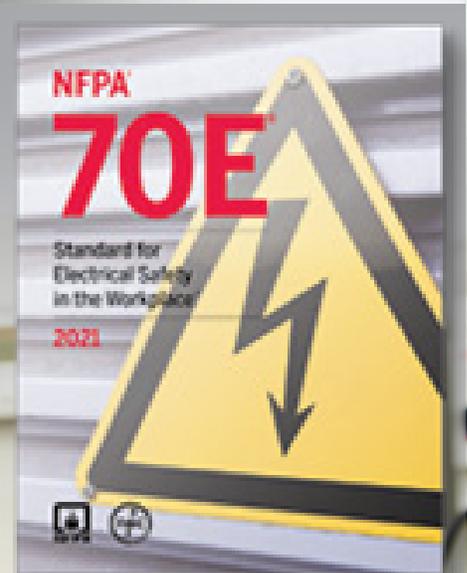


---

# Update to the NFPA 70E Standard - 2021 Edition

*The Standard for Electrical Safety in the Workplace*<sup>®</sup>  
Clarifies Provisions for Absence of Voltage Testers

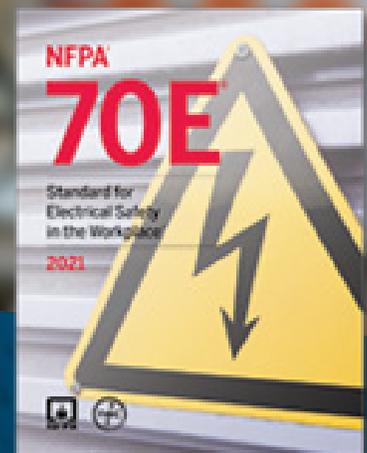


Reprinted with permission from NFPA 70E-2021, copyright © 2021 National Fire Protection Association, all rights reserved.

The numerical designation 70E<sup>®</sup>, Standard for Electrical Safety in the Workplace<sup>®</sup> and the NFPA logo are registered trademarks of the National Fire Protection Association, Quincy, MA 02169



The National Fire Protection Association (NFPA) is a trade association that develops and maintains various standards and codes designed to prevent injury and economic loss caused by fire and electrical related hazards. The organization publishes NFPA 70E, the *Standard for Electrical Safety in the Workplace* and updates the standard every three years. One change in the latest version, NFPA 70E 2021, includes new language in Article 120.5 (7) providing clarity regarding the requirements to test for the absence of voltage. This white paper examines options for absence of voltage testing, the new language, how different types of products compare, and explains how the VeriSafe Absence of Voltage Tester (AVT) complies with NFPA 70E requirements.



NFPA 70E-2021 Standard for Electrical Safety in the Workplace.



## Method for Verifying the Absence of Voltage

NFPA 70E, Article 120.5, *Process for Establishing and Verifying an Electrically Safe Work Condition*, describes a series of steps to verify the absence of voltage after equipment has been de-energized with lockout/tagout equipment applied.

Prior to 2018, the process electrical workers would use to verify the absence of voltage in a panel or other electrical equipment required the use of an "...adequately rated test instrument...", which was not very specific.

In 2018 a distinction was made between portable and permanently mounted testers. An exception was added that included specific requirements for permanently mounted absence of voltage testers (AVT). In NFPA standards, an exception is an alternate method to comply with a mandatory requirement. This means that personnel can choose to use either a portable test instrument or a permanently mounted absence of voltage tester to verify the absence of voltage, but both methods are not required.

With the release of the 2021 edition, Step (7) and the Exception were modified to improve the clarity of the requirements. From NFPA 70E (changes in the 2021 edition are underlined):

### NFPA 70E-2021 120.5

"(7) Use an adequately rated portable test instrument to test each phase conductor or circuit part to test for the absence of voltage. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Before and after each test, determine that the test instrument is operating satisfactorily through verification on any known voltage source.

Exception No. 1 to (7): An adequately rated permanently mounted absence of voltage tester shall be permitted to be used to test for the absence of voltage of the conductors or circuit parts at the work location, provided it meets the all following requirements:

- (1) It is permanently mounted and installed in accordance with the manufacturer's instructions and tests the conductors and circuit parts at the point of work;
- (2) It is listed and labeled for the purpose of testing for the absence of voltage;
- (3) It tests each phase conductor or circuit part both phase-to-phase and phase-to-ground;
- (4) The test device is verified as operating satisfactorily on any known voltage source before and after testing for the absence of voltage.

