Supplemental Material For 15kV VCP-WG
Generator Circuit Breakers

This is a user interactive supplemental booklet. This material is intended to enhance the technical information included in the instruction booklet for the 15kV VCP-WG circuit breaker manufactured by Eaton.
WARNING
INSTALLATION OR MAINTENANCE SHOULD BE ATTEMPTED ONLY BY QUALIFIED PERSONNEL. THIS SUPPLEMENTAL INSTRUCTION BOOKLET IS INTENDED TO ACCOMPANY THE ORIGINAL INSTRUCTION BOOKLET PROVIDED WITH THE VR-SERIES CIRCUIT BREAKER AND SHOULD NOT BE CONSIDERED ALL INCLUSIVE REGARDING INSTALLATION OR MAINTENANCE PROCEDURES. THIS IS NOT TO BE USED IN PLACE OF THE VR-SERIES BREAKER INSTRUCTION BOOKLET. IF FURTHER INFORMATION IS REQUIRED, YOU SHOULD CONSULT EATON.

IMPROPERLY INSTALLING OR MAINTAINING THESE PRODUCTS CAN RESULT IN DEATH, SERIOUS PERSONAL INJURY OR PROPERTY DAMAGE.

READ AND UNDERSTAND THE VR-SERIES INSTRUCTION BOOKLET BEFORE ATTEMPTING ANY OPERATION OR MAINTENANCE OF THE CIRCUIT BREAKERS.

THE CIRCUIT BREAKERS FEATURED IN THIS BOOKLET ARE DESIGNED AND TESTED TO OPERATE WITHIN THEIR NAMEPLATE RATINGS. OPERATION OUTSIDE OF THESE RATINGS MAY CAUSE THE EQUIPMENT TO FAIL, RESULTING IN DEATH, BODILY INJURY AND PROPERTY DAMAGE.

ALL SAFETY CODES, SAFETY STANDARDS AND/OR REGULATIONS AS THEY MAY BE APPLIED TO THIS TYPE OF EQUIPMENT MUST BE STRICTLY ADHERED TO.

THESE VACUUM REPLACEMENT CIRCUIT BREAKERS ARE DESIGNED TO BE INSTALLED PURSUANT TO THE AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI). SERIOUS INJURY, INCLUDING DEATH, CAN RESULT FROM FAILURE TO FOLLOW THE PROCEDURES OUTLINED IN THIS BOOKLET.

ALL POSSIBLE CONTINGENCIES WHICH MIGHT ARISE DURING INSTALLATION, OPERATION, OR MAINTENANCE, AND ALL DETAILS AND VARIATIONS OF THIS EQUIPMENT ARE NOT COVERED BY THESE INSTRUCTIONS. IF FURTHER INFORMATION IS DESIRED BY THE PURCHASER REGARDING A PARTICULAR INSTALLATION, OPERATION, OR MAINTENANCE OF THIS EQUIPMENT, THE LOCAL EATON’S ELECTRICAL SERVICES & SYSTEMS REPRESENTATIVE SHOULD BE CONTACTED.

WARNING
TO PROTECT THE PERSONNEL ASSOCIATED WITH INSTALLATION, OPERATION, AND MAINTENANCE OF THESE BREAKERS, THE FOLLOWING PRACTICES MUST BE FOLLOWED:

• Read the instruction booklet provided with the VR-Series circuit breaker before attempting any installation, operation or maintenance of these breakers.
• Only qualified persons, as defined in the National Electrical Safety Code, who are familiar with the installation and maintenance of medium voltage circuits and equipment, should be permitted to work on these breakers.
• Always remove the breaker from the enclosure before performing any maintenance. Failure to do so could result in electrical shock leading to death, severe personnel injury or property damage.
• Do not work on a breaker with the secondary test coupler engaged. Failure to disconnect the test coupler could result in an electrical shock leading to death, personnel injury or property damage.
• Do not work on a closed breaker or a breaker with closing springs charged. The closing spring should be discharged and the main contacts open before working on the breaker. Failure to do so could result in cutting or crushing injuries.
• Do not use a circuit breaker by itself as the sole means of isolating a high voltage circuit. Remove the breaker to the Disconnect position and follow all lockout and tagging rules of the National Electrical Code and any and all applicable codes, regulations and work rules.
• Do not leave the breaker in an intermediate position in the cell. Always have the breaker either in the Test or Connected position. Failure to do so could result in a flash over and possible death, personnel injury or property damage.
• Always remove the maintenance tool from the breaker after charging the closing springs.
• Breakers are equipped with safety interlocks. Do not defeat them. This may result in death, bodily injury or equipment damage.

