

ELEVATORS AND CONVEYING SYSTEMS

Many of the below items are code requirements and if not adhered to will prevent the elevator from passing the final acceptance inspection performed by a state elevator inspector.

AE Process for Elevator Specification and Drawing Development: Follow the elevator design process as described in *Exhibit 14 20 00-1, AE Process for Elevator Specification and Drawing Development* and complete the Elevator Design Process Worksheet as shown in *Exhibit 14 20 00-2*.

In addition to the Division 14 technical standards, The AE shall refer to:

1. *Equipment Rooms, Mechanical* general guideline
2. *Section 08 11 13 – Hollow Metal Doors and Frames*
3. *Section 09 65 80 - Elevator Flooring Requirements*
4. See *Section 21 10 00 – Water-Based Fire Suppression Systems*
5. *Section 22 13 29 – Sewerage Pumps*
6. *Section 26 80 00- Elevator Electrical Requirements*
7. *Section 27 00 00 – Communications*
Section 28 30 00 – Fire and Smoke Detection System

Elevator Consultants shall be hired by the AE firm whenever there is elevator work associated with any project. Elevator work includes new elevator installations, elevator modernizations / alterations, or significant alterations to elevator, elevator equipment, machine rooms or hoistways.

Compliance: The design and construction of all conveying systems shall be in complete compliance with the *current required Edition of the Elevator Safety Code (ASME A17.1) as per the state of IL Elevator Safety ACT* and the *U of I Facilities Standards*. This code is to be viewed as the “final authority” for establishing minimum requirements. The requirements of the *U of I Facilities Standards* often exceed the minimum requirements of these applicable codes. The more stringent standard is applicable.

Wheelchair Lifts: The use of wheelchair lifts on campus shall be minimized. They shall be installed to serve existing facilities

only in cases where it is highly impractical to install a code-compliant ramp or elevator. They shall never be installed to meet accessibility requirements in new facilities.

Elevators: The appropriate number, capacity and size of elevators shall be installed to serve each building as determined by calculations that represent the industry standard. Each elevator shall have a rated capacity of 2500 lb. minimum, regardless of the style or type.

HOW MANY ELEVATORS ARE NEEDED: (And how frequently will the elevator operate)

Appropriate Number: Each U of I building shall be equipped with at least two elevators that service all floors. One heavy concentrated loading elevator shall be included in all buildings

Consideration shall be given that elevators require monthly maintenance and must be removed from service to perform such. If a building has only one elevator, accessibility for the entire building is lost when it has a failure due to a multitude of possible causes, and during the performance of routine maintenance. Consideration shall also be given to the potential future use of a building when determining the quantity and loading characteristics of elevators to be provided.

Speed: Hydraulic elevators with less than 30 feet of travel shall operate at 100 to 125 feet per min (fpm); and from 30 feet to 45 feet of travel shall operate at a minimum of 125fpm to a max of 150 fpm. Traction Elevators less than 50 feet of travel shall operate at 200 fpm and more than 50 feet of travel shall operate at 350 fpm.

Appropriate Size: The capacity, car size, door opening size, and platform area for a given elevator shall be adequate to serve the equipment transportation needs of the building's 100 year design. Larger buildings with larger mechanical and electrical equipment located within the building (typically within basement and penthouse equipment rooms) require elevators of larger capacity and size to transport the equipment located in these areas for purposes of repair or replacement. Buildings that house large

pieces of departmental equipment (typically research/laboratory buildings) also require elevators of larger capacity and size. Elevators that may be exposed to this type of heavy point loading require a C3 loading classification. Consideration shall also be given to the potential future use of a building when sizing elevators. Elevators shall be designed to last 50 years due to profound budgetary restraints regarding the replacement cycle for a fleet of over 300 elevators.

Security Issues: If an elevator provides direct access to a penthouse or basement mechanical area without intervening corridors and door ways, then a means shall be provided to prevent non authorized persons from having access to these mechanical spaces. This may be accomplished by means of a mechanical key switch (see the *Keying Systems & Lockset Functions* general guideline for key requirements for mechanical spaces) or electronic card reader.

TYPES OF ELEVATORS

Appropriate Application: The following types of elevators are permitted on campus: Overhead Traction Elevator, In Ground Hydraulic Elevator, and Hole-less Hydraulic Elevator. In some instances, Cable Assisted Hydraulic Elevators may be used with concurrence of the Elevator shop.

