



Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 1 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

1. ABOUT THIS PROTOCOL

Purpose	This document was developed to ensure work performed on electrical equipment is done safely.
Objective	This Devon Energy Protocol establishes minimum safe work practices and electrical safety management requirements. Employees must comply with this protocol as well as all applicable local, state and federal regulations.
Scope	This protocol applies to all Devon operated equipment, facilities and all Devon employees. Contractors will have their own document that meets or exceeds Devon’s Protocol. This protocol does not cover utility line, or distribution system work covered by 1910.296. Work or operations on those systems will be done in accordance to 1910.296 and applicable state or local regulations. This protocol applies to electrical equipment greater than 50 volts.
Applicability	This document is applicable to qualified electricians, and their supervisors.
Variances	None
Superseded Documents	Electrical Safety Protocol



Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 2 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

2. TABLE OF CONTENTS

1.	About this Protocol	1
2.	Table of Contents.....	2
3.	Roles.....	4
4.	Protocol Prerequisites	4
4.1	Protocol Overview	4
4.2	Applicable Standards.....	4
5.	Protocol.....	5
5.1	Risk Assessment – Arc Flash Risk Assessment.....	5
5.2	Electrically Safe Work Condition	6
5.3	Energized Equipment	6
5.4	Troubleshooting	7
5.5	Live Electrical Work	7
5.6	Working on Energized Enclosures	8
5.7	Personal Protective Equipment.....	9
5.8	Contractor Participation.....	10
5.9	Procurement and Design.....	11
5.10	Review and Verification	11
6.	Terms and Definitions.....	12
7.	Document Management.....	13
7.1	Revision Details	13
7.2	Approval	13
7.3	Seeking and Approving Variances	14
7.4	Related Documents	14
7.5	Cited Documents	14
8.	Additional Related Information	14
8.1	Training and Certification Requirements	14
8.2	Permits/Forms/Refrence Material	15
8.3	Records/Logs/Reports.....	16

PROPRIETARY INFORMATION Devon Energy Corporation
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Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 3 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

Appendix A – PPE Inspection Frequency 17

Appendix B: Electrical Safety Labeling Examples 19

Attachment A: Approval, Review, and Modification History 20



Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 4 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

3. ROLES

Qualified Electrician	Responsible for working on electrical equipment, testing and troubleshooting activities. These individuals are also responsible for developing and implementing safe electrical work procedures.
Qualified Representative	Responsible for overseeing electrical and electrical safety aspects of work performed by contractors.
Supervisor/PIC	Responsible for coordinating and overseeing work and activities. Responsible to ensure safe electrical work procedures are in place and being implemented.

4. PROTOCOL PREREQUISITES

4.1 PROTOCOL OVERVIEW

This protocol covers potential hazards, exposures and work performed by qualified electricians. The document covers what is required for risk assessment activities, personal precautions and procedures. Additionally, the protocol includes requirements to mitigate risk associated with troubleshooting or live electrical work. The document defines what steps are required to engage contractors who will be performing those activities. Electrical work done on utility systems will follow requirements listed in 29 CFR 1910.269.

4.2 APPLICABLE STANDARDS

OSHA Electrical Safety Standards
29 CFR 1910 Subpart S
29 CFR 1910.269

Hierarchy Level: Procedure	Document Type: Protocol	Page: 5 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

5. PROTOCOL

5.1 RISK ASSESSMENT – ARC FLASH RISK ASSESSMENT

Step	Required Action	Role
5.1.1	Determine how to assess and communicate arc flash hazards. This can be done with a formal arc flash hazard assessment, or tables in NFPA 70E. Document needs to be readily available to persons likely to perform examination, servicing, maintenance and operation of the equipment. The information can be documented via a label on the electrical boxes, or other written documentation.	BU Leadership

Note: Formal arc flash hazard assessments will be updated after revisions, or expansions are done to the system. Additionally, they will be reviewed for accuracy every 5 years.

5.1.2	<p>Document the following information for switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers prior to examination, adjustment, servicing, or maintenance while energized. Information will be document as per 5.1.1.</p> <ul style="list-style-type: none"> • Nominal system voltage • Arc flash boundary • One of the following <ul style="list-style-type: none"> ○ Available incident energy and corresponding working distance OR the arc flash PPE category in Table 130.7(C)(15)(a) or Table 130.7(C)(15)(b) ○ Minimum arc rating of clothing ○ Site Specific level of PPE 	BU Responsibility
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Note: The available incident energy is preferred.

