



# PowlVac® Vacuum Integrity Tester



POWELL ELECTRICAL MANUFACTURING COMPANY  
8550 MOSLEY DRIVE · HOUSTON, TEXAS 77075 USA  
PHONE (713) 944-6900 · FAX (713) 947-4453  
[www.powellelectric.com](http://www.powellelectric.com)  
[www.powellservice.com](http://www.powellservice.com)



## **WARNING**

THIS DEVICE WILL PRODUCE A VOLTAGE WHICH CAN CAUSE SERIOUS INJURY OR DEATH.

THE EQUIPMENT IS DESIGNED FOR USAGE, AND MAINTENANCE BY KNOWLEDGEABLE USERS OF SUCH EQUIPMENT HAVING EXPERIENCE AND TRAINING IN THE FIELD OF HIGH VOLTAGE ELECTRICITY. THIS DOCUMENT, AND ALL OTHER DOCUMENTATION SHALL BE FULLY READ, UNDERSTOOD, AND ALL WARNINGS AND CAUTIONS SHALL BE ABIDED BY. IF THERE ARE ANY DISCREPANCIES OR QUESTIONS, THE USER SHALL CONTACT POWELL ELECTRICAL MANUFACTURING COMPANY IMMEDIATELY AT 1-800-480-7273.



# Table of Contents

- I. INTRODUCTION ..... 4
  - A. INSTRUCTION BULLETINS ON THE WEB ..... 4
- II. SAFETY ..... 4
  - A. X-RAYS ..... 5
  - B. SAFETY LABELS AND INSTRUCTIONS ..... 5
- III. DESCRIPTION ..... 5
- IV. OPERATION ..... 7
- V. INSTALLATION ..... 9
- VI. MAINTENANCE ..... 9
- VII. SPECIFICATIONS ..... 10
  - Index ..... 11
  - Notes ..... 12

# Illustrations

- Figure 1. Vacuum Integrity Tester ..... 5
- Figure 2. Control Module ..... 6
- Figure 3. High Voltage Module ..... 6
- Figure 4. Vacuum Integrity Tester Typical Connections ..... 8
- Figure 5. Control Module and Circuit Breaker Connections - Front View ..... 8
- Figure 6. High Voltage Module and Circuit Breaker Connections - Rear View ..... 8

# Tables

- Table I. SPECIFICATIONS ..... 10



## I. INTRODUCTION

Vacuum interrupters used in PowlVac® vacuum circuit breakers are highly reliable interrupting elements. Satisfactory performance of these devices is primarily dependant upon the integrity of the vacuum in the chamber and the internal dielectric strength. Both of these parameters can be readily checked by a high potential test.

The Vacuum Integrity Tester (figure 1) is specifically designed to provide a portable, quick, and reliable method to verify the internal dielectric rating of the vacuum interrupters utilized for PowlVac® vacuum circuit breakers by applying a high voltage AC signal across the vacuum interrupter contacts for approximately 10 seconds. The applied voltage is 25kV for designs rated 15kV and below. This voltage is based on the Paschen curves for the vacuum interrupters used in all PowlVac® circuit breaker designs.

*NOTE: THIS TEST DOES NOT REPLACE ANY INSULATION TESTING THAT IS PART OF A ROUTINE MAINTENANCE CYCLE AND SUCCESSFUL TESTING WITH THE VACUUM INTEGRITY TESTER DOES NOT IMPLY THAT THE TOTAL INSULATION SYSTEM OF THE CIRCUIT BREAKER HAS MET THE SYSTEM DIELECTRIC REQUIREMENTS.*

### A. INSTRUCTION BULLETINS ON THE WEB

Powell Electrical Manufacturing Company Instruction Bulletins are posted on the company website at [www.powellservice.com](http://www.powellservice.com). For more information, please contact Powell Apparatus Service Division (PASD) at 1-800-480-7273, 713-944-6900, or [info@powellservice.com](mailto:info@powellservice.com).

## II. SAFETY

Each user has the responsibility to instruct and supervise all personnel associated with usage, operation, and maintenance of this equipment on all safety procedures, which must be observed. Furthermore, each user has the responsibility of devising a complete safety program for each type, or class of equipment encountered.

To insure the safety of personnel associated with usage, operation, and maintenance of the vacuum integrity tester, it is mandatory that the following rules be observed. These rules are not intended to be a complete safety program, or to take the place of the user's complete safety program. They are rather guidelines intended to cover the more important aspects of personnel safety related to PowlVac® vacuum integrity tester.