Traction Elevators may be geared or gearless. Traction elevators (generally) are capable of faster speeds and smoother operation.

There is no minimum or maximum travel distance for a geared traction elevator. Typically, any elevator with a travel distance over 45 feet should be a geared traction elevator and any travel distance over 130 feet should be gearless.

All new installations shall have the elevator machine located directly over the hoist way. Offset machines located adjacent to the top of the hoist way are not to be used except when replacing existing offset machines. Because of their high initial cost and higher maintenance cost, basement set traction elevators are not permitted.

“In-ground” hydraulic elevators shall be limited to applications of 45 ft. of travel or less. This distance is the maximum travel from the lowest landing level to the uppermost landing level. For two to four-stop applications, hydraulic elevators are normally most practical. A hydraulic elevator shall not be used to replace an existing traction elevator.

High Use, Low Rise Hydraulic Elevators:

For shorter total travel requirements hydraulic elevators will normally suffice. If the anticipated use of the elevator is high, it is necessary to design the hydraulic elevator with the high usage in mind. High hydraulic oil heat and high motor usage is a problem with frequently used hydraulic elevators. Extra large hydraulic oil reservoirs to help dissipate heat build-up, and motors located outside of the oil (dry pumping units) with motors rated at 120 starts per hour shall be minimum requirements for high use hydraulic elevators. Hydraulic elevators are inherently slower than traction elevators. A high use elevator with 40 feet of travel should be provided with a traction elevator for reasons of better speed, reliability, and longevity.

“Hole-less” hydraulic elevators shall be limited to applications of 15 ft. of travel or less.

Cable-assisted hydraulic elevators and any form of telescoping hydraulic jack elevator are not allowed.

CLASS and CAPACITY REQUIREMENTS

Considerations for sizing an elevator—inside cab area and capacity characteristics. See ASME A17.1 for the definitions of the different loading design requirements for elevators

Capacity: All U of I elevators must be a minimum of 2500-pound capacity.

In buildings with more than one elevator, at least one elevator shall be a class C3 elevator. In buildings with only one elevator, (existing) that elevator shall be able to carry a single piece load of 1500 lbs minimum and the load to be loaded with an 18” x 18” four wheeled dolly.

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Size: Size of elevator should be determined by what the building will need to carry on the elevator. Clear ceiling height (underneath the drop ceiling) and clear wall-to-wall dimensions (handrails protrude from walls 2 inches *usually*) need to be determined. Once the inside area of the elevator has been determined the elevator hoist way may be sized. (Usually with the assistance of an elevator contractor).

Consideration must be given to the intended use of the elevator. Will it be used for passengers, freight, or both? What will be the largest single piece of equipment or furniture that the elevator will need to carry? Will it have to transport: pallets of paper – 4'X8' sheets of building materials – computers (tall) – copy machines – large pieces of lab equipment or other large pieces of equipment- concentrated loads – motors or building system components?.

If the elevator is to be placed in a building that is four or more stories in height as defined by the International Building Code, the cab dimensions of at least one elevator must be large enough to accommodate a 24-inch by 76 inch ambulance stretcher in the horizontal, open position. This elevator must be designated with the international symbol for emergency medical services (star of life).

“Class A” Passengers Only: Is the lightest weight and flimsiest elevator design there is. If the elevator is to be used ONLY for passenger transport the elevator may be designed for a “Class A” “general freight loading” and defined as such in the bid documents. This loading design is only capable of carrying a single piece load equal to one fourth of the elevator capacity. The platform is subject to extreme loading stresses and a Class A should not be specified if heavier loads are EVER to be carried on the elevator. The load (pieces / passengers) of a Class A elevator must be evenly distributed on the floor area of the elevator. Larger single piece concentrated loads will damage the elevator.

“Class C3” Freight/Passenger Elevators: U of I Freight elevators shall be designed with Class C3 design requirements as defined by the elevator code unless

industrial truck loading is required, in which case C1 will be needed. C3 loading design allows single piece loads exceeding 25% of the rated capacity but not exceeding the rated capacity of the elevator (including the weight of the loading equipment) to be loaded onto the elevator in single pieces. The elevator platform and components are designed to handle concentrated loads to be placed anywhere inside the elevator cab.

