/ER EQUIPMENT 1,000 VOLTS AND ABOVE: METAL CLAD LOAD INTERRUPTER SWITCHES, FUSED /R UNFUSED.

- SWITCH OPERATION, DOORS CLOSED - FR Coverall, and as required Double-Layer Switching Hood, and Hearing Protection.

- WORK ON ENERGIZED PARTS, INCLUDING VOLTAGE TESTING - Flash Suit, Flash Pants, Double-Layer Switching Hood, Hearing Protection, Rubber Gloves, FR Hard Hat Liner, and Use Insulated Tools.

- REMOVAL OF BOLTED COVERS (TO EXPOSE BARE, ENERGIZED PARTS) - Flash Suit, Flash Pants, Double-Layer Switching Hood, Hearing Protection, Rubber Gloves, and FR Hard Hat Liner.

- OPENING HINGED COVERS (TO EXPOSE BARE, ENERGIZED PARTS) - FR Coverall, Double-Layer Switching Hood, Hearing Protection, and FR Hard Hat Liner.

- OUTDOOR DISCONNECT SWITCH OPERATION (HOOKSTICK OPERATED) - FR Coverall, Double-Layer Switching Hood, Hearing Protection, Rubber Gloves, FR Hard Hat Liner, and Use Insulated Tools.

- OUTDOOR DISCONNECT SWITCH OPERATION (GANG-OPERATED, FROM GRADE) - FR Coverall, and as required Double-Layer Switching Hood, and Hearing Protection.

- INSULATED CABLE EXAMINATION, IN MANHOLE OR OTHER CONFINED SPACE - Flash Suit, Flash Pants, Double-Layer Switching Hood, Hearing Protection, Rubber Gloves, and FR Hard Hat Liner.

- INSULATED CABLE EXAMINATION, IN OPEN AREA - FR Coverall, Rubber Gloves, and as required Double-Layer Switching Hood, and Hearing Protection.

8.0 JOB TASK ELECTRICAL SAFE WORK PROCEDURES

8.1 COMPANY SAFETY POLICIES, PROCEDURES, AND ACTION PLANS

The Company's Safety & Loss Control Manual provides the safety policies, procedures, and action plans required to establish the Company project site-specific safety procedures. Site Superintendents may wish to supplement this manual with additional, more detailed procedures that are better suited to their specific site operations. However, any additional procedures must be at least as effective as the Company's Safety & Loss Control Manual.

The Company's site-specific safety procedures will address all actual and potentially hazardous phases of the Company's and the Subcontractor's site electrical work packages to eliminate or drastically reduce employees' exposures to hazardous exposures and unsafe conditions.

Based upon project information received from the Customer at the pre-bid and pre-job orientation meetings; the President and Site Superintendent should formulate a Company Pre-Construction Safety Action Plan that will address site-specific safety and loss control requirements as listed below:

- Finalize the Company's site-specific safety procedure and issue copy to Customer's Project Manager.

- Provide a copy of the Subcontractors' site-specific safety procedures to the Customer's Project Manager for review and comments prior to the start of any Subcontractors' work activities taking place on the project site.

- Deliver a copy of the Company's task-specific electrical safety procedure to the Customer's Project Manager for review and comments prior to the start of any Company work involving hazardous (classified) locations or other hazardous job tasks.

- Locate the Company's site office trailer, storage and equipment trailer, parking areas, and material storage areas to address safety, security, traffic control, and fire protection factors.

- Obtain the various governmental agency work permits and licenses prior to the start of any Company or Subcontractors' work.

- Notify the Company's insurance broker and carriers of this new construction project and meet with insurance carrier's claims handling supervisor assigned for the project.

- Establish Company agreements with local physicians, medical clinics, hospitals and ambulance companies, as required.

- Review the Customer's project design specifications and constructability review studies to determine the need to develop/ implement job-task safety procedures and address electrical hazardous work exposures.

- Schedule job tasks to minimize the number of Company and Subcontractor employees working in any one area at the same time.

- Determine employees' personal protective equipment requirements and place orders for timely delivery of safety equipment to the site.

- Arrange for timely site delivery of other safety materials, supplies, testing devices, first-aid kits, signs, posters, fire extinguishers, lockout/tagout kits, OSHA, NEC, NFPA 70E codes and standards, etc.

- Plan the Company and Subcontractor's job site operations to ensure that the Customer's project and operating facilities are not interrupted or shutdown.

8.2 PROJECT DESIGNS, SPECIFICATIONS, DRAWINGS, AND VENDOR EQUIPMENT MANUALS

The Customer's contract document or purchase order agreement terms and conditions covering safety, health, medical, security, drug testing, environmental/pollution control, OSHA compliance, insurance coverages, and indemnification clauses should be reviewed by the President and Site Superintendent to determine if there are any potential liability exposures and/or questions that should be reviewed with the Customer's Project Manager or Company's legal counsel prior to submitting a Company bid document.

Special consideration will be given by the President and Site Superintendent to the following Customer bid proposal document scope of services, whenever:

- The Company will be responsible for installing poles throughout the project sites and bring temporary overhead electric power lines onto the Customer's property from the local utility company's overhead power lines.

- There will be removal of existing transformer/other equipment contaminated with PCB's or other toxins.

- Work is to be performed:

  - On towers, tanks, overhead cranes, and other high structures.
  - Inside confined space entry work locations.
  - At hazardous (classified) locations.

- There will be Group lockout/tagout operations with other site contractors and/or operation personnel.

- Employees are required to perform live work on energized electrical components and circuit parts.

- Any work tasks that can directly or indirectly cause the existing facility operations to shutdown.

- Any work exposes employees to vehicle or heavy equipment traffic.

/ject Safety Design Studies

.e President or responsible designee should:

- Become knowledgeable of the Customer's designs, specifications, drawings, plans, vendor equipment manuals, and criteria documents that apply to the temporary and permanent electrical cables, equipment, components, and systems to be installed, upgraded, tested, serviced, and/or maintained by the Company and its Subcontractors.

- Conduct a project design review meeting with Home Office staff and, if available, the Site Superintendent, who will be assigned to the project.

- Notify the Customer, in writing, of any design problems found within the Customer's project designs, specifications, drawings, plans, vendor equipment manuals, and criteria documents. The President or designee should request a written waiver from the Customer, if the Customer mandates that the original designs, specifications and criteria still be engineered into the project. The Customer's waiver must address all situations where it seems impractical or not cost effective for the Customer to have the Company meet the industry standards or codes and/or normal construction industry methods, procedures, or work practices.

- Check Company field installation plans and vendor designs for compliance with the Customer's project design plans, drawings, contract document specifications, and criteria at each stage of the project.

- Consult with the Customer's engineering and design company project specialist to help recognize oversights or inadequate evaluations of project construction phase risks.

b. *Project Constructability Review Study*

The constructability review process allows for the optimum project application of the Customer, engineer & designer, and construction managers' knowledge and expertise to achieve overall project objectives. The President and Site Superintendent should ask at the pre-bid meeting, if the Customer has performed a constructability review study on the phase of work that the Company will be bidding on. If so, they should try to obtain a copy from the Customer prior to submitting the Company's bid document. The Customer's constructability review study should clearly identify and address construction phase safety and total loss control hazardous exposures that will require adequate planning by the Company or the Subcontractors.

8.3 CUSTOMER'S AS-BUILT DRAWINGS, SOP'S, AND MAINTENANCE DEPARTMENT SERVICE REPORTS

During the Customer's pre-job review meeting, the Site Superintendent should request that the Customer's Project Manager provide, in a timely fashion, copies of the existing Customer's facility electrical system's as-built drawings, appropriate SOP's, and equipment service records.

