## 12.1 Policy Statement

The purpose of this policy is to establish safe work practices that are intended to prevent electric shock, electrical burns, arc flash burns and other injuries resulting from either direct or indirect electrical contacts when work is performed near or on equipment, circuits, or near overhead wires which are or may be energized. ASMG does not have any equipment or machine that cannot be shut down to safely perform service or maintenance activities. This section is to ensure ASMG is compliant with the OSHA Standards on electrical safe work practices 29 CFR 1910.331 through 1910.335 and 1926 Subpart K and NFPA 70E which was adopted by OSHA. The program will be monitored by licensed certified electrician.

## 12.2 Understand Electricity

To handle electricity safely, it is necessary to understand how it acts, how it can be directed, what hazards it presents, and how these hazards can be controlled. Operating an electric switch may be considered analogous to the turning on of a water faucet. Behind the faucet or switch there must be a source of water or electricity, with something to transport it, and with pressure to make it flow. In the case of water, the source is a reservoir or pumping station; the transportation is through pipes; and the force to make it flow is pressure, provided by a pump. For electricity, the source is the power generating station; current travels through electric conductors in the form of wires; and pressure, measured in volts, is provided by a generator.

- **How Shocks Occur:** Electricity travels in closed circuits, and its normal route is through a conductor. Electric shock occurs when the body becomes a part of the electric circuit. The current must enter the body at one point and leave at another.
- **Shock Severity:** The severity of the shock received when a person becomes a part of an electric circuit is affected by three primary factors: the amount of current flowing through the body (measured in milliamperes), the path of the current through the body, and the length of time the body is in the circuit. Other factors that may affect the severity of shock are the frequency of the current, the phase of the heart cycle when shock occurs, and the general health of the person.
    - Effects can range from a barely perceptible tingle to immediate cardiac arrest. Although there are no absolute limits or even known values that show the exact injury from any given current, the following table shows the general relationship between the degree of injury and amount of current for a 60-cycle hand-to-foot path of one second's duration of shock.
    - A difference of less than 20 milliamps exists between a current that is barely perceptible and one that can kill. Muscular contractions may not allow the victim to free himself or herself from the circuit, and the increased duration of exposure increases the dangers to the shock victim. The so-called low voltages can be extremely dangerous because, all other factors being equal, the degree of injury is proportional to the length of time the body is in the circuit. **LOW VOLTAGE DOES NOT IMPLY LOW HAZARD!** Remember, ***120 volts can kill you just as easily as 23,000 volts given the right conditions.***

| Effects of Electrical Current in The Human Body | |
|---|---|
| **Current, 60Hz, 1 Second** | **Reaction** |
| **1 Milliamp** | Perception level. Just a faint tingle. |
| **5 Milliamps** | Slight shock felt; not painful but disturbing. Average individual can let go. However, strong involuntary reactions to shocks in this range can lead to injuries. |
| **6-30 Milliamps** | Painful shock, muscular control is lost. This is called the freezing current or "let-go" range; death is possible. |
| **50-150 Milliamps** | Extreme pain, respiratory arrest, severe muscular contractions. Individual cannot let go. Death is possible. |
| **1,000-4,300 Milliamps** | Ventricular fibrillation. (The rhythmic pumping action of the heart ceases.) Muscular contraction and nerve damage occur. Death is most likely. |
| **10,000-Milliamps** | Cardiac arrest, severe burns, and probable death. |

### 12.3 Preventing Electrical Hazards

Electrical accidents can be caused by a combination of three possible factors- unsafe equipment and/or installation, workplaces made unsafe by the environment, and unsafe work practices. There are various ways of protecting people from the hazards caused by electricity. These include insulation, guarding, grounding, electrical protective devices, and safe work practices. The purpose of these written procedures is to keep you, the worker, safe from the adverse effects of coming in contact with live electrical parts. These procedures are to be followed whenever electrically qualified employees work on or near exposed de-energized parts of conductors and electric equipment where the employee may be exposed to a potential electrical hazard. Conductors and parts of electric equipment that have been de-energized but have not been locked out or tagged out in accordance with these procedures shall be treated as energized and proper safe work practices and PPE around live electrical parts shall be followed.

