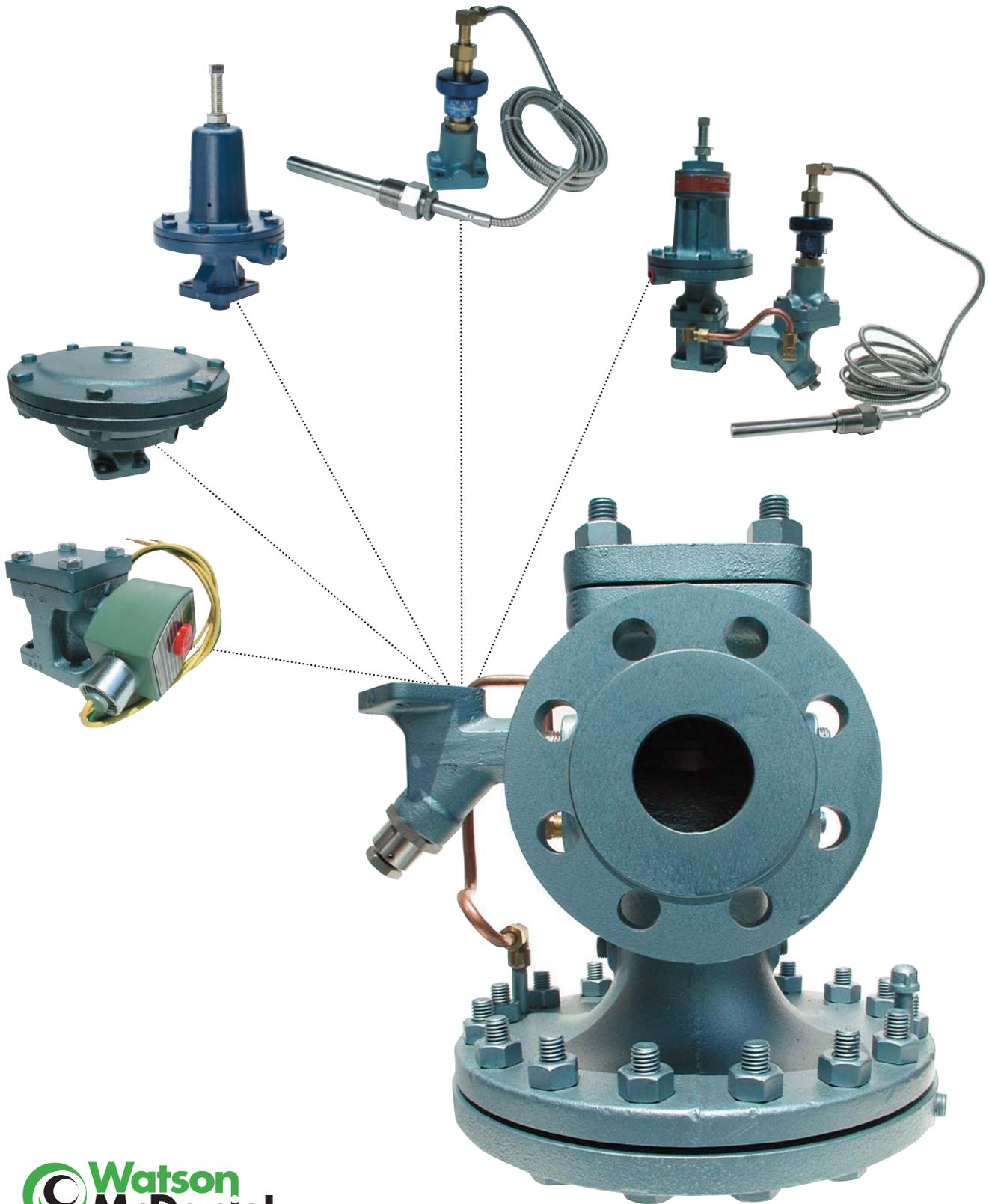


# Pilot-Operated Regulating Valves

Pilot-Operated  
REGULATORS



# HD Regulating Valve & Pilots

## Table of Contents

Pilot-Operated  
REGULATORS



**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**



HD Regulator with  
PP-**PRESSURE** Pilot  
(See Page 210)



HD Regulator with  
PT-**TEMPERATURE** Pilot  
(See Page 214)



HD Regulator with PP-**PRESSURE** Pilot  
& PT-**TEMPERATURE** Pilot  
(See Page 214)

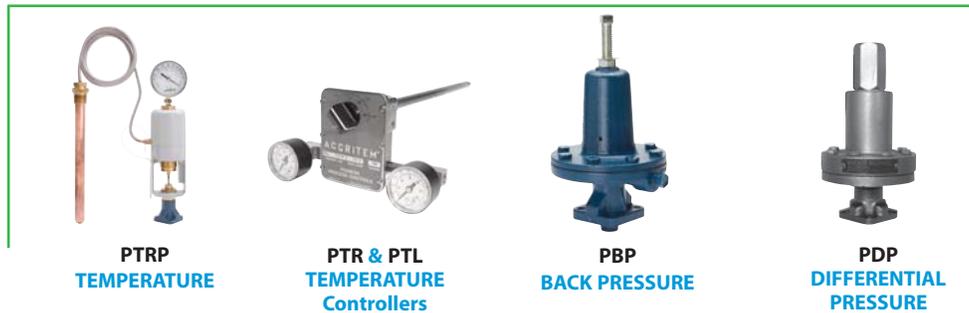


HD Regulator with  
PA-Air Loaded **PRESSURE** Pilot  
(See Page 218)



HD Regulator with  
PTRP-**TEMPERATURE** Pilot  
(See Page 222)

### Other HD Pilots



**PTRP**  
TEMPERATURE

**PTR & PTL**  
TEMPERATURE  
Controllers

**PBP**  
BACK PRESSURE

**PDP**  
DIFFERENTIAL  
PRESSURE

HD Series Pilot-Operated Regulating Valves - **Introduction**

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**Main Valve** for HD Regulators • **Ductile Iron**

**208-209**

**Pilots** for HD Regulators

**210-230**

<b>PP &amp; PP5-Pressure Pilots</b>	Spring-loaded pressure pilots for general service steam pressure reducing.	<b>210</b>
<b>PBP-Back Pressure Pilot</b>	For controlling upstream pressure of the HD Regulator.	<b>212</b>
<b>PT-Temperature Pilot</b>	General purpose liquid-filled temperature pilot used when heating liquids to a desired temperature.	<b>214</b>
<b>PA-Pressure Pilot</b> (Air-Loaded)	Air-loaded Pressure Pilot can be used instead of spring-loaded PP pilots for pressure regulation in remote installations. Also used in conjunction with PTR & PTL temperature controllers.	<b>218</b>
<b>PS-Solenoid Pilot</b>	Solenoid Pilot can be used in conjunction with any of the listed pilots for electrical on/off control of HD Regulators.	<b>222</b>
<b>PTRP Temperature Pilot</b>	Special purpose vapor tension temperature pilot for increased sensitivity and reduced reaction time when controlling temperature of liquids and air.	<b>224</b>
<b>PTR &amp; PTL Temperature Controllers</b>	These temperature controllers have a wider temperature span than the PT temperature pilot. They are used in conjunction with the PA-Air Pilot to deliver an air signal to the HD valve.	<b>228</b>
<b>PDP-Pilot</b>	Differential Pressure Pilot with two separate sensing ports for maintaining differential pressure between steam and an alternate medium.	<b>230</b>

**Noise Attenuators** for HD & HSP Regulators: Reduces noise in pressure reducing applications **236**

**Capacity Charts** for HD & HSP Regulators **240**



**HSP Series Pressure Regulators • Cast Steel**

**231**

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 **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; available with pressure pilot only.

### 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)

#### For Pressure Control

- HD Main Valve *with*
- PP Pressure Pilot



Model: PP

#### For Temperature Control

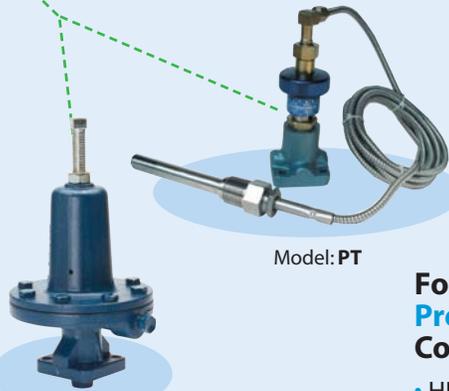
- HD Main Valve *with*
- PT Temperature Pilot



Model: PT

#### For Combination Pressure & Temperature Control

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



Model: PT

Model: PP

### 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.

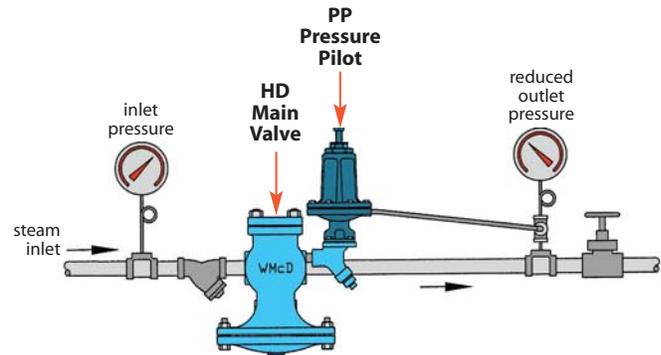
## Introduction • Typical Applications

### 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.



Pilot-Operated  
REGULATORS

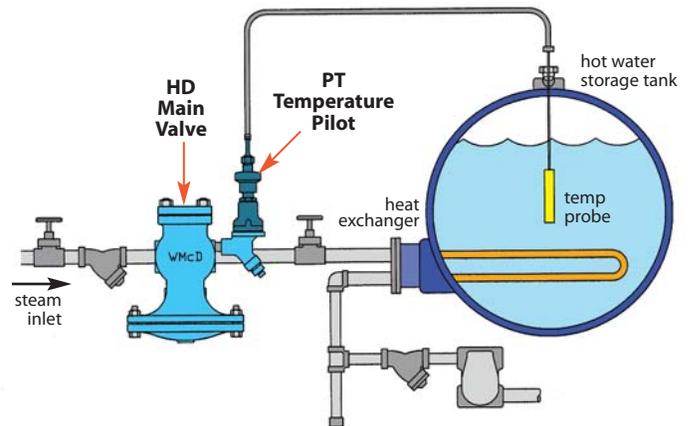
### HD Main Valve with PT-Temperature Pilot



#### 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.

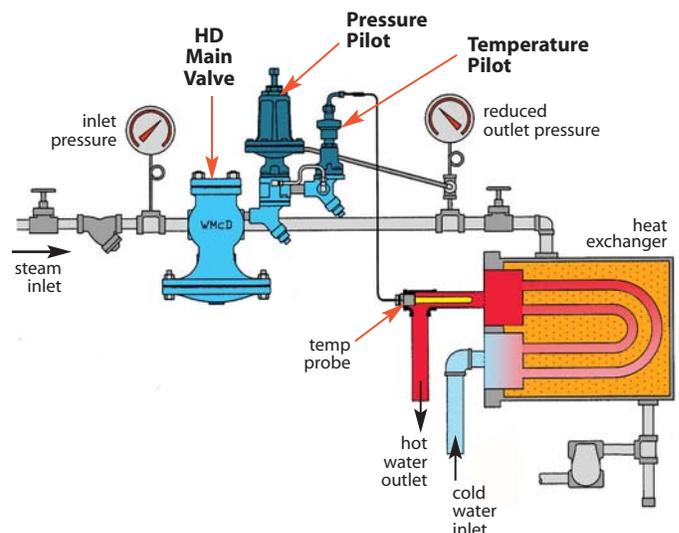


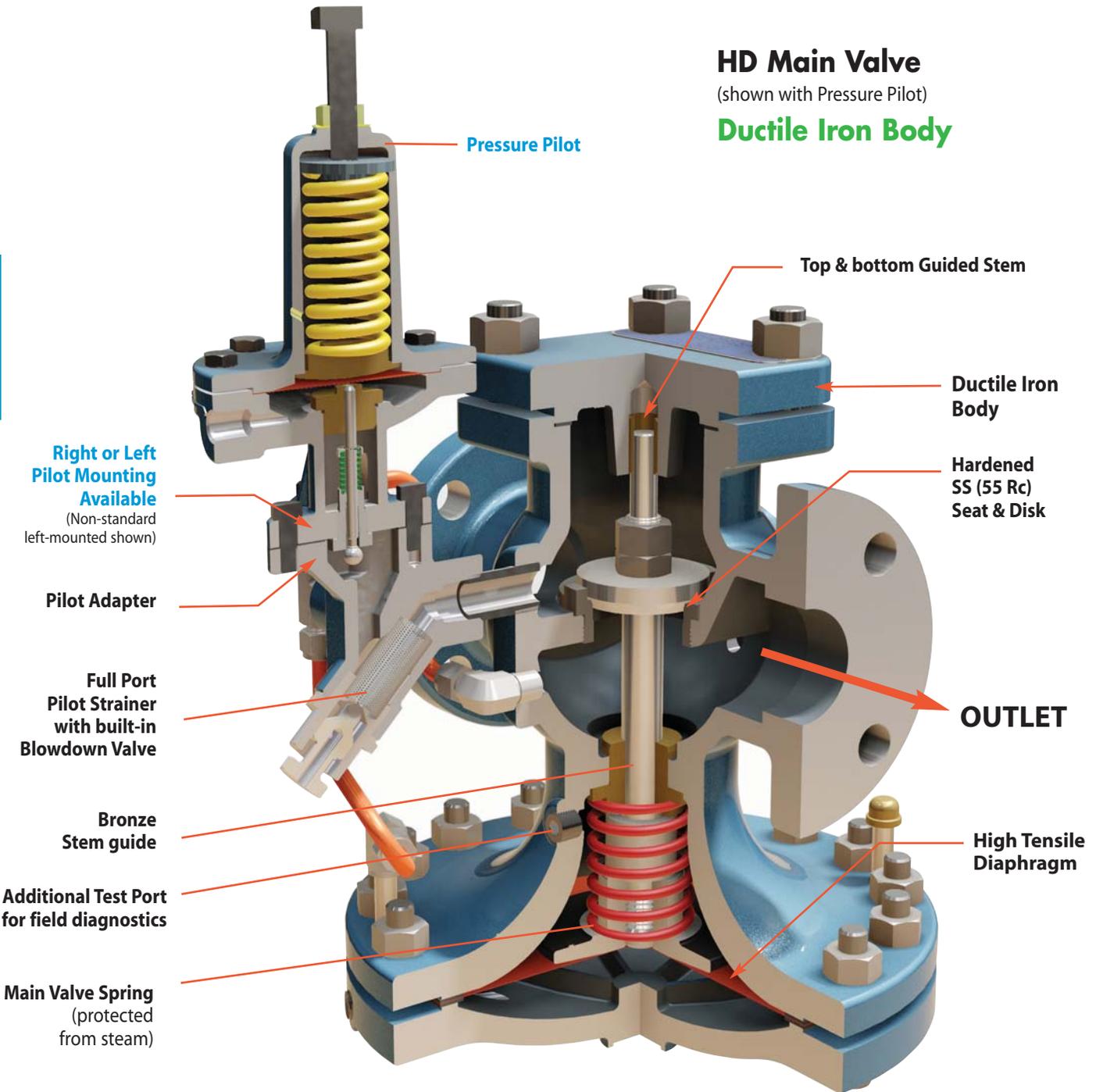
### HD Main Valve with PP-Pressure Pilot and PT-Temperature Pilot



