

Tempe Fire Department Policies and Procedures

Elevators

405.13

Rev 10-07-09

PURPOSE

To familiarize personnel with types, construction, use, and rescue from elevators.

PROCEDURE

COMMON CHARACTERISTICS

All elevators operate in a shaft (hoistway). They can be single, multiple, or blind (no landings for an area). Each landing has a hoistway door that operates in conjunction with the car doors. Each hoistway and door has a fire rating: 1 hour hoistway - 60 min. door. 2 hour hoistway - 90 min. door.

Primary Components

Hoistway, Machine/ Control Room, and Car

Types of Hoistway Doors

Center opening - The most common with 2 doors that meet in the center and open away from each other. Interlock is at the center.

Single slide - One door that will slide. The side the door closes into is called the striker jamb. Interlock near the striker jamb.

Two speed - A double door that slides to one side with the doors on a different plane. The outside door moves faster than the inside. Interlock will be near the striker jamb of the outside door.

Vertical bi-part door - Used on freight elevators, one door up the other down, counterbalanced. Locks on the side near the meeting point.

Swing Doors- Common in residential applications

Each elevator rides on rails that are T shaped and fastened to the sides of the hoistway.

At the bottom of each hoistway is the pit, which has buffers designed to cushion an over speeding elevator (not a fall). These are either spring or oil filled.

Each hoistway has a terminal switch at the top and bottom that will cut power to the operating system if the car exceeds its normal travel distance. It must be reset when tripped, which can be caused by a car, a short, water, flames, etc.

All elevators have a machine room that can be anywhere, usually above, but can be beneath or to the side of the hoistway. The machine room houses the controller (brain) which operates with up to 500 volts, main disconnect (by number), motor/generator (AC to DC) and speed governor, or hydraulic pump.

Cars are constructed of metal and wood and do not have a fire rating. They have a metal beam across the top called a crosshead (smaller on hydraulic elevators). This is where the ropes attach for traction elevators. The floor

(platform) rests on another metal beam at the bottom of the car called a safety plank. This plank is the surface that strikes the buffers if the car over speeds down to the pit. It is also where the safeties are attached. The sides can be wood (metal covered) or sheet metal and outside there are rollers/guides that fit the rail. The main doors have a metal bar (driving vane) that will unlatch the interlock of hoistway doors at a landing so both sets of doors will open in unison. This unlatching process takes place for the length of the driving vane and is called the landing zone. The doors operate by a small electric motor, usually on top of the car. For two speed type, the motor operates the inside with a cable attached to the outside. The types of doors on the car match the hoistway doors. Usually car doors are not latched and can be pushed open from inside the car. Some places (ASU) have installed locking pins that are released at the landing zone to prevent tampering with the car doors during movement.

There can be escape doors on top, to the side, or none at all. They may be hidden from the inside and take a removable handle to open.

The power cables to the car are usually attached at the mid-point of the hoistway and loop down to fasten below the car.

All elevator stop switches remove power from the drive motor: emergency stop, terminal switch, pit stop, and the switches on the car and hoistway doors.

TYPES

There are several makes of elevators: Otis, Montgomery, and Dover to name a few. There are strict regulations governing elevators and thus they are the safest form of all powered transportation. A busy elevator may travel 25,000 miles a year. There are 2 main types of modern elevators.

Traction - These are cable drawn (wire rope) which have an 8/1 safety factor and last about 20 years.

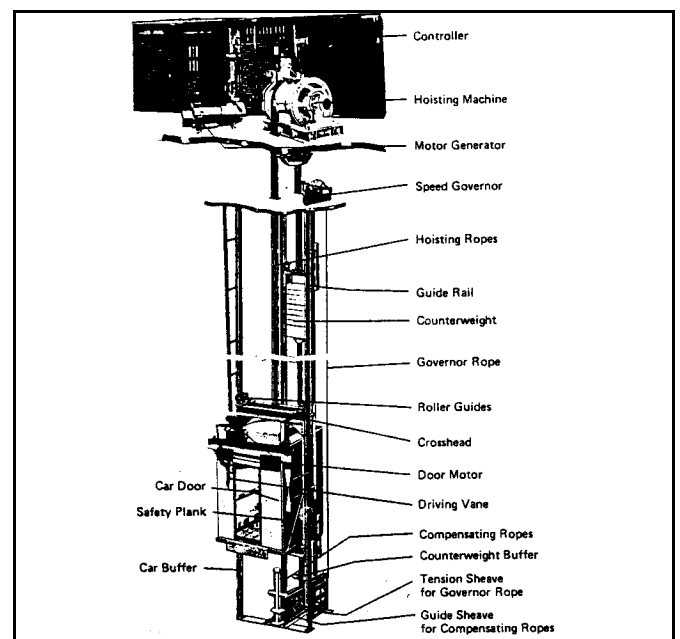
Components include the car, cables, traction sheave and drive motor, and counter weights.

