ELECTRICAL SAFE WORK PRACTICES

I. PURPOSE

This program provides guidelines for safeguarding personnel and property from electrical hazards presented by energized or potentially energized exposed electrical components.

II. SCOPE

This program covers all work activities on or near energized parts. Examples may include but are not limited to working on electrical equipment related to elevator machine rooms, controllers, motors, power panels, relays, escalators, and disconnects.

III. DEFINITIONS

a. **Accessible (as applied to equipment) –** Admitting close approach; not guarded by locked doors, elevation, or other effective means.

b. **Accessible (as applied to wiring methods) –** Capable of being removed or without damaging the building structure or finish or not permanently closed in by the structure or finish of the building.

c. **Alternative Methods** – Equivalent means of protection to lockout tagout when lock out tagout is infeasible or creates a greater risk to the employee. These methods must provide effective employee protection to prevent the unexpected energization of equipment being serviced.

d. **Barricade –** A physical obstruction such as tapes, cones, or A-frame-type wood or metal structures intended to provide a **warning** about and to limit access to a hazardous area.

e. **Barrier – A physical obstruction intended to prevent contact with equipment or live parts or unauthorized access to a work area.**

f. **Bonding –** The permanent joining of metallic parts to form an electrically conductive path that ensures electrical continuity and the capacity to conduct safely any current likely to be imposed.

g. **Bus –** A conductor or group of conductors that serve as a common connection for two or more circuits.

h. **Cable Tray System –** A cable tray system is a unit or assembly of units or sections, and associated fittings, made of metal or other noncombustible materials forming a rigid structural system used to support cables. Cable tray systems include ladders, troughs, channels, solid bottom trays and other similar structures.

i. **Capable of being locked out** - An energy isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.

j. **Circuit Breaker –** A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating.

k. **Conductive –** Suitable for carrying electric current.

l. **Conductor, Bare –** A conductor having no covering or electrical insulation whatsoever.

m. **Conductor, Covered –** A conductor encased within material of composition or thickness that is **not** recognized by this standard as electrical insulation.

n. **Conductor, Insulated –** A conductor encased within material of composition and thickness that is recognized by this standard as electrical insulation.

o. **Control Circuitry -** Use of alternative safeguarding measures the safety control circuit may be used in cases in which minor tool changes and adjustment, and other minor servicing activities, are performed during normal production operations, and are routine, repetitive, and integral to the use of equipment for production.

p. **Deenergized –** Free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of the earth.

q. **Electrical Single-Line Diagram –** A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used in the circuit or system.

r. **Energized –** Electrically connected to or having a source of voltage.

s. **Energy Isolating Device –** A physical device that prevents the transmission or release of electrical energy such as, but not limited to, a draw-out circuit breaker, disconnect switch, or other similar device with a visible indication of the position of the device.

t. **Exposed –** Not isolated, insulated or guarded.

u. **Flash Hazard Analysis –** A study investigating a worker's potential exposure to arc-flash energy, conducted for the purpose of injury prevention and the determination of safe work practices and the appropriate levels of personal protective equipment (PPE).

v. **Ground –** A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

w. **Guarded –** Covered, shielded, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.

x. **Impracticability:** Is the impact of applying lockout tagout to the equipment/process which creates additional hazards or risks, such as electrical device wear, task interference, power needed to task completion and additional risks to employee. (ANSI Z244.1.2016, Annex L-1, Page 88)

y. **Infeasible: Not** capable of being done or carried out. (NOTE ANSI B11, pending- strike from record once placed in reference document)

z. **Lockout -** The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

aa. **Lockout device -** A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in a safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.

bb. **Servicing and/or Maintenance:** workplace activities, such as setting up, adjusting, inspecting, modifying and maintaining and/or servicing equipment. These activities include lubrication, cleaning or adjusting, where Otis qualified personnel may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

cc. **Tagout -** The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

dd. **Tagout device -** A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

ee. **Qualified Person –** One who is trained and competent in the hazards involved in any area which may be within his job description or assigned responsibility, such as construction, installation, operation and maintenance of equipment.

ff. **Qualified Person (In-Training) –** One who is undergoing on-the-job training for the purpose of obtaining the skills and knowledge necessary to be considered a qualified person, and who during such training demonstrates an ability to perform specific duties safely at his or her level of training, and who is under the direct supervision of a qualified person shall be considered to be a qualified person for the performance of those specific duties.

