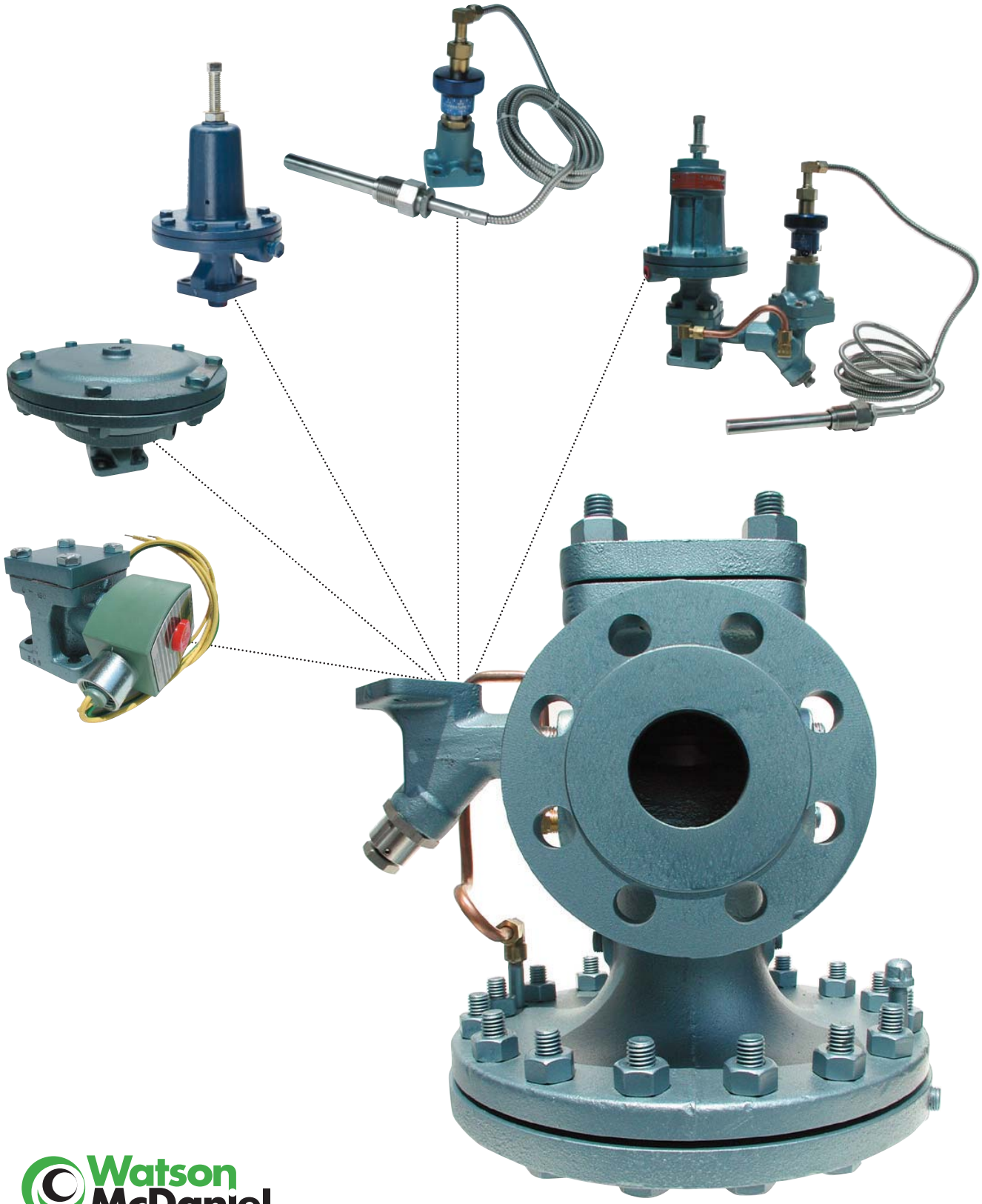
Pilot-Operated Regulating Valves



Watson McDaniel

HD Regulating Valve & Pilots

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HD Main Valve
Ductile Iron

Most Common HD Pilots

PP & PP5
PRESSURE
Spring-Loaded

PT
TEMPERATURE
Liquid Filled

PA
PRESSURE
Air-Loaded

PS
On/Off
(Solenoid)