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Vacuum Interrupter

Vacuum Interrupter

Vacuum interrupters offer the advantages of enclosed arc interruption, small size and weight, longer life, reduced maintenance, minimal mechanical shock, and elimination of contact degradation caused by environmental contamination.

In the closed position, current flows through the interrupter moving and fixed stems and the faces of the main contacts. As the contacts part, an arc is drawn between the contact surfaces. The arc is rapidly moved away from the main contacts to the slotted contact surfaces by self-induced magnetic effects. This minimizes contact erosion and hot spots on the contact surfaces. The arc flows in an ionized metal vapor and as the vapor leaves the contact area, it condenses into the metal shield which surrounds the contacts.

At current zero, the arc extinguishes and vapor production ceases. Very rapid dispersion, cooling, recombination, and de-ionization of the metal vapor plasma and fast condensation of metal vapor causes the vacuum to be quickly restored and prevents the transient recovery voltage from causing a restrike across the gap of the open contacts.

Vacuum Interrupter Assembly

Each interrupter is assembled at the factory as a unit to assure correct dimensional relationships between working components. The interrupter assembly consists of a vacuum interrupter, a molded glass polyester stand-off insulator, upper and lower clamps, flexible shunts, bell crank, operating rod, and contact load spring. The vacuum interrupter is mounted vertically with a fixed stationary stem and a moving stem to open and close the contacts. The upper and lower glass polyester stand-off insulator and clamps support the interrupter and are fastened to the breaker’s stored energy mechanism frame. Upper and lower flexible shunts provide electrical connections from each interrupter to the breaker’s primary bushings while providing isolation from mechanical shock and movement of the interrupter’s moving stem. The operating rod, loading spring, and bell crank transfer mechanical motion from the breaker’s operating mechanism to the moving stem of the interrupter. A vacuum interrupter contact erosion indicator is located on the moving stem of the interrupter. It is visible when the breaker is withdrawn and is viewed from the rear of the breaker.
Unique Fault Current Conditions

The two key unique fault current conditions encountered by generator circuit breakers are shown in Figure 1.

**Figure 1. Typical Generator Circuit**

- Faults at location “a” are called “System-source Faults” or “Transformer-fed Faults”.
- Faults at location “b” are called “Generator-source Faults” or “Generator-fed Faults”.

The differences between these two fault conditions become apparent when the important parameters of each are discussed below.

The transformer-fed fault current can be very high because the full energy of the power system feeds the fault. The low impedance of the transformer and the short, very low-loss buses connecting the generator, generator circuit breaker, and transformer, do little to limit the fault current because of their very low impedance. To clear these kinds of faults, generator circuit breakers must be tested and proven capable of interrupting not only the high symmetrical fault current, but also the higher asymmetrical fault currents resulting from extreme DC components of fault current, up to 75% as required in section 5.8 of IEEE C37.013.

Generator-fed fault currents, while usually lower in magnitude, are subject to much higher degrees of asymmetry, sometimes resulting in another type of very demanding condition called “Delayed Current Zeroes”. This unique characteristic of the fault current comes from the very high X/R (inductive reactance to resistance) ratio of the circuit and the operating conditions of the generator, which can combine to produce a DC component of the fault current exceeding 100%! This means the asymmetrical fault current peak becomes so high, and its decay becomes so slow, that the first current zero can be delayed for several cycles. (See Figure 2.)

Since circuit breakers rely on a current zero crossing in order to interrupt, generator circuit breakers must be able to withstand longer arcing times and greater electrical, thermal, and mechanical stresses when clearing this kind of fault. Sections 5.8.2.3 and 7.3.5.3.5.1 of IEEE Standard C37.013 require verification by test that the circuit breaker can interrupt under these extreme conditions.

Depending on the minimum opening time, the generator circuit breaker must demonstrate the ability to interrupt three-phase fault currents with DC components of 135% at one fault current level and of 110% with a higher fault current level, each time with the related delayed current zero. Kulicke and Schramm [7] were among the first to recognize the importance of the ability of the interrupter to withstand very long arcing times during the delayed current zero condition. In particular, they demonstrated that vacuum interrupters are well suited to this requirement because they retain the ability to interrupt even after the contact motion has ceased.

