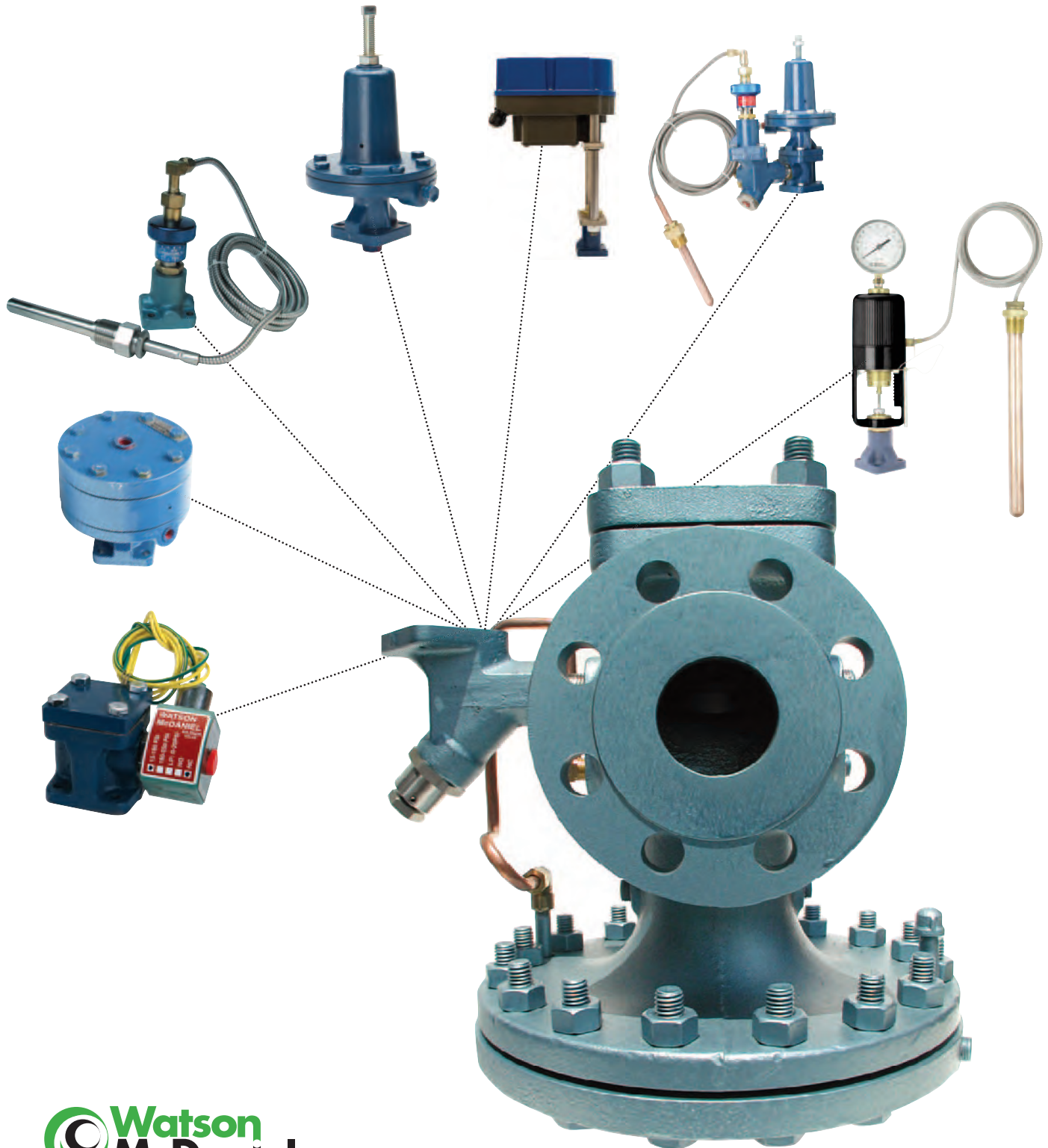


Pilot-Operated Regulating Valves



Pilot-Operated
REGULATORS



HD Regulating Valve & Pilots

Table of Contents

HD Main Valve
Ductile Iron



Most Common HD Pilots



PP & PP5
PRESSURE
Spring-Loaded



PT
TEMPERATURE
Liquid Filled



PA
PRESSURE
Air-Loaded



PS
On/Off
(Solenoid)

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

Other HD Pilots



PTRP
TEMPERATURE



PTR & PTL
TEMPERATURE
Controllers



PBP
BACK PRESSURE



PDP
DIFFERENTIAL
PRESSURE



TSP
TRIP-STOP
PRESSURE



EP
ELECTRONIC
CONTROL

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

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Pilots for HD Regulators

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PP & PP5-Pressure Pilots	Spring-loaded pressure pilots for general service steam pressure reducing.	226
PBP-Back Pressure Pilot	For controlling upstream pressure of the HD Regulator.	228
PT-Temperature Pilot	General purpose liquid-filled temperature pilot used when heating liquids to a desired temperature.	230
PA-Pressure Pilot (Air-Loaded)	Air-loaded Pressure Pilot can be used instead of spring-loaded PP pilots for pressure regulation in remote installations. Also used in conjunction with PTR & PTL temperature controllers.	234
PS-Solenoid Pilot	Solenoid Pilot can be used in conjunction with any of the listed pilots for electrical on/off control of HD Regulators.	238
PTR & PTL Temperature Controllers	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.	240
PTRP Temperature Pilot	Special purpose vapor tension temperature pilot for increased sensitivity	242
TSP-Pilot	The Trip Stop Pilot is used to prevent over pressurization of downstream steam piping systems, and reduced reaction time when controlling temperature of liquids and air.	246
PDP-Pilot	Differential Pressure Pilot with two separate sensing ports for maintaining differential pressure between steam and an alternate medium.	247
EP-Pilot	The Electric Pilot is used with HD regulators for a variety of applications including on/off control and slow system warm-up.	248



HD Regulator with PP-**PRESSURE** Pilot



HD Regulator with PT-**TEMPERATURE** Pilot



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



HD Regulator with PTRP-**TEMPERATURE** Pilot

Pilot-Operated REGULATORS



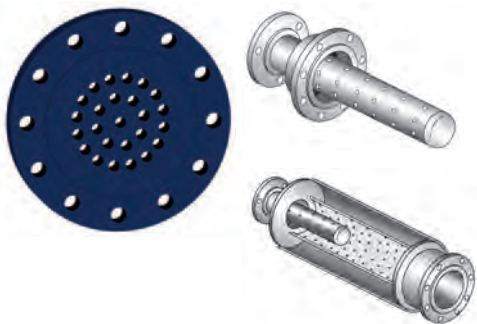
HSP & HSP-SS Series Pressure Regulators • Cast Steel • Stainless Steel 250

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

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

Accessories for Pilot-Operated Regulators

254-257



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

254

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

257

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

258



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

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

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

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

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

Pilot-Operated
REGULATORS

1) Select HD Main Valve →

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

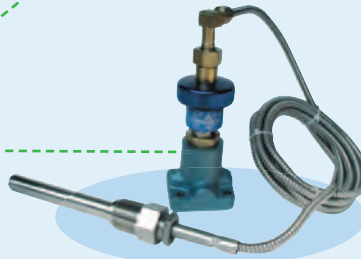
2) Select HD Pilot(s)



Model: PP

For Pressure Control

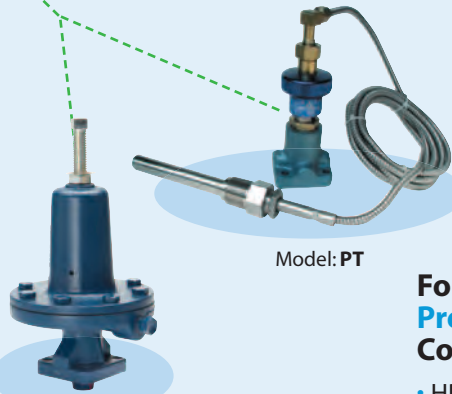
- HD Main Valve *with*
- PP Pressure Pilot



Model: PT

For Temperature Control

- HD Main Valve *with*
- PT Temperature Pilot



Model: PT

For Combination Pressure & Temperature Control

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

Model: PP

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.



Typical Applications

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

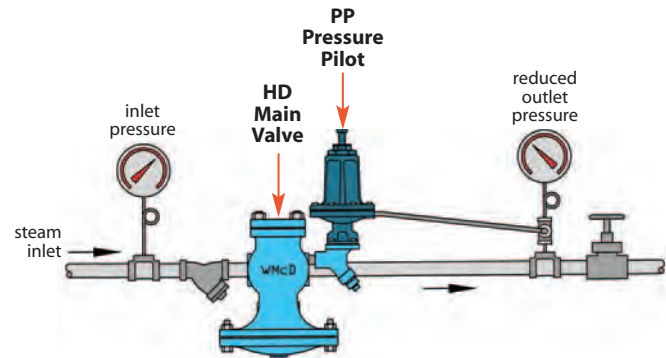
Introduction • Typical Applications

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

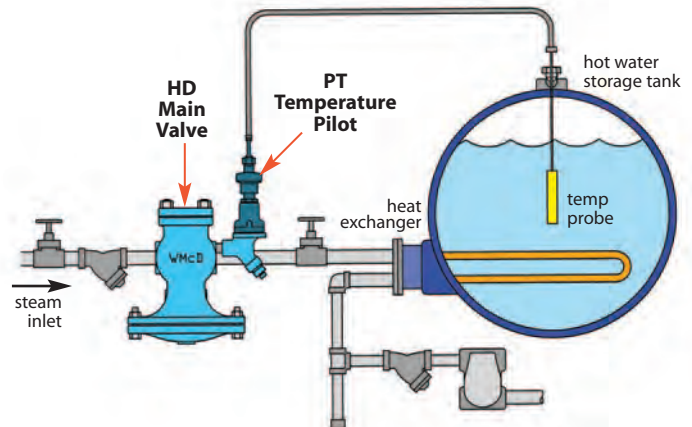
HD Main Valve with PT-Temperature Pilot



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.

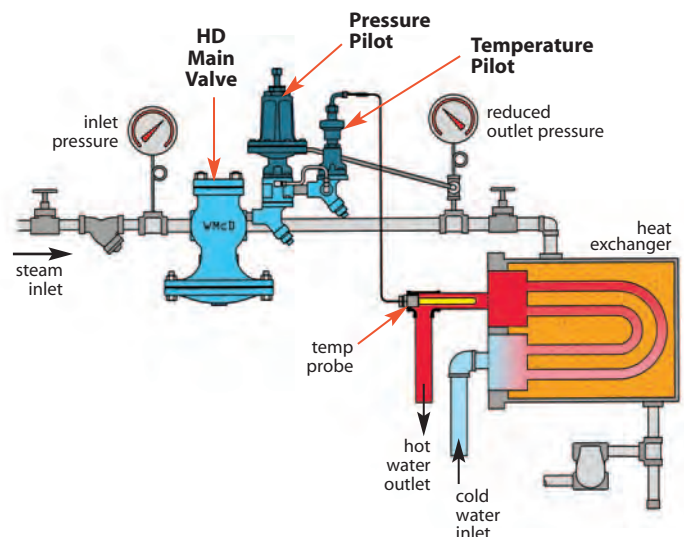


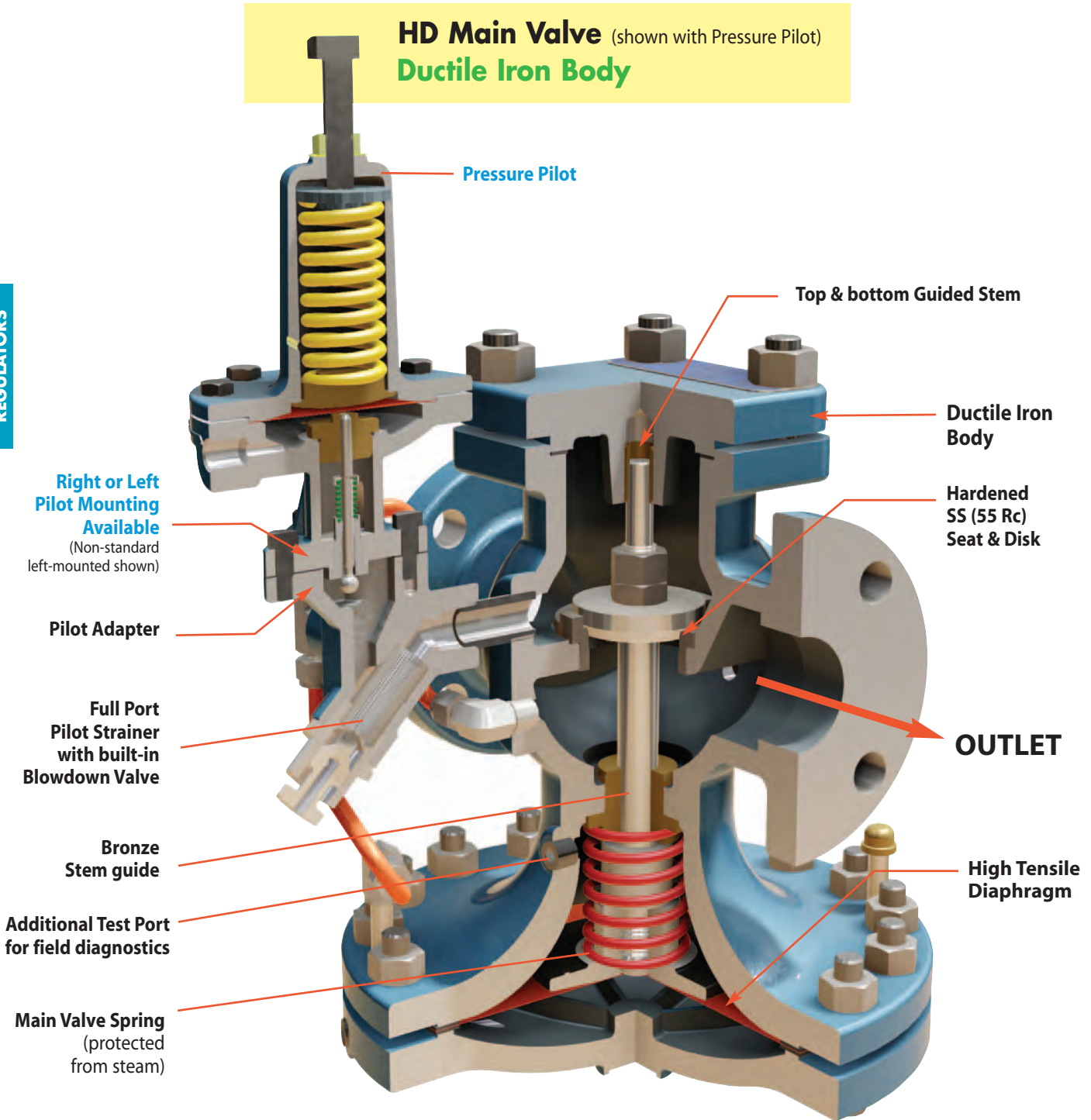
HD Main Valve with PP-Pressure Pilot and PT-Temperature Pilot



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.