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

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

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

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

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

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

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Other HD Pilots

PTRP
TEMPERATURE

PTR & PTL
TEMPERATURE
Controllers

PBP
BACK PRESSURE

PDP
DIFFERENTIAL
PRESSURE

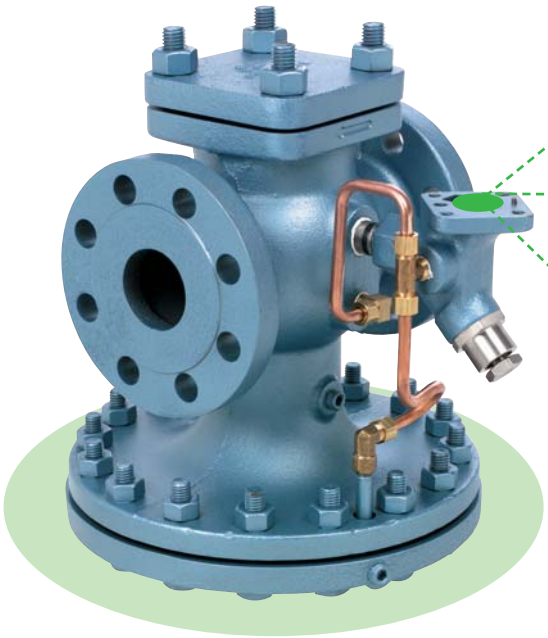
Introduction

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

The **HSP Pressure Regulator** has a Cast Carbon Steel body; available with pressure pilot only.

1) Select HD Main Valve →

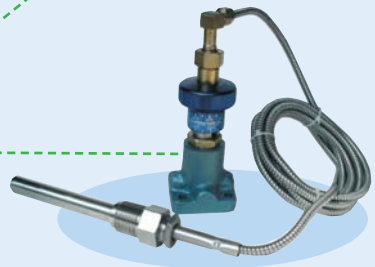
The HD Series Pilot-Operated Regulating Valves are used for controlling pressure and temperature in industrial and HVAC steam applications.



2) Select HD Pilot(s)