1. Read this Instruction Bulletin and the circuit breaker instruction bulletin thoroughly. It is also necessary to follow all instructions, warnings, and cautions, which are associated with handling the circuit breaker.
2. Only supervised and qualified personnel trained in the usage, operation, and maintenance of high voltage electrical equipment shall be allowed to work with this equipment.
3. Do not work on a circuit breaker with the main closing springs charged.
4. When using the Vacuum Integrity Tester:
  - a. Always conduct High Voltage Testing with a witness or helper.
  - b. Do not attempt to test a closed circuit breaker.
  - c. Do not connect the tester to any of the switchgear bus.
  - d. Insure that the circuit breaker is securely connected to earth ground.
  - e. Place the High Voltage Module and Circuit Breaker in an area of limited access, or behind barricades to prevent inadvertent contact by personnel.



- A minimum boundary of 1 meter ( 3 feet ) is recommended.
- f. Use all warning and safety equipment specified by job site regulations for operating high voltage test equipment.

## A. X-RAYS

When high voltage is applied across the contacts of a vacuum interrupter, there is the possibility of generation of X-rays. The intensity of this radiation is dependant on the peak voltage and the contact gap. At the normal operating voltage for this class of equipment, the radiation levels are negligible. At the voltage specified for testing, the user shall be in front of the circuit breaker, such that the two layers of steel used in the frame, and front cover construction are between the user and the vacuum interrupters, and that the user be no closer than one meter from the front cover of the circuit breaker when using the portable Vacuum Integrity Tester. The control module is equipped with a 3 meter long cable to allow adequate separation from the high voltage. The circuit breaker shall be fully open when these tests are made.

## B. SAFETY LABELS AND INSTRUCTIONS

Follow all warning and caution labels found on the equipment and in the associated instruction bulletins for the equipment.

## III. DESCRIPTION

The Vacuum Integrity Tester is designed to apply a high voltage AC signal across the open contacts of a vacuum interrupter for approximately 10 seconds. It is calibrated to automatically shut down if a current of approximately 55 mA is detected flowing across the vacuum interrupter contacts.

It should be noted that because the vacuum interrupter is mounted on a circuit breaker, there will be leakage current associated with the circuit breaker insulation system. This leakage current may give a false indication of interrupter failure. For this reason, the circuit breaker must be cleaned in accordance with the instructions found in the appropriate instruction bulletin for the circuit breaker prior to testing.



*Figure 1. Vacuum Integrity Tester*

Refer to section IV. OPERATION for specific details on evaluating failure indications.

The Vacuum Integrity Tester, Powell part number 60900G04 for 60 Hz applications and 60900G06 for 50 Hz applications, is a portable device, designed for field testing vacuum interrupters, which are installed on all PowlVac® vacuum circuit breakers rated 4.76kV, 8.25kV, and 15kV. It should be noted that this device is specifically designed for the vacuum interrupters, which are utilized by PowlVac® circuit breakers, and while it can be connected to other types of vacuum interrupters and other manufacturers equipment, test results are only valid for PowlVac® designs.

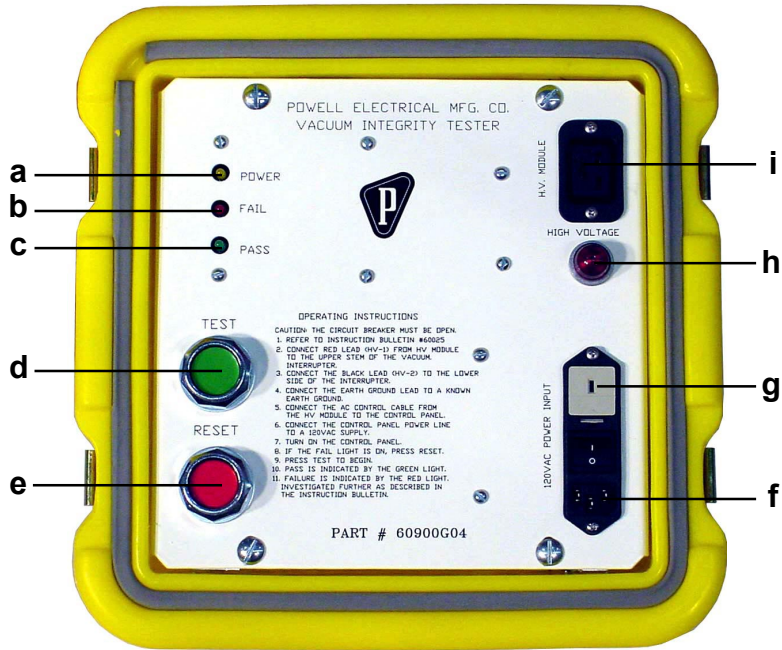




Figures 2 and 3 show the Vacuum Integrity Tester broken down into its two components with the controls and connections identified.