The Site Superintendent and Foremen should incorporate into the Company's job task electrical safe work procedures the Customer's current as-built drawings, standard operating procedures (SOP's), and maintenance department guidelines, safety work practices, and servicing procedures.

8.4 COMPLIANCE WITH APPLICABLE OSHA AND CONSENSUS STANDARDS

It should be the policy of the Company to comply with the current OSHA 1910 and 1926 electrical safety standards, National Electrical Codes, NFPA 70E- 2000 Edition guidelines, applicable state and local building codes, and manufacturers' instructions, when installing, upgrading, testing, servicing, and/or maintaining temporary and permanent electrical cables, equipment, components, and systems.

If the Customer's project specifications, government or consensus codes, or the manufacturers' instructions exceed the Company's safety standards and best practices guidelines, then the Site Superintendent should ensure that Foremen and employees comply with the most stringent safety standards, guidelines, and code requirements.

However, if the Customer's project specifications are found to be below the criteria established by the current OSHA 1910 and 1926 electrical safety standards, National Electrical Codes, NFPA 70E- 2000 Edition guidelines, applicable state and local building codes, and/or manufacturers' instructions, the Site Superintendent must notify the Customer's Project Manager. The Site Superintendent should request, in writing, that the Customer's Project Manager re-issue to the Company revised project specifications that are in compliance with the current OSHA, NEC, NFPA 70E or other consensus standards or provide written authorization directing the Company to follow the original Customer's project specifications.

Note: Under NEC 100 Definitions and NEC 90.4 Enforcement, the authority having jurisdiction for enforcing the Code is authorized to permit alternate methods, when an installation is not covered by the Code or where noncompliance is necessary, so that the electrical systems can function properly. This will only be permitted, when the authority is satisfied, that equivalent electrical safety will be achieved. According to NEC 100, special permission is the written consent of the authority having jurisdiction.

8.5 PROVIDING AN ELECTRICALLY-SAFE WORK CONDITION

The Site Superintendent and Foremen should provide employees with electrically-safe work conditions. This is defined by the NFPA 70E as a state in which the electrical conductor or circuit parts to be worked on, or near, have been:

- Disconnected from energized parts (verified by checking single line diagrams).
  Note: Current drawings are very important to make sure that alternate supplies are known.
- Locked and tagged out-of-service in accordance with the Company's site-specific LOTO procedures.
- Tested to ensure the absence of voltage.
- Grounded if determined necessary.

Only qualified employees will be assigned to perform work on energized electrical conductors or circuit parts in accordance with the Company's electrical safety work practices procedures.

8.6 TEST INSTRUMENTS AND EQUIPMENT USE

a. *Company Electrical Test Equipment*

The Site Superintendent should only purchase test instrument meter products that meet the IEC (International Electrotechnical Commission) safety standards for electrical test equipment - IEC 1010. The standards for meters for CAT I (electronic and low energy equipment), CAT II (appliances, PCs, TVs and all outlets more than 30 feet from a CAT III source), and CAT III (motor control panels, including feeders and short branch circuits, distribution panel devices, and heavy appliance outlets) are already in place. Once CAT IV standards are approved, these become the standards at the primary supply level for measuring outdoor equipment and service entrance equipment and will cover exterior transformers and meters, such as, service drops from pole to building, overhead lines to detached buildings, and underground lines to well pumps.

b. *Over-Voltage Installation Categories Table*

The IEC - 1010-1 standard defines over-voltage installation categories I through IV. The categories take into account three main criteria: nominal steady voltage, peak impulse transient voltage, and source impedance. The test values for categories I, II, and III are shown.

CAT I	600V	2500V peak impulse transient	30 Ohm source
CAT I	1000V	4000V peak impulse transient	30 Ohm source
CAT II	600V	4000V peak impulse transient	12 Ohm source
CAT II	1000V	6000V peak impulse transient	12 Ohm source
CAT III	600V	6000V peak impulse transient	2 Ohm source
CAT III	1000V	8000V peak impulse transient	2 Ohm source

Values for category IV are not addressed in IEC-1010-1, but will be included in the second edition.

st Equipment & Equipment Inspections

ne Site Superintendent and Foremen should only assign qualified employees to perform tests on or near live electrical circuits parts operating at 50 volts or more.

The qualified employees should be required to visually inspect test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors for external defects and damage before the equipment is used on any shift. When there is a defect or evidence of damage that may expose an employee to injury, the defective test equipment or damaged item should be taken out of service, tagged defected, and given to the Safety Coordinator to have repaired and re-certified by the repair company.

d. *Employee Safety Guidelines for Using Test Instruments and Equipment*

Each Foreman should conduct a safety toolbox meeting with crew members that will instruct employees on the Company safety guidelines to be followed, when performing tests on or near live electrical circuits parts operating at 50 volts or more. Employees should be trained to:

- Always wear safety glasses with sideshields.
- Wear 500 V rubber gloves with soft leather protectors.
- Never test a high energy circuit alone.
- Double check to make sure that multimeter and test leads have adequate voltage and safety category ratings for the job. If testing a 480 V service panel, the meter and test leads must have a minimum rating of CAT III 600 V.
- Inspect the multimeter and test leads for any damage prior to performing test.
- Check the multimeter set-up before you connecting it to a live circuit. (Are test leads in the correct input jacks? Did you first check for a low battery? Is the function switch in the correct position?)
- Check the multimeter's internal fuses if measuring current with a clamp or current transformer accessory. (Do this by putting the multimeter into the ohms mode and connect the red test lead from the volt/ohms jack to the current jack. An OL reading indicates an open fuse. Return multimeter to Safety Coordinator to have bad fuses replaced with the equivalent type fuses.)
- Verify the multimeter set-up by measuring a known live circuit, such as the nearest wall outlet.
- Double check to ensure task-specific lockout/tagout procedure has been completed.
- Take a measurement on a high energy circuit only after using a rubber insulated mat to stand on.
- Test Smart - If measuring the ground, make the ground connection first. If using an alligator clip, look for a bare section of wire rather than a screw head. If you are measuring voltage in a service panel, look for the branch circuit breaker with the lowest current rating and measure at the output. Do not reach blindly into areas, which can contain energized live parts that can give a fatal electrical shock.
- Don't become complacent. When you stop being alert, you lose your edge and maybe a lot more.

8.7 LOCKOUT AND TAGOUT

The Site Superintendent should establish the Company's site-specific lockout/tagout (LOTO) procedures and provide training sessions for the Foremen and employees. Each Foreman will be required to develop a task-specific lockout/tagout procedure and conduct job briefings with crew members prior to de-energizing electrical cables, equipment, component, or systems. A sample lockout/tagout procedure is provided in Exhibit 14.7 on page 141.

8.8 PREPARE JOB TASK WORK PROCEDURES

The Foreman should prepare written work procedures for each job task that is not routine, the work is complicated or particularly hazardous, or the qualified employees will be required to work on energized electrical conductor or circuit parts.

The Foreman's written job task work procedures should include the following:

- Purpose of task and number of shifts to complete the work.
- Task-specific LOTO procedure.
- If work is to be performed on live parts, explain why LOTO can't be used.
- Number of qualified employees and any special hands-on work experience needed.
- Findings from Foreman's job hazard survey.
- Approach boundary requirements and types of access controls to be used.
- Electrical safety work practices to be used by crew members.
- PPE, other rubber protective equipment, and tools.
- Applicable MSDS's.
- Electrical diagrams.
- Equipment manufacturers' instructions and manuals.
- Special conditions, work permits requirements, or hazardous (classified) locations exposures.
- Copies of applicable Company, OSHA, NEC, NFPA 70E or other safety-related codes or standards.

The Foreman should submit the written job task work procedure to the Site Superintendent and Safety Coordinator for their review and comments prior to starting any work. The Foreman should not start the work, until changes and/or additional safety precautions recommended by either the Site Superintendent or Safety Coordinator have been added to the original written job task work procedure.