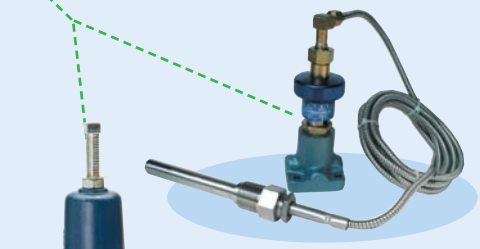
Model: **PP**

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



Model: **PT**

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



Model: **PT**

Model: **PP**

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

Typical Applications

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

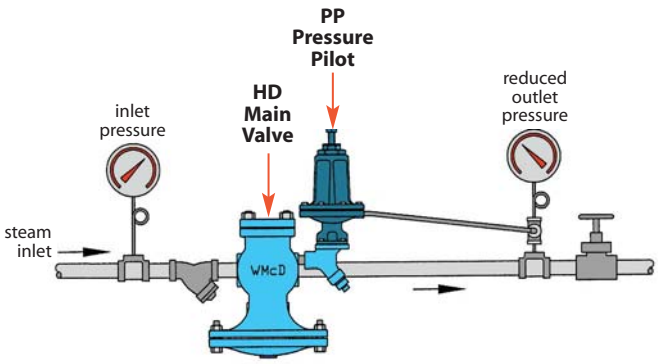
Combination Pilots

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

HD Main Valve
with
PP-Pressure Pilot

Reducing Pressure

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

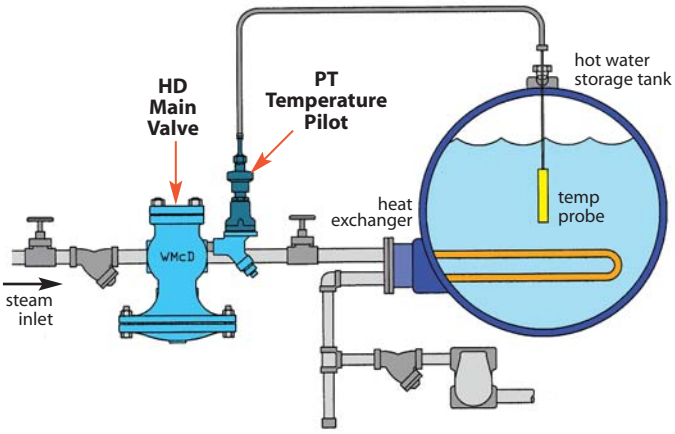


HD Main Valve
with
PT-Temperature Pilot

Controlling Temperature

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

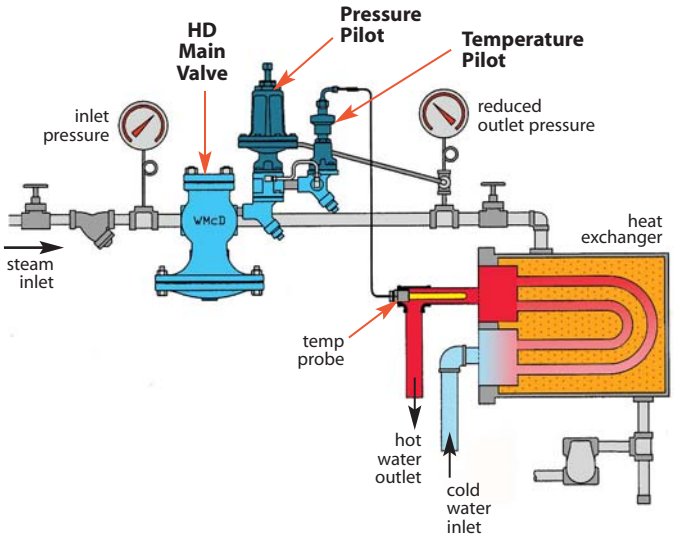
The PTL temperature controller uses a bi-metal element to sense temperature and deliver an appropriate air signal to a PA air pilot that controls the operation of the HD main valve.



