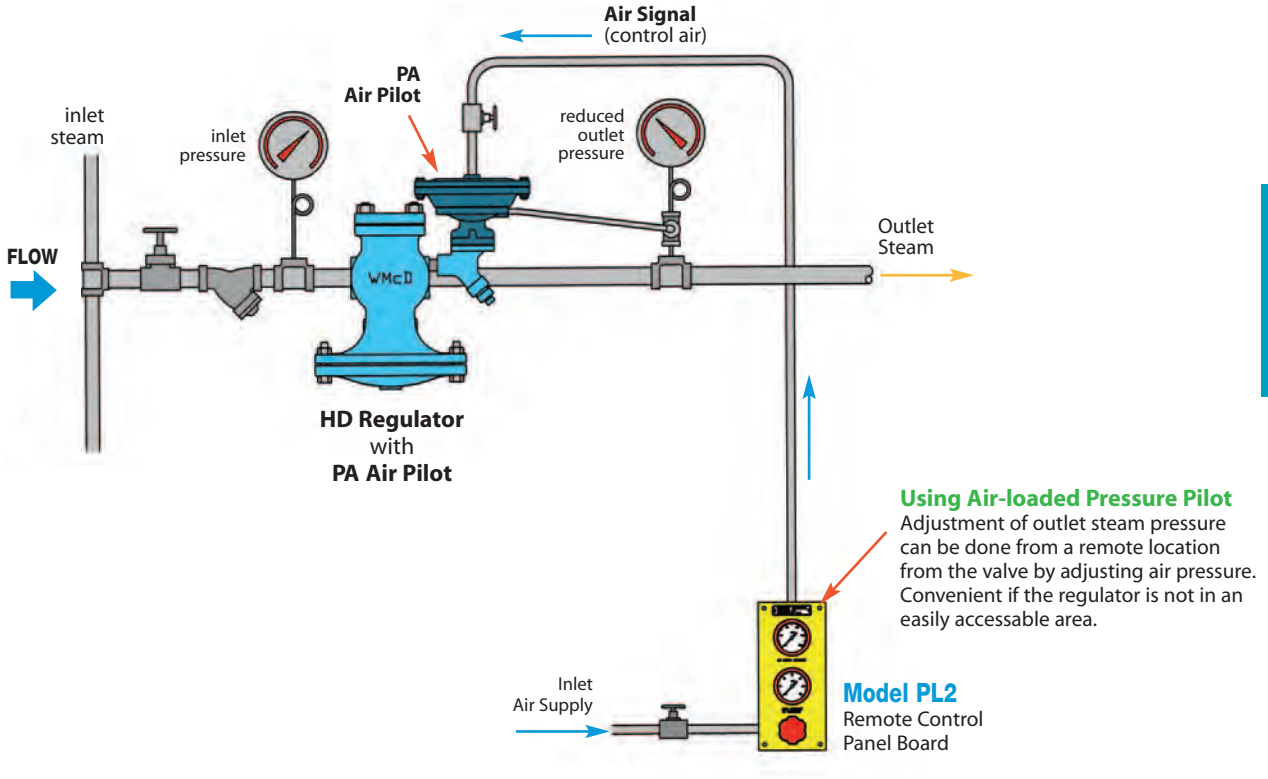


DIMENSIONS – *inches*

Model	A	B
PA1	5 1/4	5
PA4	5 1/4	7 7/8
PA6	5 1/4	9 1/2

Pressure Control with **PA Air-Loaded Pressure Pilot**

Pressure Reducing Station Using HD Regulator with an Air Pilot



Description of Operation

The **PA-Air Pilot** is being used in conjunction with the **PL2 Control Panel Board** to regulate steam pressure. A small air regulator on the panel board can be adjusted to control the air pressure to the pilot. One gauge on the panel board measures air line pressure to the panel board and the other gauge shows the air pressure being sent to the pilot. Steam pressure at the outlet of the regulator is controlled by the air pressure signal to the pilot. Depending on the air pilot model chosen (**PA1**, **PA4**, **PA6**), there will be a 1:1, 4:1, or 6:1 ratio of outlet steam pressure to air pressure.

REMOTE CONTROL PANEL BOARDS

Three different options of remote control panel boards can be used along with the Air Pilots. Supply air is fed directly through the control panel board to the air pilot. You can choose one of the three options of control panel boards when using the air piloted regulators. Minimum of 5 PSIG air supply pressure is required.

PL1

PL2

PL3

PL1

The **PL1** is made up of an air pressure regulator with adjustment knob and pressure gauge that measures the amount of air pressure going to the pilot (air signal). Steam pressure of the system is controlled by adjusting the air pressure regulator.

PL2

The **PL2** is the same as the PL1 with the addition of an extra air pressure gauge for measuring the air supply pressure to the control panel board.

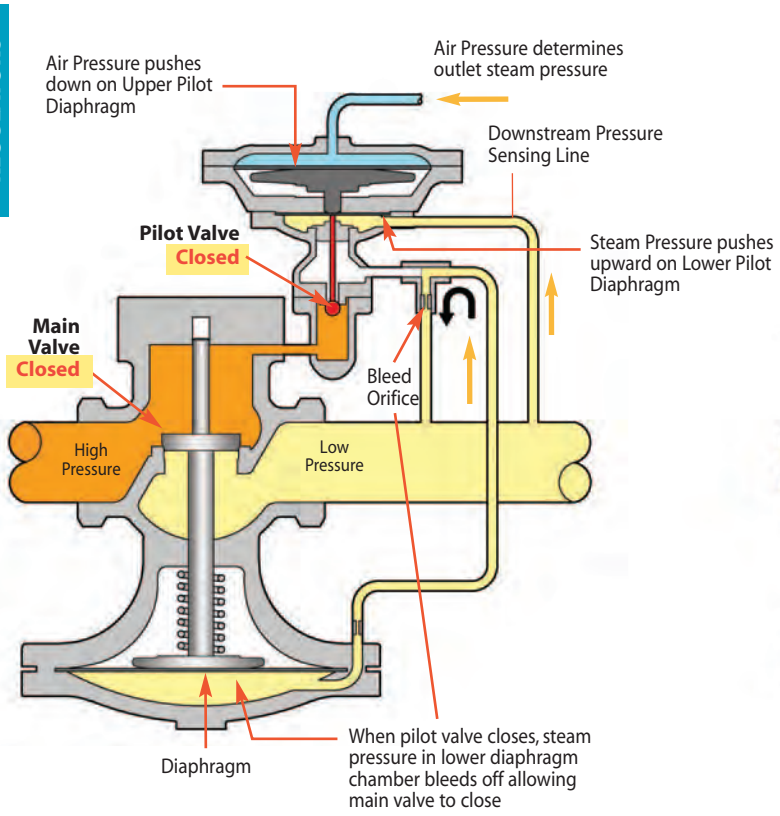
PL3

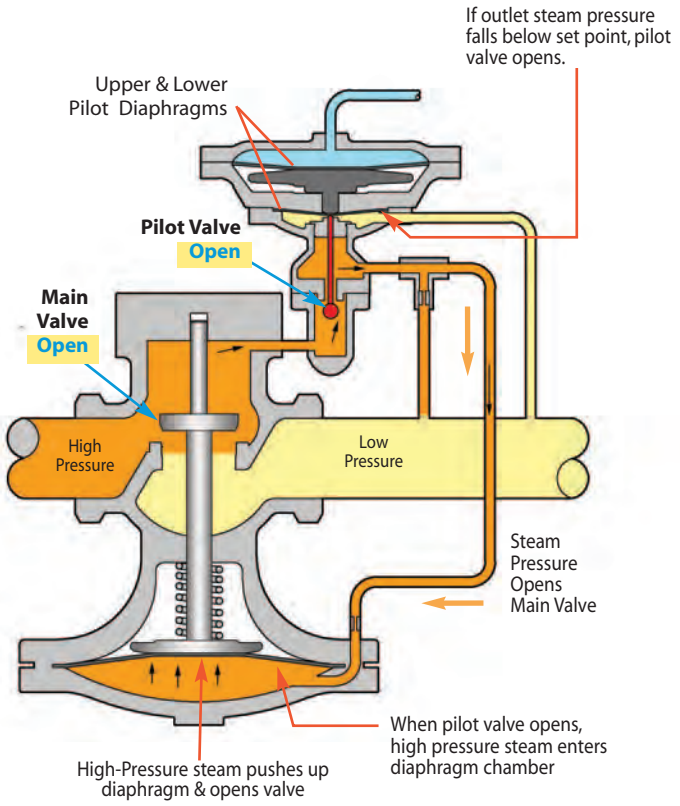
The **PL3** is the same as the PL2 with the addition of a Steam Pressure Gauge for measuring steam pressure on the outlet side of the regulating valve.

Pressure Control with **PA Air-Loaded Pilot**

How it Works

When air pressure is applied to the upper chamber of the air pilot, it exerts a downward force on the air pilot's diaphragm. The lower chamber of the air pilot is connected to the outlet side of the regulator using a sensing line. The purpose of the sensing line is to sense the pressure on the outlet side of the regulator and direct it under the lower pilot diaphragm to push it upwards. When the intended set pressure is reached, the pilot valve closes, which then closes off the flow path of steam to the underside of the diaphragm chamber in the regulator body. The regulator modulates open and closed maintaining the desired downstream pressure. To change downstream pressure, increase or decrease air pressure to pilot accordingly.





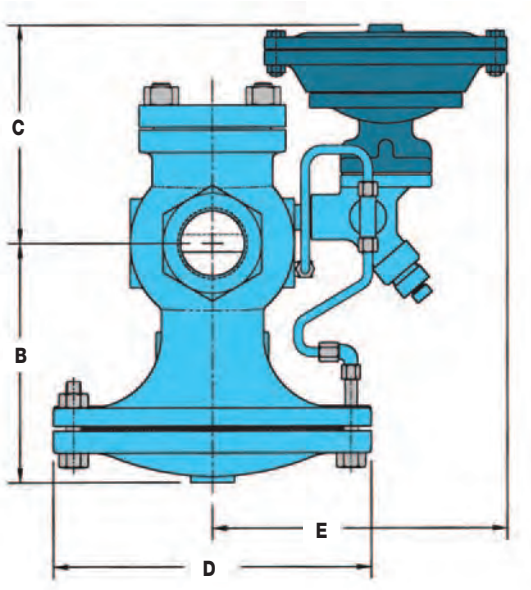
MAXIMUM CONTROL AIR PRESSURE ON AIR PILOT IS 125 PSIG

PRESSURE ADJUSTING RANGES		
Model	**Pressure Ranges**	**Description**
PA1	**3-125 PSIG**	**1:1** ratio of steam pressure to control air pressure
PA4	**3-200 PSIG**	**4:1** ratio of steam pressure to control air pressure
PA6	**20-200 PSIG**	**6:1** ratio of steam pressure to control air pressure

The larger Diaphragm area of the **PA4** & **PA6** Air Pilots allow the use of lower control air pressure to regulate higher pressure steam.

PA Series Pilots
HD Series

Pressure Control with **PA Air-Loaded Pilot**



DIMENSIONS HD-Series – *inches*

Size	Face-To-Face NPT	Face-To-Face 150#	Face-To-Face 300#	B	C*	D	E**	Weight (lbs) NPT	Weight (lbs) FLG
1/2"	4 3/8			5 5/8	7 1/2	6 3/4	7 3/8	18	
3/4"	4 3/8			5 5/8	7 1/2	6 3/4	7 3/8	18	
1"	5 3/8	5 1/2	6	6 1/4	7 1/2	7 1/8	7 1/2	23	35
1 1/4"	6 1/2			7 3/8	7 1/2	8 7/8	8 1/8	43	
1 1/2"	7 1/4	6 7/8	7 3/8	7 3/8	7 1/2	8 7/8	8 1/8	43	60
2"	7 1/2	8 1/2	9	8 1/4	7 1/2	10 7/8	8 3/8	65	85
2 1/2"		9 3/8	10	9	7 1/2	11 3/4	8 1/2		105
3"		10	10 3/4	8 7/8	7 1/2	13 1/4	9 1/4		145
4"		11 7/8	12 1/2	11	7 1/2	14 3/4	10 1/4		235
6"		15 1/8	16	14 1/2	8 1/4	19 3/4	11 7/8		470

Dimension based on PA1 Air Pilot.
** Add 2 1/2" to "C" dimension for PA4 or PA6 Air Pilots on 2" thru 4" valves.*
*** Add 1 1/2" to "E" dimension for PA4, and 2 1/4"" for PA6.*

MATERIALS for PA Pressure Pilot

Pilot Body & Cover (PA1)	**Cast Steel**
Pilot Body & Cover (PA4, PA6)	**Cast Steel/Ductile Iron**
Head & Seat Gasket	302 SS
Cover Screws	Steel, GR5
Head & Seat Assembly	Hardened SST (55 Rc)

MATERIALS for HD Main Valve

Body	**Ductile Iron**
Cover	**Ductile Iron**
Gasket	Grafoil/Garlock
Cover Screws	Steel
Pilot Adapter	**Cast Steel**
Screen	Stainless Steel
Tubing	Copper
Valve Seat	Hardened SST (55 Rc)
Valve Disc	Hardened SST (55 Rc)
Diaphragm	Phosphor Bronze

OPERATING PRESSURES

Inlet Pressure Range:
15-300 PSIG (Standard Main Valve)
5-20 PSIG (Low Pressure Main Valve)

Minimum Differential Pressure:
10 PSI (Standard Main Valve)
3 PSI (Low Pressure Main Valve)

CONTROL AIR PRESSURE RANGE

A-Pilot Control Pressure:
3-125 PSIG (depending on pilot selected and desired outlet pressure)

HD Main Valve with **PA-Pressure Pilot** Air-Loaded

Model Code for Main Valve: **HD-17-F150**
(2" HD Series Valve with 150# Flanges)

Model Code for Pilot: **PA4**
(Air Pilot, 4:1 ratio of steam pressure to control air pressure)

How to Size / Order

PA - AIR PILOT

Specify:
- Air Pilot **PA1**, **PA4** or **PA6**
- Remote Control Panel Board **PL1**, **PL2** or **PL3**

REGULATOR BODY

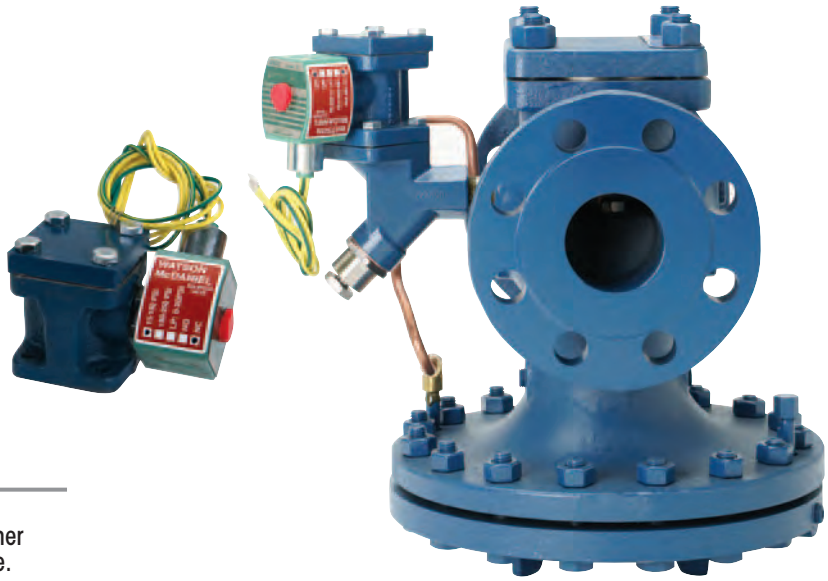
Specify:
- **HD** regulator body
- Regulator size or capacity and pressure range of steam required
- End connections (threaded, 150/300# flanged)

Solenoid Pilot
HD Series

On/Off Control using an Electric Solenoid

- **Max Inlet Pressure: 250 PSIG**

Solenoid Pilot (Electric)	**PS1 & PS2**
Pilot Body Material	**Cast Iron**
Valve Head & Seat	**Stainless Steel**
Max Inlet Pressure	**250 PSIG**
Pressure Range	
PS1	**15-180 PSIG**
PS2	**180-250 PSIG**
PS1-LP	**0-20 PSIG**



Typical Applications

Typically used for automatic operation, remote control, programmed cycling, sequential function interlocks with other equipment, and emergency shut-off in case of power failure.

How it Works

The **PS-Solenoid Pilot** can be used in conjunction with Pressure, Temperature, or Air Pilots to electrically control on/off operation of the **HD** Regulator. When the solenoid pilot is used, the regulator can be turned on or off by electrically activating or de-activating the solenoid.

Normally Closed (NC) – Standard
The normally CLOSED Solenoid Pilot remains closed in the non-activated state. The regulating valve will remain closed until an electrical signal is sent to the solenoid pilot. The signal is required to allow the regulator to operate. This is known as a fail-safe condition.

Normally Open (NO) – Optional
The normally OPENED Solenoid Pilot remains open in the non-activated state. The regulating valve will function normally unless an electrical signal is used to shut off the solenoid pilot.

Features

- Available normally opened (NO) or normally closed (NC)
- Full-port strainer and blow-down valve on pilot adapter to eliminate failure caused by contaminated steam systems

Options

- Normally open solenoid
- NEMA Ratings: NEMA 4 and NEMA 7
- Voltage: 24 VAC*, 120 VAC, 240 VAC

Standard Solenoid Pilots Available	
Steam Inlet Pressure	0-180 PSIG 180-250 PSIG
NEMA Ratings	NEMA 4 – Waterproof (standard) NEMA 7 – Explosion-proof (optional)
Voltage	24 Volts AC* 110-120 Volts AC 220-240 Volts AC
Control Action	Normally Closed (standard) Normally Open (special order)

Model Code	PMO PSIG	Weight lbs
PS1	15-180	4.5
PS2	180-250	5.5
PS1-LP	0-20	4.5

Use PS1-LP for Low Pressure applications under 15 PSI.

Model Code Configuration Chart

Models	Pressure PSI	Code	Voltage	Code	Action	Code	Rating
PS1	15-180 PSIG	**24**	24 VAC*	**NC**	Normally Closed (Standard)	**N4**	Standard. Meets enclosure Type 4 (water proof).
PS2	180-250 PSIG	**120**	110 -120 VAC	**NO**	Normally Open (special order)	**N7**	Meets NEMA 4 & 7 Rating (water proof & explosion proof)
PS1-LP	0-20 PSIG	**240**	220 - 240 VAC				

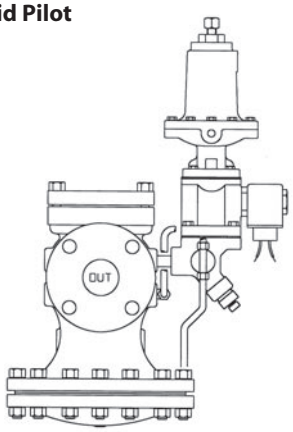
* Note: Max. PMO with 24 VAC is 50 PSIG

Example Model Codes:

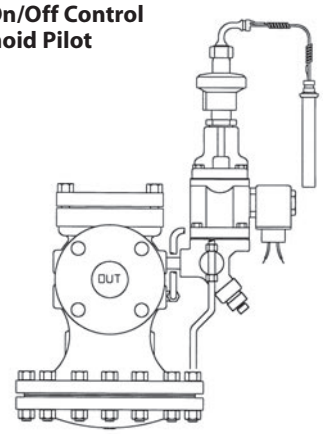
1) **PS1-120-NC-N4** NEMA 4 (standard)
2) **PS1-120-NC-N7** NEMA 4 & 7 (waterproof & explosion proof)

Solenoid Pilot
HD Series

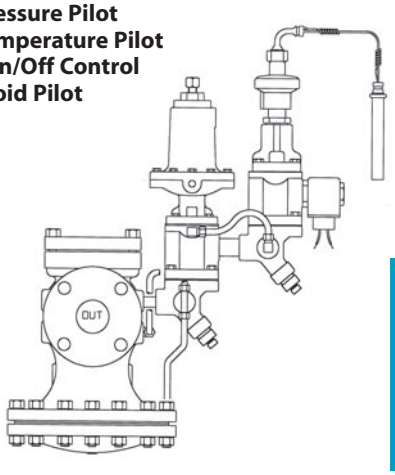
HD Main Valve
with
PS1 On/Off Control Solenoid Pilot

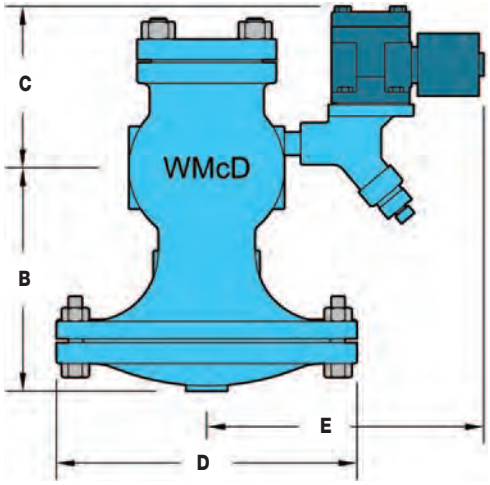


HD Main Valve
with
- **PT-Temperature Pilot**
- **PS1 On/Off Control Solenoid Pilot**



HD Main Valve
with
- **PP-Pressure Pilot**
- **PT-Temperature Pilot**
- **PS1 On/Off Control Solenoid Pilot**





DIMENSIONS HD-Series – *inches*

Size	Face-To-Face NPT	Face-To-Face 150#	Face-To-Face 300#	B	C	D	E	Weight (lbs) NPT	Weight (lbs) FLG
1/2"	4 3/8			5 5/8	7 5/8	6 3/4	7 3/4	18	
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1 1/2"	7 1/4	6 7/8	7 3/8	7 3/8	7 1/2	8 7/8	8 3/8	43	60
2"	7 1/2	8 1/2	9	8 1/4	7 1/2	10 7/8	8 3/4	65	85
2 1/2"		9 3/8	10	9	7 1/2	11 3/4	8 3/4		105
3"		10	10 3/4	8 7/8	7 1/2	13 1/4	9 1/2		145
4"		11 7/8	12 1/2	11	7 1/2	14 3/4	10 1/2		235
6"		15 1/8	16	14 1/2	8 1/4	19 3/4	12 1/4		470

MATERIALS for On/Off Solenoid Pilot

Pilot Body & Cover	**Cast Iron**
Seat Gasket	302 SS
Cover Screws	Steel, GR5
Internals	Stainless Steel

MATERIALS for HD Main Valve

Body	**Ductile Iron**
Cover	**Ductile Iron**
Gasket	Grafoil/Garlock
Cover Screws	Steel
Pilot Adapter	**Cast Steel**
Screen	Stainless Steel
Tubing	Copper
Valve Seat	Hardened SST (55 Rc)
Valve Disc	Hardened SST (55 Rc)
Diaphragm	Phosphor Bronze

OPERATING PRESSURES

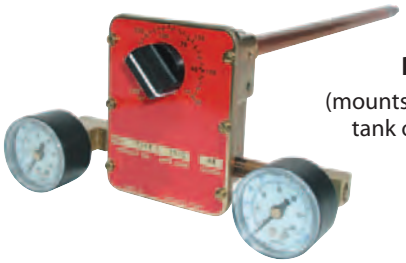
Inlet Pressure Range:
15-300 PSIG (Standard Main Valve)
5-20 PSIG (Low Pressure Main Valve)

Minimum Differential Pressure:
10 PSI (Standard Main Valve)
3 PSI (Low Pressure Main Valve)

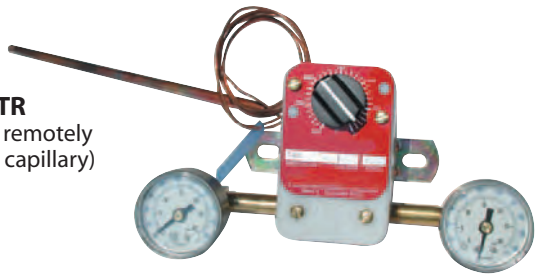
Pneumatic Temperature **Controllers** (must be used with PA-Air Pilot)

Temperature Controller Temperature Adjustment Range	**PTL** 50 - 350 ˚F	**PTR** 0 - 300 ˚F
Maximum Air Supply Pressure	35 PSIG	35 PSIG
Sensing Bulb	**Bi-Metallic**	**Hydraulic Fill**
Max. Pressure	250 PSIG	250 PSIG
Max. Temperature	400˚F	350˚F
Material	Copper	Copper
Optional Material	Stainless Steel	Stainless Steel
Capillary Length	**N/A**	**4-ft.**

- **Temperature Range: PTR: 0-300 ˚F**
  PTL: 50-350 ˚F



PTL
(mounts directly on tank or vessel)



PTR
(mounts remotely with 4-ft. capillary)

Typical Applications

The **PTL** and **PTR Pneumatic Temperature Controllers** operate over a wider temperature range and react faster than our standard **PT** temperature pilot. This makes them a preferable choice for instantaneous hot water applications.

How it Works

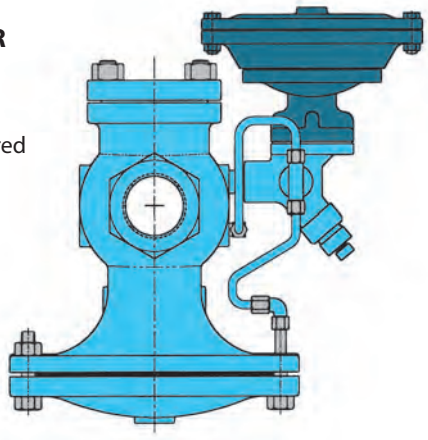
The **PTL** and **PTR Pneumatic Temperature Controllers** are used in conjunction with a **PA-Air Pilot** to control the operation of the **HD** Regulator. The **PTL** uses a bi-metallic element to sense temperature and the **PTR** uses a hydraulically-filled bulb (with 4-ft. capillary) to sense temperature. The air supply is connected to the inlet of the controller and the air output signal is fed directly to an Air Pilot, which controls the opening and closing of the steam regulating valve.

Features

- Accurate and rapid response to temperature changes
- Temperature control range of 0-350 ˚F

Model Code	Product Description Bulb & Capillary	Capillary Length	Weight lbs
PTL-E7	Pneumatic temperature controller, direct mount	N/A	5.3
PTR-E8	Pneumatic temperature controller, remote mount	4'	3.0

for **PTL** & **PTR** Pneumatic Temperature Controller, Air Pilot is required



OPERATING PRESSURES

Inlet Pressure Range:
15-300 PSIG (Standard Main Valve)
5-20 PSIG (Low Pressure Main Valve)

Minimum Differential Pressure:
10 PSI (Standard Main Valve)
3 PSI (Low Pressure Main Valve)

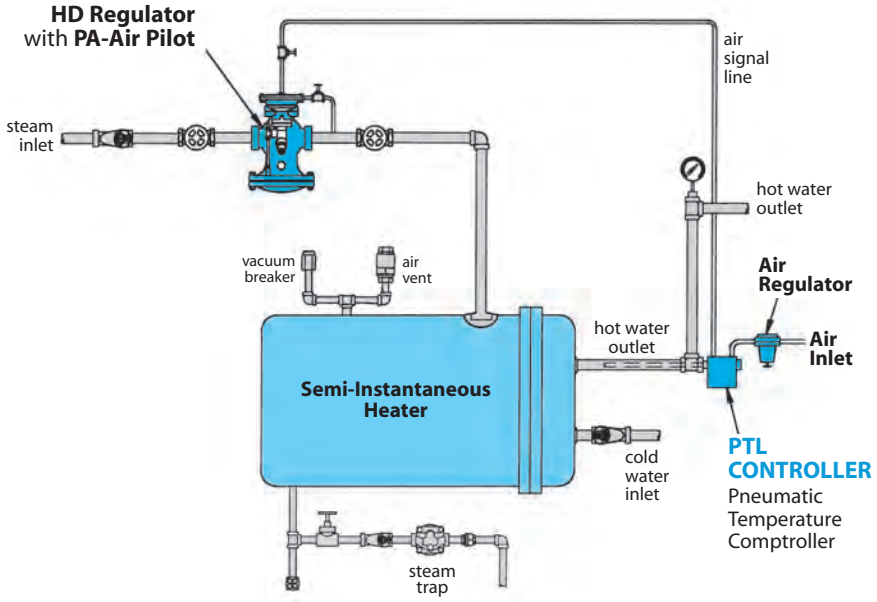
How to Size / Order

PTL & PTR PNEUMATIC TEMPERATURE CONTROLLER
Specify: • **PTL** or **PTR** controller model (air pilot required for operation)

AIR PILOT
Specify: • **PA1**, **PA4** or **PA6** Air Pilot model (refer to Air Pilot section)

REGULATOR BODY
Specify: • **HD** regulator body
• Regulator size or capacity
• End connections (threaded, 150/300# flanged)

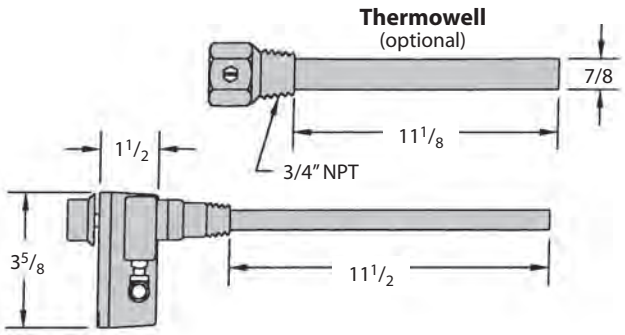
Pneumatic Temperature **Controllers** (must be used with PA-Air Pilot)

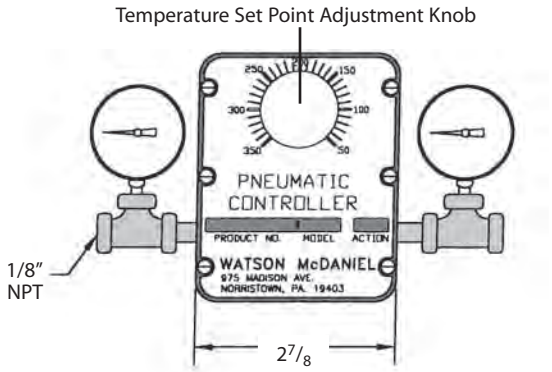


Description of Operation

The **PTL Pneumatic Temperature Controller** senses outlet water temperature on a semi-instantaneous hot water heater. When the outlet water temperature falls below the set point, the PTL pneumatic temperature controller sends an air signal to the **PA Air Pilot**, which opens the regulator, allowing steam to heat the tank. When the water reaches the desired set temperature, the PTL pneumatic temperature controller shuts off the air signal to the **PA Air Pilot** and the regulator closes, cutting off steam to the heater.

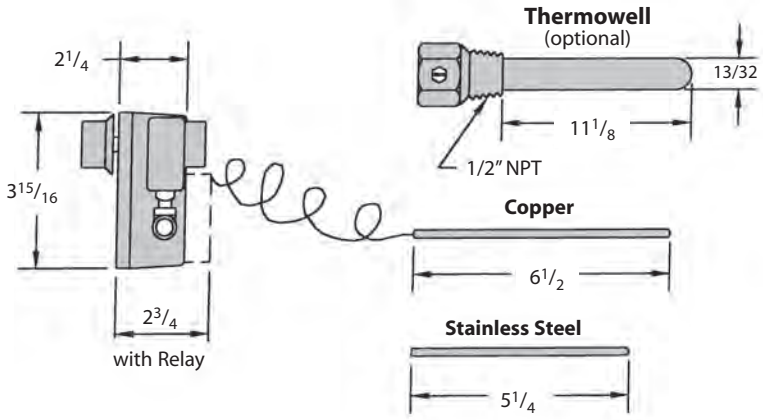
Model PTL (DIRECT Mounted)

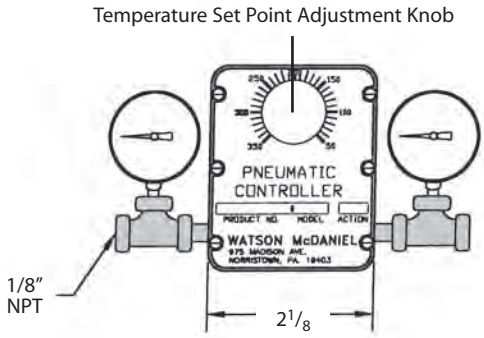




Units: inches

Model PTR (REMOTE Mounted)





PTRP Series Pilots
HD Series

Temperature Control with PTRP Temperature Pilot

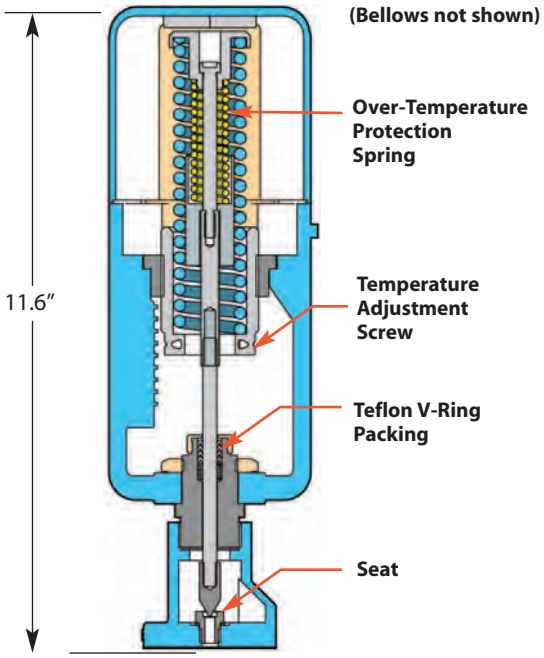
Model	PTRP
Pilot Body Material	**Cast Steel**
Max Inlet Pressure	**300 PSIG**
Temperature Control Range	**20-440° F**
Steam Inlet Pressure Range (when Standard Temperature Pilot is used with **HD** Standard main valve)	**15-300 PSIG**
Steam Inlet Pressure Range (when Low-Pressure Temperature Pilot is used with **HD-LP** Low-Pressure main valve)	**5-20 PSIG**

LOW PRESSURE PTRP-LP Pilot (pressures under 15 PSIG)
Use Code **LP**: Low pressure Temperature Pilot is required for steam pressure under 15 PSI. (Range 5 - 20)
PILOT: Example Model Code: PTRP-LP-06-08-S15

LOW PRESSURE HD Main Valve (pressures under 15 PSIG)
Use Code **LP**: A Low Pressure Main Valve must be used in conjuction with a Low Pressure Temperature Pilot for steam pressure under 15 PSIG
MAIN VALVE: Example Model Code: HD-13-N-LP (Range 5 - 20)

Model PTRP-94 contains Temperature Indicating Dial

Model PTRP-91 is Non-Indicating



Typical Applications

The **PTRP-Temperature Pilot** is used with the HD Regulator to control temperature in various processes and systems. The PTRP uses a vapor tension system to actuate the bellows in the temperature pilot giving it a faster reaction time and better temperature sensitivity than the standard PT pilot. They can be used on: oil heaters, ovens, process heaters, vats, dryers, jacketed kettles, and semi-Instantaneous water h-eaters.

