Design Guideline 132100
Controlled Environment Rooms

Scope

In general, follow the guidelines below when specifying package environmental rooms and related items. Several aspects of environmental rooms require close coordination with work of other sections. Among these are:

- Casework and shelving.
- Structural steel.
- Mechanical utilities.
- Electrical utilities.

Clearly indicate in specifications and on drawings all mechanical and electrical work which is required within the controlled environment room and which is required for connection to building utilities. Make sure that the equipment specification contains language that this work must conform to the requirements of Division 21, 22, 23 and 26 specification sections.

Include in the Specifications a requirement for submitting an Installation Manual (with the other project submittals) and an Operations and Maintenance Manual (prior to project completion).

Environmental rooms should be included in the list of equipment requiring commissioning in the project.

It is the Architect/Engineer's responsibility to obtain from the client and the Design Manager a complete understanding of how the environmental room(s) will be utilized and occupied and the required operating conditions (including special requirements such as the need for backup power and cooling). Backup power and cooling should not be provided routinely. It should be reserved for critical operations.

Related Sections

U-M Design Guideline Section:
1. Code and Regulatory Agencies

Design and Installation Requirements

General

No University-wide standards exist for interior and exterior panel materials or finishes. Most commonly, painted aluminum exteriors are specified with either painted aluminum or stainless steel interiors.

Size unit to suit user requirements and available area. Specify height requirements as well as length and width. Manufacturers have unique standard sizes, so close tolerances will need

special coordination during design. In general, avoid specifying units with less than 7.5 feet interior height (approximately 8 feet outside dimension).

Provide necessary wall reinforcement for shelving, countertops, equipment and any other wall-mounted items.

The door hardware must include a break-away type latch (with cylinder lock if needed) and inside safety release handle so that the door can be opened from the inside even if it is locked.

Provide slip-resistant flooring.

Provide adequate access, clear of any interference from other building elements, to the condensing unit and any other equipment mounted exterior to the unit. This access must incorporate a reasonable means of getting from the floor to the top of the unit (for example room for a ladder from the floor to the above-ceiling space). In most circumstances, access through a 2 x 2 ceiling grid will not be considered adequate unless portions of the grid can be easily dismantled to allow for a larger opening. Include a fluorescent light fixture, power receptacle, and switch mounted in the ceiling space to provide illumination and power for servicing at top of unit. Clearly delineate the required access on the drawings.

Consider enclosure panels around the top of units which do not meet suspended ceiling height. Panels may need to be vented and removable to accommodate roof-mounted equipment.

For environmental rooms that will be used for crystallization, provide the following special features:

- Remote mounted compressor/condenser units (not mounted on roof of environmental room).
- Self-closing and sealing doors.
- Quiet relays and switches.
- Refrigeration system piping, blower, dessicant wheel (if any) and other vibration sources mounted on vibration isolators, and not along environmental room walls.

For environmental rooms that will be used to house animals, provide quiet switches and relays.

Operating Requirements

Specifications should include information regarding at least the following project specific criteria:

- Operating temperature range.
- Control range
- Uniformity range
- Estimated door openings per hour and maximum per day
- Number of occupants (maximum at any time and average).
- Heating load in watts of operating equipment (scientific apparatus, etc.) within the room. If this load cannot be determined during design, assume heat load will equal 50 percent of outlet power capacity.
- Humidity range if applicable. Do not specify range if special humidity control is not required.

- Ambient conditions of the space in which the room will sit. Identify the maximum adverse condition likely to be encountered.
- Temperature range of process chilled water, if a water-cooled condenser is being used.
- Temperature and humidity range of makeup air (see Mechanical Design Requirements below) being supplied to the environmental room.

Furnishings and Equipment

Manufacturers

Shelving is available through the suppliers of environmental rooms, and is a recommended source of shelving if no casework from another source is to be provided in the environmental room.

Some laboratory casework is available from environmental room manufacturers. Refer to suppliers' use inside environmental rooms.

Materials

- Casework: Painted metal
- Countertops: Epoxy resin
- Free standing shelving: Stainless steel wire post and shelf systems. Consider specifying specifying the following:
    - Inlay mats to create a flat surface for small items.
    - Lateral stability clips
- Wall mounted shelving: Adjustable heights stainless steel wire shelving designed for environmental room use or standard laboratory solid phenolic shelves on adjustable brackets and standards.

Coordinate design of shelving/casework in environmental rooms with overall lab design.

Structural Steel

Structural steel support frames may be required if remote mounted condensing units are selected. For example, support frames will usually be required when mounting units on building roofs, and when condenser is to be located within the laboratory area, but not on the roof of the environmental room (occasionally necessary, due to overhead space limitations).

Mechanical Design Requirements

Coordinate utility installation, and ensure mechanical design takes into account the following:

- Makeup air to the environmental room: Provide makeup air if the room is to be occupied (rather than just used for storage of materials and samples). Follow Code requirements for ventilation. For other circumstances, the A/E must establish whether ventilation is required or advantageous. In general, if there is not a specifically identified need for ventilation, UM recommends not

providing it, since makeup air may introduce unwanted humidity in environmental rooms. If makeup air is provided, exhaust or relief must also be provided. Provide ducted exhaust connections (hard pipe or thimble connection as required) to meet the requirements for both environmental room exhaust and/or desiccant dryer exhaust. Do not allow exhaust to be discharged from the environmental room into the ceiling plenum.

