Series 2000

Pressure and/or Temperature Pilot Operated Steam Regulators (continued)

How To Size Series 2000 Main Valves

Selecting the proper Series 2000 Pilot-Operated Regulator provides accuracy and efficiency in the control and operation of steam systems and their components. Series 2000 Regulator main valves are controlled by pilot valves. Pilot valves of different types can be used individually or in combination to:

- Control downstream steam pressure
- Control process temperature
- Control both downstream pressure and process temperatures in system components
- Provide a safety override.

A complete Series 2000 Regulator consists of:

- Main valve
- Control pilot or combination of pilots
- Hardware kit

For computer aided selection of steam regulators and pilots, please refer to the "Steam Specialty Component Selectors" on the Hoffman Specialty website, www.hoffmanspecialty.com or, for a stand-alone version of ESP-PLUS, contact your local Hoffman Specialty Representative (see back cover for listing).

Main Valve Sizing

1. Determine the available steam inlet pressure.
2. Determine the reduced steam outlet pressure.
3. Determine the capacity required by referring to the manufacturer's specifications for your equipment.
4. Apply the specifications (as determined in steps 1-3) to the Full Port Steam Capacity Table to determine the main valve size. If steam inlet pressure is below 30 psig (2.1 bar) use the Low Pressure Steam Capacity Table for Models 2150 or 2250 Main Valves.

   Guidelines:
   - To prevent seat damage and maintain control and accuracy, do not oversize the main valve. Select a regulator main valve that will operate between 50 - 100% of its capacity rating. If necessary, use Normal or Reduced Port Steam Capacity Tables.
   - A Normal or Reduced Port Main Valve is recommended for systems that will expand in the future.
   - The maximum recommended pressure drop across a single valve is 100 psig (6.9 bar). Operating with more than a 100 psig (6.9 bar) pressure drop may cause wire draw in the seat and excessive noise.
   - Although not recommended, a Series 2000 Main Valve may be used for pressure drops up to 150 psi (10.4 bar).
   - Main Valve noise data is available through "Steam Specialty Component Selectors" on the Hoffman Specialty website, ESP-Plus or upon request.
   - To prevent excessive relief valve popping, the relief valve set point pressure must be capable of being set as follows:

Downstream system pressure at no load pressure	Relief valve set point pressure = downstream pressure plus
≤ 35 psig	5 psig
> 36 psig	10 psig

5. Use the Main Valve Body Style Chart to select a model number (based on size and pressure).
6. Use the Ordering Information Chart to determine the part number (based on the model number).
7. Size inlet and outlet piping for velocity:
   For heating or indoor applications –
   4,000-6,000 ft./min. (1,219-1,828 m/min.)
   For industrial or outdoor applications –
   8,000-12,000 ft./min. (2,438-3,657 m/min.)

   Note: Main valve noise data available through ESP-Plus, or upon request.
8. Install drip traps ahead of regulators to drain condensate from steam lines.

Series 2000
Pressure and/or Temperature Pilot Operated Steam Regulators (continued)

Sizing Examples

Example 1.

Conditions:
In this example, the steam supply to the process equipment in the installation (system) will be regulated by one Series 2000 pressure regulator. Assume all equipment will be operating at the same time at a constant load.

Problem:
Calculate the steam load requirements for all of the equipment in the process system by referring to the equipment name plate. Then select a Series 2000 pressure regulator from the Steam Capacity Tables to determine the specific model pressure regulator and valve size needed.

Known Data
Inlet pressure 75 psi (5.3 bar)

Equipment Identification	Operating Pressure psi (bar)	Maximum Pressure psi (bar)	Equipment Steam Loads Requirements lbs./hr. (kg/hr.)	Pipe Size in.
A	20 (1.4)	40 (2.8)	300 (136)	½
B	20 (1.4)	30 (2.1)	600 (272)	¾
C	20 (1.4)	25 (1.75)	400 (181)	¾
D	20 (1.4)	25 (1.75)	800 (363)	1
E	20 (1.4)	25 (1.75)	500 (227)	½
F	20 (1.4)	50 (2.5)	600 (272)	¾
Total Capacity 3200 lbs./hr. (1453 kg/hr.)				

