

## BP-Husky Refinery – Toledo, OH

<b>Document Type:</b> Procedure	<b>Refinery Wide</b>	<b>Procedure No.:</b> SAF 095
<b>Effective Date:</b> 2/25/16	Working on or near Energized Electrical Equipment	<b>Rev. No.:</b> 6
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<b>SCOPE</b>	This procedure is designed to guard against and minimize injury to personnel who work on or near energized electrical equipment.
<b>HEALTH</b> <b>Special PPE &amp; Special Hazards</b>	The procedure details specific PPE designed against Arc Flash, Blast and Shock.
<b>SAFETY</b>	Protection from electrical hazards including Shock, Arc Flash and Blast.
<b>REFERENCE DOCUMENTS</b>	NFPA 70E 2015 SAF 037 OSHA 1910.269
<b>SPECIAL MATERIALS &amp; EQUIPMENT</b>	N/A
<b>QUALITY</b>	N/A
<b>ENVIRONMENTAL</b>	N/A

## OVERVIEW

Electrical incidents and injuries are preventable. This procedure is designed to guard against and minimize injury to personnel and provide for the protection of property by educating employees in the proper safe electrical work practices, including the use of appropriate personal protective equipment.

This procedure applies to energized electrical systems 50 volts or greater, nominal. This procedure applies to all electrical employees including visitors and contractors while working at the BP Toledo Refinery. Only qualified persons may work on or near energized electrical equipment. Such persons shall be trained and capable of working safely on or near energized circuits and be familiar with the proper use of special precautionary techniques, personal protective equipment, shielding and insulating, insulated tools and site specific procedures.

### 1.0 Definitions

1. **Arc Flash Boundary** – When an arc flash hazard exists, an approach limit from a prospective arc source in which a person could receive a second degree burn (1.2 cal/cm<sup>2</sup>) if an electrical arc flash were to occur. Refer to Table 2.0
2. **De-Energized** – Isolated from electrical energy. Free from any electrical voltage or electric charge and not having a potential different from that of earth.
3. **Electrically Qualified Person** – An experienced person properly trained and familiar with the construction and operation of the equipment and the hazards involved. Qualified persons must be at least able to distinguish exposed live parts and their nominal voltages, as well as the clearance distances and the corresponding voltages to which they will be exposed. Whether an employee is considered to be a qualified person will depend upon various circumstances in the workplace. It is possible and, in fact, likely for an individual to be considered qualified with regard to certain equipment in the workplace, but unqualified as to other equipment. See Section 8.0 for training requirements.
4. **Electrical Hazard** – A potential source of personal injury, either directly or indirectly caused by an electrical energy source. The hazards include shock, blast, burns, arc flash or fire.
5. **Electrical Safe Work Condition** – A state in which the conductor or circuit part to be worked on or near has been disconnected from energized parts, tested to ensure the absence of voltage, grounded if determined necessary and locked/tagged in accordance with refinery standards.
6. **Electrical Supervisor** – BP Electrical Engineer, E & I Shop Supervisor or E & I Field Supervisor.
7. **Electrical Engineer** A BP Electrical Engineer or other Electrical Engineer duly appointed to be a BP-representative.
8. **Energized** – Electrically connected to or having a source of voltage.

9. **Energized Electrical Work** – Whenever an electrically qualified person places a tool or body part on or near an exposed, energized conductor or within limited approach boundary (See Table 2.0 ).
10. **Exposed** – Capable of being inadvertently touched or approached nearer than a safe distance by a person or conductive object. Applies to parts not suitably guarded, isolated or insulated.
11. **Incident Energy** – The amount of thermal energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. Incident energy is usually measured in cal/cm<sup>2</sup>.
12. **Limited Approach Boundary** - A distance from an exposed live part within which a shock hazard exists. This is the boundary which a nonqualified person shall not cross. The limited approach boundary for Toledo-Husky Refinery are shown in Table 2.0.
13. **NFPA 70 E Level 2 hazard** – Working on or near exposed, energized equipment that have greater than 4 cal/cm<sup>2</sup> incident energy.
14. **Personal Protective Equipment** - Includes such items as voltage rated rubber gloves, flash hoods, hearing protection, rubber insulating mats, blankets and voltage rated insulated tools, flash suits and equipment.
15. **Prohibited Approach Boundary** – An approach limit at a distance from an exposed live part within which work is considered that same as making contact with the live part. The prohibited approach limits for Toledo Refinery shall be to avoid contact for 240 volts or less, 1 inch for 480 volts, 1 foot for 4160 / 13,800 volts, and 3 feet 6 inches for 69 / 138 kV. Refer to Table 2.0.
16. **Restricted Approach Boundary** – An approach limit at a distance from an exposed live part within which there is an increased likelihood of shock, due to an electrical arc over combined with inadvertent movement, for personnel working in close proximity to the electrically energized part. The restricted approach limits for BP Toledo Refinery shall be to avoid contact for 240 or less, 1 foot for 480 volts, 2 feet, 6 inches for 4160/13,800 volts, and 4 feet for 69 KV / 138KV. Refer to Table 2.0.

