



INTEGRATED MANAGEMENT SYSTEM

# GUIDELINES

## ELECTRICAL SAFETY

DEPARTMENT	DOC. NO	EFFECTIVE DATE	REV. NO.	PAGE NO.
HEALTH & SAFETY	EHS-SFT-GUI-017	03 Aug 2016	00	1 of 7

### REVISION HISTORY

Rev. No.	Effective Date	Details of Revision
00	03 Aug 2016	Initial Release

### 1. PURPOSE

To define minimum safety requirements for working with or near electrical equipment.

### 2. SCOPE

This guidelines covers safety precautions for working on Electrical Equipment within the EAGLE CEMENT PLANT and its premises.

### 3. DEFINITIONS

- 3.1. **Ampere:** The unit of current.
- 3.2. **Circuit:** The complete path of an electric current.
- 3.3. **Current:** The rate of flow of electric charge.
- 3.4. **Electrical Hazard:** recognizable, dangerous condition involving electrical equipment or systems, which could be the cause of an injury or fatality if proper precautions or actions are not taken.
- 3.5. **Electricity:** Electric current for lighting, heating, etc.
- 3.6. **Fuse:** A protective device inserted in series with a circuit. It contains a metal that will melt or break when current is increased beyond a specific value for a definite period of time.
- 3.7. **Ground:** A metallic connection with the earth to establish ground potential. The ground directs electric current away from unwanted areas in order to prevent injury, death and/or property damage.
- 3.8. **Resistance:** Any condition which retards electrical flow. It is measured in ohms.
- 3.9. **Shall:** Signifies mandatory requirements.
- 3.10. **Should:** Signifies recommended/optional requirements.
- 3.11. **Qualified Employee:** An employee familiar with the construction and operation of specific equipment or with a specific work method and trained to recognize and avoid electrical hazards that may be present in his work environment. An employee may be considered qualified with respect to certain equipment and methods but still are unqualified for others.
- 3.12. **Voltage:** A unit of electrical potential difference (Can be correlated to the pressure in a water pipeline). It is measured in volts.

### 4. REQUIREMENTS

EAGLE CEMENT shall develop procedures and programs that meets the following requirements on Electrical equipment Safety:

- 4.1 Only authorized personnel shall perform work on or near exposed electrical conductors or equipment.



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## ELECTRICAL SAFETY

DEPARTMENT	DOC. NO	EFFECTIVE DATE	REV. NO.	PAGE NO.
HEALTH & SAFETY	EHS-SFT-GUI-017	03 Aug 2016	00	2 of 7

- 4.2 Work should not be carried out within at least 3 meters from overhead power lines, without appropriate protection and authorization.
- 4.3 Warning signs regarding high voltages shall be posted.
- 4.4 Entry into high voltage area and sub-stations shall be restricted.
- 4.5 Electrical Lock-out and tag out system shall be used when working on electrical equipment.
- 4.6 Appropriate lighting shall be provided for work on or near electrical equipment.
- 4.7 Only approved electrical equipment properly insulated and grounded shall be used in confined spaces.
- 4.8 Unsafe electrical equipment or conditions shall be tagged and immediately reported to the concerned employees.
- 4.9 Appropriate communication and protection shall be provided to the employees working on equipment containing capacitors because capacitors store electrical charge and can be a source of shock.
- 4.10 Work on energized circuits shall be performed only when no other choice exists. The following requirements shall be considered prior to working on energized equipment:
  - 4.10.1 A written job plan shall be prepared and approved by relevant authority.
  - 4.10.2 The job plan shall identify, as a minimum, required personal protective equipment, necessary test equipment, approved safety equipment to be used, and specific steps to be taken to perform the work.
  - 4.10.3 Two employees must be present at all times whenever work is being performed.
  - 4.10.4 Ladders and scaffolds used while working on electrical circuits shall be made of non-conductive material.
  - 4.10.5 Disconnecting means and over current devices shall be readily accessible.
- 4.11 Electrical equipment shall only be used for its intended purpose as indicated by listing, labeling, or certification.
- 4.12 The following shall be considered for guarding Live Parts:
  - 4.12.1 Attachment plugs and connectors shall be so constructed that there are no exposed current-carrying parts, except the rings, blades, or pins. The cover for wire terminations shall be an essential part of an attachment plug or connector (dead-front construction).
  - 4.12.2 Unused openings in electrical boxes, cabinets, and fittings, shall be effectively closed.
  - 4.12.3 All live parts of electrical equipment operating at 50 volts or more shall be guarded against accidental contact.
  - 4.12.4 Conductors entering boxes, cabinets, or fittings shall be protected from abrasion, and the openings through which conductors enter shall be effectively closed.
- 4.13 The following shall be considered for Marking/Labeling/Posting:
  - 4.13.1 Each disconnect shall be legibly marked to indicate its purpose, unless it is located and/or arranged so that its purpose is evident.
  - 4.13.2 All outlets that are on the same circuit shall be labeled.



