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Environmental Health & Safety

Safe Access and Maintainability

It is important that safe access and maintainability of equipment and systems is provided to reduce risks and contain lifecycle costs. A safe means of access is mandated by the Washington Administrative Code which requires that the University provide to each employee a place of employment free from recognized hazards that are causing or likely to cause severe injury or death.

It is recommended that considerations of the code requirements and risk reduction measures are designed in the planning and design phases of a project. The hierarchy of controls should be applied to reduce injuries and illnesses from occurring, and whenever possible, eliminate potential hazards through inherent safe design. Next, implement engineering controls to minimize risks, followed by administrative controls and personal protective equipment.

1. General Design Guidance

Designing for safe access shall take into consideration the type of equipment/component and the frequency and work activity required. Provide a narrative of maintenance access requirements, noting any areas of the building where known fall or other safety hazards exist, and provide a plan for mitigating these hazards to provide safe access.

- a. Frequency of servicing and maintenance of equipment and components:

Frequent Access

- Good design and configuration should facilitate access for maintenance consistent with the frequency and type of maintenance required to be undertaken. Equipment such as cooling towers, chillers and air handling units (AHU) that require frequent access (up to monthly) for inspection and maintenance, and critical control devices (pressure relief valves, fire/smoke dampers, emergency shut-off valves) designed for preventing or mitigating major or severe impacts should provide clear and immediate access such as permanent stairs or guarded platforms and catwalks.
- Provide fixed stairs or a ships ladder where access to different roof elevations is required for such purposes as gauging, inspection, regular maintenance, etc., and when carrying tools or equipment by hand is normally required.
- For multi-story buildings provide at least one stair access to the main (flat) roof level and terminate in an enclosed space such as a penthouse. The slope of this stair should be uniform all the way to the roof. The top landing shall have enough space for the worker to set down tools and supplies while opening the door or hatch to the roof. The location of the door or hatch shall be designed without the requirement for personal fall protection equipment.

Occasional Access

- Equipment and components such that require occasional access (up to 6-monthly intervals) for inspection and maintenance should provide semi-clear access through clearly marked hatches and panels.
- For high level work areas where fall protection is required, access could be via permanent guarded ladders (platform ladders), guarded catwalks and scissor lifts. Such maintenance activities should not require the dismantling of services and building elements. Avoid designs that require personnel to work from portable ladders.

Infrequent Access

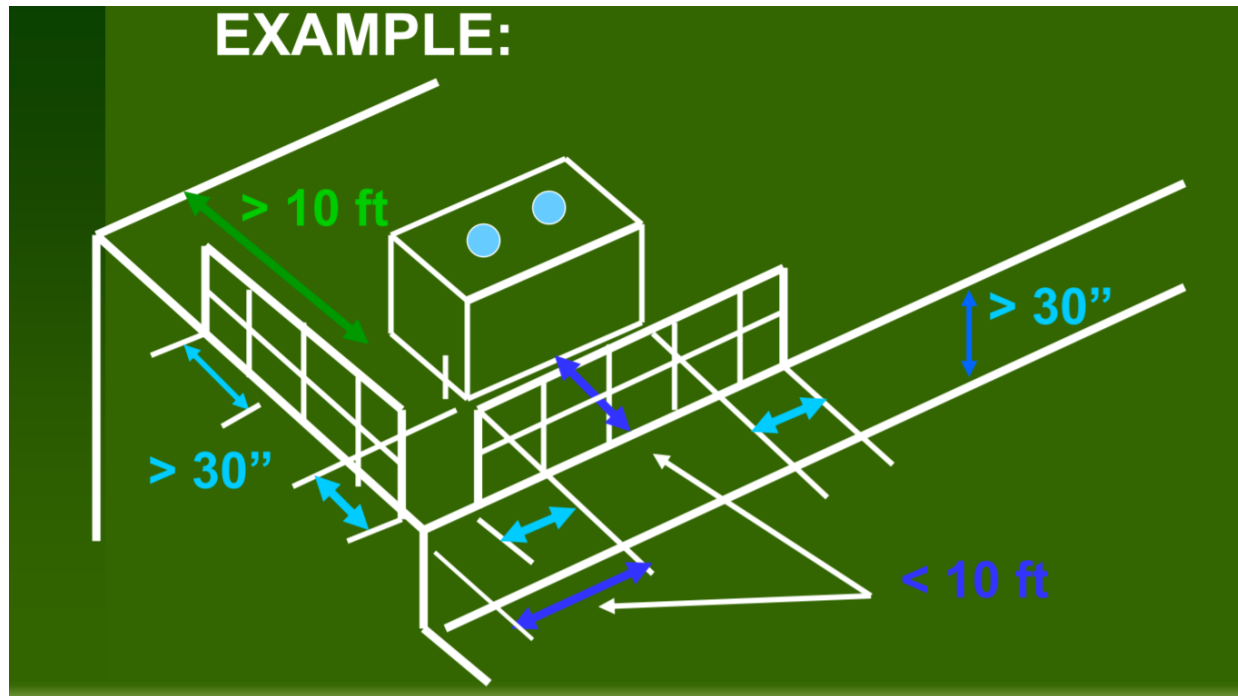
- Maintenance activities that require infrequent access (up to yearly intervals) and repair or replacement (e.g., plant components, pipework, ductwork), access could be provided through semi-permanent panels.
- For high level work areas where fall protection is required, temporary access equipment such as scaffolding, scissor lifts and portable ladders could be considered. Such maintenance activities should not result in extensive renovation or repair work. When fall protection is required the following hierarchy of practices should be implemented:
 - Eliminate the hazard
 - Standard guardrails
 - Fall restraint
 - Fall arrest