Features

- Stainless steel heat-treated valve and seat for extended service life
- Standard bulb & capillary is copper, which has the best heat transfer properties.
- Standard capillary length is 8 ft. with 316 stainless steel armour-protection

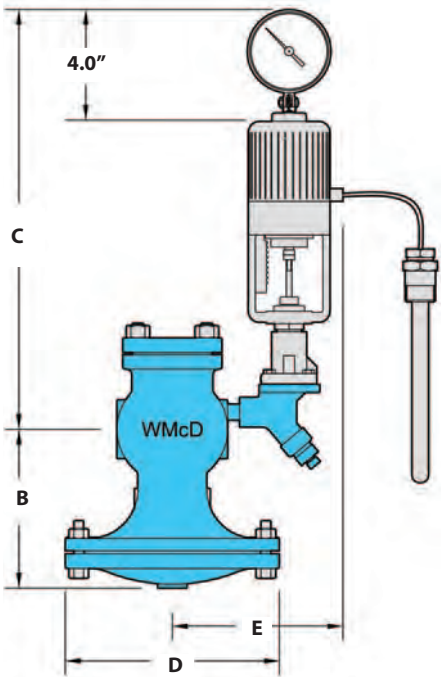
Options

- **Capillary Lengths:** Available in 8, 12, 16, 20 & 24-ft.
- **Special Materials:** Sensing bulb, thermowells, and capillary are available in special corrosion resistant materials.
  - 316 stainless steel capillary, bulb & bushing
  - 316 stainless steel armor with standard capillary
- **Thermowell (Separable Socket):** Available in stainless steel or copper
- **Temperature Sensing Dial:** Indicates temperature of process being controlled
- **SDWA Compliance (Safe Drinking Water Act);** Suffix Code SDWA

Specifications

Dial Thermometer:	4" dial, stainless steel case, swivel and angle adjustment (Model PTRP-94 only)
Housing:	Die cast aluminum, epoxy powder coated grey finish
Bellows:	High pressure brass, corrosion resistant, tin plated finish (not shown)
Over-Temperature Protection:	Upper range limit +100° F

PTRP Series Pilots
HD Series



DIMENSIONS HD-Series – *inches*

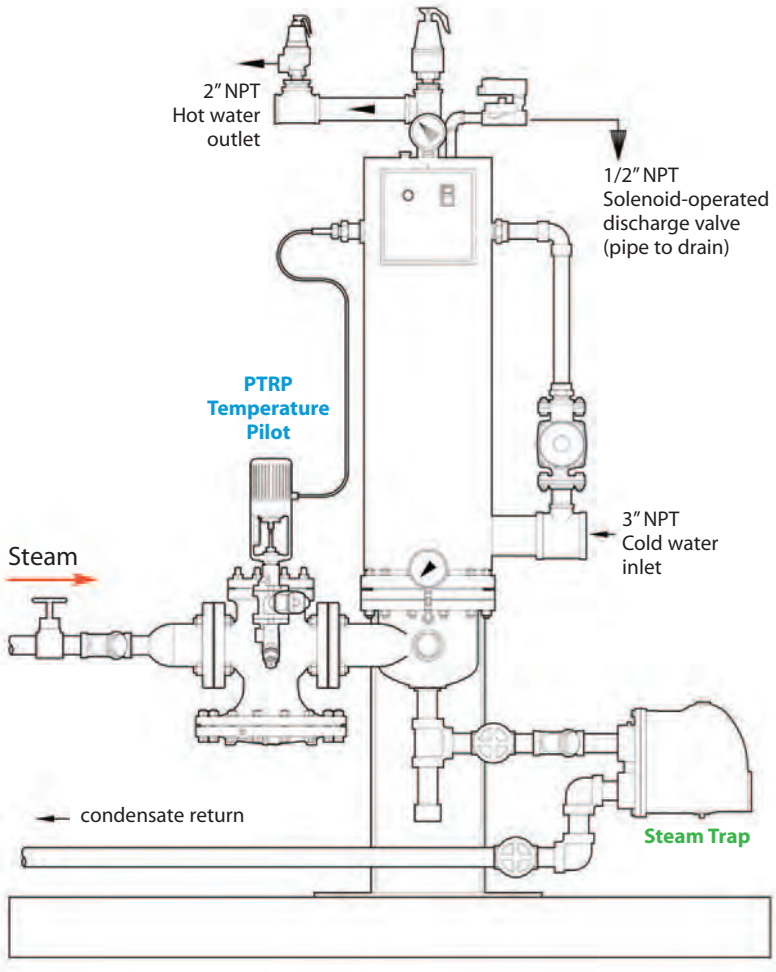
Size	Face-To-Face NPT	Face-To-Face 150#	Face-To-Face 300#	B	C	D	E	Weight (lbs) NPT	Weight (lbs) FLG
1/2"	4 3/8			5 5/8	14	6 3/4	7 3/4	18	
3/4"	4 3/8			5 5/8	14	6 3/4	7 3/4	18	
1"	5 3/8	5 1/2	6	6 1/4	14	7 1/8	7 3/4	23	35
1 1/4"	6 1/2			7 3/8	14	8 7/8	8 1/4	43	
1 1/2"	7 1/4	6 7/8	7 3/8	7 3/8	14	8 7/8	8 1/4	43	60
2"	7 1/2	8 1/2	9	8 1/4	14	10 7/8	8 1/2	65	85
2 1/2"		9 3/8	10	9	14	11 3/4	8 1/2		105
3"		10	10 3/4	8 7/8	14	13 1/4	9 1/2		145
4"		11 7/8	12 1/2	11	14	14 3/4	10 1/2		235
6"		15 1/8	16	14 1/2	14 1/2	19 3/4	11 3/4		470

MATERIALS for PTRP Pilot

Pilot Body	Cast Steel
Valve and Seat	Heat-treated Stainless Steel
Support Bracket	Aluminum
Bulb & Capillary	Copper (optional stainless steel)
All Other Parts	Brass

MATERIALS for HD Main Valve

Body	**Ductile Iron**
Cover	**Ductile Iron**
Gasket	Grafoil/Garlock
Cover Screws	Steel
Pilot Adapter	**Cast Steel**
Screen	Stainless Steel
Tubing	Copper
Valve Seat	Hardened SST (55 Rc)
Valve Disc	Hardened SST (55 Rc)
Diaphragm	Phosphor Bronze



HD Valve with PTRP-Temperature Pilot Application

A semi-instantaneous steam-to-water heater is a common application where the simple benefits of a self-contained, pilot-operated regulator with temperature sensing pilot may be favored over more complex and expensive control valves. The thermally sensitive bulb of the PTRP pilot contains a fluid that creates a vapor which increases or decreases in pressure as the sensing bulb – sensing the heated water – temperature increases or decreases. This vapor pressure is transmitted hydraulically to the bellows, which actuates the pilot and HD regulator to control the flow of steam into the heater. At start-up, the pilot is manually-adjusted to raise the temperature set point and allow steam to flow through the pilot and valve. As the heated water nears the temperature set point, the vapor pressure in the sensing bulb increases and expands the bellows, closing the pilot and regulator to proportionally limit the steam supply.

Temperature Control

Sensing Bulb Selection & Installation:

The sensing bulb and capillary is available in either Copper (standard) or Stainless Steel (for corrosive applications). Copper has the best heat transfer properties and should always be chosen unless used in corrosive service. Sensing bulb length is dependent upon the capillary length required; longer capillary lengths require a longer bulb to hold the additional actuating fluid. When installing the sensing bulb, the Union Hub is first threaded into a tank or piping system. The bulb slides thru the Union Hub and held in place by threading in the Union Nut. The angled seating surface of the bulb forms a metal-to-metal seal to the Union Hub, preventing the leakage of process fluid.

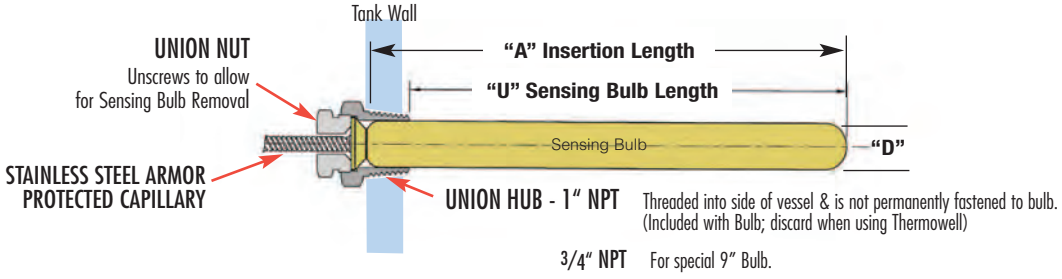
Sensing Bulb & Capillary

ORDER CODE	Sensing Bulb Material	Capillary Tubing Material		Capillary Length in Feet 8, 12, 16	20	24	"D" Bulb Dia.
S15	Copper (Brass Union Hub)	Copper with Stainless Steel Spiral Armor	A	13"	16"	20"	1"
			U	12.25"	15.25"	19.25"	
S16	Stainless Steel (Stainless Steel Union Hub)	Stainless Steel with Stainless Steel Spiral Armor	A	13"	16"	20"	1"
			U	12.25"	15.25"	19.25"	
SB15* (special 9")	Copper (Brass Union Hub) (9" bulb)	Copper with Stainless Steel Spiral Armor	A	9"	9"	9"	3/4"
			U	8.25"	8.25"	8.25"	
SB16* (special 9")	Stainless Steel (Stainless Steel Union Hub) (9" bulb)	Stainless Steel with Stainless Steel Spiral Armor	A	9"	9"	9"	3/4"
			U	8.25"	8.25"	8.25"	

For SDWA Compliance (Safe Drinking Water Act) of bulb and connection, use Suffix Code SDWA.
Example Model Code: **PTRP-91-06-08-SB15-SDWA**

***Note for 9" Bulb:**

Care should be taken when using 9" bulbs, and they should only be used in applications where space considerations exist. They should not be used when the temperature of the actuator housing is higher than the sensing bulb temperature, as this condition may create erratic temperature control. The temperature of the actuator housing is affected by the surrounding ambient temperature as well as the steam temperature flowing through the valve and may reach 140°F.



Thermowell Option (ordered separately)

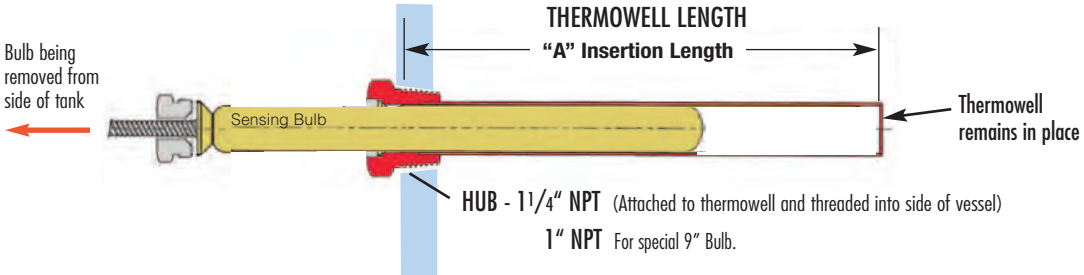
Thermowells isolate and protect the sensing bulb from the process fluid; available in either brass (better heat transfer properties) or Stainless Steel for corrosion resistance. They allow for sensing bulb removal and replacement without having to drain liquid from the system. For corrosive applications, a Stainless Steel thermowell (with a copper sensing bulb) can be used. For best temperature control use a copper sensing bulb with a brass thermowell. Thermowells are also recommended for applications with excessive system pressures or extremely turbulent flow to protect the sensing bulb from damage.

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

THERMOWELLS - Model Numbers & Lengths

Brass Model No.	Stainless Steel Model No.	Nominal Length	"A" INSERTION LENGTH (in.) BULB	THERMOWELL	Capillary Length in Feet
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
535-M2*	535-M6*	9"	8.25	9.00	8, 12 or 16

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.



PTRP Series Pilots
HD Series

Model Code Chart with Temperature Ranges (8 ft. Capillary Lengths)

Range Code	Nominal Range (˚F)	Recommended* Working Span (˚F)	Model Code NON-Indicating	Model Code Indicating	Weight lbs
01	20 - 70	40 to 65 °F	PTRP-91-01-08	PTRP-94-01-08	8
02	40 - 90	65 to 85 °F	PTRP-91-02-08	PTRP-94-02-08	8
03	30 - 115	85 to 110 °F	PTRP-91-03-08	PTRP-94-03-08	8
04	50 - 140	110 to 135 °F	PTRP-91-04-08	PTRP-94-04-08	8
05	75 - 165	135 to 160 °F	PTRP-91-05-08	PTRP-94-05-08	8
06	105 - 195	160 to 190 °F	PTRP-91-06-08	PTRP-94-06-08	8
07	125- 215	190 to 210 °F	PTRP-91-07-08	PTRP-94-07-08	8
09	155- 250	210 to 245 °F	PTRP-91-09-08	PTRP-94-09-08	8
10	200 - 280	245 to 275 °F	PTRP-91-10-08	PTRP-94-10-08	8
11	225 - 315	275 to 310 °F	PTRP-91-11-08	PTRP-94-11-08	8
12	255 - 370	305 to 365 °F	PTRP-91-12-08	PTRP-94-12-08	8
13	295 - 420	365 to 415 °F	PTRP-91-13-08	PTRP-94-13-08	8
14	310 - 440	415 to 435 °F	PTRP-91-14-08	PTRP-94-14-08	8

* The Recommended Working Span typically falls within the upper third of the nominal temperature range.

CROSS REFERENCE: PTRP = Spence T-14

Model Code Configuration Chart

Models		Temperature Range		Capillary Length		Bulb	
PTRP-91 PTRP-94 PTRP-LP-91 PTRP-LP-94	Non-Indicating Indicating Dial Non-Indicating Indicating Dial	01 – 14	Refer to Temperature Range Chart	08 12 16 20 24	8 Feet (std) 12 Feet 16 Feet 20 Feet 24 Feet	S15 S16 SB15 SB16	(copper bulb) (standard) (SS bulb) (9” copper bulb) (9” SS bulb)

Note: Thermowells are ordered separately.
LP = Low Pressure Models.

HD Main Valve with **PTRP-Temperature Pilot**

Model Code for Main Valve: **HD-17-F150** (2” HD Series Valve with 150# Flanged)

Model Code for Pilot: **PTRP-94-06-08-S15**
(Temperature Pilot with Indicating Dial (105-195˚F) with 8 Ft. Capillary, Copper Bulb)

How to write proper model number:

Explanation of Model Number:	PTRP-91	06	08	S15
	Model	Temp. Range	Cap. Length	Bulb Type
Model Number:	**PTRP-91-06-08-S15**			

Model PTRP-94 contains Temperature Indicating Dial
Model PTRP-91 is Non-Indicating

Example Model Codes:

1) **PTRP-91-06-08-S15** (105°F - 195°F Temp Range, 8 ft. Capillary, 12” Copper Bulb)
2) **PTRP-94-06-08-S15** (105°F - 195°F Temp Range, with Dial Thermometer, 8 ft. Capillary, 12” Copper Bulb)

Trip-Stop

Trip-Stop Pilot	**TSP**
Body Material	**Cast Steel**
Max Inlet Pressure	**300 PSIG**
Inlet Pressure Range (with **HD** Standard main valve) (with **HD-LP** Low-Pressure main valve)	 **15-300 PSIG** **5-20 PSIG**
Minimum Differential Pressure (with **HD** Standard main valve) (with **HD-LP** Low-Pressure main valve)*	 **10 PSI** **3 PSI**

*Note: A Low Differential Pressure (LDP) HD Main Valve is typically selected to minimize pressure drop across the valve. Consult factory for assistance, if needed.

Typical Applications

The **Trip-Stop Pilot** is designed to prevent over-pressurization of downstream piping in steam systems where application codes allow its use in lieu of a safety valve (SRV). The pilot is installed on a separate HD Series main valve that is installed downstream of the main pressure reducing valve. If the downstream control pressure increases above the factory-set pressure on the Trip-Stop pilot, the pilot trips to release the diaphragm pressure and close the main valve to stop the steam flow. Once the pressure downstream is below the set point, the pilot may be manually reset.

Features

- The TSP-Trip Stop Pressure Pilot is used to protect downstream steam pressure from over pressurizing
- Pilot is installed using 1/4" NPT Connection
- Solid floating diaphragm
- Watson McDaniel's pilots can be used with other manufacturers' regulators

MATERIALS for TRIP-STOP Pressure Pilot	
Pilot Body & Cover	**Cast Steel**
Seat Gasket	302 SS
Diaphragm	Phosphor Bronze
Head & Seat Assembly	Hardened SST (55 Rc)

OPERATING PRESSURES

Inlet Pressure Range:
15-300 PSIG (Standard Main Valve)
5-20 PSIG (Low Pressure Main Valve)

Minimum Differential Pressure:
10 PSI (Standard Main Valve)
3 PSI (Low Pressure Main Valve)

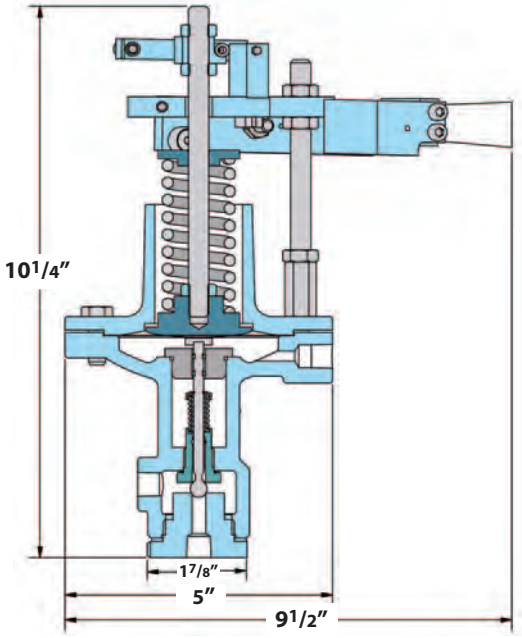
*** XXX = Set Pressure**

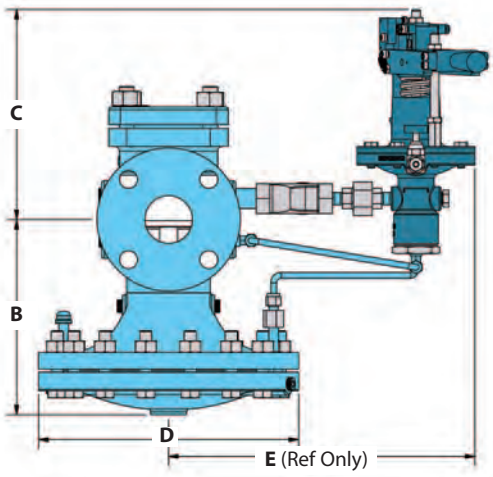
Pressure Range PSI	Model Code	Spring Color	Weight lbs
3-25	**TSP-Y-XXX***	Yellow	16
20-100	**TSP-B-XXX***	Blue	16
80-200	**TSP-R-XXX***	Red	16

How to Size / Order

TSP - TRIP STOP PILOT
Specify: • Trip Set Pressure (factory set)
Example: **TSP-B-040:** TSP Pilot with 40 PSIG set pressure

REGULATOR BODY
Specify: • **HD** regulator body
• Regulator size or capacity
• End connections (threaded, 150/300# flanged)





PDP Pilots
HD Series

Differential Pressure

Differential Pressure Pilot	PDP
Body Material	Cast Steel
Max Inlet Pressure	300 PSIG
Reduced Outlet Pressure Range	3-200 PSIG
Inlet Pressure Range	
(with **HD** Standard main valve)	15-300 PSIG
(with **HD-LP** Low-Pressure main valve)	5-20 PSIG
Minimum Differential Pressure	
(with **HD** Standard main valve)	10 PSI
(with **HD-LP** Low-Pressure main valve)	3 PSI

Pressure Range PSI	Model Code	Spring Color	Weight lbs
3-25	**PDP-Y**	Yellow	16
20-100	**PDP-B**	Blue	16
80-200	**PDP-R**	Red	16

Typical Applications

The **PDP-Differential Pressure Pilot** is used with the **HD Regulator** to maintain steam pressure at a set differential pressure above another media source. This is typical on an oil burner where steam used for atomization is injected into the oil burner at a set pressure above the incoming oil supply pressure. When oil pressure fluctuates (based on demand), the steam pressure will maintain a constant differential pressure above the oil pressure.

Features

- The PDP-Differential Pressure Pilot is used to maintain downstream steam pressure to a set differential pressure above loading pressure
- Accuracy to within ±2 PSI
- 3 overlapping spring ranges to choose from
- Pilot is installed using only four bolts
- Full port strainer and blowdown valve on pilot adapter for ultimate protection from dirt and scale
- Solid floating diaphragm
- Watson McDaniel's pilots can be used with other manufacturers' regulators

Options

- Solenoid pilot can be added for remote on/off control of regulator

MATERIALS for PDP Differential Pressure Pilot	
Pilot Body	**Cast Steel**
Seat Gasket	302 SS
Diaphragm	Phosphor Bronze
Head & Seat Assembly	Hardened SST (55 Rc)

OPERATING PRESSURES

Inlet Pressure Range:
15-300 PSIG (Standard Main Valve)
5-20 PSIG (Low Pressure Main Valve)

Minimum Differential Pressure:
10 PSI (Standard Main Valve)
3 PSI (Low Pressure Main Valve)

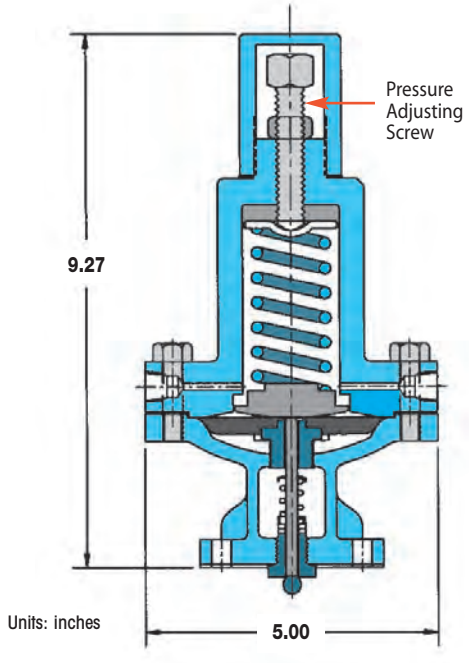
How to Size / Order

PDP - DIFFERENTIAL PRESSURE PILOT

Specify: • Reduced pressure range –
Example: **PDP-Y:** PDP Pilot with 3-25 PSIG spring

REGULATOR BODY

Specify:
- **HD** regulator body
- Regulator size or capacity
- End connections (threaded, 150/300# flanged)

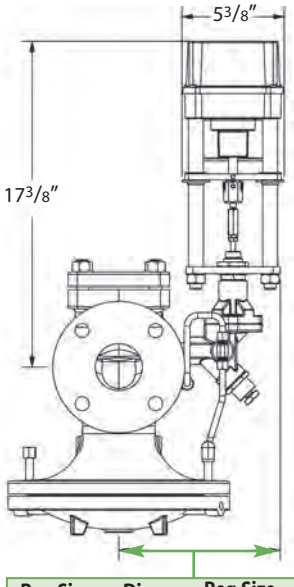


EP Pilots
HD Series

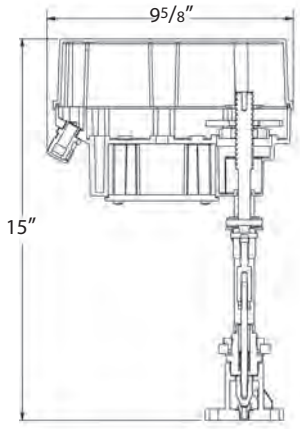
Electric Pilot with ES Spring Return Actuator

HD Main Valve
with **EP Pilot**

Electric Pilot	**EP**
Body Material	**Cast Steel**
Max Inlet Pressure Reduced Outlet Pressure Range	**300 PSIG** **3-200 PSIG**
Inlet Pressure Range (with **HD** Standard main valve) (with **HD-LP** Low-Pressure main valve)	 **15-300 PSIG** **5-20 PSIG**
Minimum Differential Pressure (with **HD** Standard main valve) (with **HD-LP** Low-Pressure main valve)	 **10 PSI** **3 PSI**



Reg Size	Dim.	Reg Size	Dim.
(1/2″-3/4″)	7 5/8″	(2 1/2″)	8 3/4″
(1″)	7 3/4″	(3″)	9 1/2″
(1 1/4″-1 1/2″)	8 3/8″	(4″)	10 1/2″
(2″)	8 5/8″	(6″)	12 1/8″



ES Electric Actuator Specifications

Power Supply	24VAC
Nominal Current (A)	0.4
Max Current (A)	0.4
Max Power Consumption (W)	6
Force	225 lbs
Stem Velocity	0.012 in/sec
Nominal 3/4" Travel Time	60 sec
Duty Cycle, IEC 60034-1,8	S2 30 min S4-1200 c/h - 50% ED
Ambient Temperature	14 to 140°F
Actuator Weight	12.4 lbs

Typical Applications

The **Electric Pilot** is used with HD regulators for a variety of applications including On/Off Control. The control signal range is 4-20mA or 0-10V. A Low-Pressure version (-LP) is available for 5-20 psig steam supply pressures.

Features

- Fail-Safe Mode: An integrated power spring is used to drive the valve fully closed or open in the event of power loss to the actuator.
- Integral Positioner: Accepts 4-20mA or 0-10 VDC control signals, eliminating the need for a separate I/P transducer.

OPERATING PRESSURES

Inlet Pressure Range:
15-300 PSIG (Standard Main Valve)
5-20 PSIG (Low Pressure Main Valve)

MATERIALS for EP Electric Pilot

Pilot Body & Cover	**Cast Steel**
Seat Gasket	302 SS
Head & Seat Assembly	Hardened SST (55 Rc)

How to Size / Order

EP - ELECTRIC PILOT
Specify: • Fail Close/open
Example: **EP-ESB-10:** Spring Fail-Closed, 24VAC, 4-20mA Signal

REGULATOR BODY
Specify: • **HD** regulator body
• Regulator size or capacity
• End connections (threaded, 150/300# flanged)

Additional Technical Information

Motor Protection	Electric motor current monitoring with safety cut-off
Set Value Feedback	4-20mA or 0-10 VDC selectable,
Valve Positioner Function	Integrated positioner, deadband 0.6 % of full signal range, shut-off min
Automatic Start-up	Recognizing the end position(s) and auto-scaling set and feedback values
Internal Fault Monitoring	Torque, set value, temperature, power supply
Cable Glands	2x M20x1.5 & 1x M16x1.5

Model Code Configuration Chart

Models	Valve Inlet Pressure	Code	Actuator	Code	Power Supply	Code	Control Signal
EP	Standard	**ESA**	Spring—Fail-Open	**1**	24 VAC	**0** **1**	4-20mA 0-10V
EP-LP	Low-Pressure (5-20 PSIG)	**ESB**	Spring — Fail-Closed				

HSP Pressure Regulating Valves

Cast Steel & Stainless Steel

Cast Steel & Stainless Steel Pressure Regulating Valve

Model	HSP	HSP-SS
Body Material	Carbon Steel	Stainless Steel
Sizes	1", 1½", 2", 3", 4"	
Connections	150#/300# Flange	
PMO Max. Operating Pressure	450 PSIG	
TMO Max. Operating Temperature	650˚F	
Pressure/Temp Ratings	150# FLG: 150 PSIG @ 550˚F	150 PSIG @ 566˚F
	300# FLG: 550 PSIG @ 650˚F	450 PSIG @ 600˚F

OPERATING PRESSURES

Inlet Pressure Range:
15-450 PSIG (standard Main Valve)
5-20 PSIG (low-pressure Main Valve)

Minimum Differential Pressure:
10 PSIG (standard Main Valve)
3 PSIG (low-pressure Main Valve)

ANSI/FCI 70-3 Class IV Shut-off

PRESSURE-ADJUSTING SPRING RANGES

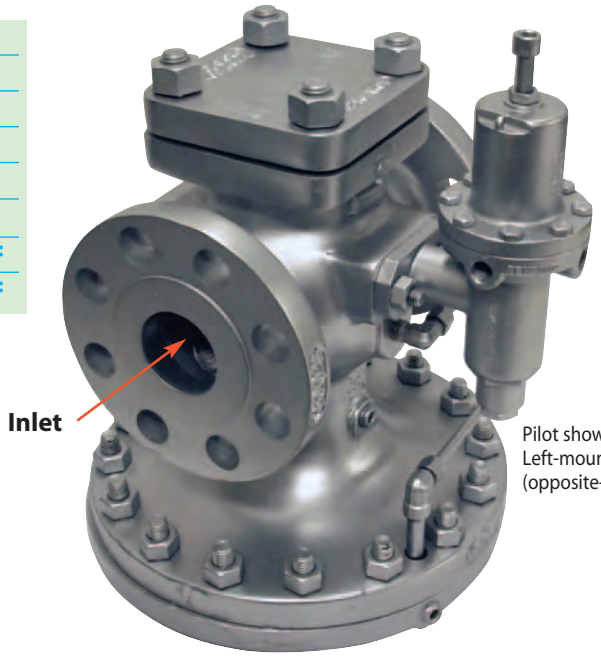
Pressure Ranges	Identifying Colors
10-40 PSIG	yellow
25-100 PSIG	blue
75-300 PSIG	red

Typical Applications

The **HSP & HSP-SS Series** Main Valve with **integral Pressure Pilot** reduces steam pressure in steam system piping mains and process applications. This pilot-operated regulator is specifically used in applications where the properties and benefits of Cast Steel or Stainless Steel are desired and/or specified. Using steel as the material of construction for the main valve body extends the pressure-temperature rating of the regulator. A unique two-bolt pilot adapter design and field-reversible tubing offer even greater versatility to this type of regulator, further reducing maintenance downtime. These valves share the same design and proven reliability of the Watson McDaniel HD-Series Regulators, providing extremely accurate control of downstream system pressure even when inlet pressure to the regulator fluctuates or steam usage varies.

Features

- Cast Steel body for higher pressure and temperature ratings
- Stainless Steel body for improved corrosion resistance
- New, convenient bolt-on pilot design simplifies installation
- New diaphragm design improves performance and extends life
- Hardened stainless steel trim for extended life
- Full port strainer and blowdown valve on pilot adapter for ultimate protection from dirt and scale
- Maintains downstream pressure to ±1.0 PSIG
- Choice of three overlapping spring ranges
- Pre-mounted pilot & tubing simplifies installation



Pilot shown Left-mounted (opposite-mounted)

HSP and HSP-SS available with other pilots (i.e. temperature, back pressure, etc.); Consult factory.

