

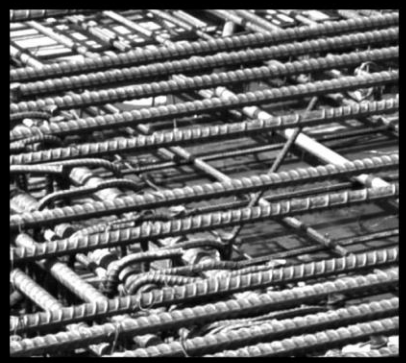
Elevator Maintenance + Repair

Eric Munz, CSP, MBA

Doosan Fuel Cell America, Inc.



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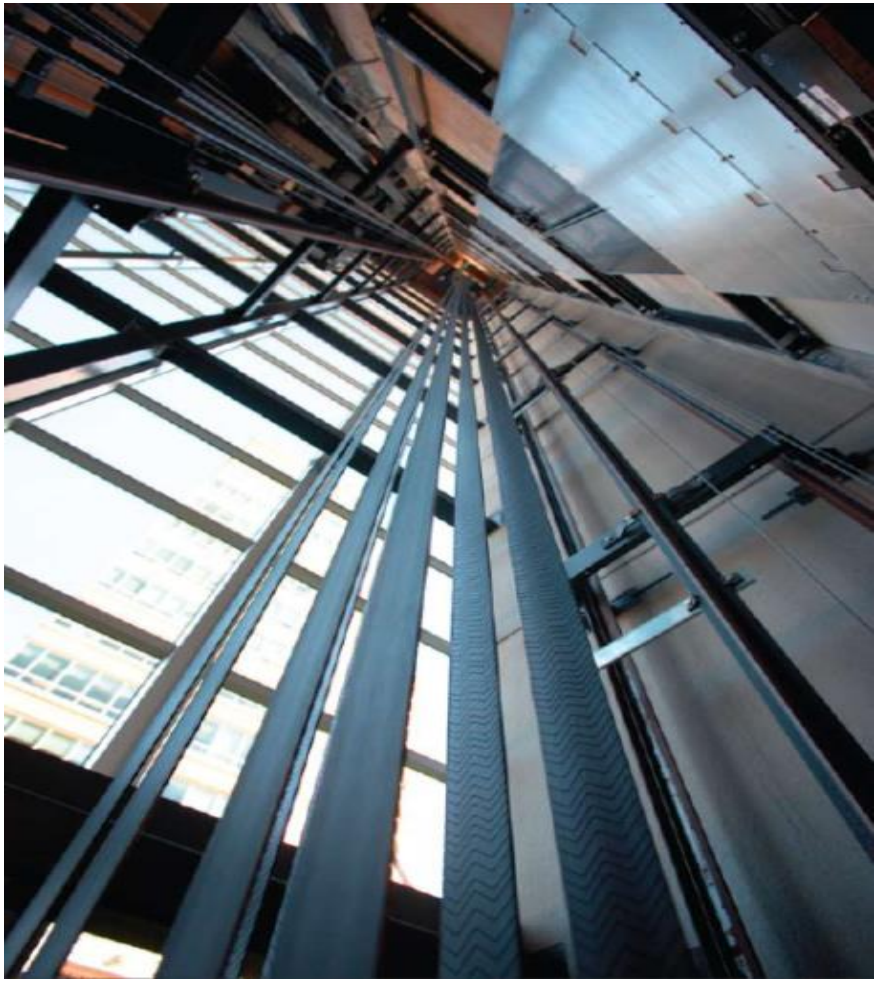
NYC Department of Buildings

Best Practices and Engineering Controls for Public Safety and Mechanics During Elevator/Escalator Repairs in Occupied Buildings

Agenda

- Public Safety Factors
  - Car Control
  - Jumper Management
  - Caution Tape
  - Deep Pit Protection
  - Barricades
- Mechanic Safety Practices
  - Access/Egress MR
  - LOTO/Electrical Safety
  - Jumpers
  - Mechanical Safety
  - Hoistway Access Procedure
  - Fall Protection
- Safety Culture, Creation & Maintenance



Elevators 101

There are 900,000 elevators in the U.S.

Elevators are statistically the safest way to travel.

