



# Health Safety & Environmental Program Manual

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| <b>Title</b>  |
| GMB Power Line Service<br><b>Health Safety &amp; Environmental Program Manual</b> |

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|---------------------------|--------------------------------------|---------------|
| <b>Content Authority</b>  | _____<br>Signature of Safety Manager | _____<br>Date |
| <b>Approval Authority</b> | _____<br>Signature of CEO/President  | _____<br>Date |

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## **2. Safety Manual**

### **2.1. Purpose**

This manual has been prepared to provide employees a manual that contains instructions, safety rules, best practices, and regulations necessary to perform our work safely and productively.

### **2.2. Safety**

Our aim is quality work and safe work. We believe that the two go together and that no job is so urgent that an employee cannot take the necessary time to perform it safely.

### **2.3. Effectiveness**

This manual outlines the required expectations, rules, regulations, work methods, and procedures. Additional rules and regulations may be in effect for a particular customer. Where customer rules conflict in any way with the information in this manual, the rule providing the safest approach for the job being performed shall apply. If at any time any part of this manual is found to conflict with governmental laws or regulations, then that part in conflict and only that part is hereby declared null, and void provided the governmental laws, rules, or regulations provide a higher margin of safety for the job being performed than existing Company rules.

### **2.4. Occupational Safety & Health Requirements**

GMB Powerline Service must ensure that all employees comply with all aspects of the Occupational Safety and Health Act and associated rules and regulations and therefore employees may be subject to corrective actions for violations. As stated in the Occupational Safety and Health Act, "Each employee shall comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to the Act which are applicable to his own actions and conduct." Employee misconduct which violates or threatens to violate occupational safety and health rules is not tolerated by GMB Powerline Service.

### **2.5. Conditions Not Covered in this Manual**

If an employee encounters a condition not covered in this manual, or if he/she does not completely understand the work to be done, he/she shall stop what he/she is doing and get instructions from their supervisor before proceeding.

### **2.6. Qualification for Performing Work**

Any foreman, supervisor, or employee in charge who suspects one of his employees is either mentally or physically unfit for the work assigned, shall not allow the employee to work until satisfactory medical or other evidence indicating his fitness is secured.

## 2.7. Safety Goal

GMB Powerline Services goal is ZERO accidents and incidents and for each employee to safely return home at the end of each day.

## 2.8. Safety Vision

GMB Powerline Service will be the contractor of choice by our customers, the employer of choice by our employees, and recognized as a leader of health and safety excellence.

## 2.9. Safety Mission Statement

GMB Powerline Service is committed to protecting the health and safety of our employees, customers, and the communities in which we operate. We strive to create and foster a World Class safety culture and for continuous improvement in our services through our environmental, health and safety management systems.

## 2.10. Guiding Principles for Safety

1. Safety is our most important value.
2. Working safely is a condition of employment.
3. Management leads the way by providing a safe work environment, creating a safety culture of zero tolerance, and fostering continuous safety improvement.
4. Each employee is responsible for their own safety, the safety of other employees, and the safety of the public.
5. Any employee that observes an unsafe act or condition is responsible to take the necessary action to stop the act and/or eliminate the condition.
6. All employees will receive the training necessary to safely perform their work.
7. New ideas for safety improvement are encouraged and welcomed.
8. Customer requirements and feedback will be incorporated in the safety plans for working on their property.

## 2.11. Definitions

**APPROVED:** Refers to the methods, tools, or equipment approved by Company through committee, departmental action, or in an established Safety Rule.

**AUTHORIZED PERSON:** One who has the authority to perform specific duties under certain conditions or who is carrying out orders from responsible authority.

**BARRICADE:** A physical obstruction such as tapes, screens, or cones intended to warn and limit access to a hazardous area.

**COMPANY:** GMB Powerline Service

**DE-ENERGIZED:** means being disconnected from all sources of electrical supply by open switches, disconnectors, jumpers, taps, or other means. NOTE: De-energized conductors or

equipment could be electrically charged or energized through various means, such as inductions from energized circuits, portable generators, lightning, etc.

**DEAD:** When the word “dead” is used in connection with wires or equipment that are a part of the electrical system, it shall be taken to mean disconnected from any electrical source of supply and properly tagged, shorted, and grounded.

**ENERGIZED:** (Syn: Hot, Alive or Live): means being electrically connected to a source of potential difference, or electrical charge so as to have a potential that is significantly different from that of earth in the immediate vicinity.

**GROUNDING:** means the method of connecting an electrical conductor or a conductive object to earth potential so as to provide an alternate path through which electricity can travel.

**GUARDED:** Covered, fenced, enclosed, or otherwise protected by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to limit the likelihood, under normal conditions, of dangerous approach or accidental contact by persons or objects.

**HOT, ALIVE or LIVE:** see ENERGIZED.

**INSULATED:** means being separated from other conducting surfaces by a dielectric medium (including air space) offering a high resistance to the passage of current.

**ISOLATED:** means not readily accessible to persons unless special means for access are used.  
**MINIMUM CLEARANCE DISTANCE:** Safe working distances from overhead/underground electrical conductors as defined in the Tables section of this manual.

**RUBBER GOODS:** means blankets, line hoses, insulator hoods, rubber gloves, rubber sleeves, climber guards, overshoes, and any other rubber or rubber like material made for the protection of electrical workers.

**SHORT:** means an electrical conductor in contact with another electrical conductor at a different potential or a ground.

### 3. Safety Rules & Corrective Actions

GMB Powerline Services goal is to perform safe, quality work every day. No job is so urgent that an employee cannot take the necessary time to perform it safely. It is the responsibility of the foreman or employee in charge to see that employees under their supervision follow all GMB safety rules and correct any violations observed. It is the responsibility of each employee to perform their work safely!

GMB Powerline Service electric safety rules are designed to protect employees! Violation of these rules could result in death or serious injury and will result in corrective action as outlined below. This list is not intended to be exclusive, and employees remain subject to termination at any time with or without cause or advance notice.

Specific guidelines and work procedures are available upon request. Additional rules and regulations may be in effect for a particular customer. Where these conflict in any way with the information in this manual, the rule providing the safest approach for the job being performed at the time shall apply.

#### 3.1. Mandatory Rules

Mandatory rules are in place to prevent serious electrical incidents. Compliance with these rules are mandatory and carry severe penalties for violating at GMB Powerline Service.

##### 1. **KNOW YOUR VOLTAGE, PLAN YOUR WORK**

Before performing work on energized lines:

- Distinguish the exposed live parts from other parts of electrical equipment.
- Determine the nominal voltage of exposed live parts.
- Determine the minimum approach distances corresponding to the voltages to be worked.
- Determine the personal and line protective equipment needed as well as insulated tools to be used for working on exposed or energized parts.

##### 2. **WEAR RUBBER GLOVES AND SLEEVES**

Approved Rubber Gloves Will Be Worn When:

- Ground to ground when working on any structures with energized conductors or equipment.
- Lock to Lock (From time UG equipment is unlocked until it is relocked) in underground work.
- When handling conductors even if the line is flagged, tagged, and grounded including storm work.
- Within 6 feet of any energized conductors or equipment.
- When involved in such tasks as installing or removing guys, pulling wire, and setting poles when any part of the work is in close proximity to energized conductors.

There are no exceptions to this rule without a written variance from a General Foreman or Supervisor.

Violations of the rubber glove rule result in immediate termination on the first offense.

Approved Rubber Sleeves Will Be Worn When:

- Employees are within reaching distance, located above, or moving past equipment energized over 600 volts.
- Employees climb above any secondary conductor or the common neutral (This same rule applies to work performed from buckets).
- The common neutral is on the same level or above the primary.

**3. COVER UP**

- Approved protective cover (line hoses, blankets, hoods) will be applied to all energized and grounded hardware/conductors, except the part to be worked on, that are within extended reach of the body or that could become accidentally energized during the work.

**4. FLAG, TAG AND GROUND**

- All de-energized lines will be properly tested, flagged, tagged, and grounded before beginning work unless working as energized with approved personal protective equipment.

**5. SECURE JUMPERS**

- Jumper ends will not be located inside buckets when the other end is attached to or near energized
- equipment, neutrals, or grounds.
- Lineman will remain in control of jumper ends at all times.
- Jumpers shall be handled properly at all times.
- Lineman shall use echo protocol when installing or removing jumpers.

**3.2. General Safety Rules**

1. The following actions are not acceptable on any GMB job sites:

- Careless Work.
- Poor Work Habits.
- Lack of Attention.
- Not Performing a Pre-Job Briefing.
- Not Using Echo Protocol for Required Procedures including Raising or Lowering Outriggers and Grounding Mobile Equipment.

2. Personal Protective Equipment is required on all GMB job sites:

- Hard hats and safety glasses will be worn at all times on the job unless traveling in a motor vehicle.
- Ear Protection is required when a normal conversation cannot be understood from two feet away.
- Leather work gloves should be worn when handling materials with sharp or jagged edges and are encouraged to be worn during all work procedures.
- Foot Protection
  - Employee will wear a work boot that offers protection to the feet and ankles.
- Clothing

- FR shirt, vest, or coat will be worn as outer garment along with FR pants on the job.
  - A traffic vest will be worn when working on or near any roadway.
  - Fall Protection
    - Harness and lanyard will be used while operating aerial lifts.
    - 100% fall protection or restriction is required when climbing.
3. Excavations
- **Any excavation 5 feet or deeper or excavations deemed unsafe by a competent person must have protective systems in place prior to entry.**
  - All materials must be at least 2 feet from edge of any occupied excavation.
  - A ladder is required within 25 feet of each employee in an excavation over 4 feet deep.
  - Before excavating in any area where any buried facilities are suspected, an effort will be made to determine if any underground lines or other equipment exist in the area.
  - Whenever excavating is done in close proximity to buried facilities, it will be done only by hand-digging tools.
4. Confined Space
- Tests will be conducted for oxygen deficiency or the presence of any other hazardous atmospheric condition prior to and during the work.
5. Vehicle Operation
- Wheel chocks will be used at all times when vehicle is parked or prior to operation of derrick or boom.
  - Outriggers will be properly extended at all times a derrick, crane, or aerial boom is in operation.
  - All equipment will be properly grounded when working on or near energized lines or equipment.
  - A spotter will be used if available when backing. If no spotter is available, the driver must get out and view the area around the vehicle before backing.
  - Equipment will be stored, secured, and maintained to prevent accidents, damage, or loss of property.
  - Equipment will not be operated in a negligent or reckless manner and always operated in accordance with DOT regulations.
  - Seat belts will be used on all equipment that is equipped with them.
  - Do not text or email while driving a company vehicle and / or on company business (driver shall be familiar with and follow cell phone use laws for each state in which he or she is driving).
  - The use of hand-held mobile devices are not allowed while driving a commercial vehicle.
6. Work Area Protection
- “Men Working” and other D.O.T. required warning signs and cones will be placed at each end of a job site.

### 3.3. Basic Work Rules

In addition to our safety regulations, there are a few basic common rules of conduct that employees are expected to follow. They are not meant to cover everything, but they establish GMB's position.

#### **Attendance and Promptness**

Regular attendance and promptness in reporting to work is very important to the success of our business. Employees are expected to be at their job location at work and on time every day they are scheduled to work. All absences shall be arranged with your Supervisor in advance, where possible. When an emergency or sudden illness arises which will cause you to be late or keep you from work, you are still required to contact your supervisor. This contact should be made before you are scheduled to report and must be made EACH day you are absent. Absence without notification is considered a very serious matter.

#### **CODE OF CONDUCT**

##### **Behavior**

We expect our employees to treat everyone they meet through their jobs with courtesy and respect. Any other behavior disrupts the workplace and dampens the morale. GMB has invested a great deal of money in the property and equipment that our employees use to perform their job. It is a drain on GMB's bottom line when company property is misused or damaged.

Because of these and other reasons, the following actions reflect behavior that cannot be permitted on the job if we are to work together as a team and may be cause for immediate termination.

- Willful destruction or unauthorized use of GMB's, a fellow employee's or the customer's property
- Serious, preventable damage to GMB or customer equipment, tools or property.
- Threatening or inappropriate language
- Harassment
- Fighting
- Using intoxicants on the job or coming to work under the influence of alcohol or drugs is considered grounds for immediate termination.

##### **Courtesy**

Many of our jobs bring us in contact with customers, and each employee is a representative of GMB. Therefore, it is very important that each employee present the type of image GMB has outline in its policies and within the Code of Conduct. This means personal neatness, being attired in a proper manner and observing the highest standards of courtesy, not only with the public, but with each other.

##### **Trustworthiness & Honesty**

Trustworthiness and honesty are expected at GMB. The following actions as well as any actions of this type cannot be permitted on the job if we are to work together as a team and may be cause for immediate termination.

- Falsification of records or hours worked
- Stealing

- Sleeping on the job

### **Teamwork**

Teamwork is the key to success, that success requires coaching. Leadership is your coach, and their instructions need to be followed. We must all do our assigned work and work together as a team if our efforts are to be successful. The following actions as well as any actions of this type cannot be permitted on the job if we are to work together as a team .

### **Possession of Firearms**

Possession of firearms is prohibited while on the job, on company or customer property, in company vehicles or on company equipment.

## **3.4. Corrective Actions**

For any company to have an effective safety program, rules are necessary, along with corrective actions.

- All GMB employees in charge will promote and enforce the safety rules.
- Due to various working conditions, it may be necessary to incorporate additional rules on certain jobs. The rules as listed are in effect at all times, except that while performing overhead transmission bare hand work the rules may be adjusted as necessary, with the knowledge of the safety department. and or the corporation under whose responsibility the work is being performed.
- Any employee discharged as a result of safety infractions may reapply for employment after one year and may be rehired with approval of an officer of GMB.
- Any employee found in violation of GMBs Safety Rules by any federal, state, or other governmental authority is subject to the corrective actions set forth in this manual.
- The HSE Manager has the responsibility and the authority necessary to enforce the rules and regulations in this manual. The HSE Manual may delegate the authority necessary to enforce the rules and regulations to other employees under his supervision.
- Special conditions may exist on a particular job where a departure from the regular work rules would serve a worthwhile purpose and would not reduce the safety margin.
- Permission may be granted to depart from the rules as set forth in this manual only in the following way:
  - An Area Supervisor and the Safety Manager may, after careful consideration and job study, jointly decide that a departure from the rules would be in order. Any departure from the rules must be in writing and must be signed by both the Safety Manager and the Area Supervisor with responsibility over the particular area of GMB where the job is being performed.



## 4. Responsibility for Safety

### 4.1. General

GMB has a responsibility to provide a workplace free of recognized hazards and employees have the responsibility to work safely and follow applicable rules, work methods, policies, and procedures. Specific responsibilities are outlined below.

### 4.2. Employee Responsibility for Safety

- An employee should NEVER perform any task for which they are not appropriately trained.
- Every employee is responsible for their own safety and the safety of others.
- Proper PPE, cover up and work zone setup will be used as require.
- Each employee must make sure that they have a good understanding of the site conditions and the tools, methods, and procedures to be used before beginning work.
- If at any time during the work an employee is unsure of site conditions or the tools, methods, or procedures to be used, the employee shall stop work or perform other work they can perform safely until the employee can obtain the appropriate information.
- Take proper care of all tools, equipment, and materials.
- Tools and equipment will be inspected before use.
- Materials and / or equipment being installed will be verified for correct size, voltage, rating, capacity, etc. for the application for which it will be used before being installed or put into service.
- Only qualified employees shall work on or near energized lines or equipment.
- Do not bypass or disable safety devices on any tools or equipment.
- Employees shall adhere to applicable rules, regulations, and work methods.

### 4.3. Foreman or Employee in Charge

The Foreman or person in Charge is responsible for leading his crew. Effective leaders do two things; they build trust and achieve results. Trust is built through character, competence, and connection. Results are achieved through clarity, accountability, and support. Specific actions leaders must take are as follows:

- Ensure employees are adequately trained and evaluated prior to allowing them to perform a task.
- Provide on-the-job training to employees.
- Ensure that pre job briefings are conducted as required.
- When two or more employees are on the job together, one will be designated as the employee in charge and noted on the pre job briefing.
- Should the employee in charge have to leave the work location:
  - Another employee will be designated as the employee in charge.
  - A new pre-job briefing will be conducted.
- Where one employee is at work alone, that employee is responsible for his safety.
- Set a good example and see that all employees know and follow all safety rules.

- Make certain that all your crew have the necessary information and work skills to perform the work safely.
- Correct any employee in violation of company rules, work methods, or policies.
- Determine qualified employees capable of working around energized lines or equipment.
- Be a qualified employee and competent person applicable to the work being performed.
- Orient visitors to the jobsite and ensure unqualified visitors remain a safe distance away from energized work.
- Maintain of copy of this manual.

**Table 1 Qualities of Leadership**

| Leaders Lead by:   |  |   |
|--|--|---|
| Outcome  | Area   | Action Items  |
|  | Character  | Sets the example for desired attitude, behavior, and work methods.  |
| Build Trust  | Competence   | Be a qualified and competent person for the work being performed. Related to safety: <ul style="list-style-type: none"> <li>• A competent person is one who can identify existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.</li> <li>• A qualified person must have a recognized degree, certificate, etc., or extensive experience and ability to solve the subject problems, at the worksite</li> </ul> |
|  |  | Connection  |
|  | Achieve Results  | Clarity   |
| Utilize the pause button when changes in the work plan are merited by changing conditions. |  |   |
| Make sure each crew member understands their specific task.                                |  |   |
| Utilize echo protocol to ensure communication results in mutual understanding.             |  |   |
| Accountability   |  | Provide immediate positive feedback for desired behaviors.  |
|  |  | Timely coach and correct any undesired behaviors.   |
|  |  | Escalate consequences for repeated behaviors (positive and negative).   |
| Support  |  | Ensure each employee is adequately trained for the work they perform.   |
|  | Provide continuous on-the-job training to each crew member.  |   |
|  | Verify the crew has the knowledge, equipment, materials, and tools to perform their work and that equipment, materials, and tools are in safe working order. |   |

#### 4.4. Work Planning

##### **Requirement**

Employees shall plan and execute safe work. At a minimum, work planning shall be documented through a pre-job briefing. Work plans shall be adjusted for changing conditions.

##### **Pre Job-Briefings**

- A Pre Job-Briefing is a documented conversation about job safety, scope, and specific plans to identify and control hazards specific to the job.
  - The person in charge must make certain a pre job briefing is held before beginning work and as needed by changing conditions.
  - At a minimum, a pre job briefing should cover:
    - Hazards associated with the job.
    - Work procedures involved.
    - Special precautions.
    - Energy source controls.
    - Personal protective equipment requirements.
  - Guidelines for an effective pre job briefing:
    - Every employee should participate in the hazard identification process.
    - Every employee should understand:
      1. The task to be performed.
      2. Hazards associated with each task.
      3. Protective measures that will be taken to mitigate each hazard.
    - Each employee should sign the pre job briefing.
    - The pre job briefing should be reviewed with each jobsite visitor and they should be given a chance to sign.
    - All members of the crew are required to give full attention and participate in the Job Briefing.
    - Employees will respond to the person conducting the briefing using Echo Protocol to confirm their understanding of the hazards, individual responsibilities, and steps necessary for safe and effective job task execution.
    - Any member of the crew may request to be re-briefed if at any time they become unsure of their job task.
  - An emergency plan should be in place before beginning work.
    - Where required by customers, in situations with little or no cellular service, and/or working in remote “off road” locations the pre job briefing should be supplemented with an Emergency Action Plan.
    - Emergency action plan requirements:
      - An Emergency Action Plan must be completed prior to beginning work on any job as required by customers or in situations where the GMB pre-job form will not provide adequate information. The foreman or employee in charge is responsible for making this determination. He should ask himself, “If an emergency arises, can we contact emergency personnel, and will they be able to find our work location and provide timely assistance?” If the answer to this question is no, an emergency action plan is required. In addition, an

Emergency Action Plan should be developed prior to beginning work for any customer requiring such a plan.

- A good Emergency Action Plan will require the form be filled out completely. It is important that this information be written down so each employee can find it quickly in an emergency. Information that must be included is location of jobsite including address, and landmarks to help identify the work location, written directions to nearest medical facility, details of how the crew will ensure emergency personnel can find the jobsite, a plan to take the injured to emergency personnel if the site is not accessible by ambulance, a means of communication if cellular service is not available (nearest landline, radio, etc.), and any other pertinent information. A laminated map including driving directions to the nearest medical facility is recommended. Remember when using any driving directions or a map, it is a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. It is highly recommended that 4 someone from the crew drive the route indicated on the map to ensure there are no road closures or detours.
- Each employee on the jobsite should sign the emergency action plan and it should be stored along with the pre-job briefing for that day. This ensures the plan will be changed if conditions or work locations change during the day and that each employee knows exactly where to look for the plan should an emergency arise.

### **Job Hazard Analysis**


- Job Hazard Analysis (JHA)s are required for certain jobs based on customer and GMB requirements and recommended for all work.
- A JHA is a tool used to break jobs down into steps, identify the hazards associated with each step, and determine appropriate controls for each hazard.
- JHA are useful tools to:
  - Preplan jobs.
  - Review existing jobs
  - Identify training and re-training needs.
  - Consideration of procedures to be used.
  - Identify hazardous conditions before an incident/accident occurs.
  - Provide a safe work environment. o Increase quality and productivity.
- To complete a JHA:
  - Identify each step in a job.
  - Identify the hazards associated with each step.
  - Determine the controls needs for each hazard identified.
- When completing a JHA:
  - Evaluate all aspects of the job task, even if performed infrequently.
  - Observe more than one employee doing a specific job task.

- Take enough time observing the job.
- Observe a worker, doing the job, not just describing the job.
- Ask these questions:
  - What can go wrong?
  - What are the consequences?
  - How can it happen?
  - What are the contributing factors?
  - How likely is it to happen?
  - How can I eliminate the hazard?

Figure 1 Pre Job-Brief Form

Figure 2 Emergency Action Plan


## Emergency Action Plan





---

| CONTACT               | NAME | PHONES (Land Line)  | Mobile (Cellular) |
|-----------------------|------|---------------------|-------------------|
| Plant Manager         |      | Work:<br>Home:      |                   |
| EHS Manager           |      | Work:<br>Home:      |                   |
| Operations Manager    |      | Work:<br>Home:      |                   |
| Maintenance Manager   |      | Work:<br>Home:      |                   |
| Control Room Operator |      | Main:<br>Emergency: |                   |

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**FIRE EMERGENCY**  911 or

**MEDICAL EMERGENCY**  911 or

**ENVIRONMENT RESPONSE** 

- NYSDEC – 24hrs
- EPA Region 2 – 24hrs

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Revision 00

#### 4.5. Echo Protocol

##### Requirement

- Echo protocol is a communication tool in which all affected parties must verbally state and repeat what they have heard and understood. It is used to ensure:
  - Each employee involved in a task understands their role in the task and the next step that will ensue.
  - One employee has spoken, and the other has responded by repeating what he heard
- Echo protocol should be used anytime more than one employee is involved in a task and is required for the following procedures:
  - Raising or lowering outriggers.
  - Installing or removing mechanical jumpers.
  - Grounding mobile equipment.

Table 2 Echo Protocol Examples

| Echo Protocol  |   |  |
|--|---|--|
| Task   |   |  |
| Lowering Outriggers-4 man crew                           | 2 Linemen Installing Mechanical Jumpers                         | Grounding Mobile Equipment                                       |
| Example  |   |  |
| Employee at Equipment Controls –“Outriggers coming down” | Lineman 1 – “Mac on A phase coming hot to you.”                 | Lineman in bucket – “Installing truck ground on common neutral.” |
| Employee 1 – “I understand. I am in the clear.”          | Lineman 2 – “I understand, A mac phase coming hot to me.”       | Observer – “I understand. I am in the clear.”                    |
| Employee 2 – “I understand. I am in the clear.”          | Qualified Observer – “I understand, mac on A phase coming hot.” |  |
| Employee 3 – “I understand. I am in the clear.”          |   |  |

#### 4.6. Non-English-Speaking Employees

##### Requirement

- At least one bilingual employee able to communicate with the crew will be on the jobsite at all times while work is being performed.

## 5. Personal Protective Equipment

### Lineman's Safety Equipment



## 5.1. General

Safety is the most important aspect of every job at GMB. Working safely requires knowledge of how to do the work and how employees should protect themselves. One means of keeping safe is utilization of Personal Protective Equipment (PPE). It is essential to safety each employee knows when and how to utilize PPE as well as how it should be handled, stored, and inspected. Remember that every job at GMB will require some form of PPE and that it must be protected so it can provide protection.

- GMB is responsible for:
  - Performing a "hazard assessment" of the workplace to identify and control physical and health hazards.
  - Identifying and providing appropriate PPE for employees.
  - Training employees in the use and care of the PPE.
  - Maintaining PPE, including replacing worn or damaged PPE.
  - Periodically reviewing, updating, and evaluating the effectiveness of the PPE program.
- In general, employees should:
  - Proper use of PPE,
  - Attend training sessions on PPE,
  - Care for, clean and maintain PPE, and
  - Inform a supervisor of the need to repair or replace PPE.
  - PPE will be provided at no cost to employees.
  - If an employee elects to provide their own PPE, it must be approved by the Safety Department prior to being used.
- Employees will be trained on the following for any type of PPE they are required to utilize:
  - When PPE is necessary.
  - What PPE is necessary.
  - How to properly put on, take off adjust, and wear PPE.
  - Limitations of PPE.
  - Proper care, maintenance, useful life, and disposal of PPE.

## 5.2. Head Protection

- Hard hats:
  - Must be company approved and worn at all times on the job site unless traveling in a motor vehicle.
  - Must have a hard outer shell and a shock absorbing lining that incorporates a headband and straps suspending the shell away from the head.
  - Must be inspected daily for damage such as cracks, perforations, deformities, and indications of exposure to extreme heat or chemicals.
  - Can only be decorated as approved (CPR, safety years sticker, Allergic to Bees, etc.).



### 5.3. Eye Protection

- Must be ANSI- Z87.1 approved and worn at all times on the job site unless traveling in a motor vehicle.
- Employees with corrective lenses must either wear eye protection that incorporates the prescription into the design or wear additional eye protection over their prescription lenses.



### 5.4. Hand Protection

Employees should wear leather work gloves when handling materials or doing general work tasks to reduce cuts, scrapes, skin contact with chemicals and treatments on poles, as well as other soft tissue related injuries.

- Leather work gloves:
  - Should be worn when handling objects with sharp or jagged edges
  - Should be worn when handling ropes to avoid burns.
  - Should be worn when working with hand tools to avoid splinters, contact with fiberglass, and blisters.
  - Should be worn when handling wire ropes to avoid cuts, punctures and abrasions.
  - Should be worn when working on tools or equipment.
  - Should be worn during all work procedures.
    - Note some of our customers require that work gloves shall be worn at all times.
    - Inspect work gloves each day before beginning work.
    - Replace if there are holes or the glove is worn thin.



#### **Rubber Gloves**

- Must be covered with leather protectors
- Must be worn under the following conditions:
  - Within 4ft. when working on any structures with energized conductors or equipment.
  - Lock to Lock (From time UG equipment is unlocked until it is relocked) in underground work.
  - When handling conductors even if the line is flagged, tagged, and grounded including storm work.
  - Within 6 feet of any energized conductors or equipment.

- When involved in such tasks as installing or removing guys, pulling wire, and setting poles when any part of the work is in close proximity to energized conductors.
- Where approved rubber gloves can be used with live line tools, they shall be used and considered as the primary employee protection.
- Store in approved bags at all times when not in use.
- Only turn inside out for testing.
- Gloves must be stored and shipped right side out. Turning them inside out for extended periods creates cracking and damages the gloves. Gloves shipped to test lab inside out are not tested.
- Must be visually inspected and air tested prior to each use.
- Must be Dielectric tested every 6 months.



Figure 4 Air Testing Rubber Gloves

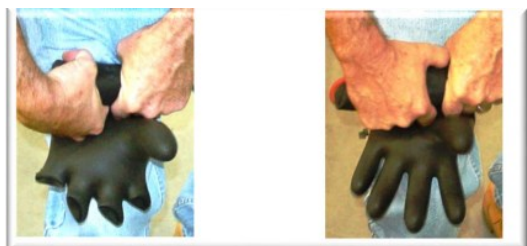





Table 3 Classes of Rubber Gloves & Sleeves

| Rubber Glove & Sleeve Classes & Use |                           |
|-------------------------------------|---------------------------|
| Class Designation of Glove & Sleeve | Maximum use AC Voltage, V |
| 0                                   | 1000                      |
| 1                                   | 7500                      |
| 2                                   | 17000                     |
| 3                                   | 26500                     |
| 4                                   | 36000                     |

Figure 5 Testing of Rubber Gloves

| How Your Rubber Gloves are Tested   |   |  |
|---|---|--|
| <p>You visually and air test your rubber gloves before each use for ensuring they will provide protection. In addition, gloves are sent in for testing every 6 months. What happens during that test? Understanding how rubber gloves are tested should provide additional assurance about the protection they provide.</p> <p>First, new gloves are tested before they leave the manufacturer and are shipped to GMB. GMB has a third-party testing on gloves at least once every 6 months. Every employee essentially has at least 2 pair of gloves – the gloves in use and a pair in testing or shipping process. Gloves are tested as follows:</p> <ul style="list-style-type: none"> <li>● Gloves are washed in a 40-minute soap wash at 120° followed by 3 cold water rinses in 13 minutes (coating beads are added the last 15 minutes of the wash).</li> <li>● Gloves are dried for 10 minutes and then sorted by class.</li> <li>● A visual inspection is conducted as the gloves are air tested.</li> <li>● Gloves are dielectrically tested. This involves dipping the glove in water while exposing it to voltage based on class of glove for 1 ½ minutes after which the machine counts down 1 ½ for each glove.</li> <li>● Gloves are dried for 10 minutes, sorted by class, and stamped with test date.</li> </ul> |   |  |
|  <p>Visual and Air Test</p>  |  <p>Drying</p> |  <p>Dielectric Testing</p> |

## 5.5. Shoulder & Arm Protection

- Rubber sleeves:
  - Must be worn in conjunction with rubber gloves with cuff inside gloves.
  - Visually check before each use.
  - Rubber sleeve straps must be worn over shoulders.
  - 2 straps are required – one in front and one in back.
  - Worn when:
    - Employees are within reaching distance, located above, or moving past equipment energized over 600 volts.
    - Employees climb above any secondary conductor or the common neutral (This same rule applies to work performed from buckets).
    - The common neutral is on the same level or above the primary.
  - Must be Dielectric Tested every 12 months.
  - Must be stored in bag when not in use.

Figure 6 Rubber Gloves & Sleeves



Figure 7 Rubber Sleeve Straps



## 5.6. Clothing

- GMB FR shirt, vest, or coat must be worn as outer garment on the job.
  - GMB FR shirt is considered a uniform and must be worn at all times after it is issued.
  - In addition to arc and flame protection, FR clothing provides protection from the sun and insect bites.
- Approved FR pants must be worn.
- Clothing and underclothing made of acetate, nylon, polyester, and rayon is not permitted to be worn.
- These materials will not provide protection in the event
  - they are exposed to an arc or flame. They will melt and
  - burn causing the burn injuries to be more severe.
- When working in view of the public a traffic vest must be worn.
- A traffic vest will be worn when working on or near any roadway.
- A traffic vests must be worn any time employees are involved in any type of
  - traffic flagging operations or where the hazard of being struck by oncoming
  - traffic may exist.
- Must be an appropriate traffic vest that meets all regulations (may vary state to state).
- Inspect traffic vest before use and do not modify traffic vests in any way.



Figure 8 FR Shirt

## 5.7. Jewelry

- Loose jewelry shall never be worn when working around machinery.
- Jewelry should be removed when working around energized lines or equipment and must be secured underneath properly rated FR clothing and protective equipment if it is worn.
- Loose, dangling watch chains, key chains, unnecessary metal of any kind shall not be worn when working around energized lines and equipment.



## 5.8. Fall Protection

### General

- A harness and lanyard must be worn when operating aerial lifts.
- 100% Fall Protection is required when climbing or working on poles, towers, or similar structures.
- Employees must be trained in and familiar with the fall protection device they are using.
- Personal fall arrest equipment shall meet applicable regulations.
- Body belts and safety straps for work positioning shall meet applicable regulations.
- Body belts, safety straps, lanyards, lifelines, and body harnesses shall be inspected before use each day to determine that the equipment is in safe working condition.
  - Defective equipment may not be used.
- Lifelines shall be protected against being cut or abraded.
- Fall arrest equipment, work positioning equipment, or travel restricting equipment shall be used by employees working at elevated locations more than 4 feet (1.2 m) above the ground on poles, towers, or similar structures if other fall protection has not been provided.
- The following requirements apply to personal fall arrest systems:
  - If vertical lifelines or droplines are used, not more than one employee may be attached to any one lifeline.
  - Snap hooks may not be engaged directly to webbing.
  - Snap hooks may not be connected to each other.
- A harness and shock absorbing lanyard must be worn when operating aerial lifts.
  - Shock absorbing lanyard must:
    - Be removed from service when subjected to a fall and inspected by a competent person even if the lanyard does not fully deploy.
    - Have a minimum breaking strength of 5,000 pounds.
    - Be made of synthetic fibers.



### Wood Poles

- When climbing wood poles that have pole steps or other obstructions the hitch hike climbing method, utilizing the work positioning equipment, may be used to ascend or descend when rigged such that an employee cannot fall more than two feet.
- When working on wood poles, positioning equipment may be used when rigged such that an employee cannot fall more than two feet (work positioning equipment used within two feet above an attachment that would stop a fall). Fall protection / restricting devices must be used at all times the employee can fall more than two feet while working on a wood pole.

### Lattice Structures

- Fall Protection Equipment (FPE) shall be used when ascending, while in the working position, when changing positions, descending, and/or performing rescue operations while on a lattice structure.
- FPE shall be inspected and used in accordance with the manufacturer’s instructions and guidelines.
- Lattice structure climbers shall be trained and competent in the care, use, and inspection of the equipment used for fall protection.
  - Climbers must be trained in the selection and safe use of the equipment/system.
  - Training shall only be conducted by qualified trainers.
- Visual inspections shall be performed prior to, and during climbing, to ensure that the structure is in acceptable condition for the safe execution of the tasks to be performed.
  - Verify step bolts are secure and in acceptable conditions.
  - Verify acceptable conditions of footers.
  - Verify steel members are secure on each end before applying or transferring weight.
  - Check for damage or distortion to the structure members.
- Types of fall protection which may be used:
  - Full body harness with double lanyards (with proper snap hooks).
  - Rebar hooks and belay line with full body harness and double lanyards.
  - Temporary horizontal lifelines.
  - Self-retracting lifelines (SRL).
  - Double safety’s (skids) are acceptable when the safety is rigged such that a climber cannot fall more than two feet.
  - Vertical lifelines, rope grabs, body harnesses with frontal and dorsal D-rings.



### 5.9. Ear Protection

- Required depending on the noise level and time of exposure.
- Ear protection must be worn when a normal conversation cannot be heard from two feet away.
- Employees required to wear hearing protection based on permissible noise exposures will be placed in a hearing conservation program.

| PERMISSIBLE NOISE EXPOSURES |                                 |
|-----------------------------|---------------------------------|
| Duration per Day (Hours)    | Sound Level (dBA Slow Response) |
| 8                           | 90                              |
| 6                           | 92                              |
| 4                           | 95                              |
| 3                           | 97                              |
| 2                           | 100                             |
| 1.5                         | 102                             |
| 1                           | 105                             |
| .5                          | 110                             |
| .25 or less                 | 115                             |

Table 4 Permissible Noise Exposure

### 5.10. Foot Protection

#### Work Boots

- Employees must wear work boots that provide protection to the feet and ankles to help prevent ankle sprains, stains, and soft tissue injuries to the feet.
- Work boots that cover the feet and ankles must be worn at all times on the job.
  - Tennis shoes, sandals, flip flops, dress shoes or other types of footwear that do not offer appropriate foot and ankle protection are not allowed to be worn at GBE.
- A quality work boot designed for line work will offer the most protection and be more comfortable and easier to wear throughout the workday.
- Inspect work boots each day before putting them on.
- Look for:
  - Cracks or tears in the leather.
  - Oil or other leather treatments will lengthen the use life of leather boots.
  - Broken eyes or laces and broken or frayed strings which might snag on equipment and cause a tripping hazard.
  - Other signs of damage.
- Replace damaged work boots as needed.

### 5.11. Respiratory Protection

#### Requirements

- In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general or local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used.
- Respirators shall be provided in a clean and sanitary condition in good working order when such equipment is necessary to protect the health of the employee.



- Selection of appropriate respirators shall be based on the respiratory hazard(s) to which the employee is exposed and workplace and user factors that affect respirator performance and reliability.
- A NIOSH-certified respirator must be selected. Respirators shall be used in compliance with certification conditions.
- Employees will be medically evaluated, fit tested, and trained before respirator use.
- All respirators must be stored so they are protected from damage, contamination, harmful environmental conditions and damaging chemicals, and deformation of the facepiece and exhalation valve.
- Regular inspections to ensure the continued reliability of respiratory equipment must be made.
- Employees who voluntarily use respirators must:
  - Use an approved respirator they maintain in good working order.
  - Be fit tested for anything more than a gas mask.
  - Receive Voluntary Respirator training.
- All filters, cartridges, and canisters used in the workplace shall be labeled and color-coded with the NIOSH approval label. The label must remain legible and affixed to the cartridge, filter, or canister while in service.

#### **Medical Evaluation**

- Medical evaluations associated with the use of respiratory protection equipment shall be coordinated by GMB and conducted by a physician or other licensed health care professional (PLHCP).
- A medical evaluation, to determine the employee's ability to use a respirator before the employee is fit tested or required to use the respirator in the workplace, shall be provided.
- The medical questionnaire and evaluation shall be administered confidentially during the employee's normal working hours or at a time and place convenient to the employee.
  - The employee shall be given the opportunity to discuss results with the PLHCP.
  - The following information must be provided to the PLHCP before the PLHCP makes a recommendation:
    - The type and weight of the respirator to be used by the employee;
    - The duration and frequency of respirator use (including use for rescue and escape);
    - The expected physical work effort;
    - Additional protective clothing and equipment to be worn; and
    - Temperature and humidity extremes that may be encountered.

#### **Fit Testing**

- Before an employee is required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee must be fit tested with the same make, model, style and size of respirator that will be used.
- All employees who are required to use a tight-fitting respirator must pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT).
- Appropriate fit tests shall be performed as follows:
  - Prior to initial use of the respirator;



- Whenever a different respirator face piece (size, style, model or make) is used;
- Whenever an employee reports physical condition changes that could affect respirator fit;
- Whenever the employee is observed to have undergone physical changes that could affect respirator fit; and at least annually.

### **Training**

- Effective training must be provided to all employees who are required to wear respirators. Employees must be trained sufficiently to:
  - Show a knowledge of why the respirator is necessary;
  - How improper fit, usage, or maintenance can compromise the protective effect of the respirator;
  - Know the limitations and capabilities of the selected respirator;
  - Deal with emergency situations involving the use of respirators or with respirator malfunction;
  - Inspect, don, remove, and check the respirator seal;
  - Understand procedures for respirator maintenance and storage;
  - Know the medical symptoms and signs that may limit or prevent the effective use of respirators; and
  - Understand the general requirements of the regulatory requirements.
- Training must be understandable and be given to an employee prior to using a respirator, and annually thereafter. Additionally, if there is reason to believe that any employee who has already been trained does not have sufficient understanding and skill to use the respirator, the employee must be retrained.



**Table 5 Respiratory Protection**

| Respiratory Equipment Selection Chart   |  |
|---|--|
| Hazard  | Respirator   |
| 1. Oxygen deficiency  | 1. Self-contained breathing apparatus. Hose mask with blower. Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.  |
| 2A. Gas and vapor contaminants immediately dangerous to life and health                           | 2A. Self-contained breathing apparatus. Hose mask with blower. Self-rescue mouthpiece respirator (for escape only). Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.  |
| 2B. Not immediately dangerous to life and health  | 2B. Air-line respirator. Air-purifying, half-mask, or mouthpiece respirator with chemical cartridge.   |
| 3A. Particulate contaminants immediately dangerous to life and health                             | 3A. Self-contained breathing apparatus. Hose mask with blower. Self-rescue mouthpiece respirator (for escape only). Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.  |
| 3B. Not immediately dangerous to life and health  | 3B. Air-purifying, half-mask or mouthpiece respirator with filter pad or cartridge. Air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.  |
| 4A. Combination gas, vapor, and particulate contaminants immediately dangerous to life and health | 4A. Self-contained breathing apparatus. Hose mask with blower. Self-rescue mouthpiece respirator (for escape only). Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.  |
| 4B. Not immediately dangerous to life and health  | 4B. Air-line respirator. Air-purifying, half-mask or mouthpiece respirator with chemical cartridge and appropriate filter.   |
|   | <p><i>*Note: For the purpose of this chart, “immediately dangerous to life and health” is defined as a condition that poses either an immediate threat to life and health or an immediate threat of severe exposure to contaminants, such as radioactive materials and asbestos, which are likely to have an adverse delayed effect on health.</i></p> |

## 6. Cover up

Cover up must be used on any job in which conductors or equipment are energized or may become energized. The cover up required will depend on the work being performed.

### 6.1. General Guidelines

- Cover Up to isolate from any and all differences in potential.
  - Example – crossarms; wood, steel, and concrete poles; etc.
- Cover up when work is to be done on or near energized lines or equipment, all energized and grounded conductors or guy wires within extended reach of any part of the body except the part being worked on.
  - Example 12kV - phase to ground minimum approach distance is 2'2" and the average reach is 3 feet so 5'2" needs to be covered.
    - Take into consideration the work – if holding a 3-foot piece of wire an extra 3 feet must be covered.
    - Cover all energized equipment within reaching distance except the immediate area being worked.
    - Electricity will find any exposed conductor or path to follow.
- Employees shall cover the nearest and lowest conductors first to protect themselves as they progress to the work area.
- Remove cover in the reverse order it was applied.



Figure 10 Installation of Cover Up



Figure 11 Line Hose

### 6.2. Types of Cover Up

#### Line Hoses

- Used to cover conductors.
- Slit should face the ground .
- Male and female ends should be joined together.

Figure 12 Blanket wrapped Conductor & Insulator



#### Blankets and Split Blankets (GBE typically uses Class 4 Blankets)

- Blankets must be wrapped and pinned with no open seam to provide full protection.
- Blankets are used in underground work to cover all energized parts of transformer not being worked on.
- A blanket used in a manner that may damage the blanket (laid on ground when opening an underground transformer, for example) should be marked and not later used as cover.
- Tape should not be used on blankets.
  - Electricity can track across tape marks and dirty surfaces causing blankets to fail.

- Blankets are tested with a ground below and energized source above. They are not tested for tracking across a blanket.

**Figure 13 Split blanket used to cover Cross arm & bottom of insulator**



**Figure 14 Blankets wrapped and pinned**



**Figure 15 Blankets used in underground work**



### Hoods

- Insulator Hoods can be used to cover the insulator and a small portion of the conductor on each side



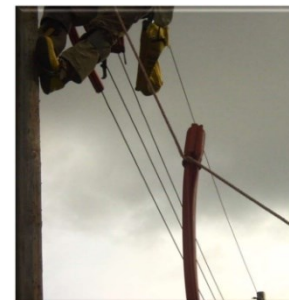
**Figure 16 Insulator Hood**

### 6.3. Inspection

- Inspect all cover before each use.
- Look for defects including holes, tears, cuts, and embedded objects.
- Feel for defects including swelling, softening, hardening, holes, cuts, etc.
- Immediately take defective cover up materials out of service.

### 6.4. Handling & Storage

- Do not fold line hoses or blankets for storage.
- Roll blankets when they are not in use.
- Folding rubber creates creases which weaken integrity and can lead to failure.
- Store away from anything that may cause damage (sharp objects, chemicals, etc.).
- Do not leave rubber goods on energized lines or equipment overnight without the approval of a supervisor.
- Do not use the hook on the handline to raise or lower rubber goods.



**Figure 17 Line Hose on Handline**

### 6.5. Di-Electric Testing

- Blankets must be tested every 12 months.
- Hoses and covers are tested when there is a reason to suspect integrity.
- New cover is tested by the manufacturer and by 3<sup>rd</sup>-party.
- It is extremely important all blankets are returned to the lab for testing.



**Figure 18 Split**



**Figure 19 Rubber Blanket**

| Rubber Cover Up Classes and Use                      |                           |
|--|---------------------------|
| Class Designation of Line Hose, Blankets, and Covers | Maximum use AC Voltage, V |
| 0  | 1000                      |
| 1  | 7500                      |
| 2  | 17000                     |
| 3  | 26500                     |
| 4  | 36000                     |

**Table 6 Classes of Rubber Hose, Blanket, & Covers**

## 7. Grounding

### 7.1. De-Energized Lines

#### **ELECTRICAL CONDUCTORS MAY BE WORKED AS DEAD (DE-ENERGIZED AND GROUNDED) UNDER THE FOLLOWING CONDITIONS:**

- A visible opening must exist between the source and work location and checked to ensure the line is de-energized
- The line may be opened, load permitting, with a load buster, a disconnect, a fused switch, or by removing a tap jumper.

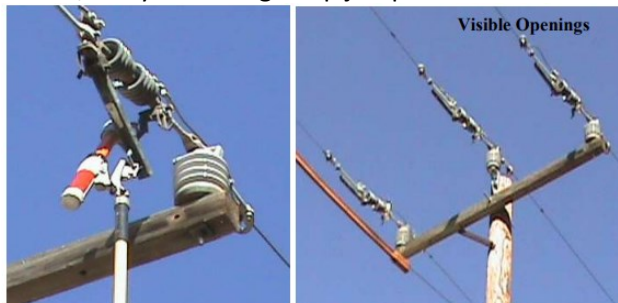


Figure 20 Load Buster

Figure 21 Visible Opening

- De-energizing a line by opening a recloser or a sectionalizer, will not suffice as a visible opening.
- Primary, as well as secondary lines and equipment may not be worked as dead unless de-energized, tested, flagged, tagged, and adequately grounded.

**Due to the nature of storm restoration work and the risk of generator back feeds, approved rubber gloves shall be worn even if the line is flagged, tagged, and grounded.**



Figure 22 De-energized Visible Opening



Figure 23 Tested



Figure 24 Tagged



Figure 25 Flagged, Tagged & Grounded

- Avoid unnecessary delay between testing for voltage and applying the grounds. If workers are interrupted between testing and grounding, the circuit shall be retested for voltage before grounding is commenced.
- The de-energized line must be grounded to the system neutral, an appropriate flag installed on the same structure, and tags attached at all points where equipment or circuits can be energized.

### 7.2. General Grounding Guidelines

- A ground is only as good as its weakest link.

- Check grounds for corrosion, breaks, etc. in the ground conductor and connections before installation.
- Be sure the attachment point is clean, and the ground connection is made securely.
- Use approved insulated tools such as a hot stick to install grounds.
- Ground connections are always first on and last off.
- Inspect all grounding cables and connecting clamps before installation to ensure all connections are solid and wires or connectors are not frayed or corroded.

| Case Study   |
|--|
| <p>During storm work, the customer attempted to energize a line without communicating with the crew.</p> <p>Homeowners incorrectly hooked up generators that back fed through transformers and energized lines. Another contractor removed GBE's grounds.</p> <p style="text-align: center;"><b>Lessons Learned</b></p> <ul style="list-style-type: none"> <li>• Flag, tag, and ground for electrical protection and communication with other workers.</li> <li>• Wear PPE, especially rubber</li> </ul> |

### 7.3. Why Ground

- To provide the best possible conducting path for electricity to travel from source to ground in case of accidental energizing of conductors or equipment.
  - Accidental energizing of conductors or equipment can be caused by closing of switches, auto accidents, induced current, generator back feed, lightning, equipment failure, capacitive reactance, etc.
  - Some current will flow in all resistors in a circuit when a fault occurs.
- Prove isolation of conductors or equipment.
- To create ground potential.
- To lock out the circuit in 15 to 30 cycles (1/4 to 1/2 a second).
- To protect workers from differences in potential.
- Differences in potential cause current to flow and could make the human body become a conductor.
- Severity of the shock depends on:
  - Path of current through the body
  - Amount of current flowing through the body (amps)
  - Duration of the shocking current through the body,
- Low voltage does not mean low hazard.

