

# **D Square Construction LLC**

## **Lock Out-Tag Out (LOTO) and Zero Voltage Verification (ZVV) Process and Plan**

### **Energized Work Process and Permit**

## Table of Contents

- 1) Instruction for using Decision Tree Analysis
- 2) Decision Tree Analysis for LOTO & ZVV
- 3) 50 Volts to 240 Volts Plan
- 4) 241 Volts - 600 Volts Plan
- 5) Energized Work Procedures
- 6) Energized Electrical Work Permit Flow Chart
- 7) Energized Work Permit

**Instruction for using  
Decision Tree Analysis  
for NFPA-70E Plan**

- Step 1** Evaluate voltage of Circuit/Equipment  
A) 50 volts to 240 volts  
B) 241 volt to 600 volts
- Step 2** Perform Lock Out-Tag Out using proper Hazard/Risk Category {Category per NFPA-70E, Table 130.7(c)(9)}
- Step 3** Zero Voltage Verification: Evaluate whether the part being tested is Exposed or Protected

Examples of testing on a non-exposed part

- Junction box/Receptacle with cover plate
- Insulated wire
  - Must meet requirements of 310.13 and table 310.61 of NEC

Examples of testing on an exposed part

- Circuit breakers with covers removed
- Junction box/Receptacle missing cover plate
- Any part that is not suitably guarded, isolated or insulated

Site Specific  
NFPA-70E  
Lock Out-Tag Out and  
Zero Voltage Verification Plan

50 Volts to 240 Volts  
Use Plan  
240 V and Below

Lock Out – Tag Out  
Hazard/Risk Category:  
**0**

Zero Voltage Verification

Testing on a  
Non Exposed  
Part

Hazard/Risk Category:  
**0**

Testing on an  
Exposed Part

Hazard/Risk Category:  
**1**

240 Volts – 600 Volts  
Use Plan  
>240 V up to 600 V

Lock Out – Tag Out  
Hazard/Risk Category:  
**0**

Zero Voltage Verification

Testing on a  
Non Exposed  
Part

Hazard/Risk Category:  
**0**

Testing on an  
Exposed Part

Hazard/Risk Category:  
**2\***

# 50 Volts – 240 Volts Plan

**SITE SPECIFIC SAFETY PLAN  
FOR LOCKOUT/TAGOUT AND  
ZERO VOLTAGE VERIFICATION  
(240 V and Below)**

This plan is intended to provide necessary information for effective site implementation of Safety Policies that apply to specific site conditions. This plan will be completed prior to starting any work on projects that involve exposed energized parts or Lock Out Tag Out.

Company Name: \_\_\_\_\_ Project Start Date: \_\_\_\_\_

Point of Contact: \_\_\_\_\_ Phone # \_\_\_\_\_

Lower Tier Subcontractor (if applicable): \_\_\_\_\_

Centennial/JV Project Name: \_\_\_\_\_

Description of Project: \_\_\_\_\_

Qualified Person: \_\_\_\_\_

\*Please attach the Qualified Person Credentials to this plan.

**Emergency Procedures**

Employees exposed to shock hazards will be trained in methods to release a victim from contact with exposed energized electrical conductors or circuit parts. All affected employees will be trained in first aid procedures and certified in cardiopulmonary resuscitation (CPR) annually. If anyone receives a shock they are required to see a physician to obtain medical clearance to return to work.

**Lock Out and Tag Out (LOTO)**  
**Hazard/Risk Category 0**

This process is designed for 240V, and below, for circuit breaker or fused switch operation with covers on and all blanks inserted. (No exposed parts).

**PPE Requirements of the NFPA 70-E {Table 130.7(C)(10)}**

- (1) Shirt (long Sleeve)
- (2) Pants (Long)
- (3) ANSI Safety glasses or goggles
- (4) Hearing protection (ear canal inserts)
- (5) Leather Gloves (ASTM F 696)
- (6) Hard hat

**LOTO Steps**

- 1) Determine all sources of electrical supply to the specific equipment.
- 2) After properly interrupting the load current, open the disconnecting device(s) for each source.
- 3) Visually verify that all blades of the disconnecting devices are fully open or that draw-out type circuit breakers are withdrawn to the fully disconnected position.
- 4) Apply LOTO devices
- 5) Use an adequately rated voltage detector to test each phase conductor or circuit part to verify that they are de-energized. If verifying from an energized unprotected part, 50 v or greater, you will need to be in PPE for Hazard/Risk Category 1, please see following procedures on Zero Voltage Verification (ZVV).
- 6) Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them.