**Figure 2. Short-circuit Current with Delayed Current Zeroes**

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- Faults at location “b” are called “Generator-source Faults” or “Generator-fed Faults”.

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**WARNING**

APPLYING ABNORMALLY HIGH VOLTAGE ACROSS A PAIR OF CONTACTS IN VACUUM MAY PRODUCE X-RADIATION. THE RADIATION MAY INCREASE WITH THE INCREASE IN VOLTAGE AND/OR DECREASE IN CONTACT SPACING. X-RADIATION PRODUCED DURING THIS TEST WITH THE RECOMMENDED VOLTAGE AND NORMAL CONTACT SPACING IS EXTREMELY LOW AND WELL BELOW MAXIMUM PERMITTED BY STANDARDS. HOWEVER, AS A PRECAUTIONARY MEASURE AGAINST POSSIBILITY OF APPLICATION OF HIGHER THAN RECOMMENDED VOLTAGE AND/OR BELOW NORMAL CONTACT SPACING, IT IS RECOMMENDED THAT ALL OPERATING PERSONNEL STAND AT LEAST ONE METER AWAY IN FRONT OF THE BREAKER.

Vacuum interrupters used in Type VR-Series circuit breakers are highly reliable interrupting elements. Satisfactory performance of these devices is dependent upon the integrity of the vacuum in the interrupter and the internal dielectric strength. Both of these parameters can be readily checked by a one minute AC high potential test, using the appropriate test voltage in the following table.

<table>
<thead>
<tr>
<th>Breaker Rated Maximum Voltage</th>
<th>Vacuum Interrupter Integrity Test Voltage AC 60Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to and including 15.0 kV</td>
<td>27 kV</td>
</tr>
</tbody>
</table>

**Note:** Roll over each high potential test diagram configuration above to see the correct lead connection to the equipment.

**Note:** The secondary disconnect must be grounded during test.

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**WARNING**

DC HI-POTENTIAL TESTS ARE NOT RECOMMENDED BY EATON’S POWER BREAKER CENTER. DO NOT APPLY DC AT ANY LEVEL TO VR-SERIES POWER CIRCUIT BREAKERS.

With the breaker open and securely sitting on the floor, connect all top/front primary studs (bars) together and the high potential machine lead. Connect all bottom/rear studs together. Do not ground them to the breaker frame. Start the machine at zero potential, increase to appropriate test voltage and maintain for one minute.

Successful withstand indicates that all interrupters have satisfactory vacuum level. If there is a breakdown, the defective interrupter or interrupters should be identified by an individual test and replaced before placing the breaker in service.

After the high potential unit is removed, discharge any electrical charge that may be retained. This charge is particularly true from the center shield of vacuum interrupters. To avoid any ambiguity in the AC high potential test due to leakage or displacement (capacitive) current, the test unit should have sufficient volt-ampere capacity. It is recommended that the equipment be capable of delivering 25 milliamperes for one minute.

Although an AC high potential test is recommended, a DC test may be performed if only a DC test unit is available, but is not recommended and can yield false results.

In this case the equipment must be capable of delivering 5 milliamperes for one minute to avoid ambiguity due to field emission or leakage currents and the test voltage shall be as shown in Table 6.1.

The current delivery capability of 25 mA AC and 5 mA DC apply when all three VI’s are tested in parallel. If individual VI’s are tested, current capability may be one third of these values.
Primary Circuit:
The integrity of primary insulation may be checked by the AC high potential test. The test voltage depends upon the maximum rated voltage of the breaker. For the breakers rated 4.76 kV, 8.25 kV and 15 kV the test voltages are 15 kV, 27 kV and 27 kV RMS, 60 Hz respectively. Conduct the test as follows:

Close the breaker. Connect the high potential lead of the test machine to one of the poles of the breaker. Connect the remaining poles and breaker frame to ground. Start the machine with output potential at zero and increase to the test voltage. Maintain the test voltage for one minute. Repeat for the remaining poles. Successful withstand indicates satisfactory insulation strength of the primary circuit.

Open the breaker. Connect the high potential lead of the test machine to one of the poles of the breaker. Connect the remaining poles and breaker frame to ground. Start the machine with output potential at zero and increase to the test voltage. Maintain the test voltage for one minute. Repeat for the remaining poles. Successful withstand indicates satisfactory insulation strength of the primary circuit.