Note: It is recommended that the information be documented during installation on equipment that is likely to require examination, adjustment, servicing, or maintenance while energized.



Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 6 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

5.2 ELECTRICALLY SAFE WORK CONDITION

Step	Required Action	Role
5.2.1	<p>Establish an electrically safe work condition prior to performing electrical work activities. See section 5.3-5.6 if the equipment cannot be de-energized.</p> <p>Perform live electrical work only when:</p> <ul style="list-style-type: none">• De-energizing introduces additional or increased hazards, or,• De-energizing is infeasible due to equipment design or operational limitations. <p>Note: Consider the use of engineering controls as the preferred electrical hazard risk control.</p>	Qualified Person
5.2.2	Isolate equipment following the Energy Isolation Protocol.	Employee

5.3 ENERGIZED EQUIPMENT

Step	Required Action	Role
5.3.1	Determine if the activity is live electrical work or trouble shooting.	Qualified Person
5.3.2	Complete the Electrical Safety Analysis (ESA) form prior to beginning work.	Qualified Person
5.3.3	Determine the appropriate PPE level based on the PPE category or incident energy analysis.	Qualified Person

Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 7 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

5.3.4 Ensure nonqualified individuals remain outside the limited approach boundary when energized panels, breakers, boxes are open. Setup a barricade or use a spotter in place of a physical barrier when unqualified person(s) are in close proximity to the limited approach boundary. Qualified Person

Note: Tools and other potential tripping objects need to be placed outside the limited approach boundary.

5.3.5 Remove or cover conductive articles of jewelry and clothing (e.g., watch bands, bracelets, necklaces, rings, key chains, metalized aprons, metal eyewear, or metal headgear) if they could contact exposed energized parts. Qualified Person

5.4 TROUBLESHOOTING

Step	Required Action	Role
5.4.1	Determine the appropriate tools and equipment for troubleshooting activities.	Qualified Person
5.4.2	Review safe work practices during the pre-task tailgate. Include steps 5.3.2 and 5.3.3 as safe work practices.	Qualified Person
5.4.3	Don selected PPE prior to beginning the task.	Qualified Person
5.4.4	Do not perform live electrical work during troubleshooting.	Qualified Person

5.5 LIVE ELECTRICAL WORK

Step	Required Action	Role
5.5.1	Assign qualified person(s) to work on energized electrical systems when any of the following criteria are met: <ul style="list-style-type: none"> De-energizing introduces additional or increased hazards, or, De-energizing is infeasible due to equipment design or operational limitations. 	Line Supervisor



Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 8 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

5.5.2 Complete a Live Electrical Work Permit before beginning the task. Qualified Person
 Ensure the permit is completed by at least two qualified persons prior to starting the activity.

The permit will be completed prior to initiating a live electrical work task and will be reviewed during the Pre-task tailgate process.

The permit and completed Electrical Safety Analysis (ESA) must be posted in a visible locations where the live electrical work is occurring.

Permit Approvals

- Qualified individuals performing the work,
- Devon supervisor – this approval can be authorized via phone.
- Qualified Contractor (when applicable)

5.5.3 Ensure work on energized circuits 600 volts or greater is not Qualified Person
 conducted alone. At a minimum the work must include a stand-by person who is current in CPR and First Aid.¹

5.5.4 Notify emergency medical assistance and local utilities immediately Employee
 if an individual has made contact with energized wiring.

5.6 WORKING ON ENERGIZED ENCLOSURES

Step	Required Action	Role
5.6.1	Use protective shields, barriers, or insulating materials as necessary to avoid accidental contact with energized parts.	Qualified Person
5.6.2	Follow the Hot Work Protocol when opening an energized electrical equipment enclosure in a classified location.	Qualified Person
5.6.3	Keep doors, panels and covers of electrical equipment enclosures closed according to manufacturer’s specifications except while: <ul style="list-style-type: none"> • Taking readings, • Making repairs, or • Troubleshooting. 	Qualified Person

Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 9 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

5.6.4 Brace door open in a safe manner while working on the enclosure. Qualified Person

Note: Doors must be capable of being opened at least 90 degrees.

