

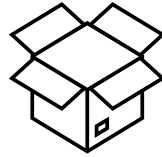


January 2024
(Version-2.0.0)

VDPRG-V4 - Test Unit Manual



Testing requirements according to CSA Z32-21 standard for electrical safety and essential electrical systems in health care facilities (Figures 2,3 and 4).



ABOUT THE TEST KIT

The VDPRG-V4 measurement circuits have been designed in accordance with Figures 2,3 and 4 of the CSA Z32-21 standard for electrical safety and essential electrical systems in health care facilities.

This unit, utilizing accessory and customer supplied calibrated voltmeter meeting the specifications of CSA Z32-21, tests receptacle polarity, continuity and voltage difference between receptacle bonding poles and exposed conductive non-current-carrying parts in the same patient care environment (Figure 3), voltage drop (Figure 2), and ground return path voltage rise (Figure 4) on 15A and 20A 120-volt receptacles installed in solidly grounded system.

Insulation resistance, branch circuit breaker mechanical operation, receptacle identification and retentive force are tests to be completed manually that may require customer supplied accessories.



SAFETY PRECAUTIONS

Please read this user's guide before operating the instrument. Read and understand all safety precautions and operation instructions before attempting to use this unit. The purpose of this equipment is limited to use as described in this user's guide. Do not use the equipment or its accessories with any device other than those specifically described.

The test set and equipment to which it is connected are a possible source of electric shock hazard. Persons not engaged in the test must stand clear of all parts of the test circuit and connections, unless the test set is de-energized. Every effort has been made to point out the proper procedures and precautions to be followed by the user in operating this equipment.

It is not possible to foresee every hazard which may occur in the various applications of this equipment. It is therefore essential that the user, in addition to following the safety rules, also carefully consider all safety aspects of the test before proceeding.

- Safety is the responsibility of the user.
- Misuse of this equipment can be extremely dangerous. Never connect the test set to equipment that the test unit isn't designed for.
- For safety reasons, tests shall not be performed on circuits that are supplying energy to connected medical equipment.
- Ensure cooling inlets and outlets are never blocked.
- Ground connection to the unit is in the power connection cord and should be made first and removed last. Use the supplied receptacle polarity tester to ensure polarity and ground integrity of the supply power outlet. Any interruption of the grounding connection can create an electrical shock hazard. It is recommended that the power to the unit be supplied from a GFI circuit.
- Always disconnect test leads from the devices under test before attempting to disconnect them at the test set.
- Do not use the test set in an explosive atmosphere.
- Test instruments must only be used by suitably trained and competent people. Observe all safety warnings marked on the equipment.
- Corrective maintenance must only be performed by qualified personnel who are familiar with the construction and operation of the test set and the hazards involved.
- The results of any test from this unit must be evaluated by a trained person that understands the testing procedure and can verify the accuracy of the testing results.



BEFORE TESTING

Read this manual

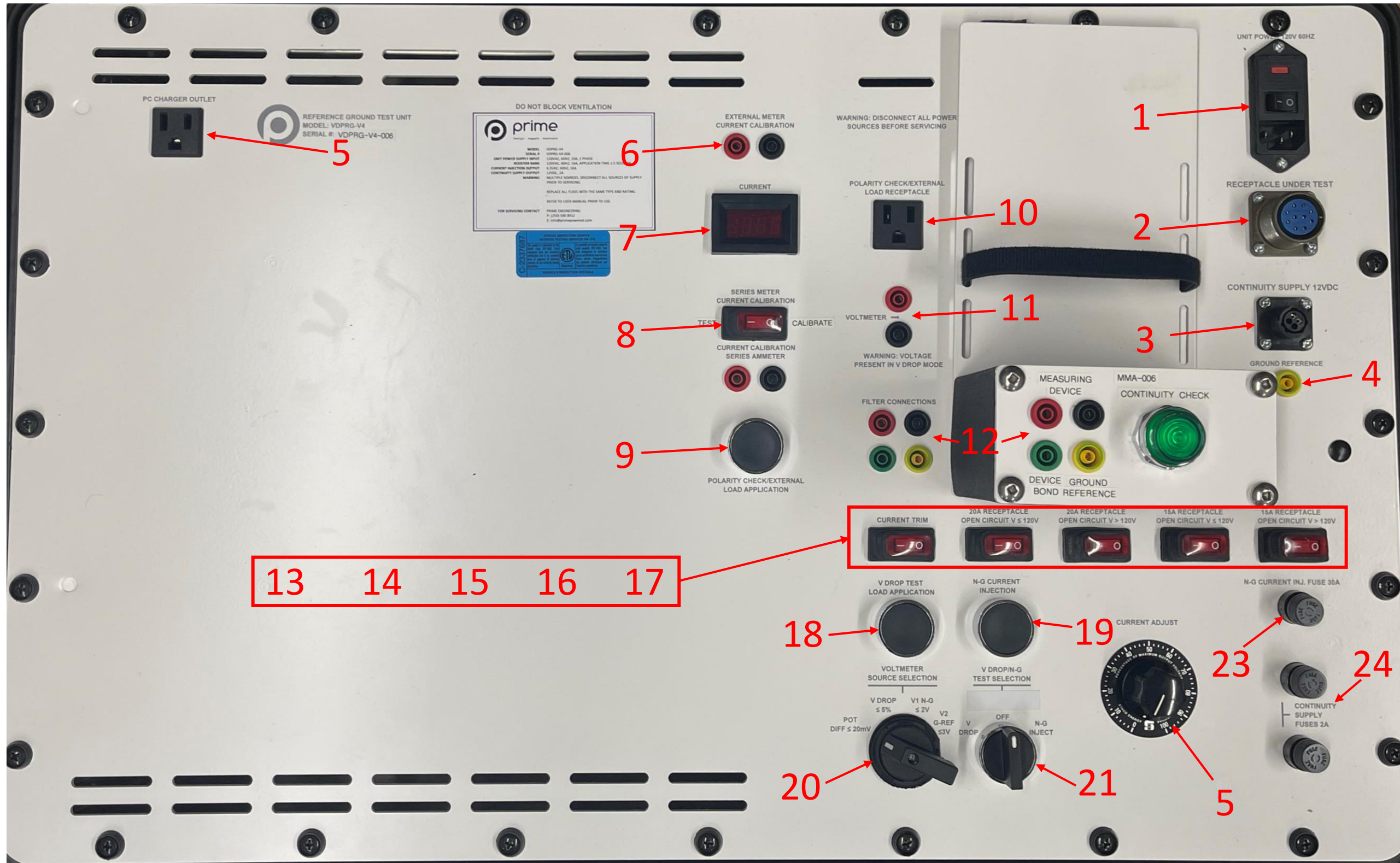
Along with the VDPRG-V4 Unit, you will need:

