IB-60320  PowlVac® 63kA 5000 AMP Stationary Circuit Breaker

Model: 15PV63STA 5000A

August, 2005
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THE EQUIPMENT DESCRIBED IN THIS DOCUMENT MAY CONTAIN HIGH VOLTAGES AND CURRENTS WHICH CAN CAUSE SERIOUS INJURY OR DEATH.

THE EQUIPMENT IS DESIGNED FOR USE, INSTALLATION, 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 SYSTEMS, INC. IMMEDIATELY AT 1-800-480-7273.

BEFORE ANY ADJUSTMENT, SERVICING, PARTS REPLACEMENT, OR ANY OTHER ACT IS PERFORMED REQUIRING PHYSICAL CONTACT WITH THE ELECTRICAL WORKING COMPONENTS OR WIRING OF THE EQUIPMENT DESCRIBED IN THIS DOCUMENT, THE POWER SUPPLY MUST BE DISCONNECTED. FAILURE TO FOLLOW THIS WARNING MAY RESULT IN INJURY OR DEATH.
THE INFORMATION IN THIS INSTRUCTION BULLETIN IS NOT INTENDED TO EXPLAIN ALL DETAILS OR VARIATIONS OF THE PowlVac® 63kA 5000 AMP STATIONARY CIRCUIT BREAKER, NOR TO PROVIDE FOR EVERY POSSIBLE CONTINGENCY OR HAZARD TO BE MET IN CONNECTION WITH INSTALLATION, TESTING, OPERATION, AND MAINTENANCE OF THE EQUIPMENT. FOR ADDITIONAL INFORMATION AND INSTRUCTIONS FOR PARTICULAR PROBLEMS, WHICH ARE NOT PRESENTED SUFFICIENTLY FOR THE USER’S PURPOSES, CONTACT POWELL ELECTRICAL SYSTEMS, INC. AT 1-800-480-7273.

I. INTRODUCTION

A. SCOPE

This instruction bulletin describes the following:

PowlVac® 63kA 5000 AMP Stationary Circuit Breaker

B. PURPOSE

This instruction bulletin is intended to provide the information required to properly operate and maintain the PowlVac® 63kA 5000 AMP Stationary Circuit Breaker described in Section A. Scope.

This instruction bulletin provides:

1. Guidelines for safety
2. Instructions for installation and placing the circuit breakers into service
3. Instructions for part replacement
4. Renewal parts lists

It should be noted that some of the illustrations contained herein may not represent the exact construction details of each particular type. These illustrations are provided as general information to aid in showing component locations. To the extent required, the products described herein meet the applicable ANSI, IEEE, and NEMA Standards; however, no such assurance is given with respect to local codes and ordinances since the specifications vary greatly.

C. INSTRUCTION BULLETINS AVAILABLE ELECTRONICALLY

Many Powell Electrical Systems, Inc. instruction bulletins are available through hyperlinks on the Web site: www.powellind.com. Click the following links: Publications, Services, and Instruction Bulletins.

To obtain instruction bulletins by phone or email, contact the Powell Apparatus Service Division (PAS) at 1-800-480-7273 or 713-944-6900, or email PAS at info@powellservice.com.
II. SAFETY

A. SAFE WORK CONDITION

The information in Section A is quoted from NFPE 70E 2004 —Article 120, 120.1 Establishing an Electrically Safe Work Condition

120.1 Process of Achieving an Electrically Safe Work Condition.

1. Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.

2. After properly interrupting the load current, OPEN the disconnecting device(s) for each source.

3. Wherever possible, visually verify that all blades of the disconnecting devices are fully OPEN or that drawout type circuit breakers are withdrawn to the fully disconnected position.

4. Apply lockout/tagout devices in accordance with a documented and established policy.

5. Use an adequately rated voltage detector to test each phase conductor or circuit part to verify they are deenergized. Test each phase conductor or circuit part both phase-to-phase, and phase-to-ground. Before and after each test, determine that the voltage detector is operating satisfactorily.

6. Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being deenergized could contact other exposed energized conductors or circuit parts, apply ground connecting devices rated for the available fault duty.

B. SAFETY GUIDELINES

Study this instruction bulletin and all other associated documentation before uncrating the PowlVac® 63kA 5000 AMP Stationary Circuit Breaker.

Each user has the responsibility to instruct and supervise all personnel associated with usage, installation, 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 of equipment encountered.

