Overview

This document details electrical safety procedures for Traffic Signal employees, ensures compliance with Occupational Safety and Health Administration (OSHA) and National Electrical Code (NEC) standards, and establishes minimum requirements for 'qualified' employees. Only qualified Traffic Signal employees are permitted to work on energized electrical equipment.

Requirements for working on electrically energized traffic signal equipment were established after a thorough hazard assessment by Program Management and Employee Safety, and are specific for that equipment and type of work. These requirements shall not be applied to other types of electrical work. The method for all other electrical work in the Department is always to de-energize equipment in accordance with Safety Bulletin on Lockout/Tagout Procedures, and Safety Bulletin on Electrical Safety.

Except where specifically noted in the section on Personal Protective Equipment (PPE), all existing Department policies and requirements remain in effect including: High Visibility Apparel & Hard Hat Policy, Fall Protection, Aerial Lift Devices, and Railroad Safety.

Definitions

**Insulating Aerial Lift Devices:** Insulating aerial lift devices shall meet the requirements of ANSI/SIA A92.2-2009, Vehicle-Mounted Elevating and Rotating Aerial Device, commonly referred to as an insulated bucket truck.

**AED:** Automated External Defibrillator

**Arc Flash Suit:** A complete arc rated clothing and equipment system that covers the entire body, except for the hands and feet.


Energized: Equipment and/or wiring electrically connected to a source of voltage.

Flame Resistant: ASTM listed clothing, designed to reduce shock and burn potential from electric arcing to a survivable injury.

Arc Rating: The value attributed to the materials that describe their performance to exposure to an electric arc discharge. The arc rating is expressed in cal/cm^2 and is derived from the determined value of the arc thermal performance value (ATPV) or energy of breakopen threshold (Ebt) (should a material system exhibit a breakdown response below the ATPV value).

MAD: Minimum Approach Distances (Excerpt from OSHA Table 1910. 269 (x). Employees that are qualified and properly equipped with personal protective equipment, tools and lifts may work within the MAD.

<table>
<thead>
<tr>
<th>Nominal voltage in kilovolts (KV)</th>
<th>Distance: Phase to ground exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05 to 1.0</td>
<td>Avoid contact 2'-1&quot; (0.64m)</td>
</tr>
<tr>
<td>1.1 to 15.0</td>
<td></td>
</tr>
<tr>
<td>Reference Table R-6 in [1910.269(l)(10)]</td>
<td></td>
</tr>
</tbody>
</table>

NEC: National Electrical Code.


PPE: Personal Protective Equipment.

OSHA: Occupational Safety and Health Administration.

PDA: Power Distribution Assembly, a traffic signal cabinet component.

Qualified Employee: An Employee who has successfully undergone on-the-job training for the purpose of obtaining skills and knowledge necessary to be considered a qualified employee, and who has attended department provided training on electrical safety, and who has demonstrated ability to work safely on energized equipment at his or her level of training.
All employees must be observed performing the work on which they are to be qualified by a Supervisor. The supervisor must certify that the employee is qualified to work on energized equipment. (The Supervisor can assign another qualified employee to work with the employee before the employee is qualified.)

**Prohibited Approach Boundary:** Minimum approach distance to exposed live parts to prevent flashover or arcing. For traffic signal cabinet and signal head work, the minimum prohibited approach boundary begins with opening of cabinet and/or enclosure.

**Limited Approach Boundary:** An unqualified person shall maintain a minimum approach distance of 4 feet from all energized equipment for voltages of less than 600 volts, unless accompanied by a qualified person. For voltages above 600 volts, the minimum approach distance for an unqualified person, unless accompanied by a qualified person, shall be those found in the NYS High Voltage and Proximity Act but **at no time be less than 10 feet.**

**Restricted Approach Boundary:** Closest distance to exposed live parts a qualified person shall approach without proper PPE and tools. For all exposed conductors, the restricted approach boundary is 1 foot. Restricted approach boundary does not apply to closed cabinets.