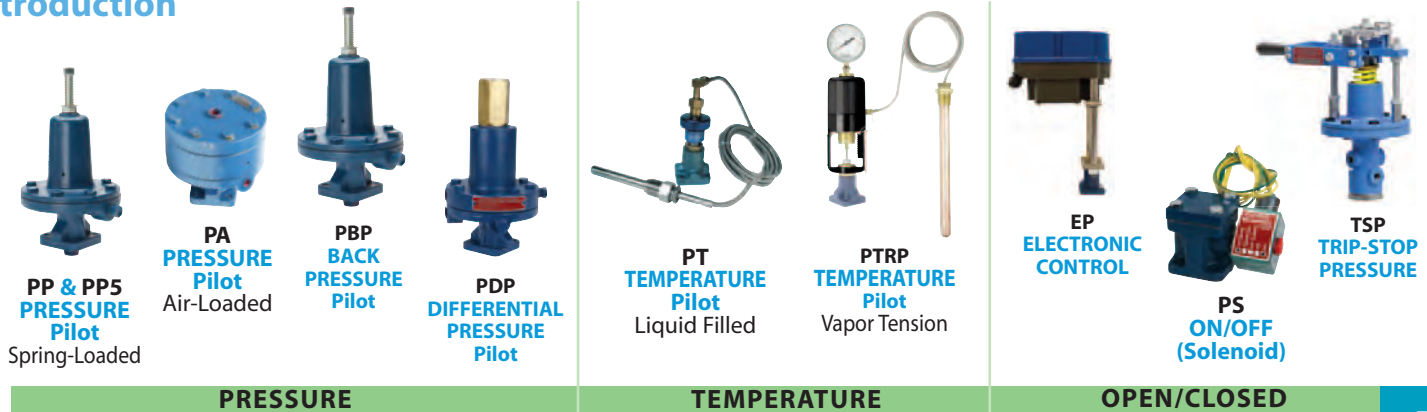


Features of the HD Regulating Valve

- 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.

HD Pilot-Operated Regulating Valve

Introduction



Typical Configurations

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

Pressure Control

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

Temperature Control

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

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

Temperature-Pressure Control

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

On-Off Operation

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

Trip-Stop Pressure

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

Back Pressure

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

Differential Pressure

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

Stainless Diaphragm Option

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

Stainless Tubing Option

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

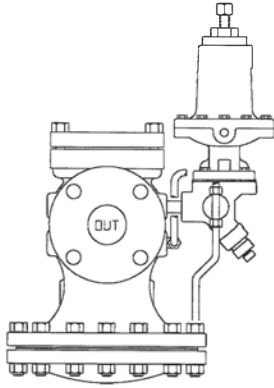
Reduced port trim Option:

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

Low pressure (differential and inlet) Option:

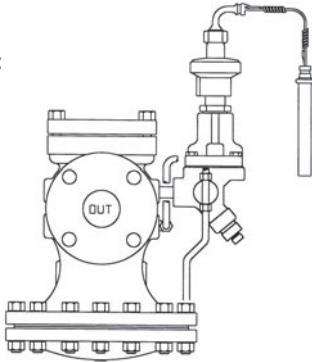
Regulators require a minimum Inlet pressure as well as a minimum pressure drop across the valve to operate properly. The HD Standard Main valve requires a minimum inlet pressure of 15 PSIG and minimum differential pressure of 10 PSI. The Low Pressure Main valve requires 5 PSIG minimum inlet pressure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

HD Main Valve
with
PP-Pressure Pilot
Spring-Loaded



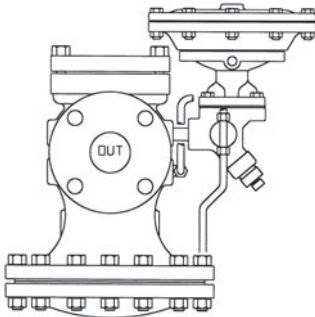
Shown with **PP** Pressure control Pilot. Spring-loaded pressure pilots are the most typical method of controlling downstream pressure in Steam Systems. Adjustment screw on top of pilot controls downstream steam pressure.

HD Main Valve
with
PT-Temperature Pilot



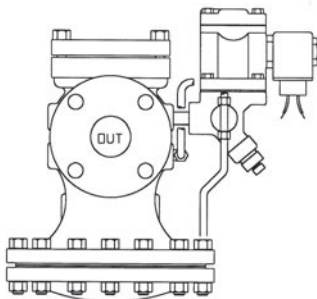
Shown with Temperature control Pilot: The **PT** Temperature Pilot will control the flow of steam flowing through the HD valve based on the temperature of the sensing bulb. The liquid-filled sensing Bulb is available in standard 8 ft and 15 ft capillary lengths. Other lengths available.

HD Main Valve
with
PA-Pressure Pilot
Air-Loaded



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

HD Main Valve
with
PS On/Off Control
Solenoid Pilot



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

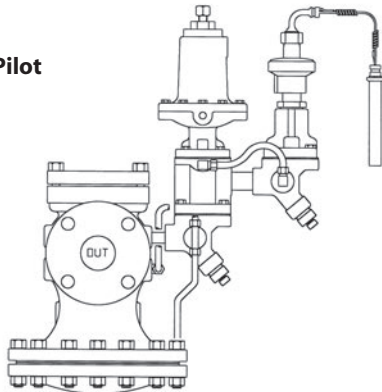
HD Pilot-Operated Regulating Valve

HD Regulator & Pilot Combinations

HD Main Valve

with

- PT-Temperature Pilot
- PP-Pressure Pilot



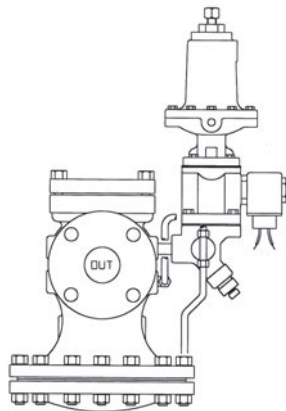
The **PT** Temperature Pilot will maintain the proper flow of steam through the main valve to keep the process it's controlling at the proper temperature. The **PP** pressure Pilot will **LIMIT** the downstream pressure to a maximum value. This combination of Pilots is very convenient when the Steam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

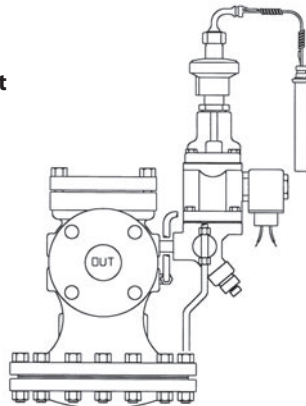


The **PP** Pressure Pilot will maintain the desired downstream set pressure as long as the **PS** ON-OFF (solenoid) Pilot is in the ON position. Available in either Normally-ON or Normally-OFF configuration; an electrical signal turns valve OFF or ON.

HD Main Valve

with

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

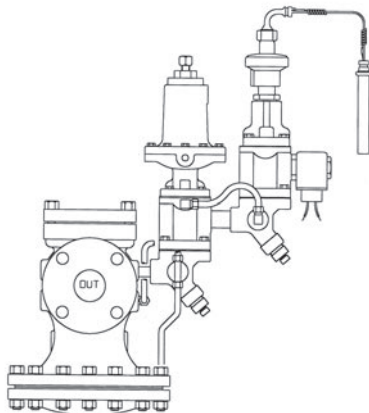


The **PT** Temperature Pilot will maintain the proper flow of steam through the main valve to keep the process it's controlling at the proper temperature as long as the **PS** ON-OFF (solenoid) Pilot is in the ON position. Available in either Normally-ON or Normally-OFF configuration; an electrical signal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

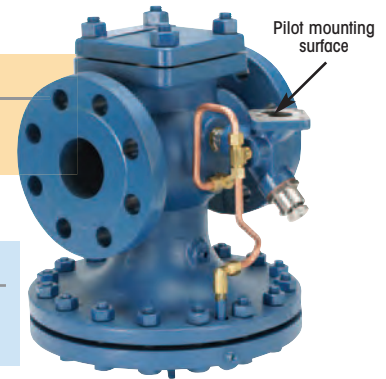
Main Valve	HD-Series	
Sizes	1/2" – 6"	
Connections	NPT: 1/2" - 2" FLG: 1" - 6"	
Body Material	Ductile Iron	
PMO Max. Operating Pressure	300 PSIG	
Design Pressure/ Temperature Ratings	NPT	450 PSIG @ 650° F
	150# FLG	150 PSIG @ 566° F
	300# FLG	450 PSIG @ 650° F

STANDARD Main Valve Spring:

Inlet Pressure: **15-300 PSIG**
Example Model Code: **HD-12-N**

LOW-PRESSURE Main Valve Spring:

Inlet Pressure: **5-20 PSIG**
Example Model Code: **HD-12-N-LP**



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 (LP Spring, EPDM Diaphragm, & By-Pass Tubing)
		15	1 1/4"	F300	300# FLG (1" - 6")	LDP Low-Differential Pressure (LDP Spring & Bronze Diaphragm)
		16	1 1/2"			Note: For more than one Option, combine suffixes. Example: SSD-SSXT
		17	2"			
		18	2 1/2"			
		19	3"			
		20	4"			
		22	6"			

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

ANSI/FCI 70-3 Class IV Shut-off

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

Ordering Instructions:

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

Use part number: **(BADAPTER)**

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

*Low-Differential Valves: **LDP**

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

By-Pass Tubing (pre-installed)

See Parts Section for Kit #

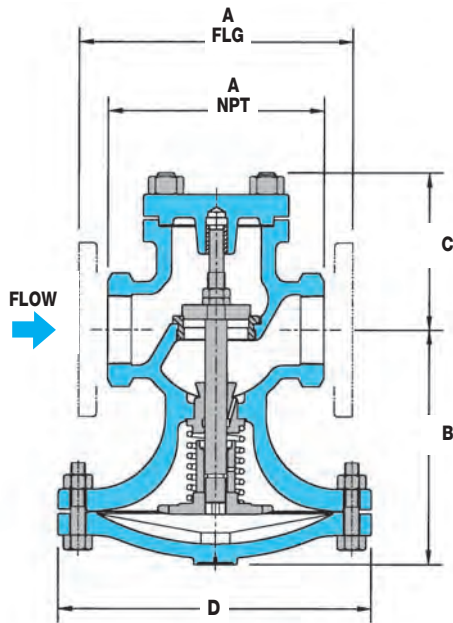
Use for improved control when excessive system condensate is possible (included on LP valves)

Low-Pressure Main Valve not available with SS Diaphragms

Example Model Codes for Main Valve:

- 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



OPERATING PRESSURES

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

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

* Not required for Temperature Pilot applications

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

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

Option: Stainless diaphragms and external tubing - consult factory




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

MATERIALS

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

Ordering Instructions: HD Series Regulator with a Pilot

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

HD Valve with Pressure Pilot	HD Valve with Temperature Pilot	HD Valve with Pressure & Temperature Pilots
 <p>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)</p>	 <p>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)</p>	 <p>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</p> <p>* If 2 Pilots are used on the same valve, a Secondary Pilot Adapter is required.</p>

Pilot-Operated REGULATORS

Pressure Regulating with PP & PP5 Spring-loaded Pilot

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



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

Options

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

Example: PP-B Pilot at 20-100 PSIG

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

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

HD Main Valve

with **PP-Pressure Pilot**



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

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

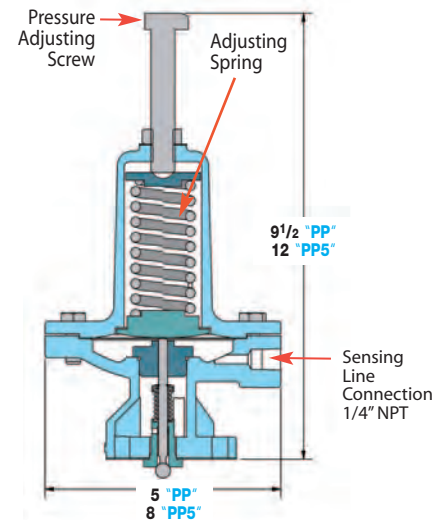
MATERIALS for PP Pressure Pilot

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

MATERIALS for HD Main Valve

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

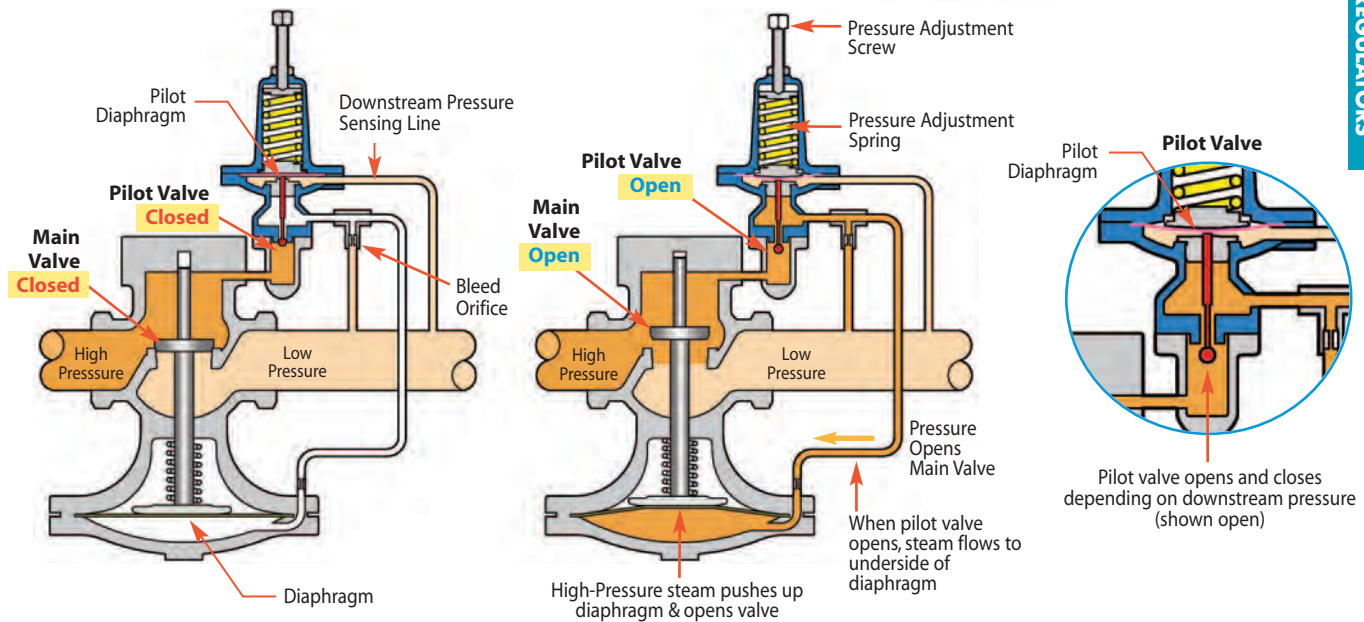
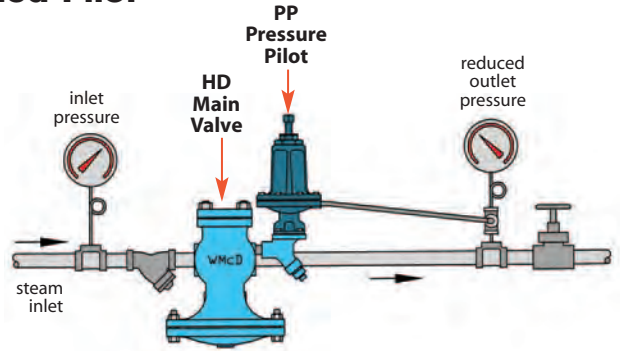
Units: inches



Pressure Regulating with PP & PP5 Spring-loaded Pilot

Reducing Pressure

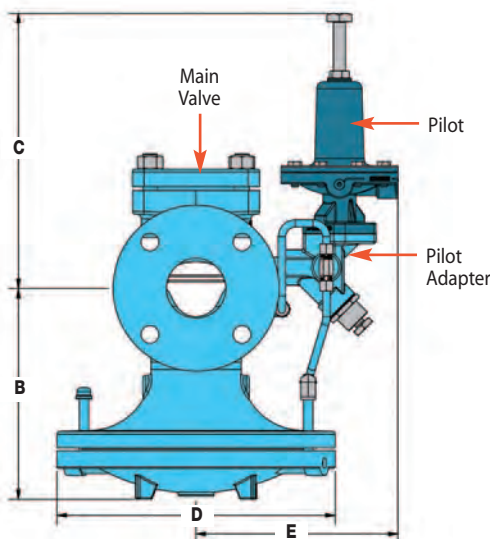
The PP-Pilot and the PP5-Pilot are both spring-adjusted pressure pilots. The PP-Pilot is used on typical general-purpose pressure reducing applications. The PP5-Pilot is used when higher accuracy is required and is capable of maintaining a control pressure window of less than 1 PSI.