IV. RESPONSIBILITY

Each business unit has the responsibility for ensuring the requirements of this program.
Department heads (Engineering, Field Service, New Equipment, Modification) are responsible for ensuring specific electrical work plans are implemented and audited for all work activities on or near energized electrical parts.

Branch supervisors are responsible for defining what type of work is performed on or near energized electrical parts and identifying Qualified Persons. Supervisors shall ensure that all Qualified Persons have received required training before permitting any work to take place.

The Environmental Health and Safety Manager shall ensure that proper PPE is obtained and utilized, all procedures are adequate from a safety perspective, training is properly conducted and documented, and the Electrical Safety Program is reviewed and properly revised on an annual basis.

V. GENERAL REQUIREMENTS

Safe Work General Practices

All electrical equipment shall be marked with voltage, current, wattage, and other rating, as necessary. All disconnecting means shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident. If the equipment has rear access, it shall be labeled on the rear compartments exactly as labeled on the front.

All machines, equipment and electrical tools shall be properly grounded. Ground connections on fixed electrical equipment and structures shall be routinely inspected to ensure connections are tight and ground wires are in good condition.

Safe Work Zones

The area around electrical equipment shall be kept clear of materials, equipment, and any other articles that may deter access to the electrical equipment. The clearance distances required by NFPA 70E shall be adhered to. The tops of motor control centers (MCC), switchgear, transformers and other electrical enclosures shall not be used as a storage area. They shall be kept clean and clear.

Area Protection

a. In some instances, such as modifications or equipment additions, it shall be necessary to install a barrier or otherwise identify a work area as containing exposed electrical hazards not normally encountered during routine maintenance.

b. Approach boundaries shall be established per NFPA 70E Article 130

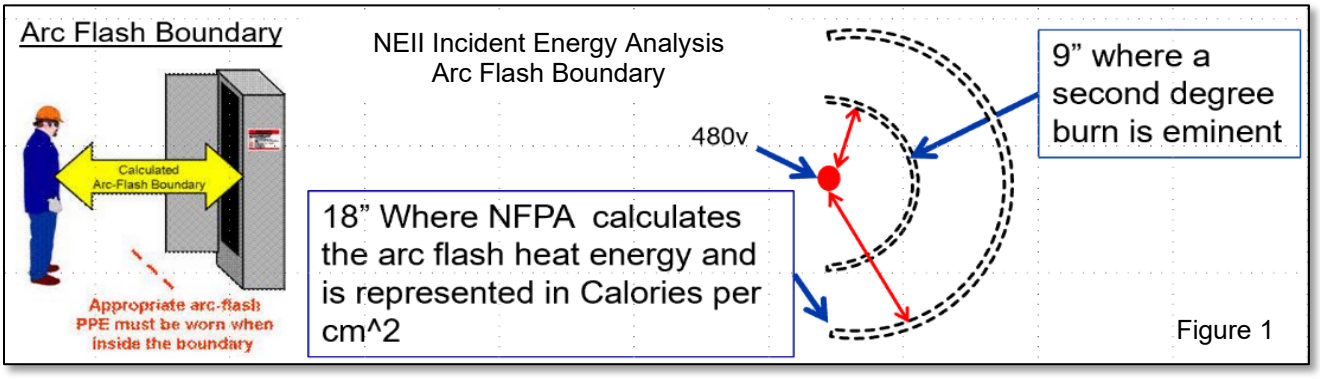
c. An arc flash boundary from exposed electrical elevator industry equipment for restricted approach boundary of 12” is established per NFPA 70E Article 130 for elevator industry equipment for qualified persons. A limited approach boundary of 10’ shall be maintained by un-accompanied unqualified personnel (*See Figure 1 below*)

d. If the work exposes energized components that should be normally protected, danger signs shall be displayed, and suitable barricades shall be erected to restrict other personnel from entering the area.

e. Personnel shall not enter spaces containing exposed energized components unless illumination is provided that enables the employees to perform the work safely.

f. Persons other than a competent person (unqualified workers) shall not come within 10’ of an energized source over 50v.

g. No part of any vehicle or machinery shall approach closer than 20’ of any overhead power line.