**Zero Voltage Verification (ZVV)  
Hazard/Risk Category 1**

This process is designed for 240V, and below, for voltage testing. While zero voltage verification is being performed, the qualified person will communicate the hazards of energized parts. Signs and barricades will be required. At no time will an unqualified person be allowed to enter the Limited Approach Boundary.

**PPE Requirements of the NFPA 70-E Table 130.7(C)(10)**

- (1) Arc-rated long sleeve shirt (min. arc rating of 4)
- (2) Arc-rated pants (min arc rating of 4)
- (3) Arc-rated face shield or arc-flash suit hood (min arc rating of 4)
- (4) Safety glasses or safety goggles
- (5) Hearing Protection (ear canal inserts)
- (6) Leather gloves (ASTM F 696) over rubber insulating gloves (ASTM D120)
- (7) Hard hat
- (8) Leather work shoes

\*Arc-rated coveralls may be substituted for shirt and pants (min arc rating of 4)

**Equipment used for testing**

Test equipment must be selected based on the intended use and expected voltage or current rating. Leads and probes must be rated at least as much as the instrument.

Make/Model: \_\_\_\_\_

Voltage Rating: \_\_\_\_\_

Verify the test instruments operation before and after zero voltage verification.

**Communication with other trades:**

Once an electrically safe work condition is achieved and verified, the electrical subcontractor will place a de-energized tag on all exposed de-energized circuits or a sign designating the room/area is in an electrically safe working condition. This will allow un-qualified workers to perform work around circuits that have been placed in an electrically safe condition.



**Approach Boundaries:**

Limited Approach (Unqualified Persons):	3'6"
Restricted Approach:	Avoid Contact
Prohibited Approach:	Avoid Contact
Arc Flash Protection Boundary:	4'

**Additional Required Training**

Employees will be trained to understand the specific hazards associated with electrical energy and the relationship between electrical hazards and possible injury. Employees must have received specific training on:

- 1) What electrical hazards are presented by the specific job.
- 2) How electrical hazards affect body tissues.
- 3) How to avoid exposure to hazards
- 4) How to minimize risk by body positioning.
- 5) What PPE is needed for the employee to perform his or her work assignment
- 6) How to select and inspect PPE
- 7) What employer-provided procedures, including specific work practices, the employee must implement
- 8) How increased duration of exposure increases the opportunity of injury
- 9) How to perform a hazard/risk analysis
- 10) How to determine limited, restricted, and prohibited approach boundaries.

### **Instructions**

1) This plan is intended to be used by an electrically qualified person and operating in conditions between 50 and 240 volts. If project is outside of this voltage range then you will need to contact your Corporate Safety Manager for assistance.

2) Page 1 is General Site Conditions, personal qualifications and basic emergency procedures.

3) Page 2 is the procedure to LOTO a system 240 volts and below using an electrically qualified person. It also contains the PPE requirements and LOTO steps. If zero voltage verification can be accomplished without exposure to a potentially energized part (i.e. receptacle with cover plate) then the tester can be in Hazard/Risk Category 0. However, if the tester is verifying from a potentially unprotected energized part the tester needs to be in Hazard/Risk Category 1 and follow the procedures for Zero Voltage Verification on page 3.

4) Page 3 and 4 are used when the electrically qualified person needs to verify the absence of voltage using an exposed unprotected part.

5) After LOTO and ZVV have been accomplished and verified, CCE personnel are now authorized to use a rated voltage test instrument on unprotected parts to re-verify the absence of current. If for some reason the presence of voltage is found during this re-verification process, all unqualified personnel will be removed from the exposed area until an electrically qualified person de-energizes and verifies the circuit(s).

# 241 Volts – 600 Volts Plan

**SITE SPECIFIC SAFETY PLAN  
FOR LOCKOUT/TAGOUT AND  
ZERO VOLTAGE VERIFICATION  
(>240V and up to 600v)**

This plan is intended to provide necessary information for effective site implementation of Safety Policies that apply to specific site conditions. This plan will be completed prior to starting any work on projects that involve exposed energized parts or Lock Out Tag Out.