The circuit breaker described in this instruction bulletin is operated by high energy, high speed mechanisms interlocked to provide specific operating sequences. To ensure the safety of personnel associated with usage, installation, operation, and maintenance of these circuit breaker, it is mandatory that the following safety rules be observed. THESE RULES ARE NOT INTENDED TO BE A COMPLETE SAFETY PROGRAM, BUT ARE INTENDED TO COVER ONLY THE IMPORTANT ASPECTS OF PERSONNEL SAFETY RELATED TO POWLVAC® 63kA 5000 AMP STATIONARY CIRCUIT BREAKER.

C. GENERAL

1. Only supervised and qualified personnel trained in the usage, installation, operation, and maintenance of the circuit breaker shall be allowed to work on this equipment. It is mandatory that this instruction bulletin, any supplements, and service advisories be studied, understood, and followed.

2. Maintenance programs must be consistent with both customer experience and manufacturer’s recommendations, including service advisories and the instruction bulletin(s). A well-planned and executed routine maintenance program is essential for circuit breaker reliability and safety.
3. Service conditions and circuit breaker applications shall also be considered in the development of maintenance programs, including such variables as ambient temperature and humidity, actual continuous current, thermal cycling, number of operations, interrupting duty, and any unusual local conditions such as excessive dust, ash, corrosive atmosphere, vermin, and insect problems.

D. SPECIFIC

1. **DO NOT WORK ON AN ENERGIZED CIRCUIT BREAKER.** If work must be performed on a circuit breaker, remove it from service.

2. **DO NOT WORK ON A CIRCUIT BREAKER WITH THE CONTROL CIRCUIT ENERGIZED.**

3. **EXTREME CARE MUST BE EXERCISED TO KEEP ALL PERSONNEL, TOOLS, AND OTHER OBJECTS CLEAR OF MECHANISMS WHICH ARE TO BE OPERATED, DISCHARGED, OR RELEASED.** The circuit breakers utilize stored-energy mechanisms. These mechanisms must be serviced only by skilled and knowledgeable personnel capable of releasing each spring load in a controlled manner. Detailed information regarding these mechanisms is found in this instruction bulletin.

4. **DO NOT ATTEMPT TO CLOSE THE CIRCUIT BREAKER MANUALLY ON AN ENERGIZED CIRCUIT.**

5. **DO NOT USE AN OPEN CIRCUIT BREAKER AS THE SOLE MEANS OF ISOLATING A HIGH VOLTAGE CIRCUIT.**

6. **ALL COMPONENTS SHALL BE DISCONNECTED BY MEANS OF A VISIBLE BREAK AND SECURELY GROUNDED FOR THE SAFETY OF PERSONNEL PERFORMING MAINTENANCE OPERATIONS ON THE CIRCUIT BREAKER.**

7. Interlocks are provided to ensure the proper operating sequences of the circuit breaker and for the safety of the user. If for any reason an interlock does not function as described, do not make any adjustments, modification, or deform the parts. **DO NOT FORCE THE PARTS INTO POSITION. CONTACT POWELL ELECTRICAL SYSTEMS, INC. FOR INSTRUCTIONS.**

E. 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 dependent on the peak voltage and the contact gap. At the normal operating voltage for this type of equipment, the radiation levels are negligible. At the voltages specified for testing, test personnel 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 test personnel and the vacuum interrupters, and that the test personnel be no closer than one meter (4 feet) from the front of the circuit breaker. **THE CIRCUIT BREAKER SHALL BE EITHER FULLY OPEN, OR FULLY CLOSED WHEN MAKING HIGH POTENTIAL TESTS. DO NOT TEST WITH THE CONTACTS PARTIALLY OPEN.**

F. SAFETY LABELS

The circuit breaker has **DANGER, WARNING, CAUTION,** and instruction labels attached to various locations. All equipment **DANGER, WARNING, CAUTION,** and instruction labels shall be observed whenever the circuit breaker is handled, operated, or maintained.

◄ SECTION END ►
III. EQUIPMENT DESCRIPTION

A. GENERAL DESCRIPTION

PowlVac® 63kA 5000 AMP Stationary Circuit Breakers use sealed vacuum interrupters to control the primary circuit. See Figures 1, 2, and 3 for stationary circuit breaker exterior illustrations. For stationary circuit breaker interior illustration, see Figure 4.

The primary current path side of the circuit breaker is considered the rear of the circuit breaker, while the side with the cover containing the various indicators and manual operators is considered the front of the circuit breaker. By removing the front cover, the operating mechanisms of the circuit breaker are exposed (Figure 4). The stored-energy mechanism assembly provides motion to each of the vacuum interrupter moving contact assemblies through operating pushrods (Figure 2, i). In the same metal enclosed compartment as the stored-energy mechanism are the circuit breaker interlocks which control TRIP and DISCHARGE functions.