WARNING
APPLYING ABNORMALLY HIGH VOLTAGE ACROSS A PAIR OF CONTACTS IN VACUUM MAY PRODUCE X-RADIATION. THE RADIATION MAY INCREASE WITH THE INCREASE IN VOLTAGE AND/OR DECREASE IN CONTACT SPACING. X-RADIATION PRODUCED DURING THIS TEST WITH RECOMMENDED VOLTAGE AND NORMAL CONTACT SPACING IS EXTREMELY LOW AND WELL BELOW MAXIMUM PERMITTED BY STANDARDS. HOWEVER, AS A PRECAUTIONARY MEASURE AGAINST POSSIBILITY OF APPLICATION OF HIGHER THAN RECOMMENDED VOLTAGE AND/OR BELOW NORMAL CONTACT SPACING, IT IS RECOMMENDED THAT ALL OPERATING PERSONNEL STAND AT LEAST ONE METER AWAY IN FRONT OF THE BREAKER.

In VR-Series breakers, insulation maintenance primarily consists of keeping all insulating surfaces clean. This can be done by wiping off all insulating surfaces with a dry lint free cloth or dry paper towel. In case there is any tightly adhering dirt that will not come off by wiping, it can be removed with a mild solvent or distilled water. But be sure that the surfaces are dry before placing the breaker in service. If a solvent is required to cut dirt, use Isopropyl Alcohol or commercial equivalent. Secondary control wiring requires inspection for tightness of all connections and damage to insulation.

Power Frequency Withstand Voltage Testing Configuration: Open Circuit

Power Frequency Withstand Voltage Testing Configuration: Closed Circuit

Note: Roll over each high potential test diagram configuration above to see the correct lead connection to the equipment.

Note: The ground connection can be attached to the plated frame.

Note: The secondary disconnect must be grounded during test.

Insulation Integrity Test
Current Path Resistance Test

Purpose
To measure and record the DC electrical resistance of the main current carrying pole unit assembly in the VR-Series power circuit breaker. This measurement is performed by injecting 100A DC from terminal to terminal of each pole unit in the closed position and measuring the voltage drop across the terminals. The resistance can be calculated from Ohm’s Law and is expressed in micro-ohms.

The main contacts are inside the vacuum chamber, which remain clean and require no maintenance at any time. The VR-Series design does not have sliding contacts at the moving stem and use a highly reliable and unique flexible clamp design that eliminates the need for lubrication and inspection for wear.

This test may be performed during regular maintenance intervals and the results should not exceed the factory recorded values by 15% when adjusted to the same temperature recorded during the factory tests.

Equipment
This test should be performed with a low voltage, direct current (DC) power supply capable of delivering no less 100A DC. The factory performs this test using a Digital Low Resistance Ohmmeter (DLRO). The DLRO injects 100A DC, measures the voltage drop across the terminals and displays the resistance in micro-ohms.

Procedure
The current path resistance test is to be performed per ANSI/IEEE C37.09-1999 section 5.5.

Test
Perform the test as follows (Using the DLRO)

1. Remove the circuit breaker from its enclosure if installed (follow the removal procedures) and move it to a suitable area away from the Arc-Flash boundary.
2. Remove the finger clusters from the terminals being tested.
3. Manually or electrically charge the breaker.
4. Manually or electrically close the breaker. If the breaker is being closed electrically, the charging motor will run if control power is present after the breaker is closed.
5. Provide control power to the DLRO and turn it to the ON position. Select 100A output, if adjustable.
6. Connect the DLRO positive current lead to the TOP terminal of the phase being tested.
7. Connect the DLRO negative current lead to the BOTTOM terminal of the phase being tested.
8. Press the TEST button on the DLRO. Once the TEST button is pressed, 100A DC will flow through the phase being tested. If the circuit breaker is not closed, the DLRO will not inject current.
9. Apply the DLRO positive measurement test lead to the TOP terminal. Be mindful not to connect this measurement lead to the current lead. This insures that the current lead is not being calculated into the resistance of the current path.
10. Apply the DLRO negative measurement test lead to the BOTTOM terminal. Be mindful not to connect this measurement lead to the current lead. This insures that the current lead is not being calculated into the resistance of the current path.
11. While both measurement leads are connected, observe the resistance reading and record the value.
12. Press the TEST button on the DLRO to stop the current flow.
13. Remove the measurement leads and current leads from the phase being tested.
14. Install the finger clusters back onto the terminals of the circuit breaker.
15. Repeat above procedure for the remain phases of the circuit breaker.
16. Open the circuit breaker after completion of the testing.
17. Turn the DLRO to the OFF position and remove control power if necessary.
18. Re-insert the circuit breaker into the enclosure per insertion procedures.

