

Subject Electrical Systems Safe Work Practices	Effective Date May 9, 2003	Initiated Power Systems Branch
	Supersedes New	Approved Engineering Department Head

Applicability

This standard provides safe work practices that shall be used for electrical work on:

- 120/208 Volt panelboards
- 480 Volt Motor Control Centers
- 480 Volt Network Protectors
- 480 Volt, 4 kV & 13 kV Switchgear
- 26 kV & 138 kV Switchyards at PPPL

Introduction

NFPA 70E 2000, a national consensus standard, is referenced in OSHA 29CFR1910 Subpart S, and therefore compliance by PPPL is required. Although NFPA 70E is quite detailed in delineating safe work practices there are some areas that require additional interpretation. Examples of such areas and the corresponding PPPL safe work practices, based on NFPA 70E 2000 and accepted industrial practices, follow:

120/208 Volt Panelboards

When the supply circuit breaker of a 120/208 Volt panelboard is located inside the panelboard, normal construction activities such as adding a circuit breaker, installing conduit, pulling cables, etc., may be performed if all of the following conditions are met:

- The panelboard appears to be in good condition both on the outside and inside, i.e., no sign of moisture, corrosion, mechanical damage, etc;
- The room in which the panelboard is located is reasonably dry, i.e., no sign of condensation on room or equipment surfaces;
- the line terminals of the supply circuit breaker have a polycarbonate shield;
- the supply breaker is opened, locked and tagged per ESH-016;
- a zero voltage check is been performed on load side;
- the basic complement of protective clothing and PPE for all electrical work is worn: 5 cal FR shirt, cotton T shirt and 8 cal FR pants, leather work shoes/boots, hardhat, and safety glasses/goggles (hard hat may be removed after zero voltage check if there are no overhead activities);
- leather gloves are worn to protect the hands from injury unless good finger dexterity is required to perform a particular task;
- fiberglass (non-conductive) fish tape is used to pull cable or wires.

If all the conditions specified above are not met, the panel board shall be de-energized.

Basis: The line terminals of a circuit breaker remain energized after the circuit breaker is open. The polycarbonate shield prevents accidental contact with energized parts either directly or via a conductive object such as a tool. Thus both electric shock and worker initiated arc flash are prevented

480 Volt Motor Control Centers

Maintenance work in an MCC cubicle while the MCC is energized is permitted if all of following conditions are met:

- The MCC and all cubicles appear to be in good condition both on the outside and inside, i.e., no sign of moisture, corrosion, mechanical damage, etc;
- The room in which the MCC is located is reasonably dry, i.e., no sign of condensation on room walls or equipment surfaces;
- the line terminals of the cubicle supply circuit breaker have a polycarbonate shield;
- the supply breaker is opened, locked and tagged per ESH-016;
- a zero voltage check is been performed on load side;
- all circuits in the MCC cubicle that derive power externally shall be locked and tagged;
- the basic complement of protective clothing and PPE for all electrical work is worn: 5 cal FR shirt, cotton T shirt and 8 cal FR pants, leather work shoes/boots, hardhat, and safety glasses/goggles (hard hat may be removed after zero voltage check if there are no overhead activities);
- leather gloves are worn to protect the hands from injury unless good finger dexterity is required to perform a particular task.

If all the conditions specified above are not met, the MCC shall be de-energized.

Basis: The line terminals of a circuit breaker remain energized after the circuit breaker is open. The polycarbonate shield prevents accidental contact with energized parts either directly or via a conductive object such as a tool. Thus both electric shock and worker initiated arc flash are prevented.

Insertion or Removal of Starter Buckets

The normal practice shall be to de-energize the MCC prior to insertion or removal of starter buckets. Insertion or removal into a live MCC may be done if the incident energy is less than 1.2 cal/cm² and the worker is dressed for a hazard category 3 task. The AC Power Section will perform the calculation for incident energy.