**Arc Flash Protection Boundary:** The farthest established boundary from the energy source. If an arc flash occurred, this boundary is where an employee would be exposed to a curable second degree burn (1.2 calories/cm²).

**Voltage Rated (VR) Tools:** ASTM rated tools for work on energized circuits, and shall be rated for a minimum of 600 volts.

**General Requirements**

Qualified Traffic Signal employees shall work on energized electrical equipment consistent with their training and within the limitations of their tools and personal protective equipment.

Traffic signal employees shall not perform work on electrical utility lines or perform emergency repairs or any other work that is clearly responsibility of the utility. Employees shall consult with their supervisor or Regional Traffic Signal Engineer-In-Charge (EIC) with any questions.

Unqualified persons, including non-Department employees and members of the general public, shall not be permitted closer than 4 feet of an open "Energized" traffic signal box (limited approach boundary). Employees shall verify that cabinets are not energized by using a non contact voltage detector prior to making physical contact with the enclosure. Traffic Signal employees shall wear all appropriate PPE, including but not limited to, eye protection, gloves and safety footwear prior to work on exposed or live conductors (restricted approach boundary).
Personnel working from non-insulated platform trucks or other vehicles that are not insulated shall not be closer than 10 feet to energized equipment of 600 volts or greater. The distance will be measured from the closest body part of the employee or any part of the non insulated vehicle to the closest energized conductor.

Non-insulated platform trucks or other un-insulated vehicles shall not be used within the Minimum Approach Distances (MAD).

When an energized conductor will be less than 10 feet from the Traffic Signal employee and the voltage is unknown, the Supervisor shall be consulted and contact the Utility as necessary. If the Utility cannot provide the voltage the conductor shall be considered to be 600V or greater. Only ANSI/ASI approved aerial lifts shall be used when working closer than 10 feet to energized equipment of 600V or greater.

Any work performed in close proximity to energized equipment of 600 volts or greater shall be done under adequate lighting conditions, either natural or artificial. A spotter shall observe all overhead operations while personnel is in proximity to energized conductors of 600V or greater. Spotters shall be trained in the operation of the insulated lift device.

Traffic Signal employees shall report any electrical shocks to their immediate supervisor. Supervisors shall determine the likely cause and recommend corrective actions prior to work beginning again. All Traffic Signal Employees shall be certified in CPR/First Aid/AED annually. A first aid kit shall be provided in all traffic signal crew response vehicles.

Training

Part 1. Electrical Training Qualifying Employees to work on Energized Department Equipment (Signal Heads and Traffic Signal Cabinets, etc) shall include the following:

All new Traffic Signal employees assigned to work on energized equipment shall be provided Department specific formal training as soon as practical after the time of hire. Un-trained employees shall not work on energized equipment. Training shall include:

- Effects, causes and prevention of electrical shocks and arc burns.
- Selection, inspection, limitations, and wearing of PPE.
- Department work practices for energized equipment.
- Safety requirements contained in this and other relevant Department safety issuances.

Part 2. In addition to Part 1, training that qualifies employees to work within the Minimum Approach Distances (MAD) shall be provided and include the following elements:

- The different types of electrical conductors used by the electrical Utility likely to be encountered by Traffic Signal employees.
- The voltage associated with the different energized conductors.
• Any special precautions that are needed when working with or near an energized conductor.
• The MAD for the respective voltage of conductors.
• The PPE required for work within the MAD.
• The Department policy when the voltage is unknown or unidentified.
• The appropriate aerial lift device and other tools needed for work within the MAD.
• Training to be renewed annually.

Part 3. As part of their training all Traffic Signal employees shall receive the Department’s electrical safety handbook.

Retraining:

Refresher training shall be provided to all employees, in addition to the Department specific formal training, every three years.

Verification of employee compliance with safety-related work practices:

Through regular supervision or through inspections conducted on at least an annual basis, each employee shall be observed to make sure he/she is complying with the safety-related work practices required by this standard. The result shall be recorded in the employee annual performance evaluation.