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

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

Back Pressure Regulating with PBP Back-Pressure Pilot

Pilot-Operated REGULATORS

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

Minimum Differential Pressure:

- 10 PSI** (Standard Main Valve)
- 3 PSI** (Low Pressure Main Valve)



Typical Applications

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

Features

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

Option

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

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

Units: inches

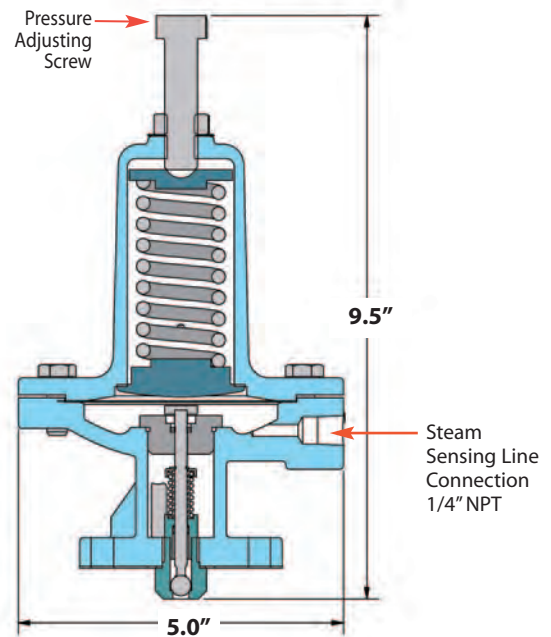
OPERATING PRESSURES

Inlet Pressure Range:

- 15-300 PSIG** (Standard Main Valve)
- 5-20 PSIG** (Low Pressure Main Valve)

Minimum Differential Pressure:

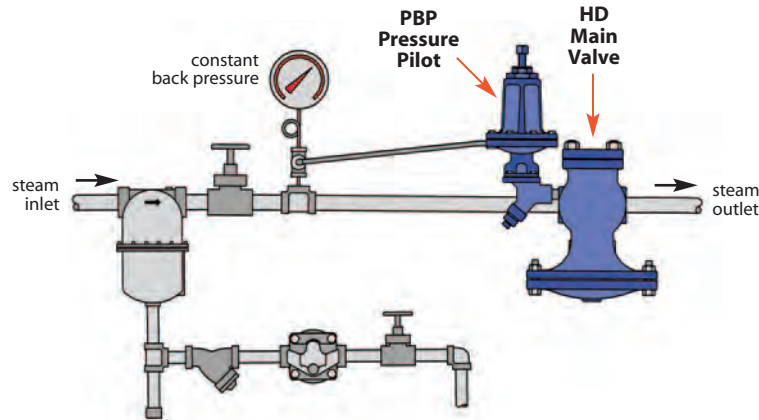
- 10 PSI** (Standard Main Valve)
- 3 PSI** (Low Pressure Main Valve)



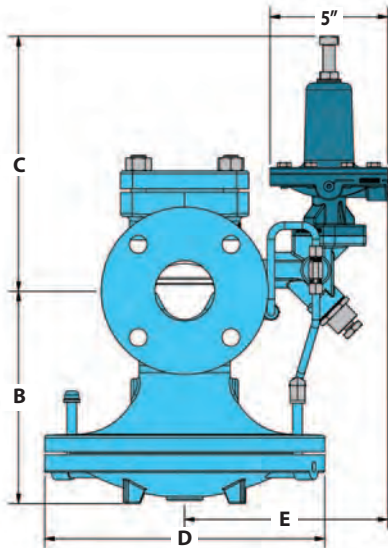
Back Pressure Regulating with PBP Back-Pressure Pilot

Back Pressure

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



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 ³ / ₈			5 ⁵ / ₈	11 ⁷ / ₈	6 ³ / ₄	7 ³ / ₄	18	
3/4"	4 ³ / ₈			5 ⁵ / ₈	11 ⁷ / ₈	6 ³ / ₄	7 ³ / ₄	18	
1"	5 ³ / ₈	5 ¹ / ₂	6	6 ¹ / ₄	11 ⁷ / ₈	7 ¹ / ₈	7 ³ / ₄	23	35
1 1/4"	6 ¹ / ₂			7 ³ / ₈	11 ⁷ / ₈	8 ⁷ / ₈	8 ¹ / ₄	43	
1 1/2"	7 ¹ / ₄	6 ⁷ / ₈	7 ³ / ₈	7 ³ / ₈	11 ⁷ / ₈	8 ⁷ / ₈	8 ¹ / ₄	43	60
2"	7 ¹ / ₂	8 ¹ / ₂	9	8 ¹ / ₄	11 ⁷ / ₈	10 ⁷ / ₈	8 ¹ / ₂	65	85
2 1/2"		9 ³ / ₈	10	9	11 ⁷ / ₈	11 ³ / ₄	8 ¹ / ₂		105
3"		10	10 ³ / ₄	8 ⁷ / ₈	11 ⁷ / ₈	13 ¹ / ₄	9 ¹ / ₂		145
4"		11 ⁷ / ₈	12 ¹ / ₂	11	11 ⁷ / ₈	14 ³ / ₄	10 ¹ / ₂		235
6"		15 ¹ / ₈	16	14 ¹ / ₂	12 ¹ / ₂	19 ³ / ₄	11 ³ / ₄		470

MATERIALS for PBP Back-Pressure Pilot

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

MATERIALS for HD Main Valve

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

HD Main Valve with PBP-Pressure Pilot



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

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

Temperature Regulating with PT Temperature Pilot

Pilot-Operated REGULATORS

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

Typical Applications

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

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

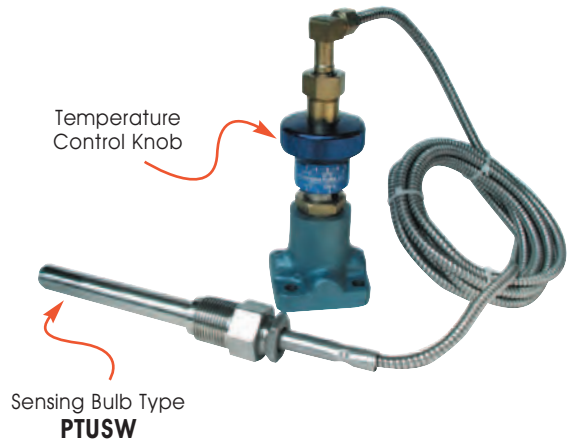
Using both the temperature and pressure pilots on the same regulator eliminates the need for two separate regulators to control temperature and pressure.

Features

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

Options

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



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

LOW PRESSURE HD Main Valve (pressures under 15 PSIG)
 Use Code **LP**: A Low Pressure Main Valve must be used in 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
60 - 120°F (16 - 49°C)
100 - 160°F (38 - 71°C)
120 - 180°F (49 - 82°C)
160 - 220°F (71 - 104°C)
200 - 260°F (93 - 127°C)
240 - 300°F (116 - 149°C)

Model Codes for Individual Thermowells for PT & PTU Pilots

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

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

Temperature Regulating with PT Temperature Pilot

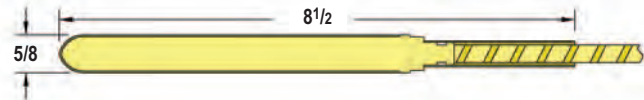
PT Pilots with 8 Ft. Capillary & Sensing Bulbs

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

All Sensing Bulbs are Copper

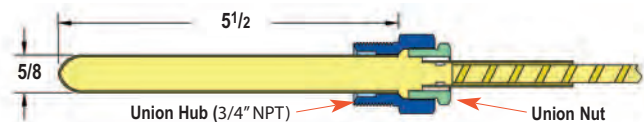
Dimension (inches)

PT



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

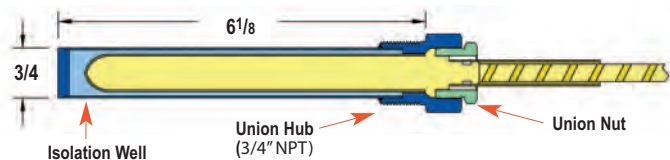
PTU



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

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

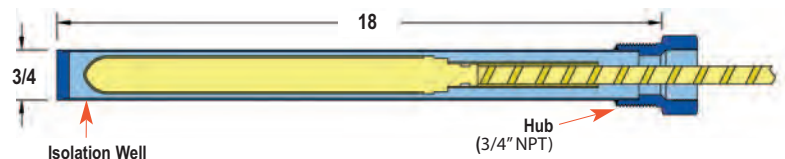
PTUBW: Brass Well
PTUSW: 316L SS Well



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

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

PTBW: Brass Well
PTSW: 316L SS Well



For deeper & variable insertion depths into tanks or vats; up to 18\"/>

Example Model Codes:

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

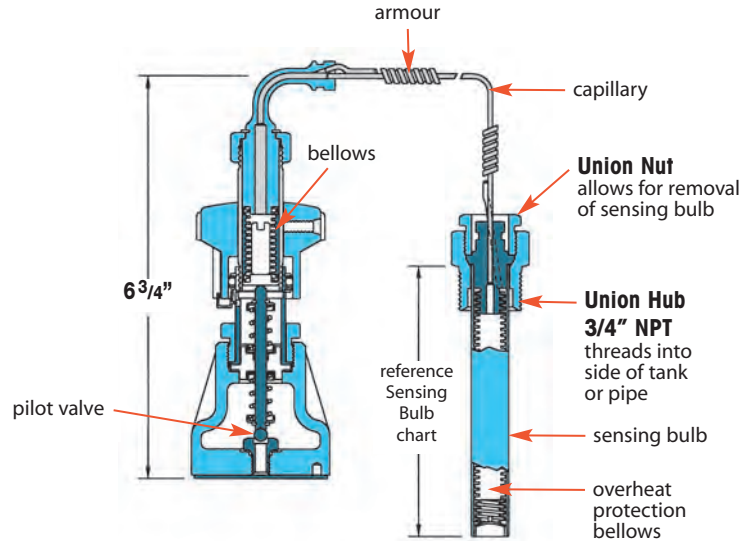
Model Code Configuration for Temperature Pilot

Example Model: **PTBW-31-8-LP**

Bulb Type		Code	Temperature Range	Code	Capillary Length	Code	Options (Suffix)
PT	Plain Sensing Bulb (no threaded connection)	12	60°F - 120°F	8	8 Feet	LP	Low Pressure (required under 15 PSI)
PTU	Sensing Bulb with Threaded Union Connection	14	100°F - 160°F	15	15 Feet	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

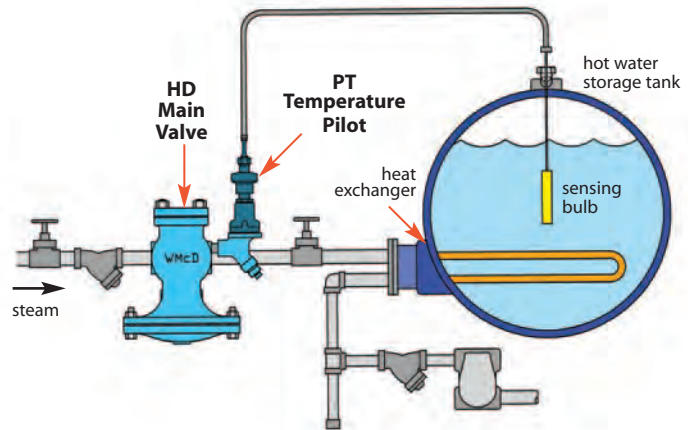
HD Main Valve

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.



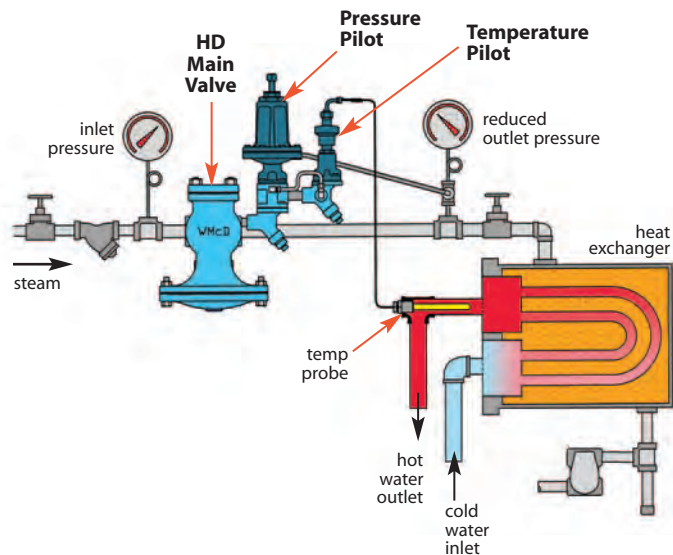
Controlling Temperature and Limiting Pressure using PT-Temperature Pilot & PP-Pressure Pilot

HD Main Valve

with
• PP-Pressure Pilot
• PT-Temperature Pilot

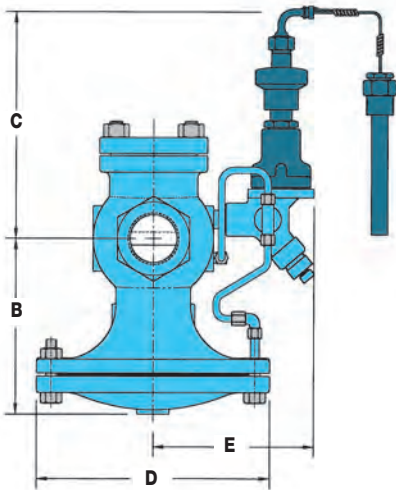
Controlling Temperature & Limiting Pressure to a Maximum Value

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.