![Figure 1. PowlVac® 63kA 5000 AMP Stationary Circuit Breaker (Front View)](image)

- a. Primary Conductors
- b. Handle
- c. Nameplate
- d. Escutcheon
- e. Manual Charging Crank
- f. Manual Close Operator
- g. Operation Counter
- h. Spring Charge Indicator
- i. Lockout Provision
- j. OPEN/CLOSE Indicator
- k. Manual Trip Operator
- l. Front Cover
- m. Secondary Wiring Terminal Blocks
- n. Interphase Barrier
- o. Side Barrier
Figure 2. PowlVac® 63kA 5000 AMP Stationary Circuit Breaker (Rear View)

- a. Side Barrier
- b. Primary Conductors
- c. Interphase Barriers
- d. Vacuum Interrupter
- e. Lower Primary Conductors
- f. Pole Support
- g. Ground Connection
- h. Circuit Breaker Frame
- i. Operating Pushrod Assembly
- j. Pushrod
- k. Contact Loading Spring
- l. Spring Yolk
- m. Lock Nut
**Figure 3. PowlVac® 63kA 5000 AMP Stationary Circuit Breaker (Side View)**

- a. Secondary Wiring Terminal Blocks
- b. Lifting Eyes
- c. Handle
- d. Circuit Breaker Frame
- e. Access Cover
- f. Jackshaft Bushing
- g. Trip-Discharge Lever (Positive Interlock)
- h. Wheel
- i. Ground Connection
- j. Side Barrier
Figure 4. PowlVac® 63kA 5000 AMP Stationary Circuit Breaker - Interior View (Front Cover Removed)

- a. Side Barrier
- b. Primary Conductors
- c. Anti-Pump Relay
- d. Opening Spring
- e. Shock Absorber (Dashpot)
- f. Primary Shunt Trip Coil
- g. Anti-Bellows Springs
- h. Auxiliary Switch
- i. Operations Counter
- j. Charging Motor
- k. Connecting Rod
- l. Main Closing Spring
- m. Wiring Harness
- n. Secondary Wiring Terminal Blocks
- o. Motor Cutoff Cam
- p. Charging Motor Drive Shaft
- q. Motor Cutoff Switch
- r. Close Bar Adjusting Screw
- s. Latch Check Switch
- t. Jackshaft
- u. Crank Pin
- v. Crank Arm
- w. Secondary Trip Prop Adjusting Screw
- x. Holding Pawl Support Arm
- y. Holding Pawl Adjusting Eccentric
- z. Closing Coil
- aa. Reset Spring
- ab. Main Closing Cam
- ac. Secondary Trip Prop
- ad. Main Cam Roller
- ae. Cam shaft
- af. Pawl Lift Plate
- ag. Drive Pawl
- ah. Pawl Support Arm
- ai. Close Latch Shaft
- aj. Close Latch Arm
- ak. Ratchet Wheel
B. THE STORED-ENERGY MECHANISM

1) Mechanical Description

a) General

The stored-energy mechanism is located in the front of the circuit breaker behind the front cover (Figure 1). The front cover bolts and cover may be removed to provide access to the stored-energy mechanism and its interlocks, auxiliary switches, and other control devices. The equipment users must ensure that the circuit breaker is in the OPEN position and the main closing spring (Figure 4, l) is fully discharged before removing the front cover. FAILURE TO ENSURE THE CIRCUIT BREAKER IS IN THE OPEN POSITION MAY RESULT IN INJURY.

On the escutcheon (Figure 1, d) of the stored-energy mechanism, there are two (2) indicators that show the various states of operation of the mechanism, and two (2) manual operators that will OPEN/CLOSE the stored-energy mechanism. The circuit breaker nameplate (Figure 1, c) is also located on the mechanism escutcheon.

The mechanism employed in the circuit breaker is a stored-energy system which uses a charging motor to compress the main closing spring. During the closing operation the energy stored in the main closing spring is released. This allows the mechanism to CLOSE the vacuum interrupter contacts, compress the contact loading springs, charge the opening springs, extend the anti-bellows springs (Figure 4, g), and overcome frictional forces. When the circuit breaker is opened, the energy stored in the opening and contact loading springs is released, and the vacuum interrupter contacts are opened.

b) Main Spring Charging System

The charging motor (Figure 4, j), located on the bottom right of the base pan, is assembled to the circuit breaker by a bracket that is bolted to the base pan. The charging motor drive shaft inserts into the eccentric drive shaft. The eccentric drive shaft is supported by needle roller bearings in the mechanism frame side sheets and transmits the motor torque to the left side of the mechanism.