- Unit power supply cord
- Receptacle under test lead
- Receptacle polarity tester
- Receptacle tension tester
- Ground reference connection lead and connection options:
 - Pin lead
 - Alligator clip
 - Ground plug adaptor
- Standard load and measuring device and continuity supply lead.
- VDPRG-V4 to voltmeter connection leads
 - QTY: 1 Black, 1 Red
- VDPRG-V4 to standard load measuring device "FILTER CONNECTIONS"
 - QTY: 1 Black, 1 Red, 1 Green, 1 Green/Yellow
- Insulation resistance test lead



Customer supplied and optional accessories

- Calibrated voltmeter, having an input impedance of at least 150k Ω , indicate the applied potential to within $\pm 2\%$ and have a minimum resolution of 0.1V.
- 500 Volt DC Megohmmeter
- Optional: 30 Amp receptacle adaptor
- Optional: Calibrated clamp on current meter for current meter verification over 10 amps.



VDPRG-4 Main Unit		
1	UNIT POWER 120V 60Z	Unit control power supply port. Ensure this is fed from a receptacle that is on a separate circuit than the receptacle under test.
2	RECEPTACLE UNDER TEST	Connection for supplied test lead to the receptacle under test.
3	CONTINUITY SUPPLY 12VDC	Connection for standard load and measuring device 12VDC continuity verification supply cord.
4	GROUND REFERENCE	Connection to patient care environment ground reference point.
5	PC CHARGER OUTLET	Convenience receptacle utilized for PC charging.
6	EXTERNAL METER CURRENT CALIBRATION	Connections for external current injection test set for the purpose of calibrating the onboard ammeter.
7	CURRENT	Onboard digital ammeter display.
8	SERIES METER CURRENT CALIBRATION	Toggle switch and series ammeter connections to enable ammeter calibration utilizing the receptacle under test. When in the CALIBRATE position (O), a series ammeter is required to be connected to conduct current injection tests and or calibrate meter. Note: Do not exceed current rating of external series ammeter.
9	POLARITY CHECK/EXTERNAL LOAD APPLICATION	Pushbutton utilized to energize the POLARITY CHECK/EXTERNAL LOAD RECEPTACLE from the receptacle under test.
10	POLARITY CHECK/EXTERNAL LOAD RECEPTACLE	Insert receptacle polarity tester or external load banks to this location as required.
11	VOLTMETER	Connections to externally supplied calibrated voltmeter.
12	FILTER CONNECTIONS	Color coded connections to standard load and measuring device.
13	CURRENT TRIM	Load application toggle switch used to engage current trim resistor. Utilized for fine tuning of applied current during voltage drop testing.
14	20A RECEPTACLE OPEN CIRCUIT V ≤ 120V	Load application toggle switch utilized to engage bulk resistance suitable for 20A receptacles where the initial open circuit voltage measured is less than or equal to 120V.
15	20A RECEPTACLE OPEN CIRCUIT V > 120V	Load application toggle switch utilized to engage bulk resistance suitable for 20A receptacles where the initial open circuit voltage measured is greater than 120V.
16	15A RECEPTACLE OPEN CIRCUIT V ≤ 120V	Load application toggle switch utilized to engage bulk resistance suitable for 15A receptacles where the initial open circuit voltage measured is less than or equal to 120V.
17	15A RECEPTACLE OPEN CIRCUIT V > 120V	Load application toggle switch utilized to engage bulk resistance suitable for 15A receptacles where the initial open circuit voltage measured is greater than 120V.
18	V DROP TEST LOAD APPLICATION	Momentary pushbutton utilized to apply load to receptacle under test.
19	N-G CURRENT INJECTION	Momentary pushbutton utilized to apply load between the neutral and ground conductors of the receptacle under test.
20	VOLTMETER SOURCE SELECTION	4 position-maintained selector switch utilized to apply appropriate signal to calibrated volt meter for the test being performed.
21	V DROP/N-G TEST SELECTION	3 position-maintained selector switch. Select between V DROP/OFF/N-G INJECT as applicable.
22	CURRENT ADJUST	When the VDRO/N-G TEST SELECTION switch is in V DROP, CURRENT TRIM is on and V DROP TEST LOAD APPLICATION is pressed, CURRENT ADJUST is utilized to make fine adjustments on the load applied to the receptacle under test. CURRENT meter will display applied load to receptacle. When the VDRO/N-G TEST SELECTION switch is in N-G INJECT and N-G CURRENT INJECTION is pressed, CURRENT ADJUST is utilized to vary the current injected between the neutral and ground bonding of the receptacle under test. CURRENT meter will display the injected current value during this test.
23	N-G CURRENT INJ. FUSE 30A	Replacement fuse for receptacle neutral to ground current injection circuit.
24	CONTINUITY SUPPLY FUSES 2A	Replacement fuses for 12VDC continuity check circuit.