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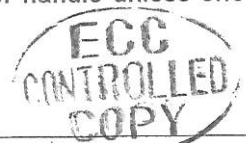
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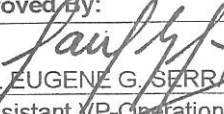
# GUIDELINES

## ELECTRICAL SAFETY

DEPARTMENT	DOC. NO	EFFECTIVE DATE	REV. NO.	PAGE NO.
HEALTH & SAFETY	EHS-SFT-GUI-017	03 Aug 2016	00	3 of 7

- 4.13.3 Warning signs shall be posted for high-voltage equipment. Entry to high voltage rooms and substation shall be restricted.
- 4.13.4 Entrances to rooms or other enclosures containing exposed live electrical parts shall be marked with conspicuous warning signs forbidding entry of unauthorized persons.
- 4.14 The following shall be considered for use of Flexible/Extension Cords:
  - 4.14.1 Damaged Flexible cords shall not be used. Cords should be inspected before each use. Flexible cords shall be used only in continuous lengths without splice or tap.
  - 4.14.2 Flexible cords shall not be passed through doorways, along the floor, in water, or in any other area where it might become damaged.
  - 4.14.3 Kinking or excessive bending of extension and power cords shall be avoided.
  - 4.14.4 The extension cord and socket box shall be made of insulating material.
  - 4.14.5 Flexible cords and cables should not be used as a substitute for fixed wires of a structure; where run through holes in wall, ceilings, or floors; where run through doorways, windows, or similar openings; where attached to building surfaces; or where concealed behind building walls, ceiling, or floors.
  - 4.14.6 Flexible cords and cables shall be approved and suitable for conditions of intended use and location.
- 4.15 The following shall be considered for Electrical Work in Hazardous Atmospheres:
  - 4.15.1 Enclosures that contain circuit breakers, and are in wet locations, shall be so constructed or protected that exposure to the weather will not interfere with successful operation.
  - 4.15.2 Appropriate electrical equipment shall be used for work in a wet or damp location.
  - 4.15.3 Adequate bonding and grounding shall be provided for equipment handling flammable liquids.
- 4.16 Grounding / Bonding shall meet the following requirements:
  - 4.16.1 The path to ground from circuits, equipment, and enclosures shall be permanent and continuous.
  - 4.16.2 Bonding and grounding conductors shall be provided where needed to dissipate static charge accumulations.
  - 4.16.3 Electrical appliances shall be grounded with a grounding conductor or shall be double insulated.
  - 4.16.4 All receptacles/cords sets on construction sites shall be protected by ground fault circuit interrupters (GFCI).
  - 4.16.5 A program shall be in place to periodically verify integrity of grounding system. Continuous test and ground resistance measurement shall be conducted.
- 4.17 The following shall be considered for working on energized conductors and apparatus:
  - 4.17.1 Work on approach or handling of any energized electrical conductor, bus bar, etc. shall not be permitted without an approved insulated tool, instrument or handle unless one of the following conditions is met:



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INTEGRATED MANAGEMENT SYSTEM

# GUIDELINES

## ELECTRICAL SAFETY

DEPARTMENT	DOC. NO	EFFECTIVE DATE	REV. NO.	PAGE NO.
HEALTH & SAFETY	EHS-SFT-GUI-017	03 Aug 2016	00	4 of 7

- The employee is insulated or guarded from the energized part. (Gloves or gloves with sleeves rated for the voltage involved shall be considered insulation of the employee from the energized part.)
- *The energized part is insulated or guarded from the employee and any other conductive object at a different potential.*

4.17.2 The hazard of falling/touching of tools on live circuits/breakers shall be understood by all concerned and appropriate precautions shall be taken.

4.17.3 If work is to be done on energized electrical conductor, buss, etc., a second standby person, capable of recognizing electrical hazards and capable of summoning rescue assistance, shall be present at all times. This standby person shall, in no way, be involved in performing work.

