Permanent Electrical Safety Devices Keep Workers on the Safe Side of Lock-out Tag-out.

Safe Work Conditions Based Upon NFPA 70E and OSHA

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Keeping Workers Away from Voltage:

- Exceeding NFPA 70E 120.1 (1-6) in “creating electrically safe work conditions”

- We do LOTO without opening the door and PPE.*

- Your voltmeter no longer ‘stands alone’ between you and voltage.

*Provided a hazard risk analysis on the panel.
The “Voltmeter” for LOTO:

- The writers of 70E only ‘envisioned’ a voltmeter to validate zero electrical energy.
- This portable tool precisely meets the ‘letter of the law’ 120.1(1-6).
- ...means that PPE is always required because voltage always ‘EXISTS’.
- Regardless of the task, workers still need to validate their voltmeter (to a separate known voltage source) for all tasks.
“Creating Electrically Safe Work Conditions”
NFPA 70E 120.1 (1-6) with

“Permanent Voltage Detection”

• Is ALWAYS present.
• Designed around a 3-phase system.
• Simplifies/eliminates PPE requirements for opening enclosures.
• Eliminates potential voltage exposure during mechanical LOTOs.
• Needs validation ‘before and after’ each use.
• Effectively ‘labels’ voltage sources.
Built upon time-tested safety principles

Permanent Electrical Safety Devices (PESDs) build upon existing electrical safety procedures
Our Objectives:

Show how Permanent Electrical Safety Devices (PESDs):

• ...exceed NFPA 70E 120.1 (1-6)
• ...the validation process also meets NFPA 70E 120.1 (1-6).
• ...simplify PPE requirements for opening enclosures? (hazard risk analysis was performed on the panel(s)).
Our Agenda:

**PESDs:**
- Defined
- Described
- Validated
- Applied
- Benefits
PESDs Defined:

Definition – PESDs:

...are permanently mounted to electrical systems and reduce arc flash and shock hazard risks.

...provide voltage verification without exposure to voltage.

...are directly connected to voltage(s) source(s) within an electrical enclosure.

....self-powered; requiring no separate power supply.

...provide multiple voltage state determinations; audible, visual indications, and/or a physical action by the worker.

...label all voltage sources wired to PESDs (NFPA 70E 120.1(1))
PESDs Described:

Voltage Indicator: A ‘Voltage Only’ device that illuminates when voltage is present between any 2 phases.

Hardwired
Checks L1-L2-L3-GRD Simultaneously 24/7/365

AC/DC Operation
(40-750VAC/30-1000VDC)

Class 1 Division 2 Rated

Powered by Line Voltage - No Batteries

Cat III & IV Rated

Long Life LEDs
PESDs Described:

Voltage Portal:

- Isolator
- Grounded Metallic Enclosure
- Non Contact Voltage Detector
- #18 AWG 6’ Lead wire with metal end
- Nema 4X Gasket
PESDs Described:

3-Phase Voltage Portal:

- Isolator
- #12 AWG 6' Lead wire with metal end
- Non Contact Voltage Detector
- Gasket
- Grounded Metallic Enclosure

Fig. 1
PESDs Described:

Combination Unit:

Two independent PESDs results in redundancy.
PESDs Described:

Medium Voltage Indicator (R-1VL/R-1VH)

Features:

- Qty. (3) Long Life LED's per Unit
- 2KV to 43KV Operating Range
- ½” bolt hole mounting
- Viewing Angle Adjustability

Capacitive Ground Coupling
Ground Ring
Adjustable Viewing Angle
Connection to Bus (½” bolt)
Validating Voltage Detectors

“Before and after each test, determine that the voltage detector is operating satisfactorily” NFPA 70E 120.1(5)

Test the voltage detector to a known voltage source
Test the actual voltage source
Retest to a known source.

Voltage Indicator-impractical
NCVD--practical

Current must flow between two potentials for a voltage detector circuit to detect voltage.
A Typical 480V 3-Phase System

Normal: Current flow between L1, L2 & L3. No Current to Ground

One Phase Lost: Current flow between L1, L3, & Ground

Two Phases Lost: Current Flow between L1 & Ground

NO Ground—NO voltage indications with one phase live.

6 possible current paths
PESDs Validated:

Reliability

High Resistance Passive Input Impedance for High Surge Immunity and Current Limiting

Internal Flashing Circuitry

Voltage if Illuminated

Dual (+/-) LED’s per Phase
Complete circuit needs two phases

Written procedure must validate device.
PESDs Validated:

NCVDs work on current flow

Law of Capacitance

Parasitic Capacitance

Completed Circuit

Capacitance Voltage Drop

Smaller

To Other Energized Conductors

Bigger
PESDs Validated:

Validating the NCVD-Portal “System”

- Verify capacitive path to ground
- Reduce parasitic capacitance within panel design
Where will a NCVD work more reliably?
PESDs Validated:

How Does Thru-Panel Voltage Detection meet NFPA 70E 120.1 (1) – (6)?

- **(1)** “Determines ALL sources” with PESDs ‘labels’ all sources on the outside of the panel.
- **(5)** “adequately rated”—CAT III/IV.
- **(5)** Hardwired to source.
- **(5)** Phase-Phase & Phase-GRD Check
- **(5)** NCVD can be verified after test, voltage indicator cannot.
- **(5)** FPN Certified under UL 61010-1.
LOTO with Voltage Indicator  
(NFPA 70E Annex G)  

6.0 Before LOTO  
6.1 Locate electrical energy  
6.2 Open the disconnect  
6.3 Apply Lock-out Devices  
6.4 Try to operate the disconnect  
6.5 Inspect voltmeter  
6.6 Verify voltmeter, test for voltage  
6.7 Re-verify voltmeter  
6.8 Install grounding straps if necessary  
6.X Reapply Power and Verify Voltage Indicator
Voltage Indicator/Voltmeter Comparison

- ‘Voltage only’ device
- Hardwired to the voltage source
- Permanent device - less opportunity for damage
- Checks L1-L2-L3-GRD 24/7/365
- Detects both AC & DC (Stored energy)
- Self-powered (no batteries)
- ‘Visual blade’ indication
Benefit Summary

• Mechanical LOTO on the safe side of electrical energy
• Provides information (phase loss, blown fuse, etc.)
• Thru-panel labeling for voltage sources.
• Verification of zero electrical energy before opening the panel. Electrician checks a ‘dead’ panel with a voltmeter.
• Reduce arc flash risks when voltage checking and more distance from arc flash source.
PESD's Benefits:

Resources (http://www.graceport.com/thru_door.cfm)

- Voltage Portals Improve Non-Contact Voltage Detectors (NCVD) Application Note:
- Voltage Indicator: How Does It Work?
- Voltage Indicator Overcurrent Protection Application Note:
- Thru-Door Voltage Detection Makes Sense:
Keeping workers on the SafeSide™ of voltage

“Hey Burnie, it says here that frying is bad for your health.”

Permanent Electrical Safety Devices