Chapter 7 - Electrical Safety

Policy

It is the policy of Hayward Electric to take every reasonable precaution in the performance of work to protect the health and safety of employees and the public and to minimize the probability of damage to property. The electrical safety requirements contained in this chapter are regulations set forth by Hayward Electric. It is our intent to meet or exceed the requirements of NFPA 70E which is the Standard to Electrical Safety Requirements for Employee Workplaces. Please refer to the latest edition of the NFPA 70E for complete safety requirements.

Employee Responsibility

All Hayward Electric personnel are responsible for all aspects of safety within their own groups. The Responsible Safety Officer is responsible for providing information, instruction, and assistance, as appropriate, concerning Hayward Electric electrical safety requirements and procedures.

Individual employees are responsible for their own and their co-workers' safety. This means:

• Become acquainted with all potential hazards in the area in which they work.

• Learn and follow the appropriate standards, procedures, and hazard control methods.

• Never undertake a potentially hazardous operation without consulting with appropriate supervision.

• Stop any operation you believe to be hazardous.

• Notify a supervisor of any condition or behavior that poses a potential hazard.

• Wear and use appropriate protective equipment.

• Immediately report any occupational injury or illness to the Responsible Safety Officer, any on site Medical Services Department and the appropriate supervisor.
Each employee acting in a supervisory capacity has specific safety responsibilities. These include:

**Procedures**

It is the policy of Hayward Electric to follow the fundamental principles of safety, which are described below. A clear understanding of these principles will improve the safety of working with or around electrical equipment.

Practice proper housekeeping and cleanliness. Poor housekeeping is a major factor in many accidents. A cluttered area is likely to be both unsafe and inefficient. Every employee is responsible for keeping a clean area and every supervisor is responsible for ensuring that his or her areas of responsibility remain clean. Identify hazards and anticipate problems. Think through what might go wrong and what the consequences would be. Do not hesitate to discuss any situation or question with your supervisor and coworkers.

- Developing an attitude and awareness of safety in the people supervised and seeing that individual safety responsibilities are fully carried out.
- Maintaining a safe work environment and taking corrective action on any potentially hazardous operation or condition (including adequate illumination as required by jobsite conditions).
- Ensuring that the personnel he/she directs are knowledgeable and trained in the tasks they are asked to perform.
- Ensuring that safe conditions prevail in the area and that everyone is properly informed of the area’s safety regulations and procedures.
- Ensuring that contract personnel are properly protected by means of instructions, signs, barriers, or other appropriate resources.
- Ensuring that no employee assigned to potentially hazardous work appears to be fatigued, ill, emotionally disturbed, or under the influence of alcohol or drugs (prescription, over the county medicinal or otherwise).

Management at every level has the responsibility for maintaining the work environment at a minimal level of risk throughout all areas of control. Each manager:

- Is responsible for being aware of all potentially hazardous activities within the area of responsibility.
• May assign responsibility or delegate authority for performance of any function, but -

• Remains accountable to higher management for any oversight or error that leads to injury, illness, or damage to property.

Resist "hurry up" pressure. Program pressures should not cause you to bypass thoughtful consideration and planned procedures.

Design for safety. Consider safety to be an integral part of the design process. Protective devices, warning signs, and administrative procedures are supplements to good design but can never fully compensate for its absence. Completed designs should include provisions for safe maintenance.

Maintain for safety. Good maintenance is essential to safe operations. Maintenance procedures and schedules for servicing and maintaining equipment and facilities, including documentation of repairs, removals, replacements, and disposals, should be established.

Document your work. An up-to-date set of documentation adequate for operation, maintenance, testing, and safety should be available to anyone working on potentially hazardous equipment. Keep drawings and prints up to date. Dispose of obsolete drawings and be certain that active file drawings have the latest corrections.

Have designs reviewed. All systems and modifications to systems performing a safety function or controlling a potentially hazardous operation must be reviewed and approved at the level of project engineer or above.

Have designs and operation verified. All systems performing safety functions or controlling a potentially hazardous operation must be periodically validated by actual test procedures at least once a year, and both the procedures and actual tests must be documented.

Test equipment safety. Tests should be made when the electrical equipment is de-energized, or, at most, energized with reduced hazard.

Know emergency procedures. All persons working in areas of high hazard (with high voltage power supplies, capacitor banks, etc.) must be trained in emergency response procedures, including cardiopulmonary resuscitation (CPR) certification.
General Safety Guidelines

1. Electricians shall be instructed in the Company Electrical Safety Rules and in lockout/blockout/tagout procedures.

2. All employees are required to report as soon as practicable any obvious hazard to life or property observed in connection with electrical equipment or lines.

3. Employees are required to make preliminary inspections and/or appropriate tests to determine what conditions exist before starting work on electrical equipment or lines.

4. When electrical equipment or lines are to be serviced, maintained, or adjusted, the necessary switches must be opened, locked-out and tagged whenever possible (see Lockout Procedure).

5. Portable electrical tools and equipment must be grounded or of the double insulated type.

6. Extension cords must have a grounding conductor for construction use.

7. Multiple plug adapters which interrupt the continuity of the equipment grounding connection are prohibited.

8. Ground-fault circuit interrupters (GFCI) are to be installed on each temporary 15 or 20 ampere, 120 volt AC circuit at locations where construction, demolition, modifications, alterations or excavations are being performed.

9. All temporary circuits are to be protected by suitable disconnecting switches or plug connectors at the junction with permanent wiring.

10. Exposed wiring and cords with frayed or deteriorated insulation shall be repaired or replaced promptly.

11. Flexible cords and cables must be free of splices or taps.

12. Clamps or other securing means must be provided on flexible cords or cables at plugs, receptacles, tools, equipment, etc.

13. The location of electrical power lines and cables (overhead, underground, under floor, other side of walls, etc.) must be determined before digging, drilling, or similar work is begun.
14. Metal measuring tapes, ropes, hand lines, or similar devices with metallic thread woven into the fabric are prohibited where they could come in contact with energized parts of equipment or circuit conductors.

15. The use of metal ladders is prohibited.

16. All disconnecting switches and circuit breakers must be labeled to indicate their use or equipment serviced.

17. Disconnecting means must always be opened before fuses are replaced.

18. All interior wiring systems must include provisions for grounding metal parts of electrical raceways, equipment, and enclosures.

19. All electrical raceways and enclosures must be securely fastened in place.

20. All energized parts of electrical circuits and equipment must be guarded against accidental contact by approved cabinets or enclosures.

21. All unused openings (including conduit knockouts) in electrical enclosures and fittings must be closed with appropriate covers, plugs, or plates.

22. Electrical enclosures such as switches, receptacles, junction boxes, etc., must be provided with tight fitting covers or plates.

23. Back feeding or Interconnection: No electrical source, permanent or temporary, shall be connected to a premises wiring system, or parts of such a system, unless positive means are used to prevent the transmission of electricity beyond the premises wiring system, or beyond any intentionally segregated parts of such system.

24. Accident Prevention Tags:

   A. Suitable accident prevention tags shall be used to control a specific hazard. Such tags shall provide the following minimum information

      1. Reason for placing tag.

      2. Name of person placing the tag and how that person may be contacted.

      3. Date tag was placed.

25. Employees who regularly work on or around energized electrical equipment or lines should have knowledge in the cardiopulmonary resuscitation (CPR) methods.
26. Electricians are prohibited from working alone on energized lines or equipment rated at 480 volts or more.

27. Employees who regularly work around energized electrical equipment or lines shall have knowledge in the hazards associated with electricity, including shock, high current arcs, and ignition of combustible atmospheres.

28. Load rated switches, circuit breakers, or other devices specifically designed as disconnecting means shall be used for the opening, reversing, or closing of circuits under load conditions. Cable connectors not of the load-break type, fuses, terminal lugs, and cable splice connections may not be used for such purposes, except in an emergency.

29. After a circuit is de-energized by a circuit protective device, the circuit may not be manually re-energized until it has been determined that the equipment and circuit can safely be energized. The repetitive manual re-closing of circuit breakers or re-energizing circuits through replaced fuses is prohibited.

30. Over current protection of circuits and conductors may not be modified, even on a temporary basis, beyond that of OSHA regulations pertaining to installation safety requirements for over current protection.

31. Test instruments and equipment, all associated test leads, cables, power cords, probes, and connectors must be visually inspected for external defects and damage before the equipment is used. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged items must be removed from service and no employee may use it until necessary repairs and tests to return the equipment to its proper operating condition have been made.

**General Guidelines Working Around Energized Equipment**

Employees shall become familiar with the following general guidelines:

1. Only qualified personnel shall work on electrical equipment, systems, and installations. Direct any questions to your foreman.

2. Electrical systems and equipment shall be treated as energized until tested, grounded and locked out, tagged-out, or otherwise proven to be de-energized.

3. Electrical work shall be performed with great care to maximize personnel safety during and after completion of the task. **Shortcuts will not be tolerated.**
4. Electrical installations and maintenance of electrical systems and equipment shall be maintained in a safe condition in accordance to applicable guidelines: Cal OSHA/, OSHA, NEC, etc.

5. Supervisor/Foreman shall be responsible for the enforcement of electrical safety procedures.

6. Metal jewelry, belt buckles, etc., shall not be worn in close proximity to energized circuits, systems, equipment, or worn under rubber gloves.

7. Employees shall remain alert at all times when working around or near energized electrical equipment, systems, or circuits.

8. In the event an electrical accident/injury occurs, rescue/aid shall not be attempted until the systems or circuit have been de-energized or it is deemed safe to attempt aid by the rescuer upon examination of the scene.

9. Suitable eye protection and P.P.E. shall be worn by personnel whenever exposed to electrical flash, or arcing.

10. Safety devices and personal protection devices shall be properly used and stored by all employees. Employees shall verify "good condition" of all safety equipment before each use.

11. Never reach blindly into areas that may contain energized parts.

12. Cable reels shall be securely blocked so they cannot roll accidentally.

13. No materials or tools shall be carried on the shoulder when working around or near energized electrical equipment, systems, or circuits.