- This statement does not apply when using approved voltmeter, etc., to monitor voltage, amperage, etc.
- The only exception to the regulations listed above is when qualified personnel must open or close switches. (See below minimum hot stick clearances.)

4.17.3 Hazards and appropriate protection for work on live circuits shall be communicated to all concerned involved in the job.

4.18 The following shall be considered for Electrical Safety Inspection and Test Requirements:


4.18.1 Electrical safety equipment (i.e., gloves, sleeves, blankets, hot sticks) shall be inspected prior to each use. Rubber personal protective equipment shall be inspected, maintained, and tested in accordance with ANSI S3.40. Gloves shall be given the air test before each use. If a defect is suspected, the equipment shall be immediately taken out of service for inspection and testing.

4.18.2 Electrical safety gloves shall be formally inspected and tested. Following is the guideline on testing of the gloves:

- Hold the glove downward and grasp the cuff.
- Twirl the glove upward toward the body to trap air inside the glove.
- Squeeze the rolled cuff tightly to keep trapped air inside. Look for hidden damage exposed by inflation.
- Hold the inflated glove close to the ear and listen for air escaping from any holes.



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 <b>INTEGRATED MANAGEMENT SYSTEM</b>	<b>GUIDELINES</b>			
	<b>ELECTRICAL SAFETY</b>			
DEPARTMENT	DOC. NO	EFFECTIVE DATE	REV. NO.	PAGE NO.
HEALTH & SAFETY	EHS-SFT-GUI-017	03 Aug 2016	00	5 of 7

4.18.3 An inspection program shall be in place to inspect and test Electrical safety equipment as per the following schedule:

Equipment	Maximum Usage Before Retesting
Rubber gloves	4 months
Rubber sleeves	8 months
Rubber blankets	8 months
Line hose	14 months
Insulator hoods	14 months
Mechanical jumpers	14 months
Rubber Foot Mats	18 months

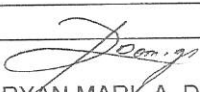
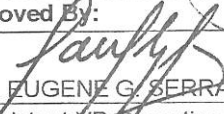
4.19 The following shall be considered for Grounding De-Energized Transmission and Distribution Circuits and Apparatus:

- 4.19.1 When circuits and apparatus are de-energized for work, they shall be grounded with approved grounding equipment on both sides of the location where the work is to be done, regardless of whether or not there is more than one source of supply.
- 4.19.2 The grounding cable shall be connected to an effective ground before clamps are applied to the conductors.
- 4.19.3 Before the grounding clamps are applied, check to determine that the circuit or apparatus has been de-energized.
- 4.19.4 The conductor nearest the worker shall be grounded first, then the next nearest, etc., until all phases have been grounded. The clamps shall be removed in the reverse order.
- 4.19.5 Grounding cable shall be of a size large enough to operate the protective device supplying the conductor. In no case shall the grounding cable be less than No. 2 AWG copper or equivalent.

4.20 The following shall be considered for handling Batteries:

- 4.20.1 Appropriate Personal Protective equipment such as Chemical splash goggles, face shield, rubber gloves and rubber apron shall be worn when performing work with battery acid and batteries.
- 4.20.2 The charging rate of acid should be held at a point that will prevent the rapid liberation of hydrogen gas, to prevent explosion.
- 4.20.3 Smoking, open flames and other sources of ignition shall not be allowed while working on or near batteries.
- 4.20.4 Provision shall be made in battery storage/recharging areas for sufficient diffusion and ventilation of the gases from the battery to prevent the accumulation of an explosive mixture.
- 4.20.5 Particular care shall be taken to prevent short circuits while batteries are being charged, tested or handled. Hydrogen gas, which is accumulated while charging, is highly explosive. A spark from a short circuit could easily ignite the gas, causing serious damage to personnel and equipment.
- 4.20.6 Extreme caution shall be exercised when installing and removing batteries since batteries are heavy for their size and somewhat awkward to handle.



