

Mechanical Energy Policy

Otis Safety Handbook 2012

7.0 MECHANICAL ENERGY

Cardinal Rule:

Always control rotating and adjacent equipment when working within close proximity (5ft) of the hazard.

Always mechanically secure the escalator from movement by two independent means, prior to working in the truss.

Always be aware of other mechanical energy hazards, such as bi-parting doors, gang box lids, roof hatches, escalator floor plates, etc.

7.1 Hydraulic Elevators

When working on the hydraulic or suspension system of a hydraulic elevator, roped hydraulic or dumbwaiter, or while performing any work that could damage the integrity of the piping or hydraulic system, in addition to lockout and tag, the elevator must be "landed" on pipe stands or similar supports to prevent incidental motion.

To perform a brief inspection (maximum 15 minutes) mechanical blocking is not required unless conditions indicate the need. (Refer to Pit Access Procedure)

When working in the pit of a single-bottom cylinder hydraulic elevator pipe stands must be in place at all times.

When working in pits of 20 in. or less, mechanical blocking is required in addition to a label instructing of this requirement.

NOTE: Precautions must be taken to lockout/guard mechanical systems to eliminate various forms of stored energy and/or moving equipment (e.g., working in multiple hoistways within close proximity 20 in. [500 mm] of adjacent moving equipment). If you observe any of these conditions, always conduct a Job Hazard Analysis with your supervisor.

Hydraulic elevators must be supported/blocked with approved pipe stands under the following circumstances. The intent is to prevent movement of the car should there be a loss of pressure anywhere in the system.

- Prior to working on the hydraulic pressure system
- If any task exceeds 15 minutes
- If a known or perceived single bottom cylinder
- If the pit refuge space is 20" or less
- Repair or construction

Environmental and Safety Considerations:

- ALL hydraulic elevators MUST have unit record logs present in the machine room.
- The unit record must be completed whenever the machine room is visited by the mechanics. The log is designed to document oil checks and whether or not oil is added.
- ALL hydraulic elevator tanks MUST have a magnet indicating the oil level.
- Oil may only be added if the oil loss has been identified in the machine room or pit.
- If at any time oil loss is unexplained, the following procedure is to be followed: Under no circumstances shall oil be added when the cause of oil loss is not identified and observed (e.g., on the pit floor or in the machine room). Refer to SPG 113 for further information.

7.2 Residential Elevators / Dumbwaiters

Residential Elevators

Residential elevators have similar hazards to dumbwaiters. Field associates may not work on these units very often and therefore extra caution should be exercised.

Working on the Car Top:

Residential elevators are not normally designed for personnel to work on the top of them. If you ride the top of a residential elevator, it must be equipped with top of car inspection or you must follow the rules stated in Section 8.0. At a minimum working on the car top would require the following assessment:

- Does the residence elevator have top of car inspection operation? If not, Lock and Tag Out the main line switch.
- Is the car top strong enough to support a person, tools and equipment? If not, take steps to reinforce the car top.
- Can you get in and out of the hoistway safely? Use ladders properly and make sure the hoistway is large enough for you to enter, exit, and work safely.
- Be aware that overhead space is usually very small. Do not take chances by having an operator run the car unless you have taken steps to ensure that a safe refuge space is available.
- Always wear fall protection and tie off if a fall hazard exists.

Working in the Pit:

1. Lock and tag out the mainline switch before entering the pit.
2. Mechanically block the residence elevator to prevent incidental motion.
3. For pit depth of 20 in. or less, mechanical blocking is required at all times during any pit activity.

General Safety Rules:

- Some residence elevators have drum machines. Always be aware that slack cable can cause the elevator to fall. Even a few inches of slack can cause serious injury and illness when reaching inside or underneath the car.
- Controllers are often in remote locations. Do not take chances in moving the car without proper communication. Be careful, drum machines can create slack cable.
- If more than one elevator shares a common hoistway, always shut down the adjacent car(s) and lock it out when you need to work inside the hoistway. If you are working within 20 in. (500 mm) of adjacent car, a barrier between hoistways could also afford proper protection.

Dumbwaiters

Because dumbwaiters are small, many field associates have been injured because they did not take them seriously. Often, dumbwaiters can be more hazardous than most elevators.