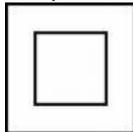
5.7 PERSONAL PROTECTIVE EQUIPMENT

Step	Required Action	Role
5.7.1	Wear the appropriate Hazard Rated Category (HRC) PPE that meets the NFPA 70E requirements for the job. PPE selection is based on the information provided on the Approach Boundary Table (Live Electrical Work Permit) and/or label posted on the electrical equipment prior to opening the cabinet to perform troubleshooting or live electrical work.	Qualified Person
5.7.2	Wear class E hard hat, full or partial brim that meets ANSI Z89.1	Qualified Person
5.7.3	Wear nonconductive PPE for the face, neck, and chin whenever there is a danger of injury from exposure to electric arcs, or flashes. Eye and face protection will conform to ANSI Z87.1.	Qualified Person
5.7.4	Wear safety shoes having a rating of dielectric footwear as per ASTM F2413 (formerly ANSI Z41) and/or CAN/CSA Z195 and Z195.1.	Qualified Person
5.7.5	Wear hand insulating rubber gloves that are properly rated and tested prior to coming into contact with energized parts.	Qualified Person
	Note: When rubber gloves are used for shock protection, outer leather protectors and inner cloth liners will be provided and worn.	
5.7.6	Inspect and test electrical PPE as required to ensure that it is maintained in a safe and reliable condition. See Appendix A for testing frequency.	Qualified Person
5.7.7	Remove PPE that is damaged or failed to pass test requirements until repairs or permanently discarded/destroyed.	Qualified Person
5.7.8	Use hot sticks in accordance with the manufacture's recommendations for working with energized electrical systems.	Qualified Person

Hierarchy Level: Procedure	Document Type: Protocol	Page: 10 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

5.7.9 Use insulated tools and equipment when working in proximity to energized or potentially energized conductors and /or exposed electrical components.⁴ Insulated tools must display the international double triangle or double square symbol (see illustrations below.)

Double Square Symbol



International Double Triangle



5.8 CONTRACTOR PARTICIPATION

Step	Required Action	Role
5.8.1	<p>Designate an individual to fill the role of qualified representative when arrangements have been made for contractor(s) to perform live electrical work.</p> <p>The individual will perform the following coordination and informational functions:</p> <ul style="list-style-type: none"> • Provide the contractor with a copy of this protocol. • Ensure the contractor understand their electrical program must meet or exceed the requirements of this protocol. • Inform the contractor of the known hazards of electrical equipment and precautions that have been implemented in or near the system that will be accessed by the contractor’s employees. 	Line Supervisor
5.8.2	<p>Ensure an approved Live Electrical Work Permit has been developed and approved by contract supervisor. A Devon representative must sign the permit prior to the activity being performed.</p>	Qualified Representative



Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 11 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

5.9 PROCUREMENT AND DESIGN

Step	Required Action	Role
5.9.1	Design and maintain the area around electric panels so personnel are not required to stand in water while operating switches.	Supervisor / Employee
5.9.2	Mark equipment and circuit disconnects legibly to indicate the equipment or circuit. Additionally, "ON" and "OFF" will be clearly distinguishable.	Qualified Person
5.9.3	Ensure that electrical cabinet doors rated for 600 volts or greater AC or DC have either lock or interlocks	Qualified Person
5.9.4	Ensure and verify equipment is installed accordance with the National Electric Code specifications.	Qualified Person
5.9.5	Ensure switches, controllers and circuit breakers are able to be mechanically locked out in the off position.	Qualified Person
5.9.6	Install classified area boundary seals when required by NFPA 70.	Qualified Person

5.10 REVIEW AND VERIFICATION

Step	Required Action	Role
5.10.1	Ensure the protocol is reviewed every three years to verify compliance with the most current version of NFPA 70E.	Shared Safety
5.10.2	Review a representative sample of field activities to verify the electrical safety protocols are being followed. The Electrical Field Review in section 8.2 may be used or referenced as a guide.	Supervisor

Note: Any corrective action identified must be corrected at the time of observation.