#### 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.





### 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



**PT  
TEMPERATURE  
Pilot**  
Liquid Filled



**PBP  
BACK  
PRESSURE  
Pilot**



**PS  
ON/OFF  
(Solenoid)**



**PTRP  
TEMPERATURE  
Pilot**  
Vapor Tension



**PDP  
DIFFERENTIAL  
PRESSURE  
Pilot**

### 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**. 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**.

### 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.

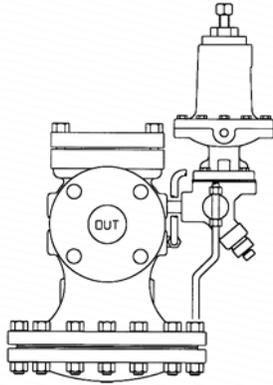
### Reduced port trim Option:

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:

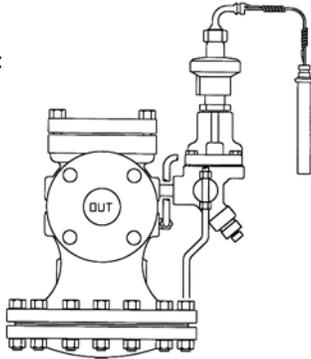
Regulators require a minimum Inlet pressure as well as a minimum pressure drop across the valve to operate properly. The HD Standard Main valve requires a minimum inlet pressure of 15 PSIG and minimum differential pressure of 10 PSI. The Low Pressure Main valve requires 5 PSIG minimum inlet pressure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

**HD Main Valve**  
with  
**PP-Pressure Pilot**  
Spring-Loaded



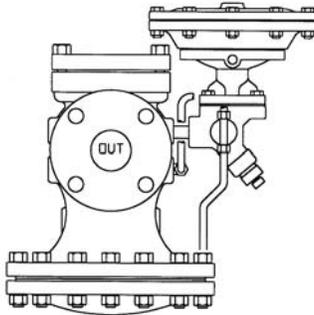
Shown with **PP** Pressure control Pilot. Spring-loaded pressure pilots are the most typical method of controlling downstream pressure in Steam Systems. Adjustment screw on top of pilot controls downstream steam pressure.

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



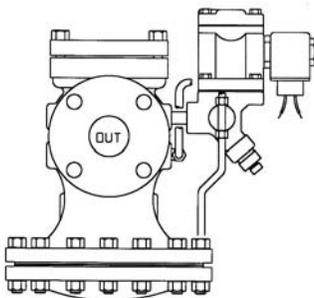
Shown with Temperature control Pilot: The **PT** Temperature Pilot will control the flow of steam flowing through the HD valve based on the temperature of the sensing bulb. The liquid-filled sensing Bulb is available in standard 8 ft and 15 ft capillary lengths. Other lengths available.

**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**



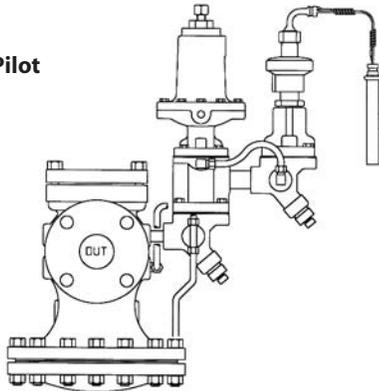
Shown with **PS ON-OFF**(solenoid Pilot) control pilot: The **PS ON-OFF** (solenoid) Pilot allows for the HD valve to be opened and closed using an electrical switch to activate a small solenoid valve. The **PS** Pilot can be used for system automation or as a safety shut down device. The ON-OFF pilot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

## HD Regulator & Pilot Combinations

### HD Main Valve

with

- PT-Temperature Pilot
- PP-Pressure Pilot



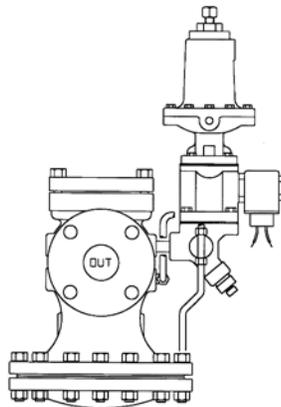
The **PT** Temperature Pilot will maintain the proper flow of steam through the main valve to keep the process it's controlling at the proper temperature. The **PP** pressure Pilot will **LIMIT** the downstream pressure to a maximum value. This combination of Pilots is very convenient when the Steam 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

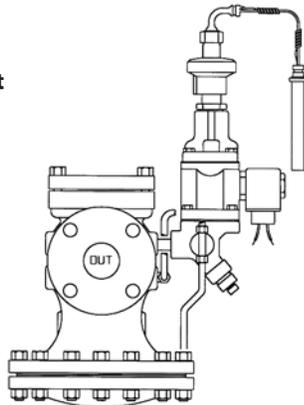


The **PP** Pressure Pilot will maintain the desired downstream set pressure as long as the **PS ON-OFF** (solenoid) Pilot is in the ON position. Available in either Normally-ON or Normally-OFF configuration; an electrical signal turns valve OFF or ON.

### HD Main Valve

with

- PT-Temperature Pilot
- PS1 On/Off Control Solenoid Pilot

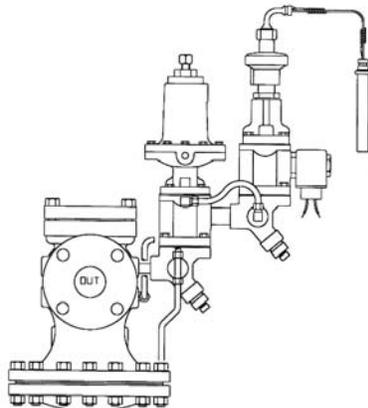


The **PT** Temperature Pilot will maintain the proper flow of steam through the main valve to keep the process it's controlling at the proper temperature as long as the **PS ON-OFF** (solenoid) Pilot is in the ON position. Available in either Normally-ON or Normally-OFF configuration; an electrical signal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

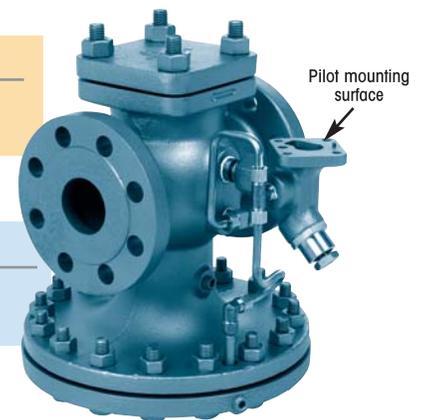
Main Valve	<b>HD-Series</b>
Sizes	<b>1/2" - 6"</b>
Connections	<b>NPT: 1/2" - 2"</b> <b>FLG: 1" - 6"</b>
Body Material	<b>Ductile Iron</b>
PMO Max. Operating Pressure	<b>300 PSIG</b>
Design Pressure/	NPT 450 PSIG @ 650° F
Temperature Ratings	150# FLG 150 PSIG @ 566° F
TMA/PMA	300# FLG 450 PSIG @ 650°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



Pilot-Operated REGULATORS

#### 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 Main Valve Spring with EPDM Diaphragm
	15	1 1/4"	F300	300# FLG (1" - 6")	
	16	1 1/2"			
	17	2"			
	18	2 1/2"			
	19	3"			
	20	4"			
	22	6"			

Note: For more than one Option, combine suffixes.  
Example: SSD-SSXT

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.

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:

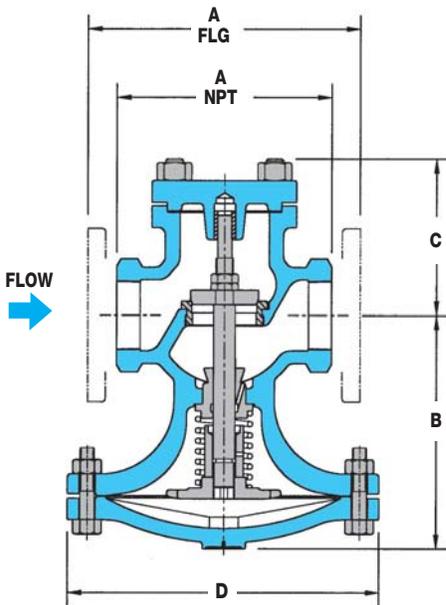
	Code
Low Pressure Main Valve:	<b>LP</b>
Reduced Port Valves:	<b>HDR</b>
Stainless Steel Diaphragm:	<b>SSD</b>
Stainless Steel External Tubing:	<b>SSXT</b>

Required for secondary Pilot: **BADAPTER**  
(Not required for Solenoid Pilot)

#### Example Model Codes for Main Valve:

- HD-15-N**  
(HD Series Valve with 1 1/4" Threaded, NPT connections)
- HDR-16-F150**  
(HD Series Valve, Reduced Port with 1 1/2" 150# Flanged connections)
- HD-20-F300-SSXT**  
(HD Series Valve with 4" 300# Flanged connections & SS External tubing)

HD Main Valve • Ductile Iron



HD-Series DIMENSIONS - inches									
Size	(A) Face-To-Face			B	C	D	Weight (lbs)		
	NPT	150#	300#				NPT	150#	300#
1/2"	4 <sup>3</sup> / <sub>8</sub>			5 <sup>1</sup> / <sub>2</sub>	3 <sup>3</sup> / <sub>8</sub>	6 <sup>1</sup> / <sub>2</sub>	18		
3/4"	4 <sup>3</sup> / <sub>8</sub>			5 <sup>1</sup> / <sub>2</sub>	3 <sup>3</sup> / <sub>8</sub>	6 <sup>1</sup> / <sub>2</sub>	18		
1"	5 <sup>3</sup> / <sub>8</sub>	5 <sup>1</sup> / <sub>2</sub>	6	6 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>2</sub>	7	23	40	45
1 <sup>1</sup> / <sub>4</sub> "	6 <sup>1</sup> / <sub>2</sub>			7 <sup>3</sup> / <sub>8</sub>	4 <sup>7</sup> / <sub>8</sub>	8 <sup>3</sup> / <sub>4</sub>	43		
1 <sup>1</sup> / <sub>2</sub> "	7 <sup>1</sup> / <sub>4</sub>	6 <sup>7</sup> / <sub>8</sub>	7 <sup>3</sup> / <sub>8</sub>	7 <sup>3</sup> / <sub>8</sub>	4 <sup>7</sup> / <sub>8</sub>	8 <sup>3</sup> / <sub>4</sub>	43	55	60
2"	7 <sup>1</sup> / <sub>2</sub>	8 <sup>1</sup> / <sub>2</sub>	9	8 <sup>1</sup> / <sub>4</sub>	5 <sup>3</sup> / <sub>8</sub>	10 <sup>7</sup> / <sub>8</sub>	65	75	85
2 <sup>1</sup> / <sub>2</sub> "		9 <sup>3</sup> / <sub>8</sub>	10	9	5 <sup>3</sup> / <sub>4</sub>	11 <sup>3</sup> / <sub>4</sub>		100	105
3"		10	10 <sup>3</sup> / <sub>4</sub>	8 <sup>7</sup> / <sub>8</sub>	6 <sup>3</sup> / <sub>4</sub>	13 <sup>1</sup> / <sub>4</sub>		130	145
4"		11 <sup>7</sup> / <sub>8</sub>	12 <sup>1</sup> / <sub>2</sub>	10 <sup>7</sup> / <sub>8</sub>	7 <sup>1</sup> / <sub>2</sub>	14 <sup>3</sup> / <sub>4</sub>		215	235
6"		15 <sup>1</sup> / <sub>8</sub>	16	14 <sup>1</sup> / <sub>8</sub>	10	19 <sup>3</sup> / <sub>4</sub>		420	470

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 PSIG** (Standard Main Valve)  
**5 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	Ductile Iron/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)

Pilot-Operated  
REGULATORS

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



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.

