



DESIGN REQUIREMENTS

GENERAL MECHANICAL REQUIREMENTS

GENERAL INFORMATION

- 1.1 These Design/Construction Standards are prepared by the Columbia University Facilities Office. This is an effort to assist Design Professionals to understand the minimum standard requirements for all Columbia University Projects and to assist the design team in selecting systems and equipment that have performed well for the University in recent past projects.
- 1.2 It is not the intent to relieve the Design Team of their responsibility to seek out the best architectural/engineering solutions for a given project and to make certain that the project goals of quality, function, durability, aesthetics, budget, and schedule are best served by the design.
- 1.3 The Standards are prepared from past experiences with materials, equipment and systems and with recommendations from consultants and other Universities. If, in the course of the design the Design Professionals should wish to deviate from these Standards or indicate a particular item is not in the best interest of the University, the issue should be brought to the attention of Columbia University's Project Managers in writing for review and consideration by the Columbia University authority having jurisdiction.
- 1.4 Refer to Section 230800 for Commissioning Requirements.
- 1.5 Refer to list of Preferred Manufacturers.
- 1.6 Refer to Columbia University Guidelines for Laboratory Design Criteria.

DESIGN REQUIREMENTS

- 2.1 Design facilities to minimize annual operating costs and future repair and replacement costs.
- 2.2 There is a campus-wide Chilled Water and Steam Loop. Prior to connection to these loops, the loads must be analyzed to ensure proper flow and pressure is maintained in the system. The project engineer must provide demand load calculations to CU Facilities prior to tying into the Campus Loop Systems.
 - a. Condensate from the Steam System shall be returned to the boilers. In no case is the condensate to be dumped.

DESIGN REQUIREMENTS

- b. Flash Tanks with pumped condensate are the preferred method for returning condensate to the campus system.
- c. Any welding of high pressure steam piping needs to be x-ray inspected in accordance with the New York City Building Code
- d. Sustainable design, efficient operation and ease of maintenance are key elements of the Engineering Design. Each project should identify the use of various areas and ensure that the proposed design meets all the requirements of each area within the building (e.g. Classrooms, Offices, Lab Spaces, general use, etc.).
- e. Equipment rooms must be large enough to house the equipment and provide adequately sized access pathways for the repair, maintenance and eventual replacement of the equipment. Equipment access pathways shall be large enough to allow for the removal of coils and other large pieces of equipment. Access pathways shall be identified on the design document drawings.
- f. Mechanical rooms containing chillers shall include space requirements for tube punching and cleaning, as well as provide a lifting beam for removal of the chiller heads.
- g. Routing of utilities shall be done with future growth and renovations in mind. Coordinate with all trades to ensure unimpeded access to items requiring maintenance.
- h. A Basis of Design (BoD) Narrative shall be provided for ALL projects and shall include the following information for each space:

1. Indoor dry bulb temperature (Summer and Winter).

Note: Summer indoor design temperature shall be 78°F and winter indoor design temperature shall be 72°F. Coordinate space requirements, including humidification for critical spaces such as laboratories, with Columbia University Facilities.

2. Indoor relative humidity (Summer and Winter).
3. Outdoor dry bulb temperature (Summer and Winter).

Note: Summer outdoor design wet bulb and dry bulb temperatures shall be in accordance with New York State Energy Conservation Construction Code. Coordinate design criteria for systems serving critical spaces such as laboratories with Columbia University Facilities.

4. Outdoor wet bulb temperature (Summer and Winter)
5. Occupancy, hours and diversity factor



DESIGN REQUIREMENTS

6. Lighting and miscellaneous power
7. Ventilation – recirculation and outside air
8. Internal loads (heat and electric)
9. Special loads (heat and electric)
10. Insulating R-values for roof, wall, glass, etc.
11. Percentage of glass – fenestration
12. Type of glass, including coatings and solar coefficients
13. Building pressurization and infiltration
14. Building mass
15. Code requirements and impact on criteria
16. Air quality design criteria
17. Noise criteria
18. Fire and life safety
19. Energy efficiency and cost
20. Sustainability
21. Maintainability

Note that a statement of “meet local or city code” for any of this information is unacceptable for the bod narrative.

- i. Acoustic, indoor and outdoor design criteria must be stated on the drawings (first sheet of the applicable section). This should include indoor temperature, humidity and cleanliness (as applicable), outdoor temperature and humidity and Noise Criteria or Room Criteria goals for each occupancy classification.
- j. Design systems and components with maximum reliability, flexibility and minimum operation and maintenance cost. Give full consideration for future system alterations with a minimum of system shutdowns. Preventative maintenance should be accomplished without a major building shutdown. Maintenance accessibility is of extreme importance. Meet all current regulations for worker safety including fall protection. Provide access platforms wherever possible to reach equipment located above 10' AFF, group valves and items around platforms for ease of maintenance. Lifts or removable



DESIGN REQUIREMENTS

ladders shall not be relied upon for access unless approved in writing by Columbia University Facilities.