Each of the items addressed in this revised written job task work procedure should be reviewed in detail at the job briefing with the qualified employees assigned to perform the work.

8.9 GENERAL INSTALLATION REQUIREMENTS

The Site Superintendent should ensure that Foremen and employees installing electrical cables, equipment, components, and systems have complied with the Customer's project specifications, cable and equipment manufacturers' recommendations, and the latest applicable NEC, and NFPA 70E code requirements.

8.10 BELOW GROUND CABLE INSTALLATIONS

a. *General*

All Company personnel involved in any excavation and/or trenching operation needs to be given safety training concerning OSHA safety standards governing excavation and trenching operations.

When the Company subs out the trenching and excavation phase of the work to a Subcontractor, the Site Superintendent should verify that the Subcontractor does not have a history of OSHA citations and fines resulting from the Subcontractor's non-compliance with OSHA's trenching and excavation standards. This can be done by going to www.osha.gov and then clicking on Statistics & Inspections, next click on Establishments Name and enter in the Subcontractor's Name, and hit Search.

The Excavation Subcontractor should be responsible for the measurements and producing as-built drawings showing routing, locations and depths of all underground electrical facilities. All such as-built drawings are to be maintained in the Subcontractor's on-site office trailer and turned over to the Company's Site Superintendent at the end of the Subcontractor's site work.

b. *Installation Guidelines*

The Site Superintendent should document that the Customer's project specifications for directly buried electrical cables have been fully complied with by employees installing underground cable. When the Customer's project specifications do not address the criteria for directly buried electrical cable, then as a minimum, the following Company guidelines should be applied:

armored or other heavy-duty electrical cables should be directly buried.
eel conduit, metal braids, or substantial armor should be used where cables may be subject to rodents.
Cables installed in ground water or freezing water conditions should be a 100% gel-filled cable eliminating possible moisture migration or humidity changes due to ingress and/or outer jacket damage.

- Cables should be buried below the frost line.
- Cables plowed into place should be designed for that type of installation.

For the Company to successfully bid on a large project involving extensive cable installation the Site Superintendent and Foremen will need to train new employees in modern cable pulling techniques. Advanced cable pulling equipment has for the most part eliminated back and hernia injuries caused by manually pulling cable, but oddly enough, can produce the same types of injuries due to the setting up of such equipment. Only by planning the work and working the plan can the Cable Pulling Foreman get the job done on time and without having crew members injured.

c. *Safety Procedures*

The Site Superintendent should only assign Foremen and employees to install electrical cables below ground, who have attended safety training sessions covering the following Company safety manual procedures:

- Excavations.
- Directional boring.
- Traffic control and work zone protection.
- Lockout/tagout.

Note: For safety guidelines covering the below ground installation of low-voltage and limited-energy, fiber optic, or telecommunication cables, please review NECA's Voice-Data-Video Safety Compliance Manual Index #5124 - see Exhibit 14.1.

d. *Job Safety Survey*

Prior to assigning employees to perform electrical cable installations below ground, the Foreman should conduct a job safety survey to identify at least the following:

- Exposures to motor vehicle traffic and work zone safety considerations.
- Exposures to above and below ground electric, gas, water, sewer, and chemical lines.
- Exposures to railroad operations.
- Transporting, off-loading, setting-up, and operating directional boring machines.
- Hazards involving trenching and excavation activities.
- Ergonomic factors concerning transporting, off-loading, storing, moving cable reels and pulling cable.
- Approach distances to exposed energized overhead power lines and parts.
- Required personal protective equipment, rubber insulating equipment, and special tools.
- Customer's lockout/tagout procedures and work permit requirements.
- Adverse weather conditions - winter storms, thunderstorms, lightning, tornadoes, high temperatures.
- Health hazard exposures caused by toxic materials, insects, harmful plants and animals, etc.
- Availability of local emergency rescue team support services.

e. *Pre-Job Safety Planning Meeting*

The Foreman should conduct and document a pre-job planning meeting with employees assigned to install electrical cables below ground to address at least the following:

- Actual or potentially hazardous exposures found by the Foreman's job safety survey.
- Review of the Company's safety procedures required to safeguard employees.
- Site-specific motor vehicle traffic and work zone protection plans
- Personal protective equipment to be issued and worn by employees.
- Implementation of the material handling plan.

- Testing trenches and excavations for oxygen deficiency, toxic and/or combustible gases.
- Safe access in and out of trenches and excavations.
- Directional boring operations safety factors, if applicable.
- Obtaining and following the Customer's lockout/tagout procedure and work permits, if required.
- Task-specific lockout/tagout procedures, if required.
- Review applicable material safety data sheets.
- Safe methods for pulling, installing, supporting, protecting, and testing cables.
- Housekeeping and removal of waste materials and empty cable reels.
- Emergency rescue action plans and notification procedures.

8.11 WORKING IN CONFINED SPACES

All work which requires employees to enter into a confined space must be done in accordance with all safety requirements listed in the Company's site-specific confined space entry procedures. Each employee must be fully knowledgeable of and fully comply with confined space safety requirements.

a. *Safety Procedures*

The Site Superintendent should only assign Foremen and employees to install electrical cables, equipment, components, or systems in confined spaces, who have attended safety training sessions covering the following Company safety manual procedures:

- Confined space entry.
- Personal protective equipment.
- Respiratory protection program.
- Traffic control and work zone protection.
- Lockout/tagout.

All confined spaces should be considered by the Site Superintendent, Foremen, Employees, and the Safety Coordinator as being permit-required confined spaces, until pre-entry procedures demonstrate otherwise.

Note: For safety guidelines covering confined space entry procedures, see purchasing information for NECA's Confined Space Entry Manual - Index #5090 - Exhibit 14.1 on page 87.

b. *Job Safety Survey*

Prior to assigning employees to perform electrical cables, equipment, components, or systems installations in a confined space, the Foreman should conduct a job safety survey to identify at least the following:

- Exposures to motor vehicle traffic and work zone safety considerations.
- Ergonomic factors concerning transporting, off-loading, storing, moving cable reels and pulling cable.
- Exposures to energized electrical, gas, chemical, and wastewater lines in utility manholes.
- The presence of contaminated soil.
- Requirements for atmospheric testing meters and sampling equipment.
- Ventilation equipment requirements.
- Respiratory protection requirements.
- Rescue retrieval systems for each confined space.
- Required personal protective equipment, rubber insulating equipment, and special tools.
- Customer's lockout/tagout procedures and work permit requirements.
- Adverse weather conditions - winter storms, thunderstorms, lightning, tornadoes, high temperatures.
- Health hazard exposures caused by toxic materials, insects, rodents, waste products and chemicals, etc.
- Availability of on-site and off-site emergency rescue team support services.
- Emergency rescue action plan, support equipment, and notification procedures.

c. *Pre-Job Safety Planning Meeting*

The Foreman should conduct and document a pre-job planning meeting with employees assigned to install electrical cables, equipment, components, or systems in a confined space to address at least the following:

- Actual or potentially hazardous exposures found by the Foreman's job safety survey.
- Review of the Company's safety procedures required to safeguard employees.
- Required personal protective equipment, respirators, atmospheric testing meters, and sampling devices.
- Motor vehicle traffic control and work zone safety plans.
- Safe methods of off-loading, storing, and positioning cable reels.
- Fall protection requirements and compliance by crew members.
- Safe means of access and egress from excavations and confined spaces.
- Customer's lockout/tagout procedures and/or work permits, if required.
- Task-specific lockout/tagout procedures, if required.
- Applicable material safety data sheets.
- Safe methods for pulling, installing, supporting, protecting, and testing cables and equipment.
- Housekeeping and removal of waste materials and empty cable reels.
- Emergency rescue action plans and notification procedures.
- Required training.

