

PRESSURE REDUCING STATION DESIGN GUIDELINES

I. SINGLE STAGE PRESSURE REGULATOR

1. When to use single stage regulator:
 - A. When load turndown requirement is generally no greater than 10:1.
 - B. When ratio of specific volume of steam, outlet to inlet, is no greater than 3 to 1.
 - C. When only one reduced steam pressure level is required.

II. PARALLEL PRESSURE REGULATORS

1. When to use parallel pressure regulator stations:
 - A. When maximum specified capacity requires selection of a pressure regulator greater than 12 inch pipe size. (It may be more economical to install two smaller valves than one very large one.)
 - B. When normal conditions require operation at 10% or less of specified maximum capacity for sustained periods.
 - C. When there are two distinct load requirements; i.e., summer/winter operation.
2. When to use a pneumatically operated parallel pressure regulator station:
 - A. When the combined accuracy of regulation of mechanically operated controls is unacceptable.
 For Spence mechanically operated regulators normal sizing/selection results in accuracy of regulation of approximately 5% of set pressure. Combined accuracy of regulation of mechanically operated parallel installed regulators is approximately 10% of set pressure.
 Pneumatically operated regulators equipped with reset maintain set point within 1% for all sustained flows.

III. TWO STAGE PRESSURE REGULATORS†

1. When to use two stage pressure regulator stations:

† Primary PRV requires optional base bypass and 1/8" bleedport.

- A. When intermediate steam pressure is required.
- B. When concerned with PRV generated noise, use two stage station when specific volume ratio, outlet to inlet, is greater than 3 to 1, unless manufacturer offers assurance or other means of meeting noise specification.
- C. When complying with Power Piping Code ANSI B31.1-1986, which reads, in part, "in district heating and steam distribution systems where the steam pressure does not exceed 400 psi (2758 kPa) and where the use of relief valves and vent piping are not feasible, two or more pressure reducing valves may be installed in series, each set at or below the safe working pressure of equipment served and no relief valve is required."

IV. TWO STAGE PARALLEL PRESSURE REGULATORS†

1. Whenever any condition from II and any condition from III applies.

SPACE CONSIDERATIONS FOR REDUCING STATIONS

1. Following are rules of thumb for approximating space requirements for installing reducing stations:
 - A. Single stage (with or without noise suppressors)

Inlet side: ten (10) diameters of PRV pipe size

Outlet side: twenty (20) diameters of final pipe size, where final pipe size is determined on the basis of 10,000 fpm line velocity.
 - B. Two stage

Inlet side of primary: ten (10) diameters of PRV pipe size.

Intermediate: twenty (20) diameters of secondary PRV pipe size.

Outlet side: twenty (20) diameters of final pipe size, where final pipe size is determined on the basis of 10,000 fpm line velocity.
 - C. Two stage with muffling orifice; same as A above.

PRESSURE REDUCING STATION GENERAL SPECIFICATION

- A. Pressure Reducing Station shall consist of:
 - pressure regulator
 - inlet strainer
 - inlet and outlet stop valves (gate type)
 - by-pass valve (globe type)
 - trap at inlet to pressure regulator
 - pressure gauges on inlet and outlet of station
 - pressure relief valve downstream of regulator
- B. Stop valves and strainer shall be at least pressure regulator size
- C. Expand pressure regulator outlet pipe size to obtain discharge line velocity which will not exceed:

Up to and including 2"	15,000 FPM
2 1/2" up to 8"	10,000 FPM
Above 8"	8,000 FPM

Regulator outlet velocity shall be limited to:

Up to and including 2"	45,000 FPM
2 1/2" up to 8"	30,000 FPM
Above 8"	24,000 FPM
- D. Unions shall be used on either side of screwed end by-pass valve and pressure regulator to facilitate removal.
- E. Pressure regulators 2-1/2" and larger shall have flanged ends and be suitable for pressure and temperature specified.
- F. Limit pressure regulator inlet velocity to:

Up to and including 2"	15,000 FPM
2 1/2" thru 8"	10,000 FPM
Above 8"	8,000 FPM
- G. Regulator sound pressure level while operating at specified maximum capacity shall not exceed 90 dbA as measured at a point three feet downstream and three feet from uninsulated pipe surface.
- H. Pressure regulator capacity shall not be greater than 120 of specified maximum capacity.
- I. For details of safety valve sizing and installation, please refer to the latest National Board Inspection Code and ANSI B31.1 Code.