



New Paltz
STATE UNIVERSITY OF NEW YORK

POLICIES AND PROCEDURES

DEPARTMENT: Environmental Health and Safety

SUBJECT: Electrical Safety Program

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BACKGROUND

ELECTRIC SHOCK

It is well known that the human body will conduct electricity, and that if direct contact is made with an electrically energized part while a similar contact is made simultaneously with another conductive surface which is maintained at a different electrical potential, a current will flow, entering the body at one contact point and exiting at another contact point, usually the ground.

Each year, many workers suffer pain, injuries, and death from such electric shocks. OSHA estimates that there are more than 300 electrical fatalities in general industry each year. Burns and "secondary" injuries from collisions and falls are also of concern when working with electricity.

NATURE OF ELECTRICAL ACCIDENTS

Electrical accidents, when studied, often appear to be caused by circumstances which are varied and peculiar to the incidents involved. However, further consideration usually reveals the underlying cause to be a combination of three possible factors: an unsafe environment, unsafe equipment, and unsafe acts. It should also be noted that inadequate maintenance can cause equipment or installations which were originally considered safe to deteriorate, resulting

in an unsafe condition.

PROTECTIVE MEASURES

There are various ways of protecting employees from the hazards of electric shock, including insulation and guarding of live parts. Insulation provides an electrical barrier to the flow of current. To be effective, the insulation must be appropriate for the voltage and the insulating material must be undamaged. Equipment grounding is another method of protection from electric shock.

However, even though equipment may be in compliance with installation requirements, personnel may still be exposed to electrical hazards. For example, an employee carrying a ladder could approach exposed live parts guarded by an installation beyond normal reaching distance. The employees bringing the ladder close to the live parts expose the worker to hazards greater than those present under usual working conditions.

Another important safety practice involves the use of electrical protective devices, such as rubber gloves and rubber mats for the purpose of insulation against live parts, or live-line tools for purposes of both insulation and manipulation of energized parts from a distance. Regular maintenance of such material is an important consideration in order to keep this equipment from deteriorating into an unsafe condition.

PROCEDURES

Procedures outlined in this program are supplemental, and therefore do not supersede any national, state, and local codes, laws, or regulations.

GENERAL

Live parts to which an employee or student may be exposed shall be de-energized before work is performed on or near them. In certain specific, rare incidents, de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations. Such cases include, but are not limited to, shutdown of hazardous location ventilation equipment or removal of illumination for a critical area. Such exceptions shall be approved by the Manager Plant Services.

If the exposed live parts are not de-energized (for reasons of increased or additional hazards or infeasibility), then 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 employees against contact with energized circuit parts directly with any part of their body or indirectly through some other conductive object.

DE-ENERGIZING CIRCUITS

Conductors and parts of electric equipment that have been de-energized but have not been locked out or tagged out shall be treated as energized parts.

While any employee is exposed to contact with parts of fixed electric equipment or circuits which have been de-energized, the circuits energizing the parts shall be locked out or tagged or both.

Circuits and equipment to be worked on shall be disconnected from all electric energy sources. Control circuit devices, such as push buttons, selector switches, and interlocks, may not be used as the sole means for de-energizing circuits or equipment. Interlocks for electric equipment may not be used as a substitute for lockout/tagout.

Stored electrical energy which might endanger personnel shall be released. Capacitors shall be discharged and high capacitance elements shall be short-circuited and grounded, if the stored electrical energy might endanger personnel.

APPLICATION OF TAGS AND LOCKS

A lock and a tag shall be placed on each disconnecting means used to de-energize circuits and equipment on which work is to be performed, except as provided later in this document. The lock shall be attached so as to prevent persons from operating the disconnecting means unless they resort to undue force or the use of tools.

Each person applying a lock will have his/her own unique lock and key. Opening of an person's

lock under certain circumstances may entail calling the individual back to the campus.

Each tag shall contain a statement prohibiting unauthorized operation of the disconnecting means and removal of the tag.

If a lock cannot be applied, or if it can be demonstrated that tagging procedures will provide safety equivalent to that of a lock, a tag may be used without a lock. In such cases, the following additional requirements shall be met:

The tags shall be of a distinctive, standardized design that clearly prohibits unauthorized energizing of the circuits and removal of the tag.

A tag may not be used without an additional safety measure such as the removal of an isolating circuit element, blocking of a controlling switch, or opening of an extra disconnecting device, or removal of wires from supply at the source.

All persons who have access to controlling devices shall be trained in and familiar with tagging

procedures.

A lock may be placed without a tag only under the following conditions:

Only one circuit or piece of equipment is de-energized

AND

The lockout period does not extend beyond the work shift

AND

Affected employees are familiar with this procedure

Verification of the de-energized condition is vital. A qualified person shall operate the equipment operating controls or otherwise verify that the equipment cannot be started. A qualified person shall verify that the circuit elements and equipment parts are de-energized. A determination shall also be made for inadvertently induced or unrelated voltage "backfeed" which can be introduced into the circuit. Shop supervisors will determine qualifications.