Training documentation:

Training documents shall be maintained for the duration of the employee’s employment through SLMS (Statewide Learning Management System). The documentation shall contain the content of the training, each employee’s name, and dates of training.

Auditing:

The electrical safety policy shall be audited by Employee Safety and Health to verify the principles and procedures of the electrical safety policy are in compliance with the standard. The frequency of the audit shall not exceed 3 years. Also, field work shall be audited to verify the requirements contained in the procedures of the electrical safety policy are being followed. When the auditing determines that the principles and procedures of the electrical safety program are not being followed, the appropriate revisions to the training program or revisions to the procedures shall be made. The audit shall be documented.
**Personal Protective Equipment (PPE)**

PPE requirements are intended to:

- Ensure compliance with existing Department procedures in Safety Bulletins on Work Clothing Guidelines, High Visibility Apparel & Hard Hat Policy, and Safety Footwear Policy; and comply with NFPA 70E recommendations to protect employees from electrical shocks and electrical arc hazards.

(To meet the above requirements and/or as new products or work procedures warrant, Traffic Signal management may change or substitute PPE.)

Where potential exists for contact with energized components or equipment, employees shall wear, during all work on poles, cabinets, cabling or signal heads, appropriate PPE identified in Tables 1 & 2 below and found under Procedures, Power Distribution Assembly (PDA) Special Circumstances on page 7.

<table>
<thead>
<tr>
<th>Head</th>
<th>Department issued, high-visibility orange, non-conductive, high impact, ANSI EG rated hard hat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>ANSI Z87.1 Safety Glasses</td>
</tr>
<tr>
<td>Hand</td>
<td>ASTM voltage rated gloves with leather over gloves*</td>
</tr>
<tr>
<td>Torso</td>
<td>Garments that meet current Department requirements for high visibility apparel. ASTM Arc Rated Clothing may be required when working on un-fused PDAs.</td>
</tr>
<tr>
<td>Foot</td>
<td>ASTM F/I/75/C/75 or M/I/75/C/75 with EH (nonconductive notation).</td>
</tr>
<tr>
<td>Tools</td>
<td>Voltage rated tools</td>
</tr>
</tbody>
</table>

**Table 1**

**Minimum PPE for Work on Fused Energized Equipment**

<table>
<thead>
<tr>
<th>Head and Face</th>
<th>Department issued, high-visibility orange, non-conductive, high impact, ANSI EG rated hard hat and arc rated balaclava and face shield.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>ANSI Z87.1 Safety Glasses</td>
</tr>
<tr>
<td>Hand</td>
<td>ASTM voltage rated gloves*, heavy duty leather gloves (as needed)</td>
</tr>
<tr>
<td>Torso</td>
<td>ASTM arc rated coveralls or arc rated rain jacket and pants.</td>
</tr>
<tr>
<td>Foot</td>
<td>ASTM F/I/75/C/75 or M/I/75/C/75 with EH (nonconductive notation) and insulated over boot.</td>
</tr>
<tr>
<td>Tools</td>
<td>Voltage rated tools</td>
</tr>
<tr>
<td>Hearing protection</td>
<td>Ear canal insert</td>
</tr>
</tbody>
</table>

**Minimum PPE for Work on Un-fused Energized Equipment**
All rated gloves will be inspected by a manufacturer-approved laboratory every 6 months or replaced. All new and unused gloves contained in a sealed bag shall be inspected annually.

To avoid damage from sharp edges, during maintenance, component changes and troubleshooting, and when changing the controller and cards, leather gloves shall be worn in addition to VR rated gloves.

