

Security / Identification: All mechanical equipment rooms that house equipment/systems for which the F&S Division has responsibility shall be lockable/securable such that access is limited to appropriate employees of the F&S Division. The door lock serving each room shall be keyed to the standard mechanical room key. Therefore it will be necessary for the F&S Locksmith Shop to provide keying. No departmental equipment/systems that require access by non-F&S personnel shall be located within building mechanical equipment rooms for safety and security reasons. Each mechanical equipment room shall be labeled "Mechanical Equipment".

Equipment Room Access: Each mechanical equipment room shall be accessible from an egress corridor and/or from the exterior of the building only. Access to equipment rooms shall not be provided through other spaces such as restrooms, offices, etc. It shall not be necessary to travel through a vulnerable finished area or a functioning occupied area in order to reach an equipment room. Otherwise, finishes will become soiled and/or personnel/functions will be disturbed. Mechanical equipment room doors shall open outward.

Equipment Room Size / Layout: Mechanical equipment rooms shall be adequate in size and layout such that all mechanical equipment components such as heat transfer coils, heat recovery wheels, air-to-air heat exchangers, dampers, fans, fan motors and drives, heat exchanger tube bundles, pumps, pump motors, chiller tubes, chiller compressors, boiler tubes, and sump pumps can be conveniently accessed for inspection and/or maintenance and can be conveniently removed for repair or replacement. Service platforms shall be provided as required to provide convenient access to equipment that is not readily accessible from the floor level. Failure to provide adequately sized and properly configured equipment rooms results not only in initial installation difficulties but, more importantly, in operation/performance and maintenance problems for the entire life of the equipment. The importance of compliance with this requirement cannot be over-stated.

AHU / Ductwork Considerations: Each mechanical equipment room that houses air handling units shall be adequate in size and layout to allow the outdoor air plenum and ductwork, the return air ductwork and the actual mixing area upstream of each air handling unit to be properly configured. Proper configuration ensures that outdoor air enters the room/unit without water or snow entrainment and outdoor air and return air streams mix thoroughly prior to entering the unit. In order to accomplish this, a significant amount of space is required. This prevents coil freeze-up problems as well as nuisance trip-outs of freeze protection thermostats. VAV air handling units are especially susceptible to this problem. Each equipment room that houses ducted fans shall be adequate in size and layout for the installation of properly configured fan inlet and discharge ductwork. This results in proper air distribution system operation with maximum efficiency and minimal noise. However, it also requires space, space that must be provided when initially sizing and laying out the equipment room.

Provision for Equipment Removal: Mechanical equipment rooms shall be laid out internally and provided with one or more access openings that can accommodate the removal of all equipment assemblies or major subassemblies from the building for replacement or for repair and reinstallation.

Heat Rejection Equipment: As stated in the *Heat Rejection Equipment* paragraph within the *Building Cooling Systems* section of these *General Guidelines*, air cooled heat rejection equipment shall be located outdoors. Exception is made for smaller units dedicated to year-round process loads such as cold rooms and constant temperature rooms.

Lower Level Equipment Rooms: To the greatest extent practical, mechanical equipment and associated piping shall be housed within equipment rooms located at the lowest level of a building. This is especially true of rotating equipment prone to generating noise and vibration. Examples of such equipment include air compressors, vacuum pumps, air conditioning/refrigeration compressors, chillers and pumps. It is also important that systems prone to leaking fluid

or vapor or those prone to generating uncontrolled heat gain be located in lower level equipment rooms. These include chilled water BTU metering / pressure regulating stations, steam pressure regulating stations, steam reboiler humidification equipment, condensate return units, hot water generating equipment, chilled water heat exchangers and water treatment systems. It is acknowledged that optimized ventilation and heat recovery system design often places air-handling equipment at locations other than the lower level. However, all things being equal, the lower level is preferred.

Leak Prevention: It is inevitable that leaks or spills will occur in mechanical equipment rooms. Sometimes this is the preventable result of coil cleaning or draining operations. Regardless, special consideration shall be given to preventing leaks from impacting adjacent spaces when they do occur. Of special concern, of course, is the impact upon spaces below. Equipment rooms located on floors other than the lowest level shall have floors and wall bases sealed watertight. Floor penetrations for piping and conduit shall be sleeved and caulked, with the top of sleeves extended above floor level. Floor penetrations for ventilation ductwork shall have metal angles attached and caulked around the perimeter of each penetration to accomplish the same end. The above requirement for watertight wall bases applies even to lower level equipment rooms when adjacent to finished spaces. An adequate number/distribution of floor drains shall be provided in all mechanical equipment rooms and floors shall be aggressively pitched toward these drains. Proper pitching of floors toward drains is rarely achieved, resulting in many unnecessary problems. A curbed, watertight basin or secondary drain pan shall be provided beneath any piece of equipment that is especially vulnerable to leakage.

Vibration Isolation: We have found that mechanical equipment located in equipment rooms at the lowest level of a building rarely cause vibration problems. Thus, our standard approach is to “hard-mount” and “hard-pipe” floor-supported equipment. Having said this, it may still be prudent to

use a limited number of spring hangers for ceiling support of piping on either side of sizable pumps. Vibration isolation of sizable rotating equipment on upper floors requires more extensive structural planning. A less desirable, but alternatively necessary action may be to utilize vibration isolation devices such as inertia bases, vibration isolators and flexible pipe connectors for larger equipment although it may not be necessary for smaller equipment.

Adjacent Areas: Any space that is particularly sensitive to noise and/or vibration shall not be located adjacent to (including above or below) a mechanical equipment room that houses noise and/or vibration generating equipment.

Highly Sensitive Areas: Past experience has shown that it may be impractical (or impossible) to achieve adequate vibration and/or sound isolation to prevent unacceptable levels of transmission to highly sensitive lab equipment (e.g. high resolution electron microscopes) via HVAC system design. Although it is important to be aware of such requirements and give them adequate consideration, it is typically more cost effective to pursue special isolation and attenuation measures at the lab or instrument level and use standard HVAC system design for the balance of the building. Thus, the installation of costly vibration isolation equipment at each piece of mechanical equipment may not prove to be the most appropriate course.

Ventilation: Mechanical equipment rooms with significant heat gain shall be mechanically ventilated/cooled with filtered outdoor air. Makeup air shall not be mechanically cooled but may be heated if winter ventilation of the equipment room is required. Mechanical rooms that house heat producing equipment such as boilers, steam PRV stations, condensate handling equipment, heat exchangers, domestic water heaters, air compressors, and steam/condensate and/or hot water piping systems will likely require such ventilation. Mechanical rooms that do not house heating equipment typically do not require outdoor air ventilation. Given that such ventilation introduces undesired humidity within the

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building during summer operation it shall be provided only where needed.

Overheating: Steps shall be taken to prevent overheating, not only within the equipment room itself, but also within adjacent spaces, particularly those located directly above heat producing equipment (e.g. steam PRVs).

Equipment Pads: A reinforced concrete housekeeping pad that is dowelled into the concrete floor shall be provided for each piece of floor mounted mechanical equipment.

Sill Cock: Each mechanical equipment room shall be equipped with at least one sill cock with integral vacuum breaker. A minimum of one floor drain shall also be provided.

Safety: An approved eye wash and safety shower shall be installed at each location where hazardous chemicals are stored or handled.