- a. Power Indicator (amber LED)
- b. Fail Indicator (red LED)
- c. Pass Indicator (green LED)
- d. Test Pushbutton
- e. Reset Pushbutton
- f. Power Inlet / On-Off Switch
- g. Fuse Drawer
- h. High Voltage Indicator (red)
- i. Control Power Output Connection

**Figure 2. Control Module**



- a. High Voltage Output Lead for Lower VI Terminal (HV-2)
- b. Earth Ground Connection
- c. Incoming AC Control Cable
- d. High Voltage Output Lead for Upper VI Terminal (HV-1)

**Figure 3. High Voltage Module**





## IV. OPERATION

The Vacuum Integrity Tester is internally protected by BUSS type MDL 5 fuses.

***DO NOT SUBSTITUTE FUSE TYPES OR OPERATE WITHOUT FUSE PROTECTION.***

***NOTE: ALWAYS CLEAN THE CIRCUIT BREAKER IN ACCORDANCE WITH THE RECOMMENDED MAINTENANCE PROCEDURES PRIOR TO THIS TEST.***

Refer to figures 2 and 3 for the location of items described.

***CAUTION: FOLLOW ALL SAFETY PRECAUTIONS DESCRIBED IN SECTION II.***

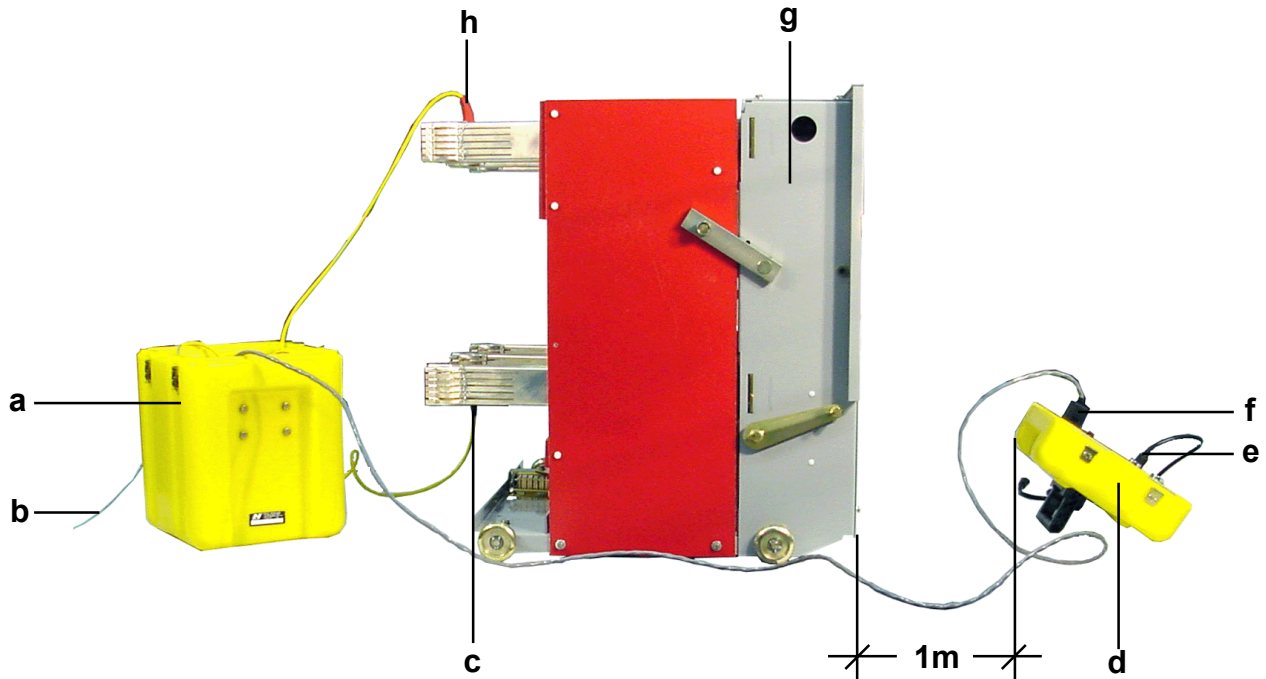
1. Place the circuit breaker in a location for testing, which is inaccessible to personnel other than the tester and/or barrier a test perimeter with caution labels.
2. Open the tester and perform the following:
  - a. Place the HIGH VOLTAGE MODULE close to the test sample primary disconnects.
  - b. Connect the HV-1 lead to the upper primary disconnects, or upper stem of the vacuum interrupter to be tested.