14. Employees shall become familiar with company/department work procedures and avoid creating shortcuts that may compromise safety. Your safety is paramount - follow safe work practices.

Specific Procedures for Working On Energized Equipment (Refer to NFPA 70E for more details)

1. Before any energized work is performed you must request an outage. If an outage is unreasonable and is denied, proceed following the Hayward Electric Energized Work Procedures as described below. However, if the work creates an unreasonable risk or
compromises safety you may need to postpone the work until an outage is possible regardless of the clients' desire.

2. The Hayward Electric Energized Work Job Hazardous Analysis (JHA) (Refer to Appendix 2 - Forms) needs to be completed and reviewed before any work is done on or near energized wires, equipment, apparatus, etc., “NEAR” means close enough that you or your tools could accidentally make contact with the energized part because of the lack of appropriate barricades between you and the energized parts.

3. A. Work shall not be performed on or near exposed energized parts of equipment or systems until the following conditions are met:

   1. Responsible supervision has determined that the work is to be performed while the equipment or systems are energized.

   2. Involved personnel have received instructions on the work techniques and hazards involved in working on energized equipment.

   3. Suitable personal protective equipment must be provided and used. Suitable insulated gloves shall be worn for voltages in excess of 300 volts, nominal, and UV Rated Face Shield and suitable Flame Retardant Clothing (Flash suit or Nomex) must be worn.

   4. Suitable eye protection has been provided and is used.

   5. Where required, suitable barriers, barricades, tags, or signs are to be placed for personal protection.

   6. Warning signs and barriers shall be appropriately placed to isolate other personnel from the electrical hazards. Suitable barricade tape would be Red Tape with Black letters reading "Danger" or "Warning". Personnel shall obey the warnings.

   7. Never re-position, remove, or tamper with warning signs or barricades unless authorized by your foreman.

   8. Do not perform work on energized 480V equipment, circuits, or systems alone. A minimum of a two man crew is required.

B. After the required work on an energized system or equipment has been completed, an authorized person shall be responsible for:
1. Removing from the work area any temporary personnel protective equipment, and
2. Reinstalling all permanent barriers or covers.

**EXERPTS FROM NFPA 70E**

**Approach Boundaries to Live Parts for Shock Protection**

No qualified person shall approach or take any conductive object closer to live parts than the restricted approach boundary set forth in Table 2-1.3.4 of Part II NFPA 70E. This table is partially shown for your reference for voltages up to 15KV.

**Excerpt from NFPA 70E Table 2-1.3.4**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50</td>
<td>Not Specified</td>
<td>Not Specified</td>
<td>Not Specified</td>
<td>Not Specified</td>
</tr>
<tr>
<td>51-300</td>
<td>10 ft 0 in.</td>
<td>3 ft 6 in.</td>
<td>Avoid Contact</td>
<td>Avoid Contact</td>
</tr>
<tr>
<td>301-750</td>
<td>10 ft 0 in.</td>
<td>3 ft 6 in.</td>
<td>1 ft 0 in.</td>
<td>0 ft 1 in.</td>
</tr>
<tr>
<td>751-15 kV</td>
<td>10 ft 0 in.</td>
<td>5 ft 0 in.</td>
<td>2 ft 2 in.</td>
<td>0 ft 7 in.</td>
</tr>
<tr>
<td>See NFPA 70E for voltages above 15 kV</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 4 - Excerpt from NFPA 70E Table 2-1.3.4*
Definitions

Limited Approach Boundary - A shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which is not to crossed by unqualified persons unless escorted by a qualified person. In other words, the limited boundary is for unqualified personnel. No unqualified person may approach any exposed energized conductor any closer than the limited approach boundary.

Restricted Approach Boundary - A shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which, due to its proximity to a shock hazard, requires the use of shock protection techniques and equipment when crossed. In other words, qualified persons are not allowed to approach exposed, energized conductors any closer than the restricted approach boundary unless they are wearing appropriate personal protective equipment (PPE) and they have a written, approved plan for the work they are to perform. They must break the restricted boundary only to the extent that is absolutely necessary to perform their work.

Prohibited Approach Boundary - A shock protection boundary to be crossed by only qualified persons (at a distance from alive part which, when crossed by a body part or object, requires the same protection as if direct contact is made with a live part. In other words, crossing the prohibited boundary (qualified personnel only) is considered the same as actually contacting the exposed energized part. In addition to the requirements for the restricted approach boundary, personnel must perform a risk assessment before the prohibited boundary is crossed.

Selection of Personal Protective Equipment

There are many common electrical work tasks that require PPE. Common tasks are identified in NFPA 70E Table 3-3.9.1 and are associated with the appropriate Hazard/Risk Categories from Category 0 through Category 4. The first step is to identify the Hazard/Risk Category. Once the Hazard/Risk Category, refer to Table 3-3.9.2 to find the requirements for protective clothing and other protective equipment.

Hazard Risk Categories and the Associated Work Tasks—Partial Summary of NFPA 70E Table 3-3.9.1 (Note: Depending on short circuit current available, the Hazard/Risk Category may be reduced by one—see NFPA 70E for details).
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Hazard Risk Categories (240 volt and below)

Category 0
1. Operate CB or fused switch with covers on or off
2. Open hinged cover to expose energized parts
3. Work on energized 120 volt control circuit

Category 1
1. Work on energized parts, including voltage testing
2. Remove/install CB’s or fused switches
3. Remove bolted cover on panel or switchboard

Hazard Risk Category Classifications (>240 and up to 600 volt)

Category 0
1. Operate CB, fused switch, or starter with covers on
2. Operate panel meter switch

Category 1
1. Operate CB, fused switch, or starter with cover off
2. Open a hinged cover to expose energized parts

Category 2
1. Work on energized parts, including voltage testing
2. Work on control circuits with energized parts >120 volts
3. Application of safety grounds after voltage test
4. Removal of bolted cover to expose energized parts
5. Insertion/removal (racking) of CB’s from cubicles with doors closed

Category 3
1. Insertion or removal of individual starter buckets from MCC
2. Insertion/removal (racking) of CB’s from cubicles with doors open
Hazard Risk Category Classifications (1KV-15KV)

Category 0

1. Operate a panel meter switch

Category 1

1. Nothing approved

Category 2

1. Operate CB, fuse, or starter with doors closed
2. Work on control circuits with energized parts 120 volts or below
3. Insertion or removal (racking) of CB’s from cubicles, doors closed
4. Outdoor disconnect switch operation (gang-operated, from grade)
5. Insulated cable examination, in open area

Category 3

1. Open hinged covers to expose energized parts
2. Outdoor disconnect switch operation (hookstick operated)

Category 4

1. Operate CB, fuse, or starter with doors open
2. Work on energized parts, including voltage testing
3. Work on control circuits with energized part >120 volts
4. Insertion or removal (racking) of CB’s from cubicles, doors open
5. Application of safety grounds, after voltage test
6. Removal of bolted covers to exposed energized parts
7. Opening voltage transformer or control power transformer compartments
8. Insulated cable examination, in manhole or other confined space

Minimum Personal Protective Clothing and Equipment for Each Category—Partial Summary of NFPA 70E Table 3-3.9.2

Category 0

- Hard hat (ANSI Z89.1)
- Safety glasses (ANSI Z87.1)
- Long sleeve shirt (ASTM F 1506)
- Long pants (ASTM F 1506)
- Leather gloves (as needed) (ASTM F 696)
- Leather work shoes (ANSI Z41)

**Category 1**

- Hard hat
- Safety glasses
- FR long sleeve shirt
- FR long pants
- Or FR coveralls (See NFPA 70E for more details)
- Leather gloves worn external to voltage rated rubber gloves rated and tested for the maximum line to line voltage for which work will be done (ASTM F 696, ASTM D 120).
- V-rated tools rated and tested for the maximum line-to-line voltage for which work will be done.
- Leather work shoes
- Rated face shield

**Category 2**

- Hard hat
- Safety glasses
- FR long sleeve shirt
- FR long pants
- Or FR coveralls (See NFPA 70E for more details)
- Leather gloves worn external to voltage rated rubber gloves rated and tested for the maximum line to line voltage for which work will be done (ASTM F 696, ASTM D 120).
- V-rated tools rated and tested for the maximum line-to-line voltage for which work will be done.
- Double layer switching hood and hearing protection
- Leather work shoes

**Category 3**

- Hard hat with FR liner
- Safety glasses
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- FR long sleeve shirt
- FR long pants
- AND FR coveralls (See NFPA 70E for more details)
- OR Flash Suit
- Leather gloves worn external to voltage rated rubber gloves rated and tested for the maximum line to line voltage for which work will be done (ASTM F 696, ASTM D 120).
- V-rated tools rated and tested for the maximum line-to-line voltage for which work will be done.
- Double layer switching hood and hearing protection
- Leather work shoes

Category 4

- Hard hat with FR liner
- Safety glasses
- FR long sleeve shirt
- FR long pants
- AND FR coveralls
- AND FR coveralls under double layer switching coats plus pants (flash suit) See NFPA 70E for more details.
- Leather gloves worn external to voltage rated rubber gloves rated and tested for the maximum line to line voltage for which work will be done (ASTM F 696, ASTM D 120).
- V-rated tools rated and tested for the maximum line-to-line voltage for which work will be done.
- Double layer switching hood and hearing protection
- Leather work shoes

Protective Clothing Characteristics

The characteristics and degree of protection for various clothing must correspond with Hazard/Risk Category Number and shall have an arc thermal performance exposure value (ATPV) of at least listed in NFPA 70E Table 3-3.9.3. ATPV values can be obtained from FR clothing manufacturer.
Excerpt from NFPA 70E Table 3-3.9.3

<table>
<thead>
<tr>
<th>Hazard Risk Category</th>
<th>Clothing Description (Number of Clothing Layer shown in parentheses)</th>
<th>Total Weight oz/yd²</th>
<th>ATPV Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Untreated Cotton (1)</td>
<td>4.5 - 7</td>
<td>N/A</td>
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<tr>
<td>1</td>
<td>FR shirt and pants (1)</td>
<td>4.5 – 8</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Cotton Underwear plus FR shirt and FR pants (2)</td>
<td>9 – 12</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Cotton underwear plus FR shirt and FR pants plus FR coverall (3)</td>
<td>16 -20</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Cotton underwear plus FR shirt and FR pants plus double layer switching coat and pants (4)</td>
<td>24 -30</td>
<td>40</td>
</tr>
</tbody>
</table>

Figure 5 - Excerpt from NFPA 70E Table 3-3.9.3

Summary of PPE Standards

When working on energized equipment, PPE must be chosen carefully. Standards for head protection, eye and face protection, hand and arm protection, foot and leg protection, and body protection are identified in NFPA 70E. Please refer to it and do not hesitate to contact the responsible safety officer with any questions.