2.0 Safe Work Practices

1. Safe work practices must be utilized to safeguard personnel from injury while repairing, modifying, operating or performing maintenance on or near equipment or circuits that may be energized.
2. It is the general policy that equipment will be placed into an Electrically Safe Work Condition prior to performing work. Lockout/tagout will be completed per the BP Toledo Refinery Lockout/Tagout procedure SAF 037.
3. Conductors and parts of equipment that have been de-energized but have not been locked, tagged and tested per the procedure shall be treated as energized parts.

3.0 Energized Electrical Work

BP Toledo refinery recognizes two (2) levels of electrical energized work. Level 1 is energized Electrical Work performed within the limited approach boundary but not within the prohibited approach boundary. Level 2 is energized electrical work performed within the prohibited approach boundary.

1. Level 1 Energized Electrical Work (Work within the Limited Approach Boundary)

- a) Work within the limited approach boundary, with exposed energized conductors, is considered Level 1 Energized Electrical Work. The Limited Approach Boundary limits shall be 4 feet at 480 volts or less, 10 foot for 4160 volts, 13.8kV, 69 kV and 138kV and can be found in Table 2.0
- b) Only electrically qualified people may perform Level 1 Energized Electrical work. Such persons shall be capable of working safely near energized circuits and shall be familiar with the proper use of precautionary techniques, personal protective equipment, insulating and shielding materials and insulated tools. They shall have both classroom training per Section 8.0 and have demonstrated skills and knowledge of the electrical equipment.
- c) An Energized Electrical - Supplementary Certificate is not required for any work performed near live parts related to testing, troubleshooting, or taking voltage or amperage measurements. It is also not required if only performing visual inspections as long as the prohibited approach boundary is not crossed. However, safe work practices and the proper PPE requirements must be followed.
- d) The area around the energized work shall be barricaded at a minimum of 10 feet.
- e) Level 1 Energized Electrical Work requires a Level 1 Risk Assessment.

2. Level 2 Energized Electrical Work (Work within the Prohibited Approach Boundary)

- a) Work is considered Level 2 Energized Electrical Work whenever a qualified person places a tool or body part on or within the Prohibited Approach Boundary. The limits of approach shall be to avoid contact at 240 volts or less, 1 inch for 480 volts, 1 foot for 4160 / 13,800 volts, and 3 feet 6 inches for 69 / 138 kV.
- b) Level 2 Energized Electrical work shall only be completed when it can be demonstrated that de-energizing introduces additional or increased hazards or it is infeasible due to equipment design or operational limitations. Some examples of reasons to complete energized work are:
  - 1. Increased personnel risk due to deactivation of emergency alarms or fire protection systems.
  - 2. De-energizing is infeasible due to equipment design.
  - 3. De-energizing creates operational risks or hazards.
  - 4. Testing of electric circuits that can only be performed with the circuit energized

3. The following should be considered prior to completing energized work.

- a) Delay the energized work and perform the work during a time when the equipment can be de-energized.
- b) Identify alternate electrical configurations to eliminate the need for performing energized work. This may include installing temporary power until a time the equipment can be shutdown.