VDPRG-4 Standard Load and Measuring Device		
1	MEASURING DEVICE	Connection points to calibrated voltmeter from the standard load and measuring device
2	DEVICE BOND	Connection point from the bonded device under test to the standard load and measuring device
3	GROUND REFERENCE	Connection point from the standard load and measuring device to the patient care environment ground reference point
4	CONTINUITY CHECK	Pushbutton LED. When proper connections are made to the standard load measuring device and the bonding circuit under test is continuous, this LED will illuminate.





TEST SHEETS

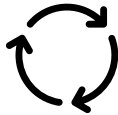
Refer to CSA Z32 Annex H for sample test sheets.



PATIENT CARE AREA

Prior to conducting any tests, consult the health care facility administrator to identify the patient care area and the patient care environment to determine the scope of testing.

CSA Z32 Figure 1 shows a typical patient care environment.



PROCEDURE

Disclaimer: All procedures described herein pertain to the use of the VDPRG-4 and provided accessories only. These procedures do not describe the requirements for the patient care environment prior to conducting tests, facility specific precautions, patient care areas, patient care environments or what tests are mandatory. Pass/fail criteria may be referenced within this manual for certain tests; however, it is the responsibility of the user to fully understand CSA Z32:21 and confirm that the test methods and results obtained are in accordance with this standard and project specific requirements identified by the authority having jurisdiction, design engineer, health care facility (HCF) and health care facility administration.

Fault or Substandard Condition

CSA Z32 states the following for any fault or substandard condition found during inspection, testing or commissioning:

If a fault or substandard condition is discovered during inspection, testing or commissioning,

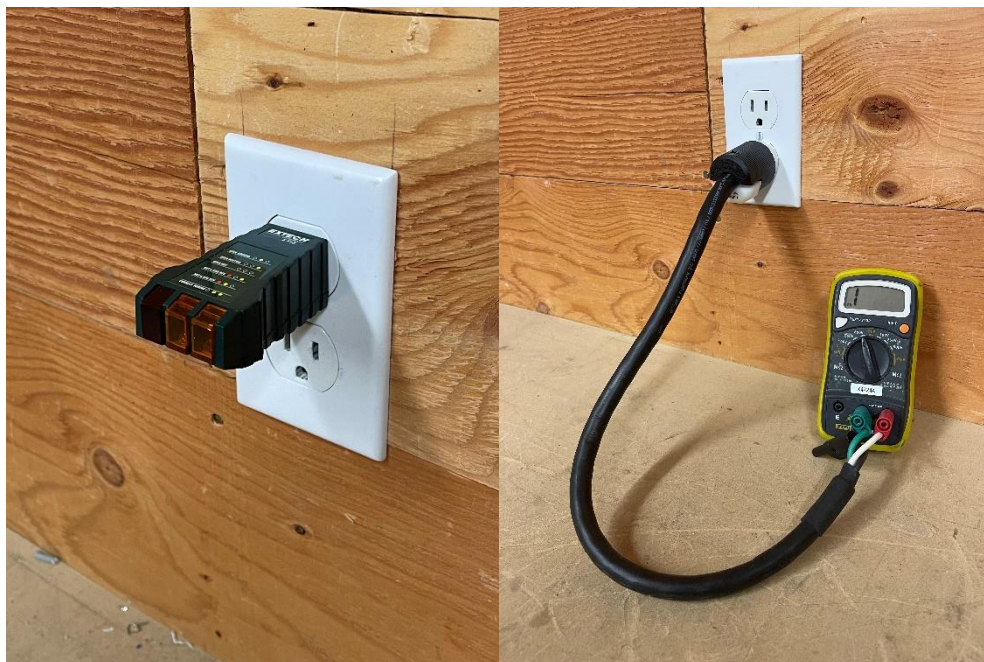
- a) The dates on which the condition was discovered and corrected shall be entered in the log;*
- b) The cause shall be identified and corrected;*
- c) The tests that identified the fault or substandard condition shall be repeated for that branch circuit; and*
- d) Any previous tests directly affected by the tests that identified the fault or substandard condition shall also be repeated.*

Insulation Test

If the Contractor has not provided insulation test results for the installation an insulation test is to be performed.