Working on the Car Top:

Dumbwaiters are not normally designed for personnel to work on the top of them. Never ride the top of a dumbwaiter unless it is designed for top of car operation. If working off the top of the car is required, assess the situation and carefully plan your work as follows:

- Does the dumbwaiter have top of car inspection operation? If not, lock and tag out the main line switch.
- Does the dumbwaiter have safety devices? If not mechanically block the car and wear fall protection and tie off to a solid structure or lifeline.
- Is the car top strong enough to support a person, tools and equipment? If not take steps to reinforce the car top. What is the rated capacity of the car?
- Can you get in and out of the hoistway safely? Use ladders properly and make sure the hoistway is large enough for you to enter, exit, and work safely.

Working in the Pit:

1. Lock and tag out the main line switch before entering the pit.
2. Mechanically block the dumbwaiter to prevent incidental motion.
3. For pit depth of 20 in. or less, mechanical blocking is required at all times during any pit activity.

General Safety Rules:

- Most dumbwaiters have drum machines. Always be aware that slack cable can cause the dumbwaiter to fall. Even a few inches of slack can cause serious injury and illness when reaching inside or underneath the car. Use a mechanical blocking device (e.g., brackets, beams, pipes, slings) to safeguard against incidental downward motion of the dumbwaiter.
- If more than one dumbwaiter shares a common hoistway, always shut down the adjacent car(s) and lock it out when you need to work inside the hoistway. If you are within 20 in. (500 mm) of adjacent car, a barrier between hoistways must be installed for protection.
- Many dumbwaiters have locks and contacts instead of interlocks. Ensure that the dumbwaiter cannot run with the doors open.

7.3 Material Storage

Materials on all jobsites and warehouses must be secured from inadvertent or unexpected movement by tying material back or laying material flat.

While loading or unloading vehicles at a dock wheels must be chocked to prevent movement of the vehicle.

Always use proper lifting techniques while lifting and moving objects. Never lift with your back and never twist while lifting to prevent back strains.

7.4 Hanging Elevators & Counterweights

Elevators must be supported by a minimum of 2 means (hoists) each with the capacity to support the elevator on their own (see ORM 11.1-A). CWTs must be landed on approved steel pipe stands.

7.5 Escalator Truss

When work is being performed in the truss of the escalator, movement of the steps/axle must be controlled by 2 independent means in both directions using a combination of the following:

- Lockout/Tagout (with machine brake set)
- Lock bar around machine/drive
- Ratchet straps or synthetic slings (padding) around step axle and truss securing movement in both directions

Procedures requiring access to the truss must utilize escalator walking or step boards.

Barricades must be positively secured to the escalator to prevent public from accessing the area.

7.6 Bi-Parting Doors

For major repairs where chains must be changed or repaired, Bi-Parting doors must be secured by 2 independent means (see OSC approved tools).

7.7 Use of Chemicals

Only use approved chemicals. Highly flammable propellant products are prohibited (i.e., WD40). Chemicals must be properly labeled and stored. MSDS chemical information can be found by calling 3E MSDS solutions 1 (800) 451-8346.

7.8 Pipe Stands

Pipe stands must be readily available for all hydraulic elevators pits, and on site for all single bottom cylinders and pits with 20" or less of refuge space.

7.9 Two-Person Pit Procedures

During 2 person pit and car top procedures, the unit cannot be returned to normal operation unless the person in the pit has egressed and made visual contact with the person on the car top.

7.10 Overhead Protection

Overhead Protection

Never work at staggered elevations in the same hoistway or common hoistways without overhead protection and / or hoistway screening as described in this section.

Overhead protection must be provided in the hoistway and in any other work area where there is exposure to falling objects. This protection must prevent all parts of the body from being struck by falling tools, debris, small parts, etc.

NOTE: A job hazard analysis must be written, SWPs referenced, and a site plan developed to establish overhead protection requirements.

Effective overhead protection in most hoistways shall consist of two-inch planking with 3/4 in. plywood decking. The NAA Tool Facility will design and supply overhead protection for false cars.

On sites where elevators are running on either side, adequate protection (partitions) must be used between hoistways. This may involve the installation of barricades and screening on top of the car on which the work is being performed or the installation of hoistway screening.