8.12 WORKING IN CEILINGS AND OVERHEAD CABLE TRAYS

a. *Installation Guidelines*

The Site Superintendent should ensure that Foremen and employees install electrical cables in ceiling spaces, vaults, overhead cable trays and similar overhead locations as required by the project specifications and applicable code requirements.

b. *Ceilings With Removal Panels*

Employees should install electrical cables in ceilings so as not to prevent the removal of ceiling panels required to access electrical equipment.

c. *Recessed Lighting Fixtures*

The Site Superintendent should ensure that lighting fixtures are installed by the Company as required by NEC 410 Luminaires.

d. *Cable Trays*

Employees should install electrical in cable trays as per code requirements in NEC 392 - Cable Trays and in accordance with the respective articles and sections.

e. *Safety Procedures*

The Site Superintendent should only assign Foremen and employees to install electrical cables in ceiling spaces, vaults, overhead cable trays and similar overhead locations, who have attended safety training sessions covering the following Company safety manual procedures:

- Personal protective equipment.
- Tools - power and hand.
- Fall protection.
- Ladders.
- Scaffolds.
- Lockout/tagout.

f. *Job Safety Survey*

Prior to assigning employees to perform electrical cable installations in ceiling spaces, vaults, or overhead cable trays, the Foreman should conduct a job safety survey to identify at least the following:

- Asbestos materials applied to pipes, spray on structural steel beams, firestops materials, etc.
- Health hazard exposures caused by insects, molds, bacteria, fungi, high temperatures, dust, rodents, etc.
- Fall hazards involving working off of fixed and portable ladders, stepladders, and scaffolding.
- Electrical, mechanical, pneumatic, thermal, chemical, fluids, gases, and other energy sources.
- Ergonomic factors concerning material handling, installing cable trays, cable pulling, installing innerducts or cable barriers, lighting, tagging cables, testing cables, etc.
- Other Customer or Contractor work activities that will directly impact employees.
- Customer's lockout/tagout work permit and hot work permit requirements.
- Customer's emergency rescue team support services.

g. *Pre-Job Safety Planning Meeting*

The Foreman should conduct and document a pre-job planning meeting with employees assigned to work in ceiling spaces, vaults, or overhead cable trays to address at least the following:

- Actual or potentially hazardous exposures found by the Foreman's job safety survey.
- Review of the Company's safety procedures required to safeguard employees.
- Personal protective equipment to be issued and worn by employees.
- Review of the material handling plan.
- Fall protection requirements and compliance by crew members.
- Safe means of access and egress from ceilings and cable trays.
- Customer's work permits and task-specific lockout/tagout procedures, if required.
- Applicable material safety data sheets.
- Safe methods for installing new cable trays, modifying existing overhead cable trays, or installing innerducts or barriers into existing cable trays.
- Safe methods for pulling, installing, supporting, protecting, and testing cables.
- Housekeeping and removal of waste materials and empty cable reels.
- Emergency notification procedures.

8.13 INSTALLATIONS THROUGH FIRE PENETRATIONS

a. *Customer Bid Packages and Contract Documents*

The President and Site Superintendent should review the Customer's request for quotation and/or proposal document, project specifications, and contract document or purchase order agreements for all electrical work to be bid on to determine the local building code requirements, number, locations, and types of firestops to be newly installed or penetrations made through the existing firestops.

The Customer's project specifications will, on most projects, clearly state firestops code requirements and the type of firestops to be installed by the Company. When this is not the case, the President and Site Superintendent should, prior to submitting the Company's bid proposal document, notify the Customer, architect, or design firm, in writing, that the firestops code requirements and installation methods have not been provided in the project's specifications.

If the Customer, architect, or design firm do not revise the project specifications to address firestops code requirements, than the Company's policy is to bid the work with a bid qualification statement added as an addendum to the Company's bid proposal document stating that the Customer waives installation of firestops by the Company and that the Customer will provide firestops. The Company/Customer contract document or purchase order agreement must also state that the Customer waives installation of firestops by the Company and that the Customer will provide firestops.

It is also the Company's policy that, whenever the local building codes do not meet the national codes for firestops, the Company will install new firestops or repair existing firestops to comply with the current version of the national codes. The Company's bid proposal document and contract document should clearly state, as an addendum, that Company will perform the electrical work in compliance with the national firestops codes. If the local building codes exceed the requirements of the national firestops codes then the Company will comply with the local building firestops code requirements.

b. *Firestops Codes*

Firestops code are included in most model building codes and local ordinances, such as, the Uniform Building Code (UBC), the National Building Code (NBC), or the Standard Building Code (SBC). The National Fire Protection Association (NFPA) Life Safety Code and the National Electrical Code (NEC) require firestops. The following NEC Sections require that electrical cables must be installed so that they do not increase the spread of fire or smoke as stated in Section 300.21 Spread of Fire or Products of Combustion:

- Section 640.3 (A) - Audio Signal Processing, Amplification, and Reproduction Equipment.
- Section 725.3 (B) - Class 1, Class 2, and Class 3 Remote Control, Signaling & Powered-Limited Circuits.
- Section 760.3 (A) - Fire Alarm Systems.
- Section 770.3 (A) - Optical Fiber Cables and Raceways.
- Section 800.52(B) - Communications Systems.
- Section 820.3 (A) - CATV.
- Section 830.3 (A)- Network-Powered Broadband Communications Systems.
- Section 830.58(B) - Network-Powered Broadband Communications Systems.

NEC 300.21 Spread of Fire or Products of Combustion: Electrical installations in hollow spaces, vertical shafts, and ventilation or air-handling ducts should be made so that the possible spread of fire or products of combustion will not be substantially increased. Openings around electrical penetrations through fire-resistant-rated walls, partitions, floors, or ceiling should be firestopped using the approved methods to maintain the fire resistance rating. Firestops also have to meet the test standards of the American Society of Testing Materials (ASTM) and Underwriters Laboratories.

c. *Types of Firestops*

- Firestopping types include:
- Three intumescent types of firestops:

    * The first swells or expands when exposed to sufficient heat.
    * The second forms a hard char, when they burn that insulates and protects the material behind it.
    * The third releases moisture and is self-cooling.

- Mechanical firestops expand and consist of metal frames containing elastomeric (resembling rubber) modules fitted around the cables or conduits, applying compression to the assembly.
- Putty, caulks, foams, or compounds referred to as "cementitious" (pourable, trowelable, pumpable) that set up firmly and must be broken, if reentry is necessary.
- Intumescent sheets used with the caulk or putty.
- Intumescent wrap strips used for firestopping plastic pipe, cable, cable bundles, and conduit.
- Prefabricated pillows enabling frequent cable changes.
- Cable coatings applied at intervals to restrict the fire to areas between the fire breaks.
- Pipe chokes that seal penetrations.
- Blankets to protect cables present in existing or new plenums that are not plenum-rated.

d. *Firestops Documentation*

The Site Superintendent should document all electrical work involving firestops to show the applicable national or local building code requirements, number, locations, and types of firestops that were newly installed or penetrations made to existing firestops.

The Site Superintendent should request that the Customer's Project Manager perform a joint inspection with the Site Superintendent of the Company's work locations, where firestops were installed or resealed.

During this joint inspection, the Site Superintendent should take photos of each of the Company's firestops installations or resealing job tasks. Each photo must be identified on the back with an indelible pen to state the Company's name, Customer's name, project name, date, building location, and names of the Site Superintendent and Customer Project Representative.