4. The following process shall be used when Level 2 Energized Electrical work is considered.

- a) The BP Electrical Engineer shall be notified whenever Level 2 Energized Electrical Work is proposed to be completed.
- b) The BP Electrical Engineer shall determine the extent of the outage to place the equipment in an Electrically Safe Work Condition or develop alternate plans to eliminate the need to complete energized work.
- c) The BP Electrical Engineer will discuss the required outage with an operations representative to determine if the outage is possible.
- d) If Level 2 Energized Electrical Work is agreed as the best option, the planner shall assemble the Task List (formerly JTTC) and Control of Work Package including the Task Risk Assessment *Energized Electrical- Supplementary Certificate*.
- e) A Level 2 Risk assessment shall be completed. The PA, AA and BP Electrical Engineer are required participants. Appropriate approvals shall be obtained per the Task Risk Category Table.
- f) A job site safety meeting shall be completed immediately prior to the work commencing. Required participants are the Qualified Electricians or Technicians completing the task, Supervisor, BP Electrical and a BP Safety Representative. The following questions, at a minimum, will be discussed at the job site safety meeting:
  - 1. All equipment to be worked energized appears to be in satisfactory condition.
  - 2. If applicable, ladder and/or scaffolding are sufficient.
  - 3. Lighting is sufficient.
  - 4. If applicable, the weather is sufficient.
  - 5. The energized equipment is accessible.
  - 6. There is a clear escape route.
  - 7. The work area is clear of tripping hazards.
  - 8. All affected people have been notified.
  - 9. Conductive jewelry and clothing items have been removed.
  - 10. Under layers beneath the FR clothing are not meltable fibers such as acetate, nylon, polyester, polypropylene or spandex.
  - 11. Verified voltage and current ratings of the replacement parts.
  - 12. Any new parts or cables have had an insulation resistance test (Megger) completed.
  - 13. One line diagrams are available.
  - 14. All required Safety and PPE items are on the job site.
  - 15. All agree the energized work can be completed safely.
- g) After the above consideration are completed and satisfied the Level 2 Energized Electrical Work can commence.

5. Only electrically qualified people may complete Level 2 Energized Electrical work. Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of precautionary techniques, personal protective equipment, insulating and shielding materials and insulated tools. They shall have both classroom training per section 8.0 and have demonstrated skills and knowledge of the operation and construction of the electrical equipment and the hazards involved.
6. A Task Risk Assessment *Energized Electrical - Supplementary Certificate* is not required for any work performed near live parts related to testing, troubleshooting or taking voltage or amperage measurements. However, safe work practices and the proper PPE requirements must be followed.
7. A minimum of two electrically qualified persons are required when completing Level 2 electrical energized work. The number of people on or near the energized electrical equipment must be kept to a minimum.
8. The area around the energized work shall be barricaded at a minimum of 10 feet or Arc Flash Boundary (see Table 2).
9. Inserting or removing a bucket into an energized motor control center (MCC) shall require a Task Risk Assessment *Energized Electrical - Supplementary Certificate* unless the MCC and bucket are listed for this purpose.
10. Level 2 Energized Electrical work is not permitted on Switchracks or Motor Control Centers with over 40 cal/cm<sup>2</sup> incident energy.

#### 4.0 Personal Protective Equipment

1. Employees working in an area where there are potential electrical hazards shall be provided with, and shall use, electrical protective equipment that is appropriate for the specific parts of the body and the work to be performed.
2. Protective equipment shall be properly stored and maintained in a safe reliable condition.
3. A two category modified Arc rated (AR) clothing and PPE system will be used. This will apply only to electricians who work on or near exposed energized electrical equipment having greater than 4 cal/cm<sup>2</sup> incident energy. It is not required for electricians who are working on new construction or equipment that have been properly isolated, LOTO and tested.
4. Meltable fibers such as acetate, nylon, polyester, polypropylene and spandex shall not be worn as under layers beneath the Arc rated (AR) clothing.
5. Table 1.0 in the attachments will detail the appropriate clothing system to be used for specific tasks.
6. Exceptions to Table 1.0 may occur that require a higher level of PPE. These exceptions will be clearly labeled on the equipment.
7. Voltage rated gloves, face shields or insulated tools may be required for a specific task. This will be detailed in attachments of Table 1.0.
8. "Everyday Work Clothing"
  - a) AR long sleeve shirts and pants or coveralls with a minimum ATPV rating of 8 cal/cm<sup>2</sup>.
  - b) Hard Hat.
  - c) Safety glasses with side shields.

