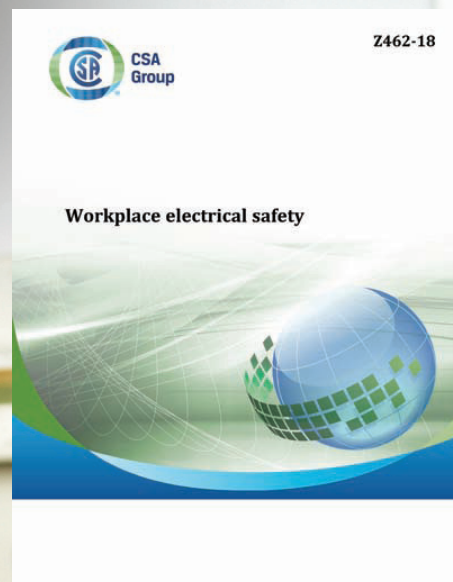


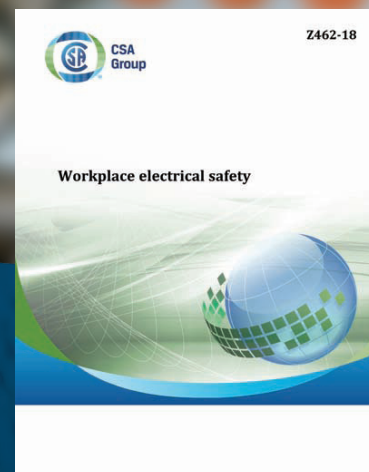
Update To The CSA Z462 Standard

Workplace Electrical Safety Standard Adds
Clarifications for Absence of Voltage Testers





The CSA Group's **Standard Develop** organization is a collection of 10,000 members committed to improving safety, health, environment, **economic efficiency** in Canada. The organization publishes many electrical safety standards, including the Canadian Electrical Code (CEC), CSA C22.2 NO. 14-18 (Industrial Control Equipment) and Workplace Electrical Safety (CSA Z462). CSA Z462, Workplace Electrical Safety, is updated every 3 years. One change in the latest version includes new language in 4.2.5 about absence of voltage verification with a permanently mounted tester. This white paper examines the new CSA Z462 options for absence of voltage testing, reviews the advantages and limitations of various voltage testing and voltage indicator products, and explains how the VeriSafe™ Absence of Voltage Tester (AVT) complies with the new CSA Z462 requirements.



CSA Z462 Workplace
Electrical Safety Standard



Updated Method of Verifying Absence of Voltage

In the 2018 edition of CSA Z462, the process electrical workers would use to verify the absence of voltage the use of an “...adequately rated test instrument...” which has typically been interpreted as a hand-held voltage tester. The 2018 edition also included an informational note to part (g) on using products other than handheld test instruments. The note describes an “adequately rated permanently mounted test device”, known as an Absence of Voltage Tester (AVT), that can be used to supplement the absence of voltage test. While including this note in the 2018 edition was a step in the right direction for safety, it did not allow for the complete elimination of the portable test process and potential hazards associated with it.

In the upcoming 2021 edition of CSA Z462, section 4.2.5(g) made an important change to permanently mounted test devices, and their involvement with the method for checking for absence of voltage. The 2021 edition added an exception, also known as an approved alternative, to using a hand-held test instrument. Instead of being used as a supplement, adequately rated permanently mounted absence of voltage testers can now be used in lieu of a portable test instrument.

The new proposed language in CSA Z462 4.2.5(g) states:

Exception 2): An adequately rated permanently mounted absence of voltage tester may be used to test for the absence of voltage of the conductors or circuit parts at the work location, provided it meets the following requirements:

- a. 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
- b. It is listed and labeled for the purpose of verifying the absence of voltage
- c. It tests each phase conductor or circuit part both phase-to-phase and phase-to-ground
- d. The test device is verified as operating satisfactorily on any known voltage source before and after verifying the absence of voltage”

In addition, the 2021 edition also includes a key informational note providing clarity as to what an “adequately rated” absence of voltage tester is:

Notes: 1) 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.

For the remainder of this paper, CSA Z462 4.2.5(g) Exception 2 will be referred to as Exception 2.

Part of the motivation for including Exception 2 was to stimulate original solutions and development of new technology for safety applications and make testing for an absence of voltage safer and more efficient. For example, when performing the traditional method of using a hand-held voltage tester to check for an absence of voltage in a control panel, the door must be open to conduct the test. This exposes the electrical worker to potentially lethal voltages. However, implementing permanently mounted AVTs allows the worker to verify the absence of voltage prior to opening the panel which reduces the risk of an electrical incident.



Meeting Exception 2 of CSA Z462 2021, Section 4.2.5(g)

While there are several permanently mounted products on the market, it is important to examine how they perform against each of the criteria in Exception 2.

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 (b) of Exception 2—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 (b) of Exception 2.