Hierarchy Level: Procedure	Document Type: Protocol	Page: 12 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

6. TERMS AND DEFINITIONS

Arc Rated	PPE that is designed and performance tested for exposure to an electrical arc discharge. Performance test results are expressed in cal/cm ² .
Class I Division 1 area	Location where flammable gases or vapors are, or may be, present in the air qualities sufficient to produce explosive or ignitable mixtures.
Class I, Division 2 area	Location in which flammable gases or vapors may be present, but normally are confined within closed systems.
Double Insulated	Electric tool with insulated internal wiring and an insulated outer casing.
Electrical Hazard	Dangerous condition in which contractor or equipment failure can result in electric shock, arc flash burn, thermal burn or blast.
Enclosed	Surrounded by a case, housing, fence, or wall(s) that prevent people from accidentally contacting energized parts.
Enclosure	Case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts, or to protect the equipment from physical damage.
Explosion-Proof Equipment	Electrical equipment (conduit, junction box, motor, etc.) enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor which may occur within it and preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes or explosion of the gas or vapor within which operates at such an external temperature that it will not ignite a surrounding flammable atmosphere.
Live Electrical Work	Maintenance and tie-in activities performed on an energized electrical system. Examples include but are not limited to <ul style="list-style-type: none"> • Installing or removing a live bus, • installing or removing a circuit breaker at voltage greater than 240V, • performing a live electrical tie-in, • overhead utility line tie-in, etc.

Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 13 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

Isolation	Disconnection and separation of electrical equipment from source(s) of supply.
Troubleshooting	The act of determine source of electrical malfunction within equipment. This can include testing equipment, opening cabinet / boxes for visual observation, voltage testing.
Unqualified Person	Person who has little or no training regarding electrical hazards and may not be exposed to energized parts. The unqualified person must be familiar with any electrical related safety practice that is necessary for their safety.
Qualified Person	One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risk.
Voltage, Nominal ²	Nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts).

7. DOCUMENT MANAGEMENT

7.1 REVISION DETAILS

The following are the specific changes made to this Protocol during the latest revision:

Section	Changes Made	Reasons for Change
8.3	Revised the field review record retention time from CY + 3 years to 1 year. Revised the enterprise classification structure code from EH45 to N/A.	Reduce the amount of records that are scanned, saved, and/or stored.

7.2 APPROVAL

This procedure has been approved by:

Name	Title
Garrett Jackson	VP, Operations



Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 14 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

7.3 SEEKING AND APPROVING VARIANCES

Variations to this document will be submitted in accordance with the EHS Document Control and Records Management Protocol.

7.4 RELATED DOCUMENTS

Document Name

[Specification for Determining Electrical Area Classification](#)

Available Through IHS Engineering Workbench

Note: There are two different access points for the IHS Engineering Workbench. Select link below that fits your office location.

[Oklahoma City](#)

[Field Office](#)

API RP 500 – Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2

NFPA 70 – National Electrical Code

NFPA 70E – Standard for Electrical Safety in the Workplace

IEEE National Electric Safety Code

7.5 CITED DOCUMENTS

Reference #	Citation or Source
1	29 CFR 1910.269(l)(2)
2	NFPA 70 E – Article 100 - Definitions
3	29 CFR 1910.137(c)(2)(xii) – Table 1-5
4	NFPA 70 E 130.7(D)(1)

8. ADDITIONAL RELATED INFORMATION

8.1 TRAINING AND CERTIFICATION REQUIREMENTS

Devon employees responsible for performing troubleshooting and/or live electrical work will be required to complete qualified training. Qualified training can be provided by an outsourced contractor

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Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 15 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

or a Devon employee who is qualified as a journeyman or master electrician. Qualified training addresses the following elements:

- Discuss training objectives
- Employees will receive both classroom and practical training on live electrical work.
- Classroom:
 - The Dangers of Live Electricity – Electrical Accidents in E&P Facilities
 - Review NFPA 70E & protocol. Individuals working on utility systems will also review applicable IEEE standards, and OSHA 1910.269.
 - All NFPA 70E is discussed:
 - Definitions, assessing hazards, hazard risk categories, lockout/tagout, work boundaries, PPE requirements, permits & safety assessments, etc.
 - Where and how to use an appropriately classified multi- meter safely, how to confirm electrical apparatus is de-energized, as well as functional metering uses such as testing phase to phase, phase to ground voltage, resistance, continuity, etc.
 - Review Electrical PPE requirements
 - Inspection/Testing
 - How to perform a Risk Assessment in an effort to complete an Electrical ESA and Permit
 - Proper emergency support (CPR/first-aid trained separately)
- Field Exercise
 - Complete ESA/permit for electrical as a group
 - Use of a multi-meter
 - Don PPE & arc flash protection
 - Establish safe work boundaries
 - Review proper stance & method for opening & closing breakers & disconnects
 - Open a cabinet and simulate the testing of live voltages
 - Review electrical hazards as they pertain to oilfield apparatus