These elevators operate at different speeds and span many floors; there are no height restrictions for buildings they serve. The hoisting machine will have a traction sheave and a motor brake. This brake is to slow the car down near a landing and hold it in place. It may not stop an over speeding car, as it is designed to hold at a landing.

A speed governor has a separate cable that works on centrifugal force to slow down over speeding. At 115 percent of normal speed a gripping jaw tightens on the governor cable letting it slip (to avoid breaking). As the car continues, the tensioned governor cable trips the safeties.

Safeties are attached to both ends of the safety plank on each car, one for each rail. They are designed to stop an over speeding car and can do so if all ropes fail (very rare). They consist of tapered jaws that wedge against the rail. For example: an elevator that operates at 800 fpm would trip at 970 fpm and stop the car in 4' - 12.5'.

Counterbalance weights ride on their own rails in the hoistway. They are usually heavier than the loaded car. Compensating ropes may connect to the bottom of the car and the counterbalance weights. This is so balance is maintained whether the car is at the top or bottom of a long hoistway. When counterbalance weights are situated above an occupied area, they must have safeties also (upper floor elevator). Machine/Control room is usually

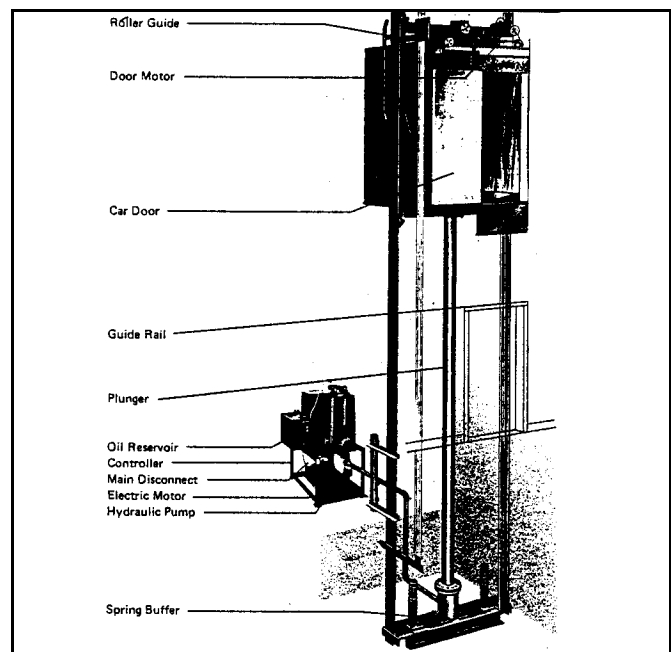


Electric Traction Elevator

located above the hoistway.

Hydraulic – Components include Car, cylinder and piston, and hydraulic pump and reservoir. These elevators are driven by a hydraulic pump that operates a large piston from beneath the car. One piston will span 3 floors. A telescoping piston will span 5 floors. Installation of hydraulic elevators is usually limited to buildings 6 stories or less.

Hydraulic elevator cars do not have safeties. The descent is controlled by the size of the oil bleed off for the piston. They are much slower than traction elevators, and there are no counterbalances weights. Machine rooms are normally located near the bottom of the shaft.