Informational Note No. 2: For additional information on rating and design requirements for permanently mounted absence of voltage testers, refer to UL 1436, Outlet Circuit Testers and Other Similar Indicating Devices."

Although Exception No. 1 has been in NFPA 70E since the 2018 edition, recent updates in 2021 add clarity by changing “test device” to “absence of voltage tester.” As the new Informational Note No. 2 states, more information on permanently mounted AVTs can be found in the product standard for absence of voltage testers, UL 1436. This new reference to UL 1436 is important because of item (2) in Exception 1 – the requirement to be listed and labeled for the purpose of testing for the absence of voltage. There are several types of permanently mounted products, some of which are listed for other purposes, but do not comply with absence of voltage testing listing requirements. Permanently mounted products are not all equal so be sure to look for the UL 1436 listing.



To further improve readability, terminology was updated to remain consistent with the rest of the standard. In several instances, “verify” was changed to “test for” (verify is used to determine if a test instrument is operating properly, while testing is used to describe the process of checking for a circuit condition). Similarly, “deenergized” was replaced with “absence of voltage” throughout this section.

## Meeting Exception 1 of NFPA 70E-2021, Section 120.5 (7)

While there are several types of electrical safety products on the market that are permanently mounted, not all are suitable or for absence of voltage testing. It is important to thoroughly examine the features and functionality of each type of product to determine if they satisfy the criteria set forth in NFPA 70E.



### Voltage Test Portals with a Hand-held Voltage Tester

Test portals are permanently mounted devices that can be used with a portable tester, such as a digital multimeter, to measure voltage. These devices are an excellent tool for troubleshooting and determining the magnitude or value of any voltage that is present.

However, using test portals with a portable test instrument can lead to unreliable results when testing for the absence of voltage and is not recommended. For example, test portals do not meet the requirements of part (2) of Exception 1—there is no way to confirm that the probes of the hand-held tester are in direct contact with the electrical conductors inside the enclosure at the time of test. If the leads from a voltage portal are not properly terminated or disconnected, voltage will not be detected, regardless of whether or not the conductor is energized. Often the leads of test portals are fused, resulting in a measurement at the load side of the fuse, not the source conductor. An open fuse will lead to a de-energized measurement, even when voltage is present. Further, although some test portals may be UL listed, they are not listed for the purpose of verifying the absence of voltage and do not meet part (2) of Exception 1.

Test portals are permanently mounted but rely on a portable tester. As a hybrid, test portals would have to meet the requirements of both Step 7 and Exception No. 1 to ensure a reliable result. The test portal can be thought of as an extension of the circuit part or source conductor – not the actual circuit part. Portals are okay to do a preliminary verification check at the portal. However, before removing PPE or performing any work, best practice is to perform an additional test with the portable test instrument directly at the source conductor or actual circuit part to conclusively prove a de-energized condition exists.

Test portals are a great tool to reduce risk when troubleshooting and measuring voltage presence. However, proving absence of voltage through a permanently mounted device has additional requirements that test portals do not meet.

## Panel Meter

Although it may appear that a panel meter would meet the requirements of Exception 1, the problems lie with part (2), (3), and (4). These do not meet part (2) without a listing for verifying the absence of voltage, such as UL 1436. Part (3) dictates that the tester analyzes each phase from phase-to-ground and phase-to-phase. In-panel voltage meters are hard wired but typically only measure phase-to-ground voltage.

A panel meter does not have a self-test function to verify proper operation, required in part (4). A panel meter checking for voltage may be defective and therefore may not indicate that voltage is present when equipment is energized. Another cause for misindication can occur if one of the sensing leads has dislodged and is no longer connected to the source. Panel meters can warn of voltage presence, but any indication of absence of voltage is not guaranteed.

## Voltage Indicator

A voltage indicator is an installed device that illuminates when voltage is present; however, a voltage indicator can be unreliable. When lights on the indicator are off, there could still be voltage if there is a hardware failure, such as the indicator functioning abnormally or if the LEDs fail. Improper installation of a voltage indicator or loose leads can cause the voltage indicator to become disconnected from its source, resulting in false or unreliable indications. These are some of the reasons why OSHA stated in an Interpretation Letter<sup>1</sup> that voltage indicators are not allowed to be used to verify the isolation and deenergization of a machine or equipment. Regardless of whether electrical or mechanical work will be performed, voltage indicators are not a test instrument and should not be used when verifying the absence of voltage. Ultimately, voltage indicators do not meet the requirements for part (2), (3), and (4) of Exception 1.