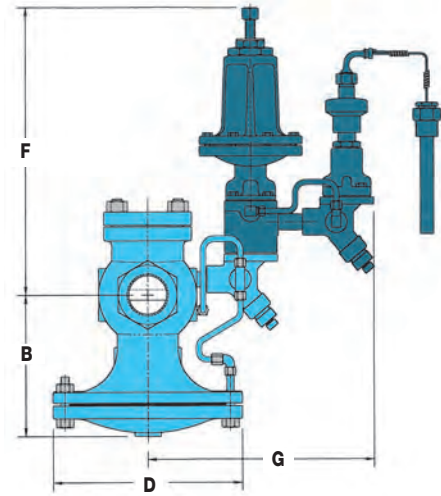


Temperature Regulating with PT Temperature Pilot

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 ³ / ₈	–	–	5 ⁵ / ₈	9 ¹ / ₄	6 ³ / ₄	6 ¹ / ₂	14 ¹ / ₂	10 ¹ / ₄	18	–
3/4"	4 ³ / ₈	–	–	5 ⁵ / ₈	9 ¹ / ₄	6 ³ / ₄	6 ¹ / ₂	14 ¹ / ₂	10 ¹ / ₄	18	–
1"	5 ³ / ₈	5 ¹ / ₂	6	6 ¹ / ₄	9 ¹ / ₄	7 ¹ / ₈	8 ¹ / ₄	14 ¹ / ₂	10 ¹ / ₄	23	35
1 ¹ / ₄ "	6 ¹ / ₂	–	–	7 ³ / ₈	9 ¹ / ₄	8 ⁷ / ₈	7 ¹ / ₄	14 ¹ / ₂	10 ³ / ₄	43	–
1 ¹ / ₂ "	7 ¹ / ₄	6 ⁷ / ₈	7 ³ / ₈	7 ³ / ₈	9 ¹ / ₄	8 ⁷ / ₈	7 ¹ / ₄	14 ¹ / ₂	10 ³ / ₄	43	60
2"	7 ¹ / ₂	8 ¹ / ₂	9	8 ¹ / ₄	9 ¹ / ₄	10 ⁷ / ₈	7 ¹ / ₂	14 ¹ / ₂	11 ¹ / ₄	65	85
2 ¹ / ₂ "	–	9 ³ / ₈	10	9	9 ¹ / ₄	11 ³ / ₄	7 ³ / ₄	14 ¹ / ₂	11 ¹ / ₄	–	105
3"	–	10	10 ³ / ₄	8 ⁷ / ₈	9 ¹ / ₄	13 ¹ / ₄	8 ¹ / ₂	14 ¹ / ₂	12	–	145
4"	–	11 ⁷ / ₈	12 ¹ / ₂	11	9 ¹ / ₄	6 ¹ / ₂	9 ¹ / ₂	14 ¹ / ₂	13	–	235
6"	–	15 ¹ / ₈	16	14 ¹ / ₂	9 ³ / ₄	19 ³ / ₄	10 ³ / ₄	15	14 ¹ / ₄	–	470

For Pressure Pilot

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

HD Main Valve with PT-Temperature Pilot



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

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

HD Main Valve

- with
- PP-Pressure Pilot
- PT-Temperature Pilot



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

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

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

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

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

MATERIALS for PT Temperature Pilot

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

MATERIALS for PP Pressure Pilot

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

MATERIALS for HD Main Valve

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

Pressure Control with PA Air-Loaded Pilot

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

Minimum Differential Pressure:

10 PSI (Standard Main Valve)

3 PSI (Low Pressure Main Valve)

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

Pilot-Operated REGULATORS

Typical Applications

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

How it Works

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

Features

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

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



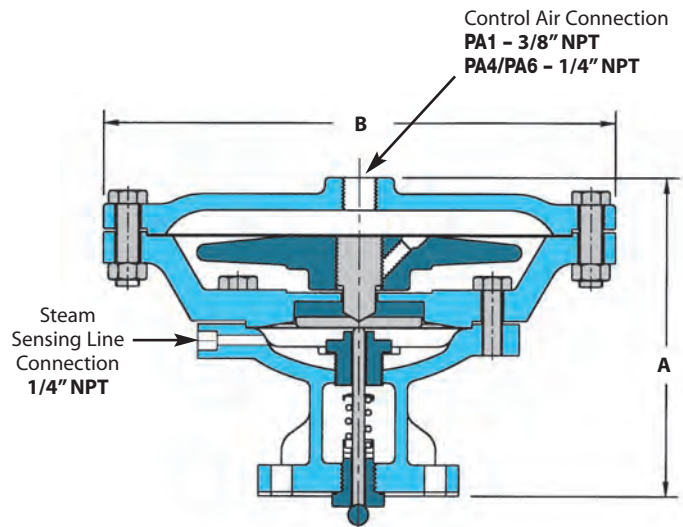
Model PA1
(Pilot shown)

HD Main Valve
with **PA4 Pilot**

MAXIMUM CONTROL AIR PRESSURE ON AIR PILOT IS 125 PSIG

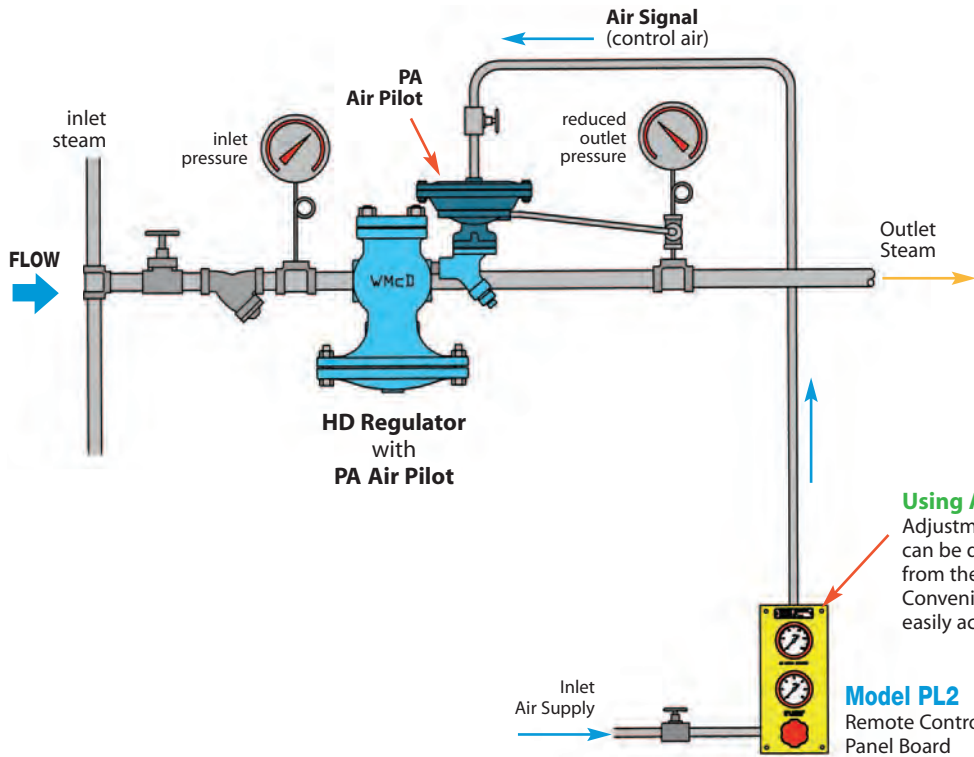
PRESSURE ADJUSTING RANGES		
Model	Pressure Ranges	Description
PA1	3-125 PSIG	1:1 ratio of steam pressure to control air pressure
PA4	3-200 PSIG	4:1 ratio of steam pressure to control air pressure
PA6	20-200 PSIG	6:1 ratio of steam pressure to control air pressure

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



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

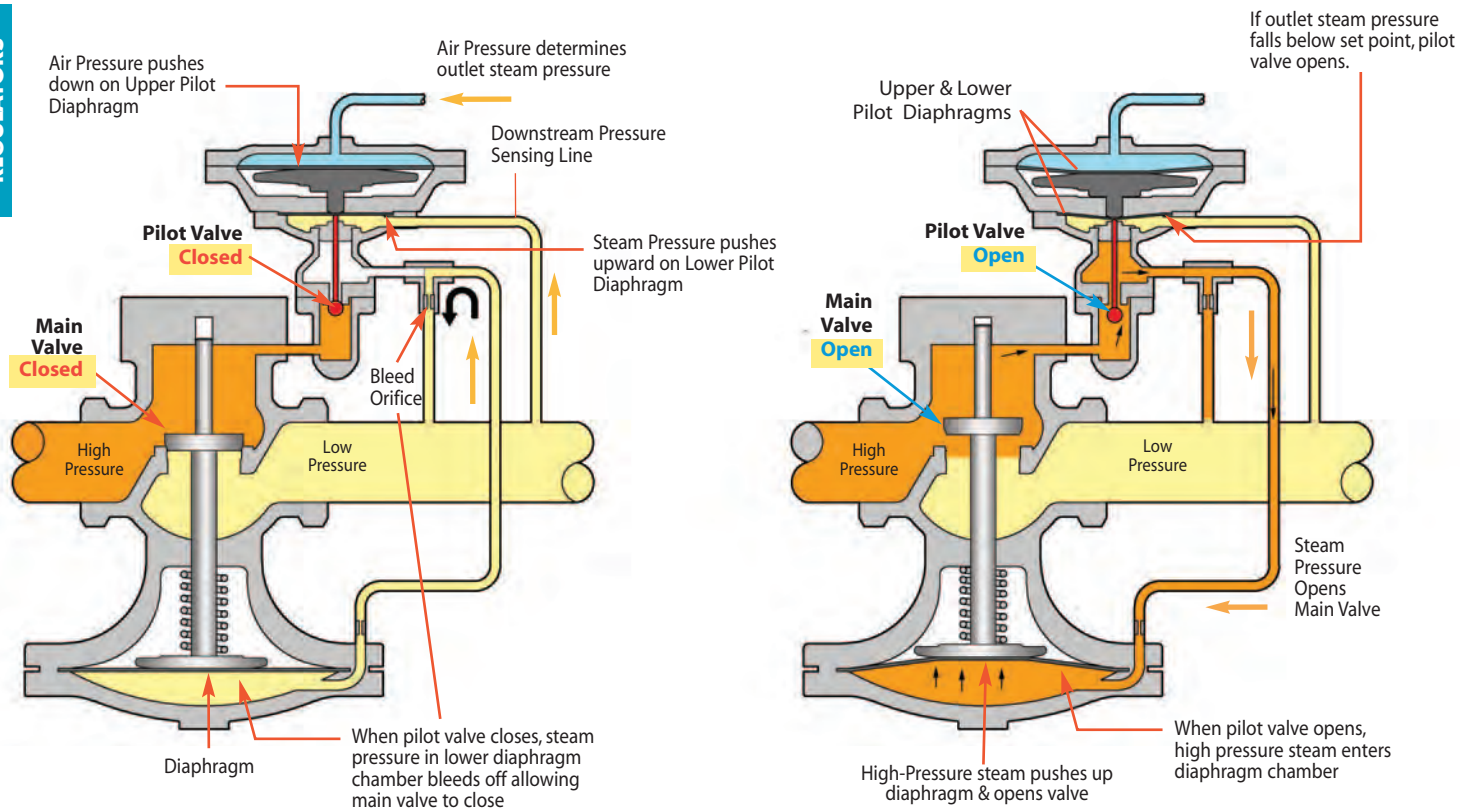
The PL3 is the same as the PL2 with the addition of a Steam Pressure Gauge for measuring steam pressure on the outlet side of the regulating valve.

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

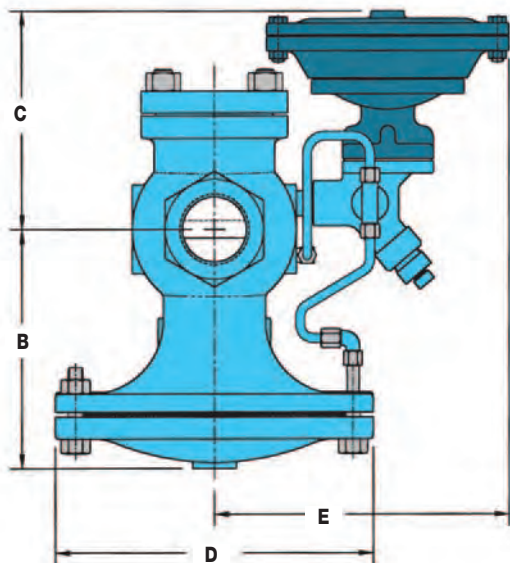


MAXIMUM CONTROL AIR PRESSURE ON AIR PILOT IS 125 PSIG

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

Dimension based on PA1 Air Pilot.

* Add 2¹/₂" to "C" dimension for PA4 or PA6 Air Pilots on 2" thru 4" valves.

** Add 1¹/₂" to "E" dimension for PA4, and 2¹/₄" for PA6.

Pilot-Operated REGULATORS

MATERIALS for PA Pressure Pilot

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

MATERIALS for HD Main Valve

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

OPERATING PRESSURES

Inlet Pressure Range:

15-300 PSIG (Standard Main Valve)

5-20 PSIG (Low Pressure Main Valve)

Minimum Differential Pressure:

10 PSI (Standard Main Valve)

3 PSI (Low Pressure Main Valve)

CONTROL AIR PRESSURE RANGE

A-Pilot Control Pressure:

3-125 PSIG (depending on pilot selected and desired outlet pressure)

HD Main Valve

with PA-Pressure Pilot Air-Loaded



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

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

How to Size / Order

PA - AIR PILOT

Specify:

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

REGULATOR BODY

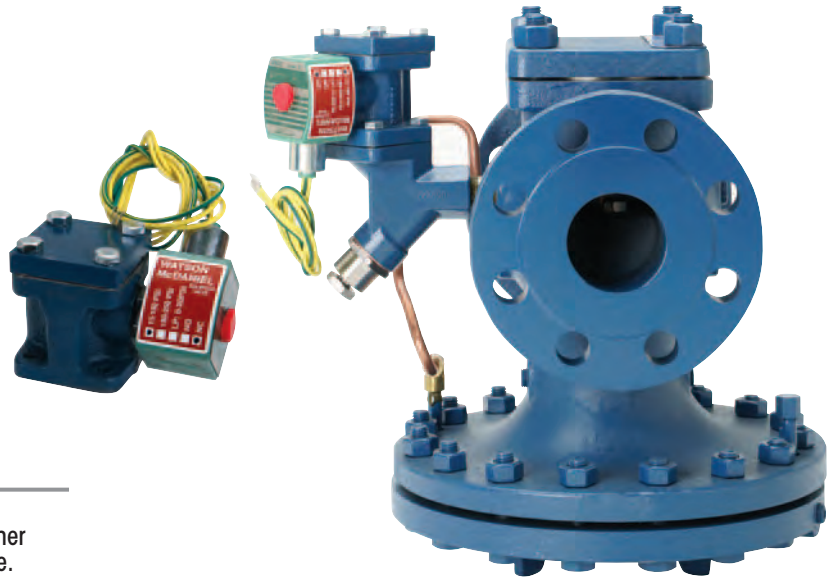
Specify:

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

On/Off Control using an Electric Solenoid

- Max Inlet Pressure: 250 PSIG

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



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

Model Code Configuration Chart

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

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

Example Model Codes:

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

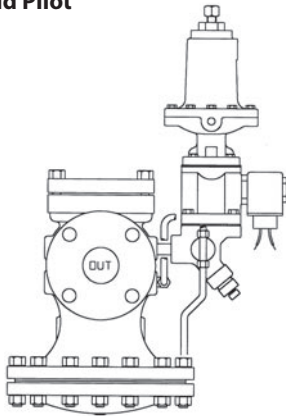
Standard Solenoid Pilots Available

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

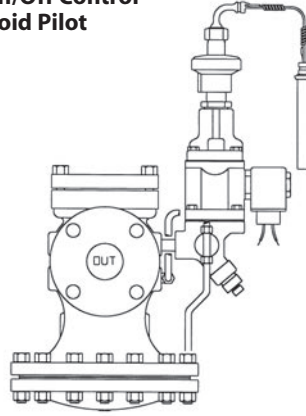
Model Code	PMO PSIG	Weight lbs
PS1	15-180	4.5
PS2	180-250	5.5
PS1-LP	0-20	4.5