Procedure:
The steps to size a Series 2000 pressure regulator are listed on page 139. For this problem assume :

1. An inlet pressure of 75 psi (5.2 bar).
2. An outlet pressure of 20 psi (1.4 bar).
3. The steam load adds up to 3200 lbs./hr. (1453 kg/hr.) as shown to the left.

Procedure (continued):

4. Be sure to review the recommendations for good practice in selecting pressure regulators.
5. Refer to the Full Port Capacity Table page 45 first for the selection. The normal and reduced trim capacity tables should be used if there is a possibility the system will be expanded in the future.
6. Select the smallest regulator possible that will handle the steam load requirements. Typically it can be found in the Full Port Capacity Table.
7. When the outlet steam pressure is 50% or less of the inlet pressure, use the lowest outlet pressure shown in the capacity table.

Answer:

1. Referring to the Full Port Capacity Table, with the conditions given above under procedure, the correct valve to select would be a Model 2100 1½" Main Valve-Full Port.
2. Since in this example there is no supply of compressed air in the plant nor a need to also control temperature, a spring pilot would be selected to handle the outlet pressure requirements. This would be a Model SPS-30 with an adjustable range of 2 to 30 psi (.14 to 2.0 bar). Adjust the pilot to 20 psi (1.4 bar). A model SPS-60 pilot with an adjustable range of 5 to 60 psi (0.3 to 4.1 bar) could also be used.

Example 2.

Conditions:
In this example, a pressure/temperature regulator has to be selected to regulate the steam going into a steam to water heat exchanger. Due to a planned plant addition in the next 5 years, the steam system will be enlarged.

Problem:
The exchanger heats water from 50°F to 150°F (10-65°C) and has an assumed water flow of 50 gpm (189 lpm). The heat exchanger is limited to a 20 psi (1.4 bar) steam pressure. Assume the steam supply pressure is 100 psi (6.9 bar).

Known Data:
Temperature Rise — 150°F - 50°F = 100°F (66 - 10 = 56°C)
Water Flow — 50 gpm (189 lpm) = 3000 gph (11,356 lph)
Steam Inlet — 100 psi (6.9 bar)
Steam Outlet — 20 psi (1.4 bar) (heat exchanger limit)

Procedure:

1. Refer to table 2, page 126 to obtain the steam required to satisfy the above conditions. This would be 2500 lbs./hr. (1134 kg/hr.) according to the tables.
2. Since it is planned to enlarge this system at a later date, refer to the steam capacity tables for a normal port to obtain the regulator size .

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Pressure and/or Temperature Pilot Operated Steam Regulators (continued)

Sizing Examples

Example 2. (continued)

3. When the outlet steam pressure is 50% or less of the inlet pressure, use the lowest outlet pressure shown in the capacity table.

Answer:

1. Using the above data and referring to the Normal Port Capacity Table page 46, a 1¼" NPT main valve with a normal port that passes 2880 lbs./hr. (1306 kg/hr.) of steam would be selected.
   The order would be for:

   One, Model 2100, 1¼" NPT Main Valve-Normal Port.

2. Since temperature must be controlled, a combination of spring and temperature pilots should be selected. This would be:

   One Model SPS-60 with adjustable range of 5 to 60 psi. (0.3 to 4.1 bar) or one Model SPS-30 with adjustable range of 2 to 30 psi (0.1 to 2.0 bar). The pilot would be adjusted to the required 20 psi (1.4 bar).

   One Model STPA-200 with a temperature range of 50-200°F (10-93°C) would be selected and adjusted to 150°F (65°C) to maintain the desired temperature of water leaving the heat exchanger.

NOTE: An alternate option is to use a pneumatic temperature pilot with an air pressure pilot and an air regulator. This would be:

One Model 315 PNT with a temperature range of 50-300°F (10-149°C) adjusted to 150°F (65°C) to maintain the desired temperature of water leaving the heat exchanger.

One Model AP-1A Air Pressure pilot to receive the control signal from the pneumatic temperature pilot.

One Air PRV Regulator, adjusted to maintain a maximum 20 psi (1.4 bar) outlet pressure.