- d) Hand Protection.
- e) Hearing Protection.
- f) Other PPE as required for a specific area in the refinery.

9. "Switching Clothing"

- a) 40 cal/cm<sup>2</sup> multi layer blast suit with hood, pants and jacket.
  - b) Voltage Rated Gloves.
  - c) Hand Protection.
  - d) Hard hat.
  - e) Safety Glasses with side shields.
  - f) Hearing Protection.
10. A face shield with a minimum arc rating of 4 is required when work is being performed on panelboards or starters of 240 volts or less. The face shield need not be worn when testing at a 240 volt or less device in the field. i.e. testing a 120V lighting fixture in the unit.
11. A face shield with a minimum arc rating of 8 and a balaclava (sock hood) with a minimum rating of 8 are required when work, including testing and troubleshooting, occurs at 480 volts. If the task requires switching clothing, then the 40 cal/cm<sup>2</sup> switching hood is required.
12. Work involving open, exposed, energized parts operating at 480 volts or greater shall be barricaded using blue barricade tape at a minimum of 10 feet or the arc flash boundary.
13. All personnel inside the arc flash boundary shall have the same PPE requirements when work is being performed on energized parts.
14. Electrically qualified people are required to wear voltage rated, insulated gloves when working on energized equipment greater than 150 volts. This includes testing and troubleshooting. For any level 2 energized work, the appropriate class of voltage rated insulated gloves, shall be worn. Table 1.0 in the attachment details specific tasks that require voltage rated gloves.
15. Three levels of gloves shall be used:
- a. Class 00 insulating rubber gloves shall be worn for level 2 energized work, or on any energized circuit where the voltage exceeds 150 volts.
  - b. Class 0 insulating rubber gloves shall be worn when work is performed on low voltage equipment (600 volts nominal or less)
  - c. Class 1 insulating rubber gloves shall be worn when work is performed on 4160 volt equipment.
16. Glove protectors (leather) shall be worn over the rubber gloves to protect the insulation from damage and shall be used for electrical work only.
17. Gloves (rubber insulating) shall be visually inspected for damage and

defects before every use and immediately following any incident suspected of having caused damage. In addition, rubber gloves must be given an air test along with each visual test.

18. Gloves (rubber insulating) will be electrically tested or replaced at an interval not to exceed six months.
19. Insulated sleeves may be required depending on the specific task
20. The following PPE shall be used at a minimum when working on vented lead acid battery systems.

- a. Chemical Resistant Goggles and Face Shields
- b. Chemical Resistant Gloves
- c. Protective aprons or coat

21. High line tools shall be tested at a minimum once every two years.

22. Alerting Techniques – Look alike equipment. Where work performed on equipment placed into an Electrically Safe Work Condition exists in an area with other energized equipment similar in size, shape, and construction, safety signs and tags, or barricades should be used to prevent all personnel from entering adjacent energized equipment.

5.0 Insulated Tools

1. Insulated tools and handling equipment are required to be used while working on or near exposed energized parts. Table 1 in the appendix will detail the specific task that insulated tools are required.
2. Insulated tools shall be rated for the voltage that they will be used. Taped tools are not considered electrically insulated.
3. Insulated tools shall be inspected before each use.

6.0 Test Instruments

1. Only electrically qualified persons that are trained to work with test instruments and equipment shall be permitted to perform testing on electrical circuits or equipment.
2. Test instruments and equipment and all associated test leads, cables, power cords, probes and conductors are required to be visually inspected for defects before each use. If there is a defect or evidence of damage that might expose someone to injury, the defective or damaged item shall be removed from service.
3. Test instruments and their accessories shall be rated for the circuit where they are to be used for testing. The test instruments shall be suitable for the environment they will be exposed to and the manner in which they will be used.
4. The operation of the test instrument shall be verified on a known source before and after the test to verify the absence of voltage.
5. Solenoid or “Wiggy” style testers shall not be used in the refinery.
6. Low voltage, lighted, non-contact style voltage detectors shall not be used to determine an electrically safe work condition when a direct contact test can be made. They should be used as a final check for insulated connections such as untaping a motor or cutting an insulated wire. They also can be used for simple troubleshooting efforts.
7. Leather gloves at a minimum shall be used when holding a test instrument while it is in use.
8. Non contact style test instruments can be used for 4160 volts and above.
9. Test instruments shall be rated for a minimum of 1000 volts and a



CAT III safety rating. Specialty type meters may be a lower rating as long as they are suitable for the application.