### Pressure Regulating with PP & PP5 Spring-loaded Pilot

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



Pilot-Operated REGULATORS

#### 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  $\pm 1$  PSIG
- **PP5**-Pilot can maintain downstream pressure to  $\pm 0.5$  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
<b>PP-Pressure Pilot (for Standard Industrial Applications) 1.0 PSIG accuracy</b>			
3-25	<b>PP-Y</b>	Yellow	10
20-100	<b>PP-B</b>	Blue	10
80-200	<b>PP-R</b>	Red	10
<b>PP5-Pressure Pilot (Special Applications) 0.5 PSIG accuracy</b>			
1-10	<b>PP5-Y*</b>	Yellow	25
10-25	<b>PP5-B*</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)

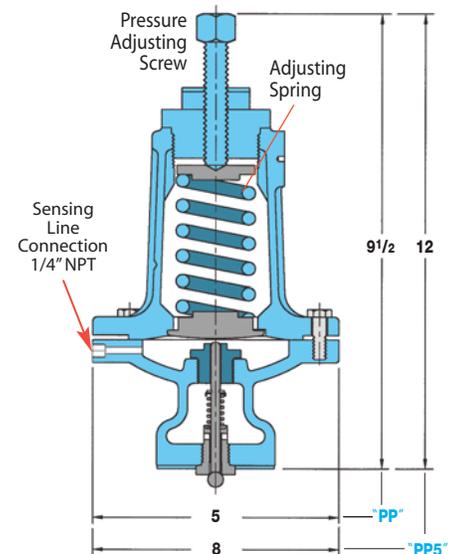
#### MATERIALS for PP Pressure Pilot

PP Pilot Body	<b>WCb 216 Cast Steel</b>
PP5 Pilot Body	<b>Cast Iron</b>
Head & Seat Gasket	302 SS
Diaphragm	Phosphor Bronze
Head & Seat Assembly	Hardened SST (55 Rc)

#### MATERIALS for HD Main Valve

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

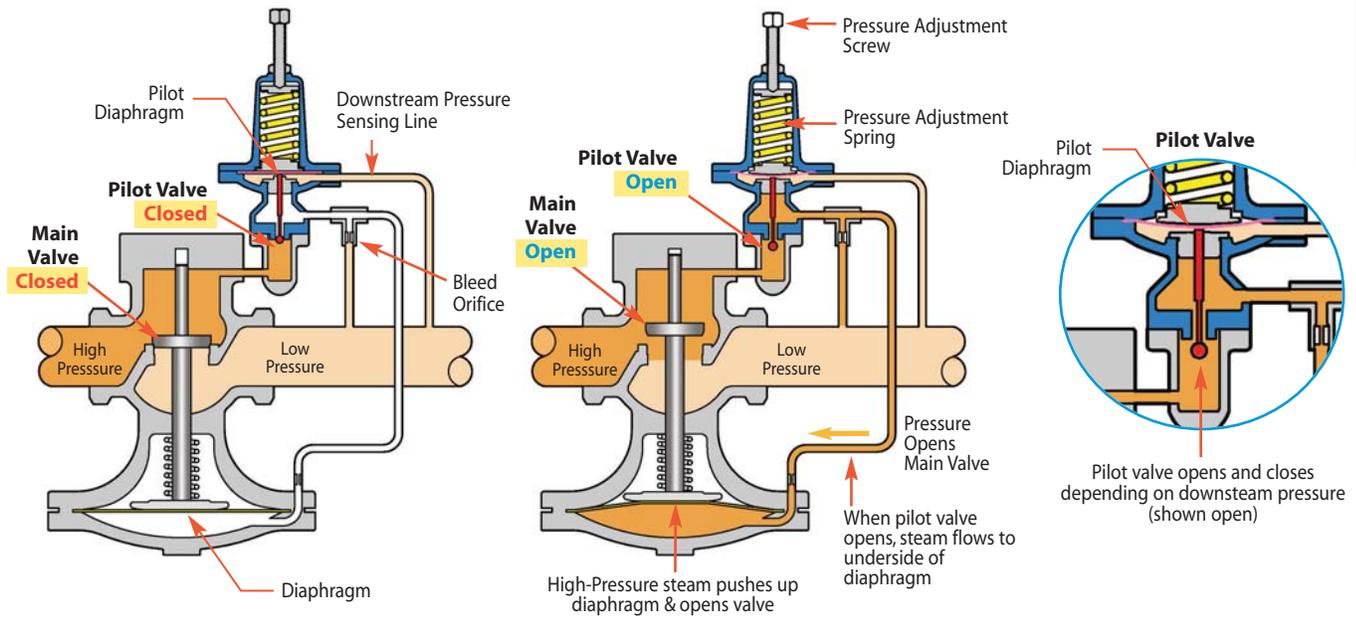
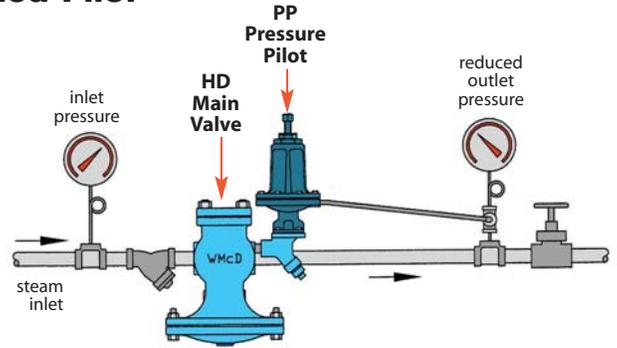
Units: inches



Pressure Regulating with PP & PP5 Spring-loaded Pilot

Reducing Pressure

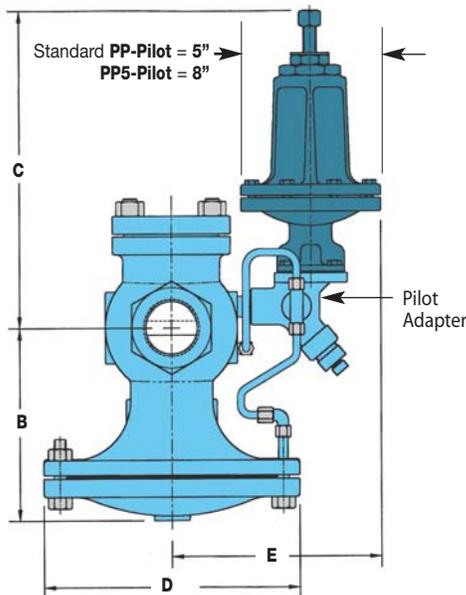
The PP-Pilot and the PP5-Pilot are both spring-adjusted pressure pilots. The PP-Pilot is used on typical general-purpose pressure reducing applications. The PP5-Pilot is used when higher accuracy is required and is capable of maintaining a control pressure window of less than 1 PSI.



Pilot-Operated REGULATORS

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

Pilot-Operated REGULATORS

Back Pressure Pilot	<b>PBP</b>
Pilot Body Material	<b>Ductile Iron</b>
Max Inlet Pressure	<b>300 PSIG</b>
Reduced Outlet Pressure Range	<b>10-200 PSIG</b>
Inlet Pressure Range (when used with <b>HD</b> Standard main valve)	<b>15-300 PSIG</b>
Inlet Pressure Range (when used with <b>HD-LP</b> Low-Pressure main valve)	<b>5-20 PSIG</b>

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  $\pm 1$  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	<b>PBP-Y</b>	Yellow	10
20-100	<b>PBP-B</b>	Blue	10
80-200	<b>PBP-R</b>	Red	10

#### OPERATING PRESSURES

Inlet Pressure Range:

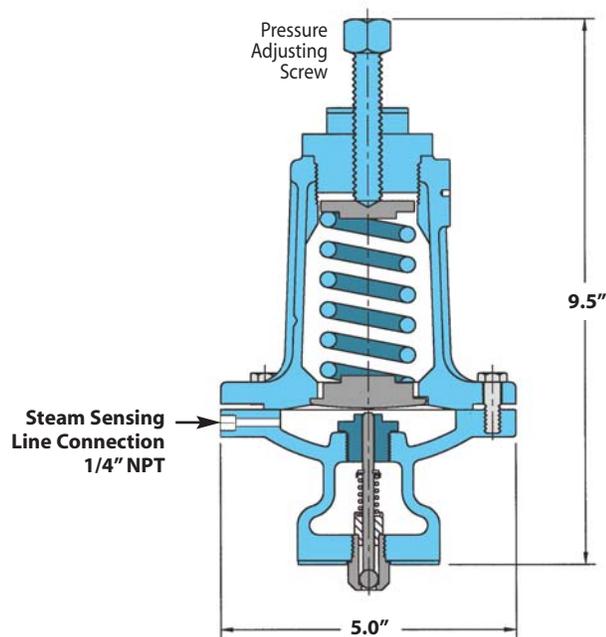
**15-300 PSIG** (Standard Main Valve)

**5-20 PSIG** (Low Pressure Main Valve)

Minimum Differential Pressure:

**10 PSI** (Standard Main Valve)

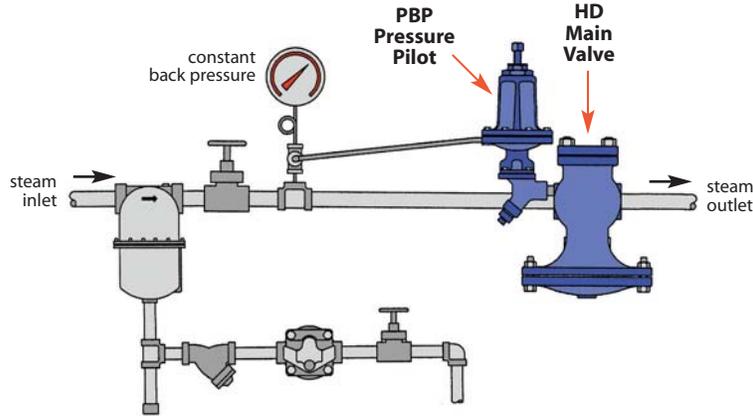
**3 PSI** (Low Pressure Main Valve)



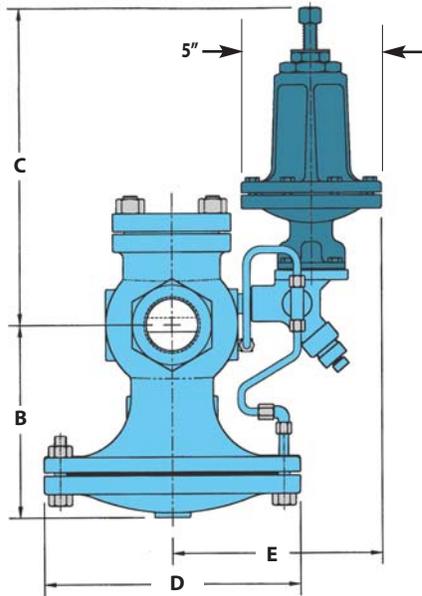
**Back Pressure Regulating with PBP Back-Pressure Pilot**

**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.



Pilot-Operated REGULATORS



**DIMENSIONS HD-Series – inches**

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

**MATERIALS for PBP Back-Pressure Pilot**

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

**MATERIALS for HD Main Valve**

Body	<b>Ductile Iron</b>
Cover	<b>Ductile Iron</b>
Gasket	Grafoil/Garlock
Cover Screws	Steel
Pilot Adapter	<b>Ductile Iron/Cast Steel</b>
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**

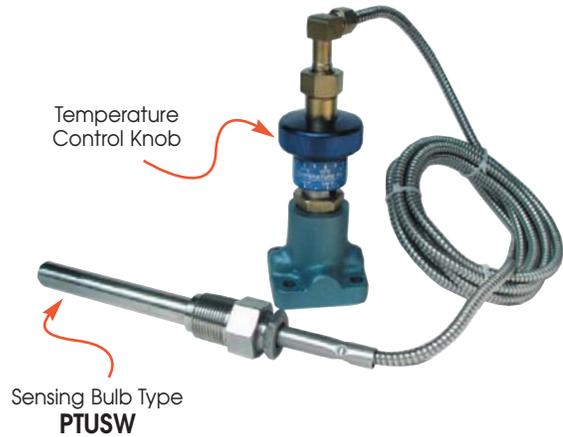


Model Code for Main Valve: **HD-17-F150**  
(2" HD Series Valve with 150# Flanges)

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

### Temperature Regulating with PT Temperature Pilot

Temperature Pilot	<b>PT</b>
Pilot Body Material	<b>Ductile Iron</b>
Max Inlet Pressure	<b>300 PSIG</b>
Temperature Control Range	<b>60-300°F</b>
Steam Inlet Pressure Range (Standard) (when Standard Temperature Pilot is used with <b>HD Standard</b> main valve)	<b>15-300 PSIG</b>
Steam Inlet Pressure Range (Low) (when Low-Pressure Temperature Pilot is used with <b>HD-LP</b> Low-Pressure main valve)	<b>5-20 PSIG</b>



Pilot-Operated REGULATORS

#### 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 conjunction 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. armored capillary is available for corrosive applications or to meet SWDA requirements. Use code **SSBBAC**

#### For Temperature Pilot

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

#### Model Codes for Individual Thermowells for PT & PTU Pilots

Model Code	Description of Thermowell
<b>WELL-TU-BR</b>	Brass Thermowell for PTU pilot
<b>WELL-TU-SS</b>	Stainless steel Thermowell for PTU pilot
<b>WELL-T-BR-EXT</b>	Extended brass Thermowell for PT pilot
<b>WELL-T-SS-EXT</b>	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**

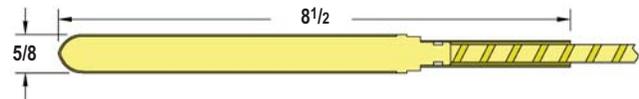
**PT Pilots with 8 Ft. Capillary & Sensing Bulbs**

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**

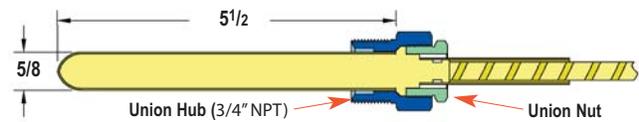
Dimension (inches)