Company Name: \_\_\_\_\_ Project Start Date: \_\_\_\_\_

Point of Contact: \_\_\_\_\_ Phone # \_\_\_\_\_

Lower Tier Subcontractor (if applicable): \_\_\_\_\_

Centennial/JV Project Name: \_\_\_\_\_

Description of Project: \_\_\_\_\_

Qualified Person: \_\_\_\_\_

\*Please attach the Qualified Person Credentials to this plan.

**Emergency Procedures**

Employees exposed to shock hazards will be trained in methods to release a victim from contact with exposed energized electrical conductors or circuit parts. All affected employees will be trained in first aid procedures and certified in cardiopulmonary resuscitation (CPR) annually. If anyone receives a shock they are required to see a physician to obtain medical clearance to return to work.

**Lock Out and Tag Out (LOTO)**  
**Hazard/Risk Category 0**

This process is designed for >240V and up to 600V, for circuit breaker or fused switch operation with covers on and all blanks inserted (no exposed parts).

**PPE Requirements of the NFPA 70-E {Table 130.7(C)(10)}**

- (1) Shirt (long Sleeve)
- (2) Pants (Long)
- (3) ANSI Safety glasses or goggles
- (4) Hearing protection (ear canal inserts)
- (5) Leather Gloves (ASTM F 696)
- (6) Hard hat

**LOTO Steps**

- 1) Determine all sources of electrical supply to the specific equipment.
- 2) After properly interrupting the load current, open the disconnecting device(s) for each source.
- 3) Visually verify that all blades of the disconnecting devices are fully open or that draw-out type circuit breakers are withdrawn to the fully disconnected position.
- 4) Apply LOTO devices
- 5) Use an adequately rated voltage detector to test each phase conductor or circuit part to verify that they are de-energized. If verifying from an energized unprotected part, 240-600 v, you will need to be in PPE for Hazard/Risk Category 2\*. Please see following procedures on Zero Voltage Verification (ZVV).
- 6) Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them.

**Zero Voltage Verification (ZVV)  
Hazard/Risk Category 2\***

This process is designed for >240V, and up to 600v, for voltage testing. While zero voltage verification is being performed, the qualified person will communicate the hazards of energized parts. Signs and barricades will be required. At no time will an unqualified person be allowed to enter the Limited Approach Boundary.

**PPE Requirements of the NFPA 70-E Table 130.7(C)(10)**

- (1) Arc-rated long sleeve shirt (min. arc rating of 8)
- (2) Arc-rated pants (min arc rating of 8)
- (3) a. Arc-rated flash suit hood or  
b. Face shield with a min arc rating of 8 and balaclava (sock hood) with min arc rating of 8
- (4) Safety glasses or safety goggles
- (5) Hearing protection (ear canal inserts)
- (6) Leather gloves (ASTM F 696) over rubber insulating gloves (ASTM D120)
- (7) Leather work shoes
- (8) Hard hat

\*Arc-rated coveralls may be substituted for shirt and pants (min arc rating of 8)

**Equipment used for testing**

Test equipment must be selected based on the intended use and expected voltage or current rating. Leads and probes must be rated at least as much as the instrument.

Make/Model: \_\_\_\_\_

Voltage Rating: \_\_\_\_\_

Verify the test instruments operation before and after zero voltage verification.

**Communication with other trades:**

Once an electrically safe work condition is achieved and verified, the electrical subcontractor will place a de-energized tag on all exposed de-energized circuits or a sign designating the room/area is in an electrically safe working condition.

This will allow un-qualified workers to perform work around circuits that have been placed in an electrically safe condition.

**Approach Boundaries:**

Limited Approach (Unqualified Persons):	3'6"
Restricted Approach:	1'
Prohibited Approach:	0'1"
Arc Flash Protection Boundary:	4'

**Additional Required Training**

Employees will be trained to understand the specific hazards associated with electrical energy and the relationship between electrical hazards and possible injury. Employees must have received specific training on:

- 1) What electrical hazards are presented by the specific job.
- 2) How electrical hazards affect body tissues.
- 3) How to avoid exposure to hazards
- 4) How to minimize risk by body positioning.
- 5) What PPE is needed for the employee to perform his or her work assignment
- 6) How to select and inspect PPE
- 7) What employer-provided procedures, including specific work practices, the employee must implement
- 8) How increased duration of exposure increases the opportunity of injury
- 9) How to perform a hazard/risk analysis
- 10) How to determine limited, restricted, and prohibited approach boundaries.