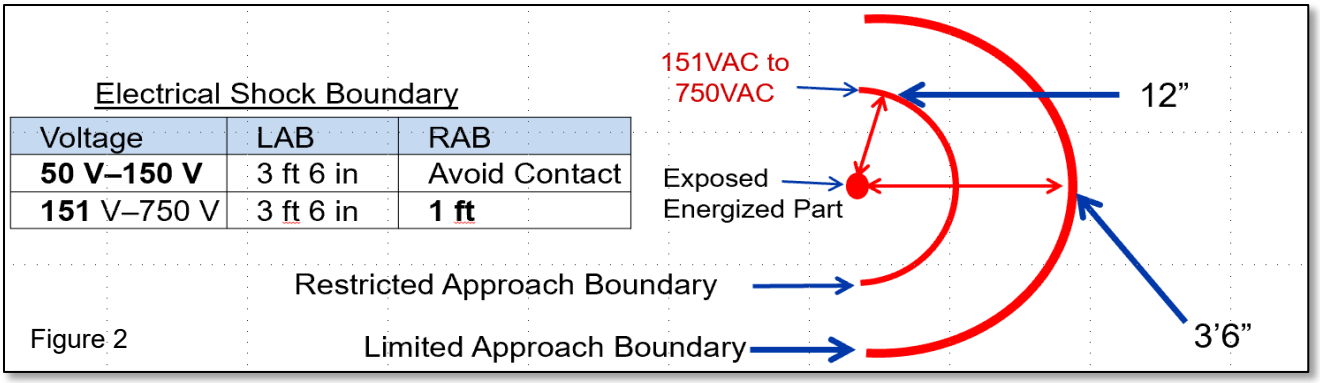
SERVICING ELECTRICAL EQUIPMENT AND SYSTEMS

a. Troubleshooting

i. All work shall be performed with equipment and/or systems in a de-energized state, when possible. De-energized work that is not feasible due to equipment design, operational limitations or deenergizing would create a new greater hazard.

ii. Energized work will be permitted only after the approved Energized Work Permit for the specific task has been properly filled out. Appropriate shock protection e.g., voltage rated rubber gloves with leather protectors shall be worn any time there is direct contact with voltages over 50v to 150V phase to phase nominal and within 12" inches of any exposed energized part from 150V to 750V nominal.

iii. The 20' shock protection boundary shall not be encroached upon by any employee for voltages exceeding nominal 750V phase voltage. (See Figure 2 below)



iv. If an overload device trips the circuit and/or process, an investigation shall be made to determine the cause prior to resetting the relay. The repetitive re-closing of circuit protective devices or replacing of fuses is not permitted. If the device is over 600 volts, resetting is prohibited, and a Qualified Person must investigate to determine the cause.

NOTE

- **No instantaneous over-current device, ground fault device or differential relay shall be reset or replaced, and the circuit re-energized until the cause of the trip has been determined and corrected by a Qualified Person.**
- **Devices not designed with load interrupting capabilities shall not be used as a disconnecting means for energized circuits.**

b. **Modifications and/or Installation**

Modifications to existing equipment and systems should be performed in a de-energized state. All modifications shall be approved by Qualified Persons and drawings updated.

c. Capacitors

Prior to performing work on capacitors, qualified persons shall, when possible, disconnect the capacitor from the energized source and observe a wait period of at least 5 minutes from the time of disconnection. Grounding devices shall then be applied to discharge capacitors to ground before working on or near the capacitors.

d. Maintenance/Service

Items covered in this section include maintenance requirements of electrical installations and equipment that relate directly to employee safety in the workplace and not specifically covered elsewhere in this program. It is not the intent of this section to define specific maintenance methods since there may be several approaches that will satisfy the acts of testing, preserving, and restoring.