Lockout / Tagout

Purpose
The purpose of this policy is to comply with the OSHA standard when working on equipment from injury caused by unexpected release of stored energy and any accidental start-up.
**Scope**

This program applies to all of our controlled worksites where one of our, or a subcontract employee may be occupationally exposed to an unexpected release of stored energy and any accidental start-up.

**Definitions**

Acceptance - The acknowledgment by the persons performing tasks that all isolating devices that may expose them to an unexpected release of energy are properly positioned and that all hazards associated with the job have been addressed and communicated by the owner.

*Cable Tie* - A non-reusable, hand attached, self-locking device with a minimum breaking strength of no less than fifty pounds. (50 lb.) It is used to attach tags to isolating devices.

*Crew Contact* - A person that has the responsibility of being the focal point of communication for a work crew.

*Energy Source* - Any source of energy that can be harmful to personnel, including chemical, electrical, thermal, mechanical, pneumatic, hydraulic, gravity, and radioactive.

*Exclusive Control* - When an individual performing a task is in continual attendance of, has visual contact with, and is in arms length of the isolating device(s).

*Individual Tag* - Lock and/or tag to be attached by an individual that can only be removed by that individual, except for provisions set forth in this document.

*Isolating Device* - A physical device that prevents the transmission (or release) of energy or materials. Examples include slide gates, slip blinds air gaps, valves, physical blocks, and electrical disconnects.

*Isolation Procedure* - A documented energy control procedure which must contain, as a minimum:

- The intended use of the procedure.
- Steps for shutting down, isolating, blocking, and securing the isolated system.
- Steps for placing, removing, and transferring lockout/tagout devices, and the responsibility for them.
- Procedures for testing the isolated system to verify the effectiveness of the energy control and lockout/tagout procedures.

**Job Representative** - The person representing the workers performing the job. They assure that the requirements of this standard are met, including sufficient isolation. (A Job Representative can be a crew contact, a worker, or a supervisor.)

**Lockout** - The process of securing an isolating device to prevent accidental energizing, by using a lock or bolting. Lockout can also be used to provide "one-plus" protection on devices that would not normally be considered isolating devices.

"One-Plus Lockout/Tagout" - The requirement of an additional means of isolation or restraint, whenever tagout is used without locks, to prevent inadvertent operation of an isolating device. "One Plus" requires that two separate, unrelated actions must occur to defeat the source isolation.

**Operations Representative** - A person representing company operations that is qualified to isolate, lock and/or tag equipment. This person must have a full and clear understanding of the work to be performed.

**Operations Lock and/or Tag** - The first lock and/or tag to be attached to, and the last lock and/or tag to be removed from an isolating device by a qualified operations representative.

**Owner** - An individual who is in control of a specific piece of equipment or process.

**Release** - Certification by the person performing work that they have completed their task and will no longer be working on the isolated equipment.

**Tagout** - The attachment of a standardized Tag to an isolating device. These tags indicate that the equipment must not be operated until the Tag is properly removed.

**Worker** - An individual directly responsible for an operation, service or maintenance task.

**Lockout/Tagout Specifications**

Locking and/or tagging a piece of equipment involves securing an isolating device to prohibit repositioning of the isolating device. There are certain specifications that must be followed when a piece of equipment is locked and/or tagged out.

For the purpose of tagging equipment, a Tag shall be affixed to each isolating device.
When line blinds and other isolating devices are used, they must be designed to adequately isolate the maximum amount of energy possible for the system being isolated.

In the case of slip blinds, they must be made visible, distinguishable from orifice plates, easily identifiable, compatible with the process materials, and capable of holding a cable tie for the purpose of attaching a Tag.

- Tags must be legible.
- Tags shall be attached to all isolating devices with a cable tie. In the case of locks, the Tag may be attached to the lock or shackle.
- No Tags should be used longer than 90 days. Periods, which may exceed 90 days, shall require additional considerations such as permanent isolation or periodic replacement of Tags.
- All Individual Tags shall be identified prior to installation. A qualified person shall install all Individual Tags. They must be removed before any Operations Tags.

Prior to any work being performed on an isolated system, there shall be a written procedure.

Any physical device that may be inadvertently repositioned must be made safe using the "One Plus Lockout/Tagout" system. "One Plus" requires an additional means of isolation or restraint whenever tagout is used without locks.

**EXCEPTIONS:**

While there are specifications for every lock and/or tag procedure, there are a few exceptions. These exceptions can include:

- Minor tool changes and adjustments. When routine, repetitive tool changes and adjustments that are integral to the use of the equipment for production take place during normal productions operations they are not subject to the Lockout/Tagout procedures outlined in this standard.
- Minor servicing operations. If minor servicing activities are routine, repetitive and integral to the use of the equipment for production they are not subject to the Lockout/Tagout standard. The work to be performed must be done using
different measures which prevent accidental activation or moving of the device. These measures can include push buttons that have to be twisted and pulled out to activate, key-locked switches, or interlocks.

- Exclusive control. If a worker has exclusive control over a piece of equipment it means that the worker is in continual attendance of, has visual contact with, and is in arms reach of the isolating device.

- All Exceptions have to be approved by either the Responsible Safety Officer, the Estimator member of the Safety Committee or the Electrical member of the Safety committee and shall have a documented safe operating procedure.

Responsibilities

*Owner Responsibilities:* An individual who is in control of a specific piece of equipment or process is considered the owner.

As a minimum, the Owner must:

- Establish an isolation procedure for equipment. The steps that need to be taken to isolate the equipment, including who is responsible for each step, are a part of the isolation procedure.

- Specify and buy lockable equipment when available. The owner determines what type of new equipment is necessary to successfully administer a lock and/or tag.

*Operations Representative Responsibilities:* The Operations Representative for a lockout/tagout procedure is the person representing plant operations who is qualified to isolate, lock and/or tag equipment. This representative must have a full and clear understanding of the work to be performed. As a minimum the Operations Representative for a Lockout/Tagout Procedure must:

- Attach the operations locks and/or tags on equipment requiring isolation. The Operations Representative is responsible for not only making sure that the locks and/or tags are on isolating devices, but also that the right locks and/or tags are used. This includes using "One-Plus" when necessary.

- Physically verify that residual energy and/or materials have been relieved, drained, disconnected, restrained or otherwise rendered safe. This verification can take place through inspections and testing.
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- Review the condition of equipment with Job Representative and workers assigned to do the job before any work is started and assure proper accountability is in place. The Operations Representative is responsible for making sure that the workers know what’s going on, and what each of their roles in the lockout/tagout procedure is.

- Address any concerns expressed by the workers and/or Job Representative regarding equipment isolation and preparation. The Operations Representative shall follow up concerns expressed by workers.

- Reviewing all addenda and communicate to Job Representative. The Operations Representative is responsible for communicating all information about the job, including any changes or additions to the procedures, to the Job Representative.

- Verify the "Release" and removal of locks and/or tags after the work is completed, and that equipment is returned to a safe operable condition.

- Notify personnel in the area that equipment is being placed back into service. This notification can be done over the radio, in the logbooks or in person.

**Job Representative Responsibilities:** The person representing the workers performing the job is the Job Representative. It is the Job Representative’s responsibility to ensure that the requirements of the Lockout/Tagout Safety Standard are met. A Crew Contact, a worker, or an operator can all be Job Representatives. As a minimum, the Job Representative must:

- Review scope of job with the Operations Representative. The scope of the job includes the dates that the job will take place, a description of the job, and the reason that the job is being done.

- Resolve any differences with Operations Representative as they apply to the isolation of the systems. If the Job Representative has a concern about the isolation of the system, the differences must be brought to the attention of the Operations Representative and resolved.

- Review, verify, and confirm isolation of the system.

**Worker Responsibilities:** Any individual who is directly responsible for an operation, service or maintenance task falls into the category of Worker. As a minimum the Worker must:

7-20
• Review the status of the equipment prior to attaching individual locks and/or tags. Signing "Accepted" or attaching locks and/or tags means the Worker is aware of the isolation that is to take place and is in agreement with it.

• Communicate any concerns regarding equipment isolation and preparation to the Operations Representative. This communication must take place before a safe work permit is issued and work begins.

• Notify the Operations Representative of completion of work, any changes in job scope, or identification of any new hazards. The Worker must communicate with the Operations Representative concerning all aspects of the job.

• Sign "Release" for the Master System and/or remove individual locks and/or tags. This indicates completion of assigned tasks or intention not to work on the system.

• Return the equipment to a safe operable status relative to the work that was performed. (Replacing guards, housekeeping, etc.)

Core Lockout/Tagout Procedure

The Core Lockout/Tagout procedure is common to all lockout/tagout procedures. These common steps can be used to achieve 100% control and 100% accountability of all-isolating devices and personnel. As a common base for all other lockout/tagout procedures, personnel involved should complete their required steps in the order given:

OPERATIONS:
• Establishes isolation procedure. (Master or Individual)
• Creates tag location listings and completes Operations Tags.
• Isolates the system.
• Verifies and tests isolation, and attaches operations locks and/or tags.
• Reviews jobs to be performed with Job Representative or Workers.
• Issues addenda as needed.