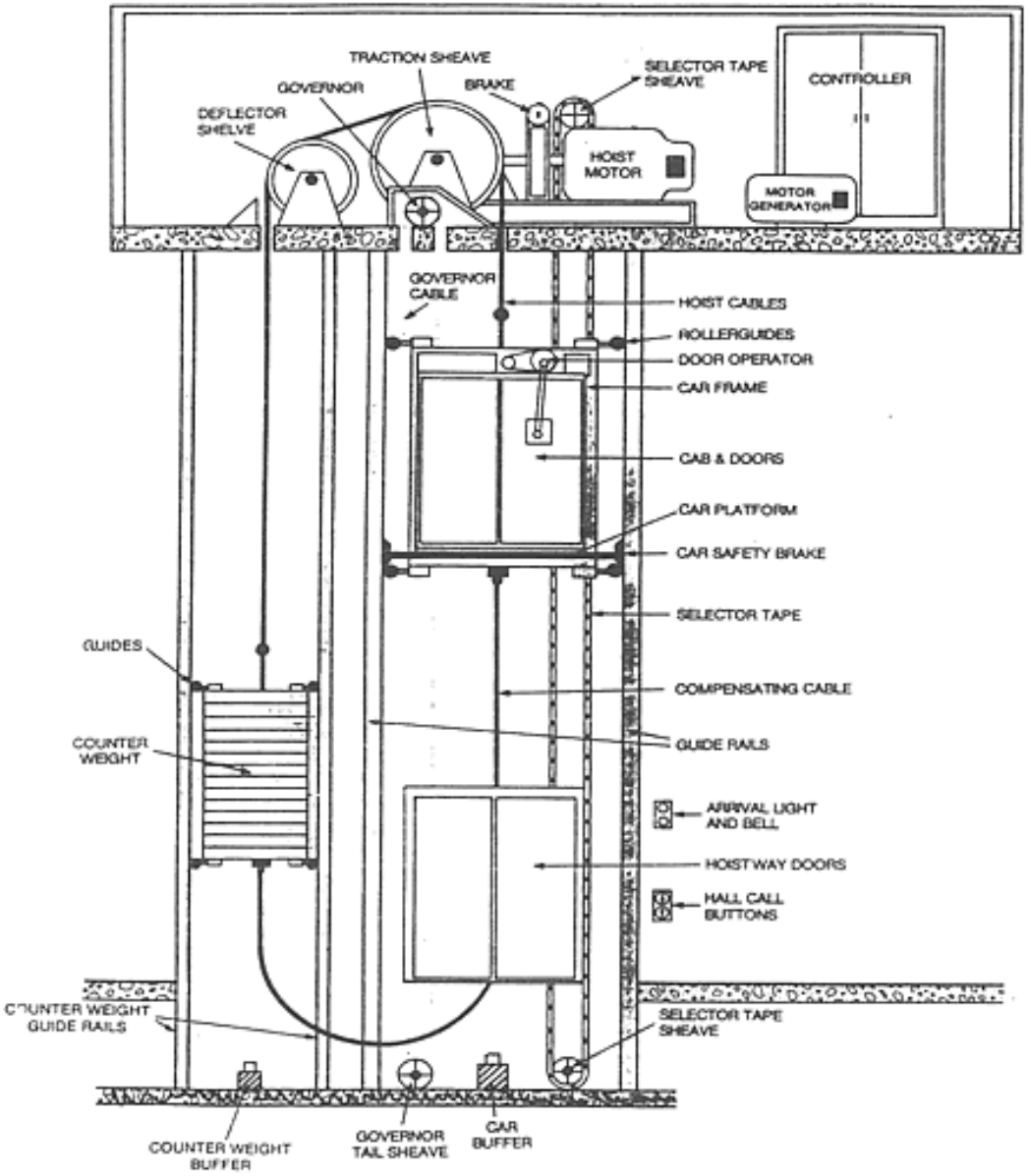
Elevators are twenty times safer than escalators.

Each elevator carries 20,000 people/yr

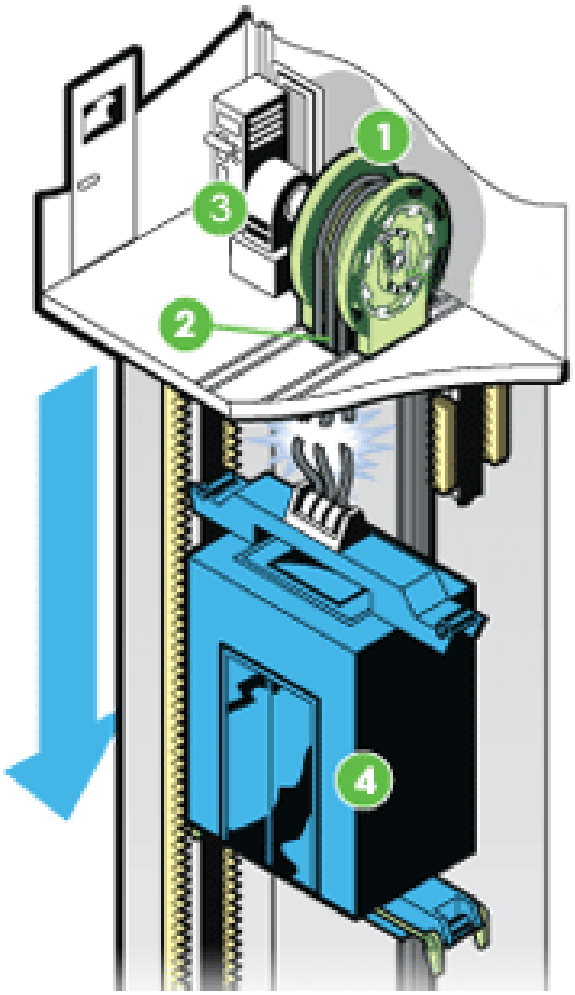
All elevators put together carry the equivalent of the Earth's population every 3 days!