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

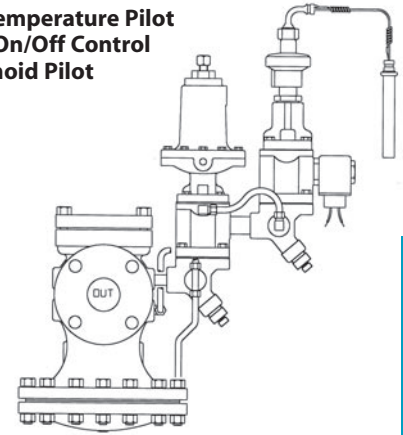
HD Main Valve
with
PS1 On/Off Control Solenoid Pilot



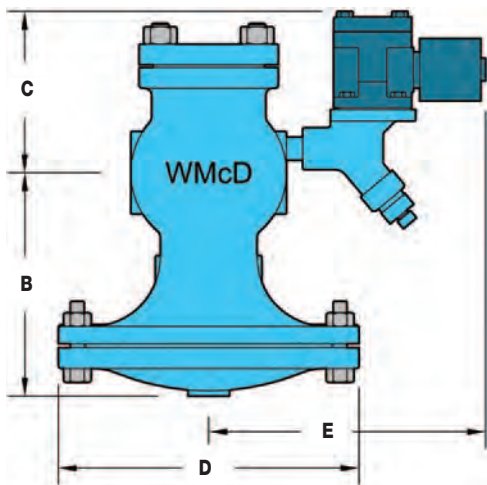
HD Main Valve
with
• **PT-Temperature Pilot**
• **PS1 On/Off Control Solenoid Pilot**



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 ³ / ₈			5 ⁵ / ₈	7 ⁵ / ₈	6 ³ / ₄	7 ³ / ₄	18	
3/4"	4 ³ / ₈			5 ⁵ / ₈	7 ¹ / ₂	6 ³ / ₄	7 ³ / ₄	18	
1"	5 ³ / ₈	5 ¹ / ₂	6	6 ¹ / ₄	7 ¹ / ₂	7 ¹ / ₈	7 ³ / ₄	23	35
1 ¹ / ₄ "	6 ¹ / ₂			7 ³ / ₈	7 ¹ / ₂	8 ⁷ / ₈	8 ³ / ₈	43	
1 ¹ / ₂ "	7 ¹ / ₄	6 ⁷ / ₈	7 ³ / ₈	7 ³ / ₈	7 ¹ / ₂	8 ⁷ / ₈	8 ³ / ₈	43	60
2"	7 ¹ / ₂	8 ¹ / ₂	9	8 ¹ / ₄	7 ¹ / ₂	10 ⁷ / ₈	8 ³ / ₄	65	85
2 ¹ / ₂ "		9 ³ / ₈	10	9	7 ¹ / ₂	11 ³ / ₄	8 ³ / ₄		105
3"		10	10 ³ / ₄	8 ⁷ / ₈	7 ¹ / ₂	13 ¹ / ₄	9 ¹ / ₂		145
4"		11 ⁷ / ₈	12 ¹ / ₂	11	7 ¹ / ₂	14 ³ / ₄	10 ¹ / ₂		235
6"		15 ¹ / ₈	16	14 ¹ / ₂	8 ¹ / ₄	19 ³ / ₄	12 ¹ / ₄		470

MATERIALS for On/Off Solenoid Pilot

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

MATERIALS for HD Main Valve

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

OPERATING PRESSURES

Inlet Pressure Range:

15-300 PSIG (Standard Main Valve)

5-20 PSIG (Low Pressure Main Valve)

Minimum Differential Pressure:

10 PSI (Standard Main Valve)

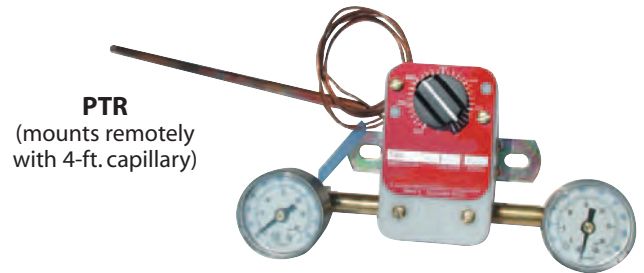
3 PSI (Low Pressure Main Valve)

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

Pilot-Operated
REGULATORS

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

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



Typical Applications

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

How it Works

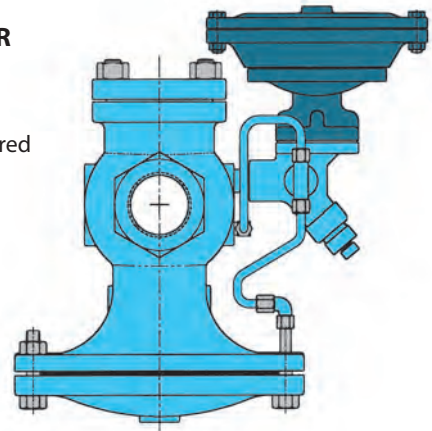
The **PTL** and **PTR Pneumatic Temperature Controllers** are used in conjunction with a **PA-Air Pilot** to control the operation of the **HD Regulator**. The **PTL** uses a bi-metallic element to sense temperature and the **PTR** uses a hydraulically-filled bulb (with 4-ft. capillary) to sense temperature.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

Features

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

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

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



OPERATING PRESSURES

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

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

How to Size / Order

PTL & PTR PNEUMATIC TEMPERATURE CONTROLLER

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

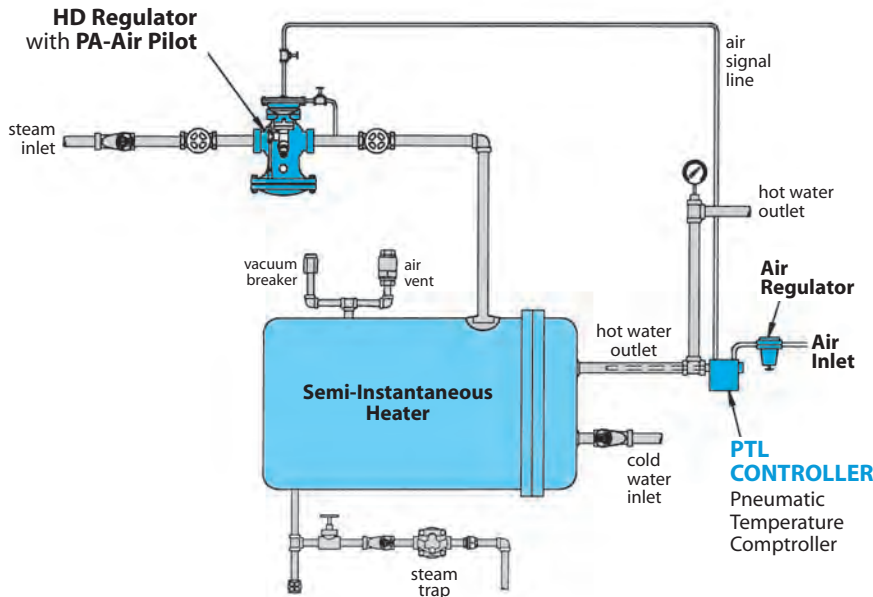
AIR PILOT

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

REGULATOR BODY

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

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

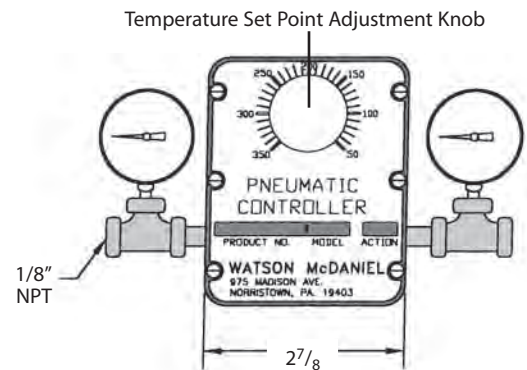
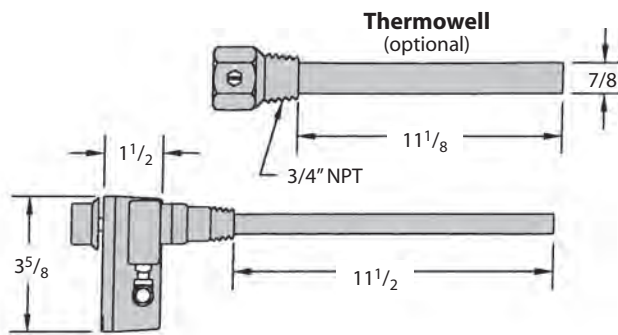


Description of Operation

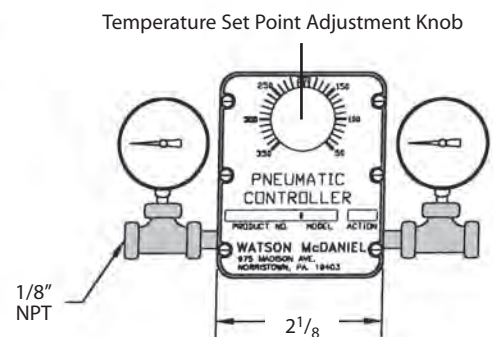
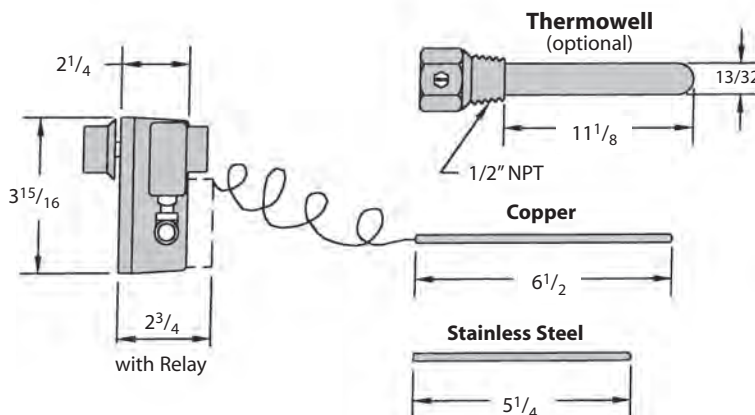
The PTL Pneumatic Temperature Controller senses outlet water temperature on a semi-instantaneous hot water heater. When the outlet water temperature falls below the set point, the PTL pneumatic temperature controller sends an air signal to the PA Air Pilot, which opens the regulator, allowing steam to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

Pilot-Operated REGULATORS

Model PTL (DIRECT Mounted)



Model PTR (REMOTE Mounted)



Units: inches

Temperature Control with PTRP Temperature Pilot

Pilot-Operated REGULATORS

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

LOW PRESSURE PTRP-LP Pilot (pressures under 15 PSIG)

Use Code **LP**: Low pressure Temperature Pilot is required for steam pressure under 15 PSI. (Range 5 - 20)

PILOT: Example Model Code: **PTRP-LP-06-08-S15**

LOW PRESSURE HD Main Valve (pressures under 15 PSIG)

Use Code **LP**: A Low Pressure Main Valve must be used in 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

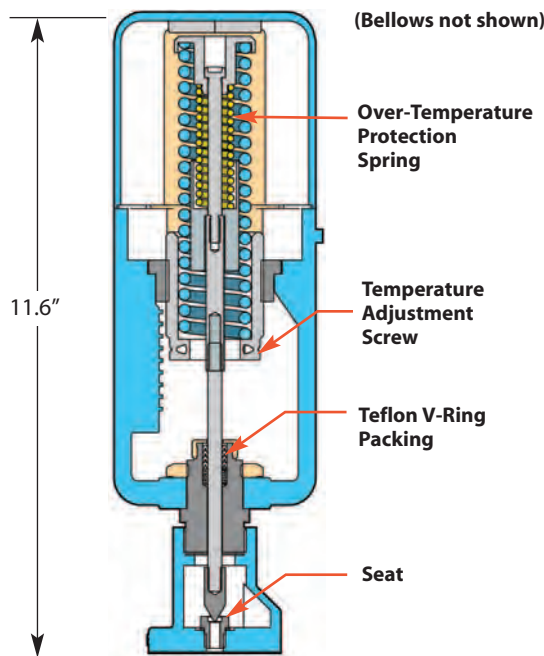
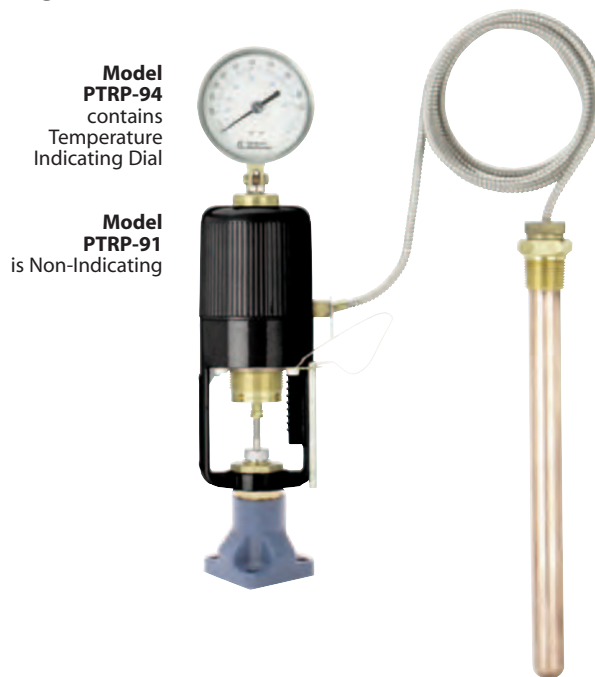
The **PTRP-Temperature Pilot** is used with the HD Regulator to control temperature in various processes and systems. The PTRP uses a vapor tension system to actuate the bellows in the temperature pilot giving it a faster reaction time and better temperature sensitivity than the standard PT pilot. They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