JOB REPRESENTATIVE: (Worker is Job Representative if the Individual System is used.)
• Verifies isolation.
• Reconciles any difference and updates tag location listing with Operations Representative.
WORKER:

- Reviews isolation, signs "Acceptance" if the Master System is used, and, if desired, attaches Individual Tags.
- Completes a tag location listing if Individual Tags are to be used.
- Obtains Safe Work Permit.
- Begins work.
- Initiates Addendum if needed.
- Returns completed Safe Work Permit.
- Signs "Release" if Master System is used.
- Removes and signs Individual Tags.

OPERATIONS:

- Removes and signs Operations Tags.
- Reconciles Tags.
- Makes equipment operable.

Individual Lockout/Tagout

The Individual Lockout/Tagout System requires that every person working within the isolated system attach his or her Individual lock and/or tag to each isolating device. The Individual System is mandatory for simple jobs. When this system is used the following rules must be followed:

- Operations Representative is required to attach operation locks and or tags to each isolating device.

- Each Worker shall complete the required information on the Tag. Each worker is required to attach and Individual lock and/or tag to all appropriate isolating devices that have an Operations Tag attached.

- After completing the work, the worker(s) must remove their locks and/or tags. If the worker cannot account for all Tags, this must be brought to the attention of the Operations Representative.

- The Operations Representative removes the Operations locks and/or tags. The Operations Representative must have full reconciliation with the location listing prior to putting equipment back into service.

Note: Troubleshooting or testing of equipment may require that the equipment be energized.
Group Lock Out / Tag Out

In the event that multiple users have the need to lock out in the same location, Group Lock Out / Tag Out can be used utilizing a “Group Lock Box”. One example of the use of the Group Lock Out /Tag is as follows:

One appointed representative places his locks and tags at all the energy sources required to isolate the system to be worked on. The representative then places the key or keys to his lock or locks in the “Group Lock Out” box. The representative is then responsible for the system isolation. The representative then demonstrates to all authorized and effected employees the system isolation including showing location of locks and tags. All employees are required to place locks and tags on the system then place their locks on the “Group Lock Out” box. From this point on Lock Out / Tag Out is used for each individual employee as performed in “Individual Lock Out / Tag Out.

When the system is ready to be restored to the normal operating condition the removal of locks and tags for all employees is performed as in “Individual” Lock Out / Tag Out. Once the appointed representative has verified that all authorized and effected employees has removed their lock from the “Group Lock Out” box he then removes his key, then removing his locks from the system isolation locations. At this time the system should be ready for normal start up as performed in the “Individual” Lock Out / Tag Out.

Tags/Locks

Tags are to be used for identifying all isolating devices in use for energy control. When Tags/Locks are used, the following rules must be followed:

- Operations Tags and/or locks must not be removed until all workers removed any Individual Tags. The removal of Operations tags must be the last operation prior to putting the equipment back into service.

- Workers may attach their Individual locks and/or tags to isolating devices. All Individual Tags must be identified as such.

- All operating units must have a procedure to account for all keys.

Tag and/or Lock Removal for Unavailable Worker

Procedures for the removal of locks and/or tags when an individual has failed to sign off of a completed job, or remove their individual locks and/ or tags, must include:

- Some form of verification that the individual is not at the facility. This verification should include contacting the supervisor.
Hayward Electric Injury & Illness Prevention Program

- Attempted contact of the individual for verbal "Release". If release is obtained, only the person receiving the release can remove the lock and/or tag.

- If the employee cannot be contacted:
  1. Verify that the system is safe for removal or Tags and/or Locks.
  2. Approval by the Owners Representative or his documented designee is required before work can be released for that individual employee who failed to release or remove locks/tags.
  3. Notify the individual upon his or her return to the facility that locks and/or tags have been removed.

Audits

An audit is a formal examination or review. As a minimum, the procedures listed below must be followed:

- At least annually, there will be audits of compliance by the Company Safety Committee. This audit will be documented.

- Interviews of all persons around or performing a job task must be conducted. These interviews will be documented.

- Audits must include a representative sample of lockout/tagout work done. These audits will be documented.

- A qualified person not directly involved in the job that is being done must perform audits.

Training

Training on lockout/tagout procedures is required for all workers, both users and non-users.

- Training must be fully documented. The name of the trainer, the trainee, the dates of training, and whether the employee was trained as a user or a non-user of Lockout/Tagout Procedures needs to be documented.

- Training will be given to all new personnel concerning the Lockout/Tagout Process.
Each work site shall provide training on an annual basis to ensure that everyone understands the purpose and function of the Lockout/Tagout Program.

Retraining will be required annually. Retraining will also be required under the following special circumstances:

1. When there is a change in the Lockout/Tagout Procedure.
2. When an audit or incident reveals deviations from procedures.
3. When either audit or incidents determine that inadequacies exist in personnel knowledge of or adherence to energy policies and/or procedures.
4. When there are changes in equipment or job assignments (only the workers affected).

**Electrical Transmission and Distribution Overhead**

**Safe Working Guidelines**

A. Only qualified employees shall be assigned work on overhead conductors or apparatus.

B. When an employee is performing work on any conductor or apparatus energized in excess of 600 Volts, phase to phase, a second employee shall act primarily as an observer for the purpose of preventing an accident.

**Suitable Clothing & Personal Protective Equipment**

A. A shirt or jumper with full length sleeves rolled down and approved long gauntlet gloves shall be worn when climbing on erected poles or similar structures and under such other conditions as the employee in charge shall direct. Personnel, other than Electric T&D employees, performing similar work may be permitted by their supervisors to utilize other approved types of gloves.

B. Hard Hat - A hard hat/cap, furnished by the Company, shall be worn by all employees when exposed to energized conductors or apparatus, falling or flying objects, or as required by the employee in charge.
C. Watch chains, wrist bands, key chains, exposed neck chains, tie chains and clasps made of metal shall not be worn when working on or adjacent to exposed energized conductors or apparatus.

D. Proper eye protection must be worn whenever working on energized conductors or apparatus or performing switching operations. Shaded lenses are recommended for outdoor work during daylight hours. Clear lenses shall be worn during darkness or when vision is reduced by other factors.

**Energized Low Voltage Conductors or Apparatus**

No employee shall touch any exposed conductors or apparatus energized at less than 300 Volts, phase to phase, unless insulated from other conducting surfaces with adequate protective devices. When such conductors are located within non-climbable metal poles, aerial work shall be done only from an aerial lift. Where clearance specified in APR 405(a) cannot be maintained, all energized primary conductors shall be adequately covered up or barricaded with suitable protective devices.
Chapter 7 – Electrical Safety

Working Distance

A. Table 1 lists the minimum working distances from energized conductors or apparatus, which are not properly covered with approved protective equipment:

<table>
<thead>
<tr>
<th>VOLTAGE (Phase to Phase)</th>
<th>DISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 300</td>
<td>Not Specific</td>
</tr>
<tr>
<td>301 - 2,000 Volts</td>
<td>12&quot;</td>
</tr>
<tr>
<td>2.1 - 15 KV</td>
<td>24&quot;</td>
</tr>
<tr>
<td>15.1 - 35 KV</td>
<td>28&quot;</td>
</tr>
<tr>
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<tr>
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<td>48&quot;</td>
</tr>
<tr>
<td>230 KV</td>
<td>72&quot;</td>
</tr>
<tr>
<td>500 KV</td>
<td>144&quot;</td>
</tr>
</tbody>
</table>

Figure 6 - Minimum working distances from Energized Conductors

B. Distances in the above table does not prohibit working on conductors or apparatus energized from:

1. 300 to 5,000 Volts, nominal phase to phase, with approved protective equipment.

2. 5,000 to 21,000 Volts, nominal phase to phase, using approved Rubber Glove work methods.

C. Nothing in this rule shall prohibit climbing past bond wires.

D. The above working distances do not apply to energized conductors or apparatus protected by a suitable barrier or properly covered with approved protective devices.
However, intentional contact shall not be made with the protective coverings, except for installation or removal.

**Testing Conductors and Apparatus**

A. Conductors which normally operate at ground potential may sometimes become energized by reason of faulty or inadequate connection. Always treat conductors and apparatus as energized until tested otherwise.

B. Ground conductors should be handled with the same caution as is used with energized conductors.

**Pole Mounted Apparatus**

A. All cutouts and disconnects shall be operated with a fuse or switch stick, or approved telescoping live line tool.

B. Contact with transformer, capacitor, regulator or oil switch cases, bond wires, hardware supporting primary voltage insulation and other apparatus shall be avoided except when tested and grounded or worked upon with approved devices.

C. Report any defective line or portion of apparatus to supervision immediately. Do not take unnecessary risks attempting to correct defects.

**Working Position**

Always perform work on energized conductors or apparatus from below unless it is not practicable.

**Grounding Overhead Lines**

A. Only approved grounding devices shall be used to ground overhead lines.

B. Any exposed de-energized part of a overhead line normally operated at a voltage in excess of 600 Volts, phase to phase, shall not be worked on until the normally energized parts have been tested de-energized and all conductors of the circuit have been short circuited and grounded against all possible sources of energy.

C. When Single Point Grounds are used on Distribution or Transmission circuits, a single point ground shall be installed at each work location. The pole band, which is a part of the single point grounding procedure, provides an equal potential work zone. On steel structures the equal potential zone is established with the combined use of a butt ground and shunt.
D. When Master Grounds are used, grounds shall be installed between the work area and all possible sources of energy. Energized high voltage lines which cross over or under a de-energized line shall be considered possible sources of energy.

E. In addition, where only distribution circuits are involved, a personal ground (pole band and shunt) or lineman rubber gloves shall be used when working within the master grounds under any of the following conditions:

1. The wood pole surface is considered very damp or wet after being exposed to rain, wet fog, etc.
   
   A. There is less than two feet of clearance measured along the surface of the pole between the lineman working in the normal primary area and any ground attached to the pole.
   