Extra Sill Loading Requirements: Threshold sills on the car and in the hallway for all Class C3 designed elevators must be made of a material harder than aluminum (cast iron, bronze, stainless steel or nickel). Stronger hoist way sill supporting angles, normally installed by the general contractor, along with grouting of the hall sills is usually required for Class C3 elevators.

Load Weighing Device: All elevators with capacities and load carrying requirements greater than Class A general freight loading shall be provided with a load weighing device which prevents overloading of the elevator.

Passenger elevators that need to carry large single piece loads: A passenger elevator may carry large single piece loads (like a freight elevator) if it is designed to do so. Typically the elevator is designed with “Class C3” loading design requirements as defined by the code and the cab and doorframes etc are designed for that of a passenger elevator. The elevator may be able to be custom designed as well, such as a 2500 lb capacity elevator that will need to carry 1800 lb single piece loads. This should be clearly defined in the specifications if there is such a need.

Determine Expected Occupancy of the Building: There are elevator programs or consultants that can assist with determining these factors. Once this information has been determined the type of elevator, traction or hydraulic, can be specified as well as the recommended speed of the elevator.

Elevator Replacements: An existing traction elevator shall be replaced with a traction elevator, not a hydraulic elevator.

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Appropriate Operation: All elevators shall be of the selective collective type of operation, and duplex or group operation where more than one elevator is installed next to or across from another as is applicable as per elevator consultant and the Owner.

Access to All Areas: The highest and lowest interior areas in each building (typically mechanical and/or electrical equipment rooms or large attic areas) shall be accessible by elevator.

Hoistways: Hoistways shall incorporate the following features:

1. Hoist ways must be sized so that all elevator manufacturers' equipment will fit within the U of I hoistways for project bidding purposes and in the event future upgrading is desired.
2. A minimum clearance of five ft. (from the top of the elevator crosshead to the lowest ceiling obstruction) when the elevator is at its highest point of travel. This is preferred although not specifically required by code.
3. A grating type floor is frequently required at the top of hoistways when the machine room serving a traction elevator is not located directly above the hoistway. A floor to ceiling height of 72" is preferred, although a height of only 54" is required by code. This is a costly and troublesome project requirement and is another reason offset traction elevators should be avoided whenever possible.
4. Masonry construction: Elevator shaft and machine room walls shall be masonry or concrete construction. Gypsum board assemblies are not permitted.

When an elevator has been designed for C3 or other heavy loading, the hall sills shall be fully grouted with a Pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 4000 psi at 28 days. *[Note to AE: Provide written requirement in masonry section of construction documents. This work is normally provided by the masonry contractor.]*

Grouting Elevator Door Frames: Entrance frames installed in masonry and concrete walls shall be fully grouted in place. Spreaders shall be used to prevent elevator doorframes from bowing. *[Note to AE: Provide written requirement in masonry section of construction documents.]*

5. **No Pipes, Ducts, or Any Other Equipment in Hoistway:** *[Note to AE: This is a frequently missed item.]* Only equipment that serves or is associated with the elevator may be installed in any elevator hoist way. This includes electrical piping, plumbing, drain lines, telecom equipment, ductwork, etc. ASME-A17.1 Section 2.8
6. **Ledges in Hoistways:** Elevator hoist ways are required by code to be substantially flush. Any ledge projecting into the elevator hoist way over 4 inches is required to have a 75 degree bevel on the top of it. This includes steel I beams, concrete floor ledges, etc. A17.1 Section 2.1.6.2
7. Overhead clearance minimum requirements are governed by the elevator code and need to be taken into consideration with every elevator installation.
8. **Hoisting Beam in Overhead:** Hoisting beams adequately sized to safely support the weight of the car and piston shall be installed at the tops of hydraulic elevator hoist ways. Overhead clearance requirements to the overhead beam shall still be met as required by code.
9. **Fire Rating:** *[Note to AE: This is a frequently missed item.]* Hoist way shall have all holes and penetrations fire caulked to meet fire rating of hoist way, including the top of the hoist way, where the ceiling meets the walls.
10. **Ventilation of the Hoistway:** "Hoistways of elevators shall be provided with means to prevent the accumulation of smoke and hot gases in case of fire as required by the IBC." IBC 2000 3004.1. .

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An exception is possible as per code to delete this venting, see code.

11. **Sprayed-On Fiber Insulation:** Sprayed-on fiber insulation shall not be applied to any surface of the hoist way walls to achieve the required fire rating of the hoist way.