1. Ensure the circuit is de-energized and provisions are made to ensure the circuit cannot be energized during tests.
2. Ensure all sensitive temporary or permanently connected devices that would be susceptible to damage because of this test are disconnected. Refer to Z32 standard Section 5.3.
3. Utilize a megohmmeter to perform insulation resistance measurements as described in Z32 Section 5.3. An adaptor to attach between a receptacle and megohmmeter has been provided, however per the Z32 standard: *This test is optimally performed by the installer immediately before connecting the circuit conductors at the panel. If done after the circuit have been energized, it will require isolation and reconnecting the circuit conductors.*

A megohmmeter is not supplied with the VDPRG-4, however may be supplied as an optional accessory upon request.



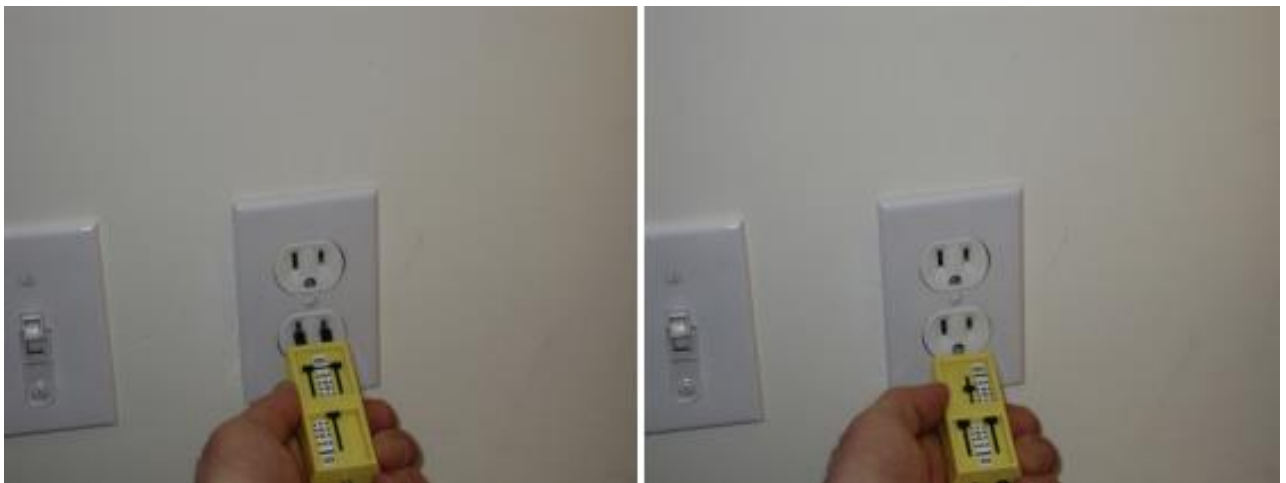
Receptacle Retentive Force Tests

Per CSA Z32:

Section 24 of the Canadian Electrical Code, Part I, requires that all 15 and 20 A non-locking receptacles in patient care areas be hospital grade. Such receptacles shall provide a minimum force as stated in Items a) to c) when using a receptacle retention tester designed and constructed for the purpose.

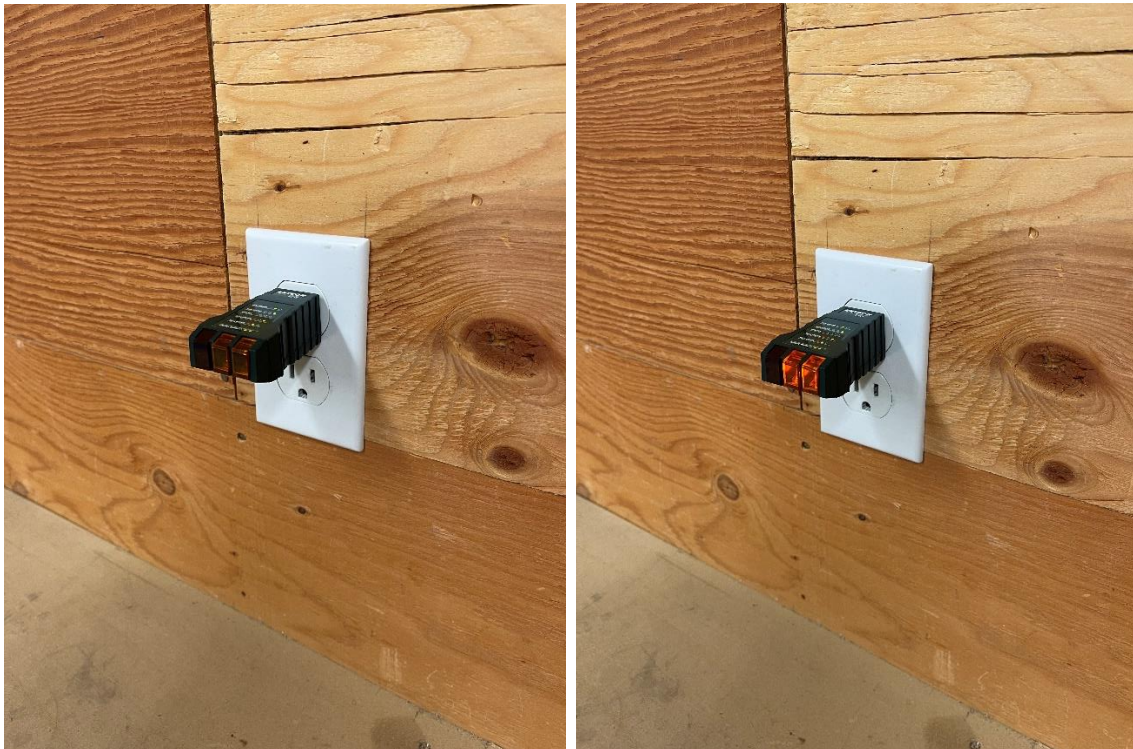
- a) 1.1 N (4.0 ounce-force) using a round test pin in the ground slot;
- b) 2.2 N (8.0 ounce-force) for one pin, using a two-pin test plug; and
- c) 13 N (47.0 ounce-force) for both pins combined, using a two-pin test plug.