2. Fall Protection Requirements

- Provide guardrails for open-sided floors, walkways, and platforms at 4 feet or above.
- Roofs shall be designed with parapets at 42 inches +/- 3 inches.
- Provide [fall protection](#) when working at heights of 10 feet or greater. Fall protection using guardrails, fall restraint and fall arrest should be applied in the order of priority.
- Non-certified anchors designed for fall arrest must be load rated for 5,000 lb. Load rating of anchors can be reduced to 3,000 lb. with a self-retracting lifeline restricting the fall to two feet. Certified anchors shall be designed to 2 x maximum arresting force.
- Anchors designed for other than fall arrest can be designed in accordance with the fall protection regulations for fall restraint or positioning systems.

3. Location and maintenance of equipment and components

- Do not locate equipment within 10 feet of railings or parapet, unguarded platforms or walking/working surfaces or skylights. Locate equipment 15 feet from unprotected edges which eliminates the need for fall protection



- Provide building access doorways and pathways (minimum width of 28 inches) that are designed to manage the size and weight of the equipment in the event of removal.
- Avoid installation of utilities (mechanical, electrical, and plumbing) across walking and working surfaces to eliminate tripping hazards.
- Window washing shall be designed and construction to be performed from the ground, finished floor or platform with standard guardrails.
- Ensure walking and working surfaces have clear access of six feet eight inches (80 inches) above the finished floor or surface.
- Provide specified walkways or pathways on roof surfaces to minimize tripping and slipping hazards.
- Provide all working surfaces (including roofs) with 10 footcandles or more.
- Provide an installed hoisting system or a portable lifting device designed for the maximum intended load for removal of equipment where equipment and ancillary components weighing greater than 50 lbs. requires removal for maintenance or servicing, The material handling equipment shall be designed to effectively lift and remove the load to a desired location. Located lifting points directly above the equipment to be lifted. Provide portable hoists or install anchors rated for a chain or electric hoist that is designed with a safety factor of at least five.
- Provide clearance to allow for lifting and setting of equipment without interference with equipment or personnel.
- Provide safe access zones for servicing and maintenance. Provide sufficient working space around all equipment to allow safe operation and maintenance of equipment. In general, provide a minimum of three feet clearance to allow for variations in personnel dimensions

(anthropometric U.S. 95th percentile male population), utilization of tools and supplies, and code required clearance criteria for specific equipment.

- Lighting systems shall be provided with safe access for bulb, lamp and/or ballast replacement.
- Avoid locating access for servicing and maintenance in public areas. If access is in public areas, conduct operations using barriers and/or after hours.
- Locate valves six feet seven inches (79 inches) above finished floor or platform to minimize overhead work activity where arms are raised over 60 degrees. Located above this height, valves are recommended to be operated by a chain operator. Chain shall be accessed from floor or platform.
- Pipe discharges from pressure relief valves within six inches of finished floor or outside to the exterior of the building.
- Fire/Smoke Dampers shall be accessible and include the following:
 - Access doors shall be provided to dampers and shall not be obstructed. Swinging access doors shall open a minimum of 90 degrees.
 - Access doors should be large enough to permit inspection and maintenance (LOTO) of the damper and its moving parts. The door shall not be less than 12 inches square unless provided with a removable duct.
 - Access doors shall not impair fire resistive construction.
 - Access doors shall not require the use of tools, keys or special knowledge.
 - Access doors on fire dampers shall be located so that the spring catch and fusible links are accessible when the damper is closed.
 - Access doors should be installed as close to the fire and smoke damper as feasible. If feasible, the underside of the duct should be used rather than the side door.
- Locate all flexible hose connections between knee and chest height. Provide accessible gauges and vents/drains to ensure there is a method to verify pressure status and relieve residual/stored pressure.
- Nip and pinch points shall be guarded. Include interlocks where appropriate.