Test portals are permanently mounted but rely on a portable tester. As a hybrid, test portals would have to meet the requirements of both 4.2.5(g) and Exception 2 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 2, the problems lie with part (b), (c), and (d). These do not meet part (b) without a listing for verifying the absence of voltage, such as UL 1436. Part (c) 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 (d). 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. 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 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 61508¹

¹IEC 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 2. Only the VeriSafe AVT meets all of the requirements for verifying the absence of voltage.

Table 1. Comparison of Products and Capabilities

CSA Z462 2021, Section 4.2.5(g) Exception 2		 Panel Meter	 Voltage Indicator	 Voltage Test Portals	 VeriSafe AVT
(a)	It is permanently mounted and installed in accordance with the manufacturer's instructions	Yes	Yes	Yes	Yes
(a)	and tests the conductors and circuit parts at the point of work	N/A (no test function)	N/A (no test function)	No (no guarantee hand-held tester is in contact with circuit)	Yes
(b)	It is listed and labeled for the purpose of testing for the absence of voltage	No	No	No	Yes
(c)	It tests each phase conductor or circuit part both phase-to-phase and phase-to-ground	Only phase-to-ground	Only phase-to-ground	Yes, with hand-held tester	Yes
(d)	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

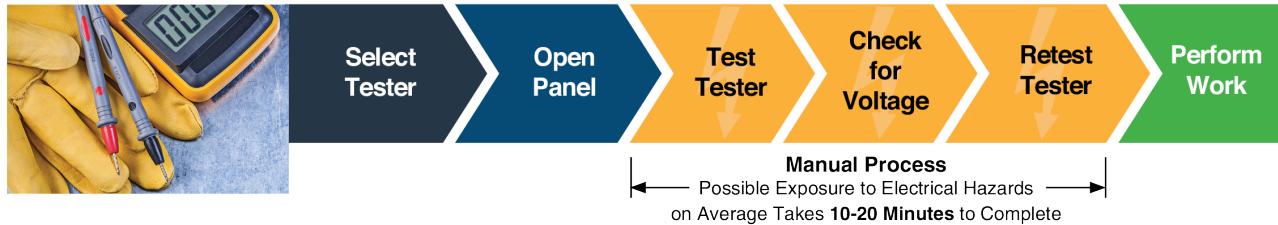
When servicing electrical equipment, workers must comply with safety regulations that require a voltage verification test to validate the absence of voltage. Prior to performing de-energized work on electrical equipment, CSA Z462 requires that workers verify equipment is in an electrically safe work condition. The VeriSafe AVT is the first absence of voltage tester listed to UL 1436 designed specifically for the requirements of CSA Z462-21, Section 4.2.5 (g), Exception 2.



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.

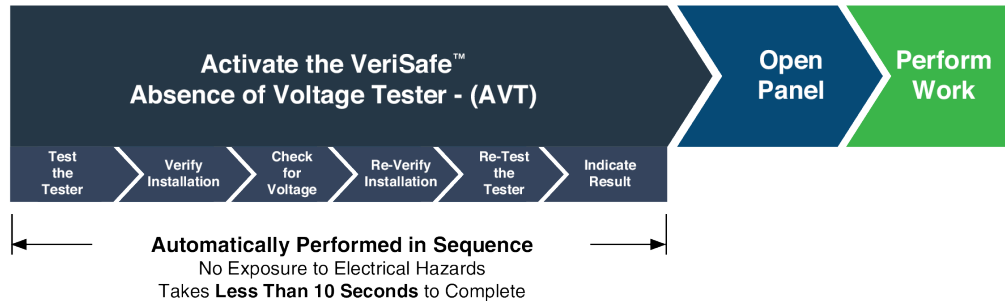
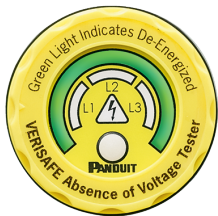
Visit <http://www.panduit.com/verisafe> for more information.

Portable Testers

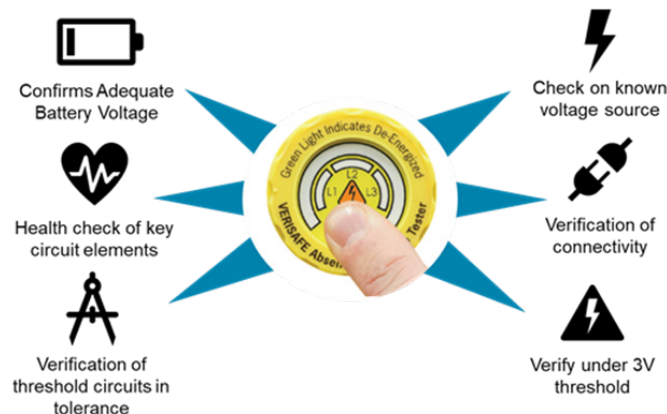


VS.

VeriSafe™ Absence of Voltage Testers



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

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