When the charging motor is energized, the eccentric drive shaft rotates and causes the pawl support arms to pivot about the cam shaft (Figure 4, ae). The drive pawl (Figure 4, ag), which is supported by the arms, engages with the ratchet wheel and drives the ratchet wheel one tooth at a time. To prevent backwards motion of the ratchet wheel, a spring-loaded holding pawl is used to latch the ratchet wheel after each advance from the drive pawl.

To ensure correct synchronization of the drive and holding pawl, the position of the holding pawl support arms are adjustable by the holding pawl adjusting eccentric (Figure 4, y) located at the left front of the mechanism. When the mechanism is operated manually, the top pawl becomes the drive pawl and the bottom pawl becomes the holding pawl.

As the ratchet wheel (Figure 4, ak) rotates, projections from its side faces engage the drive plates. The rotation of the drive plates, which are attached to the cam shaft, cause the cam shaft to rotate. Attached to the ends of the cam shaft are crank arms (Figure 4, v). Crank pins (Figure 4, u) are a part of the crank arms, which point outward. The crank arms engage the bottom ends of the connecting rods (Figure 4, k). The pins that project from the spring yoke, which straddles the main closing spring, engage the top ends of the connecting rods. As the cam shaft rotates the connecting rods will pull the spring yoke downward, compressing the main closing spring.

The ratchet wheel drives the cam shaft so that the connecting rods go down to their lowest position, and then start to move upward. At a certain point, the spring force will overcome friction and resistance and start to rotate the
cam shaft. At the same time, the pawls are uncoupled from the ratchet wheel by the pawl lift plate (Figure 4, af) and the motor cutoff switch is operated. The motor cutoff switch (Figure 4, q), located at the right of the mechanism, is operated by the spring charge indicator and motor cutoff cam (Figure 4, o). The spring charge indicator (Figure 1, h) will display that the mechanism is charged.

The cam shaft would continue to rotate, except that it is restrained by the CLOSE latch arm (Figure 4, aj) engaging against the close latch shaft (Figure 4, ai). The main closing cam, located between the mechanism side sheets, is now in a position where the fundamental linkage can move to the reset position.

The CLOSE latch, when released either by the closing coil or the manual CLOSE operator, allows the main closing spring to pull the crank arms upward thus rotating the main closing cam and driving the fundamental linkage into the closed position. This causes the main linkage to rotate the jackshaft such that the operating pushrod assemblies (Figure 2, i and Figure 17) are driven toward the current carrying side of the circuit breaker.

c) Vacuum Interrupter Drive System

Each operating pushrod assembly (Figure 2, i) has a recess at each end which encloses a contact loading spring. At the end of this spring is a spring yoke, which connects with bell cranks. The spring yoke is restrained by a lock nut on a stud which passes through the contact loading spring and is attached to the operating pushrod assembly. The contact loading spring has initial compression such that as soon as the vacuum interrupter contacts touch, the springs are preloaded to a value sufficient to resist vacuum interrupter contact separation under the highest electromagnetic forces exerted by the rated short-circuit current. Further movement of the operating pushrod assembly compresses the contact loading spring even more and produces a gap between the face of the spring yoke and the lock nut. This nut gap is used to evaluate the erosion of the vacuum interrupter contacts.

For each phase, bell cranks are located on the bottom, inside of the lower primary conductors (Figure 2, e) and are supported by bearings. Each bell crank is connected to an operating pin which engages an extension to the vacuum interrupter assembly thus moving the vacuum interrupter contact. The bell cranks give an approximate 3 to 1 multiplication of the contact loading spring force, enabling a lower spring rate to be used. It also multiplies the contact movement by a factor of approximately 3, so that the mechanism linkages have relatively large movements and are less critical.

d) Tripping System

In the cam and fundamental linkage positions shown in Figure 5, b and d, the contact loading springs and the main opening springs are both acting to compress the three (3) main mechanism links. The jackshaft (Figure 4, t and Figure 6, j) extends from the left to the right side of the circuit breaker frame and is supported at the main circuit breaker frame side sheets and by the mechanism side sheets. The outer operating levers on the jackshaft have connections to the circuit breaker opening springs.