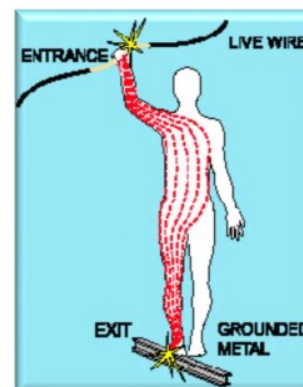


Figure 26 Human Body as a Conductor

### 7.4. Induced Voltage

- Induction is the transfer of electric energy from an energized line to an isolated line through a magnetic or electric field.
- In general, there are two kinds of induction:
  - Magnetic Induction (sometimes referred to as electromagnetic induction).
  - Electric Induction (sometimes referred to as electrostatic induction).
- Even though a distribution line may be disconnected or isolated from an electrical source, it is still not safe to work on until it is properly tested for potential voltages and grounded.
  - Before grounding, the line can still have hazardous charges on it because of induction.
  - After grounding, a hazard can still exist if grounds are not spaced properly.

- Factors that affect the strength of induced charges are:
  - The amount of current (amperage) and voltage on the neighboring energized line. The higher the amperage and/or voltage, the higher the (Induction) on the line.
  - The distance between the isolated and energized line. The closer the lines, the greater the induced charge.
  - The distance the isolated and energized lines run parallel to each other. Lines that run parallel for a long-distance result in a higher induced charge than for shorter runs.
  - The size of the conductor is also a contributing factor. The larger the surface, the greater the induced charge.
- Many lines are not greatly affected by induction and as a consequence it is easy to forget about the hazard it poses. The hazard of induction is very real, and generally presents itself when those working on the lines have in fact, forgotten about the hazard and have not taken proper precautions to guard against it. In order to eliminate this hazard, approved grounding, bonding and jumpering techniques must always be used when working on isolated lines.

### 7.5. Grounding Overhead Distribution Lines

- Use approved insulated tools when attaching or removing grounds.
- Ground connections are always first on last off.
- A grounding lead (including attached clamps) shall be capable of conducting the anticipated fault current and shall have a minimum conductance of 1/0 copper.
- Install grounds from neutral to phase to phase to phase.
- Keep grounds clear of the body during installation and removal.
- Multiple phase lines should be short circuited and grounded.
  - Short circuit means each phase is tied to one another.
- Place grounds at the opening point between all sources of energy. In addition, the line to be worked should be grounded at each work location.
- The foreman or other employee in charge will inform all crew members when the line is grounded. Before the line is re-energized, the employee in charge must inspect the line and inform all crew members.



**Grounds are required at the opening point between all sources of energy and at each work location. This is especially important in storm restoration work for electrical protection and to communicate with other work groups.**



Figure 27 Grounding in steps



Figure 28 Short Circuited, Grounded & Flagged

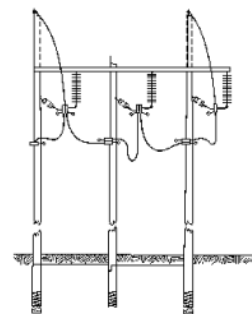
## 7.6. Grounding Transmission Lines

- When grounding transmission lines the grounds must be placed outside the work area open point or take off and personal protective grounds must be placed at the point where the work is being done.
- The most utilized types of grounding overhead transmission lines are:
  - Single Point
    - Ground at the work location.
  - Bracket
    - All phases to phase to phase to phase to a single ground point. o Equipotential
    - Worker is completely inside grounds and conductor being worked (such as in a box).
  - Chain Grounding
    - Vertical construction ground to phase to phase to phase.
  - Personal Grounding
    - Utilizing a ground on the conductor being worked at the present time (Ground must be same size as line grounds).
      - 200 ohms is the minimum on any structure as the fault goes through a relay causing the recloser to operate.
      - Lower resistance is recommended if possible.
      - GBE policy is to work between grounds at all times.
      - Best ground sources
        - Station grid ground, tower, main line neutral, pole ground, etc.
        - Acceptable resistance is 25 ohms or less.
        - A grounding lead (including attached clamps) shall be capable of conducting the anticipated fault current.

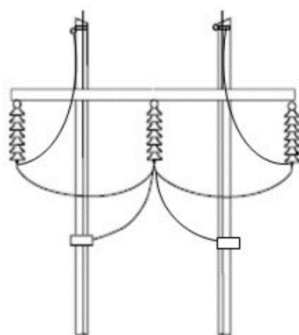


Figure 29 Chain Grounding (Daisy Chain)

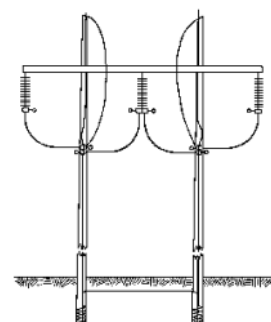
- Grounding of Transmission Lines without Distribution Underbuilds
  - This is the most commonly used grounding set up.
    - If the structure has a shield wire, a ground jumper must be installed between the shield wire and a phase conductor.
    - If a worker is to be positioned on each pole, a cluster bracket and personal ground would need to be installed on the opposing structure.



**Figure 30** Grounding jumper installation, three pole grounded Structure



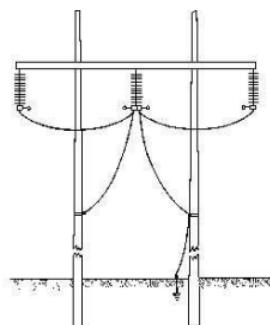
**Figure 31** Grounding of Transmission Line without distribution under build



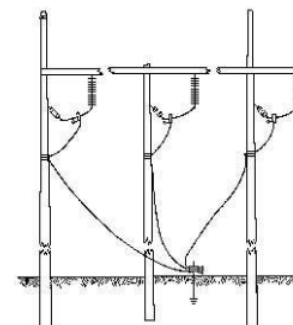
**Figure 32** Grounding jumper Installation, two pole grounded structure

### Grounding of Various Transmission Line Ungrounded Structures

- Transmission circuit ground in the absence of an overhead shield wire.
- The area around the ground rod must be secured to ensure:
  - Employees remain a safe distance from the ground rod to avoid step potential. No one removes the clamp from the ground rod while the opposite end is attached to the conductor.



**Figure 33** Grounding Cable Two pole ungrounded structure

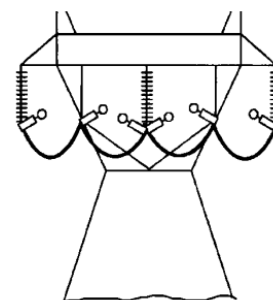


**Figure 34** Grounding three pole ungrounded structure



### Grounding of Lattice Transmission Towers

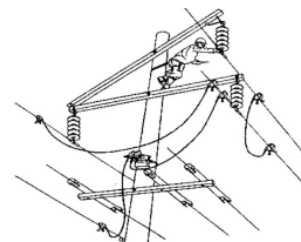
- When working on steel towers check bonds at foot of tower and on shield wires.
  - Insulated shield wires must be considered as energized conductors until they are effectively bonded to the tower or structure ground.
- Ground tower to outside phase, tower to center phase, center phase to tower, tower to outside phase.
- Procedure:
  - Obtain a clearance.
  - Identify and isolate the line - obtain visible openings on the source side (and the load side if possible) of the line or equipment.
  - Use a voltage detector to test the line or equipment to be sure it is de-energized.
  - Inspect the tower structure grounds to make sure they are in good condition. If they are not, the grounds will have to be repaired first.
  - Install tower clamps on the tower legs, leaving adequate working space above them.
  - Clamp one end of a suitable length grounding jumper to a tower clamp, and the other end to the closest phase conductor. Install the other grounding jumpers to the tower clamps and other phases if required.



**Figure 33 Lattice Tower Grounding**

### Transmission Lines with Distribution Under build

- When working on a structure with distribution under build the neutral wire must be included in the grounding of the transmission using a ground bar or (ground tree).
- Procedure:
  - Obtain a clearance.
  - Identify and isolate the line - obtain visible openings on the source side (and the load side if possible) of the line or equipment.
  - Use a voltage detector to test the line or equipment to be sure it is de-energized.
  - Install a cluster bar on the pole just below the work area. Leave adequate clearance above it.
  - Install a grounding jumper from the system neutral to the cluster bar.
  - Jumper from the cluster bar to the closest phase conductor. Jumper the other phases together, working from the nearest to the farthest away.
    - NOTE: If necessary, install barriers to prevent grounding jumpers from contacting energized conductors.
    - NOTE: It is important to bond the phases together so that the protective devices will work.
  - Remove the grounds in reverse order.



**Figure 34 Grounding Transmission lines with Underbuilds**

## 7.7. Grounding De-Energizing Underground Equipment

- Electrical conductors may be worked as dead under the following conditions:
  - The line or cable must be de-energized, tested, identified and a visible opening exists between the electrical source and the work location.
  - Grounds shall be installed on all de-energized cable sections, switch gear, transformers, and/or other equipment prior to performing any work.
  - The line must then be checked to make sure that it is de-energized by using approved means
    - Phasing Sticks
    - Tick Tracer (only on certain customers)
  - The employee shall not remove his required protective equipment without having confirmed the cable has been grounded. (Unnecessary delay shall be avoided between testing for voltage and applying the grounds. If workers are interrupted between testing and grounding, the circuit shall be retested for voltage before grounding is commenced.)
  - Precautions to prevent back feed shall be taken. This shall include grounding of secondary conductors.



Figure 35 Grounding URD Equipment

**IMPORTANT: The de-energized line must be grounded to the system neutral, an appropriate flag installed on the same structure and tags attached at all points where equipment and circuits can be energized.**

## 7.8. Grounding Underground Lines

- Grounds must be attached to the neutral first and removed from the neutral last.
- A grounding lead (including attached clamps) shall be capable of conducting the anticipated fault current and shall have a minimum conductance of 1/0 copper.
- Every phase must be grounded.
- Grounds shall be installed and removed from current carrying conductors with hot sticks.
- **NOTE: A capacitance charge can remain in an underground cable after it has been disconnected from the circuit and a static-type arc can occur when grounds are applied to such cables.**
  - **An underground cable can act as a capacitor, store charges, and must be grounded before handling.**
  - **An underground cable can build an induced voltage charge while being pulled along the ground and it must be grounded before handling.**
- All underground cables and equipment, including services, that have been energized or could become energized from any source, shall be treated as energized until the equipment is positively proven to be de-energized and has been grounded.
- De-energized cables to be worked on, shall be grounded at a point as close to the work as possible.

- All underground cables and apparatus carrying current at voltages above 600 volts shall be de-energized and grounded before cables are cut into or spliced.

### Grounding Mobile Equipment

- When working in close proximity to energized circuits or circuits that may become energized, the metal parts of all mobile equipment shall be grounded.
- Equipment must be grounded to protect employees and equipment on the ground by reducing the voltage to an acceptable level by providing the best possible path for electricity to flow.
- When attaching grounds, employees shall pay close attention to make sure that all ground connections are secured tightly for continuity. (A ground is only as good as its weakest link!)
- The preferred ground is the system common neutral unless the neutral is located on the same level or above the energized conductor(s). When the common neutral is unavailable, the employee can install the grounding cable to one of the following attachment points, selecting one of the following in order:

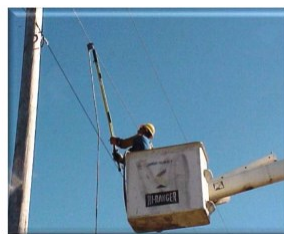


1. Substation ground system
2. Tower ground footing
3. Copper pole ground (preferably bonded to neutral)
4. Anchor rod, or
5. Driven ground rod
6. A screw ground may only be used when a better ground source is not available, and approval has been given by the immediate supervisor or employee in charge.



**Figure 36 Rolling Ground**

- Only one piece of equipment should be hooked to a screw ground
- Truck grounds must be completely removed from the bin and not left coiled up in the bin or coiled up on the ground.
- Running grounds shall be used in wire pulling operations when working in close proximity to energized circuits or circuits that may become energized. The running ground and the wire pulling equipment shall be connected from the conductor being pulled to the system neutral prior to the operation of the wire pulling equipment. (Any deviation from the above shall be approved by the immediate supervisor or employee in charge.)
- When operating a wire puller or tensioner in any area where the conductor being pulled could become energized, the puller or tensioner shall be isolated from other pieces of equipment by using an insulated rope, nylon sling, or other insulated material.



- Mobile equipment grounds shall be placed on the common neutral from the aerial bucket by using an approved live line shotgun stick.
- Echo protocol will be utilized between employee installing ground and ground personnel when grounding mobile equipment.

### Grounding Substation Equipment

- Inspect grounds for corrosion, breaks, loose connections, and other defects. Clean connecting clamps inside and make sure they are working properly before installation.
- Be sure attachment points are clean and ground connections are made securely.
- All equipment must be grounded following company grounding procedures.



- Consider substation bus and equipment as energized until they have been isolated, tested for voltage and grounded.
- Use approved testing device on live-line tool to test for presence of voltage. Inspect testing device and test on a known source prior to testing for voltage on equipment to be worked.
- Using a live-line tool, attach the ground end connection first and then attach the other end to conductor or buss.
- When removing grounds, use live-line tool to remove the conductor or buss end first and then remove the ground end connection.
- If a section of bus or switch/disconnect is opened and work is to be performed on both sections of the open point, both sides shall be grounded.
- If a section of bus is being installed or removed, the section being handled shall be bonded to the existing buss, which is grounded, until secured or removed.
- De-energize static capacitors and wait 5 minutes before installing grounds.
- Capacitors equipped with vacuum switches must be grounded on the capacitor side of the vacuum switch.
- Capacitors equipped with reactors and/or vacuum switches should not have grounds installed in such a manner that will allow the weight of the grounds to damage reactor coils or vacuum switches.



## 8. Safe Work Practices

### 8.1. Working Around Energized Conductor & Equipment

- Carry a hand line when going aloft on a pole or in an aerial bucket.
  - o Hand lines shall be used for moving tools and equipment up and down poles.
  - o Hand lines can serve as a means of escape in an emergency.
- A qualified observer should be appointed to watch linemen working aloft, especially during critical work.
- Avoid distractions when climbing or working from a pole or a bucket.
- Before performing work on energized lines or equipment:
  - o Distinguish the exposed live parts from other parts of electrical equipment.
    - Examples: – Substations look for insulators supporting buss work and bare conductors. – Transmission look for insulators supporting conductors and jumpers. – Distribution look for switches, transformers, reclosers, jumpers, and insulators supporting conductors. – Underground look for primary risers, elbows, bushings, and grounds in transformers.
  - o Determine the nominal voltage of exposed live parts.
    - Station single line diagrams.
    - Feeder maps of overhead and underground systems.
    - Transformer nameplates (circuit breaker nameplates can be misleading).
  - o Determine the minimum approach distances corresponding to the voltages to be worked.
    - Minimum approach is the distance a qualified employee can bring a non-insulated or conductive object (including their body) to an object energized at a different potential.
    - Minimum approach also applies to taking an energized object in proximity to a grounded object or object of a different potential.
    - Changes in weather must be factored in.
    - Extended reach must be added.
  - o Determine and utilize the personal and line protective equipment needed as well as insulated tools to be used for working on exposed or energized parts.
    - Alive With Five rules.
    - Check rubber gloves, line hoses, and blankets to ensure they are rated for voltage.
- Two workers shall not work separate primary energized phases at the same time while on the same pole or other structure, while in the same bucket, or while in two buckets attached to the same boom.
- Two workers shall not work separate energized primary equipment and secondary or grounded equipment at the same time when within reach of each other.
  - o Echo protocol should be used to ensure employees understand each other and are prepared for the next step.



Figure 37 Hand Line Use

- Linemen shall avoid any contact with a second phase, neutral or ground, when working on an energized phase wire.
- When linemen are working in the vicinity of energized conductors, either from an aerial bucket truck or a bucket attachment on a line truck, all personnel will stay clear of the vehicle as much as practical.
- Obtain a “One Shot” (non-reclosing) when conductors are being installed, removed, relocated, or crossing over energized lines if the design of the circuit-interrupting devices and customer will allow. “One Shots” should be coordinated with the customer.
- When working on energized lines or apparatus, work should be done from below, if possible.
- The primary side of a cut-out shall not be energized until the equipment below it (transformers, arresters, or other equipment) has been installed and all the necessary grounding connections have been completed. All primary connections required for underground risers or taps shall be completed prior to energizing the high side of a cut-out when possible.
- Primary leads to transformers, primary tap jumpers, cut-outs, and other devices used to energize and de-energize electrical apparatus shall be opened, closed, installed, or removed by using approved hot sticks. For example, use approved hot sticks to open, close, install, or remove:
  - Primary leads to transformer.
  - Tap jumpers.
  - Cut-outs.
  - Other devices used to energize and de-energize electrical apparatus.
- Approved rubber gloves will be used with live line tools and will be considered as the primary employee protection.
  - Where live line work will be performed involving voltages in excess of approved rubber glove usage (voltages in excess of 36 KV phase to ground), the primary employee protection shall be the live line tool where approved.
- Live line tools used for primary protection shall be removed from service every two years and tested or when notable defects or contamination exists that could adversely affect the insulating qualities or mechanical integrity of the live line tool.
- Always observe minimum approach and clearance distances.
- All primary voltage energized equipment and ground sources (including guys, neutrals, conductors, and service cables) must be covered, if possible, when working within reach.
- Employees shall not touch or work on any exposed energized lines or apparatus except when wearing protective equipment approved for the voltage to be worked.



**Figure 38 Hot Stick Usage**

## 8.2. Special Rules & Conditions for Working on Different Voltage Ranges

- Voltages up to and including 600 volts phase-to phase; may be worked from poles while wearing Class 2 rubber gloves and protectors. Rubber sleeves are not required if no higher voltage is within reaching distance of the worker. On poles with energized primary conductors, the worker must put on rubber sleeves when he climbs above the point where his safety belt attachment would be above any secondary conductor or the common neutral.
- Voltages from 600 volts phase-to-phase up to and including 15,000 volts phase-to-phase (8500 volts phase-to-ground); may be worked from a pole, hot board, or aerial bucket by linemen wearing gloves and sleeves rated for the voltage being worked. (Voltages below 35KV require approved gloves and sleeves as primary employee protection with use of insulated sticks.)
- Voltages above 15,000 volts phase-to-phase up to and including 25,000 volts phase-to-phase:
  - May only be worked from an aerial bucket with a liner (either a bucket truck or line truck with fiberglass extension and pin-on bucket) by a lineman wearing gloves and sleeves rated for the voltage being worked. This equipment may also be worked with approved hot sticks either from a bucket, pole, or other structure. Gloves and sleeves are required with hot stick use.
  - May be worked with rubber gloves and sleeves while standing on a hot board only under the direct supervision of a Company area supervisor or general foreman and only in areas inaccessible to bucket and line trucks.
- Voltages above 25,000 volts phase-to-phase up to and including 35,000 volts phase-to-phase:
  - May be worked with approved rubber gloves and sleeves only from an aerial bucket truck (not a line truck with a bucket attached). This equipment may be worked with approved hot sticks either from an aerial bucket, pole, or other structure.



## 8.3. Qualified Observer

- A Qualified Observer should be utilized any time a lineman is working on energized conductors, including but not limited to:
  - Closing or opening switches to energize/de-energize equipment.
  - Installing/removing mechanical jumpers.
  - Moving/relocating energized conductors.
  - Installing and connecting equipment to energized conductors.
- A Qualified Observer must be a qualified person in the work being performed. A qualified person is:
  - A person who has the training and experience in avoiding the electrical hazards of working on or near exposed energized parts.
  - One who is familiar with the construction and operation of the equipment and hazards involved with the job.

- A Qualified Observer must know:
  - Specific regulations and work methods that apply.
  - Hazards associated with electricity.
  - How to determine nominal voltage of live parts.
  - How to determine clearance distances of live parts.
  - How to distinguish between live parts and other parts.
  - Emergency procedures.
- The Qualified Observer must be positioned so as to be able to visually monitor the work being observed.
- The Qualified Observer’s duty is to provide timely warning any time a hazard or improper work procedure is recognized.
- The designated observer cannot be assigned other duties that interfere with the ability to give a timely danger warning to employees being observed.
- The Qualified Observer should be noted on the Pre-job briefing form.

**Case Study**

In a two-week period, investigations of 3 outages determined the Foreman, who had designated himself as the Qualified Observer during the pre-job briefing, stepped away to answer a telephone call or talk with a customer representative who had pulled up on the jobsite.

#### **8.4. Minimum Approach Distance**

- When working near energized conductors or equipment, it is important that a safe working distance be maintained. No employee shall be permitted to approach or take any conductive object without an approved insulating handle closer to exposed energized parts UNLESS:
  - The employee is insulated or guarded from the energized conductor or equipment by use of rubber gloves and sleeves rated for the voltage involved OR;
  - The energized part is insulated or guarded from the employee and any other conductive object at a different potential OR;
  - The employee is isolated, insulated or guarded from any other conductive objects as during live line barehand work.

**Table 7 MAD Chart**

| A/C Live Line Minimum Approach Distances        |   |                                     |
|---|---|-------------------------------------|
| Nominal Voltage<br>Phase to Phase<br>(Kilovolt) | Distance Phase<br>to Ground<br>Exposure | Distance Phase to<br>Phase Exposure |
| .05 to 1  | Avoid Contact                           | Avoid Contact                       |
| 1.1 to 15                                       | 2 ft. 1 in.                             | 2 ft. 2 in.                         |
| 15.1 to 36                                      | 2 ft. 4 in.                             | 2 ft. 7 in.                         |
| 36.1 to 46                                      | 2 ft. 7 in.                             | 2 ft. 10 in.                        |
| 46.1 to 72.5                                    | 3 ft. 0 in.                             | 3 ft. 6 in.                         |
| 72.6 to 121                                     | 3 ft. 2 in.                             | 4 ft. 3 in.                         |
| 138 to 145                                      | 3 ft. 7 in.                             | 4 ft. 11 in.                        |
| 161 to 169                                      | 4 ft. 0 in.                             | 5 ft. 8 in.                         |
| 230 to 242                                      | 5 ft. 3 in.                             | 7 ft. 6 in.                         |
| 345 to 362                                      | 8 ft. 6 in.                             | 12 ft. 6 in.                        |
| 500 to 550                                      | 11 ft. 3 in.                            | 18 ft. 1 in.                        |
| 765 to 800                                      | 14 ft. 11 in.                           | 26 ft. 0 in.                        |



**\*NOTE 1:** Minimum Safe Approach Distances (MSADs) include values for flashover distance and inadvertent movement by a worker. Due to the differences in work methods and personnel positioning, a smaller value for inadvertent movement is included in MSADs for voltages above 72.5 kV. These MSADs are required by the National Electrical Safety Code and OSHA regulations.

**\*NOTE 2:** These distances take into consideration the highest switching surge an employee will be exposed to on any system with air as the insulating medium and the maximum voltages shown.

**\*NOTE 3:** The clear live-line tool distance shall equal or exceed the values for the indicated voltage ranges.

| Altitude Correction Factor |                   |
|----------------------------|-------------------|
| Altitude (In feet)         | Correction Factor |
| 3000                       | 1.00              |
| 4000                       | 1.02              |
| 5000                       | 1.05              |
| 6000                       | 1.08              |
| 7000                       | 1.11              |
| 8000                       | 1.14              |
| 9000                       | 1.17              |
| 10000                      | 1.20              |
| 12000                      | 1.25              |
| 14000                      | 1.30              |
| 16000                      | 1.35              |
| 18000                      | 1.39              |
| 20000                      | 1.44              |

Table 8 Altitude Correction Chart

- If electrical equipment and devices are insulated, or isolated, or both, such that the multiphase exposure on a grounded wye circuit is removed and if supplemental insulation (e.g., insulated aerial device or structure-mounted insulating work platform approved for the voltage being worked) is used to insulate the employee from ground, then the nominal design voltage may be considered as the phase-to-ground voltage on that circuit.
- NOTE: Conductor support tools, such as link sticks, strain carriers, and insulator cradles, may be used, provided, that the clear insulation is at least as long as the insulator string or the minimum distance for the operating voltage.
- MAD must be corrected when working at elevations greater than 3,000 feet.
  - MAD is adjusted by multiplying the MAD by the correction factor for a given altitude.
  - Example MAD for 7200 kV phase to ground is 2 feet, 1 inch. When working at 8,000 feet, multiple 25 inches by 1.14 and get an adjusted MAD of 28.5 inches, or 2 feet, 4.5 inches.

## 8.5. Climbing Wood Poles

### Requirements

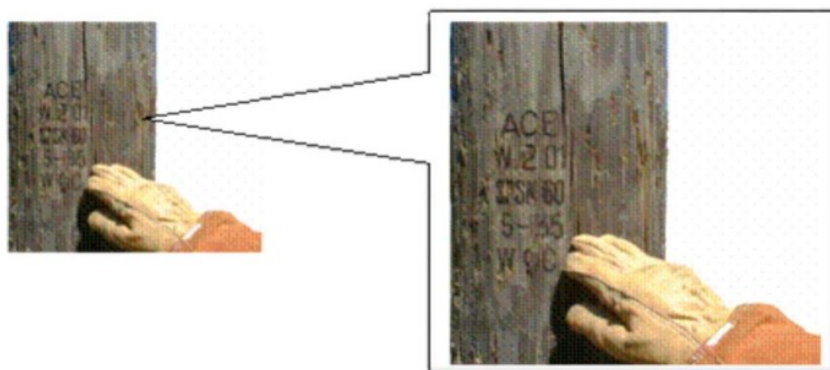
- Wooden poles must be inspected before they are climbed.
- Climbing and fall protection equipment must be maintained properly and inspected before each use.
- 100% fall protection or restriction is required.

### Pole Inspection

- The person climbing the pole must inspect the pole.
- Sound Test o First check the pole by using the sound test method. Sound testing a pole involves striking the pole with a hammer from the ground line up to as high as possible. Continue this while moving around the entire circumference of the pole.
  - There are 3 things to look and listen for when sound testing:
    - A dull sound.



- Lack of recoil in the hammer.
- Shell crack.
- Bore Test
  - Some poles have been in the ground for many years and may not be suitable for climbing. The bore test is used for inspecting poles below the ground surface. A bore test is conducted by:
    - Removing dirt from around the pole (6" to 12").
    - Drive a screwdriver in the pole:
      - At the base below dirt level.
      - At a 45-degree angle.
      - If the screwdriver drives easily, decay is present, and precaution should be taken.
    - While inspecting a pole there are several other factors to be considered. These include:
      - Insects.
      - Woodpecker holes.
      - Open cracks or lightning damage.
      - Nail, tacks, and or knots that could cause cut outs.
      - Read the birthmark.
      - Depth of pole.
      - Strain on pole.
      - Guying.
      - Ice on the pole.
      - Leaning or crooked poles.
      - Loose hardware on the pole.

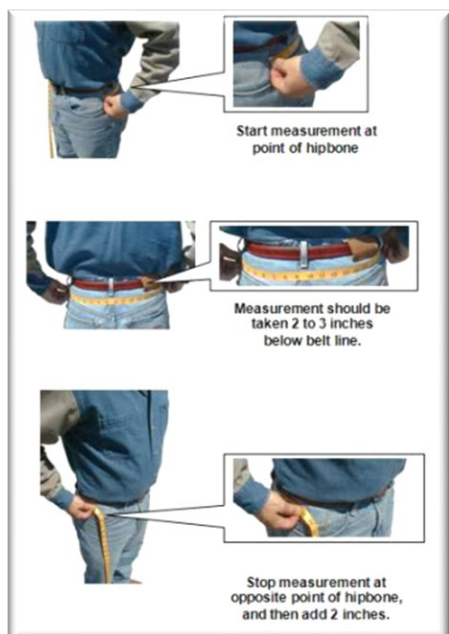


## Climbing Tools

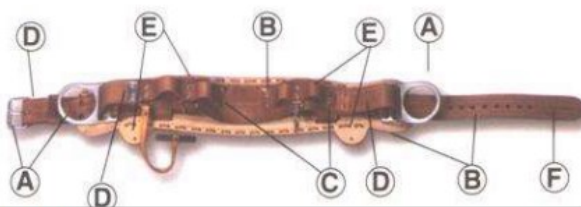
- Body Belt
  - A body belt provides support while working on a pole. It also holds your tools. For your safety and comfort, it is extremely important that your belt is adjusted and cared for properly.
- Adjustment
  - The belt should ride on your hips instead of around your waist so your body weight will be distributed around your hips instead of the small of your back, putting you in a more comfortable position.
- Care
  - Keep your belt dry – If it gets wet, simply hang it to dry.
  - Clean and treat your belt at least 3 times a year to prevent hardening and/or cracking
  - Clean using saddle soap.
  - Preserve the leather with light applications of leather preservers such as Mink Oil.
- Repairs
  - If the sewing on the belt breaks, take it to a competent shoemaker. Make sure the shoemaker does not alter the integrity of the belt.
  - Metals and nylons can be cleaned with mild soap and water solution.
  - Never buff forged hardware as the heat will ruin the temper.
  - Never use petroleum-based cleaners on nylon.
  - You can make rivet repairs on your belt. Make sure the rivets are the same types as the original when you replace them.



### Proper Fitting Body Belt



### Parts and Inspection of Body Belt



- |    |                           |  |
|----|---------------------------|--|
| A. | Hardware                  | Cracks, deformation, loose attachment points.                      |
| B. | Sewing                    | Loose, cut, or frayed stitches                                     |
| C. | Leather or Nylon Material | Abraded strength member, cuts, fraying, or chemical deterioration. |
| D. | Rivets                    | Loose or bent rivets.  |
| E. | Tool Loops - Tool Holster | Elongated loops, improper tool fit, or loose attachment points.    |
| F. | Tongue                    | Broken stitches, elongated holes, fraying, or worn material.       |

### Safety Strap

- The safety strap or positioning strap is used for support while working on a pole or structure. The strap comes with double locking snap hooks on each end of the strap that should be latched into the D-rings of your body belt.
- Note: A safety strap is used as a positioning device and is not considered fall protection. Use 100% fall protection while climbing or descending structures.

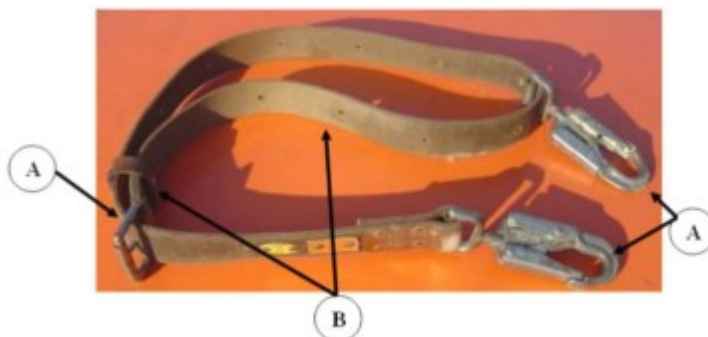


### Adjustment

1. Place the safety strap around the pole with the strap at a slight angle. At this point your safety strap should be attached to your body belt with the safety snaps attached to your D-rings.
2. Lean back in your body belt putting pressure on your safety strap.
3. Place your feet at a slight angle toward the bottom of the pole and lay the palms of your hands flat against the pole
4. Extend or straighten your arms forward. If you can do this without having to move your body forward or backward then your safety strap is properly adjusted. If it is not, then adjust it prior to climbing the pole.

### Inspection

- A-Hardware Cracks, deformation, loose attachment points, improper latch, or spring tension on the snap.
- B-Leather on Nylon Material
  - Extreme wear, cuts, fraying, broken or loose stitches, chemical deterioration, or exposed red center material
- Any safety strap that does not pass inspection should be removed from service and marked and/or destroyed so it is not used by anyone else.



### Inspecting Pole Straps and Positioning Lanyards

- These straps and lanyards must be inspected prior to each use.
- They should be inspected for the following:
  - Electrical burns, cracks, or deformation of the snap-hooks, buckle, or adjustable carabineer.
  - Loose rivets or broken stitching on the hardware attachment points, sewn splices or compression fittings, and other primary strength members.
  - Degraded or torn nylon strength members, as well as other physical, chemical, heat or age-related damage.
  - Dry rotted leather.



- Exposed wear indicator.
- Elongated holes, or broken stitches on the strap material or rope.

### Climbers and Gaffs

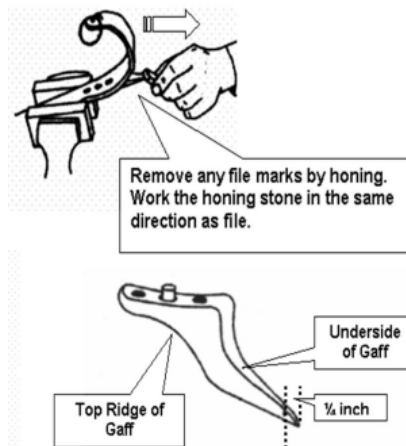
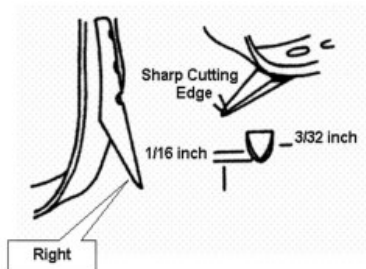
- General Inspection Procedures

- Check for wear and deterioration
  - Before each use, carefully inspect the complete system for signs of wear, deterioration, or any type of damage.
  - Visually inspect for loose threads, pulled rivets, cuts, abrasions, or other evidence of chemical or physical deterioration that may have weakened the material or assembly.
- Inspect hardware for malfunctions or cracks.
  - Check all hardware, including rivets and buckles.
- Destroy and replace all worn or damaged equipment.
- Immediately destroy and replace any component which does not pass inspection.
- **WARNING:** Inspect straps for any deterioration before each use; this means cracking, wearing thin, tearing, weakening, or chemical attack. Maintain with mink oil or equivalent. Remove from service and destroy and discard strap if it does not pass inspection.



- Instructions for Sharpening Gaffs on Climbers

- Always use a fine-tooth file.
- Never grind on a wheel as you are likely to set up heat which will spoil the temper making it dangerous to use.
- Set climber in smooth jaw vice or in bed of truck with the gaff so that you can file from heel to point of gaff.
- Remove only sufficient material to make a good point.
- Never cross-file. Cross-filing marks tend to weaken the part under load.
- The underside of the gaff should be left perfectly straight (flat) to within ¼ inch (6.35 mm) of the point, then rounded slightly toward the top ridge of the gaff on a radius of ¼ inch (6.35 mm).
- At a distance of 1/16 inch (1.59 mm) back from the point, you should have a width of approximately 3/32 inch (2.38 mm) measured on the underside of the gaff.



### Plane Test

- Place climber with point of gaff pointing downward and upper strap loop resting against a wood surface. (Any convenient board will do, or you can use a pole.)
- Hold the leg iron with the stirrup vertical and the leg iron parallel with the wood surface.
- Now push the climber horizontally along the surface in the direction of the gaff with the point of the gaff still in contact with the wood - as you would a carpenter's plane. Use no downward pressure except the weight of the climber.
- The point of the gaff should function as a chisel, cutting its way into a pole. The chisel point should penetrate the pole easily with little effort.
- If the gaff point buries itself in the wood within a few inches to where continued pushing will move it no farther, the gaff may be considered properly sharpened.
  - If the gaff point merely slips, slides, or plows a shallow groove in the wood, it is not properly sharpened and should not be used until re-sharpened and successfully tested.
- The critical part of the climber is the point of the gaff – it is a cutting edge like that of a chisel. Results of the “plane test” indicate that a slight defect in the gaff point, scarcely noticeable to the naked eye, might lead directly to a “cut-out” accident.

### Climbing

- When two workers are required to work on the same pole, the second must not begin to climb until the first is in position. Extreme care shall be taken when working above or climbing past another worker.
- There are two parts to climbing:
  - The first part is the motion or movement on the pole. This is accomplished using the legs and climber.
  - The other part is the balance or attachment to the pole, which is accomplished by the belt, pole strap, and hands.

### Hazards

- Poles coated with ice, snow, or frost should be climbed using extreme care. Ice or snow in most cases covers only half of the pole surface, due to the prevailing winds. While climbing, the gaffs are applied to the ice or snow side of the pole, and the safety strap placed on the bare wood side, which offers a safer gripping surface.
- When you walk up to the pole you are about to climb, stop and look at the way the pole is leaning. All poles are not set straight up in the air; some may be set having an angle or leaning in one direction or the other. This may have been done intentionally or by some other means such as storm damage (wind), wire tension.
- Workers must be aware that the characteristic action of flipping the safety strap and applying body weight into it results in a non- rhythmic motion causing the line conductors to sway. Critical swaying will reduce clearances, causing the conductors to “short-circuit”. To reduce pole motion to a minimum, climbing is performed either on the face or back of the pole so that the bending forces at the ground line are absorbed line-wise by the guying effect of the line conductors.
  - Climb in line with the conductors.
- All poles are not the same when they come from the factory. You will see that when the poles get taller, they are more prone to not be straight. The pole may have been

straight to start with but may have been improperly guyed causing the pole to bend or bow. If you must climb this type of pole, then you need to take a little extra time in climbing. Climbing a crooked pole also is made easier by climbing on the high side or the upward part of the pole where the bow is. The bow is going to change your position, making your arms and legs approach distance varied.

- Never use any of the pole material as a means to assist you when you are climbing up or down the pole. If you are not paying attention or get distracted, you may come in contact with an energized source. Also, the material may not have been tightened and could come loose from the pole causing you to slip and fall.

### Ascending Wood Poles

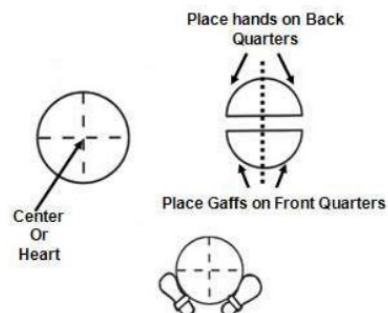
- You have already set your fall restraint device and are ready to ascend the pole. Remember that the pole is going to change in size as you climb up. You may have to re-adjust your safety and fall protection when you reach your workstation.
- Whenever possible plan a route up the pole that will allow climbing the high side or (upward side), of a leaning pole.
- While on the ground plan your route, look over the pole.
- Determine how to climb over crossarms, or around obstructions, where to apply the safety strap, and what final position will be assumed on the pole.
- When climbing, you are required to use a fall restraint device and a positioning safety. Using these methods ensures you are always tied off during a climb.
- Once you have reached the work position and have set your positioning safety, lean back in your belt so to put strain on your safety strap.
- Unless you are within two feet of a bolted attachment which would stop a fall, the fall restraint device must be used.
- While working on the pole you may have to be in one position for a long period of time. Place one foot slightly above the other to take the weight off one leg. This will let you rest your leg; as the leg with the weight on it becomes fatigued, change the weight to the other leg.

Whenever possible  
always climb the  
high side of pole.



### Movement on the Pole

- When climbing up or down the pole, remember to take short steps, about 6 to 8 inches in length. It will be less tiring taking short steps than taking long steps. Also, in the event that you happen to cut out, it will be easier for you to regain control and set your gaff back into the pole. Some poles are harder than others making it difficult for you set your gaffs deep enough. If this is the case, then you will have



to put more force down on your gaffs. You will know this after taking only a few steps. Remember, if the pole is soft and you put excessive force on your gaff, the harder it will be to pull out of the pole. Again, after climbing for any length of time, all excess force soon adds up to fatigue.

- The leg or foot should be angled slightly to place the gaff in the proper position. After a step is taken, lock the knee before taking the next step. Locking the knee will keep the strain on the legs to a minimum. By moving in this fashion, you will be able to climb to the work location. One thing you need to remember is to 10 always climb using a quarter of the pole, using more or less will not let you set your gaffs properly, making it easier for you to cut out.
- Keep the feet a comfortable distance apart, normally a distance of about 4 to 6 inches. Aim gaffs at the heart, or centerline, of the pole. Do not jab the pole. Allow your body weight to set the climber gaffs into the pole. Remember to keep your knees turned slightly outward and use comfortable steps.

| Improper Gaff Positioning  |   |
|--|---|
| DO NOT- Gaff Positioning to Far Apart  | DO NOT- Gaff Positioning too Close Together   |
|  |  |

**Table 9 Improper Gaff Positioning**

- The climber gaffs should always be directed toward the "center" or "heart" of the pole in the front quarters.
- The heels of the hands go on the back quarters with the wrists away from the pole.
- When climbing a pole raise your right hand up with your right leg and your left hand up when you raise your left leg. Repeat these steps until you have completed the climb. Use your legs to climb and lift your body up; do not pull up with your arms.
- When ascending the pole look straight ahead or in the upward position. Do not look at your feet, unless you are moving over an obstacle. The reason for looking up is so that you can see what you may or may not be climbing into.
- Once you are at the work height, it will be necessary to establish a stable position to prevent you from pivoting back and forth on your climbers. Keeping your feet at slightly different heights does this.

### **Moving Around the Pole**

- If you need to rotate around the pole, place the foot that is in the direction that you need to rotate slightly lower than the other, shift your weight to the higher leg and lift yourself up, the lower leg should or gaff should come out of the pole, move slightly in the direction you intend to go and drop on the lower leg. Be sure to lock the lower leg



before moving around the pole. Repeat until you have reached your intended position. Try to get in the most comfortable position possible. Beware of your surroundings, (energized primary, secondary, etc.).

- If your work is on the left side rotate in you belt, shift your safety and weight to the left, this will let you reach your work, do the opposite if your work is in the other direction.
  - **NOTE:** A good rule of thumb to remember is: Leading Leg Low
  - To rotate around the pole, pull one gaff out of the pole and drop it down 6 to 8 inches, or a comfortable step, and around and away from the other foot.



### Descending the Pole

- Look, Lock, Aim, and Drop
- Descending the pole is much the same as ascending the pole. The main difference is that instead of stepping your gaff out of the pole, you should roll your foot out away from pole.
- Note: Look at where you want to place your gaff, lock your knee, aim it, and drop.

### Working Position

- Working as a line worker not only involves climbing but also requires you to know how to do the work after you have reached your work position. A lot of work involves having to position yourself while working in climbing equipment. To accomplish this task, you must rotate in your belt and safety strap.
  - Place the leg that is closest to the work being performed in the lower position with your knee locked.
  - Rotate in your belt and rotate your positioning strap toward the work being performed. The final position should be with your body parallel to your work.
  - The opposite leg may be placed behind the pole using the foot to help stabilize you while working from this position.

### Preventing Cut-outs

- A cut-out occurs when a gaff cuts through the pole material causing the climber to lose his footing and possibly fall. Cut-out hazards are mitigated by the following considerations:
- Condition of poles
  - Inspect poles before climbing and use an aerial device or other method to reach the top of poles deemed unsafe to climb.
- Equipment on poles
  - Conduit, ground wires, signs, posters, insect nests, and other equipment or materials on poles can cause hazards. Utilize extra caution when climbing these types of poles and ensure one worker gets into position before other attempts to climb the pole if multiple workers will be utilized for a job.
- Clothing.
- Worn or loose heels on shoes, loose or ragged clothing, and wrong size gloves present climbing hazards. Mitigate these by wear approved footwear and protective equipment and do not wear loose or ragged clothing.

- Climbing practices.
  - Ascending or descending too fast, climbing the low side of a pole, fatigue, using too long of steps, and distractions are climbing hazards mitigated by eliminating unsafe climbing practices and paying attention to what you are doing.
  - Observers should be appointed to watch climbers.
- Improper Equipment.
- Inspect all your climbing and protective equipment before each use and take any defective tools or equipment out of service

## 8.6. Wire Pulling

### **Stringing or Removing DE energized Conductors**

- Prior to stringing operations, a briefing shall be held setting forth the plan of operation and specifying the type of equipment to be used, grounding devices and procedures to be followed, crossover methods to be employed, and the clearance authorization required.
- Where there is a possibility of the conductor accidentally contacting an energized circuit or receiving a dangerous induced voltage buildup, one of the following shall be done to further protect the employee from potential hazardous voltage:
  - Ground the conductor being installed or removed, or
  - Insulate or isolate the employee from the conductor.
- If the existing line is de-energized, either:
  - Secure proper authorization and ground the conductor(s) on both sides of the crossover, or
  - Consider and work the conductor being strung or removed as energized (using approved personal and line protective equipment).
- When crossing over energized conductors in excess of 600 volts rope nets or guard structures shall be installed unless provision is made to isolate or insulate the workman or the energized conductor. The automatic reclosing feature of the circuit interrupting device shall be made inoperative. In addition, the line being strung shall be grounded on either side of the crossover or considered and worked as energized.
- Conductors being strung in or removed shall be kept under positive control by the use of adequate tension reels, guard structures, tie lines, or other means to prevent accidental contact with energized circuits.
- Guard structure members shall be sound and of adequate dimension and strength, and adequately supported.
- Catch-off anchors, rigging, and hoists shall be of ample capacity to prevent loss of the lines.
- The manufacturer's load rating shall not be exceeded for stringing lines, pulling lines, sock kellum grips and all load-bearing hardware and accessories.
  - Pulling lines and accessories shall be inspected regularly and replaced or repaired when dependability is doubtful.
- Conductor grips shall not be used on wire rope unless designed for this application.
- While the conductor or pulling line is being pulled (in motion) employees shall not be permitted directly under overhead operations, nor shall any employee be permitted on the crossarm.

- A transmission clipping crew shall have a minimum of two structures clipped in between the crew and the conductor being sagged. When working on bare conductors, clipping, and tying crews shall work between grounds at all times. The grounds shall remain intact until the conductors are clipped in, except on dead end structures.
- Except during emergency restoration procedures, work from structures shall be discontinued when adverse weather (such as high wind or ice on structures) makes the work hazardous.
  - Stringing and clipping operations shall be discontinued during the progress of an electrical storm in the immediate vicinity.
- Reel handling equipment, including pulling and braking machines, shall have ample capacity, operate smoothly, and be leveled and aligned in accordance with the manufacturer's operating instructions.
  - Reliable communications between the reel tensioner and pulling rig operator shall be provided.
  - Each pull shall be snubbed or dead ended at both ends before subsequent pulls.

### **Stringing Adjacent to Energized Lines**

- The potential for dangerous induced voltage buildups exists where stringing operations are taking place parallel to existing energized distribution or transmission lines. Prior to stringing parallel to an existing energized distribution or transmission line, a determination shall be made by the employee in charge to ascertain whether dangerous induced voltage buildups have occurred, and proper precautions taken to make sure high voltage hazards are eliminated prior to performing work on these lines, particularly during switching and ground fault conditions. Precautions listed below shall be followed to eliminate high voltage hazards:
- When stringing adjacent to energized lines the tension stringing method or other approved methods which prevent unintentional contact between the lines being pulled and any employee shall be used.
- All pulling and tensioning equipment shall be isolated, insulated or effectively grounded.
- A ground shall be installed between the tensioning reel setup and the first structure in order to ground each bare conductor, sub conductor, and overhead ground conductor during stringing operations.
- During stringing operations, each bare conductor, sub conductor, and overhead ground conductor shall be grounded at the first structure adjacent to both the tensioning and pulling setup and in increments so that no point is more than 2 miles from a ground.
- The grounds shall be left in place until conductor installation is completed.
  - Such grounds shall be removed as the last phase of aerial cleanup.
  - Except for moving type grounds, bare conductors shall be grounded at all dead-end or catch off points.
- Conductors, sub conductors, and overhead ground conductors shall be grounded at all dead-end or catch off points.
- A ground shall be located at each side and within 10 feet of working areas where conductors, sub conductors or overhead ground conductors are being spliced at ground level. The two ends to be spliced shall be bonded to each other. If practical the splicing shall be carried out on either an insulated platform or on a conductive metallic grounding mat bonded to both grounds. (If a situation exists where an insulated platform or metallic grounding mat cannot be used contact a supervisor for

instructions.) When a grounding mat is used, it is recommended that the grounding mat be roped off and an insulated walkway provided for access to the mat.