A receptacle tension tester has been supplied with the VDPRG-V4. Confirm receptacles are hospital grade and that adequate force is required.



Branch Circuit Breaker – Mechanical Operation Test and Circuit Identification

1. The receptacle is required to be permanently labeled (not on the plate as the plates can be mixed up or lost). Turn off the receptacle and check that the circuit identification is correct. Operate the breaker at least 3 times to ensure circuit breaker integrity. Panels are required to be labeled and circuit directories are to be complete and accurate.



VDPRG-V4 Connections/Initial Setup

1. Connect the VDPRG-V4 **UNIT POWER** to a 15A 120VAC outlet that is on a circuit separate from the receptacle to be under test.
2. Plug the receptacle polarity tester into the **POLARITY CHECK/EXTERNAL LOAD RECEPTACLE**.
3. Connect the **GROUND REFERENCE** lead to the patient care environment ground reference location.
4. Connect the VDPRG-V4 **VOLTMETER** connections to a calibrated voltmeter.
5. Connect VDPRG-V4 **FILTER CONNECTIONS** to standard load measuring device.
6. Connect the 12VDC **CONTINUITY SUPPLY** lead to the standard load and measuring device.
7. Connect the **RECEPTACLE UNDER TEST** lead to the energized receptacle to be tested.
8. Place **VDROP/N-G TEST SELECTION** switch to the off position.
9. Ensure **SERIES METER CURRENT CALIBRATION** switch is in the – (TEST) position.

Receptacle Polarity

1. Ensure the receptacle polarity tester is inserted into the **POLARITY CHECK/EXTERNAL LOAD RECEPTACLE**.
2. Press and hold the **POLARITY CHECK/EXTERNAL LOAD APPLICATION** button.
3. Confirm lamp indication on the receptacle polarity tester used is correct.

Warning: Do not proceed with further testing if the receptacle polarity is not correct. Damage to the unit may occur if further tests are conducted with incorrect polarity. Immediately correct receptacle wiring defects.



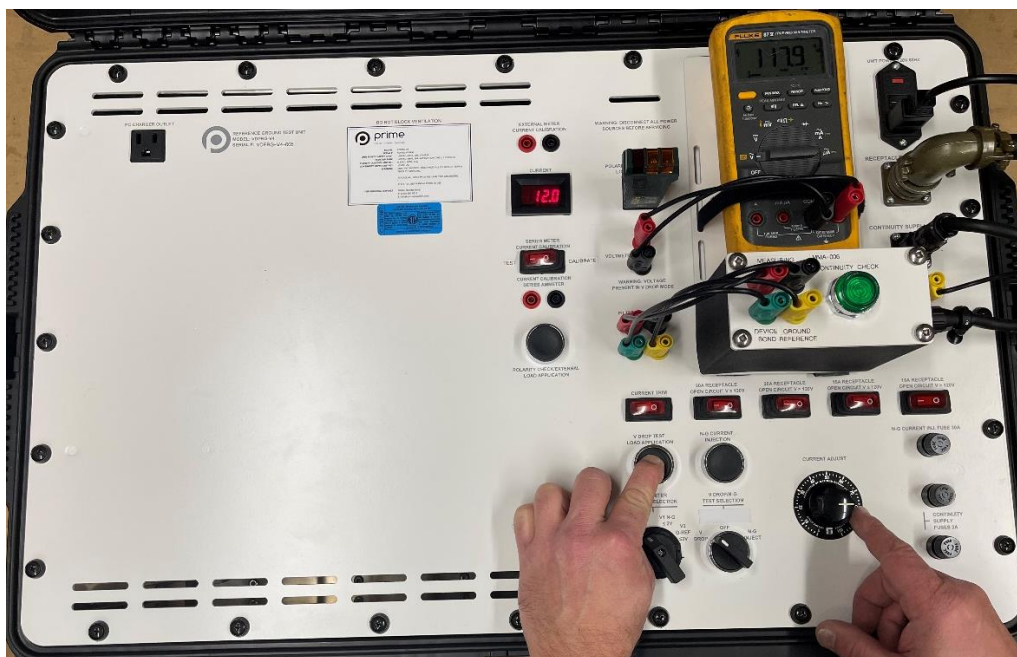
Voltage Difference Between Ground Points – Receptacle