Pilot Mounting

Standard pilot mounting is on the right side of the regulator when looking into the outlet port. For opposite-mounting, specify when ordering. Pilot mounting on HSP & HSP-SS regulators are field-reversible.

Pressure Pilot

The spring-adjusted Pilot is used for general purpose pressure reducing applications.

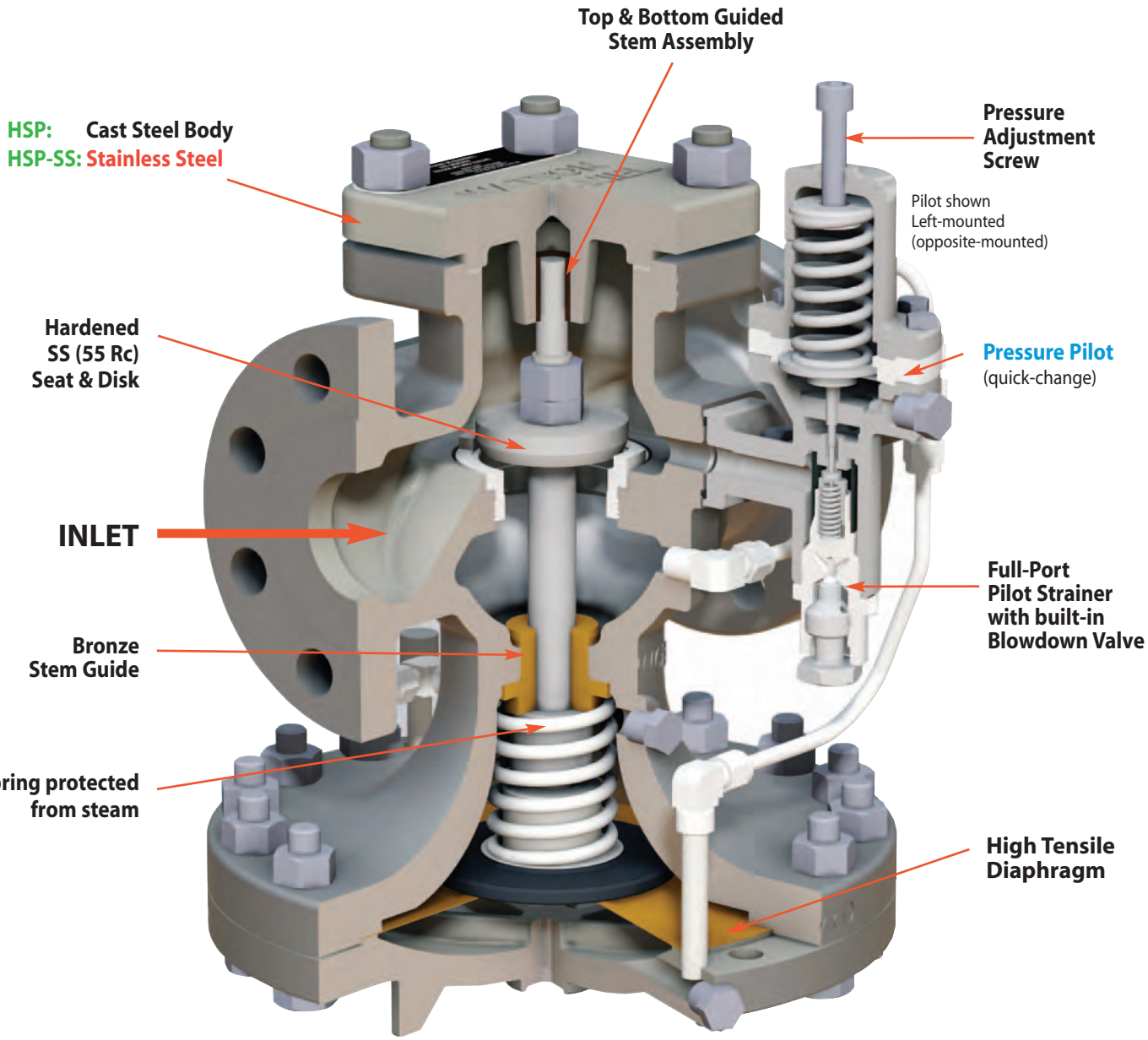
MATERIALS

	HSP	HSP-SS
Body	ASTM A-216 GR WCB	ASTM A-351 CF8M
Cover	ASTM A-216 GR WCB	ASTM A-351 CF8M
Diaphragm Cover	ASTM A-216 GR WCB	ASTM A-351 CF8M
Pilot	ASTM A-216 GR WCB	ASTM A-351 CF8M

Other MATERIALS for both Models

Gaskets	Garlock 3400/grafoil SLS
Seat	Hardened SST (55Rc)
Disc	Hardened SST (55Rc)
Diaphragm	Bronze
Diaphragm for LP Model	EPDM
Mfg. Bolts (HSP)	SA-193 GR B7
Mfg. Bolts (HSP-SS)	SA-193 GR B8M
Spring	302 SS
Stem	416 SS

Cast Steel & Stainless Steel **Pressure** Regulating Valve



Pressure Regulator shown with Left-mounted Pilot (right-mounted is standard)

Cast Steel & Stainless Steel **Pressure** Regulating Valve

Model includes HSP Main Valve with Pressure Pilot

Size/Connection		Model **Code** HSP	Model **Code** HSP-SS	Pressure Pilot Range **(PSI)**	Weight **lbs**
1"	150# FLG	**HSP-14-F150-Y**	**HSP-SS-14-F150-Y**	10-40	36
		HSP-14-F150-B	**HSP-SS-14-F150-B**	25-100	
		HSP-14-F150-R	**HSP-SS-14-F150-R**	75-300	
	300# FLG	**HSP-14-F300-Y**	**HSP-SS-14-F300-Y**	10-40	38
		HSP-14-F300-B	**HSP-SS-14-F300-B**	25-100	
		HSP-14-F300-R	**HSP-SS-14-F300-R**	75-300	
1 1/2"	150# FLG	**HSP-16-F150-Y**	**HSP-SS-16-F150-Y**	10-40	60
		HSP-16-F150-B	**HSP-SS-16-F150-B**	25-100	
		HSP-16-F150-R	**HSP-SS-16-F150-R**	75-300	
	300# FLG	**HSP-16-F300-Y**	**HSP-SS-16-F300-Y**	10-40	64
		HSP-16-F300-B	**HSP-SS-16-F300-B**	25-100	
		HSP-16-F300-R	**HSP-SS-16-F300-R**	75-300	
2"	150# FLG	**HSP-17-F150-Y**	**HSP-SS-17-F150-Y**	10-40	87
		HSP-17-F150-B	**HSP-SS-17-F150-B**	25-100	
		HSP-17-F150-R	**HSP-SS-17-F150-R**	75-300	
	300# FLG	**HSP-17-F300-Y**	**HSP-SS-17-F300-Y**	10-40	90
		HSP-17-F300-B	**HSP-SS-17-F300-B**	25-100	
		HSP-17-F300-R	**HSP-SS-17-F300-R**	75-300	
3"	150# FLG	**HSP-19-F150-Y**	**HSP-SS-19-F150-Y**	10-40	170
		HSP-19-F150-B	**HSP-SS-19-F150-B**	25-100	
		HSP-19-F150-R	**HSP-SS-19-F150-R**	75-300	
	300# FLG	**HSP-19-F300-Y**	**HSP-SS-19-F300-Y**	10-40	175
		HSP-19-F300-B	**HSP-SS-19-F300-B**	25-100	
		HSP-19-F300-R	**HSP-SS-19-F300-R**	75-300	
4"	150# FLG	**HSP-20-F150-Y**	Consult Factory	C.F.	255
		HSP-20-F150-B	Consult Factory	C.F.	
		HSP-20-F150-R	Consult Factory	C.F.	
	300# FLG	**HSP-20-F300-Y**	Consult Factory	C.F.	265
		HSP-20-F300-B	Consult Factory	C.F.	
		HSP-20-F300-R	Consult Factory	C.F.	

Pilot Ranges

Code	Color	PSIG
Y	Yellow	10-40
B	Blue	25-100
R	Red	75-300

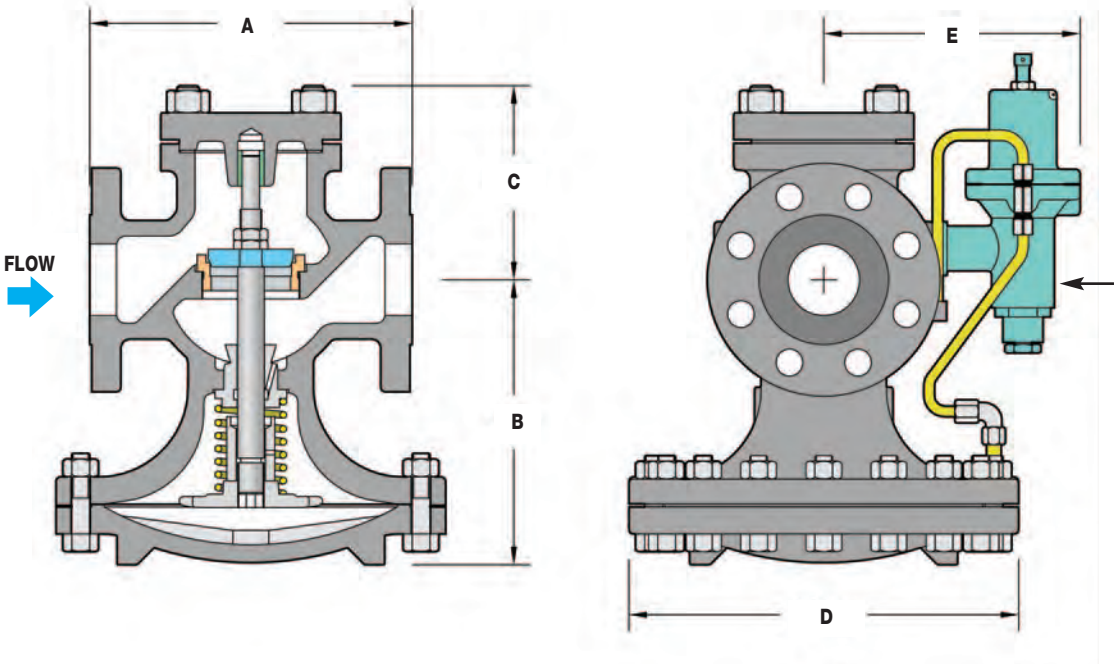
Model Configuration Chart

Models		Code	Size	Code	Connection	Code	Pressure Range (PSIG)	Code	Options (Suffix)
HSP	Full Port	**14**	1"	**F150**	150# Flanged	**Y**	10-40 (yellow)	**LP**	Low Pressure Main Valve Spring
HSPR	Reduced Port	**16**	1 1/2"	**F300**	300# Flanged	**B**	25-100 (blue)	**SSD**	SS Diaphragm
HSP-SS	Full Port	**17**	2"			**R**	75-300 (red)		
HSPR-SS	Reduced Port	**19**	3"						
		20	4"						

Example Model Codes:

1) **HSP-17-F150-Y** (HSP Full port valve, 2" 150# Flg, 10-40 PSIG, with no options)
2) **HSPR-17-F300-B-ST** (HSP Reduced port valve, 2" 300# Flg, 25-100 PSIG, with Stellite Trim)

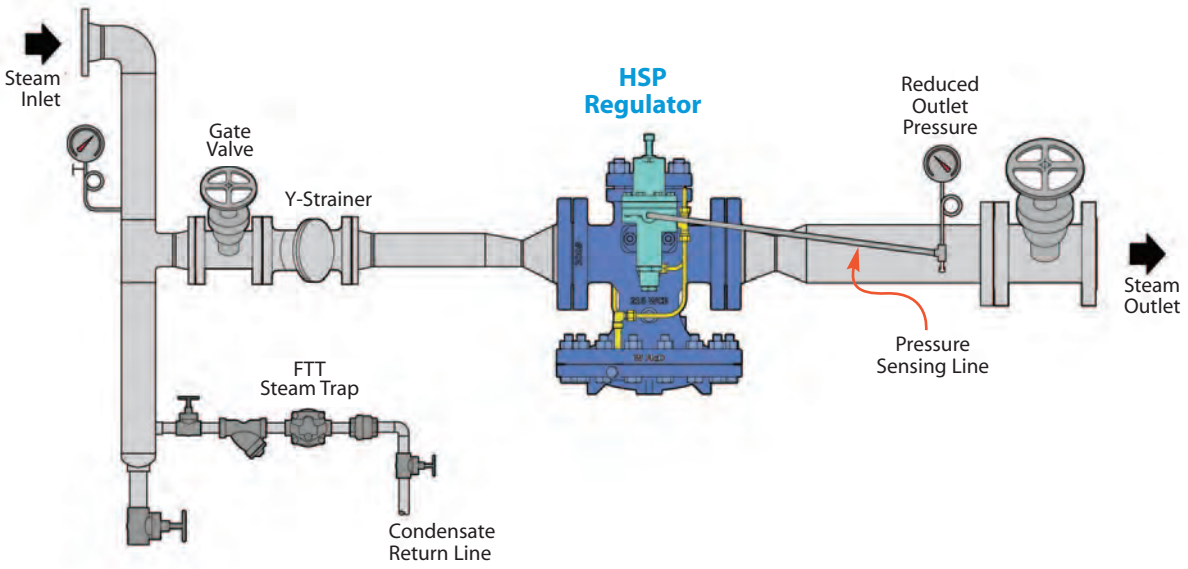
Cast Steel & Stainless Steel **Pressure** Regulating Valve



Standard pilot mounting is on the right side of the regulator when looking into the outlet port (as shown). Pilot mounting on HSP regulators are field-reversible.

DIMENSIONS HSP Series – *inches*

	(A) Face-To-Face						Weight (lbs)	
Size	150#	300#	B	C	D	E	150#	300#
1"	5 1/2	6	6 1/4	3 1/2	7	6 3/8	40	45
1 1/2"	6 7/8	7 3/8	7 3/8	4 7/8	8 3/4	7 1/16	55	60
2"	8 1/2	9	8 1/4	5 3/8	10 7/8	7 3/16	75	85
3"	10	10 3/4	8 7/8	6 3/4	13 1/4	8 3/16	130	145
4"	11 7/8	12 1/2	10 7/8	7 1/2	14 3/4	9 5/16	215	235

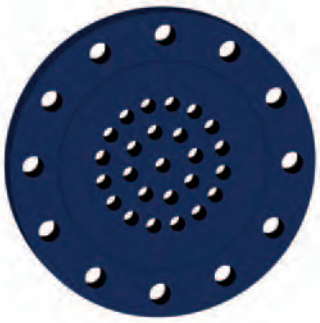


Pressure Reducing Station for Steam Application

Noise Reduction

Noise Attenuation Equipment is used to reduce unwanted or excessive noise that commonly occurs in pressure reducing stations.

Noise Reduction Capability: 5–10 dBA



Series-OP
Orifice Plate

Description

Selection: **Series-OP** orifice plates are custom engineered to maximize noise attenuation and reduce dbA to the lowest achievable value. The number and diameter of holes will be determined based on application conditions, and the plate diameter will typically be equal to the recommended downstream pipe size. Therefore, the following information is required for selection:

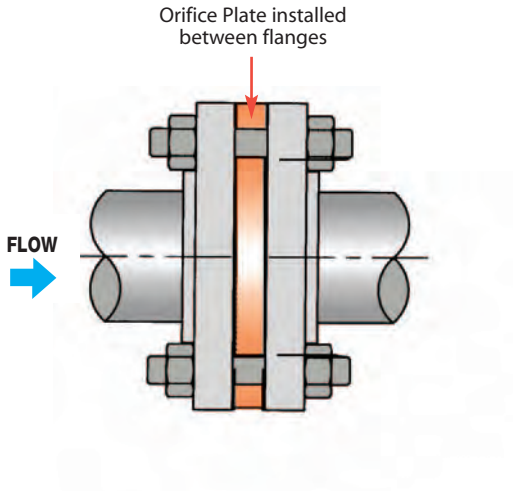
- Inlet (Supply) Pressure to the HD/HSP Regulator*
- Outlet (Downstream) Pressure of the HD/HSP Regulator*
- Steam Flow Rate (lb/hr)

How it Works

The **Series-OP** Orifice Plate with its drilled orifice pattern is installed after the pressure regulating valve to smooth out turbulence caused by the pressure drop across the regulator. Noise reduction levels of **5–10 dBA** can typically be achieved; higher possible.

Installation

The **Series-OP** Orifice Plate is installed between ANSI flanges immediately after the regulator.



Flange Size	Connection	Full Model Code
1″	150# FLG	OPX-14-150-##-0.000
	300# FLG	OPX-14-300-##-0.000
1 1/2″	150# FLG	OPX-16-150-##-0.000
	300# FLG	OPX-16-300-##-0.000
2″	150# FLG	OPX-17-150-##-0.000
	300# FLG	OPX-17-300-##-0.000
2 1/2″	150# FLG	OPX-18-150-##-0.000
	300# FLG	OPX-18-300-##-0.000
3″	150# FLG	OPX-19-150-##-0.000
	300# FLG	OPX-19-300-##-0.000
4″	150# FLG	OPX-20-150-##-0.000
	300# FLG	OPX-20-300-##-0.000
5″	150# FLG	OPX-21-150-##-0.000
	300# FLG	OPX-21-300-##-0.000
6″	150# FLG	OPX-22-150-##-0.000
	300# FLG	OPX-22-300-##-0.000
8″	150# FLG	OPX-23-150-##-0.000
	300# FLG	OPX-23-300-##-0.000
10″	150# FLG	OPX-24-150-##-0.000
	300# FLG	OPX-24-300-##-0.000
12″	150# FLG	OPX-25-150-##-0.000
	300# FLG	OPX-25-300-##-0.000
14″	150# FLG	OPX-26-150-##-0.000
	300# FLG	OPX-26-300-##-0.000
16″	150# FLG	OPX-27-150-##-0.000
	300# FLG	OPX-27-300-##-0.000
18″	150# FLG	OPX-28-150-##-0.000
	300# FLG	OPX-28-300-##-0.000
20″	150# FLG	OPX-29-150-##-0.000
	300# FLG	OPX-29-300-##-0.000

X = Material
1 = A105 CS
2 = 304 SST
3 = 316 SST

= Number of Holes
Factory Determined

0.000 = Diameter of Holes
Factory Determined

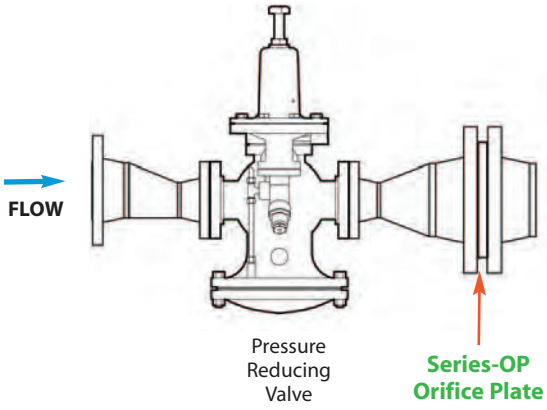
Notes: 1) Other sizes and flange connections available; Consult Factory.
*2) Orifice Plates available for other valves; Consult Factory.

Series OP (continued)
Series H

for Pressure Regulating Valves

Noise Reduction

Series-OP Typical Hook-up



Series-OP OUTSIDE DIAMETER – *inches*

Pipe Size	150# Flange	300# Flange
1″	4 1/4	4 7/8
1 1/2″	5	6 1/8
2″	6	6 1/2
2 1/2″	7	7 1/2
3″	7 1/2	8 1/4
4″	9	10
5″	10	11
5″	11	12 1/2
6″	13 1/2	15
8″	16	17 1/2
12″	19	20 1/2
14″	21	23
16″	16	17 1/2
18″	19	20 1/2
20″	21	23

Notes: 1) All dimensions follow ASME/ANSI B16.5 flange standard, including thickness, bolt circle, bolt hole diameter, etc.
2) Unless otherwise specified, all OP Series Orifice Plates supplied as raised face.

Acoustic Silencer for Pressure Regulating Valves

Series H

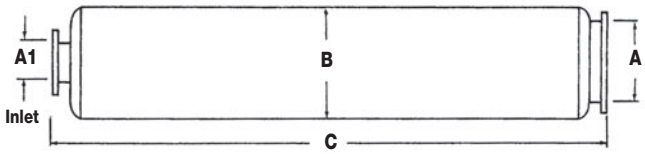
Noise Attenuation Equipment is used to reduce unwanted or excessive noise that commonly occurs in pressure reducing stations.

How it Works

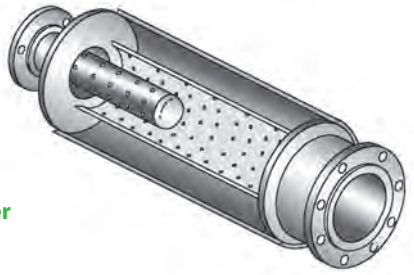
The **Series-H** Acoustic Silencer incorporates a **Dual Diffuser** tube design. The inner tube has a drilled orifice pattern and the outer tube contains an integral layer of sound absorbing insulation. Noise reduction levels of **20-30 dBA** can typically be achieved.

Installation

The **Series-H** Diffuser Tube should be installed immediately downstream of the regulator, as shown below.



Noise Reduction Capability:
20-30 dBA



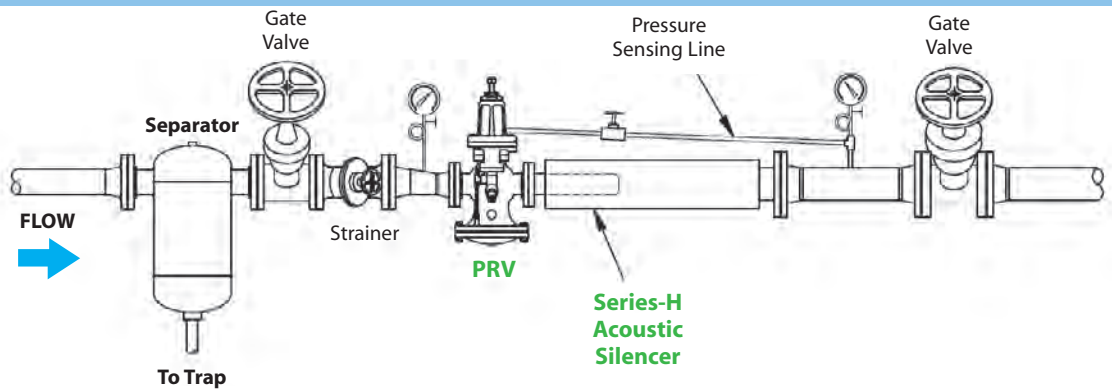
Series-H Acoustic Silencer

Series-H DIMENSIONS

Model	FLG A1	FLG A	(inches) B	C	Weight (lbs)
412-08A-XXX*	4	8	14″	72″	400
412-10A-XXX*	6	10	16″	78″	550
412-12A-XXX*	6	12	18″	90″	620

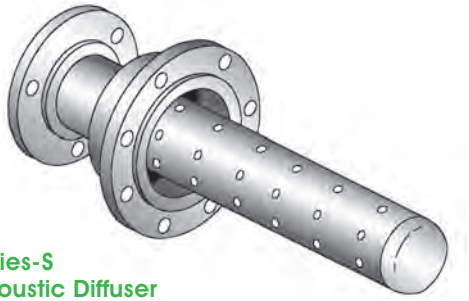
Notes: Other sizes available. Consult factory.
XXX = Numbers will be assigned at time of order for internal use.

Series-H Typical Hook-up



Noise Reduction

Noise Reduction Capability: 10-15 dBA



Series-S
Acoustic Diffuser

How it Works

The **Series-S** Acoustic Diffuser incorporates a single tube with a drilled orifice pattern which reduces downstream turbulence. Noise reduction levels of **10-15 dBA** can typically be achieved.

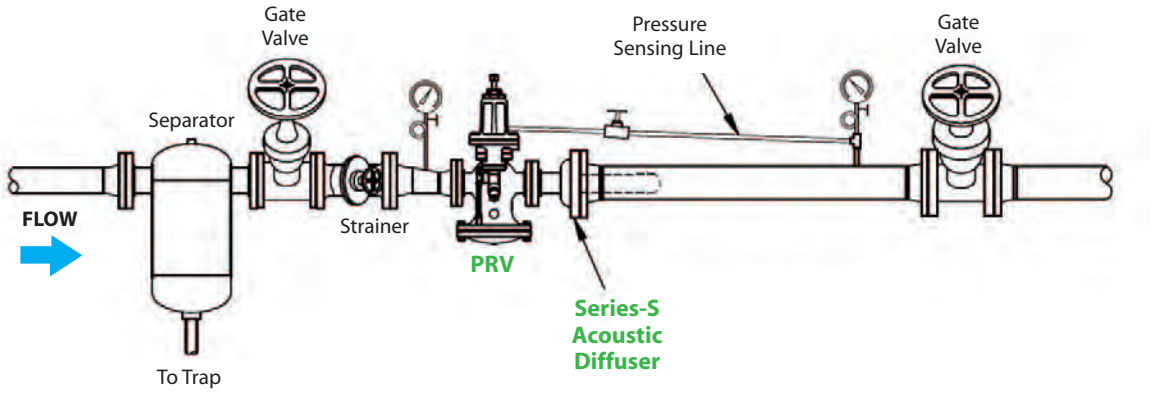
Installation

The **Series-S** Diffuser Tube should be installed immediately downstream of the regulator, as shown below.

MATERIALS

Fabricated Carbon Steel

Series-S Typical Hook-up



Model Selection Chart for Series-S Diffuser

Steam Capacity (lbs/hr)	Valve Inlet Pressure (PSIG)															
	15	20	25	30	40	50	60	75	90	100	125	150	175	200	225	250
1000	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3
1500	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3	S-3
2000	S-4	S-4	S-4	S-4	S-4	S-4	S-4	S-4	S-4	S-4	S-4	S-4	S-4	S-4	S-4	S-4
3000	S-4	S-4	S-4	S-4	S-4	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5
4000	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5
6000	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6
8000	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8
10000	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8

Note: For higher capacity models, S-10 & S-12, consult factory.

Noise Reduction

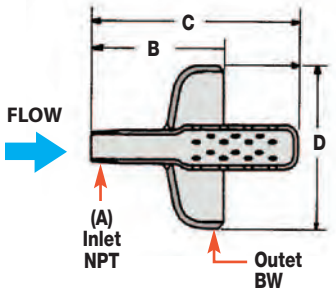
Series-S DIMENSIONS – *inches*

Model	Inlet (A)		Outlet	NPT x Weld Dimensions		
	NPT	FLG	FLG/BW	B	C	D
S-3	3/4		2	5 1/2	13 1/2	2 3/8
	1		2	5 1/2	13 1/2	2 3/8
S-4	3/4		4	6 1/2	13 1/2	4 1/2
	1		4	6 1/2	13 1/2	4 1/2
	1 1/4		4	6 1/2	13 1/2	4 1/2
	1 1/2		4	6 1/2	13 1/2	4 1/2
	2		4	6 1/2	13 1/2	4 1/2
S-5	3/4		4	6 1/2	16 1/2	4 1/2
	1		4	6 1/2	16 1/2	4 1/2
	1 1/4		4	6 1/2	16 1/2	4 1/2
	1 1/2		4	6 1/2	16 1/2	4 1/2
	2		4	6 1/2	16 1/2	4 1/2
	2 1/2	2 1/2	4	6 1/2	16 1/2	4 1/2
S-6	1 1/4		6	8	14	5 5/8
	1 1/2		6	8	14	5 5/8
	2		6	8	14	5 5/8
	2 1/2	2 1/2	6	8	14	5 5/8
	3	3	6	8	14	5 5/8
S-8	1 1/2		8	10	17	8 5/8
	2		8	10	17	8 5/8
	2 1/2	2 1/2	8	10	17	8 5/8
	3	3	8	10	17	8 5/8
	4	4	8	10	17	8 5/8
S-10	2		12	12	14	12 3/4
	2 1/2	2 1/2	12	12	14	12 3/4
	3	3	12	12	14	12 3/4
	4	4	12	12	14	12 3/4
	6	6	12	12	14	12 3/4
S-12	2 1/2	2 1/2	12	12	21	12 3/4
	3	3	12	12	21	12 3/4
	4	4	12	12	21	12 3/4
	6	6	12	12	21	12 3/4

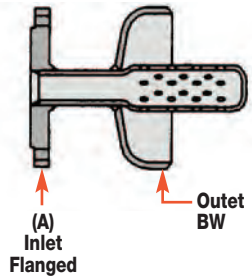
Notes: 1)150# & 300# flanged available.
2) Other sizes available; consult factory.

BW = Butt-weld

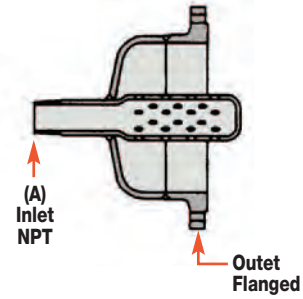
NPT x Butt-Weld



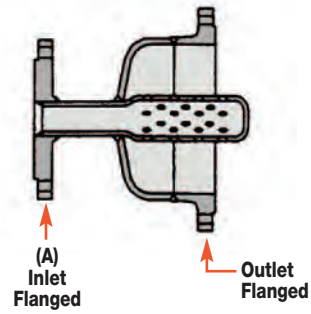
Flanged x Butt-Weld



NPT x Flanged



Flanged x Flanged



Series INSUL — Insulation/Acoustic Jackets for HD Regulator

Noise Reduction Capability: 0-5 dBA

The **Series INSUL** Thermal Insulation Jacket is designed to fit and be used on the HD, HSP, & HSP-SS Series Pilot- Operated Regulating Valve. This jacket provides insulation to minimize heat energy losses. The jacket thickness and materials of construction can also help to reduce noise when installed on the HD, HSP, & HSP-SS Series Regulators.

MATERIALS
Inner 17 oz. Silicone Coated Fiberglass Cloth
Outer 17 oz Silicone Coated Fiberglass Cloth
1" Insulation 5# Fiberglass (Utilicore)
Teflon Thread
Velcro Closure Belts
304SS Tag with Embossed Model Number

Model Code	Size
INSUL-CVR-HD-13	1/2", 3/4"
INSUL-CVR-HD-14	1"
INSUL-CVR-HD-16	1 1/4", 1 1/2"
INSUL-CVR-HD-17	2"
INSUL-CVR-HD-19	2 1/2", 3"
INSUL-CVR-HD-20	4"
INSUL-CVR-HD-22	6"

Note: Must specify regulator Connection Type when ordering.