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

Controlling Temperature & Limiting Pressure to a Maximum Value

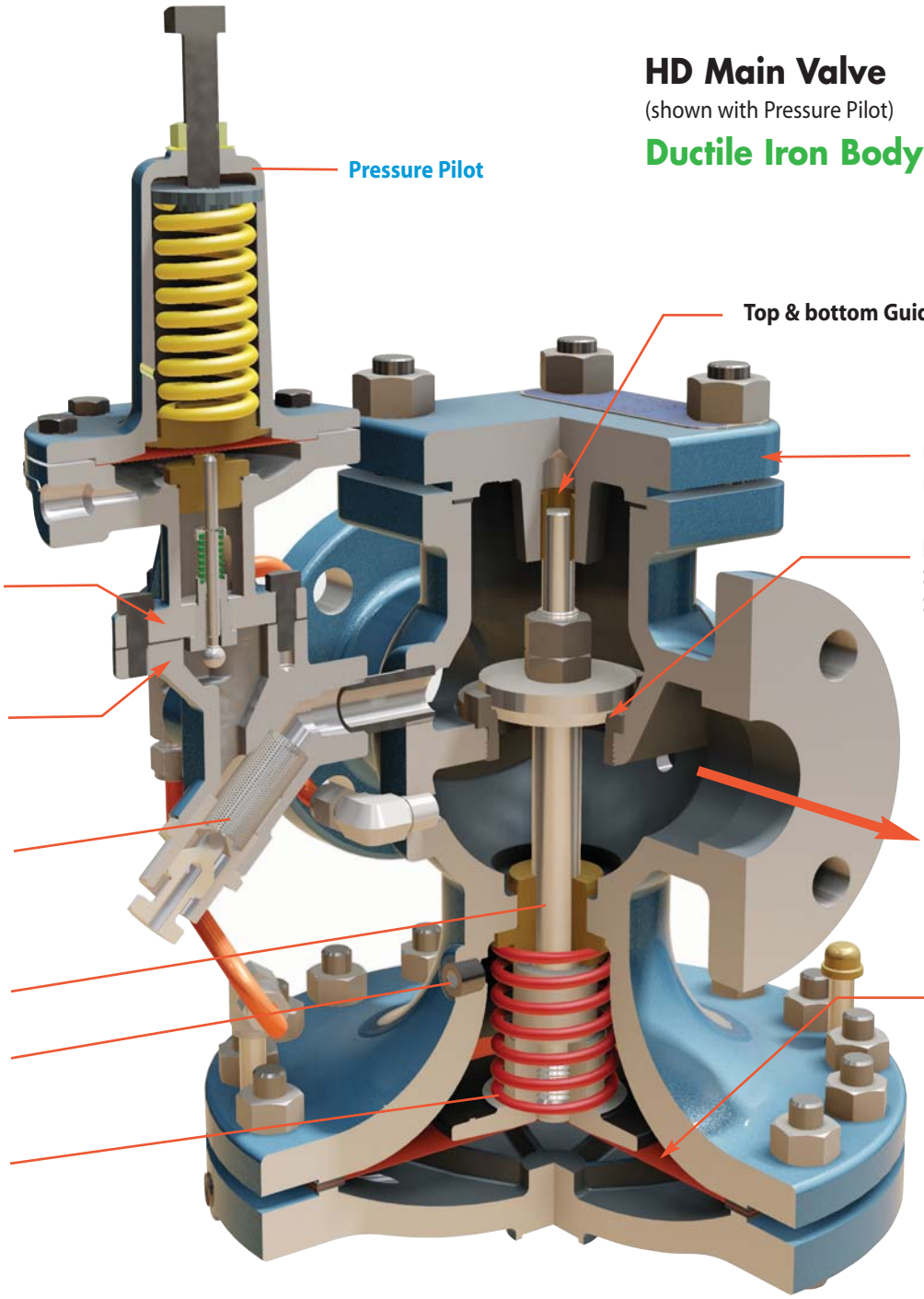
The PT & PP Pilot combination is used when it's required to control **temperature** while limiting **downstream pressure** to a maximum value. When the PT & PP Pilot combination is used, the downstream pressure is limited to a maximum setting by the pressure pilot, while the temperature pilot maintains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



HD Main Valve

(shown with Pressure Pilot)

Ductile Iron Body



Features of the HD Regulating Valve

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

Introduction

PP & PP5
PRESSURE
Pilot
Spring-Loaded

PA
PRESSURE
Pilot
Air-Loaded

PT
TEMPERATURE
Pilot
Liquid Filled

PBP
BACK
PRESSURE
Pilot

PS
ON/OFF
(Solenoid)

PTRP
TEMPERATURE
Pilot
Vapor Tension

PDP
DIFFERENTIAL
PRESSURE
Pilot

Typical Configurations

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

Pressure Control

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

Temperature Control

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

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

Temperature-Pressure Control

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

On-Off Operation

Electrical **On-off control** of the regulator is possible by using the **PS**-Solenoid Pilot. The **PS**-Pilot allows the regulator to be shut off or turned on **electrically**. Normally the regulator is equipped with either a **PP**-Pressure Pilot or **PT**-Temperature Pilot in addition to the **PS**-Solenoid Pilot.

