

OPF - ELECTRICAL SAFETY

1. PURPOSE

The purpose of this program is to establish safe work practices that are intended to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts when work is performed near or on equipment or circuits which are or may be energized and to comply with the HIOSH/OSHA Standard on electrical safe work practices 29 CFR 1910.331 through 1910.335.

2. AUTHORITY & REFERENCE

Occupational Safety and Health Administration (OSHA) 29 CFR 1910.331 through 1910.335
Industry, Labor and Human Relations (HIOSH) 32.15

3. APPLICATION

This program applies to both Qualified persons and Unqualified persons (see the definitions below) who are working on, near, or with the following electrical installations:

- A. Premises Wiring. Installations of electrical conductors and equipment within or on buildings or other structures, and on other premises such as yards, carnival, parking and other lots and industrial substations;
- B. Wiring for Connection to Supply. Installations of conductors that connect to the supply of electricity;
- C. Other Wiring. Installations of other outside conductors on the premises;
- D. Optical Fiber Cable. Installations of optical fiber cable where such installations are made along with electrical conductors; and
- E. Exposed Energized Parts. Installations that involve work performed by unqualified persons on or near exposed energized parts.

4. RESPONSIBILITY FOR COMPLIANCE

The development and administration of this electrical safety program shall be the shared responsibility of the FMO's Electrical Engineer (Registered Engineer II) and the Electrical Supervisor II (Electrician Shop).

The administrative responsibility of these individuals shall include:

- A. Identification and location of hazardous exposures.

- B. Supervision of employee training.
- C. Selection and use of personal protective equipment.
- D. Periodic evaluation of the program to determine its continued effectiveness.

5. DEFINITIONS

Qualified Person - Means a person permitted to work on or near exposed energized parts who has been trained in and familiar with:

- A. The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment;
- B. The skills and techniques necessary to determine the nominal voltage of exposed live parts;
- C. The knowledge, skills and techniques to work safely on energized circuits;
- D. The proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools; and
- E. The clearance distances for work performed near overhead lines that are specified in the OSHA standard that appears in 29 CFR 1910.333(c) and the corresponding voltages to which the person will be exposed.

Unqualified Person - Means a person with little or no training in avoiding the electrical hazards of working on or near exposed energized parts.

On or Near - Means close enough to exposed line parts (by either personal contact or contact by tools or materials) for an employee to be exposed to any hazard they present.

6. GENERAL REQUIREMENT

Appropriate safe work practices shall be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts when work is performed near or on equipment or circuits that are or may be energized. Those specific work practices will be consistent with the nature and extent of the associated electrical hazards.

7. WORK ON OR NEAR EXPOSED DE-ENERGIZED PARTS

- A. Live parts to which an employee may be exposed shall be de-energized before any employee works on or near them, unless de-energizing will introduce additional or increased hazards or is not feasible due to equipment design or operational limitations (See below for examples).
 - a. Live parts that operate at less than 50 volts to ground need not be de-energized if there will be no increased exposure to electrical burns or to explosion due to electric arcs.
 - b. Examples of increased or additional hazards include interruption of life support equipment, deactivation of emergency alarm systems, shutdown of hazardous location ventilation equipment, or removal of illumination for an area.
 - c. Examples of work that may be performed on or near energized circuit parts because of infeasibility due to equipment design or operational limitations include testing of electric circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.
- B. Whenever any employee is exposed to contact with parts of fixed electric equipment or circuits that have been de-energized, the circuits energizing the parts shall be properly locked out or tagged out (see the Lockout/Tagout Requirements section of the OPF – Safety Program).
- C. Conductors and parts of electric equipment that have been de-energized but have not been properly locked out or tagged out shall be treated as energized.
- D. Safe procedures for de-energizing circuits and equipment shall be determined before circuits or equipment are de-energized.
- E. 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 procedures.
- F. Stored electric energy that might endanger personnel shall be released before starting work. Capacitors shall be discharged and high capacitance elements shall be short-circuited and grounded, if the stored electric energy might endanger personnel. If the capacitors or associated

equipment are handled in meeting this requirement they are treated as energized.