Hydraulic Elevator

INSPECTION STATION

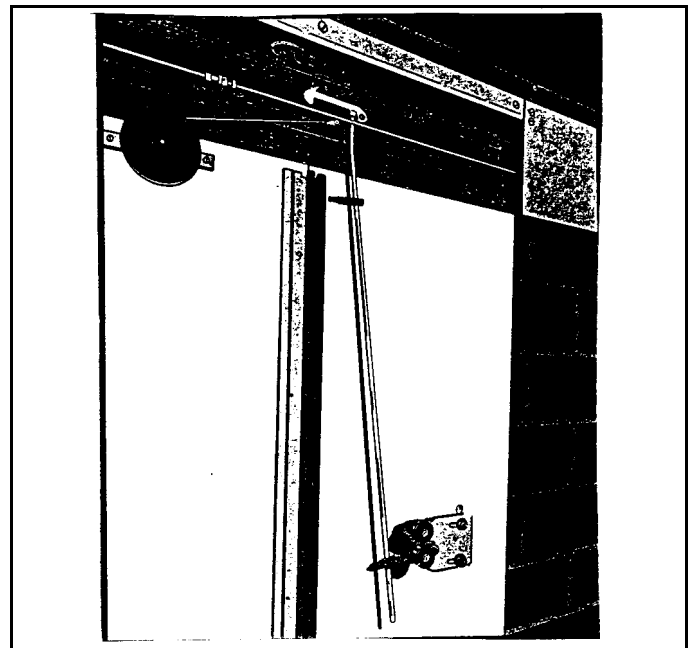
On top of most cars is an inspection station which includes a light, a run/inspect switch, and control buttons. Once the inspection feature is engaged, the car is only controlled from the inspection station. There are usually 3 vertical buttons marked up/down, the center button is not marked. To move the car up the hoistway, press the center and up button together, release to stop. To move the car down the hoistway, press the center and down button together, release to stop. Although designed for hoistway inspection, this feature can be used in rescue.

To access the inspection station you will have to enter a hoistway door above the car. Remember to keep all body parts well inside the edge of the car. There are lots of items in the hoistway that could injure you.

RESCUE

People trapped in a stalled elevator are not in danger unless there is a medical problem (or fire). If an elevator mechanic is responding within a short time it is probably best to wait for them. Usually one of the safety switches has tripped cutting off power to the drive motor. The car fan and lights are on a different circuit and should still operate. If the decision has been made to attempt to rescue the occupants, here are some guidelines.

- Communicate with the occupants. There may be a phone or intercom system you can use. Have the occupants turn off/on the emergency stop a few times, then push different floor buttons (probably already done). This may return the car to the landing.
- Determine where the car is in reference to a landing. Look at the position indicator, talk to occupants, enter pit (engage pit stop switch) and look up the shaft, look from the top of the hoistway through the smoke vent or rope openings.
- Open hoistway doors. If the car is in the landing zone you can just push the hoistway doors open and easily access the car doors. If the hoistway door nearest the car has a key hole you can access the car doors and have a quick rescue. Make sure the main power is off to the drive motor as well as the emergency stop before opening hoistway. Multiple hoistways have keyed doors at the landing next to the pit and sometimes at the top floor. Using special door keys, the interlock can be released from outside the door. Each will operate the control rod for the interlock.
- Lunar key- a straight rod with a groove. The hole resembles a quarter moon. Stick the key straight in the hole and pull down. If you do not have this key, a screwdriver may work (phillips best).
- Drop key- a rod type key with a flat hinged bar on the end. Insert in the hole until bar drops and rotate away from leading edge of door. Some keys have a double drop for a larger radius.
- T key - a T shaped bar with a hole similar. Use like the lunar key. (old)



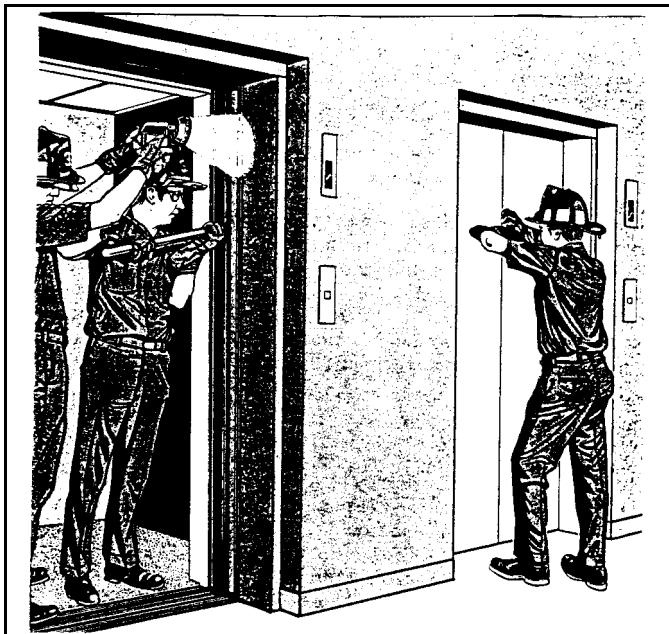
Interlock on Hoistway Door

If there is no key hole a hard rap at the top of the doors by the interlock may jar it open. This also may work if debris is in the door track.

