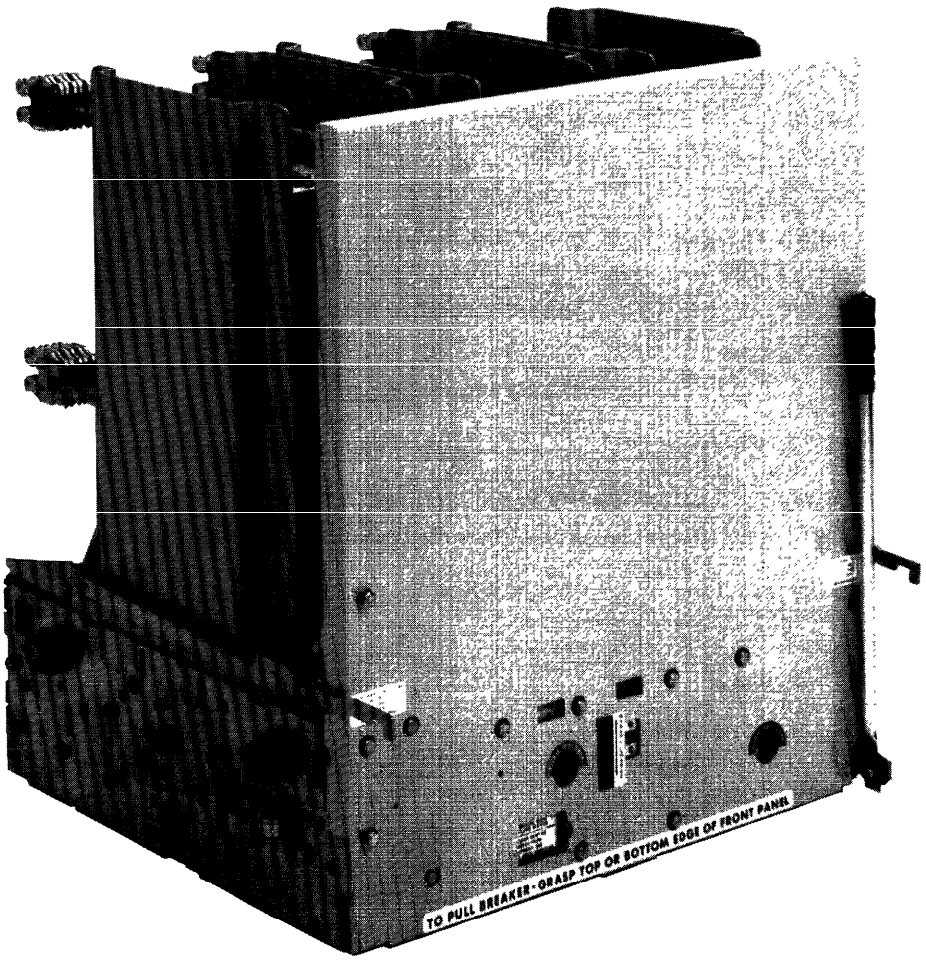
PowerVac® Vacuum Circuit Breaker With ML–17 Mechanism



TYPES: Vacuum Breaker – Nominal Voltage – Nominal MVA – Continuous Current – Close and Latch Kiloamperes – Model Designator – (No number on breaker nameplate indicates -0 Model)

VB–4.16–250–3000A–78–0, -1, -2, -3

VB–4.16–350–1200A–78–0, -1, -2, -3
VB–4.16–350–2000A–78–0, -1, -2, -3
VB–4.16–350–3000A–78–0, -1, -2, -3

VB–7.2–500–1200A–66–0, -1, -2, -3
VB–7.2–500–2000A–66–0, -1, -2, -3
VB–7.2–500–3000A–58–0, -1, -2, -3

VB–13.8–500–3000A–58–0, -1, -2, -3

VB–13.8–750–1200A–58–0, -1, -2, -3
VB–13.8–750–2000A–58–0, -1, -2, -3
VB–13.8–750–3000A–78–0, -1, -2, -3

VB–13.8–1000–1200A–77–0, -1, -2, -3
VB–13.8–1000–2000A–77–0, -1, -2, -3
VB–13.8–1000–3000A–77–0, -1, -2, -3

ILLUSTRATIONS

6.1 CONTROL POWER

Control power for electrical operation of the breaker may be from either an alternating or direct current source. The operating ranges for the closing, tripping and spring charging motor voltages are specified on the breaker nameplate.

If the closed circuit voltage at the terminals of the coil or motor does not fall in the specified range, check the voltage at the source of power and line drop between the power source and breaker.