- Tower Grounding:
  - All conductors, sub conductors, and overhead ground conductors shall be bonded to the tower or any isolated tower where it may be necessary to complete work on the transmission line.
  - Work on dead-end towers shall require grounding on all de-energized lines. Grounds may be removed as soon as the work is completed provided that the line is not left open circuited at the isolated tower at which work is being completed.
  - When performing de-energized work from the structures, clipping crews and all others working on conductors, sub conductors, or overhead ground conductors shall be protected by individual grounds installed at every work location.

#### **Interstate and Four Lane Highway Crossings**

- In addition to all requirement listed above, when pulling wire over Interstates and four lane highways with speed limits of 55 mph or greater, the following procedures should be utilized:
  - The crossing shall be reported to the corporate office at least one week in advance of the pull. This report must include:
    - Location of pull.
    - Supervisor.
    - Job specific pulling plan that includes triple redundant protective measures that should include:
      - Traffic control.
      - Guard structures.
      - Observers.
      - Double catch-offs.
  - Traffic control will be coordinated with the customer, law enforcement, and/or traffic control professionals.
    - Pulls should be scheduled at times when there is the least amount of traffic
  - The pre-job briefing and pulling plan must be approved by an Area Supervisor prior to pulling any conductor or rope over an Interstate or four lane highway crossing.
  - An Area Supervisor must be onsite during the pull.
  - Whenever possible, multiple guard structures will be utilized in the median and on each side of the roadway.
    - Buckets may be used as guard structures only as a last resort.
    - Use rollers and not booms when utilizing bucket trucks as guard structures.
  - Tools, materials, and equipment must be thoroughly inspected before use.
  - Whenever traffic is moving, positive control shall be maintained on ropes and conductors not installed in a dead-end shoe.
    - Methods of maintaining positive control include equipment brakes, hoists, grips, and ropes. Conductors and ropes will be securely connected using Kellum grips.
    - Use correct size Kellum and swivel.
    - Band using 2 bands approximately 2" away from the tail end of Kellum.

- Hoists should be doubled and a second safety tie off grip should be installed on each conductor not securely under tension or secured in a dead-end shoe.
- Echo protocol shall be used between employees involved in the pull and observers, to stop and release traffic, and before removing a hoist or grip.
- Reconductoring
  - If possible, obtain an outage or get the line switched out.
  - Old wire should be laid out to provide adequate clearance.
  - After load is transferred, stop traffic before lowering old conductors.
  - Maintain positive control as conductors are being lowered.

## 8.7. Cutting & Grinding

### Requirement

- Before performing cutting, or grinding, evaluate and safeguard the work area for combustible items.
- When cutting, or grinding in elevated areas, cover the grating as much as possible and post a fire watch below as needed.
- Before applying heat, thoroughly clean, decontaminate, and/or purge machinery, tanks, drums, etc. that could contain explosives or combustible/flammable materials.
- Use #2 welding screens whenever pulsing oxy /acetylene to cut, and face shield during grinding operations.
- Keep cutting and grinding areas clean and free from accumulations of trash, rags, and other combustible items.
- For all hot-work processes in congested areas, wear clothing appropriate for welding.
- Clothing that is not appropriate for Hot-Work includes:
  - Synthetics such as nylon, polyester, acetate, and rayon
  - Blends of these synthetics such as polyester/cotton
  - Flame-resistant clothing intended for electrical work (including light weight Nomex and PBI-Kevlar).
- When extreme conditions exist, wear leather sleeves, aprons, and welding coats.
- While performing any hot-work operation, dress appropriately to protect exposed skin from sparks, radiant heat, and hot surfaces.
- When performing cutting operations, eliminate the possibility of sparks being caught in cuffed pants.
- When coveralls are worn for body protection, ensure that either a zip-front type is worn or that the flaps of button-type coveralls are secured with no openings.
- When welding on a crane or suspended load, establish an independent ground.
- Where air contaminants exceed permissible exposure limits, use proper ventilation/ respiratory protection.
- For stationary manifold systems, follow manufacturer system design criteria.

### Grinding

- Inspect grinders before use to ensure the grinder is in good repair and all safety guard devices are properly attached.
- Ensure guards on 90-degree grinders are between the user and the wheel.
- Before operating a grinder, ensure guards are in place.
- Before installing a grinding wheel, check the grinder to ensure the spindle speed does not exceed the maximum operating speed indicated on the wheel.

- Before changing wheels or rocks, disconnect grinders from energy source.
- Keep hand-held grinders in control until the wheel or rock comes to a complete stop.
- Operate and control grinders according to manufacturer's recommendations.
- Do not make adjustments to tool rests while the wheel is in motion.
- Where tool rests are required, adjust them to a maximum of 1/8 inches from the wheel. Ensure the distance between the wheel periphery and the adjustable tongue on the end of the peripheral member at the top never exceeds 1/4 inches
- Before installing wheels on stationary grinders, ring-test them to ensure integrity.
- On pedestal or bench grinders, ensure wheel or rock comes to a complete stop before leaving the area.
- Assemble air grinders according to the manufacturer's recommendations.

### **Oxy/Acetylene Safety**

- Inspect oxy/acetylene equipment before use. Immediately remove defective equipment from service, identify it, and do not use it until repaired.
- Do not permit oil or grease to come in contact with regulators, fittings, valves, gauges, and the torch assembly.
- Ensure the pressure of the oxygen and the acetylene does not exceed manufacturer's recommendation for the particular cutting or brazing operation being performed.
- When opening the valves on a regulator, always stand to one side and away from the valve opening.
- Before installing a regulator, crack the valve to remove any dirt or trash that could damage the regulator.
- When installing regulators, use the proper tool and do not over-tighten connections.
- Before opening the cylinder valve, back out the regulator handle. Then slowly adjust the regulator pressure.
- Before removing a regulator, close the cylinder valve and release all gas from the hose and regulator.
- When oxy/acetylene equipment is not in use, close cylinder valves and release the pressure in the hose.
- Always open the oxygen cylinder valve slowly, allowing it to backseat.
- Do not use acetylene at pressure exceeding 15 psi. (Pounds per square inch).
- Always use and store acetylene cylinders in an upright position.
- Do not store cylinders near combustible materials (e.g., waste, rags, oil, grease).
- Use a friction or stationary striker to light a torch. Do not light torches with matches, cigarette lighters, or hot work.
- To protect against flashback, ensure all oxy/acetylene equipment is equipped with flashback arresters at the regulator outlet and at the torch for both gases. A check valve alone does not satisfy this requirement.
- Remove gauges and replace caps on oxy/acetylene cylinders when they are not in use if the valve may be damaged by being bumped or knocked over.
- Ensure valve handles and/or wrenches are in place and use.
- When ventilation does not reduce airborne contaminants below the permissible exposure limits, wear respiratory protection.
- Do not use acetylene at a rate exceeding 1/7 of the contents of the cylinder per hour.
- Remove oxygen and acetylene cylinders from a standard dolly cart and return to storage if it can be reasonably anticipated that the cylinders will not be used in the next 24 hours.

## Compressed Gas Cylinders

- Compressed Gas Cylinder Storage
  - All compressed gas cylinders shall be stored in an upright position.
  - Cylinders shall be secured by a chain to ensure that they will not be accidentally knocked over.
  - Storage locations shall be well ventilated and ambient room storage temperatures shall not be allowed to exceed 125°F.
  - Cylinder storage locations shall be distinctly marked with the names of each compressed gas maintained at the location. NO SMOKING - FLAMMABLE GAS signs shall be posted at all entrances to locations where flammable gases are stored.
  - Each compressed gas cylinder maintained at a storage location shall be labeled with proper identification of its contents.
  - All cylinders in storage shall require valve protection caps at all times except when the cylinder contents are being dispensed.
  - Storage locations for oxidizing gas (i.e., oxygen) and flammable gas (e.g., acetylene) cylinders shall maintain a minimum distance of 20 ft to separate the oxidizing and flammable gas cylinders or by a non-combustible barrier at least 5 feet high having a fire resistance rating of at least one-half hour.
  - Cylinder storage areas containing flammable gases shall be stored to avoid contact with a possible ignition source. Walls of the storage area shall have a fire rating resistance of at least 1 hour, and doors shall be in accordance with NFPA 80.
  - Flammable gas storage areas shall be heated by indirect means (i.e., steam or hot water).
  - Electrical equipment within a flammable storage area shall be in accordance with NFPA 70.
  - Portable fire extinguishers consisting of carbon dioxide and/or dry chemical shall be available at the storage locations.
- Handling Compressed Gas Cylinders
  - Compressed gas cylinders shall not be used in areas where the cylinder tank may come in contact with any sparks or flames.
  - Compressed gases contained within a cylinder are under extremely high pressure. Therefore, whenever gas is to be withdrawn from a cylinder, pressure-reducing valves shall be used. Under no circumstances is gas to be removed from a cylinder without the use of a pressure reducing valve.
  - All cylinder connections, hoses, valves, etc., shall be inspected prior to using the compressed gas cylinder. All connections shall be tight with no leaks. The damaged and/or deteriorated cylinder, valves, couplings, hoses, etc., shall not be used.
  - When opening cylinder valves, gas outlets shall always be pointed away from the user and any other facility personnel standing in the immediate usage area.
  - All cylinder valves shall be opened slowly using only approved wrenches for the cylinder as provided by the supplier.
    - NOTE: When using a compressed gas cylinder, the operating wrench shall remain on the cylinder valve at all times.
  - All compressed gas-cylinder valves, couplings, hoses, etc., shall not be lubricated or allowed to come in contact with oil and/or grease.

- Torch handles can be purchased with flashback arrestors built-in, or flashback arrestors shall be added if not equipped.
- Separate flashback arrestors must be added to the regulators.
- Only experienced and properly trained persons shall use compressed gases.
- Cylinders of compressed gases shall not be placed in areas where there may be oil and/or grease nor handled with oily and/or greasy hands.
- After each use of a compressed gas, the cylinder valve shall be fully closed and all gas remaining in the regulator valve shall be slowly purged. The regulator valve shall be removed, the cylinder valve cap shall be installed, and the cylinder tank shall be removed from the work area and returned to its proper storage location.
- If the contents of a compressed gas cylinder are depleted, the cylinder valve shall be fully closed, and the valve protection cap shall be reinstalled. The cylinder tank shall be appropriately marked with an EMPTY TANK, sign and the tank shall be stored in a secured upright position.
- Secure cylinders upright, using substantial means suitable for the conditions. Ensure securing devices are capable of supporting the weight of the secured cylinders. Tape, string, ribbons, or rope less than 0.25 inches in diameter are not acceptable. If two devices are used, the cylinder must be secured between the top half and the bottom half of the cylinders.
- Identify, tag, and remove from service damaged cylinders and notify supplier.
- When cylinders are not in use and are designed to accept a cap, ensure valve-protection caps are in place and hand-tight.
- Do not store cylinders near combustible materials (e.g., waste, rags, oil, grease).
- Ensure compressed gas cylinders are properly identified and labeled.
- Do not store or set up cylinders near heat-producing devices or open flames.
- Do not store oxygen and flammable gas cylinders such as acetylene together. Separate them by 20 feet or a 1/2-hour flame-resistant barrier 5 feet high
- When transporting cylinders:
  - Keep them upright.
  - Compressed gas cylinders shall never be rolled, slid, or dragged from one location to another.
  - To transport cylinders, only a weight approved dolly (i.e., hand truck) shall be used to allow the cylinder to be moved in a secured upright position. ○ All pressure regulators shall be removed, and valve protection caps shall be installed prior to moving any cylinders.
- Do not use valve-protection caps for lifting cylinders.
- Before lifting or moving cylinders, ensure valve-protection caps are in place.
- Compressed gas cylinders may be stored in the sun, but storage area temperatures must not exceed 125°F.
- Compressed gas cylinders having residual product must be considered full and stored appropriately.
- Tag empty cylinders EMPTY, and keep valves closed and protective caps in place.
- Do not smoke, weld, or use open flames near compressed gases that are flammable, oxidizing, or reactive.



- When using compressed gas cylinders for welding operations, keep them far enough away from actual welding or cutting operations to prevent hot slag or flames from reaching the cylinder.

## 8.8. Confined Spaces

### Requirement

**\*NOTE: GMB Treats all Confined Space as permit Required unless deemed otherwise by a competent person.**

- When unsafe conditions are detected, the work area shall be ventilated until safety has been assured by additional tests.
  - Employees shall ensure there is adequate continuous supply of air.
- Emergency entry may be made into confined spaces when an unsafe atmospheric condition exists if a fresh air breathing apparatus is used (e.g., air line respirator, supplied air unit, oxygen generating apparatus, etc.). • When working in an unsafe or unknown atmosphere, a safety lifeline and the “buddy system” must be used.
- Smoking is not allowed in manholes. Under no circumstances shall gasoline or similar fuels be allowed in manholes.
- When manholes are open, signs and guards shall be in place to alert vehicles and pedestrians.
- Proper entry and rescue procedures shall be utilized. Confined Space Entry Procedure (Each step is explained in greater detail below)
  1. Determine if there is a confined space.
  2. Determine the type of confined space.
  3. Reclassify the confined space to the lowest possible level.
  4. Enter the confined space using proper procedures.
- Determine if there is a confined space
  - Space must be large enough for full body entry and;
  - Entry or exit must be restricted or limited and;
  - Space must NOT be designed for continuous occupancy.
- Determine the type of confined space
- Permit Required Confined Space (PRCS)
  - A confined space with hazards in addition to atmospheric associated with it.
  - Any of the hazards below would constitute a PRCS. – Hazardous Atmosphere
  - An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from one or more of the following:
    - Flammable gas, vapor, or mist in excess of 10 percent of its Lower Explosive Limit (LEL).
      - Airborne combustible dust at a concentration that meets or exceeds its LEL.
      - Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet or less.
      - Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent.
      - Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart C, Occupational

Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances.

- Note: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, and impairment of ability to self-rescue, injury or acute illness due to its health effects is not covered by this provision.
- Any other atmospheric condition that is immediately dangerous to life or health.
- Engulfment
  - The surrounding and effective capture of a person by a liquid or finely divided (flowing) solid material that can be breathed in to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.
- Taper Surfaces That May Trap Employees
  - A space with a tapering configuration in which an employee should become jammed, could find himself trapped and not be able to initiate a self-rescue, or be constricted in such a way as not to be able to breathe and thus be subject to suffocation. Examples are coal hoppers, dust collectors, duct work, etc.
- Enclosed Space
  - A confined space in which the only hazard or potential hazard associated with that space is atmospheric and that atmospheric hazard can be made safe and maintained safe for entry by means of continuous forced air ventilation.
- Non-Permit Required Confined Space
  - A space that meets the three conditions for a confined space but has no physical or atmospheric hazard.
  - Reclassify the confined space to the lowest possible level
- Permit Required to Non-Permit Required
  - Can be accomplished by eliminating ALL hazards, including atmospheric, from the space and demonstrating the hazardous atmosphere has been eliminated and cannot recur during entry.
  - Every effort should be made to do this from outside the space so as to eliminate the need for any permit entry.
  - Elimination of atmospheric hazards can be accomplished by purging the space with fresh air, cooling a unit down, providing natural ventilation, etc.
  - Permit Required to Enclosed Space
    - Accomplished by eliminating all of the hazards except atmospheric.
    - Lockout/tagout, blanking/binding of lines, and guarding are considered means of eliminating hazards. – Controlling atmospheric hazards with forced air ventilation is NOT considered elimination.
    - Should be done from outside the space to eliminate a permit entry.
  - Enclosed Space to Non-Permit Required
    - Same reclassification procedure as Permit Required to Non-Permit Required.
- Enter the confined space using proper entry procedures
  - Permit Required Confined Space

- Requirements
  - Must have authorized entrants, attendants, and an authorizing person train in permit required confined space entry procedures. – Prevent unauthorized entry.
  - Initial and periodic air monitoring.
  - An entry permit.
  - Rescue procedures (on site team or outside services) in place.
  - Equipment Requirements:
    - Testing, monitoring, ventilating, communications, and lighting equipment.
    - Barriers and shields.
    - Rescue and emergency equipment except when provided by offsite rescue service.
    - Ladders and equipment needed for safe entry and exit
    - Retrieval equipment unless its use would produce more of a hazard than not using it.
    - PPE (respirator equipment, protective clothing, fall protection).
- Enclosed Space
  - Demonstrate that the only hazard associated with the space is atmospheric.
  - Demonstrate (with air monitoring) that continuous forced air ventilation is sufficient to maintain the space for entry.
- Provide written certification to the entrants documenting that the above conditions are true (Enclosed space certification shall be executed and maintained at the site).

## 8.9. Excavations

### Requirement

- Underground facilities shall be identified before digging and precautions shall be taken when digging near underground facilities.
- Excavations must be inspected by a competent person.
- A ladder or other means of exit is required within 25 feet of each worker in excavations 4 feet or deeper.
- Occupied excavations 5 feet or deeper need protective systems based on proper soil classification.
- All materials must be at least 2 feet away from the edge of an occupied excavation.

### Underground Installations

- Before excavating in any area where any buried facilities are suspected, an effort shall be made to determine if any underground lines or other equipment exist in the area. If in doubt as to the location of equipment, call the utility involved (gas, telephone, sewer, water, etc.). In larger service areas Locate Centers are available and shall be contacted when excavations are to take place in that area.



Figure 39 Water Accumulation

- Whenever excavating is done in close proximity to buried facilities, it shall be done only by use of hand-digging tools or air knife. Employees shall not dig in a negligent or reckless manner under any circumstances.
- If electric cables are damaged, the following steps shall be taken:
  - The owner shall be notified at once.
  - The area shall be barricaded, and the public kept out until hazardous conditions can be eliminated.
- If gas lines are damaged, the following steps shall be taken as soon as possible:
  - The hole shall be left open to allow the gas to dissipate into the atmosphere. All possible sources of igniting the gas shall be removed or eliminated. (It is extremely important that no attempt be made to plug or crimp the line for purpose of stopping gas flow as this could create a spark igniting the gas.)
  - Residents of the area shall be warned when necessary and the public kept out of the area.
  - The local fire department shall be notified immediately.
  - The gas company shall be notified at once.
  - The local police department shall be notified.
- If communication cables are damaged, the communication company shall be notified at once.
- Access and egress: When employees are required to be in trenches 4 feet deep or more, an adequate means of exit, such as a ladder or steps shall be provided and located so as to require no more than 25 feet of lateral travel.
- Warning system for mobile equipment: When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.
- Protection for hazards associated with water accumulation
  - Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation.
- Stability of adjacent structures
  - Where the stability of adjoining buildings, walls or other structures is endangered by excavation operations, support systems such as shoring, bracing or underpinning shall be provided to ensure the stability of such structures for the protection of employees.
  - Sidewalks, pavements, and branch structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.
- In excavations which employees may be required to enter, excavated soil or other material or equipment shall be effectively stored and retained at least 2 feet or more from the edge of the excavation.
  - Sides of trenches 5 feet or more in depth shall be



**Figure 40 Spoil Piles**

shored, sloped, benched, or otherwise supported by means of sufficient strength to protect employees working within them. o Excavations less than 5 feet in depth shall be examined by a competent person\* to determine if shoring or sloping may be required.

- When trenches are left open, warning devices, barriers, barricades, or guard rails shall be placed to adequately protect the public and employees.
- At the end of each day’s work, as much of the trench as practical shall be closed.
- No more trenches shall be opened at one time than necessary.

**Inspections**

- Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a “Competent Person” for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions.
- An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift.
- Inspections shall be made after every rainstorm or other hazard-increasing occurrence. Note: Above inspections are only required when employee exposure can be reasonably anticipated.
- A “COMPETENT PERSON” (as related to excavations):
  - Must be able to identify existing and predictable hazards in the surroundings.
  - Must be able to identify working conditions which are hazardous or dangerous to employees.
  - Must be able to take prompt corrective measures to eliminate hazardous working conditions.
  - Must have had specific training in and be knowledgeable about:
    - Soil analysis.
    - Use of protective systems.
    - Requirements of the excavation standard.
- Fall protection: Where employees or equipment are required or permitted to cross over excavations; walkways, bridges, or standard guard rails shall be provided.

**Protective Systems**

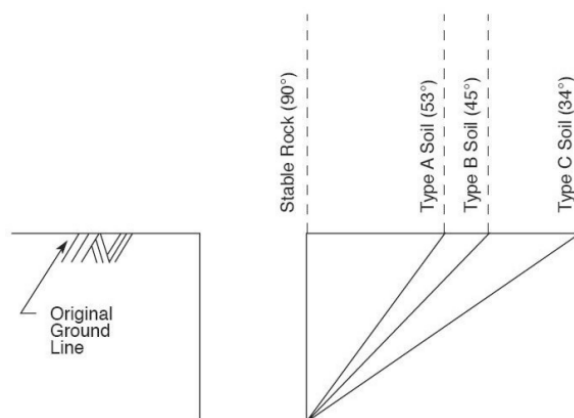
- Requirements for Protective Systems
  - Each employee in an excavation shall be protected from cave-ins by one of the adequate protective systems described in this section except when:
    - Excavations are made entirely in stable rock.
    - Excavations are less than 5 feet in depth and examination of the ground by a competent person provides no indication of a potential cave-in.
- Type of protective systems

**Table 10 Maximum Allowable Slopes**

| Maximum Allowable Slopes   |                     |
|--|---------------------|
| Soil or Rock Type  | Maximum Slope (H:V) |
| Stable Rock  | Vertical (90°)      |
| Type A   | 3:4:1 (53°)         |
| Type B   | 1:1 (45°)           |
| Type C   | 1-1/2:1 (34°)       |
| Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off. |                     |

A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°). Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

- Sloping & Benching
  - Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal) unless soil classification allows steeper slope.
  - Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.
  - Type C soil cannot be benched.
- Shoring
  - A pre-engineered shoring system comprised of aluminum hydraulic cylinders (cross braces) used in conjunction with vertical rails (uprights) or horizontal rails (Wales). Such a system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.
  - When shoring is used as a trench cave-in protective system, employees shall always remain within the confines of the shored area.



**Table 11 Maximum Allowable Slopes**



**Figure 41 Shoring Protective System**

**Table 12 Aluminum Hydraulic Shoring Soil Type A**

| <b>Aluminum Hydraulic Shoring – Vertical Shores for Soil Type A</b> |   |  |                               |                        |                         |
|---|---|--|-------------------------------|------------------------|-------------------------|
| <b>Depth of Trench (Feet)</b>                                       | <b>Hydraulic Cylinders</b>                                |  |                               |                        |                         |
|   | <b>Maximum Horizontal Spacing (Feet)</b>                  | <b>Maximum Vertical Spacing (Feet)</b> | <b>Width of Trench (Feet)</b> |                        |                         |
|   |   |  | <b>Up to 8</b>                | <b>Over 8 up to 12</b> | <b>Over 12 up to 15</b> |
| <b>Over 5 up to 10</b>  | <b>8</b>  | <b>4</b>                               | <b>2 INCH Diameter</b>        | <b>2 INCH Diameter</b> | <b>3 INCH Diameter</b>  |
| <b>Over 10 up to 15</b>   | <b>8</b>  |  |                               |                        |                         |
| <b>Over 15 up to 20</b>   | <b>7</b>  |  |                               |                        |                         |
| <b>Over 20</b>  | <b>See OSHA STANDARDS 1926.652 (C)(2) 1926.652 (C)(3)</b> |  |                               |                        |                         |

\*FOR APPLICATIONS OTHER THAN THOSE LISTED REFER TO 1926.652(C)(2) FOR USE OF MANUFACTURERS TABULATED DATA

**Table 13 Aluminum Hydraulic Shoring Soil Type B**

| <b>Aluminum Hydraulic Shoring – Vertical Shores for Soil Type A</b> |   |  |                               |                        |                         |
|---|---|--|-------------------------------|------------------------|-------------------------|
| <b>Depth of Trench (Feet)</b>                                       | <b>Hydraulic Cylinders</b>                                |  |                               |                        |                         |
|   | <b>Maximum Horizontal Spacing (Feet)</b>                  | <b>Maximum Vertical Spacing (Feet)</b> | <b>Width of Trench (Feet)</b> |                        |                         |
|   |   |  | <b>Up to 8</b>                | <b>Over 8 up to 12</b> | <b>Over 12 up to 15</b> |
| <b>Over 5 up to 10</b>  | <b>8</b>  | <b>4</b>                               | <b>2 INCH Diameter</b>        | <b>2 INCH Diameter</b> | <b>3 INCH Diameter</b>  |
| <b>Over 10 up to 15</b>   | <b>6.5</b>  |  |                               |                        |                         |
| <b>Over 15 up to 20</b>   | <b>5.5</b>  |  |                               |                        |                         |
| <b>Over 20</b>  | <b>See OSHA STANDARDS 1926.652 (C)(2) 1926.652 (C)(3)</b> |  |                               |                        |                         |

\*FOR APPLICATIONS OTHER THAN THOSE LISTED REFER TO 1926.652(C)(2) FOR USE OF MANUFACTURERS TABULATED DATA

## 8.10. Shoveling & Hand Digging

### General

- Use the correct tool for the task.
  - Shovel for digging or moving loose granular materials from one spot to another.
  - Spade for digging straight edged holes, slicing, and lifting sod or edging.
- Prepare the Body.
  - Maintain good physical health.
  - Do flexing and stretching exercises to loosen muscles and prevent injury.
- Recommended Rate.
  - 18-21 scoops a minute for shoveling tasks of short duration.
  - 15 scoops per minute for continuous shoveling tasks.
- Recommended Weight per Scoop.
  - At a rate of 15 scoops per minutes 10 to 15 pounds per scoop is the maximum.
  - Load should not exceed 25 pounds regardless of shoveling rate.
- Recommended Throw Height.
  - Throw height should not exceed 4 feet from the ground.
- Recommended Throw Distance.
  - Optimal throw distance is around 3 feet.

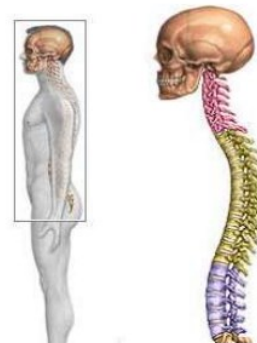


Figure 42 Natural Curvature of Spine.

### Shoveling

- Keep feet wide apart (slightly wider than shoulder width).
- Place front foot close to shovel.
- Put weight on front foot and use legs to push the shovel.
- When the load is on the shovel shift weight to rear foot.
- Keep the load close to the body.
- Turn feet in the direction of the throw and use legs to help throw the material.

### Digging

- Stand slightly behind the area where digging will occur.
- Place the shovel at a slight angle on the ground.
- Put foot on the spade and use leg muscles to push down.
- Ensure the load is free from the ground.
- Slide the load close to the body as it is picked up and keep it close.
- Turn feet in the direction the load will be thrown.
- Shift weight to the rear and use legs to help with the throw.

**\*NOTE: USE THE ENTIRE BODY WHEN SHOVELING OR DIGGING. DO NOT SHOVEL OR DIG WITH JUST ARMS AND MAINTAIN THE NATURAL CURVATURE OF THE SPINE.**



## 9. Overhead Distribution

### 9.1. Distribution Reclosers



- Reclosers are designed to interrupt and reclose a circuit automatically a predetermined number of times. A recloser opens a circuit in the same manner as a fuse in case of a fault but also tries to reclose the circuit after a predetermined time period. If the fault persists through the entire cycle of the recloser, it will lock the circuit out.
- Put another way, a distribution recloser is a fancy switch that can count. If a fault occurs, the recloser will try to close the circuit a set number of times (usually 3) and then lock the circuit out if it is not successful.
- This is advantageous for faults with temporary causes such as wires swinging together, lightning, tree branches, or animals.
- To protect line equipment and for employee safety, the recloser can be set on “one shot” meaning it will lock the circuit out immediately and not attempt to reclose the circuit.



Reclosers can be set to “one shot” using the “one shot” handle



Handle for opening and closing the recloser



## 9.2. Capacitors

Capacitors are used on distribution systems to neutralize the effect of customer inductive loads (irrigation pumps, for example). This improves the power factor which reduces current flow and raises voltage.

Capacitors consist of a metal container, one or two porcelain bushings, and a metal bar on the positive and negative sides with an insulating fiber between these bars. This makeup allows them to absorb and hold reactive current built up in an electrical circuit.



- Classifications
  - Fixed Capacitor Bank
    - Manually turned on or off
    - Protected by a fuse on each phase to one or as many units are banked for the phase
  - Switched Capacitor Bank
    - Uses a controller to turn itself on when needed and off when not
    - Switched banks are protected with fused cut-outs and oil reclosers for each phase to each unit or bank of units to quench opening arcs in oil
- Do not work on capacitors until they have been disconnected, grounded, tested, and short circuited.
  - Capacitors should be disconnected from their source for at least five minutes before grounding, testing, and shorting the terminals.
  - When checking the voltage, also check KVAR and ensure it is the proper amount for the location.

**\*NOTE: A capacitor is not dead immediately after being disconnected from the system**

- Handling and Storage
  - Before handling de-energized capacitors, they must be grounded between bushings using a ground chain and approved hot stick.
  - Stored capacitors should have a solid ground wire between the hot and ground bushings.
- Use a load break tool that is rated for the system voltage on the end of a live line tool to de-energize fixed capacitors or capacitor banks.
  - DO NOT use load break tools on back-to-back (parallel) capacitor banks.
    - Back-to-back capacitors should be oil switched because the current value can easily exceed the rating of the tool.
    - Per the manufacturer the tools are not designed for this purpose.



**Figure 43 Example of why a load buster on a stick should be used on capacitor banks.**

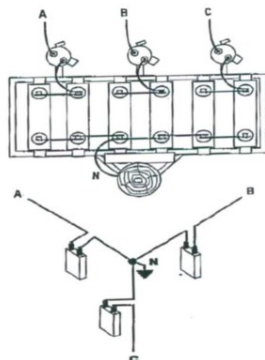
**Table 14 Capacitor bank Switching with Load Break Tool**

| Switching of Single Capacitor Banks with Load Break Tool |   |  |  |  |
|--|---|--|--|--|
|  |   | Maximum Capacitor Bank Rating-kVAR-Three Phase |  |  |
|  |   | Solidly or Effectively Grounded System         |  | Ungrounded System                                  |
| Tool Rating  | Nominal System Voltage, kV, Three Phase | Single Banks, Grounded Wye Connected           | Single Banks, Ungrounded Wye Connected | Single Banks, Grounded or Ungrounded Wye Connected |
| 25 kV & below  | 12 – 14.4                               | 1800   | 1800                                   | 1800   |
|  | 16                                      | 2400   | 2400                                   | 2400   |
|  | 20.8 – 23.9                             | 3000   | X                                      | X  |
|  | 24.9 & 26                               | 3600   | X                                      | X  |
| 25 kV & above  | 12 – 14.4                               | 3000   | 3000                                   | 3000   |
|  | 16                                      | 3600   | 3600                                   | 3600   |
|  | 20.8 – 23.9                             | 3600   | 3600                                   | 3600   |
|  | 24.9 & 26                               | 4800   | X                                      | X  |

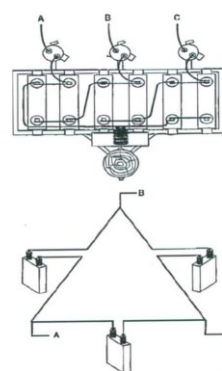
- When installing and removing capacitors
  - As with a transformer – check the nameplate on each unit before installation to make sure the voltage rating is correct for the system
  - Inspect capacitors that have blown fuses before refusing them
    - Look for bulged tanks or leaking fluids o Never use bushings as handle – use the hanger brackets
  - Use the lugs on the capacitor rack to lift banks
  - Allow each unit enough distance between the next for circulating air used in cooling
  - Ground the rack and units properly
  - Make sure the bank is protected with the proper type and size fuse

**\*NOTE: Helpful Hint – One shot should be given up before energizing a capacitor bank (check with customer)**

- Connections
  - Power capacitors should only be connected on systems where the terminal-to-terminal voltage does not exceed 110% of the rated voltage on the capacitor nameplate
  - Capacitors connected in Wye must be rated at line to neutral system voltage
  - Capacitors connected in Delta must be rated at the line-to-line system voltage



**Wye Connection-Phase to Ground**



**Delta Connection-Phase to Phase**

### 9.3. Overhead Phasing

#### Purpose

- Phasing sticks are used to:
  - Check for primary voltage.
  - Check to see if phases can be tied together.



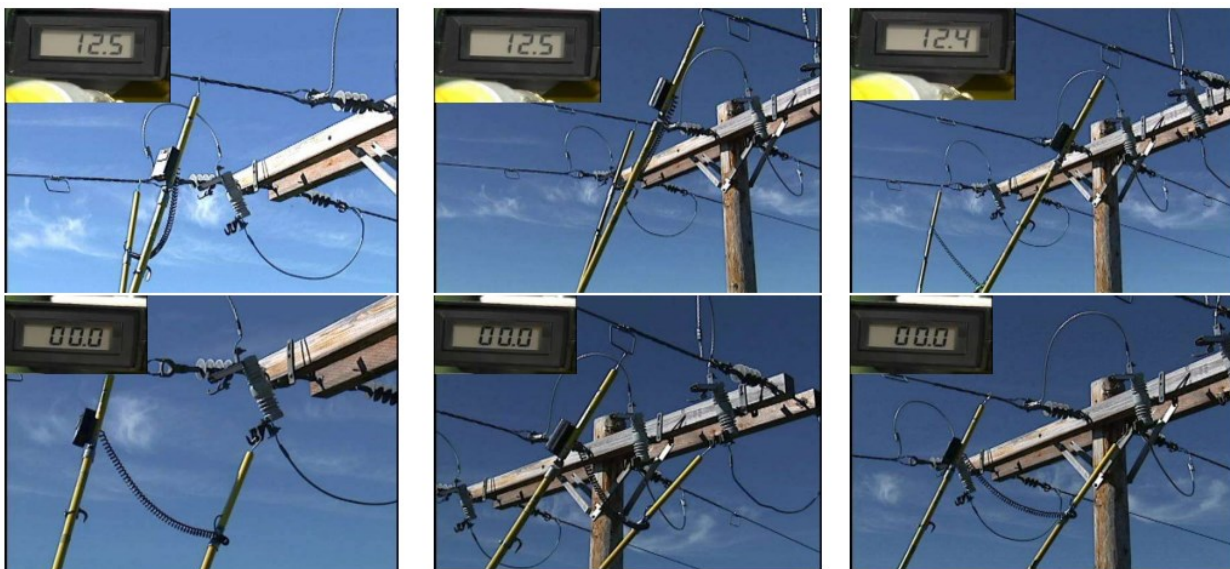
#### Materials Needed

- Phasing sticks.
- Resistors if necessary for high voltage.
  - Must be installed in pairs.
  - Multiply by multiplication factor to get voltage.
    - Example – One pair of resistors – multiply readout by 2
- Phasing sticks are to be considered conductive.
- Wear PPE as required.



#### Phasing an Overhead Line

The pictures below show a crew checking a circuit to see if a feeder can be tied. They are checking phase to phase voltages (road to center, center to field, and road to field) on both the high and low side of the cut-outs. This is a 12.5kV line so one would expect a reading of 12.5 phase to phase and a reading of zero across the same phase.



#### Understanding the Reading

- If the reading is zero – can be tied together.
- If there is a reading – do not attempt to tie.
  - Note – a very small reading (200 volts pictured) may only be in the meter and the circuit can still tie together – contact customer before switching.

- Get another meter to double check – DO NOT take chances.

#### Digital Readout

- Measured in kV to nearest 100 volts - Must multiply by 1,000 to get volts.
- 12.5 readout, for example, was 12,470 volts



Digital Readout

### 9.4. Mechanical Jumpers

#### Guidelines for Mechanical Jumpers

- Inspect before use.
- Control jumper ends at all times.
  - Secure jumper ends to the phase on which they will be installed.
  - Never have an energized or grounded jumper end in the bucket.
- Communicate (Pre-Job Briefing, Site Specific Discussion, Echo Protocol) before installing or removing mechanical jumpers.
- If unsure – ask before proceeding!
- Cover up properly.
  - Jumper insulation is for incidental contact only.
  - Jumpers must be isolated or secured in the clear.
- When double macking a line:
  - Mark the jumpers for identification.
  - Use echo protocol.
- Assign an observer and clearly indicate his responsibilities.
  - Observer should avoid distractions.
    - Visitors to the crew must wait to talk to observer until work is complete. Site Specific Mechanical Jumper Discussion
- Held at base of each structure on which mechanical jumpers will be installed or removed.
- Must include:
  - Step by step work plan.
    - Installation of mechanical jumpers should be the first step in the plan.
  - Each crew member's roles and who will be responsible for each step of the work plan.
  - Observer assignment and responsibilities.
  - Overview of structure and mechanical jumpers to ensure they are installed on the correct phase.



Jumper end secured with collar rope



Jumper end secured with T-Handle

#### Mechanical Jumper Inspection

- To inspect a mack:
  - Step-1 Visually inspect the jumper for any signs of defects.



New Style Clear Head / Old Style Orange Head

- New style jumpers have clear heads so the inside of the head can be seen. Step 2 is especially important for old style jumpers because it is not possible to see inside the head without first unscrewing it and sliding it down.
- Step-2 Unscrew the head of the jumper.
  - Checks
  - Overall conditions of clamps, cables, and ferrules.
  - All connections are tight – pay careful attention to the jam nut.
  - Burn marks.
  - Cleanliness.
    - If the mack is dirty use a wire brush to clean the threaded parts and the ends.
    - If the mack has a set screw (see picture) ensure it is in place and tight.

| Alive With Five Rule  |
|---|
| <ul style="list-style-type: none"> <li>• Jumper ends will not be located inside buckets when the other end is attached to or near energized equipment, neutrals, or grounds.</li> <li>• Lineman will remain in control of jumper ends at all times.</li> <li>• Jumpers shall be handled properly at all times.</li> <li>• Lineman shall use echo protocol when installing or removing jumpers.</li> </ul> |

### Mechanical jumper work plan

- Mechanical jumper work plan are not required to be documented but doing so is considered a best practice. It is also advisable to draw a diagram of the circuit and how mechanicals will be run to ensure effectiveness of the plan.
- Below is a sample mechanical jumper work plan that should be utilized during site specific mechanical jumper discussions.

**Table 15 Mechanical Jumper Work Plan**

| Mechanical Jumper Work Plan  |
|--|
| Use this form as a guideline for each structure specific discussion you have before installing or removing mechanical jumpers to ensure jumpers are handled properly and that each member of the crew understands their responsibilities and the steps to be taken.  |
| Qualified Observer   |
| Designate a qualified observer with no other responsibilities other than to watch and ensure jumpers are handled correctly and the work plan is followed.  |
| Phasing  |
| Discuss a plan to ensure jumpers are installed on the correct phases. If there are existing jumpers follow them to ensure correct phasing. Phasing should be a part of echo protocol if multiple employees will be involved. Discuss securing jumpers on the phase to which they will be installed. Talk about marking jumpers if you will be double macking a line. |
| Distractions   |
| Plan for distractions. Discuss who besides the qualified observer will handle any visitors to the crew. If there is a major distraction that interrupts the work discuss stopping and having another discussion before proceeding.   |
| Echo Protocol  |

|  |
|--|
| Discuss what echo protocol means.<br>Go through an example of how echo protocol will be used during the work that includes phasing.  |
| <b>Cover Up</b>  |
| Talk about the cover up to be used during the work.  |
| <b>Mechanical Jumper Safety</b>  |
| Discuss Alive with Five Rule Number Five, potential hazards of mechanical jumpers and the need to secure jumper ends at all times. Review never having energized jumper ends in a bucket.  |
| <b>Work Plan</b>   |
| Discuss a step-by-step work plan for installing and removing the jumpers and who will perform which task in what order.  |
| Do not proceed with installation or removal of jumpers without: <ul style="list-style-type: none"> <li>• Using this form as a guideline for your discussion at each structure on which mechanical jumpers will be installed or removed.</li> <li>• The agreement of the crew on the work plan</li> <li>• Ensuring each employee understands their roles and responsibilities in the work plan</li> </ul> |

### 9.5. Connecting Service at Meter Base

More and more of the electrical system is being installed underground. Line workers must install the cables correctly to maintain a high standard of service reliability.

- Steps to Install a Service
  1. Ensure the lines being worked are de-energized and the other end is in the clear.
    - Stubbed up outside of transformer with ends taped or capped.
    - Rolled up with ends taped or capped in bottom of transformer.



2. Remove meter base cover plate.
3. Push the conductor up the conduit into the meter base so that the ends extend 12" above the top of the meter base.



**\*NOTE: Be careful not to damage insulation on cable while performing the above task.**

4. Measure all 3 conductors by bending them into the position. Shape the conductors in an inverted 'U'. Two conductors go up one side of the meter base and along the top of the base before bending down to the lugs. The other conductor goes up the opposite side of the meter base and then along the top before bending down to the appropriate lug.

**\*NOTE: Check with customer about specifications.**

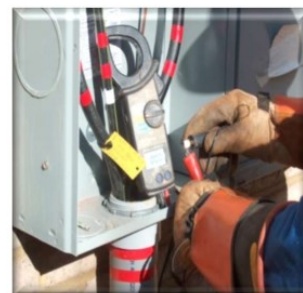
5. Mark the conductors where they exit the bottom of the lug.

- This can be done with a mark or a knife.
6. Cut the conductors at the marks and remove the shielding and insulation from the end to expose the amount of bare conductor required to make the connections.  
**\*NOTE: Be sure to use the PROPER TOOLS and CUT AWAY from the body when using a knife.**
  7. Wire brush connectors before applying anti-oxide inhibitor to the bare conductor ends.
  8. Insert the conductors into the appropriate lugs and tighten.
  9. Test customer side for open breaker and / or shorts (refer to Meter Setting).
  10. Re-install meter base cover plate.
  11. Make service connections in transformer.
    - If parallel service be sure proper conductors are connected by ohm-ing the cable.
  12. Go back to meter base and check for proper voltage.
  13. Set meter.



#### 9.6. Making a Service Hot

1. Determine that customer is not on site, but the disconnect switches are accessible.
2. Turn main and water heater disconnects (all customer switches) to OFF position.
3. Check customer's meter enclosure to make sure it is wired correctly and has no loose connections.
4. Using a voltmeter in the AC Voltage mode check first the line side terminals, phase to phase and phase to neutral for correct voltage.  
**\* CAUTION: WHEN RECONNECTING SERVICE THAT HAS A BYPASS DEVICE, CUSTOMER WIRING CHECKS (STEPS 3 and 4) MUST BE PERFORMED WITH METER INSTALLED AND BYPASS OPEN. AFTER DETERMINING THAT NO VOLTAGE OR SHORTS ARE PRESENT ON THE LOAD SIDE, THE BYPASS MAY BE CLOSED IN ORDER TO REMOVE BOOTS OR SLEEVES, THEN REINSTALL METER AND OPEN BYPASS.**
5. With voltmeter still in the AC Voltage mode, check the load side lugs, phase to phase to neutral for voltage. If any voltage is read, do not proceed unless the voltage can be removed (back feed).
6. Test the customer's wiring from the load side of the meter socket for short circuits or grounds. With the voltmeter in the Ohms mode, first touch the ends of the test leads together. The meter should read 0. If not, obtain another voltmeter before proceeding. Next, check across the load side lugs (phase to phase) and each load side lug to the neutral/ground terminal (phase to neutral) of the meter enclosure. If the readings are anything other than OL (Open Line), do not set or connect the meter.





7. Make service to line side of meter socket hot (if this has not already been done). Check the line voltage (refer to Step 4).
8. Insert meter into socket. Seal the enclosure properly.

**In Case of Difficulty**

- If the customer’s wiring does not check out free of short circuits or grounds, do not set meter.
- Advise the customer of difficulty found.
- If the customer is not on site, the disconnect switches are not accessible, and there is load on the customer’s wiring; do not set the meter.
  - The order cannot be worked.

**9.7. Crossarm Change Out**

- Set up equipment and cover up.
- Get a non-reclose (one shot) order if customer allows.
- Determine proper location to install new arm(s).
- Listed below are various methods to replace a crossarm:
  - **Float conductors**

Recloser set to “One Shot”



- **Float conductors**
  1. Untie outside phases and check for clearance as conductor is being lowered (when floated out wire should be no more than two feet below the arm).
  2. Untie center phase if it is on the arm and secure it to the pole.
  3. Change out arm and reconnect phase.



- **Place new arm just below old arm on opposite side**

1. Untie conductor and place covered conductor on bucket.
2. Remove old insulator and install insulator in new arm.
3. Re-tie conductor.
4. Repeat this process on other phases until completed.
5. Remove old arm.



- **Place temporary arm beneath old arm**

1. Transfer conductors to temporary arm.
2. Remove old arm and install new arm.
3. Transfer conductors to new arm.



- **Replacing Double Arms**

1. Double arms can be replaced one at a time.
2. Install temporary arms.
3. Install two hoists from eye nut on old DA bolt to conductor and jack a bubble in conductor.
4. Install two more hoists from eye nut on new DA bolt to conductor.
5. Slack off hoists on old arm while taking up on the hoists installed on the new arm to transfer conductor down.

6. Install new arm and reverse procedure to move conductors to permanent arm.
7. Remove temporary arm.

### 9.8. Opening & Closing Cut-out Doors

- Do not stand directly beneath a cut-out door when it is being opened or closed. Standing beneath the door puts an employee in the line of fire from falling objects such as debris and the door itself.
- Proper position is so the stick is at a 45° angle to the cut-out as pictured.
  - This is true whether standing on the ground or working from a bucket.
  - If the stick is not long enough to obtain this position on the ground, climb the pole or open / close the cut-out from a bucket.

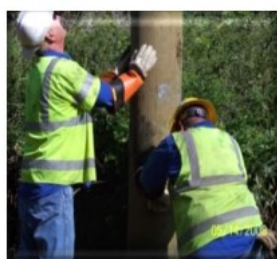


### 9.9. Pole Framing

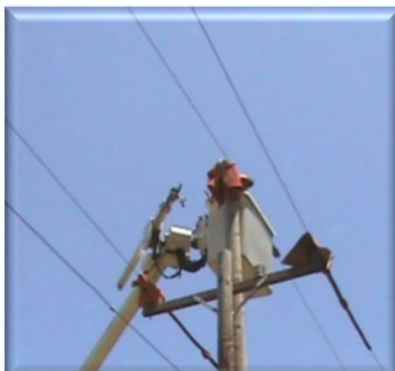
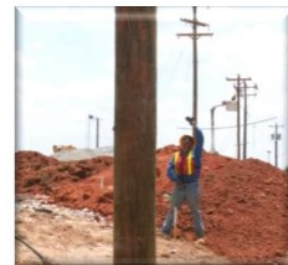
- Preparing newly installed poles for conductor stringing is a regular part of a lineman's duties. In pole framing, the pole is prepared for conductor installation. The needed hardware, crossarms, insulators etc., are installed in preparation for conductor stringing.
- Pole framing must be done accurately and to customer specifications. Some accepted standards are:
- Bore holes through the center of the pole and at right angles to the pole. Recloser set to "One Shot".
- Bore holes slightly larger than the bolt, i.e., 11/16" bit for a 5/8" bolt; 13/16" bit for a 3/4" bolt.
- Crossarms are to be at right angles to both the pole and the line they will support.
- Cotter pins in insulators and dead-end clamps are to face toward the pole.
- All measurements for spacing, etc., are to match the drawing and are taken from the top of the pole.