480 Volt Network Protectors

480-Volt Network Protectors may not be manually operated while energized.

Basis: Operating a network protector requires that the door is open and the operator must be positioned very close to the equipment. Because the available short circuit current at this location is extremely high (~ 80 kA), a substantial arc blast hazard exists.

480 Volt, 4 kV & 13 kV Switchgear

Racking:

- Switchgear must be de-energized as a prerequisite to racking a circuit breaker. Power Systems Branch Head approval (or Electrical Engineering Division Head approval in his absence) is required to rack a circuit breaker with a hot bus.
- For this purpose, it is acceptable to use the switchboard bus voltmeter as the means of verifying that the bus is de-energized. The voltages of all three phases should be checked prior to de-energization and the absence of voltage for all three phases after de-energization.
- Racking may be done on a hot bus, without the approval of the Power Systems Branch Head (or Electrical Engineering Division Head approval in his absence), if the switchgear is provided with remote rack capability. The person performing the racking operation shall stand to the side of the cubicle as far away as the remote rack cable permits and behind a convenient barrier. The area shall be cleared of all other workers and controls established to prevent pedestrian traffic. Entering the cubicle when the breaker is racked in, to set up for remote racking, is a hazard category 3; remote racking is a hazard category 2.

Basis: The failure of a circuit breaker during racking could result in shrapnel travelling at high speeds. Protective clothing and PPE offer no protection against shrapnel.

26 kV & 138 kV Switchyards

Entrance restrictions:

- Only qualified workers are permitted in the 26 kV & 138 kV switchyards.
- A qualified worker must escort unqualified workers in the switchyard.
- Safety ropes (to define a safe work area) and training may be used in lieu of an escort for unqualified workers for a given task.

Basis: OSHA 29CFR1910.269(u)(4).

- A hard hat and safety glasses must be worn in the 26 kV (SE Quad switchyard) and 138 kV switchyard.

Basis: Standard practice of PSE&G and Philadelphia Electric.

Disconnect switch operation:

If disconnect switch operation is performed (26 kV or 138 kV), a hardhat with FR rated faceshield, safety glasses, FR clothing, V rated gloves and dielectric overshoes must be worn over leather shoes. This task is a hazard category 2. Prior to operation of the disconnect switch, the switchyard shall be cleared of all unnecessary personnel.

Basis: NFPA 70E, Table 3-3.9.1, Other Equipment 1kV and Above, Outdoor disconnect switch operation (gang-operated from grade).
NFPA 70E, Part II, Sections 3-3.7 & 3-5.9.5.2.
PSE&G standard operating practices

Trouble Shooting

When making voltage measurements, as part of trouble shooting activities, safety glasses (in lieu of an FR rated face shield) and Class 00 **black** rubber gloves (in lieu of V rated gloves with leather protectors) may be used for the following circuits when the available short circuit current is below the levels shown:

1. 125 Volt DC control circuits where the available short circuit current is less than 5 kA and the incoming DC feed is fused at the control cabinet. Examples of control cabinets that meet this criterion are as follows:
 - C & D Sites MG control cabinets,
 - 138 kV Switchyard relay house control racks
 - 5 kV & 15 kV Switchgear **control** cubicles

The above cabinets have this in common; they are all at least 50 ft from the Main DC Distribution Cabinet and are fed by #2 wire.

2. 120/208 Volt AC Power & Lighting Cabinets where the available short circuit current is less than 10 kA.

NOTE: In situations where the above circuits share an area or cubicle with a high energy circuit that is not in an electrically safe work condition, the level of PPE will be determined on the basis of the high energy circuit.

Basis: Trouble shooting requires good visibility and finger dexterity. An FR rated face shield reduces visibility and V rated gloves with leather protectors reduces finger dexterity. When the hazard is insufficient to warrant their use, safety and efficiency are better served by using more appropriate PPE.

If there is any question regarding the available short circuit current for a control cabinet or power panel contact the AC Power Section.

Attachments

None