Maximum altitude that one cable hoisted elevator can achieve is 1700 feet.

Close Door button will not make door close faster.

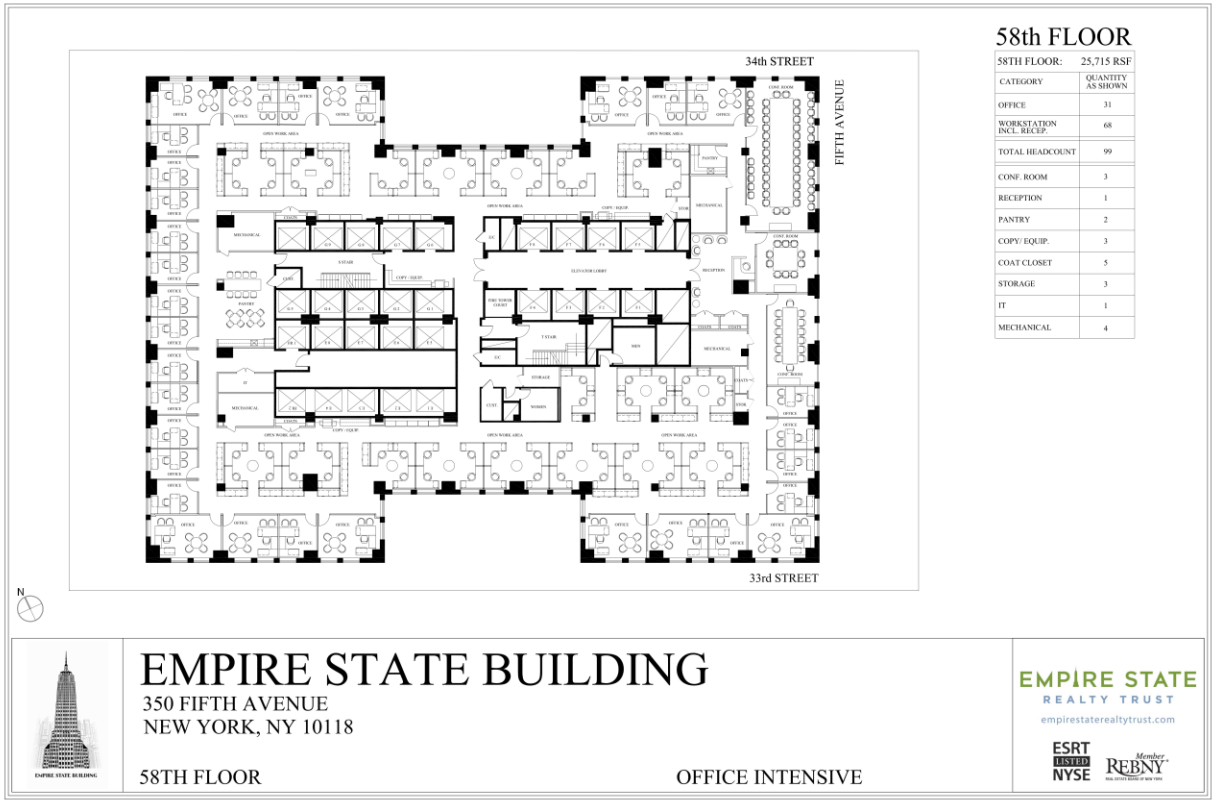


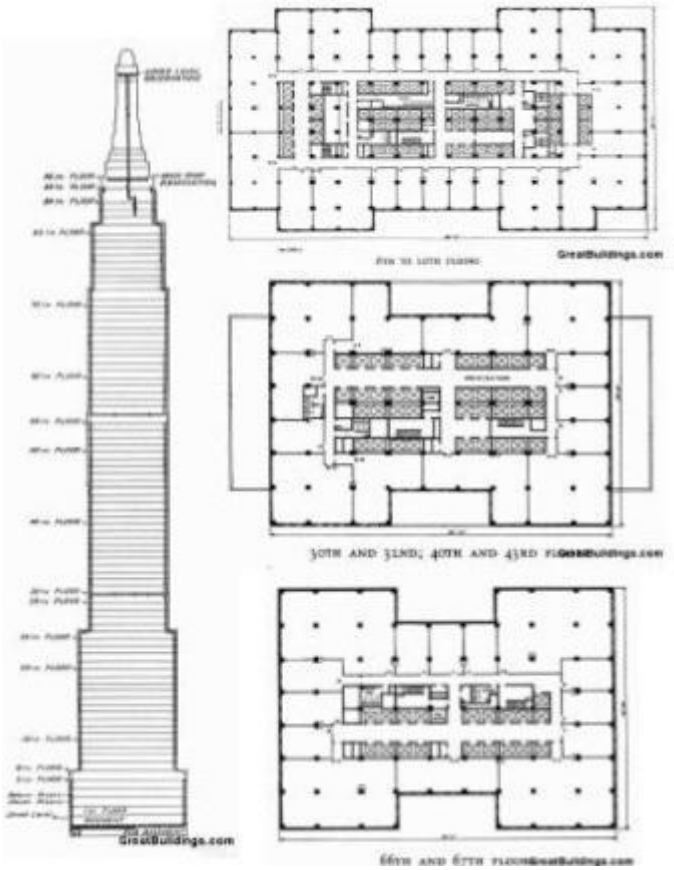
Elevators 101



1. Steel cables bolted to the the car loop over a **sheave**.
2. The sheave's grooves grip the **steel cables**.
3. The **electric motor** rotates the sheave, causing the cables to move, too.
4. As the cables move, the **car** is lifted.