Full Port

CAPACITIES — Steam (lbs/hr) FULL PORT

Inlet Pressure (PSIG)	Outlet Pressure (PSIG)	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"
C_V Factors		3.8	6.7	11	15	21	37	55	71	113	241
5	0	85	150	250	350	500	800	1200	1600	2600	5500
	2	80	140	230	310	440	770	1100	1500	2400	5100
7	0	115	200	325	450	600	1100	1650	2100	3600	7800
	2	105	180	300	400	575	1000	1500	2000	3100	6700
	3	90	160	275	375	525	900	1300	1800	2800	6000
10	0	150	260	425	575	850	1500	2200	2800	4600	9900
	2	140	240	400	550	800	1400	2100	2700	4300	9100
	5	100	175	300	400	600	1000	1600	2000	3200	6900
12	0	160	280	475	600	900	1600	2400	3100	4900	10300
	4	140	240	400	550	800	1400	2100	2700	4300	9100
	7	125	200	375	500	700	1200	1900	2400	3800	8200
15	0-3	190	325	550	750	1000	1800	2700	3500	5600	12000
	5	175	300	500	700	900	1700	2500	3200	5200	11100
	8	140	250	400	500	800	1300	2000	2600	4200	8900
20	0-5	210	375	625	850	1200	2100	3100	4000	6400	13700
	10	190	325	550	750	1000	1800	2700	3500	5600	12000
	12	170	300	500	675	950	1600	2500	3200	5100	10800
25	0-7	250	450	775	1050	1500	2600	3800	5000	7900	16900
	10	225	425	700	975	1300	2400	3600	4600	7300	15600
	15	200	350	600	800	1100	2000	3000	3900	6200	13200
30	0-12	275	500	800	1100	1500	2700	4100	5200	8300	17800
	15	250	450	750	1000	1400	2500	3800	4900	7800	16600
	20	225	375	650	850	1200	2100	3200	4100	6500	14000
40	0-18	350	600	1000	1350	1900	3300	5000	6400	10300	21900
	25	300	500	850	1150	1600	2800	4200	5400	8700	18500
	30	250	425	700	1000	1400	2500	3700	4700	7600	16100
50	0-20	400	700	1200	1650	2300	4100	6000	7800	12400	26500
	30	350	650	1100	1500	2000	3600	5400	6900	11000	23600
	40	275	500	800	1100	1500	2700	4100	5200	8300	17800
60	0-30	475	850	1350	1900	2600	4600	6900	8900	14200	30300
	35	425	775	1250	1700	2400	4300	6400	8200	13100	27900
	50	300	525	850	1200	1600	2900	4300	5600	8900	19000
75	0-35	575	1000	1650	2300	3200	5600	8300	10800	17200	36600
	50	475	825	1350	1900	2600	4600	6900	8900	14100	30100
	60	400	700	1150	1600	2200	3900	5800	7400	11800	25200
90	0-45	675	1200	1950	2700	3700	6600	9800	12700	20200	43100
	60	575	1000	1700	2300	3200	5700	8500	10900	17400	37100
	75	425	750	1200	1700	2300	4100	6100	7900	12600	27000
100	0-50	750	1300	2100	3000	4100	7300	10800	14000	22200	47500
	60	700	1200	2000	2700	3800	6700	10000	12900	20500	43800
	80	500	875	1400	1900	2700	4800	7100	9200	14700	31300
125	0-60	925	1650	2700	3700	5200	9100	14000	17500	28000	59500
	75	825	1475	2400	3300	4600	8200	12200	15700	25000	53500
	100	625	1100	1800	2500	3500	6200	9200	11900	19000	40400
150	0-75	1100	1900	3100	4300	6000	10600	15800	20400	32400	69100
	100	925	1600	2700	3600	5100	9000	13400	17400	27700	59000
	125	650	1150	1900	2600	3600	6400	9500	12300	19600	41900
175	0-85	1275	2250	3700	5000	7100	12500	18600	24000	38200	81400
	125	1000	1800	2900	4000	5600	9900	14700	18900	30100	64300
	150	750	1300	2100	2900	4100	7300	10800	14000	22200	47500
200	0-100	1450	2500	4200	5700	8000	14100	21000	27100	43100	92000
	125	1300	2300	3700	5100	7100	12600	18700	24100	38400	81900
	150	1075	1900	3100	4300	6000	10600	15700	20300	32300	68900
225	0-120	1575	2800	4600	6200	8700	15400	22900	29500	47000	100200
	150	1450	2500	4200	5700	8000	14100	21000	27200	43300	92300
	175	1350	2400	3900	5300	7400	13100	19500	25200	40100	85500
250	0-130	1750	3100	5100	6900	9700	17100	25500	32900	53400	111800
	150	1650	2900	4700	6500	9100	16000	23800	30800	49000	104600
	200	1200	2100	3500	4800	6700	11900	17600	22800	36200	77300
300	0-160	2045	3605	5920	8075	11310	19220	29610	38230	60840	129750
	175	1945	3425	5625	7670	10740	18925	28130	36320	57800	123270
	200	1780	3140	5155	7030	9840	17340	25780	33275	52960	112950
400	0-200			7980		14800	24000		48800	78000	
	250			7550		13800	23800		46200	73950	
	300			6700		12100	21200		41000	65200	
450	0-225			8970		16000	28000		55000	87600	
	300			8500		15000	26900		52100	83200	
	350			7540		13300	23900		46200	73900	

Note: For inlet pressures in green shaded area, use low pressure main valve and low pressure temperature pilot.
For 400 & 450 PSIG inlet pressures, use HSP & HSP-SS regulator only.

CAPACITIES — Steam (lbs/hr) REDUCED PORT

Inlet Pressure (PSIG)	Outlet Pressure (PSIG)	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"
C_V Factors		1.4	3.3	5.6	7.8	13.3	18.8	25.9	41.7	74	163
5	0	15	35	59	82	140	197	272	438	777	1712
	2	13	32	53	75	128	181	249	401	712	1569
7	0	21	48	82	115	195	276	381	613	1088	2396
	2	20	46	79	110	187	265	365	587	1042	2296
	3	19	44	74	104	177	250	344	554	983	2165
10	0	29	70	117	164	279	395	544	876	1554	3423
	2	28	68	115	160	274	387	533	858	1523	3354
	5	25	60	102	142	242	342	471	758	1346	2964
12	0	35	83	141	197	335	473	653	1051	1865	4108
	4	33	78	133	185	316	446	615	990	1758	3873
	7	29	68	115	160	272	385	530	854	1515	3336
15	0-3	43	102	173	241	410	580	800	1287	2284	5031
	5	41	98	166	232	395	558	769	1238	2198	4841
	8	37	88	149	208	354	500	690	1111	1972	4343
20	0-5	57	134	227	317	541	764	1053	1696	3009	6629
	10	51	120	204	284	483	684	942	1517	2692	5929
	12	47	111	188	262	447	632	870	1401	2486	5477
25	0-7	70	166	282	393	670	948	1305	2102	3730	8215
	10	67	158	269	375	640	905	1246	2006	3561	7843
	15	59	139	235	328	559	790	1088	1751	3108	6846
30	0-12	81	190	323	450	768	1085	1495	2408	4273	9411
	15	76	180	305	426	726	1025	1413	2275	4037	8892
	20	66	155	263	366	625	883	1216	1958	3475	7654
40	0-18	105	248	420	585	998	1410	1943	3128	5551	12227
	25	99	199	367	511	872	1232	1698	2734	4852	10688
	30	78	183	311	433	739	1044	1439	2317	4111	9056
50	0-20	135	318	539	751	1280	1809	2492	4013	7121	15686
	30	118	277	470	655	1117	1579	2175	3502	6216	13692
	40	88	208	353	491	838	1184	1632	2627	4662	10269
60	0-30	153	360	611	851	1451	2051	2826	4550	8074	17786
	35	143	338	573	798	1361	1924	2651	4268	7573	16682
	50	98	230	390	543	926	1309	1804	2904	5154	11353
75	0-35	195	460	780	1086	1853	2619	3608	5809	10308	22706
	50	164	387	657	916	1561	2207	3040	4895	8687	19135
	60	132	312	529	737	1257	1777	2448	3941	6993	15404
90	0-45	229	540	916	1277	2177	3077	4239	6825	12112	26680
	60	197	465	789	1100	1874	2648	3649	5874	10425	22962
	75	146	345	585	815	1389	1964	2705	4357	7731	17029
100	0-50	255	600	1018	1419	2419	3419	4710	7584	13458	29644
	60	235	554	940	1310	2234	3158	4351	7006	12432	27384
	80	176	416	706	983	1676	2367	3263	5254	9324	20538
125	0-60	322	760	1290	1796	3063	4329	5964	9603	17041	37536
	75	294	693	1176	1638	2793	3948	5439	8757	15540	34230
	100	221	518	882	1229	2095	2961	4079	6568	11655	25672
150	0-75	381	900	1527	2128	3628	5128	7065	11376	20187	44467
	100	329	775	1315	1831	3123	4414	6081	9791	17374	38270
	125	243	575	975	1385	2316	3274	4510	7261	12885	28382
175	0-85	449	1060	1800	2505	4272	6939	8320	13396	23771	52362
	125	360	849	1440	2006	3421	4835	6661	10725	19032	41923
	150	265	625	1060	1476	2518	3558	5606	7893	14008	30855
200	0-100	509	1200	2037	2837	4838	6838	9420	15168	26916	59288
	125	459	1082	1836	2557	4360	6164	8492	13672	24262	53442
	150	389	917	1556	2167	3695	5223	7195	11584	20557	45232
225	0-120	560	1319	2238	3117	5360	7514	10351	16667	29577	65150
	150	493	1162	1972	2747	4684	6621	9121	14686	26061	57405
	175	416	980	1663	2316	3950	5583	7692	12384	21976	48409
250	0-130	628	1480	2511	3498	5964	8431	11614	18700	33184	73095
	150	588	1386	2352	3276	5586	7896	10878	17514	31080	68460
	200	441	1040	1764	2457	4190	5922	8159	13136	23310	51345
300	0-160	755	1775	3015	4200	7160	10120	13945	22450	39840	87760
	175	715	1690	2865	3990	6800	9615	13250	21330	37850	83370
	200	655	1550	2625	3655	6235	8810	12140	19545	34680	76400
400	0-200			4070		9460	14500		29980	51450	
	250			3860		8970	12380		27460	48750	
	300			3430		7970	11010		24410	43330	
450	0-225			4580		10650	15000		32600	57890	
	300			4340		10090	13930		30890	54840	
	350			3860		8970	12380		27460	48750	

Note: For inlet pressures in green shaded area, use low pressure main valve and low pressure temperature pilot.
For 400 & 450 PSIG inlet pressures, use HSP & HSP-SS regulator only.

Ductile Iron • Carbon Steel • Stainless Steel

Model		DLCS	DLSS
Body Material	Ductile Iron	Carbon Steel	Stainless Steel
Sizes	1/2" – 4"	1" thru 4"	1" thru 3"
Connections	NPT, 150# & 300# FLG	150# & 300# Flanged	
PMO Max. Operating Pressure	300 PSIG	450 PSIG	
Pressure/ Temperature Ratings	NPT: 450 PSIG @ 650° F 150# FLG: 150 PSIG @ 550° F 300# FLG: 450 PSIG @ 650° F	Carbon Steel 150# FLG: 150 PSIG @ 550° F 300# FLG: 550 PSIG @ 650° F	Stainless Steel 150# FLG: 150 PSIG @ 566° F 300# FLG: 450 PSIG @ 600° F

DLDI
Ductile Iron

Watson McDaniel's DL Series Dome-Loaded Regulators were designed as a direct replacement for Leslie's GP-Series Dome-Loaded Regulators.

OPERATING PRESSURES

Inlet Pressure Range:
15*-300 PSIG (DLDI)
15*-450 PSIG (DLCS & DLSS)
*Note: Minimum Inlet Pressure 5 PSIG with Teflon diaphragm.

Minimum Differential Pressure: **3 PSIG**

DLCS
Carbon Steel

DLSS
Stainless Steel

Typical Applications

The **DL Series Dome-Loaded** regulator uses Air Pressure to directly load the diaphragm to control downstream steam pressure. These valve are used for general steam distribution, as well as specific applications such as rubber molding lines and other steam process applications. An external sensing line connected between the valve diaphragm area and the outlet piping provides the feedback necessary for accurate pressure control. Downstream steam pressure is then easily controlled by adjusting the air pressure to the diaphragm. Use Air-Loading Chart to determine air pressure required to control desired steam pressure. These valves share the design and proven reliability of the Watson McDaniel HD Series Regulators. The specially designed diaphragms allow for 100:1 flow rangeability.

Features

- Ductile Iron body for higher pressures than cast iron
- Cast Steel body for higher pressure and temperature ratings
- Stainless Steel body for improved corrosion resistance
- New diaphragm design improves performance and extends life
- Hardened stainless steel trim for extended life
- 100:1 Flow Rangeability
- Maintains downstream pressure to ±1.0 PSIG
- Can be used for other modes of control including temperature control and back pressure. (Consult factory for additional information.)
- Optional soft disc trim for increased shut-off tightness in low-pressure steam applications

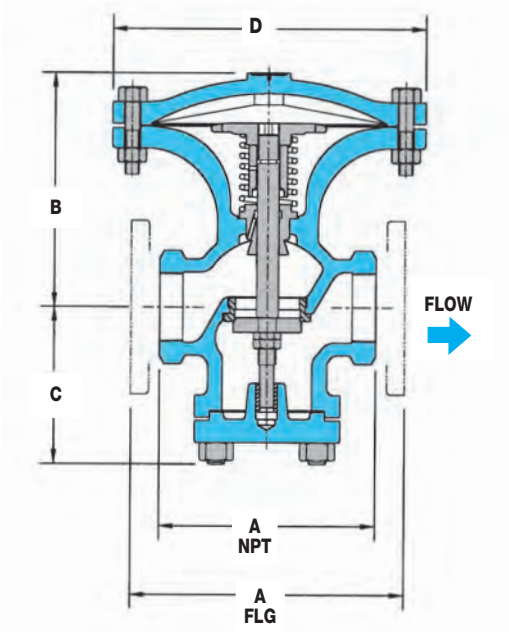
MATERIALS

	DLDI	DLCS	DLSS
Body	Ductile Iron	ASTM A-216 GR WCB	ASTM A-351 CF8M
Cover	Ductile Iron	ASTM A-216 GR WCB	ASTM A-351 CF8M
Diaphragm Cover	Ductile Iron	ASTM A-216 GR WCB	ASTM A-351 CF8M

Other MATERIALS for all Models

Gaskets	Garlock 3400/grafoil SLS
Seat	Hardened Stainless Steel (55Rc)
Disc	Hardened Stainless Steel (55Rc) Option: Mica-filled PTFE
Diaphragm	Corrugated 316 Stainless Steel (std) PTFE Teflon (opt)
Mfg. Bolts	SA-193 GR B7 (DLDI, DLCS) SA-193 GR B8M (DLSS)
Spring	302 SS
Stem	416 SS

Ductile Iron • Carbon Steel • Stainless Steel



DL-Series DIMENSIONS – *inches*

Size	A Face-To-Face NPT	150#	300#	B	C*	D	Weight (lbs) NPT	150#	300#
1/2"	4 3/8			5 5/8	3 3/8	6 3/4	24		
3/4"	4 3/8			5 5/8	3 3/8	6 3/4	24		
1"	5 3/8	5 1/2	6	6 1/4	3 1/2	7 1/8	30	31	34
1 1/4"	6 1/2			7 3/8	4 7/8	8 7/8	50		
1 1/2"	7 1/4	6 7/8	7 3/8	7 3/8	4 7/8	8 7/8	51	54	60
2"	7 1/2	8 1/2	9	8 1/4	5 3/8	10 7/8	72	80	82
2 1/2"		9 3/8	10	9	5 3/4	11 3/4		105	109
3"		10	10 3/4	8 7/8	6 3/4	13 1/4		150	158
4"		11 7/8	12 1/2	11	7 1/2	14 3/4		230	250

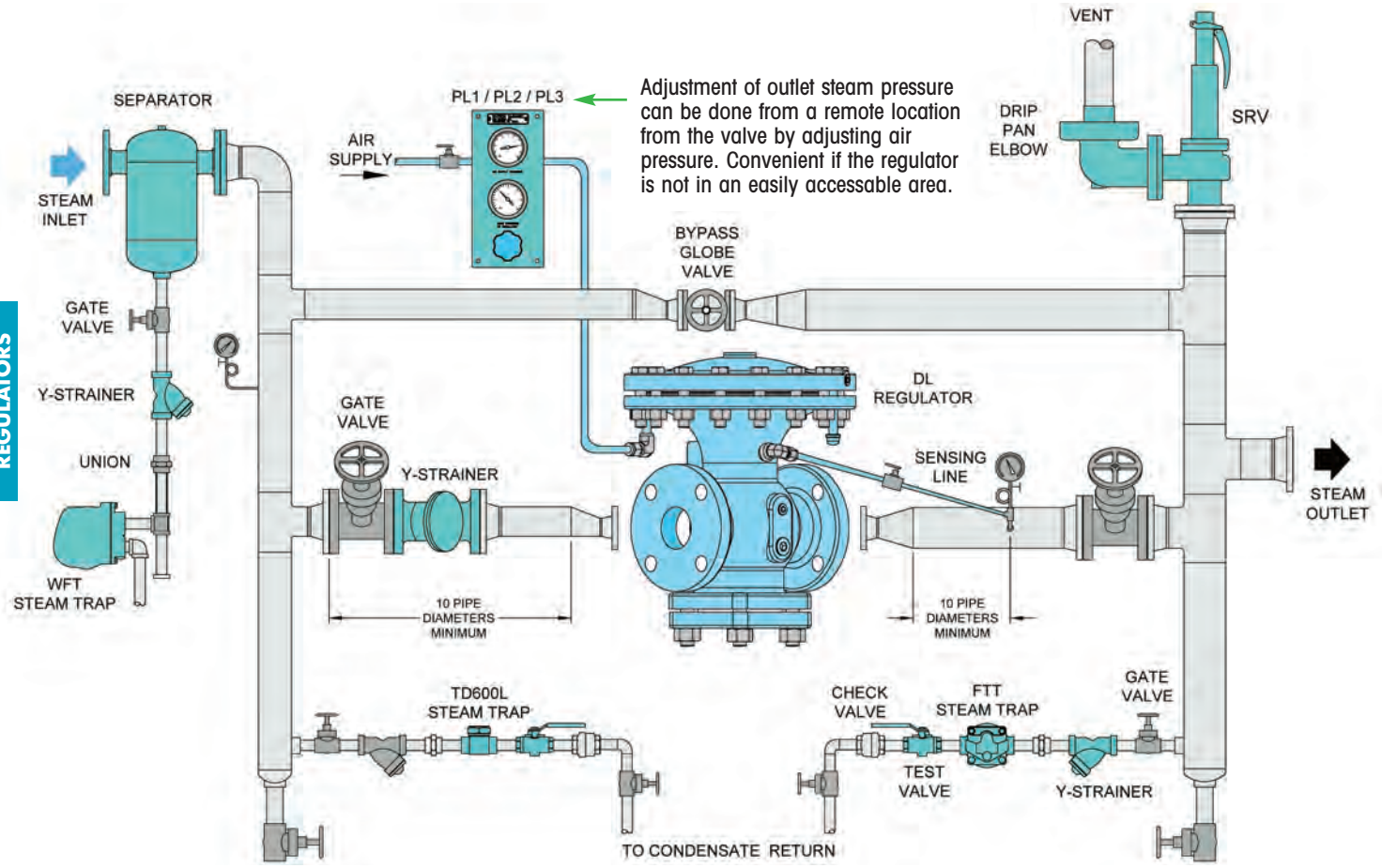
Notes: 150# flanges are flat face.
300# flanges are raised face.

Size/Connection		Ductile Iron Model Code DLDI	Carbon Steel Model Code DLCS	Stainless Steel Model Code DLSS	Weight lbs
1/2"	NPT	DLDI-12-N	–	–	24
3/4"	NPT	DLDI-13-N	–	–	24
1"	NPT	DLDI-14-N	–	–	30
	150# FLG	DLDI-14-F150	DLCS-14-F150	DLSS-14-F150	31
	300# FLG	DLDI-14-F300	DLCS-14-F300	DLSS-14-F300	34
1 1/4"	NPT	DLDI-15-N	–	–	50
1 1/2"	NPT	DLDI-16-N	–	–	51
	150# FLG	DLDI-16-F150	DLCS-16-F150	DLSS-16-F150	54
	300# FLG	DLDI-16-F300	DLCS-16-F300	DLSS-16-F300	60
2"	NPT	DLDI-17-N	–	–	72
	150# FLG	DLDI-17-F150	DLCS-17-F150	DLSS-17-F150	80
	300# FLG	DLDI-17-F300	DLCS-17-F300	DLSS-17-F300	82
2 1/2"	150# FLG	DLDI-18-F150	–	–	105
	300# FLG	DLDI-18-F300	–	–	109
3"	150# FLG	DLDI-19-F150	DLCS-19-F150	DLSS-19-F150	150
	300# FLG	DLDI-19-F300	DLCS-19-F300	DLSS-19-F300	158
4"	150# FLG	DLDI-20-F150	DLCS-20-F150	–	230
	300# FLG	DLDI-20-F300	DLCS-20-F300	–	250

Model Configuration Chart - Reference Chart above for availability

Models		Code	Size	Code	Connection	Code	Options (Suffix)
DLDI	Ductile Iron	12	1/2"	N	NPT (1/2"-2")	TFD	Teflon Diaphragm (for low ΔP)
DLCS	Carbon Steel	13	3/4"	BSP	BSPT (1/2"-2")	SD	Soft Disc Trim
DLSS	Stainless Steel	14	1"	F150	150# FLG (1"-4")		
		15	1 1/4"	F300	300# FLG (1"-4")		
		16	1 1/2"				
		17	2"				
		18	2 1/2"				
		19	3"				
		20	4"				

Ductile Iron • Carbon Steel • Stainless Steel



Description of Operation

The **DL Series Regulator** is being used in conjunction with the **PL2 Control Panel Board** to regulate steam pressure. A small air regulator on the panel board can be adjusted to control the air pressure to the valve diaphragm chamber. One gauge on the panel board measures air line pressure to the panel board and the other gauge shows the air pressure being sent to the valve. Steam pressure at the outlet of the regulator is controlled by the air pressure signal to the valve. The Air Loading graph in this section can be used to determine the air loading pressure required to maintain the desired steam outlet pressure.

REMOTE CONTROL PANEL BOARDS

Three different options of remote control panel boards can be used along with the DL Series Regulator. Supply air is fed directly through the control panel board to the Regulator. You can choose one of the three options of control panel boards when using the Dome-loaded regulators. Minimum of 5 PSIG air supply pressure is required.

PL1

PL2

PL3

PL1

The **PL1** is made up of an air pressure regulator with adjustment knob and pressure gauge that measures the amount of air pressure going to the valve (air signal). Steam pressure of the system is controlled by adjusting the air pressure regulator.

PL2

The **PL2** is the same as the PL1 with the addition of an extra air pressure gauge for measuring the air supply pressure to the control panel board.

PL3

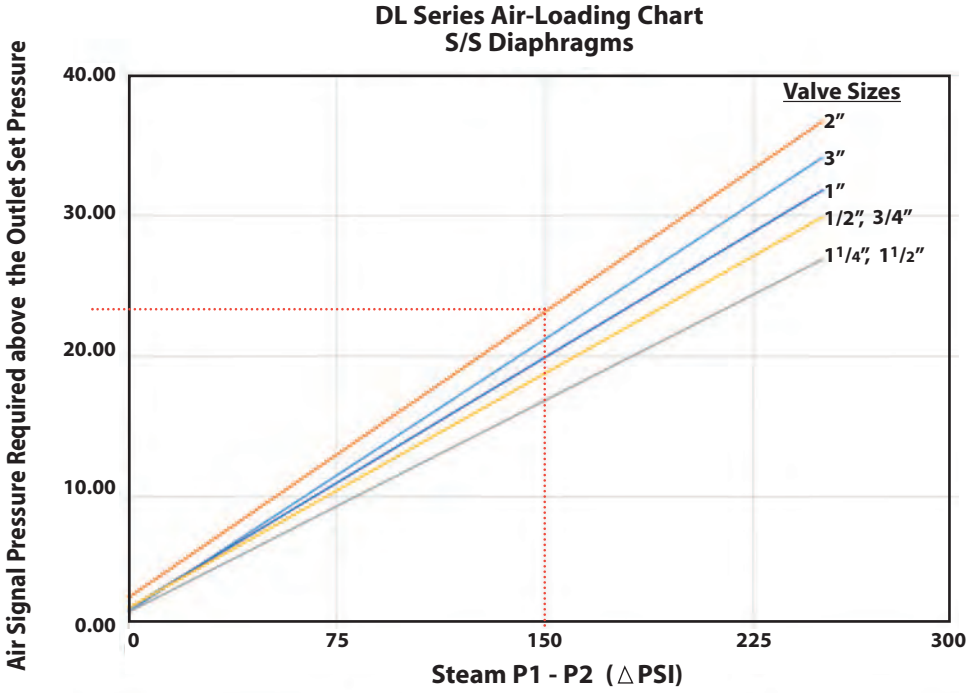
The **PL3** is the same as the PL2 with the addition of a Steam Pressure Gauge for measuring steam pressure on the outlet side of the regulating valve.

Ductile Iron • Carbon Steel • Stainless Steel

CAPACITIES – *Steam (lbs/hr)* — **FULL PORT**

Inlet Pressure (PSIG)	Outlet Pressure (PSIG)	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
C_V Factors		3.8	6.7	11	15	21	37	55	71	113
15	0-3	190	325	550	750	1000	1800	2700	3500	5600
	5	175	300	500	700	900	1700	2500	3200	5200
	8	140	250	400	500	800	1300	2000	2600	4200
30	0-12	275	500	800	1100	1500	2700	4100	5200	8300
	15	250	450	750	1000	1400	2500	3800	4900	7800
	20	225	375	650	850	1200	2100	3200	4100	6500
50	0-20	400	700	1200	1650	2300	4100	6000	7800	12400
	30	350	650	1100	1500	2000	3600	5400	6900	11000
	40	275	500	800	1100	1500	2700	4100	5200	8300
100	0-50	750	1300	2100	3000	4100	7300	10800	14000	22200
	60	700	1200	2000	2700	3800	6700	10000	12900	20500
	80	500	875	1400	1900	2700	4800	7100	9200	14700
150	0-75	1100	1900	3100	4300	6000	10600	15800	20400	32400
	100	925	1600	2700	3600	5100	9000	13400	17400	27700
	125	650	1150	1900	2600	3600	6400	9500	12300	19600
200	0-100	1450	2500	4200	5700	8000	14100	21000	27100	43100
	125	1300	2300	3700	5100	7100	12600	18700	24100	38400
	150	1075	1900	3100	4300	6000	10600	15700	20300	32300
300	0-160	2045	3605	5920	8075	11310	19220	29610	38230	60840
	175	1945	3425	5625	7670	10740	18925	28130	36320	57800
	200	1780	3140	5155	7030	9840	17340	25780	33275	52960
450	0-225			8970		16000	28000		55000	87600
	300			8500		15000	26900		52100	83200
	350			7540		13300	23900		46200	73900

Notes: 1) Capacities based on 95% accuracy (2 psi minimum droop).
2) For inlet pressures greater than 300 PSIG, use DLCS or DLSS regulators only.
3) For expanded capacities, refer to chart in HD Series section.



How To Use Air Loading Chart

Example using 2" DL Series:

- **Steam Inlet Pressure (P1) = 175 psig**
- **Steam Reduced Pressure (P2) =25 psig**

Use the air loading chart to determine the Air Signal required above the Steam Outlet Set Pressure. Then, add the additional air signal to the Steam Outlet Pressure to determine the Total Air Pressure required.

Find **150 psi** △P on bottom of chart (i.e. 175 psig-25 psig = 150 psi) and read up vertically to **2" diagonal line**. Then read horizontally left for the additional air signal required.

Then Add additional Air Signal to P2.
P2 = 25 psig
(additional air signal) = **23 psig**

Total Air Pressure Required to Control Downstream Steam Pressure to 25 psig

Air Signal = 25 + 23 = 48 psig

Note: Consult factory for Teflon diaphragms and 2 1/2" & 4" DL Series Air-Loading Requirements.

Direct-Operated Pressure & Temperature Regulating Valves

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

Pressure Regulating Valves	Page No.

O-Series - Cast Iron • 3/8″ – 2″

268-271

Steam • Water • Oil • Air • other Liquids & Gases

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 Water, Oil, Air as well as other Liquids & Gases. Soft Seat options available for tight shut-off.

OSS-Series - Stainless Steel • 1/2″ – 1 1/4″

272-273

Steam • Water • Oil • Air • other Liquids & Gases

The OSS-Series is the Stainless Steel CF8M version of our popular and versatile O-Series and can be configured for Steam, Water, Oil, Air as well as other Liquids & Gases. Hardened Stainless Steel Internals are standard; Soft-Seating options are available for tight shut-off are available.

B-Series • 1/2″ – 4″

274-275

Water • Air • Oil • other Liquids & Gases

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.

455-Series • 1/2″ – 4″

276-277

Steam • Air • Other Gases

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.

403 -Series • 1/2″ – 4″

278-281

Steam • Air

The 403 are pilot-operated, piston-actuated, pressure regulators primarily used for reducing pressure in STEAM systems. This regulator is available with an optional internal sensing line which simplifies installation.

Direct-Operated Pressure & Temperature Regulating Valves

Relief & Back-Pressure Valves

Page No.

R-Series & 10691-Series - Bronze • 1/2" – 3"

282-284

Relief & Back Pressure Valves: Water, Liquids, Air

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. 10691-Series is similar to the R-Series with the exception of a soft-elastomeric seat for bubble-tight shut-off.

3040-Series - Bronze/Stainless Steel • 1/2" – 2"

285-287

Relief & Back Pressure Valves: Water, Liquids, Air

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.

Temperature Regulating Valves

W91 & W94 Series

289-312

Self-Operating Temperature Regulating Valves:

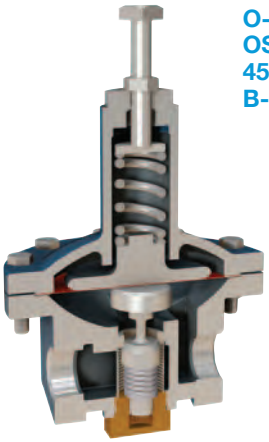
Heating, Cooling, Mixing & Diverting

The W91/W94 Series Temperature Regulating Valves are used for controlling process temperature in industrial and HVAC applications.

Typical applications are: Heating different processes & devices with steam, Cooling equipment with chilled water, or Mixing & Diverting hot & cold liquids using 3-Way Valves.

What are Pressure Regulating Valves (PRVs) used for?

Steam, liquids and other gases are typically transported through piping systems at relatively higher pressure than ultimately needed and therefore need to be reduced to a lower pressure at the final point of use. The purpose of the Pressure Regulating Valve (PRV) is to reduce the pressure of steam, liquid or gas to a lower pressure appropriate for its final application. All pressure regulating valves are self-operated, which means they do not require any outside source of power such as air pressure or electric actuators to operate. In contrast, Control valves do require an outide source of power to actuate the valve. All pressure regulating valves are Self-Operated; however, they are categorized as either **Direct-Operated** or **Pilot-Operated**. The Pilot-Operated Regulators are either **Piston-Actuated** or **Diaphragm-Actuated**.



Direct-Operated

O-Series for Steam, Air & Water
OSS-Series for Steam, Water, Oil & Air
455-Series for Steam
B-Series for Water & Liquids.

O-Series

OSS-Series

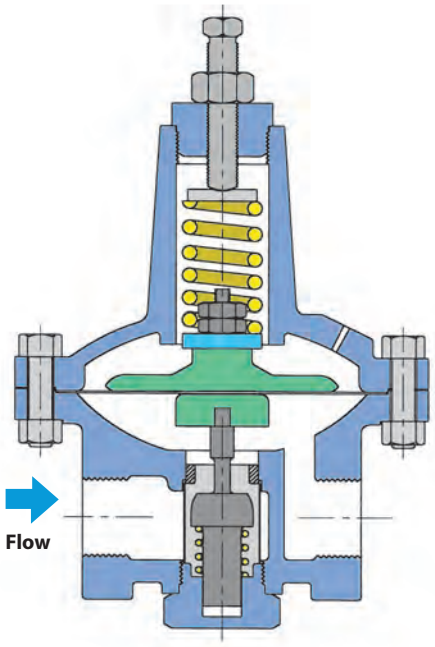
B-Series

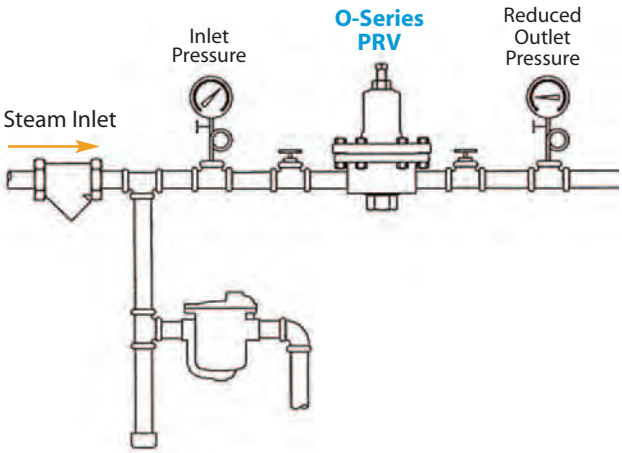
455-Series

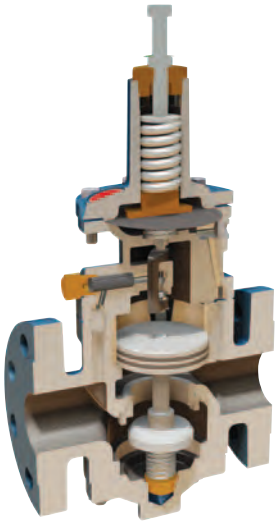
Direct-operated pressure regulating valves are the simplest in design and the most economical to purchase and therefore should be used whenever suitable. The downstream pressure of the steam or liquid being regulated is used to position the diaphragm and valve disc to control the amount of flow through the valve. Downstream pressure adjustment is easily made by turning the adjustment screw to increase or decrease compression on the control spring. The limitation of the direct-operated type regulator is a variation of up to 10% of initial set pressure depending on changes in flow through the valve. As flow requirements through the valve increase, the outlet set pressure will tend to decrease.

For example; Inlet pressure is 100 PSIG and downstream pressure is adjusted to maintain 50 PSIG while 250 lbs/hr of steam flows through the valve. If the steam flow rate happens to increase to 500 lbs/hr, then the outlet pressure would drop to 45 PSIG.

Direct-operated regulators are suitable for many less critical uses in the low-to-moderate flow range including small heaters, humidifiers, hospital equipment, tire molds, typical applications in food processing, as well as many other general uses.