- Heat from condensing coil must be rejected to building exterior or a cooling loop.
- Water-cooled units should normally be specified. Do not specify air-cooled units which reject heat into occupied space or suspended ceiling plenum. Water-cooled units using city water as the primary cooling fluid are not permitted. However, if continuous operation of the environmental room is critical, consideration must be given to backup cooling which might include City water. If city water backup is required, specify an alarm to notify BAS that the unit is operating with city water cooling.
- Provide accessible filters for the evaporator coil.
- Utility piping may be factory installed and concealed in environmental room walls, or may be surface mounted in the field. Either method is acceptable, as long as appropriate coordination of factory and field work requirements is provided. Note that crystallization rooms require piping mounted on vibration isolators.
- Pipe penetrations through environmental room walls must be coordinated with the room supplier. Room suppliers may, or may not, want to make the penetrations themselves. Mechanical specifications should call for coordination; leave the final decision of who makes the penetration to the Contractor. Penetrations must be sleeved and sealed.
- A drain line must be shown from the evaporator unit drip pan to a safe waste (one containing an air gap). In freezer rooms, the drain line from the evaporator unit drip pan should be routed outside of the room. Coordinate location and consider installing floor drain to accommodate the drain line.
- Humidification: If required, the A/E must evaluate the most cost-effective method for providing humidification for the environmental room. If house steam can be made available cost-effectively at the room location, it should be used for humidification. If a steam generator is specified, the water quality for the steam generator must be coordinated with the manufacturer's requirements. Some manufacturers may require treated water of certain resistivity. If this is not available in the building, it may be necessary to provide additional treatment as an option for the steam generator.
- Dehumidification: If required, the A/E should determine the most appropriate and economical method of dehumidification based upon the operating requirements and the type of equipment available from manufacturers. If a dessicant-type dryer is utilized, exhaust must be provided. See additional information regarding exhaust covered previously in this section.

Electrical Design Requirements

Coordinate utility installation, and ensure electrical design takes into account the following:

- Electrical panel and control panel must be provided by room manufacturer
- Electrical outlets and conduits may be factory installed and concealed in environmental room walls, or may be surface mounted in the field. Either method is acceptable (although concealed

conduits are preferred), as long as appropriate coordination of factory and field work requirements is provided.

- Conduit penetrations through environmental room walls must be coordinated with the room supplier. Room suppliers may, or may not, want to make the penetrations themselves. Electrical specifications should call for coordination; leave the final decision of who makes the penetration to the Contractor. Penetrations must be sleeved and sealed.
- Refer to Specification Section 262000 for information regarding the electrical panel.
    1. The panel should feed not only the loads within the room, but also the evaporator unit, compressor unit, control panels and any other equipment associated with the operation of the environmental room.
    2. If possible, locate the electrical panel next to the control panel. Do not locate it on the roof, or remotely from the controlled environment room.
    3. The electrical panel may be incorporated into the control panel, if this is the standard for the manufacturer. If this is allowed, the panel buses shall be braced for the available fault current, and the breakers rated to interrupt the available fault current of the distribution system. The panel shall also be UL listed for the application.

Coordinate connection of refrigeration unit, room controls and recorder, lights and outlets that are specified in Division 26.

- Lighting should be fluorescent (except incandescent for rooms with less than 0^{o} F.).
- Specify UL labeled, vapor-tight light fixtures equipped with two lamps. Refer to Design Guideline Section 265100, and Specification Section 265100 for information on the lamps and ballasts. Provide electronic ballasts where suitable for application.
- Refer to Master Specification Section 262726 for specification information for light switches.
- Provide a minimum of 3 receptacle circuits to the receptacle inside the unit. Refer to Specification Section 132100 and 262726 for specification information on receptacles. Provide ground fault circuit interrupter receptacles within 6 feet of sinks or other water sources. Receptacle circuits shall be 20 ampere rated, and each circuit shall serve no more than 3 duplex receptacles. Adjacent receptacles shall be fed from different circuits.
- Provide a 1" raceway path for any 'data outlet' installed inside the environmental room.
- Data outlets shall be two gang, deep, boxes unless installed in surface raceway. See also Section 272000.
- The controller should be digital and electronic. It should be programmed to maintain the environmental room within the operating criteria. Battery backup of the controller should be considered in critical applications to maintain temperature logs during power outages or other disruptions. The controller shall be located near the access door and maintained in clear view on the exterior of the unit.
- Recorders: Review with the Design Manager whether the manufacturer's standard chart will be adequate. Recorders for humidity-controlled rooms must include humidity as well as temperature readings.
- Alarms: Ascertain user requirements for both local and remote alarms. For remote alarms, consult with the Design Manager to determine whether alarms will be directly monitored by BAS (Building Automation System), which is typical for University Buildings, or to the Department of

Public Safety (via MOSCAD) in special circumstances. At a minimum, provide the following alarms:

- Common alarm for setpoint deviation or system trouble of temperature, humidity, etc.
- CO_2 set point deviation alarm and automatic CO_2 safety alarm (for elevated CO_2 rooms only).