The fundamental linkage is restrained from movement by the secondary trip prop (Figure 6, c) acting on the primary trip prop roller (Figure 6, k). A component of force tends to make the primary trip prop rotate upward, but it is restrained by the secondary trip prop face acting on the primary trip prop roller. The clearance between the primary trip prop roller and the secondary trip prop is controlled by the primary trip prop adjusting screw (Figure 6, l). When the trip shaft is rotated by the action of the manual trip operator or the primary shunt trip coil, the secondary trip prop face moves downward and
permits the primary trip prop to rotate upward, thus permitting the main linkage to move upward and the jackshaft to rotate, opening the circuit breaker. The left jackshaft levers engage a shock absorber (Figure 4, e), which controls the rebound of the vacuum interrupter contacts on an opening operation.

With the electrical control scheme, as soon as the main closing spring is discharged on a closing operation, the charging motor is switched on to recharge the springs. This leaves the main closing cam in a position where a tripped linkage can reset under the action of the reset spring (Figure 4, aa and Figure 6, f) and the primary and secondary trip props can fall into the reset position. The reset spring stretches between an extension of the main cam roller pin and a spring support pin located on the left mechanism side sheet. The latch check switch (Figure 4, s), operated by a lever on the trip shaft, will CLOSE as the secondary trip prop reaches the fully reset position.

C. ELECTRICAL DESCRIPTION

1) Charging Motor

The function of charging motor (Figure 4, j) is to compress the main closing spring of the stored-energy mechanism, thus providing the necessary energy to CLOSE the circuit breaker. The charging motor, located at the bottom right of the base pan, is assembled to the circuit breaker by a bracket that is bolted to the base pan.

2) Motor Cutoff Switch

The motor cutoff switch (Figure 4, q) provides an electrical break in the control circuit supplying the charging motor when the main closing spring is fully charged and the stored-energy mechanism is ready for a closing operation. It is located at the bottom right of the mechanism, and is supported by a bracket which is bolted to the circuit breaker base pan.

3) Anti-Pump Relay

The anti-pump relay (Figure 4, c and Figure 18, e) provides a logic function for the control circuit which prevents a continuous electrical CLOSE signal from causing the circuit breaker to continuously re-CLOSE after a trip signal. The anti-pump relay is located on the circuit breaker frame, left of the connecting rod, and is supported by two screws.

4) Operating Solenoids

Electrical operation of the circuit breaker is accomplished using operating solenoids.

The closing coil assembly (Figure 4, z and Figure 18, c) is an operating solenoid that is located at the bottom center of the mechanism, and is assembled to the circuit breaker base pan by bolts accessible from underneath the circuit breaker.

The primary shunt trip coil (Figure 4, f and Figure 18, b) is located at the top left side of the mechanism, and is assembled to the lower frame channel by two bolts.

Either a secondary shunt trip coil assembly (Figure 18 a) or an undervoltage device assembly (Figure 18 f) may be furnished as an option. When furnished, either of these devices will be located at the top right side of the mechanism, installed on the lower frame channel. Only one of these two operating solenoids may be furnished on any one circuit breaker, as both devices are located in the same space.
Figure 5. Cam and Fundamental Linkage Positions

Figure 6. Mechanism and Trip Linkages

a. Secondary Trip Prop Adjusting Screw
b. Secondary Trip Prop Shaft
c. Secondary Trip Prop
d. Secondary Linkage Roller
e. Main Cam Roller
f. Reset Spring
g. Cam shaft
h. Main Closing Cam
i. Center Phase Operating Lever
j. Jackshaft
k. Primary Trip Prop Roller
l. Primary Trip Prop Adjusting Screw
m. Primary Trip Prop
5) Control Circuit

A typical DC electrical control scheme is shown in Figure 7. The control scheme of any particular circuit breaker may differ from the typical scheme depending on the user's requirements, operating solenoids, and the control devices furnished with that circuit breaker.

The sequence of operation for all control schemes is shown in Figure 8. Circuit breaker mounted auxiliary contacts not used in the control circuit are brought out for control and indication functions.

![Diagram of Control Scheme](image)

**DEVICE IDENTIFICATION**

- **LS** = Spring Charge Limit Switch (shown with spring discharged)
- **LCS** = Latch Check Switch (shown with spring discharged)
- **Y** = Anti-Pump Relay
- **TC** = Breaker Trip Coil
- **CC** = Breaker Close Coil
- **M** = Charging Motor
- **52/a** = Breaker Auxiliary Contact (normally open)
- **52/b** = Breaker Auxiliary Contact (normally closed)
- **SD** = Breaker Secondary Terminal Block

*Figure 7. Typical Control Scheme*
Figure 8. Operation Sequence (Standard Control)
D. INTERLOCKING

PowlVac® 63kA 5000 Amp Stationary Circuit Breakers are provided with interlocks to ensure the proper operation of the equipment. The trip discharge bracket, located on the bottom right side of the breaker cover is not to be modified or bypassed in any way, as it is necessary for the safe operation of the circuit breaker.