- **Insulation:** One way to safeguard individuals from live electrical parts is through insulation. An insulator is any material with high resistance to electric current such as the insulation around extension cords or the plastic handles of double insulated tools.
    - Insulators-such as glass, mica, rubber, and plastic-are put on conductors to prevent shock, fires, and short circuits. Before electrically qualified employees prepare to work with electric equipment, they shall inspect the equipment to be used for visible damage and/or defects. The insulation of flexible cords, such as extension cords and cords to tools, is particularly vulnerable to damage;
    - Equipment with damaged or deteriorated insulation shall immediately be taken out of service and not used;

- **Guarding:** Live electrical parts of equipment operating at 50 volts or more shall be guarded against accidental contact. Guarding of live electrical parts may be accomplished by one or more of the following:
    - Location in a locked room, vault, or similar enclosure accessible only to qualified persons;
    - Use of permanent, substantial partitions or screens to exclude unqualified persons;
    - Location on a suitable balcony, gallery, or platform elevated and arranged to exclude unqualified persons; or elevation of 8 feet or more above the walking/working surface;
    - Covers over electrical controls and contacts;
    - Live electrical parts enclosed in secure metal cabinets with all openings covered with appropriate blanks or covers;
    - Entrances to rooms and other guarded locations containing exposed live parts must be marked with conspicuous warning signs forbidding unqualified persons to enter. Signs should read "Danger – High Voltage" and "Authorized Personnel Only" and must be locked in the absence of a qualified electrician.
- **Grounding:** An equipment grounding system is required and must be furnished by providing a dedicated path from the tool or machine through which the current can flow to the ground without flowing through a person.
    - All extension cords must be of the three wire grounded type. Two wire extension cords are prohibited.

**12.4 Circuit Protection Devices**

Circuit protection devices are designed to automatically limit or shut off the flow of electricity in the event of a ground-fault, overload, or short circuit in the wiring system. Fuses, circuit breakers, and ground-fault circuit interrupters are three well-known examples of such devices.

- **Fuses and circuit-breakers:** Fuses and circuit-breakers are over-current devices that are placed in circuits to monitor the amount of current that the circuit will carry. They automatically open or break the circuit when the amount of current flow exceeds the branch circuit's rating, and therefore unsafe. Fuses are designed to melt when too much current flows through them. Circuit breakers, on the other hand, are designed to "trip" when too much current is present in a circuit.
    - Fuses and circuit breakers are intended primarily for the protection of conductors and equipment. They prevent over-heating of wires and components that might otherwise create hazards, such as fires.. Their primary purpose is property protection versus personnel protection.
- **Ground-Fault Circuit Interrupter (GFCI):** The ground-fault circuit interrupter, or GFCI, is designed to shutoff electric power within as little as 1/60 of a second when the presence of a fault of 5milliamps or more is detected. It works by comparing the amount of current going to electric equipment through

the black conductor against the amount of current returning from the equipment through the white conductor. If the current difference exceeds 5 milliamps, the GFCI interrupts the current quickly enough to prevent injury or worse, electrocution. GFCI receptacles or devices are required for all extension cords used to operate electrical equipment on a job site, outdoors, or whenever work is being performed in a wet or damp location. GFCI's are used on all 120-volt or greater, single phase 15 and 20-ampere temporary wiring.