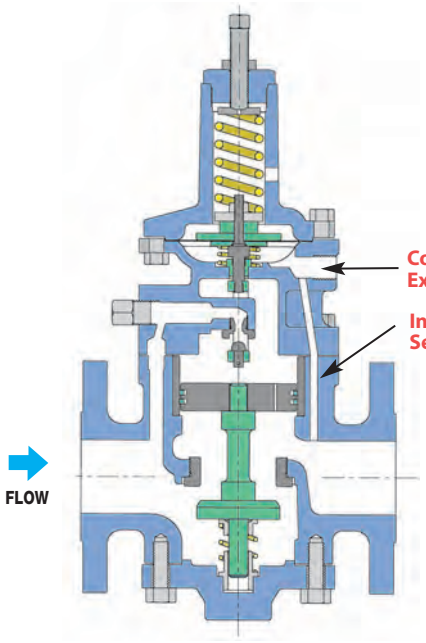


Pilot-Operated Piston-Actuated

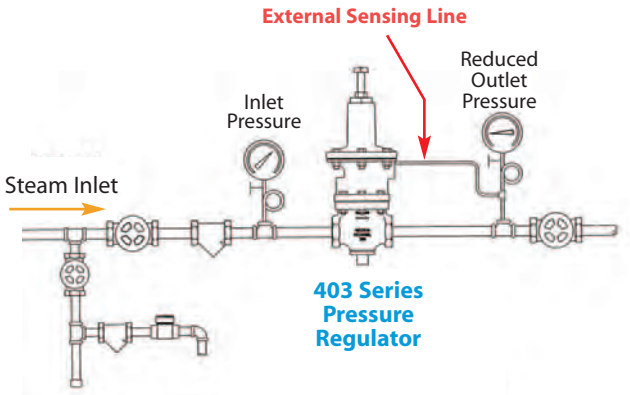
403-Series for Steam, Air & Gas Applications

Pilot-operated piston-actuated pressure regulating valves contain a separate pilot valve which is mounted on top of the main valve. The valve senses the downstream pressure (low pressure side) and precisely modulates a small amount of steam from the upstream side (high pressure side) to the top of the piston chamber, which in turn controls the opening of the main valve. When steam demand increases and downstream pressure starts to drop, the valve is opened further, allowing for additional flow. Pilot-operated piston-actuated regulators have increased accuracy and consistency of set pressure when compared to the Direct-operated type. Set pressure is more stable and will only vary a few percent over the full flow range. Downstream pressure sensing is either done internally (internally sensed) or by using an external pressure sensing line (externally sensed).

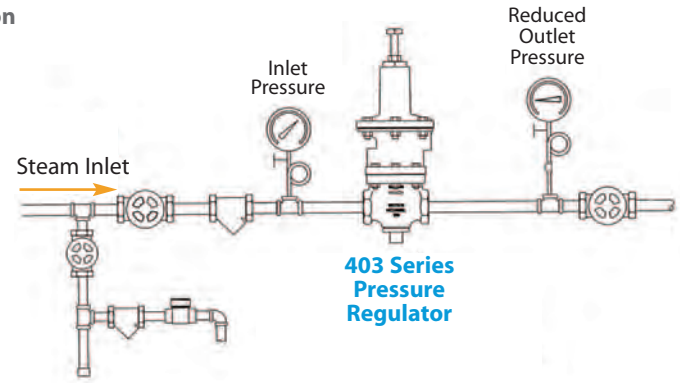
The piston-actuated valves are more compact than diaphragm-actuated valves; however, since the piston has more friction than a freely flexing diaphragm, they are not quite as accurate. These valves can be used for low-to-high flow applications or when larger flow rates or more accurate pressure control is required than can be achieved with direct-operated pressure regulators.



External Sensing (standard)
(requires sensing line)



Internal Sensing Option
(Specially drilled internal sensing path eliminates the need for an external sensing line)



Pilot-Operated Diaphragm-Actuated

Pilot-Operated Diaphragm-Actuated PRVs contain a separate pilot valve mounted externally to the main valve. The pilot valve senses the downstream pressure (low pressure side) through an external sensing line which in turn controls the opening of the main valve. The sensitivity and frictionless motion of the diaphragm, in combination with using a control pilot, make this style of regulators the most accurate. Downstream pressure can often be controlled within 1-2 % of initial set-pressure. Refer to Watson HD-Series Regulators for steam applications.

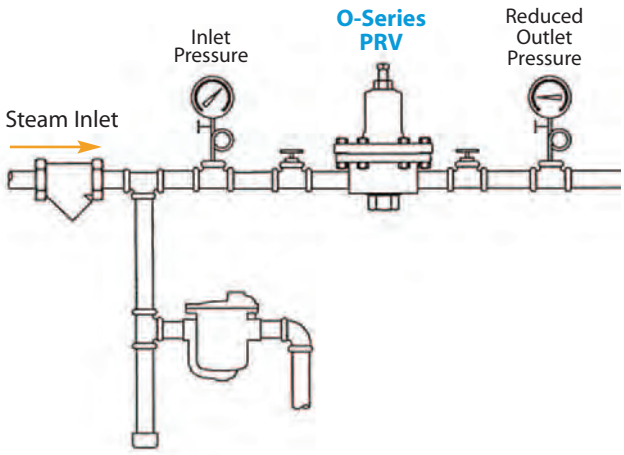
Model	**O-Series**
Service	**Steam, Air, Water & Other Liquids**
Sizes	**3/8", 1/2", 3/4", 1", 1 1/4", 1 1/2", 2"**
Connections	**NPT**
Body Material	**Cast Iron**
Seat & Disc	**Hardened 420 Stainless Steel**
Diaphragm (for Steam)	**Phosphor Bronze - Steam**
Diaphragm (for Liquid or Air)	**Viton - Water, Air & Oil (300˚F max)**
Max Inlet Pressure	**250 PSIG**
Min Inlet Pressure	**15 PSIG**
Max Differential Pressure	**125 PSI**
Min Differential Pressure	**15 PSI**

Design Pressure/Temperature Rating – PMA/TMA

NPT 250 PSIG @ 450˚F

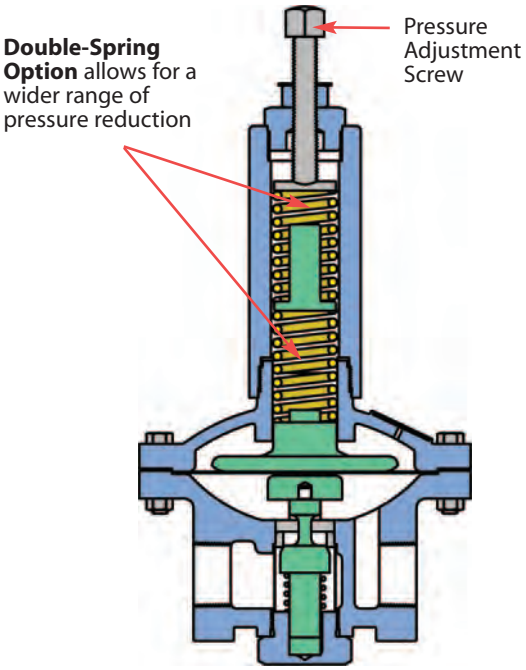
Typical Applications

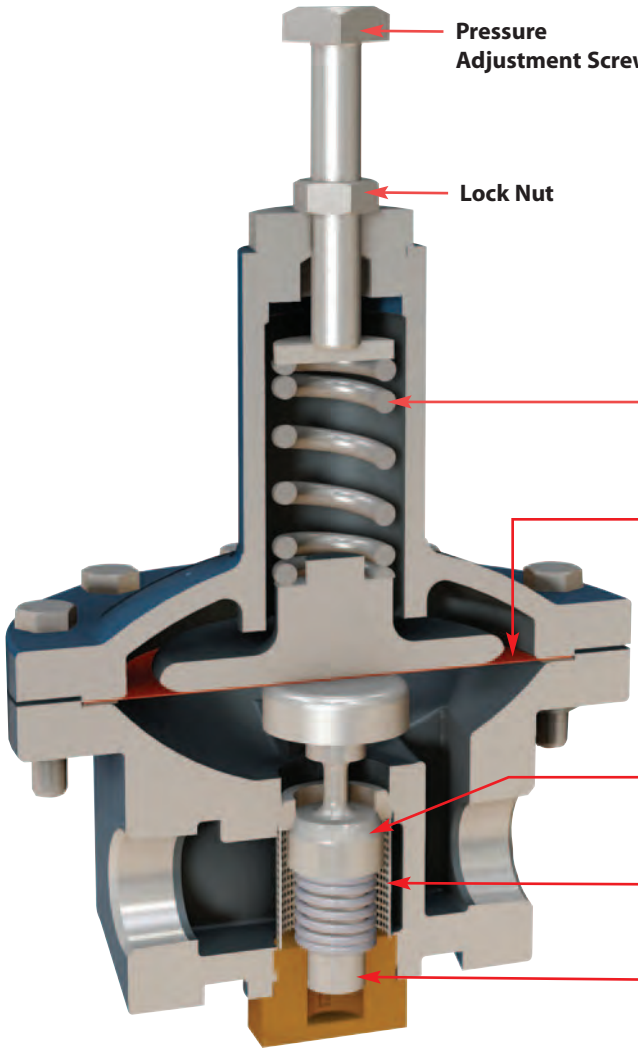
The **O-Series** direct-operated pressure regulators with heavy duty cast iron bodies are suitable for a wide range of applications in the low-to-moderate flow range. Applications include small heaters, humidifiers, various hospital equipment, tire molds, as well as many other general uses. This style of regulator does not require an external sensing line. Set pressure is controlled by turning an adjustment screw with lock nut that increases or decreases spring force above the diaphragm. Several spring ranges are available, depending upon the downstream pressure that needs to be maintained. O-Series contains hardened stainless steel seat and disc for extended service life. Phosphor Bronze Diaphragm specifically designed for Steam service is considered a preferred choice over Stainless Steel diaphragms which are prone to work-hardening and potential cracking. Viton diaphragms are specifically designed for water, air, gases and other liquid service and have a working temperature range up to 300˚F.



Features & Options

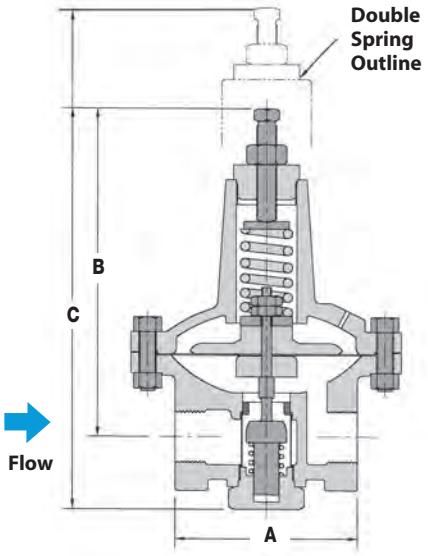
- Hardened stainless steel seat and disc for extended service life (55 Rc)
- Optional Teflon disc for increased shut-off tightness
- Phosphor Bronze diaphragm for Steam Service
- Viton diaphragm for up to 300ºF for Water, Oil & Air Service
- Double spring option available for extended outlet pressure range
- Integral stainless steel strainer on 3/4" HC, 1", 1 1/4", 1 1/2" & 2"





DIMENSIONS & WEIGHTS – *inches*

Size	A	B	C Single Spring	C Double Spring	Weight (lbs)
3/8"	3 5/8	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	4	8	10	12 1/2	15
1"	4 11/16	8 1/2	10 1/2	13	18
1 1/4"	4 11/16	8 1/2	10 1/2	13	18
1 1/2"	6 3/8	8 3/4	12	14 1/2	40
2"	6 3/8	8 3/4	12	14 1/2	40



How to Size/Order

From the Capacity chart, find the inlet pressure and required regulator outlet pressure. Follow across chart to nearest capacity (steam, air, water) that meets or slightly exceeds demand requirements. Follow vertically up to determine appropriate size. When exact application values are not shown, interpolate between values. Select a model with the spring range that accommodates the required outlet set pressure.

Example:

Application: 200 lbs/hr of 100 PSIG Steam reduced to 30 PSIG
Model Code: **O-12-N-14-B** (1/2″ O-Series, 10-50 PSIG spring range, NPT with Bronze Diaphragm for Steam)

		SINGLE Spring Only			Available with either **SINGLE** or **DOUBLE** Pressure Adjustment Spring(s)															
CAPACITIES - Steam (lbs/hr); *Air (SCFM); *Water (GPM)																			Inlet/Outlet Pressures (PSIG)		
Inlet	Outlet	3/8″, 1/2″, 3/4″			3/4″ HC **			1″			1 1/4″			1 1/2″			2″		
Press.	Press.	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
	15	45	25	4	90	51	9	128	72	13	143	80	14	177	99	18	196	109	19
30	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
	20	71	40	6	142	79	13	201	112	18	225	126	20	278	155	25	308	172	27
50	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
	40	87	49	6	174	97	13	247	138	18	276	154	20	341	191	25	377	211	27
100	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
	70	195	109	11	275	154	18	390	218	25	436	244	28	540	301	35	597	333	39
125	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
	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
150	30	307	171	22	615	341	44	871	484	62	974	540	69	1204	668	86	1332	740	95
	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
	120	239	133	11	478	267	22	677	378	31	756	422	35	935	523	43	1035	578	47
200	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
	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
250	50	494	274	28	988	549	57	1400	777	80	1565	869	90	1935	1074	111	2141	1189	123
	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.*

Notes: *For capacities of other gases multiply the air capacities by the following factors:* **Argon–0.85 CO_2–0.81 Helium–2.69 Nitrogen–1.02**
For capacities of other liquids multiply the water capacities by the following: **Diesel Fuel (68F) - 1.07 Kerosene (68F) - 1.11 Ethylene Glycol (68F) - 0.56**

Pressure Regulating Valves for

Steam: Phosphor Bronze Diaphragm

Water, Oil, Air: Viton Diaphragm

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. When used on STEAM Applications, the valve must be specified with a Phosphor Bronze Diaphragm (Suffix Code **B**). When used on Air, Water & Oil or other Liquid Applications, the valve must be specified with a Viton Diaphragm (Suffix Code **V**).

Important Application Note:
- **Use Phosphor Bronze Diaphragms for Steam.**
- **Use Viton diaphragms for Water, Air and Oil Applications.**

Phosphor Bronze Diaphragms may fracture if used on Liquid Service. Use for Steam Only.

Diaphragm Code:

B - Phosphor Bronze for Steam Service
V - Viton (300 °F Max) for Air & Other Liquids

Teflon Soft-Seat Option Suffix Code: 6T

Example Model Codes:

1) **O-13-N-14-B**
(O-Series, 3/4" NPT, 10-50 PSI, Single Spring, **Phosphor Bronze Diaphragm**)

2) **O-13-N-14-V**
(O-Series, 3/4" NPT, 10-50 PSI, Single Spring, **Viton Diaphragm**)

Size/ Connection NPT	Reduced Pressure Range (PSI)	STEAM Model Code	Water • Oil • Air Model Code	Weight lbs
SINGLE SPRING		**STEAM**	**Water • Oil • Air**	
3/8"	0-10	O-11-N-13-B	O-11-N-13-V	10
	10-50	O-11-N-14-B	O-11-N-14-V	10
	40-100	O-11-N-09-B	O-11-N-09-V	10
	100-200	O-11-N-10-B	O-11-N-10-V	10
1/2"	0-10	O-12-N-13-B	O-12-N-13-V	10
	10-50	O-12-N-14-B	O-12-N-14-V	10
	40-100	O-12-N-09-B	O-12-N-09-V	10
	100-200	O-12-N-10-B	O-12-N-10-V	10
3/4"	0-10	O-13-N-13-B	O-13-N-13-V	10
	10-50	O-13-N-14-B	O-13-N-14-V	10
	40-100	O-13-N-09-B	O-13-N-09-V	10
	100-200	O-13-N-10-B	O-13-N-10-V	10
SINGLE SPRING		**STEAM**	**Water • Oil • Air**	
3/4" HC	0-10	OHC-13-N-0003-B	OHC-13-N-0003-V	15
	10-30	OHC-13-N-0004-B	OHC-13-N-0004-V	15
	30-50	OHC-13-N-0005-B	OHC-13-N-0005-V	15
	40-85	OHC-13-N-0006-B	OHC-13-N-0006-V	15
1"	0-10	O-14-N-0007-B	O-14-N-0007-V	19
	10-30	O-14-N-0008-B	O-14-N-0008-V	19
	30-50	O-14-N-0009-B	O-14-N-0009-V	19
	40-85	O-14-N-0010-B	O-14-N-0010-V	19
1 1/4"	0-10	O-15-N-0007-B	O-15-N-0007-V	18
	10-30	O-15-N-0008-B	O-15-N-0008-V	18
	30-50	O-15-N-0009-B	O-15-N-0009-V	18
	40-85	O-15-N-0010-B	O-15-N-0010-V	18
1 1/2"	0-10	O-16-N-0008-B	O-16-N-0008-V	47
	10-30	O-16-N-0009-B	O-16-N-0009-V	47
	30-50	O-16-N-0010-B	O-16-N-0010-V	47
	40-85	O-16-N-0011-B	O-16-N-0011-V	47
2"	0-10	O-17-N-0008-B	O-17-N-0008-V	48
	10-30	O-17-N-0009-B	O-17-N-0009-V	48
	30-50	O-17-N-0010-B	O-17-N-0010-V	48
	40-85	O-17-N-0011-B	O-17-N-0011-V	48
DOUBLE SPRING		**STEAM**	**Water • Oil • Air**	
3/4" HC	0-75	OHC-13-N-0708-B	OHC-13-N-0708-V	19
	30-130	OHC-13-N-0809-B	OHC-13-N-0809-V	19
1"	0-75	O-14-N-0809-B	O-14-N-0809-V	22
	30-130	O-14-N-0910-B	O-14-N-0910-V	22
1 1/4"	0-75	O-15-N-0809-B	O-15-N-0809-V	22
	30-130	O-15-N-0910-B	O-15-N-0910-V	22
1 1/2"	0-75	O-16-N-0809-B	O-16-N-0809-V	48
	30-130	O-16-N-0910-B	O-16-N-0910-V	48
2"	0-75	O-17-N-0809-B	O-17-N-0809-V	48
	30-130	O-17-N-0910-B	O-17-N-0910-V	48

OSS-Series
Direct-Operated

Model	**OSS-Series**
Service	**Steam, Air, Water & Other Liquids**
Sizes	**1/2", 3/4", 1", 1 1/4" ***
Connections	**NPT, SW, 150# & 300# FLG**
Body Material	**Stainless Steel CF8M**
Seat & Disc	**Hardended 420 Stainless Steel (Disc Options - Teflon)**
Diaphragm (for Steam)	**Stainless Steel - Steam**
Diaphragm (for Liquid or Air)	**Viton- Water, Air & oil (300˚F max)**
Max Inlet Pressure	**300 PSIG**
Min Inlet Pressure	**15 PSIG**
Max Differential Pressure	**125 PSI**
Min Differential Pressure	**15 PSI**

*1 1/2" End Connections available; consult factory.

Design Pressure/Temperature Rating – PMA/TMA

NPT:	300 PSIG @ 450˚ F
150# FLG	195 PSIG @ 400˚ F
300# FLG	300 PSIG @ 450˚ F

Typical Applications

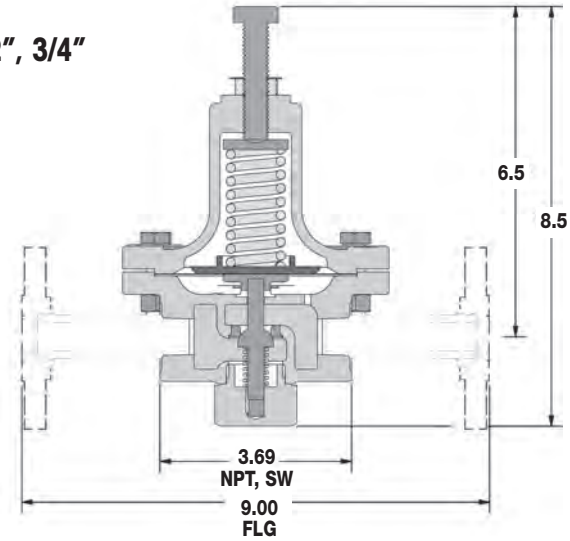
The **OSS-Series** direct-operated pressure regulators with heavy duty stainless steel bodies are suitable for a wide range of applications in the low-to-moderate flow range. Applications include small heaters, humidifiers, various hospital equipment, tire molds, as well as many other general uses. The Stainless Steel Body & Trim also make this valve a consideration for potable water service.

This style of regulator does not require an external sensing line. Set pressure is controlled by turning an adjustment screw with lock nut that increases or decreases spring force above the diaphragm. Several spring ranges are available, depending upon the downstream pressure that needs to be maintained. OSS-Series contains hardened stainless steel seat and disc for extended service life (soft seat options available). Stainless Steel Diaphragms are offered for steam service. Viton diaphragms are specifically designed for water, air, gases and other liquid service and have a working temperature range up to 300˚F.

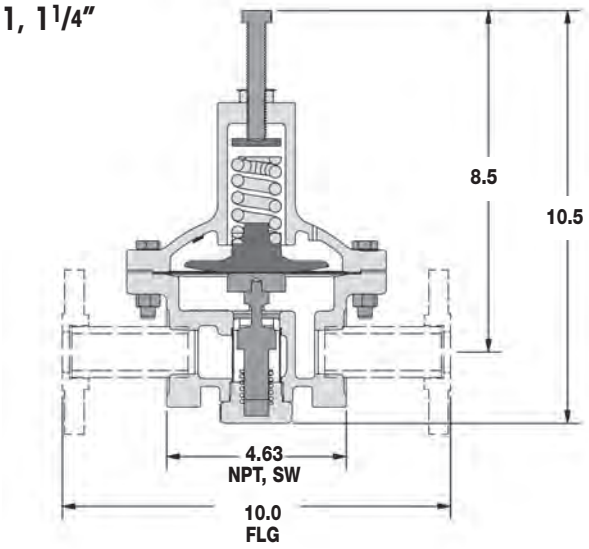
Features & Options

- Hardened stainless steel seat and disc for extended service life (55 Rc)
- Optional Teflon Disc Seats for increased shut-off tightness
- Stainless Steel diaphragm for Steam Service
- Viton diaphragm for up to 300ºF for Water, Oil & Air Service
- Integral stainless steel strainer on 1" and 1 1/4" only

1/2", 3/4"



1, 1 1/4"



MATERIALS	
Body	**Stainless Steel CF8M**
Cover	**Stainless Steel CF8M**
Gasket	Garlock (only with SST diaphragm)
Cover Screws	Stainless Steel
Cover Nuts	Stainless Steel
Adjusting Screw	Stainless Steel
Screen	Stainless Steel (1" & 1 1/4" only)
Valve Seat	Hardened 420 SST
Valve Disc	Hardened 420 SST (Teflon opt.)
Diaphragm	Stainless Steel, (steam) Viton (water, air, oil service)

WEIGHTS – *inches*	
Size	**Weight (lbs)**
1/2"	8
3/4"	8
1"	18
1 1/4"	18

Pressure Regulating Valves for

Steam: Stainless Steel Diaphragm

Water, Oil, Air: Viton Diaphragm

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

Inlet Press.	Outlet Press.	1/2", 3/4" Steam	1/2", 3/4" Air	1/2", 3/4" Water	1", 1 1/4" Steam	1", 1 1/4" Air	1", 1 1/4" Water
15	2	46	26	6	130	73	16
	5	38	21	4	106	59	13
20	5	65	36	8	184	102	22
	10	61	34	6	174	97	18
	15	45	25	4	128	72	13
30	5	83	46	10	236	131	28
	10	83	46	10	236	131	28
	15	71	40	6	201	112	18
50	5	121	67	13	342	190	38
	25	121	67	13	342	190	38
	40	87	49	6	247	138	18
100	30	214	119	17	607	337	47
	50	214	119	14	607	337	40
	70	195	109	11	390	218	25
125	30	261	145	19	739	410	55
	50	261	145	17	739	410	49
	70	261	145	15	739	410	42
	100	201	112	10	569	318	28
150	25	307	171	23	871	484	63
	50	307	171	20	871	484	57
	70	307	171	18	871	484	51
	100	298	166	14	844	471	40
	120	239	133	11	677	378	31
200	75	401	222	22	1135	630	64
	100	401	222	20	1135	630	57
	125	374	205	17	1058	583	49
	150	327	178	14	924	507	40
250	125	494	274	22	1400	777	63
	150	470	259	18	1329	734	56
	200	371	202	14	1049	574	40
300	100**	584	325	28	1721	968	80
	175	542	297	22	1598	885	63
	200	509	278	20	1499	828	56

* *Air and water capacities are based on using elastomeric diaphragms. For Water capacities, check pressure drop for cavitation. Consult factory if needed.*

** *Max. 125 psi pressure drop. Use these capacities when sizing safety valves (SRV).*

Note: *For capacities of other liquids multiply the water capacities by the following factors:*

Argon–0.85 CO2 –0.81 Helium–2.69 Nitrogen–1.02

Notes: *For capacities of other liquids multiply the water capacities by the following factors:*

Diesel Fuel (68F) - 1.07
Kerosene (68F) - 1.11
Ethylene Glycol (68F) - 0.56

Size/ Connection NPT	Reduced Pressure Range (PSI)	STEAM Model Code	Water • Oil • Air Model Code	Weight lbs
SINGLE SPRING		**STEAM**	**Water • Oil • Air**	
1/2"	0-10	OSS-12-N-13-S	OSS-12-N-13-V	10
	10-50	OSS-12-N-14-S	OSS-12-N-14-V	10
	40-100	OSS-12-N-09-S	OSS-12-N-09-V	10
	100-200	OSS-12-N-10-S	OSS-12-N-10-V	10
3/4"	0-10	OSS-13-N-13-S	OSS-13-N-13-V	10
	10-50	OSS-13-N-14-S	OSS-13-N-14-V	10
	40-100	OSS-13-N-09-S	OSS-13-N-09-V	10
	100-200	OSS-13-N-10-S	OSS-13-N-10-V	10
1"	0-10	OSS-14-N-0007-S	OSS-14-N-0007-V	19
	10-30	OSS-14-N-0008-S	OSS-14-N-0008-V	19
	30-50	OSS-14-N-0009-S	OSS-14-N-0009-V	19
	40-85	OSS-14-N-0010-S	OSS-14-N-0010-V	19
1-1/4"	0-10	OSS-15-N-0007-S	OSS-15-N-0007-V	19
	10-30	OSS-15-N-0008-S	OSS-15-N-0008-V	19
	30-50	OSS-15-N-0009-S	OSS-15-N-0009-V	19
	40-85	OSS-15-N-00010-S	OSS-15-N-00010-V	19

Connection Codes:
(N=NPT, SW=Socket Weld, F150=150# FLG, F300=300# FLG)

Important Application Note:
- **Use Stainless Steel Diaphragms for Steam.**
- **Use Viton diaphragms for Water, Air and Oil Applications.**

Stainless Steel Diaphragms may fracture if used on Liquid Service. Use for Steam Only.

Diaphragm Code:

S - Stainless Steel for Steam Service
V - Viton (300 °F Max) for Air & Other Liquids

Teflon Soft-Seat Option Suffix Code: 6T

Example Model Codes:

1) **OSS-13-N-14-S-6T**
(OSS Series, 3/4" NPT, 10-50 PSI, **Stainless Steel Diaphragm**, Teflon Disc)

2) **OSS-13-N-14-V**
(OSS-Series, 3/4" NPT, 10-50 PSI, **Viton Diaphragm,** Stainless Disc)

Model	**B-Series**
Service	**Water, Air, Oil, Other Gases & Liquids**
Sizes	**1/2", 3/4", 1", 1 1/4", 1 1/2", 2", 3", 4"**
Connections	**NPT, 125# FLG, 250# FLG**
Body Material	**1/2" - 2" Bronze & Stainless Steel** **3"& 4" Cast Iron**
Disc & Diaphragm	**Viton - 300˚F max**
Max Inlet Pressure	**250 PSIG**
Min Inlet Pressure	**10 PSIG**
Max Differential Pressure	**125 PSI**
Min Differential Pressure	**20% of Inlet Pressure**

(1/2" - 1" shown)

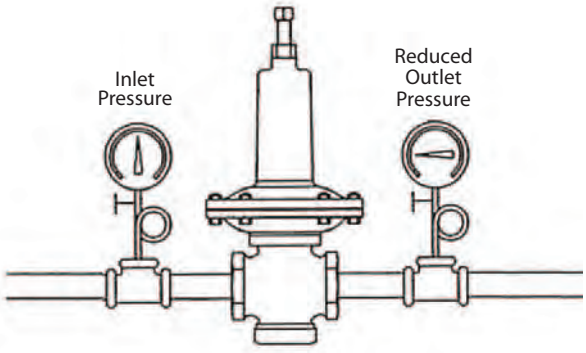
Design Pressure/Temperature Rating – PMA/TMA

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

PRESSURE Regulators

Typical Applications

The **B-Series** direct-operated pressure regulators with balanced valve trim 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. The soft-seated elastomeric Viton disc has an operating temperature up to 300˚F and will produce a Class V shutoff. No external sensing line is required with this style of regulator.



Features & Options

- Diaphragm, disc and cup packing in Viton for 300ºF service
- Balanced pressure regulator allows accurate control even when incoming pressure fluctuates
- Valve has a Class V shut-off rating due to the "soft-seated" Viton disc

B Series Spring Selection Table

Reduced Outlet Pressure (PSI) Pressure (PSI)	Spring #	Code = X
1 - 12	#4	4
5 - 35	#3	3
20 - 70	#2	2
40 - 125	#1	1

Note: Reduced Outlet Pressure 1–12 PSI (Code 4) available in 1/2", 3/4", and 1" sizes only.

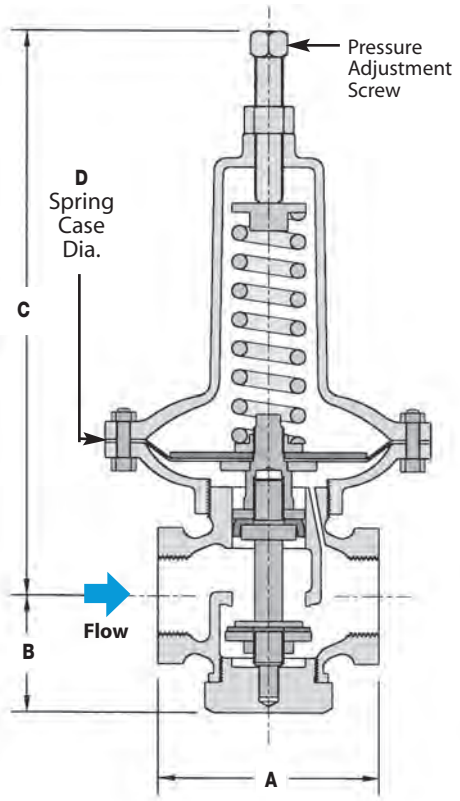
Note:
Flange selection may reduce pressure/temperature ratings.

Size/Connection		Model Code *	Body Material	Weight lbs
VITON Diaphragm & Disc (300˚F Max)				
1/2"	NPT	**B-12-N-X-V**	Bronze/SST	8
3/4"	NPT	**B-13-N-X-V**	Bronze/SST	8
1"	NPT	**B-14-N-X-V**	Bronze/SST	9
1 1/4"	NPT	**B-15-N-X-V**	Bronze/SST	13
1 1/2"	NPT	**B-16-N-X-V**	Bronze/SST	15
2"	NPT	**B-17-N-X-V**	Bronze/SST	25
	150# FLG	**B-17-F150-X-V**	Bronze/SST	37
	300# FLG	**B-17-F300-X-V**	Bronze/SST	41
3"	125# FLG	**B-19-F125-X-V**	Cast Iron	150
	250# FLG	**B-19-F250-X-V**	Cast Iron	160
4"	125# FLG	**B-20-F125-X-V**	Cast Iron	200
	250# FLG	**B-20-F250-X-V**	Cast Iron	210

X=Spring Code (reference Spring Selection Table).

Example Model Code:

B-13-N-2-V (B-Series, 3/4" NPT, 20-70 PSI Spring Range)



DIMENSIONS — *inches*

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

Note: 2" B-Series flanges are 150# or 300#.

How to Size/Order

From the Capacity chart, find the inlet pressure and required regulator outlet pressure. Follow across chart to nearest capacity (water, air) that meets or slightly exceeds demand requirements. Follow vertically up to determine appropriate size. When exact application values are not shown, interpolate between values. From the spring range chart, select the spring range that accommodates the required outlet set pressure.