The primary function of the trip discharge lever (Figure 3, g) is that of a positive interlock. The design of the trip discharge lever is such that the lever is blocked from operation when the circuit breaker main operating jackshaft is in the closed position. Conversely, the circuit breaker is both mechanically and electrically blocked from closing when the trip discharge lever is depressed.

The trip discharge lever can be locked in the depressed position by means of a padlock or key interlock.

Depressing the trip discharge lever will also discharge the main closing spring by first operating the manual trip linkages and subsequently the manual close linkage. The circuit breaker becomes mechanically trip-free in this condition and the energy in the main closing spring is safely released. The main spring is prevented from recharging by means of an interlock switch which is actuated by the trip discharge lever. The interlock switch electrically disables the charging motor circuit when the trip discharge lever is depressed.

The 63kA 5000 Amp Stationary Circuit Breaker cannot be moved unless it is unbolted from the switch and bus. Before removing the circuit breaker from the switchgear compartment, all high-voltage components shall be deenergized, disconnected by means of a visible break, and securely grounded. Stored energy must be released by pushing the TRIP/DISCHARGE lever. The circuit breaker can now be locked out with a pad lock, or a kirk lock can be added to the circuit breaker.

E. VACUUM INTERRUPTERS

PowlVac® circuit breakers utilize sealed vacuum interrupters to control the primary circuit. Some vacuum interrupters appear to be identical in size and shape externally, but types vary in ratings due to the differences in their internal construction.

F. VACUUM INTERRUPTER CONNECTION

Connection to the vacuum interrupter stems are made by means of copper vacuum interrupter castings. The top stem of the vacuum interrupter is fixed and a copper vacuum interrupter casting is fastened to the stem. The upper primary conductors are then assembled to the vacuum interrupter casting. Another copper vacuum interrupter casting with primary conductors is mounted to the bottom or moving stem of the vacuum interrupter. The multi-contact bands inside the lower vacuum interrupter casting make contact with this casting and the moving stem of the vacuum interrupter. The multiple parallel paths of the multi-contact bands keep the current density low.
IV. INSTALLATION

A. RECEIVING

When the circuit breaker is received check for any sign of damage. If damage is found or suspected, file all claims immediately with the transportation company and notify the nearest representative of Powell Electrical Systems, Inc.

B. STORAGE

It is recommended that the circuit breaker be placed into service immediately in its permanent location after completing the commissioning tests. If this is not possible, the following precautions must be taken to ensure the proper storage of the circuit breaker:

1. Since moisture has an adverse effect on the insulating parts, the circuit breaker should be carefully protected against condensation, preferably by storing it in a warm dry room of moderate temperature, such as 40°-100°F. Circuit breakers used in outdoor switchgear should be stored in the equipment only when power is available and the anti-condensation heaters are in operation.

2. The circuit breaker should be stored in a clean location free from corrosive gases or fumes. Particular care should be taken to protect the equipment from moisture and cement dust, as this combination has a corrosive effect on many parts.

3. Unplated surfaces, such as, rollers, latches, etc., should be coated with grease or oil to prevent rusting.

If the circuit breaker is stored for any length of time, it should be inspected periodically to see that rusting has not started and to ensure good mechanical condition. Should the circuit breaker be stored under unfavorable atmospheric conditions, it should be cleaned and dried before attempting the commissioning tests and before placing the circuit breaker into service.

C. PLACING THE CIRCUIT BREAKER INTO SERVICE

Before shipment from the factory, all circuit breaker functions are thoroughly checked. The user must verify functions after receipt. Powell Electrical Systems, Inc. recommends that the tests be performed in the sequence listed below:

1. High Voltage Insulation Integrity
2. Vacuum Integrity
3. Control Voltage Insulation Integrity
4. Mechanical Operation Check

1) High Voltage Insulation Integrity

WARNING

HIGH VOLTAGES ACROSS THE OPEN GAPS OF THE VACUUM INTERRUPTER CAN PRODUCE RADIATION. PERSONNEL SHOULD STAND AT LEAST ONE METER AWAY FROM THE CIRCUIT BREAKER WITH THE COVERS IN PLACE WHEN CONDUCTING HIGH VOLTAGE TEST. TEST VOLTAGES SHOULD NOT EXCEED 15kVAC (27kVDC) FOR CIRCUIT BREAKER WITH A RATED MAXIMUM VOLTAGE OF 4.76kV, AND 27kVAC (50kVDC) FOR CIRCUIT BREAKER WITH A RATED MAXIMUM VOLTAGE OF 15.0kV.

