

ELECTRICAL SAFETY WORK PRACTICES

1.0 Purpose:

To establish procedures for implementing an electrical work practices policy.

2.0 Scope:

This policy applies to all The City of Lake Forest operating facilities.

3.0 Policy:

3.1 The department head is responsible for administering this policy and maintaining records which document that the required training has been provided.

3.2 Definitions:

Qualified Persons: Those persons who **have** training in avoiding the electrical hazards of working on or near exposed energized parts.

Unqualified Persons: Those persons who **have had little or no** training in avoiding the electrical hazards of working on or near exposed energized parts.

NOTE: Whether an employee is considered to be a “qualified person” shall depend upon various circumstances in the work place. It is possible for an individual to be considered “qualified” with regard to certain equipment in the work place, but “unqualified” with other equipment.

An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his/her level of training and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties.

3.3 Training:

3.3.1 Scope of Training

Training shall be provided for those employees who face a risk of electrical shock that is not reduced to a safe level by the electrical installation.

Employees in the Public Works Department face such a risk and shall be trained. Other employees who may reasonably be expected to face a comparable risk of injury due to electrical shock or other electrical hazards shall also be trained.

3.3.2 Content of Training

Employees shall be trained in the safety-related work practices required pertaining to their respective job assignments.

3.3.3 Additional Requirements for Unqualified Persons

Employees who are covered by the SCOPE OF TRAINING section above, but who are not qualified persons, shall also be trained in any electrically-related safety practices.

3.3.4 Additional Requirements for Qualified Persons

Qualified persons (i.e., those permitted to work on or near exposed energized parts) shall, at a minimum, be trained in the following:

1. The skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment.
2. The skills and techniques necessary to determine the nominal voltage of exposed live parts, and
3. The clearance distances and the corresponding voltages to which the qualified persons will be exposed.

The training required by this section shall be of the classroom or on-the-job type. The degree of training provided shall be determined by the risk to the employee.

3.4 Selection and Use of Work Practices

Safety-related work practices shall be employed to prevent electrical 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. The specific safety-related work practices shall be consistent with the nature and extent of the associated electrical hazards.

3.4.1 De-energized Parts

Live parts to which employees may be exposed shall be de-energized before the employees work on or near them, unless the employer can demonstrate that de-energizing introduces additional or increased hazards or is not feasible due to equipment design or operational limitations. 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.

Examples of increased or additional hazards include:

1. interruption of life support equipment
2. deactivation of emergency alarm systems
3. shutdown of hazardous locations ventilation equipment, or
4. removal of illumination for an area.

Examples of work that may be performed on or near energized circuit parts because of unfeasibility due to the equipment design or operational limitations include:

1. testing of electric circuits that can only be performed with the circuit energized, and
2. work on circuits that form an integral part of a continuous industrial process in a chemical plant that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

3.4.2 Energized Parts

If the exposed live parts are not de-energized (i.e., for reasons of increased or additional hazards or unfeasibility), other safety-related work practices shall be used to protect employees who may be exposed to the electrical hazards involved. Such work practices shall protect the employees against contact with energized circuit parts 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 electrical conductors or circuit parts.

3.4.3 When an unqualified person is working in an elevated position near overhead lines, the location shall be such that the person and the longest conductive object he/she may contact cannot come closer to any unguarded, energized overhead line than the following distances:

1. For voltages to ground 50kV-10 feet (305 cm);
2. For voltages to ground over 50kV-10 feet (305 cm), plus four inches (10 cm) for every 10kV over 50kV.

NOTE: For voltages normally encountered with overhead power lines, objectives which do not have an insulating rating for the voltage involved are considered to be conductive.

When 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 shown in Table S-5 unless:

1. 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
2. the energized part is insulated from all other conductive objects at a different potential and from the person, or
3. the person is insulated from all conductive objects at a potential different from that of the energized part.

3.4.4 Vehicular and Mechanical Equipment

Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so a clearance of 10 feet (305 cm) is maintained. If the voltage is higher than 50kV, the clearance shall be increased 4 inches (10 cm) for every 10kV over that voltage; however, under any of the following conditions, the clearance may be reduced:

1. If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 feet (122 cm). If the voltage is higher than 50kV, the clearance shall be increased 4 inches (10 cm) for every 10kV over the voltage.
2. 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.

3. 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 Table S-5

Employees standing on the ground shall not contact the vehicle or mechanical equipment or any of its attachments unless:

1. the employee is using protective equipment rated for the voltage, or
2. the equipment is located so that no uninsulated part of 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 the first paragraph of this section.

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 ground may not stand at the grounding location whenever there is a possibility of overhead line contact. 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, which can develop within the first few feet or more outward from the grounding point.

3.4.5 Illumination

Employees may not enter spaces containing exposed energized parts unless illumination is provided that enables the employees to perform the work safely.

Where lack of illumination or an obstruction precludes observation of the work to be performed, employees may not perform tasks near exposed energized parts. Employees may not reach blindly into areas which may contain energized parts.

3.4.6 Confined or Enclosed Work Spaces

When an employee works in a confined or enclosed space (such as a vault or manhole) that contains exposed energized parts, the employee shall use protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts. Doors, hinged panels, and the like, shall be secured to prevent their swinging into an employee and causing the employee to contact exposed energized parts.

3.4.7 Conductive Materials and Equipment

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 contact with exposed energized conductors or circuit parts. If an employee must handle long dimensional conductive objects (such as ducts and pipes) in areas with any exposed live parts, the employer shall institute work practices (such as the use of insulation, guarding, and material handling techniques) which will minimize the hazard.

3.4.8 Portable Ladders

Portable ladders shall have non-conductive side rails if they are used where the employee or the ladder could contact exposed energized parts.

3.4.9 Conductive Apparel

Conductive articles of jewelry and clothing (such as watch bands, key chains, bracelets, rings, necklaces, metalized aprons, metal headgear or cloth with conductive thread) shall not be worn if they might contact exposed energized parts; however, such articles may be worn if they are rendered non-conductive by covering, wrapping or other insulating means.

3.4.10 Housekeeping Duties

Where live parts present an electrical contact hazard, employees may not perform housekeeping duties at such distances to the parts that there is a possibility of contact, unless adequate safeguards (such as insulating equipment or barriers) are provided.

Electrically conductive cleaning materials (including conductive solids such as steel wool, metalized cloth, and silicon carbide, as well as conductive liquid solutions) shall not be used in proximity to energized parts unless procedures are followed to prevent electrical contact.

3.4.11 Use of Equipment

1. Portable Electric Equipment

Portable equipment shall be handled in a manner which will not cause damage. Flexible electric cords connected to equipment shall not be used for raising or lowering the equipment. Flexible cords shall not be fastened with staples or otherwise hung in such a fashion as could damage the outer jacket or insulation.

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 remain connected once they are put in place and are not exposed to damage need not be visually inspected until they are relocated.

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 repairs and tests to render the equipment safe have been made. If 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.

2. Grounding-Type Equipment

A flexible cord used with grounding-type equipment shall not be connected or altered in a manner which would prevent proper continuity of the equipment grounding conductor at the point where the plugs are attached to receptacles. Additionally, these devices shall not be altered to allow the grounding pole of a plug to be inserted into slots intended for connection to the current-carrying conductors.

Adapters which interrupt the continuity of the equipment grounding connection shall not be used..

3. Conductive Work Locations

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 shall be approved for those locations.

4. Connecting Attachment Plugs

Employees' hands may not be wet when plugging and unplugging flexible cords and cord and plug-connected equipment is energized equipment is involved.

Energized plug and receptacle connections shall be handled only with insulating protective equipment if the condition of the connection could provide a conducting path to the employee's hand (if, for example, a cord connector is wet from being immersed in water).

Lock-type connectors shall be properly secured after connection.

5. Electric Power and Lighting Circuits – Routine Opening and Closing of Circuits

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

6. Closing Circuits After Protective Device Operation

After a circuit is de-energized by a circuit protective device, the circuit shall not be manually re-energized until it has been determined that the equipment and circuit can be safely energized. Repetitive manual closing of circuit breakers or re-energizing circuits through replaced fuses is prohibited.

NOTE: When it can be determined from the design of the circuit and overcurrent devices involved that the automatic operation 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 re-energized.

7. Overcurrent Protection Modification

Overcurrent protection of circuits and conductors shall not be modified, even on a temporary basis.

8. Test Instruments and Equipment

Only qualified persons may perform testing work on electrical circuits or equipment.

9. Visual Inspection

Test instruments and equipment and all associated test leads, power cords, cables, probes and connectors shall be visually inspected for external defects and damage that might expose an employee to injury, the defective or damaged item shall be removed from service and no employee shall use it until necessary repairs and tests to render the equipment safe have been made.

10. Rating of Equipment

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.

11. Occasional Use of Flammable or Ignitable Materials

Where flammable 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. Such materials include, but are not limited to, flammable gases, vapors or liquids, combustible dust, and ignitable fibers or flyings.

3.4.12 Safeguards for Personal Protection

1. Use Protective Equipment

Employees working in areas where there are potential electrical hazards shall be provided with and shall use the electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed.

Protective equipment shall be maintained in a safe, reliable condition and shall be periodically inspected or tested.

If the insulating capability of protective equipment may be subject to damage during use, the insulating material shall be protected. For example, an outer covering of leather is sometimes used for the protection of rubber insulating material.

Employees shall wear non-conductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts.

Employees shall wear protective equipment for their eyes or face wherever there is danger of injury to their eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion.

2. General Protective Equipment and Tools

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.

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

Ropes and hand lines used near exposed energized parts shall be non-conductive.

Protective shields, barriers, or insulating materials shall be used to protect employees 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. When normally enclosed live parts are exposed for maintenance or repair, they shall be guarded to protect unqualified persons from contact with the live parts.

3. Alerting Techniques

The following 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.

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

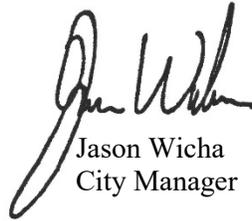
Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas exposing employees to uninsulated energized conductors or circuit parts. Conductive barricades shall not be used where they might cause an electrical contact hazard.

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.

4.0 Distribution

Employee Information website, www.citylf.org.



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City Manager

created 5/96
reviewed 5/99, 5/05, 5/10, 5/15, 5/20

Table S-5

APPROACH DISTANCES FOR QUALIFIED EMPLOYEES ALTERNATING CURRENT

<u>Voltage Range (Phase to Phase)</u>	<u>Minimum Approach Distance</u>
300V and Less	Avoid Contact
Over 300V, Not Over 750V	1 Foot, 0 Inches (30.5 cm)
Over 750V, Not Over 2kV	1 Foot, 6 Inches (46 cm)
Over 2kV, Not over 15kV	2 Feet, 0 Inches (61 cm)
Over 15 kV, Not Over 37kV	3 Feet, 9 Inches (91 cm)
Over 37kV, Not Over 87.5kV	3 Feet, 6 Inches (107 cm)
Over 87.5kV, Not Over 121kV	4 Feet, 0 Inches (122 cm)
Over 121kV, Not Over 140kV	4 Feet, 6 Inches (137 cm)