- G. Stored non-electrical energy (hydraulic, pneumatic, etc.) in devices that could reenergize electric circuit parts shall be blocked or relieved to the extent that the circuit parts could not be accidentally energized by the device.
- H. No work shall be performed on or near de-energized live parts, circuits or equipment until their de-energized condition has been verified. Verification of the de-energized condition shall be made as follows:
 - a. A qualified person shall operate the equipment operating controls or otherwise verify that the equipment cannot be restarted.
 - b. 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.
 - c. The test shall also determine if any energized condition exists as a result of inadvertently induced voltage or unrelated voltage backfeed even though specific parts of the circuit have been de-energized and presumed to be safe.
- I. Before any circuit or equipment is **re-energized** (even temporarily) the following requirements shall be met in the order listed:
 - a. 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.
 - b. Employees exposed to the hazards associated with reenergizing the circuit or equipment shall be warned to stay clear of circuits and equipment.
 - c. Each lock and or tag shall be removed by the employee who applied it, or under his or her direct supervision.
 - d. If that employee is absent from the workplace, then the lock may be removed by a qualified person designated to perform this task provided that the Supervisor is certain that the employee who applied the lock is not available at the workplace, and that employee is made aware that the lock has been removed before he or she resumes work.

- e. There shall be a visual determination that all employees are clear of the circuits and equipment.

8. WORK ON OR NEAR EXPOSED ENERGIZED PARTS

ENERGIZED EQUIPMENT

- A. In those cases where the exposed live parts are not de-energized, either because of increased or additional hazards or because of infeasibility due to equipment design or operational limitations, other safety-related work practices must be used to protect employees who may be exposed to the electrical hazards involved.
- B. The work practices used must protect employees against contact with energized circuit parts directly with any part of their body or indirectly through some other conductive object. The work practices that are used shall be suitable for the conditions under which the work is to be performed and for the voltage level of the exposed electric conductors or circuit parts.
- C. Only qualified persons may work on electric circuit parts or equipment that has not been de-energized. These employees must be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.

OVERHEAD LINES

- D. Whenever work is to be performed near overhead lines, the lines shall be de-energized and grounded, or other protective measures shall be provided before work is started.
- E. When overhead lines are to be de-energized, arrangements to de-energize and ground them shall be made with the organization that operates or controls the electrical circuits involved.
- F. When protective measures are provided such as guarding, isolating, or insulating, those precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.
- G. Only qualified employees will be permitted to install insulating devices on overhead power transmission or distribution lines.
- H. Whenever an unqualified employee is working in an elevated position near overhead lines, the location will be such that the person and the longest

conductive object he or she may contact cannot come closer to any unguarded, energized overhead line than the following distances:

- a. For voltages to ground 50kV or below - 10ft.(305cm);
 - b. For voltages to ground over 50kV - 10 ft. (305cm) plus 4 inches (10 cm) for every 10kV over 50kV.
- I. Whenever an unqualified employee is working on the ground in the vicinity of overhead lines, the person may not bring any conductive object closer to unguarded, energized overhead lines than the distances given above.
- J. For voltages normally encountered with overhead power lines, objects which do not have an insulating rating for the voltage involved are considered to be conductive.
- K. Whenever a qualified person is working in the vicinity of overhead lines, whether in an elevated position or on the ground, the person may not approach or take any conductive object without an approved insulating handle closer to exposed energized parts than that shown in **Table S-5** of 29 CFR 1910.333(c)(3) (see paragraph d. below), unless:
- a. The person is insulated from the energized part. Gloves, with sleeves if necessary, rated for the voltage involved, are considered to be insulation of the person from the energized part on which work is performed, or
 - b. The energized part is insulated both from all other conductive objects at a different potential and from the person, or
 - c. The person is insulated from all conductive objects at a potential different from that of the energized part.
 - d. The minimum safe approach distances are as follows:

