Design Guideline 140000
Conveying Systems - General Requirements

Scope

This section defines general requirements for various conveying systems. Refer to individual Division 14 sections for additional requirements.

Consult with the U-M Design Manager for project specific requirements.

Related Sections

Design Guideline Sections:
5.6 Parking Structures

U-M Master Specification Sections: (A digitally accessible version is pending; please email AEC-Digital Accessibility Support if assistance is needed)
7.0 MS142100 – Electric Traction Passenger Elevator
7.0 MS142400 – Hydraulic Elevators
7.0 MS142216 – Wheelchair Lifts

Preferred Manufacturers and Sub-Contractors

Refer to individual Division 14 Specification Sections.

Operation and Maintenance

On the Ann Arbor Campus, all conveying systems discussed in this section (except as noted) are operated and maintained by the F&O Maintenance Services Elevator staff who can be reached at the Facility Services call center (734-647-2059). The Design Manager shall contact the Elevator Program Manager for specific maintenance records, inspection information or access, and for renovation or replacement recommendations. If working with an outside designer, the DM shall be the liaison for all information. Most general fund buildings are maintained directly by the Elevator staff. The elevators at the U-M Hospital, Athletics, and Student Life are covered under maintenance contracts with outside contractors, with limited oversight by the Elevator Program Manager.

The Elevator Program Manager shall be consulted at the beginning and throughout the design of all conveying systems, and should be included in review of shop drawing submittals, and O&M manuals for conveying systems.

Inspection and Licensing Requirements

Most conveying systems in the State of Michigan discussed in this section are inspected and certified by the State of Michigan. Refer to Design Guideline Section 1. "Codes and Regulatory Agencies."

Codes

In addition to the adopted version of the Michigan Elevator Code listed on the AEC website, design team shall also familiarize themselves and comply with all sections relating to elevators in other U-M adopted codes, such as Michigan Building Code, Michigan Electrical Code, Michigan Plumbing Code, Michigan Mechanical Code and all codes incorporated by reference therein. A list of these codes is located under Design Guidelines on the AEC website.

Elevators

Definitions

Passenger/service elevators with horizontally sliding doors typically for general use of all types, including cars, entrances, controls, safety equipment, and elevator machinery.

Freight elevators include vertically sliding bi-parting doors with automatic power operation used for transporting food, trash, and equipment.

Roped Hydraulic: The car is supported by steel hoist ropes and sheaves, which are moved up and down by a holeless single section piston in a cylinder.

Holeless Hydraulic: The car is connected on each side with a single section position that moves up and down in a cylinder, which is mounted on top of the pit floor.

Application

Passenger/service elevators are preferred over freight elevators in almost all cases, including "service" applications, where users expect to be moving trash, equipment, and materials in the elevator on a regular basis.

Requirements of Regulatory Agencies

Perform all work in accordance with applicable codes, the State of Michigan Elevator Code, the National Electrical Code, and the American Society Mechanical Engineering Code for Elevators ASME A-17.1 (latest edition accepted by State of Michigan). All tests shall be made in the presence of the authorized representative of such authorities and the Owner's representative.

Comply with barrier free sections of State codes and ADA.

Design and Construction Method

The delivery method for elevators specifies installation of **specific non-proprietary components** with which the University has a successful track record. Installation is done by a pre-qualified **elevator installation contractor**. Installation of "elevator manufacturer's standard" elevator is not acceptable. Refer to Master Specification Sections 142400, and 144200.

Non Proprietary

The non-proprietary delivery method shall be evaluated by the design team. A non-proprietary elevator allows for maintenance to be done by the U-M elevator staff or an authorized elevator repairman. The

components do not require specific manufacturer knowledge or tools for repair. Non-proprietary elevator applications may have a higher purchase and installation cost. This higher installation cost may be offset by lower long term maintenance costs and faster repair service.

Proprietary

The proprietary delivery method shall be evaluated by the design team. A proprietary elevator is limited in that only the manufacturer may service the installed elevator and may require special knowledge or tools for repair. Typically a proprietary elevator is purchased with an ongoing maintenance plan for a specific term. Service by the U-M Elevator staff is limited. Consideration should be given to life cycle cost for installation. A smaller up front purchase and installation cost may be outweighed by the long term maintenance contract requirements. Business units considering this application may consider the impact to their annual maintenance budgets versus original construction costs.