Service

Overhead protection can be achieved *by one or a combination of the following examples:*

- Keeping all hoistway doors closed
- Guarding all holes in the machine room and secondary levels
- Prohibiting simultaneous work in hoistway and machine room with unguarded holes
- Prohibiting simultaneous work in common hoistways where no hoistway screening exists between hoistways

Modernization and Repair

Always follow Standard Work Processes supplied by Field Support. In general, overhead protection can be achieved in addition to the above examples by one or a combination of the following examples:

- Installation of an overhead barrier which covers all areas where employees may have to stand or reach to install hoistway components.
- Installation of a false floor, extending from wall to wall, directly above the work area.
- Protection of all hoistway openings above the work area (e.g., installation of hoistway doors or entrance screening/barricades that cover the full length and width of all hoistway openings, guarding all openings in the machine room floor and hoistway wall through which material could enter the hoistway).

Construction

Always follow Standard Work Procedures. Overhead Protection must meet the following requirements:

- Installation of an approved canopy system for all false cars and running platforms of installations of 60' or greater vertical rise.
- Protection of all hoistway openings above the work area (e.g., installation of hoistway doors or entrance screening/barricades that cover the full length and width of all hoistway openings and if available secure the lobby areas to prevent other trades from working, accessing hoistway areas, or storing materials.
- Guarding all openings in the machine room floor and hoistway wall through which material could enter the hoistway.
- All work on false cars and running platforms must remain at same level unless the following conditions are met:

- Full front to back hoistway screening or
- Full enclosure of the platform using screening only if work activity does not require extension outside the platform.
- Secured Lobby Areas must follow the specific requirements such as signage, barricades and screening. See SWP N-0.1.5-9 for details

Barricades

Wooden barricades meeting regulatory requirements and Otis job site standards should be installed at elevator hoistway openings by the general contractor after either rough or finished floors are in place or on modernization jobs where entrances have been removed.

NOTE: Wire rope barricades are not recommended for the following reasons:

- Wire rope usually cannot be maintained to Otis/OSHA standards.
- Wire rope has been found to require extensive maintenance to eliminate snag hazards.
- Toe boards are typically omitted with wire rope barricade systems.
- Top rails and mid rails typically sag more than 2 in., allowing for inadequate protection.

Exception: Given no choice regarding the use of wire rope barricades, a written JHA must be conducted and a process (which includes daily inspections) must be implemented.

Barricades for open hoistways must consist of a top rail at 42 in., mid rail at 21 in., toe board at 4 in., and be capable of withstanding a 200 lb. (90 kg) of lateral force or be comprised of a solid enclosure (e.g., plywood). Horizontal spans must not exceed 8 feet without additional vertical support.

In occupied buildings where the removal of hoistway doors is necessary, a barricade covering the full height and width of the opening is required.

If it is necessary to remove hoistway barricades, be sure to replace them before leaving the area. Remember if you remove a barricade you may be exposed to a fall if the elevator is not at that floor. Other fall protection must be used in these circumstances.

The methods included in this text are recommended to offer maximum protection and flexibility during construction. Other methods of equal strength may be acceptable. Contact your supervisor if you have any questions.

NOTE: Refer to Section 5.4 Barricades for additional information.

7.11 Entrance and Hoistway Screening

Screening is required when working in new construction on each landing and including the first floor with pits 6 feet or greater. Open holes in machine room must be covered.

Screening must cover the full height and width of the entrance (opening) and must not be removed until the hoistway is enclosed.

Mod: Adjacent equipment must be locked out or full hoistway screening installed (back to front) or screening of the exposed side and car top being worked on, as long as work does not extend beyond the screening.

7.12 Compressed Gasses

Propane Cylinder Storage Location

Cylinders awaiting use should be stored in a well ventilated area away from heavy traffic. Propane cylinders stored upright should be placed on a flat surface such as concrete or other non-flammable material that will not collect water. Cylinders stored in places such as damp grass or mud subject the cylinder to rust and/or pitting that may render the cylinder useless. Storing propane containers inside buildings is not advisable. It is recommended that propane be stored outside on a firm surface and away from any source of ignition.

Position of LP Gas Cylinders In Storage

Propane cylinders should always be positioned so that their relief valve is in direct communication with the vapor space of the container. Cylinders that are stored vertically upright will have the relief valve communicating with vapor space. Regarding the cylinder relief valve, it is important to keep the safety relief valve pointed away from anything that escaping propane could come in contact with possibly causing a fire or incident. If cylinders are stored improperly, such as on their side with the relief valve in contact with propane liquid and the safety relief valve opens for any reason, liquid will escape instead of vapor posing a much greater danger. All consumer propane cylinders should be stored vertically upright in all circumstances.

