Hospital Checkup

Today’s hospitals are among the most complex of all building types. A hospital is comprised of an extensive assortment of services and components. They include analytical and treatment functions, such as clinical laboratories, imaging, emergency rooms, and surgery centers. Hospitality functions such as laundries, linen processing, waste management, food service, dietary facilities, laboratories, therapy pools, and maintenance shops make up the vast array of supplementary areas requiring specialty design. This assortment is echoed in the extensiveness and specificity of regulations, codes, and supervision that preside over hospital construction and functions. Due to the widespread and continuously developing needs of hospitals, their complicated plumbing systems require specialized knowledge and expertise to design and maintain.

A thorough hospital design is critical because lives are at stake. The design must meet not only the minimum code standards, but also must be customized to meet the limitations of people who do not have the physical capabilities of healthy people. The need for reliability, safety, flexibility, quality, and redundancy is vital for this type of occupancy.

Cross-contamination of piping systems has resulted in countless deaths throughout the United States in recent years. Most states have mandated that medical gas installers be certified and that a comprehensive testing and quality control program be performed for compliance. Good hospital design should save lives instead of taking lives.

Control of Legionella bacteria and other waterborne illnesses is also a critical component. The source of contamination is often the domestic water system. Water systems should be designed to avoid stagnation. Water systems need to be recirculating; piping should not be oversized; and water should be disinfected. Backflow preventers also are required on equipment between potable and nonpotable systems. Use instantaneous steam heat exchanger-type water heaters so hot water does not need to be stored. Decorative fountains should not be provided because they are a source of bacteria and waterborne illnesses.

A hospital’s plumbing design involves operations that occur at all times. This requires reliable, redundant pumps and equipment, backup water supplies, and high-quality systems. The systems will be used far more than those in a school or office building. The equipment must be designed and installed to last. It is difficult to remove critical components without backup systems. Shutdowns may not be possible. The equipment must be fully accessible for constant service and maintenance. Provisions should be made for isolating equipment, wings, floors, and sections of systems with valves and fittings. Equipment should be located to ensure quiet operation to not disturb occupants and staff.

JAMES STENQVIST, CPD, LEED AP, is a project engineer with Diversified Technology Consultants in North Haven, Conn. For more information or to comment on this article, e-mail articles@psdmagazine.org. This article is meant to provide some basic guidelines. Always check all relevant codes and resources for a particular project.
CHECKLIST FOR HOSPITAL CHECKUP

CODES TO FOLLOW
- NFPA 99: Standard for Health Care Facilities
- AIA Guidelines for Design and Construction of Health Care Facilities
- International Plumbing Code
- National Standard Plumbing Code
- Uniform Plumbing Code
- Americans With Disabilities Act
- State and local codes and standards
- U.S. Green Building Council

PLUMBING FIXTURES
- Water closets
- Lavatories and sinks
- Urinals
- Showers and bathtubs
- Drinking fountains and water coolers
- Service sinks

SPECIALTY FIXTURES
- Clinical sinks
- Scrub sinks
- Laboratory sinks
- Bedpan flushing devices
- Emergency showers and eyewashes
- Service outlets
- Hand-washing stations
- Bathtubs

SPECIALTY EQUIPMENT
- Dialysis machines
- Heart and lung machines
- Electron microscopes
- Stills
- Sterilizers
- Film processing equipment
- Dental equipment
- Ice machines
- Washers and dryers
- Decontamination equipment
- Kitchen equipment

MEDICAL GAS SYSTEM DESIGN
- Analyze each specific area to determine specific needs.
- Which piped medical gas systems are required?
- How many different types of medical outlets are required?
- Where should the outlet and inlet terminals be located?
- Which type and style of terminals meet the needs of the medical staff?
- Where are outlets and terminals located?
- What size and capacity of outlets and terminals are needed?

FUTURE EXPANSION
- Which direction will expansion take place (vertically or horizontally)?
- What size piping is needed for the future?
- Are valves for future connections required?

DETERMINE LOCATIONS OF MEDICAL GAS SUPPLY SOURCES
- Bulk oxygen (O₂)
- Cylinder manifolds (O₂, N₂O, N₂)
- Vacuum pumps
- Air compressors

VALVE AND ALARM LOCATIONS
- Zone valves
- Isolation valves
- Master alarm panels and sensors
- Area alarms

DEMAND LOADS
- Calculate peak and anticipated demands for each system.
- Appropriately size each section of pipe to avoid exceeding maximum pressure drops allowed.
- Size piping for future expansion.

IF PROJECT IS AN ADDITION
- What medical gases are currently provided?
- What are the locations and number of stations?
- Who is the current gas supplier?
- Will existing equipment handle additional loads?
- Are any existing systems valved for future extension?
- Are existing systems adequate to handle additional loads?
- What type of equipment is in use?
- Who manufactured the equipment?
- Is existing equipment state of the art?
- What is the physical condition of existing equipment?
- Is there space for new equipment at existing locations?
- Is existing equipment scheduled for replacement?
- What is the maintenance history of existing equipment?

TESTS
- Initial pressure tests
- Cross-connection test
- Pipe purge test
- Standing pressure test
- Pressure differential test
- Valve test
- Alarm test
- Pipe particulate test
- Pipe purity test
- Gas concentration test
- Air concentration test
- Labeling of piping and equipment
- Sequence of operation

QUALITY CONTROL
- Verify installer qualifications.
- Verify manufacturer qualifications.
- Verify materials and quality of workmanship.
- Ensure commissioning of systems.
- Verify installer performed testing and reports.
- Verify witness of tie-in points and cross-connection avoidance.
- Obtain test and witness reports and affidavits.