**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.

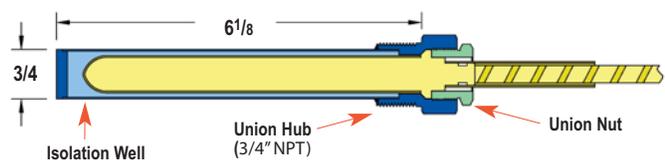
**PTU**



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)**

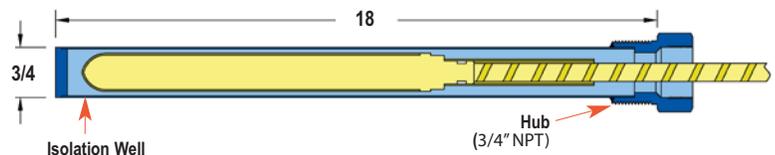
PTUBW: Brass Well  
PTUSW: 316L SS Well



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:**

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

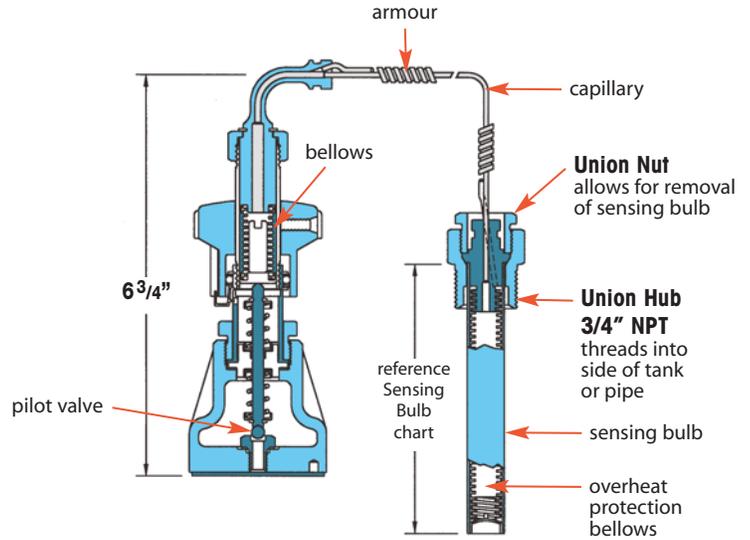
**Model Code Configuration for Temperature Pilot**

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	SSBAC	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



Pilot-Operated REGULATORS

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

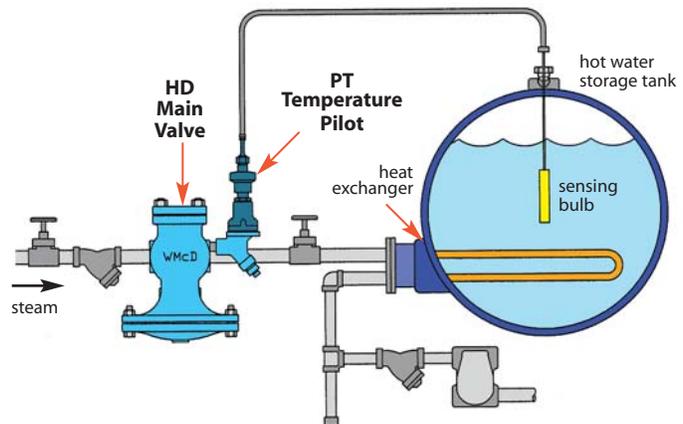
#### HD Main Valve

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 overhear protection bellows is incorporated into sensing bulb.



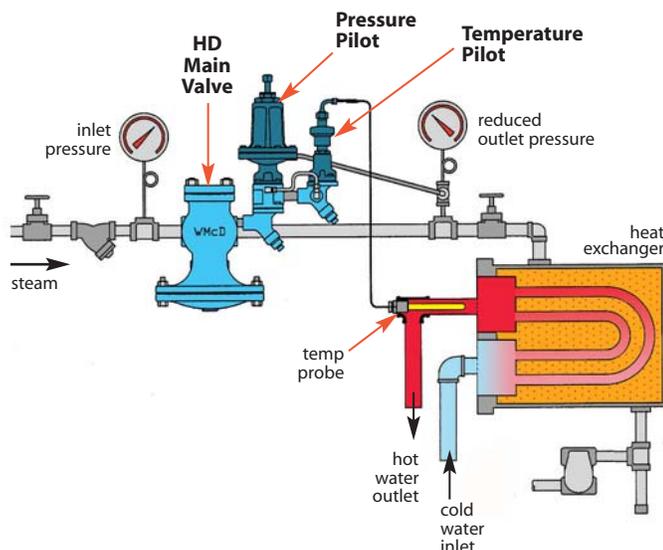
### Controlling Temperature and Limiting Pressure using PT-Temperature Pilot & PP-Pressure Pilot

#### HD Main Valve

with  
• PP-Pressure Pilot  
• PT-Temperature Pilot

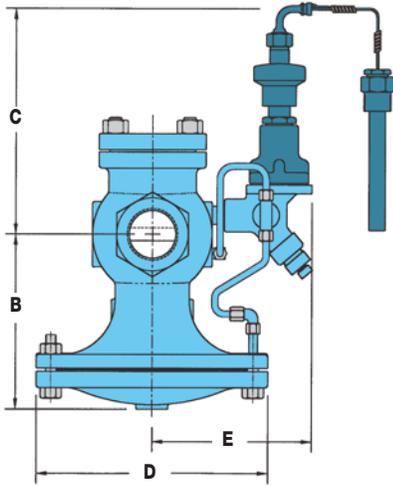
#### Controlling Temperature & Limiting Pressure to a Maximum Value

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.

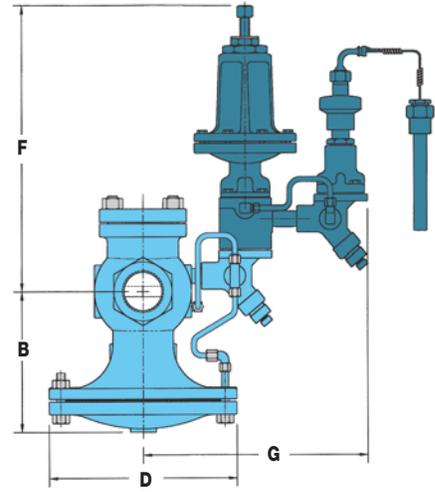


Temperature Regulating with PT Temperature Pilot

HD Valve with Temperature Pilot



HD Valve with Temperature & Pressure Pilot



Pilot-Operated REGULATORS

**DIMENSIONS HD-Series** – inches

Size	Face-To-Face				B	C	D	E	F	G	Weight (lbs)	
	NPT	150#	300#								NPT	FLG
1/2"	4 <sup>3</sup> / <sub>8</sub>	–	–	–	5 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>4</sub>	6 <sup>1</sup> / <sub>2</sub>	6 <sup>1</sup> / <sub>2</sub>	14 <sup>1</sup> / <sub>2</sub>	10 <sup>1</sup> / <sub>4</sub>	18	–
3/4"	4 <sup>3</sup> / <sub>8</sub>	–	–	–	5 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>4</sub>	6 <sup>1</sup> / <sub>2</sub>	6 <sup>1</sup> / <sub>2</sub>	14 <sup>1</sup> / <sub>2</sub>	10 <sup>1</sup> / <sub>4</sub>	18	–
1"	5 <sup>3</sup> / <sub>8</sub>	5 <sup>1</sup> / <sub>2</sub>	6	–	6 <sup>1</sup> / <sub>4</sub>	9 <sup>1</sup> / <sub>4</sub>	7	8 <sup>1</sup> / <sub>4</sub>	14 <sup>1</sup> / <sub>2</sub>	10 <sup>1</sup> / <sub>4</sub>	23	35
1 <sup>1</sup> / <sub>4</sub> "	6 <sup>1</sup> / <sub>2</sub>	–	–	–	7 <sup>3</sup> / <sub>8</sub>	9 <sup>1</sup> / <sub>4</sub>	8 <sup>3</sup> / <sub>4</sub>	7 <sup>1</sup> / <sub>4</sub>	14 <sup>1</sup> / <sub>2</sub>	10 <sup>3</sup> / <sub>4</sub>	43	–
1 <sup>1</sup> / <sub>2</sub> "	7 <sup>1</sup> / <sub>4</sub>	6 <sup>7</sup> / <sub>8</sub>	7 <sup>3</sup> / <sub>8</sub>	–	7 <sup>3</sup> / <sub>8</sub>	9 <sup>1</sup> / <sub>4</sub>	8 <sup>3</sup> / <sub>4</sub>	7 <sup>1</sup> / <sub>4</sub>	14 <sup>1</sup> / <sub>2</sub>	10 <sup>3</sup> / <sub>4</sub>	43	60
2"	7 <sup>1</sup> / <sub>2</sub>	8 <sup>1</sup> / <sub>2</sub>	9	–	8 <sup>1</sup> / <sub>4</sub>	9 <sup>1</sup> / <sub>4</sub>	10 <sup>7</sup> / <sub>8</sub>	7 <sup>1</sup> / <sub>2</sub>	14 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>4</sub>	65	85
2 <sup>1</sup> / <sub>2</sub> "	–	9 <sup>3</sup> / <sub>8</sub>	10	–	9	9 <sup>1</sup> / <sub>4</sub>	11 <sup>3</sup> / <sub>4</sub>	7 <sup>3</sup> / <sub>4</sub>	14 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>4</sub>	–	105
3"	–	10	10 <sup>3</sup> / <sub>4</sub>	–	8 <sup>7</sup> / <sub>8</sub>	9 <sup>1</sup> / <sub>4</sub>	13 <sup>1</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>2</sub>	14 <sup>1</sup> / <sub>2</sub>	12	–	145
4"	–	11 <sup>7</sup> / <sub>8</sub>	12 <sup>1</sup> / <sub>2</sub>	–	10 <sup>7</sup> / <sub>8</sub>	9 <sup>1</sup> / <sub>4</sub>	6 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>2</sub>	14 <sup>1</sup> / <sub>2</sub>	13	–	235
6"	–	15 <sup>1</sup> / <sub>8</sub>	16	–	14 <sup>1</sup> / <sub>8</sub>	9 <sup>3</sup> / <sub>4</sub>	19 <sup>3</sup> / <sub>4</sub>	10 <sup>3</sup> / <sub>4</sub>	15	14 <sup>1</sup> / <sub>4</sub>	–	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	Ductile Iron
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	Ductile Iron/Cast Steel
Screen	Stainless Steel
Tubing	Copper
Valve Seat	Hardened SST (55 Rc)
Valve Disc	Hardened SST (55 Rc)
Diaphragm	Phosphor Bronze

### Pressure Control with PA Air-Loaded Pilot

Pilot-Operated REGULATORS

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

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



#### 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  $\pm 1$  PSIG

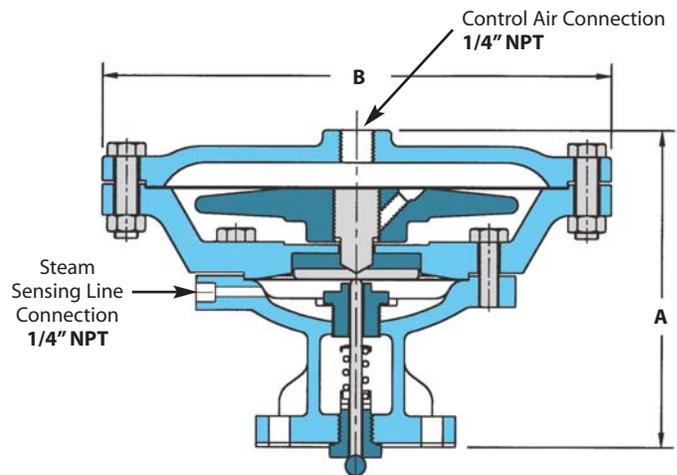
#### DIMENSIONS – inches

Model	A	B
<b>PA1</b>	5 <sup>1</sup> / <sub>4</sub>	5
<b>PA4</b>	5 <sup>1</sup> / <sub>4</sub>	7 <sup>7</sup> / <sub>8</sub>
<b>PA6</b>	5 <sup>1</sup> / <sub>4</sub>	9 <sup>1</sup> / <sub>2</sub>

MAXIMUM CONTROL AIR PRESSURE ON AIR PILOT IS 125 PSIG

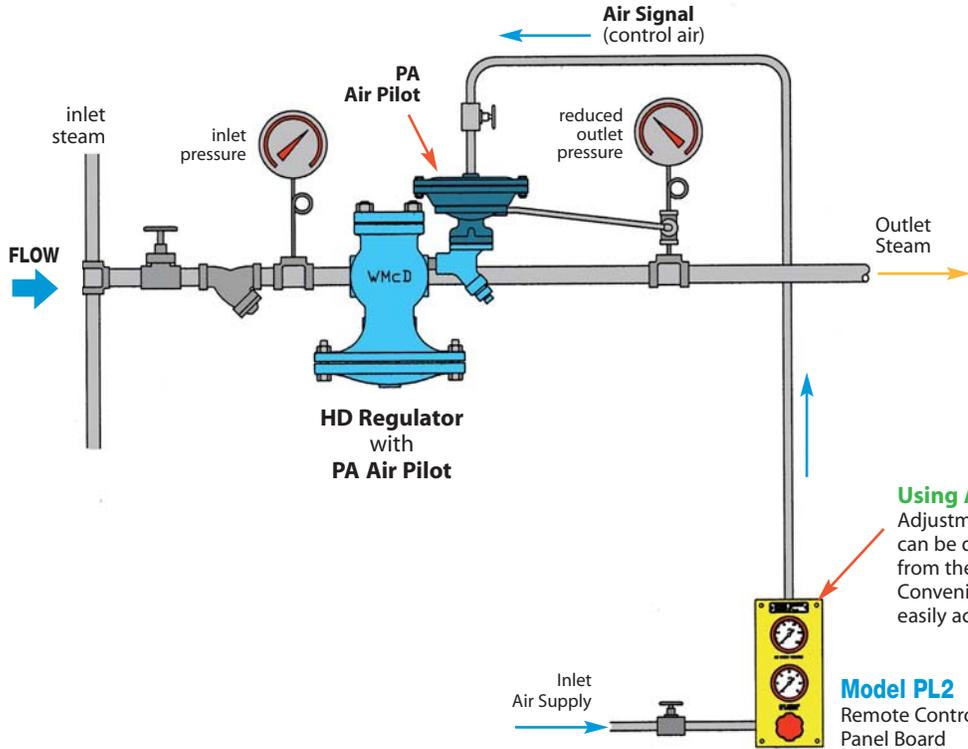
PRESSURE ADJUSTING RANGES		
Model	Pressure Ranges	Description
<b>PA1</b>	<b>3-125 PSIG</b>	<b>1:1</b> ratio of steam pressure to control air pressure
<b>PA4</b>	<b>3-200 PSIG</b>	<b>4:1</b> ratio of steam pressure to control air pressure
<b>PA6</b>	<b>20-200 PSIG</b>	<b>6:1</b> ratio of steam pressure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



Pressure Control with PA Air-Loaded Pressure Pilot

Pressure Reducing Station Using HD Regulator with an Air Pilot



Pilot-Operated REGULATORS

**Using Air-loaded Pressure Pilot**  
Adjustment of outlet steam pressure can be done from a remote location from the valve by adjusting air pressure. Convenient if the regulator is not in an easily accessible area.