Example:
Application: 35 GPM of 70 PSIG Water reduced to 20 PSIG
Model Code: **B-14-N-3-V** (B-Series, 1" NPT, 5-35 PSIG spring range)

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

Note: *For capacities of other gases multiply the air capacities by the following:* **Argon–0.85 CO_2–0.81 Helium–2.69 Nitrogen–1.0**
For capacities of other liquids multiply the water capacities by the following: **Diesel Fuel (68F) - 1.07 Kerosene (68F) - 1.11 Ethylene Glycol (68F) - 0.56**

455 Series
Direct-Operated

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# FLG, 250# FLG
Body Material	1/2"– 2" SS Body/Brass Stuffing Box 2 1/2"– 4" Cast Iron
Seat & Disc	Stainless Steel
Diaphragm	Viton
Max Inlet Pressure	**250 PSIG**
Min Inlet Pressure	**5 PSIG**
Max Differential Pressure	**125 PSI**
Min Differential 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 Applications

The **455 Series** direct-operated pressure regulatoring valves are used for pressure reduction applications on steam, air and other gases. Balanced seat and disc design allows these valves to be used in applications with low inlet pressure; down to 5 PSIG. Unlike pilot-operated valves, the 455 does not contain any small pilot orifices and are therefore less susceptible to issues caused by dirt and pipe scale. The 455-Series is installed using an external sensing line which is connected several feet downstream of the valve. Placing the pressure sensing line out of range of valve discharge turbulence improves accuracy of downstream pressure.

Features

- Operates with minimum inlet pressure of 5 PSIG
- Stainless steel internals
- Excellent for use in steam systems that contain excessive amounts of pipe scale and other contaminants
- Pressure balanced valve & seat for more precise control of downstream pressure

Options & Notes:

Must Specify Spring Code when Ordering:
Use the **455 Spring Selection Table** to specify the proper spring(s) based on valve size and reduced pressure range by Replacing the "X" with Spring Code from chart.

Example Model Codes:

1) 455-15-N-65
(455 Series, 1 1/4" NPT, 1-6 PSIG outlet pressure)

2) 455-18-F125-73
(455 Series, 2 1/2" 125# Flanged, 40-70 PSIG outlet pressure)

Note:
Flange selection may reduce pressure/temperature ratings.

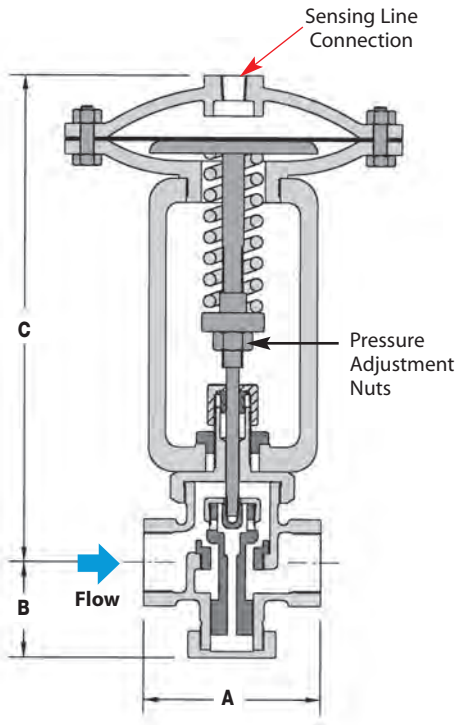
Size/Connection		Model Code *	Body Material	Weight lbs
STEAM Applications - 455				
1/2"	NPT	455-12-N-X	SST	15
3/4"	NPT	455-13-N-X	SST	15
1"	NPT	455-14-N-X	SST	15
1 1/4"	NPT	455-15-N-X	SST	18
1 1/2"	NPT	455-16-N-X	SST	18
2"	NPT	455-17-N-X	SST	29
	150# FLG	455-17-F150-X	SST	41
	300# FLG	455-17-F300-X	SST	45
2 1/2"	125# FLG	455-18-F125-X	Cast Iron	105
	250# FLG	455-18-F250-X	Cast Iron	105
3"	125# FLG	455-19-F125-X	Cast Iron	125
	250# FLG	455-19-F250-X	Cast Iron	125
4"	125# FLG	455-20-F125-X	Cast Iron	175
	250# FLG	455-20-F250-X	Cast Iron	175

X=Spring Code (reference Spring Selection Table).

455 Spring Selection Table

Size	Reduced Outlet Pressure (PSI)	Spring Case Dia. (in.)	Spring #	Code = X
1/2" – 2"	1 - 6	6	#5	65
	5 - 20	6	#3	63
	15 - 45	6	#2	62
	40 - 70	6	#1	61
	60 - 125	5	#1	51
3" – 4"	1 - 6	13	#4	134
	5 - 20	9	#4	94
	15 - 45	9	#3	93
	40 - 70	7	#3	73
	60 - 125	7	#2	72

455 Series
Direct-Operated



DIMENSIONS — *inches*

Size	Face-to-Face A			B	C	Sensing Line Connection NPT
	NPT Threaded	125# Flanged	250# Flanged			
1/2"	4 1/4			2 3/8	10 1/4	1/4"
3/4"	4 1/4			2 3/8	10 1/4	1/4"
1"	4 1/8			2 3/8	10 1/4	1/4"
1 1/4"	5			3 1/8	10 3/4	1/4"
1 1/2"	5 1/4			3 3/8	11	1/4"
2"	6 5/8	10*	10 1/2*	3 3/8	12 3/16	1/4"
2 1/2"		10 5/8	11 1/4	6 1/4	18 3/4	3/8"
3"		10 7/8	11 5/8	7 1/8	19 1/4	3/8"
4"		12 1/2	13 1/8	8 1/4	20	3/8"

*Note: 2" 455 flanges are 150# or 300#.

How to Size/Order

From the Capacity chart, find the inlet pressure and required regulator outlet pressure. Follow across chart to nearest capacity (steam) that meets or slightly exceeds demand requirements. Follow vertically up to determine appropriate size. When exact application values are not shown, interpolate between values. From the spring range chart, select the spring range that accommodates the required outlet set pressure.

Example:

Application: 1000 lbs/hr of 20 PSIG Steam reduced to 5 PSIG
Model Code: **455-16-N-65** (455-Series, 1 1/2" NPT, 1-6 PSIG spring range)

PRESSURE Regulators

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	2	95	7.1	171	12.7	342	25.0	494	37.0	722	54.0	1026	76.0	1596	119	2090	156	2660	198
	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
20	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
	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
30	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
	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
50	0-20	295	13.7	531	24.6	1062	49.0	1534	71.0	2242	104	3186	148	4956	230	6490	301	8260	383
	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
75	0-30	402	16.8	724	30.2	1447	60.0	2090	87.0	3055	127	4342	181	6754	282	8844	369	11256	470
	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
100	0-50	522	17.7	940	31.8	1879	64.0	2714	92.0	3967	134	5638	191	8770	297	11484	389	14616	495
	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
125	0-60	635	20.2	1143	36.3	2286	73.0	3302	105	4826	153	6858	218	10668	339	13970	443	17780	564
	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
150	0-70	750	22.4	1350	40.2	2700	80.0	3900	116	5700	170	8100	241	12600	376	16500	492	21000	626
	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
200	0-100	977	25.0	1759	45.0	3517	90.0	5080	130	7425	190	10552	270	16414	420	21494	550	27356	700
	125	850	21.7	1530	39.0	3060	78.0	4420	113	6460	165	9180	234	14280	364	18700	476	23800	606
250	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*

403 Series
Pilot-Operated

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

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

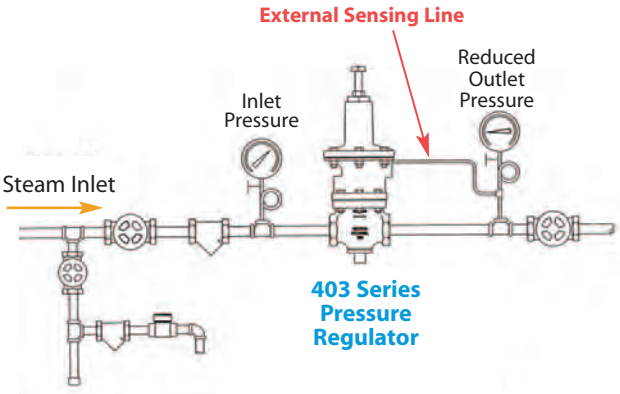
The **403 Series** pilot-operated (piston-actuated) pressure regulating valves are used for pressure reduction on steam mains and other process equipment. Pilot-operated regulators will maintain a constant and accurate downstream pressure regardless of fluctuations in supply pressure or usage. These regulators can be supplied with an optional internal sensing line which simplifies installation. Piston-actuated regulators are more compact than Diaphragm-actuated regulators. The 403 Series contains all stainless steel internals for high-pressure applications up to 450 PSIG. The Double-Spring option is available for a wider range of reduced pressures.

Features & Options

- Pilot-operated regulators minimize outlet pressure fluctuations 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)

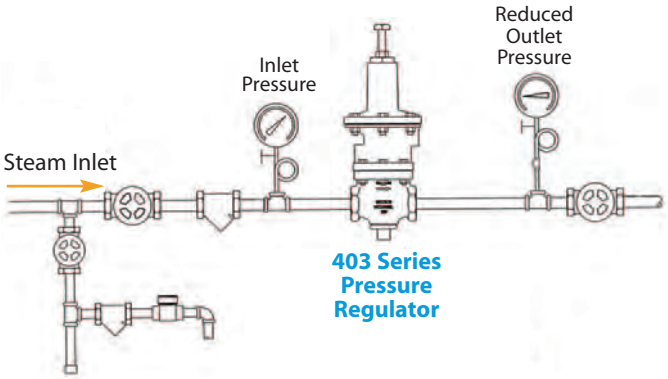
Pressure Reducing Station with External Sensing Line

External Sensing (standard)
(requires sensing line)

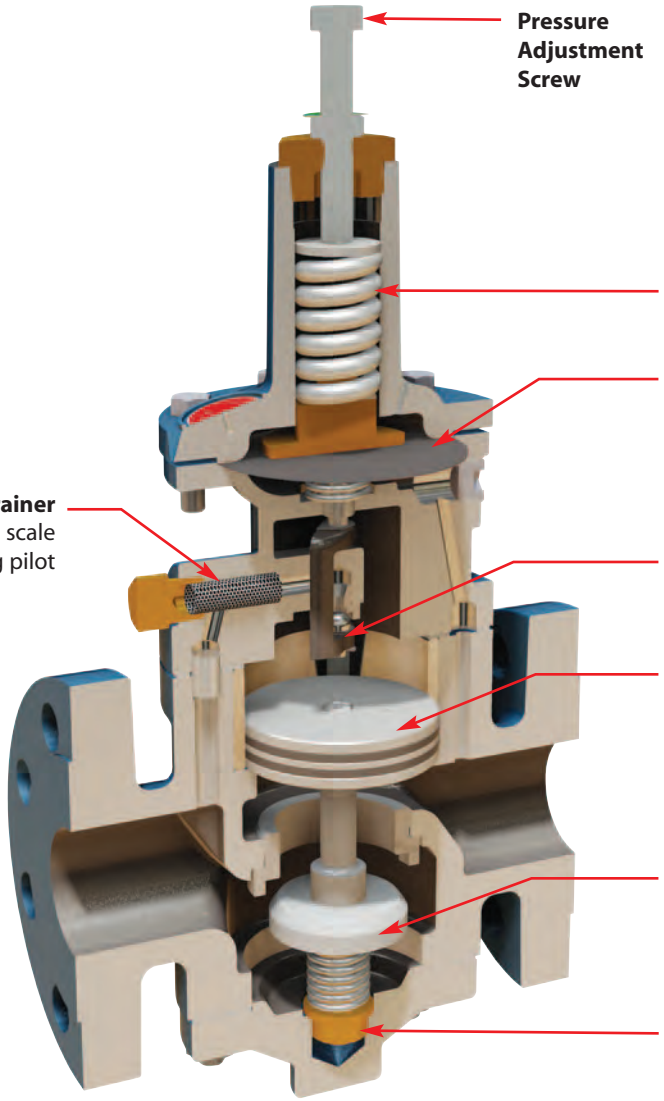


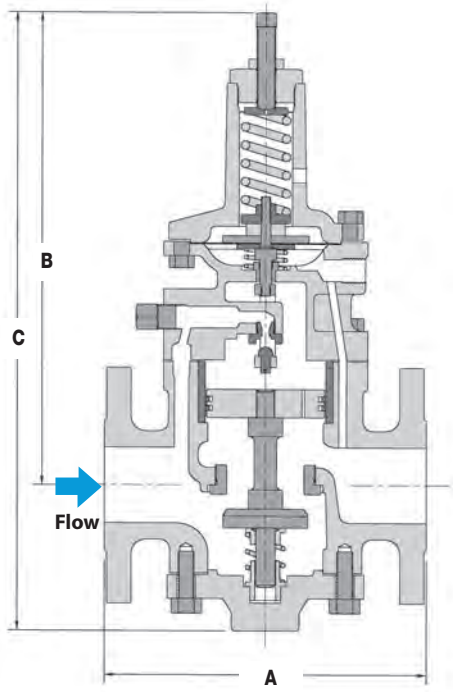
Pressure Reducing Station with Internal Sensing Line

Internal Sensing Option
(Specially drilled internal sensing path eliminates the need for an external sensing line)



403 Series
Pilot-Operated





DIMENSIONS – *inches*

Size	Face-to-Face A			Centerline to Top B		Overall Height C	
	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
3/4"	4 1/2			12	14 3/8	14 3/8	16 3/4
1"	4 1/2			12	14 3/8	14 3/8	16 3/4
1 1/4"	8 3/16			12 3/4	15 1/8	16 1/8	18 1/2
1 1/2"	8 3/16			12 3/4	15 1/8	16 1/8	18 1/2
2"	8 3/4	8 1/4	8 3/4	13	15 3/8	17 1/8	19 1/2
2 1/2"		9 1/8	9 3/4	13 3/4	16 1/8	18 1/4	20 5/8
3"		9 3/4	10 1/2	14 3/4	16 1/8	19 3/4	22 1/8
4"		13 1/2	14	16	18 3/8	24	26 3/8

403 Series
Pilot-Operated

How to Size/Order

From the Capacity chart, find the inlet pressure and required regulator outlet pressure. Follow across chart to nearest capacity (steam, air) that meets or slightly exceeds demand requirements. Follow vertically up to determine appropriate size. When exact application values are not shown, interpolate between values. From the spring range chart, select the spring range that accommodates the required outlet set pressure. Specify Internal or External (remote) Pressure sensing.

Example:

Application: 12,500 lbs/hr of 300 PSIG Steam reduced to 125 PSIG
Model Code: **403-17-N-0010-R** (2″ 403 Series Valve, 100-200 PSIG spring range, with external sensing

Note: Flange selection may reduce pressure/temperature ratings.

Size/Connection		Model Code *	Weight lbs
REMOTE Pressure Sensing - Requires External Sensing Line			
1/2″	NPT	403-12-N-X-R	20
3/4″	NPT	403-13-N-X-R	20
1″	NPT	403-14-N-X-R	20
1 1/4″	NPT	403-15-N-X-R	37
1 1/2″	NPT	403-16-N-X-R	38
2″	NPT	403-17-N-X-R	54
	150# FLG	403-17-F150-X-R	54
	300# FLG	403-17-F300-X-R	56
2 1/2″	150# FLG	403-18-F150-X-R	66
	300# FLG	403-18-F300-X-R	69
3″	150# FLG	403-19-F150-X-R	88
	300# FLG	403-19-F300-X-R	96
4″	150# FLG	403-20-F150-X-R	174
	300# FLG	403-20-F300-X-R	182
INTERNAL Pressure Sensing - No Sensing Line Required			
1/2″	NPT	403-12-N-X-I	20
3/4″	NPT	403-13-N-X-I	20
1″	NPT	403-14-N-X-I	20
1 1/4″	NPT	403-15-N-X-I	37
1 1/2″	NPT	403-16-N-X-I	38
2″	NPT	403-17-N-X-I	54
	150# FLG	403-17-F150-X-I	54
	300# FLG	403-17-F300-X-I	56
2 1/2″	150# FLG	403-18-F150-X-I	66
	300# FLG	403-18-F300-X-I	69
3″	150# FLG	403-19-F150-X-I	88
	300# FLG	403-19-F300-X-I	96
4″	150# FLG	403-20-F150-X-I	174
	300# FLG	403-20-F300-X-I	182

X = Spring Code (reference Spring Selection Table).

403 Spring Selection Table

Reduced Outlet Pressure PSI	Spring #	Code = X	Color
SINGLE Spring Ranges			
0 to 10	#13	0013	Blue & yellow
10 to 50	#14	0014	Black & yellow
40 to 100	#9	0009	Red & yellow
100 to 200	#10	0010	Green & blue
DOUBLE Spring Ranges			
30 to 125	#14 & #9	1409	Red & yellow Black & yellow
50 to 200	#9 & #10	0910	Red & yellow Green & blue

Note: For 200 - 280 PSI use Bellville washers (Code = 0015)

Notes:

Must Specify Spring Code when Ordering:
Use the **403 Spring Selection Table** to specify the proper spring(s) based on reduced pressure range by Replacing the "X" with Spring Code from chart.

Internal Sensing (not available with 0-10 PSI range)

Pressure Sensing Codes:
Code **R** - **Remote** Pressure Sensing
Code **I** - **Internal** Pressure Sensing

Example Model Code:
1) 403-15-N-0014-R
(403 Series, 1 1/4″ NPT, 10-50 PSI, Remote Pressure Sensing)

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
Cv Factors		3.5		8.5		12		17		26		55		77		98	
20	0-10	175	60	425	145	600	204	850	289	1300	442	2750	935	3850	1309	4900	1666
30	0-10	270	88	655	213	924	300	1309	425	2002	650	4235	1375	5929	1925	7546	2450
	20	203	67	493	162	696	228	986	323	1508	494	3190	1045	4466	1463	5684	1862
50	0-20	385	130	935	315	1320	444	1870	629	2860	962	6050	2035	8470	2849	10780	3626
	30	343	116	833	281	1176	396	1666	561	2548	858	5390	1815	7546	2541	9604	3234
100	0-50	690	231	1675	561	2364	792	3349	1122	5122	1716	10835	3630	15169	5082	19306	6468
	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
	100	588	196	1428	476	2016	672	2856	952	4368	1456	9240	3080	12936	4312	16464	5488
150	0-70	1019	343	2474	833	3492	1176	4947	1666	7566	2548	16005	5390	22407	7546	28518	9604
	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
200	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
	175	739	245	1794	595	2532	840	3587	1190	5486	1820	11605	3850	16247	5390	20678	6860
250	0-125	1652	550	4012	1335	5664	1884	8024	2669	12272	4082	25960	8635	36344	12089	46256	15386
	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
300	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
	250	1250	417	3035	1012	4284	1428	6069	2023	9282	3094	19635	6545	27489	9163	34986	11662
400	0-200	2657	875	6452	2125	9108	3000	12903	4250	19734	6500	41745	13750	58443	19250	74382	24500
	280	2146	711	5211	1726	7356	2436	10421	3451	15938	5278	33715	11165	47201	15631	60074	19894
450	0-225	2975	984	7225	2389	10200	3372	14450	4777	22100	7306	46750	15455	65450	21637	83300	27538
	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** **CO_2–0.81** **Helium–2.69** **Nitrogen–1.02**

Model	R Series	10691 Series*
Service	Liquids	Liquids
Sizes	1/2" – 3"	1/2", 3/4", 1"
Connections	NPT	NPT
Body	Bronze	Bronze
Seat Material	Bronze	Bronze
Disc Material	Stainless Steel (1/2" – 1 1/2") Bronze (2" – 3")	EPDM* Optional Viton or Teflon
Max Inlet Pressure	300 PSIG	300 PSIG

* **10691-Series** Relief Valves use a soft elastomeric disc for tight shut-off. Available in 1/2", 3/4" & 1" sizes only.

Design Pressure/Temperature Rating – PMA/TMA

NPT 300 PSIG @ 180°F

Description

The **R-Series** & the **10691-Series** Back Pressure & Relief Valves relieve upstream pressure in a variety of processes. **R-Series** has a stainless steel disc and the **10691-Series** has a soft elastomeric disc for tight shut-off. These valves automatically maintain 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 or for protection against intermittent overpressure conditions.

NOT TO BE USED ON STEAM.

Typical Applications

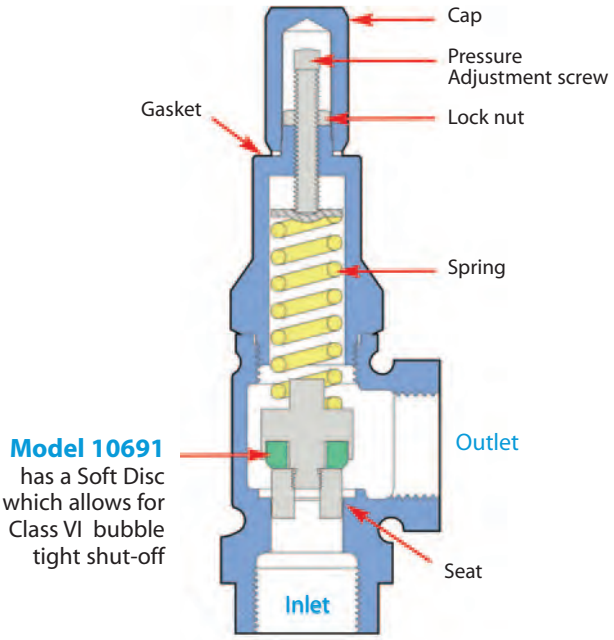
The **R-Series** & **10691 Series** Back Pressure Relief Valves are used in the following applications:

- 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

Note: Not to be used as a safety relief valve on steam systems.

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") Viton or Teflon options available

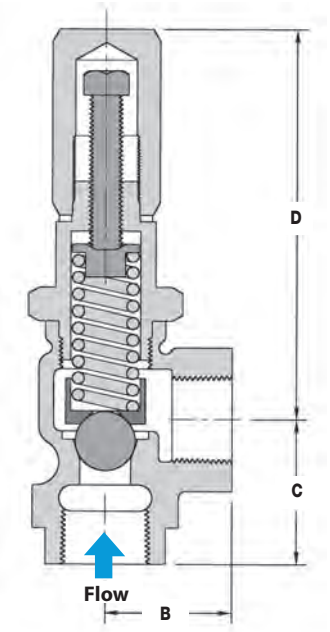


Model 10691 has a Soft Disc which allows for Class VI bubble tight shut-off

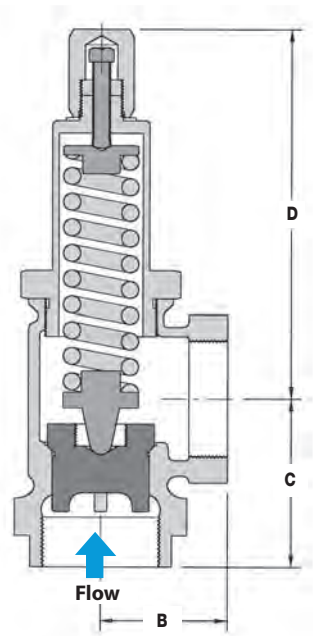
1/2" – 1"
10691-Series

Pressure Adjustments

To adjust set pressure of valve, remove top cap, loosen lock nut and adjust pressure by rotating adjustment 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.



1/2" – 1 1/2"
R-Series



2" & 3"
R-Series

DIMENSIONS & WEIGHTS – *inches*

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 1/2	5 9/16	6
1 1/2"	2 3/16	2 3/4	6 5/8	8
2"	2 1/2	3 5/16	7 3/8	10
3"	3 1/2	4 3/4	9 7/8	25

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

Spring Selection Table

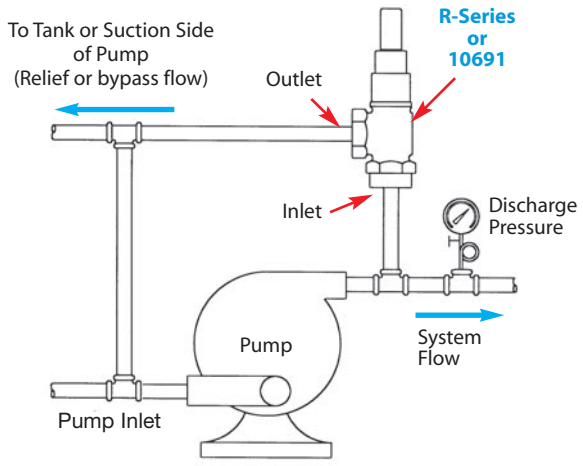
Relief Pressure (PSI)	Spring #	Spring Color
1 - 6	#4*	yellow
5 - 35	#3	silver
25 - 100	#2	blue
75 - 300	#1	red

* 1/2" – 1 1/2" R-Series type only.
Not available on 2" & 3" models.

PRESSURE Regulators

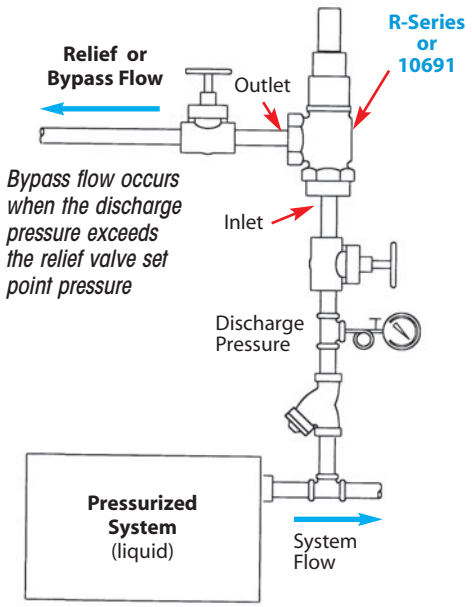
How it Works

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% and 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.

Protection Against Over-pressure Condition



Water, Oil & Other Liquids

Options & Notes:

Factory Setting of Relief Pressure Option:
Specify Set-Pressure when ordering. Add desired factory set pressure to the end of the model code.
See Example below:

R-Series Example Model Code with Set-Pressure Option:
R-12-N-2, *Set at 50 PSI*
(R Series, 1/2" NPT, 25-100 PSIG Spring Range, with a Factory Set Relief Pressure of 50 PSIG)

10691 Example Model Code with Set-Pressure Option:
10691-14-N-2-E, *Set at 75 PSI*
(10691 Series, 1" NPT, 25-100 PSIG Spring Range, EPDM disc, with a Factory Set Relief Pressure of 75 PSIG)

10691-Series
Disc Material: standard in EPDM (Sufffix Code **E**)
Also available in: Teflon (Sufffix Code **T**)
& Viton (Sufffix Code **V**)

Size/ Connection NPT	Model Code R-Series	Model Code 10691 Series EPDM Disc	Relief Pressure Range (PSI)	Weight lbs
1/2"	R-12-N-4	NA	1-6	1.5
	R-12-N-3	10691-12-N-3-E	5-35	1.5
	R-12-N-2	10691-12-N-2-E	25-100	1.5
	R-12-N-1	10691-12-N-1-E	75-300	1.5
3/4"	R-13-N-4	NA	1-6	2.5
	R-13-N-3	10691-13-N-3-E	5-35	2.5
	R-13-N-2	10691-13-N-2-E	25-100	2.5
	R-13-N-1	10691-13-N-1-E	75-300	2.5
1"	R-14-N-4	NA	1-6	3.3
	R-14-N-3	10691-14-N-3-E	5-35	3.3
	R-14-N-2	10691-14-N-2-E	25-100	3.3
	R-14-N-1	10691-14-N-1-E	75-300	3.3
1 1/4"	R-15-N-4		1-6	4.5
	R-15-N-3		5-35	4.5
	R-15-N-2		25-100	4.5
	R-15-N-1		75-300	4.5
1 1/2"	R-16-N-4		1-6	6.3
	R-16-N-3		5-35	6.3
	R-16-N-2		25-100	6.3
	R-16-N-1		75-300	6.3
2"	R-17-N-3		5-35	10.3
	R-17-N-2		25-100	10.3
	R-17-N-1		75-300	10.3
3"	R-19-N-3		5-35	25.0
	R-19-N-2		25-100	25.0
	R-19-N-1		75-300	25.0

The Relief Valve remains closed until the **Set-Pressure** is reached. When the Set-Pressue is met or exceeded, the spring will compress, allowing the valve to open and flow to occur. It is standard practice to publish flow values at 10% and 20% over the **Set-Pressure**.

Example: A 1" valve set at 50 PSIG will pass 3.1 GPM if the system pressure exceeds the set point by 20%.

The **R Series & 10691** Relief Valve water capacities at inlet pressures of 10% and 20% over **Set-Pressure:**

CAPACITIES — *Water (GPM)*

Spring Range	Set Pressure (PSIG)	1/2" (PSIG)	3/4"	1"	1 1/4"	1 1/2"	2"	3"
At 10% Over Set Pressure								
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								
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

3040 Series

Water, Air, Oil & Other Liquids

Model	**3040 Series**
Service	**Water, Oil, other Liquids, Air**
Sizes	**1/2", 3/4", 1", 1 1/4", 1 1/2", 2"**
Connections	**NPT, Flanged (2" only)**
Body Material	**Stainless Steel**
Seat Material	**Stainless Steel**
Disc Material	**Viton - 300°F max**
Diaphragm	**Viton - 300°F max**
Max Inlet Pressure	**250 PSIG**

Design Pressure/Temperature Rating – PMA/TMA		
NPT	300 PSIG	@ 200° F
150# FLG	195 PSIG	@ 400° F

3040
(1/2" - 1" shown)

Typical Applications

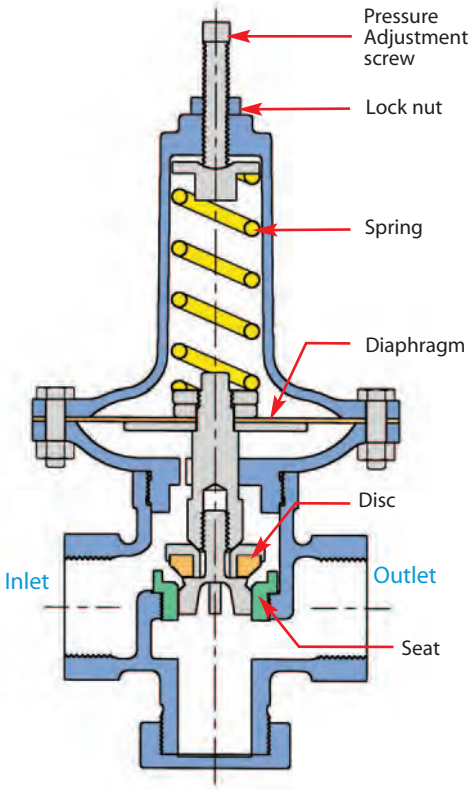
The **3040 Series** Back Pressure Valves relieve upstream pressure in a variety of processes. Automatically maintains desired maximum pressure in a vessel or system by relieving excess pressure into lower pressure return line or to atmosphere. Ideally suited for use as pump bypass control valve by maintaining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

Features & Options

- Fast response
- Viton Trim for 300°F service
- Soft "Seat" for tight shut-off
- Optional Disc options include Teflon and 316SS

Pressure Adjustments

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 the locknut after adjustment.

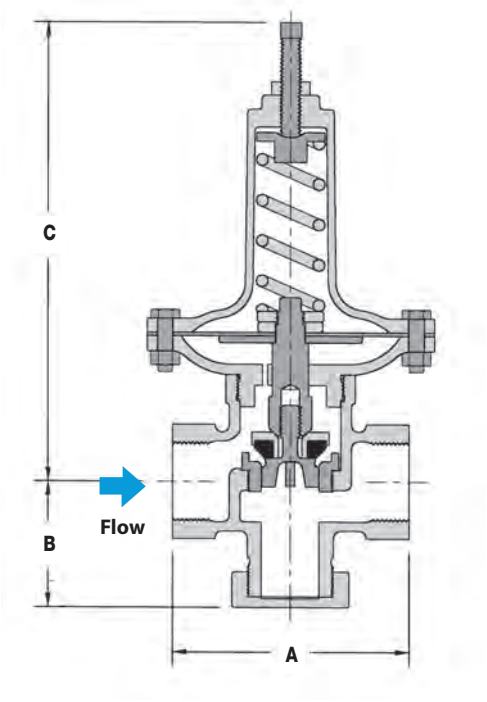


(1 1/4" - 2" shown)

Relief & Back Pressure Regulating Valve

3040 Series

Water, Air, Oil & Other Liquids



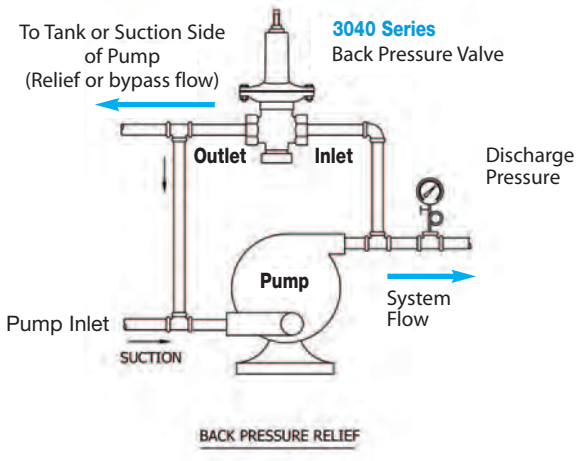
DIMENSIONS – *inches*

Size	Face-to-Face			B	C
	A NPT Threaded	A 150# Flanged	A 300# Flanged		
1/2"	4 1/8			2 5/16	9
3/4"	4 1/8			2 5/16	9
1"	4 1/8			2 5/16	9
1 1/4"	4 13/16			3 1/4	12 3/4
1 1/2"	5 3/16			3 1/2	13 1/4
2"	6 5/8	10	10 1/2	3 3/8	12

How it Works

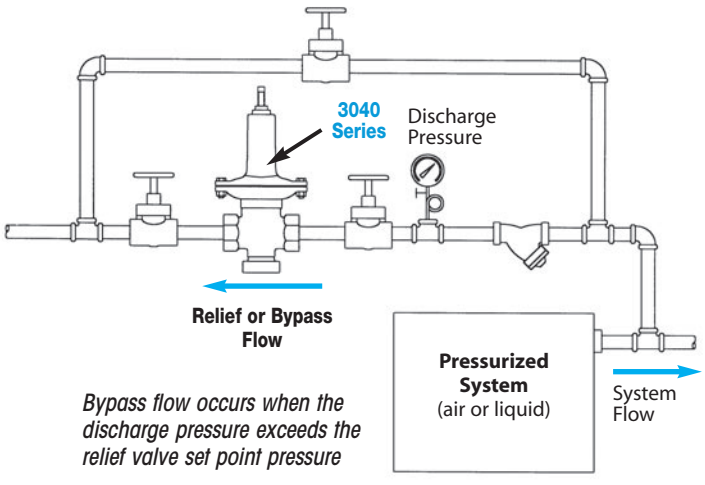
The **3040 Series** Back Pressure Valve senses upstream pressure acting on the underside of the diaphragm through a port in the bottom diaphragm case. An increase in the upstream pressure above the set point will compress the spring and allow the valve to open. The spring will close the valve as the 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.