Elevators 101





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Elevator Safety – General Public

CAR CONTROL

- Maintained while on “inspection” mode, removing the unit from the bank
- Electrical and mechanical energy is isolated during repair tasks
  - “Safety Chain” includes: door lock, inspection switch, stop switch

De-Energize

Inspection Control

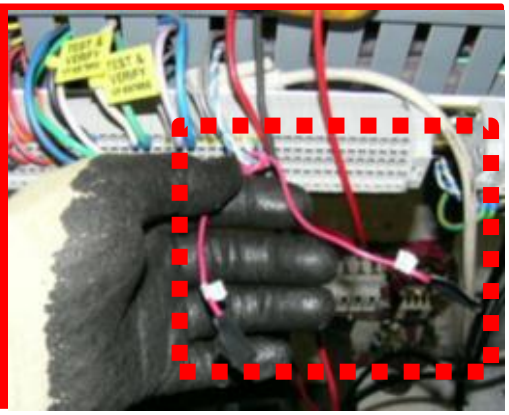
Elevator Safety – General Public

JUMPER MANAGEMENT

- The controller is programmed to prevent unwanted movement of the car, jumpers defeat these circuits
- Robust management practices must be applied
- Personal accountability for jumpers must start with the Mechanic

Controlled Jumper

Uncontrolled jumper



Elevator Safety – General Public

Jumper Best Practices

- Jumpers must not be used as a diagnostic tool.
- Temporary bridging devices must never be used to short out hall door contacts.
- Exceptions must have a written JHA approved by supervision.
- Never jump-out door and gate contacts at the same time.
- Ensure that elevator is on inspection prior to placing jumpers on door, gate, or safety circuits.
- When passenger(s) are trapped inside a stalled car, mechanic must never jump car gate and move the car from the machine room unless they have communication either directly with the passenger(s) or with a second mechanic. In these types of situations it is preferable to move the elevator using TOCI.

Elevator Safety – General Public

CAUTION TAPE (NYC)

- The code specifies 3” yellow caution safety tape installed at 18” and 54” on the inside car door threshold when working on the elevator
- The tape needs to be utilized when the elevator is removed from normal service and a Mechanic is not working in front of the entrance of the actual device
- Prevents unintended public entrance
- Lights out/Doors open communicates that the car is out of service

Elevator Safety – General Public

DEEP PIT PROTECTION

- Pits designed with bottom landing access points represent a challenge for public protection
- Falls of any height can cause injury
- Deep pit depths can be as great as 20’
- Substantial barricades offer a higher level or protection and OSHA compliance