The primary circuit insulation on the circuit breaker may be checked phase-to-phase and phase-to-ground using a 2500V insulation resistance tester. Since definite limits cannot be given for satisfactory insulation values when testing with an insulation resistance tester, a record should be kept of the insulation resistance tester readings as well as the temperature and humidity readings. This record should be used to detect any weakening of the insulation system from one check period to the next.
To check insulation integrity, the AC high potential test described below is strongly recommended. DC testing is not the preferred method, however, values are provided due to the availability of DC test sets.

1. Perform circuit breaker insulation integrity testing with the circuit breaker vacuum interrupter contacts in the CLOSED position.

2. Test each pole of the circuit breaker separately, with the other 2 poles and the frame grounded.

3. Perform field dielectric tests at the voltage level appropriate for the equipment. (See Table A.)

**Table A. Field Dielectric Test Values**

<table>
<thead>
<tr>
<th>Rated Maximum Voltage (kV rms)</th>
<th>Power Frequency Withstand (kV rms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.0</td>
<td>27</td>
</tr>
</tbody>
</table>

The field dielectric test checks all of the primary phase-to-ground and phase-to-phase insulation integrity.

**CAUTION**

AFTER THE HIGH POTENTIAL IS REMOVED, AN ELECTRICAL CHARGE MAY BE RETAINED BY THE VACUUM INTERRUPTERS. FAILURE TO DISCHARGE THIS RESIDUAL ELECTROSTATIC CHARGE COULD RESULT IN AN ELECTRICAL SHOCK. ALL SIX PRIMARY CONDUCTORS OF THE CIRCUIT BREAKER AND THE METALLIC MID BAND RING, IF PRESENT, SHOULD BE GROUNDED AND REMAIN GROUNDED FOR AT LEAST ONE MINUTE TO REDUCE THIS ELECTRICAL CHARGE BEFORE COMING INTO CONTACT WITH THE PRIMARY CIRCUIT.

**CAUTION**

REPLACE ALL GROUNDING CONDUCTORS APPLIED FOR THIS TEST BEFORE PLACING THE CIRCUIT BREAKER BACK INTO SERVICE.

The tests described above are the only tests required to ascertain insulation integrity. Because of the design of the PowlVac® insulation system, no valid data can be obtained utilizing other types of high-voltage insulation tests.

2) Vacuum Integrity

**CAUTION**

APPLYING ABNORMALLY HIGH VOLTAGES ACROSS THE OPEN GAPS MAY PRODUCE X-RADIATION. THE RADIATION MAY INCREASE WITH INCREASED VOLTAGE AND/OR DECREASED CONTACT SPACING. X-RADIATION PRODUCED DURING THIS TEST WITH THE VOLTAGE SPECIFIED IN TABLE L. AND NORMAL CONTACT SPACING IS EXTREMELY LOW AND WELL BELOW THE MAXIMUM PERMITTED BY STANDARDS.

DO NOT APPLY VOLTAGE THAT IS HIGHER THAN THE RECOMMENDED VALUE. DO NOT USE CONTACT SEPARATION THAT IS LESS THAN THE NORMAL OPEN POSITION SEPARATION OF THE CIRCUIT BREAKER CONTACTS.
Powell recommends performing AC testing for reliable verification of vacuum integrity. All PowlVac® 5kV and 15kV circuit breakers shall be tested with a minimum of 25kVAC applied across fully OPEN contacts for 10 seconds. No dielectric breakdown during the test period constitutes a successful test.

**NOTE:** This test does not replace the AC high potential testing (Hipot) used to determine High voltage insulation integrity. See Section IV. INSTALLATION, 1) High Voltage Insulation Integrity.

Powell offers a compact and lightweight PowlVac® Vacuum Integrity Tester designed specifically for PowlVac® circuit breakers. If this device is used refer to the instruction bulletin provided with the vacuum integrity tester.

Powell recognizes the widespread use of DC hipot equipment in the field and the desire to use this equipment to verify vacuum integrity. However, the capacitive component of the vacuum interrupter during DC testing may yield false negative test results, which are often misinterpreted as vacuum interrupter failure. When DC testing is performed, a test set providing a full wave rectified 50kVDC hipot voltage can be applied for 5 seconds as a “go - no go” test.

Recording the leakage readings is not necessary, as a dielectric breakdown will trip all portable DC hipot test sets. If a DC test breakdown occurs, the test must be repeated after reversing the DC high voltage test supply connection across the vacuum interrupter. A vacuum interrupter should be questioned only if it has failed both tests.