Typical Guidelines for Selection of Temperature Regulators

The degree of temperature variation depends on load change. The chart below is based on 0% through 100% load change.

Type of Heater	Application	Type of Regulator
Instantaneous Heater	Domestic Hot Water	Series 2000 with pneumatic pilot for ± 4˚F (± 2.2 ˚C). (must be used with anti-scald protection)
	Process fluids	Series 2000 with pneumatic pilot for ± 4˚F (± 2.2 ˚C). Series 2000 with STPA pilot for ±10˚F (± 5.6 ˚C). (System recirculation is recommended)
	Wash down stations	Same as process fluids (Pneumatic recommended if available)
	Steam to water converters	Series 2000 with either direct or pneumatic operated pilots. ± 10˚F (± 5.6 ˚C) accuracy.
Semi-instantaneous Heater or Storage Heater	Domestic hot water	Series 2000 with pneumatic temperature pilot ± 4˚F (± 2.2 ˚C) accuracy (must be used with anti-scald protection)
	Process fluids	Series 2000 with pneumatic temperature pilot ± 4˚F (± 2.2 ˚C) accuracy. Direct-operated pilots ± 10˚F (± 5.6 ˚C) accuracy.
	Wash down stations	Same as process fluids

Series 2000

Pressure and/or Temperature Pilot Operated Steam Regulators (continued)

A complete Series 2000 Regulator consists of:

– Main valve
– Control pilot or combination of pilots
– Hardware kit

There are a number of types of pilot control valves available:

- **Series SPS Spring Pressure Control Pilots –** for self-contained pressure regulation.
- **Series AP Air Pressure Control Pilots –** for remote pressure control using air pressure (requires an air pressure signal).
- **Series STPA Self-Contained Temperature Control Pilots –** for direct control of temperature in heated fluids.
- **Series 315 PNT and Series 240 PNT Pneumatic Temperature Control Pilots –** for rapidly changing load requirement applications (requires an air pressure signal and an AP Air pressure Control Pilot).
- **Series SLD Solenoid Pilots –** for remote control or safety overrides.

Different types of pilot valves can be used in combination to control more than one function or as a safety override. For example, a temperature pilot may be used in conjunction with a spring pressure pilot to control both temperature and pressure. Or, a temperature pilot may be used with a solenoid pilot to provide automatic shutdown when an over-temperature condition occurs.

For computer aided selection of steam regulators or pilots, please refer to the "Steam Specialty Component Selectors" on the Hoffman Specialty website, www.hoffmanspecialty.com. Or, for a stand-alone version of ESP-Plus, contact your local Hoffman Specialty Representative (see back cover for listing).

How to Select Series 2000 Pilots

Series SPS Spring Pressure Control Pilots

– for self-contained pressure regulation.

1. Determine the reduced steam outlet pressure to be maintained downstream of main valve.
2. Use the Spring Pilot Ordering Information Chart to:
   a) Select a model number (based on the outlet pressure determined above).
   b) Determine the part number (based on the model number).

Series AP Air Pressure Control Pilots – for remote pressure control using air pressure (Air PRV Regulator is also required)

1. Determine the reduced steam outlet pressure to be maintained downstream of main valve.
2. Determine the air loading pressure available from the Air PRV or Pneumatic Temperature Pilot.
3. Use the Air Loading Data Graph to select a model number that meets the requirements of the outlet steam pressure and available air loading pressure as determined above.
4. Use the Air Pilot Ordering Information Chart to determine the part number (based on the model number).
5. Use the Air PRV Regulator Ordering Information Chart to determine the part number.

Series STPA Self-Contained Temperature Control Pilots – for direct control of temperature in heated fluids.

1. Determine the process temperature of the fluid whose temperature is being controlled.
2. Determine the length of capillary tube required between the main valve and the temperature monitoring point.
3. Use the Self-Contained Temperature Pilot Ordering Information Chart to:
   (a) Select a model number (based on the temperature range and capillary range as determined above).
   (b) Determine the part number (based on the model number).
4. (Optional) Use the Well Ordering Information Chart to:
   (a) Select a model number (based on desired bulb material).
   (b) Determine the part number (based on the model number).