8.14 AERIAL CABLE INSTALLATION

a. *Safety Procedures*

The Site Superintendent should only assign Foremen and employees to install aerial electrical cables, who have attended safety training sessions covering the following Company safety manual procedures:

- Aerial lifts.
- Traffic control and work zone protection.
- Lockout/tagout.
- Motor vehicle and mobile equipment.

b. *Job Safety Survey*

Prior to assigning employees to perform aerial electrical cable installations, the Foreman should conduct a job safety survey to identify at least the following:

- Exposures to motor vehicle traffic and work zone safety considerations.
- Ergonomic factors concerning transporting, off-loading, storing, installing, supporting, climbing poles.
- Off-loading, storing, and installing poles near energized power lines or equipment.
- Verification of the condition of existing wooden poles by testing.
- Need to guy, brace, or otherwise support poles or structures before installing or removing cable.
- Fall hazards involving working off of poles or structures.
- Accessability to poles or structures using bucket trucks, aerial work platforms, or derrick trucks.
- Ergonomic factors concerning transporting, off-loading, storing, moving cable reels and pulling cable.
- Approach distances to exposed energized overhead power lines and parts.
- Required personal protective equipment, rubber insulating equipment, and special tools.
- Exposure to electromagnetic radiation from microwave communication systems.
- Tree trimming operations and minimum working distances from energized conductors.
- Customer's lockout/tagout procedures and work permit requirements.
- Adverse weather conditions - winter storms, thunderstorms, lightning, tornadoes, heat wave, etc.
- Health hazard exposures caused by insects, harmful plants and animals, etc.
- Availability of local emergency rescue team support services.

c. *Pre-Job Safety Planning Meeting*

The Foreman should conduct and document a pre-job planning meeting with employees assigned to install aerial electrical cable to address at least the following:

- Actual or potentially hazardous exposures found by the Foreman's job safety survey.
- Review of the Company's safety procedures required to safeguard employees.
- Required personal protective equipment and rubber insulating equipment.
- Motor vehicle traffic control and work zone safety plans.
- Review of the material handling plan.
- Fall protection requirements and compliance by crew members.
- Safe means of access and egress from poles or structures.
- Customer's lockout/tagout procedures and/or work permits, if required.
- Applicable material safety data sheets.
- Safe methods of off-loading, storing, installing, and supporting poles and structures.

...fe methods for pulling, installing, supporting, protecting, testing aerial electrical cables.
Tree trimming, pruning, removing; or clearing operations.
- Housekeeping and removal of waste materials and empty cable reels.
- Emergency action plans to include pole top and bucket rescues and notification procedures.

8.15 CONSTRUCTION SITE TEMPORARY ELECTRIC POWER AND LIGHTING INSTALLATIONS

The Site Superintendent should ensure that Foremen and employees install, maintain, and service the temporary electric power and lighting installations as required in the Customer's contract document or purchase order agreement scope of work and in accordance with the NEC 527 Temporary Installations code requirements.

At the Customer's daily progress review meetings with site contractors, contractor representatives should be requested to provide timely request for their need to have the Company install additional temporary electric power or lighting and/or make repairs to existing temporary power or lighting systems.

Unless approved in advance by the Company's President, the Site Superintendent should not provide any Company support services to either the Customer or site contractors that have not been required in the Company's contractor document or purchase order agreement under the Company's scope of work.

a. Temporary Electric Power for Construction Site Locations

1. Overhead Power Lines

i. Handling Suspension Strand

The Foreman should insure that when handling cable suspension strand, which is being installed on poles carrying exposed energized power conductors, employees should wear insulating gloves and should avoid body contact with the strand, until after it has been tensioned, dead-ended and permanently grounded.

The strand should be restrained against upward movement during installation:

- On joint-use poles, where there is an upward change in grade at the pole.
- On non-joint-use poles, where the line crosses under energized power conductors.

ii. Need for Testing Wood Poles

Unless temporary guys or braces are attached, the following poles should be tested and determined to be safe before employees are permitted to climb them:

- Dead-end poles, except properly braced or guyed "Y" or "T" cable junction poles.
- Straight line poles, which are not storm-guyed and where adjacent span lengths exceed 165 feet.
- Poles at which there is a downward change in grade and which are not guyed or braced corner poles or cable junction poles.
- Poles, which support only telephone drop wire.
- Poles, which carry less than ten communication line wires. On joint use poles, one power line wire should be considered as two communication wires.

iii. Methods for Testing Wood Poles

One of the following methods or an equivalent method should be used for testing wood poles:

- Rap the pole sharply with a hammer weighing about 3 pounds, starting near the ground line and continuing upwards circumferentially around the pole to a height of approximately 6 feet. The hammer will produce a clear sound and rebound sharply when striking sound wood. Decay pockets will be indicated by a dull sound and/or a less pronounced hammer rebound. When decay pockets are indicated, the pole should be considered unsafe. Also, prod the pole as near the ground line as possible using a

pole prod or a screwdriver with a blade at least 5 inches long. If substantial decay is encountered, the pole should be considered unsafe.

- Apply a horizontal force to the pole and attempt to rock it back and forth in a direction perpendicular to the line. Caution should be exercised to avoid causing power wires to swing together. The force may be applied either by pushing with a pike pole or pulling with a rope. If the pole cracks during the test, it should be considered unsafe.

iv. Unsafe Poles or Structures

Poles or structures determined to be unsafe by test or observation may not be climbed, until made safe by guying, bracing or other adequate means. Poles determined to be unsafe to climb should, until they are made safe, be tagged by the Foreman in a conspicuous place to alert and warn all employees of the unsafe condition.

v. Test Requirement for Cable Suspension Strand

Before attaching a splicing platform to a cable suspension strand, the strand should be tested and determined to have strength sufficient to support the weight of the platform and the employee.

The following method or an equivalent method should be used for testing the strength of the strand: A rope, at least three-eighths inch in diameter, should be thrown over the strand. On joint lines, the rope should be passed over the strand using tree pruner handles or a wire raising tool. If two employees are present, both should grip the double rope and slowly transfer their entire weight to the rope and attempt to raise themselves off the ground. If only one employee is present, one end of the rope, which has been passed over the strand, should be tied to the bumper of the truck, or other equally secure anchorage. The employee then should grasp the other end of the rope and attempt to raise himself off the ground.

vi. Inspection of Strand

Where strand passes over electric power wires or railroad tracks, it should be inspected from an elevated working position at each pole supporting the span in question. The strand may not be used to support any splicing platform, scaffold or cable car, if any of the following conditions exist:

- Corrosion, so that no galvanizing can be detected.
- One or more wires of the strand are broken.
- Worn spots.
- Burn marks, such as, those caused by contact with electric power wires.

vi. Outside Work Platforms

Unless adequate railings are provided, safety straps and body belts should be used while, working on elevated work platforms, such as, aerial splicing platforms, pole platforms, ladder platforms and terminal balconies.

vii. Other Elevated Locations

Safety straps and body belts should be worn by employees, when working at elevated positions on poles, towers, or similar structures, which do not have adequately guarded work areas.

viii. Installing and Removing Wire and Cable

Before installing or removing wire or cable, the pole or structure should be guyed, braced, or otherwise supported, as necessary, to prevent failure of the pole or structure.