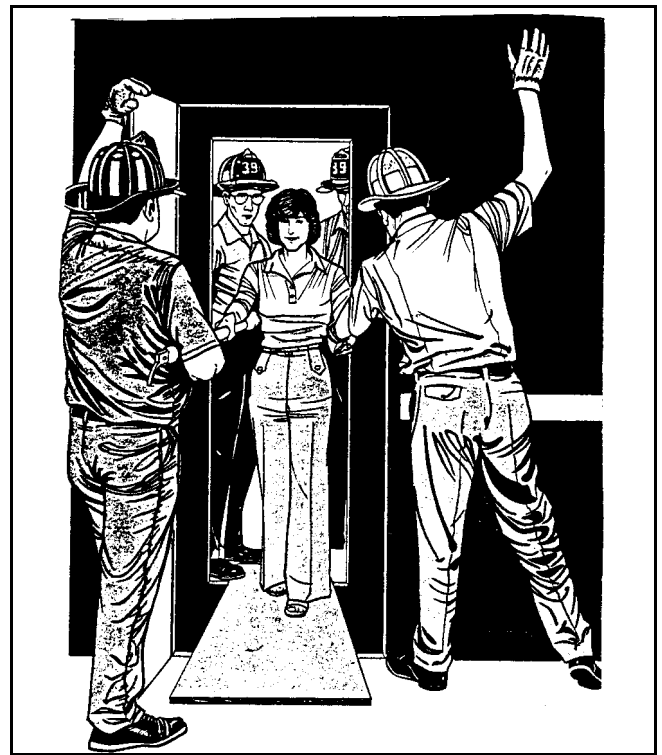
Have the passengers open the car door. It should not be locked and can be pushed open by hand by overcoming the resistance of the door motor. Then if they can see the interlock connecting rod explain for them how to unlatch the hoistway doors, then push open. Again some car doors may have a clinoid locking pin to disengage first.

Use an adjacent elevator to access the interlock with a long tool. You may also be able to do the same from the hoistway door above or below the stalled car.

Use side exits on multiple hoistways. When the cars are level people can pass from side to side. You might need removable handles to open from the inside. Use a bridge made from an attic ladder, backboard, or the like and keep hold of the passengers from both sides. Again power to the drive motors of both cars is secure. Shut down all the elevators to avoid car movement or being struck by another car or counterbalance weight in multiple hoistways.



Unlocking Interlock from Adjacent Car



Multiple Hoistway Side Door Rescue

Force the doors. This is a last resort. Damage = down time = loss of revenue for the owner. Force from the top of the door(s) near the interlock. On single slide and 2 speed doors, force from the striker jamb side. This may be hard to determine. One way is stick a flat object between the door and the jambs (card, paper). The side that blocks the probe is the striker jamb. For a double door, force between the doors at the top.

It is possible to cut a hole in the door with a saw and reach the interlock. This may be less expensive. Warn passengers of the noise. Firefighters should be at the pit in case there is a fire from the sparks.

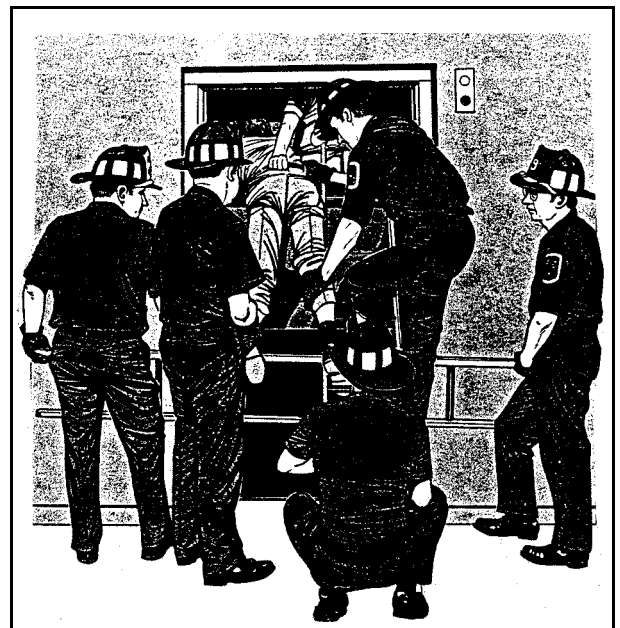
Remove the passengers carefully.