***NOTE: TAKE CARE TO KEEP THE HV-1 LEAD AWAY FROM GROUNDED SURFACES.***

- c. Connect the HV-2 LEAD to the lower primary disconnects, or lower stem of the vacuum interrupter to be tested. Note that it is at ground potential.
- d. Connect the EARTH GROUND cable to a known ground source.
- e. Move the CONTROL MODULE to the front of the circuit breaker, approximately 1 meter away from the front cover, as shown in figure 4.
- f. Connect the AC CONTROL CABLE from the HIGH VOLTAGE MODULE to the CONTROL MODULE.
- g. Connect the CONTROL MODULE to a 120 VAC source capable of a minimum output of 15 amperes. **BE CERTAIN THE FREQUENCY OF THE SOURCE IS CORRECT FOR THE TEST DEVICE: DEVICE 60900G04 REQUIRES 60 HZ. DEVICES 60900G06 REQUIRES 50 HZ. INCORRECT SOURCE FREQUENCY CAN PRODUCE ERRONEOUS TEST RESULTS.**

Figure 4 shows the general connection arrangement described above.

3. Insure that the circuit breaker is open and press the POWER ON pushbutton on the control panel. The POWER light will illuminate. If the PASS or FAIL lights illuminate on the power-up cycle, press the RESET pushbutton to clear the circuit.
4. To test:
  - a. Press the RESET push button to clear the circuit, only the POWER (yellow) light should be illuminated.
  - b. Press the TEST pushbutton to initiate the test. The HIGH VOLTAGE indicator (large red light) will illuminate.
  - c. The test will apply high voltage across the vacuum interrupter contact gap for approximately 10 seconds.
    - i. PASS is indicated by the extinguishing of the HIGH VOLTAGE indicator and the PASS light illuminating.



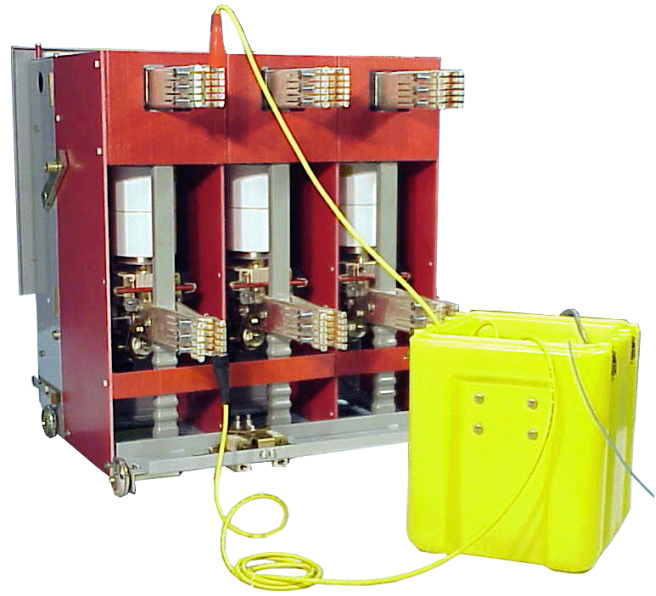
- a. High Voltage Module
- b. Earth Ground
- c. High Voltage Lead ( black )
- d. Control Module High

- e. AC Power Cord
- f. Control Power Cable
- g. Circuit Breaker
- h. Voltage Lead ( red )

**Figure 4. Vacuum Integrity Tester Typical Connections**



**Figure 5. Control Module and Circuit Breaker Connections - Front View**



**Figure 6. High Voltage Module and Circuit Breaker Connections - Rear View**





- ii. FAIL is indicated by the extinguishing of the HIGH VOLTAGE indicator and the FAIL light illuminating. A failed condition will lock the circuit for approximately 1 minute. Reset is not possible until the lock out timer has released. This allows the high voltage transformer to cool prior to the next test.