### 9.10. Pole Change-Out

- Ensure locates are current.
- Make sure pole size matches work order.
- Best location for new pole could be determined by:
  - Old pole leaning.
  - Equipment on pole.
  - Primary dips.
- Set up equipment and cover up.
- Get a non-reclose (one shot) order if customer allows.
- Reposition old wire as necessary for clearance.
- Check pole and adjacent structures for:



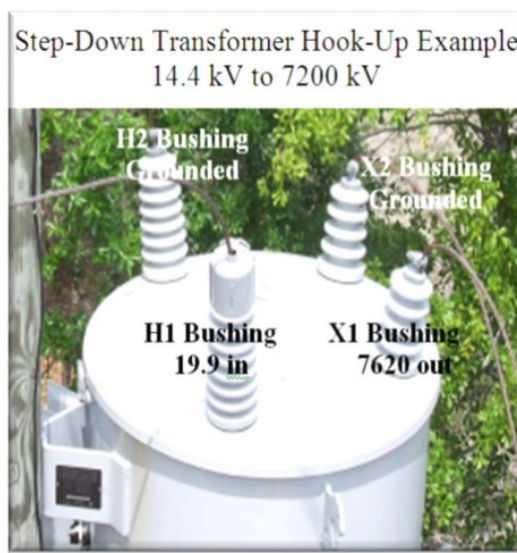
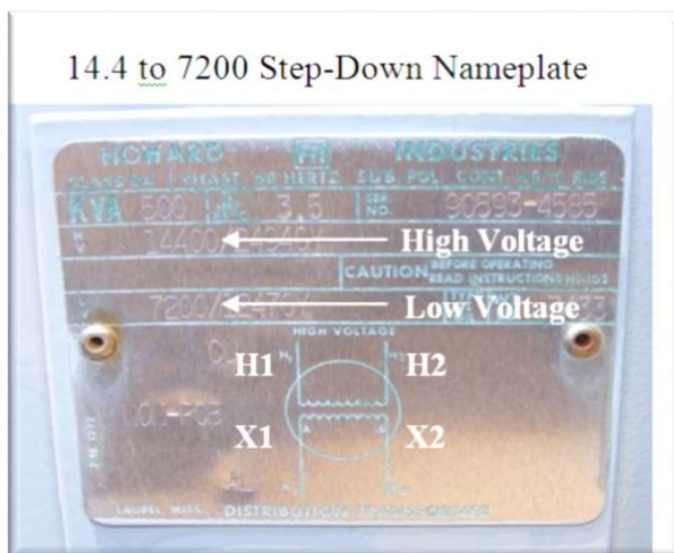
- Rotten poles.
- Rotten crossarms and braces.
- Deteriorated wire.
- Broken tie wire.
- Dig pole hole to proper depth.
  - Avoid damage to telephone, cable, water, or fiber optic lines (hand dig if necessary).
- Ensure that the old pole is stable and secure prior to digging the new pole hole.
- Set the pole.
  - Use transferrable pole claws if needed because of energized lines or reach.
    - See Digger Derricks for more information on transferrable pole claws.
  - Ensure cable is placed high enough on the pole to make the pole butt heavy.
  - Stand clear of the vehicle whenever a pole is being set unless involved in the operation.
  - Watch for winch line buildup on one side.
  - Energized lines or poles must be covered with protective equipment.
  - Keep an eye on the pole grabs.
- Plum the newly set pole to ensure it is set correctly – take pride in the work.
- Tamp the hole properly to prevent future settling.
- Transfer conductors and attachments.
- Cut the top off the old pole
  - If pole must be salvaged for reuse the pole ground should be removed or cut low enough on the pole so it does not become energized in case of contact with the primary lines.
  - **NOTE: DO NOT PULL WITH WINCH LINE**
  - Dig a hole adjacent to pole if needed.
    - Move the pole left to right to break it loose from the ground.
  - Pull with boom only while repositioning winch line as needed.
- Ensure cable is placed high enough on the pole to make the pole butt heavy.
- Remove the remaining pole butt if possible.
- Tamp the old pole hole.



## 9.11. Step Down Transformer Installation

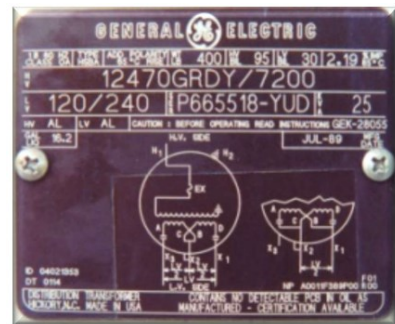
### Procedure

- Install the unit(s) on the pole so the bushing will align with the conductors as much as possible.
- Units with two tall and two short bushings.
  - One tall and one short must be grounded.
  - One tall and one short must be energized.
    - See example of 14.4 to 7200 nameplate and hook-up.
- Check nameplate for voltages
  - Stepping down from what voltage to what voltage.
- Be sure to cut jumpers or conductors on conversion day to eliminate bypassing the step-down unit.
- Should two or more units on 2 or 3 phase circuits be installed with transformer banks, all units must be connected. properly to keep the polarities the same on all phases.
- When energizing or de-energizing:
  - Use an approved hot stick.
  - Do not work directly underneath the transformer as the lid could blow off if the transformer is faulty.
- Questions regarding connecting or checking a step-down transformer should be directed to a foreman, general foreman, or supervisor before proceeding.
- A general foreman or supervisor is required to verify all step-down transformer installations before the job can be cleared.



## 9.12. Transformer Change-Out

- Check nameplate before loading transformer per work order.
- On the job site:
  - Verify primary voltage on the transformer matches system voltage.
  - Verify secondary voltages on old and new transformers match.
  - Visually inspect each transformer for cracked bushings or oil leaks.
- Notify customer of outage.
- Set up equipment and cover up.
- De-energize transformer.
- Remove hot line clamp with approved live line tool.
- If squeezed up solid use appropriate cover up on switch after door has been removed.
- Remove secondary leads from transformer.
- Remove hot legs first / neutral and grounds last.
- Prepare to remove the old transformer.



### Blocks

- Attach blocks as high as practical on pole and use a tag line.
- Tighten up on the blocks, loosen bolts, slack off blocks, and place a screwdriver behind the top hanger to help the transformer slide off the top bolt and keep it from digging into the pole.

### Line Truck or Material Handler

- Position boom, attach winch rope to sling, and remove transformer.
- Lower transformer to the ground.
- Install new transformer.
- Hook up neutral and grounds.
- Reinstall high side jumper and energize.
- Check secondary voltage phase to phase and phase to ground.
- De-energize transformer.
- Install secondary leads.
- Re-energize transformer.
- Check voltage again and check customer's meter.



## 9.13. Transformer Handling & Transportation

- Transformers are subject to various types of damage. Most of these result from poor handling and transporting practices. Some of the most common damages are:
  - Porcelain bushings being broken or cracked due to rough handling or over tightening of the bushing connector.
  - Tank damage in the form of scratches, dents, or punctures. Scratches cause premature rusting of the tank. Dents Helpful Hint Tighten up on the blocks, loosen bolts, slack off blocks, and place a screwdriver behind the top hanger to

help the transformer slide off the top bolt and keep it from digging into the pole. Dents reduce clearances between line internal windings and the grounded tank. Punctures allow the insulating/cooling transformer oil to expel causing rapid deterioration of the transformer.



- Gasket damage at the lid and bushings often caused by improper alignment and tightening allows moisture to enter the tank. This moisture destroys the insulating qualities of the oil and accelerates rust.
- Core damage often results when the mounting brackets break due to a drop or rough handling. Also exercise care when lifting the lid on top mounted bushing transformers to ensure the ends of the primary lead(s) are not pulled out of the core.
- Transformers are delivered from the manufacturer in wooden crates. They should be left in the shipping crate until erected. If the crate must be removed before transporting, secure the transformer by tying to prevent any movement on the truck.
- Before putting a transformer into service, it should be checked carefully for damage. Inspect it for dents and scratches to the tank, oil leaks due to damaged gaskets and the bushings for broken or missing connectors. An internal check of the transformer would be required if the tank has dents, bushing cracks, or gaskets damaged.

#### 9.14. Transformer Name Plate Data

- Interpretation of the following data found on the transformer nameplate is essential to its proper selection and connection:
  - kVA or capacity in thousand volt-amperes.
  - HV, the voltage to be applied across the high voltage coil must be matched to the nameplate rating. Some transformers have two or more tap settings on the primary coil allowing their installation on different primary voltages. If this is the case, ensure that it is placed on the correct setting.
  - LV, the voltage value required across the secondary coil or coils.
  - Insulated for Wye connection. This indicates that one high voltage terminal should be grounded and the other connected to a phase, with a phase to ground voltage equal to the HV rating.



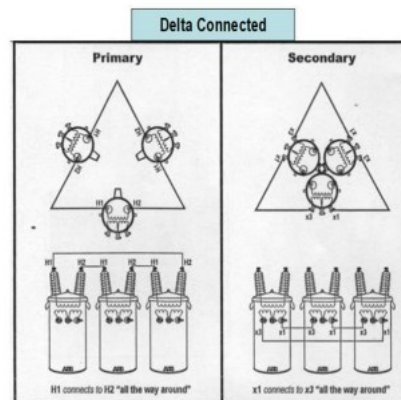
- The A, B, C, and D connections to the X1, X2, X3 secondary bushings. These provide a means of placing the secondary coils in series or parallel to give 120 V, 120/240 V or 240 V output.
- Hz, hertz, or frequency, whether the transformer is built to operate at 25 or 60 cycle power.
- Serial number and name of manufacturer, usually recorded to maintain a reference as to the location of each transformer.
- Weight that must be rigged to handle.
- Number of liters of oil installed when manufactured.

### 9.15. Transformer Banking

- As a lineman, you will often install, maintain, and trouble-shoot three-phase transformer banks. Understanding how the bank works will help you install it to standard and fix it should trouble occur. Before connecting transformers, whether single phase or three phase, you must have the following information:
  1. Primary or High Voltage - a transformer is rated to operate on a given primary voltage. If it is supplied with other than its rating, it will not give the rated secondary voltage.
  2. Secondary or Low Voltage - is the voltage the transformer is rated to deliver if the primary voltage is supplied as rated on the nameplate.
  3. If the transformers in a bank have tap changers, all transformers must be on the same percentage tap position to ensure the same output voltage on all three phases.
  4. The impedances of banked transformers must be as close as possible to bank properly. If not, the one with the lowest impedance (most efficient) will tend to hog the load or overwork.
- When these four conditions are met, the transformers are ready to bank. Most distribution systems today are Wye systems with three phases and a neutral. A Wye system has the following characteristics:
  - Three-phase, four wire
  - Phases are said to be positive
  - Neutrals are negative and are grounded There are two voltage levels, phase to ground and phase-to-phase, with the phase-to-phase value being 1.73 times the phase to neutral (ground) value

#### General Guidelines

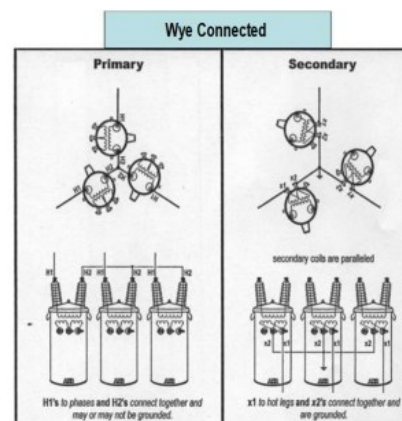
- It is the responsibility of the foreman or person in charge to check the nameplate on each transformer to be installed, making sure the nameplate voltage and the voltage specified by the work order match.
- Transformer nameplates must be checked for polarity and percentage impedance when installing a three-phase bank or when changing out a defective transformer in a bank, in order that the transformers will bank properly. The



**Delta Connected: When three coils are connected in SERIES it is known as Delta.**

phase rotation must also be checked before any connections to the load are made.

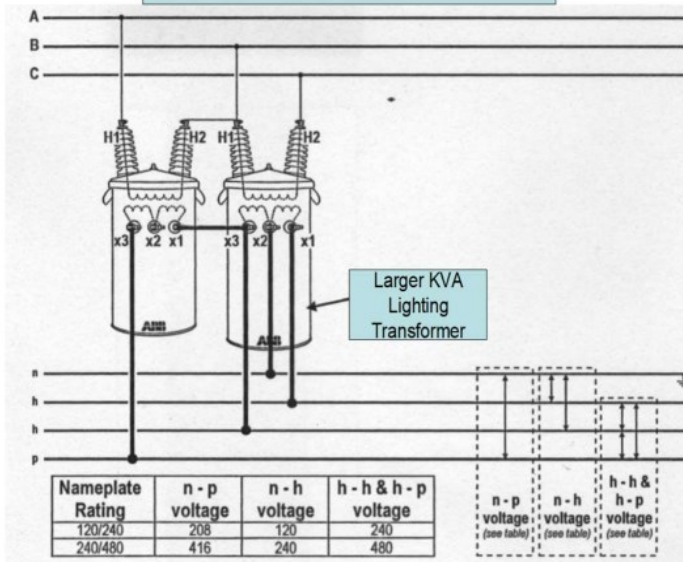
- Visually inspect each transformer for cracked bushings or oil leaks prior to installation and tag and report these to your supervisor or the customer for whom the work is being performed.
- During transformer installations, the neutral and/or ground attachments will be made first. During the removal of transformers, the neutral and/or ground attachments will be removed last.
- Taps made from the high side of a transformer must be made with an approved Hot Stick.
- Transformer connections shall be tightened snugly when installing and transferring transformers. (Bending and repositioning existing secondary bus can cause loosening at lug points potentially resulting in future problems.)
- It is the responsibility of the employee in charge to check (with a voltmeter) the secondary voltage of transformers prior to energizing the secondary conductors to the customers.
- When installing or performing work on transformer banks, a rotation check will be made, and the secondary leads properly marked. It should be noted that if an existing transformer bank is being transferred or new bank is being installed, any previous lead marking installed by others should be ignored. (Linemen typically mark leads red, white, and blue for phase rotation – Installations made by commercial wiring electricians denote white and gray as neutral conductors – For this reason it is imperative that the customers neutral be identified before any secondary leads are connected.)
- When checking voltage on a transformer bank, check all phases- phase to phase and phase to ground
- On straight 240 or 480 power bank the phase to ground reading will fluctuate
- In order to supply three phase power, single phase transformers are inter-connected into a configuration that involves all three phases and is either connected Wye or Delta. Open Delta – Open Delta and Open Wye – Open Delta Bank Connections Open Wye/Open Delta or Open Delta/Open Delta connections are often the most economical way to serve a small three-phase load because only two primary phases and two transformers are needed to provide three-phase power. This connection supplies a three-phase load 86% of the total capacity of the two transformers and are approximately 57.7 percent as efficient as closed banks.



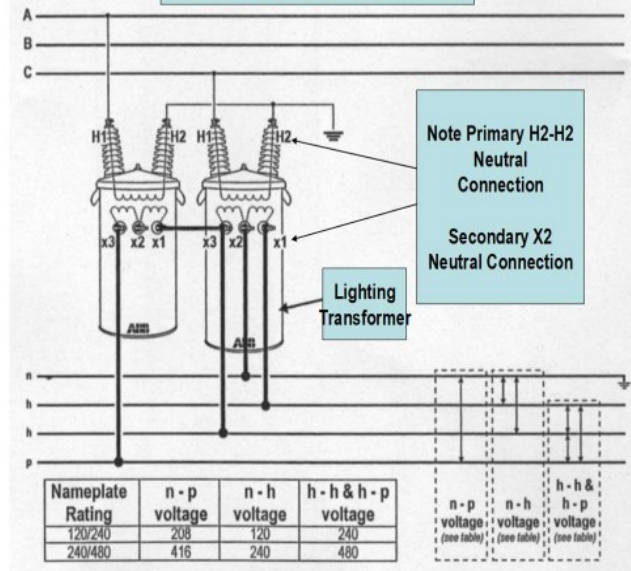
**Wye Connected: When three coils are connected in PARALLEL it is known as Wye.**



### Open Delta-Open Delta Bank



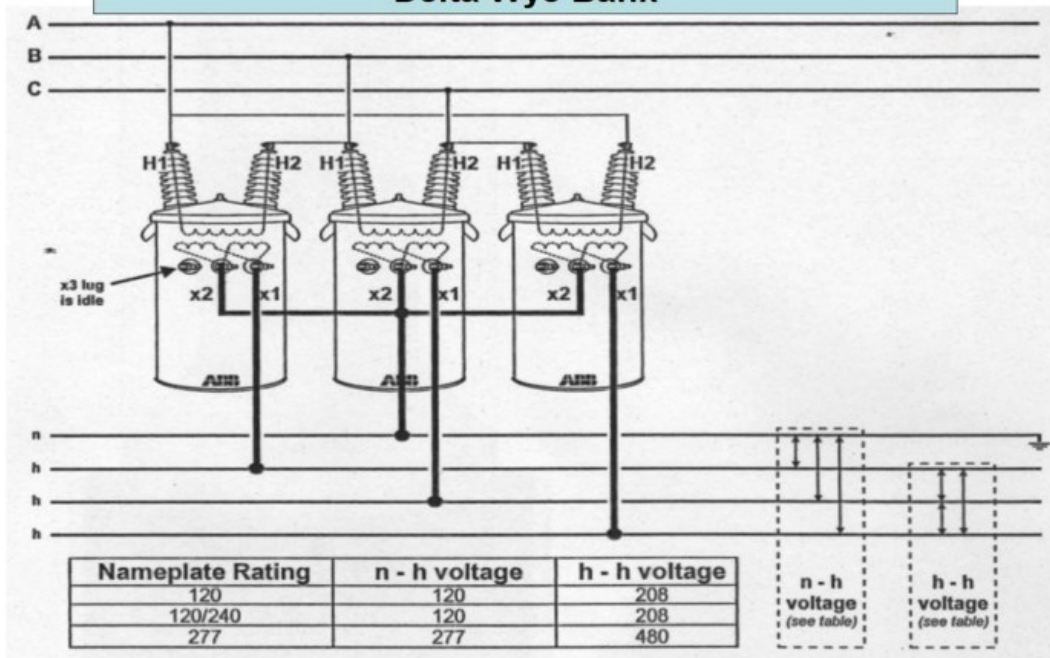
### Open Wye-Open Delta Bank



### Delta Wye Connections

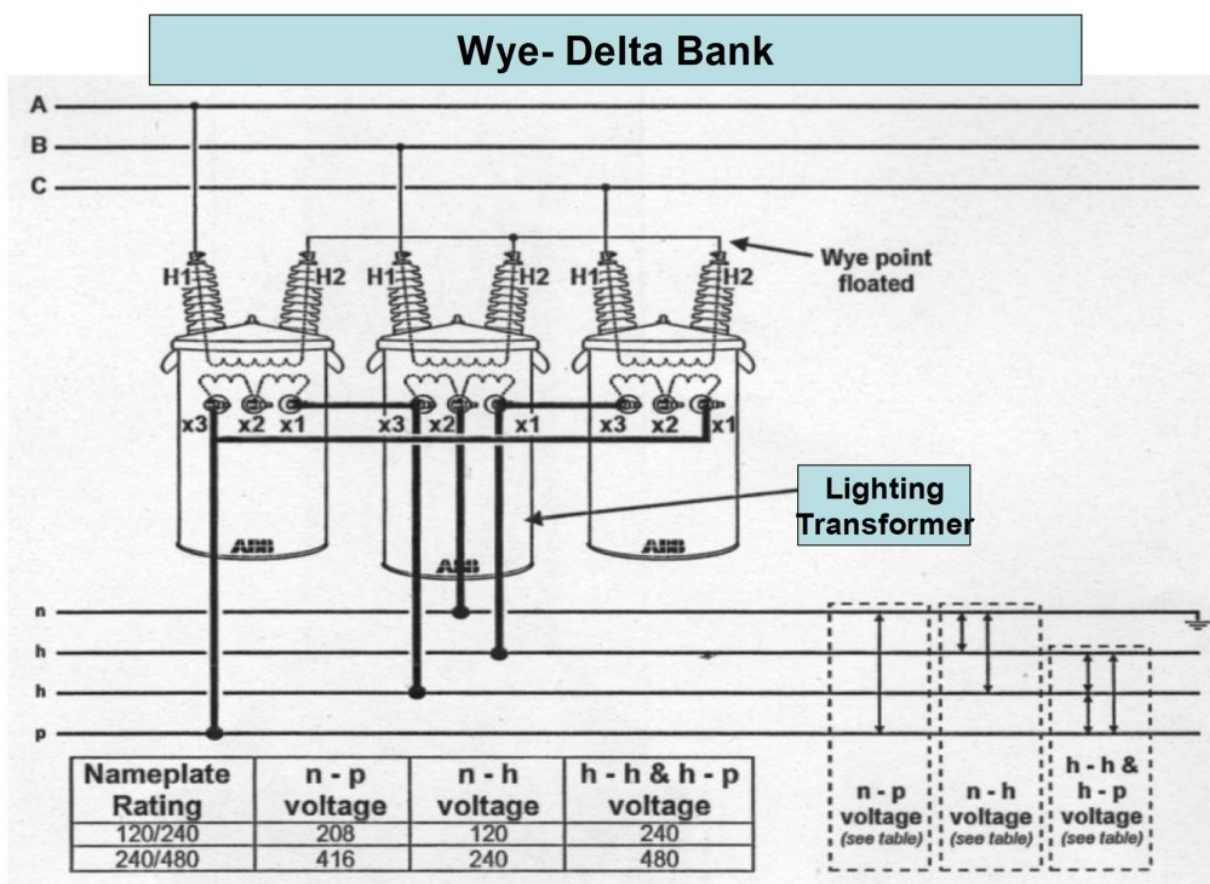
- Another type of transformer bank connection is a Delta-Wye, which has a Delta-connected primary and a Wye-connected secondary. This type of transformer bank is a combination of a primary side Delta connection and a Wye connection on the secondary side.

### Delta Wye Bank

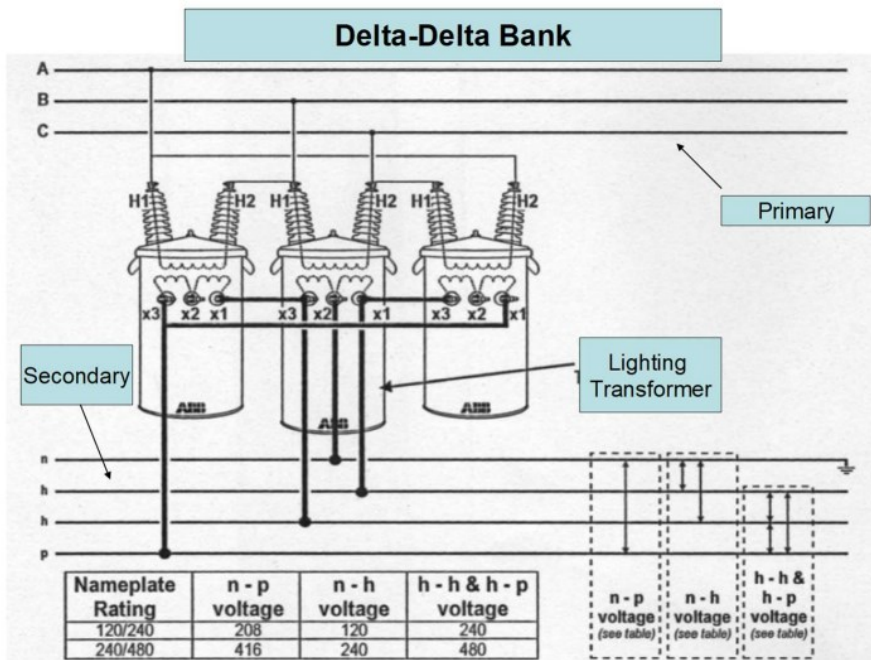


### Wye Delta Connections

- During connection and operation, transformer banks exhibit definite Wye or Delta characteristics, depending on the secondary voltage required.
- A "floating neutral" brings with it some hazard, as it may be alive at line voltage (remember it is not grounded).
- Transformers used in this connection must have two primary bushings.
- This connection has a common or neutral point, even though it is not grounded. As three phases are connected, each phase (and transformer primary coil) will have voltage across it.
- Unbalanced secondary voltages may result from any of these causes: unbalanced primary supply voltages, unequal loads between phases, banked transformers having different tap settings, banked units of different rated KVA, or banked units of different impedance.
- Lighting Transformer is largest KVA.

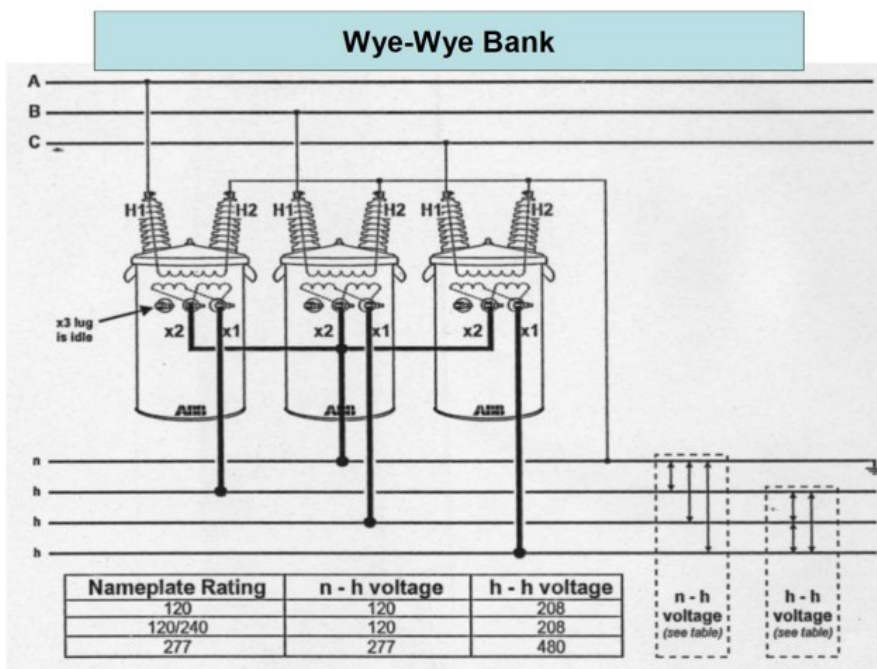


## Delta-Delta Connections



## Wye-Wye Connections

- Secondary coils are paralleled leaving X3 bushing on each transformer idle. This connection permits balancing single-phase loads among the three phases. This bank can be built using single or dual primary bushing transformers.



### Supply Line Fault

- Delta connected secondary, fed from Wye connected primaries have a floating neutral in the primary wiring connection. The floating neutral is interconnected among the three distribution transformers H2 bushings, but not connected to the system neutral.
- If a primary phase supplying the transformer bank loses power (floater, tree contact, etc.) the problem will not be immediately evident by looking at the transformer bank fused cut-outs. A voltage reading at the customer's panel will indicate this condition by giving voltage readings of approximately:
  - 210 v, as read phase to phase in the panel box. A line patrol of the line feeding the bank should indicate the problem on the main line.
  - This condition may be indicated also by reports of some single-phase customers out of power.

### Bad Secondary Connection (at transformer)

- Note: A floating neutral brings with it some hazard; in that it may be alive at line voltage. Transformers used in this have three primary bushing connections at H2 bushings.

### Troubleshooting Three Phase Transformer Banks

#### • Switch Open

- In most cases, when a transformer has malfunctioned, the transformer switch will be open. The following are the most common causes of transformer outages with the switch in the open position:
  - High voltage surge (lightning; switching surges)
  - Broken fuses
  - Short circuit to ground through external causes (broken bushings, birds, animals, etc.)
  - Overload on secondary due to high customer loading
  - Short circuit on secondary caused by tangled service wires (a type of overload)
  - Internal short circuit from burned off coils or broken leads
- All of these can usually be determined by visual inspection, except internal short circuit which is inside the transformer.
- Most transformers are protected from over-current by a cut-out type fuse. Common practice, in an attempt to restore power, is to re-fuse and close in the cut-out.
- Some transformers have a current limiting fuse in series with the cut-out fuse. If the current limiting fuse is blown, the transformer may have faulted internally.
- Remove the secondary leads, replace the current limiter, and re-energize transformer with the fused cut-out.
- Check for voltage if voltage is correct the transformer is good.
- If fuse blows or voltage is incorrect the transformer has faulted internally and must be replaced.



#### • Switch Closed

- If the transformer is not working but the switch is closed:
- First, make sure the fuse in the closed switch is intact. Sometimes, on minor overloads, the fuse melts but the cut-out fuse holder may not drop open.

- Check this by opening the cut-out with a switch stick. If the fuse is defective, it will be evident as soon as the switch is opened. If the fuse is intact check for an isolated primary line. Other reasons for failure may be:

- Broken primary leads (phase or neutral)
- Faulty connections in primary leads o Faulty secondary connections (usually results in partial power)
- Open circuit internally (primary or secondary)



- Most of these can be determined by visual inspection, except open circuit internally, which is inside the transformer.

- **Verifying the Transformer is Faulty**

- Open all remaining switches
- Isolate the faulted transformer from the bank
- If the bank is a closed Delta 120/240 (with a high leg) the floating primary neutral must be grounded
- If it is one of the power transformers, then a neutral lead must be placed in the center bushing
- Energize this transformer individually
- Check for correct voltage
- If voltage is good, then the fault is most likely in the service



- **Checking the Service**

- Check the service or services for any visible damage.
- There may be clues as to the location of an underground problem such as signs of fresh digging for fences, shrubs, recent landscaping, etc.

- **Ferro-resonance**

Ferro-resonance may produce very high voltages on three-phase transformer banks. This condition is most likely on higher voltages such as 25KV on banks connected ungrounded Wye to Delta. A grounding switch properly used will usually prevent ferro-resonance.

- If customer guidelines differ from ours, follow customer instructions.
- The following procedures should be used for pole-mounted or platform-mounted banks equipped with a grounding switch:
- Energizing the bank:
  - Close the ground switch.
  - Close middle fuse cut-out first (lighting transformer), then either of the remaining cut-outs next, making sure the fuse holders are closed properly.
  - Open the ground switch.
  - Check the secondary voltages.

- Replacing blown fuses:
  - If one fuse is blown, close the grounding switch and open outside cut-outs first, the middle (lighting cut-out) last.
  - If two fuses are blown, open the remaining cut-out and then close the grounding switch.
  - Refuse the blown fuses.
  - Close middle fused cut-out (lighting cut-out) first, then two outside cut-outs next, and making sure the fuse holders are closed properly.
  - Open the ground switch with load buster.
  - Check the secondary voltages.
- De-energizing the bank (no fuses blown):
  - Close the ground switch.
  - Open outside fused cut-outs first and the middle-fused cut-out (lighting cut-out) last.
  - Open the ground switch.
  - Check for back feed.
- Notes:
  - Close lighting transformer cut-out first if customer's main is closed. o Open outside transformer cut-outs before the lighting transformer cut-out if customer's main is closed. o If lighting transformer fuse is blown, do not close grounding switch until customer's main is open. o Know that when one cut-out is open on a Wye Delta bank, the bottom of the cut-out will be hot.
  - Ferro-resonance is likely when energizing or de-energizing a three-phase transformer fed through an underground cable where the cut-outs are pole mounted on the dip pole.
  - Ferro-resonance is likely when a conductor is broken or opened on a three-phase tap line, feeding on an ungrounded Wye Delta bank. The longer the tap, the more likely the Ferro-resonance so long as there are no single-phase transformers between the open conductor and the bank.
  - Ferro-resonance is not usually a problem under the following conditions:
    - When using three-phase switching.
    - When the transformers have secondary load connected.
    - When the bank is connected open Wye.

**9.16. Street Light Work**

- Series street light circuits (arc circuits) shall be worked as energized primary circuits in accordance with rules for the distribution voltages on the system.
- Multiple control street light circuits are to be worked as energized secondary.



## 10. Underground Distribution

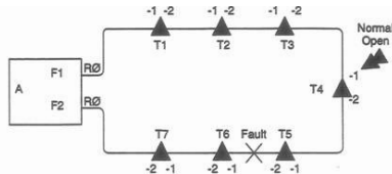
### 10.1. General

- Gloves and Sleeves must be worn along with overshoes and eye protection when unlocking electrical equipment (i.e., transformers, high voltage cabinets, etc.) unless the equipment is known to be de-energized and grounded between that location and all possible sources of energy. Continue to wear gloves until the equipment is relocked or de-energized and grounded. If the employee believes the line is de-energized and grounded, he shall not remove his rubber gloves or overshoes until he checks the line by approved means.
- Approved hot sticks will be used during the switching process when primary switching is being performed, the secondary will be covered with rubber blankets or secondary boots approved for the voltage being worked.
- Employees should always be aware of the possibility that the outer casing of a pad mount transformer could be energized particularly if they are changing out bad cable where a concentric neutral may have corroded.

### 10.2. Underground System Components

Depending on the location, underground systems may be fed directly from a substation or from an overhead line. If fed directly from a substation, the underground cables will be connected to the station breakers via a stress cone or pothead terminator and will enter the ground within the station.

If fed from an overhead line, the pole where the underground cable taps onto the line is called a "riser" or "dip" pole, and the cable is protected on the pole by enclosing it in conduit. The underground cable taps into the overhead line via a switch, lightning arrester and cable termination called a stress cone or pothead.

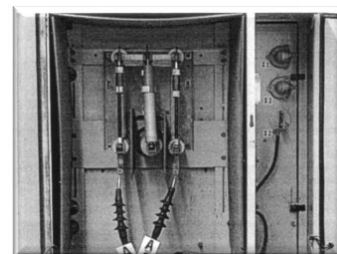


The preferred underground system has a loop feed. This means that there is more than one possible feed into the system, providing a backup supply should a fault occur on the main feed or on a section of cable within the system.

There are two groups of transformers used in the underground system, live front, and dead front.

#### Live Front

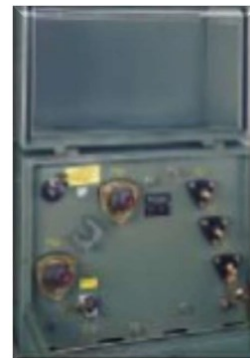
- Live front installations have two cable compartments, primary and secondary, with separate doors. Equipment energized at primary voltage is exposed when the primary cabinet is open, and the switches are of the "arc-strangler" type.
  - There are more hazards to operating personnel since the high voltage parts are exposed and clearances between live and grounded components are relatively small. The operating clearances in the live front transformers are limited and extreme care is necessary when opening the switches or working in the secondary compartment.





### Dead Front

- Dead front the other group of transformers is the dead front type wherein all primary voltage connections are enclosed in insulated components such as load break elbow type switches. There are no exposed high voltage parts.
  - The mini-pad low profile transformer is very popular in the underground system. It is the dead front type where there are no exposed high voltage parts, and the secondary bushings are located to provide easy access for service connections
  - While these transformers do sit above grade their contoured design and low profile (24" high) makes them less obtrusive than full size Pad mount units.
  - The easy access to the primary and secondary bushings allows for quick installation of conductors and reasonably quick transformer change outs in the event of transformer damage.



### Load Break Elbows

- Load break elbows are available in 15 kV through 35 kV voltage levels.
- They are used to terminate primary underground cable in transformers and other pad-mounted equipment.
- When mated with a load break bushing, the load break elbow provides a connection that:
  - Can be used to make or break current up to 200 amps;
  - Can be used in single phase or three phase switching;
  - Is fully insulated and achieves the dead front construction in pad-mounted equipment.
- The white/black/white molded rubber band around the elbow body identifies it as having three phase load break capabilities.
- A single white molded rubber band around the elbow body identifies it as having single phase load break capabilities.
- The elbow is equipped with a capacitive test point which is used to check for potential (voltage) on an elbow-connected underground cable.
- Note: An isolated load break elbow in a piece of pad-mounted equipment must always be parked on a 200A bushing interface. This method of parking protects the exposed parts of the elbow from moisture and contamination.

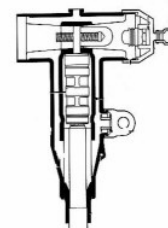


### Underground Fault Indicator

- Devices which, when installed on underground equipment properly, give an idea of where to begin looking for a fault. Note: When indicator has tripped, it must be reset so that it will be operable and free to work.

### Dead Break Elbows

- Dead break elbows are available in 15 kV through 35 kV voltage levels.
- They are used to terminate primary cable in transformers, vaults, manholes, switches, and other installations to provide an insulated, dead front construction connection.



- It can be easily identified by the bail assembly that secures the elbow to the junction rack on the dead break bushing.
- The elbow is equipped with a capacitive test point used to check for potential (voltage) on the underground cable.
- Note: The dead break elbow, when mated with a dead break bushing, cannot be used to make, or break any current or voltage. The elbow-connected cable must be isolated before any switching is performed or a flash-over will occur.

#### **Load Break Bushing Inserts**

- Load break bushing well inserts are available in 15 kV and 25 kV voltage levels.
- They provide a 200A load make/break interface between the transformer's bushing well and the load break elbow.
- Bushing well inserts are installed by placing the lubricated bushing insert into the isolated apparatus bushing well and hand tightened in a clockwise direction until it bottoms out.
- The contact snuffer tube assembly inside the load break portion of the bushing insert is easily replaceable in the field.
- Note: Unused energized and isolated load break bushings must always be covered with insulated protective caps to keep them clean, dry and to eliminate a shock hazard.



#### **Stand Off Insulator Bushings**

- Portable stand-off insulator bushings are available in 15 kV through 35 kV voltage levels.
- The stand-off insulator bushing provides a temporary or permanent parking position for an energized elbow-connected underground cable.
- It mounts directly into the parking stand on pad-mounted equipment.
- A shotgun stick is used to tighten the stainless-steel bolt on the bushing mounting pole to prevent movement.
- The stand-off insulator bushing is used in a transformer when a loop feed system is temporarily left open at a switching point (N/O point).
- The small ground lug on the stand-off insulator is connected to a system ground with a small flexible wire to bleed off any discharge.
- Note: Unused portable stand-off insulator bushings should always be mated with an insulated protective cap to keep them clean, dry and silicone lubricated.



#### **Portable Feed Through Bushings**

- The portable feed-through bushing is available in 15 kV through 35 kV voltage levels.
- The feed-through bushing is designed to accommodate two energized load break elbow-connected cables and is used in conjunction with the elbows to make or break current up to 200 amps.
- It is most commonly used for temporarily bypassing dead front, pad-mounted transformers.
- It is also installed in pad-mounted transformers at normally open points on loop feed underground systems.
- Other uses include making temporary underground cable taps, isolating energized underground cable and in testing and grounding functions.



- It mounts directly into the parking stand on pad-mounted equipment.
- A shotgun stick is used to tighten the stainless-steel bolt on the feed-through mounting plate to prevent movement.
- Note: Unused portable feed-through bushings should always be mated with an insulated protective cap to keep them clean, dry and silicone lubricated.

### Grounding Elbow

- Grounding elbows are available in 15 kV through 35 kV voltage levels.
- Grounding elbows are becoming the preferred operating method for grounding dead front underground systems due to its safe fault close-in capability.
- The grounding elbow provides a visible ground for pad-mounted transformers, junction points and switch gear when mated with their 200A load break bushing. It also keeps the equipment's bushing interface clean and dry during the grounded interval.
- When the grounded elbow is used in combination with a portable feed-through bushing, it provides a visible ground for an elbow-connected cable.
- The grounding elbow's 6' 2/0 copper ground cable connects directly to a system ground.
- The grounding elbow plugs directly onto the pad-mounted equipment's isolated 200A load break bushing using a shotgun stick.
- The grounding elbow's probe is replaceable in the event that the elbow is closed into an energized bushing.

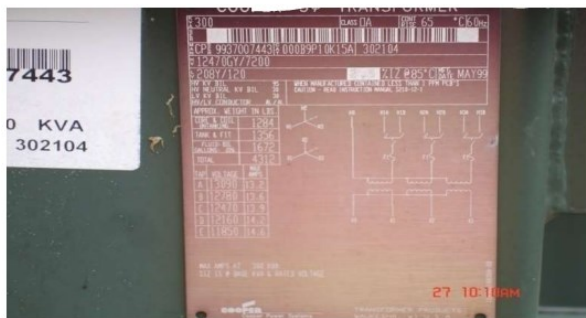


## 10.3. Underground Phasing

### Material Needed

- Phasing sticks with underground attachment. Underground Phasing Procedures (Example of 12kV Circuit)
  1. Become familiar with the voltage to be phased (transformer nameplate).
  2. Set the voltmeter for appropriate voltage.
  3. Cover up.
  4. Check meter for voltage (phase to ground and phase to phase).





Begin with phase to ground to ensure meter is working properly.

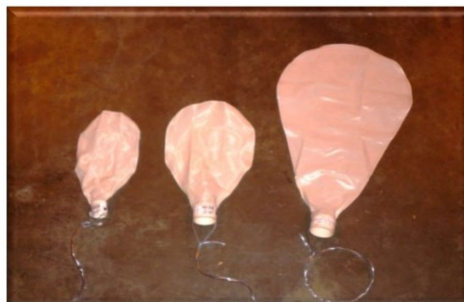


### Understanding the Reading

- Voltage reading is zero – cable can be tied together.
- If there is a voltage reading – cable cannot be tied together.

### 10.4. Installing Underground Primary into Conduit

- When installing underground primary in conduit some factors to consider are:
  - Number and type of angles.
  - Length of pull.
  - Conduit size and type. Wire size.
  - Equipment.
    - Use funnel if possible.
    - If using rollers, be sure they are correct size.
  - Customer specifications.
  - Steps in installing the cable:
    1. Use an air compressor and balloon (rat) to blow in the string.
    2. Pull in the rope.
    3. Pull in the steel cable.
    4. Pull in the conductors.



Balloon (Rat)

- Know the pressure that can be put on the conductor (manufacturer specifications).
- Be careful not to skin the conductor during the pull.
- Use the correct Kellum and / or wire eye and swivel for the conductor.
- Utilize wire lubricant.



## 10.5. Underground Cable Construction & Splicing

### Construction of High Voltage Underground Cable

- Cables and conductors are selected based on the ampacity and voltage requirements of the circuits in which they are installed.
- The basic parts of high voltage underground cable and their functions are:
  - Metal conductors (copper or aluminum)
    - Carry current.
  - Conductor shield.
    - Polyethylene material with carbon particles added to make it sufficiently conductive to carry any appreciable amount of current. It smooths out the irregular geometry of the surface of the stranded conductor, so the insulating material is not subjected to a nonuniform stress pattern.
  - Primary insulation.
    - Cross-linked polyethylene (XLPE) or ethyl propylene rubber (EPR) extruded in the thickness required to withstand the voltage the phase conductor will be energized above ground potential.
  - Insulation shield.
    - Semi-conducting material identical to that used for the conductor shield. Its function is to present a uniform ground phase against the insulation.
  - Concentric neutral wires.
    - Provide a return path for system neutral current. The concentric neutral strands also provide some mechanical protection to the insulated core and present a grounded surface for initial contact in the event of a dig-in incident.
  - Jacket.

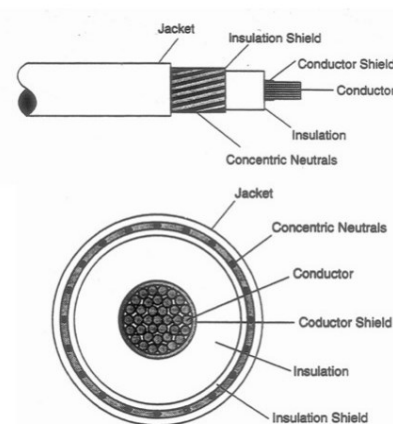


Figure 44 Underground Cable Construction

- Provides some additional mechanical protection and holds the concentric neutral strands against the insulation shield. The jacket also prevents the tinned copper neutral strands from touching earth, which can impede fault locating procedures and promote corrosion activity with other types of metals.

### Splicing Underground Cable

- The shielding must be completely removed during splicing and termination.
- The presence of any semi conducting material at the wrong place reduces the reliability of the splice or termination.
- Use only approved tools and methods when removing shielding.
- Clean the insulation thoroughly after shielding is removed.
- A splice is the joining of two conductors with a suitable connector, re-shielding and re-insulating it with compatible materials applied to a properly prepared conductor and insulation surface.
- When installing an underground high voltage cable, it is not always possible to run a single length of cable from one termination point to another. A splice is required to join the two lengths of cable. Reasons for splicing include:
  - Cable damaged during installation.
  - Cable damaged by dig-ins.
  - To add onto an existing underground cable installation.
  - Cable failure.
- Splicing high voltage cable is primarily rebuilding the portions of the cable which were cut. These portions consist of these major components:
  - Conductor is joined with a compression connector which must be able to carry the same electrical load (current) as the rest of the cable conductor.
    - The compression connector must also have sufficient strength to withstand any mechanical pressure exerted on it.
    - The compression connector must match the conductor size.
- Insulation must be of sufficient di-electric (insulation) strength to withstand the applied cable voltage.
- Shielding must prevent abnormal stresses at the connector.
- The insulation semi-conductor shield must be rebuilt to control electric fields inside the insulation.
- Concentric neutral must positively grounds and shields the underground splice.
- Pre-molded splice selection is very important. The correct pre-molded splice size for a particular underground cable application is chosen according to:
  - The cable's conductor size, e.g., 1/0 aluminum.
  - The cable's insulation size, e.g., cable's outside diameter (OD).
- Cable preparation is essential for an effective splice.
  - When splicing underground cable, always cut the cables long enough to allow for connecting the concentric neutral wires from each cable.
  - When preparing the cables, follow the manufacturer's installation instructions. A wrong measurement will probably result in a splice failure.
  - Care must be taken not to cut or nick the cable insulation, semi-conducting jacket, or conductor during preparation. Cuts and nicks cause voids inside the splice and can result in a premature splice failure.
- Conductor connecting:

- Always wire brush the aluminum conductors on both cables and immediately insert them into the compression connector to eliminate aluminum surface oxide.
- If more than one crimp is required on each side of the barrier in the compression connector:
  - Start crimping from the center of the connector and crimp out to each end of the sleeve.
  - Rotate each successive crimp 90° to prevent the sleeve from bending.
- After the compression connector has been installed, wipe off any excess inhibitor with an approved cleaner. Be careful not to get inhibitor on the insulation.

- Splice installation:
- When installing the pre-molded splice, always apply silicone grease lubricant where and when the installation instructions indicate. The silicone grease lubricant:

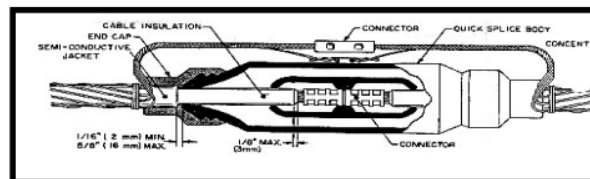


Figure 45 Pre-Molded Splice

- Allows easy installation of splice parts
  - Prevents internal damage to the splice housing
  - Helps in moisture-proofing the splice
  - Fills in voids between the cable insulation and splice housing
  - Turns into an adhesive over time and holds splice housing in place.
- Note: Never interchange the silicone grease. Use grease from the sleeve on the sleeve. Never use silicone from an elbow on a sleeve. Sleeve grease acts as a form of glue to waterproof and adhere the sleeve jacket to the conductor.
  - When sliding the splice housing over the insulation and compression connector into its final sitting position, ensure the housing is centered over the connector. Positioning of the splice housing is critical to the operation of a pre-molded splice. Refer to manufacturer's instructions. Cable can be marked with PVC tape where the housing should rest when splice is complete.
  - Grounding the pre-molded splice is accomplished by attaching a concentric neutral wire from each cable to the grounding eyes in the splice body's molded conductive shield. The connection of the concentric neutral wires places the molded shield at ground potential.
  - Prior to making a pre-molded splice:
    - Study the manufacturer's installation instructions provided with the splice kit. Measure twice, cut once!
    - Check the splice kit to ensure all necessary parts are supplied and undamaged.
    - Check all splice components to ensure proper fit with the cable's conductor and insulation size.
    - Ensure all tools required to make the splice are sharp, clean, dry, and free from inhibitor.
    - Make sure to have an approved cleaner and abrasive tape for cleaning the cable insulation.
    - Place wiping rags in a dust free enclosure to keep them clean and dry.

## 10.6. Terminating Primary Cable

### Terminating Cable on Riser Pole

- Set up equipment.
- Verify the other end of cable is either:
  - Grounded.
  - In the clear with no access to any energized source.
- Make measurements and prepare to pull conductor up the pole.
  - Measure for conduit or U Guard.
- Pull cable through conduit into position and secure.
- Measure for termination.
- Cable should be terminated on the ground if possible.
- If cable cannot be terminated on the ground, then position bucket below common neutral.
  - With a variance, rubber gloves may be removed during cable termination after the following criteria have been met:
    - Everything must be covered properly.
    - Someone on the ground must be notified and reply.
    - Bucket must remain stationary throughout termination.
  - Once termination is complete, gloves must be put back on before moving bucket after receiving confirmation from someone on the ground.
- Install terminated cable in primary position.
- If job is complete cable can be energized.
- If not, cable must be grounded.