**Model PL2**  
Remote Control Panel Board

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

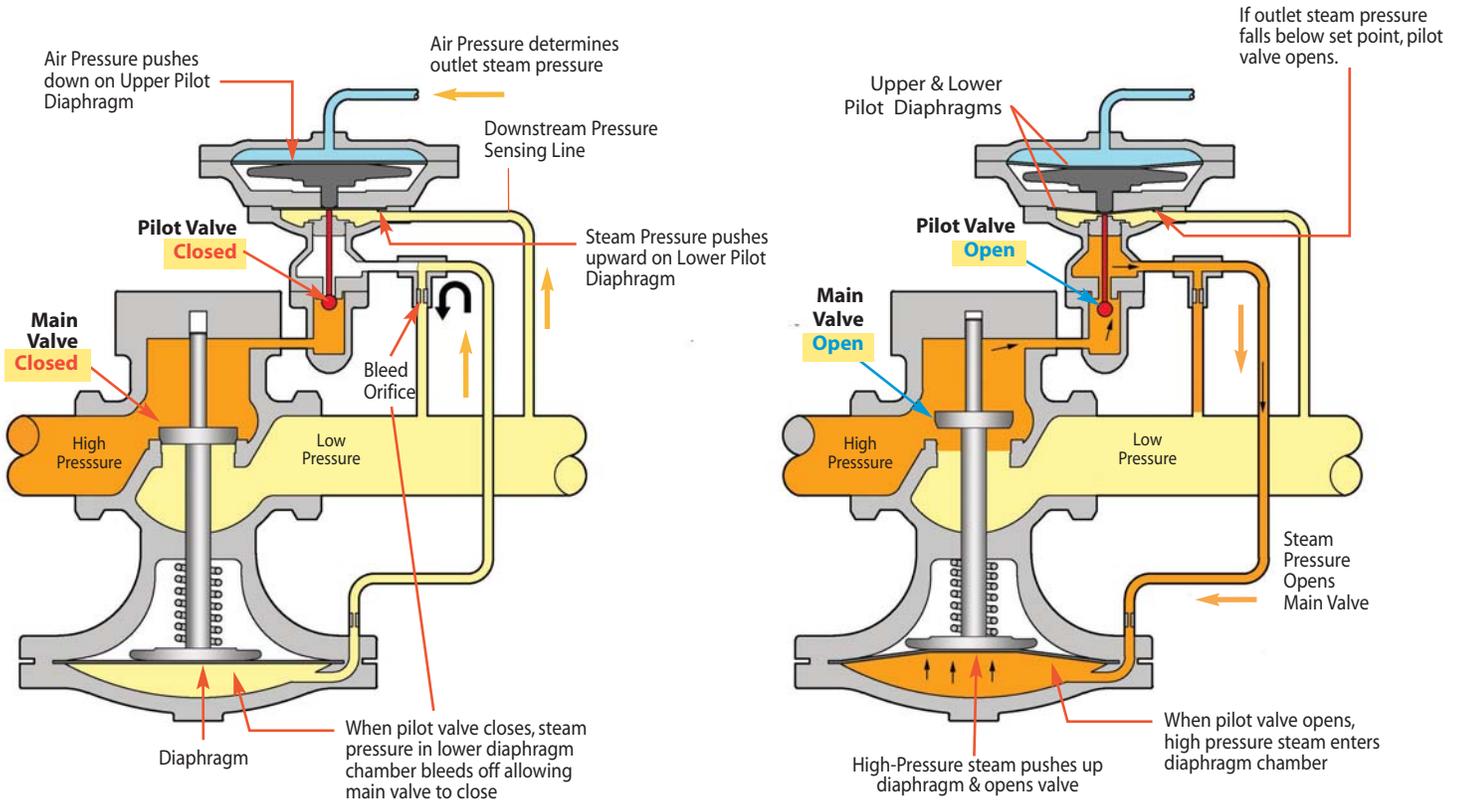
The PL3 is the same as the PL2 with the addition of a Steam Pressure Gauge for measuring steam pressure on the outlet side of the regulating valve.

### 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.

Pilot-Operated REGULATORS

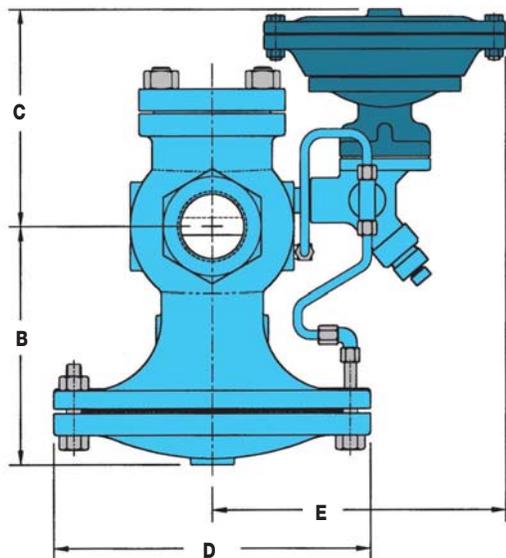


MAXIMUM CONTROL AIR PRESSURE ON AIR PILOT IS 125 PSIG

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.

### Pressure Control with PA Air-Loaded Pilot



#### DIMENSIONS HD-Series – inches

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

\* Add 2<sup>1</sup>/<sub>2</sub>" to "C" dimension for PA4 or PA6 Air Pilots on 2" thru 4" valves.

\*\* Add 1<sup>1</sup>/<sub>2</sub>" to "E" dimension for PA4, and 2<sup>1</sup>/<sub>4</sub>" for PA6.

#### MATERIALS for PA Pressure Pilot

Pilot Body & Cover	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	Ductile Iron/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

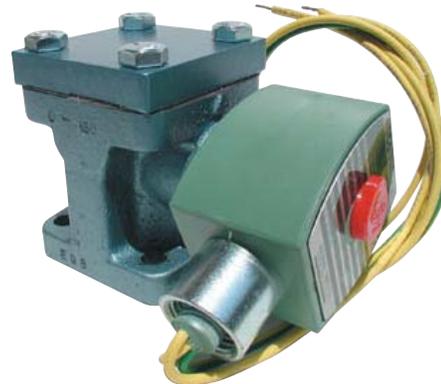
Specify:

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

### On/Off Control using an Electric Solenoid

- Max Inlet Pressure: 250 PSIG

Solenoid Pilot (Electric)	<b>PS1 &amp; PS2</b>
Pilot Body Material	<b>Cast Iron</b>
Valve Head & Seat	<b>Stainless Steel</b>
Max Inlet Pressure	<b>250 PSIG</b>
Pressure Range	
PS1	<b>0-180 PSIG</b>
PS2	<b>180-250 PSIG</b>



Pilot-Operated REGULATORS

#### 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 ordered)

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.

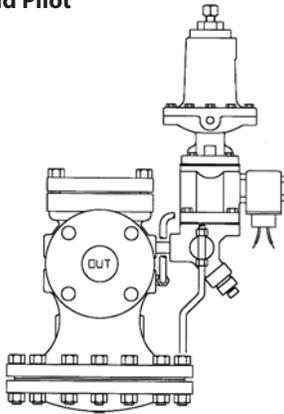
#### Model Code Configuration Chart

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 ordered)	N7	Meets NEMA 4 & 7 Rating (water proof & explosion proof)
PS1-LP	0-20 PSIG	240	220 - 240 VAC				

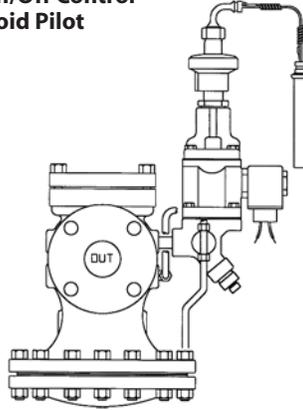
#### Example Model Codes:

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

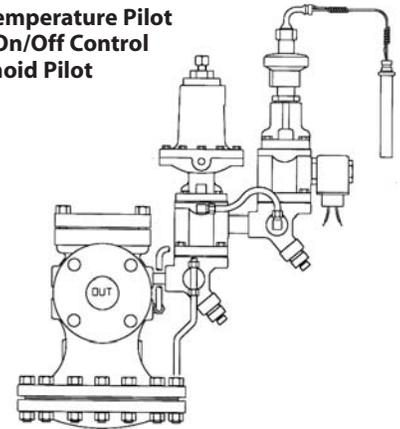
**HD Main Valve**  
with  
**PS1 On/Off Control Solenoid Pilot**



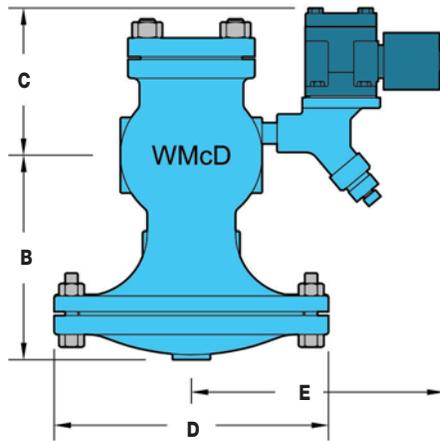
**HD Main Valve**  
with  
• **PT-Temperature Pilot**  
• **PS1 On/Off Control Solenoid Pilot**



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



Pilot-Operated  
REGULATORS



### DIMENSIONS HD-Series – inches

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

### MATERIALS for On/Off Solenoid Pilot

Pilot Body & Cover	<b>Ductile Iron</b>
Seat Gasket	302 SS
Cover Screws	Steel, GR5
Internals	Stainless Steel

### MATERIALS for HD Main Valve

Body	<b>Ductile Iron</b>
Cover	<b>Ductile Iron</b>
Gasket	Grafoil/Garlock
Cover Screws	Steel
Pilot Adapter	<b>Ductile Iron/Cast Steel</b>
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 PSIG** (Standard Main Valve)

**5 PSIG** (Low Pressure Main Valve)

Minimum Differential Pressure:

**10 PSI** (Standard Main Valve)

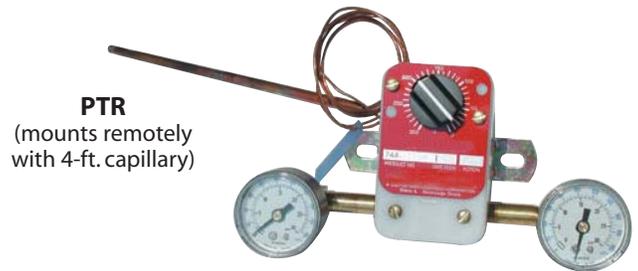
**3 PSI** (Low Pressure Main Valve)

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

Pilot-Operated REGULATORS

Temperature Controller	PTL	PTR
Temperature Adjustment Range	50 - 350 °F	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



### 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

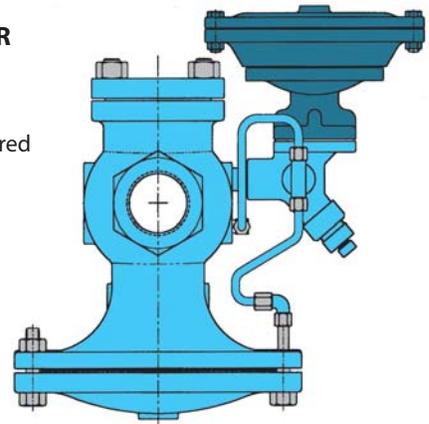
The **PTL** and **PTR Pneumatic Temperature Controllers** are used in conjunction with a **PA-Air Pilot** to control the operation of the **HD Regulator**. The **PTL** uses a bi-metallic element to sense temperature and the **PTR** uses a hydraulically-filled bulb (with 4-ft. capillary) to sense temperature. 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
<b>PTL-E7</b>	Pneumatic temperature controller, direct mount	N/A	5.3
<b>PTR-E8</b>	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)

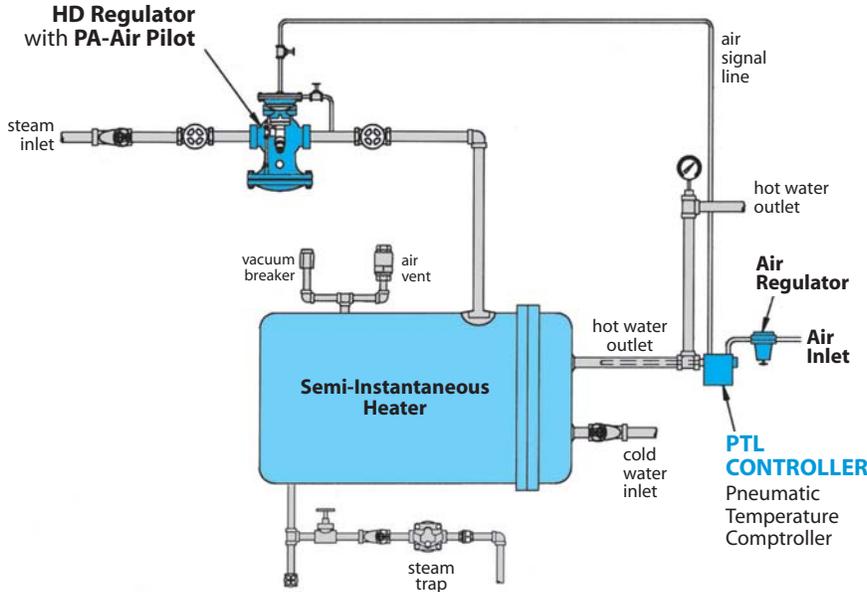
#### AIR PILOT

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)

