

Conveying Systems

Dumbwaiters

Dumbwaiters transport small items between floors in a building.

They are most often found in large homes and buildings that offer food service to their clients or guests.

Dumbwaiters are also found in hospitals, libraries and office buildings where they can transport medicine, books and mail.

A dumbwaiter is a mechanism that consists of a movable frame in a shaft with platforms attached to the frame that moves up and down.

Elevators

Elevators are vertical transport systems that transport people between floors of a building.

An elevator system consists of a hoisting mechanism that is connected to a car or platform.

This car or platform then moves vertically, in most cases, on guides that are attached to the fire-resistant sides of a *hoistway*.

Residential Elevators

Residential elevators are designed to move people from one floor to another in a building.

They come in a variety of sizes and may be wheelchair accessible.

Residential elevators may use hydraulic or electric traction systems very similar to commercial passenger systems.

The cars are steel reinforced, come in a variety of finishes, range in size from 36- 48 inches and handle up to 450 pounds, depending on its load capacity.

Elevator Hoistway

A hoistway is a vertical fire-resistant shaft. It is enclosed and the elevator moves through this shaft.

The hoistway is accessed by doors that open into the shaft when the elevator is called to the opening on that floor.

It has a pit at the bottom of it, where *buffers* are required.

Buffers are energy-absorbing units that absorb any impact should the elevator descend below the normal level.

Some hoistways have penthouses at the top where the machine room can be placed.

Code may require that the hoistway be vented in case of fire.

Hoistway Doors

Hoistway doors are installed in the openings of the shaft at each floor level.

They are rated as a 1-1/2 hour fire door and are controlled by an automatic operating system.

Codes specify the type of doors required for each type of elevator.

Doors close automatically when the elevator car leaves the *landing zone*, an area 18 inches above or below the floor.

The elevator car will not move if all doors are not closed and locked.

The doors cannot be opened from the landing side except for emergencies.

Hoistway Sizes

Hoistway sizes are specified in the National Elevator Industry Standard and the Elevator Engineering Standard Layouts.

Each hoistway must be sized according to the clear inside dimensions that a hoistway must be to accommodate the elevator car and all required cables and moving equipment.

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Machine Rooms

Machine rooms are designed as part of the hoistway.

They provide a fire-resistant area that will house the required equipment to operate the elevator car, such as hoisting machinery, controls, hydraulic oil and pumps.

The area must be air-conditioned to control the temperature.

If the machine room is located in a penthouse, the floor must be strong enough to hold the dead weight of the machinery and accessories plus the live weight of the maintenance crew.

With new technology; traction motors that boast gearless units; permanent magnet drive units that are more efficient and compact and electronic processors that replace the mechanical relays, traction elevators can now be built without a dedicated machine room.

Elevator Code Standard

Codes are established by the American National Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks, ANSI/ASME A17.1 and local building codes. Standard sizes and shapes for elevators are determined by the National Elevator Industries, Inc. (NEII)

Elevator Types

There are passenger elevators, freight elevators and hospital elevators.

Passenger elevators are designed to transport people from one floor of a building to another.

Freight elevators carry materials from one floor to another, can be large enough to transport heavy equipment such as cars, and fully loaded trucks and trailers.

Hospital elevators are found in medical facilities.

These elevators are equipped with a “Code Blue” service for emergencies.

Electric Traction Elevators

Electric elevators are operated by *traction machines*.

This is an electric motor connected to a driving sheave.

Gear-driven traction machines provide slower rise speeds and gearless direct drive machines provide high riser speeds.

When power is lost in an electric traction elevator system, all elevators come to a halt and one by one, each car returns to the ground floor, opens its doors and shuts itself down.

Geared Traction Elevators

Geared traction machines are driven by AC (alternating current) or DC (direct current) electric motors that use worm gears to control movement of the car.

This is achieved by rolling steel hoist cables over a *drive sheave* (gearbox) that is attached to a high-speed motor.

Typical riser speeds range from 350 to 500 ft/min for passenger elevators and 50 to 200 ft/min for freight elevators.

Gearless Traction Elevators

Gearless traction elevators are low speed, high torque motors that are driven by AC or DC motors.

With gearless traction machines, the drive sheave is directly attached to the end of the motor.

They can reach speeds up to 2000 ft/min or higher but typically range from 500 to 1200 ft/min.

A brake is mounted between the drive sheave and motor to hold the elevator.

Gearless Traction Elevators

In each case, geared or gearless, cables are attached to a hitch plate on top of the elevator car and then looped over the drive sheave to a counterweight attached to the other end of the cables.