### Terminating Cable in Energized Pad Mounted Transformer

- Other end of cable must be in the clear with no access to any energized source.
- Cover up as needed inside transformer.
- Measure and cut wire for length of termination.
- Pull cable out past face of transformer.
- With a variance, remove rubber gloves and terminate cable.
- Rubber gloves must be put back on immediately after termination is complete.
- Install feed through bushing.
- Ground cable.
- Close and lock transformer.
- Proceed to other end and install cable in transformer.
- Repeat the above process.
- After terminating this end, put it in feed through bushing or parking bushing.
- Go back to other end and remove ground.





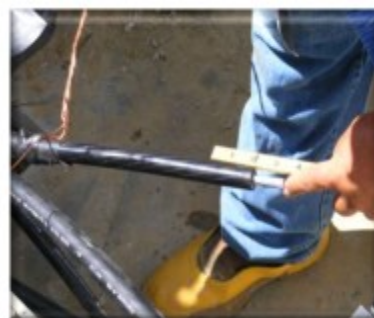
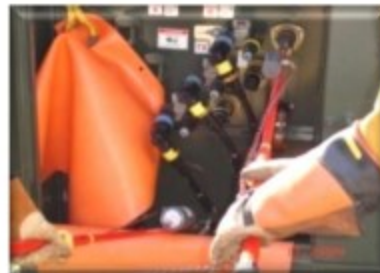
## 10.7. Underground Switching Transformer Changeout

- Ensure there is an up-to-date map.
- Verify the open point.
  - If normal open point as shown on map is closed
    - Locate where the loop is open.
    - Inquire with customer because normal open point has been moved.
- Verify the same phase using phasing sticks .
- Once phasing is verified close open point.
- Isolate transformer to be changed out.
  - Standoff cable in feed through bushing in adjacent transformer.
  - Go to adjacent transformer on other side and standoff cable in feed through bushing.
  - Check for voltage at both isolation points if no voltage is found then apply grounds.
- Disconnect secondary.
  - Mark secondary if needed. ○ Identify any parallel services.
- Disconnect neutrals and grounds.
- Remove old transformer and install new transformer.
- Reconnect neutrals and grounds.
- Put dust cover on one bushing and plug one elbow in at the new transformer.
- Remove grounds in the adjacent transformer.
- Energize new transformer and check secondary voltage.
- If voltage is good, de-energize transformer and reground primary cable.
- Install secondary connections.
- Remove grounds.
- Energize cables.
- Re-establish the open point.



## 10.8. Troubleshoot and Repair Bad Underground Cable

- Ensure there is an up-to-date map.
- Verify the open points.
  - If normal open point as shown on map is closed.
    - Locate where the loop is open.
    - Inquire with customer as to why normal open point has been moved.
- Identify the outage.
- Determine what phase is out.
- Determine which run of cable is bad by using fault finding equipment.
  - Isolate the run of cable.
- Test for voltage.
- Install grounds.
- Re-energize both sides of the loop up to where it is stood-off.
- If possible, switch out and ground other phases in ditch.
- Expose cable.
  - GMB bad cable with approved spiking tool and 8-foot shotgun stick.
  - Cut the cable and ohm out both sides.
  - Ohm from center of conductor to ground should give zero reading.
  - Verify by pulling off ground on the other end should read OL for open.
  - Re-apply grounds.
- Make repairs.
- Remove grounds.
- Return loop to normal.



## 10.9. Troubleshooting Three Phase Transformers

- Have a current map (one line)
- Verify the overhead fuse is or is not blown
- If the overhead fuse is blown and the system has fault indicators:
  - Start with the first enclosure from the transformer that is single phasing and work toward the overhead termination to find the run of cable that has faulted.
    - As each enclosure is checked, look for any problems, (elbow backed out, flashed bushing, etc.)
  - Isolate this run of cable, and back feed if the circuit is in a loop, if radial follow proper switching and grounding to repair the fault.
- If the overhead fuse is not blown:
  - Check the transformer
  - Check secondary voltage to find which phase is out.
    - If voltage is good the problem is customer related.
    - If voltage not good:
      - De-energize transformer by parking all three elbows
      - Remove bayonet fuse if the unit is equipped with these
      - Bayonet fuse is blown, (open the customer’s main breaker if possible)
      - Replace it and re energize
      - Not blown or not present:
        - Pull the elbow of the phase that is supposedly out and check for primary voltage.
        - If primary voltage is present and bayonet fuse is good the transformer has an internal fault and must be changed out.



### \*Notes:

- Some customers do not use bayonet fuses
- Some customers will reenergize with the bayonet.
- Some customers require de energizing and reenergizing with elbows only.
- There are many new installations in service, as well as many old ones that may require different methods of switching.
- Always be familiar with the equipment and the customer’s requirements.
- Remember to always use proper switching procedures when working on any system.

## 10.10. Trenchless Technology (Guided Boring Systems)

- Follow all instructions as indicated in the manufacturer's operator manual.
- Barricades must be set up around the boring system prior to use in order to keep spectators and unauthorized workers away from the machine and work areas while in operation.

### Strike Alert Systems

Guided boring systems are equipped with Strike Alert systems. The Strike Alert system detects electrical strikes by sensing the following:

- \*Voltage differences between the high voltage of the machine and the low voltage at the voltage stake.
- A current flow through the sensing coil.
- \*For the system to function properly, the voltage stake must be located in soil through which a current can pass. To improve the conductivity of dry and loose sand, dry soil, or asphalt: ensure that the stake is fully inserted into the ground 6 feet or more away from the machine but not over the boring path.
- The Strike Alert alarm will only sound after the drill has contacted an energized power line or source. The Strike Alert is only a warning device, not a protective device. If the Strike Alert horn sounds, the drill may have contacted an energized electrical line or source. Other indications of an electrical strike are electrical arcing, explosion, smoke, or popping noises.
- Remain seated on the machine with feet on the foot platform when operating the machine. Do not touch the ground during operation. If a strike occurs while touching the ground, electrocution is possible when the body becomes a direct current path to the ground.
- When an electrical strike occurs:
  1. Large voltage differences may exist on the surface of the ground near the machine and along the drill string. Standing or walking in these areas may cause electrical shock from the difference in voltage between the feet. Anyone in the work area, including the locator must wear electrically insulated boots or overshoes.
  2. If on the machine, stay on the machine. If standing on the ground, do not move and do not touch the equipment.
  3. Warn other people in the area that a strike has occurred, and they should stay away from any equipment and the immediate area.
  4. While remaining on the seat with feet on the platform, retract the down hole tool to the limit of the stroke of the machine to attempt to interrupt electrical contact. Do not attempt to disconnect a drill pipe or rod joint.
  5. The operator is not required to wear electrically insulated gloves while seated on this self-contained directional boring machine. However, the operator must wear approved electrically insulated overshoes or boots to provide protection



against electrical shock in case of inadvertently stepping off the machine during an electrical strike.

**Warnings**

- Removing and reinstalling boring rods when contact has been made with energized lines may cause electrocution.
- Maintain a safe distance from the rotating drill rod and cutting tool.
- Do not wear loose clothing that could catch on rotating equipment.

## 11. Transmission

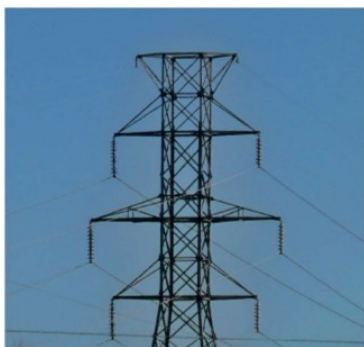
### 11.1. General

- Transmission and sub-transmission lines over 35,000 volts:
  - May be worked with approved hot sticks without rubber gloves or sleeves.
    - Exception: Rubber gloves and sleeves may be required, should circumstances dictate, by the foreman or other person in charge or by Company safety personnel.
  - In some cases, transmission lines may be worked “bare-hand” by employees with previous experience in the technique who shall be supervised only by employees who have previous experience supervising “bare-hand” work. Prior to any “bare-hand” work, GMB’s Safety Manager or an Executive Officer of GMB shall be made aware of when and where the work will be done and who will be the job supervisor.
  - Under special circumstances, permission may be granted by GMB Management and the supervisor over the work involved to work voltages between 26,500 and 36,000 (phase to ground) with Class 4 rubber gloves and sleeves from approved aerial buckets. The 26,500 to 36,000 (phase to ground) reference here includes 44,000-to-46,000-volt phase to phase lines with the multiphase exposure eliminated and minimum clearance distances maintained during the cover-up process. Permission granting this work shall be in writing which includes the special rules involved.

### 11.2. Transmission Structures

Transmission structures are used to support conductors for high voltage transmission of electric power. They vary in size and design based on terrain, soil conditions, and voltage being transmitted. Transmission structures can be lattice steel structures, tubular steel poles, or wooden structures. Furthermore, they can be classified as dead-end structures, suspension structures, and angle or deviation structures.

- Suspension structures are typically used in straight and level runs or for long, shallow turns. They use vertical string insulators to support conductors.
- Dead end structures are used at endpoints including transitioning from transmission to distribution and at substations. Horizontal tension string insulators are used on dead end structures.
- Angle structures are used to change the direction of transmission lines and on inclines. Tension string insulators are used on these types of structures to support conductors.



**Figure 46 Lattice Tower Suspension Structure with Vertical Insulators**



**Figure 47 Lattice Tower Angle Structure With Horizontal Insulators**

### 11.3. Transmission Erection

- Before erecting a transmission structure make sure to have proper access, ROW clearing, structure foundations, structure framing, guys, and anchors if required, and electrical grounding, bonding, and testing.
- Transmission towers are erected by:
  - Following customer specifications, safety rules, and environmental considerations.
  - Preparing site access that may involve creation of a non-public road.
    - Temporary access roads must be restored to original condition after work is complete.
  - Clearing ROW.
    - Trees and vegetation are cleared in a strip of sufficient width for the transmission structure and circuit.
    - – Remove only the trees and vegetation necessary to allow for construction, operation, and maintenance of the line.
    - Danger trees (those that could harm the line) must be removed.
    - Dispose of debris properly.
    - Follow applicable safety and environmental regulations.
    - Installing footings.
    - Site must be properly graded. – Typically slope cannot be greater than 3:1. – Graded area should be compacted to at least 90% relative density and must be able to support all structures, materials, personnel, and equipment on the site. – Surface water should be directed towards natural drainage to prevent ponding.
    - Excavations shall be made in compliance with applicable rules and regulations and to allow space for installation of forms and caissons as required.
    - Concrete must be thoroughly mixed and in a uniform state and allowed to cure completely.
  - Grounding tower base.
  - Tower erection.
  - Insulator and conductor installation.

### 11.4. Hot Stick Work

- Hot sticks (live line tools) are used to handle energized conductors that cannot be bare handed or handled with rubber gloves.
- Hot sticks used for primary protection must be removed from service and tested at least once every two years or when notable defects or contamination exists that could adversely affect the insulating qualities or mechanical integrity of the tool.
  - Hot sticks must be able to withstand 100,000 volts (100 kV) per foot of length for five minutes.
- Hot sticks must be kept clean and dry when in use and must be properly stored when not in use.
- Protective insulators (cover up) should be used as permitted by voltage being worked.
  - Cover nearest and lowest conductors and components first and remove cover in reverse order.
  - Cover energized surfaces first followed by paths to ground.

- Inspect cover before each use.
- Maintain and store cover properly.
- Safety considerations for hot stick work include:
  - Use of only properly trained and qualified workers.
  - Weather including wind with a plan to suspend work in adverse conditions.
  - Proper tools and equipment should be readily available and in safe working order.
  - Safe working loads of equipment must be adhered to at all times and all factors that place load on conductors, insulators, and structures must be taken into consideration.
  - Minimum approach distances must be followed at all times.













**Table 15 Proper Storage of Live Line Tools**

**Proper Live Line Tool Storage**





**Table 16 Hot Stick Tool Attachments**  
**Hot Stick Tools**

|  |  |   |
|--|--|---|
|         |          |    |
| <p>Wire Tong Lever Lift. Used to lift heavy conductors.</p>                              | <p>Pole Mounted Saddle With Pole Clamps. Used to secure wire tongs</p>                     | <p>Conductor Tensioning Tool. Used to temporarily isolate sections of line.</p>       |
|         |          |    |
| <p>Pole Mounted Snubbing Bracket. Used for terminating block fall lines.</p>             | <p>Cross Arm Tool Hanger Bracket Used for hanging hot sticks.</p>                          | <p>Conductor Holder with Insulator Used on insulated fiberglass arms.</p>             |
|       |        |  |
| <p>Heavy Duty Spiral Link Stick Used to isolate rope lines, hoists, and rope blocks.</p> | <p>Wire Tongs</p>  | <p>Pole Clamps</p>  |
|       |        |  |
| <p>Roller Link Stick Used to spread and hold conductors.</p>                             | <p>Multi-Purpose Holding Tool Provides positive control for shaping and bending wires.</p> | <p>Universal Hot Stick Tool Attachments</p>   |

- Hot sticks must be wiped clean each day and inspected before each use. Check for:
- Loose or missing hardware.
- Clean, dry, and undamaged surface.
- Breaks, cracks, or deep scratches in the surface.
- Only qualified and properly trained employees should perform hot stick work.
- Never exceed safe working loads or rated capacities of hot sticks.



Figure 48 Wire Tongs

**\*NOTE: Live line tools that do not pass inspection should be removed from service and returned for repair and testing.**

### Wire Tongs

- A wire tong is an insulated pole with a hook clamp on one end and a swivel on the other. They are used primarily to hold live conductors and serve the purpose of moving live conductors away from work being performed.
- Are commonly used in pairs – one to lift the conductor and another to move it horizontally.
- Are not designed for handheld maneuvering and like any tool, should only be used for their intended purpose.
- The wire tong mounted at the highest point is the holding tong. The lower mounted wire tong is the lifting tong which will hold most of the conductor's weight. Maximum working loads shall never be exceeded.
- Increasing the distance between the saddles minimizes the forces applied to the wire tongs.



Figure 49 Pole Mounted Saddle  
Used to Secure Wire Tongs

**\*NOTE: Calculating Force on Wire Tongs**  
**Force on lifting tong = conductor weight \* (distance from lifting pole saddle to conductor / distance between the two saddles)**  
**Force on holding tong = conductor weight \* (distance from the holding pole saddle to conductor / distance between the two saddles).**

## 12. Substation

### 12.1. General

- Before entering a substation, perform a visual inspection of the substation to ensure all copper wire is intact before touching the gate. If copper is missing or a gate that has been tampered with, contact the customer, and DO NOT touch the gate or enter the substation. Look for:
  - Jumpers bonded to the gate.
  - Broken connections. ○ Missing copper.
  - Signs of tampering with the copper or the gate.
- Prior to starting work, conduct a job briefing that includes the location of energized equipment in or adjacent to the work area.
- When multiple groups such as client crews or other contract crews are working in close proximity to each other, job briefings should be coordinated between all affected crews.
- Conduct additional job briefings if conditions change that could affect employee safety.
- If personnel changes are made during any part of the job, conduct additional job briefings to ensure the job can be completed safely.
- Ensure only qualified employees work on or near exposed, energized electrical equipment.
- When performing substation work, employees shall wear approved fire-retardant clothing.
- Consider all lines and equipment as energized until they have been flagged, tagged, and grounded.
- Upon entering an attended substation, an employee should report his presence to the employee in charge.
- Lock substation entrances that cannot be monitored and controlled while working in substation.
- Report to supervision or the system dispatcher any unusual conditions observed on substation structures, equipment ground conductors, buses, and wiring.
- Except in emergencies, before energizing or de-energizing any substation equipment, and the associated lines or buses, obtain permission from the system dispatcher or other authorized person. Only qualified and authorized employees shall perform switching operations.



- Attach only approved and properly completed clearance or hold tags to equipment controls to indicate line or equipment status.
- To prevent inadvertent contact, provide guarding around live parts over 50 volts-to-ground that do not have an insulating cover, unless the location of the parts gives sufficient horizontal or vertical clearance to minimize the possibility of accidental contact.
- Carry or place conductive materials so as to prevent contact with energized lines, equipment, or bus (see minimum approach distances).
- Do not use metallic cloth tape, metal tapes, metal rules, metal fish tapes or other conductive materials near energized conductors or equipment.
- When working near energized equipment, use only flashlights with exposed parts made of non-conductive materials.
- Use red tape to designate energized areas adjacent to work area.
- Attach red tape or red flags to designate safe heights above which employees may not climb because of energized lines.

## **12.2. Station Storage Batteries (Lead Acid)**

- When working with station batteries, wear appropriate personal protective equipment. (e.g., chemical resistant gloves, apron, face shield, and eye protection.)
- Keep battery locations free of debris.
- Maintain ventilation sufficient to prevent build-up of explosive fumes.
- Keep unauthorized persons out of battery storage areas.
- Post keep out signs to warn unauthorized persons.
- Ensure all persons handling or servicing batteries are properly trained.
- Take extreme caution when carrying or using conductive materials around batteries. Use insulated hand tools.
- Do not smoke or create sparks, arcs, or flames in battery areas.
- If eyes or skin is splashed with acid, wash the affected areas immediately and see a doctor.

## **12.3. Testing High Voltage Substation Apparatus and Equipment**

### **High Voltage Testing Procedure**

- Hazard Identification will be performed by the crew to identify the hazards at each job site. This will involve determining if the equipment is in a Green Field/not-previously-energized lot or in an already energized station, as well as determining if the test equipment itself is capable of putting out a hazardous voltage level (50 Volts or greater).
- Fill out a pre-job briefing sheet before work is started. If more than one piece of equipment is to be tested a new job briefing should be filled out for each piece.
- Conduct job briefing with all crew members before starting each job.



- Acquire station address and emergency contact info for job briefing.

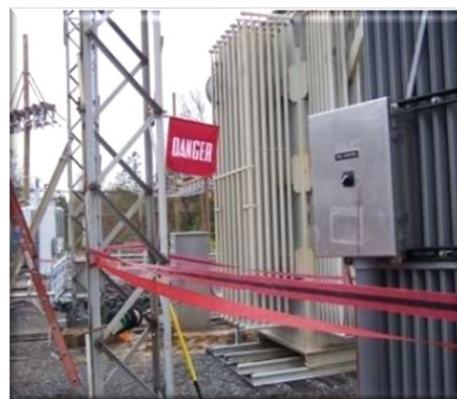
**The following procedures apply for work in energized stations or stations that have been previous attached to an energized grid:**

- If customer representative not on site with crew, make customer aware of the date and time that we will be performing work.
- Request required clearance with customer or customer contact.
- Verify clearance, lockout and tag out with all crew members and customer operating personnel.
- Perform dead test with live-line tool and approved HV tester.
- Install grounds if the work involves removing the leads to the equipment after dead test with live-line tools.
- Grounding procedures require FR clothing, hard hat, safety glasses, rubber gloves, tester and live-line tools.
- Flag and/or tape adjacent energized equipment/areas as needed.
- Make sure all applicable test equipment grounds are in good working condition, cleaned and applied.
- When testing is the only work being performed all the equipment shall be treated as energized.
- For periodic, routine, and commission testing only on equipment, it is not necessary to install grounds prior to conducting the test provided all four of the following criteria are met:



1. The equipment is properly cleared and isolated from energized source, switches locked and/or tagged in the open position, and the equipment tested for voltage with an approved tester, Flagged and Tagged.
2. Appropriate PPE shall be worn.
3. Assurance that there is no possibility of contact between the equipment to be tested and any other energized source.
4. The hazard of induced voltage is not present. Statically ground the equipment with the test leads by installing test leads with HV gloves.

- Once equipment is made safe to apply test leads Echo Protocol shall be used between the technician applying the leads and the other technician at test set. This should be maintained throughout the test procedure until all test leads have been removed. If a third party is available, they should be used as the “Qualified Observer” if they are qualified and should have no other duties other than “Qualified Observer”.
- Do not carry leads around station on raised Telescopic sticks or any other live-line tools.
- Only raise leads at the equipment being tested.



- If test leads are raised with live-line tool from the ground to apply to equipment the employee will use HV gloves, sleeves and over shoes. Make sure the lead is clear of the body while installing.
- Other employees shall be in the clear until lead is installed.

**The following procedures apply for equipment that is located in Green Field/not-previously-energized stations and the only electrical hazard would be from the test equipment itself:**

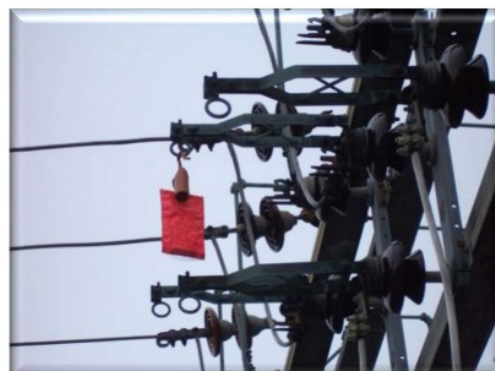
- Once the equipment has been identified for testing the crew will ensure the equipment to be tested is electrically isolated from any other work, i.e. (other crews working) and that the test area is appropriately barricaded to keep un-authorized personnel out of the area.
- Any other work crews shall be notified of testing before starting and should remain clear of area.
- Once equipment is made safe to apply leads Echo Protocol shall be used between the technician applying the leads and the other technician at test set. This should be maintained throughout the test procedure until all leads have been removed. If a third party is available, they should be used as the “Qualified Observer” if they are qualified and should have no other duties other than “Qualified Observer”.
- Installing leads would require the use of FR clothing, hard hat, safety glasses and HV gloves to protect the technician from the test set voltage if test set is capable of generating 50 volts or greater.

#### **12.4. Arc Welding in Substations**

- The ground lead of an arc welder shall not be grounded to the substation ground mat.
- The ground lead should be electrically connected to the piece to be welded and connected as close to the weld as possible.
- Both work lead and electrode lead must be properly insulated and follow the same route to the work area.
- Always protect personnel by using appropriate personal protective grounding on equipment within extended reach of the work area.

#### **12.5. Working on De-energized Equipment**

- Before considering substation equipment to be worked on as de-energized, ensure it is isolated, tested for voltage, and grounded (flagged, tagged, and grounded).
- For equipment under the control of a dispatcher or operator, obtain a clearance to de-energize the equipment according to standard operating procedures.
- De-energize the equipment by ensuring the proper switching devices such as disconnects, breakers, and switches are opened.
- For equipment not under the control of a dispatcher or operator, ensure that it is isolated by one or more of the following methods:
  - Removing fuses
  - Disconnecting recloser leads



- Opening switches ○ Removing jumpers
- Render inoperable as design permits and tag the following:
  - Automatically and remotely controlled switches that could cause the opened disconnection means to close (tag at the point of control)
  - All switches, disconnects, jumpers, taps, and other means through which electricity may be supplied to the lines and equipment.
- If design permits, render the recloser inoperable and tag it; remove source and load side leads. For parking the leads, use stand-off tool.
- Render inoperable any disconnecting means that are open to protect employees and that are accessible to the public.
- Test to verify that the lines and equipment are de-energized.
- Install grounds as outlined in “Grounding” section.
- Do not release a clearance or re-energize lines unless:
  - The system operator is informed, if applicable.
  - The crew is notified.
  - Everyone is clear and accounted for, all equipment is in the clear, and all grounds are removed.
- This section applies to any station or equipment that has been physically connected to the power grid that is capable of being energized.

#### **Ground Fault Protection for Personnel**

- Employees must be protected from ground fault hazards as described below during activities involving construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities. These requirements do not apply for the use of cord sets/extension cords/tools in office or administrative areas.

#### **Temporary Wiring**

- Use Ground Fault Circuit Interrupter (GFCI) on all 120 volts, single-phase 15-, 20- and 30-amp receptacles that are not part of the permanent wiring of a building or structure.

#### **Portable Generators**

- Follow National Electric Code requirements. GFCI is not required on receptacles on 2-wire, single-phase portable or vehicle mounted generators rated not more than 5 KW where the circuit conductors of the generators are insulated from the generator frame and all other grounded surfaces. For all other conditions, GFCI is required.

#### **Cord Sets, Extension Cords and Cord and Plug-Connected Tools**

- Comply with one of the following options:
- Option 1
  - Use GFCI on all cord sets, extension cords and cord and plug connected tools. When using portable GFCI’s, install the GFCI between the receptacle and the cord set – not between the tool and the cord set.
- Option 2
  - Implement an assured equipment grounding program.
- Visually inspect cord sets, extension cords and tools before each day’s use for external defects (e.g., deformed, or missing pins, insulation damage or indications of possible internal damage). Do not use defective equipment.
- Ensure cord sets and extension cords are one of the following:
  - Supplied with Ground Continuity Monitor on the receptacle (female) end. Ensure that employees check the Ground Continuity Monitor before and after

each use. Where a Ground Continuity Monitor does not illuminate, take cord out of service immediately.

- Ensure that tools which are required to be grounded (e.g., tools with 3-prong plugs) are tested before first use, quarterly and following repairs. Testing is not required for double insulated tools.

### Extension Cords

- Do not use damaged extension cords.
- Do not raise and lower equipment with extension cords connected to the equipment.
- Do not fasten extension cords with staples or hang them in a fashion that could damage the outer jacket, insulation, or conductors.
- Elevate cables and cords passing through work areas so as to protect them from damage and to eliminate tripping hazards.
- If energized equipment is involved, use dry hands when plugging or unplugging extension cords.
- Properly secure locking connectors after connection, if applicable.
- If an extension cord is wet from immersion, handle it with protective equipment if it is still energized or if the state is unknown.
- Elevate or protect extension cords from vehicular traffic (e.g., forklifts, man lifts, tractors).

**Table 17 Color Chart**

| Quarterly Color Code Chart |               |
|----------------------------|---------------|
| January - March            | <b>RED</b>    |
| April - June               | <b>WHITE</b>  |
| July - August              | <b>BLUE</b>   |
| October - December         | <b>YELLOW</b> |

## 12.6. Energized Equipment

### Job Briefing

- Before starting work, conduct, document, and discuss, at a minimum, the following in a job briefing:
  - Hazards associated with the job.
  - Emergency action plan.
  - Work procedures.
  - Special precautions.
  - Protective equipment.
  - Energy source controls.
  - Work zone.
  - Contingency plan.
- Before starting work, determine existing conditions such as:
- Voltage of equipment.
  - Switching transient voltage.
  - Fault current availability.
  - Integrity of grounds.
  - Condition of structures.
  - Weather conditions.
  - Location of energized equipment.



- If conditions change that could affect employee safety, hold, and document additional job briefings with everyone involved. If personnel changes are made during any part of a job, conduct additional job briefings and document before work continues to ensure the job can be completed safely.

### Qualified Observer

- Any qualified electrical worker can be a designated qualified observer.
- Adequate safety measures must be taken to protect employees and others from induced voltages as well as direct contact to energized lines. A qualified observer's main responsibility is to limit the movement of personnel or equipment to prevent contact with energized overhead or underground electrical facilities. Qualified Observers shall take a suitable location and give undivided attention to ensure that no action on the part of the workers being watched can result in violation of the minimum approach distances. There must be a definite understanding between the qualified observer and the persons being watched as to when the watching begins and ends. Qualified Observer, who must leave their assigned jobs, shall first make sure that all workers are in the clear and remain in the clear until the qualified observer returns or is replaced. Safety watchers have the authority to halt the work operation whenever any unsafe act or condition is imminent.
- Qualified Observers are required under any of the following conditions:
  - When inadvertent movement by a worker could result in violating the minimum approach distance.
  - When operating or moving motor-driven equipment in the vicinity of high-voltage circuits and the possibility exists of violating the minimum approach distance.
  - Whenever the condition otherwise determines a is necessary.
- In order for an employee to be a safety watcher, the following requirement must be met:
  - The employee shall be a qualified electrical worker with work experience in an energized high-voltage facility similar to the facility in which he is currently assigned to watch.



### Qualified Workers

- Ensure only qualified employees work on or near exposed, energized electrical equipment.
- De-energize equipment or circuits before working on or near them, unless:
  - De-energizing increases hazards.
  - De-energizing is not feasible because of equipment design or operational limitations.
  - Energized equipment/circuits operate at < 50 volts-to-ground and exposure to electrical burns or explosion caused by electrical arcs is not increased.
- If an unqualified person, do not open enclosures or panels that contain exposed energized electrical parts or equipment.

- When working on energized equipment, alert others of potential hazards by doing at least one of the following:
  - Post appropriate signs/tags.
  - Place barricades and/or tape to mark off the work area, using red tape for electrical and yellow tape for non-electrical.
  - Use attendants.
- Ensure qualified workers do not approach or take any conductive object without an insulating handle closer to exposed energized parts than the minimum approach distances.
  - Employee is insulated from the energized part with rubber gloves and/or sleeves.
  - Energized part is insulated from the employee with line hose/blanket/etc.
- Ensure unqualified workers stay away from overhead power lines as stated below:
  - For lines 50 KV and under -- 10 feet
  - For lines over 50 KV -- 10 feet plus 4 inches for every 10 KV over 50 KV

#### **Live-Line Tools**

- Each day before use, visually inspect live-line tools and wipe them clean.
- Do not put live-line tools on the ground.
- Inspect live-line tools to ensure dielectric tested every two years by validating the date on the displayed tag.
- Properly wax live-line tools as needed.
- Immediately remove damaged live-line tools from service.
- Do not use tele-poles for:
  - Installing or removing live-line clamps,
  - Closing or opening energized disconnects, in-line blade disconnects (Opening these requires a load break tool.)
  - Substation switching.
- Use tele-poles only when positive control can be achieved.

#### **Testing for Voltage**

- Before working on any electrical circuit or equipment, check voltage levels and the presence of all potential sources.
- Visually inspect test instruments/equipment and the following for external damage before use:
  - All associated test leads.
  - Cables.
  - Power cords.
  - Probes.
  - Connectors.



## 12.7. Tools & Equipment

- When working near energized circuits, use only flashlights with exposed parts made of nonconductive material.
- When working on or near electrical equipment, use ladders with nonconductive side rails.
- When working on metal scaffolds, use additional protective equipment or precautions and use fall protection.
- Before replacing fuses, verify that ratings and types are correct.
- Before working on energized equipment, try to dry wet floors. If floors cannot be dried, use rubber gloves, insulating blankets, and a wooden foundation to elevate the blanket above the moisture.
- Secure or remove doors, hinged panels, etc. to prevent them from swinging into an employee and causing contact with exposed energized parts.
- When working on motor control circuits remove or secure the cubicle to prevent re-engagement to the bus.
- Do not use metallic cloth tapes, metal tapes, metal rulers, metal fish tapes or other conductive material near energized conductors or equipment.

### **Electrical Equipment in Damp or Wet Locations:**

- Ensure that cord and plug connected equipment used in damp or wet locations are one of the following:
  - Grounded
  - Double-insulated
  - Supplied through an isolating transformer with an ungrounded secondary not over 50 volts
- Ensure that cord and plug connected equipment and extension cords used in damp or wet locations are one of the following:
  - Approved for use in damp or wet locations.
  - Used with Ground Fault Circuit Interrupter protection.
- When performing activities (e.g., wetting down areas for asbestos abatement) that could cause fixed electrical equipment to get wet, cover the equipment.
- Render inoperable as design permits and tag the following:
- Automatically and remotely controlled switches that could cause the opened disconnection means to close (tag at the point of control) All switches, disconnects, jumpers, taps, and other means through which electricity may be supplied to the lines and equipment.
- If design permits, render the recloser inoperable and tag it; remove source and load side leads. For parking the leads, use stand-off tool.
- Render inoperable any disconnecting means that are open to protect employees and that are accessible to the public.
- Test to verify that the lines and equipment are de-energized.
- Install grounds as outlined in “Grounding” section.
- Do not release a clearance or re-energize lines unless the system operator is informed, if applicable, the crew is notified, and everyone is clear and accounted for.

## 12.8. Substation Structures

### General Precautions

- Before climbing steel structures:
  - Carefully examine to ensure it is safe.
  - Inspect base for corrosion or structural defects.
- Use the approved inspection standards to inspect concrete or steel before climbing.
- If a structure is suspected to be unsafe, do not climb it and contact supervision immediately. Tag unsafe structures to prevent others from climbing and follow procedures to correct the situation.

### Transferring Materials and Tools

- Raise and lower all light-weight equipment using a hand line, canvas bucket, or other suitable container.
- To prevent being struck by falling objects, stay clear of overhead work.
- Do not throw tools and material from the ground to employees working aloft.
- Do not throw or intentionally drop tools and material from above to the ground.
- Do not let tools or materials drop or fall.
- Use nonconductive tag lines, measuring tapes, and hand lines near energized lines and equipment.
- Where it is necessary to prevent hazards to employees or damage to equipment or material, use tag lines to control loads being hoisted.
- Keep area around base of structure clear of tools and hardware. Investigating

### Downed Conductors

- If an employee who is not a qualified substation technician locates a downed conductor during normal working conditions, report the condition immediately and have the location guarded until help arrives. Keep personnel and the public at least 10 feet away from the conductor.

### Steel Structure Rescue

- If a fall occurs while an employee is using fall protection and the employee is injured or if an employee suffers from heat exhaustion and requires assistance, a specific rescue procedure must be followed. Employees should:
  - Assess the situation.
  - Alert other employees.
  - Ensure victim is clear of energized.
  - Determine condition of victim.
  - Administer first aid if victim is accessible.
  - Contact 911 and implement rescue procedure.

## 13. Rescue Procedures

### 13.1. General

- Emergencies, including electrical contacts, heart attacks, heat exhaustion, etc., can arise while employees are working aloft. It is important to have trained personnel on the ground to handle these emergencies. Should an emergency arise?
  - Remain calm.
  - Contact emergency response as prescribed in the pre-job briefing or emergency action plan specific to the jobsite.
  - Yell to the employee working aloft and attempt to get a response.
  - If there is no response or if the employee is unable to get himself down:
    - Perform a rescue utilizing the most appropriate procedure described below.
    - Initiate CPR and First Aid until emergency response arrives.

### 13.2. Rescue Procedure -Articulating Aerial Bucket

1. Employees shall be familiar with the proper procedure for operating the lower controls of the aerial bucket.
2. Equipment needed: hand line and collar rope to go around the boom twice.
3. After surveying the scene, lower the top boom down to the side of the truck and raise the bottom boom all the way up.
4. Tie the collar rope onto the boom wrapping it two times around the boom and tying a square knot. Slide the collar rope up the boom as far as possible.
5. Single the hand line and hook the block in the collar rope (attaching the hook backwards, with one wrap only). This draws the collar rope tight to the boom.
6. Bring one end of the hand line through the lanyard connection loop of the victim's body harness then carry it up to the collar rope located on the aerial boom snapping it on to the collar rope at the same location the hand line block is hooked into.



**\*NOTE: If the hand line has a hook, never hook into the bottom of the hand line block. If the rope "two blocks" it may kick the hook out dropping the victim.**

7. Raise the top boom 12-15 feet from the truck; far enough that the victim will not swing into the truck. 8. Pull the hand line raising victim out of the bucket and lower them to the ground.



**\*NOTE:** In the event the victim is tall, and the collar rope is not high enough on the boom to pull him clear of the bucket, when his waist clears the rim of the aerial bucket his upper body weight will pull him the rest of the way out of the aerial bucket and he can then be lowered to the ground.

**\*NOTE:** Manual lifting is the preferred method over using the hydraulics as it is quicker

- To use the hydraulics of the truck to do the lifting, use steps 1-7 then:
  1. Take all the slack out of the hand line and make sure that the rope is not overlapped.
  2. Use one wrap around the step or upper boom rest
  3. Take a firm grip on the hand line and raise the upper boom as in step 8 while holding the hand line firmly. Care should be taken not to “two block” the rope because the tension on the rope by the hydraulic system can break the rope and drop the victim.
- The victim should be removed by hand or by the hydraulic system, whichever is the safest, quickest method.



### 13.3. Rescue from a Pin-On Type Aerial Bucket

#### Method 1

- Step-1: Lower the bucket to the ground using the lower controls. When the bucket is contacting the ground, exit the vehicle and move to the bucket.
- Step-2: Pull out the retaining pin located on the outside of the bucket in the same manner as horizontal storage of the bucket.
- Step-3: Run out the stinger until the bucket is at approximately a 45-degree angle to the ground.
- Step-4: Unhook the victim’s lanyard from the pole strap and pull them out of the bucket to the ground using their harness straps.
- Step-5: Place the victim’s arms at their side and cross their legs at the ankles. Gently roll the victim over until they are lying on their back.



Step-1



Step-2



Step-3



Step-4



Step-5

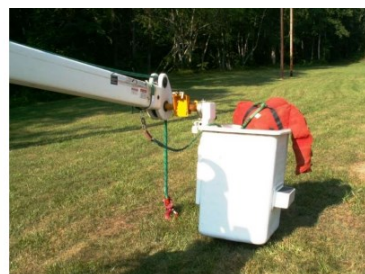
## Method 2

- Employees shall be familiar with the proper operating procedures of the equipment being used.
- After surveying the scene:
  - Step-1: The bucket should be lowered to the ground.
  - Step-2: Unhook the victim's lanyard from the pole strap.
  - Step-3: Pull the victim's arms over the lip of the bucket.
  - Step-4: Grasp the victim's harness and pull them upward and forward resting them on the rim of the aerial bucket.
- Climbing back to the ground, grasp the victim under his chest, pull, and roll him to the ground so he will be on his back when he reaches the ground. Roll with the victim as he rolls to the ground.

**\*NOTE: Lift with your knees not your back.**



Step-1



Step-2



Step-3



Step-4

#### 13.4. Pole Top Rescue

- Time is of the essence in an emergency situation. For this reason, a lineman must be familiar with pole top rescue procedures and practice them in order to minimize rescue time. Know the following steps and remember it is of vital importance to remain calm in emergency situations.

##### **Check**

- Determine if the lineman up the pole is in trouble.
- Assess the situation for potential hazards.

##### **Call**

- Call 911 or follow the emergency action plan.
- If two persons are available, one of them should get help while the other proceeds with the rescue procedure.

##### **Care**

- Perform Pole Top Rescue.
- Provide First Aid and/or CPR as necessary.

##### **Pole Top Rescue**

- If injured is located on a pole near a crossarm:
  - Climb the pole wearing all PPE and taking a hand line.
  - Place safety above the injured person's safety
  - Give injured two breaths if necessary.
  - Position hand line over cross arm or other part of structure.
  - One rescuer should make one complete wrap around crossarm. (Two rescuers may elect not to use wrap.)
    - Keep the hand line block on belt until rope is wrapped around the arm.
    - Make sure the line runs freely.
    - Position line for clear path to ground usually 2 or 3 feet from pole.
- If injured is located on pole without a crossarm:
  - Climb the pole wearing all PPE and taking a hand line.
  - Place safety above the injured person.
  - Give injured two breaths if necessary.
  - Drive a screwdriver into pole at a location above the injured:
    - No less than 1" depth into pole.
    - Flat head should be parallel to ground.
  - Keep the hand line block on belt until rope is wrapped around the pole.
  - Load rope should be on bottom of wrap.
- Preparation for lowering.
  - Pull enough slack in rope to tie around injured person's chest.
  - Pass rope around injured person's chest.
  - Tie 3 half hitches.
    - Put the knot in front, near an armpit, and high on chest.
  - Snug knot.
- Cutting the injured person's safety.
  - Pull slack out of the rope, and grasping the lower lines, cut the injured person's safety strap (or unclip safety) on the side opposite the desired direction of swing.
    - Caution – An employee should not cut his own safety or the hand line.
- Give two breaths, if necessary, before lowering.



- Lowering the injured.
  - Guideline with one hand and control the rate of descent with the other.

**\*NOTE: All linemen who are working will be trained annually on Rescue Procedures.**

### 13.5. Tower Rescue

- GMB will utilize a basic rope rescue type rescue plan, similar to pole top rescue using slings as the anchor point and a figure eight as a belay device to lower the employee to the ground as needed. The figure eight device works as a friction aid which allows one person to safely and easily handle the weight of an injured employee as they are lowered to the ground. The figure eight can be attached at the sling, an anchor point at the bottom of the structure, or on an employee safety belt.



#### Equipment Required

- One standard 1/2" hand line.
- One 1-inch X 3-foot eye to eye sling with a twisted figure 8 ring and carabineer attached.
- Fall protection harness with lanyards, body belt with safety.
- One skinning knife to cut the safety lanyard.



#### Procedure

- Assess the situation. After determining that the employee is in trouble and needs assistance, call 911 with an accurate description of the location.
- Alert co-workers in the immediate area and others by radio if vehicles are so equipped. Do not wait for a reply but prepare to assist the victim.
- Be sure that the victim is clear of any energized conductors or equipment. If not de-energize.
- Rescuer climbs steel structure using 100% fall protection taking with him the hand line, anchor rope with figure 8, and knife.
- Determine the condition of the victim
- Administer first aid if victim is accessible. If CPR is necessary, the victim must be lowered to the ground as quickly as possible.
- Secure anchor rope above victim and rescuer with hand line rigged into figure 8 ring.
- Secure one end of hand line after running through figure 8 to the nylon loop in the rear of the fall protection harness of the victim by tying a bowline knot or three half hitches.
- Take slack out of hand line back through the figure 8 and secure fall line. This will lessen the length of drop when the fall arrest lanyard of victim is cut.
- Maintain control of fall line at all times.
- Cut the safety belt (positioning belt) of victim that is holding victim in position on structure.
- If fall protection lanyard has no pressure (weight of victim) un-hook lanyard. If needed cut the fall protection lanyards near the hook end and lower victim to the ground.

**\*Warning: Be sure to cut the fall arrest lanyard near the ladder hook end.**

- The rescuer then climbs down the structure using 100% fall protection and administers the necessary CPR and first aid to the victim.



## 14. Environmental, Health & Ergonomics

### 14.1. Asbestos

#### Requirement

- Without specialized training, GMB employees are not qualified for asbestos removal and / or disturbing to make the material friable (airborne). Most asbestos is found inside buildings and with the exception of substation workers, GMB employees have limited potential exposure. This section provides asbestos awareness guidance. If asbestos are encountered, employees should stop work immediately and contact their supervision who will work with the Safety Department and the customer to arrange for asbestos removal.

#### General

- Asbestos is a mineral mined from the earth known to cause health problems in humans.
- Exhibits substantial resistance to heat/chemicals.
- Asbestos used as insulation during 1870-1900.
- After 1900, common use as boiler/pipe insulation in ships.
- After 1940s, amosite widely used in insulation.
- 1950-1970: Estimates indicate more than half of the large multi-story buildings constructed in this time contain some form of spray-applied asbestos.

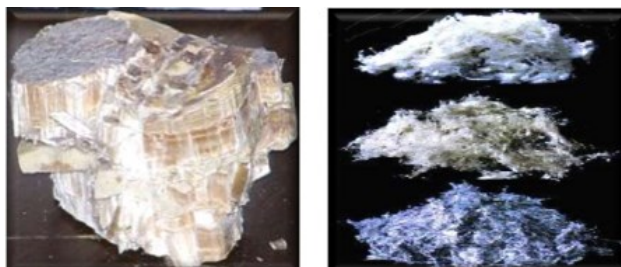


Figure 51 Asbestos

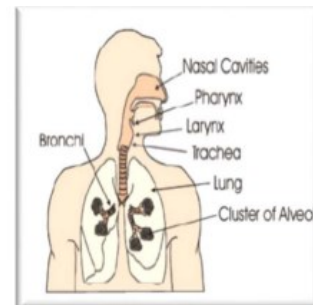
#### Types of Asbestos

- Serpentine Group.
  - Chrysotile - white asbestos.
- Amphibole Group.
  - Amosite - brown asbestos.
  - Crocidolite - blue asbestos.
  - Anthophyllite.
  - Tremolite.
  - Actinolite.

#### Likely Occurrences

| Health Effects |   |
|----------------|---|
| •              | Routes of entry:                              |
| ○              | Inhalation.                                   |
| ○              | Oral Exposure – ingestion.                    |
| ○              | Dermal - through skin.                        |
| •              | Asbestos is known to cause:                   |
| ○              | Asbestosis (fibrotic scarring of lung tissue) |
| ○              | Lung Cancer.                                  |
| ○              | Mesothelioma and other cancers.               |
| ○              | Pleural Plaque and Pleural Effusion           |

- Surfacing material such as:
  - Acoustical plaster.
  - Fireproofing.
  - Decorative plaster with a honeycombed structure and loosely bound fibers.
- Other materials:
  - Floor tiles.
  - Ceiling tiles.
  - Transit/cement products.
  - Caulking.
  - Wiring. Considerations When Working Inside Facilities



- The age of the facility;
- Whether any facility records exist documenting the known presence and location of ACM and PACM;
- Whether any signs or labels are posted at the facility identifying the presence and location of ACM and PACM; and
- A description of general types and locations of ACM and PACM present, if any.  
Remember GMB employees are generally qualified to work around but not to remove or disturb asbestos. DO NOT take any chances if asbestos are encountered.

## 14.2. Bloodborne Pathogens

### Requirement

- Employees will follow Universal Precautions any time they are potentially exposed to Bloodborne Pathogens (BBPs).
- Employees exposed to BBPs must undergo medical evaluation or sign a waiver.
- Proper PPE will be utilized when administering First Aid / CPR or handling potentially infected substances.

### Definition of Exposure

- Reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties.

### Exposure Determination

- Listed below are job classifications that are not expected to be exposed to human blood or other potentially infectious materials in their normal work duties but could be called on to provide "first aid" or "CPR" to an injured co-worker. These employees would have less risk to exposure of bloodborne pathogens.
  - Clerical and Administrative
- Listed below are job classifications that are not expected to be exposed to human blood or other potentially infectious materials in their normal work duties but could be called on to provide "first aid" or "CPR" to an injured co-worker. These employees would have a higher risk to exposure of bloodborne pathogens.
  - Groundman, Truck Driver, Equipment Operator, Lineman, Foreman, Mechanic, General Foreman, Substation Technician, Laborer, Engineer, and Area Supervisor.

### Universal Precautions

- Universal precautions shall be observed to prevent contact with blood or other potentially infectious materials. When differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.
- The following are universal precautions and required work practices for BBP:



Figure 52 Universal Precautions

- Employees must wash their hands immediately or as soon as possible after removing gloves or other personal protective equipment.
- Employees must wash their hands and any other skin immediately or as soon as possible following contact with blood or other potentially infectious materials.
- Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where there is a reasonable likelihood of occupational exposure.
- Place contaminated materials in labeled plastic bags.
- Any equipment (machines involved in an accident where an employee has been injured) which may be contaminated must be decontaminated with disinfectant prior to handling, if feasible.
- Broken glassware which may be contaminated must be cleaned up with a dustpan and brush, shovel, tongs, or other means. Employees may not clean up broken glassware directly with their hands.



Figure 53 Biohazard Labeling

### Personal Protective Equipment

- When administering first aid or CPR, the following personal protective equipment shall be used to guard against exposure:
  - Latex gloves, protective eye wear or face shield, jacket, and mask.
- Protective equipment work practices:
  - Employee shall immediately, or as soon as possible, remove garments soiled by blood or other potentially infectious materials.
  - Once removed, employees must place protective equipment in a designated area or container for storage, washing, decontamination or disposal.
    - Containers of potentially infectious materials must be labeled as biohazards.
  - The biohazard symbol must:
    - Be printed in fluorescent orange or orange red have lettering of a contrasting color.
    - Red bags or containers may be used as a substitute for labels. BBP Exposures
- After an exposure:
- Immediately report the exposure incident to an Area Supervisor or the Safety Department.

- Confidential medical evaluation and follow up.
- Blood test for the source individual.
- Blood test for exposed employee.
- Hepatitis B vaccination.
- Counseling.

### **14.3. Fire Prevention & Protection**

#### **Fire Prevention**

- Gasoline-powered equipment shall be refueled only after it has been stopped. Any spilled fuel shall be removed from the equipment before restarting.
- Gasoline-powered equipment shall not be operated within 10 feet of any refueling operation or any area in which refueling has recently taken place.
- Flammable liquids shall be stored, handled, and dispensed only from metal containers or approved safety cans.
- Transfer flammable liquids from one container to another only in properly ventilated spaces free from ignition sources.
- “No Smoking” and “Stop Your Motor” signs at fuel dispensing locations shall be followed.
- Employees shall not enter confined spaces after using CO2 extinguishers until the area has been thoroughly ventilated.