*NOTE: A "FAIL" INDICATION IS NOT ALWAYS INDICATIVE OF A FAILED VACUUM INTERRUPTER. WHEN A FAILURE OCCURS, IT IS ADVISABLE TO THOROUGHLY CLEAN THAT PHASE THAT HAS FAILED AND RE-TEST. IF A SECOND FAILURE IS INDICATED, A TEST OF THE CIRCUIT BREAKER INSULATION WITH THE CIRCUIT BREAKER IN THE CLOSED POSITION IS RECOMMENDED TO VERIFY THAT FAILURE IS NOT DUE TO DAMAGED INSULATION.*

**CAUTION: GROUND THE VACUUM INTERRUPTER UPPER STEM AND MIDBAND RING, IF PRESENT, PRIOR TO TOUCHING THE INTERRUPTER.**

4. To test other phases, move the HV-1 lead and HV-2 lead to the desired phase and repeat steps 2 through 4.

## V. INSTALLATION

The Vacuum Integrity Tester requires no installation other than the connection procedure described in Section IV.

## VI. MAINTENANCE

There are no user serviceable parts on the Vacuum Integrity Tester. Should the device fail, contact Powell Apparatus Service Division (PASD) for assistance at 1-800-480-7273, 713-944-6900, or [info@powellservice.com](mailto:info@powellservice.com).

To insure proper function of the Vacuum Integrity Tester:

1. Store in a clean, climate controlled area when not in use. Note that local conditions such as humidity, salt-laden atmosphere, corrosive gases, or excessive dust are considered to be abnormal service conditions and may adversely affect the performance of the vacuum integrity tester.
2. Clean after each use. Specifically the High Voltage Leads and the High Voltage Module should be cleaned, removing any dirt, or contaminates, which may have been contacted during use. A dry lint-free cloth or an industrial wiper can be used to clean the vacuum integrity tester. If dirt adheres, and cannot be removed by wiping, clean with a mild solvent such as denatured alcohol. Be sure that the equipment is thoroughly dry before returning to service.

***DO NOT USE ANY DETERGENT TO WASH THE INSULATORS AS DETERGENT MAY LEAVE AN ELECTRICALLY CONDUCTING RESIDUE WHEN IT DRIES.***

3. Check for abnormal mechanical wear, and any reduction in spring force that would reduce the ability of the alligator clips on the High Voltage Leads and the Ground Lead to remain attached during operation.



## VII. SPECIFICATIONS

<b>Table I. Specifications</b>		
<b>Description</b>	<b>Catalog No.</b>	
	<b>60900G04</b>	<b>60900G06</b>
<b>Input Voltage</b>	120 VAC nominal 60Hz	110 VAC nominal 50Hz
<b>Input Current</b>	< 10.0 A during passing test > 11.5 A at failure / 100 A MAX for 0.06 s	< 10.0 A during passing test > 11.5 A at failure / 100 A MAX for 0.06 s
<b>Output Voltage</b>	25,000 VAC nominal	25,000 VAC nominal
<b>Output Current</b>	< 0.45 mA nominal during test > 0.55 mA @ FAIL indication 0.5 A maximum for 0.06 s ( fuse protection )	< 0.45 mA nominal during test > 0.55 mA @ FAIL indication 0.5 A maximum for 0.06 s ( fuse protection )
<b>Output Frequency</b>	60 Hz (input line dependent)	50 Hz (input line dependent)
<b>Weight</b>	50.4 lbs	50.4 lbs



***I***

Installation9  
Instruction bulletin  
on the web4  
website information4

***M***

Maintenance9

***P***

Powell Apparatus Service Division  
information4, 9  
Powell Electrical Manufacturing Company4

***S***

Safety4  
Specifications  
table10

***V***

Vacuum Integrity Tester  
operation7  
specifications10  
to test7

***X***

X-rays5





**Revision B - May 2002**

POWELL ELECTRICAL MANUFACTURING COMPANY  
8550 MOSLEY DRIVE · HOUSTON, TEXAS 77075 USA  
PHONE (713) 944-6900 · FAX (713) 947-4453  
[www.powellelectric.com](http://www.powellelectric.com)  
[www.powellservice.com](http://www.powellservice.com)