The counterweights are located in the hoistway on a separate rail system that works the opposite direction that the car is driven.

This counterweight is equal to the weight of the elevator car and 40-50% of the load capacity of the elevator.

Car Safeties

Car safeties are a device designed to stop movement of the car and hold it in position.

When the car exceeds a safe speed, it is automatically activated by applying brake shoes against the rails, stopping the car and switching off the power to the motor.

Roping

Elevator cars must be suspended from a minimum of three hoisting ropes.

This wire rope is made of steel strands laid helically around a hemp core and each strand is made of steel wires helically wrapped around a steel core.

The roping affects the performance of the traction type elevator.

Hydraulic Elevators

Hydraulic elevators are used for low-rise situations because the pressure cylinder must be sunk into the ground a distance equal to the length of the cylinder.

The car is mounted on top of the hydraulic pressure cylinder and is forced to rise as hydraulic oil is pumped under pressure to the bottom of the piston.

Hydraulic Elevators

The car lowers when oil is released from the pressure cylinder into a tank until needed again.

Hydraulic elevators are used to transport freight and people, are cheaper than electric and the mechanism is simpler.

Escalators

Escalators are inclined, continuous moving stairs and handrails that transport people from one floor to another.

They are used where elevators may be impractical but use of stairways may be too slow for the anticipated crowd.

Common places they are found are in airports, arenas, convention centers, department stores, hotels, shopping malls, transit systems, and public buildings.

Escalators

Escalators have little or no waiting interval, can be used to guide people toward exhibition areas, main entrances or exits and be waterproofed for outdoor use.

Escalators can be used as a required means of egress if they meet all requirements for emergency egress stairways, such as providing smoke and fire protection and a sprinkler system.

Escalators can move many more people faster than elevators, traveling at typical speeds of 90-100 ft/min.

Escalators

Escalators are powered with constant-speed alternating current motors. Maximum inclination of an escalator, from a horizontal surface, is 30 degrees, with a standard rise up to approximately 60 feet.

Escalator widths are typically 24, 32 and 40 inches wide.

Newer escalators have single pieces of aluminum or steel steps that move on a system of tracks in a continuous loop attached to a welded steel truss structural frame.

Escalators

Components include:

landing platforms - where the gears and curved sections of the tracks are kept

truss- a hollow metal structure that is attached to the top and bottom landings by supports

two tracks- built into the truss to guide the stop chain

stops

handrails

Escalators

There are three typical configurations:

Parallel- up and down escalators side by side or close to each other

Crisscross- stacked and all going in the same direction

Multiple parallel-two or more together that travel in one direction next to one or more traveling in the opposite direction

Regulation

The American National Standard Safety Code for Elevators, Dumbwaiters and Escalators, ANSI/ASME A17.1 and the Life Safety Code of the National Fire Protection Association regulate escalator standards.

Moving Walks and Ramps

Moving walks are slow moving, approximately 1.5 mph, or high speed, approximately 9-12 mph, horizontal conveyor belts designed to move people.

Moving ramps have a maximum incline of 12 degrees and may move people up or down an inclined area.

They may be connected together or used individually.

Moving Walks and Ramps

Both come in varying widths and are capable of going very long distances.

The sides of the moving walks and ramps usually have balustrades covered with a moving handrail going at the same speed as the walk or ramp.

The steel structural system supports the moving walk or ramp that is electrically driven.

Moving Walks and Ramps

Moving walks and ramps are built in two styles:

Pallet type-a continuous set of flat metal plates joined together; may or may not have rubber added for better traction

Moving belt- built with mesh metal belts or rubber walking surface over metal rollers.

Lifts

Wheelchair lifts are used to move a wheelchair and its passenger from one level to another.

One type of lift is a steel platform with steel sides, entry and exit gates.

The platform is covered with a rubber skid-proof surface and is operated by an electric motor that is controlled by the passenger.

The wheelchair lift does not operate until all gates are secure and the wheelchair and its passenger are in place.

Lifts

These lifts can be installed in vans, buses and other vehicles of transportation.

A wheelchair stair lift moves the wheelchair and its passenger up or down stairs on a platform with side closures that are attached to a steel rail system, that is fastened to the wall or the stair treads.

This system can transport up or down a multilevel straight stair.

For stairs with turns, two lifts are required.

Lifts

Another type of stair lift is for people who have difficulty climbing stairs.

This lift has a chair that runs along a steel or extruded aluminum rail that is mounted to the wall or the stair treads.