When two or more breakers operating from the same control power source are required to close simultaneously, the closed circuit voltage at the closing coil or motor of each breaker must fall within the range specified on the breaker nameplate.

6.2 TIMING

Timing may be checked by monitoring the control circuit voltage and by using a low voltage signal through the vacuum interrupter contacts to indicate the closed or open position. Typical time ranges vary with coil voltages but nominal values are:

Initiation of trip signal to contact parting	
5 cycle breakers	.035 to .050 seconds
3 cycle breakers	.025 to .030 seconds
Initiation of close signal to contact closing	
standard breaker	.060 to .100 seconds
fast bus transfer breaker	.062 seconds max
Instantaneous reclose time*	.128 to .221 seconds

*Time from application of trip signal and close signal until breaker opens and recloses.

6.3 MEGGAR®

Since definite limits cannot be given for satisfactory insulation values, a record should be kept of the megohmeter readings as well as temperature and humidity readings. This record should be used to detect any weakening of the insulation from one check period to the next.

The primary circuit insulation on the breaker may be checked phase to phase and phase to ground using a 2500V megohmeter.

To measure the breaker secondary circuit insulation resistance, thread a wire connecting all secondary disconnect pins except #24, (ground pin) and pins 3 and 4 (motor). The measurement may be made by connecting a 500V megohmeter between the wire and ground.

6.4 HIGH-POTENTIAL TEST

Prior to performing the test use a dry, non-linting cloth or industrial type wiper to clean accessible insulation surfaces on the interrupter supports and operating rod insulators.

If high potential tests to check the integrity of the insulation are required, the A-C high potential test described is strongly recommended. D-C high potential testing is not recommended except for quick field checks when conducting VACUUM INTERRUPTER INTEGRITY TEST (para 9.4). The following procedure must be adhered to.

CAUTION. IF D-C HIGH POTENTIAL TESTING IS REQUIRED, THE D-C HIGH POTENTIAL MACHINE MUST NOT PRODUCE PEAK VOLTAGES EXCEEDING 50 KV.

NOTE: Always recheck with an A-C tester if initial results are questionable.

6.4.1. PRIMARY CIRCUIT

The breaker should be hipotted closed. An A-C hipot machine capable of producing the test voltages shown below may be used to hipot the breaker phase to phase and phase to ground.

BREAKER VOLTAGE RATING	TEST VOLTAGE 60 HZ (RMS)
4.16 KV	14 KV
7.2 KV	27 KV
13.8 KV	27 KV

The machine should be connected with its output potential at zero and the voltage increased to the test voltage and that voltage maintained for 60 seconds. The voltage should then be returned to zero and the hipot machine removed from the circuit. NOTE: Do not exceed the test voltage indicated for the applicable breaker voltage rating.

6.4.2. SECONDARY CIRCUIT

NOTE: This test is to be performed using only one of the following procedures, depending on the breaker you are testing. Perform procedure 1 if motor leads can be disconnected.

1. Prior to hipotting the breaker secondary circuit, disconnect the motor leads and thread a wire connecting all secondary disconnect pins except #24 the ground pin. Connect the hipot machine from this wire to ground. Increase the voltage to 1125 volts (rms) 60 Hz and maintain for 60 seconds. Reduce the voltage to zero and remove the hipot machine from the circuit. Remove the wire connecting the secondary disconnect pins and reconnect the motor leads.

Perform procedure 2 if motor leads cannot be disconnected.

2. To hipot the breaker secondary circuit, thread a wire connecting all secondary disconnect pins except #24 (ground pin) and pins 3 and 4 (motor). Connect the hipot machine from this wire to ground. Increase the voltage to 1125 volts (rms) 60 Hz and maintain for 60 seconds. Reduce the voltage to zero and remove the hipot machine from the circuit. Remove the wire connecting the secondary disconnect pins.

6.5 VACUUM INTERRUPTER INTEGRITY TEST

NOTE: Use of a D-C hipot is for quick field checks only. Always recheck with an A-C tester if initial results are questionable. Prior to performing any vacuum interrupter integrity test, the outside (external surface) of the vacuum interrupters should be wiped clean of any contaminates with a non-linting cloth or industrial type wiper. This is critical; the entire external surface is to be completely free of all dirt, debris, dust, oil, etc.

CAUTION: X-RADIATION WILL BE PRODUCED IF AN ABNORMALLY HIGH VOLTAGE IS APPLIED ACROSS A PAIR OF ELECTRODES IN A VACUUM. X-RADIATION WILL INCREASE AS VOLTAGE INCREASES AND/OR AS CONTACT SEPARATION DECREASES. ONLY TEST A CORRECTLY-ADJUSTED CIRCUIT BREAKER.