4. Hazardous Energy Control (LOTO): Access to energy isolating devices

- Energy isolating devices used for Lockout/Tagout (LOTO) must be able to accept an OSHA approved lock and tag. Light switches, E-stops, control circuits are not approved energy isolating devices.
- Locate energy isolating switches or disconnecting means adjacent to the equipment.
- Provide safe access to energy isolating devices and equipment (e.g., vent or drain valves) required to relieve stored or residual energy in accordance with the general requirements above based on frequency of work and in accordance with the electrical code.
- Separate low voltage (<50 Volts) from higher voltage to reduce electrical arc flash and shock exposure when working on low voltage system and eliminate de-energization of equipment.

5. Confined Spaces

References: OSHA 1910.146 Appendix F WAC 296-809 Safety Standards for Confined Spaces;
<https://www.ehs.washington.edu/workplace/confined-space-program>

- a. Eliminate by modifying equipment and its installation.
 - Provide access to the space that is not restricted in:
 - Size (e.g., code compliant door)
 - Ingress and egress (no obstructions, steps or impeded access or exit from the space)
 - Install critical equipment (valves, gauges, etc.) that requires periodic operation, inspection, or maintenance outside the space so that entry will not be necessary.
 - Extend valve handles so they can be operated from outside the confined space.
 - Use flexible components and install retrieval systems for items that are located at the bottom of the confined space (e.g., sump pump) so they can be removed and serviced without entry.
 - Install extension tubes and fittings to make lubrication possible from outside the confined space.
 - Install catch baskets at the bottoms of tanks or other spaces that can be raised to retrieve fallen parts to prevent the need to enter the confined space.
 - Use remote monitoring systems (cameras, gas detection, leak detection, wireless meter readers, etc.) to obtain information while outside the space.
 - Select mechanical equipment for maximum service life and minimal maintenance requirements to reduce the number of entries required. Over the long term, the additional cost of such equipment may pale in comparison to the cost of routine confined space entry.
 - Install viewing and cleaning ports in tanks and other equipment so that the interiors can be seen and cleaned without entering the space.
- b. Modify the space to make entry impossible.
 - Make access openings too small for a person to fit through.
 - If existing access openings are large enough to pass through, seal the openings (use security locks, weld openings shut, etc.), or block them by installing grating across the openings.
- c. If Entry is Necessary, Eliminate or Minimize safety hazards.
 - Install sumps and pumps to prevent accumulation of free-standing liquid, such as groundwater.
 - Ensure all electrical equipment is properly enclosed, grounded, and approved for the environment (e.g., Class 1 equipment for flammable gas and vapor environments, Class II equipment for combustible dust environments).
 - Install ground fault circuit interrupters (GFCIs) in wet areas or where highly conductive surfaces exist.

- Ensure that all energy sources in the space can be locked out, ideally from outside the space.
 - Construct fixed ladders using rust-free materials strong enough to hold 350 pounds. Install climbing devices wherever possible.
 - Protect all open-sided floor edges, floor holes, wall holes, and similar hazards with standard railings and toe boards.
 - Use non-slip flooring materials where possible.
 - Provide self-closing, swinging gates at the top access openings to fixed ladders.
 - Ensure that the means of entry does not pose a hazard. Use mechanical devices to lift or open heavy in-ground doors or manway lids. Use lighter composite lids if possible. Make sure doors will not swing shut in windy conditions.
- d. Design to Ensure Ability to Rescue when confined spaces cannot be eliminated
- The space should be designed to facilitate non-entry rescue to the extent feasible.
 - Provide access platforms of sufficient size to accommodate entry and potential rescue when access openings are elevated above floor level.
 - Provide multiple access openings into the space, preferably at separate locations for better access to all areas of the space.
 - Ensure openings are at least 24 inches wide or measure 24 inches in diameter. For vessel manways, 30-inch diameters are recommended.
 - Ensure adequate overhead clearance for use of a tripod or davit arm retrieval system during vertical entries (three feet minimum above manway and five feet horizontal). If there is not sufficient clearance, install a permanent anchor point (with at least 5,000 pounds static load capacity) above the opening to which a pulley or winch can be attached for rescue.
 - Employ a pulley system or install regular access points for rescue from spaces where a horizontal entry is used.
 - Install multiple large release hatches at the bottoms of sloped spaces.