10. Test instruments shall be tested, calibrated and verified to be working correctly by a third party annually.

7.0 Electrically Qualified Standby Person

1. An electrically qualified standby person's responsibility is to look out for the safety of the electricians and other people inside the arc flash boundary.
2. An electrically qualified standby person shall be used under the following conditions:
  - a. Operating or racking switchgear operating at 4160 volts or greater.
  - b. Any time a *Task Risk Assessment Energized Electrical - Supplementary Certificate* is issued.
  - c. Work involving open, exposed, energized conductors operating at 480 volts or greater.
  - d. The maintenance foreman or electrical supervisor may require a qualified standby person at their discretion on specific tasks.
3. An Electrical Supervisor may act as a qualified standby person.
4. The electrician and the standby person shall discuss measures to take in the event of an accident prior to starting work.
5. The standby person can complete other tasks at the jobsite in addition to providing standby assistance.
6. A standby person is not required for entering a substation, substation inspections, resetting a relay on switchgear or taking readings from a panel mounted instrument.
7. The electrically qualified standby person is no longer required after equipment is placed into an electrically safe work condition and tested.

8.0 Training

1. Electrically qualified people shall be trained to understand the specific hazards associated with electrical energy. They shall be trained in safety related work practices and procedural requirements as necessary to provide protection from the electrical hazards associated with their respective job or task assignments. Employee shall be trained to identify and understand the relationships between electrical hazards and possible injury.
2. An electrically qualified person shall be trained and knowledgeable of the construction and operation of electrical equipment and or a specific work procedure and be trained to recognize and avoid the electrical hazards that might be present with respect to that equipment or work procedure.
3. Electrical tasks that are not considered skills of the trade, such as operating medium voltage electrical equipment, shall require specific training and qualification. Retraining shall be required if the task is not performed within one year.
4. An electrically qualified person shall be trained in OSHA 1910.269 to be considered qualified to work within the 69 KV or 138 KV switchyards. A qualified escort shall be required at all times for non qualified people or incidental work.
5. An individual may be trained and considered qualified with respect to certain equipment and procedures but still unqualified for others.
6. A qualified person shall be familiar with proper use of the special precautionary techniques, personal protective equipment, including

arc flash, insulating and shielding materials, insulated tools and test equipment.

7. Qualified people at a minimum shall be trained in the following:
  - a. The skills and techniques necessary to distinguish exposed energized parts from other parts of electrical equipment.
  - b. The skills and techniques necessary to determine the nominal voltage of exposed live parts.
  - c. The limited, restricted and prohibited approach distances specified in Table 2.0 and the corresponding voltages to which the qualified person will be exposed.
  - d. The decision making process necessary to determine the degree and extent of the hazard and the personal protective equipment and job planning necessary to perform the task safely.
  
8. Three levels of training will be provided for personal at BP Toledo Refinery.
  - a. BP Husky electrical personnel will receive detailed training on electrical safe work practices.
  - b. Instrument technicians and E & I Supervisors will receive awareness training of electrical safe work practices at 480 volts and below and detailed training on 120 VAC phase to ground and below.
  - c. All other refinery employees will receive awareness of electrical safety for the non electrical worker.
  
9. Electrical Contractors who work on or near energized electrical equipment will be trained in this procedure and its requirements.
10. Electrical Contractors will be responsible for providing electrical safety training to their employees who work on or near energized electrical equipment.