   B. Work is performed from steel structures.

2. In addition, when working on a distribution conductor on any wood or metal structure that supports an energized transmission circuit or that is exposed to such a transmission circuit crossing, a personal ground shall be used when working within the master grounds.

3. In addition, when work is to be performed within a cleared and grounded transmission line section, the conductor to be worked on at each location shall be grounded at that work location using an appropriate personal ground.

4. Line grounding devices that have any one of their component parts less than fifteen (15) feet above ground, except those used in the Underground, or at Substations, shall be placed so that at least one of them is readily visible to at least one member of the crew.

5. Adequate means shall be taken to prevent workers from making contact with grounding devices and energized conductors or apparatus.

6. The grounding devices shall first be connected to a ground before being brought in contact with any conductor or apparatus to be grounded. When being removed, they shall be removed from all conductors or apparatus before being disconnected from ground.

7. Employees outside of the equal potential work zone shall avoid contact with any portion of the grounding device which can become energized.
8. The employees installing the grounding device shall determine that all of the employees are a safe distance from any portion of the grounding device before contacting the conductor or apparatus with the grounding device.

9. Nothing in this rule shall prohibit working on energized conductors or apparatus by means of approved live line procedures.

**Climbing Equipment**

A. Climbers, or gaffs, shall not be used after being worn or filed to a point the gaff is 1-1/4” long. (Measured on the underside of the gaff).

B. Climbers shall only be worn when performing work that requires their use, never when driving or riding in a vehicle, setting, removing or handling poles, working on the ground or while working on floors or roofs.

**Working in Elevated Positions**

A. Before climbing poles or structures, or approaching the overhead work area, employees shall familiarize themselves with the circuits and apparatus thereon and any unusual conditions which might present a hazard.

B. Not more than one employee shall ascend or descend a pole at the same time. The first employee shall be in place on the pole or on the ground before the next employee ascends or descends the pole. When it becomes necessary for one employee to work above the other, they shall exercise extreme care.

C. Before climbing poles, ladders, scaffolds, or other elevated structures, or riding span wires, messengers or cables, or entering cable cars, boatswains' chairs or similar equipment, the employee shall first assure him/her self that said structure or device is strong enough to safely sustain his/her weight.

D. Before working on any pole or structure from which supporting conductors or guys are to be removed, or on which the stress is to be changed in any way, the employee in charge and climbing personnel involved shall make sure that the poles or structures will stand the change in stress without failing.

**NOTE.** In making such determination, they shall have considered at least the following:

1. Physical condition of pole.
2. Configuration of conductors or equipment on pole (4-way corner).
3. Location of the pole brand to make certain that the pole is set to proper depth. (Manufacturers place their pole brand 10 feet from the butt end of poles 50 feet and under and 14 feet on poles 55 feet and over.)
4. Results of test in accordance with Pole Test Procedures.

E. If it is not possible to test as set forth in the Pole Test Procedures, the pole shall be adequately supported before climbing.

**Belts and Safety Straps**

A. Only approved safety straps and body belts shall be used.

B. Employees shall not work on an erected pole, tower or other elevated structure, including truck mounted ladders and mechanical or hydraulic platform lifts, without first securing themselves with an approved safety strap or life line.

B. Employees working in aerial basket lifts shall secure themselves with an approved lanyard properly fastened to the attachment provided.

**Handlines**

A handline (non-conductive) shall be placed on every structure where line work is being performed on energized conductors or apparatus or where crew is working directly over energized primary conductors or apparatus.

**Testing Poles and Stubs**

When it is determined that a pole shall be tested, the tests shall be made as follows:

A. Make a close visual inspection and a hammer test for any physical defect which might weaken the pole.

B. Expose to at least 12 inches below ground on one side of the pole and inspect for defects as noted in (A) above. If set in pavement, test by boring as outlined in subparagraph (C) below except start the drill hole as close to the pavement as possible.

NOTE: If it is evident that the pole is defective after either of steps (A) or (B), further testing is not necessary and the pole shall be adequately supported before climbing.

C. Poles: Bore a 9/16 inch hole at the centerline of the pole at the bottom of the excavation at a 30 to 40 degree angle with the surface of the pole, to within about
2 inches of the opposite side, taking care not to break through. If the soundness
of the pole is questionable after the first boring, bore a second hole at right
angles to the first at ground level. If the soundness of the pole is questionable at
this point, it shall be adequately supported before climbing. The drill shall be
plugged with a 5/8 inch treated dowel.

D. Stubs: Wood and steel stubs used to reinforce wood poles at the ground line
shall be treated as part of the pole and tested as determined necessary. The
testing shall be performed as follows:

1. The metal stubbing bands for both wood and steel stubs shall be
   inspected and the pole shall be checked for soundness above and below
each band. The bands must be in good condition and shall be tight.

2. Wood stubs shall be tested as outlined in the previous section "Poles."

3. Galvanized steel stubs shall be checked for soundness by visual
   inspection at the ground line for rust or corrosion. If rust is detected, the
   stub shall be exposed a minimum of 12 inches to determine the extent of
corrosion. If corrosion has not penetrated more than the surface metal and
extends less than 1/3 the perimeter of the stub, it shall be sounded with a
hammer and, if found solid, be considered of adequate strength to support
the pole. If corrosion has penetrated the surface and extends the full
perimeter of the stub, or it is not possible to determine the extent of
corrosion, the pole shall be adequately supported before climbing.

**Setting or Removing Poles**

A. All persons not engaged in pole setting shall be kept out of the work area.

B. No one shall be allowed on a gin pole when it is being used to raise another pole.

C. When setting or removing poles between or near conductors, energized above 600
   volts, phase to phase, where danger of contact with conductors or equipment may exist:

   1. Ground wires, gut wires or metallic hardware running the length of the pole
      shall not be attached to the pole.

   2. The conductors shall be spread to minimize accidental contact or covered with
      approved protective devices or the pole shall be covered with an approved guard
      or the conductors shall be de-energized.
3. All personnel who may handle the butt of the pole shall wear approved linemen's rubber gloves whether or not cant hooks or slings are used.

4. No one shall step on or off the truck, or touch any part of the truck or associated equipment from the ground, while the pole is being set, or until it is secured in such a manner that it could not possibly come in contact with energized conductors or apparatus.

5. Guy ropes may be used to control the pole.

**Common Neutral Systems**

A. The common neutral conductor shall not be opened at any point except by first installing an approved temporary jumper around the proposed open point.

B. The common neutral at the secondary level and the lower end of the vertical run connecting the common neutral to a primary is considered secondary. When work requires connection or disconnection of the primary neutral to the common neutral at the secondary level, approved linemen's rubber gloves will be used. That portion of the vertical run located at less than the safe working distance from the associated primary phase conductors shall be considered as primary and shall be worked upon only with approved company live line work methods.

**Wire Stringing**

A. When stringing or removing conductors, the number of employees handling the conductor shall be held to a minimum. Running lines, hold down lines, and/or tag lines shall be used, and left attached, until the conductors are in place and properly secured. It is the duty of each employee in charge to see that such means of protection are adopted as are necessary to make the work safe.

B. When stringing or removing conductors along or over streets or highways, the pulling and tensioning equipment shall be provided with red flags on the front and rear. Other precautionary measures, such as flaggers, cradles and barriers shall be used as needed.

C. When stringing or removing conductors above or below, unattached circuits energized up to 5,000 volts, phase to phase, or on poles or towers supporting circuits energized up to 5,000 volts, phase to phase, precautions shall be taken to adequately insulate the workers by means of approved rubber protective equipment or other approved methods. Where practical, the recloser shall be cut out on the energized circuit involved in any crossover. This rule shall not apply where only 0 - 300 volt service drop conductors are involved.
D. When stringing or removing conductors or below unattached circuits energized above 5,000 volts, phase to phase, the conductor shall be pulled over a grounded roller at the first structure away from both the payout and take-up equipment. However, when a running ground is used between such equipment and the first structure, the grounded roller shall be installed on the second structure instead of the first. In addition, a grounded roller shall be installed at each crossing on the first structure beyond the crossing toward the take-up reel. Where practical, the recloser shall be cut on the energized circuit involved in any crossover.

E. When stringing or removing conductors crossing over any energized circuit, suitable protection such as rope nets or guard structures shall be the one applying to the circuit which presents the greatest hazard.

F. When stringing conductors between circuits covered by (C) and (D) of this section, the governing rule shall be the one applying to the circuit which presents the greatest hazard.

**Washing of Insulators on Energized Lines**

A. Insulator washing shall be performed only when utilizing Isolated or Insulated methods of washing energized lines.

B. When washing insulators on energized lines:

1. Water shall be tested for resistivity by use of an approved water tester at each filling of the water container.

2. Water shall have a minimum resistance as shown in the table below measured in ohms per inch cube.

NOTE: As water resistance decreases with increases in temperature, it shall be checked occasionally when tank is exposed to the sun.

C. Minimum stream length distance from the nozzle to the energized part being washed is shown in the following table:

D. Minimum 15/64 inch and 1/4 inch nozzle pressure when washing transmission lines shall be maintained at 400 psi but may be reduced to 300 psi when washing distribution lines (less than 50kV). For 5/16 inch nozzle, pressures of 300 psi and 200 psi respectively shall be maintained.
Capacitors

A. Before any work is done on switched or fixed capacitor installations, the oil circuit breakers and/or fuse cutouts shall be opened, using load break devices where applicable. Where a circuit breaker is provided, it shall be opened first. After five minutes, the capacitor terminals shall be shorted by means of approved temporary jumpers. The shorted terminals shall also be securely bonded to the capacitor cases. Wherever practical, the short circuit and bond shall be left on until all work is completed. If the primary taps from the cutouts or circuit breakers to the line conductors are not removed, portable grounds shall be placed on the leads from the cutouts or circuit breakers to the capacitor terminals.