Selection of Type of Equipment (Traction vs. Hydraulic)

Building height and use shall determine if the elevator type should be traction or hydraulic. Design Professional to evaluate and provide documentation to support decisions. Choice shall be included in BOD and OPR documentation.

For Rise up to 45 feet: Select hydraulic or traction type elevator machine. Specify a hydraulic dry pumping unit, that is, the pump, motor and valves should not be located in the hydraulic reservoir. (Note: Piston stabilizers not allowed).

For Rise above 45 feet: Select electric traction elevator machines.

Hydraulic elevators are often less expensive than electric traction elevators, and don't require an elevator machine room above or near the hoistway, and are therefore often preferred by AEs. However, there are limitations and drawbacks to their application. Traction elevators should be installed in lieu of hydraulic elevators in high volume applications, where speed of travel is a high priority

Elevator Speed

Electric Traction Elevators Passenger/Service

- Minimum: 200 ft./miner
- Maximum: 350 ft./min.

Electric Traction Elevator Freight

- Minimum: 200 ft./min.
- Maximum: 350 ft./min.

Hydraulic Passenger

- Minimum: 100 ft./min.
- Maximum: 150 ft./min.

Roped Hydraulic

- Minimum: 100 ft./min.

- Maximum: 150 ft./min.

Hydraulic Freight

- Minimum: 100 ft./min.
- Maximum: 150 ft./min.

Elevator Control/Controller

For both hydraulic and electric traction elevators: Non-proprietary microprocessor controls are preferred. Specify remote diagnostics approved by U-M Elevator Program Manager.
Provide hinged doors, not single lift-off panels.

Elevator Shaft, Lobby and Machine Room Location Considerations:

Location: Coordinate with the Architect for location in the building for optimum service for the building. Elevators should be near stairs. Facility use and traffic patterns should be considered when determining locations. Consider grouping elevators for more efficient traffic movement in the building.

Security: Provide access control at building doors, not with card readers at the elevator landings or in the elevator cars. For security, locate the elevator within the building's access controlled area.

Elevators Air Lock: An air lock or transition chamber for controlling air pressure during ingress and egress shall be provided in multistory buildings (of 10 floors or more) when the interior is at an elevated air pressure, and also in parking structures so the doors are not opening directly to the exterior to save energy for heating/cooling.

Elevator Machine Room (for non-MRL elevators)

Machine Rooms: Modernizations (replacements) may require variances to be obtained by AE during design phase. Spaces shall be fire-rated to meet Michigan Building Code.

Fire Extinguisher: Mount on the wall of the elevator machine room near the main entrance.

Door Hardware: Keyed to U-M BEST "ZV" key system.

Signage: A permanent sign shall be placed on the EMR door that will be red plastic laminate with white text. First two lines of text to be approx. 1" high, last lines to be approx. 5/8" high letters. To read: "Elevator Machine Room [RM NO.-if no existing room no. sign]/Authorized Entry Only/For Entry Contact Facilities/Service Center At (734) 647-2059".

Painting: Paint elevator machine room floor with light gray gloss epoxy paint. Paint elevator machine room walls and ceiling with white semi-gloss latex paint.

Elevator Machine Equipment: Paint elevator machine light gray with zinc primer paint

Hoist beam: Provide in the elevator machine room above the machine. Size shall be suitable for the largest live load.

HVAC: Traction and hydraulic elevators require HVAC systems to maintain temperature between 55 to 85 degrees Fahrenheit and 95% relative humidity (non-condensing). The system must be capable of operating 24/7/365. Size system for full load (building skin and internal loads, including oil cooler for hydraulic elevators). A ductless split system is generally preferred. In buildings with year-round chilled water supply, use a fan-coil unit.

Vents: Many existing, older traction machine rooms include a floor vent that communicates directly with the hoistway. Where found, remove vents and provide fire-rated separation per Michigan Building Code in its place.

Pressurization: At this time, the U-M has no buildings tall enough to require this. We prefer it is not used if not required by code due to increased maintenance issues and costs.

Plumbing and Mechanical Systems: Many existing elevator machine rooms may contain pipes or ducts conveying gases, vapors or liquid and not used in connection with elevator operation. These shall be removed or permanently separated from the room.

Isolation Transformer: Provide space in the room for an isolation transformer. The need, size and capacity for such a transformer is determined by elevator controller manufacturer's recommendation, and is likely not known until after bidding. These are provided by the elevator contractor.

Lighting and Power Receptacles: Refer to the Electrical Requirement section below for these items.