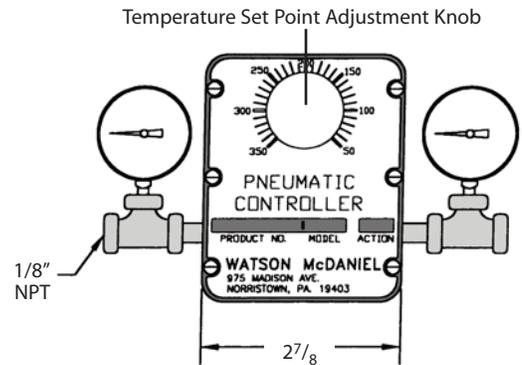
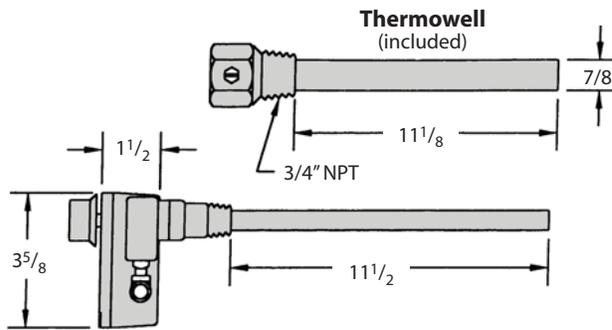


#### Description of Operation

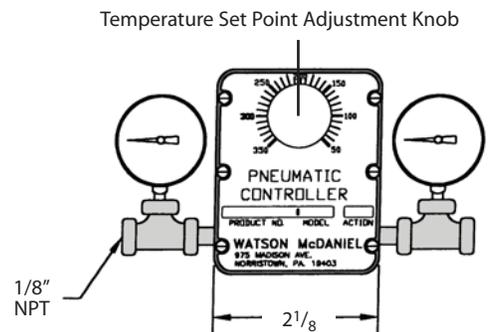
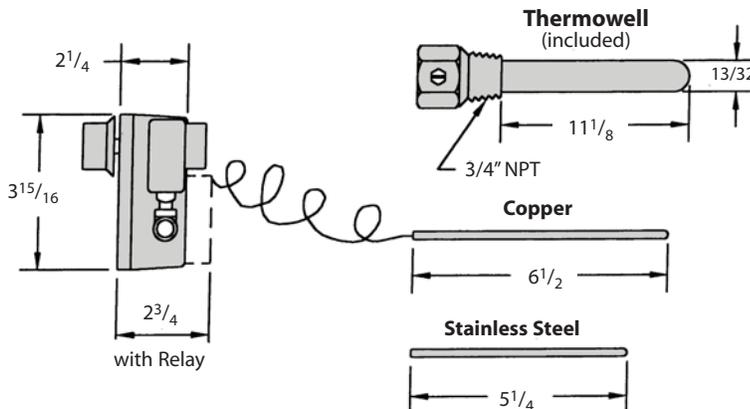
The PTL Pneumatic Temperature Controller senses outlet water temperature on a semi-instantaneous hot water heater. When the outlet water temperature falls below the set point, the PTL pneumatic temperature controller sends an air signal to the PA Air Pilot, which opens the regulator, allowing steam to 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.

Pilot-Operated REGULATORS

#### Model PTL (DIRECT Mounted)



#### Model PTR (REMOTE Mounted)



Units: inches

### Temperature Control with PTRP Temperature Pilot

Pilot-Operated REGULATORS

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

#### 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 conjunction with a Low Pressure Temperature Pilot for steam pressure under 15 PSIG

**MAIN VALVE**: Example Model Code: **HD-13-N-LP** (Range 5 - 20)

### Typical Applications

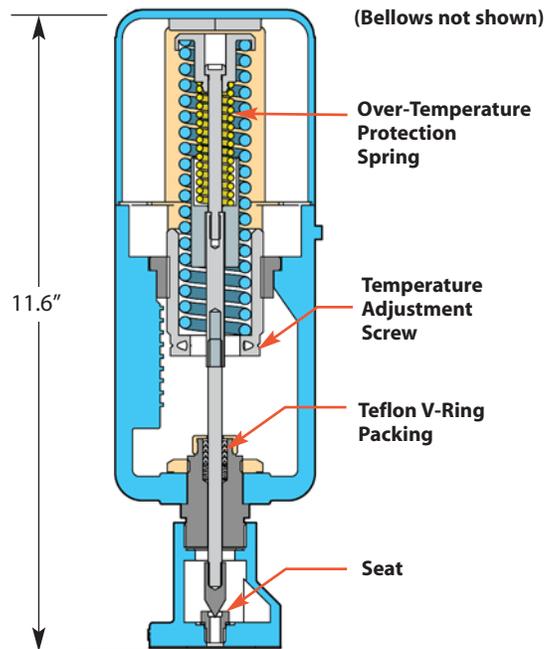
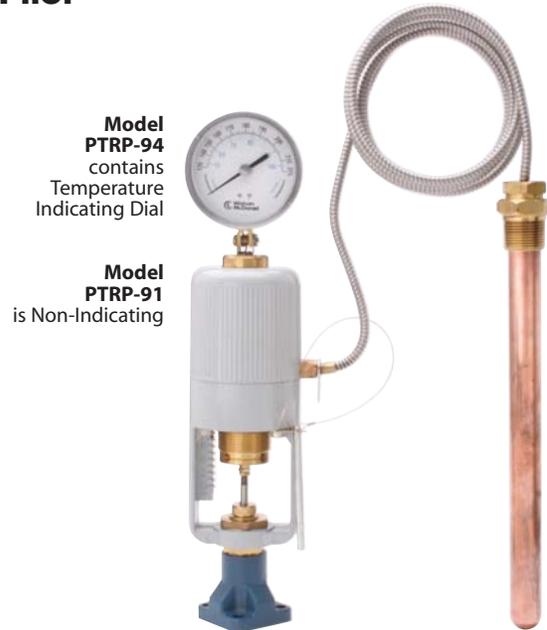
The **PTRP-Temperature Pilot** is used with the HD Regulator to control temperature in various processes and systems. The PTRP uses a vapor tension system to actuate the bellows in the temperature pilot giving it a faster reaction time and better temperature sensitivity than the standard PT pilot. They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

### Features

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

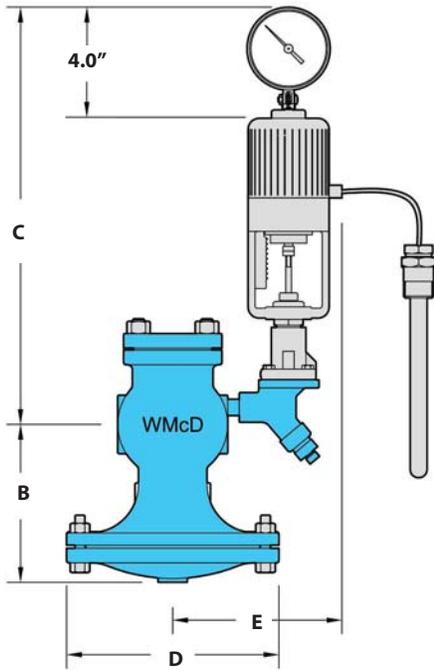
### Options

- **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)**: Consult factory



### 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



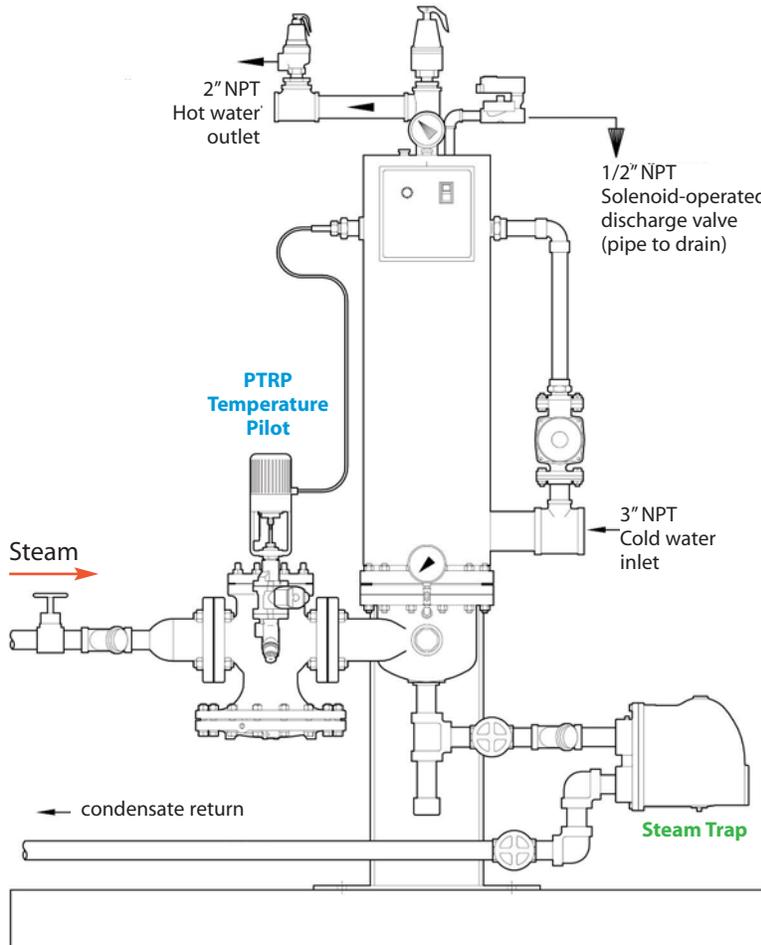
DIMENSIONS HD-Series – inches									
Size	Face-To-Face			B	C	D	E	Weight (lbs)	
	NPT	150#	300#					NPT	FLG
1/2"	43/8			5 1/2	14	6 1/2	7 3/4	18	
3/4"	43/8			5 1/2	14	6 1/2	7 3/4	18	
1"	53/8	5 1/2	6	6 1/4	14	7	7 3/4	23	35
1 1/4"	6 1/2			7 3/8	14	8 3/4	8 1/4	43	
1 1/2"	7 1/4	6 7/8	7 3/8	7 3/8	14	8 3/4	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	10 7/8	14	14 3/4	10 1/2		235
6"		15 1/8	16	14 1/8	14 1/2	19 3/4	11 3/4		470

**MATERIALS for PTRP Pilot**

Pilot Body	Cast Steel
Valve and Seat	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	Ductile Iron/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.

Pilot-Operated REGULATORS

Temperature Control

Sensing Bulb Selection & Installation:

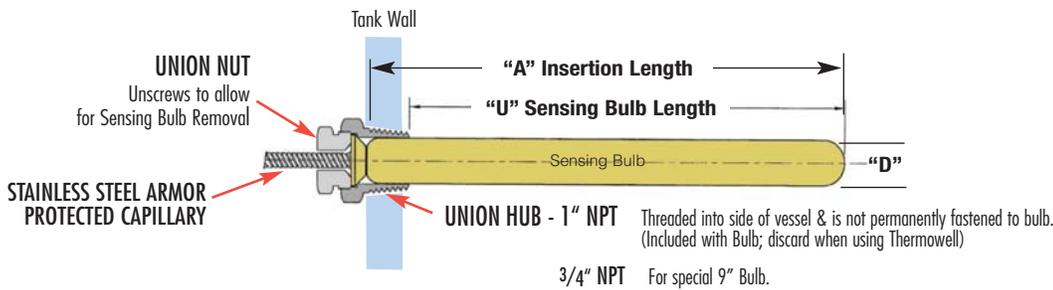
The sensing bulb and capillary is available in either Copper (standard) or Stainless Steel (for corrosive applications). Copper has the best heat transfer properties and should always be chosen unless used in corrosive service. Sensing bulb length is dependent upon the capillary length required; longer 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.

Pilot-Operated REGULATORS

Sensing Bulb & Capillary							
ORDER CODE	Sensing Bulb Material	Capillary Tubing Material	Capillary Length in Feet			"D" Bulb Dia.	
			8, 12, 16	20	24		
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"	

\*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)

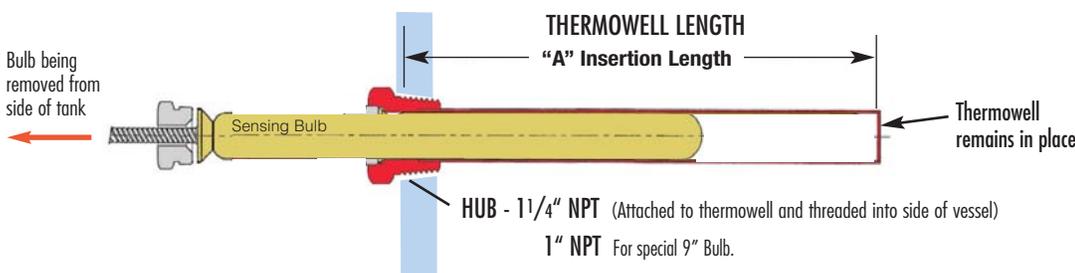
Thermowells isolate and protect the sensing bulb from the process fluid; available in either brass (better heat transfer properties) or Stainless Steel for corrosion resistance. They allow for sensing bulb removal and replacement without having to drain liquid from the system. For corrosive applications, 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.)		Capillary Length in Feet
			BULB	THERMOWELL	
536-S2	536-S6	13"	12.25	13.00	8, 12 or 16
536-SE2	536-SE6	16"	15.25	16.00	20
536-WE2	536-WE6	20"	19.25	20.00	24
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.