Features

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

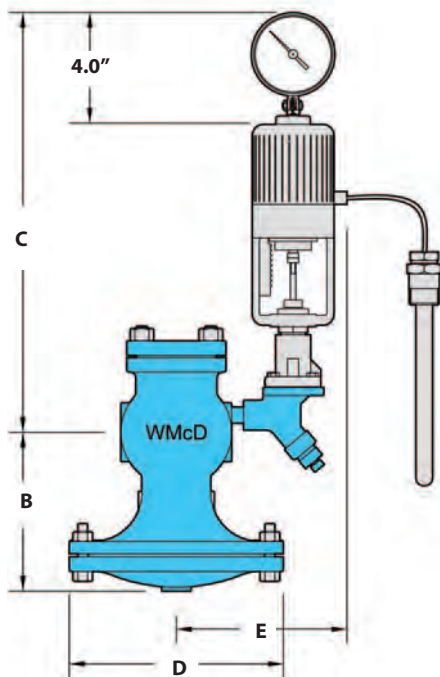
Options

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



Specifications

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



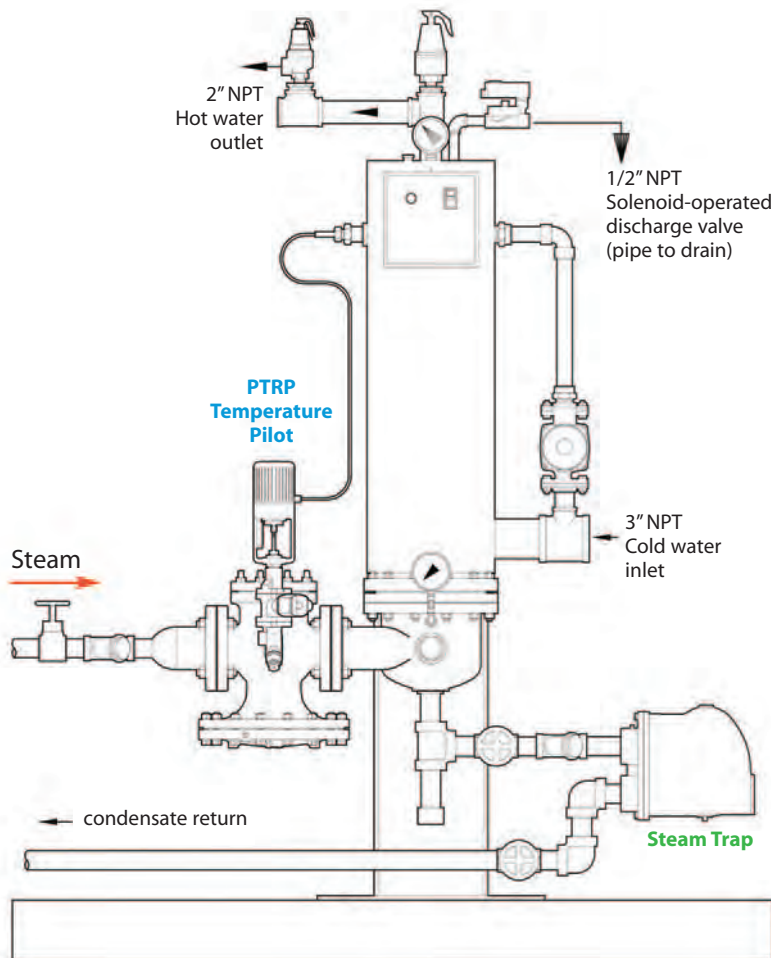
DIMENSIONS HD-Series – inches									
Size	Face-To-Face			B	C	D	E	Weight (lbs)	
	NPT	150#	300#					NPT	FLG
1/2"	4 ³ / ₈			5 ⁵ / ₈	14	6 ³ / ₄	7 ³ / ₄	18	
3/4"	4 ³ / ₈			5 ⁵ / ₈	14	6 ³ / ₄	7 ³ / ₄	18	
1"	5 ³ / ₈	5 ¹ / ₂	6	6 ¹ / ₄	14	7 ¹ / ₈	7 ³ / ₄	23	35
1 ¹ / ₄ "	6 ¹ / ₂			7 ³ / ₈	14	8 ⁷ / ₈	8 ¹ / ₄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

MATERIALS for PTRP Pilot

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

MATERIALS for HD Main Valve

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



HD Valve with PTRP-Temperature Pilot Application

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

Temperature Control

Sensing Bulb Selection & Installation:

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

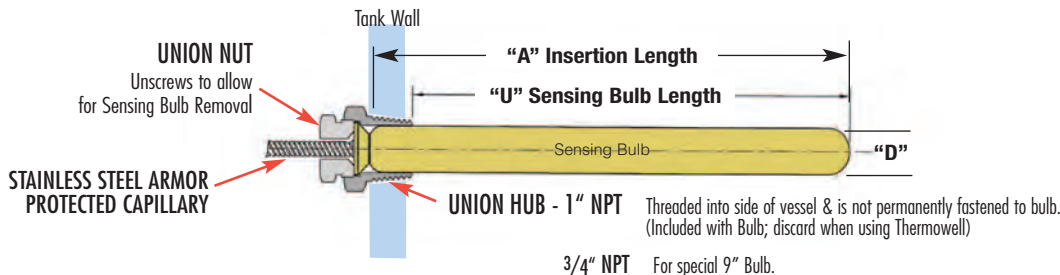
Pilot-Operated REGULATORS

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.

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



Thermowell Option (ordered separately)

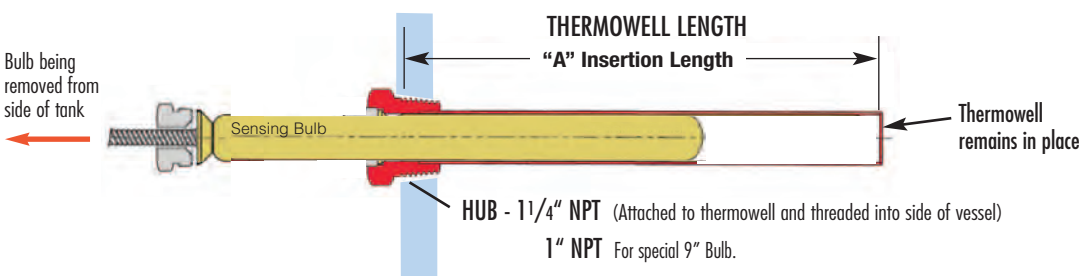
Thermowells isolate and protect the sensing bulb from the process fluid; available in either brass (better heat transfer properties) or Stainless Steel for corrosion resistance. They allow for sensing bulb removal and replacement without having to drain liquid from the system. For corrosive applications, 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-94-02-08	8
03	30 - 115	85 to 110 °F	PTRP-91-03-08	PTRP-94-03-08	8
04	50 - 140	110 to 135 °F	PTRP-91-04-08	PTRP-94-04-08	8
05	75 - 165	135 to 160 °F	PTRP-91-05-08	PTRP-94-05-08	8
06	105 - 195	160 to 190 °F	PTRP-91-06-08	PTRP-94-06-08	8
07	125 - 215	190 to 210 °F	PTRP-91-07-08	PTRP-94-07-08	8
09	155 - 250	210 to 245 °F	PTRP-91-09-08	PTRP-94-09-08	8
10	200 - 280	245 to 275 °F	PTRP-91-10-08	PTRP-94-10-08	8
11	225 - 315	275 to 310 °F	PTRP-91-11-08	PTRP-94-11-08	8
12	255 - 370	305 to 365 °F	PTRP-91-12-08	PTRP-94-12-08	8
13	295 - 420	365 to 415 °F	PTRP-91-13-08	PTRP-94-13-08	8
14	310 - 440	415 to 435 °F	PTRP-91-14-08	PTRP-94-14-08	8

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

CROSS REFERENCE: PTRP = Spence T-14

Model Code Configuration Chart

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

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

HD Main Valve with PTRP-Temperature Pilot



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

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

How to write proper model number:

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

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

Example Model Codes:

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

Trip-Stop

Trip-Stop Pilot	TSP
Body Material	Cast Steel
Max Inlet Pressure	300 PSIG
Inlet Pressure Range (with HD Standard main valve)	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

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

Pilot-Operated REGULATORS

Typical Applications

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

Features

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

MATERIALS for TRIP-STOP Pressure Pilot

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

OPERATING PRESSURES

Inlet Pressure Range:

- 15-300 PSIG** (Standard Main Valve)
- 5-20 PSIG** (Low Pressure Main Valve)

Minimum Differential Pressure:

- 10 PSI** (Standard Main Valve)
- 3 PSI** (Low Pressure Main Valve)

* **XXX** = Set Pressure

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



How to Size / Order

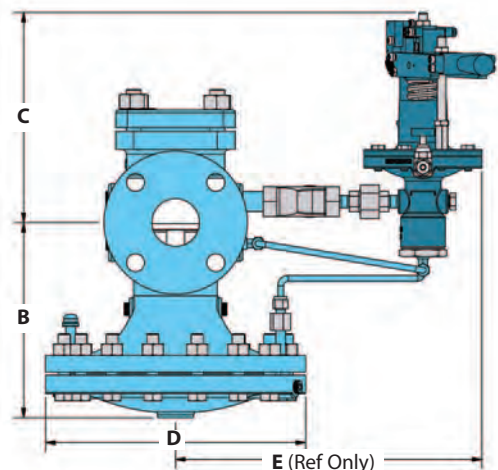
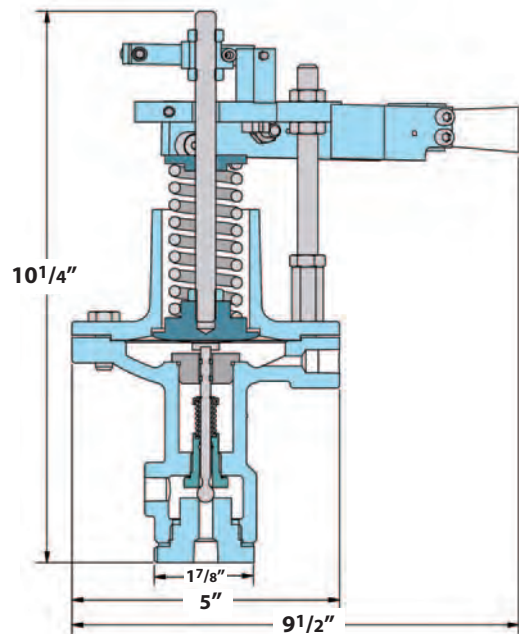
TSP - TRIP STOP PILOT

Specify: • Trip Set Pressure (factory set)

Example: **TSP-B-040:** TSP Pilot with 40 PSIG set pressure

REGULATOR BODY

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



Differential Pressure

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

Typical Applications

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

Features

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

Options

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

MATERIALS for PDP Differential Pressure Pilot

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

OPERATING PRESSURES

Inlet Pressure Range:

15-300 PSIG (Standard Main Valve)

5-20 PSIG (Low Pressure Main Valve)

Minimum Differential Pressure:

10 PSI (Standard Main Valve)

3 PSI (Low Pressure Main Valve)



Pilot-Operated REGULATORS

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

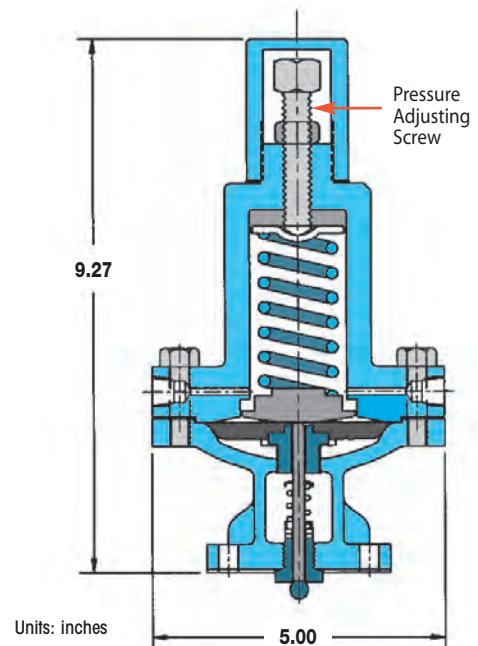
PDP - DIFFERENTIAL PRESSURE PILOT

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)



Regulators

Pilots for HD Regulating Valves

EP Pilots

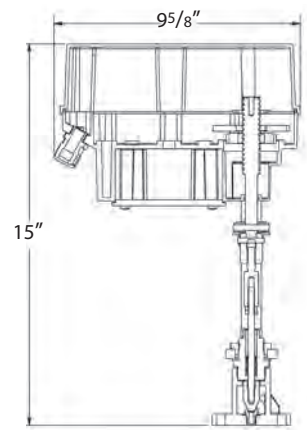
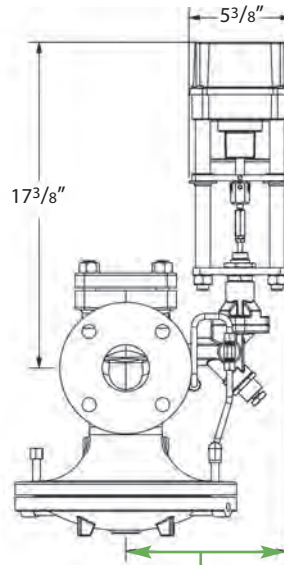
HD Series

Electric Pilot with ES Spring Return Actuator

Pilot-Operated REGULATORS



HD Main Valve
with EP Pilot



Reg Size	Dim.	Reg Size	Dim.
(1/2"-3/4")	75/8"	(2 1/2")	83/4"
(1")	73/4"	(3")	91/2"
(1 1/4"-1 1/2")	83/8"	(4")	101/2"
(2")	85/8"	(6")	121/8"

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

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

Typical Applications

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

Features

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

OPERATING PRESSURES

Inlet Pressure Range:

- 15-300 PSIG** (Standard Main Valve)
- 5-20 PSIG** (Low Pressure Main Valve)

MATERIALS for EP Electric Pilot

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

Model Code Configuration Chart

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

How to Size / Order

EP - ELECTRIC PILOT

Specify: • Fail Close/open

Example: **EP-ESB-10**: Spring Fail-Closed, 24VAC, 4-20mA Signal

REGULATOR BODY

Specify: • HD regulator body

- Regulator size or capacity
- End connections (threaded, 150/300# flanged)

Additional Technical Information

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

HSP Pressure Regulating Valves

Cast Steel & Stainless Steel



Pilot-Operated
REGULATORS

Cast Steel & Stainless Steel Pressure Regulating Valve

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

OPERATING PRESSURES

Inlet Pressure Range:

- 15-450 PSIG (standard Main Valve)
- 5-20 PSIG (low-pressure Main Valve)

Minimum Differential Pressure:

- 10 PSIG (standard Main Valve)
- 3 PSIG (low-pressure Main Valve)