#### **Flammable and combustible materials**

- Do not accumulate combustible materials in the work area.
- Do not store combustible materials in and around exits.
- Unless suitable protected, do not store combustible material around any open flame or heat producing process.
- Store all combustible in closed and labeled containers.
- Any combustible or flammable liquids that have been spilled shall be clean up properly.
- Gasoline and other flammable fuels shall be dispensed from UL (Underwriter Laboratory) or FM (Factory Mutual) approved safety containers only.
- Flammable and compressed gases shall be stored and used in well ventilated areas.
- Keep oily rags in a covered, metal container.
- Keep all combustible materials stored in approved areas or cabinets.

#### **Cord Sets, GFCI's**

- Extension cord sets used with portable electric tools and appliances shall be of three-wire type and shall be designed for hard or extra-hard usage.
- No homemade cords are allowed.
- Flexible cords used with temporary and portable lights shall be designed for hard or extra-hard usage.
- Flat Cords are not acceptable:
- Flexible cords & cables must be protected from damage.
- Cords may not run through pinch points.
- Extension cords may not be suspended by nails, staples, or wires.
- Portable cord and plug connected equipment and flexible cord sets (extension cords) shall be visually inspected before use on any shift for external defects (such as loose parts, deformed and missing pins, or damage to outer jacket or insulation) and for evidence of possible internal damage (such as pinched or crushed outer jacket). Cord

and plug connected equipment and flexible cord sets (extension cords) which 4 remain connected once they are put in place and are not exposed to damage need not be visually inspected until they are relocated.

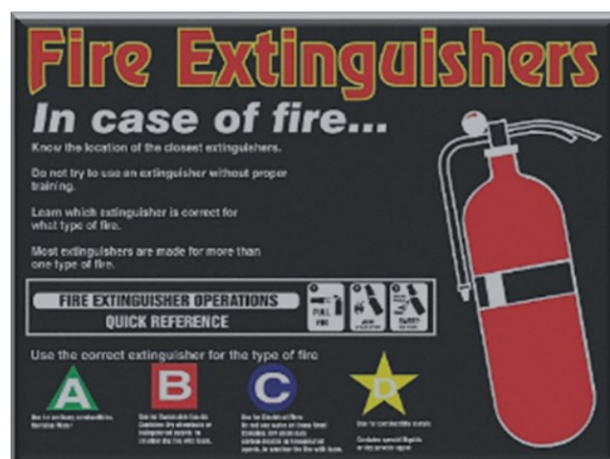
- Flexible cords shall be used only in continuous lengths without splice or tape. Hard service flexible cords No. 12 or larger may be repaired if spliced so that the splice retains the insulation, outer sheath properties, and usage characteristics of the cord being spliced.

### Ignition Sources

- Smoke only in areas that are designated to do so.
- Dispose of smoking products in appropriate receptacles.
- Control open flames/and or heat producing processes to minimize the potential for fire.
- In potentially explosive atmospheres, use electric devices (e.g., motors, lights) classified for the location.
- When using hand tools where sparks could be produced, ensure an explosive atmosphere does not develop. Use isolation, ventilation, purging, and monitoring to ensure a safe working atmosphere.

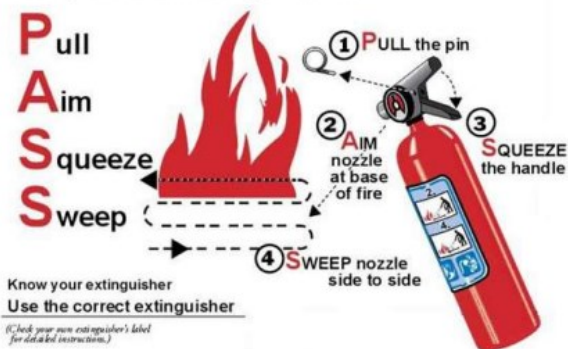
### Fire Extinguishers

- Fire protection equipment shall be properly always located. Except for actual use or inspection, employees shall not move or remove such equipment without proper authority.
- Extinguishers shall be available within 100 ft of work areas, within 30 ft of heat producing work, and adjacent to hazardous areas such as fuel storage, insulation storage, racks, and where unpacking and uncrating takes place in large quantities.
  - A fire extinguisher, rated not less than 2A, shall be provided for each 3,000 square feet of the protected building area, or major fraction thereof. Travel distance from any point of the protected area to the nearest fire extinguisher shall not exceed 100 feet.
  - Report any damaged or spent portable fire extinguishers to local supervisor for replacement.
  - Keep all access to fire extinguishers or other fire protection equipment easily accessible or unrestricted.
    - Do not use a fire extinguisher or other fire protection equipment unless trained to do so.
- Employees shall know the classes of fire, their burning characteristics, and the proper extinguishing agent to be used.
- Class BC Extinguishers are installed for use on most Company vehicles.
- Employees should always check the extinguisher labels before using extinguishers, making sure the proper extinguishing agent is being used to extinguish the proper class of fire.
  - Class "A" fires involve normal combustibles such as wood and paper. Extinguishing agents include water, soda-acid and multipurpose dry chemicals.



- Class “B” fires involve oils and flammable liquids. Extinguishing agents include CO2 and dry chemicals.
- Class “C” fires involve electrical equipment.
- Fire extinguishers shall be mounted between 3.5 and 5 feet (recommended height is 42 inches or less) unless used in motor vehicles.
- Do not mount in areas that could exceed 120°F.
- Mount fire protection equipment on trucks at an accessible location.
- Extinguishing agents include CO2 and dry chemicals.
- Halon 1301 (Freon) and Halon 1211 are gaseous extinguishing agents suitable for combating both Class “B” and Class “C” fires, especially at indoor locations. Both agents are slightly toxic in low concentrations (less than 5 percent) and will cause unconsciousness in a short period of time when the concentration is above 15 percent.
  - When the extinguishing agent is released, precautionary measures similar to those for toxic, confined spaces should be employed.
- In the event of a fire:
  1. Call the fire department.
  2. Get everyone out.
  3. Plan a retreat.
  4. Stay low to avoid smoke inhalation.
  5. If the fire can be safely extinguished, utilize the PASS method to put it out.
  6. Keep a minimum of 6 feet away from the fire.
  7. Monitor the area to ensure the fire does not reignite.
- Any fire extinguisher that has been discharged, even partially, shall be immediately recharged by a qualified fire extinguisher service agency or replaced.
- Inspect fire extinguishers at regular intervals to determine that:
  - The extinguisher is up to date on inspections.
  - The pointer on the pressure gauge is in the green operable area.
  - The nozzle opening is free of foreign objects.
  - The pull pin is intact to prevent accidental discharge.

**To operate an extinguisher:**



#### 14.4. Hazardous Chemicals

##### Requirement

- Employees shall be trained on hazardous chemicals, container labeling, and Safety Data Sheets.
- Containers will be properly labeled.
- Safety Data Sheets will be readily available for each hazardous chemical on a jobsite.

##### General

- Before starting work, identify ALL hazardous substances involved with the work task. (Hazardous substances can be chemicals involved in the work process, materials used, or coatings and insulation to be installed or removed.)
- Observe the following work practices where hazardous substances (materials and chemicals) are present:
  - Do not eat or drink; do not use tobacco products.
  - Wash hands and face at breaks. (When appropriate, shower at the end of work task or shift.)
  - Never blow on or shake off contaminated clothing, and never use compressed air to clean contaminated clothes.
  - Place contaminated clothing in plastic bags and label.
  - Using approved methods to reduce/eliminate the spread of contamination, clean contaminated work area.
  - To prevent unnecessary personnel exposure, mark off the work area as necessary with ribbons, tapes, signs, or barriers.
  - When a splash hazard exists, verify availability and location of eyewash and shower before performing tasks.
- When working with hazardous materials/chemicals, be able to perform the following in an emergency situation:
  - Identify an emergency situation.
  - Know how and when to report the chemical emergency. o Know local places of refuge/how to evacuate the area.
  - Know appropriate decontamination procedures.
  - Conduct atmospheric monitoring as necessary to ensure a safe work environment.
- Where hazardous chemicals/materials are used, stored, or disposed of in the workplace, use engineering controls (e.g., natural, forced, or local exhaust ventilation) to eliminate or reduce airborne concentrations of hazardous substances.
- Ensure protective equipment (including clothing) is specified by work procedures or trained and qualified persons based on an evaluation of the hazard and the exposure levels.
- Ensure individuals are trained and have demonstrated appropriate knowledge of:
  - Key elements of hazard communication.
  - Specific hazards of substances (e.g., chemicals/materials) to which individuals may be exposed.
- Before using hazardous substances be aware of the following:

|  |  |  |
|--|--|--|
| <b>Health Hazard</b><br><br>• Carcinogen<br>• Mutagenicity<br>• Reproductive Toxicity<br>• Respiratory Sensitizer<br>• Target Organ Toxicity<br>• Aspiration Toxicity | <b>Flame</b><br><br>• Flammables<br>• Pyrophorics<br>• Self-Heating<br>• Emits Flammable Gas<br>• Self-Reactives<br>• Organic Peroxides | <b>Exclamation Mark</b><br><br>• Irritant (skin and eye)<br>• Skin Sensitizer<br>• Acute Toxicity (harmful)<br>• Narcotic Effects<br>• Respiratory Tract Irritant<br>• Hazardous to Ozone Layer (Non-Mandatory) |
| <b>Gas Cylinder</b><br><br>• Gases Under Pressure   | <b>Corrosion</b><br><br>• Skin Corrosion/ Burns<br>• Eye Damage<br>• Corrosive to Metals  | <b>Exploding Bomb</b><br><br>• Explosives<br>• Self-Reactives<br>• Organic Peroxides  |
| <b>Flame Over Circle</b><br><br>• Oxidizers   | <b>Environment (Non-Mandatory)</b><br><br>• Aquatic Toxicity  | <b>Skull and Crossbones</b><br><br>• Acute Toxicity (fatal or toxic)  |



- Exposure effects.
- Physical hazards (e.g., flammable, explosives).
- Health hazards.
- Routes of entry.
- Emergency procedures (e.g., first aid, spills, releases).
- Personal protective equipment requirements.
- Use only materials/chemicals that are appropriately labeled and follow the label instructions for chemical use and storage.
- Ensure individuals know how and where to obtain Safety Data Sheets (SDS). SDS were formerly called Material Safety Data Sheets (MSDS).
- Use (e.g., handle/transport/store/dispose of) hazardous substances according to SDS or specific work practices.
- If a real or suspected exposure to hazardous substances exists:
  - Evacuate and isolate area and notify appropriate location personnel.

### Container Labeling

- Do not remove, cover, or deface original labeling of containers with hazardous materials.
- Manufacturers labels must include Product Identifier, Supplier Identification, Precautionary Statements, Hazard Pictogram(s), Signal Word, Hazard Statement, and Supplemental Information.
- Replace labels that become unreadable.
- Portable containers into which hazardous materials are transferred for immediate use by the person performing the transfer do not have to be labeled.
- Any container other than the original that will be used to store or transport hazardous materials must be labeled in English and include the name and manufacturer of the product.
- NFPA 704 Fire Diamond Labeling System:
  - Red – Flammability.
  - Yellow – Instability.
  - Blue – Health.
  - White – Special Information.
  - Each quadrant will contain a number from 0 to 4. A blank represents no hazard and a pictogram represents hazard.
- Hazardous Material Information System (HMIS) Labeling:
  - Similar to NFPA Fire Diamond but not in diamond format.
  - GHS labeling has changed from diamond format with numbers to pictogram labeling.



Figure 54 NFPA 704 Label



The diagram shows a sample container label form. It includes sections for:
 

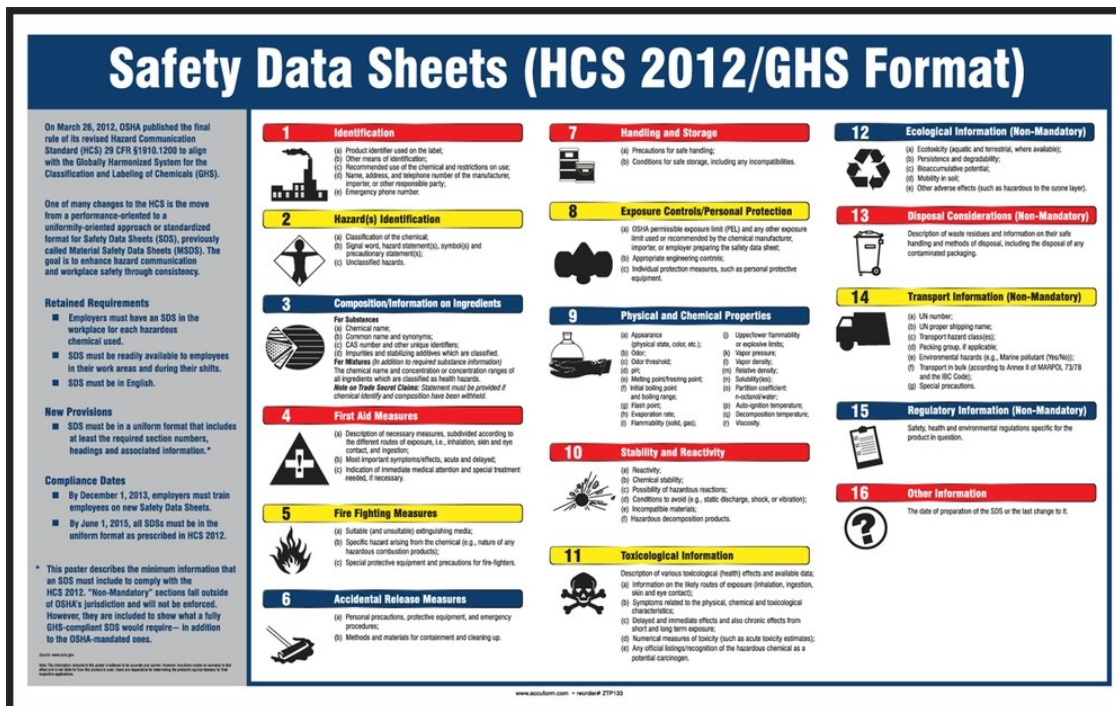
- PRODUCT IDENTIFIER:** CODE, Product Name.
- SUPPLIER IDENTIFICATION:** Company Name, Street Address, City, State, Zip, Pallet Date, Country, Emergency Phone Number.
- PRECAUTIONARY STATEMENTS:** Keep container tightly closed. Store in cool, well-ventilated area that is shaded. Keep away from heat/spark/open flame. No smoking. Do not use for breathing. Use explosion-proof electrical equipment. Take precautions to ensure adequate ventilation. Ground and bond container and receiving equipment. Do not breathe vapors. Wear Protective gloves. Do not eat, drink or smoke when using this product. Wear hand protection after handling. Dispose of in accordance with local, regional, national, international regulations as specified.
- HAZARD PICTOGRAMS:** Two pictograms (Corrosion and Flammable).
- SIGNAL WORD:** Danger.
- HAZARD STATEMENT:** Highly flammable liquid and vapor. May cause fire and safety damage.
- SUPPLEMENTAL INFORMATION:** Directions for use, Net weight, Lot Number, Gross weight, Pallet Date, Expiration Date.
- IN CASE OF FIRE:** Use dry chemical (BC) or Green Master (D) fire extinguisher to extinguish. Risk: Irritant. If exposed or Poison Center. If on skin (on face): Use of immediate and appropriate clothing. Rinse skin with water.

Figure 55 Sample Container Label

- Pictograms indicate associated hazard for specific chemical.

## Safety Data Sheets

- GMB stores SDS(s) electronically.
- Make sure to be aware of the following for each chemical in your workplace. This information can be obtained from supervision or SDS.
  - Methods and observations to detect presence or release.
  - Physical and health hazards.
  - Protective measures.



**Safety Data Sheets (HCS 2012/GHS Format)**

On March 26, 2012, OSHA published the final rule of its revised Hazard Communication Standard (HCS) 29 CFR 1910.1200 to align with the Globally Harmonized System for the Classification and Labeling of Chemicals (GHS).

One of many changes to the HCS is the move from a performance-oriented to a uniformly-oriented approach or standardized format for Safety Data Sheets (SDS), previously called Material Safety Data Sheets (MSDS). The goal is to enhance hazard communication and workplace safety through consistency.

**Retained Requirements**

- Employers must have an SDS in the workplace for each hazardous chemical used.
- SDS must be readily available to employees in their work areas and during their shifts.
- SDS must be in English.

**New Provisions**

- SDS must be in a uniform format that includes at least the required section numbers, headings and associated information.\*

**Compliance Dates**

- By December 1, 2013, employers must train employees on new Safety Data Sheets.
- By June 1, 2015, all SDSs must be in the uniform format as prescribed in HCS 2012.

\* This poster describes the minimum information that an SDS must include to comply with the HCS 2012. "Non-Mandatory" sections fall outside of OSHA's jurisdiction and will not be enforced. However, they are included to show what a fully SDS-compliant SDS would require-- in addition to the OSHA-mandated ones.

**1 Identification**

- Product identifier used on the label;
- Other means of identification;
- Recommended use of the chemical and restrictions on use;
- Name, address, and telephone number of the manufacturer, importer, or other responsible party;
- Emergency phone number.

**2 Hazard(s) Identification**

- Classification of the chemical;
- Signal word, hazard statement(s), symbol(s) and pictogram(s) (statement(s));
- Unclassified hazards.

**3 Composition/Information on Ingredients**

**For Substances:**

- Chemical name;
- Common name and synonym(s);
- CAS number and other unique identifiers;
- Impurities and stabilizing additives which are classified.

**For Mixtures (in addition to required substance information):**

The chemical name and composition ranges of all ingredients which are classified as health hazards. **Mark as their Severe Classes. Statement must be provided if chemical identity and composition have been withheld.**

**4 First Aid Measures**

- Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion;
- Most important symptoms/effects, acute and delayed;
- Indication of immediate medical attention and special treatment needed, if necessary.

**5 Fire Fighting Measures**

- Suitable (and unstable) extinguishing media;
- Specific hazard arising from the chemical (e.g., nature of any hazardous combustion products);
- Special protective equipment and precautions for fire-fighters.

**6 Accidental Release Measures**

- Personal precautions, protective equipment, and emergency procedures;
- Methods and materials for containment and cleaning up.

**7 Handling and Storage**

- Precautions for safe handling;
- Conditions for safe storage, including any incompatibilities.

**8 Exposure Controls/Personal Protection**

- OSHA permissible exposure limit (PEL) and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet;
- Appropriate engineering controls;
- Individual protection measures, such as personal protective equipment.

**9 Physical and Chemical Properties**

- Appearance (physical state, color, etc.);
- Odor;
- Color transition;
- Melting point;
- Freezing point;
- Boiling point;
- Evaporation rate;
- Flammability (solid, gas);
- Upper/lower flammability or explosive limits;
- Vapor pressure;
- Vapor density;
- Relative density;
- Solubility(ies);
- Partition coefficient: n-octanol/water;
- Auto-ignition temperature;
- Decomposition temperature;
- Viscosity.

**10 Stability and Reactivity**

- Reactivity;
- Chemical stability;
- Possibility of hazardous reactions;
- Conditions to avoid (e.g., static discharge, shock, or vibration);
- Incompatible materials;
- Hazardous decomposition products.

**11 Toxicological Information**

Description of various toxicological (health) effects and available data:

- Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact);
- Symptoms related to the physical, chemical and toxicological characteristics;
- Delayed and immediate effects and also chronic effects from short and long term exposure;
- Numerical measures of toxicity (such as acute toxicity estimates);
- Any official listings/recognition of the hazardous chemical as a potential carcinogen.

**12 Ecological Information (Non-Mandatory)**

- Ecotoxicity (aquatic and terrestrial, where available);
- Persistence and degradability;
- Bioaccumulative potential;
- Mobility in soil;
- Other adverse effects (such as hazardous to the ozone layer).

**13 Disposal Considerations (Non-Mandatory)**

Description of waste residues and information on their safe handling and methods of disposal, including the disposal of any contaminated packaging.

**14 Transport Information (Non-Mandatory)**

- UN number;
- UN proper shipping name;
- Transport hazard class(es);
- Packing group, if applicable;
- Environmental hazards (e.g., Marine pollutant (Ch+M));
- Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code);
- Special precautions.

**15 Regulatory Information (Non-Mandatory)**

Safety, health and environmental regulations specific for the product in question.

**16 Other Information**

The date of preparation of the SDS or the last change to it.

www.osha-sds.com • Number Z1P-133

Figure 56 -16 Sections of an SDS-

## Chemicals on Jobsites

- In field operations, there is potential exposure to creosote on poles, diesel fuel, hydraulic fluid, gasoline, two-cycle oil mix and bar lube for chainsaws.
  - There is a minimal chance of exposure to PCB oil in older transformers and similar equipment.
  - There may be other exposures specific to a job. Identify all chemicals on a jobsite. Protection Measures
- Inspect all tools and equipment, and contact fleet for repairs if any leaks are found.
- Keep liquids stored in approved and labeled containers.
- Know that chemicals typically found in field operations have similar health hazards.
  - They are skin irritants – if contact with skin occurs, wash immediately with soap and water, and remove any contaminated clothing.
  - Thoroughly rinse eyes with water if contact occurs.
  - If any of these chemicals are ingested orally or injected into or under the skin seek medical treatment immediately.
    - Small land spills can be recovered by pumping or with suitable absorbents.
    - Water spills should be contained if possible and reported to NATIONAL Regulatory Compliance Department.
    - Report any chemical contact or spillage to supervision immediately.

- Other chemicals may be found on jobsites. Ask the foreman for a list of chemicals specific to a jobsite.

**\*NOTE: Always ask supervision if ever in doubt when working with any chemical....it is an employee's right to know!**

## 14.5. Oil Spill Handling, Disposal, & Response

### Spill Prevention

- Spill prevention begins by taking steps to prevent and contain the spill before it occurs.
- Employees will attempt to stop small spills at the source. Employees will act to prevent any unsuspecting personnel from coming in contact with spilled materials.
- Any oil discharged from transformers, regulators, capacitors, mechanical equipment, etc. which meets any of the criteria listed below must be reported immediately to a supervisor, Safety Department, and/or customer representative as required:



- Spills (regardless of PCB level) which reach or may reach surface waters including drainage ditches, ground water, storm sewer systems or sanitary sewer systems.
- Spills of any size from a piece of equipment which may contain PCBs at any concentration.
- Large spills (generally considered 3 gallons or more) from PCB-free equipment requiring significant clean-up efforts.

- Clean Up, Documenting, and Reporting:
  - Evaluate extent of spill.
  - Check equipment for PCB and non-PCB labeling.
  - Check condition of equipment.
  - De-energize equipment if necessary.
  - Contain oil spill and take care of clean up.
  - Restrict flow of spill using most appropriate method (i.e., shovel dirt, apply oil-absorbent pads, apply straw bales, install oil booms, etc.).
  - Secure area of spill.
  - Repair equipment or stop leakage if possible.
- Restore service - concurrently with spill clean-up when possible.
- Initiate documentation of spill such as:
  - Location of the spill.
  - Time and cause of spill.
  - Type and quantity of fluid discharged.
  - Cleanup effort and estimated time cleanup will be completed.
  - Any personal injury or property damage caused by the spill.

**Hazardous Materials Minor Spill and Release Incident Report Form**  
Approved jointly by CAGS (Community Awareness & Emergency Response) and Santa Barbara County Fire Chiefs  
For Complete Report to Santa Barbara County Public Health - CAGS, Follow-up with response verification to 805-348-0488  
FAX (805) 348-0405

| 1. INCIDENT AND RESPONSE DESCRIPTION  |  | B11 Called? <input type="checkbox"/> Yes <input type="checkbox"/> No                     |  |
|---|--|--|--|
| Date / Time Discovered  | Units / Vans Discharged  | Discharge Stopped  | <input type="checkbox"/> Yes <input type="checkbox"/> No                                     |
| Incident Reporting Code / Type  |  |  |  |
| Incident Location - Site Name   |  |  |  |
| Incident Address  |  |  |  |
| Other Location (Pole, Tower, Oil Field, Leaky Well & GSE)   |  |  |  |
| Please describe the incident and include specific causes and area affected.   |  |  |  |
| Indicate actions to be taken to prevent similar spills from occurring in the future.                                  |  |  |  |
| 2. ADMINISTRATIVE INFORMATION   |  |  |  |
| Business Name   |  |  |  |
| Address   |  |  |  |
| Supervisor in charge at time of incident  |  | Phone  |  |
| Contact Person  |  | Phone  |  |
| 3. CHEMICAL / RELEASE INFORMATION <small>Can B11 not be used with methanol, acetone, or other polar solvents.</small> |  |  |  |
| Chemical  | Quantity   | <input type="checkbox"/> gal. <input type="checkbox"/> lbs. <input type="checkbox"/> qt. |  |
| Chemical  | Quantity   | <input type="checkbox"/> gal. <input type="checkbox"/> lbs. <input type="checkbox"/> qt. |  |
| Chemical  | Quantity   | <input type="checkbox"/> gal. <input type="checkbox"/> lbs. <input type="checkbox"/> qt. |  |
| Clean-Up Procedures & Timeline  |  |  |  |
| Completed By _____ Phone _____  |  |  |  |
| First Name _____ Title _____ Date and Time _____  |  |  |  |
| SANTA BARBARA COUNTY PUBLIC HEALTH - RRS USE ONLY   |  |  |  |
| Date Reported   | Time   | RRS Control #  | OR #   |
| Reported By   | Assigned To  | Dispatched To  | RRS <input type="checkbox"/> Yes <input type="checkbox"/> No                                 |
| Date / Time Reported to B11   | Late Report <input type="checkbox"/> Yes <input type="checkbox"/> No                           | Incident #   |  |
| From B11 Dispatch <input type="checkbox"/> Yes <input type="checkbox"/> No  | Dispatch Required (M/J) Reported <input type="checkbox"/> Yes <input type="checkbox"/> No      | Type of Dispatch Request   |  |
| Time (M/J) Reported   | Time On Scene  | Time Back in Service   | <input type="checkbox"/> 2 hrs <input type="checkbox"/> 4 hrs <input type="checkbox"/> 6 hrs |
| Phone # <input type="checkbox"/> Yes <input type="checkbox"/> No  | Send/Text to RRS   | Send/Text to County OEM  |  |
| Methane   | Volatil  |  |  |
| Hazardous <input type="checkbox"/> Yes <input type="checkbox"/> No  |  |  |  |
| Current Status  |  |  |  |
| <input type="checkbox"/> Clean-Up Underway  | <input type="checkbox"/> Pollution Characterization Underway                                   | <input type="checkbox"/> Case Closed (Clean-Up Completed or Unnecessary)                 |  |
| <input type="checkbox"/> Condition Monitored  | <input type="checkbox"/> Preliminary Site Assessment Underway                                  | <input type="checkbox"/> Investigated  |  |
| <input type="checkbox"/> No Action Taken  |  |  |  |
| Detection   |  |  |  |
| Mechanism of Detection  | How? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown | Location <input type="checkbox"/> Yes <input type="checkbox"/> No                        | APIS <input type="checkbox"/> Yes <input type="checkbox"/> No                                |
| <input type="checkbox"/> Owner's O&M Personnel  | <input type="checkbox"/> Owner's Personnel   | <input type="checkbox"/> Owner's Asst  | <input type="checkbox"/> O&M   |
| <input type="checkbox"/> Santa Barbara County   | <input type="checkbox"/> Santa Barbara County  | <input type="checkbox"/> Santa Barbara County  | <input type="checkbox"/> Santa Barbara County  |

CSMT Hazardous Materials Minor Spill & Release Incident Report (March 2014) Page 1 of 1

Figure 57 Spill Report

## 14.6. Material Handling & Lifting

### Requirement

- Cross arms, pole tops, pole pullers, wire, and other tools and equipment utilized in powerline construction are very heavy. It is essential to properly handle materials and use proper lifting procedures. Know what is being lifted and get help when needed.

### General

- Obtain assistance from another person or utilize lifting equipment if a load is too heavy to lift manually.
- Do not attempt to lift beyond individual capability and avoid twisting or turning during the lifting process.
- Take caution when lifting or pulling in an awkward position.
- When two or more persons are carrying a load, each employee, if possible, should face the direction in which the load is being carried.
- When two or more persons are carrying a heavy load that is to be lowered or dropped, there shall be a prearranged signal for releasing the load.
- Maintain a clean and safe work environment to eliminate slip, trip, and fall hazards while lifting and carrying.
- No employee shall be permitted underneath loads handled by lifting or digging equipment.
- Employees must stand away from any vehicle being loaded or unloaded to avoid being struck by spillage or falling materials.
- Keeping physically fit will reduce the chances of a back injury.
- Lift the load mentally before physically picking it up.
  - Size it up – How much does it weigh? How is it shaped and packaged? Is help needed or is there equipment that could be utilized?

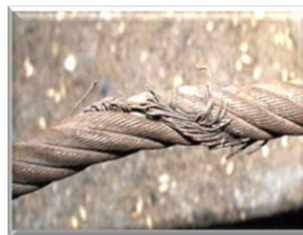
**\*NOTE: The right way to lift is easiest and safest. Crouch or squat with the feet close to the load; secure good footing; take a firm grip; bend the knees; keep the back vertical; and lift by using the knees, the leg and thigh muscles.**

### Slings

- Never exceed the rated capacity.
- Never use a damaged sling.
- Never shorten with knots, bolts, or other devices.
- Always protect slings from sharp edges of the load.
- Always keep hands and fingers clear of slings under tension.
- Always be aware of down strain at dead end poles and take that into account when calculating sling capacity.
- Sling Inspection.
  - All slings (synthetic or steel) should be inspected before use.
  - All slings must be labeled.



- Synthetic web slings must be marked with name or trademark of manufacturer, rate capacities for each type of hitch to be used, and type of material.
  - Any sling that does not pass inspection should be immediately removed from service.
  - Inspect synthetic web slings for:
    - Acid or caustic burns.
    - Melting or charring to any part of the sling surface.
    - Snags, punctures, tears, or cuts.
    - Broken or worn stitches.
    - Other signs of damage.
    - Red stitching indicates damage and sling shall NOT be used.
  - Inspect steel slings for:
    - Excessive broken wires.
    - Kinking or bird caging.
    - Crushing.
    - Deformation.



- Sling Storage.
  - Store in a dry environment out of sunlight.
  - Store off the floor or ground to prevent corrosion.
  - Hang from hook to prevent tangling.
  - Store away from electrical sources.
  - Store by sling type (Do not mix steel slings with synthetics, etc.).

### Hooks

- Hooks should have safety latches installed.
- When a piece of equipment or tool has a safety latch on a hook, adhere to the following:
  - Ensure safety latches are installed and operable.
  - Never attempt to use a damaged hook.
  - Use only original equipment and do not modify.
  - Do not place hands or finger between hook and load.
  - Do not tip load hooks.



Figure 58 Hook with Safety Latch

### Chain Hoists

- Inspect before each use. Look for:
  - Deformations, chemical damage, and cracks.
  - Check that both hooks swivel freely.
  - Check hook latches for damage.
  - Check all operating mechanisms (control lever, lifting lever, thumb latch, and safety pin) for proper functioning.
  - Check load chain and connecting links for wear, twist, spread side plates, presence of foreign material, and adequate lubrication.
- Operator shall be aware of and stay within rated capacity.
  - Overloading not only causes damage to the hoist but presents serious threats to persons around the hoist.

- Never use a handle extender (cheater bar). The hoist is designed to lift or pull its rated capacity when a reasonable effort is exerted by one person.
  - If effort is excessive recheck the load and use a larger capacity hoist if necessary.
- Avoid side loading. Always pull in a straight line between hooks. Side loading over a sharp corner may damage the hoist and its components.
- Be sure there are no twists in the load chain.
- Do not wrap the chain around the load. Use a sling.

#### **Alloy Steel Chains**

- Must have permanent affixed durable identification stating size, grade, rated capacity, and reach.
- Coupling links or attachments must have rated capacities equal to or greater than the chain.
- Alloy steel chains must be inspected before each use.
- In addition, they must be inspected at least annually. A documented record of inspection must be maintained for each chain.

### **14.7. Housekeeping Storage**

#### **Requirement**

- Jobsites, materials, and equipment shall be maintained in a clean and orderly manner.
- Spills, trip hazards, hazards from falling objects, and any condition that causes a hazard shall be immediately corrected.
- Materials shall be stored, and jobsites maintained to eliminate safety hazards: facilitate material handling: provide safe working surfaces: and allow for movement of personnel, materials, and equipment.

#### **Housekeeping**

- Work locations, vehicles, buildings, and grounds shall be kept clean and orderly to the extent that the nature of the work allows.
- Keep individual/teamwork areas orderly, clean, and free of housekeeping hazards.
- Properly dispose of scrap and waste materials at frequent and regular intervals or at the end of each shift.
- A clean and orderly work environment can be achieved and maintained through ongoing housekeeping efforts undertaken by personnel at all levels. Supervisors shall initiate participation in housekeeping activities and good work habits, not only at the end of a work assignment, but throughout the evolution of the task.
- Containers shall be provided for the collection of waste, trash, and other refuse generated at the facility.
- For trash, recyclables, and other waste materials, do the following:
  - Separate, dispose of, and keep waste in approved and properly labeled containers.
  - Keep oily rags in a covered, metal container.
  - Safeguard sharp objects before disposal (e.g., broken glass disposed of in a cardboard box).
  - Load trash containers to protect material handlers from personal injury from contents. (e.g., heavy objects)

- Overcrowding is an impediment to proper housekeeping and a deterrent to safety and health. Blocked or restricted aisles, stairwells, and travel ways inhibit the safe movement of equipment and materials.
- Planning the location of equipment and storage facilities shall take into consideration the flow of personnel, equipment, materials, fire hazards, and the prevention or obstruction of evacuation, firefighting, or rescue activities. o Eliminate tripping hazards or restrict access to the area.
- Identify, cover, or mark temporary cables or cords passing through work areas. o Use adequate lighting to perform work safely.
- All spills that could lead to slips or falls should be cleaned up immediately.

#### **Storage**

- Materials shall be stored in a manner that facilitates access of material handling equipment and personnel handling limitations. Lack of sufficient workspace and storage capacity leads to the potential for accidents and decreases efficiency.
- Storage of any material and supplies shall be planned with consideration given to the flow of personnel, equipment, materials, fire hazards, and the prevention or obstruction of evacuation, firefighting, or rescue activities.
- Storage of flammable liquids, paints, and thinners shall be prohibited unless required for maintenance and operation of building or equipment. Such storage shall be within a metal storage cabinet that has been labeled and approved for the storage of flammable liquids.
- Store pipes, poles, rods, and similar materials in racks to prevent rolling and facilitate safe handling.
- Materials with protruding nails, staples, or similar hazards should be immediately removed from walkways and stored in a manner to prevent injuries.
- Sharp or jagged materials (broken porcelain) should be protected before it is stored and stored in a manner to prevent cuts and punctures with the sharp or jagged edge facing away from the point of access.

**\*NOTE: A CLEAN WORKPLACE IS A SAFE WORKPLACE**

## 14.8. Poisonous Plants

- These plants contain Urushiol oil, which is what causes the rash and irritation.
- Urushiol oil adheres to almost any surface (skin, clothing, towels, etc.) so:
- Avoid Contact.
  - Be able to identify the plants.
  - Wear long sleeve GMB(s) FR shirt and keep as much of the body covered as possible.
  - In the event of contact with poisonous plants:
  - Wash the affected area with soap and water within ten minutes of exposure.
  - Contact a supervisor who will provide an ointment that will help alleviate the symptoms.
  - Avoid scratching or touching infected area as the oils can be spread very easily.
    - It is important that to follow the directions provided on the tube for maximum relief.

Table 17 Poisonous Plants




| Commonly Encountered Plant Types  |   |   |
|---|---|---|
| <p>Poison Oak</p>   | <p>Poison Ivy</p>    | <p>Poison Sumac</p>   |
| <p>Found below 5,000 feet in moist areas without much sunlight<br/>Shrub with 3 leaves<br/>Hair found on fruit, trunk, and leaves of the shrub<br/>Most common in western and southern US</p> | <p>3 pointed leaflets on a vine<br/>Middle leaflet will have a much longer stalk<br/>Reddish in spring, green in summer, and yellow, orange, or red in the fall<br/>Most common in eastern US</p> | <p>Grows in moist and marsh-like environments and in standing water<br/>Leaves have groups of 7 to 13 leaflets<br/>Grows on bush or shrub<br/>Less common but equally problematic</p> |



Figure 59 Example of Skin Irritation



## 14.9. Pesticides

### General

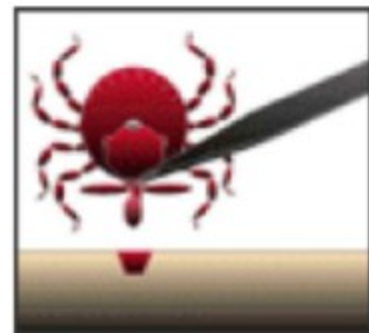
- Ensure applicators follow label and Safety Data Sheet (SDS) directions to identify proper safety equipment and to note health concerns of pesticides.
- Ensure applicators have appropriate SDS readily available and are knowledgeable of the product they are applying.
- As appropriate or as recommended on the label, wear the following personal protective equipment when handling, mixing, or applying pesticides:
  - Long-sleeved shirt and full-length trousers or long-sleeved coveralls.
  - Non-canvas or nonporous shoes or boots.
  - Safety glasses or face shield.
  - Neoprene gloves.
  - Respirator if necessary.
- Ensure respiratory protection is based upon SDS, exposure assessment, and work practices.
- Ensure applicators required to wear any form of respiratory protection have medical clearance, training, fit testing, and approved respirators.
- Do not use single-use dust masks; they do not protect against pesticides.
- Ensure applicators adhere to the following guidelines for caring for personal protective equipment:
  - After each day's use, launder reusable clothing.
  - Do not launder contaminated clothing with normal household clothing.
  - After each day's use, discard disposable clothing.
- For several scheduled applications at different locations in a single day, disposable clothing may be reused, providing the garment is in reasonably good condition (e.g., not heavily soiled, saturated, or torn areas).
- Place contaminated disposable clothing in impervious waste bags, and label as to the type of pesticide contamination.
- Do not handle contaminated clothing with unprotected hands.
  - At the end of each day, wash reusable personal protective equipment with detergent and clean water. Dry this equipment in a clean, dry place.
  - Replace pesticide respirator cartridges after 8 hours of use or more if the odor of the pesticide can be detected while wearing the device.
- To minimize or eliminate potential personal exposure to pesticides through inhalation, ingestion, and/or skin absorption:
  - Never eat, drink, or smoke when handling pesticides.
  - Remove all jewelry before handling pesticides.
  - Wash hands with soap and water after handling, mixing, or applying pesticides.
- Determine what pesticide application equipment is necessary for the task.
  - Check to make sure all the equipment needed is available and that it is clean and in good operating condition.
  - Ensure that anyone who will use the equipment knows how to operate it safely and correctly.
- Pesticides may easily be transferred to other people or objects from clothing, gloves, shoes, or PPE.

- Spills should be cleaned immediately, reported as required, and PPE should be worn when cleaning after a spill.
- Ensure people and animals are out of the area prior to applying pesticides.

#### 14.10. Insects

##### Requirement

- Working outside brings the potential for insect bites. Take precautions to avoid insect bites and know what to do in the event of an insect bite.
  - Tips to avoid insect bites:
    - Wear work gloves.
    - Shake out clothes and PPE (especially gloves) before putting them on.
    - Use an insect repellent containing DEET.
    - Do not roll up sleeves.
    - Check entire body after being in an area where insects are likely to be found.
    - Keep open drinks and uneaten food well-guarded.
  - If bitten by a tick:
    - To remove an attached tick:
    - Use fine-tipped tweezers. If they are not available, use fingers.
      1. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin.
      2. After removing the tick, thoroughly disinfect the bite site and wash hands with soap and water.
      3. Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms.
        - Save the tick for identification in case of illness.
        - Clean the bite site thoroughly.
        - Closely monitor overall health and the bitten area.
        - Any of the symptoms below could be signs of infection and a doctor should be consulted immediately.
          - Pain, swelling, redness or warmth around the bitten area.
          - Red streaks leading from bitten area.
          - Swollen lymph nodes in neck, armpit, or groin.
          - Fever or chills.
          - Rash, headache, joint pain, or flu-like symptoms.
- Tips to avoid bee stings:
  - Avoid wearing fragrances including hair spray, scented soaps, lotions, and oils.
  - Do not wear brightly colored clothing, especially floral designs.
  - Keep open drinks and uneaten food well guarded.
  - Wash hands immediately after eating sugary or sticky foods.
  - If a bee lands on, the body:
    - Hold still and gently blow on the bee.
  - If a bee comes inside a vehicle, remain calm and stop the vehicle as safely as possible and open the windows to let the bee out.



- In the Event of a Bee Sting
  - Gently attempt to scrape out the stinger with a blunt-edged object such as a credit card or dull knife.
  - Wash the area with soap and water several times a day.
  - Apply a cold ice pack for a few minutes after the sting.
  - Apply a paste of baking soda and water for 15-20 minutes.
  - Take acetaminophen if needed for pain.
  - Contact medical personnel if:
    - The victim of the sting is allergic to bee stings.
    - The victim was stung in the mouth or nose.
    - The sting results in swelling, abnormal breathing, tightness in throat or chest, dizziness, hives, fainting, nausea and/or persistent pain or swelling.
- If an employee is allergic to bees:
  - They should obtain a sticker for their hard hat.
  - Carry EpiPen or other medication.
  - Make sure the crew knows what to do in the event of a sting.



#### 14.11. Dog Bites

##### Requirement

- Observe the work area at all times. Look for dog trails, food or water bowls, dog houses, fences, chains, dumped garbage cans, behind bushes, under cars and houses.
- Employees should be wary of dogs behind them. Almost all attacks occur this way.
- When entering a property, rattle the gate or make a noise. If there is a dog, this may give provide a chance to meet the dog before entering the property.
- Never think that a dog that is tied up cannot attack. Chains can break and may be longer than they appear. Dogs are also more aggressive when tied up.
- Fight or Flight. Almost all bites occur out of fear. If approaching a doorstep where a dog is resting, give the dog plenty of room to escape. A frightened, cornered dog will come out fighting when its “chase response” is triggered. If the dog is the nervous type (runs away barking), ensure that there is an escape route for the dog.
- Do not reach toward a dog’s head. This is a dominant gesture, and some dogs are punished by being hit in the head area.
- Never lean over a dog or hold direct eye contact with it. This is a dominant stance and may prompt an attack.
- Always assume that a strange dog may see a stranger as an intruder or a threat.
- If there is evidence of a dog in the yard, employees should always knock on the door and request that the customer confine the dog so that they may enter the yard.
- Following a thorough hazard assessment, if an employee feels that the chained dog is not completely secured, the employee should refuse to access the yard.

##### How to tell when a dog might bite:

- The dog may stand stiff and still, maybe with its hair up.
- It may stare.

- The dog may hold its tail stiff and up in the air. Very important – a dog that is friendly will wag its tail, and the wagging will be very relaxed. If a dog’s tail is up, stiff, and wagging very fast, watch out! That can be a danger signal.

**If a dog may attack or its actions are uncertain:**

- Stand very still and try to be calm. Do not scream, kick, or run. Standing to the side of a dog is much less threatening than standing head-on.
- Be aware of where the dog is located. Employees should not turn their back to a dog or stare into its eyes.
- Look for an escape route, on or under a car, behind a fence, anywhere out of their territory.
- If the dog comes up to sniff, let it. In most cases, the dog will go away when it decides there is no threat.
- Speak calmly and firmly.
- Try to stay still until the dog leaves, then back away slowly until it is out of sight. Smooth and slow movements are less likely to threaten a dog. Walk backward out of the area and do not turn away from the dog. If possible, employees should put something between themselves and the dog.
- If a dog does attack suddenly, “feed” it a clipboard, jacket or anything that may distract it, giving it something to bite.
- Should an employee fall or be knocked down, he should curl into a ball with his hands over his head, ears, and neck. Try not to scream or roll around.
- If multiple dogs attempt to surround an employee, he should back himself against a wall, tree, car, or fence. Keep an eye on the “alpha” dog, he/she will be 6”-12” ahead of the others and is not necessarily the largest in the group.

**In the event of a dog bite:**

- If an employee is bitten by a dog, try not to panic.
  - Immediately wash the wound thoroughly with soap and warm water.
  - Contact a physician for additional care and advice.
- Report the bite to local animal care and control agency. Tell the animal control official everything known about the dog, including his owner's name and the address where he lives. If the dog is a stray, tell the animal control official what the dog looks like, where he was seen, whether he has been seen before, and in which direction he went.

**14.12. Radiofrequency / Electromagnetic Energy**

**The FCC standard divides exposure into two groups, Occupational/ Controlled Environments and General Population/Uncontrolled Environments.**

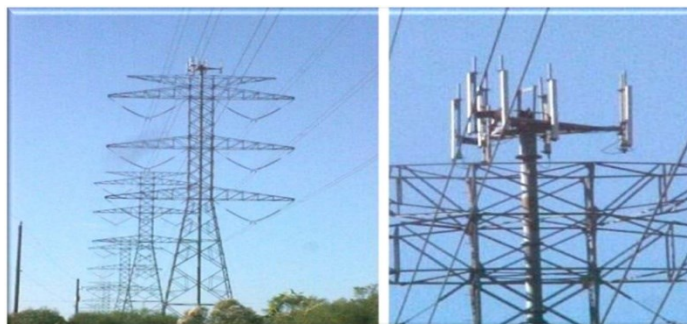
- General Population/Uncontrolled Environment limits apply to individuals assumed to have no knowledge of or control over their possible exposure to RF energy.
- Occupational/Controlled Environment limits apply to individuals who should know that there is a potential for exposure as a requirement of employment, may exceed exposure levels beyond the General Population/Uncontrolled environment.

**Exposure levels greater than the General Population Limit**



- Work environments do not automatically fall into the less restrictive Occupational limit.
  - General Population limits could apply if employees are not aware of the exposure or cannot exercise control over the exposure.
  - OSHA requires training for all employees who are exposed to more than the General Population limit must receive RF training.
- When workers do fall into the occupational limit, the following applies:
  - Awareness Training is required for all workers.
    - All personnel who have occasion to work in a controlled area, where power densities could exceed the public MPE limits, should be aware of the potential for their exposure to RF fields and should be informed as to the steps they can take to ensure they will not be exposed to RF fields in excess of the MPE limits.
  - All personnel entering a RF EME exposure site must be authorized.
    - Only personnel who have been EME awareness trained and understand the EME situation and other safety requirements associated with site work should be allowed access without escorts. When untrained individuals access the site's, trained escorts are required.
  - Obey all posted signs.
    - This guideline emphasizes the importance of observing and understanding the instructions on posted signs at a transmitter site.
    - For example, certain areas may be designated "NO ACCESS" unless certain antennas are shut down. It is important that these signs be understood and obeyed, to assure EME exposure below the FCC guidelines.
    - The requirement for RF protective clothing for workers is another precaution that could be identified on signs designating areas of potential exposure in excess of FCC limits.
  - Personnel should assume all antennas are active and energized.
    - Unless a worker has direct knowledge that an antenna is either a receive antenna or has been deactivated, the worker should consider antennas to be active and energized.
    - No different from OHD or URD procedures, even when knowledge has been given or received the antenna is de-activated; it must still be considered energized until tested.
    - A testing monitor is an RF threshold detector that alarms when RF exceeds the threshold of the device, normally 50% of the Occupational/Controlled MPE.
  - Personnel should habitually maintain a minimum distance of three (3) feet from all activated antennas.
    - In some cases, antennas should be given more than 3 feet clearance (in such instances, appropriate signs and other warning must be posted to indicate the necessary clearance).
    - FCC studies have shown that a three-foot clearance is a practical approach to assure that exposure remains within FCC limits. This ensures a distance is always maintained unless work is required on an antenna. Work on a specific antenna should only be accomplished after the attached transmitters have been turned off. A small increase in

- distance from an antenna can have a substantial effect on reducing the EME exposure.
- Do not stop in front of antennas.
    - While climbing, resting, or changing locations personnel should not stop near Omni-directional antennas or in front of (within the transmit zone) directional antennas, and should keep below elevated antennas if possible.
  - Before working on antennas notify owners and disable appropriate transmitters.
    - Before working on an antenna, workers must ensure that all attached transmitters are deactivated.
    - When possible, Lockout/Tagout tags should be used to make sure someone else does not inadvertently turn on the transmitter while work on the antenna is being performed.
    - Remember, antenna/transmitters must be tested and verified deactivated before work can begin.
  - Continually use RF monitors to determine antennas being worked on are deactivated, and while working adjacent to energized antennas.
    - Special care must be exercised when working on or very near energized antennas. Although the EME fields cannot be sensed directly, transmitter activity can be detected close to an antenna with a RF monitor.
    - Use of a monitor will allow workers to ensure that all connected transmitters have been turned off before they begin maintenance or are outside the distance needed to exceed MPE thresholds. If the monitor alarms, they should move away from the antenna, determine which transmitters are still on, (or too close to their location) and disable the identified transmitters.
  - Reduce power of nearby activated antennas when needed.
    - By lowering power to the antenna, cumulative RF fields at the site may be lowered. This may facilitate overall site-wide compliance.
    - Powering down may enable some facilities to qualify for a categorical exclusion which would allow keeping the antenna energized while work is performed on an adjacent antenna.
    - A monitor must be used to ensure level are kept low enough to facilitate this compliance
  - Never operate transmitters without shields during normal operation.
    - Some work at antenna sites involves troubleshooting and repair of the



radio transmitters. The shields within transmitter power amplifiers are there to prevent

- strong RF fields from radiating out of the transmitter cabinet.
- Operating the transmitter without shields could cause interference and exposure of the technician performing the service to EME levels in excess of the FCC guidelines.
  - While shields must be removed for many maintenance tasks, they should always be properly reinstalled before returning the transmitter to normal operation.
  - Do not operate base station antennas in equipment room.
    - Transmitting antennas should never be operated inside the equipment rooms, even for short term testing. This includes mobile magnet mount antennas attached to the top of transmitter cabinets as temporary installations. Just like with an arc flash, distance is your friend.
    - Using transmit antennas inside equipment rooms can increase the exposure to EME levels above FCC guidelines and create undesirable radiofrequency interference. The procedures described here are intended to provide a safe work environment for those who must work near RF transmission equipment. If unsure of the group, Occupational/ Controlled Environment or General Population/Uncontrolled Environments, contact a supervisor or the Safety Department for clarification, and to schedule Radio Frequency/Electromagnetic Energy awareness training if needed.