<u>Voltage Range (Phase to Phase)</u>	<u>Minimum Approach Distance</u>
300V and less	Avoid Contact
Over 300V, not over 750 V	1 ft. 0 in. (30.5 cm)
Over 750V, not over 2kV	1 ft. 6 in. (46 cm)
Over 2kV, not over 15kV	2 ft. 0 in. (61 cm)
Over 15kV, not over 37kV	3 ft. 0 in. (91 cm)

Over 37kV, not over 87.5kV	3 ft. 6 in. (107 cm)
Over 87.5V, not over 121kV	4 ft. 0 in. (122 cm)
Over 121kV, not over 140kV	4 ft. 6 in. (137 cm)

- L. Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 ft. (305 cm) is maintained. If the voltage is higher than 50kV, the clearance shall be increased 4 in. (10 cm) for every 10kV over that voltage. However, under any of the following conditions, the clearance may be reduced:
- a. If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 ft. (122 cm). If the voltage is higher than 50kV, the clearance shall be increased 4 in. (10 cm) for every 10kV over that voltage.
 - b. If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the vehicle or its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.
 - c. If the equipment is an aerial lift insulated for the voltage involved, and if the work is performed by a qualified person, the clearance (between the uninsulated portion of the aerial lift and the power line) may be reduced to the distance given in said Table S-5 (see paragraph no. K. d. above).
- M. Employees standing on the ground may not contact the vehicle or mechanical equipment or any of its attachments, unless:
- a. The employee is using protective equipment rated for the voltage;
or
 - b. The equipment is located so that no uninsulated part its structure (that portion of the structure that provides a conductive path to employees on the ground) can come closer to the line than permitted in paragraph number 12 (see above).
- N. If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding

shall not stand at the grounding location whenever there is a possibility of overhead line contact.

- O. Additional precautions, such as the use of barricades or insulation, shall be taken to protect employees from hazardous ground potentials, depending on earth resistivity and fault currents that can develop within the first few feet or more outward from the grounding point.

ILLUMINATION

- P. Employees may not enter spaces containing exposed energized parts, unless illumination is provided that enables the employees to perform the work safely.
- Q. Where lack of illumination or an obstruction precludes observation of the work to be performed, employees may not perform tasks near exposed energized parts.
- R. Employees must not reach blindly into areas which may contain energized parts.

CONFINED OR ENCLOSED SPACE

- S. Prior to entry employees must be trained in the confined space entry requirements.
- T. Whenever an employee works in a confined or enclosed space (such as a manhole or vault) that contains exposed energized parts, he/she must be provided with, and he shall use, protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with those parts.
- U. Doors, hinged panels, and the like that are present in any confined or enclosed space shall be secured to prevent their swinging into an employee and causing the employee to contact exposed energized parts.

CONDUCTIVE MATERIALS AND EQUIPMENT

- V. Conductive materials and equipment that are in contact with any part of an employee's body shall be handled in a manner that will prevent them from contacting exposed energized conductors or circuit parts.
- W. Whenever an employee must handle long dimensional conductive objects (such as ducts and pipes) in areas with exposed live parts, appropriate work practices (such as the use of insulation, guarding and

material handling techniques) shall be instituted which will minimize the hazard.

PORTABLE LADDERS

- X. All portable ladders shall be nonconductive if they are used where the employee or the ladder could contact exposed energized parts.

CONDUCTIVE APPAREL

- Y. Conductive articles of jewelry and clothing (such as watch bands, bracelets, rings, keychains, necklaces, metalized aprons, 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.

HOUSEKEEPING DUTIES

- Z. Where live parts present an electrical contact hazard, employees may not perform housekeeping duties at such close distances to the parts that there is a possibility of contact, unless adequate safeguards (such as insulating equipment or arrears) are provided.
- AA. Electrically conductive cleaning materials (including conductive solids such as steel wool, metalized cloth, and silicon carbide, as well as conductive liquid solutions) may not be used in proximity to energized parts unless appropriate procedures are followed that will prevent electrical contact.

