## PART 1 - INTRODUCTION

1.1 PURPOSE

A. This section is intended to define the general installation and minimum product requirements for Steam Pressure Reducing Valve Stations, it is not inclusive to the control valve, and encompasses the general requirements for the PRV station. The standard applies to both Building and Utility Systems.

1.2 EQUIPMENT AND SYSTEMS OF THIS STANDARD

A. PRV Stations
B. PRV Valves.

## PART 2 - GENERAL UNIVERSITY DESIGN REQUIREMENTS

2.1 MINIMUM DESIGN REQUIREMENTS

A. General:
   1. Pressure reducing valves shall generally be of the self-regulating pilot operated type. However, there will be applications where maximum and minimum response times to loads are not conducive to a self-regulating pilot operated regulator. In such an instance, the consultant shall review the application of air (pneumatic) operated control valve. Regardless of the valve type, consideration shall be given to the operating range (Lbs./Hr. flow) of the system and the use of parallel valves to prevent erosion of the valve and seat.
   2. Configure both single and two stage PRV stations with parallel two-third and one-third PRV valves. See applicable Yale detail for reference and requirements.

B. The consultant shall adhere to the following guidelines.
   1. Match the PRV Station to the application.
      a. Turndown ration: Turn down will likely govern the need for parallel PRV stations. The consultant shall understand the system minimum and maximum loads and the respective turndown ratios of the specified PRV.
      b. Although maximum steam flow rates are seldom, or never, reached in the operation of the steam PRV station, be certain the PRV meets or exceeds this rate. Just as important, the PRV needs to accommodate the minimum flow rate, as it will be a frequent and important control point. To summarize: the steam *PRV station* must be able to operate successfully at the minimum and maximum steam flow rates.
      c. Following are guidelines for turndown rations, the consultant shall select the PRV and manual valve configuration on manufacture specific turndown rations. Again, the following are guidelines only.
         1) PRV Station: 20 to 1

2) Globe valve: 30 to 1

d. In addition to meeting the requirements for a given application, all valves in a steam PRV station—including control and isolation valves—also need to meet permissible internal leak rate standards as designated by FCI/ANSI or API. The standards denote the tolerance level for steam leaking across the valve seat to pass downstream or to the atmosphere. FCI/ANSI designates six permissible leak rates, or classes, numbered I through VI. The higher the leak rate number, the lower the permissible internal leak rate.

e. Therefore, all the isolation and PRV valves should be Class IV or higher.

C. Specify a noise level of 85 dBA or lower

1. Setting an upper noise limit of 85 dBA for a PRV is more a function of managing outlet velocity and extending valve life, with the added benefit of reducing noise. PRVs that have high dBA levels will also have high outlet velocities and reduced operational life. A PRV with low dBA levels, or lower velocities, will have a much longer reliable operational life.
2. There are many ways to lower the dBA level in a PRV application, including increasing the valve outlet pipe size, muffling the orifice, or adding special trim. The valve manufacturer will provide the appropriate pipe size required after the PRV to achieve the desired dBA level. One can also use a muffling orifice plate to reduce a high-pressure drop across the steam valve to reduce velocities. In addition, special trim can be used to minimize velocity and noise.

D. Include a steam line drip pocket and steam trap.

1. All steam PRVs must have a condensate removal drip pocket piped upstream of the valve, with steam trap assembly.

E. Include a strainer with a blow-down valve

1. A strainer is also a requirement upstream of a steam PRV to protect the valve from materials that may corrode and or compromise valve seating. Steam lines frequently contain residual solid materials from corrosion in the steam line. The strainer will filter the steam stream and prevent this material from lodging within the valve, which could otherwise cause premature failure.
2. Never mount the strainer with the strainer segment in a down position; instead, install the strainer segment in a horizontal position. This will prevent condensate from accumulating in the strainer pocket and eventually passing through the PRV, thereby reducing the likelihood of internal erosion and premature valve failure. Finally, install a blow-off valve on the strainer to allow plant personnel to periodically clean out the strainer.