## Attachments

Table 1.0 (Table intended for qualified electricians who work within Limited Approach Boundary; on or near energized electrical equipment with potential NFPA 70 E Level 2 hazards)

- E = Everyday Work Clothing per Section 4.0**
- S = Switching Clothing per Section 4.0**
- N = Not Required**
- Y = Required**

**\* Refer to Section 4.0 for specific details of face shield and balaclava requirements.**

<b>Task</b> (Assumes equipment is energized and work is done within the flash protection boundary)	<b>FR Clothing category</b>	<b>Face Shield Required*</b>	<b>V-Rated Gloves Required</b>	<b>V-rated Tools Required</b>
<b>Panel Boards Rated 240 V and Below</b>				
Circuit breaker or fused switch operation with covers on	E	N	N	N
Circuit breaker or fused switch operation with covers off	E	Y	N	N
Work on energized parts, including voltage testing	E	Y	Y	Y
Remove/install circuit breakers or fused switches	E	Y	Y	Y
Removal of bolted covers (to expose bare, energized parts)	E	Y	N	N
Opening hinged covers (to expose bare, energized parts)	E	Y	N	N
<b>Panelboards or Switchboards Rated &gt; 240 V Up to 600 V (with molded case or insulated case circuit breakers)</b>				
Circuit breaker or fused switch operation with covers on	E	N	N	N
Remove/install circuit breakers or fused switches	S	Y	Y	Y
Circuit breaker or fused switch operation with covers off	E	Y	Y	N
Work on energized parts including voltage testing	E	Y	Y	Y
<b>480 V Class Motor Control Centers</b>				
Circuit breaker or fused switch or starter operation with enclosure doors closed	E	N	N	N
Reading a panel meter while operating a meter switch	E	N	N	N
Circuit breaker or fused switch or starter operation with enclosure doors open	E	Y	Y	Y
Work on energized parts,	E	Y	Y	Y

<b>Task</b> (Assumes equipment is energized and work is done within the flash protection boundary)	<b>FR Clothing category</b>	<b>Face Shield Required*</b>	<b>V-Rated Gloves Required</b>	<b>V-rated Tools Required</b>
including voltage and amperage testing				
Work on control circuits with energized parts less than 120 V	E	N	Y	Y
Work on control circuits with energized parts greater than or equal to 120 V, exposed	E	Y	Y	Y
Insertion or removal of individual starter “buckets” from MCC	S	Y	Y	Y
Application of safety grounds, after voltage test	E	Y	Y	N
Removal of bolted covers (to expose bare, energized parts)	S	Y	N	N
Opening hinged covers (to expose bare, energized parts)	E	Y	N	N
Voltage testing of the incoming line or main bus.	S	Y	Y	Y
<b>480 Volt Outdoor Switchracks (with explosion proof or raintight enclosures)</b>				
Work on control circuits with energized parts less than 120 V	E	N	Y	Y
Work on control circuits with energized parts greater than or equal to 120 V, exposed	E	Y	Y	Y
Circuit breaker or fused switch or starter operation with enclosure doors open	E	Y	Y	Y
Work on energized parts, including voltage or amperage testing	E	Y	Y	Y
Removal of bolted covers on bus box to expose bare energized parts	S	Y	Y	N
Opening of bolted enclosure starter with hinged cover	E	Y	N	N
Opening of screw type dome enclosure	E	Y	Y	Y
Replacement of starter components with line side of breaker energized (enclosure breaker de-energized)	E	Y	N	Y
<b>480 V Class Switchgear (with power circuit breakers or fused switches)</b>				
Circuit breaker or fused switch operation with enclosed doors closed	S	Y	Y	N
Reading a panel meter while operating a meter switch	E	N	N	N

<b>Task</b> (Assumes equipment is energized and work is done within the flash protection boundary)	<b>FR Clothing category</b>	<b>Face Shield Required*</b>	<b>V-Rated Gloves Required</b>	<b>V-rated Tools Required</b>
Circuit breaker or fused switch operation with enclosure doors open	S	Y	Y	N
Work on energized parts, including voltage testing	S	Y	Y	Y
Work on control circuits with energized parts less than 120 V	E	N	Y	Y
Work on control circuits with energized parts greater than or equal to 120 V, exposed	S	Y	Y	Y
Insertion or removal (racking) of circuit breakers from cubicles, doors open	S	Y	Y	N
Insertion or removal (racking) of circuit breakers from cubicles, doors closed	S	Y	Y	N
Application of safety grounds, after voltage test	S	Y	Y	N
Removal of bolted covers (to expose bare, energized parts)	S	Y	Y	N
Opening hinged covers (to expose bare, energized parts)	E	Y	N	N
<b>Other 600 V Class (277 V through 600 V, nominal) Equipment</b>				
Lighting or small power transformers (600 V, maximum)	-			-
Removal of bolted covers (to expose bare, energized parts)	E	Y	N	N
Opening hinged covers (to expose bare, energized parts)	E	Y	N	N
Work on energized parts, including voltage testing	E	Y	Y	Y
Application of safety grounds, after voltage test	E	Y	Y	N
<b>4160 Volt Fused Motor Contactor</b>				
Manual or local contactor operation with enclosure doors closed	S	Y	Y	N
Reading a panel meter while operating a meter switch	E	N	N	N
Contactor operation with enclosure doors open	S	Y	Y	N
Work on energized parts, including voltage testing	S	Y	Y	Y
Work on control circuits with energized parts 230 V or below, exposed	E	Y	Y	Y
Work on control circuits with energized parts > 230 V, exposed	S	Y	Y	Y