1. Place the **VOLTMETER SOURCE SELECTION** switch to **POT DIFF $\leq 20\text{mV}$** .
2. Press and hold the **CONTINUITY CHECK** pushbutton on the standard load measuring device. Ensure the green LED within the pushbutton illuminates indicating a continuous circuit between the receptacle ground slot and the ground reference connection.
3. Release the **CONTINUITY CHECK** pushbutton on the standard load and measuring device. View the displayed voltage measurement on the calibrated voltmeter.
4. Note each instance where the measurements exceed 20mV.



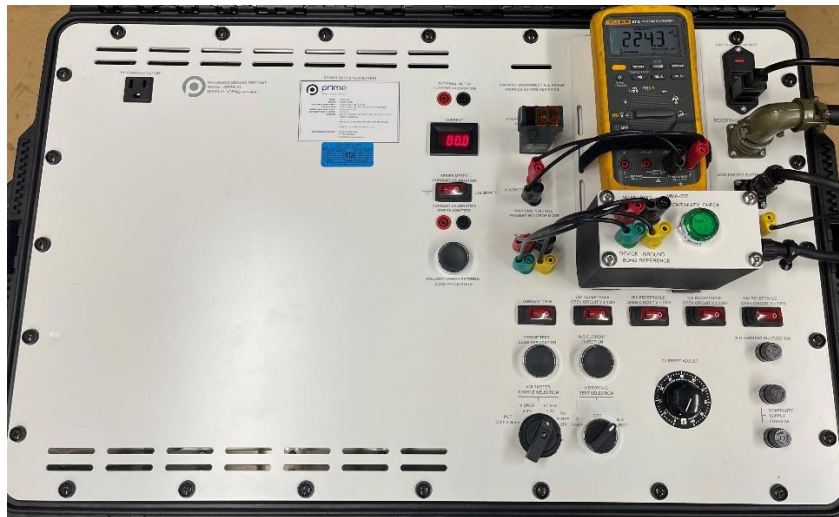
Voltage Drop Test

1. Ensure all load application toggle switches are in the O (off) position.
2. Place the **VOLTMETER SOURCE SELECTION** to **V DROP \leq 5%**.
3. Place **VDROP/N-G TEST SELECTION** switch to **V DROP**.
4. Record open circuit voltage without load for 5s as V_o .
5. Select and turn on the load application toggle switch that most accurately reflects the recorded open circuit voltage for the ampere rating of receptacle to be tested.
 - a. Example: Open circuit voltage measured is 119.0 volts on a 15-amp receptacle. Select load application toggle switch **15A RECEPTACLE OPEN CIRCUIT \leq 120V**.
6. Select and turn on the **CURRENT TRIM** toggle switch.
7. Press and hold the **V DROP TEST LOAD APPLICATION** pushbutton. Note applied current. Utilize the **CURRENT ADJUST** rotary knob to apply 80% of the rated current of the circuit between receptacle poles for 5 seconds.
 - a. Note: The VDPRG-V4 load resistor bank is equipped with a thermostat, designed to interrupt the circuit on over temperature. However, all applications of the load resistor bank for the purpose of the voltage drop test shall be as brief as possible, not to exceed 5 seconds to reduce accumulated heating of the unit.
8. Record the current.
9. Record the terminal voltage displayed on the calibrated voltmeter as VL.
10. Release the **V DROP TEST LOAD APPLICATION** pushbutton.
11. Determine voltage drop from recorded values.