B. Rubber gloves, or other approved devices shall be used while placing the temporary jumpers on capacitors normally energized at voltages up to 5,000 volts, phase to phase. On voltages above 5,000 volts, phase to phase, live line tools, or other approved devices or procedures shall be used.

C. Before any work is done on capacitors installed on secondary circuits without cutouts or switches, the capacitors shall be de-energized and cleared as provided in section (A) of this rule, using approved rubber gloves.

Apparatus Leads

Ground the conductors between the open switch of fuse holders and the apparatus before working on de-energized apparatus normally energized above 5,000 volts, phase to phase. Where impracticable to ground as above, the taps shall be removed from the line with the live line tools.

Banked Secondaries

Where secondaries of transformers are banked or there is a possibility of back feed, the transformer secondary leads shall be disconnected in addition to removing primary fuses or disconnecting the primary leads from the line before any work is done on the transformer.

Portable Power Tools

Only approved portable electric tools shall be used on erected poles, towers or structures and caution shall be used to maintain safe working distances.
Use of Metallic Hoisting Lines

Metallic hoisting lines shall not be taken above the lead of conductors or apparatus energized in excess of 600 volts, phase to phase, except when using pole setting equipment with a boom extending beyond that level and then only when the conductors or apparatus are covered with the acceptable protective equipment or are spread to prevent accidental contact.

Metal Ratchet Hoists

Metal ratchet hoists shall not be attached to any energized conductor. Such hoists shall not be used in any position where conducting parts thereof can come closer to any energized conductor than the "minimum working distances prescribed in the Alternating Current Maximum Distance Table 1 which follows under the caption "Live-Line Tools" unless the energized conductors are first covered with approved protective equipment for the voltage involved or when approved bare hand procedures are used.

Live Line Tools

The following rules shall govern the use of live line tools:

A. Personnel shall be instructed in the proper use of live line tools before using them.

C. When using live line tools, employees shall not place their hands closer than is absolutely necessary to energized conductors, equipment or metal parts of the tool being used, and in no case closer than specified in table 1:
Table I

<table>
<thead>
<tr>
<th>VOLTAGE (Phase to Phase)</th>
<th>DISTANCE</th>
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<tbody>
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<td>500 KV</td>
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</tr>
</tbody>
</table>

Figure 7 - Minimum Safe Distance from Energized Lines

Electric Transmission and Distribution Underground

Safe Working Guidelines

1. Only qualified employees, or employees under continuous supervision or instruction of a qualified employee, shall be assigned to work on underground conductors or apparatus energized in excess of 600 Volts, phase to phase.

2. Do not touch any exposed conductor or apparatus energized at less than 300 Volts, phase to phase, unless insulated from other conducting surfaces or protected by appropriate devices intended for that purpose.
3. The following table lists the minimum safe working distances from energized conductors or apparatus which are not properly covered with approved protective equipment.

4. The above safe working distances do not apply to conductors or apparatus properly protected. However, intentional contact shall not be made with the protective covering except for installation and removal.

   **Suitable Clothing**

   A. A shirt or jumper with full length sleeves rolled down and approved gloves shall be worn when working in manholes, vaults, excavations, or similar areas, or under such conditions as the employee in charge shall direct.

   B. Watch chains, wrist bands, exposed neck chains, key chains, tie chains, and clasps made of metal shall not be worn when working on or adjacent to exposed energized conductors or apparatus.

5. Prior to entry into manholes, vaults, or similar structures the Supervisor in charge shall ensure that the Hayward Electric Confined Space Entry Program is reviewed and complied with as applicable (Training and instrumentation will be provided by Hayward Electric).

   **Enclosure Covers**

   A. All vaults, manholes, or other subsurface covers which are not hinged or provided with special lifting devices shall be raised slightly on one edge and slid off the opening.

   B. Non-round covers must be handled in a manner which will minimize the possibility of the cover dropping into the enclosure.

   C. Covers with hold-down bolts or devices shall be removed only with approved tools. Such bolts or devices shall always be reinstalled when the cover is replaced.

   D. Whenever the cover is removed from a vault or manhole similar structure, adequate warning devices shall be displayed in locations conspicuous to pedestrians and vehicular traffic. These warning devices shall not be removed until permanent covers are in place. Where permissible and practicable the employee's vehicle shall also be placed in such a manner as to guard against oncoming traffic.
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Protective Equipment

A. An approved protective smock, hood, and rubber gloves with protectors shall be worn by all personnel in manholes, vaults, and confined transformer rooms when:

1. Engaged in inspections involving the exposure of energized primary equipment, such as 4 kV junction boxes, fuse cabinets, etc.

2. Engaged in operating energized primary equipment including but not limited to oil switches, oil-filled cutouts, overhead type cutouts, and junction boxes. (Note: Protective trousers shall also be worn when operating oil-filled equipment in manholes or vaults.)

3. Performing any work on network protectors until the transformer links and backup fuses have been removed and the protector rolled out, unless both the transformer and secondary buses are de-energized.

B. The smock and hood are not required when operating padmount or subsurface apparatus with the use of approved live line tools; however, it is recommended that they be worn when operating equipment which is suspected of being faulty.

6. Approved gloves and safety goggles shall be worn while heating or handling hot metals or insulating compound.

7. Appropriate eye and body protection shall be worn by all employees as work assignments warrant.

Fishing Ducts

A. A non-metallic duct fishing wire or device shall be used when fishing ducts containing energized conductors.

B. Ducts shall always be fished in the direction which presents the least hazard. An employee shall be stationed at each end when required.

Warning Workers

Before lowering material or tools into a manhole, the employee so doing shall warn all employees in the manhole or vault.
Fire Equipment

Each vehicle engaged in underground type work shall be equipped with an approved fire extinguisher, which shall be kept in good operating condition and immediately accessible at all times.

8. Every possible precaution shall be taken to assure the correct identity (voltage, circuit, phase, etc.) of the cable or apparatus to be worked on. Failure to properly identify the system could result in an injury.

9. All cables and/or apparatus shall be considered energized and worked with adequate protective devices until:

   A. Tested with an approved device and proven to be de-energized.

   B. Grounded from all possible sources of power (including transformer secondary back feed).

   C. Proven de-energized at the work location.

10. The following procedures shall be used to determine cables are de-energized at the work location:

   A. For cables normally energized at 600 Volts or less, phase to phase, which can be positively identified, remove the sheath or jacket, cut or remove the insulation to expose a spot on the conductor for direct metallic contact and test with an approved voltage meter.

   B. Cables normally energized at more than 600 Volts, phase to phase, or any cable whose voltage or identity is questionable, shall be proven de-energized by one of the following methods:

      1. Cable terminals or apparatus which are equipped with capacitive test points or have bare, exposed parts shall be proven de-energized with an approved test device.

      2. Cable terminals and apparatus which cannot be proven de-energized with an approved test device shall be either:

         A. Ground from all possible sources of power and positively traced from the grounded point to the work location, or
B. Spiked from the outside of the manhole, vault, etc., or location at which the work will be performed. A positive ground must be attached to the cable spike.

11. Before starting work on any section of cable or apparatus to which cable is connected, care must be exercised to assure that the cable has been grounded for a sufficient length of time to drain off any static charge.

12. Do not cut or splice any energized cable with a difference in potential of over 600 volts, phase to phase, unless a device is used which is approved for this application and you have received authorization from supervision.

13. Where needed, suitable protective covers or adequate barriers shall be utilized to prevent accidental contact with energized conductors or grounded surfaces.

14. Do not open neutral conductors without the prior installation of suitable bypass conductors or assuring the proper de-energization of the circuit.

15. The moving of energized underground cables shall only be attempted after obtaining specific authorization from the supervisor in charge. Prior to moving any energized electric underground cable check for any defects which could result in failure.

16. Do not operate junction boxes with exposed air-brake blades energized above 600 Volts, phase to phase, to pick up or drop load.

17. De-energize (and test "dead") the circuit before separating or connecting a dead break type separable connector. Suitable live line tools shall be used to operate or connect this type of connector unless the circuit is tested de-energized and grounded.

18. Internal transformer primary load brake switches shall be operated with an approved live line tool. Safe working distances as specified in Table I of guideline 3 (this section) shall be maintained from any exposed energized parts, unless insulating barriers are used. **Do not take short cuts.**

19. All primary cables of pad mounted apparatus must be de-energized and tested "dead" before moving primary jumpers, stress cone cable terminations, or replacing dead-break fuses in transformer cabinets. Suitable live line tools will be used to perform these operations.

20. Safe working distance as specified in Table I of guideline 3 (this section) shall be maintained from any exposed energized parts when operating pad mounted disconnects, fuse devices and resetting fault indicators with the proper live line tools.
21. Work shall not be performed in the primary compartment or sections of any pad-mounted transformer, switch or fuse enclosure which there are exposed parts energized in excess of 600 Volts, phase to phase, unless all such parts are effectively barricaded or isolated from the work area. All exposed, de-energized parts in the compartment must be tested dead and grounded before any work is performed.

22. Use of extreme care where uncovering direct buried cables to avoid damaging the cable insulation. Assure the cables have been de-energized prior to uncovering them.

23. Do not stand on unprotected cables.

24. Protect exposed cables in the work area with boards or other non-conductive materials.

25. Temporary cable installations shall be performed in a manner that maximizes personnel safety. If apparatus must be left open and energized, suitable warnings and barricades must be in place.

26. Do not use wire rope to pull cable in a duct already occupied by conductors. In such cases, a non-metallic fishing wire or similar device shall be used.

27. Always fish ducts in the direction which presents the least hazard. An employee shall be stationed at each end when required.

**Electric Substations**

*Scope and Purpose*

1. These rules apply to all electric substations and comparable electric installations.

2. These rules are for the purpose of calling attention to specific exposures and establishing rules to minimize or avoid them.