Refresher training required every three years or more frequently when deemed appropriate by supervision on the following items:

- Safety related work practices, and
- applicable changes in NFPA 70E

8.2 PERMITS/FORMS/REFERENCE MATERIAL

[Electrical Field Review](#)

[Electrical Safety Analysis](#)

[Live Electrical Work Permit](#)



Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 16 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

8.3 RECORDS/LOGS/REPORTS

Record	File Location & Number	Retention Time	Enterprise Classification Structure Code
Electrical Safety Analysis	N/A	Job Completion	N/A
Field Review	See Field Office File Directory	1 Year	N/A
Live Electrical Permits	N/A	Job Completion	N/A

Note: The Records Management Enterprise Classification Structure Code is listed as a reference, which should be used when records are sent to stored records.



Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 17 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

APPENDIX A – PPE INSPECTION FREQUENCY

Personal Protective Equipment (PPE)	Frequency	Conducted by Whom
Electrical Gloves	<p>Pre-Use Inspection: Visual inspection to check for: Nicks, tears, rips, punctures To test gloves for pinholes and other damage, fill the glove with air. The use of a portable glove inflator is recommended. Or in lieu of a glove inflator, roll up the cuff of the glove to make a seal, and squeeze the glove. Then hold the inflated glove close to the face and ear to feel and listen for air escaping from holes Proper Storage: Gloves in service will be properly stored. Insulating rubber gloves and leather protectors may be properly stored. Gloves will not be folded, creased, or rolled while in storage. Gloves will be protected from heat, sunlight, and from contact with sharp articles or materials likely to damage gloves or cause deterioration of the rubber. Gloves shall not be stored in close proximity to any electrical sources. Clean gloves according to manufacturer’s specifications. Do not use solvents, oils, or grease on rubber gloves.</p>	Employee
	<p>Electrical Tests: Every six months from service³.</p> <p>New insulating equipment is not permitted to be placed into service unless it has been electrically tested within the previous 12 months.</p>	Outside Service
Blankets/ Sleeves	<p>Pre-Use Inspection: Visual inspection to check for: Nicks, tears, rips, punctures</p>	Employee
	<p>Electrical Tests: Every 12 months from service.</p>	Outside Service
Arc Rated Apparel	<p>Pre-Use Inspection: Before each use. Work clothing or arc flash suits that are contaminated, or damaged to the extent that their protective qualities are impaired, shall not be used.</p> <p>Protective items that become contaminated with grease, oil, or flammable liquids or combustible materials shall not be used.</p> <p>Do not remove warning or rating tags.</p>	Employee
	<p>Electrical Tests: Not Applicable</p>	N/A



Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 18 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

Personal Protective Equipment (PPE)	Frequency	Conducted by Whom
Flash Protection Overalls (e.g., 12 cal., 40 cal., 50 cal., etc.)	<p>Pre-Use Inspection: Arc-rated apparel shall be inspected Before each use. Work clothing or arc flash suits that are contaminated, or damaged to the extent that their protective qualities are impaired, shall not be used.</p> <p>Protective items that become contaminated with grease, oil, or flammable liquids or combustible materials shall not be used.</p> <p>Do not remove warning or rating tags.</p>	
	<p>Electrical Tests: Not Applicable</p>	N/A
Hot Stick	<p>Pre-Use Inspection: Conduct visual inspection for cracks, nicks, punctures, contaminants (e.g.; paint, grease, etc.) and wipe the stick down, removing any difficult to see contaminants.</p>	Qualified Person
	<p>Electrical Test: Every two years of service.</p> <p>If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is present after wiping, the tool shall be removed from service and examined and tested by an outside provider.</p>	Outside Service
Hand Tools	<p>Pre-Use Inspection: Conduct pre-use inspection to ensure the equipment is kept clean and dry. UL approved hand tools use two different color layers of insulation making damage to the insulation easy to recognize.</p>	Qualified Person
	<p>Electrical Tests: Not Applicable</p>	N/A

Hierarchy Level: Procedure	Document Type: Protocol	Page: 19 of 20
Document Owner: VP EHS	Applies to: Devon, US	Doc ID: 121117178
Revision Date: 5/7/2020	Review Cycle: Every 3 Years	Effective: 12/20/2018

