National Elevator Industry, Inc.

5003 Westfield Blvd. PO Box 231137 Centreville, VA 20120 • 703.266.3100

Building Transportation Safety Codes Backgrounder

Education Provided by the National Elevator Industry, Inc.

Founded in 1880, the American Society of Mechanical Engineers (ASME) is a professional organization with more than 130,000 members in 158 countries focused on technical, educational and research issues in the engineering and technology community. ASME produces and maintains approximately 600 codes and standards, covering a variety of technical areas, including elevators, escalators and moving walks. The National Elevator Industry, Inc. (*NEII*®) works closely with ASME to promote adoption and enforcement of the latest industry codes and standards to help ensure the safety of the riding public.

Safety Code for Elevators and Escalators, ASME A17.1/CSA B44

US and Canadian committees[1] comprised of technical experts who demonstrate a concern and proficiency in this area write the Safety Code for Elevators and Escalators, ASME A17.1/CSA B44. This was previously known in the United States as the Safety Code for Elevators and Escalators, ASME A17.1, and in Canada as the Safety Code for Elevators, CSA B44. This code is used by every jurisdiction with an elevator code in the U.S. and Canada.

As a companion to the Safety Code, ASME A17.7/CSA B44.7 was introduced and is known as the Performance-Based Safety Code (PBC). It provides Authorities Having Jurisdiction (AHJ) with an objective and structured method for approving new technology while ensuring continued elevator safety. ASME also publishes a number of other codes and standards: ASME A17.3, ASME A17.4, ASME A17.6, and CSA B44.1/ASME A17.5.

Building transportation is required to comply with many other model codes and standards, including building and fire codes along with material and fire testing standards. Organizations producing these standards include the ASTM International (ASTM), International Code Council (ICC), National Fire Protection Association (NFPA) and Canadian Standards Association (CSA).

The following are a few examples of some of the elevator and escalator/moving walk requirements in some of the model codes and standards.

ELEVATORS ACCESSIBILITY STANDARDS

There are three accessibility standards enforced in the U.S. for individuals with disabilities. The American National Standard for Accessible and Usable Buildings and Facilities (ICC/ANSI A117.1) specifies that buildings must be accessible to and usable by people with physical disabilities. The model building codes require compliance with this standard.

The other standard is the Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG). ADAAG has been replaced by the Americans with Disabilities Act/Architectural Barriers Act Accessibility Guidelines (ADA/ABA AG). This standard must be complied with under the regulations of the Americans with Disabilities Act and Architectural Barriers Act.

Examples of elevator requirements in these standards include hall and car button location, identifications and size, dimensions of elevator cars and doors to allow for wheelchair access, audible signals at landings and in cars to identify car direction and location, etc.

Door Requirements

Elevator doors must open and close automatically. They must be equipped with a reopening device that must stop and reopen a car door and hoistway door automatically if the door becomes obstructed by an object or person. Door reopening devices shall remain effective for at least 20 seconds. After such an interval, doors may close in accordance with the requirements of ASME A17.1/CSA B44.

Car Controls and Car Sizes

Car controls must be located so they are accessible to persons in a wheelchair or of short stature. They must be identified with raised characters and Braille for the visually impaired. Car and door size and location must allow for the turning of a wheelchair.

ASME A17.1/CSA B44 ELEVATOR REQUIREMENTS

Door Requirements

Car doors should be configured so that they are able to be moved by hand from inside the car when the car is stopped within the

unlocking zone and power to the door operator is cut off. When the elevator is outside the unlocking zone, it is unsafe for a passenger to try to exit the elevator entrance unassisted.

When a car is outside the unlocking zone, the car doors must be configured so that they cannot be opened more than 4 inches from inside the car. The car doors must be configured so they can be open from outside the car by elevator personnel without the use of a special tool(s). Passenger elevator hoistway doors should also be equipped with interlocks, a device that prevents the elevator from moving away from the landing unless the hoistway door is locked in the closed position and the door can't open when the car is not at the landing.

Car Safeties

Every elevator car suspended by wire ropes must have a safety device attached to the underside of the car frame to provide a safe stop for the passengers in the event of an over-speeding descending car. The safety devices should be designed to reduce the elevator speed in free-fall condition.

Additionally, all electric traction elevators, except those whose empty car weight exceeds the total weight of the suspension ropes and counterweight, must have a device to prevent an ascending elevator from striking the hoistway overhead structure.