F. Locate the pressure reducing valve

1. Placing the steam PRV correctly in the station helps to ensure proper system operation. Make sure the distance after the steam PRV is at least 10 pipe diameters

before and after any change in steam flow direction or before the steam line takes offline. Pipe diameters shall be based on the pipe size before and after the connection to the PRV, not the PRV valve pipe size. Additionally, the sensing pilot shall be a minimum of five pipe diameters downstream of the PRV.

G. Position the pressure-reducing valve
   1. To extend the life of PRVs, always install them on horizontal steam lines, never vertically. A PRV in a vertical installation has no ability to eliminate the build-up of condensate prior to the valve's inlet. Condensate passing through a steam PRV always negatively affects the valve's life.

H. Use bypass valves and warm-up valves
   1. Bypass valves and warm-up valves should be used in all PRV installations. The warm-up valve warms the steam line within recommended time frames for the steam line. The warm-up is modulated and controlled during the start-up procedure. A steam PRV should not be used for warming up a steam distribution line.
   2. The bypass valve must have a flow coefficient (Cv) no greater than the PRV. When using the same diameter bypass valve as the PRV, the safety valve will have to be sized for the bypass valve, which shall have a Cv value no greater than that of the operating valves. Sizing the safety valve for the bypass valve will usually require the safety valve to be extremely large in size and capacity.

I. Safety valve requirement
   1. Safety valves are an important consideration in a steam PRV station. But they may not be required in every case. If any steam component or the steam line downstream of the steam PRV is not rated for the maximum inlet steam pressure to the PRV station, then a safety valve must be installed to protect the system.
   2. The safety valve needs to be sized for the maximum steam flow with the highest steam pressure that could be provided to the PRV. In addition, to ensure the proper safety valve size, perform calculations with the actual Cv trim available for the PRV. When installing a safety valve, be sure the discharge is piped to a location where it will not pose a safety risk for plant personnel.

J. Evaluate number of PRV's required.
   1. There will be times when a steam PRV station requires more than one PRV. For example, when the steam flow varies greatly and one valve does not have the required turndown capabilities, an additional valve—or valves—will be required to achieve the desired outlet pressure. In systems with more than one PRV, the safety valve must be sized based on the maximum capacity output of both valves.
   2. Note that the piping from the PRV to the downstream isolation valve should be designed and installed to meet the highest steam pressure at the inlet to the PRV. The downstream isolation valve is located before the safety valve that protects the system.

Therefore, if the isolation valve is closed and the PRV opens, the piping could experience the inlet steam pressure. Sensing shall be before isolation valve.

K. Install before and after pressure gauges
   1. Provide pressure gauges before and after the steam PRV as diagnostic tools. Be sure to include a siphon pipe and isolation valve for maintenance purposes.

L. Class and P&T Rating
   1. Devices such as but not limited to PRV's, and valves down steam of a PRV valve shall at a minimum have the same rating of said upstream PRV valve. For example, devices downstream of a Class 300 PRV valve shall have the same rating.
      a. Exception:
         1) If there is a pressure safety valve downstream of the PRV, devices are allowed to be derated to said maximum operating parameters of safety valve if compliant with applicable governing codes.

M. Establish a Standard Operating Procedure
   1. Every PRV station requires a SOP to ensure that plant personnel are starting, operating, and shutting down the valve station correctly and safely. Valve manufacturers shall provide a SOP as part of the documentation with the equipment.

## 2.2 MINIMUM PRODUCT AND SYSTEM REQUIREMENTS

A. General:
   1. Provide steam pressure regulators inlet and outlet pressure gages with cocks, inlet and outlet valves, inlet strainer with blowdown valve and globe-valve bypass line installed at the same plane as the main. Valves shall be rated for service pressure and temperature and tight shut-off against full line pressure.
   2. Pipe pilot valve to the main valve and the outlet side of the main. Pressure-sensing lines for pilot-operated regulators must be sloped continuously away from the valve pilot port to the sensing connection. Locate the first outlet side elbow at least 10 outlet pipe diameters from the regulator.
   3. Pipe reducers shall be eccentric type, flat side on bottom.
   4. Strainers shall be placed in a horizontal position, the orientation of the blow-down shall be placed at three or nine o'clock position, it shall not point down..
   5. Valve Sizing: Size such that flow velocity will be no greater than 8000 FPM, and in certified compliance with OSHA and Yale requirements for maximum dBA throughout operational range
   6. Safety Valve: Provided by the regulator manufacturer, matched for capacity and pressure compatibility, ASME labeled. Independently vent to atmosphere.
   7. Adjust regulators to the stated project required set-point.
   8. Provide steam traps per Yale standard detail.
   9. Provide in accordance with the Steam Pressure Regulating Valve Data Sheets of this

section.