Machine-Room-Less Elevators (MRL)

Control Room Location: The control room shall comply with codes and manufacturer requirements.

Communication: Two-way visual communication shall be installed between the car and the control room. Car position, movement, location and direction shall be monitored from the control room.

Signage: A permanent sign shall be placed on the Control Room or Closet door that will be red plastic laminate with white text. First two lines of text to be approx. 1" high, last lines to be approx. 5/8" high letters. To read:

"Elevator Control Room [or Closet] [RM NO. -if no existing room no. sign]/Authorized Entry Only/For Entry Contact Facilities/Service Center At (734) 647-2059". Do not provide a sign for in-jamb controllers.

Main Floor Signage: A permanent sign shall be mounted on the head jamb of the main floors entrance which shall read "MRL-Control Room Located On [No.] Floor". The letter size shall a minimum of 3/4" and shall be of contrasting color with that of the background

Working Clearance: A working clearance of at least 3'-6" shall be maintained in front of the elevator controller at all times. If in a shallow closet, clearance may extend into the adjacent corridor when the control room door is open. Additional width is preferred in the corridor to allow for more distance between mechanics and passers-by.

Other Control Room Disconnect Switches: See Electrical Requirements Section below.

Isolation Transformer: Provide space in the control room for an isolation transformer. The need, size and

capacity for such a transformer is determined by elevator controller manufacturer's recommendation, and is likely not known until after bidding. These are provided by the elevator contractor.

HVAC: The control room, closet, and hoistway shall be required to maintain a temperature range of 55 to 85 degrees Fahrenheit and 95% relative humidity (non-condensing)

Lighting and Power Receptacle: Refer to Electrical Requirements Section below.

Hydraulic Elevator Cylinder Unit

Pumping Unit: Pumping unit shall be dry and have the valve and motor located outside the reservoir. The unit must be mounted on isolation pads.

Hydraulic Oil Lines and Access: Provide clear access for hydraulic oil line between machine room and hoistway. It shall remain in conditioned space from end to end and remain within the building footprint. Existing underground piping must be replaced to meet code in replacement projects. Pipe to be scheduled 80 threaded.

Hydraulic Cylinder Casings: Comply with master hydraulic elevator specs.

Hoistways

Size/configuration: Hoistways shall be sized to fit the largest available equipment of the approved manufacturers listed in the AEC Master Specifications so that any company's equipment can fit in the space (when periodically replaced). Do not include a specific manufacturer as basis of design and sizing to meet that product's size requirements in construction documents, as low bidder's size could be larger.

Shaft Enclosures: Comply with Michigan Building Code for shaft enclosure rating.

Hoistway Entrance Doors and Frames: Entrances shall be painted hollow metal or stainless steel construction. Consider corner guards in areas where carts will be used. Specify the rear (hoistway) side of landing doors to be white, to provide reflectance for safer working conditions in the hoistway.

Sills: Sills shall be of extruded aluminum or nickel silver construction with non-slip wearing surface. Supported on steel brackets and securely fastened to the floor slab. If cast still is in acceptable condition re-use.

Class of Loading for Elevator: Provide Class C3 loading for sill and platform for all types of elevators.

Shaft Paint: Painting is provided in Student Life / Housing, Parking Structures and Medical School buildings. Painting is not required in general fund buildings. In Parking Structures or on exterior walls, paint elevator shaft interior walls with latex ceramic wall paint per LTP Painting Specifications to insulate the shaft against heat loss and moisture damage. Use white paint to provide the most reflectance for safer working conditions in the shaft.

Hoistway Ventilation: Hoistway venting is required per code, except where the building is equipped throughout with an approved automatic sprinkler system.Location of Vents: Vents shall be located at the top of the hoistway and shall open directly to the outer air or through noncombustible ducts to the outer air with a back draft damper.

Pressurization: At this time, the U-M has no buildings tall enough to require this. We prefer it is not used if not required by code due to increased maintenance issues and costs.

Hoistway Heating: In hoistways in parking structures or with any exposed exterior wall, provide an electric heater mounted inside the hoistway in the pit, middle, and top (determined based on height and dimensions of hoistway(s)). Do not use steam or gas heat. Temperature set point to be 70 degrees F. This is to prolong the life of the equipment in the hoistway.

Exterior Hoistway: Provide automatically controlled heat in hoistways to meet code requirements, accounting for building envelope losses and infiltration at doors. Use listed/certified electric heaters with disconnect switches for each unit heater in accessible locations inside the hoistway. Also refer to the section for Elevator Lobbies.

