

Basis of Design

This section applies to the design and installation of compressed air, vacuum, natural gas, and nitrogen systems.

Design Criteria

- Compressed air at 100 psig is available as a central piped utility in the tunnel distribution system. Determine the availability of compressed air central piped utility. Compressed air must be reduced to 30 psig before distribution to the laboratory compressed air system within buildings. Occasionally there is a requirement for 60 psig air, which should be served separately.
- Consider the use of an air dryer at the building compressed air service entrance because the dew point of the utility compressed air service is in the range of 60°F to 70°F.
- Size laboratory compressed air piping based on 0.5 scfm per outlet (unless actual flow is known) plus any known flow required for specific pieces of lab equipment. Apply reasonable diversity factors to the compressed air outlets based on the size of the system.
- In addition to laboratory use, compressed air will likely be used to serve the environmental control system pneumatic actuators and dry fire protection sprinkler systems. Provide a separate valved branch to serve each of the connections to the environmental control air system and the fire protection system at the building service entrance.
- Provide central building laboratory vacuum systems with an ASME receiver where practical. Duplex liquid ring pumps are the preferred type. Consider water conservation options for vacuum pump unit selections. Air cooled vacuum pumps are acceptable if cooling water is not available, check with Campus Engineering.
- The building central vacuum piping system will be sized to limit pressure drop across the system to a maximum of 3 inches of mercury vacuum.
- Size laboratory vacuum piping based on 0.5 scfm per inlet (unless actual flow is known) plus any known flow required for specific pieces of lab equipment. Apply reasonable diversity factors to system inlets based on the size of the system.
- Vacuum pumps will be controlled by a pressure switch in the receiver set to operate between 22 and 25 inches of mercury vacuum.
- Branch vacuum shall be connected to the top of the main vacuum piping.
- Natural gas is available as a direct buried utility throughout the campus. Coordinate with the civil consultant on the project team regarding the availability of natural gas utility piping near new project sites.
- Determine the natural gas anticipated usage for the project. Sizing of natural gas piping must be accomplished in accordance with the local code.
- Nitrogen storage for central systems should be from vendor provided cryogenic storage tanks located outside of the building.
- Provide isolation valves at each floor, laboratory and equipment connection.
- Laboratory nitrogen gas piping will be sized based on 0.5 scfm per outlet (unless actual flow is known) plus any known flow required for specific pieces of lab equipment. Apply reasonable diversity factors to the nitrogen gas outlets based on the size of the system.

Design Evaluation

The following information is required to evaluate the design:

- Programming Phase: Provide a narrative description of compressed air, vacuum, natural gas and nitrogen systems to include maximum anticipated usage volume. Define known future increases in anticipated usage volume if any. Describe each system's major components. Describe the flexibility of each system to accommodate future addition or renovation. Provide an estimate of energy and water usage for vacuum pumps and air compressors. Describe system reliability based on equipment selection to minimize downtime.
- Schematic Design Phase: Provide a block layout of the central equipment, pressure reducing stations, and pipe headers. Locate pipe risers, horizontal pipe runs, and the concept of outlet connections.
- Design Development Phase: Provide a preliminary layout of the central equipment, pressure reducing stations, and pipe headers. Identify the locations of outlets and equipment utilizing each service. Provide a preliminary layout of the horizontal pipe runs and risers. Provide preliminary one line system diagrams including the central equipment and the distribution piping. Provide a preliminary equipment schedule. Provide an outline of specifications and design calculations.
- Construction Document Phase: Provide a final layout of the central equipment, pressure reducing stations, service entrance, and pipe headers. Provide a final layout of the horizontal pipe runs, risers, and all outlet locations. Provide a final one line system diagram including the central equipment and the distribution piping. Provide a final equipment schedule. Provide final specifications and design calculations.

Construction Submittals

- Provide industry standard construction submittals.
- Provide layouts and diagrams of vendor provided equipment.

Related Sections

- Facilities Services Design Guide – Mechanical - General Requirements
- Facilities Services Design Guide – Mechanical - Plumbing
 - Plumbing Pressure Testing
- Facilities Services Design Guide – Mechanical - Piping, Valves & Accessories
- Facilities Services Design Guide – Mechanical - Hangers and Supports
- Facilities Services Design Guide – Mechanical - Metering and Gauges
- Facilities Services Design Guide – Mechanical - Nonstructural Component Seismic Design
- Facilities Services Design Guide – Mechanical - Identification
- Facilities Services Design Guide – Mechanical - Insulation
- Facilities Services Design Guide – Mechanical - Noise and Vibration Control

- Facilities Services Design Guide – Mechanical - Environmental Control Systems
- Environmental Health & Safety Design Guide – Sprinkler Protection & Standpipes
- Facilities Services Design Guide – Mechanical - Commissioning
- Facilities Services Design Guide – Civil – Earthwork
- Facilities Services Design Guide – Civil – Gas Distribution

Installation, Fabrication and Construction

- Natural gas or natural gas vent piping must never be installed in the campus utility tunnel system.
- Natural gas service entrance piping must be protected from accidental damage by vehicles, foundation settlement, or vibration. Where practical, the natural gas service entrance pipe should be above grade and provided with a self tightening swing joint prior to entering the building.
- Natural gas meters must be installed outside the building to avoid leakage concerns.

END OF DESIGN GUIDE SECTION