This stair lift is capable of moving around corners and across landings, allowing the passenger to disembark safely away from the top of the stairs.

Controls are usually located on the arm of the chair and many have radio frequency or infrared remote controllers.

Lifts

Chairlifts are a type of aerial lift that consists of a continuous steel cable loop strung between two terminals.

The cable continuously circulates between the terminals and intermediate towers allowing the chairs to move in opposite directions.

Chairlifts are commonly used at ski resorts, amusement parks, tourist attractions and in urban transport.

Facility Chutes

A facility chute is a vertical or inclined passage through which objects can be passed through by means of gravity.

Chutes are common in older high-rise residential and commercial buildings.

This is to allow rapid transport of trash, laundry, mail, or construction debris from upper floors to the exterior of the building, the entry floor or the basement area.

Shuttle Transit

Shuttle transit systems are fast, efficient means of horizontal transportation where the distance between points are impractical to walk.

A few usages for shuttles are between airport terminals, remote parking areas and office and retail complexes.

Shuttle transit systems operate much like elevators, only horizontally rather than vertically.

Several cars operate within the same system, allowing passengers to board cars as needed.

Shuttle Transit

They use standard gearless traction machine drives and cable equipment to operate.

The steel cable is attached to the side of the shuttle car.

A steel guide and power rails are adjacent to the running surface where the vertical load is supported by air-cushioned pads on the bottom of the car and the guideway.

The guideway running surface can be a single or double lane track.

Conveyors

Several types of conveyor and pneumatic tube systems are used to move materials within commercial buildings.

A conveyor system moves materials from one place to another within the building.

They allow quick and efficient transportation for most materials that make them popular in the packaging and material handling industries.

Conveyors

Conveyor systems are commonly used in many industries to move items of all sizes, shapes and weights. They include a belt, rollers and segmented moving surfaces. Some types of conveyor systems are:

- Gravity Roller Conveyor
- Gravity Skatewheel Conveyor
- Belt Conveyor
- Wire Mesh
- Plastic Belt
- Belt Driven Line Roller
- Line Shaft Roller Conveyor
- Chain Conveyor
- Screw Conveyor

Pneumatic Tubes

Pneumatic tubes use compressed air or a vacuum system to transport small items through a complex of tubes.

Although very popular at one time, modern methods of transportation have replaced many.

Pneumatic Tubes

Still using this method are banks, hospitals, pharmacies, factories, and larger stores and restaurants that transport money from the cash registers, to a safe in a remote area of the building.

Pneumatic Tubes

Pneumatic tube systems are computerized to serve many purposes.

They transport tube-like carriers, typically 3-3/4 inches to 5-3/4 inches in diameter and 15-16 inches long.

The carriers move through a system of piping and are controlled by a computerized control center.

It can be a single zone route or have multiple zones, depending on its usage.

Pneumatic Tubes

Another pneumatic system used in hospitals and hotels is larger and used to transport linens and/or trash.

These are an improvement over gravity fed chutes that may become clogged and have to be cleaned out.

With a pneumatic tube system, linens or trash can be placed in bags sized to fit through the tube.

Cranes and Hoists

Cranes and hoists are lifting machines used to move heavy materials from one place to another.

There are many types of cranes and hoists designed to do specific jobs.

Cranes and hoists are generally supported by the structural frame of the building so it becomes an important part of the design.

Other types have an independent structural system and are much more versatile because they can be moved from one side to another.

Cranes and Hoists

An overhead crane is attached to two fixed overhead tracks.

The crane bridge can move back and forth along the top of the track, accessing materials and carrying them to another site along the tracks.

The *hoist* is what lifts the materials using an electric motor and winch that is attached to a trolley that moves along the crane bridge.

Cranes and Hoists

Monorails have the hoist slung low, below a single steel track.

The electric hoist is attached to a trolley that travels along the bottom flange of the single track that is attached to the buildings structural frame.

The operator of these crane types is usually on the floor using a control to move the materials.

Cranes and Hoists

Another type of crane is the gantry crane. There is also a powered mobile gantry crane available in two-wheel or four-wheel drive.

A typical crane is capable of lifting several hundred ton at one time.

Cranes and Hoists

The gantry crane has an overhead track and a trolley that runs on a steel track or steel web truss.

This track or truss is attached to legs that have wheels and run across the top of rails that are attached structurally to the building frame or the foundation.

Gantry cranes are operated with controls located in an operator cab mounted to one of the structural steel legs.