DESIGN GUIDELINE 230010
HVAC DESIGN

Scope

General requirements for HVAC design including zoning, design weather data, temperature and humidity, acoustics, and ventilation.

Related Sections

U-M Design Guideline Sections:
SID 2.1 - Owner's Project Requirements and Basis of Design Documents

Definitions

Zone: A group of one or more spaces having a single thermostatic control.

HVAC Zoning

Normal zoning for offices and office like spaces at the University of Michigan shall be:

- Exterior Spaces: Two spaces per thermostatic control zone.
- Interior Spaces: Four spaces per thermostatic control zone.

However, zoning for these as well as all other space types shall be configured to assure that the required temperature and humidity control ranges are attained.

Conference rooms and spaces on corner building exposures should be on a separate zone.

When establishing zones the following shall be considered:

- Similarity of sensible and latent loads
- Occupancy
- Occupant transiency
- Space type, e.g. lab, open office, class room, etc.
- Exterior exposure location/number of exterior exposures
- Allowable temperature and humidity range
- Impact of zoning on potential energy conservation opportunities
- Energy code requirements
- LEED credits

This is not a comprehensive list. The A/E shall determine the considerations specific to the project and design the zoning accordingly.

Mechanical System Design Criteria

Determine project specific temperature, humidity, air change rate, cleanliness, acoustic, and other design criteria for each space by consulting with the User and the U-M Design Manager. Indoor and outdoor design criteria shall be stated in the Owner's Project Requirements/Basis of Design Documents (OPR/BOD). When no OPR/BOD is planned, indicate this information on the drawings (first sheet of the applicable section).

Outdoor Air Design Conditions (Summer: ASHRAE Detroit Willow Run airport data)

HVAC Winter: Negative 10F & 0% RH

HVAC Summer: 87.9F DB / 72.7F WB (ASHRAE 1%) for lab/research areas
84.5F DB / 70.9F WB (ASHRAE 2.0%) for office/classrooms

Cooling Towers: 95F DB / 78F WB

Dehumidification (critical spaces): Select 0.4% or 1% ASHRAE dehumidification data in consultation with the U-M Design Manager.

Typical Indoor Design Conditions - Acoustics

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

Labs with Fume Hoods: NC/RC 50

Indoor Air 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 Design Manager. 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 Design Manager. Criteria must be carefully selected to balance human comfort with building skin integrity. General winter humidification criteria: 30% RH. Central power plant steam contains amines; when used for direct injection humidification this may be objectionable in some cases. For office and other areas with relatively low outside air requirements a "clean steam" humidification system may be appropriate. Clean steam typically consists of a steam to steam heat exchanger with RO make-up water. In lab areas and other high outside air environments, direct steam is often acceptable. Consult with the User and the University Design Manager early in the design phase to clarify project specific humidification requirements.

Typical Space Design Criteria

(These are the minimum performance levels the HVAC system shall be designed to achieve when the User or the U-M Design Manager is unable to provide specific requirements):

Office/Classrooms/Labs

Summer: 75F maximum dbt, 60% maximum RH

Winter: 72F minimum dbt, 30 % minimum RH

Typical Space Set Points

The following set points shall be indicated on the project control drawings when the User or the U-M Design Manager is unable to provide specific requirements for a space:

Office/ Classrooms/Labs:

Heating Setpoint: 71°F

Cooling Setpoint: 76°F

Throttling Range (DDC controls): minus 1°F heating, +1°F cooling.

Dead Band (minimum): 5°F

Ventilation

Provide designs that comply with the Michigan Mechanical Code (MMC) and with the latest edition of ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality. However, the natural ventilation requirements of the MMC shall govern over the requirements found in ASHRAE 62.1. The natural ventilation approach shall typically be limited to dormitories.

For any air handling system exceeding 5000 CFM that has multiple recirculation paths, use the Appendix A approach of ASHRAE 62.1 to optimize the System Ventilation Efficiency to adjust the required system outdoor air rate to the point which provides the lowest over-all energy cost. This is most easily accomplished using energy modeling software such as Carrier Hourly Analysis Program.