.voiding Contact With Energized Power Conductors or Equipment

When cranes, derricks, or other mechanized equipment are used for setting, moving, or removing poles, all necessary precautions should be taken to avoid contact with energized power conductors or equipment.

x. Handling Poles Near Energized Power Conductors

- Joint use poles may not be set, moved, or removed, where the nominal voltage of open electrical power conductors exceeds 34.5kV phase to phase (20kV to ground).
- Poles that are to be placed, moved or removed during heavy rains, sleet or wet snow in joint lines carrying more than 8.7kV phase to phase voltage (5kV to ground) should be guarded or otherwise prevented from direct contact with overhead energized power conductors.
- In joint lines, where the power voltage is greater than 750 volts, but less than 34.5kV phase to phase (20 kV to ground), wet poles being placed, moved or removed should be insulated with either a rubber insulating blanket, a fiberglass box guide, or equivalent protective equipment.
- In joint lines, where the power voltage is greater than 8.7 kV phase to phase (5kV to ground), but less than 34.5kV phase to phase (20 kV to ground), dry poles being placed, moved, or removed should be insulated with either a rubber insulating blanket, a fiberglass box guide, or equivalent protective equipment.
- Where wet or dry poles are being removed, insulation of the pole is not required if the pole is cut off 2 feet or more below the lowest power wire and also cut off near the ground line.
- Insulating gloves should be worn when handling the pole with either hands or tools, when there exists a possibility that the pole may contact a power conductor. Where the voltage to ground of the power conductor exceeds 15kV to ground, Class II gloves (as defined in ANSI J6.6) should be used. For voltages not exceeding 15kV to ground, insulating gloves should have a breakdown voltage of at least 17kV.
- The guard or insulating material used to protect the pole should meet the appropriate 3-minute proof test voltage requirements contained in the ANSI J6.4.

xi. Vehicle-Mounted Equipment

When there exists a possibility of contact between the pole or the vehicle-mounted equipment used to handle the pole, and an energized power conductor, the following precautions should be observed:

- When on the vehicle, which carries the derrick, avoid all contact with the ground, with persons standing on the ground, and with all grounded objects, such as, guys, tree limbs, or metal sign posts. To the extent feasible, remain on the vehicle as long as the possibility of contact exists.
- When it is necessary to leave the vehicle, step onto an insulating blanket and break all contact with the vehicle before stepping off the blanket and onto the ground. As a last resort, if a blanket is not available, the employee may jump cleanly from the vehicle.
- When it is necessary to enter the vehicle, first step onto an insulating blanket and break all contact with the ground, grounded objects and other persons before touching the truck or derrick.

xii. Working Position on Poles

Climbing and working are prohibited above the level of the lowest electric power conductor on the pole (exclusive of vertical runs and street light wiring), except:

- Where communications facilities are attached above the electric power conductors, and a rigid fixed barrier is installed between the electric power facility and the communications facility.

- Where the electric power conductors are cabled secondary service drops carrying less than 300 volts to ground and are attached 40 inches or more below the communications conductors or cables.

xiii. Metal Tapes and Ropes

Metal measuring tapes, metal measuring ropes, or tapes containing conductive strands may not be used, when working near exposed energized parts. Where it is necessary to measure clearances from energized parts, only nonconductive devices should be used.

2. Temporary Electric Power Substations

Energized transformers and other related electrically energized equipment over 150 volts to ground should be protected so as to prevent accidental contact with any person. Protection should be provided by individual integrated housing or by an enclosure, such as an electrical substation fence, which accommodates a group of such equipment. Metallic enclosures should be grounded.

Access to energized transformers should be secured by lock or otherwise secured requiring the use of a special tool to open them. Signs indicating danger and prohibiting unauthorized access should be conspicuously displayed on the housing or other enclosure around the equipment. Transformers mounted on utility poles at a height of more than 12 feet from the ground are exempt from these requirements.

b. Inspections

In order to preserve the integrity of the temporary power systems throughout the construction site, the following inspections must be carried out by Company Foremen:

1. Construction Illumination (Daily)

During construction, poor lighting conditions usually develop due to the following causes:

- Burnt-out light bulbs not being replaced promptly.
- Light fixtures and/or their protective light bulb cages have been damages.
- Light fixtures being blocked by overhead staging.

These conditions must be corrected immediately to provide safe working conditions as well as to increase production. Upon receiving a request from the Customer or other site contractors of the need to service damaged temporary power or lighting fixtures, the responsible Foreman should assign a crew member to correct the problem within a reasonable time period and during the normal day shift.

2. Voltage and Amperage Readings (Bi-monthly)

The Site Superintendent should assign a Foreman the responsibility of ensuring that bi-monthly voltage and amperage readings are taken and documented on feeder(s) from both the main substation to stationary distribution centers and from a stationary distribution center(s) to mobile load center(s). The qualified employee performing this task should record these results and submit to the Foreman for retention.

Note: If persistent voltage fluctuations occur or if the potential over loading of the cable(s) is indicated, a recording volt-ampmeter should be installed to monitor intermittent voltage surges or fluctuations and to assist in determining the necessity for the installation of another feeder or the removal of load from a subject load center.

3. Connections (Bi-monthly)

The Site Superintendent should assign a Foreman the responsibility of ensuring that bi-monthly visual and physical inspections are performed and documented on the following:

- Transformers.
- Disconnects.
  * Safety switches.
  * Circuit breakers.
- Splices.
- Grounds.

The qualified employee performing this task should record and submit these results and to the Foreman for retention.

c. Ground Fault Circuit Interrupter Protection for Personnel

Normally, electricity flows into a tool or appliance through a hot wire and returns to ground through a neutral wire. A potential ground fault exists, when insulation on wires within the tool becomes frayed or wet, permitting current to leak out and energize the housing or cabinet. When a worker touches the tool, some current is diverted from the normal hot line-to-ground path and courses through the body to the earth.

Depending on a number of factors, including the worker's age and health, the victim of a ground fault accident may be killed, hurt, or may just feel a tingle. If, for example, the worker's wearing rubber-soled shoes and standing on a wooden pallet, chances are the shock will be slight. If one is standing on a wet concrete floor, or touching a metal water pipe, the shock could be fatal.

Much depends upon the path the current takes through the heart or brain, death, or at least permanent damage, is likely. If the current passes into and out of fingers on the same hand, the worker will be burned, but live.

It doesn't take much current or much time for a fatality to occur. At about 10/1000 of an ampere (10 milliamperes) the victim is frozen to the power source, once that happens, the current can produce a lethal dose. If the current is passing through the victim's heart (from a power source in the person's left hand to a ground at his or her right hand or feet) breathing may be arrested at 18 milliamperes.

At 60 milliamperes ventricular fibrillation may set in (the heart stops pumping rhythmically) and without immediate medical attention, death is likely unless cardio-pulmonary resuscitation is immediately started. A 60 milliampere current takes about a second to produce fibrillation. A current above 300 milliamperes could affect the heart in 1/3 second.

1. Vital Safety Margin

Fuses or circuit breakers won't protect a worker against a ground fault. Their principal function is to guard against fire; if a circuit is overloaded with appliances demanding more amperes than the fuse is rated to deliver, or if a low-resistance fault develops in the circuit and current drains off, the fuse blows or circuit breakers open before wires can overheat. A 20-ampere fuse, then won't blow until the power drain exceeds 20 amperes - hundreds of times more than a lethal dose.

Three-wire grounded systems, now required by the National Electrical Code, are vital to safety, but no guarantee against ground fault accidents. In order to be effective, the third wire must be firmly bonded to all exposed metal housing, raceways, frames, fittings, and the like. Its job is to provide a low-resistance path to ground, when any fault current develops. Under ideal conditions, the grounding wire would allow enough current to flow to overload the circuit and blow the fuse or open the breaker.

If a ground fault develops in a tool with 3-wire protection, the user would feel some shock, but, because the ground wire would take most of the energy, the dose shouldn't be lethal. As long as everything is working properly. But, time, human error, deliberate bypass, rust, or corrosion could defeat the effectiveness of the 3-wire system and create a death trap. In short, regardless of the other safety devices employed, ground fault circuit interrupters represent a life-saving safety backup.

2. How They Work

Most commonly, the heart of the GFCI is a ring-shaped sensor that surrounds both the hot wire and the neutral wire. The sensor continually monitors the amount of current passing through the hot wire and the amount returning via the neutral wire. If less current is returning than went out (a situation normally indicating a ground fault) the sensor trips a switch, opens the circuit and cuts off power.