**12.5 Safe Work Practices**

- Electrically qualified employees working with electrical equipment need to use safe work practices while working with this electrical equipment. These safe practices may include de-energizing and locking out electric equipment before inspecting or making repairs, using electric tools rated for the voltages that they will be used, are in good repair, using good judgment when working near energized lines, and using appropriate protective equipment.
- Electrical cords and equipment are inspected daily before use. Each cord set, attachment cap, plug and receptacle of cord sets, and any equipment connected by cord and plug, except cord sets and receptacles which are fixed and not exposed to damage, shall be visually inspected before each day's use for external defects, such as deformed or missing pins or insulation damage, and for indications of possible internal damage. Equipment found damaged or defective shall be taken out of service until it can be repaired.
- **Nonconductive clothing:** Conductive articles of jewelry and clothing (such as watch bands, bracelets, rings, key chains, necklaces, metalized aprons, fall protection/harnesses, cloth with conductive thread, or metal headgear) may not be worn if they might contact exposed energized parts. However, such articles may be worn if they are rendered nonconductive by covering, wrapping, or other insulating means.
- **Lighting:** Employees are prohibited from entering areas containing exposed energized parts unless adequate illumination is provided to ensure work can be performed safely and effectively. If lighting is insufficient or if visibility is obstructed in a way that prevents safe observation of the work area, no work shall be performed near exposed energized components. Additionally, employees must never reach blindly into areas where energized parts may be present. All tasks involving potential electrical hazards must be conducted with clear visibility and full awareness of surroundings to prevent accidental contact with live electrical components.
- **Confined or enclosed spaces:** When working in confined or enclosed spaces (e.g., manholes or vaults) containing exposed energized parts, employees must use appropriate protective shields, barriers, or insulating materials to prevent accidental contact. Doors, panels, or similar components must be secured to prevent movement that could cause an employee to come into contact with energized parts. Follow confined space policy for details.
- **LOCKOUT/TAGOUT:** While any employee of All States Materials Group is exposed to contact with parts of fixed electric equipment and/or circuits, all the circuits which energize the parts shall be shut down and locked out and tagged in accordance with the requirements set forth in the Lockout/Tagout

Section 13 of this Safety Manual. The requirements for Lockout/Tagout shall be followed in the order in which they are presented.

- **De–energizing equipment:** Safe procedures for de-energizing circuits and equipment shall be determined before circuits or equipment is de-energized. o The circuits and equipment to be worked on shall be disconnected from all electric energy sources. Control circuit devices, such as push buttons, selector switches, and interlocks, may not be used as the sole means for de-energizing circuits or equipment. Interlocks for electric equipment may not be used as a substitute for lockout and tagging procedures.
    - Stored electric energy that might endanger personnel shall be released and grounded. Capacitors shall be discharged and high capacitance elements shall be short–circuited and grounded, if the stored electric energy might endanger personnel.
    - Stored non–electrical energy in devices that could re-energize electric circuit parts shall be blocked or relieved to the extent that the circuit parts could not be accidentally energized by the device.
- **Application of locks and tags:** A lock and a tag shall be placed on each energy isolation device used to de-energize circuits and equipment on which work is to be performed as outlined in the Lockout/Tagout procedures of this Safety Manual. Each tag shall contain a statement prohibiting unauthorized operation of the energy isolation device, the name, division, and phone number of the employee applying the lockout/tagout devices, the date and time of the application of the lockout/tagout devices. All lockout locks shall have a tag attached with this information.
- **Verification of de-energized condition:** The requirements of this paragraph shall be met before any circuits or equipment can be considered and worked as de-energized:
    - A qualified person shall operate the equipment operating controls or otherwise verify that the equipment cannot be restarted.
    - A qualified person shall use test equipment to test the circuit elements and electrical parts of equipment to which employees will be exposed and shall verify that the circuit elements and equipment parts are de-energized.
    - The test shall also determine if any energized condition exists as a result of inadvertently induced voltage or unrelated voltage back feed even though specific parts of the circuit have been de-energized and presumed to be safe. The test equipment shall be checked for proper operation immediately before and immediately after this test.
    - **The above verification by a qualified person shall be witnessed by all authorized employees who are locked out and tagged out on that piece of equipment to be worked on.**
- **Re–energizing equipment:** These requirements shall be met, in order given, before circuits or equipment are re-energized, even temporarily.