Emergency Operation and Signaling Devices

All elevators must be provided with an emergency phone to signal a problem. Emergency phones replace emergency alarm bells found in older elevators. The communication means shall provide authorized personnel the building location and car number on demand. This two-way communication ensures that passengers in stalled cars can communicate with authorized personnel who can take appropriate action. When the location of the two-way communication means is not staffed 24 hours a day by authorized personnel, the communication must automatically be directed within 30 seconds to an additional on- or-offsite location, staffed by authorized personnel, who can take appropriate action.

Car Top Emergency Exit

An emergency exit with a cover must be provided in the top of all elevator cars (except cars in partially enclosed hoistways). The top emergency exit is used for evacuating passengers from a stalled elevator when necessary.

The exit cover must be attached to the car top by chain or hinges to assure it is not removed or cannot fall off the top of the car. The exit cover can be opened from the top of the car only to guarantee emergency personnel access. Passengers cannot gain access to the car top until emergency personnel deem it necessary.

Car Illumination

At least two lamps are required for both normal and auxiliary lighting in the event that if one burns out, the car passengers will not be placed in total darkness.

Passenger elevators also must have auxiliary lighting 48 inches above the car floor and approximately 12 inches in front of the car-operating device. The intensity of auxiliary lighting should not be less than 2 lx (unit of illumination). Auxiliary lights should be automatically turned on in all elevators (in service) after normal car lighting power fails. The power system must be located on the car and have the capability to maintain the above light intensity for a period of at least 4 hours.

Firefighters' Emergency Operations

In most buildings, the building code requires a sign in elevator lobbies to advise building occupants not to use elevators in a fire. However, some new buildings may have elevators that can be used for occupant evacuation in case of a fire or other emergency. In these buildings, electrical signs in elevator lobbies advise building occupants when elevators can be used in a fire and provide directions for their use.

Phase I Emergency Recall Operation

The elevator will be automatically or manually recalled to a specific landing and removed from normal service when firefighter service is activated by a smoke detector in an elevator lobby, hoistway or machine room, or by a key switch. Once fire personnel arrive and ensure the elevators have been recalled safely and are safe to use again, they can be put back into Phase II operation. When Phase I is activated, passengers in the car will be alerted by a visual (illuminated fire hat symbol) and audible signal.

Phase II Emergency In-Car Operation

Firefighters will have the maximum number of elevators available to use in emergencies.[2] All elevators are required to have Phase II Operation.

A key-operated switch is provided in the operating panel in each car behind a locked cover of the "Fire Operation" panel. The switch will be activated only when**Phase I Emergency Recall Operation** is in effect and the car has been returned to the recall level. When the "Fire Operation" switch is on, the elevator will be in **Phase II Emergency In-Car Operation**, for use by emergency personnel only. The elevator will be operable only by the person in the car.

ASME A17.1/CSA B44 ESCALATOR AND MOVING WALK REQUIREMENTS

ASME A17.1/CSA B44 specifies that a handrail entry device must be provided at each newel, located at both the lower and upper

limits of the escalator, and assist passengers in boarding and exiting the escalator. The handrail entry should be a manual device that may cause the escalator to stop by removing power from the driving machine motor and brake. It should operate in one of two ways:

a. If an object becomes caught between the handrail and the handrail guard; or
b. If an object approaches the area between the handrail and the handrail guard.

For those units that rely on an opening of the balustrade to prevent entrapment, all handrail entry devices shall be operative whenever the handrails are operating.

With moving walks, each balustrade should have a handrail moving in the same direction and at substantially the same speed as the treadway.

ASME A17.1/CSA B44 requires that hand guards be provided at the point where the handrail enters the balustrade[3]. Hand guards help prevent items from becoming entrapped in the handrail opening in the newel. Usually made of rubber, a hand guard fits over the outside of the handrail at a point where the handrail enters or leaves the balustrade.

A handrail speed monitoring device, which monitors handrail speed and is designed to shut down the escalator if the handrail and step speeds are not synchronized, activates an alarm whenever the speed of either handrail deviates from the step speed by 15 percent or more within a period of 2 to 6 seconds. The device also must shut down the driving machine and brake's electric power when the speed deviation is in the specified range.

Comb Plate Requirements

Firefighters will have the maximum number of elevators available to use in emergencies. All elevators are required to have Phase II Operation.

a. There must be a comb plate (the portion of the landing adjacent to the step) at the entrance and exit of every escalator/moving walk.
b. The comb teeth should set into the slots of the tread surfaces so that the points of the teeth are always below the upper surface.
c. Comb plates must be adjustable vertically. Sections forming the comb teeth must be readily replaceable.
d. The comb section, comb plate and landing plate assemblies must not make contact with the step treads when a weight of 350 lbs. is applied to an area measuring 8 x 12 inches and the dimension is parallel to the direction of travel.