## Absence of Voltage Tester (AVT)

An AVT differs from other permanently mounted electrical safety products because it is designed specifically to prove the absence of voltage exists. The traditional method of using a portable voltage tester to check for an absence of voltage requires equipment doors to be open to conduct the test. This exposes the electrical worker to potentially lethal voltages. However, AVTs allow the worker to verify the absence of voltage prior to opening the panel which reduces the risk of an electrical incident.

To operate an AVT, a user pushes a button to initiate the test sequence. The test sequence is performed automatically and includes verifying the tester is functioning with a known voltage source, ensuring the tester is properly installed and in direct contact with the circuit at the time of testing, and testing for absence of AC and DC voltage phase-to-phase and phase-to-ground. If all requirements in the test sequence are satisfied, a green indicator will illuminate to visually convey that the absence of voltage has been confirmed.

All AVTs use active indicators to visually convey that voltage is not present. As an additional safety feature, some testers such as the VeriSafe AVT incorporate voltage indicators to show when voltage is present, similar to a voltage indicator. Requirements in UL 1436 for AVTs are very extensive and include a variety of features to ensure the absence of voltage test function is fail-safe and reliable. Active indicators, built-in overcurrent protection, and SIL 3 reliability for all safety functions are some of the important features. In addition, AVTs are designed to keep hazardous voltage away from the door and user interface.

### Key features of an AVT

- Tests without exposure to harmful voltages
- Self-contained; no need for additional meters or tools
- Built-in pre-/post-verification test
- Verification that the tester is in contact with the circuit before and after every test
- Tests for absence of AC and DC voltage
- Tests phase-to-phase and phase-to-ground
- Automated test sequence
- Active indication for absence of voltage
- Safety functions meet safety integrity level (SIL) 3 per IEC 61508<sup>2</sup>

<sup>1</sup>Galassi, T. (2012, December 12). Whether an LED type device can be used for the isolation and deenergization verification requirements of 1910.147 and 1910.333. Retrieved from <https://www.osha.gov/laws-regs/standardinterpretations/2012-12-12www.osha.gov/laws-regs/standardinterpretations/2012-12-12>.

<sup>2</sup>IEC 61508 *Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems*.



## Product Comparison

Table 1 shows a side-by-side comparison on how permanently mounted products including voltage meters, voltage indicators, test portals, and the VeriSafe AVT perform with respect to the requirements in Exception 1. Only the VeriSafe AVT meets all of the requirements for verifying the absence of voltage.

Table 1. Comparison of Products and Capabilities

NFPA 70E-2021 120.5 (7) Exception No. 1		 Panel Meter	 Voltage Indicator	 Voltage Test Portals	 VeriSafe AVT
(1)	It is permanently mounted and installed in accordance with the manufacturer's instructions and tests the conductors and circuit parts at the point of work	Yes	Yes	Yes	Yes
(2)	It is listed and labeled for the purpose of testing for the absence of voltage	N/A (no test function)	N/A (no test function)	No (no guarantee hand-held tester is in contact with circuit)	Yes
(3)	It tests each phase conductor or circuit part both phase-to-phase and phase-to-ground	No	No	No	Yes
(4)	The test device is verified as operating satisfactorily on any known voltage source before and after testing for the absence of voltage	Only phase-to-ground	Only phase-to-ground	Yes, with hand-held tester	Yes
(5)	The test device is verified as operating satisfactorily on any known voltage source before and after testing for the absence of voltage	No	No	No (hand-held tester requires access to a known voltage source)	Yes
Note 1	Meets rating and design requirements for absence of voltage testers described in UL 1436	No	No	No	Yes

## VeriSafe AVT – The Safe, Efficient, Reliable Way to Verify

When servicing electrical equipment, workers must comply with safety regulations that require a test to confirm the absence of voltage. Prior to performing de-energized work on electrical equipment, NFPA 70E requires that workers verify equipment is in an electrically safe work condition. Permanently mounted testers, like the VeriSafe AVT make testing for absence of voltage safer and more efficient. The VeriSafe AVT is the first absence of voltage tester listed to UL 1436 designed specifically for the requirements of NFPA 70E-2021, Section 120.5 (7), Exception 1.