*Qualified Persons*

Only qualified persons shall be assigned to work on conductors or equipment energized in excess of 600 Volts, phase to phase. Employees in training who are qualified by experience and training shall be permitted to work on conductors or equipment energized in excess of 600 Volts, phase to phase, while under the continuous supervision or instruction of a qualified employee. Except for replacing fuses, operating switches or other operations which do not require the person to work on such energized conductors or parts of equipment, no such employee shall be assigned to work alone.
Chapter 7 – Electrical Safety

Working on Station Equipment

1. No person shall work on any station apparatus without first obtaining proper authorization.

2. When testing, switching, hot washing or other work which may affect operations is to be done in an unattended station, the Switching Center having jurisdiction shall be notified before the work is started and after the work is completed. In the case of a supervisory controlled station, the controlling station shall be notified as well as the Switching Center having jurisdiction.

3. Before any maintenance is attempted on equipment or piping containing air or gas under pressure, all isolating valves shall be closed and pressure relieved before opening manholes or breaking pressure connections.

4. Before any maintenance is attempted on equipment containing SF6 Gas, for arc extinguishing purposes, the equipment is to be inspected for arc by-products. If these by-products are present, proper clean-up procedures are to be followed. Contact the Safety Officer for guidance.

5. Before any work which requires personal entry into tanks, etc., contact the Safety Officer to ensure that confined space entry procedures are followed.

6. The secondary of a current transformer shall not be opened while energized. If the entire circuit cannot be properly de-energized before working on an instrument, a relay, or other section of a current transformer secondary circuit, the employee shall bridge the circuit with jumpers so that the current transformer secondary will not be opened.

Energized Lines or Equipment

1. When working on or immediately adjacent to conductors or equipment energized at above 300 Volts and below 500 Volts, nominal phase to phase, employees shall work from below when practicable. All energized conductors or equipment within reach of any part of the body while working shall be covered with approved protective equipment or protected by a physical barrier.

2. Approved low voltage rubber gloves with leather keepers, or other adequate insulating devices, shall be used when working on conductors or equipment energized from 0 to 150 Volts, phase to ground.

3. Work on conductors or equipment energized at above 150 Volts, phase to ground, and below 5,000 Volts, nominal phase to phase, shall be done by the use of approved rubber gloves with leather keepers or live line tools.
4. Work on conductors or equipment energized at above 5,000 Volts, nominal phase to phase shall be done only with approved live line tools.

**Working Upon De-energized Conductors or Equipment**

1. Clearances are required on conductors or equipment normally operated at a voltage in excess of 600 Volts, phase to phase. Such clearance shall be obtained by the employee directly in charge of the work to be performed. Such employee shall be responsible for determining that the conductors or equipment are disconnected from all sources of supply.

2. After the employee in charge of the work is notified that such conductors or equipment are cleared for work, or the proper clearance obtained, that employee shall make such tests as are necessary to determine the conductors or equipment are de-energized (a Hill testers or similar test instrument shall be used).

3. Before any work is done on de-energized conductors or equipment, grounds shall be applied as set forth in the Grounding segment of this section. Where the working hazard would be increased by the application of grounds, they need not be applied if the Supervisor in charge approves this action.

**Instructing Workers Relative to Condition of Line or Equipment**

Each employee in charge shall make sure any statements made, or orders given relative to the condition or clearances of lines or equipment, are understood and acknowledged by every person concerned before work is started. If the condition or status of lines or equipment is changed, the employee in charge shall see that everyone concerned in the work is notified and acknowledges the notice thereof.

**Work That May Present Unusual Hazards**

Work that may present unusual hazards shall not be started without first consulting the Supervisor in charge, or his or her designated representative.

**Clearance on Station Equipment**

1. Work shall not be performed on station apparatus until such equipment is cleared and a clearance has been issued to the foreman in charge unless the work is to be done on energized lines or equipment.

2. Before starting work on a clearance, the foreman in charge shall check with the Operator in charge or other qualified person to ensure the all controls are non-operative, including all feedback circuits from potential transformers or other sources and
determine that the equipment is cleared. Locks and/or tags shall be installed in accordance with applicable Lockout/Blockout/Tagout procedure.

3. Before beginning work on any equipment or structure at any existing station, the employee in charge of the work shall conduct a Tailboard Conference. The conference shall include the status of the equipment, what part if any is energized, location of grounds, what the limits of the working space are, and what open switches disconnect the equipment from the source of supply. If for any reason there is an interruption in the work or conditions change, another conference shall be conducted in order that all of the employees will be familiar with the new conditions.

4. When employees are working in a structure supporting energized equipment, and disconnect switching is necessary, any employees working in the structure shall be called "down" out of the structure until the switching is completed. The status of conductors and equipment in the structure shall be rechecked before the employees are allowed to return to work in the structure.

**Minimum Working Distances**

1. Minimum working distance shall be maintained between workers and all exposed energized parts.

   1. Table 1 lists the minimum working distances from energized conductors or equipment which are not properly covered with approved protective equipment:
Table I

<table>
<thead>
<tr>
<th>VOLTAGE (Phase to Phase)</th>
<th>DISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 300</td>
<td>Not Specific</td>
</tr>
<tr>
<td>301 - 2,000 Volts</td>
<td>12 inches</td>
</tr>
<tr>
<td>2.1 - 15 KV</td>
<td>24 inches</td>
</tr>
<tr>
<td>15.1 - 35 KV</td>
<td>28 inches</td>
</tr>
<tr>
<td>35.1 - 46 KV</td>
<td>30 inches</td>
</tr>
<tr>
<td>46.1 - 72.5 KV</td>
<td>36 inches</td>
</tr>
<tr>
<td>72.6 - 121 KV</td>
<td>48 inches</td>
</tr>
<tr>
<td>230 KV</td>
<td>72 inches</td>
</tr>
<tr>
<td>500 KV</td>
<td>144 inches</td>
</tr>
</tbody>
</table>

Figure 8 - Minimum Working Distance

**Barriers and Barricade Tape**

When it is necessary to perform work near energized high voltage equipment, approved temporary barriers shall be placed between the space occupied by workers and the nearest energized equipment, as a protection and a reminder as to the limits of safe working space. Where the barriers are to be placed is the responsibility of the individual holding the clearance on the equipment out for work, and they are to be moved only under that person's direction. When the work is finished, the person holding the clearance will remove the barriers prior to releasing the clearance.

**Grounding**

1. Any exposed ungrounded part of a conductor or piece of equipment normally operated at voltage in excess of 600 Volts, phase to phase, shall not be worked on until de-energized, and not until the normally energized parts to be grounded
have been tested for indication of voltage and all conductors have been grounded against all possible sources of supply. This shall not preclude the temporary removal of grounds for test purposes.

2. Grounds shall be so placed that one of them is readily visible to at least one member of the crew.

3. Approved grounding devices shall be used. They shall be first connected to a ground before being brought in contact with any de-energized conductors or equipment; they shall be removed from the conductors or equipment first before removing the ground connection.

4. Grounds shall be applied with approved insulated devices. All employees shall stay clear of the cables and connecting devices while grounds are being applied.

5. This rule shall not preclude working on energized conductors or equipment by means of approved devices.

**Suitable Clothing and Eye Protection**

1. Hard hat.

2. A shirt or jumper with full-length sleeves rolled down shall be worn by all employees when switching in stations, working on or in station structures or as directed by the employee in charge.

3. Jewelry should not be worn where there is a danger of electrical contact or snagging on machinery, materials or other objects.

4. Protective switching hood and smock, and approved rubber gloves with protectors shall be worn by all personnel when:

   A. Engaged in performing manual switching or grounding operations in confined spaces, or where close proximity to the equipment is required for such operation;
   B. Engaged in installing or removing switches or grounding devices in metal clad switchgear, unless such equipment has been previously de-energized and externally grounded;
   C. Using high voltage detectors or phasing devices in close proximity to energized equipment, including metal clad switchgear; or
   D. Deemed advisable by the Supervisor in charge.
5. Eye protection: Minimum of safety glasses, but may require goggles and/or face shield.

6. Employees working on or testing batteries shall wear suitable eye protection devices (cover goggles and face shield) which provide side as well as frontal protection. In addition, a long-sleeved shirt, acid-resistant gloves and apron shall be worn. Plastic eye rinse bottles, filled with fresh drinking quality water, shall be available at the job site for the duration of the work. Smoking is not permitted within five feet of the battery.

**Unusual Electrical Hazards**

1. No employee shall perform work or take any conducting object closer than the minimum working distance or within the area where there exists a hazard of creating an arc or contact with energized conductors or equipment by reason of the work that is being done, unless directly under the observation of a qualified observer.

2. No material or tools of any sort shall be carried on the shoulder when working around energized equipment. Long material, including lumber, shall be carried in a horizontal position. Caution shall be exercised to prevent any material or tools from accidentally contacting energized conductors or equipment.

3. If the Supervisor in charge, or authorized representative, determines a job to be hazardous because of proximity to energized equipment and shall decide that an observer is necessary to reduce such hazard and prevent accidents, such person shall designate a qualified observer.

   A. Observers shall be thoroughly instructed and familiarized with all specific hazards before they are allowed to assume the duty of checking.

   B. Observers shall give the workers under their observation their undivided attention and allow no distraction to remove their attention from the workers.

   C. Observers shall give warning when workers are approaching energized parts or other hazards and shall repeat this warning when workers are near energized parts as often as is necessary to keep the workers constantly aware of the hazard.

   D. Where the nature and extent of the work at any one location is such that one observer cannot adequately watch the movements of all workers in hazardous areas, additional observers as necessary shall be used.
E. Workers shall first notify the observer before changing from one location to another, and shall designate the route to be taken to the new location.

**Visitors and Uninstructed Workers**

Visitors, or uninstructed workers shall be accompanied by a qualified employee in stations and around properties where life might be endangered.

**Working on Energized Disconnect Switches**

Work shall not be done on any open disconnect devices of 5 kV or over while one side is energized, except by the use of live line tools or approved barriers with the specific permission of the Supervisor in charge.