Substantial Barricade

Standard Barricade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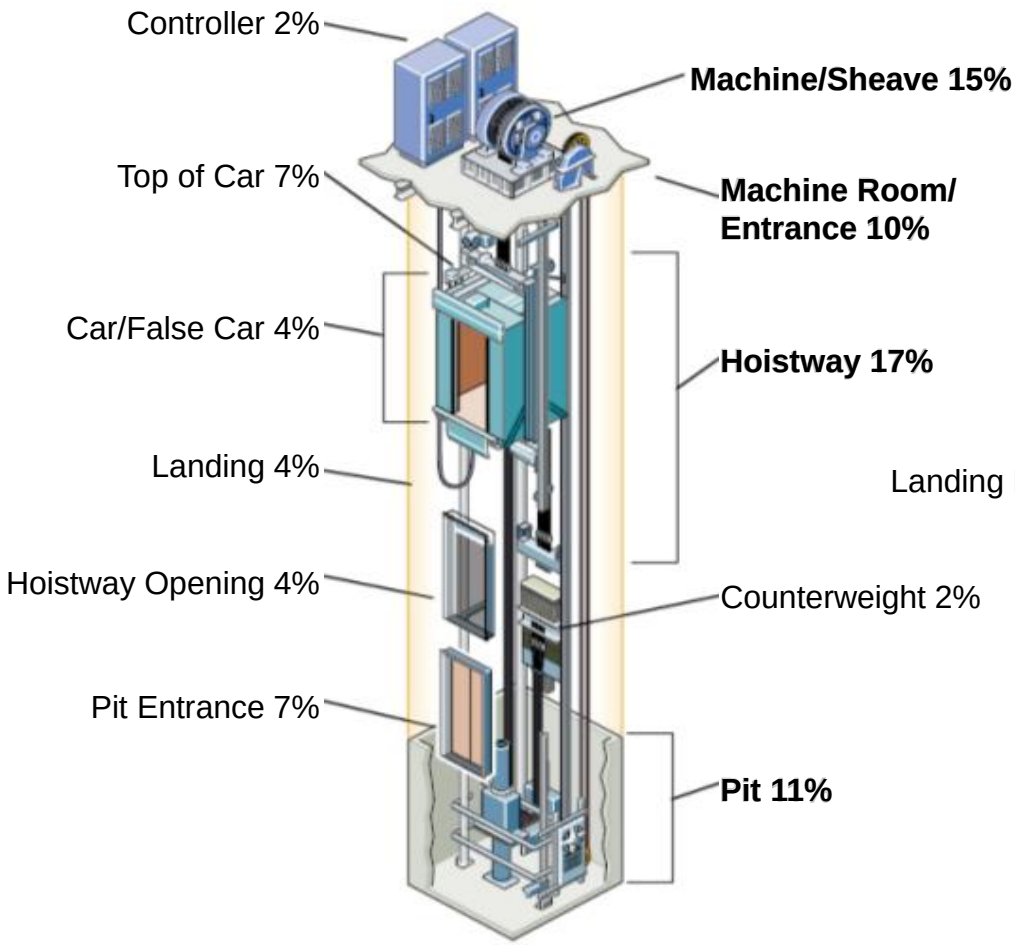
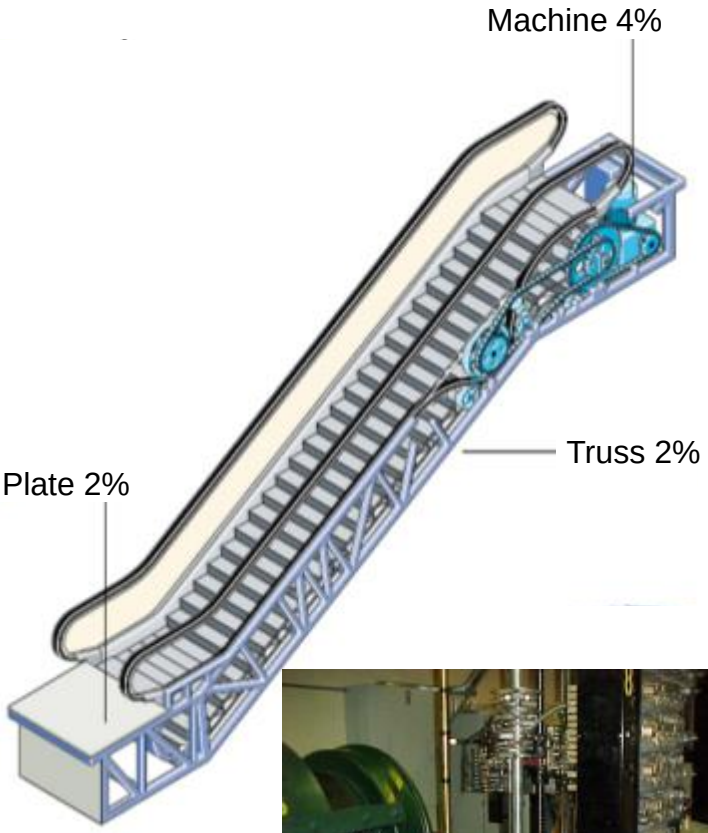
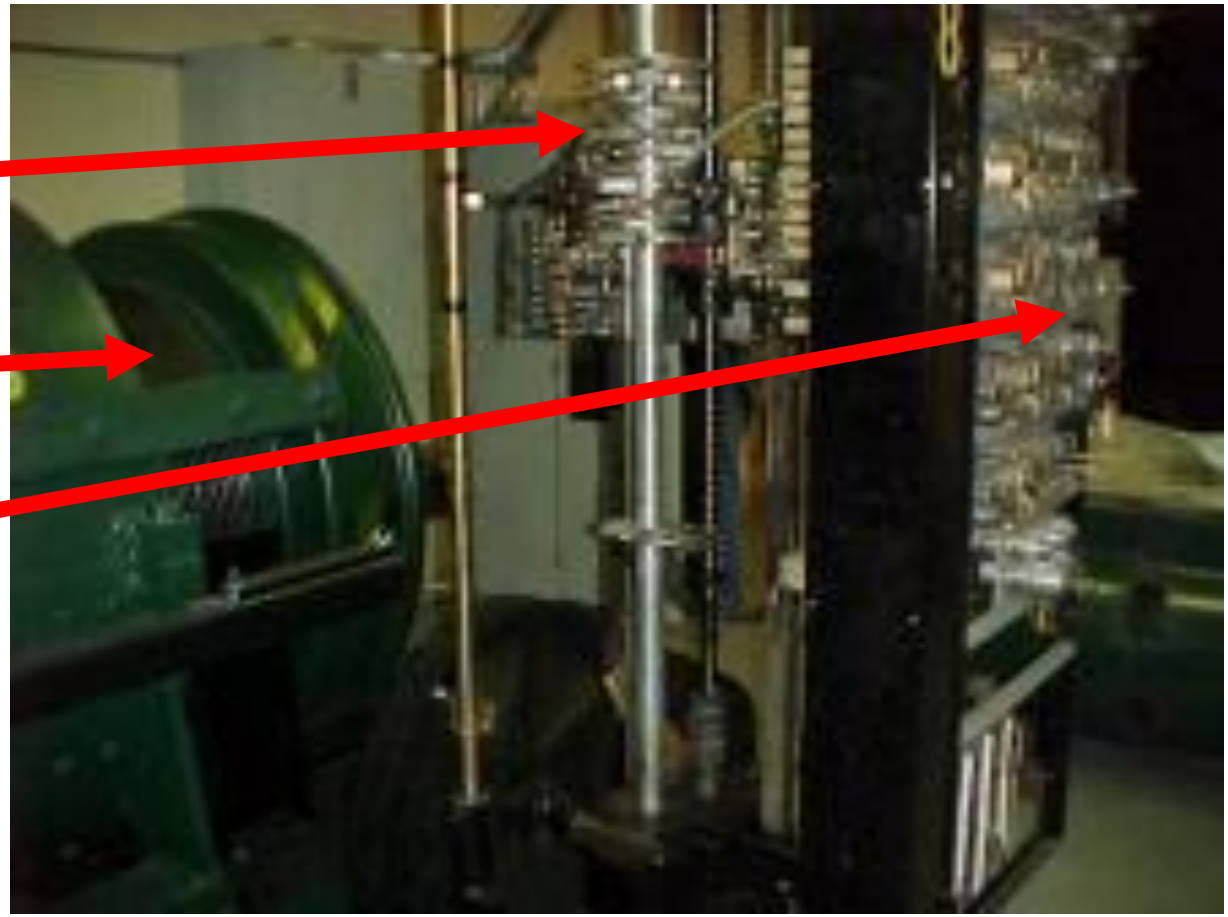
Elevator Safety – Elevator Mechanic Serious Injury Risk Areas