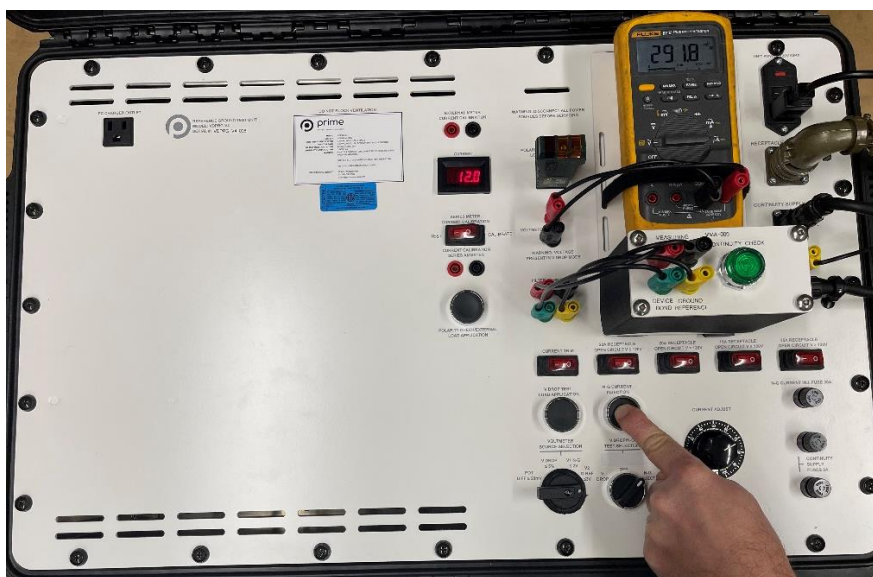


Ground Return Path Voltage Rise Test

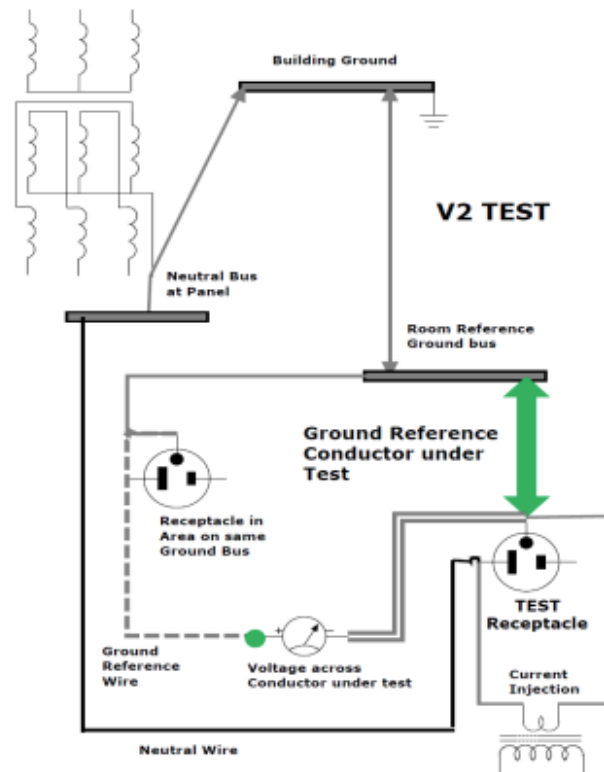
1. Place the **VDROP/N-G TEST SELECTIONS** switch to **N-G INJECT**.
2. Place the **VOLTMETER SOURCE SELECTION** switch to **V1 N-G \leq 2V**.
3. Record the voltage displayed on the calibrated voltmeter as V_N , the neutral to ground voltage without load. If this value exceeds approximately 2V, determine the cause and correct the defect.



4. Place the **VOLTMETER SOURCE SELECTION** switch to **V2 G-REF \leq 3V**.
5. Press and hold the **N-G CURRENT INJECTION** pushbutton.
6. Utilize the **CURRENT ADJUST** rotary knob to apply 80% of the rated current of the circuit between the neutral and the bonding conductor for 5 seconds.
7. Record the applied current and the voltage indicated by calibrated voltmeter as V_R .
8. The ground return path voltage rise, V_R , shall be not greater than 3V.



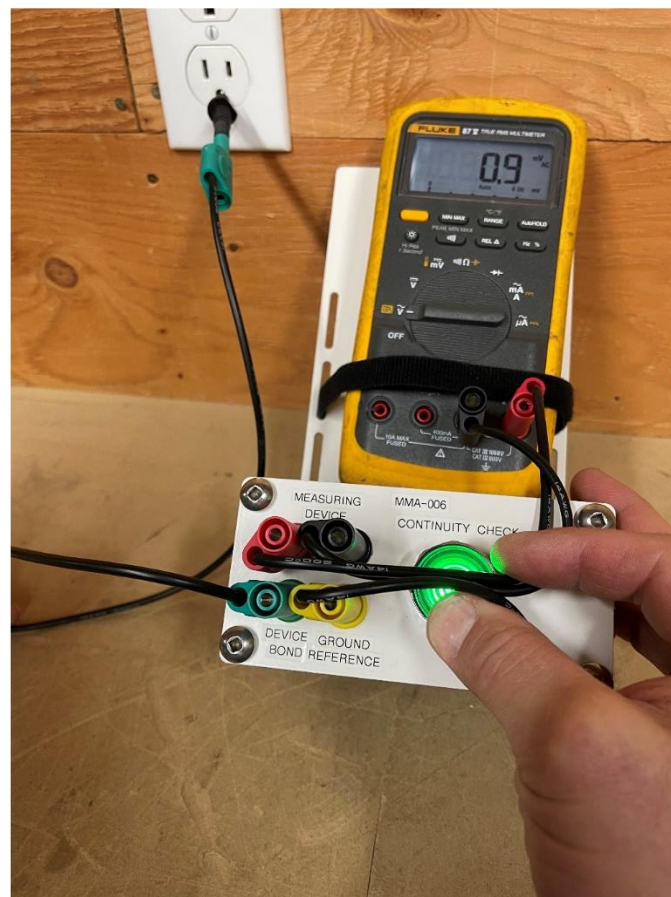
Note: When the circuit is loaded, and the switch is in the **V1 N-G ≤ 2V** position the voltage meter will read the voltage output of the current injection transformer. This is not part of the required tests, but the voltage required to drive the 12 Amps is dependent on the length of the feeder (impedance) and will show a relationship to the voltage drop test (i.e.- a high % volt drop will also require a higher injection current voltage). The Z32 standard requires the transformer be able to output 5 volts. If the test requires more than 5 volts, then there is a wiring problem and investigation is required.



