BASIC MECHANICAL REQUIREMENTS

General

Within the scope defined by the Program Documents, perform the project mechanical design work and produce the project mechanical construction documents in accordance with these Design Guidelines.

Related Sections

Tab “Special Instructions to Designers” - Section SID-F “Codes and Regulatory Agencies”

Design Requirements - Codes and Standards

In addition to the **Codes** listed in section "Codes and Regulatory Agencies", the following **Standards** apply to mechanical projects. Use most current update. Where these **Standards** conflict with related **Codes, Code** shall take precedence.

- State of Michigan Fire Marshal Division, "Fire Damper Clarification".
- NFPA 101, "Safety to Life from Fire in Buildings and Structures".
- NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- Factory Mutual loss prevention data sheets.
- NFPA 13 "Installation of Sprinkler Systems".
- ANSI/ASHRAE/IES 90A Energy Standard.
- ANSI/ASHRAE/IES 100.5 Energy Standard.
- AABC National Standards for Total System Balance.
- ACGIH Industrial Ventilation.
- ASHRAE Handbook - Fundamentals, Equipment, HVAC Systems and Applications, Refrigeration.
- ASHRAE 62 Ventilation for Acceptable Indoor Air Quality.
- SMACNA - HVAC Testing, Adjusting and Balancing.
- NEBB - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems.
- AWS D 9.1 - Welding of Sheet Metal.
- AMCA - Standards, Definitions, Terms and Test Codes for Louvers, Dampers and Shutters.
- NFPA 14 - Standpipe and Hose Systems.
- Michigan Occupational Safety and Health Act.

The enforcing authority is the University of Michigan.

Design Requirements - Future Growth, Spare Capacity, Existing Conditions

When designing new installations, consider providing spare capacity for future growth. When designing renovations to existing installations, verify the existence of spare capacity before utilizing it for the new loads. Also field verify existing conditions - do not assume that existing design drawings are complete or accurate.

Design Requirements - Maintenance Accessibility

Locate equipment requiring maintenance so that it is easily accessible. Avoid installations that require the use of lifts or scaffolding, or the removal of other equipment for routine maintenance. Provide access doors to all maintainable equipment located behind walls or above permanent ceilings.

Preferred Manufacturers

The University (Facilities Planning and Design) maintains a "Mechanical Trades Preferred Manufacturers List". This list is updated regularly, generally in February and August. The A/E shall use this list in developing construction document specifications. Obtain a current copy from the University Project Coordinator. This list is also available through this website.

Where specific manufacturers are specified in the detailed specifications other approved manufacturers listed may be substituted provided a model with similar quality exists.

Demolition Requirements

To maximum extent feasible, remove abandoned branch piping and ductwork back to risers/mains. Remove abandoned conduit and equipment.

The A/E 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.

Other systems which are presently operating that are to be abandoned, as well as those previously abandoned should be removed.

Operating and Maintenance Instruction Manuals

Four sets of **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. O&M manuals shall include a steam trap inventory with individual trap identification, service, manufacturer and model.

A single copy of each **job specific** O&M manual shall be submitted immediately after all shop drawings have been approved. This copy will be reviewed by the A/E and University personnel, then sent back to the contractor for corrections. All four corrected copies must be received by the University two weeks prior to any scheduled training.

Mechanical System Design Criteria

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. Confirm criteria with the University Project Coordinator

Outdoor Air Design Conditions

HVAC Winter:	Negative 10F & 0% RH
HVAC Summer:	92F DB / 72F WB (ASHRAE 1%) for lab/research areas 89F DB / 71F WB (ASHRAE 2.5%) for office/classrooms
Cooling Towers:	95F DB / 78F WB

Indoor Design Conditions - Acoustics

Class/Meeting rooms: NC/RC 30
Offices: NC/RC 40
Labs: NC/RC 50

Indoor Air Design Conditions - Temperature and Humidity

Design projects to produce acceptable indoor comfort. Consider the design application, all HVAC loads as well as initial and operating costs of various alternatives. To minimize cold drafts, provide new and existing buildings with perimeter radiation heat unless this requirement is specifically waived by the University Project Coordinator. At the same time, consider optimization of building skin to allow perimeter heat to be eliminated without compromising comfort.

Humidification is generally required, except where specifically waived by the University Project Coordinator. Criteria must be carefully selected to balance human comfort with building skin integrity. General winter humidification criteria for offices and classrooms: 30% RH. Several buildings have used central power plant steam for direct injection humidification. Some building occupants have complained about chemical treatment (amines) used in the central steam system. For this reason, the current standard for humidification in office areas (and other areas with relatively low outside air requirements) is to install a "clean steam" system, typically a steam to steam heat

exchanger, with RO or DI make-up water. In lab areas and other high outside air environments, direct steam is still acceptable. Consult University Project Coordinator early in the design phase to clarify project specific humidification guidelines.

General Space Criteria:

Office/ Classroom:	Summer: 72-75F dbt, 50-55%RH Winter: 72-75Fdbt, 25-35% RH
Laboratories:	Summer: 72-75F dbt, 55-60%%RH Winter: 72-75F dbt, 25-30% RH

Drawing Requirements

The amount of outdoor air for each air handling system must be shown on the equipment schedules.

Prepare the following mechanical drawings (as applicable to the project) for use during construction:

- Demolition plans and details
- Plumbing plans, including underground (within 5 feet of the building)
- Piping plans and details, including all utility meter locations
- HVAC plans and details
- Mechanical room layouts showing free space required for maintenance
- Plumbing, piping (including specialty gases) and HVAC (SA, RA, EA) risers

The drawing shall be of high quality in accordance with the Construction Documents Section of the Special Instructions to Designers.

Shop Drawings and Air/Water Test and Balance Reports

The University will retain three copies of all such submittals and the A/E will retain one copy. Therefore, the Contractor will be required to submit four copies of all such submittals plus however many copies he wishes to retain.

Access for Maintenance Operations

Add access hatches as required to service valves, dampers, coils, VAV boxes and mechanical equipment.

Structural Supports

All supports for piping and equipment shall be selected so that deflection caused by the load does not exceed 1/240th of the span.

Dust Protection

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

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