Table 2

<table>
<thead>
<tr>
<th>Additional PPE for Work on Energized Equipment During Foul Weather</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torso and Legs</td>
</tr>
<tr>
<td>Foot</td>
</tr>
</tbody>
</table>

Tools and Equipment

ASTM voltage rated tools shall be used for all work on energized equipment. Inspection is required prior to each use. Voltage rated tools have a laminated exterior coating. A contrasting interior color is revealed when scratched or damaged. If this interior coating is exposed, the **voltage rating is void, and the tool shall be removed from service.**

Procedures

Power Distribution Assembly (PDA) or Electrical Service Disconnects Special Circumstances

Existing traffic signal cabinets may not be provided with a disconnect from the utility. Installing or removing a PDA in these cabinets necessitates working on electrical lines with unlimited amperage. Replacing Electrical Service Disconnects represents a similar hazard. This work presents potential for an arc flash exceeding the protection afforded by the PPE identified in Tables 1 & 2. Therefore, qualified employees replacing PDAs in Traffic Signal Cabinets not provided with utility service disconnects or Electrical Service Disconnects shall require the utility to temporarily disconnect electrical service to safely replace the PDA; **OR** qualified employees shall wear ASTM arc rated full rain suit or coveralls; balaclava, face shield, safety glasses, hardhat, EH rated overboots, EH rated work boots and hearing protection. (This ensemble must have a minimum ASTM flash arc rating of 8 calories/centimeter squared.) A physical barricade must also be installed to prevent unqualified employees, employees not provided with appropriate personal protective equipment, other workers, and the general public closer than four (4) feet to the traffic signal cabinet when replacing a live PDA or Electrical Service Disconnect.
Troubleshooting Following a Traffic Accident or Physical Damage to Signal Installation

Approach the general area cautiously and evaluate for overhead or ground hazards before approaching the traffic signal equipment. Minimum PPE (Table 1) and VR tools shall be used when approaching the pole and cabinet. If snow, ice, rain or water has accumulated in the area, ASTM arc rated rubber boots shall be worn.

If the electrical service equipment is damaged, local power company shall be called to disconnect the service feed until DOT’s pole, weather head and electrical service equipment have been installed or repaired. A non-contact voltage detector/meter shall be used to determine if surrounding area is energized. The pole and cabinet shall be tested to determine if they are energized. If the service feed is intact and the disconnect is O.K., turn off the power, open and secure door and begin replacing components that are damaged.

Qualified Traffic Signal employees working between the HVPA distance and the MAD: MAD (Minimum Approach Distance) 600V or Greater.

- The Supervisor or his or her designee shall determine that the work can be performed safely, and is necessary to be performed. An electrical work permit shall be issued in CarteGraph or by written permit (see attached example).
- When there is a question regarding the voltage of the energized conductor the Supervisor shall verify the voltages with the Utility.
- The Traffic Signal Supervisor shall ensure that employees working up to the MAD are qualified.
- The Traffic Signal Supervisor shall verify that the appropriately rated personal protective equipment, tools and vehicles are used. Any work to be performed within the MAD the Supervisor shall contact the utility company and request that the Utility Company de-energize or insulate or relocate the hazard for voltages of 600V and above or a Close Proximity to High Voltage Energized Electrical Work Permit shall be issued.
- All questions will be referred to the Regional Traffic Signal EIC.

Engineering Considerations for Traffic Signal Installations

- Each electrical utility service shall have a lockable service entrance disconnect, located for easy and safe access (some services may also require meters).
- Access to the poles, cabinets, cabling and the weather heads shall not create a hazard in reference to overhead high voltage lines, secondary lines, street lamps, and deep ditches. The pole top must be accessible by bucket/tower truck.
- Ground wires from poles to ground rods shall be identified by a drawing located in the cabinet or marked on the outside of the pole to indicate location and direction.
- Main electrical disconnects shall be located on the signal pole or isolated post to reduce potential exposure to traffic and the public.
• Traffic signal cabinets should be located to reduce potential exposure to vehicle traffic, the public and should be placed in a safe location for the Traffic Signal employee to work on the cabinet. Cords on the controller shall be protected from pinching. Cabinets shall contain outside labels to warn of hazardous voltage, and indicate that the unit is to be accessed by qualified personnel only. The inside of the cabinet shall be labeled to warn for potential arc flash and shock hazard.