Circuit path of the V2 test

Voltage Difference Between Ground Points – Exposed Conductive Non – Current Carrying Parts

1. Remove red and black leads from calibrated voltmeter.
 - a. Note: Shrouded leads have been provided. When leads are connected to the VDPRG-V4 **VOLTMETER** terminals, 120VAC from the receptacle under test may be present at the ends of the test leads. Ensure to use only the provided shrouded leads or equivalent alternative.
2. Remove red and black **FILTER CONNECTIONS** from the VDPRG-V4 and insert those connections to the calibrated voltmeter.
3. Remove the VDPRG-V4 green and yellow leads from the standard load measuring device.
4. Connect 24" green shrouded device bond lead with the supplied pin adaptor to the standard load measuring device.
5. Remove the yellow ground reference lead from the VDPRG-V4 and connect that lead standard load measuring device.
6. Ensure the calibrated voltmeter is on the correct scale. Utilizing the 24" green shrouded device bond lead with the supplied pin adaptor, make contact with the device under test. Press and hold the **CONTINUITY CHECK** pushbutton on the standard load measuring device. Ensure the green LED within the pushbutton illuminates indicating a continuous circuit between the device under test and the ground reference connection.
7. Release the **CONTINUITY CHECK** pushbutton on the standard load measuring device. View the displayed voltage measurement on the calibrated voltmeter.
8. Note each instance where the measurements exceed 20mV.



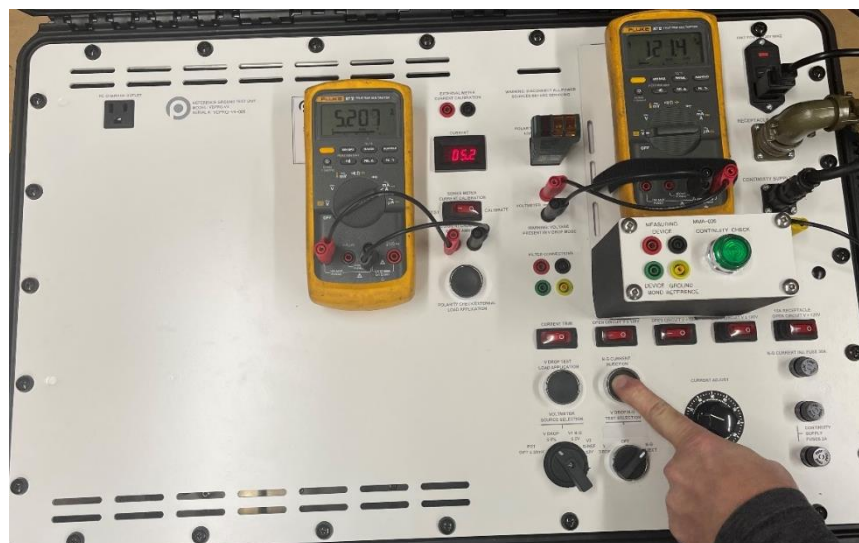


CURRENT CALIBRATION

The VDPRG-V4 ammeter uses a small current transformer to measure current during the voltage drop and ground return path voltage rise tests. To ensure the ammeter is functioning, there are two options described below. For both options, the VDPRG-V4 must have control power.

Option #1 – SERIES METER CURRENT CALIBRATION

1. Ensure a calibrated current meter is connected in series to the test points labelled **CURRENT CALIBRATION SERIES AMMETER**. Alternatively, a loop can be plugged into the calibration points and a calibrated clamp-on ammeter can be used to check higher currents (> 10A i.e. – 16A for 20A circuits and 24A for 30A circuits).
 - a. Note: Most multimeter series ammeters are usually limited to 10 Amps.
2. Ensure the **RECEPTACLE UNDER TEST** lead is plugged into a receptacle that is part of an installed and proven complete circuit.
3. Move the **SERIES METER CURRENT CALIBRATION** switch to the O (CALIBRATE) position.
4. Ensure the **CURRENT ADJUST** dial is at 0.
5. Ensure the **TEST SELECTION** switch is on the **N-G INJECT** position.
6. When the **N-G CURRENT INJECTION** pushbutton is pressed, the VDPRG-V4 digital ammeter and external ammeter should read the same value.



Option #2 – EXTERNAL METER CURRENT CALIBRATION

An external calibrated current source can be used to check current readings as well. The **EXTERNAL METER CURRENT CALIBRATION** points are connected to a wire that goes through the ammeter current transformer. Simply connect and inject a known current value to these points and ensure the VDPRG-V4 digital ammeter displays an acceptable reading.

A calibration screw on the rear of the VDPRG-V4 ammeter will change calibration settings, however the unit must be opened to perform this procedure. Extra care is required as live wiring is exposed during this calibration process. The CSA Z32 standard requires the ammeter to correct within +/- 5%.