i. All grounding and bonding systems shall be maintained, inspected annually, and tested on a scheduled basis.
ii. Open wiring systems shall be separated by barrier or physical location from personnel work areas.
iii. Worn, frayed or damaged flexible cables shall be removed from service, repaired, or destroyed.
iv. Attachment plugs, receptacles, cover plates and connectors shall be maintained to include the following:

1. There are no breaks, damage or cracks exposing energized components.
2. Terminations have no stray strands or loose terminals.
3. There are no missing or bent blades, pins, or contacts.
4. There are no missing cover plates.
5. Polarity is correct.

v. All portable power tools, lamps and extension cords shall be verified as safe prior to use. Verifications shall confirm proper polarity, continuity of conductors and validity of insulation at intervals defined by service use and conditions. Thereafter, they shall be inspected following repairs or modifications.
vi. Physical protection systems and enclosures shall be maintained to guard against unauthorized access or accidental contact with exposed energized components.
vii. Substation, switchgear, and other electrical equipment enclosures shall be kept free of miscellaneous material and spare components.
viii. Up-to-date drawings and instructions for operation, maintenance and testing shall be maintained and made available to Qualified Personnel.

ESTABLISHING AN ELECTRICALLY SAFE WORK CONDITION (LOCK OUT PROCEDURE)

a. Preparation

i. Prior to turning off the equipment, the qualified person(s) shall have knowledge of the equipment or process they are working on, work equipment, the type and magnitude of the energy source, the hazards of the energy source, the hazards of the energy to be controlled, and the method and means to control it.

ii. The shock and flash protection boundaries shall be determined, with barrier equipment placed in service around the work envelope.

iii. All appropriate work tools, test equipment, lockout equipment, and PPE shall be obtained and inspected prior to initiating this work plan.

iv. Test equipment shall be tested for proper operation prior to each use.

b. Shutdown

i. When appropriate, specific equipment shutdown procedures should be conducted.

ii. Prior to system shutdown, the qualified person(s) shall review the load-side of the designated electrical system to ascertain and evaluate the effects of system de-energization and isolation. Personnel notification and control alternatives should be implemented, if applicable.

iii. All energy sources identified in the plan preparation stage must now be de-energized. This task should be verified by all qualified personnel involved. The qualified personnel entering into the flash protection boundary shall don appropriate flash protection equipment (PPE).

c. **Energy Isolation/Lockout Application**

i. All energy sources must be isolated

ii. All energy sources capable of being locked out must be locked and tagged out by the authorized person.

iii. All lock out devices must be affixed in a manner that will secure the device in a safe position

iv. Tagout devices, where used, shall be affixed to clearly indicate that the operation or movement of energy isolating devices from the safe or off position.

d. Release of Stored Energy

i. The qualified personnel entering into the flash protection boundary shall don appropriate flash protection equipment (PPE).

ii. PPE shall be worn continuously throughout all tasks or procedures until equipment is verified to be electrically safe.

iii. Appropriate voltage-rated equipment shall be used only by a qualified person for such tasks.

iv. Where accumulation in electrical or mechanical energy is possible, such as inductive capacitive charge or mechanical equipment release, special precautions such as grounded (earthing) and mechanical stop blocks shall be placed.

v. When LOTO devices must be removed for testing, all applicable electrical safe practices must be utilized. If zero energy is needed again, each step of the LOTO test and verify procedures will be performed.

e. Isolation Verification

i. The qualified personnel entering into the protection boundaries shall don appropriate protection equipment (PPE).
ii. PPE shall be worn continuously throughout all tasks or procedures until equipment is verified to be electrically safe.
iii. Appropriate voltage-rated equipment shall be used only by a qualified person for such tasks.
iv. Once isolation is verified, the qualified person(s) may proceed with work.

f. Release From Control/Isolation

i. Ensure all personnel are clear of the equipment.
ii. Remove all ground conductors.
iii. Replace all removed equipment components (doors, guards, etc.)
iv. Remove all tools and equipment.
v. Remove lockouts from electrical isolation devices.
vi. Energize system.

ALTERNATE METHODS (SERVICE AND REPAIR)

The primary means for the elimination of electrical hazardous energy is lockout tagout. In the event that it is infeasible, lacks practicability or is more hazardous to remove the employee from the area to perform LOTO, control circuitry shall be utilized.