7.13 Oxygen and Acetylene Use

All employees shall:

1. Maintain and operate oxygen-acetylene equipment in a safe manner as directed by supervision and in compliance with this procedure.
2. Utilize all required personal protective equipment.
3. Report all defective equipment and hazardous conditions to supervision.
4. Comply with instruction given by supervision.
5. Welders including 220VAC are required to have a GFCI which can be obtained from the tool facility.

Marking the Cylinders

- Oxygen and acetylene cylinders are to be legibly marked as to the contents. Color coding is not a positive means of identifying the contents of a cylinder.
- Cylinders, where the contents are not positively identified, are not to be used.
- Empty cylinders are identified as such by the words "Empty" or "MT".

Handling of Cylinders

- All oxygen and acetylene cylinders are to be handled carefully.
- Cylinders are not to be dropped, struck or allowed to strike other objects.
- Cylinders are not to be rolled or used as a support to roll other cylinders or equipment.
- Cylinders are to be transported, stored, and used only when secured in an upright position. Racks, chains or straps must be used to secure cylinders in the upright position.

Storage and Use of Cylinders

- Cylinders are to be stored and used in locations that are:
 - Well ventilated and away from corrosive chemicals and fumes.
 - Materials (including cylinders) are not to be stored within 6 ft. of any elevator shaft or stairs.
 - Away from sources of heat.
 - Where they cannot form part of an electric circuit.
 - Far enough away from the actual welding or cutting operations so that sparks, hot slag or flame will not reach them.
- Cylinders are to be stored at least twenty feet (6 meters) from highly combustible materials such as oil.
- Oxygen and acetylene cylinders must be stored at least twenty feet (6 meters) apart or separated by a noncombustible barrier not less than 5 ft. (1.5 meters) high having a fire resistance rating of at least thirty (30) minutes.
- When cylinders are stored outside, they are to be protected against accumulations of ice and snow during winter months, and away from the direct sunlight during summer months.
- Cylinder valves are to be closed whenever the cylinder is not being used. Empty cylinders are to be stored with cylinder valves closed and valve protection caps in place.
- Valve protection caps are to be kept in place whenever cylinders are being stored and handled.
- When storing cylinders, the hose and regulator assembly must be disconnected.
- If a leak is found in a cylinder, move the cylinder outdoors, away from any source of ignition, and notify the supplier.

Acetylene Cylinders

- Acetylene cylinders are placed with the valve end up whenever they are stored, transported or used.
- When acetylene cylinders are in use, nothing is to be placed on top of the cylinder which may damage the safety plug or interfere with the quick closing of the valve.
- Valves on acetylene cylinders are not to be opened greater than three quarters of a turn.
- If the acetylene cylinder is fitted with a valve operated by a wrench, the wrench is to be left on the cylinder while the cylinder is in use.
- Acetylene is never to be used at pressures above fifteen pounds per square inch (103 kpa) gauge.

Oxygen Cylinders

- Oxygen cylinders are to be kept free from oily or greasy substances. A jet of oxygen is never to be permitted to strike an oily surface, greasy clothes or gloves, or to enter a fuel oil tank or other compartment that has contained a flammable or combustible substance.
- Oxygen cylinders are never to be stored near any flammable or combustible materials. Stored oxygen cylinders are to be separated from acetylene cylinders by a noncombustible barrier or a distance of 20 ft. (6 m).
- Oxygen is never to be used in place of compressed air. A serious incident may result if oxygen is used in place of compressed air.
- Never use standard pipe fitting compounds or thread lubricants with oxygen cylinders, valves, or connections. Use only materials approved for use on oxygen systems.

Valves and Regulators

- Cylinders (oxygen and acetylene) are only to be used with pressure reducing regulators.
- Before connecting the regulator to the cylinder valve, the valve is to be quickly opened and closed. This action is called “cracking” and is used to clear the valves of dust and dirt. When opening the valve, stand to one side of the outlet, never in front of it. Acetylene cylinders are never to be opened near other welding work or sparks, flames, or sources of ignition.
- After the regulator has been attached to the valve, the cylinder valves are to be opened slowly. On oxygen cylinders, the valve can be opened to its full limit. Valves on acetylene cylinders are not to be opened any more than three quarters of a turn.
- The threads on oxygen connections are different than those on an acetylene connection (regulator outlets, hose couplings and torch valve inlets). If threads do not fit easily, the connections are mixed. Never force a connection.
- Regulators that are not operating properly should be replaced.
- Oxygen equipment including valves, regulators, and hoses are not to be used with other gases. Equipment used for other compressed gases cannot be used with oxygen.

