230010-H: SUPPLEMENTAL HVAC DESIGN (15070-H)

Related Sections
Basis Guideline: 230010 - “HVAC Design”

HVAC Requirements
All centralized HVAC systems serving Inpatient hospital areas shall be designed so as to be fully maintainable without disrupting 24/7/365 patient care. 100% “redundancy” is typically not required, as long as a means is provided during part-load conditions to continue to serve hospital areas and not compromise temperature & humidity control as well as code-required air change rates and respective pressurizations. Examples of a fully maintainable system are:

- A multiple AHU layout with “headered” supply and return mains, minimum 4 AHU’s per header system; which allows for one AHU to be taken out of service, during off-peak loads, while continuing to meet facility needs.
- Chiller or boiler plants utilizing multiple smaller capacity equipment in lieu of a single, large piece of equipment.
- Provisions for stand-by pumps and/or fans (with necessary isolation valves/ dampers)

Inpatient Facilities shall utilize central chiller plant/ boiler plant/ air handling unit (or Central Power Plant steam distribution) infrastructure for building conditioning. Air systems shall be fully-ducted; plenum return systems are not allowed. The emphasis should be on centralized equipment selected for operating efficiency, system longevity, sustainability and required redundancy/maintainability. Packaged HVAC equipment (i.e. rooftop units) and unitary AC equipment (i.e. split/ package DX) are not preferred and highly discouraged because of their inherent operating inefficiency, shorter equipment life cycle and high maintenance costs.

Package HVAC equipment (i.e. rooftop units) are allowable for use in serving Outpatient Facilities and Ambulatory Surgery Centers. Air systems in Outpatient Facilities can utilize plenum return systems, except:

- Rooms required to maintain a room pressurization shall be fully ducted (i.e. OR’s, clean supply, etc.).
- Rooms required to maintain a minimum humidity level where the facility as a whole is not humidified (i.e radiology suites, etc).

The preferred HVAC system in UMHH Facilities is a constant discharge air temperature air handling system with individual zone control provided by pressure-independent variable air volume terminal boxes (VAV) with hot water reheat. Each variable air volume box shall have a minimum and maximum air volume set point scheduled on the design drawings.

Where building envelope heat loss exceeds 250 BTUH/ linear foot, the use of hot water perimeter baseboard or ceiling radiant panels is highly encouraged. In areas provided with perimeter radiant heat, the control of the perimeter heat shall be interlocked and modulated in conjunction with the terminal box serving that area. The interior zone room thermostat shall modulate box air flow and hot water coil modulating valve to maintain set point. The exterior zone room thermostat shall modulate box air flow, hot water coil control valve and hot water perimeter heat control valve, in sequence, to maintain set point.

In general, a pressure-independent variable air volume box, with hot water reheat coil and room thermostat shall be used to provide space ventilation and temperature control. Each VAV box shall have a minimum and maximum airflow set point scheduled on the design documents.
**HVAC Zoning**

Zoning shall follow requirements stated under the UM campus basis guideline 230010. The only difference is normal zoning for exam rooms & offices in Outpatient Facilities can be relaxed to allow:

- **Exterior Spaces:** Four spaces per thermostat control zone.
- **Interior Spaces:** Six spaces per thermostat control zone.

All other requirements apply.

AE shall give special attention to room use in zoning. Rooms of different use or with varying occupancy schedules shall NOT be zoned together. Examples of prohibited zoning are:

- Patient care rooms (ie exam rooms) with non-patient care rooms (i.e. offices)
- Conference rooms with other spaces (conference rooms shall have dedicated zoning)
- Offices with different occupancy schedules. This is of specific concern with clinical offices where the staff is normally not present in the office during working hours sharing an HVAC zone with other offices with staff actively working.