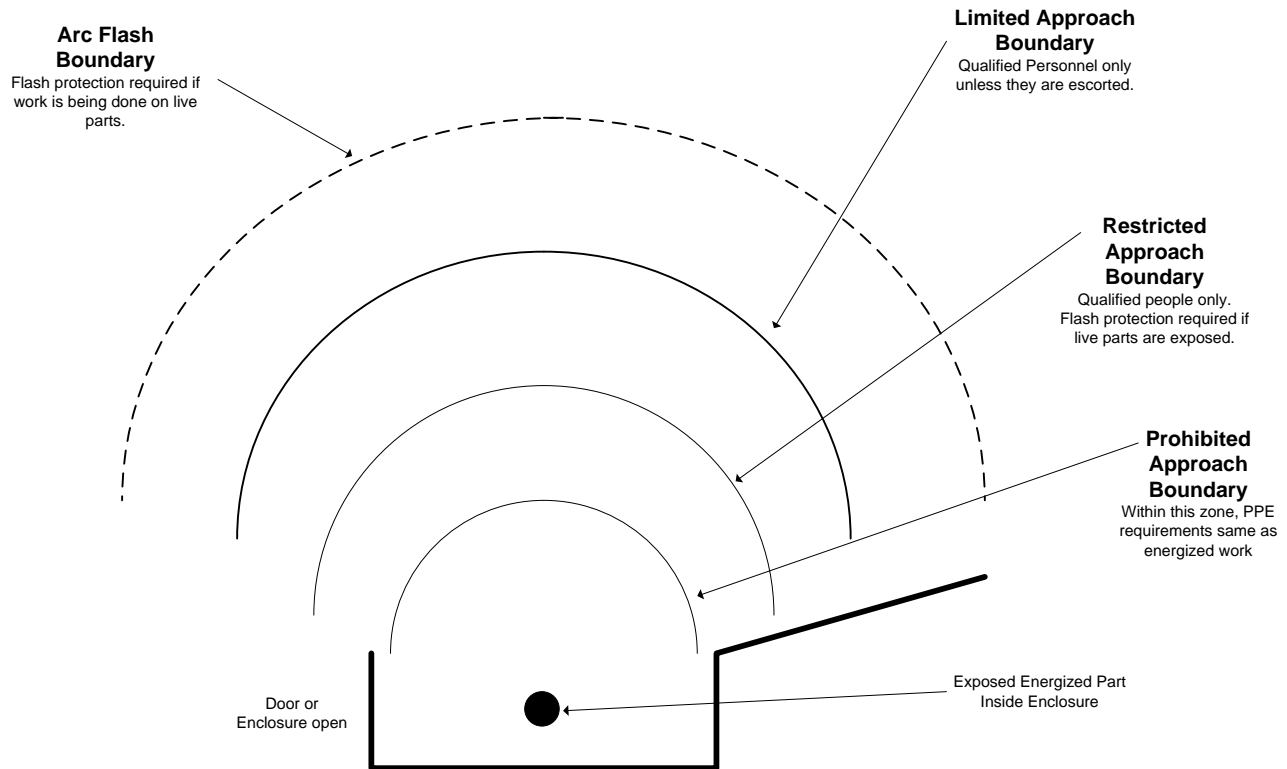
<b>Task</b> (Assumes equipment is energized and work is done within the flash protection boundary)	<b>FR Clothing category</b>	<b>Face Shield Required*</b>	<b>V-Rated Gloves Required</b>	<b>V-rated Tools Required</b>
Insertion or removal (racking) of starters from cubicles, doors open	S	Y	Y	N
Insertion or removal (racking) of starters from cubicles, doors closed	S	Y	Y	N
Application of safety grounds, after voltage test	S	Y	Y	N
Removal of bolted covers (to expose bare, energized parts)	S	Y	Y	N
Opening hinged covers (to expose bare, energized parts)	S	Y	Y	N
<b>Metal Clad Switchgear, 1 kV and Above</b>				
Manual or local circuit breaker or fused switch or starter operation with enclosure doors closed	S	Y	Y	N
Reading a panel meter while operating a meter switch	E	N	N	N
Manual or local circuit breaker or fused switch operation with enclosure doors open	S	Y	Y	N
Work on energized parts, including voltage testing	S	Y	Y	Y
Work on control circuits with energized parts less than 120 V	E	N	Y	Y
Work on control circuits with energized parts greater than or equal to 120 V, exposed	S	Y	Y	Y
Insertion or removal (racking) of circuit breaker from cubicles, doors open	S	Y	Y	N
Insertion or removal (racking) of circuit breakers from cubicles, doors closed	S	Y	Y	N
Application of safety grounds, after voltage test	S	Y	Y	N
Removal of bolted covers (to expose bare, energized parts)	S	Y	Y	N
Opening hinged covers (to expose bare, energized parts)	S	Y	Y	N
Opening transformer or control power transformer compartments	S	Y	Y	N
<b>Other 4160 Volt / 13.8kV Equipment</b>				
Metal clad load interrupter switches, fused or unfused	-		-	-
Switch operation, doors closed	S	Y	Y	N