### **Instructions**

- 1) This plan is intended to be used by an electrically qualified person and operating in conditions between >240 and 600 volts. If the project is outside of this voltage range then you will need to contact your Corporate Safety Manager for assistance.
- 2) Page 1 is General Site Conditions, personal qualifications and basic emergency procedures.
- 3) Page 2 is the procedure to LOTO a system >240 volts and up to 600 volts using an electrically qualified person. It also contains the PPE requirements and LOTO steps. If zero voltage verification can be accomplished without exposure to a potentially energized part (i.e. receptacle with cover plate) then the tester can be in Hazard/Risk Category 0. However, if the tester is verifying from a potentially unprotected energized part the tester needs to be in Hazard/Risk Category 2\* and follow the procedures for Zero Voltage Verification (ZVV) on page 3.
- 4) Page 3 and 4 are used when the electrically qualified person needs to verify the absence of voltage using an exposed unprotected part.
- 5) After LOTO and ZVV have been accomplished and verified, CCE personnel are now authorized to use a rated voltage test instrument on unprotected parts to re-verify the absence of current. If for some reason the presence of voltage is found during this re-verification process, all unqualified personnel will be removed from the exposed area until an electrically qualified person de-energizes and verifies the circuit(s).



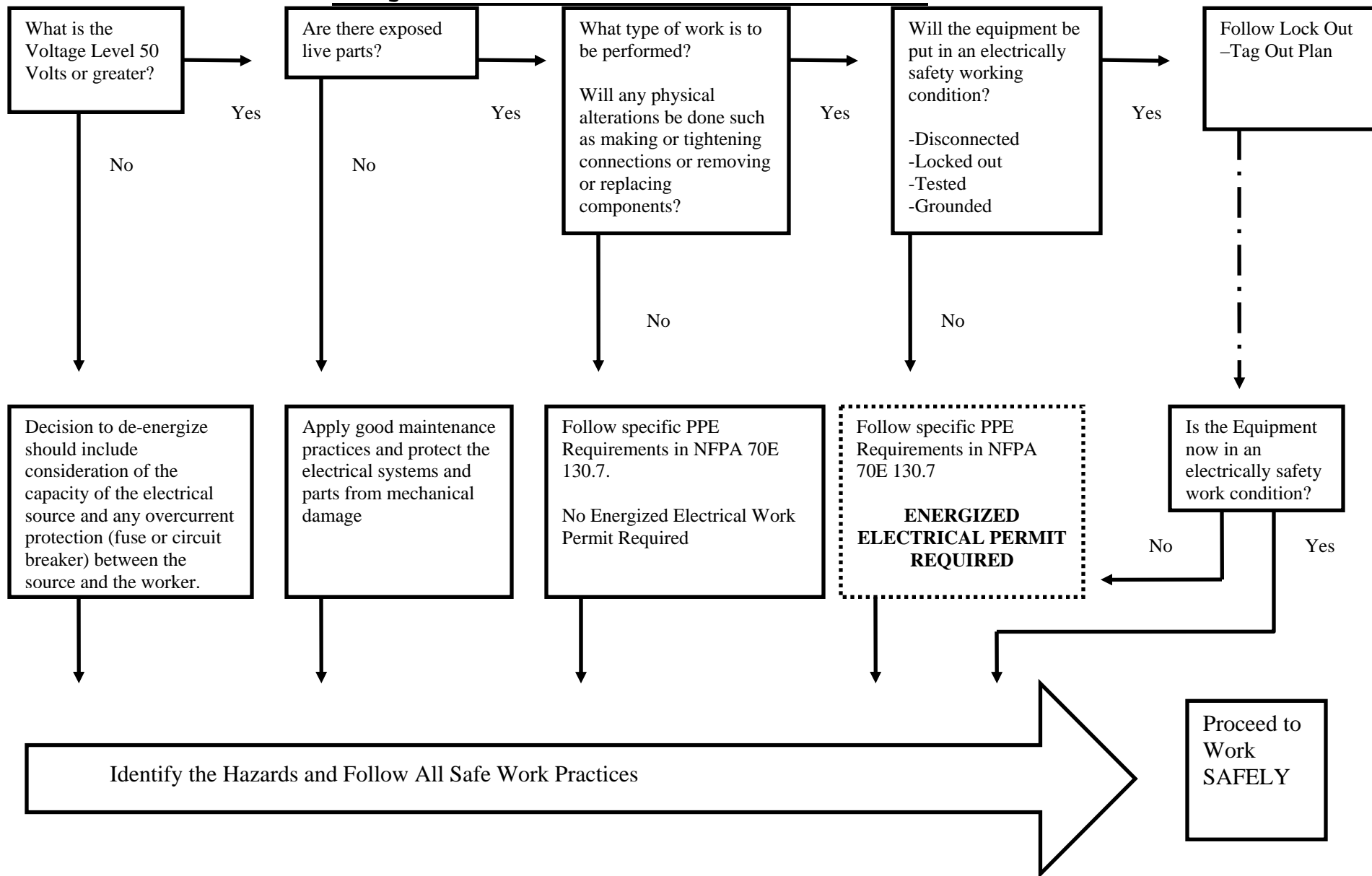
## **Energized Work Process and Permit**