DURING A HIGH POTENTIAL OR A VACUUM INTEGRITY TEST, ANY X-RADIATION WHICH MAY BE PRODUCED WILL NOT BE HAZARDOUS AT A DISTANCE SAFE FOR HIGH POTENTIAL TESTING, IF THE TEST IS CONDUCTED AT THE RECOMMENDED VOLTAGE AND WITH THE NORMAL OPEN CIRCUIT BREAKER GAP.

DO NOT APPLY VOLTAGE THAT IS HIGHER THAN THE RECOMMENDED VALUE. DO NOT USE CONTACT SEPARATION THAT IS LESS THAN THE RECOMMENDED OPEN-POSITION BREAKER CONTACT GAP.

This test of the vacuum interrupter will determine its internal dielectric condition and vacuum integrity. With the breaker open, individually check each interrupter by connecting the hipot machine "HOT" lead to the upper stud and the ground lead to the lower stud. If the machine has a center point ground, the connections may be made either way. Apply 36 KV (rms) 60 Hz or 50 KV DC and hold five (5) to ten (10) seconds. If no breakdown occurs, the interrupter is in acceptable condition. If a breakdown occurs, the interrupter should be replaced.

No attempt should be made to compare the condition of one vacuum interrupter with another or to correlate the condition of any interrupter to low values of DC leakage current. There is no significant correlation.

After the high potential voltage is removed, discharge any electrical charge that may be retained.

CAUTION: MANY DC HIGH POTENTIAL MACHINES ARE HALFWAVE RECTIFIERS. THIS TYPE OF HIPOT TESTER MUST NOT BE USED TO TEST VACUUM INTERRUPTERS. THE CAPACITANCE OF POWER/VAC* BOTTLES IS VERY LOW AND LEAKAGE IN THE RECTIFIER AND ITS DC VOLTAGE MEASURING EQUIPMENT IS SUCH THAT THE PULSE FROM THE HALFWAVE RECTIFIER MAY BE IN THE AREA OF 120kV WHEN THE METER IS ACTUALLY READING 40kV. IN THIS CASE, SOME PERFECTLY GOOD BOTTLES CAN SHOW A RELATIVELY HIGH LEAKAGE CURRENT SINCE IT IS THE PEAK VOLTAGE OF 120kV THAT IS PRODUCING ERRONEOUS BOTTLE LEAKAGE CURRENT. IN ADDITION, ABNORMAL X-RADIATION MAY BE PRODUCED.

An acceptable high potential machine is available from the Switchgear Business Department, Burlington, Iowa, Catalog Number 282A2610P001. The following machines are also acceptable:

Hipotronics	Model 860PL
Hipotronics	Model 880PL
Hipotronics	Model 7BT60A
James G. Biddle	Catalog 222060

6.6 PRIMARY CIRCUIT RESISTANCE

A resistance check of the primary circuit may be made with the breaker closed. Use a low resistance measuring instrument which measures microhms. The 100 ampere reading should not exceed 100 microhms when connected across the primary studs on the breaker side of the disconnect fingers.

7. MAINTENANCE

7.1 GENERAL

Power/Vac* circuit breakers have been designed to be as maintenance free as practicable. They include features such as sealed vacuum interrupters and long life synthetic greases which contribute to many years of trouble free performance with a minimum amount of maintenance attention.

7.2 SERVICE CONDITIONS

The frequency of required maintenance depends on the severity of the service conditions of the switchgear application. If the service conditions are mild the interval between maintenance operations may be extended to 10 years or 10,000 no load or normal load switching operations.

Mild service conditions are defined as an environment in which the switchgear is protected from the deleterious effects of conditions such as:

Salt Atmosphere
Changes in temperature that produce condensation
Conductive and/or abrasive dust
Damaging chemicals and fumes
Vibration or mechanical shock
High relative humidity (>90%)
Temperature extremes (<-30C,>40C

7.3 FAULT INTERRUPTIONS

The erosion rate of the primary contacts in the vacuum interrupters is very low for no load and normal load switching operations. However, fault current interruptions at or near the breaker rating may result in appreciable contact erosion. With frequent fault interruptions it is necessary to perform maintenance based on the number of interruptions. After each 15 fault interruptions the following should be performed.

1. Contact erosion per paragraph 5.7.
2. Wipe and gap per paragraph 5.6.
3. Vacuum interrupter integrity test per paragraph 6.5.

7.4 RECOMMENDED MAINTENANCE

The following operations should be performed at each maintenance.

1. Perform a visual inspection of the breaker. Check for loose or damaged parts.
2. Perform the slow closing operation described in paragraph 5.2.

CONTENTS