Results
The field measured resistance should not exceed the factory values no more than 15%. If measurements exceed 15%, check the primary current path for loose hardware and re-torque per the VR-Series instruction booklet. Repeat the test if any loose hardware and re-torquing is applied. If the values do not improve, contact the manufacturer.

Resistance conversion for Temperature

\[ R_{\text{conversion}} = R_{\text{Factory}}(1 + (T_{\text{Field}} - T_{\text{Factory}})\rho) \]

- \( R_{\text{conversion}} \) = Resistance correction for temperature based from the factory resistance measurement.
- \( R_{\text{Factory}} \) = Resistance measurement from the factory.
- \( T_{\text{Field}} \) = Temperature measurement in the field.
- \( T_{\text{Factory}} \) = Temperature measurement from the factory.
- \( \rho \) = Copper resistivity temperature coefficient.

- \( \rho = 0.0039 \) Copper Resistivity Temperature Coefficient / Deg C
- \( \rho = 0.002167 \) Copper Resistivity Temperature Coefficient / Deg F
Vacuum Bottle Contact Inspection

⚠️ WARNING
THERE IS NO PROVISION FOR IN-SERVICE ADJUSTMENTS OF CONTACT WIPE AND STROKE. ALL SUCH ADJUSTMENTS ARE FACTORY SET AND SHOULD NOT BE ATTEMPTED IN THE FIELD.

Contact Erosion Indicator
Contact erosion of the vacuum interrupter contacts is very minimal over time with vacuum interrupters utilizing copper-chrome contact material. Contact erosion must, however, be monitored. If contact erosion reaches or exceeds 3mm as determined by specific measurements, the interrupter assembly must be replaced.

The vacuum bottle contacts are contained inside the interrupter. Therefore, the contacts remain clean and require no maintenance. However, during high current interruptions there may be a minimum amount of erosion from the contact surfaces. Maximum permitted erosion should be less than 3.0mm. To determine contact erosion, the initial height of the adjustment conductor must first be known (Figures 6-2). Measure the height of the adjustment conductor to determine if there is any change in the adjustment conductor height from its initial setting. Measure the contact wipe with the breaker closed. This is accomplished by measuring the gap between the large jam nut centered under each pole unit and the steel trunion block above it. This gap is set from the factory at 4.0mm. The contact erosion is the sum of the change in the adjustment conductor height from the initial setting and the loss of the contact wipe (4.0 minus measured value). If the erosion has reached or exceed 3.0mm, the pole unit assembly must be replaced (Figure 6-4).

⚠️ WARNING
FAILURE TO REPLACE A VACUUM INTERRUPTER ASSEMBLY WHEN CONTACT EROSION DOES NOT MEET THE REQUIREMENTS OR WIPE IS UNSATISFACTORY, WILL CAUSE THE BREAKER TO FAIL TO INTERRUPT AND THEREBY CAUSE PROPERTY DAMAGE OR PERSONNEL INJURY.
**Mechanism Lubrication**

**15kV VCP-WG Mechanism Lubrication**

All parts that require lubrication have been lubricated during the assembly with molybdenum disulphide grease. Eaton No. 53701QB. Over a period of time, this lubricant may be pushed out of the way or degrade. Proper lubrication at regular intervals is essential for maintaining the reliable performance of the mechanism. The breaker should be relubricated once a year or per the operations table, which ever comes first with a non-synthetic light machine oil.

After lubrication, operate the breaker several times manually and electrically.

Roller bearings are used on the pole shaft, the cam shaft, the main link and the motor eccentric. These bearings are packed at the factory with a top grade slow oxidizing grease which normally should be effective for many years. They should not be disturbed unless there is definite evidence of sluggishness, dirt or parts are dismantled for some reason.

If it becomes necessary to disassemble the mechanism, the bearings and related parts should be thoroughly cleaned, remove old grease in a good grease solvent. Do not use carbon tetrachloride. They should then be washed in light machine oil until the cleaner is removed. After the oil has been drawn off, the bearings should be packed with Eaton Grease 53701QB or equivalent.