Protection Against Over-Pressure Condition



Bypass flow occurs when the discharge pressure exceeds the relief valve set point pressure

Relief & Back Pressure Regulating Valve

3040 Series

Water, Air, Oil & Other Liquids

3040 Series Spring Selection Table

Relief Pressure (PSI)	Spring #	Code = X
1 - 12	#4	4
5 - 35	#3	3
20 - 70	#2	2
40 - 125	#1	1

Note: Relief Pressure 1-12 PSI (Code 4) available in 1/2", 3/4", and 1" sizes only.

Size/Connection		Model Code *	Body Material	Weight lbs
Viton Diaphragm & Disc (300°F Max)				
1/2"	NPT	3040-12-N-X-V	SST	8
3/4"	NPT	3040-13-N-X-V	SST	8
1"	NPT	3040-14-N-X-V	SST	9
1 1/4"	NPT	3040-15-N-X-V	SST	15
1 1/2"	NPT	3040-16-N-X-V	SST	16
2"	NPT	3040-17-N-X-V	SST	24
2"	150# FLG	3040-17-150-X-V	SST	36
2"	300# FLG	3040-17-300-X-V	SST	40

X=Spring Code. (reference Spring Selection Table)

Disc Option Suffix Codes:

V - Viton (Standard)
TD - Teflon
SSD - 316SS

Example Model Code:

1) 3040-15-N-3-V
(3040 Series, 1 1/4" NPT, 5-35 PSIG Relief Pressure, Viton Disc)

PRESSURE Regulators

Note: The Relief Valve remains closed until the **Set-Pressure** is reached. When the Set-Pressure is met or exceeded, the spring will compress, allowing the valve to open and flow to occur. It is standard practice to publish flow values at 10% and 20% over the **Set-Pressure**.

Example: A 1" valve set at 50 PSIG will pass 35.6 GPM of water or 409 SCFM of air if the system pressure exceeds the set-point by 20%.

The **3040 Series** Relief Valve water and air capacities at inlet pressures of 10% and 20% over **Set-Pressure:**

CAPACITIES – *Water (GPM)*

Spring Range (PSIG)	Set Pressure (PSIG)	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
At 10% Over Set Pressure							
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							
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	27.0	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)*

1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
At 10% Over Set Pressure					
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					
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

Notes

Temperature Regulators

W91 • Non-Indicating
W94 • Indicating - Dial Thermometer

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

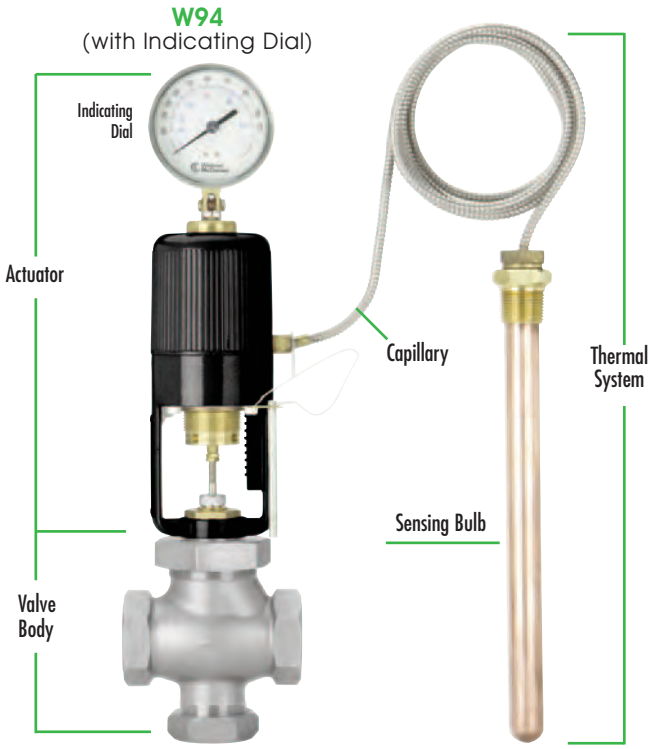
Description & Selection

The **W91/W94** Self-Operating Temperature Regulator is a mechanically operated device designed to regulate system temperature by modulating the flow of a heating or cooling fluid in response to temperature changes; requires no external power source. They are recommended for controlling temperature on relatively stable systems, where small valve stroke modulations will correct temperature drift. Where sudden or large load changes, or rapid temperature changes occur, a pneumatically-actuated Control Valve should be considered. Please consult the Control Valve Section of this catalog.

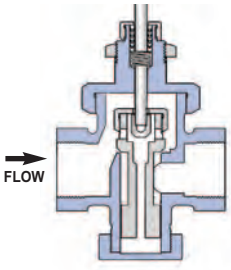
Principle of Operation

The **W91/W94** Temperature Regulator is a fully self-contained unit requiring no external power source (i.e., compressed air or electricity). Regulation takes place when the sensing element (bulb) of the thermal system is exposed to changes in temperature. The thermal system is charged with a predetermined amount of vapor fill, which, when heated, will cause the bellows within the unit's actuator housing to expand.

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



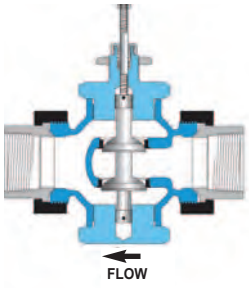
HEATING
Normally Open
(**in-to-close**)



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

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

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

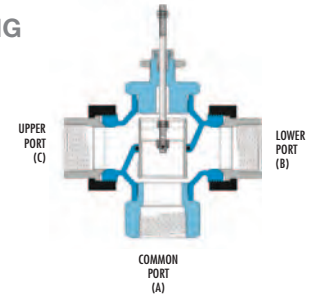


Normally Closed Valves are used for **COOLING**, so the valve stem opens (**in-to-open**) as the control signal (temperature) increases.

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

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

MIXING & DIVERTING
3-Way Valves

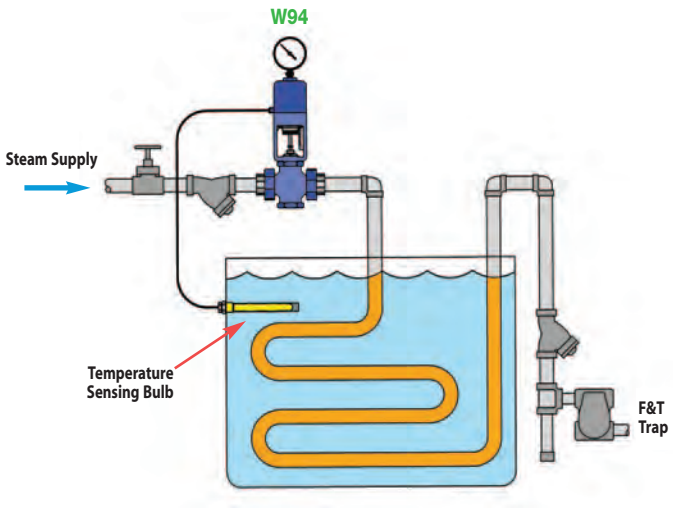


3-Way Valves are used for mixing two flows together, or for diverting a flow to or around a device (bypass). In order to produce consistent flow quantity for stable operation, the pressure drop across both flow paths (inlet to outlet) must be nearly equal. The Sleeve-Type (common port on the bottom)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

Introduction

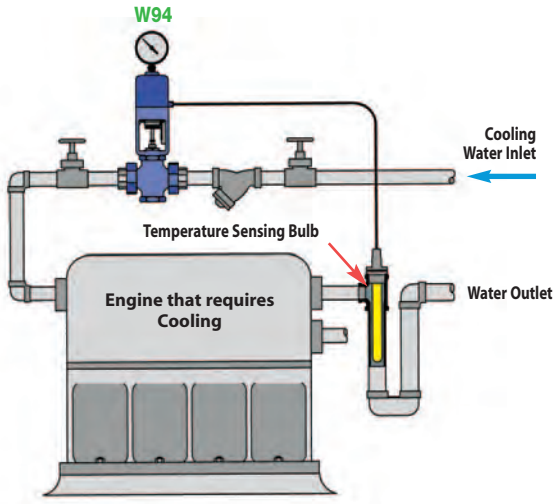
HEATING

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

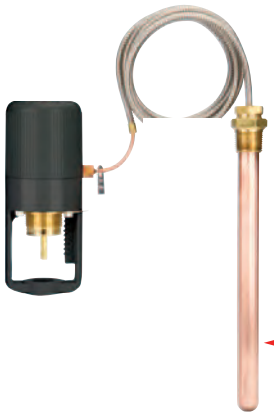


COOLING

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



Components of a Self-Operated Temperature Regulator



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

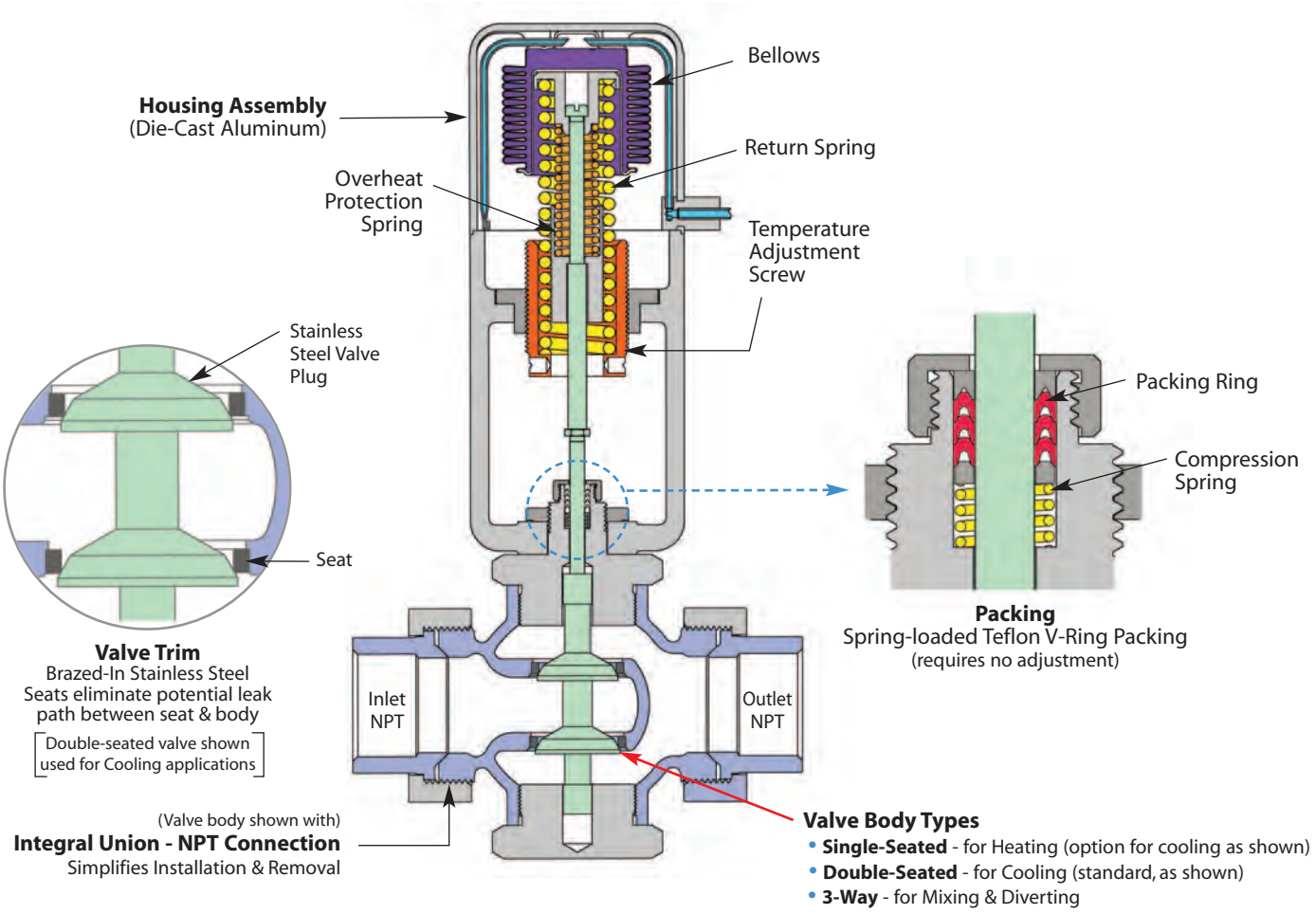
Model W94 Actuator is equipped with an integral dial thermometer to indicate sensing bulb temperature. The W94 displays the temperature at the sensing bulb. This allows for easy adjustment of the temperature set-point, as well as continuous monitoring of the application, without the installation of an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

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

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

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

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



Actuator Housing Assembly

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

Actuator Bellows & Spring Return Assembly

The accordion type bellows is corrosion resistant to provide accurate response for the life of the regulator. An adjusting bar is provided to turn the brass temperature adjustment screw, which compresses or expands the range adjustment spring, thereby setting the control-point of the unit.

Valve Body & Connection Type

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

Valve Trim

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

Packing

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

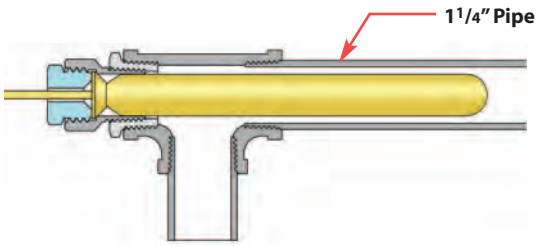
Sensing Bulb & Thermowells

Sensing Bulb

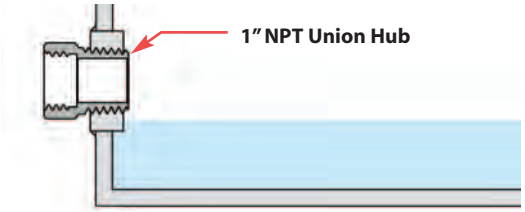
Sensing Bulb Installation

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

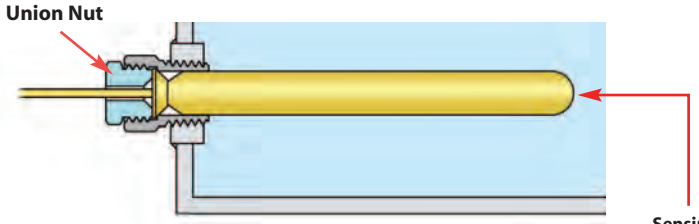
The sensing bulb is designed to be installed in either a horizontal or vertical orientation (with the tip down). If the tip must be installed upwards, please specify when ordering, as a special bulb construction is required. The sensing bulb material is available in either copper (best heat transfer)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



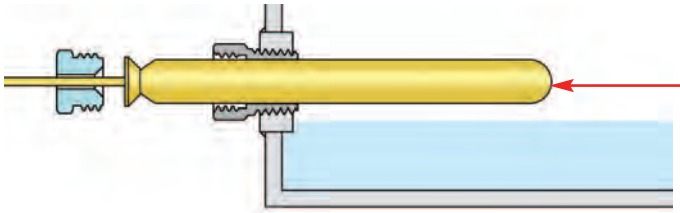
Installed in Pipe Line:
Drawing shows Sensing Bulb installed in a 1" NPT pipe fitting. 1 1/4" is minimum pipe size for adequate clearance around sensing bulb.



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



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



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

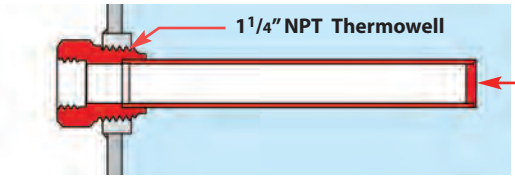
Sensing Bulb with Thermowell

Thermowell (isolates sensing bulb from process fluid)

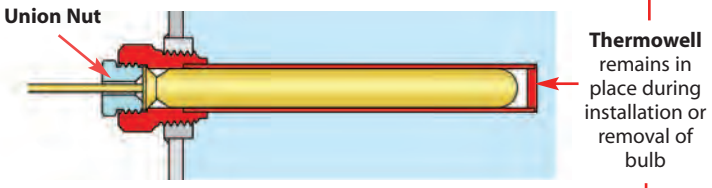
Thermowells isolate the sensing bulb from the process fluid. For applications in which the process media may be corrosive or contained under excessive pressure, the use of a thermowell is required to prevent damage to the sensing bulb. A thermowell also allows the removal of the sensing bulb without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

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

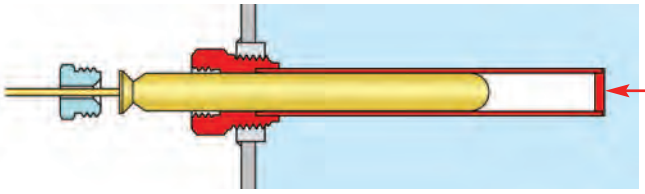
Thermowell remains installed into tank or pipeline; therefore, liquid does not require draining when replacing sensing bulb.



Thermowell threaded into tank wall



Sensing Bulb Inserted into Thermowell



Removing Sensing Bulb from Thermowell

Typical Applications for Temperature Regulators for Heating & Cooling

Temperature Range

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

Accuracy

The W91/W94 Temperature Regulator is a "set-and-forget" regulating device. Once the proper control-point setting has been achieved, the unit requires virtually no adjustments and very little maintenance. Control-point accuracy is dependent upon the sensing bulb location, load change size and speed, and valve size. The sensing bulb must be installed in an area within the process that is most representative of overall process conditions. Care should be taken not to locate the bulb in close proximity to the valve, as the regulator might respond to temperature changes before the process has had time to reach the control-point. Where sudden or large load changes occur, a pneumatically or electrically-powered Control Valve should be specified. Consult the Control Valves section of this catalog.

Valve sizing also plays a major part in regulator performance. A valve that is too small will not be able to provide the desired capacity during peak load conditions, while a valve that is too large may overshoot the control-point and operate with the valve plug too close to the seat, resulting in undue wear of the plug and seat. As part of a well-designed system, a properly sized valve (operating in the 60-90% open position) can control to within 2 to 5 °F.

Size

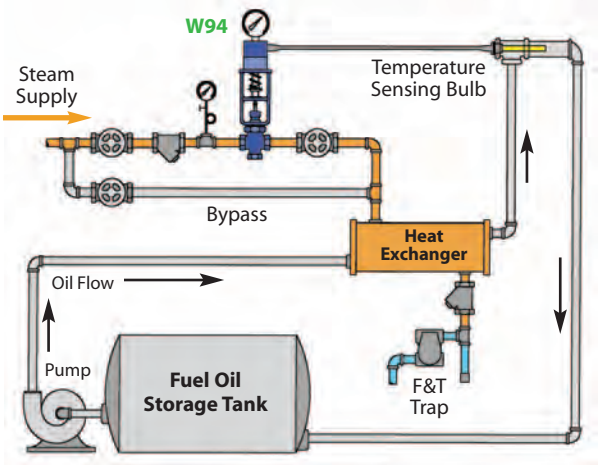
The proper sizing of a regulating valve is one of the most important factors in its selection. A valve that is too small will not be able to provide the desired capacity during peak load conditions, while a valve that is too large may overshoot the control-point and operate with the valve plug too close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

Close-Off

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

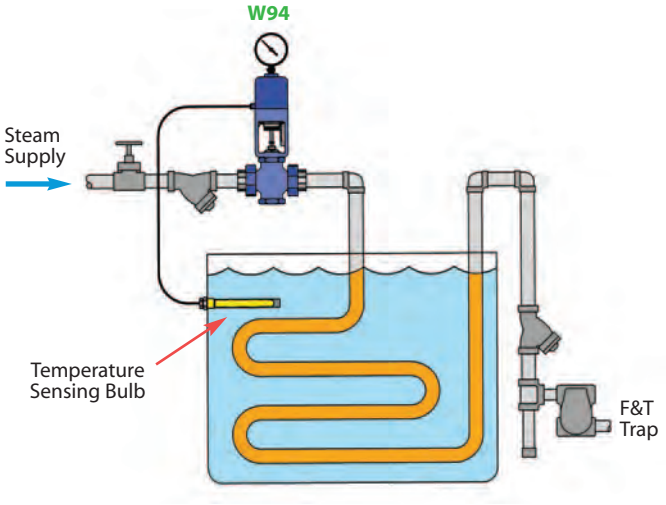
W94 Heating Fuel Oil to Proper Temperature

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



W94 Elevating Temperature of a Plating or Finishing Tank

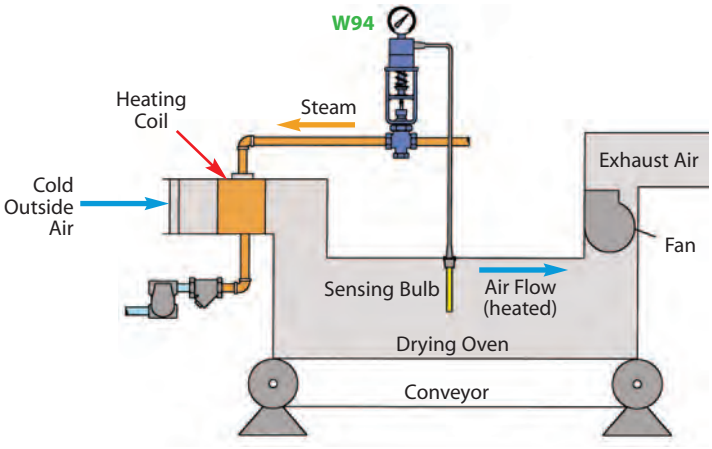
Sensing bulb should be properly placed inside tank for best temperature consistency. An optional Thermowell (Stainless Steel or Brass) may slightly reduce temperature sensitivity. However, it will isolate sensing bulb and allow for its removal without draining the tank.



Introduction

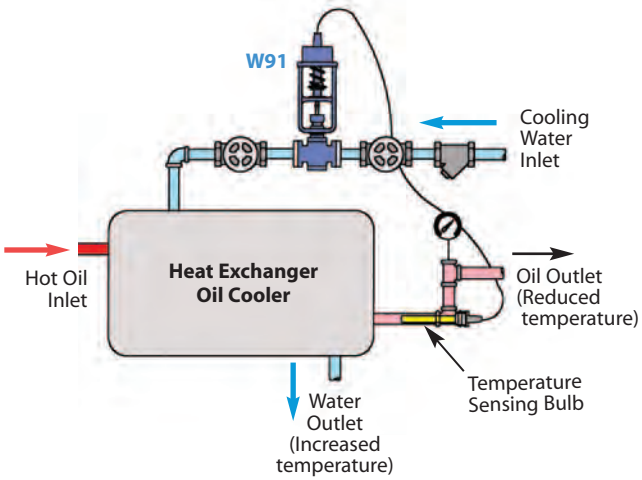
Typical Applications for Temperature Regulators for Heating & Cooling

W94 Used in a Drying Oven Application



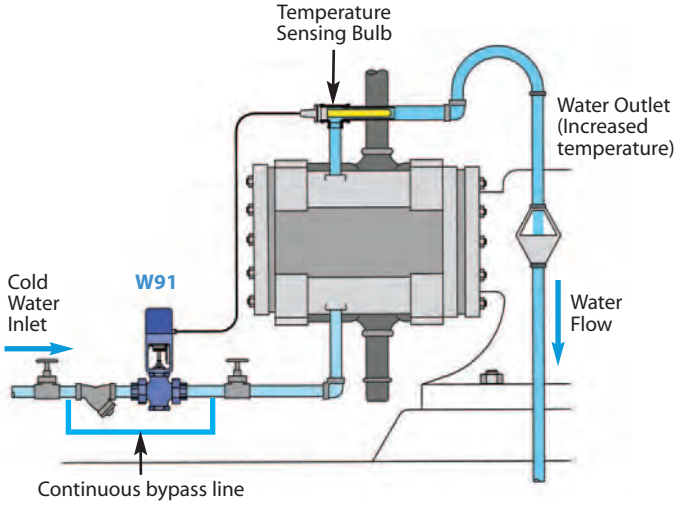
W94 Valve used to regulate the temperature of the air flow through an air heating duct. The sensing bulb is installed toward the end of the heating duct and will sense the temperature of the air flowing past the heating coils. When air temperature is below the set point, the valve will open to allow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

W91 Used to Reduce Oil Temperature In a Heat Exchanger



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

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



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

W91/W94 Series

For Heating & Cooling

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

W94

W91
(no Indicating Dial)

Typical Applications

The **W91** & **W94** Self-Operating Temperature Regulators are the preferred choice of original equipment manufacturers, mechanical contractors and specifying engineers. They require no external power source and are ideal for regulating the temperature of tanks, process streams and various types of industrial equipment. The Actuator is noted for its rugged die-cast aluminum housing, fully-enclosed bellows assembly and internal over-temperature range protection.

Model W91
Non-Indicating (without indicating dial) features a lower profile and should be specified where space constraints may be an issue.

Model W94
Temperature Indicating (with indicating dial) will allow the operator to verify the process temperature and to aid in temperature adjustment.

Features

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

Specifications

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

Temperature Regulator Valve Action

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

How to write proper model number:

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

Model Code Configuration

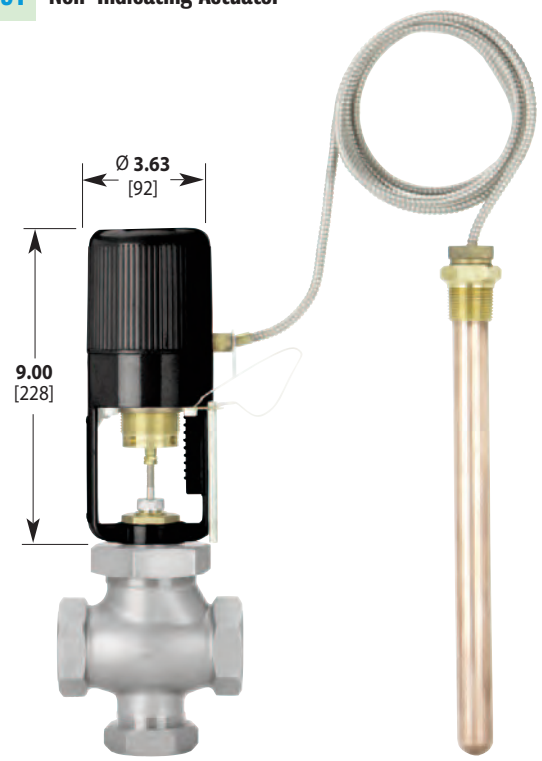
Models		Temperature Range		Capillary Length		Sensing Bulb		Valve Body Selection
W91	Non-Indicating	**01 – 14**	Refer to Temperature Range Chart	**08**	8 Feet (standard)	**S15**	Brass bulb (standard)	Refer to Valve Body Section
W94	Indicating Dial			**12**	12 Feet			
				16	16 Feet	**S16**	Stainless bulb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

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

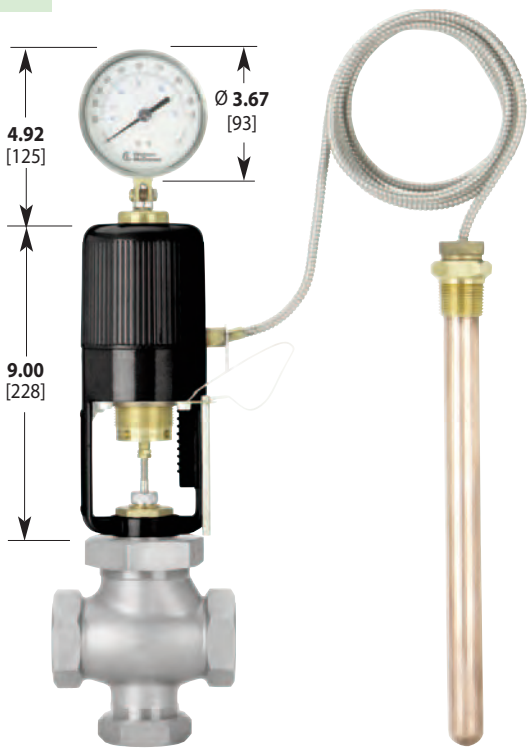
Temperature Range Selection

For Heating & Cooling

W91 Non-Indicating Actuator



W94 Temperature Indicating Actuator



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

Description of Working Span

The recommended working span typically falls within the upper third of the nominal range. Single-Seat In-To-Close, all Double-Seat, and all 3-Way valves have a recommended working span in this part of the nominal range. Using the valve in the recommended working span improves temperature response time of the system.

Temperature Range Chart

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

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

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

SENSING BULB & CAPILLARY Selection

Sensing Bulb Selection & Installation:

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

Thermowell Option **(ordered separately)**

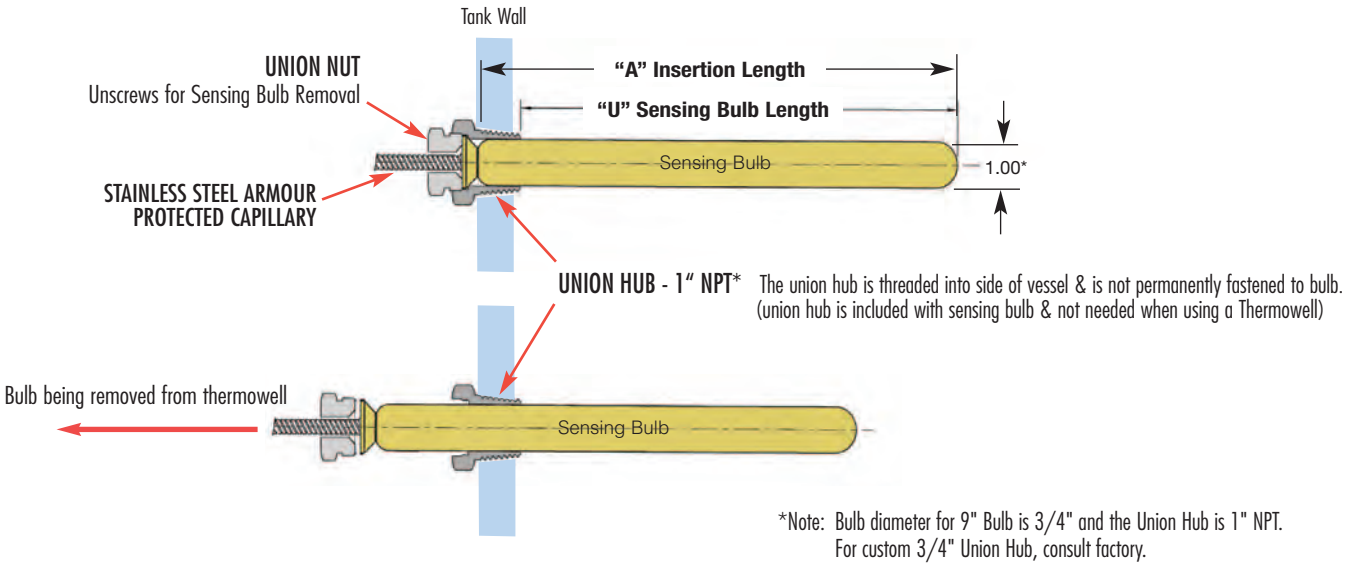
A thermowell isolates the sensing bulb from the process fluid. It can be used to remove the sensing bulb while the system is filled with fluid or to protect the sensing bulb from corrosive liquids or excessive system pressures (see following page).

Sensing Bulb & Capillary

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

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

Other Options available. Consult Factory.