Elevator Safety – Hazards of the Machine Room



Elevator Safety – Elevator Mechanic

ACCESS/EGRESS MACHINE ROOM

- Presents hazard to the mechanic
- Must commonly access rooftops, staircases and mechanical spaces not designed for public access

Elevator Safety – Elevator Mechanic

ELECTRICAL HAZARDS

- If electricity is required for the task, the mechanic must work safely around it.
- Increase distance from the hazard
- Temporarily guard the hazard
- Permanently guard the hazard

Temporary Electrical Guarding

Exposed Electrical

Elevator Safety – Elevator Mechanic

JUMPER MANAGEMENT

- Jumpers must not be used as a diagnostic tool
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- Never jump-out door and gate contacts at the same time.
- Ensure that elevator is on inspection prior to placing jumpers on door, gate, or safety circuits.

Controlled Jumper

Uncontrolled Jumpers

Elevator Safety – Elevator Mechanic

MECHANICAL HAZARDS

- Elevator companies maintain equipment that is owned by another party
- Retrofitting of permanent guards is an owner decision
- Use of temporary guarding is a best practice

Guarded

Not Guarded

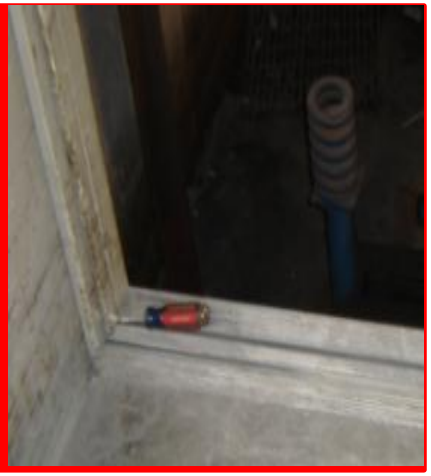
Elevator Safety – Elevator Mechanic

HOISTWAY ACCESS

- Serious injuries occur when control of the car is lost
- Specialized tooling and processes to validate the safety circuits is a best practice

Specialized Tools

Improvised Control



Elevator Safety – Elevator Mechanic

FALL PROTECTION

- Elevator mechanics can be exposed to great falls
- Guardrails eliminate the hazard

Guardrails

Fall Protection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Escalator Safety – General Public

BARRICADES

- Separate public from the hazards of fall and electricity

Escalator Safety – Elevator Mechanic

CONTROL OF ENERGY

- Redundant control of truss (steps removed)
- LOTO/Electrical

Safety Culture Development

Minimum Operational Requirements

- Comply with Federal, State and City regulations

Develop a Culture of Safety

- Develop a Safety Management System
- Proactively manage safety through

Employee training & communication
Proper safety equipment & tools
Create an environment where mechanics champion safety
Empower mechanics to own safety
Support the safest work, not the fastest
Vehicle Management/Driver Accountability
Invest in the safety program

Standardize Processes

When practical, document a standard work process

- Develops efficiencies
- Improves safety for all
- Reduces re-work and unproductive time

PRE-START CHECKLIST

Job Site Contact	Otis Project Number
Cell Phone	Name & Address
Job Site Phone & Fax	

The following items must be corrected in order to meet regulatory requirements and an efficient installation. Please ensure the Otis Modernization Superintendent is aware of any deficiencies. Any items that are not part of the scope of work must be forwarded to the Owner, Manager or project GC immediately for corrections.