RE-ENERGIZING EQUIPMENT

Prior to reenergizing equipment, a qualified person shall conduct tests and visual inspections, as necessary, to verify that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed so that the circuits and equipment can be safely reenergized. All affected employees shall be notified to stay clear of circuits and equipment. Locks and tags can then be removed after a final visual inspection has been made.

WORKING ON OR NEAR ENERGIZED PARTS

In the case of certain rare and specific instances when employees must work on energized equipment, only qualified individuals may perform such work. These persons must be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.

OVERHEAD LINES

If work is to be performed near overhead lines, the lines shall be de-energized and grounded, or other protective measures shall be taken before work is started. If the lines shall be de-energized, arrangements shall be made with the person or organization that operates or controls the electric circuits involved to de-energize and ground them. If protective measures are provided such as guarding, isolating, or insulating, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools or equipment.

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

For voltages to ground 50 kV or below - 10 feet

For voltages to ground over 50 kV - 10 feet plus 4 inches for every 10 kV over 50 kV

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 the table below unless:

The person is insulated from the energized part (gloves, etc.).

The energized part is insulated from any other conductive object at a different potential and from the person.

The person is insulated from all conductive objects at a potential different from the energized part.

ALTERNATING CURRENT APPROACH DISTANCES

<u>Voltage range</u>	<u>Maximum approach distance</u>
300V and less	Avoid contact
Over 300V, not over 750V	1 ft. 0 in.
over 750V not over 2kV	1 ft. 6 in.
Over 2kV, not over 15kV	2 ft. 0 in.
Over 15kV, not over 37kV	3 ft. 0 in.
Over 37kV, not over 87.5kV	3 ft. 6 in.
Over 87.5kV, not over 121kV .	4 ft. 0 in
Over 121kV, not over 140kV	4 ft. 6 in.

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 that a clearance of 10 feet is maintained. If the voltage is higher than 50kV, the clearance shall be increased 4 inches for every 10kV over that

voltage. However, under any of the following conditions, the clearance may be reduced:

If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 feet.

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 structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.

If the equipment is an aerial lift insulated for the voltage involved, and if the work is performed by a qualified person, the clearance may be reduced to the distance given in the above table.

Employees standing on the ground may not contact the vehicle or mechanical equipment or any of its attachments, unless the employee is using protective equipment rated for the voltage.

If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding 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.

ILLUMINATION

Employees may not enter spaces containing exposed energized parts, unless illumination is provided to enable 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.

CONFINED OR ENCLOSED WORK SPACES

When working in confined or enclosed spaces (such as manholes or vaults) that contain energized parts, employees shall take precautions (such as the use of protective shields, barriers, or insulating materials) to avoid inadvertent contact with these parts. Doors, hinged panels and the like shall be secured to prevent their swing into an employee and causing the employee to contact exposed energized parts.

The above precautions are supplemental to any and all other guidelines for working in confined spaces such as those regarding the use of respiratory protection. Refer to the College's Confined Space Entry Procedures.

CONDUCTIVE MATERIALS

Conductive materials and equipment that are in contact with any part of an employee's body shall be handled in a manner that will prevent them from contacting exposed energized conductors or circuit parts. If employees handle long dimensional conductive objects such as ducts and pipes in areas with exposed live parts, supervisors will minimize the hazards.

PORTABLE LADDERS

Portable metal ladders and ladders with longitudinal metallic reinforcement may not be used wherever employees might contact exposed energized parts.

CONDUCTIVE APPAREL

Conductive articles of jewelry and clothing (such as watch bands, bracelets, rings, key chains, necklaces, metal headgear, etc.) may not be worn if they might contact exposed energized parts. The contact hazard may be eliminated if such articles are rendered nonconductive by covering, wrapping, or other insulating means.

HOUSEKEEPING

"Housekeeping" duties involving conductive cleaning materials (including conductive solids such as steel wool and metalized cloth as well as conductive liquid solutions) shall not be used in the proximity of energized parts unless procedures are followed which will prevent electrical contact.

PORTABLE ELECTRICAL EQUIPMENT

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

Portable cord- and plug-connected equipment and flexible cord sets (extension cords) shall be visually inspected before use for external defects such as loose parts, deformed and missing pins, or damage to the outer insulation). If there is a defect or evidence of damage that might expose an employee to injury, no employee may use the defective or damaged item until necessary repairs and tests have been made.

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

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

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. Ground fault protection shall also be provided.

Employees' hands may not be wet when plugging and unplugging flexible cords and associated equipment.

RECLOSING CIRCUITS

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

PERSONAL PROTECTIVE EQUIPMENT

Employees working in areas where there are potential electrical hazards shall be provided with 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. Employees shall wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts. Employees shall wear protective equipment for the eyes or face wherever there is a danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion.

Fuse handling equipment, ropes, handlines protective shields, protective barriers, and insulated tools shall be used when appropriate to protect employees from exposed energized parts.

ALERTING TECHNIQUES

Safety signs, safety symbols, or accident prevention tags shall be used where necessary to warn personnel about electrical hazards which may endanger them. Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas exposing individuals to un-insulated energized circuit parts. Conductive barricades may not be used. If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect employees.