There must be a visual contrast, achieved by color, pattern or texture, between the comb and step.

The adjacent floor surfaces at each landing must be continuous with the top of the landing plate with no change in elevation of more than 6 mm (0.25 in.).

The entry and exit zone should be kept clear of all obstacles. The width of the zone should not be less than the width between the centerlines of the handrails. The length of the zone should not be less than twice the distance between the centerlines of the handrails. Space should be provided to accommodate all traffic in the safety zone.

Brake Requirements

Escalator Driving-Machine Brake

The brake should be applied automatically if the electrical power supply is interrupted. It must be capable of stopping the descending escalator with any load up to the brake rated load.

Moving Walk Driving-Machine Brake

Each moving walk driving machine shall be provided with an electrically released and mechanically or magnetically applied brake. If the brake is magnetically applied, a ceramic permanent magnet shall be used. There shall be no intentional time delay designed into the application of the brake.

The brake shall be applied automatically if the electrical power supply is interrupted. The brake shall be capable of stopping the down- or-horizontal-running moving walk with any load up to the brake rated load. The brake shall hold the stopped moving walk with any load up to the brake rated load.

Emergency Stop Button Requirements

A red stop button should be visible at the top and the bottom landings on the right side facing the escalator and moving walk. Remote stop buttons are prohibited.

Step Skirt Requirements

Means must be provided to shut down the electric power from the escalator driving-machine motor and brake if an object becomes caught between the step and the skirt as the step approaches the upper or lower comb plate. The device should be located at a point at which the step assumes a flat step position.

The escalator Step/Skirt Performance Index[4] must be included in one of the following, whichever is applicable:

a. Escalators without skirt deflector devices (designed to minimize the risk of side-step entrapments) will require an index of 0.15 or less.
b. Under ASME A17.1a–2000 and earlier editions and ASME A17.3: Escalators with skirt deflector devices must maintain an index of 0.4 or less.
c. Under ASME A17.1a–2002 and later editions: Escalators with skirt deflector devices must maintain an index of 0.25 or less.

Step Tread Requirements

Step treads must be horizontal and provide a secure foothold.

Means must be provided to shut down electric power from the driving-machine motor and brake in case of reverse travel (while operating in the ascending direction). The device should be of the manual-reset type.

A device must be provided to detect a missing step and bring the escalator to a stop. The device should stop the power of the driving-machine motor and brake before the gap resulting from the missing step emerges from the comb. The device shall be of the manual-reset type.

Editor's Note:

1. The ASME A17 Committee and CSA B44 Committee contains a balance of members representing various interest groups (e.g. elevator manufacturers, building owners, government inspectors, consultants, etc). No one interest group can dominate the committee.
2. Firefighters will take command during a fire, and will determine whether they will use elevators and how many. It is standard operating procedure for firefighters to use elevators not only to carry equipment for firefighting or evacuation purposes, but also to disperse fire personnel to non-fire involved floors and to evacuate those in the building that cannot use stairs.
3. The balustrades are the sides of the escalator, which are usually made of stainless steel, aluminum, glass or plastic.
4. The Step/Skirt Performance Index was created to provide a reliable standard from which all escalators, new and old, can be measured and evaluated for rider safety. This Index was developed by *NEII* in conjunction with Arthur D. Little (ADL), and is now part of the ASME A17.1/CSA B44 and ASME A17.3 Codes. The Index measures the potential for possible entrapments between the moving stair and the stationary sidewall on a basis of 0.0 to 1.0 Index.
   The field test measurement protocol starts with the inspection of an escalator, both stationary and running, to note the step/skirt gap and any abnormalities (e.g., wide gaps; damaged steps, treads or skirt panels; skirt panel misalignment; step/skirt rubbing). Next, a test apparatus is positioned to gauge the coefficient of friction and the loaded gap as the escalator runs. Finally, loaded gap values are obtained at the upper and lower levels of the escalator while stopped.

Follow National Elevator Industry, Inc. on
Copyright © 2003-2018 National Elevator Industry, Inc., Centreville, VA
www.neii.org | e-mail: info@neii.org
NEII and NEII logo – Registered, U.S. Patent and Trademark Office