The elevator industry poses some unique situations when the elevator is in certain locations in the hoistway or certain positioning in the pit. Under these conditions it may be impossible, or it may create a greater hazard to exit the work area to perform LOTO, hence an alternate effective measure of protection must be provided. In addition, ANSI Z244.1 has provided guidance in determining the applicability to the use of alternative methods (control circuitry) as an alternative to LOTO.

For control circuitry to be an acceptable alternate method to lockout tagout a Practicability/Justification Evaluation was conducted, in conjunction with a hazard risk assessment. These results have been grouped into key categories based on the tasks. This is the approved process to determine the method of control. There are no acceptable scenarios where alternative methods can be used for convenience (ANSI B11.1 Analysis – Process for how to employ Control Circuitry. Alternate effective means needs to have written procedures).

Instructions on how the elevator shall be controlled to perform the following tasks. Task/Type shall mention if Controlled Circuitry (CC) or LOTO shall be used to complete the tasks.		EGRESS CREATES GREATER RISK (ALT LOTO = Control of Car + LOTO) (CC = Control Circuitry, e.g. TOCI)			SAFE EGRESS			SIMPLE EGRESS (Cartop is +/- 30" from the landing)	NO CONFINED SPACE APPLICATION
#	Task Type / Category	Overhead or Hoistway	Pit (Hydro)	Pit (Traction)	Overhead or Hoistway	Pit (Hydro)	Pit (Traction)	Cartop w/ HW CLOSED Doors	Landing w/ HW OPEN Doors
1	Routine tasks	CC	LOTO	*LOTO/CC**	CC	LOTO	*LOTO/CC**	CC	LOTO
2	Diagnostics	CC	CC	CC	CC	CC	CC	CC	CC
3	Testing when power is required	CC	CC	CC	CC	CC	CC	CC	CC
4	Examination	CC	LOTO	CC	CC	LOTO	CC	CC	CC
5	Survey	CC	LOTO	CC	CC	LOTO	CC	CC	CC
6	Observation	CC	LOTO	CC	CC	LOTO	CC	CC	CC
7	Repair	ALT LOTO	ALT LOTO	ALT LOTO	LOTO	LOTO	LOTO	LOTO	LOTO
8	All other non-routine task	ALT LOTO	ALT LOTO	ALT LOTO	LOTO	LOTO	LOTO	LOTO	LOTO
9	Inspection	CC	LOTO	CC	CC	LOTO	CC	CC	CC
10	CAT1 & CAT5 Testing	N/A	LOTO	LOTO	N/A	LOTO	LOTO	CC	N/A

Construction and Modernization operations fall under 1926.417 and shall follow Method 1 and Method 2

* Due to the mechanical energy hazards of a hydraulic unit, alternative methods are not approved. Any deviation will require EHS and RFOM approvals.

LIVE ELECTRICAL WORK

For voltages in excess of 50 volts, a Live Work Permit is required for any contact beyond live trouble shooting (*See Appendix A Figure 1*)

a. Live Work shall only commence under 2 conditions
    i. De-energizing will introduce additional hazards
    ii. The design of the equipment makes it infeasible due to equipment design or operational limitations

b. Proper management approvals must be obtained per the Live Work Permit (*See Appendix A Figure*

c. All personnel shall follow the customized Electrical Safety Work Plan(s) that suit the electrical project undertaken at any time.
d. Prior to performing work on or near any exposed energized components, all personnel involved shall be briefed on the safety concerns and precautions regarding their assignments.
e. Safe Work Practices may dictate the need for a standby person, in addition to the Qualified Person, who is knowledgeable of both the hazards in the work area and applicable emergency procedures.