**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-94-03-08	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**

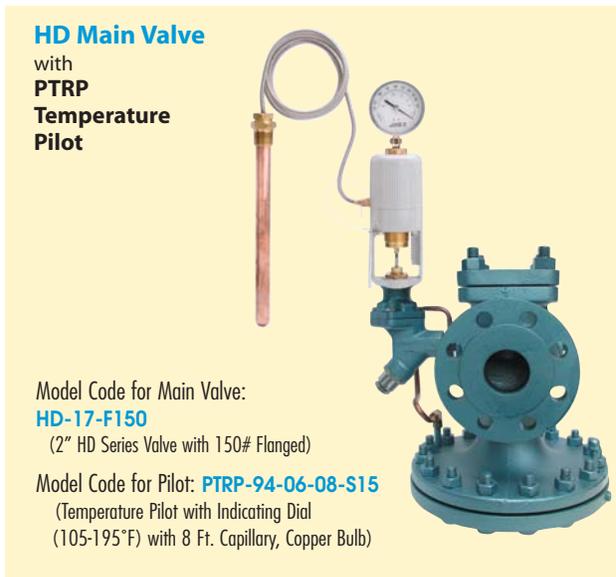
Models	Temperature Range	Capillary Length	Bulb
PTRP-91	Non-Indicating	01 - 14 Refer to Temperature Range Chart	08 8 Feet (std) 12 12 Feet 16 16 Feet 20 20 Feet 24 24 Feet
PTRP-94	Indicating Dial		
PTRP-LP-91	Non-Indicating		
PTRP-LP-94	Indicating Dial		

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

**How to write proper model number:**

Explanation of Model Number:	<u>PTRP-91</u>	<u>06</u>	<u>08</u>	<u>S15</u>
	Model	Temp. Range	Cap. Length	Bulb Type
<b>Model Number:</b>	<b>PTRP-91-06-08-S15</b>			

**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)

### Differential Pressure

Pilot-Operated REGULATORS

Differential Pressure Pilot	PDP
Body Material	Ductile Iron
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



### 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  $\pm 2$  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 & Cover	Ductile Iron & 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)

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

### How to Size / Order

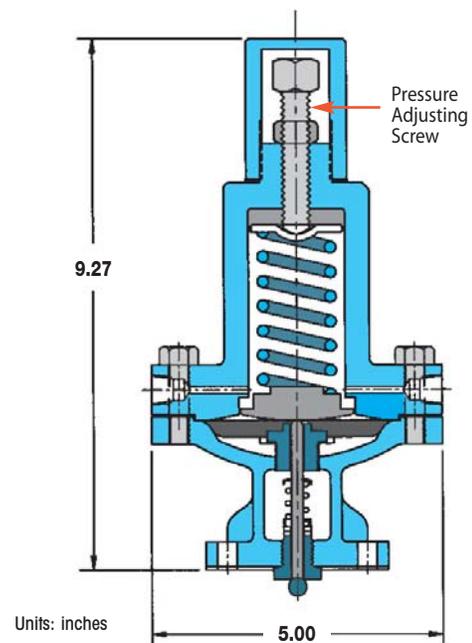
#### PDP - DIFFERENTIAL PRESSURE PILOT

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)



# HSP Pressure Regulating Valve

## Cast Steel



Pilot-Operated  
REGULATORS

**Cast Steel Pressure** Regulating Valve

Pilot-Operated  
REGULATORS

Model	<b>HSP Series</b>
Sizes	<b>1", 1 1/2", 2", 3", 4"</b>
Connections	<b>150#/300# Flange</b>
Body Material	<b>Cast Steel</b>
PMO Max. Operating Pressure	<b>450 PSIG</b>
TMO Max. Operating Temperature	<b>650°F</b>
PMA Max. Allowable Pressure	<b>550 PSIG @ 650°F</b>
TMA Max. Allowable Temperature	<b>650°F @ 550 PSIG</b>

**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)

**PRESSURE-ADJUSTING SPRING RANGES**

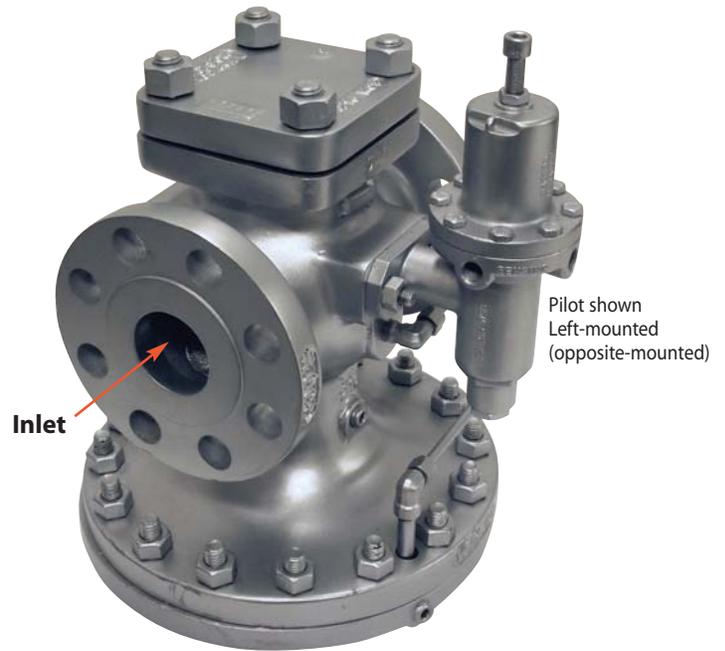
Pressure Ranges	Identifying Colors
<b>10-40 PSIG</b>	yellow
<b>25-100 PSIG</b>	blue
<b>75-300 PSIG</b>	red

**Typical Applications**

The **HSP 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 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
- New, convenient bolt-on pilot design simplifies installation
- New diaphragm design improves performance and extends life
- Hardened stainless steel trim for extended life
- Optional Stellite trim available
- Full port strainer and blowdown valve on pilot adapter for ultimate protection from dirt and scale
- Maintains downstream pressure to  $\pm 1.0$  PSIG
- Choice of three overlapping spring ranges
- Pre-mounted pilot & tubing simplifies installation



**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 regulators are field-reversible.

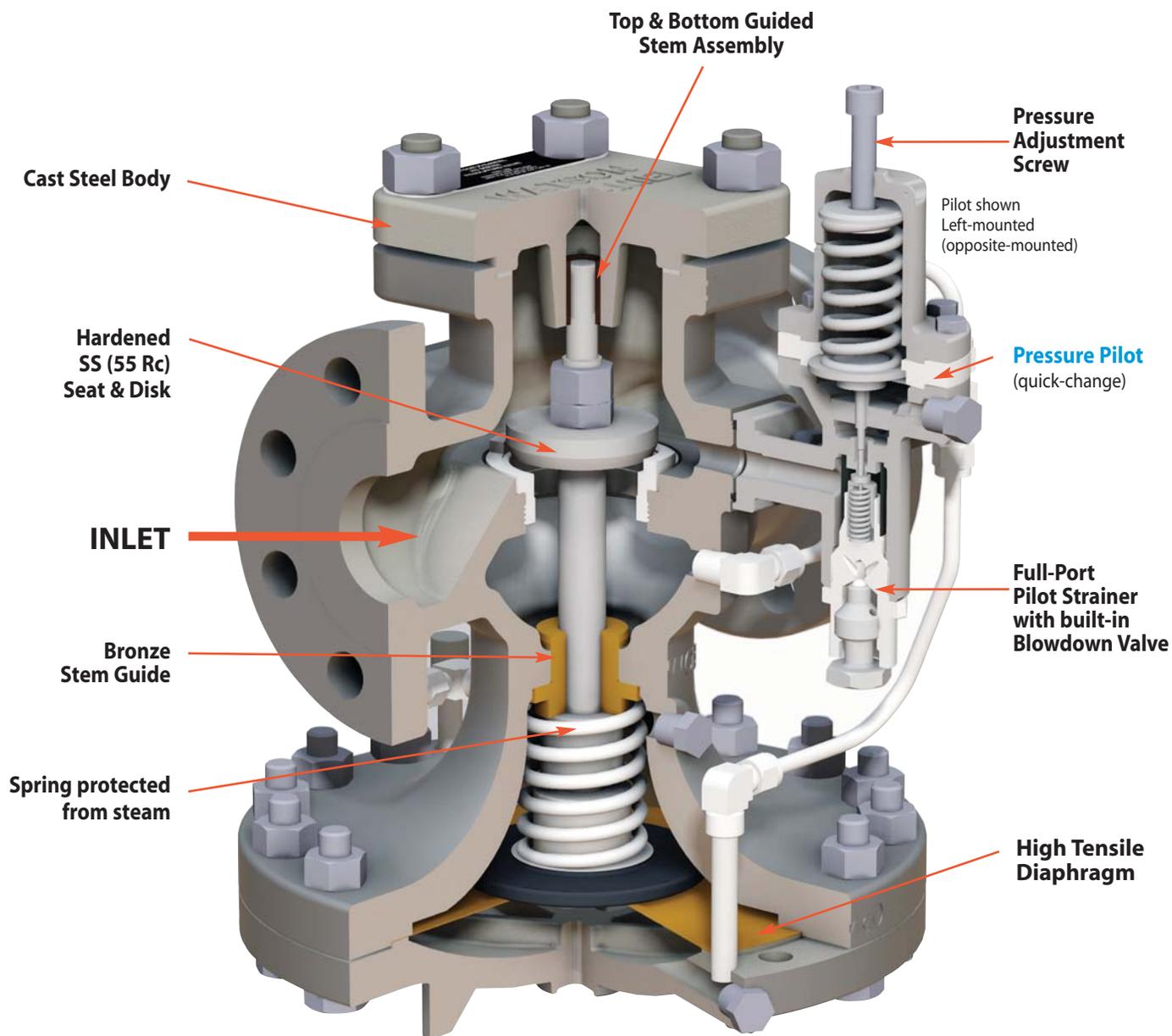
**Pressure Pilot**

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

**MATERIALS for HSP Regulator**

Body	<b>ASTM A-216 GR WCB</b>
Cover	ASTM A-216 GR WCB
Diaphragm Cover	ASTM A-216 GR WCB
Pilot	ASTM A-216 GR WCB
Gaskets	Garlock 3400/grafoil SLS
Seat	420F SS (optional Stellite seat, consult factory)
Disc	420F SS
Diaphragm	Bronze
Diaphragm for LP Model	EPDM
Mfg. Bolts	SA-193 GR B7
Spring	302 SS
Stem	416 SS

**Cast Steel Pressure** Regulating Valve



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

**Cast Steel Pressure Regulating Valve**

Model includes HSP Main Valve with Pressure Pilot

Size/Connection	Model Code	Pressure Pilot Range (PSI)	Weight lbs
1"	150# FLG	HSP-14-F150-Y	10-40
		HSP-14-F150-B	25-100
		HSP-14-F150-R	75-300
	300# FLG	HSP-14-F300-Y	10-40
		HSP-14-F300-B	25-100
		HSP-14-F300-R	75-300
1 1/2"	150# FLG	HSP-16-F150-Y	10-40
		HSP-16-F150-B	25-100
		HSP-16-F150-R	75-300
	300# FLG	HSP-16-F300-Y	10-40
		HSP-16-F300-B	25-100
		HSP-16-F300-R	75-300
2"	150# FLG	HSP-17-F150-Y	10-40
		HSP-17-F150-B	25-100
		HSP-17-F150-R	75-300
	300# FLG	HSP-17-F300-Y	10-40
		HSP-17-F300-B	25-100
		HSP-17-F300-R	75-300
3"	150# FLG	HSP-19-F150-Y	10-40
		HSP-19-F150-B	25-100
		HSP-19-F150-R	75-300
	300# FLG	HSP-19-F300-Y	10-40
		HSP-19-F300-B	25-100
		HSP-19-F300-R	75-300
4"	150# FLG	HSP-20-F150-Y	10-40
		HSP-20-F150-B	25-100
		HSP-20-F150-R	75-300
	300# FLG	HSP-20-F300-Y	10-40
		HSP-20-F300-B	25-100
		HSP-20-F300-R	75-300



**Pilot Ranges**

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

**Model Configuration Chart**

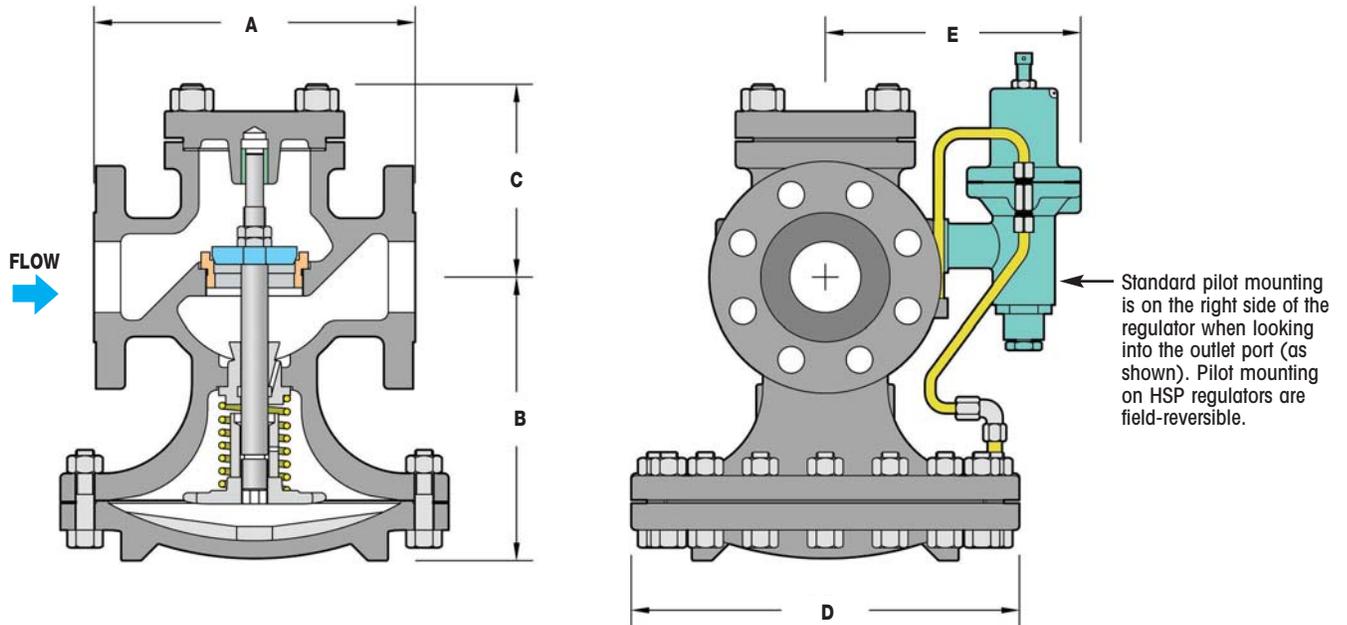
Models	Code	Size	Code	Connection	Code	Pressure Range (PSIG)	Code	Options (Suffix)
HSP	Full Port	14	1"	F150	150# Flanged	Y	10-40 (yellow)	SSXT
HSPR	Reduced Port	16	1 1/2"	F300	300# Flanged	B	25-100 (blue)	ST
		17	2"			R	75-300 (red)	LP
		19	3"					SSD
		20	4"					