- A qualified person shall conduct tests and visual inspections, as necessary, to verify that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed, so that the circuits and equipment can be safely energized.
- Employees exposed to the hazards associated with re-energizing the circuit or equipment shall be warned to stay clear of circuits and equipment. 4 feet is the minimum safe distance for up to 600 volts.
- Each lock and tag shall be removed by the employee who applied it or under his or her direct supervision. However, if this employee is absent from the workplace, then the lock or tag may be removed by a qualified person designated to perform this task provided that:
  - The employer ensures that the employee who applied the lock or tag is not available at the workplace, and
  - The employer ensures that the employee is aware that the lock or tag has been removed before he or she resumes work at that workplace.
  - **There shall be a visual determination that all employees are clear of the circuits and equipment.**

- **Overhead Lines:** Prior to construction operations, project managers/superintendents/foremen must locate overhead power lines within work zone.
  - **Overhead lines must be marked with signage or marking paint beneath sign that is visible to everyone on site**
  - All unqualified employees of All States Materials Group and all vehicles and mechanical equipment shall stay at least 10 feet away from overhead power lines.
    - If the voltage is more than 50,000 volts, the clearance shall be increased by 4 inches for each additional 10,000 volts.
  - When mechanical equipment is being operated near overhead lines, employees standing on the ground shall not contact the equipment unless it is located such that the required clearance can always be maintained even at the maximum reach of the equipment.
  - **Only Authorized Employees to Work Directly with Electricity:** Only electrically qualified employees or outside contractors (licensed electricians) can work or near exposed energized electrical equipment.
    - However, ASMG enforces a policy of ***NO WORK ON LIVE ELECTRICAL EQUIPMENT***. No other employee(s) are authorized to perform such tasks that would require them to be exposed to live electrical parts.
    - **There are currently no processes at ASMG that require work on Live Electrical Equipment as such no such work is authorized.**

- **Protective Equipment:** Employees whose occupations require them to work directly with electricity

must use the personal protective equipment required for the jobs they perform. This equipment may include but is not limited to the use of rubber insulating gloves, hoods, sleeves, matting, blankets, line hose, insulated mats, etc. Arc-rated clothing, hard hats, balaclavas, ear plugs, insulated gloves with leather outer gloves, eye protection under face shields are required. To reference the appropriate and required PPE, refer to the PPE Matrix found in the NEC 70E manual.

- The following electrical safety clothing and protective equipment is required for qualified persons working on or near exposed energized parts and conductors up to 480 volts (NFPA PPE Category 2):
    - Non-melting undergarments
    - 8 cal or greater arc rated pants
    - 8 cal or greater arc rated long sleeved shirt
    - Safety glasses with side shields or safety goggles
    - Arc-rated face shield and hardhat
    - Arc flash balaclava
    - Arc-rated jacket, parka, or rainwear as needed
    - Hearing protection ear plugs
    - Voltage rated gloves when within 1 foot of exposed parts; leather gloves required when voltage rated gloves not required
    - Safety-toed leather shoes EH rated
- **Tools:** To maximize the safety of our employees, they shall always use tools that work properly and are in good shape. Tools shall be inspected before each use, and those found questionable shall immediately be removed from service and properly tagged or destroyed. Tools and other equipment should be regularly maintained. Inadequate maintenance can cause equipment to deteriorate, resulting in an unsafe condition.
    - Tools that are used by qualified employees to work on or hear exposed energized parts and conductors be designed, constructed, rated and insulated to be able to withstand the voltages and stresses to which they are exposed.
    - Portable ladders shall have nonconductive/fiberglass side rails if they are being used where the employee or the ladder could come contact with exposed energized parts.
- **Safe Work Practices:** Perhaps the single and most successful defense against electrical accidents is the continuous use of safe work practices. All qualified employees shall be thoroughly familiar with and thoroughly trained in the safety procedures for their particular jobs and activities. When work is performed on electrical equipment some procedures are:
    - Deenergize the equipment.

- Ensure that the equipment remains deenergized by using Lockout/Tagout procedures, and verify.
- Use protective equipment and PPE.
- Keep a safe distance from all energized parts.

- **Unqualified Employees**: Unqualified employees are all employees that are not qualified. Unqualified employees need to be trained:
  - Understand the hazards of electricity and the ASMG requirements.
  - Do not perform any electrical repairs or open any electrical enclosures.
  - Do not work on or near exposed energized parts and conductors.
  - Do not operate any electrically energized equipment if it appears to have an electrical hazard. Notify your Supervisor immediately to have a qualified person inspect the equipment.
  - Receive electrical awareness training on a periodic basis.