Most general-purpose GFCIs can sense a fault current of between 4 to 6 milliamperes and react in about 25/1000 of a second - faster than a heartbeat and well within the safety margin. The user will feel a shock (threshold of perception is about 0.5 milliampere), but the amount of current should not be enough to harm a healthy adult.

Underwriters' Laboratories lists GFCIs as a Class A and Class B. Class B models have limited use. These are designed to trip with a ground fault of 20 milliamperes and were developed to protect underwater swimming pool lights. Class A GFCIs trip at a ground fault between 4 to 6 milliamperes. These are the general purpose models used most generally in industry and homes.

GFCIs include a built-in testing system. Push the "test" button and the device simulates a ground fault condition. If it's working properly, power is cut off. Manufacturers recommend monthly testing.

3. Things to Watch For

GFCIs should be installed, wherever electricity is used near water or whenever a worker, who uses electrical equipment must be grounded, for example, if the employee's work tasks are inside a metal tank, on a metal scaffold, deck, or platform.

GFI manufacturers tell users to keep these points in mind, when buying permanently installed models:

Don't use single-pole GFCIs on multiwire circuits. They won't work. The sensor in the GFI detects differences in current flow between the load and neutral wires. In a multiwire circuit, the GFI will function normally as long as there is a load in one circuit only. If a load is added to the second circuit, there is no longer a balanced current flowing through the sensor and the device will trip, when the imbalance exceeds 5 milliamperes.

Watch for GFCIs installed on circuits longer than 250 feet. This is not an absolute limit, but remember that as the length of a circuit increases, the "standing leakage" of the circuit grows. Normally, a 250-foot circuit will have a standing leakage of about 1 milliampere, more for an underground circuit. Because the GFI will trip a current difference of between 4 to 6 milliamps, extending a circuit much beyond 250 feet could cause nuisance trips.

Watch for neutral wire grounded at a junction or outlet box. The GFCI will sense a grounded neutral and trip if this error is made. In an incorrectly wired circuit, where the neutral is grounded at a point other than the supply ground, some of the return current will be diverted from the normal path. The GFCI will sense a ground fault and open the circuit. Use only the "test" button to test a Class A GFCI between 4 to 6 milliamp current, while not fatal, is still a jolt.

d. Assured Grounding Program

This program defines the minimum requirements to assure the installation and maintenance of equipment grounding conductors in accordance with the applicable requirements of OSHA standard 1926.400.

1. Purpose

The purpose of this program is to ensure the proper installation, maintenance, inspection and testing of equipment grounding conductors on construction sites to minimize injuries due to electrical ground faults.

2. Application

This procedure has direct application at all field locations. Competent persons as designated in 1926.32 (f) will be designated to implement this program at the start of the project.

3. Installation

All 120 volt, single phase, 15 and 20 ampere receptacles should be of a grounding type, and their grounding contacts should be grounded by connection to the equipment grounding conductor of the circuit supplying the receptacles in accordance with the applicable requirements of the National Electrical Code.

All 120 volt flexible cord sets (extension cords) should have an equipment grounding conductor, which should be connected to the grounding contact of the connector(s) on each end of the cord.

The exposed non-current-carrying metal parts of 120 volt cord and plug-connected tools and equipment that are likely to become energized should be grounded in accordance with the applicable requirements of the National Electrical Code.

4. Visual Inspection

The employees should be instructed that each cord set, and any equipment connected by cord and plug, except cord sets and receptacles which are fixed and not exposed to damage, should be visually inspected by the user before each day's use for external defects, such as, deformed or missing pins or insulation damage, and for indication of possible internal damage. Equipment found damaged or defective may not be used, until repaired.

5. Testing

All 120 volt, single phase, 15 and 20 ampere receptacles, 120 volt flexible cord sets, and 120 volt equipment connected by cord and plug, which are not a part of the permanent wiring of the building or structures should be tested to assure that electrical continuity is maintained through all required equipment grounding conductors and their connectors. These tests should be conducted as follows:

- All equipment grounding conductors should be tested for continuity and should be electrically continuous.
- Receptacles of cord sets should be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor should be connected to its proper terminal.
- A test log will be maintained on all equipment tested.

6. Testing Intervals

All required tests should be performed.

- Before the first use.
- Before equipment is returned to service following any repairs.
- Before equipment is used after any incident, which can be reasonably suspected to have caused damage (for example, when a cord set is run over).
- At intervals not to exceed 3 months, except that cord sets and receptacles, which are fixed and not exposed to damage should be tested at intervals not exceeding 6 months.

Note: Do not make available or permit the use by employees any equipment, which has not passed the required tests.

7. Testing Equipment

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

- While in service with a receptacle circuit tester.
- When not in service with a continuity tester.

All equipment connected by cord and plug should be tested for ground wire continuity with a volt-ohm meter or a continuity tester.

8. Test Verification

Tests should be documented by means of color coding. The following color coding system is suggested to verify that testing is current and that all receptacles, portable cords and tools have been inspected and tested as required:

Jan - White	April - Green	July - Red	Oct - Orange
Feb - White + Yellow	May - Green + Yellow	Aug - Red + Yellow	Nov - Orange + Yellow
Mar - White + Blue	June - Green + Blue	Sept - Red + Blue	Dec - Orange + Blue

All receptacles, cords and tools should be marked with the tape used to designate the period for which the inspections and tests were conducted. The tape will be placed on the receptacle cover of any electrical installed as a permanent fixture in a temporary electrical system. The tape will be placed within 4" of the male end of any electrical cord set, or electrical tool cord.

e. Company-Owned Portable Electric Tools and Equipment

Period inspections are essential to ensure that Company-owned electric power tools operate efficiently and safely. Through inspections will uncover operating defects, which can be corrected, and will thus prevent breakdown and costly repair charges and help to ensure safe operation.

Each Foreman should ensure that electric power tools and equipment under his or her control are inspected and a maintenance record of each tool is completed after each inspection. All defective tools must be tagged and withdrawn from service until repaired. Factors governing the inspection period (daily, weekly, bi-weekly) will be: condition of tools being turned in, availability of additional tools to replace defective tools, repairs done on site or sent out to tool manufacturers' service departments.

Foremen should instruct and train their crew members on how to inspect tools and to recognize defects. However, employees should be instructed not to make any repairs to the defective electric power tools or equipment unless authorized by the Foreman.

The Site Superintendent should not enter into any agreement with the Customer and/or site contractors to perform inspections and testing of non-company owned portable electric tools or equipment unless authorized by the Company's President.

8.16 HAZARDOUS MATERIALS

a. Solvent Hazards

Employees using solvents to clean various types of electrical equipment must be fully knowledgeable of all hazards involving the use of each type of solvent. Company personnel purchasing solvents should request the Vendor to send with their product a material safety data sheet (MSDS). Prior to using any solvent, the Foreman will be responsible for instructing crew members on how to safely handle, transport, use, store, and dispose solvents.

b. General Physiological Effects

Physiological effects from solvent exposures come principally from skin contact and inhalation of the vapors. Ingestion with resultant absorption into the digestive tract is not normally an exposure hazard in construction. If the solvent is present in such amounts that skin contact becomes a hazard, there will always be an inhalation hazard.