Work Tools and Test Equipment

a. **Hand Tools**
    i. All tools shall be maintained in working order.
    ii. Only tools specifically designed for the task at hand shall be used.

b. **Insulated Tools**
    i. When working in proximity to energized or potentially energized conductors and/or exposed components, workers shall use insulated tools and equipment.
    ii. The frames of all portable motors and motor-driven apparatus, such as drills, saws, grinders, etc., shall be provided with grounds and effectively tested.
    iii. Portable power tools shall be properly stored when not in use. Power tools shall never be suspended by the cord.
    iv. Electrical power tools shall be visibly inspected for external defects before each day's use for such defects as deformed or missing prongs or insulation damage and for indication of possible internal damage. Tools found to be damaged or defective shall be tagged "out of service" and not used until repaired.
    v. Electrical portable power tools (except for battery powered or double-insulated types) shall be grounded by a grounding conductor that is contained within the same cable or cord as the circuit conductors.
    vi. Power tools (except approved double insulated tools) shall have a 3-conductor cord with a 2-pole, 3-wire polarized plug for single-phase circuits, and a 4-conductor cord with a 3-pole, 4-wire polarized plug for three-phase circuits.

Portable Power Tools and Extension Cords

vii. Extension cords shall be inspected before each day's use for external damage such as bent or missing pins, insulation damage and any indication of possible internal damage.

viii. Extension cords found to be damaged shall be taken out or service and repaired or replaced.

c. **Portable Ladders**

i. Portable ladders shall have non-conductive side rails (i.e., fiberglass) and non-slip feet.

d. **Personal Protective Equipment (PPE)**

i. Personal Protective Equipment (PPE) shall be used by personnel exposed to electrical hazards, when near energized or potentially energized conductors or exposed electrical components.

e. **General Requirements for PPE**

i. PPE shall be appropriate for the specific components of the body to be protected and for the work to be performed.

ii. PPE shall be maintained in a safe and reliable condition and shall be periodically inspected and/or tested as required.

iii. Damaged equipment or equipment failing to pass test requirements shall not be used.

g. **Head Protection**

i. Personnel shall wear non-conductive head protection whenever work is being performed in proximity to energized or potentially energized electrical conductors and components and there is a danger of head injury.

ii. Helmets or hardhats shall be Class B, full or partial brim and shall conform to ANSI Z89.1.

iii. Helmets or hardhats shall be kept clean and in good condition and not be altered or defaced.

iv. Approved markings shall not contain conductive materials.

h. **Eye and Face Protection**

i. Protective equipment for the face shall be used where there is danger of injury to the face from electrical arcs or flashes, or from flying or falling objects resulting from an electrical explosion.

ii. Eye and face protection equipment shall conform to ANSI Z87.1.

iii. If the eye or face protective devices exhibit broken components, heat distortion or excessive scratches on the lens they shall be discarded and replaced.

i. **Clothing and/or Apparel**

i. All Qualified Personnel shall wear clothing that complies with the current NFPA 70E. When applicable incident energy is below 1.2 calorie per CM^2, employees are required to wear 100% natural fiber clothing. When applicable arc flash incident energy is over 1.2 calorie per CM^2. the equivalent thermal and flash protection rating of 4.5 ounce (about 127.57 g) per yard Nomex III shirting or 7.0 ounce (about 198.45 g) per square yard PROBAN® shirting. In lieu of personnel being required to wear this type of clothing while not performing electrical work, coveralls meeting these requirements can be worn.

ii. When performing work on exposed electrical equipment, any clothing with exposed zippers, buttons, metal fasteners or loose, flapping clothes is prohibited

iii. Conductive articles, such as watchbands, bracelets, rings, necklaces, and oversized belt buckles, shall not be worn when there is a danger of contact with energized components.

j. **Footwear**

i. Safety shoes shall be worn at all times when working near or on energized components (per ASTM International standards, F 2412, Test Methods for Foot Protection and F2413 Specification for Performance Requirements for Protective Footwear.)

k. Rubber Insulating Gloves

i. **Rubber insulated gloves shall be used when exposed to voltages as** outlined in the following table:

If Exposed To...	Then wear gloves that are rated...	
Up to 500 Volts	Class 00	Not Permissible
1000 Volts	Class 0	Required
7500 Volts	Class 1	Shall not need
17000 Volts	Class 2	Shall not need
26500 Volts	Class 3	Shall not need
36000 Volts	Class 4	Shall not need

ii. Gloves shall conform to ANSI/ASTM D120 specification for rubber insulating gloves and ASTM F496 specification for in-service care of insulating gloves and sleeves.

iii. Outer leather protectors shall be provided and used in conjunction with the above rubber gloves.