APPENDIX B: ELECTRICAL SAFETY LABELING EXAMPLES

WARNING
Qualified Persons Only

Arc Flash and Shock Hazard

9 inch Flash Protection Boundary **HRC0** 0.40 cal/cm² Flash Hazard at 18 Inches

480 VAC Shock Hazard 00 Glove Class
42 inch Limited Approach
12 inch Restricted Approach
1 inch Prohibited Approach

PPE REQUIRED:
Untreated Cotton Shirt & Pants + Safety Glasses

Bus: MAIN FAN ACTU Prot: MCC ER2 CB12 February 13, 2008

WARNING
Qualified Persons Only

Arc Flash and Shock Hazard

21 inch Flash Protection Boundary **HRC1** 1.58 cal/cm² Flash Hazard at 18 Inches

480 VAC Shock Hazard 00 Glove Class
42 inch Limited Approach
12 inch Restricted Approach
1 inch Prohibited Approach

PPE REQUIRED:
FR Shirt & Pants + Hard Hat + Safety Glasses

Bus: ORL LOWER Prot: ORL LOWER CBM February 16, 2008

WARNING
Qualified Persons Only

Arc Flash and Shock Hazard

54 inch Flash Protection Boundary **HRC2** 7.27 cal/cm² Flash Hazard at 18 Inches

480 VAC Shock Hazard 00 Glove Class
42 inch Limited Approach
12 inch Restricted Approach
1 inch Prohibited Approach

PPE REQUIRED:
FR Shirt & Pants over Cotton Underwear + Hard Hat + Safety Glasses + Arc-Rated Face Shield + Hearing Protection + Leather Gloves + Leather Shoes

Bus: ORL LOWER MAIN Prot: SWGR W CB14 February 16, 2008

WARNING
Qualified Persons Only

Arc Flash and Shock Hazard

74 inch Flash Protection Boundary **HRC3** 12.1 cal/cm² Flash Hazard at 18 Inches

480 VAC Shock Hazard 00 Glove Class
42 inch Limited Approach
12 inch Restricted Approach
1 inch Prohibited Approach

PPE REQUIRED:
FR Shirt & Pants + FR Coveralls + Hard Hat w/ FR liner + Safety Glasses + Cotton Underwear + Hearing Protection + Leather Gloves + Leather Shoes + Flash Suit Hood

Bus: FIRE PUMP Prot: FIRE PUMP FU February 16, 2008

WARNING
Qualified Persons Only

Arc Flash and Shock Hazard

119 inch Flash Protection Boundary **HRC4** 26.4 cal/cm² Flash Hazard at 18 Inches

480 VAC Shock Hazard 00 Glove Class
42 inch Limited Approach
12 inch Restricted Approach
1 inch Prohibited Approach

PPE REQUIRED:
FR Shirt & Pants + Hard Hat w/ FR Liner + Safety Glasses + Cotton Underwear + Hearing Protection + Leather Gloves + Leather Shoes + Flash Suit Hood + Multi-layer Flash Suit Jacket + Pants

Bus: ORL RCV MAIN Prot: SWGR W CB15 February 16, 2008

DANGER
Qualified Persons Only

Arc Flash and Shock Hazard

173 inch Flash Protection Boundary **Dangerous!!!** 49.2 cal/cm² Flash Hazard at 18 Inches

480 VAC Shock Hazard 00 Glove Class
42 inch Limited Approach
12 inch Restricted Approach
1 inch Prohibited Approach

PPE REQUIRED:
No FR Category Found

Bus: SWGR W Prot: CB-M February 16, 2008



Qualified Electrical Safety Protocol

Hierarchy Level: Procedure	Document Type: Protocol	Page: 20 of 20
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ATTACHMENT A: APPROVAL, REVIEW, AND MODIFICATION HISTORY

Revision Number	Approved/Revised /Reviewed By	Approval/Revision /Review Date	Description (Initial Approval, Revision, or Review along with further details of revision if needed)
00	Jim Farrell	12/20/2018	<ul style="list-style-type: none">Initial Approval
01	Garrett Jackson	05/07/2020	<ul style="list-style-type: none">Revised the field review record retention time in step 8.3 from CY + 3 years to 1 year.Revised the enterprise classification structure code in step 8.3 from EH45 to N/A.