B. Acceptable Manufactures
   1. Spence
   2. Armstrong
   3. Leslie
   4. Watson McDaniel

# STEAM REGULATING VALVE DATA SHEET

Valve tag: PRV – 1A

Function : Regulating

Service: High-Pressure Steam

Operating Pressure (Inlet/Outlet): (250 psig / outlet varies on project requirements) -

Maximum Rating
Pressure, psig: 450
Temperature, F: 600

Operator: Non-air remote sensing pilot

Body: Cast Steel, WCB

Trim: 304 SS

Seats: 304 SS

Seals: No seal

Packing: N/A

End connection: ANSI Class 300, RF

Body Construction: -

Accepted Models:

| Manufacturer | Figure Number | Size Range |
|---|---|---|
| Armstrong | GP-2000CS | 1/2 to 4 inch |
| - | - | - |
| - | - | - |

Notes:

1.) External pilot shall be cast steel ANSI 300.

# STEAM REGULATING VALVE DATA SHEET

Valve tag: PRV – 1B

Function : Regulating

Service: High-Pressure Steam

Operating Pressure (Inlet/Outlet): (250 psig / outlet varies on project requirements) -

Maximum Rating
Pressure, psig: 550
Temperature, F: 650

Operator: Self-Contained Pilot Operated

Body: Cast Steel, WCB

Trim: 420F SS

Seats: 420F SS

Seals: Garlock 3400 Grafoil

Packing: N/A

End connection: ANSI Class 300, RF

Body Construction: ASTM A-216 Grade WCB

Accepted Models:

| Manufacturer | Figure Number | Size Range |
|---|---|---|
| Watson McDaniel | HSP Series | 1 to 4 inch |
| | | |
| | | |

Notes:

1.) External pilot shall be cast steel ANSI 300.

# STEAM REGULATING VALVE DATA SHEET

Valve tag: PRV – 1C

Function : Regulating

Service: High-Pressure Steam

Operating Pressure (Inlet/Outlet): (250 psig / outlet varies on project requirements) -

Maximum Rating
Pressure, psig: 300
Temperature, F: 600

Operator: Self-Contained Pilot Operated

Body: Cast Steel,

Trim: SS Trim with resilient insert Buna-N, or Stellite

Seats: Diaphragm, Spiro-flex

Seals: -

Packing: N/A

End connection: ANSI B16.34 Class 300, RF

Body Construction: Cast Steel ASTM A216 GR WCB

Accepted Models:

| Manufacturer | Figure Number | Size Range |
|---|---|---|
| Leslie | GSP-1EP | ½ to 4 inch |
| | | |
| | | |

Notes:

1.) External pilot shall be cast steel ANSI 300.

# STEAM REGULATING VALVE DATA SHEET

Valve tag: PRV – 1D

Function : Regulating

Service: High-Pressure Steam

Operating Pressure (Inlet/Outlet): (250 psig / outlet varies on project requirements) -

Maximum Rating
Pressure, psig: 300
Temperature, F: 750

Operator: Self-Contained Pilot Operated

Body: Cast Steel, WCB

Trim: -

Seats: SS 316

Seals: -

Packing: N/A

End connection: ANSI Class 300, RF

Body Construction: -

Accepted Models:

| Manufacturer | Figure Number | Size Range |
|---|---|---|
| Spence | Model E | 1 to 4 inch |
| | | |
| | | |

Notes:
External pilot shall be cast steel ANSI 300.

| Date | Description of Change | Pages / Sections Modified | ID |
|---|---|---|---|
| 6/15/16 | Entire document | - | mlamore |
| 08/01/21 | Add Spence as an approved mfg. | - | mlamore |