**Equipment Labeling Requirement for Electrical Hazards:**

All traffic signal equipment shall be labeled with the following information:

1) Nominal voltage, which is 120 volts for traffic signal equipment
2) Arc Flash Boundary, which is 9” for traffic signal equipment
3) Working distance (10” for fused power)
4) Incident energy at AFB 1.2 cal/cm^2
5) One of the following:
   I. Available incident energy and the corresponding working distance (1.0 cal/cm^2 at 10”)
   II. Minimum **arc rating** of clothing (1.0 cal/cm^2 for fused cabinet power and 8.0 cal/cm^2 clothing for unfused - PDA and disconnect switch installation power)
   III. Required **level** of PPE (1.0 cal/cm^2 for fused cabinet power and 8.0 cal/cm^2 PPE for unfused - PDA and disconnect switch installation power)
   IV. Highest Hazard/Risk Category (**HRC**) for the equipment (HRC=0 for fused power and HRC=2 for unfused power)

**References**

- Safety Bulletin  Fall Protection
- Safety Bulletin  Working in Proximity to Water
- Safety Bulletin  Aerial Lift Devices
- Safety Bulletin  Rental / Leased and Surplus Equipment
- Safety Bulletin  High Visibility Apparel and Hard Hat Policy
- Safety Bulletin  Electrical Safety
- Safety Bulletin  Lockout/Tagout Procedures
- Safety Bulletin  Railroad Safety
- MAP 7.11-17  Inspection of Aerial Lift Devices
- ANSI A92.2 – 1990  Vehicle-Mounted Elevating & Rotating Aerial Device
- ANSI A92.8 – 1993  Vehicle-Mounted Bridge Inspection and
Blanket Energized Electrical Work Permit – Fused Power

PART I: TO BE COMPLETED BY REQUESTER:

1) Signals CarteGraph ID: N/A
   Work Order #: N/A

   Location Description: All locations when work is performed on fused power

2) Scope of work to be done: Any and all work performed on fused electrical circuit with voltage measured at 135 VAC or less

3) Justification of why work cannot be deferred until the circuit/equipment is de-energized, relocated or insulated: Work performed on active traffic signals where de-energizing the active power source may result in placing the public at risk or would result in removing a safety device whose purpose is to protect public safety.

   X N/A N/A
   Requester's Name Date

PART II: TO BE COMPLETED BY THE QUALIFIED PERSON DOING THE WORK:

1) Detailed job description procedure to be used in performing the above detailed work: Routine traffic signal maintenance and repair.

2) Description of the Safe Work Practices to be employed: Work to be performed using industry standard work practices.

3) Results of the Shock Hazard Analysis (NFPA 70E 130.2A): Avoid contact

4) Results of the Flash Hazard Analysis (NFPA 70E 130.3): Hazard Risk Category (HRC) 0

5) Determination of the Flash Protection Boundary (NFPA 70E 130.3A): 9 inches

6) Necessary personal protective equipment to safely perform the assigned task: Hard hat, safety glasses, EH rated work boots, voltage rated tools, voltage rated gloves with leather over glove.

7) Means employed to restrict the access of unqualified persons from the work area: Limited Approach Boundary is 4.0 ft use cones or barricades

8) Was a Job Briefing including discussion of all site-related hazards completed prior to the start of work? X Yes No

9) Can the job be completed safely? X Yes No (if No, return to requestor)

   X N/A N/A
   Electrically Qualified Person Performing Work Date

PART III: APPROVAL TO PERFORM THE WORK WHILE ENERGIZED:

   X N/A N/A
   Supervisor or Designee Date

PERMIT EXPIRATION DATE:

   X None Time: None
Energized Electrical Work Permit – Unfused Power

PART I: TO BE COMPLETED BY REQUESTER:

1) Signals CarteGraph ID: _____ - _____ - _____ Work Order #: ______________________________
   Location Description: ___________________________________________________________________

2) Scope of work to be done: __________________________________________________________________
   _______________________________________________________________________________________

3) Justification of why work cannot be deferred until the circuit/equipment is de-energized, relocated or insulated:
   _______________________________________________________________________________________

   X
   Requester’s Name ___________________________ Date ______________

PART II: TO BE COMPLETED BY THE QUALIFIED PERSON DOING THE WORK:

1) Detailed job description procedure to be used in performing the above detailed work:
   _______________________________________________________________________________________
   _______________________________________________________________________________________

2) Description of the Safe Work Practices to be employed:
   _______________________________________________________________________________________

3) Results of the Shock Hazard Analysis (NFPA 70E 130.2A): Avoid contact

4) Results of the Flash Hazard Analysis (NFPA 70E 130.3): Hazard Risk Category (HRC) = 2

5) Determination of the Flash Protection Boundary (NFPA 70E 130.3A): 32 inches

6) Necessary personal protective equipment to safely perform the assigned task: Employee shall wear minimum 8 calories/centimeter squared ASTM arc rated coveralls or arc rated rain jacket and pants; arc rated balaclava, face shield, safety glasses, hard hat, hearing protection, voltage rated and leather over gloves, EH rated work boots and insulated over boots, and voltage rated tools.

7) Means employed to restrict the access of unqualified persons from the work area: Limited Approach Boundary is 4 ft use cones or barricades

8) Was a Job Briefing including discussion of all site-related hazards completed prior to the start of work? Yes No

9) Can the job be completed safely? Yes No (if No, return to requestor)

   X
   Electrically Qualified Person Performing Work ___________________________ Date ______________

PART III: APPROVAL TO PERFORM THE WORK WHILE ENERGIZED:

   X
   Supervisor or Designee ___________________________ Date ______________

PERMIT EXPIRATION DATE:

   X
   Time: ______________
Close Proximity to High Voltage Energized Electrical Work Permit
For Aerial Cable

PART I: TO BE COMPLETED BY REQUESTER:

1) Signals CarteGraph ID: N/A Work Order #: N/A
   Location Description: All Locations in close Proximity to "AERIAL CABLE"

2) Scope of work to be done: Any and all work preformed in close proximity to "AERIAL CABLE" as described as a completely insulated and grounded Electrical transmission system which is suspended between utility poles.

3) Justification of why work cannot be deferred until the circuit/equipment is de-energized, relocated or insulated:
   As the aerial cable by design and installation is protected from the danger of Electrical shock per NESC 230C.1, it shall be considered to be made safe by the Utility Company.

   X ___________________________ ___________________________
   Requester's Name Date

PART II: TO BE COMPLETED BY THE QUALIFIED PERSON DOING THE WORK:

1) Detailed job description of procedures to be followed (Must include Description of Safe Work Practices, Assessed Shock Hazards, Assessed Flash Arch Hazard, Necessary PPE and Equipment and Restricted Access to non-qualified Persons): Any and all work conducted within close proximity to Aerial Cable shall be performed by a Qualified Employee, working within an insulated aerial lift vehicle. While Aerial Cable is considered safe, employees shall avoid physical contact with the aerial cable by persons, tools, or equipment. Only standard PPE is required when working within close proximity to Aerial Cable (Hard Hat, Eye Protection, EH Rated Safety Shoes and Approved Fall Protection).

2) Is a Job Briefing including discussion of all site-related hazards to be completed prior to the start of work?
   Yes X No

3) Can the job be completed safely? Yes X No (if no, return to requester)
   Electrically Qualified Person Performing Work
   N/A                      N/A
   Date

PART III: APPROVAL TO PERFORM THE WORK WHILE ENERGIZED:

   X ___________________________ ___________________________
   Supervisor or Designee Date

PERMIT EXPIRATION DATE:
   X ___________________________ ___________________________
   Time: None