**Capacitors**

Employees shall not work on capacitors until:

A. the capacitor bank has been de-energized;

B. the bank has been allowed to discharge for five (5) minutes; and

C. all capacitor terminals have been effectively short circuited and grounded.

**Locking Stations and Enclosures**

All stations and gates to switch structures containing energized high voltage equipment shall be kept closed and locked at all times, except when a qualified employee has such station or gate under observation.

**Fire Protection Equipment**

When working in any room, switch cell, or other compartment where automatic CO₂ equipment is permanently piped for fire protection, the CO₂ equipment must be made non-automatic while employees are working in the compartments. Working in protected rooms equipped with a pre-discharge alarm is allowed provided that written procedures or instructions are implemented to assure that employees can safely exit within the alarm period before the fire system discharges. Following a CO₂ discharge in an enclosed room or compartment, no one shall enter the room or work area until it has been ventilated, and the atmosphere tested with an approved oxygen deficiency tester and found to be safe for occupancy, unless the employee is wearing either an approved self-contained breathing apparatus or an approved air line respirator.
Hot Washing of Station Insulators

A. When hot washing station insulation:

1. Water shall be tested for resistivity by use of an approved water tested at each filling of the water container.

2. Water used shall have a minimum resistance of 1000 ohms per inch cube.

   Note: As water resistance decreases with increase in temperature, it shall be checked occasionally when tank is exposed to the sun.

3. A qualified observer shall be used when hot washing is in progress or the washing rig or boom is being moved in the station yard.

B. Minimum working distance from the nozzle to the energized part being washed is shown in the following table (1000 ohm water):

C. Minimum 15/64 inch and 1/4 inch nozzle pressure when washing transmission lines shall be maintained at 400 psi but may be reduced to 300 psi when washing distribution lines (less than 50 kV). For 5/16 inch nozzle, pressure of 300 psi and 200 psi respectively shall be maintained.

Substation Safety

1. Before beginning work on de-energized lines always perform tests to assure they are de-energized and grounded.

2. De-energized conductors and equipment shall be grounded prior to beginning work unless the application of ground would increase the working hazards. Such cases should be addressed with supervision prior to beginning the work.

3. Employees must understand statements and orders given by supervision relative to the condition or clearance of lines or equipment before work is started. If the status of lines or equipment changes, supervision shall advise all involved workers.

4. If a work task appears to present unusual hazards consult your supervisor before starting and ask questions of your foreman.

5. "Think out" your work assignment before starting and ask questions of your foreman.
6. Except under unique circumstances work shall not be performed on station apparatus until such equipment has been de-energized, locked-out, tested dead, and grounded.

7. Safe working distance shall be maintained between workmen and exposed energized parts.

8. Black and yellow barricade tape shall be used to identify and bar approach to energized areas adjacent to where the work is being done. Do not enter such areas unless observed by a co-worker.

9. When it is necessary to perform work near energized high voltage equipment, temporary barriers shall be placed between the work area and energized equipment as a protection and reminder to employee.

10. Any exposed underground part of a conductor or piece of equipment normally operated at or above 600 Volts, phase to phase, shall not be worked on until de-energized and not until the normally energized parts to be grounded have been tested for indication of voltage and all conductors have been grounded against possible sources of supply. (Some testing may require the removal of grounds.)

11. It may be necessary to post a "Safety Observer" at a work area to safeguard employees. An observer shall warn workers when they are near energized parts or notice other hazards.

12. Only those employees authorized by their foreman may perform work inside a substation.

13. Station switching shall be performed in accordance with written procedures.

14. Switching orders shall be stated in detail and the person receiving the order shall repeat it to the requester word for word before proceeding. The order shall include the purpose and the proper sequence of the switching to be performed.

15. Disconnect switches, switchboard controls, relays, knife switches, and all equipment in stations which is required to be operated or worked upon must be plainly designated by name, number, or other suitable means to properly identify such equipment.

16. Access to substations shall be locked at all time except when a competent employee has the access under observation.

17. Portable extinguishers shall be available in the work area.


**Motor Generator Systems**

1. For motor or generator work, primary feeder breaker must be opened, tagged, and locked out if possible.

2. For generator-load work, motor-start permissive key must be removed by person doing work and restored when work is complete.

**Working on Power Supplies**

The minimum requirements for working on any power supply is to turn power off and properly tag feeder circuit breaker external to power supply.

**Danger with Large Magnets**

This section describes inductors and magnets that can store more than 5 joules of energy or that operate at 130 volts or more.

The following are some hazards peculiar to inductors and magnets:

- The ability of an inductor to release stored energy at a much higher voltage than that used to charge it.

- Stray magnetic fields that attract magnetic materials.

- Time varying stray fields that induce eddy currents in conductive material thereby causing heating and mechanical stress.

- Time varying magnetic fields that may induce unwanted voltages at inductor or magnet terminals.

The following are safety practices for inductive circuits:

**Automatic Discharge:** Freewheeling diodes, varistors, thyrites, or other automatic shorting devices must be used to provide a current path when excitation is interrupted.

**Connections:** Particular attention should be given to connections in the current path of inductive circuits. Poor connections may cause destructive arcing.
Cooling: Many inductors and magnets are liquid cooled. The unit should be protected by thermal interlocks on the outlet of each parallel coolant path, and a flow interlock should be included for each device.

Eddy Currents: Units with pulsed or varying fields should have a minimum of eddy-current circuits. If large eddy-current circuits are unavoidable, they should be mechanically secure and able to safely dissipate any heat produced.

Grounding: The frames and cores of magnets, transformers, and inductors should be grounded.

Rotating Electrical Machinery: Beware of the hazard due to residual voltages that exists until rotating electrical equipment comes to a full stop.

Assured Equipment Grounding Conductor Program

Scope

The purpose of this procedure is to establish a standardized program for Assured Grounding protection on all job sites; to protect employees from electrical hazards associated with 120V AC current.

Intent

As an alternate to, or in addition to, using GFCI protection on all 120V, 60 hertz, 15 and 20 amp electrical outlets which are not a part of the building’s permanent wiring we have decided to institute an Assured Equipment Grounding Conductor Program. The program shall comply with the following minimum requirements:

1. This written description of the program, including the specific procedures adopted by the company, shall be made available at all times for inspection.

2. Employees shall be instructed to visually inspect each cord set, plug and receptacle of cord sets and all equipment connected by cord and plug before each day’s use for external defects such as deformed or missing pins or insulation damage and for indication of internal damage. When there is evidence of damage, the damaged item shall be taken out of service, tagged for testing by wrapping the Quarterly Color tape around the male prongs. The item shall not be returned to service until repaired and tested. After proper repairs have been made the item shall display a ring of the correct quarterly tape attached around the cord near the male end.
3. Test Performed:
   
   a. All equipment grounding conductors shall be tested for continuity and shall be electrically continuous.

   b. Each receptacle and plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.

4. Testing Schedule - All required tests shall be performed:
   
   a. Before first use.

   b. Before equipment is returned to service following any repairs.

   c. Before equipment is used after any incident which can be reasonably suspected to have caused damage (for example, when a cord set has been run over).

   d. At regular intervals not to exceed 3 months (normally at the beginning of the quarter).

5. Test Records - Test performed as required in this paragraph shall be recorded as follows. Each receptacle, cord set, and cord-connected equipment that passed the test shall indicate on the cord by use of color tape the quarter in which it was tested in accordance with the following color scheme.
6. Color Coding Scheme for assured grounding test record:

<table>
<thead>
<tr>
<th>Month or Quarter</th>
<th>Color Coding Quarterly</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>Yellow</td>
</tr>
<tr>
<td>February</td>
<td>“ ”</td>
</tr>
<tr>
<td>March</td>
<td>“ ”</td>
</tr>
<tr>
<td>April</td>
<td>Blue</td>
</tr>
<tr>
<td>May</td>
<td>“ ”</td>
</tr>
<tr>
<td>June</td>
<td>“ ”</td>
</tr>
<tr>
<td>July</td>
<td>Green</td>
</tr>
<tr>
<td>August</td>
<td>“ ”</td>
</tr>
<tr>
<td>September</td>
<td>“ ”</td>
</tr>
<tr>
<td>October</td>
<td>Red</td>
</tr>
<tr>
<td>November</td>
<td>“ ”</td>
</tr>
<tr>
<td>December</td>
<td>“ ”</td>
</tr>
</tbody>
</table>

![Figure 9 - Assured Grounding Monthly Color Codes](image)

Be sure that the last quarter’s color tape or number is removed before new quarter’s coding is applied.

7. The employer shall not make available or permit the use by employees of any equipment which has not met the requirements of paragraph (b)(1)(iii) of OSHA requirements.

**GROUND CHECK™ EXTENSION CORD & TOOL TEST PROCEDURES**

The company has purchased a special testing device to perform this testing procedure. If you do not have a “Ground Check™” call the purchasing department and they will have one shipped to your job.
1. Attach “Ground Check™” box to wall or toolbox in convenient place near where tools are stored.

2. Visually check extension cord for damage.
   
   A. If cord is visibly damaged, wrap the male prongs with appropriate color tape and take out of service until damage is corrected.
   
   B. If cord passes visual test, go to step #3.

3. Plug male cord into Ground Check™ unit outlet, then plug female cord onto test prong or touch a metal part of the tool to the test prong. The Green light will come on if the cord is grounded correctly. Both item 2a. & 2b. (Test Performed) are to be completed in one operation.
   
   A. If cord or tool tests okay, put proper colored tape on male end of cord.
   
   B. If cord or tools do not pass test, put appropriate quarter color tape on cord’s male prongs and remove from service until repaired.
   
   C. Retest before returning any item to be used in the field.

Note: When cords or tools check bad please insert an ink pen in the “Battery Test Hole” on the right hand side of the unit to assure the unit is working properly.

Testing Procedures if Ground Check™ is unavailable

All receptacles, attachment caps and plug receptacles of cord sets shall be tested in the following manner:

1. While in service with receptacle circuit tester.

2. When not in service with a continuity tester.