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**Table 2. Lubrication Operations Table**

<table>
<thead>
<tr>
<th>RATINGS</th>
<th>OPERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>29kA and below</td>
<td>750</td>
</tr>
<tr>
<td>Above 29kA</td>
<td>400</td>
</tr>
<tr>
<td>3000A</td>
<td>400</td>
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</table>
**Component Replacement**

⚠️ **WARNING**

 **VERIFY BREAKER IS OPEN, CLOSING SPRINGS ARE DISCHARGED AND CONTROL POWER IS DISCONNECTED.**

 **REFERENCE:** THE SPRING RELEASE COIL IS THE COIL ON THE LEFT SIDE, LOOKING INTO THE BREAKER, WITH THE GREEN “PUSH TO CLOSE” LABEL. THE SHUNT TRIP COIL IS THE COIL ON THE RIGHT SIDE, LOOKING INTO THE BREAKER, WITH THE RED “PUSH TO OPEN” LABEL.

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**Replacing Coils on the 15kV VCP-WG**

Cut 4 to 6 tie wraps that hold the wires that go between the close and trip coils to the terminal block in the lower right side of the mechanism.

Remove two wires from the terminal block (TB1 and TB2 for the Spring Release Coil/Close Coil and TB3 and TB4 for the Shunt Trip Coil) and pull the wires through the support bracket toward the coil.

Remove the 5/16 x 3 ¼ in. hex head bolt, lock washer and spacer that hold the coil in place. Be careful to capture the two fiber insulating washers behind the coil. **Note:** The 5/16 x 3 ¼ in. bolt is made of silicon bronze for magnetic purposes and must never be replaced with a steel bolt.

Slide the coil out of its bracket (to its available open side) and feed the wires through. Remove the metal core from the center of the coil.

Install new wire markers on the new coil leads. Polarity is not an issue.

Insert the metal core into the center of the new coil.

Fish the coil wires through the cut out and slide coil into the bracket while gently pulling the leads.

Insert the bolt, lock washer and spacer and place the two fiber washers on the bolt when it exits the coil (one at a time and screw bolt into washers). Screw bolt into threaded insert in bracket and tighten. Do not over tighten!

Fish wires through to the terminal block. Connect wires to terminal block (TB1 and TB2 for the Spring Release Coil/Close Coil and TB3 and TB4 for the Shunt Trip Coil) . Install tie wraps to hold wire bundle.

Mechanically and electrically test the breaker and hipot the secondary wiring.

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**Figure 9. Replacing the Shunt Trip Coil on a 15kV VCP-WG mechanism.**

**Replacement Parts**

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>DESCRIPTION</th>
<th>EATON STYLE NUMBER</th>
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</thead>
<tbody>
<tr>
<td>SHUNT TRIP</td>
<td>24Vdc</td>
<td>3759A76G11</td>
</tr>
<tr>
<td></td>
<td>48Vdc</td>
<td>3759A76G12</td>
</tr>
<tr>
<td></td>
<td>125Vdc / 120Vac</td>
<td>3759A76G13</td>
</tr>
<tr>
<td></td>
<td>250Vdc / 240Vac</td>
<td>3759A76G14</td>
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</tbody>
</table>
Component Replacement

⚠️ WARNING
VERIFY BREAKER IS OPEN, CLOSING SPRINGS ARE DISCHARGED, AND CONTROL POWER IS DISCONNECTED.

Replacing The Charging Motor

Remove the motor leads from TB7 and TB8.
Remove the spring holding the ratchet pawl in the center section of the mechanism; lift the pawl up out of the way.
Rotate eccentric on the motor shaft to the top end of the motor.
Unscrew the eccentric counterclockwise – use a wooden hammer handle to break the threads
Remove the two screws on the right hand motor support plate, using a 9/64in. Allen wrench. Remove the motor plate from the side sheet for the 5kV breaker.
Remove the motor.
Verify the new motor has the correct motor voltage on the motor sticker.
Lubricate the motor threads using molybdenum disulfide grease, Eaton No. 53701QB or equal.
Position the new motor in place and install eccentric in a clockwise direction.
Install the motor plate if it was previously removed.
Secure the motor in place using the two Allen head screws.
Install the ratchet pawl spring.
Rewire the motor leads to the terminal block; Black on TB8, and White on TB7.

Figure 10. Replacement of the charging motor on a 15kV VCP-WG mechanism.