INTERLOCKS

- BB. Only a qualified person following the requirements of the procedures set forth in this section of the program may defeat an electrical safety interlock and then only temporarily while he or she is working on the equipment.
- CC. The interlock system shall be returned to its operable condition when such work is completed.

9. PORTABLE ELECTRIC EQUIPMENT

Portable electrical equipment applies to the use of cord-and-plug connected equipment and flexible cord sets (extension cords).

HANDLING

- A. All cord- and plug- connected electric equipment, flexible cord sets (extension cords), and portable electric equipment shall be handled in a manner that will not cause damage.
- B. Flexible electric cords connected to equipment may not be used for raising or lowering the equipment.
- C. Flexible cords may not be fastened with staples or otherwise hung in such a fashion as could damage the outer jacket or insulation.

VISUAL INSPECTION

- D. Portable cord- and plug- connected equipment and flexible cord sets (extension cords) shall be visually inspected before use for missing pins, or damage to outer jacket or insulation, and for evidence of possible internal damage (such as pinched or crushed outer jacket). However, cord- and plug- connected equipment and flexible cord sets (extension cords) which remain connected once they are put in place and are not exposed to damage need not be visually inspected until they are relocated.
- E. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service, and no employee may use it until necessary repair and tests have been made to render the equipment safe.
- F. Whenever an attachment plug is to be connected to a receptacle (including any on a cord set), the relationship of the plug and receptacle contacts shall first be checked to ensure that they are of proper mating configurations.

GROUNDING TYPE EQUIPMENT

- G. A flexible cord used with grounding-type equipment shall contain an equipment grounding conductor.
- H. Attachment plugs and receptacles may not be connected or altered in a manner that would prevent proper continuity of the equipment grounding conductor at the point where plugs are attached to receptacles. Additionally, those devices may not be altered to allow the grounding

pole of a plug to be inserted into slots intended for connection to the current carrying conductors. Clipping the grounding prong from an electrical plug is prohibited.

- I. Adapters that interrupt the continuity of the equipment grounding connection may not be used.

CONDUCTIVE WORK LOCATIONS

- J. Portable electric equipment and flexible cords used in highly conductive work locations (such as those inundated with water or other conductive liquids), or in job locations where employees are likely to contact water or conductive liquids must be approved for those locations.

CONNECTING ATTACHMENT PLUGS

- K. Employees' hands may not be wet when plugging and unplugging flexible cords and cord and plug-connected equipment, if energized equipment is involved.
- L. Energized plug and receptacle connections may be handled only with insulating protective equipment if the condition of the connection could provide a conducting path to the employees hand (if, for example, a cord connector is wet from being immersed in water).
- M. Locking-type connectors shall be properly locked/secured into the connection.

10. ELECTRIC POWER AND LIGHTING CIRCUITS

ROUTINE OPENING AND CLOSING OF CIRCUITS

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

RECLOSING CIRCUITS AFTER PROTECTIVE DEVICE OPERATION

- C. After a circuit is de-energized by a circuit protective device, the circuit may not be manually re-energized until it has been determined that the equipment and circuit can be safely energized.

- D. Repetitive manual reclosing of circuit breakers or reenergizing circuits through replaced fuses is prohibited.
- E. When it can be determined from the design of the circuit and the overcurrent devices involved that the automatic operating of a device was caused by an overload rather than a fault condition, no examination of the circuit or connected equipment is needed before the circuit is reenergized.

OVERCURRENT PROTECTION MODIFICATION

- F. Overcurrent protection of circuits and conductors may not be modified, even on a temporary basis, beyond that allowed by the HIOSH/OSHA standard regulating the installation safety requirements for overcurrent protection (See 29 CFR 1910.304(e)).

11. TEST INSTRUMENTS AND EQUIPMENT

USE

- A. Only qualified persons may perform testing work on electric circuits or equipment.

VISUAL INSPECTIONS

- B. Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors shall be visually inspected for external defects and damage before the equipment is used. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service, and no employee may use the item until necessary repairs and tests to render the equipment safe have been made.

RATING OF EQUIPMENT

- C. Test instruments and equipment and their accessories shall be rated for the circuits and equipment to which they will be connected and shall be designed for the environment in which they will be used.