WARNING

AT NO TIME SHALL THE RATING OF THE GLOVE BE EXCEEDED

iv. Each glove shall be field tested at the start of the workday that it is to be used.

v. To test for pinholes and other damage, fill the glove with air, roll up the cuff of the glove to make a seal and squeeze the glove. Hold the glove to the face and ear to feel and listen for air escaping from holes.

vi. If rubber gloves fail this test, the index finger of the glove shall be cut off and the gloves discarded.

vii. Gloves in service shall be stored in glove bags. Gloves shall not be folded, creased, or rolled while in storage. Gloves shall be protected from heat, ozone, prolonged exposure to direct sunlight and from contact with sharp objects or materials likely to damage the gloves or cause deterioration of the rubber.

viii. Gloves shall be cleaned in accordance with the manufacturer's recommendations.

ix. Do not use solvents, oils or grease on rubber insulated gloves.

Contractors

Whenever outside servicing contractors are engaged in activities covered by the scope of this policy, the person requesting this service shall coordinate and document a meeting with the contractor(s).

The meeting agenda shall include informing each party of the known existing hazards, PPE/clothing requirements, safe work practice procedures and emergency/evacuation procedures applicable to the work to be performed.

The contractor shall provide evidence to the person requesting the service that the contractor's personnel have received adequate training and experience, so they are qualified as defined in Section 6.0.

Grounding

Every building and structure must be connected to an adequate ground field. All grounding shall be installed according to the National Electric Code and as specified in the Engineering Standards.

A visual inspection and connections tightness of grounds shall be made annually, and additional resistance tests performed if a ground is suspect.

Temporary Wiring

Temporary wiring shall only be used in areas under construction or repair, for experimental units and for the operation of equipment during emergencies.

Flexible cords and cables with ground wire and conductors preferably smaller than #6 AWG shall be used if necessary.

All temporary wiring must be adequately supported and protected.

All equipment served by temporary wiring shall be clearly identified with the name of the equipment served.

All temporary wiring installations shall be inspected, and their necessity reviewed at least once per month.

Circuits required for operation shall be replaced with permanent installations as soon as possible.

TRAINING REQUIREMENTS

Whether an individual is considered to be **"qualified"** will depend upon various pieces of equipment in the workplace. It is possible and, in fact, for an individual to be considered **"qualified"** regarding certain equipment in the workplace, but "unqualified" as to other equipment. For example, an individual may have received the necessary training to be considered on a particular piece of equipment. However, if that same employee were to work on other types of equipment for which they had not received the necessary training, they would be considered "unqualified" for that other equipment.

All personnel who are required to perform work on electrical devices and systems shall be competent in all safety related work practices, procedures and requirements that pertain to their respective work assignments. These practices shall include, but not be limited to, the following.

1. Skills and techniques necessary to distinguish exposed energized components from the other components of electrical equipment.
2. Skills and techniques necessary to determine the nominal voltage of exposed energized components.
3. Skills and techniques necessary to operate, maintain and service electrical equipment.
4. Knowledge and understanding of the clearance distances corresponding to voltages which personnel may be exposed to.
5. Proper use of the special precautionary techniques, PPE, insulating and shielding materials, and insulated tools associated with working on or near exposed components of electrical equipment.

RECORD KEEPING

Electrical safety training records shall be maintained in the employees' digital training records.

REFERENCES

NFPA 70E

OSHA 29 CFR 1910 Subpart S Electrical (Maintenance)

OSHA 29 CFR 1926 Subpart K Electrical (Construction)

LIVE ELECTRICAL WORK

Example Work Permit

Energized Electrical Work Permit

Branch: _____ **Request Date** _____

Job Name: _____

Elevator Identification: _____

Person Requesting permit: _____

POLICY

Under rare circumstances Otis will permit live electrical work if one of the two conditions below is present. Working live requires this permit to be completed prior to commencing work. This permit MUST be filled out by a qualified worker and **approval** by EHS or RFOM and **written or verbal approval** direct supervision.