For a car below the landing, use ladders rather than pull them out.

For a car above the landing, again use ladders and guard the open hoistway so no one falls in. Partially closing the hoistway doors will help.

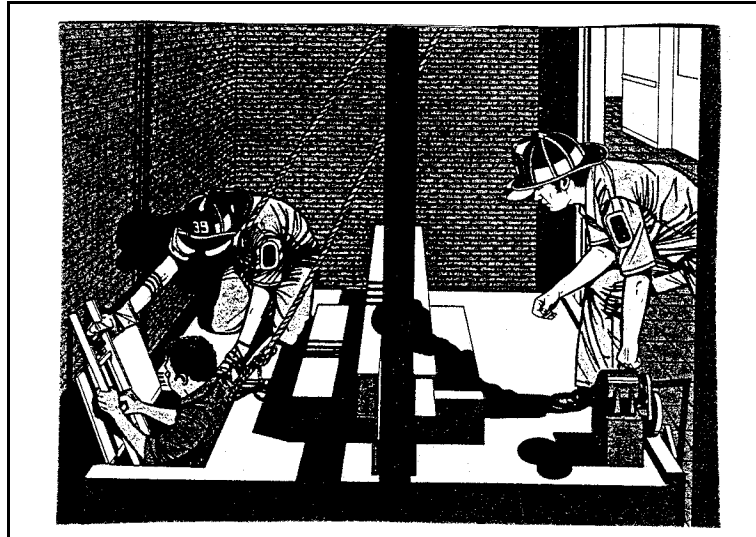


Below Landing Rescue



Above Landing Rescue

For a car between landings or in a blind shaft you may need to use the top escape door. Blind shafts usually have some type of door/s to the hoistway. Use safety lines attached to personnel and passengers. An attic ladder is used to remove the passengers from the car. In multiple hoistways you can use an adjacent car to access by making it level with the stalled car.



Top Escape Door Rescue

Hydraulic elevators may have a lowering valve. One firefighter can work the valve and drift the elevator down to the next landing by communicating with other firefighters watching from the hoistway. The elevator will move with the doors open, be careful. If the valve is not marked, use another method.

ELEVATOR USE IN FIRE

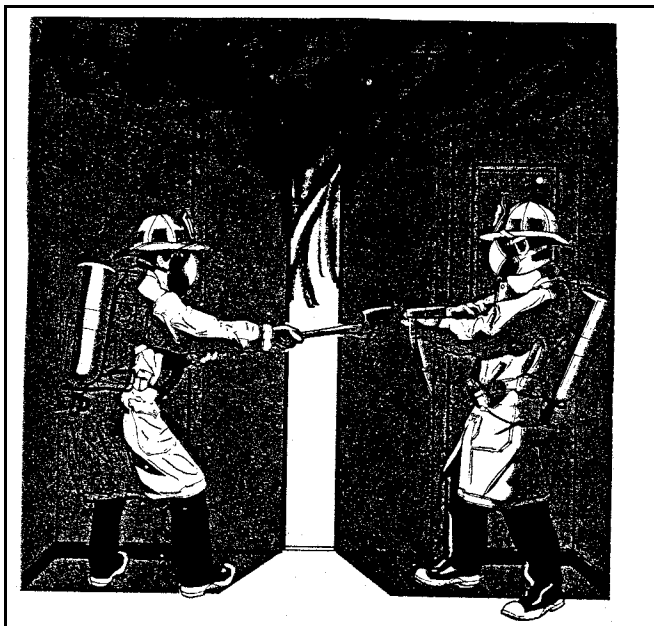
The Company Officer must exercise extreme caution when making the determination to utilize an elevator under high rise fire conditions.

You have to make sure the elevators are safe to use in fire situations. If only a few floors, use the stairs. The elevator to be used must have a firefighter operation feature. The hoistway must be clear of smoke, fire, and water. Heavy smoke or any fire may mean the fire rating has been exceeded on the hoistway or doors. The hoistway doors may warp tripping the stop switch. Water can short any of the trip switches also, killing power to the main motor. The elevator must not have a blind shaft, that is, a partial hoistway run with no openings to lower floors.