12. FLAMMABLE OR IGNITABLE MATERIALS

- A. In those situations where flammable or ignitable materials are present only occasionally, electric equipment capable of igniting them shall not be used unless measures are taken to prevent hazardous conditions from developing.

- B. Flammable materials include, but are not limited to: flammable gases, vapors, or liquids; combustible dust and ignitable fibers or filings.
- C. In those situations where flammable vapors, liquids or gases, or combustible dusts or fibers are (or may be) present on a regular basis, the electrical installation requirements contained in the HIOSH/OSHA standard regulating hazardous locations must be observed (See 29 CFR 1910.307).

13. PERSONAL PROTECTION SAFEGUARDS

USE OF PERSONAL PROTECTIVE EQUIPMENT

- A. Employees working in areas where there are potential electrical hazards shall be provided with, and shall use, electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed. This equipment may include rubber protective equipment such as insulating gloves, blankets, hoods, line hose, sleeves, and matting for use around electric apparatus.
- B. Protective equipment shall be maintained in a safe, reliable condition and shall be periodically inspected and/or tested.
- C. If the insulating capability of protective equipment may be subject to damage during use, the insulating material shall be protected by other measures. For example, an outer covering of leather can be used for the protection of rubber insulating material.
- D. Employees shall wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts.
- E. Employees shall wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion.

GENERAL PROTECTIVE EQUIPMENT AND TOOLS

- F. When working near exposed energized conductors or circuit parts, each employee shall use insulated tools or handling equipment if the tools or handling equipment might make contact with such conductors or parts. If the insulating capability of insulated tools or handling equipment is subject to damage, the insulating material shall be protected.
- G. Protective shields, protective barriers, or insulating materials shall be used to protect each employee from shock, burns, or other electrically

related injuries while that employee is working near exposed energized parts which might be accidentally contacted or where dangerous electric heating or arcing might occur.

- H. When normally enclosed live parts are exposed for maintenance or repair, they shall be guarded to protect unqualified persons from contact with their live parts.

FUSE HANDLING EQUIPMENT

- I. Fuse handling equipment, insulated for the circuit voltage, shall be used to remove or install fuses when the fuse terminals are energized.

ROPES AND HANDLINES

- J. Ropes and handlines used near exposed energized parts shall be nonconductive.

ALERTING TECHNIQUES

- K. Alerting techniques shall be used to warn and protect employees from hazards which could cause injury due to electric shock, burns, or failure of electric equipment parts as follows:
 - a. Safety Signs and Tags: Safety signs, safety symbols, or accident prevention tags shall be used where necessary to warn employees about electrical hazards which may endanger them.
 - b. Barricades: Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas exposing employees to un-insulated energized conductors or circuit parts. Conductive barricades may not be used where they might cause an electrical contact hazard.
 - c. Attendants: If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect employees.

14. TRAINING

- A. Appropriate training shall be provided for those employees who face a risk of electric shock in the form of classroom and/or on the job instruction.
- B. Each employee required to be trained shall become familiar with the safe work practices required by this program and those sections of the

HIOSH/OSHA Electrical Standard that pertain to his/her respective job assignment(s).

- C. Qualified persons (i.e. those persons permitted to work on or near exposed energized parts) shall, at a minimum, be trained in the following:
 - a. The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment,
 - b. The skills and techniques necessary to determine the nominal voltage of exposed parts, and
 - c. The clearance distances specified in Table S-5 of 29 CFR 1910.333(c) (see section #8, paragraph K on pages 6 and 7 of this Program) and the corresponding voltages to which the qualified person will be exposed.

The degree of training shall be determined by the risk likely to be encountered by the employee. The training given to “qualified persons” shall be documented on Form # 1 (see next page).

Form #1

"QUALIFIED" PERSON TRAINING CERTIFICATION

Instructor: _____

Signature: _____

Date of Training: _____

The following employees have received "QUALIFIED" person training on electrical safe work procedures:

Employee Name (Please Print)	Employee Signature