ANSI/FCI 70-3 Class IV Shut-off

PRESSURE-ADJUSTING SPRING RANGES

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

Typical Applications

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

Features

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



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

Pilot Mounting

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

Pressure Pilot

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

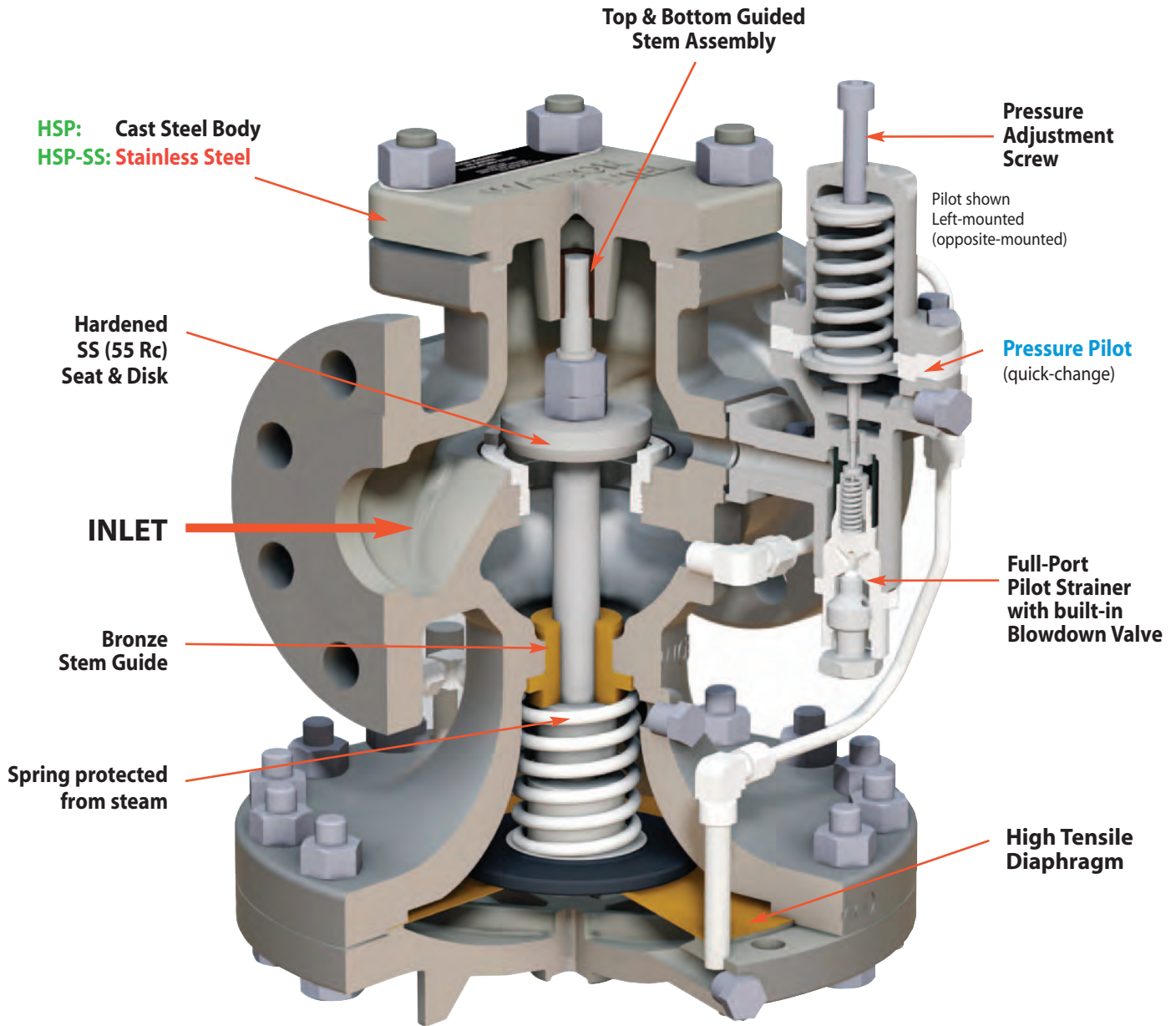
MATERIALS

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

Other MATERIALS for both Models

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

Cast Steel & Stainless Steel Pressure Regulating Valve



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

Cast Steel & Stainless Steel Pressure Regulating Valve

Pilot-Operated
REGULATORS

Model includes HSP Main Valve with Pressure Pilot

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



Pilot Ranges

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

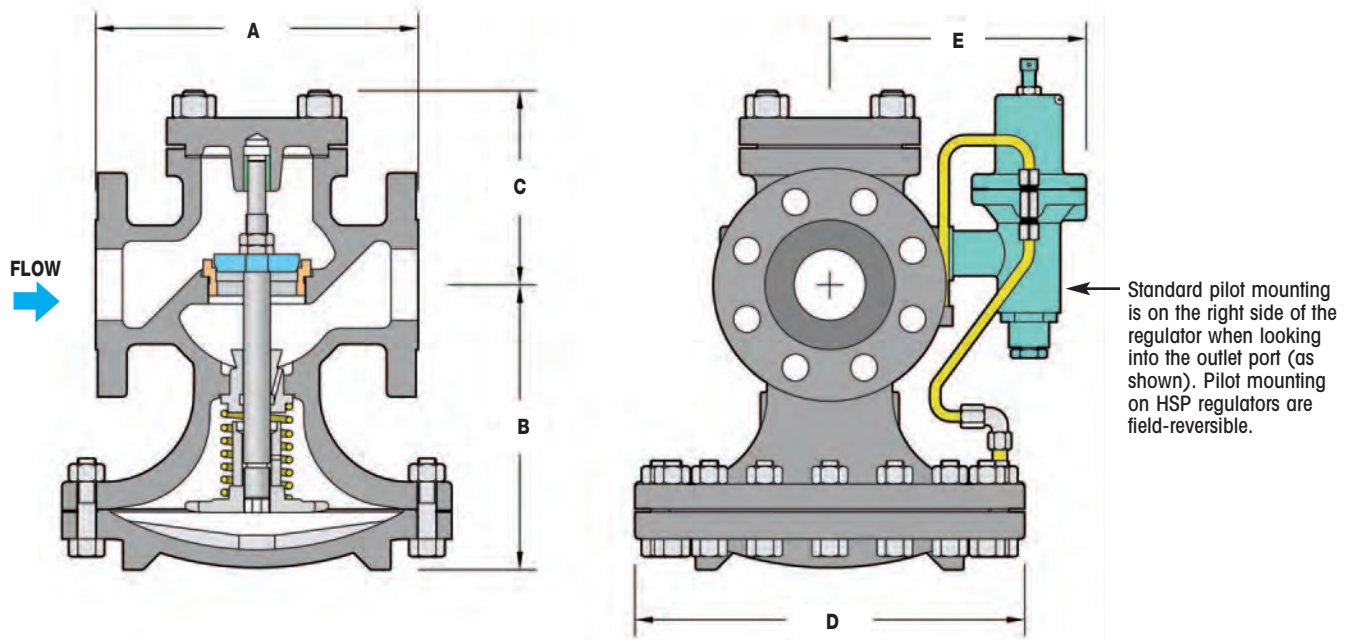
Model Configuration Chart

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

Example Model Codes:

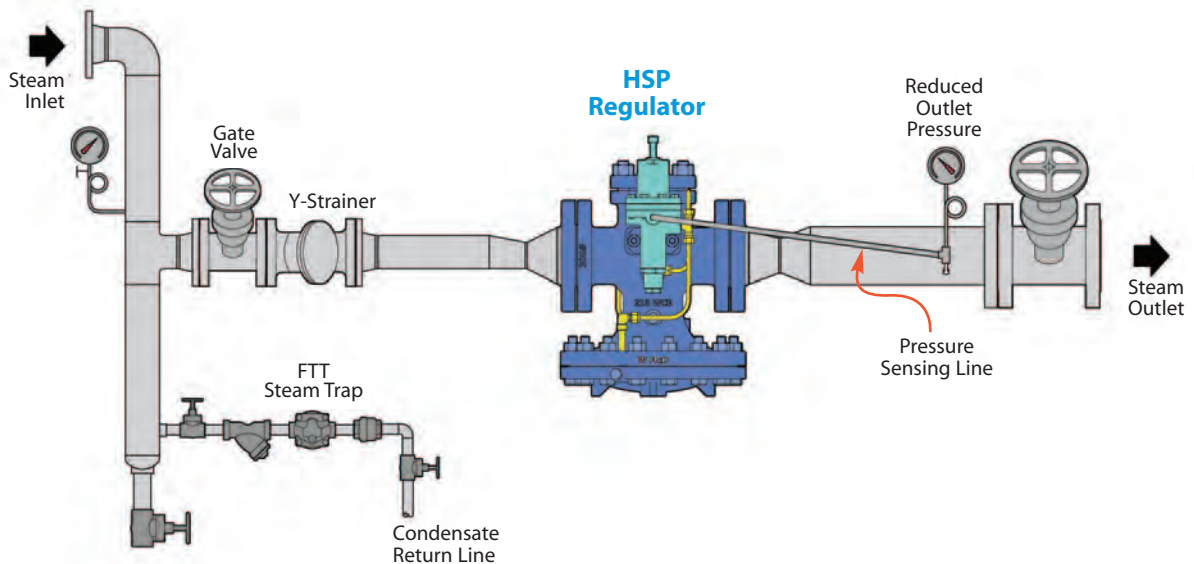
- 1) **HSP-17-F150-Y** (HSP Full port valve, 2" 150# Flg, 10-40 PSIG, with no options)
- 2) **HSPR-17-F300-B-ST** (HSP Reduced port valve, 2" 300# Flg, 25-100 PSIG, with Stellite Trim)

Cast Steel & Stainless Steel Pressure Regulating Valve



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



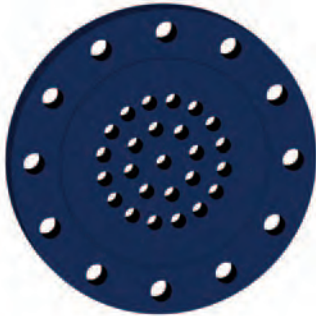
Pressure Reducing Station for Steam Application

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

Pilot-Operated
REGULATORS



Series-OP
Orifice Plate

Description

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

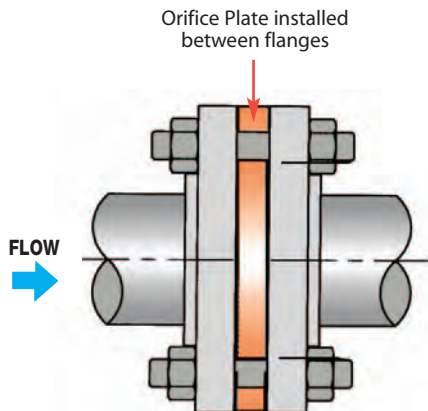
- Inlet (Supply) Pressure to the HD/HSP Regulator*
- Outlet (Downstream) Pressure of the HD/HSP Regulator*
- Steam Flow Rate (lb/hr)

How it Works

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

Installation

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



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

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

= Number of Holes
 Factory Determined

0.000 = Diameter of Holes
 Factory Determined

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

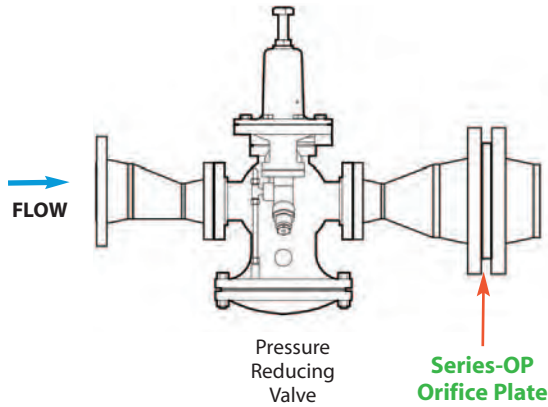
Regulators - Noise Attenuators Orifice Plate / Acoustic Silencer

Series OP (continued) Series H

for Pressure Regulating Valves

Noise Reduction

Series-OP Typical Hook-up



Series-OP OUTSIDE DIAMETER – inches

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

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

Pilot-Operated
REGULATORS

Acoustic Silencer for Pressure Regulating Valves

Series H

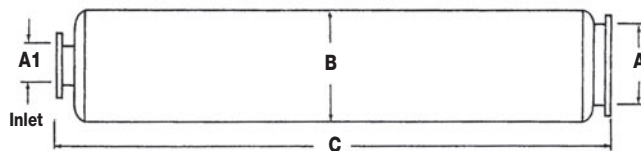
Noise Attenuation Equipment is used to reduce unwanted or excessive noise that commonly occurs in pressure reducing stations.

How it Works

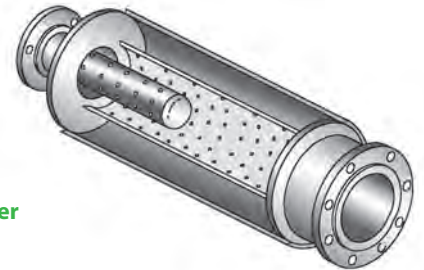
The **Series-H** Acoustic Silencer incorporates a **Dual Diffuser** tube design. The inner tube has a drilled orifice pattern and the outer tube contains an integral layer of sound absorbing insulation. Noise reduction levels of **20-30 dBA** can typically be achieved.

Installation

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



Noise Reduction Capability: 20-30 dBA



Series-H
Acoustic Silencer

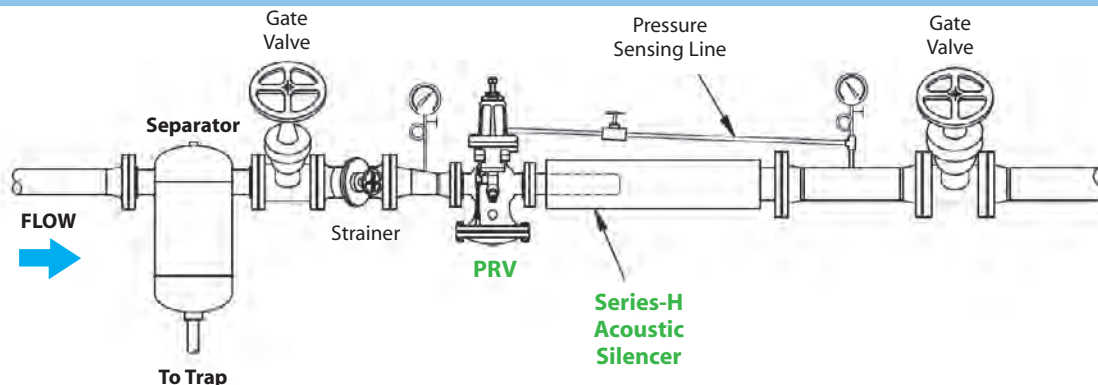
Series-H DIMENSIONS

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

Notes: Other sizes available. Consult factory.

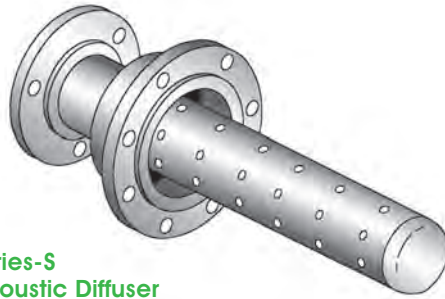
XXX = Numbers will be assigned at time of order for internal use.

Series-H Typical Hook-up



Noise Reduction

Noise Reduction Capability: 10-15 dBA



**Series-S
Acoustic Diffuser**

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.

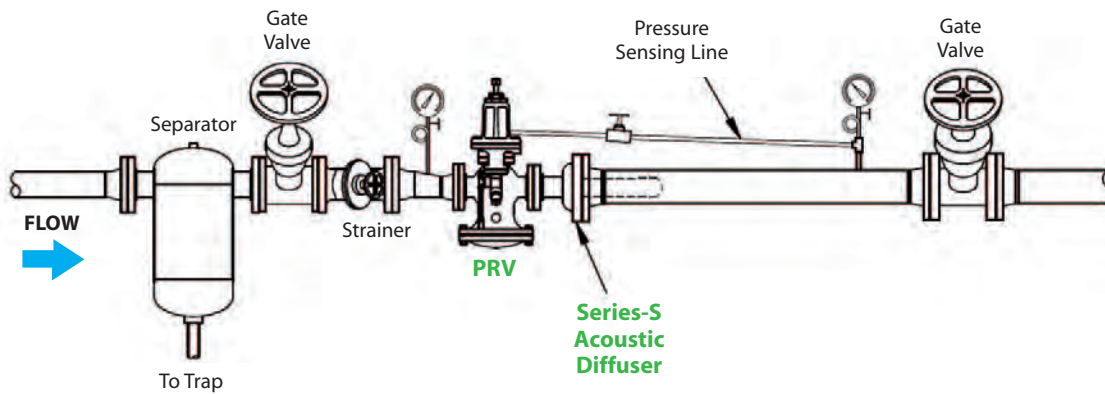
MATERIALS

Fabricated Carbon Steel

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	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5
4000	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5	S-5
6000	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6	S-6
8000	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8
10000	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8	S-8

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

Acoustic Diffuser for Pressure Regulating Valves

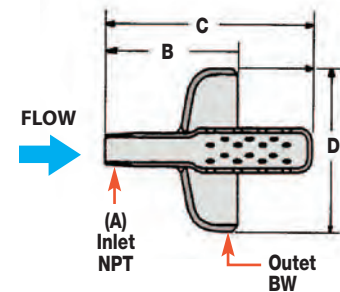
Noise Reduction

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		4	6 1/2	16 1/2	4 1/2
	2 1/2	2 1/2	4	6 1/2	16 1/2	4 1/2
	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
S-8	2 1/2	2 1/2	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
	3	3	8	10	17	8 5/8
S-10	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
	3	3	12	12	14	12 3/4
S-12	4	4	12	12	14	12 3/4
	6	6	12	12	14	12 3/4
	2 1/2	2 1/2	12	12	21	12 3/4

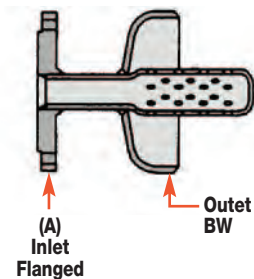
Notes: 1) 150# & 300# flanged available.
2) Other sizes available; consult factory.