Elevators are called to the fire floor for several reasons: someone signaled at the floor, the call buttons shorted, heat sensing buttons, etc. If called to the fire floor and the doors open, they may not close. Firefighters in this situation should close the door with their tools.

Entrapment can happen while using the elevator. If in this predicament, try all the methods of escape mentioned in this policy. Pull the emergency stop. Shut off any independent service. Try the inside doors and unlatch the hoistway door. If below the landing, climb out. If above leave the hoistway doors partially shut to help avoid falling in the hoistway.

If unable to use the doors, try an escape door. If none, make one, to the top on a single hoistway, or possibly to the side (easier) on a multiple hoistway. Then carefully enter the hoistway and exit the nearest hoistway door. Call for help with your radio. You may need a ladder or rope to get out of the hoistway.



Forcibly Closing Inoperable Door

Independent Service

This service uses a key from inside the car to have control and ignore the hall signals. Car controls still function. This setting in the car is usually for maintenance personnel.

Firefighter Service

This is the best independent service designed specifically for our use. Most modern elevators over 25' have firefighter service. It involves 2 phases. The first is to insert the service key in the lobby capture station and turn it to on. This calls all the cars to the floor and opens the doors regardless of call signals. If stop switches are engaged, that car won't respond. If there is an automatic ground floor return of elevators by an alarm system, the bypass position will override it.

The second phase is to remove the key from the lobby capture station (leaving the switch in the on position) and enter the elevator car. Place the key in the fireman's service in the car operating panel and switch to on. This gives you control of that car. The door close and open buttons operate the doors. Push the floor you want. [Remember to stay 2 floors below the fire and if several floors are to be covered, stop the car and check the hoistway every 5 floors] When you arrive, the doors remain closed. Push the door open button and the doors will open, let off and they close. This gives you a peek of the floor conditions. Once completely open, you have to push the door close button to close them. The "bypass" position on the car operating panel will override safety features that would otherwise prevent the car from moving (warped hoistway doors). The "hold" position will keep the car at the floor with the doors open, remember, always keep someone with the car. Make sure they have a radio.

In computing which floor you want remember, do not pass the fire floor. Beware of mezzanines which falsify actual floor count. Also omitted floors such as 13.

- Always be in full gear and carry tools.
- Be breathing air prior to opening doors.
- A rope is a good idea.
- Do not overload the rated capacity.

There is no substitute for preplanning the emergency use of elevators. Key locations, operation sequences, and building layout are critical factors that will vary from building to building. First due companies should be familiar with the firefighter feature of elevators in response areas.

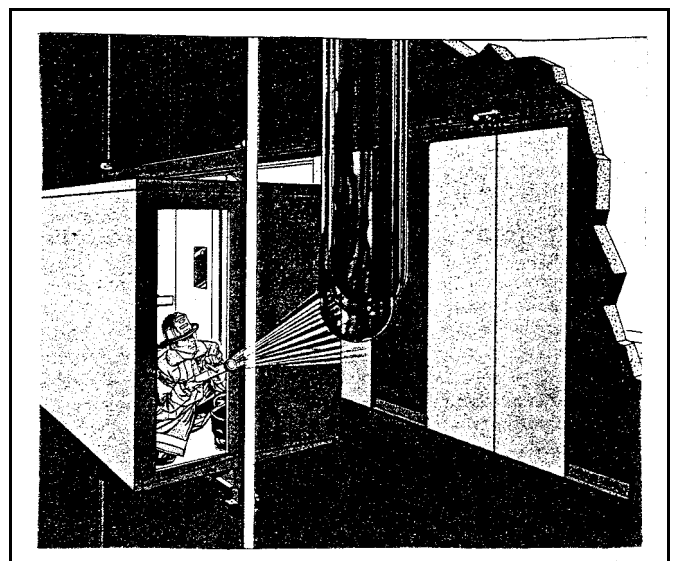
FIRE IN HOISTWAY

If there is a fire in the car it is most likely electrical, handle accordingly.

If the power cables beneath the car are involved, you may need to access them from a hoistway door or from the side door of an adjacent car in multiple hoistways.

If debris in the pit, there is usually an access door if no key hole. Be sure and switch the pit off switch before entering the pit area.

(Information from: Fire Department's Operations with Modern Elevators by Max H. McRae)



**Accessing Power Cables
From Adjacent Car**