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

SENSING BULB inside OPTIONAL THERMOWELL

Thermowell Option (ordered separately)

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

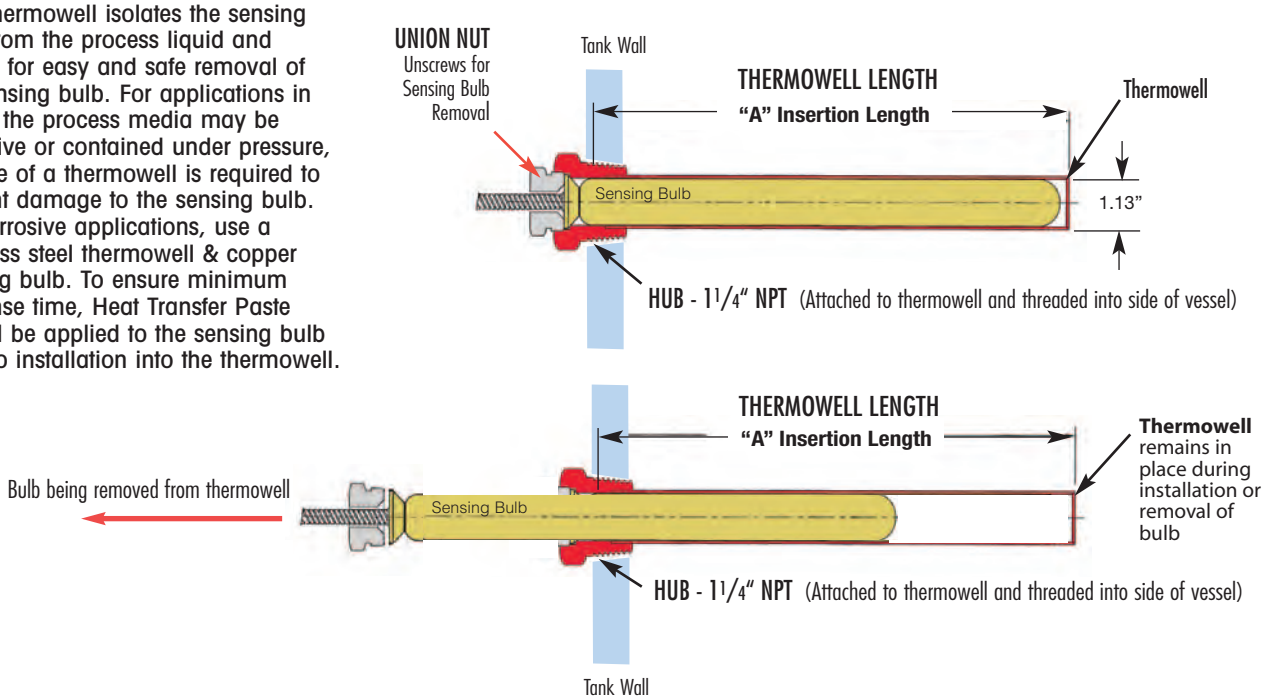
Thermowell Length must be selected based on the length of the sensing bulb. The sensing bulb length is based on the length of the Capillary used in the Thermal System. Longer capillary lengths require a longer sensing bulb to hold the additional actuator fluid inside the sensing bulb. Reference Sensing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

THERMOWELLS - Model Numbers & Lengths

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

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

The Thermowell isolates the sensing bulb from the process liquid and allows for easy and safe removal of the sensing bulb. For applications in which the process media may be corrosive or contained under pressure, the use of a thermowell is required to prevent damage to the sensing bulb. For corrosive applications, use a stainless steel thermowell & copper sensing bulb. To ensure minimum response time, Heat Transfer Paste should be applied to the sensing bulb prior to installation into the thermowell.



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

HEATING

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

Connection		W91 Non-Indicating Type Actuator with valve body. X = Temperature Range, 08 = Capillary Length 8ft., S15 = Copper Bulb	PMO (PSI)	W94 Indicating Type Actuator with valve body. X = Temperature Range, 08 = Capillary Length 8ft., S15 = Copper Bulb	PMO (PSI)	Weight (lbs)
1/2" NPT	Standard Body	W91-X-08S15-H12N	250	W94-X-08S15-H12N	250	21
	with Integral Union	W91-X-08S15-H12U	250	W94-X-08S15-H12U	250	21
3/4" NPT	Standard Body	W91-X-08S15-H13N	250	W94-X-08S15-H13N	250	21
	with Integral Union	W91-X-08S15-H13U	250	W94-X-08S15-H13U	250	21
1" NPT	Standard Body	W91-X-08S15-H14N	200	W94-X-08S15-H14N	200	21
	with Integral Union	W91-X-08S15-H14U	200	W94-X-08S15-H14U	200	21
1 1/4" NPT	Standard Body	W91-X-08S15-H15N	200	W94-X-08S15-H15N	200	24
	with Integral Union	W91-X-08S15-H15U	200	W94-X-08S15-H15U	200	24
1 1/2" NPT	Standard Body	W91-X-08S15-H16N	200	W94-X-08S15-H16N	200	25
	with Integral Union	W91-X-08S15-H16U	200	W94-X-08S15-H16U	200	25
2" NPT	Standard Body	W91-X-08S15-H17N	150	W94-X-08S15-H17N	150	57
2"	*Flanged with Standard Actuator	W91-X-08S15-H17F150	150	W94-X-08S15-H17F150	150	57
2 1/2"		W91-X-08S15-H18F125	65	W94-X-08S15-H18F125	65	65
3"		W91-X-08S15-H19F125	50	W94-X-08S15-H19F125	50	80
4"		W91-X-08S15-H20F125	40	W94-X-08S15-H20F125	40	105
2 1/2"	*Flanged with High-Force Actuator	W91H-X-08S15-H18F125	150	N/A	-	96
3"		W91H-X-08S15-H19F125	150	N/A	-	118
4"		W91H-X-08S15-H20F125	150	N/A	-	60

* 250# Flange available. Consult Factory. The Special High-Force Actuator will allow the valve to be operated at a higher operating pressure.

Model Configuration Chart

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

Models	Temperature Range = X	Capillary Length	Sensing Bulb	Valve Body Selection	Options
W91 Non-Indicating **W94** Indicating Dial **W91H** High-Force	01 – 14 (Refer to Temperature Range Chart)	**08** 8 Feet (std) **12** 12 Feet **16** 16 Feet **20** 20 Feet **24** 24 Feet	**S15** Copper Bulb (std) (with Brass Union Hub) **S16** Stainless Steel Bulb (with SS Union Hub) **SB15** 9" Brass Bulb **SB16** 9" Stainless Steel Bulb	Included in Model Code in above chart.	**W** Water Service **SDWA** Safe Drinking Water Act
W91	05 (75 - 165°F)	**12**	**S15**	**H15N** (1 1/4" NPT)	

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

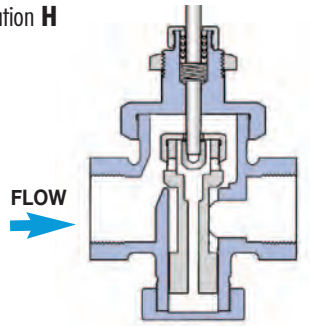
Select range so that desired set temperature is within the Recommended Working Span

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

Example Model Code configured: W91-05-12-S15-H15N
(W91, 75-165 °F Temp. Range, 12 ft. capillary, Std. Copper Sensing Bulb, 1 1/4" NPT Valve Body)

Valve bodies used for HEATING have designation **H**
(Example: **H15N**)

Normally Open
(IN-TO-CLOSE)
Single-seated
Balanced Valve with
Class IV shut-off



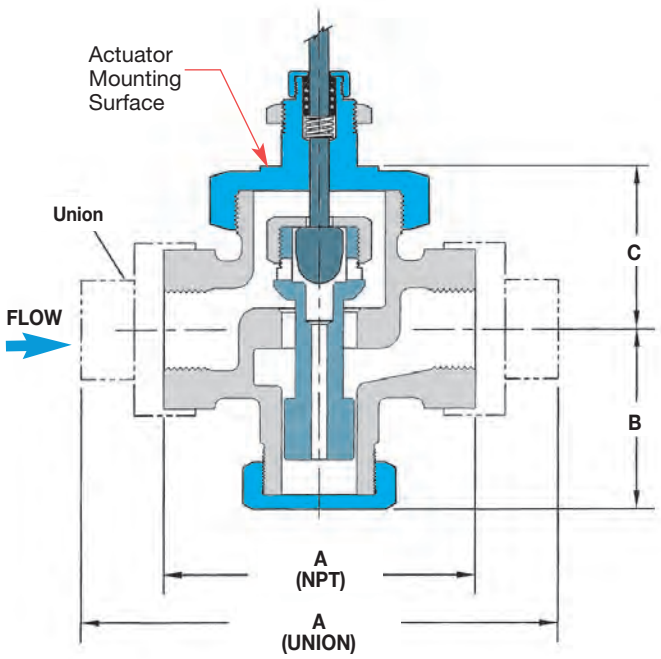
HEATING

TEMPERATURE Regulators

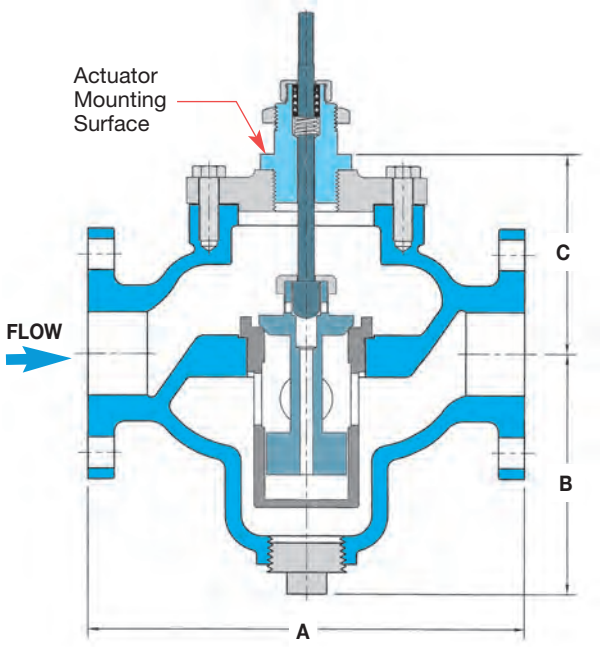
NORMALLY OPEN

Stem In-To-Close for HEATING

Dimensions in inches



THREADED & UNION



FLANGED

Valve Body Specifications

Body Material	Trim Material	Connection	Pressure & Temperature Rating
1/2"- 2" Stainless/Steel	Stainless Steel	Threaded or Malleable Iron Union Ends or Flanged**	250 PSI @ 410°F
2 1/2" - 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) NPT	Union	Size Connection NPT	Capacity Cv	Maximum Close-Off Pressure (PSI△P)		Dimensions A Threaded	A 125# FLG	A 250# FLG	A Union	B	C	Approx. Ship. Wt. (lbs) [kg]
H12N	H12U	1/2"	3.2	250		4.125	x	x	6.50	2.375	2.12	14 [6.35]
H13N	H13U	3/4"	6.3	250		4.125	x	x	6.50	2.375	2.12	14 [6.35]
H14N	H14U	1"	10.8	200		4.125	x	x	7.00	2.375	2.12	14 [6.35]
H15N	H15U	1 1/4"	15.9	200		4.810	x	x	7.50	3.250	2.50	17 [7.7]
H16N	H16U	1 1/2"	22.4	200		5.190	x	x	8.00	3.500	2.69	18 [8.2]
H17N	–	2"	33.1	150		6.625	x	x	x	3.375	3.94	23 [10.5]
FLANGED 125#	250#			Valve Type Standard	Special*							
H17F150**	H17F300**	2"	33.1	150	N/A	x	10**	10.5**	x	3.375	3.94	35 [15.9]
H18F125	H18F250	2 1/2"	47.5	65	150	x	10.625	11.250	x	7.00	5.00	96 [43.6]
H19F125	H19F250	3"	68.2	50	150	x	10.875	11.625	x	8.00	5.75	110 [49.9]
H20F125	H20F250	4"	109.5	40	150	x	12.500	13.125	x	8.75	6.50	160 [72.6]

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

* With High-Force Actuator, which allows the valve to operate at a higher differential pressure.
** 2" W91/W94 only. Flanges are 150# or 300#.

HEATING

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

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

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

Note:

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

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

Example:
H17N becomes **HW17N**

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

CAPACITIES — Water (GPM) — SINGLE-SEATED VALVES

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

HEATING

Steam Required for Heating Water

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

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

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

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

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

Capacity Formulas for Steam Loads

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

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

COOLING

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

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

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

Model Configuration Chart

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

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

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

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

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

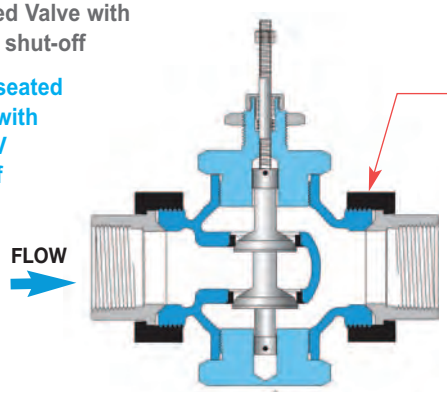
* The recommended working span typically falls within the upper third of the nominal range.

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

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

Normally Closed
(IN-TO-OPEN)
Double-seated Balanced Valve with Class II shut-off

Single-seated option with Class IV shut-off



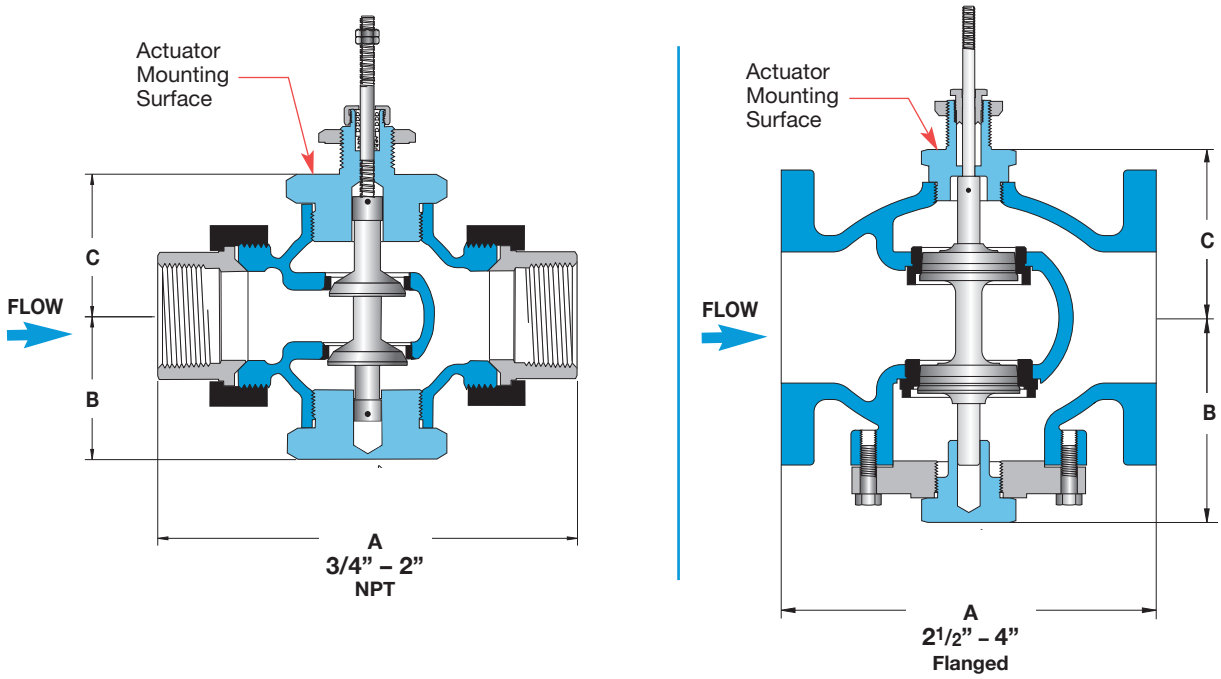
3/4" - 2" NPT with Integral Union for Easy Removal from the piping system

COOLING

NORMALLY CLOSED

Stem In-To-Open for Cooling

Dimensions in inches [mm]



Valve Body Specifications

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

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

Valve Body Selection – Threaded

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

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

Valve Body Selection – Flanged

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

MIXING & DIVERTING

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

Connection		W91 Non-Indicating Type Actuator with valve body X = Temperature Range 08 = Capillary Length 8 ft. S15 = Copper Bulb	PMO (PSI)	W94 Indicating Type Actuator with valve body X = Temperature Range 08 = Capillary Length 8 ft. S15 = Copper Bulb	PMO (PSI)	Weight
1/2" NPT	with Integral Union	W91-X-08-S15-A18	250	W94-X-08-S15-A18	250	10
3/4" NPT	with Integral Union	W91-X-08-S15-A25	250	W94-X-08-S15-A25	250	12
1" NPT	with Integral Union	W91-X-08-S15-A34	250	W94-X-08-S15-A34	250	13
1 1/4" NPT	with Integral Union	W91-X-08-S15-A45	250	W94-X-08-S15-A45	250	17
1 1/2" NPT	with Integral Union	W91-X-08-S15-A56	250	W94-X-08-S15-A56	250	18
2" NPT	with Integral Union	W91-X-08-S15-A67	250	W94-X-08-S15-A67	250	24
2 1/2"	125# FLG	W91-X-08-S15-B75	125	W94-X-08-S15-B75	125	55
3"	125# FLG	W91-X-08-S15-B80	125	W94-X-08-S15-B80	125	80
4"	125# FLG	W91-X-08-S15-B85	125	W94-X-08-S15-B85	125	105

Model Configuration Chart

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

Models	Temperature Range = X	Capillary Length	Bulb	Valve Body Selection
W91 Non-Indicating **W94** Indicating Dial	01 – 14 (Refer to Temperature Range Chart on next page)	**08** 8 Feet (standard) **12** 12 Feet **16** 16 Feet **20** 20 Feet **24** 24 Feet	**S15** Copper Bulb (with Brass Union Hub) **S16** Stainless Steel Bulb (with SS Union Hub) **SB15** 9" Brass Bulb **SB16** 9" Stainless Steel Bulb	Included in Model Code in above chart.
W91	**05** (75 - 165°F)	**12**	**S15**	**A45** (1 1/4" NPT)

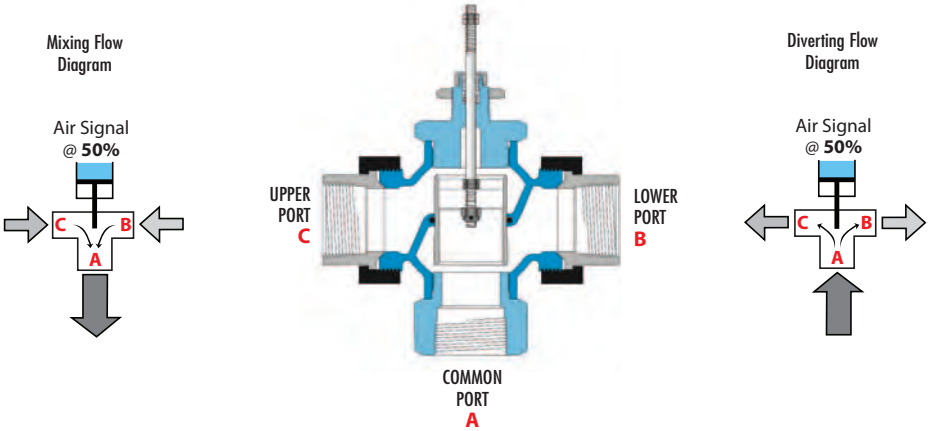
Example Model Code configured: **W91-05-12-S15-A45**
(W91, 75-165 °F Temp. Range, 12 ft. Capillary, Copper Sensing Bulb, 1 1/4" NPT Valve Body)

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

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

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

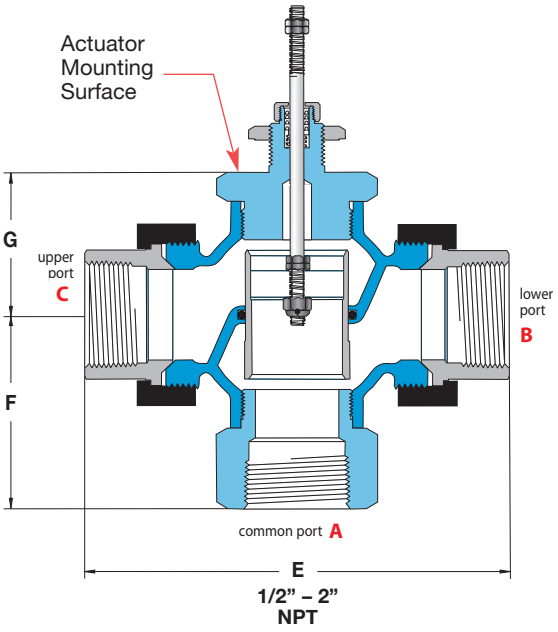
Valve Body for MIXING & DIVERTING

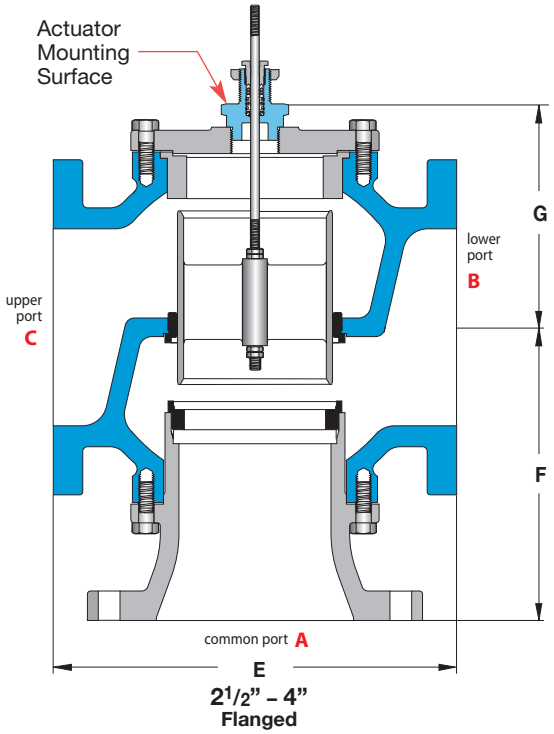


CAUTION: 3-Way Valves are not designed for use in steam applications.
To properly control the mixing of two flows, inlet pressures at ports B and C should be as equal as possible.

Dimensions in inches [mm]

for Mixing or Diverting





CAUTION: Watson McDaniel 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.

Valve Body Specifications

Body Material	Trim Material	Connection	Pressure & Temperature Rating
1/2" - 2" Bronze	Bronze	Threaded with Malleable Iron Union Ends	250 PSI @ 300°F (149°C)
2 1/2" - 4" Cast Iron	Bronze	125# Flanged	125 PSI @ 300°F (149°C)

Valve Body Selection

Valve Body Number	Size		Capacity	Maximum Close-Off Pressure	Dimensions			Approximate
	Connection (NPT)	Nominal Port	C_V	(PSI△P)	E	F	G	Shipping Wt.
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]

Valve Body Selection

Valve Body Number	Size		Capacity	Maximum Close-Off Pressure	Dimensions			Approximate
	Connection	Nominal Port	C_V	(PSI△P)	E	F	G	Shipping Wt.
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]

COOLING Double-Seated Valve Bodies

CAPACITIES — Water (GPM) — **DOUBLE-SEATED VALVES**

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

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

MIXING & DIVERTING 3-Way Valve Bodies

CAPACITIES — Water (GPM) — **3-WAY VALVES**

Pressure Drop (PSI△P)	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.

W91
Non-indicating
Replacement Actuator

W94
Indicating
Replacement Actuator

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

Replacement Actuator Model Configuration

Example Model Code configured: W91-05-12-S15

Models	Temperature Range = X	Capillary Length	Bulb
W91 **W94**	01 – 14 (Refer to Temperature Range Chart)	**08** 8 Feet (std) **12** 12 Feet **16** 16 Feet **20** 20 Feet **24** 24 Feet	**S15** Copper Bulb (with Brass Union Hub) **S16** Stainless Steel Bulb (with SS Union Hub)
W91	05 (75 - 165°F)	**12**	**S15**

Thermowells for W91 & W94 Series Self-Operated Temperature Regulators

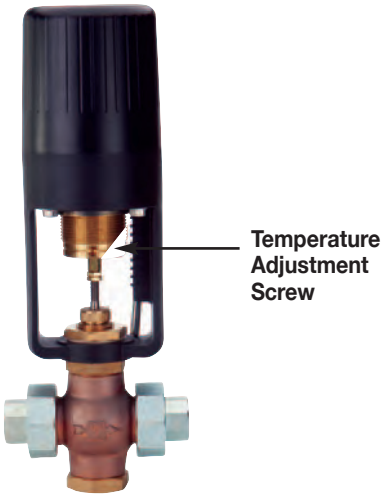
Capillary Length (ft.)	Bulb Length Required	Thermowell Length (in.)	Connection Size NPT	Brass Model #	Stainless Steel Model #
8', 12' or 16'	12.25"	13.0"	1 1/4"	**W536S2**	**W536S6**
20'	15.25"	16.0"	1 1/4"	**W536SE2**	**W536SE6**
24'	19.25"	20.0"	1 1/4"	**W536WE2**	**W536WE6**
8', 12' or 16'	8.25"	9.0"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

Notes: Thermowell Length chosen is based on the Length of the Capillary used in the Thermal System. (See chart above)

*3/4" connection available on thermowell for 9" bulb; Consult factory.

for Freeze Protection

Model	**AMBI-REG**
Service	**Steam, Water, Other Liquids**
Sizes	**1/2"– 1"**
Connections	**Threaded, Union Ends**
Body Material	**Bronze, Stainless Steel**
Seat Material	**Stainless Steel**
Max Inlet Pressure	**250 PSIG**



Typical Applications

The **AMBI-REG Temperature Control Valve** opens and closes based on ambient temperature. Therefore, it is ideal for automatic control of steam tracing lines in the winter months when flow is needed for freeze prevention and protection of outdoor pipelines, storage tanks, and plant instrumentation. It can also be used for freeze protection of outdoor water pipelines. Opening and Closing of Regulator is based on ambient temperature, it automatically opens and closes only when steam or water flow is needed, significantly reducing energy usage.

Features

- Self-contained, ambient sensing design requires no additional sensing bulb or element, simplifying installation (no external power source required)]
- Specially-designed Thermal Actuator Housing dissipates heat from nearby piping and equipment for true sensing of ambient conditions
- Lifetime lubrication is incorporated in the adjustment bushing minimizing maintenance
- Rugged industrial design with corrosion-resistant materials suitable for extended outdoor service life

Typical Applications

Housing:	Glass-Filled Nylon Yoke, Die-Cast Aluminum Cap, PEEK Bushings
Bellows:	High-pressure brass, corrosion resistant, tin plated finish
Temperature Over-range Protection:	Protects Thermal System from damage up to 100°F over high limit of range

How it Works

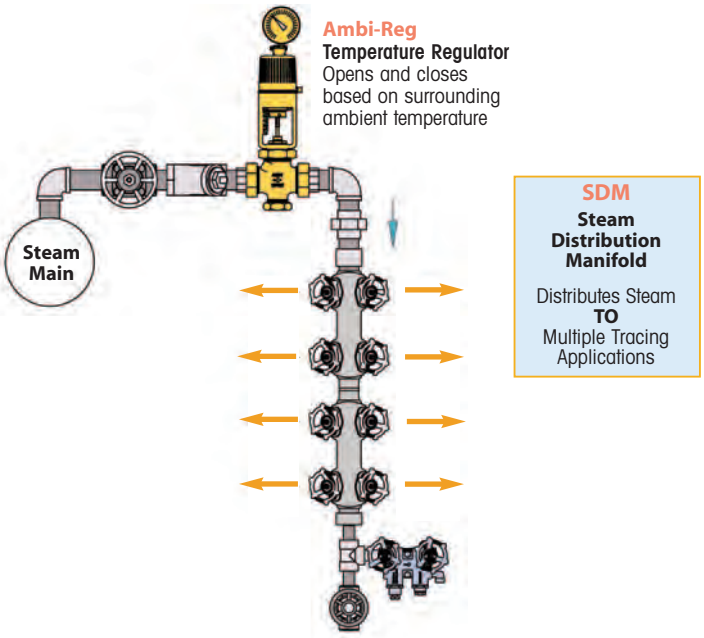
The fully self-contained regulator requires no external power source and can be field-adjusted to an ambient set temperature appropriate for opening & closing based on the application requirements. The thermal actuator assembly houses a fully enclosed bellows which senses and responds to ambient temperature. Turning the temperature adjustment screw clockwise increases set temperature and counter-clockwise for reducing set temperature.

Model Configuration Chart

Size Connection	Port Size	Model Code	PMO PSIG
1/2" NPT	1/8"	**EA01-A02**	250
	1/4"	**EA01-A08**	250
	1/2"	**EA01-A14**	250
3/4" NPT	3/4"	**EA01-A19**	250
1" NPT	1"	**EA01-A26**	250

Ambi-Reg controlling Steam flow to a Steam Distribution Manifold

Tracing Applications



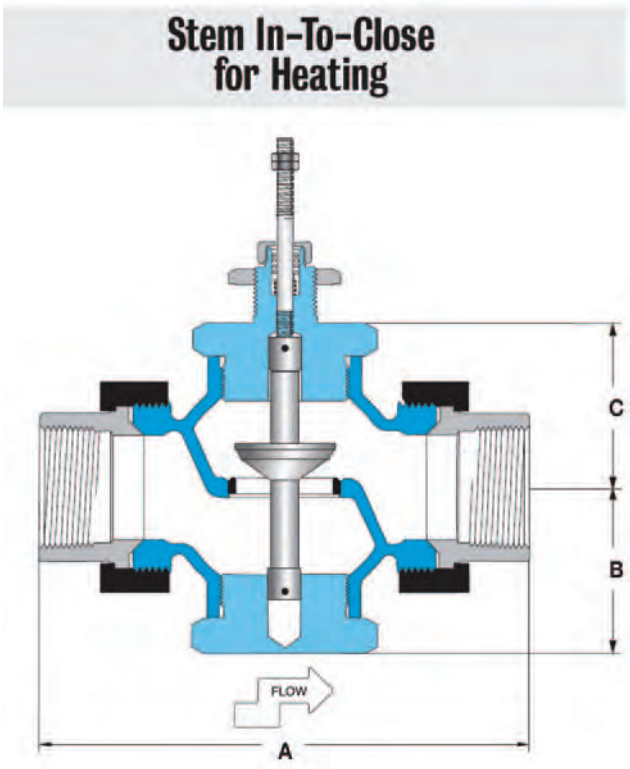
Temperature Range Chart

Range Code	Nominal Range		Recommended Working Span *	
01	20 to 70 ˚F	-10 to 20 ˚C	40 to 70 ˚F	5 to 20 ˚C

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

CAPACITIES — Steam (lbs/hr)

Inlet Pressure (PSIG)	Valve Body & Port Size				
	1/2"			3/4"	1"
Port Size (in.)	1/8	1/4	1/2	3/4	1
Cv Factors	0.17	0.7	2.8	5.6	8.4
2	5	20	81	162	243
5	6	24	95	190	285
10	7	30	118	236	354
15	9	35	141	282	423
20	10	41	164	328	492
25	11	47	187	374	561
30	13	52	210	419	629
40	15	64	255	510	765
50	18	75	300	600	901
75	25	108	412	825	1237
80	26	109	435	869	1304
100	32	131	524	1048	
125	39	159	635	1270	
140	43	175	701	1408	
250	72	297	1189		



Valve Body Specifications

Body Material*	Trim Material	Trim Style	Connection	Pressure & Temperature Rating
Bronze	Stainless Steel	Modified Linear	Threaded, malleable iron union ends	250 PSI @ 410°F (210°C)

Valve Body Selection – Threaded

Valve Body Number (In-To-Open Cooling)	Size		Capacity	Maximum Close-Off Pressure	Dimensions*			Approximate Shipping Wt.
	Connection (NPT)	Nominal Port	C_V	(PSI△P)	A	B	C	
A02	1/2	1/8"	0.17	250	4.8 [122]	1.8 [46]	1.8 [46]	3.0 lbs [1.35 kg]
A08	1/2	3/16"	0.7	250	4.8 [122]	1.8 [46]	1.8 [46]	3.0 lbs [1.35 kg]
A14	1/2	1/4"	2.8	250	4.8 [122]	1.8 [46]	1.8 [46]	3.0 lbs [1.35 kg]
A19	3/4	3/4"	5.6	140	5.6 [142]	2.3 [58]	2.3 [58]	4.9 lbs [2.21 kg]
A26	1	1"	8.4	80	6.0 152]	2.3 [58]	2.3 [58]]	6.0 lbs [2.70 kg]