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DEPARTMENT	DOC. NO	EFFECTIVE DATE	REV. NO.	PAGE NO.
HEALTH & SAFETY	EHS-SFT-GUI-017	03 Aug 2016	00	6 of 7

4.21 The following shall be considered for Crane Operations Near Electrical Distribution and Transmission Lines:

4.21.1 Except where electrical distribution and transmission lines have been de-energized and visibly grounded at the point of work, or where insulating barriers (not a part of or an attachment to the equipment or machinery) have been erected to prevent physical contact with the lines, equipment or machines shall be operated in the vicinity of power lines in accordance with the following precautions:

- For lines rated 50 kilovolt (kv) or below, the minimum clearance between the lines and any part of the crane or load shall be 3 meters.
- Guidelines below (required separation distance for crane) shall be followed for lines rated over 50 kilovolt (kv).
- In transit with no load and boom lowered, the equipment clearance shall be a minimum of 1.2 meters for voltages less than 50 kilovolt (kv), 3 meters for voltages over 50 kilovolt (kv) up to and including 750 kilovolt (kv).

4.21.2 A person shall be designated to observe clearance of the equipment and give timely warning to stop operations, if necessary, where it is difficult for the operator to maintain the desired clearance by visual means.

### REQUIRED SEPARATION DISTANCES-HOT STICKS (UTILITY PERSONNEL)

#### ALTERNATING CURRENT-MINIMUM DISTANCES

<u>Voltage range (phase to phase)</u>	<u>Minimum working and clear hot stick distance</u>
300V and less	Avoid Contact
Over 300V, not over 750V	30.5 cm
Over 750V, not over 2kV	46 cm
Over 2kV, not over 15kV	61 cm
Over 15kV, not over 37kV	91 cm
Over 37kV, not over 87.5kV	107 cm
Over 87.5kV, not over 121kV	122 cm
Over 121kV, not over 140kV	137 cm.



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HEALTH & SAFETY	EHS-SFT-GUI-017	03 Aug 2016	00	7 of 7

### REQUIRED SEPARATION DISTANCE FOR CRANES

When mobile hoist, cranes, booms or similar lifting devices are used near energized lines or equipment, the clearances set forth shall be followed unless:

An insulated barrier is installed between the energized part and the mechanical equipment, the mechanical equipment is grounded, the mechanical equipment is insulated, or the mechanical equipment is considered as energized and worked as such.

Kv.	Distance	Kv.	Distance	Kv.	Distance
60	3.2 m (10'4")	300	5.6 m (18'4")	540	8.0 m (26'4")
70	3.3 m (10'8")	310	5.7 m (18'8")	550	8.2 m (26'8")
80	3.4 m (11'0")	320	5.8 m (19'0")	560	8.2 m (27'0")
90	3.5 m (11'4")	330	5.9 m (19'4")	570	8.3 m (27'4")
100	3.6 m (11'8")	340	6.0 m (19'8")	580	8.5 m (27'8")
110	3.7 m (12'0")	350	6.1 m (20'0")	590	8.5 m (28'0")
120	3.8 m (12'4")	360	6.2 m (20'4")	600	8.7 m (28'4")
130	3.9 m (12'8")	370	6.3 m (20'8")	610	8.8 m (28'8")
140	4.0 m (13'0")	380	6.4 m (21'0")	620	8.8 m (29'0")
150	4.1 m (13'4")	390	6.5 m (21'4")	630	9.0 m (29'4")
160	4.2 m (13'8")	400	6.6 m (21'8")	640	9.1 m (29'8")
170	4.3 m (14'0")	410	6.7 m (22'0")	650	9.1 m (30'0")
180	4.4 m (14'4")	420	6.8 m (22'4")	660	9.3 m (30'4")
190	4.5 m (14'8")	430	6.9 m (22'8")	670	9.4 m (30'8")
200	4.6 m (15'0")	440	7.0 m (23'0")	680	9.4 m (31'0")
210	4.7 m (15'4")	450	7.1 m (23'4")	690	9.6 m (31'4")
220	4.8 m (15'8")	460	7.2 m (23'8")	700	9.7 m (31'8")
230	4.9 m (15'0")	470	7.3 m (24'0")	710	9.8 m (32'0")
240	5.0 m (16'4")	480	7.4 m (24'4")	720	9.8 m (32'4")
250	5.1 m (16'8")	490	7.5 m (24'8")	730	10.0 m (32'8")
260	5.2 m (17'0")	500	7.6 m (25'0")	740	10.1 m (33'0")
270	5.3 m (17'4")	510	7.7 m (25'4")	750	10.2 m (33'4")
280	5.4 m (17'8")	520	7.8 m (25'8")	760	10.3 m (33'8")
290	5.5 m (18'0")	530	7.9 m (26'0")	770	10.4 m (34'0")



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