**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)

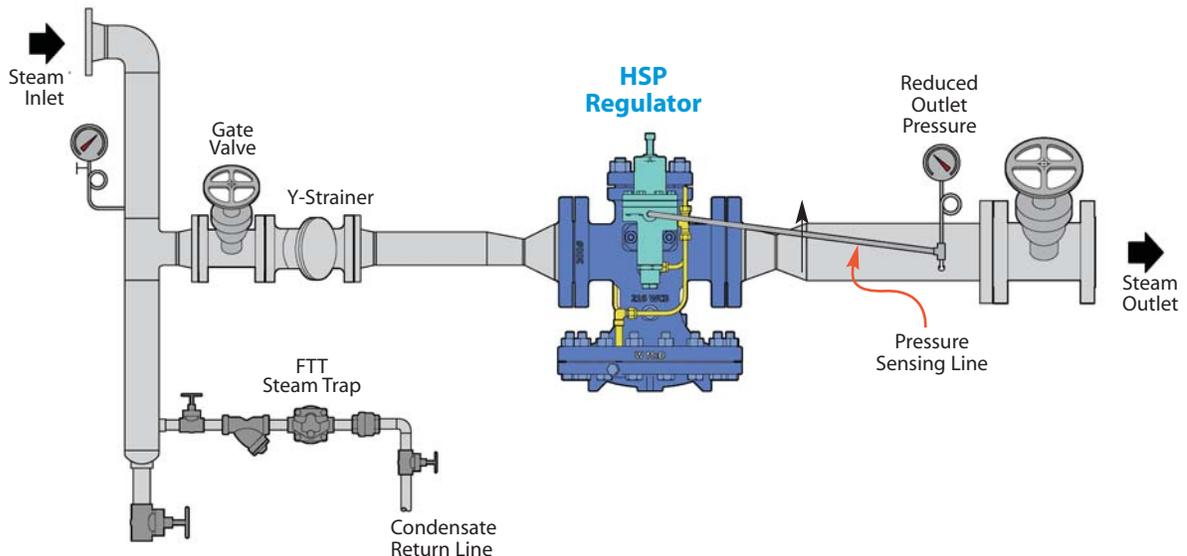
Pilot-Operated REGULATORS

**Cast Steel Pressure** Regulating Valve



Pilot-Operated REGULATORS

DIMENSIONS HSP Series – inches								
Size	(A) Face-To-Face		B	C	D	E	Weight (lbs)	
	150#	300#					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

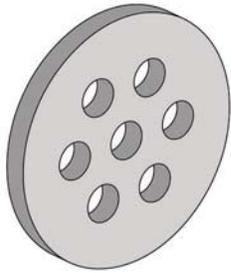


**Pressure Reducing Station for Steam Application**

**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-A Orifice Plate

Pilot-Operated REGULATORS

**Description**

Selection: Series A 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)

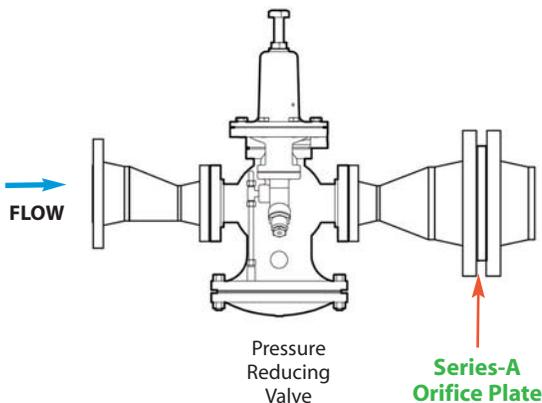
**How it Works**

The **Series-A 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.

**Installation**

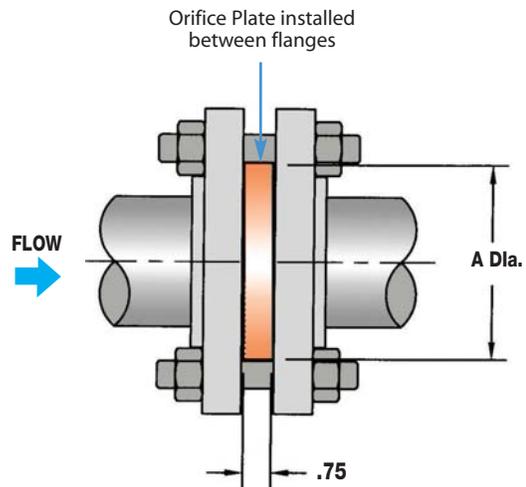
The Series-A Orifice Plate is installed between ANSI flanges immediately after the regulator. If the regulator is a flanged unit, the orifice plate is placed at the flange outlet connection.

**Series-A Typical Hook-up**



Full Model Code	Size	Pressure PSI
WSA-12-250	1/2"	5-250
WSA-13-250	3/4"	5-250
WSA-14-250	1"	5-250
WSA-15-7	1 1/4"	5-7
WSA-15-250	1 1/4"	10-250
WSA-16-250	1 1/2"	5-250
WSA-17-20	2"	5-20
WSA-17-250	2"	25-250
WSA-18-5	2 1/2"	5
WSA-18-40	2 1/2"	7-40
WSA-18-250	2 1/2"	50-250
WSA-19-5	3"	5
WSA-19-30	3"	7-30
WSA-19-250	3"	40-250
WSA-20-5	4"	5
WSA-20-30	4"	7-30
WSA-20-250	4"	40-250
WSA-22-5	6"	5
WSA-22-10	6"	7-10
WSA-22-250	6"	12-250

Notes: 1) 300# Flange plates available. Consult Factory. (WSB)  
 2) Must specify Inlet Pressure to the regulating valve when ordering



Series-A DIMENSION (A) – inches		
Pipe Size	125# Flange	250# Flange
2"	6	4 <sup>3</sup> / <sub>16</sub>
2 1/2"	7	4 <sup>15</sup> / <sub>16</sub>
3"	7 1/2	5 <sup>11</sup> / <sub>16</sub>
4"	9	6 <sup>15</sup> / <sub>16</sub>
6"	11	9 <sup>11</sup> / <sub>16</sub>

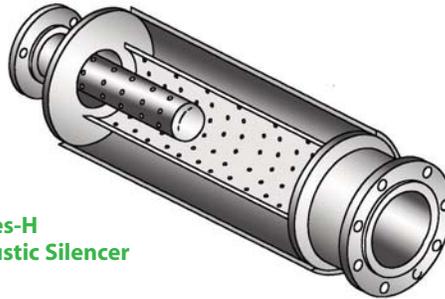
Note: Other sizes available. Consult factory.

Acoustic Silencer for Pressure Regulating Valves

Noise Reduction

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

Noise Reduction Capability: 20-30 dBA



Series-H Acoustic Silencer

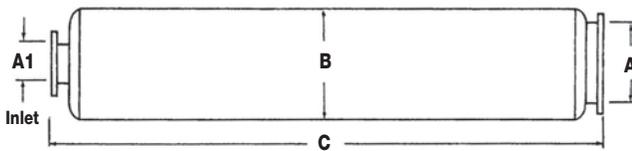
Pilot-Operated REGULATORS

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

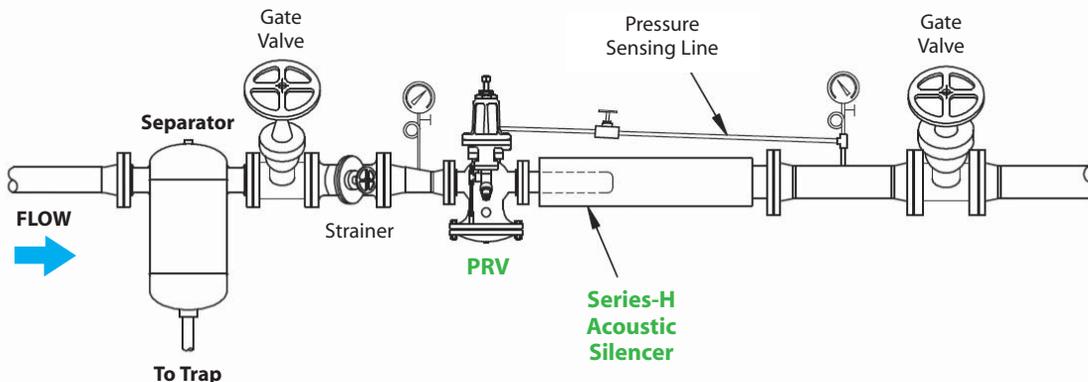
The Series-H Diffuser Tube should be installed immediately downstream of the regulator, as shown below.



Series-H DIMENSIONS - inches					
Model	A1	A	B	C	Weight (lbs)
LCV-8	4	8	14	57	145
LCV-10	6	10	16	71	210
LCV-12	6	12	18	81	295

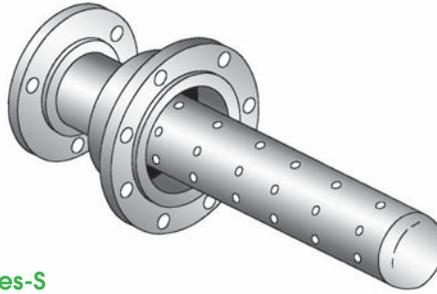
Note: Other sizes available. Consult factory.

Series-H Typical Hook-up



**Noise Reduction**

**Noise Reduction Capability: 10-15 dBA**



Series-S  
Acoustic Diffuser

Pilot-Operated  
REGULATORS

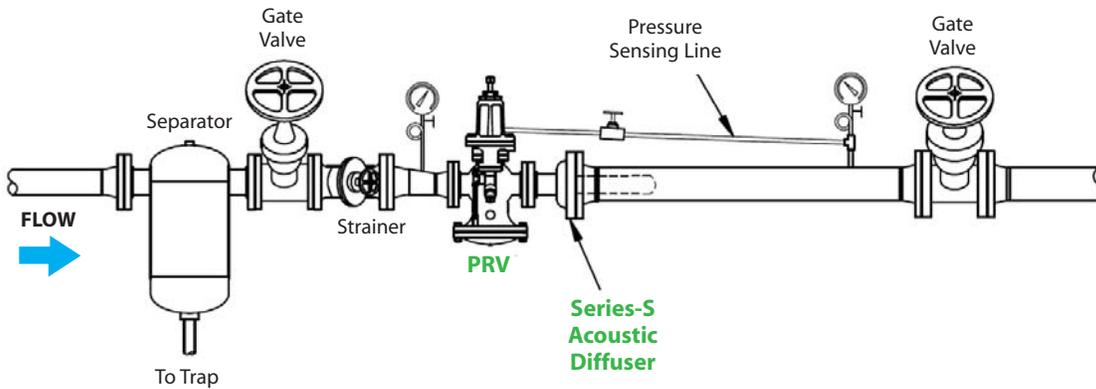
**How it Works**

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.

**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										
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.

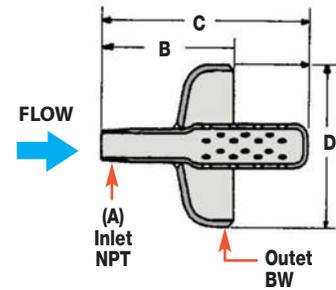
### Noise Reduction

Series-S DIMENSIONS - inches						
Model	Inlet (A)		Outlet	NPT x Weld Dimensions		
	NPT	FLG		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
S-5	2		4	6 1/2	13 1/2	4 1/2
	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
S-6	2 1/2	2 1/2	4	6 1/2	16 1/2	4 1/2
	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
S-8	3	3	6	8	14	5 5/8
	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
S-10	3	3	8	10	17	8 5/8
	4	4	8	10	17	8 5/8
	2		12	12	14	12 3/4
	2 1/2	2 1/2	12	12	14	12 3/4
S-12	3	3	12	12	14	12 3/4
	4	4	12	12	14	12 3/4
	6	6	12	12	14	12 3/4

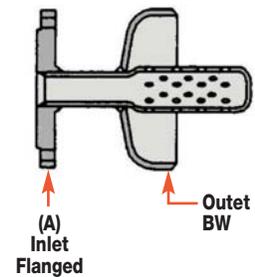
Notes: 1) 150# & 300# flanged available.  
2) Other sizes available; consult factory.

BW = Butt-weld

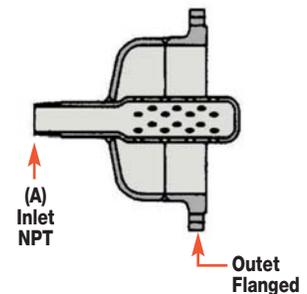
#### NPT x Butt-Weld



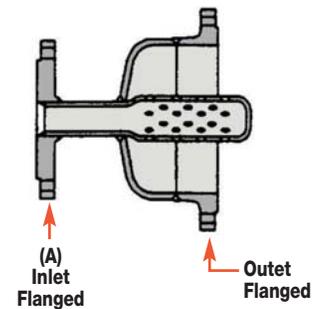
#### Flanged x Butt-Weld



#### NPT x Flanged



#### Flanged x Flanged



Pilot-Operated REGULATORS

Full Port

Pilot-Operated  
REGULATORS

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 <sub>v</sub> 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		1480	22000		48800	78000	
	250			7550		13800	23800		46200	73950	
	300			6700		12100	21200		41000	65200	
450	0-225			8970		16000	22000		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 regulator only.

Reduced Port

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 <sub>v</sub> 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	9320	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	24500		29980	51450	
	250			3860		8970	23800		27460	48750	
	300			3430		7970	21010		24410	43330	
450	0-225			4580		10650	24500		32600	57890	
	300			4340		10090	23930		30890	54840	
	350			3860		8970	23800		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 regulator only.

Pilot-Operated  
REGULATORS