Hoses

- Only approved type hoses are to be used for oxygen and acetylene operations. The hose is of a rubber reinforced fabric construction. Copper or plastic tubing is not approved for acetylene use.
- Care should be taken to protect the hose against damage such as flying sparks, hot slag, or hot objects. The hose should not be dragged across the floor.
- Red colored hose is used for acetylene; green colored hose is used for oxygen. **NOTE:** Acetylene has left-hand thread connections at hookup.
- Hoses may be taped together, however no more than 4 in. (100 mm) of tape for each 12 in. (300 mm) of hose is permitted.
- Hoses are to be frequently inspected for leaks, burns, worn places, loose connections, or other defects which may render the hose unsafe for service.
- Hoses that have been damaged or are worn out should be replaced. Tape is never to be used to repair damaged welding hose.
- New hose and hose suspected of leaking should be leak tested.

- Install flash arrestors on both ends of the hoses. One before connecting to the torch and one before connecting to the regulator.

The Torch

- Torches are to be lit using friction lighters, stationary pilot flames, or other suitable sources of ignition.
- When extinguishing the torch, close the acetylene valve first, then close the oxygen valve.
- When welding or cutting is to be stopped for extended periods of time, or when the operator leaves the scene for any period of time, the equipment is to be secured as follows:
 1. Extinguish the torch.
 2. Close both acetylene and oxygen cylinder valves.
 3. Torch valves should then be opened to vent pressure from the line and shut again.
 4. Close both regulators. The regulator pressure adjusting screws should then be released.
- Torches that are damaged or are not functioning properly should be repaired or replaced.

Ventilation

- Oxyacetylene operations are to be done in well ventilated areas. If there is any question concerning the adequacy of ventilation in a particular area, the supervisor or Safety Manager should be notified.
- Approved mechanical ventilation is required when welding or cutting is done in a confined area (e.g., exhaust fans).
- Special ventilation and respirators may be required when the welding or cutting involves:
 - Fluorine (flux)
 - Zinc (base metal or filler)
 - Lead (base metal and metals painted with a lead based paint)
 - Beryllium (base or filler metal)
 - Cadmium (coated or cadmium bearing)
 - Mercury (metals coated with mercury bearing materials)
 - Galvanized Metal

Hot Work Permit

Prior to performing any hot work that involves the use of equipment such as torches or welding equipment, a hot work permit must be completed. A hot work permit must be used to ensure that appropriate precautions have been taken to prevent and address fire. The Hot Work Permit can be found in the Partnering Handbook and can be order from the Technical Publications Group - form number 4368.

Precautions Against Fire (see Precautions Against Fire, Section 2.21 for additional information)

Protective clothing must be worn (e.g., leather gloves, aprons, leggings, vests, etc.) during any burning or welding operations. All clothing should be clean and free from flammable contaminants.

Before starting to burn or weld, floors must be swept clean. Wooden floors must be wet down, or covered with sheet metal or fire retardant material. Avoid letting sparks fall where they may start a fire or burn other workers.

Move combustible material to a safe distance away from the work (e.g., 35 ft.) if possible. If combustible material cannot be moved, cover it carefully and completely with a fire retarding blanket or sheet metal.

Do not burn or weld in old hoistways where rails may be constructed of wood or in circumstances where equipment is covered with oil or lint.

Where sparks cannot be controlled, make sure fires do not start; provide a fire watch (a person assigned to monitor the activity). At the same time, have fire extinguishers at the location where the work is being performed.

Fire extinguishers should be of the dry chemical (ABC) or CO₂ type and must be readily available where burning or welding work is being performed. These must have been inspected and tagged before use.

Never burn or weld over other workers without providing protection to prevent injury.

Always hold onto lighted torches and extinguish them before laying them down.

Before starting any electric welding operation, always ensure that you have a prepared non-flammable, non-conducting, and clear area for resting the live electrode holder.

After completing a burning or welding operation, frequently (half-hour intervals) check the scene of work area for smoldering fires. Also inspect adjoining rooms and floors above and below.

Do not use flame cutting or welding equipment near flammable liquids or on closed tanks that have held flammable liquids or other combustibles.

Keep cutting and welding equipment in good operating condition at all times. Equipment found to be defective must be tagged immediately and returned to the shop for repair.