Back Pressure

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

Differential Pressure

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

Stainless Diaphragm Option

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

Stainless Tubing Option

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

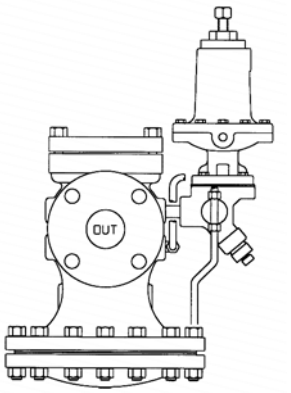
Reduced port trim Option:

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

Low pressure (differential and inlet) Option:

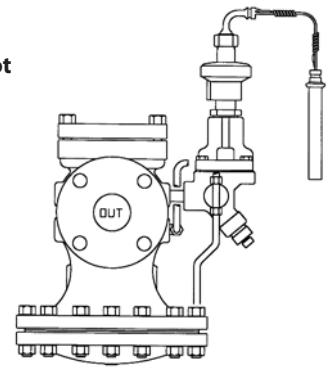
Regulators require a minimum Inlet pressure as well as a minimum pressure drop across the valve to operate properly. The HD Standard Main valve requires a minimum inlet pressure of 15 PSIG and minimum differential pressure of 10 PSI. The Low Pressure Main valve requires 5 PSIG minimum inlet pressure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

HD Main Valve
with
PP-Pressure Pilot
Spring-Loaded



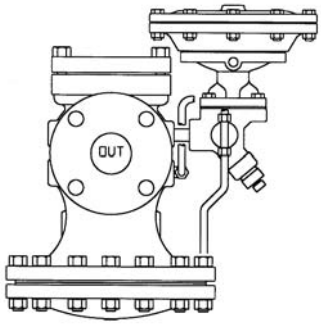
Shown with **PP** Pressure control Pilot. Spring-loaded pressure pilots are the most typical method of controlling downstream pressure in Steam Systems. Adjustment screw on top of pilot controls downstream steam pressure.

HD Main Valve
with
PT-Temperature Pilot



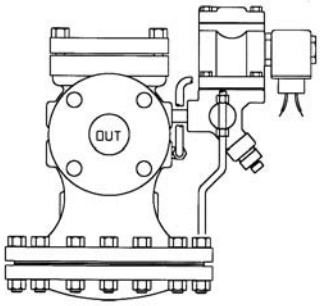
Shown with Temperature control Pilot: The **PT** Temperature Pilot will control the flow of steam flowing through the HD valve based on the temperature of the sensing bulb. The liquid-filled sensing Bulb is available in standard 8 ft and 15 ft capillary lengths. Other lengths available.

HD Main Valve
with
PA-Pressure Pilot
Air-Loaded



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

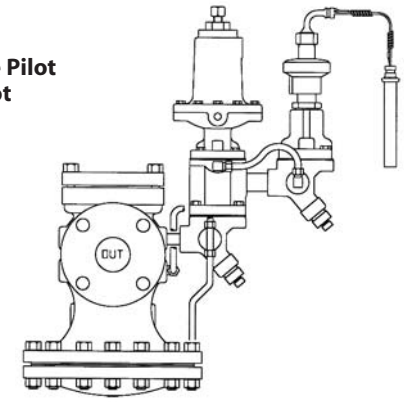
HD Main Valve
with
PS On/Off Control Solenoid Pilot



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

HD Regulator & Pilot Combinations

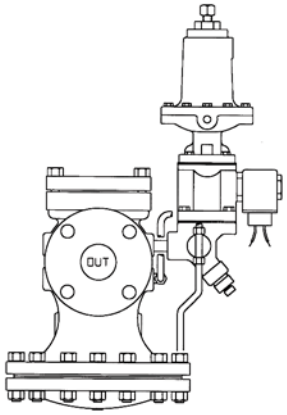
HD Main Valve
with
- **PT-Temperature Pilot**
- **PP-Pressure Pilot**



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

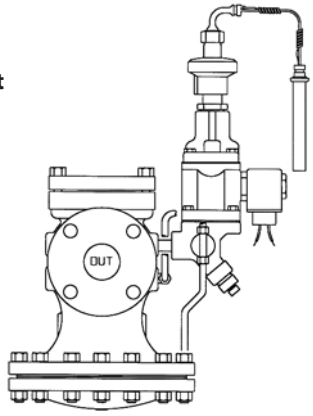
NOTE: When two or more pilots are used on the same valve: An additional Pilot Adapter for Second Pilot is required: Use part number: **BADAPTER**