1. De-energizing will introduce new hazards or increase current hazards
2. De-energizing is infeasible due to equipment design or operational limitations

Customer inconvenience or to save time or effort **IS NOT** a reason to conduct live work. Troubleshooting or performing diagnostics does not require a permit.

1. Description of circuit/equipment/job location
2. Description of work to be done:
3. Justification of why the circuit/equipment cannot be de-energized
4. Detailed job description procedure to be used in performing the above described work
5. Description of the Safe Work Practices to be employed
6. Potential Shock Hazards associate with task
7. Determination of Shock Protection Boundaries (12" for voltage =or>150VAC / Contact for voltage 50<150VAC)
8. Flash Hazard Analysis conducted by NEII appear to apply to this unit as a typical elevator with typical electrical characteristic (Yes / No)
9. Confirm elevator electrical components appear to be in good condition not increasing the Arc Flash Protection Boundary greater than 12" (Acceptable / No Acceptable)
10. Necessary personal protective equipment to safely perform the assigned task
11. Means employed to restrict the access of unqualified persons from the work area
12. Completed job specific JHA identifying electrical hazards with mitigation (Yes / No)
13. Do you agree the above described work can be done safely?

Authorized Worker: _____

Authorizing Supervisor: _____

Authorizing EHS/RFOM: _____

VERBAL: **( ) Yes ( ) No / Time Received:** _____

DATE: _____

Alternative Methods Practicability/Justification Evaluation

Otis Elevator LOTO Procedure Evaluation	
Alternative Methods - Practicability/Justification Evaluation	
Alternative Method (Lockout)	
Original Date	
Last Revision	
Category	
Method Reference	
Task	
Task Data	**Define the task characteristics (frequency of occurrence, personnel exposed; use history, current key safeguard, perceived risk)**
LOTO Impact	**What is the impact of applying conventional lockout?**
Potential Options	**What can be done to avoid using power or reducing employee exposure? (Task elimination, engineering/design changes; remote task completion; exposure reduction; product change, etc.)**
Option Practicability	**What obstacles exist that prevent using potential options listed above?**
Electrical Control Reliability	**Is the control system appropriate for the task risk? (The control system features multiple channels, hard wired, safety rated, self-monitoring, redundant components, positively guided relays, etc.)**
Prepared BY:	
Reviewed By:	
Approved By:	
Date:	

Alternate Lockout Tagout Method/Risk Assessment

Alternative Methods (Lockout) Risk Assessment			
List the elements that are related to guarding exposures or unexpected energization			
Company	Otis	**Control Number**	LOTO - 001
Department	Maintenance	**Procedure Group**	GMP (General Maintenance Procedures)

1. Risk Factors	2. Hazards	3. Risk	4. Risk Reduction Measures

5. ALTERNATIVE METHOD JUSTIFICATION: Describe the critical reasons for using power while performing this task

COMPLETION GUIDE:

1. ELEMENTS – LIST ALL KEY ELEMENTS ASSOCIATED WITH THE TASK THAT RELATE TO GUARDING OR UNEXPECTED ENERGIZATION
2. HAZARD(S) – IDENTIFY ALL HAZARDS FOR KEY ELEMENTS (EMPHASIS ON ANY GUARDING EXPOSURES OR FAILURES RELATED TO UNEXPECTED ENERGIZATION)
3. RISK – DEFINE RISK USING RISK RANKING MATRIX (HIGH, SERIOUS, MEDIUM, LOW –JSP ROADMAP RISK REFERENCE)
4. RISK REDUCTION MEASURES – FOR EACH LISTED ELEMENT IDENTIFY THE MEASURE TO ELIMINATE OR REDUCE THE RISK (CONSIDER THE HAZARD CONTROL HIERACHY); IS THE RESIDUAL RISK ACCEPTABLE/TOLERABLE?
5. ALTERNATIVE METHOD JUSTIFICATION– DEFINE THE LOGIC FOR NEEDING POWER FOR TASK EXECUTION (CONVENIENCE/HISTORICAL PRACTICE IS NOT APPROPRIATE JUSTIFICATION ALONE)

PREPARED BY:	REVIEWED BY:	APPROVED BY:	DATE: