PLANT OPERATIONS
ELECTRICAL SAFETY PROGRAM

Prepared by the Department of
Occupational Safety & Environmental Health
# PLANT ELECTRICAL SAFETY PROGRAM

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University of Michigan Plant Operations Electrical Safety Program

I. PURPOSE AND SCOPE

A. Purpose: This program is designed to help provide a safe work environment for Plant Ops employees performing electrical work and employees working in and around electrical parts.

B. Scope: All work on or near permanent or temporary electrical parts and wiring, fixtures or equipment, all work involved with constructing, installing, removing, renovating, or modifying electrical parts and wiring, fixtures or equipment, and all work involved with generating, transmitting or distributing utility electrical power services performed by Plant Ops employees.

II. DEFINITIONS

A. Arc-Flask Protection Levels – Categorical classes designated for adequate protection from arc-flash hazards demarked by a maximum level of incident energy within a specified distance from the hazard source. These levels are modeled after the categories established within the National Fire Protection Association (NFPA) Standard for electrical Safety in the Workplace (70E).

B. Diagnostic Work - non-repair work conducted inside the Prohibited Approach Boundary. Work generally carried out while parts or equipment are energized and special protective equipment is required.

C. Electrically Non-hazardous Work - work not requiring any specialized training, qualifications or equipment relative to electrical safety.

D. Electrical Parts - all wiring, generating equipment, fixtures, appliances, and appurtenances in connection with the generation, transmission, distribution, and use of electricity.

E. Electrical Work - working on, near, with, or effecting unenclosed electrical parts.

F. Electric Power Generation, Transmission or Distribution Work - electrical work on electrical power distribution systems, generally considered high voltage and lighting, and the part of the distribution system before the service drop, electrical meter, building/facility main breaker/fuse, or other similar demarcation.

G. Electric Power Generation - that part of the electrical power system specifically designed for creating electricity for distribution through a grid system to users.

H. Flash Hazard - a dangerous condition associated with the release of energy caused by an electric arc.

I. Flash Protection Boundary - a flash protection boundary to be crossed by only qualified persons (at a distance from a live part) which due to its proximity to a flash hazard requires the use of flash protection techniques and equipment when crossed.

J. Ground-Fault Circuit Interrupter (GFCI) - a device whose function is to quickly interrupt the electric circuit to the load when the difference in current between the hot line to the neutral line exceeds 5 milliamps.
K. **Limited Approach Boundary** - a shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which is not to be crossed by unqualified persons unless escorted by a qualified person.

L. **Limited Work** - work done outside of the Restricted Approach Boundary, but inside the Limited Approach Boundary. Work generally carried out while parts or equipment are energized but special protective equipment for shock hazards are not required.

M. **Prohibited Approach Boundary** - a shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which when crossed by a body part or object requires the same protection as if direct contact is made with a live part.

N. **Electrically Qualified Person** - a person trained and knowledgeable in the construction and operation of electrical equipment, specific work methods, electrical hazard recognition and avoidance techniques, use of electrical personal protective equipment, insulating and shielding materials, insulated tools, electrical testing equipment, skills and techniques to distinguish exposed energized parts and their nominal voltage, safe approach distances, the decision making process to determine the degree and extent of electrical hazards, the necessary personal protective equipment and job planning needed to safely do their assigned tasks.

O. **Personal Protective Equipment (PPE)** - Devices worn by workers to protect against hazards in the environment. Examples include safety glasses, face shields, respirators, gloves, hard hats, steel-toes shoes, and hearing protection. Also includes devices and fire resistant apparel for protection from electrical arc-flashes.

P. **Repair Work** - changing, modifying, removing or installing components or jumpering or lifting leads. Work generally carried out inside the Prohibited Approach Boundary to parts or equipment that has been de-energized and locked out in a safe mode.

Q. **Restricted Approach Boundary** - a shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which due to its proximity to a shock hazard requires the use of shock protection techniques and equipment when crossed.

R. **Restricted Work** - work done outside of the Prohibited Approach Boundary, but inside the Restricted Approach Boundary. Work generally carried out while parts or equipment are energized and special protective equipment is required.

S. **Unqualified Person Training** - general electrical safety related practices necessary for the electrical safety of an unqualified person.

T. **Voltage Rated (V-rated) Gloves** - gloves rated and tested for the maximum line-to-line voltage upon which work will be done.

U. **Voltage Rated (V-rated) Tools** - tools rated and tested for the maximum line-to-line voltage upon which work will be done.

### III. RESPONSIBILITIES

A. Department

1. Management - Supervisors will:
a. instruct their employees regarding the requirements of this program and keep records according to the Plant Ops Safety Training Program.

b. effectively enforce compliance of this program’s procedures, including the use of disciplinary action, for any violations or deviations from the procedures outlined in this program.

c. assure that the equipment required for compliance with this program is in proper working order, inspected and tested as required, and made available for use to their employees.

d. promptly investigate and report all on-the-job accidents or job related health problems.

2. Employees will:

   a. comply with the procedures of this program including wearing appropriate PPE.
   
   b. consult with their supervisor, OSEH, or other knowledgeable personnel, when they have questions regarding their safety.
   
   c. report any accidents or job related injuries or illnesses to their supervisor and seek prompt medical treatment, if necessary.
   
   d. report any observed problems or deviations from the procedures of this program, or any problems or deficiencies with their protective equipment to their supervisor.

B. Occupational Safety and Environmental Health (OSEH)

1. The OSEH Rep. for Plant Ops will provide technical assistance, when called upon, and inspect job sites.

2. Provide training, as necessary.

IV. PROCEDURE

A. General Requirements.

1. Working on energized exposed electrical parts with a nominal voltage of more than 50 volts is prohibited, unless de-energizing the part(s) will create a greater hazard, such as interrupting life support equipment, deactivation of emergency alarm systems, shutdown of hazardous location ventilation equipment, or other similar situation, or unless specific written approval has been received in accordance with the Plant Ops energized electrical permit procedures (see Appendix E). Working near energized exposed electrical parts with a nominal voltage of more than 50 volts is prohibited, unless conducting testing, trouble shooting or minor repair type activities on integrated systems or control systems that would require the shutdown of the entire system. Lockout/tagout procedures will be followed in order to assure equipment is adequately de-energized and in a safe position for work to be done.

2. Workers considered to be non-qualified for electrical work are prohibited from working on or near energized exposed electrical parts with a nominal voltage of more than 50 volts, being inside the limited approach boundary to exposed energized electrical parts without being accompanied by a qualified person, being inside the restricted approach
boundary to exposed energized electrical parts, or being inside the flash protection boundary to exposed energized electrical parts. Lockout/tagout procedures will be followed in order to assure equipment is adequately de-energized and in an electrically safe condition before the work to be done.

3. Workers working on or near exposed energized electrical parts or equipment will use appropriate personal protective equipment (PPE) and tools to protect them from the potential electric shock, arc-flash and fire hazards of the equipment being worked on or near. Workers will wear PPE in accordance with the Hazard Assessments of the Plant Ops PPE Program and the guidance of this program, or more specific Department policies and procedures. (see Appendix B).

4. All PPE used for protection from electrical energy, to include gloves, matting, blankets, covers, hoses and sleeves, must be manufactured, regularly tested and routinely inspected in accordance with the MIOSHA safety standards and the applicable American Society for Testing and Materials (ASTM) guidelines.

5. Workers working on or near electrical parts will wear clothing, including undergarments, that will not increase the hazards of exposure to flame or electric arc, such as materials made of non-synthetic natural fibers, or fabric specifically designed for use around electrical parts (see Appendix B). Workers must remove conductive articles, such as rings, watches, chains, etc., prior to working on or near electrical parts.

6. In addition to any specific safety procedures outlined in this program, all procedures required under the Plant Ops Lockout/Tagout Program, Confined Space Entry Program, and Hot Work Safety Program apply to work on electrical parts.

7. All energized electrical parts will be covered, enclosed or otherwise protected from contact with any workers, accept as allowed by this program, the MIOSHA standards, the National Electric Code (NEC), or specific variances from the NEC as allowed by state law.

8. All new installations, non-minor repair work, and replacements of multiple units that fall within the NEC, or specific electrical installations regulated by state law, will be inspected by the University electrical inspectors for compliance with these standards prior to use. Also, all repair and replacement installations that occur due to a major incident, system fault or failure will be inspected, if practical, before putting the existing systems back into operation, or as soon as possible (e.g., the next regular business day) after being put back into operation.


1. Supervisors must observe and inspect workers doing this type of electrical work at least annually, to ensure they are following safe work practices.

2. First Aid.
   a. For field work, at least two workers trained in cardiopulmonary resuscitation (CPR) and first aid will be readily available.
   b. For fixed location work, a sufficient number of personnel trained in CPR and first aid will be readily available.
c. First aid kits and supplies will be readily available for use and kept adequately stocked according to PlantOps First Aid and Personal Injury Procedures.

3. A job briefing will be conducted before each job begins and at least once daily. The briefing will cover the hazards of the job, work procedures to be followed, special precautions required, energy source controls, and PPE. Workers working alone will review these items before beginning work and get help from their supervisor on issues they are unfamiliar with or uncomfortable performing.

4. Live-line tools (hot sticks) will be designed and constructed in conformance with industry standards. They will be inspected before each use, removed from service when defective, and tested at least once every two years.

5. Work on or near energized exposed electrical parts.
   a. Two qualified employees will be present when working on or near electrical parts that carry more than 600 volts.
   b. One qualified employee may perform routine switching if conditions allow work to be done safely on equipment designed for the purpose and in normal operating condition.
   c. One qualified employee may use live-line tools if they are out of reach or otherwise not exposed to contact with live parts.
   d. One qualified employee may make emergency repairs to the extent necessary to protect the public.
   e. Workers will remain at a safe distance from energized parts unless the worker or part is adequately insulated.
   f. Workers will work in positions that help prevent inadvertent contact with live parts.
   g. When making connections to energized parts, the connection to the energized part will be made last. When disconnecting from energized parts, disconnect at the energized source first.
   h. Removing or installing fuses will be done using tools and protective equipment rated for the shock and arc-flash hazard of the parts. Workers installing expulsion type fuses will wear eye, face and head protection.

   a. A Utility Electrical Primary System Foreman or lead worker in the Electrical Primary Systems crew will be designated as in charge of line shutdowns Lock Out & Red Tagging (LORT).
   b. In order to establish clearance of the de-energized lines the following procedures will be followed:
      i. Lead worker or Foreman will initiate and write up an appropriate Switching Order.
ii. Request Approval from Primary system Foreman or Electrical Utilities and Maintenance Mgr or designated official.

iii. Disconnecting means are opened, rendered inoperable and LORT.

iv. Automatic and remotely controlled switches are rendered inoperable and LORT.

v. Lead worker receives clearance from Primary System Foreman.

vi. Lines and equipment are tested to insure they’re de-energized.

vii. Protective grounds are installed.

c. If multiple crews are working the same line, each crew will independently follow the above clearance procedures.

d. To transfer responsibility for LORT, the Primary System Foreman, all employees in the crew, and the new lead worker must be notified.

e. To release LORT clearance, the following procedures will be followed:

i. Notify all workers that LORT clearance is to be released.

ii. Ensure all workers in the crew are clear.

iii. Ensure all protective grounds are removed.

iv. Report to Primary System Foreman and release LORT clearance.

f. Release from (LORT) clearance can only happen after all protective grounds have been removed, all workers and crews are clear, and all LORT components have been removed.

7. Protective Grounding.

a. Whenever practical, lines will be grounded with No. 2/0 American Wire Gauge (AWG) sized copper wire or greater. Lines will be tested for zero nominal voltage before grounds are installed.

b. The ground connection will be made first and the connection to the line will be made using a live-line tool. Grounds will be removed at the line first, using a live-line tool. Grounds may be removed temporarily to conduct tests.

c. Work may be done without protective grounds if the lines and equipment are de-energized, there is no possibility of contact with another power source, and there is no induced voltage hazard.

8. Overhead Lines.

a. Equipment will be kept well away from overhead lines. If equipment is required in the area of overhead lines, it will be kept at the minimum safe approach distance. A worker other than the equipment operator will watch during equipment movement to insure the safe approach distance is maintained.

b. Poles will be checked to insure they can handle the additional loads and stresses, before climbing, or installing new equipment or lines on to the pole.

c. All stringing and tensioning of overhead lines will use adequate grounding and safety precautions.
d. Work will not be done on overhead lines during thunderstorms, high winds, snow or ice storms, or other adverse weather conditions, except during emergencies.

9. Tree Trimming.
   a. Tree trimmers must be trained in safety procedures and minimum safe approach distances before being allowed to work around power lines.
   b. Tree trimmers, not specifically trained to work around power lines, must remain at least 10 feet away from power lines.
   c. A tree trimmer working around power lines must have a second tree trimmer within normal, unassisted voice communication range while working near power lines.

10. Capacitors: Capacitors will be disconnected, and then after waiting five minutes, short circuited and grounded before being worked on.

11. Current Transformer Secondaries: The secondary of a current transformer may not be opened while the transformer is energized. If the primary of the current transformer cannot be de-energized before work is done on an instrument, a relay or other section of a current transformer secondary circuit, the circuit will be bridged so that the current transformer secondary will not be opened.

12. Series Street Lighting: Series street lighting will be worked by following the line clearance procedures outlined above. A series loop may only be opened after the street lighting transformer has been de-energized and isolated from the source of supply or after the loop is bridged to avoid an open circuit condition.

C. Construction Site Work.

1. All temporary electrical parts, to include temporary lighting, will be adequately grounded.

2. All extension cords, cord sets, receptacles that are not part of the permanent wiring, including temporary lighting, and equipment connected by cord and plug, will be connected to electrical power through a GFCI, or be included in the Assured Equipment Grounding Conductor Program.

3. Assured Equipment Grounding Conductor Program.
   a. All equipment under this program, and the receptacles and plugs the equipment are plugged into must be tested for continuity to insure the equipment grounding conductor is continuous.
   b. Continuity testing must be done before first use, after any repairs, after suspected damage has occurred, and at three month intervals.
   c. A current record of all equipment tested under this program will be maintained at the job site where the equipment is being used.

4. Two qualified workers will be present when working on or near exposed energized electrical parts with a nominal voltage of 440 volts or more.
D. Electrical Parts and Wiring.

1. All electrical parts and wiring, permanent or temporary, will be enclosed or protected and conform to the applicable electrical and building code requirements.

2. Temporary parts and wiring, not considered part of a continuing construction project, will be replaced with permanent wiring within 30 days of initial installation.

E. Training.

1. All workers that use electricity, electrical equipment or devices as part of their normal job duties, will be trained in the general hazards and safeguards for using electricity, electrical equipment and devices (see Appendix A).

2. All workers required to do electrical work, or work near exposed electrical parts, must be qualified and trained in the specific hazards involved with the work they are qualified to perform, the safety related work practices necessary for them to safely do their job, and the requirements listed in MIOSHA General Industry Safety Standard Part 40 (Electrical Safety-Related Work Practices) and Part 85 (Control of Hazardous Energy Sources).

3. All qualified persons required to do electrical work, work on or near exposed electrical parts, or construct, remove or demolish electrical parts or equipment must be trained in the hazards involved, safety related work practices necessary for them to safely do their job, the requirements listed in MIOSHA General Industry Safety Standard Part 33 (Personal Protective Equipment), Part 40 (Electrical Safety-Related Work Practices) and Part 85 (Control of Hazardous Energy Sources), and the requirements listed in MIOSHA Construction Industry Safety Standard Part 6 (Personal Protective Equipment), Part 16 (Power Transmission and Distribution) and Part 17 (Electrical Installations). They must also be trained in the following:

   a. The skills and techniques necessary to distinguish exposed energized electrical parts from other parts.

   b. The skills and techniques necessary to determine the nominal voltage of exposed energized electrical parts.

   c. The safety procedures, safe clearance distances, and minimum approach distances required for working near energized exposed electrical parts.

4. Workers conducting electric power generation, transmission or distribution work must be trained in the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, insulated tools for working on or near exposed energized electrical parts, first aid, CPR, and the requirements listed in MIOSHA General Industry Safety Standard Part 86 (Electric Power Generation, Transmission and Distribution).

5. Workers required to use electrical PPE for protection from electric shock or arc-flash will receive training on this PPE in conformance with the Plant Ops PPE Program.

6. Tree Trimmers required to work in close proximity (i.e., less than 10 feet) to electrical transmission lines will be trained in the necessary safety procedures, minimum safe approach distances, and the pertinent sections of the MIOSHA General Industry Safety
Standard Part 53 (Tree Trimming and Removal) and Part 86 (Electric Power Generation, Transmission and Distribution) before being allowed to work near power lines.

7. Workers will be retrained as needed, or at least once every three years, to insure adequate safety practices and procedures are maintained and followed, or at any time workers cannot adequately demonstrate knowledge of the required safety precautions.

8. All electrically qualified workers required to perform electric power generation, transmission, or distribution work, or tree trimming work will be trained in first aid, CPR and emergency procedures necessary for their assigned tasks.

F. Recordkeeping.

All training conducted for compliance with this program will be recorded and tracked as required by the Plant Ops Safety Training Program.
Electrical Safety

OBJECTIVE

To explain common electrical hazards, and ways to use electricity safely to prevent shock, burns and fires. This training is not meant for electricians; it is meant for employees whose work with electrical equipment is incidental to their primary job. This training will provide you with some basic information about electrical safety.

SUGGESTED MATERIALS TO HAVE ON HAND

* Indoor and outdoor extension cords with two and three prong plugs
* Ground Fault Circuit Interrupters (GFCIs)
* Multi-outlet cord set for computers

INTRODUCTION

Electricity is common in the workplace and this common exposure can lead to indifference to it’s hazards, which could lead to easily avoided injuries. Electrical hazards are often the least visible yet most deadly in the workplace. Electricity causes 10% of work related deaths, as well as many serious injuries. The use of simple precautions and protections will allow for a safer workplace and reduced accidents.

HAZARDS

When you get a shock, your body has become part of an electric circuit. The longer and stronger the shock, the greater the risk, especially if near your heart. Electric shock can cause many effects, from tingly skin to death. Electrical fires and explosions can happen when circuits or equipment overheat. Electrical burns are usually serious, because the electricity is passing through your body and can burn your internal tissues and organs. Electrical shock, while not always strong enough to kill or injure, can cause secondary accidents, such as falls. Water increases the potential electrical hazard.

Always report and avoid existing or potential electrical hazards. These could include:

* Loose electrical connections
* Missing guards on live electrical parts
* Improperly grounded plugs
* Improperly installed covers and conduit on permanent wiring
* Improper protection to wires entering boxes, cabinets or fittings

Watch for the following warnings of existing and potential electrical hazards:

* Loose electrical connections
* Cords with missing or frayed insulation
* Plugs that don’t match the outlet
* Indoor extension cords used outside
* Equipment running over capacity
Electrical Safety (continued)

* Power tools that smoke, smell, spark or shock
* Wires or cords running across floors
* Cords near water, hot equipment, flammable or explosive materials
* Continuous use of extension cords instead of permanent wiring
* Exposed or unprotected wiring

SAFEGUARDS

Always use the right equipment for the job. Extension cords are only for temporary use. If you have to use an extension cord continuously for more than 30 days, then permanent wiring should be installed. One exception to this is multi-outlet cord sets for computers. These can be used indefinitely, but only with computer equipment.

Indoor extension cords (light cords, usually with only two prong plugs) can only be used indoors and are meant for light duty use only. Heavy duty outdoor extension cords, with three prong plugs, are a better choice for all uses and required when used outdoors. Always try to ground electrical equipment. If the ground prong has been broken off of a three prong plug, then it should be repaired.

Use ground fault circuit interrupters (GFCIs) in wet or damp areas, and on all construction sites. A GFCI is a switch that can be attached to most powered equipment. While all electrical wiring is supposed to be grounded and have a fuse or breaker in case of overload, grounds can be broken, and fuses and breakers are designed to protect wiring, not people. A GFCI will open the circuit early and quickly enough to protect a worker from electrical exposures. They are one of the best tools for protecting workers from electrical hazards.

All permanent wiring should be enclosed and protected from damage. Parts should be de-energized whenever doing work on or near electrical equipment.

Never handle electrical equipment with wet hands. In case of an electrical fire, make sure any fire extinguishers used are rated for use on electrical fires (look for Class C on the label), and try to get the power shut off.

Listed below are safety procedures that should be used around electrical equipment:

* Inspect equipment and wires for insulation, grounding and tight connection
* Use lockout/tagout procedures before working on electrical equipment
* Remove jewelry and watches
* Follow the manufacturer’s instructions when working on equipment
* Minimize use of extension cords. Install permanent wiring when necessary
* Keep hands clean and dry
* Don’t use equipment or power tools that smell, smoke, spark or shock. Get this equipment repaired or replaced
* Watch for combustibles in the work area and store them in a safe area away from electrical equipment
* Stay away from high voltage equipment
Electrical Safety (continued)

* Avoid power lines. Always check for overhead power lines and never excavate without checking for utilities already buried (MISS DIG)
* Keep cords untangled and out of traffic

CONSTRUCTION WORK

Because construction sites often have temporary wiring, construction workers must follow an Assured Equipment Grounding Conductor Program. This is a program where all electrical equipment, power tools, and extension cords are tested and labeled every six months to insure they are adequately grounded. This can be a very tedious and time consuming process, but OSHA allows GFCIs to be used as an alternative to testing. So always use a GFCI when using your tools and equipment.

WRAP-UP

Electricity is an essential part of modern day life, which we could not do without. Don’t let the commonness of electricity make you complacent to the potential hazards it brings. Always check to make sure you, and those around you, are working safely. Report and avoid equipment that is or appears to be unsafe. Don’t take unnecessary chances with your or your co-workers’ safety. Remember, the most important person watching out for your safety, is you.

SUGGESTED DISCUSSION QUESTIONS

1. What are some commonly encountered electrical hazards?
2. What are some warning signs that an electrical hazard is present?
3. How long can an extension cord be continuously used before it should be replaced by permanent wiring?
4. What is a ground fault circuit interrupter (GFCI)?
5. What is an Assured Equipment Grounding Conductor Program, and what is an easy way to comply with this requirement?
Electrical Safety Do’s and Don’ts

DO:
* check wiring to make sure it’s properly insulated and right for the job
* check that electrical connections are tight
* make sure plugs match their outlets (three pronged plugs in three prong outlets)
* use GFCI’s for any temporary wiring or use of portable power tools or equipment, especially during emergencies
* read and follow manufacturer’s instructions
* use protective equipment
* keep machines clean and lubricated
* use properly rated extension cords suitable for use outdoors
* keep equipment and the work area clean
* leave electrical repairs to electricians
* leave enough space around equipment for maintenance
* report electrical safety hazards

DON’T:
* overload equipment or wiring
* run cords across the floor or under carpeting
* put anything in a electrical outlet, except the proper plug
* place cords near heat or water
* allow machines to get dirty, dusty or excessively greasy
* touch anything electrical with wet hands
* leave electrical or heating equipment running unattended
* let cords get twisted, tangled or lay in traffic areas
* go near a downed power line
* work near electrical power with metal tools
* wear jewelry near electric equipment
* use power tools that smell, smoke, spark or shock
* work on equipment or machinery that has not been locked out
* go near any area with guarded high voltage electrical equipment without authorization
APPENDIX B
### Electrical Safety for Qualified Workers

Electrically Qualified Workers:

A. All electrically qualified workers are limited to performing the specific electrical tasks for which they are specifically qualified to perform. Qualified workers are expected to recognize the limits of their own technical expertise, as well as the limits set forth in this safety program, and not attempt to perform tasks they are not qualified to perform.

B. Listed below are the University job titles that Plant Ops recognizes as generally being electrically qualified for the corresponding tasks listed. At any time a worker with a listed job title is assigned to perform a task they do not feel technically proficient to perform, or are unable to perform safely, the worker should not perform the task and report the situation to their supervisor or OSEH. Also, workers which have a job title listed below as generally being qualified to perform certain electrical tasks may have additional restrictions placed on the performance of these tasks at any time by Plant Ops management, up to and including the restriction from performing any electrical tasks.

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</tr>
<tr>
<td>INDUSTRIAL ELECTRICIAN</td>
<td>Low voltage vehicle electrical systems as set by qualified supervisor</td>
</tr>
<tr>
<td>INSTRUMENT &amp; CONTROL SPEC</td>
<td>Instrument and control circuits after the load side of the main unit disconnect</td>
</tr>
<tr>
<td>MAINTENANCE MECHANIC I</td>
<td>Non-systematic single unit repair (not replacement) of building lighting fixtures, generally limited to ballasts and sockets</td>
</tr>
<tr>
<td>MAINTENANCE MECHANIC II</td>
<td>Non-systematic single unit repair (not replacement) of building</td>
</tr>
</tbody>
</table>
C. Qualified electrical workers will follow the general safety procedures listed in Appendix C of the Electrical Safety Program whenever performing electrical tasks. At any time a qualified worker has any questions about proper safety procedures, they will ask their supervisor or OSEH for clarification or guidance.

E. Qualified electrical workers will use adequate personal protective equipment (PPE) for shock and arc-flash hazards as outlined in Appendix D of the Electrical Safety Program when performing electrical tasks. At any time a qualified worker has any questions as to the need or type of PPE required to safely perform a task, they should ask their supervisor or OSEH for clarification or guidance.

F. Electrically qualified workers will receive initial and periodic retraining on electrical safety requirements applicable for their assigned tasks and as outlined in Appendix F of the Electrical Safety Program.
APPENDIX C
1. Work is required on or near electrical circuits or equipment.

2. Are all workers qualified for the electrical tasks assigned or planned?
   - Yes
   - No
     2.a. Work should be reassigned to workers qualified for the expected assigned task(s).

3. Will energized equipment/conductors be exposed or potentially contacted?
   - Yes
     3.a. Workers should stay aware for unforeseen exposed electrical hazards that could arise.
   - No

4. Will workers be inside the Arc-flash Protection Boundary?
   - Yes
     5. Determine the level of arc-flash protection necessary.
   - No
     4.a. Ensure procedures are present to keep unprotected people outside the Arc-flash Boundary.

5. All people inside the Limited Approach Boundary must be qualified.

6. All people inside the Arc-flash Boundary must wear adequate arc-flash PPE.

7. All people inside the Limited Approach Boundary must be qualified or accompanied by a qualified worker.

8. All people inside the Restricted Approach Boundary must be qualified.

9. Will diagnostics/testing be done so tools, body parts or other items will be inside the Prohibited Approach Boundary to exposed energized parts?
   - Yes
     10. All workers crossing the Prohibited Approach Boundary must wear adequate shock hazard and arc-flash PPE.
   - No

11. Once diagnostics/testing is completed or maintenance/construction/repair work begins, equipment & circuits must be locked out.

12. Will maintenance, construction or repair work be done on energized conductors (inside the Prohibited Approach Boundary)?
   - Yes
   - No
     12.a. If maintenance, construction or repair work begins, lockout/tagout procedures must be followed.

13. Lockout/Tagout procedures are required unless locking out is less safe or infeasible.

14. Will the energized equipment/conductors be locked out?
   - Yes
   - No
     14.a. Follow lockout/tagout procedures. Watch for new or unforeseen hazards.

Go to page 2.
15. Will work be on substation systems (other than simple opening or closing of circuits), electric power generation or transmission systems, or circuits over 600 volts AC?

Yes

15.a. Work must conform to procedures approved by the designated Plant Ops senior manager and conform to the ANSI C2 Standard (NESC).

No

16. An approved Energized Electrical Work Permit is required before work can begin.

18. Ensure the Requester understands the potential consequences of an unplanned power loss & get the Requester's signature, if possible.

19. Get OSEH approval of permit. If an emergency and OSEH is not available, get approval of General Foreman.

20. Complete the details of work procedures on the permit.

21. Get the signature(s) of the qualified worker(s) that will be conducting the energized work, if possible.

22. Get General Foreman approval of permit.

23. Coordinate notification of energized work to affected facility occupants through Work Ctrl or other appropriate agencies.

24. Conduct work according to approved procedures.

25. Stop work if any incidents occur or unforeseen hazards arise.

26. Close out the permit when work is completed or stopped. Report any incidents or information to the supervisors and OSEH. If situation was considered an emergency, then initiate an after action review.

27. Keep the closed permit on file for at least 3 years.

28. Approved

29. Disapproved

30. From page 1.
APPENDIX D
Plant Ops Electric Arc-Flash Protection Levels

<table>
<thead>
<tr>
<th>Arc Flash Protection Level</th>
<th>Description of clothing components</th>
<th>Relevant NFPA 70E Hazard/Risk Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level A: Basic work clothing for electrically qualified workers (equivalent to NFPA 70E 2009 hazard category 0)</td>
<td>- natural fiber long sleeve shirt - natural fiber long pants - natural fiber undergarments - safety glasses - electric hazard rated safety shoes</td>
<td>Category 0 (minimum rating: 1.2 cal/cm²)</td>
</tr>
<tr>
<td>Level B: Protection for electrically qualified workers (equivalent to NFPA 70E 2009 hazard category 2*)</td>
<td>basic work clothing (Level A) plus: - 8 cal/cm² fire resistant coveralls/suit** - 8 cal/cm² arc-flash rated face shield† - 8 cal/cm² arc-flash rated balaclava† - voltage rated gloves - head protection (hard hat) - hearing protection</td>
<td>Category 2 (minimum rating: 8 cal/cm²)</td>
</tr>
<tr>
<td>Level C: Protection for electrically qualified workers (equivalent to NFPA 70E 2009 hazard category 4)</td>
<td>basic work clothing (Level A) plus: - 40 cal/cm² fire resistant coveralls/suit*** - 40 cal/cm² arc-flash rated switching hood - hearing protection</td>
<td>Category 4 (minimum rating: 40 cal/cm²)</td>
</tr>
</tbody>
</table>

† An 8 cal/cm² arc-flash rated hood with combined face shield may be substituted for the balaclava and separate face shield.
** If coveralls are rated to at least 8 cal/cm² then a long sleeved shirt and long pants are not required underneath. However, all clothing and undergarments must be natural fiber.
*** If arc-flash suit is rated to at least 40 cal/cm² then a long sleeved shirt and long pants are not required underneath. However, all clothing and undergarments must be natural fiber.

Other equipment that could be required for various electrical tasks:
- Voltage rated tools and hot sticks
- Insulated blankets and mats
- Insulated guards, covers and line hoses
- Temporary grounding equipment
Plant Operations Energized Electrical Work Permit

An Energized Electrical Work Permit is required anytime electrical work is done on systems of 50 volts or greater and not being fully locked/tagged out. Permits must be approved by an appropriate safety representative and a qualified maintenance manager with approving authority.

Preliminary Information

Project information should outline what work is to be done and why it needs to be done without lockout/tagout. This information should be completed by the people that will do the energized work. The requestor is the person wanting the work done, such as the facility manager, the project manager, the shop foreman, etc. The requester’s signature is not required, but the requestor should be aware of the information.

Requester: ________________________________ Work Request #: _________________ Date: ___________

Description of Work: _______________________________________________________________________
________________________________________________________________________________________

Circuit Information: Location: _______________________________________________________________

   Equipment: _______________________________________________________________

Date/Time Work is Planned to Occur: _________________________________________________________
________________________________________________________________________________________

Reason equipment/circuit(s) cannot be locked out (include attachment, if necessary): ________________________
________________________________________________________________________________________

Consequences of unexpected fault or loss of power while energized work is in progress: _________________
________________________________________________________________________________________

Requested of energized work (e.g., building occupant, facility manager, project manager, foreman, etc.):

Name & Title: ___________________________________ Signature: __________________

REQUIRED: Safety Representative (OSEH): Approval of reason to allow work to be done while energized:

Energized work must be approved by the Plant Ops safety department (i.e., OSEH) to ensure that the reasons for doing the energized work are appropriate and in compliance with policies and regulations (e.g., safer to leave power on, turning power off is infeasible or impractical, etc.).

Approve: □  Disapprove: □  Name/Title: __________________________Signature: __________________

Details of Work

The details of the energized work should be completed by a qualified person that will be doing the work. Signature(s) of the qualified worker(s) are not required, but workers must be fully trained, briefed, equipped and understand the procedures to be followed.

Detailed description of work to be performed: ___________________________________________________
________________________________________________________________________________________

Description of safety work practices to be followed: ______________________________________________
________________________________________________________________________________________

Shock Protection Boundary: ___ Flash Protection Boundary: ______ Flash Protection Hazard Category: ___

PPE required: _____________________________________________________________________________

Means of restricting access to work area: ________________________________________________________

Job Briefing Completed: ______

Qualified worker(s): Are adequate worker safety precautions in place and being followed?:

Name & Title: ___________________________________ Signature: __________________

Name & Title: ___________________________________ Signature: __________________

REQUIRED: Approver (e.g., electrically qualified General Foreman or other electrically qualified manager):

All energized work permits must be reviewed and approved by two qualified persons, at least one in a managerial position, before work can begin.

Approve: □  Disapprove: □  Name/Title: __________________________Signature: __________________

Close Permit: Each permit is for a specific location, time frame, and task. Once work is complete, each permit must be closed out. Any incidents, unexpected occurrences or deviations from regular work practices will be noted and discussed with the workers doing this work and their supervisors.

Name & Title: __________________________Signature: __________________
Plant Operations Energized Electrical Work Permit

### Approach Distance Boundaries

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>50 to 300 V</td>
<td>10 ft 0 in.</td>
<td>3 ft 6 in.</td>
<td>Avoid contact</td>
<td>Avoid contact</td>
<td>4 ft 0 in.</td>
</tr>
<tr>
<td>301 to 750 V</td>
<td>10 ft 0 in.</td>
<td>3 ft 6 in.</td>
<td>1 ft 0 in.</td>
<td>0 ft 1 in.</td>
<td>4 ft 0 in.</td>
</tr>
<tr>
<td>751 V to 15 kV</td>
<td>10 ft 0 in.</td>
<td>5 ft 0 in.</td>
<td>2 ft 2 in.</td>
<td>0 ft 7 in.</td>
<td>4 ft 0 in.</td>
</tr>
</tbody>
</table>

† assumes product of clearing time and available bolted fault current not exceeding 100 kA cycles (1667 ampere seconds).

### Arc-Flash Protection Levels:

<table>
<thead>
<tr>
<th>Arc Flash Protection Level</th>
<th>Description of clothing components</th>
<th>Min. Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level A: Basic work clothing for elect. qual. workers (equivalent to NFPA 70E 2004 hazard category 0)</td>
<td>natural fiber long sleeve shirt and long pants; natural fiber undergarments; safety glasses; &amp; electric hazard safety shoes</td>
<td>1.2 cal/cm²</td>
</tr>
<tr>
<td>Level B: Protection for electrically qualified workers (equivalent to NFPA 70E 2004 hazard category 2*)</td>
<td>basic work clothing (Level A) plus: 8 cal/cm² FR coveralls; 8 cal/cm² arc-flash face shield; 8 cal/cm² arc-flash balaclava; voltage rated gloves; hard hat; and hearing protection</td>
<td>8 cal/cm²</td>
</tr>
<tr>
<td>Level C: Protection for electrically qualified workers (equivalent to NFPA 70E 2004 hazard category 4)</td>
<td>basic work clothing (Level A) plus: 40 cal/cm² FR coveralls; 40 cal/cm² arc-flash hood w/ face shield; &amp; hearing protection</td>
<td>40 cal/cm²</td>
</tr>
</tbody>
</table>

### Example tasks with acceptable PPE requirements (for more information contact your foreman or OSEH):

<table>
<thead>
<tr>
<th>Task Performed on Energized Equipment</th>
<th>Arc-Flash Protection</th>
<th>V-rated Gloves</th>
<th>V-rated Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panelboards or Other Equipment Rated 240 V and Below — Note 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermography &amp; non-contact inspections outside restricted approach boundary</td>
<td>A</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Circuit breaker (CB) or fused switch operation with covers on</td>
<td>A</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>CB or fused switch operation with covers off</td>
<td>A</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Work on energized conductors and parts, including voltage testing</td>
<td>B</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Remove/install CBs or fused switches</td>
<td>B</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Removal of bolted covers (to expose bare, energized conductors and parts)</td>
<td>B</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Opening hinged covers (to expose bare, energized conductors and parts)</td>
<td>A</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Work on energized conductors &amp; parts of equip. fed directly by branch circuit of panelboard</td>
<td>B</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

| Panelboards/switchboards >240 V to 600 V (w/ molded case or insulated case CBs) - Note 1 | | | |
| Thermography & non-contact inspections outside restricted approach boundary | B | No | No |
| CB or fused switch operation with covers on | A | No | No |
| CB or fused switch operation with covers off | B | Yes | Yes |
| Work on energized conductors and parts, including voltage testing | B | Yes | Yes |
| Work on energized conductors & parts of equip. fed directly by branch circuit of panelboard | B | Yes | Yes |

| 600 V Class Motor Control Centers (MCCs) or Switchgear— Note 2 (except as indicated) | | | |
| Thermography & non-contact inspections outside restricted approach boundary | B | No | No |
| CB or fused switch or starter operation with enclosure doors closed | A | No | No |
| Reading a panel meter while operating a meter switch | A | No | No |
| CB or fused switch or starter operation with enclosure doors open | B | No | No |
| Work on energized conductors and parts, including voltage testing | B | Yes | Yes |
| Work on control circuits with energized conductors and parts 120 V or below, exposed | A | Yes | Yes |
| Work on control circuits with energized conductors and parts >120 V, exposed | B | Yes | Yes |
| Insertion or removal of individual starter “buckets” from MCC — Note 3 | C | Yes | No |
| Application of safety grounds, after voltage test | B | Yes | No |
| Removal of bolted covers (to expose bare, energized conductors and parts) — Note 3 | C | No | No |
| Opening hinged covers (to expose bare, energized conductors and parts) — Note 3 | B | No | No |
| Insertion or removal (racking) of CBs from cubicles, doors open or closed | C | No | No |

| Other 600 V Class (277 V through 600 V, nominal) Equipment — Note 2 | | | |
| Work on energized conductors and parts, including voltage testing | B | Yes | Yes |
| Insertion or removal of plug-in devices into or from busways | B | Yes | No |
| Miscellaneous equipment cover removal or installation | B | No | No |
| Lighting or small power transformers (600 V, maximum) | | | |
| Removal of bolted covers (to expose bare, energized conductors and parts) | B | No | No |
| Opening hinged covers (to expose bare, energized conductors and parts) | B | No | No |
| Work on energized conductors and parts, including voltage testing | B | Yes | Yes |
| Application of safety grounds, after voltage test | B | Yes | No |

Notes: 1. Max. 25 kA short circuit current available; max. 0.03 second (2 cycles) fault clearing time. 2. Max. 65 kA short circuit current available; max. 0.03 seconds (2 cycles) fault clearing time. 3. Max. 42kA short circuit current available; max. 0.33 (20 cycles) fault clearing time.
APPENDIX F
Q: When do we need to wear Arc-Flash PPE?

A: Whenever our work involves approaching exposed energized (above 50V) parts to within 4 feet or less (inclusive). This limit applies to transformers less than 300kVA. Otherwise, this boundary must be determined by Engineering.

The next question to ask is does the work involve contact with normally energized parts?

No: An EEWP is not necessary. However, you must wear PPE to protect from shock and arc-flash.

• Optional Note: Even though an EEWP is not necessary because contact is not made, it may be more efficient and safe to simply shut the equipment off. This would avoid the need for PPE while doing the work. If the decision is made to attempt to shut equipment down, contact foreman about initiating a shut down request without an EEWP.

No: An EEWP is not necessary. However, you must wear PPE to protect from shock and arc-flash.

• Shock protection is our gloves and EH rated shoes.

• Arc-flash protection will be determined by the EEWP document or NFPA 70E that lists example tasks along with required PPE with Electrical Engineering approval.

If the energized equipment is a 208V, 3-phase, 112.5kVA transformer or less. Level A (to be covered in later slides) protection only is required (Source: IEEE Std. 1584 – 2002). Level A is our basic work attire that includes natural fiber (long sleeved/pant) clothing.

Yes: Generally, this means that we will need to submit a shutdown request.

• The exception to this is if the work is diagnostic troubleshooting such as Voltage or current measurements, rotation metering, etc.

• If the work is diagnostic testing, we do not need to submit an EEWP, however we must wear appropriate PPE.

Yes: Generally, this means that we will need to submit a shutdown request.

• If shutdown request is not approved, we must begin EEWP process.

• Your foreman will assist in filling out the EEWP

• Your foreman will submit the EEWP to OSEH

• OSEH will approve or disapprove the EEWP.
Energized Electrical Work

If the EEWP is not approved:
• Work cannot proceed. Management will handle from here.

If the EEWP is approved:
• Work can proceed with proper PPE and work procedure

Protective Clothing/PPE: Level A

Level A clothing is the basic work clothing for Electrically Qualified Workers (Electricians).

Protective Clothing/PPE: Level B

• Basic Electrician attire: Level A clothing
• Voltage rated gloves
• Voltage rated face shield
• Hearing protection

Protective Clothing/PPE: Level C

• Basic Electrician attire: Level A clothing
• 40cal/cm² arc-flash suit with 40cal/cm² hood & face shield
• Voltage rated gloves
• Hearing protection

Protection Boundary

Default Arc-Flash Protection Boundary

Restricted Approach Boundary; Includes Movement Adder

Inadvertent Boundary; Includes Movement Adder

Example tasks with acceptable PPE requirements (for more information contact your foreman or OSEH):

* some tasks that require Level B Protection do not require an arc-flash rated face shield, hard hat and hearing protection.

Protection for Electrically Qualified Workers*

1. 25 kA short circuit current available, 0.03 second (2 cycle) fault clearing time.

2. 751 V to 15 kV

3. Movement Adder

- 300kVA. 3 phase, 3 wire cases.

Equipment:

- Panelboards or Switchboards Rated >240 V and up to 600 V (with molded case or insulated

- CB or fused switch operation with enclosure doors open

- CB or fused switch or starter operation with enclosure doors closed

- Panelboards or Switchboards Rated >240 V and up to 600 V (with molded case or insulated

- Removal of bolted covers (to expose bare, energized parts)

- Apply safety grounds, after voltage test

- Work on control circuits with energized parts A Yes Yes

- Work on control circuits with energized parts >120 V, exposed

- CB or fused switch or starter operation with enclosure doors open

- Opening hinged covers (to expose bare, energized parts)

- Opening hinged covers (to expose bare, energized parts)

- Insertion or removal of individual starter "buckets" from MCC

- Work on control circuits with energized parts B Yes No

- Application of safety grounds, after voltage test

- Means of restricting access to work area: _____________________________
Work involves approaching exposed energized electrical parts closer than 4ft for systems fed by XFMR less than 300kVA. Engineering must determine other cases.

Work involves contact with normally energized parts.

- **Y**: Is work diagnostic troubleshooting?
  - **N**: Work can be performed while equipment is energized and Electrical Energized Work Permit (EEWP) is not necessary. PPE is necessary and is determined by Qualified Electrician, GF, Foreman or Engineering, w/guidance of EEWP doc or NFPA 70E. See *Note.
  - **Y**: Proceed according to EEWP guidelines. PPE is necessary and is determined by Qualified Electrician, GF, Foreman or Engineering, according to EEWP or NFPA 70E. See *Note.

- **N**: If equipment can be readily shut down, this may be the best route and would avoid the need for PPE while doing the work. In this case, follow optional arrows where indicated.

Foreman makes shutdown request.

- **Y**: Shutdown request approved?
  - **N**: Work cannot proceed without higher level managerial approval.
  - **Y**: Proceed with lockout/tagout procedure. Use PPE when necessary. See *Note

Foreman submits EEWP to OSEH

OSEH will contact people who denied shutdown request to re-submit shutdown request

- **N**: EEWP permit approved?
  - **Y**: Proceed with lockout/tagout procedure. Use PPE when necessary. See *Note
  - **N**: Proceed according to EEWP guidelines. PPE is necessary and is determined by Qualified Electrician, GF, Foreman or Engineering, according to EEWP or NFPA 70E. See *Note.

*Note: If equipment is fed by 208V, 3-phase, 112.5 kVA XFMR and below, level A protection only is required. Arc-flash hazard is minimal. (Source: IEEE Std. 1584-2002).

*Note: If equipment is fed by 208V, 3-phase, 112.5 kVA XFMR and below, level A protection only is required. Arc-flash hazard is minimal. (Source: IEEE Std. 1584-2002).
APPENDIX G
Ballast Replacement Training

Take a copy of this procedure with you when working on ballasts.

BEFORE YOU START…

- Are you wearing any jewelry? Ring, Watch (with metal band), Necklace?
  
  Take them off.

- Are you wearing the appropriate PPE?
  
  Safety Glasses?
  
  Gloves?
  
  Cotton shirt?
  
  Put them on.

Wearing gloves may sound like overkill to some, but in almost every shock-related incident, if the mechanic had been wearing even cotton gloves, they would not have been shocked. Almost all shocks had to do with the lack of grounding conductors and changing bulbs, not the ballast, while the power to the fixture was on. Turn the power off, even if you are just changing bulbs.

- Do you have a portable light so you can turn the power off to the fixture?
• Do you have a fiberglass or wooden ladder?

• Do you have a proximity or voltage tester, and have you been trained how to use it?

• Do you have a lockout/ tagout kit for the switch breakers?

Special Precautions:
• Pay special attention to pendant or chain-hung fixtures in machine rooms or wet locations (these may not be properly hung with chains/pendants or may not have a ground).
• If it is a battery backed up emergency light, turn it over to your zone electrician.
• If you’re not sure of the condition, DO NOT DO THE WORK! Call zone electrician, your foreman, or the Zone Maintenance Business Manager
Ballast Replacement Procedure

Schedule shut down and Lockout/Tagout
1. Schedule shut down with customer.
2. Turn off power to the fixture. To see if ballast only needs to be rebooted turn power back on and check to see if light come on. If not turn back off.
3. Install a breaker lockout/tagout device, or switch lockout/tagout devices on all switches to the fixture you are working on. (Look at switch handle, if it doesn’t say ON OFF there are multiple switches for the fixture).

Voltage test
4. Open fixture; remove all the tubes and the ballast cover plate.
5. Confirm that your proximity or voltage tester is working by testing on known live circuit, and test to make sure power is off to all conductors in fixture!

Inspection
6. Identify the green grounding conductor in the fixture; if there is not one installed call your zone electrician to install one.
7. Check if the circuit’s neutral wire runs through the fixture to another fixture. If it does, DO NOT interrupt this circuit. Leave a 6” pigtail of the old smaller ballast wire still attached in the existing wire nut. (Opening this neutral connection on a multi wire circuit could present a shock hazard – even if the power has been turned off to the fixture!).
8. Check if sockets are cracked or broken; if so, they need to be replaced.
9. Inspect fixture wire insulation; if brittle and cracked, call zone electrician, he may want to meger test the insulation.

Removal
10. Cut all wires leading to ballast; if needed for identification proposes, leaving a small piece of ballast wire in the old wire nut still attached to the fixture wires.
11. Loosen nuts/screws holding ballast, remove ballast from fixture.
12. Confirm ballast specification, compare old with new; they must be an exact match (voltage, ballast type, number of wires, tube type, and number of tubes, etc.). If a match can’t be found, your zone electrician may need to rewire the fixture.

Replacement
13. Bolt new ballast into fixture to insure good grounding of the ballast.
14. Read wiring diagram on new ballast to see if it matches the color of the old ballast wires you left in the wire nuts in the fixture.(if not sure call zone electrician)
15. Match and trim old wires one at a time, to a length that is comfortable to work on but not excessive, strip wire insulation back 3/8”, and connect wires one at a time. (Be careful not to score the wire with the stripper).
16. Install a required fixture ballast disconnect, on the hot and neutral wires,
17. Make reliable joints when using wire nuts; by holding all ends of the wires even, then screw a new wire nut on, and tighten until resistance increases. (Do not reuse old wire nuts).

Quality check
18. Check that there is no bare wire exposed below the wire nuts or outside of stab-in connection.
19. Test joints; pull on each wire separately while holding onto the wire nut, or gently pull on wire terminating in stab-in connection.
Dating, Warranty and Wire Cover
20. Use a felt-tipped marker and indicate the date of the installation on the new ballast. If the old ballast is still under warranty, return it to the supplier.
21. Bundle the fixture/ballast wires neatly inside the space provided at ballast ends, and replace ballast cover.

Cleaning, New tubes, and Securing
22. Clean, if needed interior of fixture and lens/diffuser with spray cleaner.
23. Install new tubes, and assure they are installed properly. (An improperly installed bulb will shorten the life of the bulb and ballast).
24. Secure lens/diffuser and test by pulling down on it! (Many lens/defusers have fallen by not being secured properly).
25. Clean work area; desk tops, key boards, foot prints on desks, and debris on floor.

Removing Lockout/Tagout and Energizing
26. Lockout tagout devices are to be removed only by the employee who applied it.
27. Make sure that all tools and materials have been removed from the work area.
28. Notify affected employees that the lockout is going to be removed.
29. Make sure all employees are at a safe distance.
30. Remove lockout, stand to one side of switch, turn on, and verify light is working.

Customer Service and Recycling
31. Inform customer Work Request is complete.
32. Send old ballast to OSEH for recycling; (electronic ballast and old magnetic ballast that aren’t labeled stating that they don’t have PCB’s are hazardous waste)
33. Box up, label, and send old tube to OSEH for recycling.

Last updated 2/10/09 JF