Inhalation of excessive amounts of solvent vapors may produce various physiological effects. In some instances, it may result in impairments, such as lack of coordination, drowsiness, and similar symptoms that may lead to increased accident proneness. Other effects may include damage of the blood, lungs, liver, kidney, gastrointestinal system, and other critical organs or tissues.

c. Degree of Severity of Solvent Hazards

The solvent hazard is determined not only by the toxicity of the solvent itself, but by the conditions of its use. The severity of the hazard in the use of solvents depends on the following factors:

- How the solvent is used.
- Type of job operation, which determines how the workers are exposed.
- Work pattern.
- Duration of exposure.
- Operating temperature.
- Exposed liquid surface.
- Ventilation efficiency.
- Evaporation rate of solvent.
- Pattern of air flow.
- Concentration of vapor in work room air.
- Housekeeping.

d. Ventilation

When using cleaning solvents, which may be flammable and toxic, and their hazard cannot be controlled by isolation or enclosure, a good procedure is to set up local exhausts or general ventilation facilities to control the toxicity hazard rather than the flammability hazard. Ventilation that keeps the concentration of solvent vapor below the threshold limit value will also keep the concentration below the lower flammable limit. Cleaning operations lasting no more than one hour can create serious hazards, if done in small, confined rooms without adequate local exhaust removal or general ventilation.

e. PCB's (Polychlorinated Biphenyls)

- Transformers and other electrical gear which contain PCB's must be handled in such a manner that employees are not exposed to the PCB's.

- Damage to equipment with PCB's or suspected spills/contamination must be reported to the Site Superintendent and Safety Coordinator immediately.

- Electrical equipment containing PCB's must be disposed of according to Environmental Protection Agency regulations. Whenever possible the Customer should be responsible for disposal of PCB-contaminated facility equipment.

8.17 SPECIAL EQUIPMENT

a. Microwave Transmission

1. Eye Protection

Foremen should insure that employees do not look into an open waveguide, which is connected to an energized source of microwave radiation.

2. Hazardous Area

Accessible areas associated with microwave communication systems, where the electromagnetic radiation level exceeds the radiation protection guide given in 1910.97 should be posted with warning signs. The lower half of the warning symbol should include the following:

- Radiation in this area may exceed hazard limitations and special precautions are required.
- Obtain specific instruction before entering.

3. Protective Measures

When an employee works in an area where the electromagnetic radiation exceeds the radiation protection guide, the Foreman should institute measures that insure that the employee's exposure is not greater than that permitted by the radiation guide. Such measures should include, but not be limited to those of an administrative or engineering nature or those involving personal protective equipment.

b. Battery Rooms and Battery Charging

1. General Requirements - see NEC 480

- Batteries of the non-seal type should be located in enclosures with outside vents or in well-ventilated rooms, so arranged as to prevent the escape of fumes, gases, or electrolyte spray into other areas.
- Ventilation should be provided to ensure diffusion of the gases from the battery to prevent the accumulation of an explosive mixture.
- Racks and trays should be substantial and treated to be resistant to the electrolyte. Racks and trays should be grounded.
- Floors should be of acid-resisted construction or be protected from acid accumulations.
- Face shields, aprons, and rubber gloves should be provided for workers handling acids or batteries.
- Facilities for quick drenching of the eyes and body should be provided within 25 feet of the work area for emergency use.
- Facilities should be provided for flushing and neutralizing spilled electrolyte, for fire protection, and for adequate ventilation for dispersal of fumes from gassing batteries.

2. Charging

- Battery charging installations should be located in areas designated for that purpose.
- Charging apparatus should be protected from damage.
- When charging batteries, the vent caps should be kept in place to avoid electrolyte spray. Care should be taken to assure that vent caps are functioning.
- The Safety Coordinator should formulate safe operating procedures for battery charging and train employees accordingly.

8.18 CHECK-OUT AND START-UP PROCEDURES

a. Introduction

Check-out and start-up is a complex process that is potentially one of the most hazardous in the construction of a new facility or modifying an existing one. It requires adequate planning and training and involves a wide variety of people with expertise in many different disciplines. OSHA process safety management standard places greater emphasis in this area and should also be reviewed prior to any check-out and start-up work taking place. Key to hazard elimination is safety planning and training for Company, Subcontractor, or Vendor employees directly and indirectly involved with the Customer's check-out and start-up group operations.

b. Potential Hazards

- Failure to educate Company, Subcontractor, or Vendor employees with respect to their roles in supporting the Customer's check-out and start-up group.
- Company, Subcontractor, or Vendor employees are exposed to a wide range of confined space work environments under the direct control of operating facility personnel.
- Failure of those responsible for facility lockout/tagout process to recognize all potential problems and resulting Company, Subcontractor, or Vendor employees exposures, when one system is energized, while connecting system is being worked on.
- Exposures of Company, Subcontractor, or Vendor employees to toxic liquids and gasses, when leaks develop.
- Fire hazards worsening, because preventive/protective systems may not be completely operational and tested.
- Lack of emergency planning that includes Company, Subcontractor, or Vendor employees for situations requiring quick reaction time (e.g., power failure, toxic gas release, spills run-away reactions, etc.).
- Fall hazards, because construction workers are lured into false sense of security now that construction is complete.
- Failure of the Customer's check-out and start-up group to recognize that small problems can accumulate into large problems directly involving Company, Subcontractor, or Vendor employees working near the operating facility unit.
- Failure to properly study start-up conditions with respect to controllability, in order to avoid unstable process conditions, excessive temperatures, pressures, and flows.
- Lack of appropriate planning for facility shutdown, which can be equally hazardous to the Company, Subcontractor, or Vendor employees, as the Customer's facility start-up.

c. Interface With Customer's Start-Up Manager

The Site Superintendent should not assign any Company, Subcontractor, or Vendor employees to work with the Customer's check-out and start-up group, until he or she has been assured by the Customer's Start-Up Manager that each of the following safeguards have been addressed by the Customer's operating facility personnel:

- Identify all hazardous and toxic exposures that can occur and educate all Company, Subcontractor, or Vendor employees involved prior to their being assigned any work tasks involving check-out or start-up operations.
- Maximize the availability of permanent facility fire prevention and protection systems.
- Thoroughly study start-up conditions for controllability, unstable process conditions, excess temperatures, and pressures or flows.
- Review facility and public utility requirements for start-up conditions.
- Recheck fail-safe functions immediately before start-up.
- Recognize that operations outside of specified limits may occur and provide for rapid analysis of any situation that might develop.

- Make sure that all start-up team members, including Company, Subcontractor, or Vendor employees assigned to start-up task, are aware of the potential consequences of the accumulation of small problems.
- Encourage safe work practices and discourage individual risk-taking.
- Develop a master checklist and adhere to it.
- Educate Company, Subcontractor, or Vendor employees with respect to the potential hazards.
- Develop a detailed standard operating procedures for both equipment start-up and shutdown operations.
- Test the construction and operating facility emergency response action plans prior to any check-out and start-up operations.

d. Check-out

Check-out can be defined as the testing of system components for continuity and ability to withstand operating conditions before the Customer activates the system. The check-out phase involves the following activities:

- Making electrical circuit continuity checks (meggaring) and checking electrical grounds (high potential checking).
- Giving motors a rotational check (rotating/bumping).
- Verifying that the facility instruments are correctly installed (interlocked checking).
- Bench testing pump motors under load for short periods of time to check bearings (run/burn-in).
- Identification and inspection of facility equipment, piping and other systems prior to testing and cleaning.
- Reworking or otherwise providing improvements, as necessary, to correct substandard or flawed facility system components.
- Pressure testing with water or gas (hydrotesting or pneumatic testing).
- Checking the operability of control valves and validating their control room indicators (stroking).
- Removing mill scale and other impurities from piping systems by the use of chemicals (chemical cleaning).
- Blowing debris from lines by the use of steam under pressure (steam blowing).
- Checking for proper operation of lubricating oil systems (circulating testing).
- Performing all remaining modifications, adjustments, calibration, resets, and dryouts as necessary.
- Conducting the necessary safety walkthroughs (inspections).
- Commissioning involves testing of the facility's systems with test mediums.