**Energized Work Policy:** Centennial, and our joint ventures, have decided that work on or near an exposed energized electrical conductor will be a last resort and only after all other possibilities for establishing an electrically safe work condition have been exhausted. Energized work will only be authorized by permit.

**Justification for Energized work.** Centennial, and our joint ventures, will only authorize energized work if one or more of the following conditions are met.

- 1) **Greater Hazard:** Energized work shall be permitted where the subcontractor can demonstrate that de-energizing introduces additional or increased hazards. Examples include; life support equipment, deactivation of emergency alarm systems or shut down of hazardous location ventilation equipment.
- 2) **Infeasibility:** Energized work shall be permitted where the subcontractor can demonstrate that the task to be performed is infeasible in a de-energized state due to equipment design or operational limitations. Examples include; Performing diagnostics and testing, Start up or troubleshooting.
- 3) **Less than 50 Volts:** Energized electrical conductors and circuit parts that operate at less than 50 volts to ground shall not be required to be de-energized where the capacity of the source and any over current protection between the energy source and the worker are considered and it is determined that there will be no increased exposure to electrical burn or to explosion due to electrical arcs.

### Energized Electrical Work Permit Flow Chart





**Part I: TO BE COMPLETED BY SUBCONTRACTOR MAKING REQUEST**

CCE Number \_\_\_\_\_

(1) Description of circuit/equipment/job location:

---

(2) Description of work to be completed:

---

(3) Justification of why the circuit/equipment cannot be de-energized or the work deferred until the next scheduled outage:

---

\_\_\_\_\_  
Requester/Title

\_\_\_\_\_  
Date

**Part II: TO BE COMPLETED BY THE ELECTRICALLY QUALIFIED PERSON DOING THE WORK:**

(1) Description of the Safe Work Practices to be employed:

---

(2) **Shock Hazard Analysis:**

Approach Boundaries: Limited \_\_\_\_ Restricted \_\_\_\_ Prohibited \_\_\_\_

(3) **Results of Flash Hazard Analysis:**

Flash Protection Boundary: \_\_\_\_ Hazard/Risk Category \_\_\_\_\_

(4) Necessary personal protective equipment to safely perform the assigned task:

---

(5) Means employed to restrict the access of unqualified persons from the work area:

---

(6) Evidence of completion of a Job Briefing including discussion of any job-related hazards:

---

(7) Do you agree the above described work can be done safely? **YES** / **NO** (circle: If no return to requester)

\_\_\_\_\_  
Electrically Qualified Person/License #

\_\_\_\_\_  
Date

**Part III: APPROVAL TO PERFORM THE WORK WHILE ELECTRICALLY ENERGIZED**

\_\_\_\_\_  
CCE/JV SSR

\_\_\_\_\_  
Date

\_\_\_\_\_  
Corporate Safety Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
Customer

\_\_\_\_\_  
Date