Pit

- ☐ Sump Pump and cover installed per local code (If applicable)
- ☐ Pit lighting, per code, is installed and operating
- ☐ Pit ladder installed and located per local code.

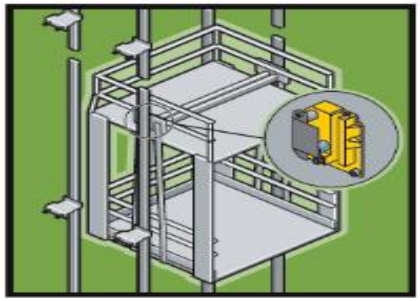
Hoistway

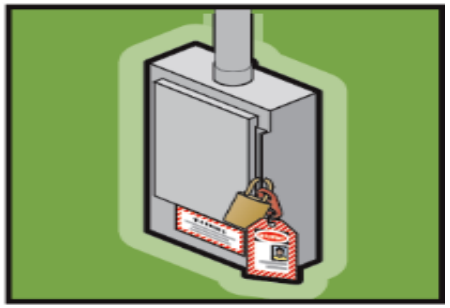
- ☐ All necessary cutting and patching scheduled and locations approved.
- ☐ Any hoistway work by others scheduled and approved. (If applicable)

Establish the Rules

ALWAYS use fall protection when a fall hazard exists.

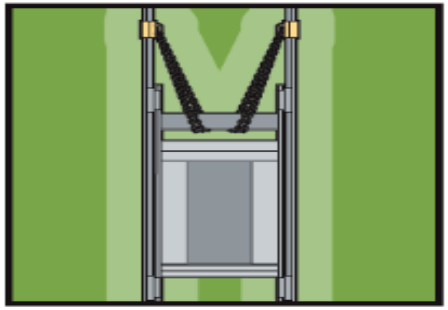
ALWAYS follow the operation authorized procedures for false cars/running platforms.





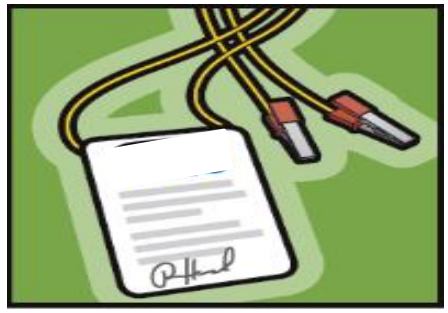
ALWAYS lock and tag out equipment when power is not required.

ALWAYS use certified & inspected hoisting & rigging equipment.

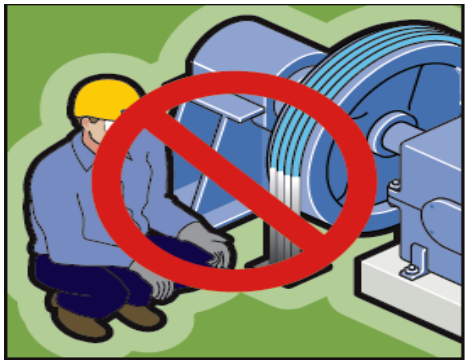


ALWAYS establish and maintain control of the unit prior to accessing.

ALWAYS follow proper jumper procedures.



Establish the Rules

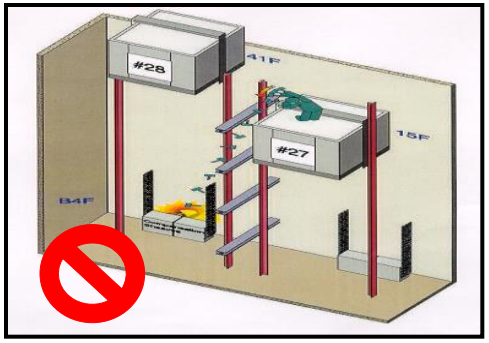


ALWAYS control live electricity and rotating equipment when working within close proximity.

NEVER ride escalator when steps are removed.

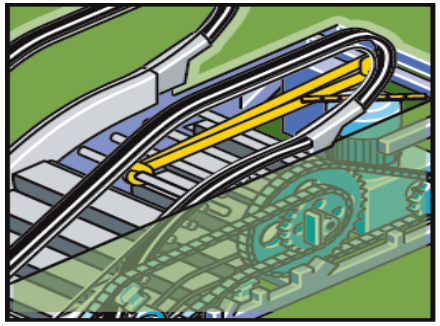
NEVER ride the car top with the elevator in normal operation.

ALWAYS secure the step chain from movement.



NEVER work above or below others when working in the hoistway.