Replacement Parts

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>DESCRIPTION</th>
<th>EATON STYLE NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPRING CHARGING MOTOR</td>
<td>48Vdc</td>
<td>6998196G08</td>
</tr>
<tr>
<td></td>
<td>125Vdc / 120Vac</td>
<td>6998196G04</td>
</tr>
<tr>
<td></td>
<td>250Vdc / 240Vac</td>
<td>6998196G05</td>
</tr>
</tbody>
</table>
**CloSure™ Test**

**Introduction:** The CloSure™ Test is a simple yet extremely effective means to determine and monitor the ability of the mechanism to close the breaker contacts fully. It provides a quantitative measure of the extra energy available in terms of over travel in inches to close the breaker contacts to their full extent. It may be used periodically to monitor the health of the mechanism.

At times, circuit breakers are called upon to operate MOC (Mechanism Operated Control) switches that place extra load upon the closing mechanism of the circuit breaker. If this load is excessive, it can prevent the circuit breaker from closing fully. In such a case, it is important to determine that the circuit breaker will close fully. The CloSure™ Test provides this assurance.

**General Information:** If the CloSure™ travel obtained is as specified, the mechanism performance is satisfactory. If the CloSure™ travel does not conform as shown in the demonstration, contact Eaton for further information.

⚠️ **WARNING**

DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE OR TESTS ON THE EQUIPMENT WHILE IT IS ENERGIZED. NEVER PUT YOUR HANDS NEAR THE MECHANISM WHEN THE CIRCUIT BREAKER IS IN THE CHARGED OR CLOSED POSITION. DEATH OR SEVERE PERSONAL INJURY CAN RESULT FROM CONTACT WITH ENERGIZED EQUIPMENT. ALWAYS VERIFY THAT NO VOLTAGE IS PRESENT BEFORE PROCEEDING WITH THE TASK, AND ALWAYS FOLLOW GENERALLY ACCEPTED SAFETY PROCEDURES.

**Safety Precautions:** Read and understand the instruction manual for specific instructions before attempting any maintenance, repair or testing on the breaker. The user is cautioned to observe all recommendations, warnings and cautions relating to the safety of personnel and equipment.

The recommendations and information contained herein are based on experience and judgment, but should not be considered to be all-inclusive or covering every application or circumstance which may arise. If further information is required, you should consult an Eaton Electrical Services and Systems representative.

**Testing Procedures:** Assuming that the circuit breaker is safely removed from the switchgear enclosure and positioned in an area outside the arc fault boundary, follow this procedure to perform the CloSure™ test. For further instructions on removal of the circuit breaker from the switchgear, refer to the appropriate section of the instruction manual.

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**Table 5. CloSure™ Tool Mounting / Testing Hole Locations**

<table>
<thead>
<tr>
<th>BREAKER LINE</th>
<th>APPROXIMATE MECHANISM CABINET WIDTH (INCH)</th>
<th>UPPER MOUNTING HOLE</th>
<th>LOWER MOUNTING HOLE</th>
<th>MARKER PLACEMENT HOLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>18WR</td>
<td>18</td>
<td>A1</td>
<td>B2</td>
<td>C1</td>
</tr>
<tr>
<td>20WR</td>
<td>20</td>
<td>A1</td>
<td>B2</td>
<td>C2</td>
</tr>
<tr>
<td>29WR</td>
<td>27</td>
<td>A1</td>
<td>B2</td>
<td>C5</td>
</tr>
</tbody>
</table>

**Illustrative Testing Tape Sample** (Illustration not to scale)

- **CloSure™ Distance**
- **5 3/16” Approx**
- **8.0” to 10”**

*Note: Use the center of the marker diameter to determine 'X' distance*
15kV VCP-WG Circuit Breaker Model

15kV VCP-WG 63kA 3000A Draw Out Breaker
15kV VCP-WG Circuit Breaker Model

15kV VCP-WG 75kA 4000A Draw Out Breaker
15kV VCP-WG Circuit Breaker Model

15kV VCP-WG 75kA 6000A Fixed Breaker
Eaton is a diversified power management company providing energy-efficient solutions that help our customers effectively manage electrical, hydraulic and mechanical power. A global technology leader, Eaton acquired Cooper Industries plc in November 2012. The 2012 revenue of the combined companies was $21.8 billion on a pro forma basis. Eaton has approximately 103,000 employees and sells products to customers in more than 175 countries. For more information, visit www.eaton.com.