Shaft Lighting: Refer to Electrical Requirements Section below.

Pit Area

Construction at bottom of hoistway: Shall meet building code for all location types.

Pit Painting: Paint pit floor and walls (up to sill) with two coats of light gray, gloss, and oil based paint. Include the interior of the new sump crock if made of concrete.

Access Ladder: Galvanized steel ladder to be mounted to floor and wall shall have skid resistant rungs and extension above landing per elevator code.

Sump Pumps:

- Provide sump pumps in compliance with the Michigan Elevator Code per ASME A-
- 17.1 (latest edition accepted by the State of Michigan) and Michigan Plumbing Code.
- Subsoil drains shall not be connected or discharged to elevator pits or sumps.
- Multiple hoistways may be served by a common sump and this is preferred by UM.
- Pumps ≤ 1 HP should normally be 120 VAC single phase.
- Pumps > 1 HP should normally be 208 VAC three phase.
- The pump power cord shall be plugged into a non-GFCI power receptacle located in the hoistway. This arrangement shall serve as the pump disconnecting means in the hoistway. Power to this receptacle shall be controlled by the pump controller to cycle the pump on and off.
- For *new hoistways* indicate that, at the contractor's option, the sump may be either (1) cast-in-place and water-proofed with the same sealer used to water-proof the hoistway floor, or (2) a fiberglass sump. In either case, a sump cover shall be provided with a cut out for discharge pipe, and the cover shall be removable without disassembling the pipe.
- For *existing hoistways*, the design should typically include a fiberglass sump with cover.
- Pumps shall be controlled by dual non-mercury float switches consisting of a “normal” level float switch and a “high level” float switch. “Oil Smart” or similar level controls shall not be used.
- Pump power cord, float switch, oil level detector cords (where oil separators are used) and any other control wiring shall not be run in metal conduit. Float switch, oil level detector cords (where oil separators are used) and any other control wiring shall be run in PVC conduit properly secured to the hoistway wall and floor. Conduit shall be connected to the sump cover and the conduit's inner diameter shall be sealed with sealing putty.

- Pumps Serving Traction Elevators:
    - Typical Sequence of Operation for Pump (modified to make project specific): the Pump shall be cycled by the "normal" float switch to maintain normal fluid level in the pit. If high fluid level is detected by the “high level” float, the pump shall start (if not already running).
- Pumps Serving Hydraulic Elevators:
    - If there are multiple elevators in the building that could potentially use one separator, size it for future use of all the elevators.
    - Status lights (pump running, high level) and alarm annunciators *associated with pump operation* **shall not** be provided. The control panel **shall not** include a pump or oil detection system “on-off” or “hand-off-auto” switch on the panel face.
    - Specify controls to monitor “half full” and “full” oil level conditions in the oil separator. Specify an annunciator, silence button, indicator lights.
    - Typical Sequence of Operation for Pump (modified to make project specific): The pump shall be cycled by the normal float switch to maintain “normal” fluid level in the pit. If high fluid level is detected by the “high level” float, the pump shall start (if not already running). The pump controller shall include a common dry alarm contact (non-latching) for monitoring by the Owner’s Building Automation System. This contact shall energize when a high level is detected.
    - Typical Sequence of Operation for Oil Separator Level Alarms:

      When the oil sensor detects a “half full” oil condition, it shall energize the Half Full indicator light, and the common annunciator. Pushing the alarm silence button shall silence the alarm but the indicator light shall remain energized until the oil level drops below half filled. When the oil sensor detects a “full” oil condition, it shall energize the Full indicator light the common annunciator (even if previously silenced). Pushing the alarm silence button shall silence the alarm but the indicator light shall remain energized until the oil level drops below the full level.

Lighting and Power Receptacles: Refer to Electrical Requirements Section below.

Elevator Car Enclosure:

Car Lighting: Provide LED strip lighting per elevator code. Downlights or drop ceiling are not acceptable.

Emergency Lighting: Provide LED emergency lighting with a battery unit in compliance with code requirements.

Car Dimension: Based on requirements of ADA Guideline and square footage floor requirements for landing per Michigan Building Code.

Car Door: Standard U-M finish is #4 brushed stainless steel.

Car Ceiling: Use car canopy as ceiling, painted white. Drop ceiling systems and islands are not acceptable.