ALWAYS use barriers and redundant controls (LOTO) when unattended



Educate Mechanics on the Process

Classroom and hands-on training reinforces the learning process

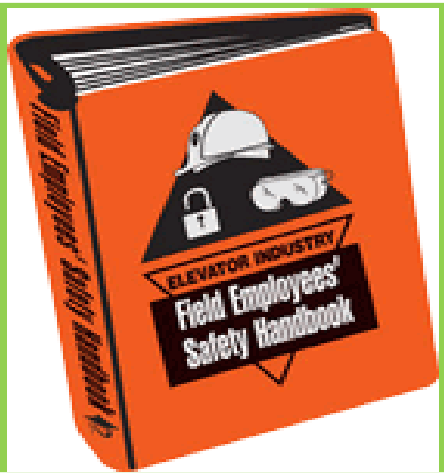
Improves accountability and compliance

Frequent training/communication

Elevator Field Employees' Safety Handbook

Engaged Training

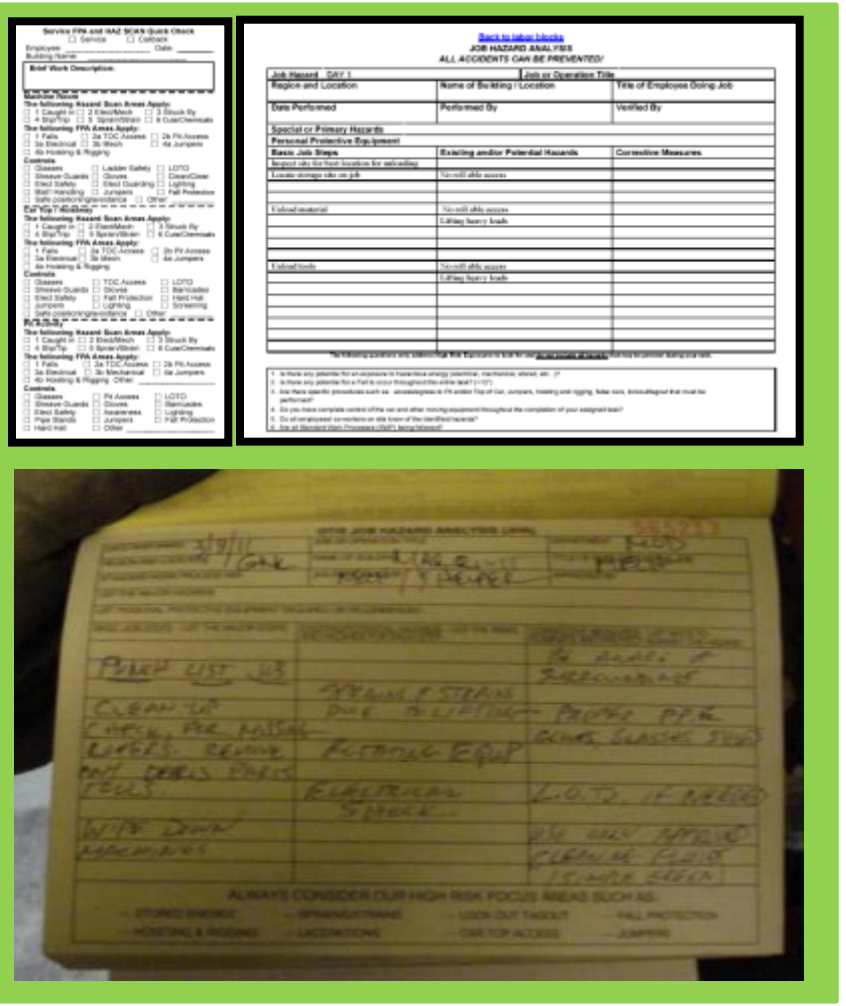
Safety Handbook



Job Hazard Analysis (JHA)

An important accident prevention tool used by mechanics is the Job Hazard Analysis Process, or JHA.

This process allows mechanics to analyze each job step, identify hazards they may encounter, and document ways accidents can be prevented by mitigating these hazards. A written JHA should be used at the start of each day, and when starting each new major task.



Jobsite Inspections

Although *NEII*® companies continue to drastically reduce the number of injuries, serious injuries still occur.

As a result, some members have developed special observation programs to assess the level of understanding of mechanics of the key hazard areas while performing typical procedures.

This assessment focuses on preventing the leading causes of serious and fatal injuries.

1. **Fall Protection**
2. **Control of the hazardous Energy**
3. **Control of the Elevator**
4. **High Risk Practices**
   a. **Scaffolding**
   b. **Running Platforms**
   c. **Hoisting & Rigging**
   d. **Jumpers**

Program Recognition & Enforcement

Mature programs

- Motivate employees to “do the right thing”
- Reinforces compliance to rules
- Formally document history
- Verbal warning to termination options
- Automatic suspensions for violations, even first time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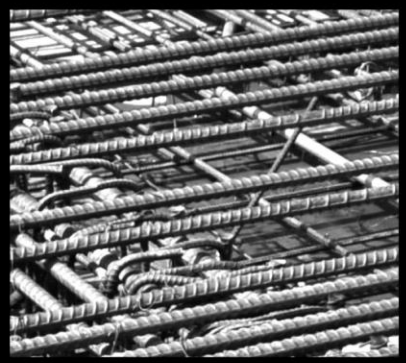


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