ELEVATOR PIT REQUIREMENTS

Elevator Pit Requirements: Elevator pits shall be constructed in accordance with *Drawings 14 20 00-1* and *14 20 00-2* and ASME-A17.1, Section 2.2.

Pitt Ladder: Pit ladders are required in any elevator pit deeper than 35 inches. The ladder shall extend at least 48 inches above the access doorsill level, be within reach of the access door, and meet the other requirements of ASME A17.1 2.2.4.2 *[Note to AE: Provide written requirements and details in the construction documents.]*

BASEMENT SET ELECTRIC TRACTION ELEVATORS:

[Note to AE: This is a frequently missed or not understood item.] In the event that a variance is granted for the use of a basement set traction elevator, or if cable type elevators that do not have the machine room located directly over the top of the hoist way are provided, access to overhead equipment must still be provided. If full body entry is not required into this space (as defined by the elevator code), only an access door to inspect the governor is required. If full body entry is required into these spaces, light switch and lighting, electrical receptacles, metal floor grating, standard railings, access ladder to access door, and additional overhead clearances are all required. Special attention needs to be given these types of installations, and the A/E must provide details and specifications in the construction documents. See *Drawing 14 20 00-5, Overhead Machinery Space Requirements* for example overhead machinery space requirements.

Access door for overhead machinery spaces: (When required) Access doors shall be provided for the inspection of equipment in elevator hoist way "machinery

spaces" as required. The access doors shall be a maximum of 24" x 24" when full body entry is not required and 29.5" x 29.5" minimum when full body entry is necessary. Doors shall be self-closing and locking and be keyed the same as the elevator machine room. See *Drawing 14 20 00-4, Overhead Machinery Space Access - Variance*. *[Note to AE: When an access door is required, the AE must show drawings and location of overhead access door, and access ladder and platform.]*

Full Body Entrance: (When applicable) *[Note to AE: This is a frequently missed or mis-understood item.]* Full body entrance is usually decided by the location of the governor. If the elevator governor is located immediately adjacent to a wall where a 24" x 24" door may be installed, full body entrance is not normally required. Architects should consult with elevator manufacturers about the location of the governor and provide appropriate detailing for either an access door or full body access.

Access Door Access Ladder: A code compliant access ladder located to the side of the access door with a standard railing and platform below the overhead access door shall be provided. See *Drawing 14 20 00-4, Overhead Machinery Space Access - Variance* for example of ladder.

Machine Room-less Elevators (MRL): MRL units are not approved on the Urbana campus yet and require a variance

Minimum MRL Requirements (if a variance is approved):

1. **MRL Overhead Access:** Overhead access shall be provided to all MRL overhead machinery spaces by means of a self closing, self locking access door as per for full body entry as defined by code and as per U of I Facilities Standards to access such doors, for overhead machinery space access.
2. **Lighting and stop switches:** lighting and stop switches, GFI outlets, etc, shall be provided in the overhead machinery space as per code for full body entry spaces.
3. **Roping:** 2:1 roping is the maximum roping that shall be allowed on any MRL unit.

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4. **T Rails:** Only standard T main and counterweight rails shall be used for MRL units.
5. **Car Frame:** Only structural shaped steel members may comprise the construction of the car frame components.
6. **Hoist way Sizing:** MRL hoist way sizing shall be adequate to install Hollister Whitney, Global Tardiff, ThyssenKrupp, and Motion Control Engineering models of MRL units. This is to allow multiple MRL units to be bid.
7. **Controllers installed out of sight:** Controllers installed out of sight of the drive machine shall be provided with a 15" flat panel minimum monitor screen connected to a CCTV so as to be able to view "real time" movement of the driving machine from the controller.
8. **Overhead Hoisting:** Means shall be provided in the hoist way overhead to accommodate the picking of the fully loaded car from the overhead for maintenance and repair of the hoist way equipment

Machine Rooms: See general guideline entitled *Equipment Rooms, Elevator*.

Temporary Use of Elevators for Construction Purposes: In general, existing or new elevators shall not be used by the Contractor during renovation or new construction projects. Any exception to this shall be by Variance to these Standards and only with clear, specific and monitored use of the equipment. Temporary use of new elevators in new and existing construction is discussed in *Section 01 76 00 – Protecting Installed Construction* of these Standards.