<b>Task</b> (Assumes equipment is energized and work is done within the flash protection boundary)	<b>FR Clothing category</b>	<b>Face Shield Required*</b>	<b>V-Rated Gloves Required</b>	<b>V-rated Tools Required</b>
Work on energized parts, including voltage testing	S	Y	Y	Y
Removal of bolted covers (to expose bare, energized parts)	S	Y	Y	N
Opening hinged covers (to expose bare, energized parts)	S	Y	Y	N
Outdoor disconnect switch operation (hookstick operated) (Short Stick)	S	Y	Y	Y
Outdoor Pole Mounted Hook stick operation	E	Y	Y	Y
Outdoor disconnect operation (gang-operated from grade)	E	Y	Y	N
Energized Insulated cable examination or movement, in manhole or other confined space	S	Y	Y	N
Insulated cable examination, in open area	E	Y	Y	N
69 KV equipment				
69 KV hook stick operated disconnect switches	E	Y	Y	Y
69 KV gang operated disconnect switches	E	Y	Y	N
69 KV Routine Equipment Inspections	E	N	N	N

Table 2.0 Approach and Arc Flash Boundaries

Task Risk Category		LEVEL 1	LEVEL 1	LEVEL 2
		if within	if within	if within
Nominal Voltage Phase to Phase	Arc Flash Boundary	Limited Approach Boundary	Restricted Approach Boundary	Prohibited Approach Boundary
240 volts or less	None	4 feet	Avoid Contact	Avoid Contact
480 volts	10 feet	4 feet	1 foot	1 inch
4160 volts	20 feet	10 feet	2 feet 6 inch	1 foot
15,000 volts	20 feet	10 feet	2 feet 6 inch	1 foot
69kV / 138kV	50 feet	10 feet	4 feet	3 feet 6 inches

Approach Boundaries illustrated from Table 2.0 showing corresponding distances from energized parts.





**Revision history**

The following information documents at least the last 3 changes to this document, with all the changes listed for the last 6 months.

Date	Revised By	Changes
6/12/13	Carl Christensen	MOC# M20132428-Updated to reflect changes in NFPA 70E 2012
2/25/2014	Dane Clark	MOC#: M2014552-001 Updated to reflect changes in NFPA 70E 2012.
2/22/2016	<b>Dane Clark</b>	M20152894-001 Updated to reflect changes in NFPA 70E 2015.

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