- k. Provide adequate access to all equipment requiring periodic maintenance. Show building access doors on both the mechanical and architectural drawing so they are properly located for maintenance and appearance. Provide equipment access doors with a minimum size of 18" x 18" unless approved in writing by Columbia University Facilities.
- l. Provide isolation valves and devices for each utility serving each space. Down feed all mechanical systems except the waste lines to minimize the number of floor penetrations.
- m. Mount equipment (fans and pumps) on a concrete housekeeping pad secured to the structural slab. Housekeeping pads shall be sized larger than the equipment and shall extend at least ten times the diameter of the mounting bolts past the equipment. Coordinate with Structural Engineer for final design.
- n. Provide pipe sleeves for all piping penetrations through floors, walls and ceilings. Include appropriate fire proofing when penetrating rated walls. Provide galvanized Schedule 40 pipe sleeves. Coordinate with Architect and Structural Engineer for location and installation.
- o. Include in the Engineering Specifications a statement that all components of the mechanical systems are to be kept clean and dry as well as undamaged as manufactured, delivered, stored and installed before operating the mechanical systems. The mechanical contractor is responsible for inspecting all equipment upon delivery for damage. Additionally, equipment shall be cleaned prior to start-up.
- p. Inter-Discipline Coordination
 - 1. Coordinate the mechanical work with other disciplines to define the work and responsibilities of the Mechanical Contractor. Because of the space taken up by the mechanical equipment, the Mechanical Engineer shall need to work closely with the Architect, Structural and Electrical Engineers to determine the building infrastructure. In many cases, the mechanical and electrical system space requirements shall necessitate changes to the floor plans, building sections and exterior elevations if not properly coordinated at the outset.
 - 2. All efforts shall be made to NOT locate equipment and valves above ceilings. Where, due to space or site conditions this is inevitable, coordinate the location of mechanical equipment above suspended ceilings with other disciplines. The lack of proper coordination can cause both construction and maintenance problems. Advise the Project Manager and Columbia University Facilities of possible conflicts and provide the details necessary to resolve those problems during the design process. Equip-

DESIGN REQUIREMENTS

ment located in ceilings shall be accessible for all maintenance activities required. This includes changing filters and motor I-belt adjustments. Equipment located above ceilings shall be placed in hallways or corridors, NOT in offices, classrooms or lab spaces.

3. Coordinate between the Mechanical Engineer and Electrical Engineer for equipment motors, motor starters, disconnect switches, thermal overload switches and mechanical controls for all mechanical equipment including AHUs, exhaust fans and pumps.

q. Record Prints

1. Record prints are available for most buildings on campus. Due to the age of the buildings, as well as the numerous (and often undocumented) renovations throughout the years, these prints should only be used as a rough guide to what exists. The Architect and Engineer should plan on extensive survey work to verify the accuracy of prints provided by the University.
2. All record prints loaned to the Architect or Engineer are to be scanned and returned as electronic versions along with the hardcopy. The scanned versions should be placed on a CD and scanned in a format suitable for importing as a background into AutoCAD.

CONSTRUCTION REQUIREMENTS

- 3.1 In renovation projects, shutdowns of existing utilities and services may be required. These shutdowns need to be coordinated through Columbia University Facilities, Capital Project Management and the Client / Users well in advance.
- 3.2 The Architect/Engineer must caution the Contractor that all shutdowns of systems serving occupied spaces outside the area of this project shall be absolutely minimized. This will require that, for example, branch duct runs shall be capped and sealed at the time of partial duct removal to allow use of the remaining duct system until the new ducts are installed. Temporarily rebalance if pressure relationships are critical. Ducts cannot be left open unless the entire system can be taken out of service throughout the full construction period.
- 3.3 Factor the impact of long lead time equipment in the project cost estimates and schedules.
- 3.4 All mechanical and electrical equipment shall be protected from construction dust. Before start-up, motors must be covered or enclosed in a dust free manner. After start-



DESIGN REQUIREMENTS

up the surrounding area must be kept as dust free as possible by regular and frequent cleaning, dust control compound, etc.

a. Renovation and Demolition

1. Remove abandoned branch piping back to risers/mains. Remove abandoned conduit and equipment. The abandonment of existing equipment and material in-place is not acceptable. Other systems which are presently operating that are to be abandoned, as well as those previously abandoned should be removed.
2. Conserve space as much as possible, ensure designs are compact.
3. The correction of existing mechanical problems and removal of abandoned mechanical equipment, while maintaining the operation of the building needs to be addressed in the contract documents.
4. Clearly identify any equipment or materials that are to be reused on the contract documents.

b. Operations and Maintenance Manuals/Turnover Documents

1. One (1) hardcopy set and four (4) sets of Columbia University Facilities approved job specific operating and maintenance (O&M) manuals shall be provided for each project. These manuals shall be collected in indexed three ring binders and contain manufacturer's operating and maintenance literature for every equipment item furnished for the project. Typical wiring or piping schematics are NOT acceptable; they must reflect the actual furnished equipment, including all options and interfaces with other equipment or systems.
2. A single copy of each job specific O&M manual shall be submitted immediately after all shop drawings have been approved. This copy shall be reviewed by the Architect/Engineer and University personnel, then sent back to the contractor for corrections. All corrected copies must be received by the University two weeks prior to any scheduled training.

REFERENCE

- 4.1 The applicable CSI Specification Section is 23 05 00.