BW = Butt-weld

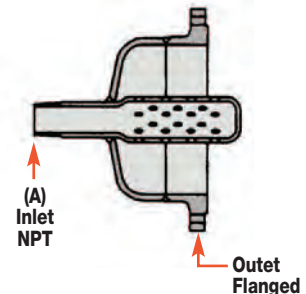
NPT x Butt-Weld



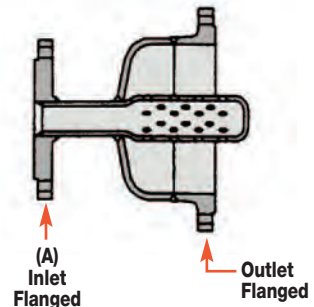
Flanged x Butt-Weld



NPT x Flanged



Flanged x Flanged



Pilot-Operated REGULATORS

Series INSUL Insulation/Acoustic Jackets for HD Regulator

Noise Reduction Capability: 0-5 dBA

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

MATERIALS

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

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

Note: Must specify regulator Connection Type when ordering.

Full Port

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

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

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 _v Factors		1.4	3.3	5.6	7.8	13.3	18.8	25.9	41.7	74	163
5	0	15	35	59	82	140	197	272	438	777	1712
	2	13	32	53	75	128	181	249	401	712	1569
7	0	21	48	82	115	195	276	381	613	1088	2396
	2	20	46	79	110	187	265	365	587	1042	2296
	3	19	44	74	104	177	250	344	554	983	2165
10	0	29	70	117	164	279	395	544	876	1554	3423
	2	28	68	115	160	274	387	533	858	1523	3354
	5	25	60	102	142	242	342	471	758	1346	2964
12	0	35	83	141	197	335	473	653	1051	1865	4108
	4	33	78	133	185	316	446	615	990	1758	3873
	7	29	68	115	160	272	385	530	854	1515	3336
15	0-3	43	102	173	241	410	580	800	1287	2284	5031
	5	41	98	166	232	395	558	769	1238	2198	4841
	8	37	88	149	208	354	500	690	1111	1972	4343
20	0-5	57	134	227	317	541	764	1053	1696	3009	6629
	10	51	120	204	284	483	684	942	1517	2692	5929
	12	47	111	188	262	447	632	870	1401	2486	5477
25	0-7	70	166	282	393	670	948	1305	2102	3730	8215
	10	67	158	269	375	640	905	1246	2006	3561	7843
	15	59	139	235	328	559	790	1088	1751	3108	6846
30	0-12	81	190	323	450	768	1085	1495	2408	4273	9411
	15	76	180	305	426	726	1025	1413	2275	4037	8892
	20	66	155	263	366	625	883	1216	1958	3475	7654
40	0-18	105	248	420	585	998	1410	1943	3128	5551	12227
	25	99	199	367	511	872	1232	1698	2734	4852	10688
	30	78	183	311	433	739	1044	1439	2317	4111	9056
50	0-20	135	318	539	751	1280	1809	2492	4013	7121	15686
	30	118	277	470	655	1117	1579	2175	3502	6216	13692
	40	88	208	353	491	838	1184	1632	2627	4662	10269
60	0-30	153	360	611	851	1451	2051	2826	4550	8074	17786
	35	143	338	573	798	1361	1924	2651	4268	7573	16682
	50	98	230	390	543	926	1309	1804	2904	5154	11353
75	0-35	195	460	780	1086	1853	2619	3608	5809	10308	22706
	50	164	387	657	916	1561	2207	3040	4895	8687	19135
	60	132	312	529	737	1257	1777	2448	3941	6993	15404
90	0-45	229	540	916	1277	2177	3077	4239	6825	12112	26680
	60	197	465	789	1100	1874	2648	3649	5874	10425	22962
	75	146	345	585	815	1389	1964	2705	4357	7731	17029
100	0-50	255	600	1018	1419	2419	3419	4710	7584	13458	29644
	60	235	554	940	1310	2234	3158	4351	7006	12432	27384
	80	176	416	706	983	1676	2367	3263	5254	9324	20538
125	0-60	322	760	1290	1796	3063	4329	5964	9603	17041	37536
	75	294	693	1176	1638	2793	3948	5439	8757	15540	34230
	100	221	518	882	1229	2095	2961	4079	6568	11655	25672
150	0-75	381	900	1527	2128	3628	5128	7065	11376	20187	44467
	100	329	775	1315	1831	3123	4414	6081	9791	17374	38270
	125	243	575	975	1385	2316	3274	4510	7261	12885	28382
175	0-85	449	1060	1800	2505	4272	6939	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	14500		29980	51450	
	250			3860		8970	12380		27460	48750	
	300			3430		7970	11010		24410	43330	
450	0-225			4580		10650	15000		32600	57890	
	300			4340		10090	13930		30890	54840	
	350			3860		8970	12380		27460	48750	

Pilot Operated
REGULATORS

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

Ductile Iron • Carbon Steel • Stainless Steel

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



DLDI
Ductile Iron



DLCS
Carbon Steel



DLSS
Stainless Steel

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

OPERATING PRESSURES

Inlet Pressure Range:

15*-300 PSIG (DLDI)

15*-450 PSIG (DLCS & DLSS)

*Note: Minimum Inlet Pressure 5 PSIG with Teflon diaphragm.

Minimum Differential Pressure: 3 PSIG

Typical Applications

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

Features

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

MATERIALS

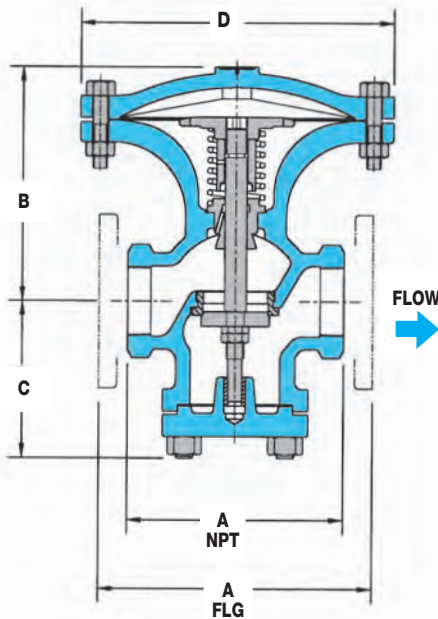
	DLDI	DLCS	DLSS
Body	Ductile Iron	ASTM A-216 GR WCB	ASTM A-351 CF8M
Cover	Ductile Iron	ASTM A-216 GR WCB	ASTM A-351 CF8M
Diaphragm Cover	Ductile Iron	ASTM A-216 GR WCB	ASTM A-351 CF8M

Other MATERIALS for all Models

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

DOME-LOADED REGULATORS

Ductile Iron • Carbon Steel • Stainless Steel



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

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

DOME LOADED REGULATORS

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

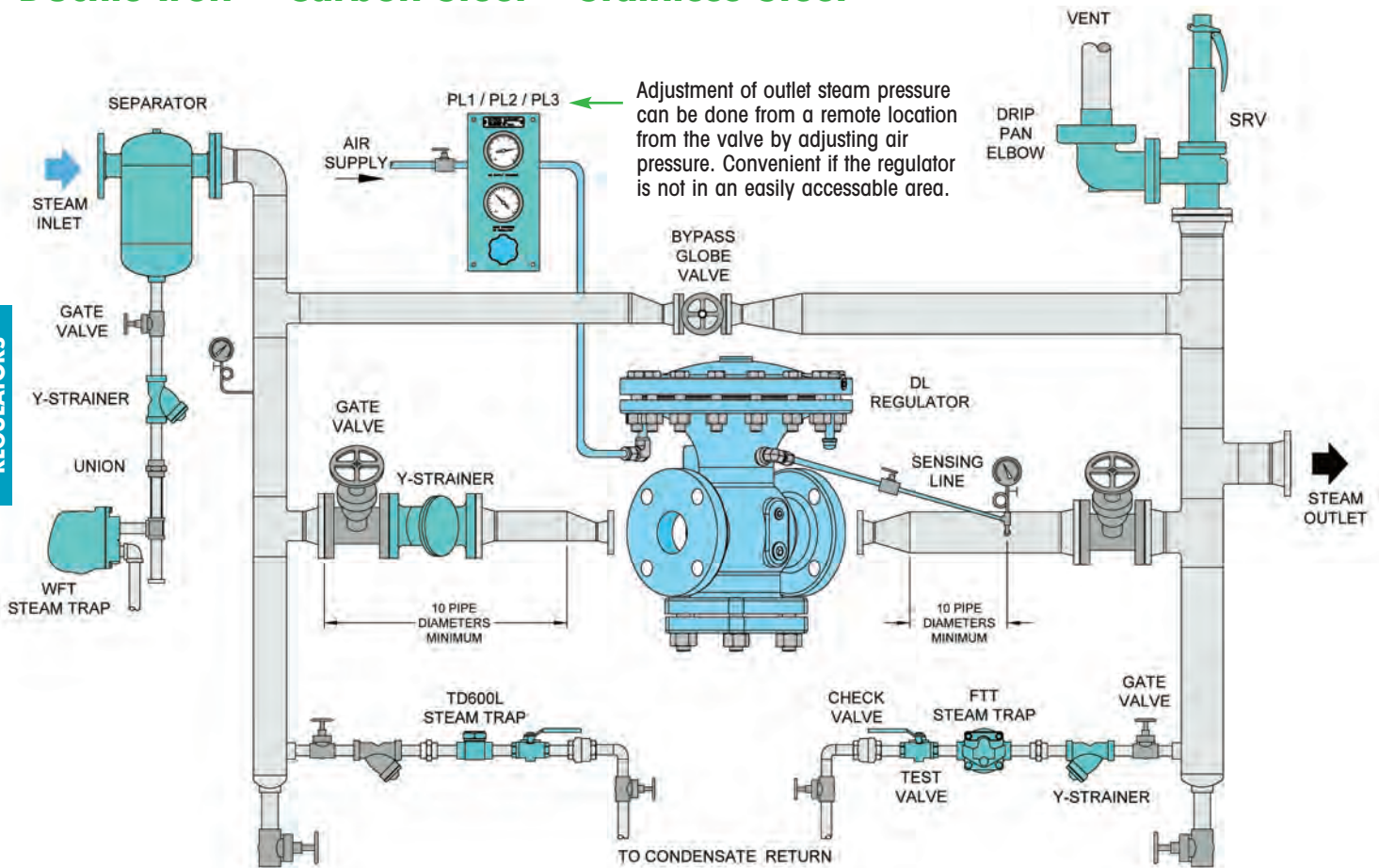
Model Configuration Chart - Reference Chart above for availability

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

Dome-Loaded Regulating Valves

Ductile Iron • Carbon Steel • Stainless Steel

DOME-LOADED REGULATORS



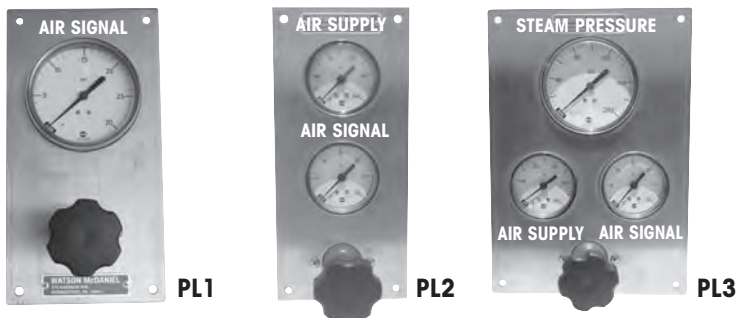
Adjustment of outlet steam pressure can be done from a remote location from the valve by adjusting air pressure. Convenient if the regulator is not in an easily accessible area.

Description of Operation

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

REMOTE CONTROL PANEL BOARDS

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



PL1

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

PL2

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

PL3

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

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

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

How To Use Air Loading Chart

Example using 2" DL Series:

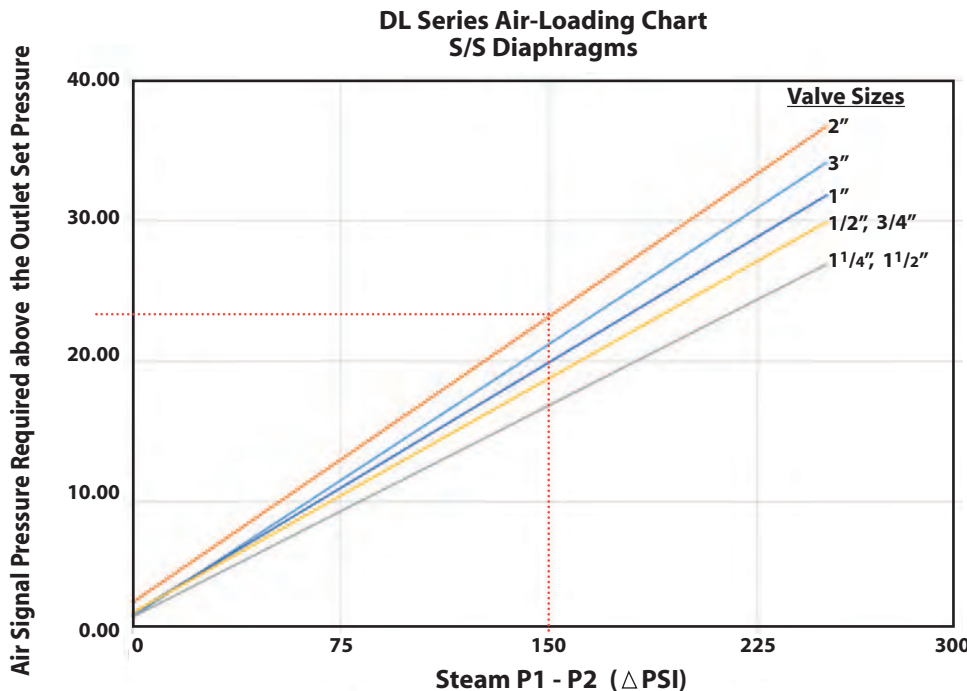
- Steam Inlet Pressure (P1) = 175 psig
- Steam Reduced Pressure (P2) = 25 psig

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

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

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

Total Air Pressure Required to Control Downstream Steam Pressure to 25 psig
 Air Signal = 25 + 23 = **48 psig**



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