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



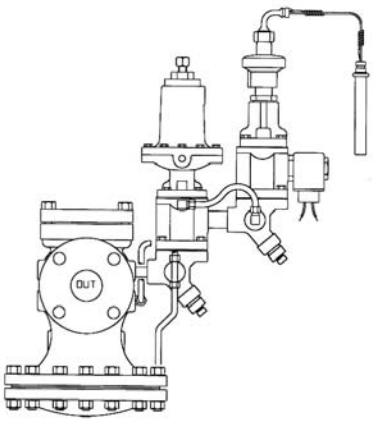
The **PP** Pressure Pilot will maintain the desired downstream set pressure as long as the **PS** ON-OFF (solenoid) Pilot is in the ON position. Available in either Normally-ON or Normally-OFF configuration; an electrical signal turns valve OFF or ON.

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



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

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



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

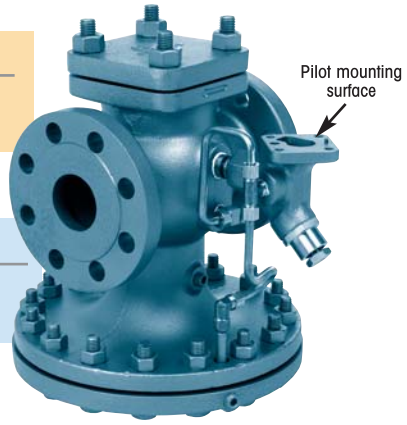
NOTE: When two or more pilots are used on the same valve: An additional Pilot Adapter for Second Pilot is required: Use part number: **BADAPTER**

HD Main Valve • Ductile Iron

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

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

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



Model Code Configuration Chart

Models		Code	Size	Code	Connection Type	Options	(Suffix)
HD	Full Port	**12**	1/2"	**N**	NPT (1/2"–2")	**SSD**	SS Diaphragm
HDR	Reduced Port	**13**	3/4"	**BSP**	BSPT (1/2"–2")	**SSXT**	SS External Tubing
		14	1"	**F150**	150# FLG (1" – 6")	**LP**	Low Pressure Main Valve Spring with EPDM Diaphragm
		15	1 1/4"	**F300**	300# FLG (1" – 6")		
		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.

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**

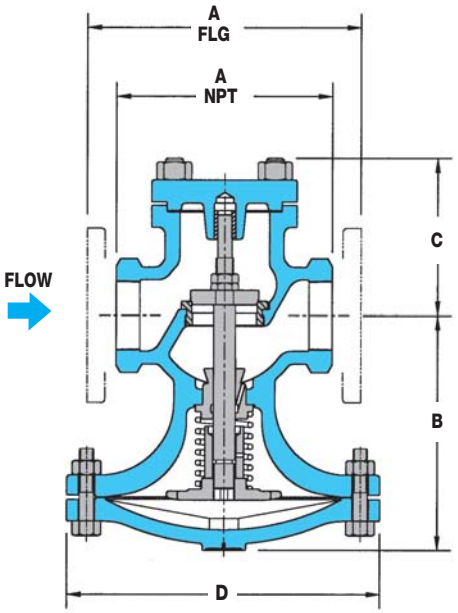
Example Model Codes for Main Valve:

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

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

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

HD Main Valve • Ductile Iron



HD-Series DIMENSIONS – *inches*

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

Option: Stainless diaphragms and external tubing - consult factory

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

OPERATING PRESSURES

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

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

** Not required for Temperature Pilot applications*

MATERIALS

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

Ordering Instructions: HD Series Regulator with a Pilot

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

HD Valve with Pressure Pilot

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

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

HD Valve with Temperature Pilot

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

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

HD Valve with Pressure & Temperature Pilots

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

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

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

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

Model Code for Secondary Pilot Adapter*: BADAPTER