#### **14.13. Thermal Exposure-Cold**

##### **General**

- Workers should realize that almost all their work is out of doors and should dress accordingly.
- Clothing should be warm but not bulky enough to retard movement. A suit of insulated underwear is recommended.
  - Outer clothing should be a type that can be easily removed if the workman gets too warm.
- Sturdy weatherproof boots or shoes should be worn in cold weather. Two pairs of medium-weight socks are usually better than one pair of heavy socks. During the winter months, workers should expect snow, mud and slushy conditions and should have their overshoes available to protect themselves against wet feet.
- Hard hats with winter liners should be adequate protection against weather and accidents.
- The best way to warm excessively cold portions of the body is to remove the covering from those parts and apply heat.
  - For example, remove gloves and apply heat to gloves and hands and remove shoes and apply heat to shoes and feet, making sure socks are dry.
- Drink warm, sweet beverages (sugar water, sports-type drinks.) Avoid drinks with caffeine (coffee, tea, or hot chocolate) and alcohol.
- Sitting or standing for prolonged periods of time shall be avoided in cold environments.
- Rest periods in warm environments shall be frequent to prevent cold stress disorders.

- An employee who becomes fatigued while working shall be removed to a warm environment and shall rest. As exhaustion approaches, the body experiences rapid loss of heat and the cooling process begins.
- Alcoholic products, including cough medication containing alcohol, should not be taken prior to work in cold environments. Alcohol dilates blood vessels near the skin surface which increases heat loss and lowers body temperature.

#### **Windchill Index**

- Air temperature alone is not sufficient to assess the cold hazard in certain environments. Therefore, the windchill index along with the air temperature shall be used. Heat loss from convection is the greatest and most deceptive factor in loss of body heat.
- The windchill index is the cooling effect of any combination of temperature and wind velocity or air movement .
- The windchill index takes into account the wind velocity. If there is no anemometer (measures wind speed), the following is a suggested guide for estimating wind speed:
  - 5 mph : light flag moves
  - 10 mph : light flag fully extended
  - 15 mph : raises newspaper sheet
  - 20 mph : causes blowing and drifting snow
- The windchill index shall be used to evaluate the cold hazard.
- The windchill index does not take into account the body part exposed to cold, the level of activity effect on the body's heat production, and the amount of clothing worn.

#### **Increased Risk**

- Workers are at increased risk when:
  - They have predisposing health conditions such as cardiovascular disease, diabetes, and hypertension.
  - They take certain medications. Check with a doctor, nurse, or pharmacy, and ask if any medicines being taken could present problems while working in cold environments.)
  - They are in poor physical condition, have a poor diet or are older.
  - They are exposed to humidity.
  - They are exposed to high winds.
  - They become wet or contact cold surfaces such as metal.
  - They wear inadequate clothing.

#### **Frostbite**

- The three degrees of frostbites are:
  - First degree - Freezing without blisters or peeling.
  - Second degree - Freezing with blisters or peeling.
  - Third degree - Freezing with death to tissues and possibly of the deeper tissues.
- Symptoms:
  - At first, skin becomes slightly flushed.
  - Skin may become white or grayish yellow.
  - Blisters may appear later.
  - Pain is sometimes felt early, but there is often no pain at all. There may be a cold, numb feeling.
- First Aid:
  - Do not rub the frozen area with snow or hand.



- Cover the frozen area with extra clothing.
- Bring the victim indoors as soon as possible.
- Give the victim a warm drink.
- Quickly rewarm the frozen area by immersing in water at body temperature. Do not use hot water.
- Handle the frozen part with great care.
- Do not use hot water bottles or heat lamps or place frozen area near a hot stove.
- Do not disturb blisters. Lightly bandage blisters if possible.

### Hypothermia

- Remove any wet clothing and dry the victim.
- Warm the body gradually by wrapping the victim in blankets or putting on dry clothing and moving the individual to a warmer place. Do not warm body quickly by immersing the person in hot water. Rapid warming can cause dangerous heart problems. If available, apply heating pads or other heating source to the body. Keep a protective barrier, such as towel, blanket, or clothing between heat source and victim to avoid burning the individual.
- If the victim is alert, give warm liquid to drink. Never give liquids to an individual who is unconscious or semi-conscious.
- Handle the victim gently.
- Get professional help immediately.

## 14.14. Thermal Exposure -Heat

### Requirement

- GMB employees work outdoors and are exposed to hazards associated with temperature extremes. The nature of the work and required PPE increases an employee's chances of heat related illness. To mitigate hazards associated with heat, employees must prepare themselves to work in hot conditions and take steps to limits their exposure throughout the day. Employees must also know the symptoms of various types of heat illness and appropriate responses for each.

| Common Beverages   |   |   |
|--|---|---|
| Water  | Sports Drinks   | Energy Drinks   |
|  |  |  |
| Always   | Sometimes   | Never   |

**Table 18 Hydration do & Do Not**

### Working in Hot Conditions

- Below are guidelines for working in hot conditions. Each is explained in detail.
  - Show up fit for duty (well rested, nourished and hydrated).
  - Remain hydrated throughout the day (drink water and electrolyte drinks such as Gatorade).
  - Employees should take regular breaks and stop work immediately if they begin to feel ill.
  - Everyone should be monitored for signs of heat illness throughout the day.
- Show up fit for duty (well rested, nourished and hydrated).

| Caffeine Levels |              |                       |
|-----------------|--------------|-----------------------|
| Beverage        | Serving Size | Caffeine (Milligrams) |
| Coffee          | 6 oz         | 80-200                |
| Espresso        | Single shot  | 29-100                |
| Tea             | 12 oz        | 30-90                 |
| Soda            | 8 oz         | 30-70                 |
| Energy drinks   | 8 oz         | 70-280                |
| Sports drinks   | 8 oz         | 0                     |

**Table 19 Caffeine Level in Common Beverages**

- Eat regular, small meals and avoid big meals before and during work hours. ○ Get a good night's sleep.
- Inform supervision of any medications being taken or pre-existing conditions such as diabetes that have side effects that can be exacerbated by heat and sun exposure.
- Remain hydrated throughout the day (drink water and electrolyte drinks such as Gatorade).
  - Shoot for 64 ounces of water a day.
  - Drink at least half a cup of water every thirty minutes during strenuous activity.
  - Drink 1 ounce of water for every 10 pounds of body weight 1-2 hours before strenuous activity.
  - Avoid excessive amounts of caffeine as it is a diuretic that increases the chances of dehydration
    - Caffeine intake should be limited to 300 to 400 milligrams daily.
  - One of the best ways to monitor personal hydration is to monitor the frequency and color of urine.
- Take regular breaks and stop work immediately if signs or symptoms of illness develop.
  - Seek shade and cooler temperatures during breaks.
  - Work at an appropriate pace while working in physically demanding situations.
  - Rotate work tasks such as working in a bucket with gloves and sleeves or strenuous manual material handling activities between employees.
- Each employee should be monitored for signs of heat illness throughout the day. ○ Know the signs and recommended treatment for various types of heat illness.
- Heat Exhaustion
  - Symptoms
    - Heavy sweating, nausea, headache, weakness, vomiting, fast pulse, tiredness.

| AM I HYDRATED?    |  |   |
|-------------------|--|---|
| Urine Color Chart |  |   |
| 1                 |  |   |
| 2                 |  | If your urine matches the colors 1, 2, or 3, you are properly hydrated. |
| 3                 |  | Continue to consume fluids at the recommended amounts.                  |
| 4                 |  | If your urine color is below the RED line, you are                      |
| 5                 |  | DEHYDRATED and at risk for cramping and/or a heat illness!!             |
| 6                 |  | <b>YOU NEED TO DRINK MORE WATER!</b>                                    |
| 7                 |  |   |
| 8                 |  |   |

Table 20 Hydration Chart

|                       |    | Heat Index       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----------------------|----|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                       |    | Temperature (°F) |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|                       |    | 80               | 82  | 84  | 86  | 88  | 90  | 92  | 94  | 96  | 98  | 100 | 102 | 104 | 106 | 108 | 110 |
| Relative Humidity (%) | 40 | 80               | 81  | 83  | 85  | 88  | 91  | 94  | 97  | 101 | 105 | 109 | 114 | 119 | 124 | 130 | 136 |
|                       | 45 | 80               | 82  | 84  | 87  | 89  | 93  | 96  | 100 | 104 | 109 | 114 | 119 | 124 | 130 | 137 |     |
|                       | 50 | 81               | 83  | 85  | 88  | 91  | 95  | 99  | 103 | 108 | 113 | 118 | 124 | 131 | 137 |     |     |
|                       | 55 | 81               | 84  | 86  | 89  | 93  | 97  | 101 | 106 | 112 | 117 | 124 | 130 | 137 |     |     |     |
|                       | 60 | 82               | 84  | 88  | 91  | 95  | 100 | 105 | 110 | 116 | 123 | 129 | 137 |     |     |     |     |
|                       | 65 | 82               | 85  | 89  | 93  | 98  | 103 | 108 | 114 | 121 | 128 | 136 |     |     |     |     |     |
|                       | 70 | 83               | 86  | 90  | 95  | 100 | 105 | 112 | 119 | 126 | 134 |     |     |     |     |     |     |
|                       | 75 | 84               | 88  | 92  | 97  | 103 | 109 | 116 | 124 | 132 |     |     |     |     |     |     |     |
|                       | 80 | 84               | 89  | 94  | 100 | 106 | 113 | 121 | 129 |     |     |     |     |     |     |     |     |
|                       | 85 | 85               | 90  | 96  | 102 | 110 | 117 | 126 | 135 |     |     |     |     |     |     |     |     |
|                       | 90 | 86               | 91  | 98  | 105 | 113 | 122 | 131 |     |     |     |     |     |     |     |     |     |
| 95                    | 86 | 93               | 100 | 108 | 117 | 127 |     |     |     |     |     |     |     |     |     |     |     |
| 100                   | 87 | 95               | 103 | 112 | 121 | 132 |     |     |     |     |     |     |     |     |     |     |     |

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

- Caution
- Extreme Caution
- Danger
- Extreme Danger

Table 21 NOAA(s) Heat Index

- Treatment
  - Move to cooler area, cool by wetting clothing and fanning, drink water, lie down, follow up with medical checkup.
- Heat Cramps
  - Symptoms
    - Severe muscle spasms in the back, stomach, arms, and legs, usually caused by drinking large quantities of water without replacing salt during periods of heavy perspiration.
  - Treatment
    - Move to cooler area, drink water moderately and take salt tablets if health allows, follow up with medical checkup.
- Heat Stroke
  - Symptoms
    - High temperature and dry skin, rapid breathing and pulse, the victim may appear disorganized and confused, with headache, nausea, vomiting, diarrhea, seizures, and possibility of coma.
  - Treatment
    - This is serious, so move fast to a cooler area, call an ambulance, remove the outer clothing, and apply cool water to the entire body, fan the victim to increase cooling until professional help arrives.

**\*Notes:**

- **Heat illness is a serious matter. DO NOT try to tough it out if symptoms are exhibited. Rest, hydrate, and take it easy before resuming normal activities.**
- **History has shown employees with a heat illness have long recovery periods. Ensure they are monitored closely and properly hydrated when they return to work.**

**14.15. Potable Water (Drinking Water)**

**Requirement**

- Drinking water shall be provided for each employee.
- Drinking water dispensers shall be designed, constructed, and serviced so that sanitary conditions are maintained, shall be capable of being closed, and shall be equipped with a tap.
- A common drinking cup (used by more than one employee) and other common utensils are prohibited.

## 15. Work Area Protection

### 15.1. Work Area Protection

- Work Area Protection is the safeguarding or protecting of pedestrians, motorists, utility workmen, and equipment by the use of barriers, warning signs, lights, flags, traffic cones, barricade ropes, flagmen, etc. on approaches to work areas.
- The foreman or other employee in charge shall be responsible for properly placing road signs, safety cones, flags, and barricades, when working near streets, roads, highways, or in any location where work area protection may be deemed necessary to protect the general public.
- Trenches, open pits, pole holes, manholes, etc. shall be barricaded any time they are left unattended. The foreman or employee in charge should make every effort to plan their work in order that these trenches, open pits, pole holes, manholes, etc. are not left open for extended periods of time.

#### **Best Practice**

- You can't control the actions of the public, but you can protect yourself.
- Equipment not in use on a jobsite should be used as a barrier at the end of the work zone from which traffic is approaching.
- Be aware of your body position in relation to parked equipment and oncoming traffic.

#### **Equipment**

- All state and local traffic codes shall be followed when providing work area protection.
- Warning devices and equipment shall be removed and stored in a proper manner as soon as the hazard is eliminated.
- Equipment parked or operating on streets or highways shall be protected by proper flashers or warning devices.
- Proper cones and/or barricades shall be used where appropriate.

#### **Traffic Control**

- Before the start of work:
  - The following major traffic control considerations shall be made:
    - What type of work will be conducted (stationary, mobile, or moving)?  
What will be the time duration of the work?
    - Where is the work zone located (on the roadway, on the shoulder, or off the roadway)?
    - What type of road is involved?
    - What is the speed of the traffic?
    - What is the traffic volume on the roadway?
    - Should the work be rescheduled to avoid heavy volume conditions?
    - Will the nature of traffic change while work is underway?
    - Do the local law enforcement agencies need to be notified?
    - What kind of signage will be required?
    - Are cones, drums, barricades, or an arrow panel needed for traffic channelization?
    - Will a flagger be required?
- "Utility Work Ahead" and other warning signs shall be placed at the beginning and end of each work area according to spacing of warning signs chart immediately after the work area is established.

- There must be a sign indicating the end of the work area.

**Typical Signs**

- The “UTILITY WORK AHEAD” sign may be used to advise motorists of maintenance or public utility work in or near the roadway.
- The “ONE LANE ROAD AHEAD” sign should be used where traffic in both directions must use the same single lane.
- The “RIGHT LANE CLOSED AHEAD” sign should be used to caution oncoming traffic that lane(s) on a multilane highway is closed. The LEFT overlay plate is available for left lane closures.
- The flagger symbol sign should be used in advance of any point where a flagger has been stationed to control traffic through a construction or maintenance project.



**Spacing of Warning Signs**

- The distance from the first sign to the start of the transition area should be long enough to give motorists adequate time to respond to the conditions. Guidelines to determine how far to locate sign(s) from the truck on the end of the traffic taper and for minimum distances between warning signs are indicated in Sign Spacing figure. (Sign spacing should be at least one block for urban streets.)

Table 22 Sign Spacing

| Spacing of Warning Signs |                                    |                                      |                                       |
|--------------------------|------------------------------------|--------------------------------------|---------------------------------------|
| Road Type                | Distance Between signs             |                                      |                                       |
|                          | Point of Restriction to First Sign | Distance Between First & Second Sign | Distance Between Second & Third Signs |
| Urban (35mph or less)    | 100 feet                           | 100 feet                             | 100 feet                              |
| Urban (36 mph plus)      | 350 feet                           | 350 feet                             | 350 feet                              |
| Rural                    | 500 feet                           | 500 feet                             | 500 feet                              |
| Expressway /Freeway      | 1000 feet                          | 1000 feet                            | 2640 feet                             |

**Lane Closure Taper (Cones, Barricades, etc.)**

- The length of taper to close a lane is determined by the speed of traffic and the width of the lane to be closed (the lateral distance that traffic is shifted). If restricted sight distance is a problem, the taper should begin well in advance of the view of the obstruction. Following is a table of taper lengths, the recommended number of devices, and the spacing of

**TAPER LENGTHS\***

| Speed (MPH) | Lane Width (feet) |     |     | # of Devices** | Spacing between Devices (ft.) |    |
|-------------|-------------------|-----|-----|----------------|-------------------------------|----|
|             | 10                | 11  | 12  |                |                               |    |
| 25          | 105               | 115 | 125 | 150            | 6                             | 25 |
| 35          | 205               | 225 | 245 | 290            | 8                             | 35 |
| 45          | 450               | 495 | 540 | 630            | 13                            | 45 |
| 55          | 550               | 605 | 660 | 770            | 13                            | 55 |
| 65          | 650               | 715 | 780 | 910            | 13                            | 65 |

channelizing devices for various speeds and lane widths.

Table 23 Taper Lengths

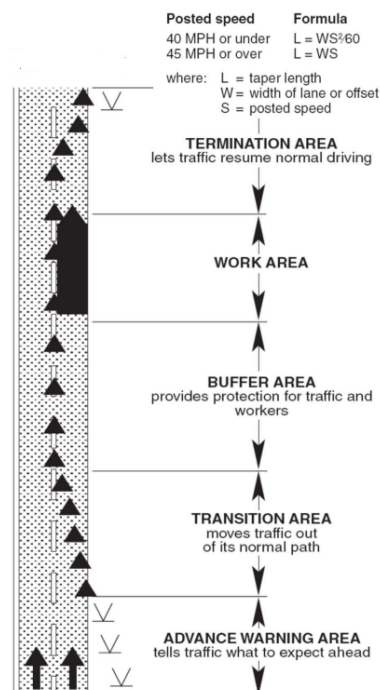


Figure 60 Area(s) in a Traffic Control Zone

### Areas in a Traffic Control Zone

- The traffic control zone is the distance between the first advance warning sign and the point beyond the work area where traffic is no longer affected. Figure 60 shows the areas in a traffic control zone.

**\*NOTE:** Cones are typically used for daytime operations. Reflective plastic barrels or Type I or II barricades, or cones with a reflective collar should be used for nighttime operations. A flagman shall be posted when the job operation presents a hazard to traffic.

### Installing Traffic Control Devices

1. Locate the beginning of Workspace and mark the location (when using paint, use white or pink colors only, as other colors have designations for the type of utility being marked).
2. From the beginning of the Workspace, measure the buffer distance (empty space in advance of the work area) and mark the beginning of the Buffer Space.
3. From the beginning of the Buffer Space, measure the taper length and mark the beginning of the taper.
4. From the beginning of the taper, measure the advance warning sign spacing distances and mark each location.
5. Install advance warning signs in Advanced Warning Area, beginning with signs located on the right shoulder first, then signs on the left shoulder if applicable:
  - 1st sign—Attracts the driver’s attention.
  - 2nd sign—Shows what the driver is approaching.
  - 3rd sign—Shows the driver what must be done.
6. Install traffic control devices in the Transition Area with the flow of traffic.
7. Install traffic control devices along the Activity Area:
  - Start installing along the Buffer Space with the flow of traffic
  - Continue placing devices along the Workspace.
8. Install traffic control devices for the Termination Area with the flow of traffic.
9. Inspect the work zone:
  - Perform a drive through inspection.
  - Document the observations.
  - Correct any deficiencies.
10. Observe motorists driving through the work zone to look for trends in motorist difficulty in maneuvering through the work zone.

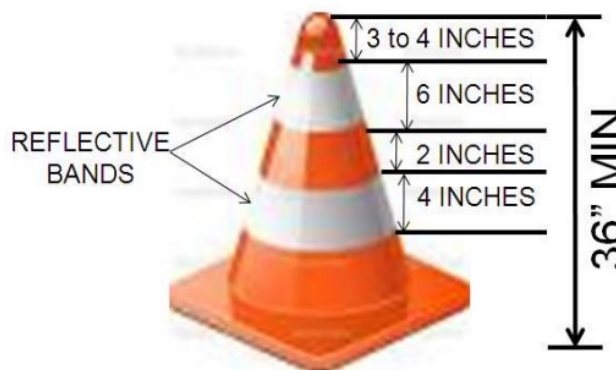


Figure 61 Traffic Control Requirement

### Removing Traffic Control Devices

1. Remove devices from the Termination Area against the flow of traffic.
2. Remove devices from the Activity Area against the flow of traffic:
  - Make sure Workspace is clear and cleaned before removing devices.

- Remove devices from the Buffer Space.
- 3. Remove devices from the Transition Area against the flow of traffic.
- 4. Remove advance warning signs in the Advance Warning Area against the flow of traffic. Remove the first advance warning sign last.

## 15.2. Flagging Procedures

### Flagging

- Employees shall wear an approved traffic vest when involved in any type of traffic flagging operations or where the hazard of being struck by oncoming traffic may exist.
- For nighttime flagging operations, the flagger station shall be illuminated.
- Flagger stations shall be located far enough in advance of the work site so that approaching traffic will have sufficient distance to reduce speed before reaching the work site.
- The flagger should stand either on the shoulder adjacent to the traffic being controlled or in the barricade lane. In certain instances where a “spot” obstruction exists, the flagger may have to position himself on the shoulder opposite the barricade section to operate effectively.
- **UNDER NO CIRCUMSTANCES SHOULD A FLAGGER STAND IN THE LANE BEING USED BY MOVING TRAFFIC.**
- STOP and SLOW paddles are the primary and preferred hand signaling devices and must be used if available. The following methods of signaling with sign paddles should be used:
  - To STOP traffic - The flagger shall face traffic and extend the “STOP” sign paddle in a stationary position with the arm extended horizontally away from the body. The free arm is raised with the palm toward approaching traffic.
  - When it is safe for traffic to proceed, the flagger shall face traffic with the “SLOW” sign paddle held in a stationary position with the arm extended away from the body. The flagger motions traffic ahead with the free hand.
    - The free hand should also be used to motion traffic to slow down.
  - When it is desired to alert or slow traffic, the flagger shall face traffic with the “SLOW” sign paddle held in a stationary position with the right arm extended horizontally away from the body.
- Flags shall be used only if paddles are not available. The following methods of signaling with a flag should be used:
  - To STOP traffic, the flagger should face traffic and extend the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible hanging below the staff. For greater emphasis, the free arm may be raised with the palm toward approaching traffic.
  - When it is safe for traffic to proceed, the flagger shall stand parallel to the traffic movement, and with flag and arm lowered from view of the driver, motion traffic ahead with the free arm. Flags shall not be used to signal traffic to proceed.

| The ABC(s) of Flagging  |
|---|
| Advance warning signs: <ul style="list-style-type: none"> <li>• Utility Work Ahead.</li> <li>• Right/Left Lane Closed / One Lane Road Ahead.</li> <li>• Flagger Ahead or Flagger Symbol.</li> </ul> |
| Be visible and alert at all times: <ul style="list-style-type: none"> <li>• Proper flagging equipment.</li> <li>• Watch your surroundings continually.</li> </ul>                                   |
| Control traffic with the proper procedures: <ul style="list-style-type: none"> <li>• Eye contact.</li> <li>• Proper commands without confusing the driver.</li> </ul>                               |

- Where it is desired to alert or slow traffic by means of flagging, the flagger shall face traffic and slowly wave the flag in a sweeping motion of the extended arm from the shoulder level to straight down without raising the arm above a horizontal position.

### Paddle and Flag Requirements

- Paddles must be:
  - Octagonal shaped
  - 18 in. wide (minimum)
  - Letters must be 6 in. tall
  - Stop shall have White Letters, White Border and Red Background
  - Slow shall have Black Letters, Black Border and Orange Background.
  - Retroreflective during night operations
  - Rigid handle on staff that is high enough to be seen by approaching or stopped traffic.
- Flags must be:
  - 24 in. square.
  - Attached to a 36 in. staff.
  - Retroreflective during night operations.
  - Construction red in color.
  - Used only during an emergency.

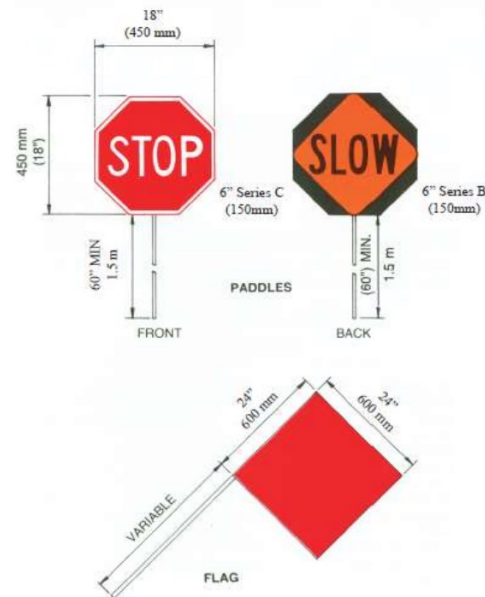


Figure 62 Paddle & Flag Requirements

| Do(s) & Do Not(s) of Flagging   |   |
|---|---|
| DO  | DO NOT  |
| <ul style="list-style-type: none"> <li>● DO Be alert at all times. An alert flagger will more likely command the respect of motorists and will be more able to respond to emergency situations.</li> <li>● DO Wear proper PPE while on duty.</li> <li>● DO Standalone where you can be identified by the motorists.</li> <li>● DO Have knowledge of the project's traffic plans.</li> <li>● DO Plan and prepare an escape route.</li> <li>● DO Treat each driver with courtesy.</li> <li>● DO Remove, fold over, or turn away the flagger sign and other inappropriate signs, when flagging is no longer being performed or during breaks of extended periods (i.e.: lunch).</li> <li>● DO Illuminate your flagger station during dusk or nighttime operations.</li> <li>● DO When in doubt, stop traffic to maintain control.</li> <li>● DO Always carry your flagging card while on flagging duty.</li> </ul> | <ul style="list-style-type: none"> <li>● DO NOT Stand in an open traffic lane or with your back to traffic.</li> <li>● DO NOT Stand with a group of people or near equipment or vehicles.</li> <li>● DO NOT Place the staff inside a cone. The staff should always be held by the flagger.</li> <li>● DO NOT Take part in unnecessary conversation with workers, pedestrians, or motorists.</li> <li>● DO NOT Use vehicle radios for communication between flaggers.</li> <li>● DO NOT Give flagging instructions contrary to traffic control devices.</li> <li>● DO NOT Read, use cell phone, or listen to music while on duty.</li> <li>● DO NOT Leave your station until properly replaced except to avoid imminent danger.</li> <li>● DO NOT Sit while performing your duty.</li> <li>● DO NOT Lean on vehicles or argue with motorists.</li> </ul> |

Figure 63 Do(s) & Do Not(s) of Flagging



## 16. Vehicle Operation

### 16.1. Driver Qualification

#### Requirement

- Only those employees specifically authorized and who possess a valid license or permit and valid medical card for the vehicle being driven shall operate company owned motor vehicles.
- In order to drive a commercial vehicle:
  - A driver should be qualified through training and evaluation.
  - An up-to-date Driver Qualification file must be established and maintained. This file must include:
    - Driver's application for employment;
    - Previous employment check;
    - Motor Vehicle Record (Initial);
    - Motor Vehicle Record (Annual);
    - Annual review of Motor Vehicle Record;
    - Annual Driver's Certification of Violations;
    - Commercial Driver's License;
    - Entry Level Driver Training Certificate;
    - Medical Certificate.
  - Each driver is responsible for:
    - Ensuring Regulatory Compliance receives a copy of their license and medical card when they are issued and each time they are renewed.
    - Completing an annual Driver's Certification of Violations and ensuring it is received by Regulatory Compliance.

#### MVR Violations

- GMB Reviews every employee's motor vehicle records at least twice a year. If it is discovered from any source that an employee has two or more moving violations or a DUI, the Safety Manager, Superintendent will meet with the employee to determine an appropriate action plan.
- If the employee is prohibited from operating an GMB vehicle, the employee must complete a Non-Driver Agreement and place the appropriate sticker on his/her hard hat.
- The MVR Violation Review Form must be completed and placed in the employee's personnel file.
- Employees receiving a DUI must notify their immediate supervisor as soon as practical. Failure to make proper notifications will result in disciplinary action, up to termination.

### 16.2. General

- A valid License and medical card must be carried while driving a commercial vehicle.
- Drivers shall familiarize themselves with and obey all federal, state and local motor vehicle laws applicable to the operation of their vehicle.
- Use Three Point(s) of Contact when getting on or off any kind of equipment.
  - At least 2 Hands and 1 Foot or 2 Feet and 1 Hand in contact at all times.
- When driving:
  - Drivers shall drive at safe speeds no greater than that permitted by law.

- Traffic, road and weather conditions shall be given consideration in determining the safe speed.
- The driver of a motor vehicle shall clearly signal his intention of turning, passing or stopping.
- The driver of a motor vehicle shall be courteous toward other drivers and pedestrians. He shall operate his vehicle in a safe manner and shall yield the right of way to pedestrians.
- Be aware of vehicle height and notice overhead obstructions that could be encountered to prevent property and vehicle damage.
- Seat belts shall be worn at all times.
- The driver will stay a sufficient distance behind when following another vehicle so that he can safely stop the vehicle in the clear distance ahead. Following distance should be determined by using the **Timed Interval Rule**.
- Drivers must exercise added caution when driving through residential and school zones.
- Before a radio equipped vehicle is driven under or adjacent to energized equipment, especially in substation areas, the radio antenna shall be lowered, and clearance checked in order to ensure that proper clearances will be maintained.
- When proceeding down grade the clutch shall not be disengaged. Trucks, particularly if heavily loaded, shall be in a lower gear on steep grades.
  - Do not over rev the engine
- Vehicles with derricks or booms shall not be moved until the derrick or boom has been lowered completely into the saddle and properly secured unless under the direct supervision of a foreman or supervisor.
- Vehicle operators shall use emergency four-way flashers to warn other drivers when moving slowly or stopped on the road.
- Vehicle operators shall adjust to weather and road conditions as required for safe operation.
- Stop at all weight stations (there are exceptions such as storm travel).
- A driver shall not allow unauthorized persons to drive, operate or ride in or on a company vehicle.
- Employees shall not allow anyone to ride on the running boards, fenders, or any part of the vehicle except on the seats.
- Employees shall not ride on trailers.
- Employees shall not jump on or off moving vehicles.
- No more than 3 persons shall ride in the front seat of a car or truck.
- If the body or bed of a truck, trailer, or similar type vehicle becomes accidentally energized, the following procedures shall be followed:
  - The Superintendent shall be notified immediately.
  - The Safety Department shall be notified immediately.
  - The equipment shall not be used until it is inspected and released by a qualified and competent person.
- Vehicles shall not be started or moved while under repair without first checking with the person performing the repairs or his supervisor.
- Texting or emailing while driving is not allowed.
- The use of handheld mobile devices is not allowed in commercial vehicles.

- The Materials of Trade exemption allows the transport of small quantities of hazardous materials such as gasoline or oil without labeling or placarding.
- Be aware drivers of utility vehicles are exempt from hours-of-service regulations.
- Drivers and front seat passengers are required to wear seat belts.

### **16.3. Five Keys to Driving**

- **EXPAND YOUR LOOK AHEAD CAPACITY**
  - Look 15 seconds ahead of your vehicle. Driving conditions may change quickly and at 30 mph you travel 1 ½ blocks in 15 seconds – ¼ of a mile at 50 mph. Know what conditions are before you get there.
- **SIZE UP THE WHOLE SCENE**
  - Decision driving involves always knowing what is happening around you and looking to see what will be happening. You should be aware 360° around your vehicle. An important part of sizing up the whole scene is to maintain proper following distance so you can see where your vehicle will be in the future.
- **SIGNAL YOUR INTENTIONS EARLY**
  - Use your lights, horn, hands, and directional signals to communicate with other drivers. Avoid driving in other's blind spots and be predictable, giving other drivers time to react to your movements. Signal 5-8 seconds before making a move that affects others such as switching lanes or turning. PLAN AN
- **ESCAPE ROUTE**
  - Make an escape route by building a cushion around your vehicle. If the vehicle in front of you slams on the brakes, you should have enough room to stop. Maintain a safe following distance while traveling and ensure you can see the bottom of the rear tires of the vehicle in front of your when stopped (The Wedge Concept). Park your vehicle so you do not have to back when possible. Travel in the right-hand lane as most vehicles will pass on the left and adjust your speed if you become boxed in. As a rule, if you do not have an escape route, you are driving too fast.
- **TAKE DECISIVE ACTION**
  - No matter how safely you are driving, a very important part of decision driving is predicting what others may do and make sure they are aware of you. This involves expanding your look ahead capacity by sizing up the whole scene and then communicating with other drivers by signaling your intentions early and having an escape route.
    - Use proper gear before going up or down a grade and do not depress clutch when going down a steep grade.
    - Maintain proper following distance.
    - Use the radio for directions – never run red lights or speed to keep up with your crew.
    - Be familiar with the stopping characteristics of your vehicle and allow ample room to stop.
    - Adjust your driving and speed to conditions such as weather, narrow loads, traffic, etc.
    - Be mindful of the rollover potential for your vehicle and how loads and / or pulling a trailer may affect it.
    - Know the vertical clearance of your vehicle.

- Secure all loads properly – keep them as low as possible on the vehicle.
- Avoid backing if possible – use a spotter or perform a walk around before backing.
- Think about boom or length of poles being hauled.
- Plan your route before you leave especially if driving in a unfamiliar area.

#### 16.4. Time Interval Rule

- This rule states that one second of following distance is needed for each 10 feet of the length of the vehicle under normal driving conditions (adjust for hazardous roads, traffic, and/or weather).
  - 1-Pick a stationary object such as a road sign in front of the vehicle being followed.
  - 2-Watch the rear of the vehicle in front pass the object and begin counting in seconds.
  - 3-Stop counting when the front of the vehicle being driven passes the same object.
- Timed Interval Rule for GMB Equipment
  - Bucket (30 feet long) and Line Trucks (26 feet 2 inches long) require 3 seconds of following distance.
  - Bucket and Line Trucks pulling a trailer (between 20 and 30 feet) require 6 seconds of following distance.

#### 16.5. Parking

- Trucks or trailers stopped on any public roadway shall be protected by proper warning lights, reflectors, or red flags in accordance with state or local requirements.
- A blue cone shall be place at the back of the vehicle to ensure the “Circle of Safety” is performed prior to re-entering the vehicle.
- When it is necessary to park on an incline, the driver shall make sure the vehicle is left in a safe position. The engine shall be turned off, the vehicle placed in the lowest gear, or “Park” position, and the parking brake set.
  - Wheel chocks must be used:
    - Prior to operation of derricks or booms
    - When a vehicle larger than a pickup is parked.
  - Chocks should be placed on each side of the wheel when the vehicle is not on a noticeable grade
- Trucks should be parked in a manner to prevent theft when being left unattended. Whenever possible:
  - Position trucks close enough so bin doors cannot be opened.
    - Store most valuable tools and equipment in least accessible bins.
  - Park in a well-lit and fenced in area.
  - Locate material trailers with doors facing the road.
  - Lock all bin doors individually as well as with the steel slide bar if equipped.



Figure 63 Blue Cone “Circle of Safety”

- Do not leave equipment on job sites over weekends, holidays, etc.
- Do not leave valuable tools and equipment such as copper wire in plain sight.
- Park equipment where it blocks movement and limits accessibility of other vehicles.
- Drivers will never use hydraulic (Mico) brake locks as parking brakes while the vehicle is unattended.
  - These brake locks will leak off and release the brakes.
- When setting up at work locations along roadways, the equipment should be set with the flow of traffic if possible and traffic warning signs used.
- When it is necessary to leave excavating equipment unattended, the blade, bucket, or scoop shall be lowered to the ground.
- Utilize pull-through parking, when possible, to avoid the need to back up.
- A road cone shall be placed at each rear corner of vehicles larger than a pickup when they are parked.

#### **16.6. Backing**

- A spotter will be used if available when backing. If no spotter is available, the driver must get out and view the area around the vehicle before backing.
- Whenever possible, the vehicle shall be positioned to avoid the necessity of backing later.
  - Back into parking places when possible.
  - If a turn is missed – continue driving until a safe place to turn around is located.
- Extreme caution shall be exercised when backing a vehicle, to avoid injury to persons and to prevent property damage.
- Keep mirrors clear and properly adjusted.

#### **16.7. Winter Driving**

##### **General**

- It is the responsibility of every driver to know the hazards of winter driving and how to drive safely despite these hazards. Winter means less daylight, slippery road surfaces, steamy or frozen windshields, dirty headlights and mirrors, and other hazards that occur during this season.
- Inclement weather conditions such as rain, ice, snow, and fog can reduce visibility, traction, control, and especially vehicle stopping distance. Keep in mind when braking on ice or other slippery surfaces, the distance needed to safely stop a commercial motor vehicle can increase from 4 to 10 times as compared to stopping in ideal driving conditions.
- Adhere to the following winter driving tips and techniques:
  - Conduct a thorough pre-trip inspection, paying particular attention to safety related items and components.
  - Greatly increase following distance.
  - Make sure lights, mirrors, and reflectors are kept clean and free of ice, snow, and dirt.
  - Avoid using high beams while driving in snow, sleet, or fog.

- High beams reflect off snowflakes and water particles decreasing visibility.
  - Since stopping distances increase in the winter, slow down gradually, which will require deceleration sooner.
  - Exercise extreme caution when passing other vehicles.
  - Watch for black ice. Black ice is a thin, transparent layer of ice that appears black on the pavement. It occurs most often on bridges, overpasses, low spots in the road, and in shady areas.
  - If conditions become too hazardous, safely pull off the road at the earliest opportunity and wait for the road to be cleared.
  - Drive at least half the normal speed on packed snow and even slower on ice.
  - Use chains as needed.
  - When first starting out:
    - Get a feel for the road and conditions.
    - Make turns gently.
    - Never brake harder than necessary.
  - Look for the following cues that can alert potential icy conditions:
    - Feel for ice on the front of the outside mirror. Icy buildup here may indicate ice on the road ahead.
    - Watch spray from other vehicles. A lack of spray on wet roads indicates icy conditions.
  - If a vehicle gets stuck:
    1. Avoid spinning the wheels which makes the situation worse.
    2. Dig out from in front of the tire.
    3. Put something (kitty litter, sand, chains) under the drive tires to increase traction.
    4. Put the engine in gear and accelerate smoothly.

## 16.8. Vehicle Inspection

- “Post-Trip/Pre-Trip Inspection Form” shall be completed daily by the driver in accordance with Federal Motor Carrier Safety Regulations.
- Vehicles or equipment deemed unsafe to operate during inspection will be taken out of service until necessary repairs are made.
- The driver shall keep the employee in charge advised of expiration dates of vehicle license, fuel stickers, inspection stickers, fire extinguishers, first aid kits, etc.
- A pre-trip inspection must be performed each day before the vehicle is driven to identify problems that might cause a breakdown or accident.
- The driver must:
  - Ensure the vehicle is in safe operating condition.

| <b>VEHICLE SAFETY INSPECTION CHECKLIST</b>   |   |   |  |
|--|---|---|--|
| Name: _____  |   | Date: _____   |  |
| Vehicle Make: _____  |   | Model: _____ Year: _____  |  |
| License Plate Number: _____  |   | State: _____ Expires: _____   |  |
| Insurance Carrier: _____   |   | Expires: _____  |  |
| <i>Please check the box next to an item that passes; circle the item if it needs to be repaired.</i>   |   |   |  |
| <b>LIGHTS:</b>   | <input type="checkbox"/> Low Beam<br><input type="checkbox"/> High Beam<br><input type="checkbox"/> Brake Lights<br><input type="checkbox"/> Back Up Lights   | <input type="checkbox"/> Left Turn Signal<br><input type="checkbox"/> Right Turn Signal<br><input type="checkbox"/> Tail Lights<br><input type="checkbox"/> Emergency Flashers  |  |
| <b>INTERIOR:</b>   | <input type="checkbox"/> Wiper Operation<br><input type="checkbox"/> Washer Operation<br><input type="checkbox"/> Heater/Defroster<br><input type="checkbox"/> Seats<br><input type="checkbox"/> Rear View Mirror<br><input type="checkbox"/> Parking Brake | <input type="checkbox"/> Door Locks Operable<br><input type="checkbox"/> Window Condition/Operable<br><input type="checkbox"/> Horn<br><input type="checkbox"/> Seat Belts<br><input type="checkbox"/> Brakes   |  |
| <b>GAUGES:</b>   | <input type="checkbox"/> Fuel<br><input type="checkbox"/> Oil Pressure  | <input type="checkbox"/> Volt/Amps<br><input type="checkbox"/> Temperature  |  |
| <b>EXTERIOR:</b>   | <input type="checkbox"/> Tire Tread (1/16")<br><input type="checkbox"/> Tire Air Pressure<br><input type="checkbox"/> Windshield Condition  | <input type="checkbox"/> Body Damage/Loose Parts<br><input type="checkbox"/> Mirrors<br><input type="checkbox"/> Wiper Blades   |  |
| <b>Not required for inspection, but recommended:</b>   |   |   |  |
| <b>FLUID LEVELS:</b>   | <input type="checkbox"/> Oil<br><input type="checkbox"/> Coolant<br><input type="checkbox"/> Brake<br><input type="checkbox"/> Power Steering<br><input type="checkbox"/> No Leaks  | <input type="checkbox"/> Belts not frayed/cracked/loose<br><input type="checkbox"/> Battery Connection clean/tight<br><input type="checkbox"/> Hoses (no cracks or leaks)<br><input type="checkbox"/> Steering<br><input type="checkbox"/> Shock Absorbers/Struts |  |
| As the owner/operator of the above-listed vehicle, I certify that I have completed this Vehicle Safety Inspection Checklist and that all items checked are in good working order, and/or that I will make any needed repairs within 30 days. |   |   |  |
| Signature _____  |   | Date _____  |  |




Figure 64 DVIR

- Review the last GMB driver vehicle inspection report.
- Properly fill out the GMB driver vehicle inspection report.
- A post-trip inspection covering the same must be completed at the end of each day and signed by the driver.
- At a minimum, the following items should be checked during a pre or post trip inspection:
  - Service brakes including trailer brakes, parking brake, steering mechanism, lighting devices, tires, horn, windshield wipers, mirrors, coupling devices, wheels and rims and emergency equipment.

**16.9. GMB Vehicle Characteristics**

- Commercial vehicles handle differently than smaller vehicles. Understanding the differences between commercial and personal vehicles is a key to safe driving. It is also important to know the height of a vehicle before it is driven.
- GMB line and bucket trucks have much different steering, braking, accelerating, and rollover characteristics than personal or passenger vehicles.
- Leave more following distance.
- Go slower around curves.
- Begin braking earlier.

**Table 24 Equipment Compared to Personal Vehicles**

| GMB Vehicles  |   |   |
|---|---|---|
| Personal Vehicle  | Bucket Truck  | Line Truck  |
|  |  |  |
| 3,500 POUNDS  | 33,000 POUNDS   | 45,000 POUNDS   |
| LOW CENTER OF GRAVITY   | HIGH CENTER OF GRAVITY  | HIGH CENTER OF GRAVITY  |
| BRAKES – SHORT DISTANCE   | BRAKES – LONG DISTANCE  | BRAKES – LONG DISTANCE  |
| FIBERGLASS / PLASTIC  | STEEL   | STEEL   |
| 15 – 20 FEET LONG   | 25 FEET LONG  | 35 FEET LONG  |
| 5 – 8 FEET TALL   | 9 – 13 FEET TALL  | 9 – 13 FEET TALL  |
| SHORT TURNING RADIUS  | LONG TURNING RADIUS   | LONG TURNING RADIUS   |
| LIMITED BLIND SPOTS   | LARGE BLIND SPOTS   | LARGE BLIND SPOTS   |

- Drivers shall be familiar with the height and weight of the vehicle they are driving before departing.
- Drivers shall always adhere to low clearance warnings.



## 16.10. Cargo Securement

- All equipment being hauled shall be tied down securely with approved devices prior to the vehicle being moved.
- One tie down is required for each 10 feet of cargo being hauled with a minimum of 2 tie downs.
- Be aware of how hauling heavy loads can affect the center of gravity of a vehicle.
  - Moves center of gravity back and up increasing the risk of turnover.
- Poles, ladders, pipe, etc. shall be loaded paralleled with the truck length. Such material shall not extend beyond the normal sides of the vehicles.
- Any load which extends more than 4 feet beyond the front or back of the truck or trailer shall have warning devices attached in accordance with the traffic laws of the state. During the day approved warning flags shall be used. At night and during periods of poor visibility, approved warning lights shall be used.

**\*CAUTION: Use extra care when turning as loaded poles will swing into other lanes of traffic.**

- When hauling long poles and entering congested areas or heavy traffic conditions, an escort vehicle displaying suitable warning signs shall be used.
- Emergency four-way flashers shall be used when hauling poles.
- When in tow position, safety chains on the vehicle being towed shall be crossed securely to the towing vehicle.
- Heavy vehicles, equipment and machinery which operate on wheels or tracks, such as backhoes, tractors and excavator backhoes that are being hauled must be restrained against movement in the lateral, forward, rearward, and vertical direction using a minimum of four tie downs.
- Accessory equipment, such as backhoes, must be completely lowered and secured to the vehicle. Articulated booms shall be restrained in a manner that prevents articulation while in transit.
- Each of the tie downs must be hooked as closely as practicable to the front and rear of the vehicle or mounting points on the vehicle that have been specifically designed for that purpose.
- Vehicles and equipment weighing less than 10,000 lbs., such as the mini excavator, can be tied down with 2 tie downs & a 3rd tie down for the bucket.