The VeriSafe AVT tests for absence of voltage in low voltage electrical enclosures, helps reduce electrical hazards and the complexity of testing with a hand-held tester, and is more reliable than a simple voltage indicator or meter.

Visit <http://www.panduit.com/verisafe> for more information.

### Portable Testers



**Manual Process**  
Possible Exposure to Electrical Hazards  
on Average Takes **10-20 Minutes** to Complete

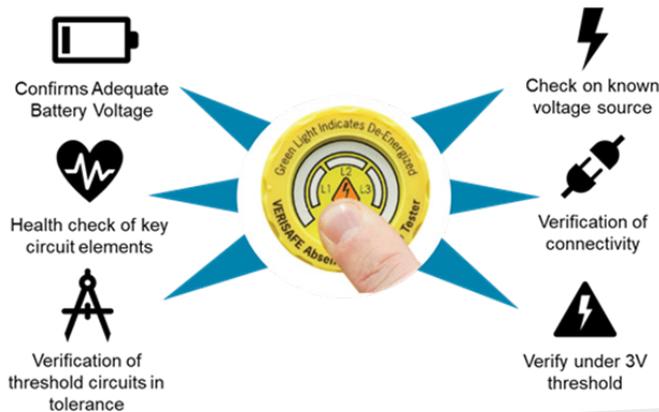
vs.

### VeriSafe™ Absence of Voltage Testers



**Automatically Performed in Sequence**  
No Exposure to Electrical Hazards  
Takes **Less Than 10 Seconds** to Complete

## What Happens During an AVT Test?





Since 1955, Panduit's culture of curiosity and passion for problem solving have enabled more meaningful connections between companies' business goals and their marketplace success. Panduit creates leading-edge physical, electrical, and network infrastructure solutions for enterprise-wide environments, from the data center to the telecom room, from the desktop to the plant floor. Headquartered in Tinley Park, IL, USA and operating in 112 global locations, Panduit's proven reputation for quality and technology leadership, coupled with a robust partner ecosystem, help support, sustain, and empower business growth in a connected world.

**For more information**

**Visit us at [www.panduit.com/verisafe](http://www.panduit.com/verisafe)**

**Contact Panduit North America Customer Service by email: [cs@panduit.com](mailto:cs@panduit.com)  
or by phone: 800.777.3300**

THE INFORMATION CONTAINED IN THIS WHITE PAPER IS INTENDED AS A GUIDE FOR USE BY PERSONS HAVING TECHNICAL SKILL AT THEIR OWN DISCRETION AND RISK. BEFORE USING ANY PANDUIT PRODUCT, THE BUYER MUST DETERMINE THE SUITABILITY OF THE PRODUCT FOR HIS/HER INTENDED USE AND BUYER ASSUMES ALL RISK AND LIABILITY WHATSOEVER IN CONNECTION THEREWITH. PANDUIT DISCLAIMS ANY LIABILITY ARISING FROM ANY INFORMATION CONTAINED HEREIN OR FOR ABSENCE OF THE SAME.

All Panduit products are subject to the terms, conditions, and limitations of its then current Limited Product Warranty, which can be found at [www.panduit.com/warranty](http://www.panduit.com/warranty).

\* All trademarks, service marks, trade names, product names, and logos appearing in this document are the property of their respective owners.

PANDUIT US/CANADA  
Phone: 800.777.3300

PANDUIT EUROPE LTD.  
London, UK  
[cs-emea@panduit.com](mailto:cs-emea@panduit.com)  
Phone: 44.20.8601.7200

PANDUIT SINGAPORE PTE. LTD.  
Republic of Singapore  
[cs-ap@panduit.com](mailto:cs-ap@panduit.com)  
Phone: 65.6305.7575

PANDUIT JAPAN  
Tokyo, Japan  
[cs-japan@panduit.com](mailto:cs-japan@panduit.com)  
Phone: 81.3.6863.6000

PANDUIT LATIN AMERICA  
Guadalajara, Mexico  
[cs-la@panduit.com](mailto:cs-la@panduit.com)  
Phone: 52.33.3777.6000

PANDUIT AUSTRALIA PTY. LTD.  
Victoria, Australia  
[cs-aus@panduit.com](mailto:cs-aus@panduit.com)  
Phone: 61.3.9794.9020