**Design Requirements- Future Growth, Spare Capacity, Existing Conditions**

When designing new installations, provide the following minimum spare, future capacity for all front-end heating, cooling & ventilation systems (AHU’s, chillers, boilers, pumps, fans, etc.):

- 25% future capacity for all Inpatient (I2 Use Group) facilities
- 10% future capacity for all Outpatient facilities and Ambulatory Surgery Centers

Verify exact requirements with UMHHC Mechanical Engineer. The design of future capacity shall include provisions in the distribution system (i.e. ductwork and/or piping) to facilitate the future capacity. A/E shall clearly indicate on the construction documents the extent of the distribution system designed for future growth.

New Inpatient facility designs shall provide shafts with a minimum of 25% free area for future growth.

Where future spare capacity prohibits the proper operation or limits the system’s energy efficiency (i.e. packaged DX systems), the A/E shall discuss a means of providing future spare capacity with UMHHC Mechanical Engineer.

When designing renovations to existing installations, verify the existence of spare capacity before utilizing it for the new loads. Field verify existing conditions- do not assume that existing "as-built" drawings are complete or accurate. The A/E shall be responsible for reflecting an accurate existing conditions plan for the scope of their work.

Architect/Engineer is responsible for hiring an approved Testing and Balancing Contractor during the investigative phase to perform pre-testing of the existing HVAC system if sufficient existing data is not available. The design must be based upon the actual performance, not initial design intent. Typically, testing data that is over 7 years old is viewed to be unreliable and new testing should be acquired. A/E shall contact UMHHC FPD Department for availability of all test and balance data.

Review of archived design & "as-built" drawings maintained at the UMHHC Facilities Planning Development department shall be an integral part of the A/E’s design process.

The A/E shall summarize the impact of all work that affects any of the hospital’s central systems. All central system upgrades/ modifications required to meet the project scope shall be identified and designed by the A/E, upon approval from the UMHHC Mechanical Engineer. As part of this work, the A/E shall be responsible for notifying UMH FPD of all UMHHC master document changes. Master riser diagrams currently kept and maintained by UMHHC FPD are:

- Chilled Water Systems
- Medical Gases
- Roof Safety Plans
- AHU Zoning/ Major Equipment Plans
Mechanical System Design Criteria

Acoustic data, indoor and outdoor design criteria shall be stated on the drawings (first sheet of the applicable section). This shall include indoor temperature, humidity, cleanliness (as applicable), outdoor temperature and humidity and Noise Criteria (NC) and/or Room Criteria (RC) goals for each occupancy classification. Confirm criteria with the University Project Coordinator or University Design Manager.

UMHHC Standard Design Criteria:

- **Outdoor Design Conditions**
  - Winter:
    - -10°F/ 0% RH
  - Summer:
    - 90°F DB/74.5° FWB (ASHRAE 0.4%) for Inpatient I-2 Facilities and Ambulatory Surgery Centers
    - 88°F DB/72.7° FWB (ASHRAE 1.0%) for Outpatient Facilities

- **Indoor Design Conditions**
  - Inpatient Operating Rooms/ Procedure Rooms (Infection Control Room Types 1 & 2)
    - Heating: 75°F DB/ 30% RH (A/E to confirm surgical need for elevated room temperatures [85-90°F] in specialized OR’s like cardiac & transplant)
    - Cooling: 62°F DB/ 60% RH
  - Ambulatory Surgery Center Operating/ Procedure Rooms
    - Heating: 75°F DB/ 30% RH
    - Cooling: 68°F DB/ 60% RH
  - All Remaining Conditioned Areas
    - Heating: 75°F DB/ 30% RH
    - Cooling: 72°F DB/ 60% RH
  - Utility Spaces (Heated and Ventilated)
    - Heating: 60°F DB
    - Cooling: 10°F above outside ambient

- **Cooling Towers Design Conditions**
  - 95°F DB/78°F WB

- **Acceptable noise levels**
  - Offices: NC/RC 40
  - Labs: NC/RC 50
  - All Remaining Areas: NC/RC 30

The minimum and maximum amount of outdoor air for each air handling system must be shown in the equipment schedules.