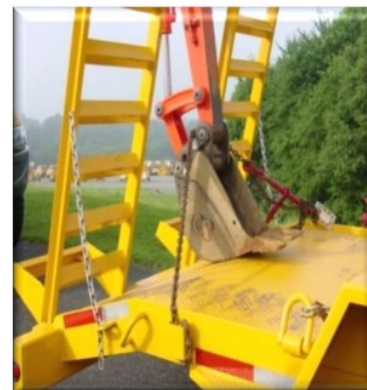


Figure 65 Proper Tie Down



### 16.11. Transporting Hazardous Materials

- Prior to operating a GMB vehicle which contains hazardous materials, the driver must have been trained in Hazardous Materials Transportation and have the proper CDL endorsement.
- A GMB vehicle which contains hazardous materials must be driven and parked in compliance with the laws, ordinances, and regulations of the jurisdiction in which it is being operated.
- A motor vehicle carrying 50 Lbs. or more, must be always attended unless all the following conditions apply:
  - The vehicle is located on the property of the motor carrier,
  - The property of a shipper or consignee of the explosives or hazardous materials,
  - In a haven
  - On a construction or survey site.
  - Hazardous materials must be loaded, blocked, braced, and unloaded in accordance with DOT safeguards.
- When transporting flammable liquid materials:
  - Bond and ground a cargo tank if it is loaded through an open filling hole.
  - Cargo tanks do not have to be bonded and grounded if it is loaded or unloaded through a vapor tight connection into a stationary tank, provided the metallic connection is in contact with the filling hole.
- Safety requirements for shipping compressed gas cylinders include:
  - Securely restrain in an upright or horizontal position.
  - Load into racks securely attached to the motor vehicle.
- Shipping papers must remain:
  - Within driver's immediate reach and readily visible.
  - In the holder mounted to the inside of the driver's door.
- A motor vehicle containing hazardous materials must not be parked:
- On or within 5 feet of the traveled portion of a public street or highway,
  - On private property without the consent of the person who oversees the property and who is aware of the hazardous materials.
  - Within 300 feet of a bridge, tunnel, dwelling or place where people work, congregate, or assemble, except when the necessities of operation make it impracticable to park in any other place.
- A motor vehicle containing hazardous materials must not be operated near an open fire unless the driver has taken precautions to ensure that the vehicle can safely pass
- A motor vehicle containing hazardous materials must not be parked within 300 feet of an open fire.
- No person may smoke or carry a lighted cigarette, cigar, or pipe on or within 25 feet of:
  - A motor vehicle which contains hazardous or flammable materials.
  - An empty tank motor vehicle which has been used to transport flammable materials or gases.
- When a motor vehicle which contains hazardous materials is being fueled:
  - Its engine must not be operating, and
  - A person must be in control of the fueling process at the point where the fuel tank is filled.

- If a tire is flat, leaking or improperly inflated, the driver must have the tire repaired, replaced, or properly inflated before the vehicle is driven.
- A placard must be placed on each side and each end of the vehicle when transporting hazardous materials.
- Hazmat shipments must be accompanied by a Bill of Lading.
- An Emergency Response Guidebook shall always remain with the vehicle.
- In the event of a vehicle accident, the driver shall:
  - Stop the unit in a safe location.
  - Remain with the unit.
  - Secure the area
  - Locate paperwork
  - Identify leaks or spillage
  - Report the accident to the safety department.
- In the event of a spill and release, the driver shall:
  - Stop the flow
  - Contain the spill
  - Dial 911, or client, if necessary,
  - Mitigate contaminants
  - Report the accident to GMB(s) Safety department.

## 17. Equipment Operation

### 17.1. General

- Only qualified operators with documented training and evaluation shall operate equipment.
- Employees shall not operate equipment or vehicles except in accordance with the recommendations of the following:
  - The manufacturer (as set forth in the operator/maintenance manual).
    - If operator/maintenance manual is not available, contact an area supervisor who will obtain one.
  - The employer (as set forth in this manual).
  - The Federal Government (as set forth by OSHA, FMCSA, and DOT Standards).
- Guards, covers, and safety devices must be in place and operational.
- Never attempt to perform lifting operations with equipment that is parked on a trailer.
- Be aware of the possibility of starting a grass fire.
  - Do not set up in areas with high grass and check the site after moving a vehicle.
- Equipment shall be inspected and deemed to be in safe working order before use.
  - Defective equipment shall be taken out of service immediately and not be used until repairs are made.

### 17.2. Seat Belts

- Where seat belts are provided, they shall be used.
  - Check for wear and tear and make sure locks work properly.
  - Report any defective seatbelts immediately.



Figure 66 Seat Belts Save Lives

### 17.3. Entering & Exiting Equipment

- Keep free from injury when entering or exiting a vehicle or piece of equipment such as a backhoe by:
  - Knowing the equipment.
    - The position and design of steps, ladders, grab handles, etc. varies by make and model of equipment. Know what is available on equipment and inspect it regularly.
  - Maintaining 3 points of contact.
    - Keep 3 limbs (one hand/two feet or two feet/one hand) in contact with the vehicle at all times.
  - Practicing proper housekeeping.

- Keep employees, tools, and equipment safe by storing all materials in their proper location. Be familiar with walking surfaces on equipment and make sure they are kept clear of slip, trip and fall hazards. Also make sure there is no hydraulic oil or other fluids on walking surfaces of equipment.
- Looking before exiting.
  - Before getting down off equipment or out of a vehicle look at the ground surface where feet will land. Inspect the area for holes, boards with protruding nails, snow, ice, debris, cracked pavement and other hazards that could contribute to a fall.
- Facing the vehicle.
  - Face the equipment when getting off or on the equipment. Never climb up or down stairs facing away from the equipment or jump from equipment.
- Keeping hands free.
  - Avoid ascending or descending equipment while carrying any material, tools, equipment, etc. Anything in the hands will interfere with the ability to maintain three points of contact.



Figure 67 3-Points of Contact

#### 17.4. Outriggers

- All outriggers shall be extended for stability before raising booms or aerial devices.
- Outrigger pads shall be placed under outriggers in areas where the soil conditions will not properly support the weight on that outrigger, where the pads are needed for stabilization, or where pads could prevent property damage.
- It shall be the responsibility of the employee positioning the outriggers to see that the area is cleared prior to lowering them.
- Visually observe moving outriggers.
- Utilize echo protocol to ensure the area is clear.
- Outriggers will be used to level equipment as required per the type of equipment being leveled. As an example, bucket and line trucks must be set up within 5 degrees or less of level.

#### 17.5. Electronic Brake Controllers

- Brake controllers must be properly adjusted.
- Proper adjustment includes changing the controller settings based on the load.
- For example, hauling an empty pole trailer requires a different setting than a loaded pole trailer.
- Follow manufacturer's instructions for all tools and equipment.

## 17.6. Battery Charging

- Wet cell batteries can and often do explode. During the process of jumping or charging wet battery, oxygen and hydrogen are generated. Add to this explosive mixture a spark from a jumper or charger clamp, cigarette, match, tool, etc. and the battery explodes hurling fragments and acid with violent force.

### **To safely charge a battery:**

- Check the terminals, clamps, and connections for corrosion, which can stop the normal flow of electricity and is the leading cause of no starts.
- If battery charging is required, follow the charger manufacturer's instructions, and to prevent sparking, shut the charger off before connecting or removing terminal clamps.
  - o Before jumping or charging:
    - o Check and restore proper fluid levels.
    - o Never attempt to jump or charge a frozen battery.
    - o Make sure the charger and batteries are the same voltage.
    - o Vehicles should not be touching.
    - o Keep vehicles in park or neutral with brakes set and wheels chocked.
    - o Turn off all accessories and ignitions.
    - o Wear rubber gloves and eye protection.
- When jump starting negative ground systems:
- Attach the red clamp to the booster cable to the positive (+) terminal of the good battery, and then the other red clamp of the same cable to the positive (+) terminal of the dead battery.
- Connect the black clamp for the second booster cable to the negative (-) terminal of the good battery and make the last connection of the black clamp to a good metal ground on the engine block, away from the battery. After starting up, remove clamps in reverse order.
- Before jump starting any vehicle, especially heavy equipment, check the operator's manual for specific requirements to prevent damage from electrical arcing and fire.
- Adhere to the following safety precautions during battery charging or jumping operations:
  - o Do not smoke.
  - o Remove flammable materials from the area.
  - o Do not charge or jump in the presence of gasoline vapors.
  - o Ensure good connections and do not plug chargers into power sources until after connections are made.
  - o Tools touching both battery posts or a battery post and metal part will short circuit and spark. Maintain positive control of tools.
  - o Keep the charger as far away from equipment being charged as cables will permit.
  - o Be aware of body position. Keep the body as far away from batteries as possible.
  - o Avoid overcharging batteries.

## 17.7. Powered Industrial Trucks - Forklifts & Industrial Lifts

### General

- Industrial trucks shall be operated only by authorized persons who are qualified and trained in their use.
  - Operators must be qualified and trained on the specific type of forklift they are operating.
- Brakes and controls shall be tested prior to use. Equipment with faulty brakes or mechanical or electrical defects shall not be operated. Needed repairs shall be reported immediately.
- Equipment shall always be operated at a safe speed for existing conditions.
- Before moving the equipment, the operator shall make sure that no person or objects are in the path of the vehicle; clearances in all directions shall always be checked, particularly overhead clearances.
  - Horns should be used to warn potential pedestrians around corners, when backing, or when vision may be obstructed in the path of travel.
- When picking up a load, forks shall be set squarely and as far as possible under the load. Loads should not be raised or lowered while traveling. Loaded or empty forks should be carried as low as possible, but high enough to clear uneven surfaces. Manufacturer specified load capacity shall not be exceeded.
- Loads shall not be suspended or swung over other persons. No one shall be allowed to stand or walk under elevated forks.
- Industrial lifts shall not be parked (for working purposes) where any wheel is closer than 6 inches from the edge of a drop off. These lifts shall not be operated in the forward or reverse direction when the lift is in the raised position and the wheels are within 2 feet of any drop off unless the lift itself is lowered completely into the cradle prior to moving.
- On inclines all types of loaded lift trucks shall be driven with the load on the upgrade side of the driver whether ascending or descending.
- Sudden stops which might spill the load shall be avoided.
- All loads shall be securely fastened or safely positioned to prevent tipping or falling.
- Lift bars on forklift trucks which are movable or replaceable shall be firmly secured by a proper securing pin.
- No one shall be allowed to ride the truck, forklift, or other equipment other than the operator, except when seats are provided for this purpose.
- When an industrial truck (forklift) is left unattended, the load shall be fully lowered, controls shall be neutralized, power shall be shut off and brakes set. Wheels shall be chocked when the truck is parked on an incline.
- Equipment with internal combustion engines shall not be operated in enclosed areas for prolonged periods of time so as not to exceed allowable levels of carbon monoxide.
- When loading or unloading trucks or railroad cars, approved dock boards which are properly secured shall be used. The wheels of the truck or railroad car shall be blocked or wedged.
- When operating industrial trucks or forklifts, hard hats shall be worn.



## 17.8. Cranes & Hoisting Equipment

### General

- A crane is a machine designed to raise and lower heavy weights and transport them as they are suspended. There are three typical types of cranes:
  1. Mobile cranes.
  2. Tower cranes.
  3. Track cranes.
- Equipment classified as cranes includes boom trucks, industrial, crawler, rough- terrain and all-terrain cranes and equipment using a winch and hook to lift material.
- Equipment not classified as cranes:
  - Digger Derricks when used in placing, removing poles, and associated material of electric lines. A digger derrick used for other purposes (moving concrete, tress, dumpsters, etc. is considered a crane.
  - Mechanic’s trucks.
  - Wheel loaders and backhoes when used with slings and other rigging to lift loads.
  - Helicopter cranes.
  - Knuckle boom truck cranes, when used to transfer materials from the truck to the ground without arranging the material in a particular sequence for hoisting.



### Operator Certification

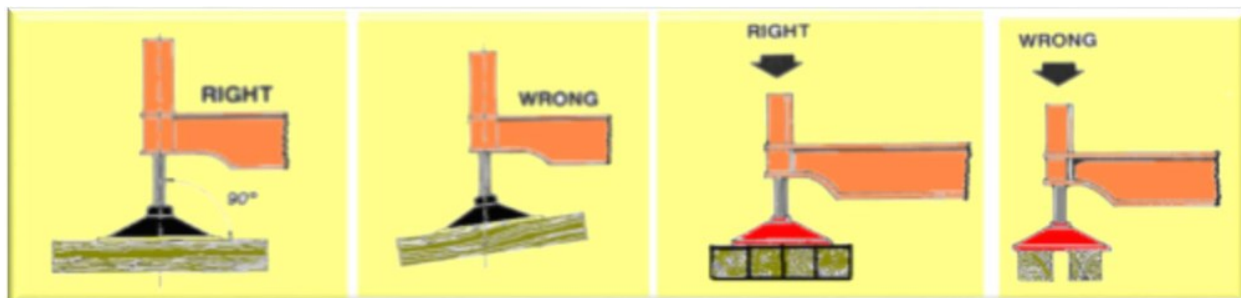
- Mobile crane operators must have a current and valid ANSI approved, OSHA compliant certification.

### Inspection

- Prior to each shift a competent operator must inspect the crane for apparent deficiencies. The inspection must include the following:
  - Control and drive mechanisms.
  - Air, hydraulic and other pressurized lines.
  - Hydraulic system proper fluid levels.
  - Wire rope condition and wire rope reeving for compliance.
  - Electrical systems.
  - Tires.
  - Operator cab windows.
  - Safety devices and operational aids for proper operation.
  - Ground conditions around equipment.
- A monthly and annual comprehensive inspection must also be completed.

### Set Up

- The machine shall be leveled on a supporting surface. ○ It may be necessary to use padding under the outrigger floats.
- Surfaces must be able to support the weight of the crane. If not, cribbing; blocking; or mats must be used when setting up and leveling the crane.
- Blocking must always be level, stable and in good condition. Blocking needs to be a hard wood or prefabricated type of material. NO REEL TOPS.



### Lifting Operations

After confirming that the site is adequately prepared by performing a thorough site analysis and the crane is set up properly, focus on completing the lift safely. Look over the site again with crane in place for other hazards including:

- Weather conditions - wind and lightning (wind adds to inability to control the load, side loading of boom, tipping or structural failures).
- Overhead hazards including energized overhead lines.
  - Use a qualified observer around overhead energized line.
- No employee shall position himself under a suspended load.
- Workers reaching under loads being landed.
- Operating within the load chart for crane set up and configuration (Radius and weight known, proper out rigger position, correct number of rope reeving).
- All safety devices on crane working properly.
- Echo protocol being used.

### Rigger

Riggers have an important part in every lift. This includes but not limited to making sure that the load is lifted in a safe manner to protect the safety of all personnel on the ground and the crane operator. The rigger along with the operator must determine if the area is adequate for the lift











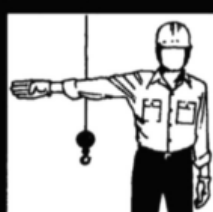





- Responsibilities of the rigger:
  - Determine the weight of the load before rigging.
  - Able to determine where the center of gravity of the load is at.
  - Ability to select the appropriate rigging material.
  - Ability to inspect the rigging for defects and proper identification.
  - Knowing how to figure in sling angle factors.
  - Understanding the use of tag lines and how to secure them to the load.
  - Know the safe working load limit of the equipment and never exceed the limit.
  - Understanding the limitations and capacities of the crane being used.
  - Immediately report defective equipment or hazardous conditions to a supervisor.

### Signalperson

Each signal person shall know and understand the type of signals used. If hand signals are used, the signal person shall know and understand the standard method (ASME) for hand signals. Examples of these are on cranes and can also be found on digger derrick trucks.



Table 25 Hand Signals

| Hand Signals for Controlling Crane Operations  |  |  |   |
|--|--|--|---|
| <br>HOIST                       | <br>LOWER                       | <br>USE MAIN HOIST     | <br>USE WHIPLINE   |
| <br>RAISE BOOM                  | <br>LOWER BOOM                  | <br>HOIST SLOWLY       | <br>STOP           |
| <br>RAISE BOOM &<br>LOWER LOAD | <br>LOWER BOOM &<br>RAISE LOAD | <br>SWING             | <br>EXTEND BOOM   |
| <br>DOG EVERYTHING            | <br>TRAVEL                    | <br>TRAVEL ONE TRACK | <br>RETRACT BOOM |

- Signal person must be competent in the application of the type of signals used.
- They must have a basic understanding of the equipment operation and limitations, including the crane dynamics involved in swinging and stopping loads and the boom deflection from lifting loads.
- The signal person must be always in clear view of the operator when using hand signals. They must be aware of the standard hand and voice signals and the path the load will take for each.
- They must have a clear view of the load, boom, hazards, and the operator.
- They must keep unauthorized persons outside the crane's operating area. o Use barricades or a warning device if needed.
- Give signals according to the operator's right or left.
- Stay focused on the work.
- Do not be distracted by cell phones or other people.

## Types of Signals

- Hand Signals
- Voice/Radio Signals
- Audible Signals (Used to signal cranes when they are traveling with a horn).
  - 1 short audible signal - Stop
  - 2 short audible signals - Go
  - 3 short audible signals - Back Up
- Communications between the operator and the signal person must be continuous. If communication is disrupted the operator shall stop movement until communications is restored.

## Load Charts

- Operators should be familiar with the limits and capabilities of their equipment to avoid overload conditions.
- These limits can be determined by becoming familiar with and understanding the load chart on each piece of equipment that an employee operates.
- Load charts vary from manufacturer to manufacturer and even vary on like cranes. Only use the load chart designed specifically for the crane being operated.
  - Load charts are not interchangeable.
- Load charts must be located at the operator's platform and permanently attached to the crane.
- Operator verifies that rigging is complete, verifies the path of travel is clear and agrees on the signals.
- The following factors must be taken into consideration when reading a load chart:
  - Level set up.
  - Boom length.
  - Boom angle.
  - Load operating radius.

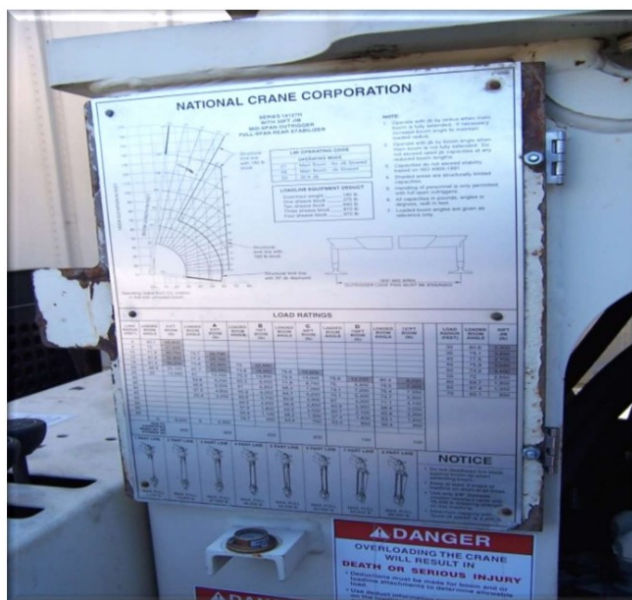


Figure 68 Load Chart

## 18. Tools & Machinery

### 18.1. General

- It is GMB policy to make available the best tools for the work being performed. It is also the intention to have tools that are safe and durable. Supervision will determine what tools are needed. Foreman's Responsibilities with Respect to Tools
- It is the responsibility of the foreman to train his crew in the use, care, sharpening, handling, and storing of tools. This training will pay off in assuring that the tools will be safer, perform better, and give longer life.
- Keep a general list of all the tools supplied to the crew.
- Make sure no tools are missing.
- See that the crew puts tools away and secures them if necessary to prevent damage or loss. Each tool should have a designated place for storage.
- Lock up compartments and take any other precautions necessary to prevent thefts.
- Perform the following checks on tools:
  - Check to see that tools are sharpened.
  - Check to make sure tools are in adjustment.
  - Check to see that tools are not leaking.
  - Check and replace ropes that are burned, cut, or frayed.
  - Check to make sure safety belt and snaps are in good condition.
  - Check to make sure striking tools are not mushroomed or chipped.
  - Check to make sure no tools have been dropped or abused in a way that might affect their operation or safety.
- Arrange for routine maintenance on tools.
- Have appropriate Owner/Operator's Manual available for reference.
- If any tools are unsuitable, contact supervision and have them exchanged.
  - A best practice is to keep information that will be useful when repair parts are needed. This could include company numbers, model and serial numbers, length of bars, etc.

### 18.2. Hand Tools

#### General

- All tools, regardless of ownership, shall be of an approved type and maintained in good condition. Tools are subject to inspection at any time. A foreman has the authority and responsibility to condemn unserviceable tools regardless of ownership. Do not use tools that have been made unsafe by damage or defect.
- Defective tools shall be tagged and removed from the job site.
- Do not use electric powered hand tools within 6 feet of energized equipment.
  - Does not apply to tools with completely self-contained batteries (cordless tools).
- Use the proper tool for the job to be performed and use tools only for their approved purpose.
- Become familiar with the proper operation of each tool either through the appropriate owner's manual or by asking a supervisor.

- Tools with sharp edges shall be stored and handled so that they will not cause injury or damage and they shall not be carried in pockets.
  - Wooden handles that are loose, cracked or splintered must be replaced.
- Tools must not be left lying around where they may cause a person to trip or stumble.
- Do not depend on the insulation on hand tools for protection from electrical shock.
- Do not use hammers with metal handles or screwdrivers with metal continuing through the handle, or metallic measuring tapes on or near energized electrical circuits or equipment.
- Tools shall not be thrown from place to place or from person to person; tools that must be raised or lowered from one elevation to another shall be placed in tool buckets or firmly attached to hand lines.
- Tools shall never be placed unsecured on elevated places.
- When impact tools such as chisels, punches, drift pins, etc. become mushroomed or cracked, they shall be dressed, repaired, or replaced before further use.

### 18.3. Knives & Cutting Tools

#### General

- When using knives or other cutting tools use the correct tool for the job. o Pocket knives should not be used.
- Always cut away from the body.
- Keep knives and cutting tools properly sharpened. Sharpening a Lineman's Knife
- Tools needed - Leather gloves and flat file.
  1. Hold knife by the handle with the blade pointing away from the body (do not rest tool against leg).
  2. Place the knife on a flat surface tilting the blade upwards slightly.
  3. Starting at the back of the knife with a flat file, push the file toward the tip of the blade.
    - Do this 8-10 times, then turn the knife over and repeat.
  4. Continue this process until the knife is sharp.
    - Do not try to sharpen the point, as this is not necessary in order to skin wire.



**\*Note: Make sure your cutting motion is away from instead of toward your body.**

### 18.4. Powered Tools

#### General

- All powered tools shall be examined prior to use to insure general serviceability and the presence of all applicable safety devices. The electric cord and electric components shall be given an especially thorough examination.
- Powered tools shall be used only within their capability and shall be operated in accordance with the instructions of the manufacturer.
- All tools shall be kept in good repair. Disconnect them from the power source while repairs are being made.



- Electrical tools shall not be used where there is a hazard of flammable vapors or gases.
- The non-current carrying metal parts of portable electric tools such as drills, saws, and grinders shall be effectively grounded (using 3 prong plug) when connected to a power source unless:
  - The tool is an approved double-insulated type.
  - The tool is connected to the power supply by means of an isolating transformer or other isolated power supply (example-24V DC system).

### 18.5. Pneumatic tools – Air Compressors Etc.

#### General

- Compressed air and compressed air tools shall be used with caution.
- Pneumatic tools shall never be pointed at another person.
- Shut off the air before changing air tools unless quick-change connectors are used. The hose shall be bled at the tool before breaking the connection.
- Do not exceed the manufacturer’s safe operating pressure for hoses, pipes, valves, and other fittings.
- Secure pneumatic hoses by some positive means to prevent the coupling from becoming accidentally disconnected.
  - Safety clips or hose whip checks shall be securely installed and maintained on pneumatic impact tools to prevent attached from becoming accidentally expelled.



### 18.6. Crimping Tools & Dies

- Use the proper die for the application. Make sure your cutting motion is away from instead of toward your body.
- Follow arrows or instructions for sleeves when making crimps.
- Make a crimp, rotate the tool 90°, make another crimp, and so on.
- The crimper must reach its finish position for a proper crimp to be achieved.
- Keep all tool surfaces free of grease, dirt, and foreign material.
- Crimping tools must be kept in proper adjustment.



## 18.7. Live Line Hot Hoist



INSPECT FOR DEFECTS PRIOR TO EACH USE

- The hoist must be visually inspected before each use.
- During use the hoist should be double strapped.
- The stress link in the fiberglass handle will flex or fracture to warn of overload conditions
  - Know and follow the load capacity of the hoist.

**Table 26 Hot Hoist Load Capacities**

| Hot Hoist Load Capacities |               |               |
|---------------------------|---------------|---------------|
|                           | Single Rigged | Double Rigged |
| 1-1/2 Ton                 | 1500 Pounds   | 3000 Pounds   |
| 2 Ton                     | 2000 Pounds   | 4000 Pounds   |

- When transferring conductors, two hoists must be used in conjunction when needed, such as when transferring a conductor on an angle pole.
- Although the web strap has dielectric properties when clean and dry, it cannot be used as an insulator.
  - An isolating device (bell or link stick) must be used when attaching the hoist to a pole or structure.
  - When working on energized conductors, blankets or other protective equipment should be used for insulation if the web strap might come in contact with a conductor, pole or other structure.
- Hot hoists are designed for hot line work and should not be used for routine groundwork.
- The hoist should be stored in a dry compartment away from contaminants such as grease and oil.
  - Hoist should be hung in truck bins when not in use.



## 18.8. Ladders

### Requirements

- Employees shall be trained on ladder usage before using a ladder.
- Ladders shall be properly maintained, inspected before each, and used only for their intended purposes.
- Manufacturer's instructions and capacities shall be followed.

### General

- Read and follow all labels and markings on ladders.
- Never exceed the maximum load rating of a ladder and be aware that tools and equipment count towards the weight the ladder is supporting.
- All ladders shall be inspected frequently and regularly.
  - Ladders with weakened, broken, or missing steps, broken side rails, or other defects shall be tagged and removed from service.
    - Other defects include but are not limited to oil, grease, and other slipping hazards; illegible warning labels; and inoperable locking mechanisms on spreader devices.
- Ladders may only be used for their intended purpose.
- Use a ladder only on a stable and level surface unless it has been secured.
- Do not place ladders on boxes, barrels, or similar unstable bases to gain height.
- Portable metal ladders shall not be used in the vicinity of energized electrical circuits.
- Do not use the top step/rung of a ladder as a step/rung unless it was intended for that purpose.
- Ladders shall not be placed in front of doors opening toward the ladder unless the door is open, locked or guarded.
- When ascending, descending, or working from ladders, employees shall always maintain three points of contact. Employees must utilize "Belt Buckle Rule". Never lean or position body where your belt buckle may become outside of the ladder rails.
- When ascending or descending ladders, use a tool belt, pouches, or other means to move tools and equipment. Never carry tools by hand while ascending or descending a ladder.
- The top of the ladder should be free of any material before the ladder is ascended or descended.
- Store ladders in such a manner they will not become warped, sagged, damaged, or contaminated with slippery surfaces.
- Straight Ladders
  - Do not use portable straight ladders without non-skid bases.
  - Place the base of the ladder so that the distance between the bottom of the ladder and the supporting point is approximately one-fourth the working length of the ladder from the vertical surface.
    - The base of a job made wooden ladder should be one-eighth its length away from the wall.
  - A ladder used to access an elevated surface must extend 3 feet above the point of support.
  - When working from a portable ladder, the ladder must be

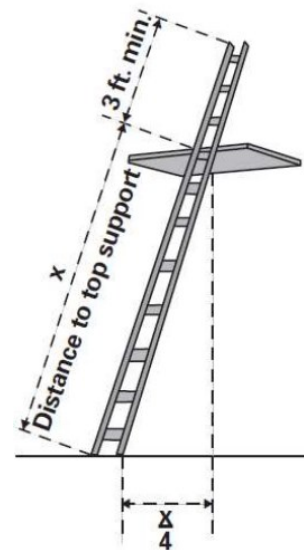


Figure 69 Ladder Requirements

- securely placed, held, tied, or otherwise made secure to prevent slipping or falling.
- o Employees shall belt off to a secured ladder whenever both hands must be used for the job
- o A ladder shall not be placed against an unsafe support.
- o Ensure the tip of the extension ladder extends at least three and a half rungs beyond the landing surface, where practical.
- o Do not stand on the top three rungs of a straight, single, or extension ladder.
- Stepladders
  - o Stepladder legs shall be fully spread, and the spreading bars locked in place.
  - o When an employee is working on a stepladder over 10 feet high, the ladder shall be held by another person.
  - o Do not stand on the top step or above the point indicated on the ladder.
  - o Never work backwards off a ladder.
  - o Never climb the back side of a ladder.

### **18.9. Scaffolds**

- All scaffolds will be constructed by a qualified scaffold builder.
- Before using a scaffold, ensure that it is built correctly and safe to use.
- Pay attention to:
  - o Footing.
  - o Planking.
  - o Guardrails, mid-rails, and toe boards.
  - o Hardware cloth (mesh screen).
  - o Connections.
  - o Welds and rust.
  - o Ladders or other access means.
- After significant events (e.g., impact loadings from vehicles, hoists, high winds) that could affect a scaffold's structural integrity, re-inspect the scaffold.
- Before working on a supported scaffold higher than 4 feet without railing, protect workers as follows:
  - o Mark the area below with caution tape. (If tape is unavailable, equivalent signs may be used.)
  - o Wrap the tape around nearby columns or caution stanchions to create the protection area.
  - o Put tape (or signs) about 5 or 6 feet high so that it can be easily read from all directions.
  - o Obtain and use fall arrest equipment.
- Where tools, materials, or equipment falling from a scaffold could strike employees below, do one or more of the following:
  - o Install a toe board.
  - o Mark with caution tape and barricade the area below to prohibit employees from entering.
  - o If materials are piled higher than the toe board, use a screen around the perimeter of the scaffold.
- Always wear fall arrest equipment with independent lifeline on adjustable suspended scaffolds.



- Connect lifelines to an anchor that is not part of the scaffold's suspension.
- For top level of multilevel suspended power scaffolds, tie off to an independent lifeline. On lower levels, tie off to scaffold.
- Do not use a defective scaffold.
  - o Tag defective scaffolding out of service until it is repaired.
- In generating facilities, report any scaffold problems discovered in inspections to the location scaffold constructor or planner/scheduler.
- Unless a retractable lifeline and fall protection is used or landings are provided, avoid climbing scaffold ladders higher than 25 feet.
- Use the access that has been designed and provided by the scaffold builders.
- Climb with hands free. (Tools and materials should be hoisted with a rope while on the scaffold.)
- Use a 3-point climbing technique at all times (2 feet and 1 hand or 1 foot and 2 hands).
- Do not use toe boards for support while climbing up or going down a scaffold.
- Do not accumulate too many tools, materials, or debris on the scaffold or overload it beyond the rated capacity.
- Do not stand on or lay tools, materials, and equipment on any scaffold railing. (This also applies to placing anything on a railing to increase scaffold's height.)
- To prevent tipping, do not load a scaffold unevenly.
- During high winds and storms, do not work on an outside scaffold.
- Do not work on an ice-coated scaffold.
- Ensure mobile scaffolds rest on a solid level footing.
- If wheels or casters are provided, lock them to prevent accidental movement on scaffolds.
- When asked to move mobile scaffolds:
  - o Get help so the pressure of pushing is not concentrated in one point on the scaffold.
  - o Ensure scaffold will move across level floors that are also free of obstructions and openings. (Otherwise, do not move the scaffold.)
  - o Apply force close to (5 feet or less) the base of the scaffold.
- Before performing work from a scaffold, identify and safeguard any electrical hazards.
- When moving mobile scaffolding, avoid obstructions (e.g., piping equipment, instrumentation, electrical lines).
- Keep the scaffold's working surface clean and organized at all times.
- When the job is completed, remove all items from the scaffold.
- Do not erect, use, dismantle, alter, or move scaffolds so that they or any conductive material handled on them comes closer to exposed and energized power lines than:
  - o 10 feet for lines under 50kV.
  - o 10 feet plus 4 inches for each 10 kV over 50kV.
- Do not use the frame on welded tubular frame supported scaffolds to access upper levels unless the distance between the integral rungs is 16-3/4 inches or less. If the distance is greater than 16-3/4 inches, use an extension or hook-on ladder.
- Use tag lines or equivalent measures to control swinging loads when they are being hoisted onto or near scaffolds or if the loads could contact the scaffold.
- Use ladders on scaffolds to increase working level height of employees only on large-area scaffolds. Ensure the following:

- If the ladder is placed against a structure which is not part of the scaffold, the scaffold is secured against the sideways force exerted by the ladder.
- The platform units are secured to the scaffold to prevent their movement.
- The ladder legs are on the same platform, or other means are provided to stabilize the ladder against unequal platform deflection.
- The ladder legs are secured to prevent them from slipping or being pushed off the platform.
- Inspect wire ropes for defects before each work shift and after any occurrence that could affect a rope's integrity. Replace ropes if:
  - Any physical damage impairs the function and strength of the rope.
  - Kinks impair the tracking or wrapping of rope around the drum(s) or sheave(s).
  - Six randomly distributed broken wires are in one rope lay, or three broken wires are in one strand in one rope lay.
  - Abrasion, corrosion, and scrubbing causes the loss of more than 1/3 of the original diameter of the outside wires.
  - Heat damage caused by a torch, or any damage caused by contact with electrical wires is evident.
  - The secondary brake has been activated and has engaged the suspension rope during an over speed condition.
- Ensure that wire rope clips on suspension scaffolds are inspected and retightened to the manufacturer's specifications at the start of each work shift.
- Ensure the wire ropes on suspension scaffolds are shielded, treated to resist corrosive substances, or made of material which is not adversely affected by the substance being used when acids and other corrosive substances are used.
- Shield suspension ropes when performing a heat-producing process.
- Reduce the possibility of welding current arcing through the suspension wire rope when welding is performed on suspension scaffolds by ensuring the following:
  - An insulated thimble is used to attach each suspension wire rope to its hanging support.
  - Excess suspension wire rope and any additional independent lines from grounding are insulated.
  - The suspension wire rope is covered with insulating material extending at least 4 feet above the hoist.
  - The tail line below the hoist is insulated to prevent contact between it and the platform.
  - The portion of the tail line that hangs free below the scaffold is guided and/or restrained so that it does not become grounded.
  - Each hoist is covered with insulated protective covers.
  - In addition to a work lead attachment required by the welding process, a grounding conductor is connected from the scaffold to the structure.
  - Ensure that the size of this conductor is at least the size of the welding process work lead, and this conductor is not in series with the welding process of the work piece.
  - If the scaffold grounding lead is disconnected at any time, the welding machine is shut off.
- An active welding rod or uninsulated welding lead is not allowed to contact the scaffold or its suspension system.

## 18.10. Load Break Tools

- Load break tools are designed to allow energized circuits to be opened easily and safely. The keys to their safe operation are maintenance, installation, and use.
- GMB utilizes two sizes of load break tools, one designed to open circuits from 7.8 kV through 25 kV and the larger designed for circuits from 25 kV through 38 kV. Both tools are rated for maximum amperage of 900 amps.
- Note: These tools are not interchangeable. Do not use the tool on applications where the voltage on the system exceeds the voltage rating of the tool. Also, never use a tool that is “overrated” for the voltage being worked.

| Load Break Tools   |
|--|
| <ul style="list-style-type: none"> <li>• Inspect tool prior to use, open cap to inspect the trailer portion of the tool.</li> <li>• Be sure tool is set prior to operation.</li> <li>• When opening switches, make a firm pull in one smooth motion.</li> <li>• Never lift up on tool while door is still attached.</li> <li>• Make sure door of switch falls free from load break.</li> </ul> |

### Maintenance

- Check the unit by pulling out the barrel and make sure the tool locks in the open position.
- Check to ensure the unit is clean as dirty tools can lead to tracking causing an arc over.
  - As with a fireplace or grill, any surface exposed to enough fire will become dirty with buildup and require cleaning.
- Store the unit in the case provided when not in use.
- Before operation, make sure the unit is completely reset by ensuring the barrel is all the way inside the tool.
- Verify it is reset by pulling the tube out a few inches and seeing that the spring force causes the tube to snap back.
- Firmly tap the end of the tool.



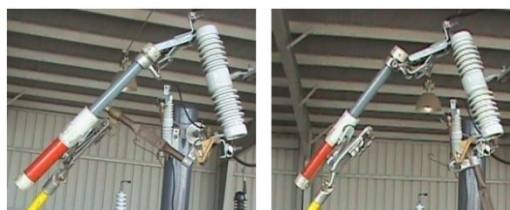
### Installation

- Correct installation of a load break tool involves mounting the tool at the correct angle on the stick.
- Approach from bottom and as close to straight out as possible.
- A 45-degree angle is optimal.
- Be sure to come across the front of the switch.
- The tool should then be placed on the switch ensuring the clip engages the clip ring on the door.
- Cover adjacent switches or apparatus, as necessary.



### Use

- Make a firm pull to open the switch in one smooth motion.
- Twist or roll the tool in the direction it is installed on the switch.
  - To the right in this example.
  - To the left if installed on left side of switch.
- Door will fall free of tool when released.
- Never lift on the tool before the door has fallen free to remove the tool. Proper use of a load break tool involves correct maintenance, installation, and use.



### 18.11. Machine Guarding

- There are three types of barrier guards that protect people from moving machinery. They consist of the following:
- Fixed guards
  - A fixed guard is a permanent machine part that completely encases potential hazards. Fixed guards provide maximum operator protection.
- Interlocked guards
  - Interlock guards are connected to a machine's power source. If the guard is opened or removed, the machine automatically disengages. Interlocking guards are often preferable because they provide adequate protection to the operator, but they also allow easy machine maintenance. This is ideal for problems such as jams.
- Adjustable guards
  - Self-adjusting guards change their position to allow materials to pass through the moving components of a power tool. These guards accommodate various types of materials, but they provide less protection to the operator.

#### **Machinery with Moving Parts**

- Whenever there is a possibility that operators may come in contact with moving mechanical parts, they shall be safely enclosed in affixed machine guards or placed behind barricades as to prevent operators from gaining access to the area of moving parts.
- Machines requiring a guard shall not be used if the guard is missing or defective. The missing or defective guard should be reported to the shop foreman immediately and replaced before the machine is operated. Only guards specified by the machine's manufacturer shall be used.
- Machine guards should be removed only for the purposes of servicing the machine. No guard, barrier, or enclosure shall be adjusted or removed from the machinery by an operator for any reason unless permission has been given by the supervisor to do so.
- Moving machine parts must be safeguarded to protect operators from serious injury. Belts, gears, shafts, pulleys, fly wheels, chains, and other moving parts must be guarded if there is a chance, they could contact an individual.
- The hazards associated with moving machinery can be deadly and must be guarded at the following locations:
  - Point of operation. Area where the machine either cuts, bends, molds, or forms the material.
  - Pinch/nip point. Area where moving machine parts can trap, pinch, or crush body parts (e.g., roller feeds, intermeshing gears, etc.)
  - Sharp edges.

#### **Procedures for Servicing Machinery with Moving Parts**

- Prior to guards or other guarding devices being removed for servicing, all power sources to the machine (electrical, pressurized fluids and pressurized gases) shall be isolated from the machine. All electrical sources shall be turned off at the main breaker. The breaker shall be locked out and tagged with a warning sign by the person performing the servicing. Only one key shall be available and should be kept by the servicing person.

- Following the servicing, the guarding shall be replaced. Once it is securely affixed, the lock and tag on the main breaker may be removed.
- **IMPORTANT:** Guards must be in place. If a guard is removed to perform maintenance or repairs, follow lockout/tagout procedures. Replace the guard after repairs are completed. Do not disable or move machine guards for any reason. If a guard is missing or damaged, contact a supervisor and have the guard replaced or repaired before use.

#### **18.12. Powder Actuated Tools**

- Explosive charges shall be carried and transported in approved containers.
- Operators and assistants using these tools shall wear approved PPE.
- Tools shall be maintained in good condition and serviced regularly by qualified persons.
- Do not use these tools on unsuitable material that could be hazardous.
- Prior to use, the operator shall ensure that the protective shield is properly attached to the tool.
- Prior to use, the operator shall inspect the tool to determine that it is clean, moving parts operate freely, and the barrel is free from obstructions.
- Powder activated tools shall not be used in an explosive or flammable atmosphere.
- Tools shall not be loaded until just prior to the intended firing.
- Only cartridges with an explosive charge adequate for the job and with proper penetration shall be used.
- Tools and cartridges shall never be left unattended.
- Do not point tools at any person.
- In case of a misfire, the operator shall hold the tool in place for 30 seconds. He shall then try to operate the tool a second time and then wait another 30 seconds. Dispose of misfired cartridges by placing them in a metal container and returning them to supervision.

#### **18.13. Gasoline Driven Power Saws -Chain Saws**

- The operator shall familiarize himself with the manufacturer's operating and safety instructions prior to operating a chain saw.
- The operator shall have secure footing when starting the saw. Drop starting of saws is permitted outside of the bucket of an aerial lift only after ensuring that the area below the lift is clear of personnel.
- The engine shall ordinarily be stopped when power saws are being carried. The saw need not be stopped between cuts during consecutive felling, bucking, limbing, or cutting operations on reasonably level ground. The chain shall not be moving and placed in the locked position and the operator's hand shall be off the throttle lever while operator is moving between work locations. One-man saws shall be carried by the worker on his side with the guide bar of the saw pointed behind his body.
- The engine shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw except where manufacturer's procedures require otherwise.
- Chain
  - Gloves shall be worn when handling the chain.
  - The chain shall be kept properly filed and snug on the bar.
- Tensioning

- Hold the nose of the bar up and tighten the chain adjusting screw until the chain will move freely without binding when pulled by hand
- To check for kinks in the chain, pull the chain out from the bar and let go then recheck the tension ○ Lift the chain from the top middle of the bar and ensure the drive links do not come out of the bar groove (this indicates saw is properly tensioned).
- Sharpening
  - The chain should feed itself into the wood. If it must be forced, it needs sharpening. Also, fine sawdust coming out of the wood instead of wood chips is an indication the saw needs sharpening.
  - Use the correct file size, guide, gauges, and angles when sharpening the chain
- Kickbacks
  - Do not allow the bar nose (tip of saw) to contact a solid object or become pinched to avoid kickback
  - The operator shall work to one side of the saw to minimize injury from kickbacks.
  - Keep the chain brake in good working condition and replace when defective.
- The operator shall remain close to the saw for maximum control and minimum wear and tear on his arms, shoulders, lower back, and legs.
- When fueling chainsaws:
- Allow hot saw to cool 2-3 minutes before refueling
- Refuel saw only in a cleared area
- Clean spilled fuel from motor before starting
- Store fuel in approved containers Be sure to use the appropriate fuel mixture as recommended by the manufacturer Case Study An employee sustained fractured ribs when he cut a limb under tension that struck him and pushed into a woodpile. An employee cut his hand with a chainsaw while attempting to saw a limb above his head with one hand.
- Do not smoke in the vicinity of any fueling location
- Work Methods
  - Before cutting a tree, branch, or limb:
    - Clear the area from slip, trip and fall hazards such as rocks and debris.
    - Think about body position in relation to where the object(s) being cut will fall.
    - Do not stand between the object being cut and an immovable object such as a wood pile.
    - Thoroughly inspect, sharpen, and tension the chain saw and blade as needed.
    - Fuel the chain saw in a safe location.
    - Maintain control of the saw and firm footing when starting a chain saw.
  - While cutting with a chain saw:
    - Do not cut higher than shoulder height.
    - Avoid using the tip of the chain saw to avoid kickbacks.
    - Always maintain control of the saw.



- Wear proper PPE.
- Do not wear loose fitting clothing.
- Avoid binding the chain saw.
- Watch for limbs and branches under tension.

#### 18.14. Mechanical Grips





##### General

- For a grip to work effectively:
  - Match the proper size and type of grip to the application (see chart).
  - Do not exceed rated capacity (see chart).
  - Wire brush jaw area of grip before each use.
  - Inspect grip for proper operation before use.
  - Wire brush conductor where grip will be attached.

##### Cleaning Guidelines

- Clean the surfaces of grips jaws anytime there is an accumulation of foreign material with emery cloth or a clean wire brush
  - Note: Aluminum conductor may have a grease coating which can deposit on jaws and must be cleaned. Be sure to clean grip jaws before and after each use on wire or cable which has been galvanized or otherwise coated.
- Keep jaws clean and dry and occasionally clean all working parts with an appropriate cleaner/degreaser.

**Table 27 Mechanical Grip Sizing & Capacity**

| Number                      | 1613-30   | 1613-40   | 1685-20  | 1611   |
|-----------------------------|---|---|--|--|
| <b>Klein Grips</b>          |  |  |  |     |
| <b>Use</b>                  | Copper Wire   | Copper Wire   | Guy Wire   | Aluminum or Stranded Conductor   |
| <b>Jaw Groove</b>           | Single "V"  | Double "V"  | Serrated Lower Jaw   | Notched  |
| <b>Cable Diameter Range</b> | .08" - .20"<br>2.03mm – 5.08mm  | .12" - .37"<br>3.05mm – 9.40mm  | .157" - .886"<br>4mm – 22mm  | 1611-20 .20" - .40"<br>1611-30 .31" - .53"<br>1611-40 .53" - .74"<br>1611-50 .78" - .88" |
| <b>Conductor Range</b>      | No.8 / No.6 / No.4 / Solid Copper   | No.2 / Solid Copper / 1/0   | Wide Range   | 1611-20 4 - 1/0<br>1611-30 1 - 3/0<br>1611-40 266-397 / 4/0<br>1611-50 477 – 556         |
| <b>Maximum Safe Load</b>    | 1500lbs   | 4500lbs   | 4500lbs  | 1611-20 4,500 lbs.<br>1611-30 4,500 lbs.<br>1611-40 8,000 lbs.<br>1611-50 8,000 lbs.     |

\*Cable diameter and conductor range should be considered a guideline and will vary by manufacturer

\*Cable diameters are for conductor only and do not take any insulation into account

## 18.15. Kellum Grips

- Kellum pulling grips are reusable tools for pulling electrical cable, bare conductor, or rope. Each grip is designed to work on a specific range of cable diameters. Kellum grips must be inspected before use. They should also be stored, handled, and used properly.

### **Kellum Guidelines**

- Kellum's should be installed by a qualified person.
- Ensure the correct grip is selected for the application.
- Do not use a kellum for any application other than pulling rope or cable.
- Ensure the recommended workload of the kellum is suitable for the application.
- Do not alter kellum in any way.
- Never attach pulling hardware to any point on the kellum other than the pulling eye.
- Do not use tape on a kellum as it allows water to build up and causes rust.

### **Factors to Consider When Selecting a Grip**

- Overhead or Underground application.
- Determine the outside diameter of the cable.
- Pulling distance.
- Estimate the tension to be put on the grip and establish the working load.
- Maximum recommended load of grip.
  - Calculated by applying a safety factor of five to the breaking strength of kellum.
- Select the correct size kellum grip for the diameter of the cable and ensure its maximum recommended load will handle the working load.
  - Tension, diameter, movement, the number of items gripped, gripping surface, and the attachments used are factors that may affect the performance of the grip. Also consider puller and tensioner setup along with proper banding of the Kellum.
- Use the correct grip and make sure it is cleaned and inspected before use to prevent slipping.

### **Inspecting a Kellum**

- Inspect kellum before each use.
- Inspect both the rope kellum and the kellum to be installed on the conductor.
- Remove any tape on the kellum before inspecting.
- Look for:
  - Abrasion(s).
  - Corrosion.
  - Signs of Abuse.
  - Visible Fraying.
  - Broken Strands.
  - Any other condition that may affect the strength of the grip.



### Banding Kellum



Figure 70 Banding Kellum's  
Apply Bands at 1" to 2" from the end of the Mesh



Figure 71 Kellum

## 19. Training

### 19.1. General Guidelines

- Training is a cornerstone of the GMB(s) Safety program.
- GMB(s) training program has the simple goal of ensuring that employees know how to perform their work safely. GMB provides qualified, competent, and/or certified trainers capable of teaching relevant skills and information utilizing a vast library of materials.
- Training begins with Employee Orientation followed by on-the-job, classroom, and virtual training programs supplemented by refreshers through regularly scheduled safety and training meetings.
- In general, each employee should receive safety training and evaluation as follows:
  - Employee Orientation before beginning work.
  - A weekly safety meeting covering safety performance, incident reviews, and lessons learned based on the Friday Call-In.
    - Monthly safety meetings based on regulatory requirements and topics chosen by the Safety Department.
    - Equipment certifications prior to operating equipment.
    - Driver training prior to driving a commercial vehicle.
    - OSHA ET&D 10- & 20-hour training with a five-year refresher.
    - Periodic training including Qualified Employee
    - Pole Top and Bucket Rescue
    - Competent Person, etc. as applicable to the work being performed.
    - Regular auditing and inspection with retraining when deficiencies are identified.
    - Safety as a key component of employee evaluations.
- Training must be conducted by qualified instructors.
- Training must be documented using a Record of Safety Training form.