Ceiling Height in Elevator Car: Minimum of 8'-0" car height.

Car Flooring: Standard U-M finish is large rubber tile, sometimes carpet, or diamond aluminum plate for freight / service cars. Materials such as stone or ceramic tile flooring add significant weight to the elevator car increasing equipment sizing and wear over time on equipment. Stone and ceramic tile flooring

materials are strongly discouraged. Coordinate flooring material selection with the end user and design manager/Architect. Provide attic stock of tile or carpet, to be kept in EMR for quick repairs. Refer to master spec for more details.

Pads and Pad Hooks-Locks: Provide pads custom sized for car dimensions and pad hooks with locks on walls near top 12" O.C. Provide a storage cabinet for the pads; do not specify storage bags for the pads. Determine a code-compliant location for the cabinet in discussion with the client.

Electrical Receptacle in Car: GFCI type duplex electrical receptacle in car approximately 2" above finished floor below car operating panel. Do not install behind a locked panel.

Elevator Lobby

Hallway Position Indicator: Provide as part of Hallway Call Panel and not a separate panel. Refer to AEC Master Spec for U-M preferred style and options.

Hallway Call Button Panels: Refer to AEC Master Spec for U-M preferred style and options.

Hoistway Access: Hoistway Access features shall be located in the door jamb or within 12" of the elevator door frame.

Lobby Lighting: Refer to Electrical Requirements section below.

Emergency Two-way Communication Device: Provide an emergency call device and signage at landings per Michigan Building Code. U-M ITS has selected a standard unit which they will furnish to the contractor to install.

Electrical Requirements (these items are provided by Electrical Contractor, not Elevator Contractor)

Main Disconnect Switch: Provide a heavy-duty 3-pole fused elevator power disconnect switch. The switch shall be lockable in the open position. Locate all disconnecting means for all elevators on the inside surface of the elevator machine room wall, immediately adjacent to the latch side of the entry door. This allows a mechanic to reach in and turn off the machines without fully entering the room.

Car Lighting Disconnect Switch: Provide a 2-pole, 240 volt, 30 amp fused elevator car lighting disconnect switch. The switch shall be lockable in the open position and contain 20 amp fuses. If

Car Receptacle and Fan Disconnect Switch: Provide a 2-pole, 120 volt, 30 amp fused elevator car receptacle and fan disconnect switch. The switch shall be lockable in the open position and contain 20 amp fuses.

HVAC for Elevator Machine and / or Control Room, and Hoistway: HVAC unit shall have a dedicated branch circuit with disconnect switch.

Power Receptacles:

> Elevator Machine / Control Room - Provide 120V GFCI receptacles in each machine room within 6'-0" from the governor, elevator controller and machine locations.
>
> MRL installations - Provide receptacle in the wall near the controller, if it is not located in a Control

Room.

In the pit area provide (1) GFCI duplex at 48" A.F.F., and (1) non-GFCI duplex (for sump pump) receptacle at 24" A.F.F.

Lighting for Elevator Machine and / or Control Room, Hoistway, and Pit and at MRL: Electrical Contractor shall provide LED strip light fixtures with anti-glare lens. Lighting shall be positioned so it does not create shadows while service personnel are working on major equipment. Elevator electrical designer has selected specific fixtures for this use and they are available on the Elevator CAD Standard Details available from AEC-A&E.

Lobby Lighting: Provide LED lighting to meet code requirements.

Electrical Ground Wiring: Main elevator feeder ground wire shall be the same size as the current conductors per Controller Manufacturer's requirements.

Emergency Power: Coordinate the need of emergency power with the activity use and code requirements.

Fire Suppression

Machine Room Sprinkler: Provide a supervised shut-off valve with flow tamper switch in the sprinkler line supplying the space. Locate the valve outside of and adjacent to the elevator machine and/or control room.

Pit Area Sprinkler: Provide a supervised shut-off valve with flow tamper switch in the sprinkler line supplying the pit. Locate the valve outside of and adjacent to the pit.

Hoistway Sprinkler: Provide a supervised shut-off valve with flow tamper switch. These items shall be located outside of and adjacent to the elevator hoistway.

Signage: Provide signage on valve outside of elevator machine and/or control room and pit area and shall read "Sprinkler Shut-off Valve for elevator # ".

Fire Alarms

Speakers/Horns for Mass Notification: Neither horns nor speakers shall be installed inside the car, hoistway or in the elevator machine and/or control room.