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**CAUTION**

**WHEN TESTING WITH DC, USE A DC HIGH POTENTIAL TEST (HIPOT) SET WITH FULL WAVE RECTIFICATION. MANY DC HIGH POTENTIAL TEST SETS USE HALF-WAVE RECTIFICATION. DO NOT USE THESE HALF-WAVE RECTIFIERS. THE CAPACITANCE OF THE VACUUM INTERRUPTER IN COMBINATION WITH THE LEAKAGE CURRENTS IN THE RECTIFIERS AND ITS DC VOLTAGE MEASURING EQUIPMENT MAY RESULT IN APPLYING PEAK VOLTAGES AS MUCH AS THREE TIMES THE MEASURED VOLTAGE. THESE ABNORMALLY HIGH VOLTAGES MAY GIVE A FALSE INDICATION OF A DEFECTIVE VACUUM INTERRUPTER, AND MAY PRODUCE ABNORMAL X-RADIATION.**

**CAUTION**

**IF DC HIGH POTENTIAL TESTING IS PERFORMED, THE DC HIGH POTENTIAL TEST MACHINE MUST NOT PRODUCE INSTANTANEOUS PEAK VOLTAGES EXCEEDING 50kV.**

No attempt should be made to try to compare the condition of one vacuum interrupter with another, nor to correlate the condition of any vacuum interrupter with low values of DC leakage current. There is no significant correlation.
3) Control Voltage Insulation Integrity

If the user wishes to check the insulation integrity of the control circuit, it may be done with a 500-volt or 1000-volt insulation resistance tester or with an AC high potential tester. The AC high potential test should be made at 1125 volts, 50 or 60 Hz for one minute. The charging motor must be disconnected prior to testing the control circuit. The charging motor itself may be similarly tested at a voltage not to exceed 675 volts, 50 or 60 Hz. Be sure to remove any test jumpers and reconnect the charging motor when the tests are complete.

![CAUTION]

REMOVE ALL GROUNDING CONDUCTORS APPLIED FOR THE CONTROL VOLTAGE INSULATION INTEGRITY TEST BEFORE PLACING THE CIRCUIT BREAKER BACK INTO SERVICE.

4) Mechanical Operation Check

![CAUTION]

CARE MUST BE EXERCISED TO KEEP PERSONNEL, TOOLS AND OTHER OBJECTS CLEAR OF MECHANISM WHICH ARE TO BE OPERATED OR RELEASED.

To test the mechanical operation of the circuit breaker perform the following steps:

1. Insert the manual charging handle into the manual charging crank and pushing down until a metallic click is heard. (This indicates that the holding pawl has dropped into place on the ratchet wheel.)

2. Lift the handle until it is horizontal and then depress.

3. Repeat step 2 until the spring charge indicator indicates CLOSING SPRING CHARGED. This requires about 60 operations of the handle.

4. Remove the manual charging handle.

5. Push the manual CLOSE operator (Figure 1, f) inward and the circuit breaker will CLOSE. The circuit breaker OPEN/CLOSED indicator located above the manual CLOSE operator will now display BREAKER CLOSED.

6. Push the manual trip operator (Figure 1, k) inward, which is located at the top of the escutcheon and the circuit breaker OPEN/CLOSED indicator will now display BREAKER OPEN.

◄ SECTION END ►
V. MAINTENANCE

A. GENERAL DESCRIPTION

1) Introduction

A regular maintenance schedule must be established to obtain the best service and reliability from the circuit breaker. PowlVac® 63kA 5000 AMP Stationary Circuit Breakers are designed to comply with industry standards requiring maintenance every 500 operations, or once a year.

Actual inspection and maintenance or equipment will depend upon individual application conditions such as number of operations, magnitude of currents switched, desired overall system reliability, and operating environment. Any time the circuit breaker is known to have interrupted a fault current at or near its rating, it is recommended that the circuit breaker be inspected and the necessary maintenance be performed as soon as practical. Some atmospheric conditions such as extremes of dust, moisture, or corrosive gases might indicate inspection and maintenance at more frequent intervals. Very clean and dry conditions combined with low switching duty will justify longer times between inspection and maintenance operations. With experience, each user can set an inspection and maintenance schedule that is best suited for use.

When maintenance is performed at longer than one year time intervals, and if it has been more than one year since the last vacuum integrity test was performed on the circuit breaker, the test should be performed each time the circuit breaker is removed from service for reasons other than scheduled maintenance.

A permanent record of all maintenance work should be kept and the degree of detail required depends on the operating conditions. The record will be a valuable reference for subsequent maintenance work and for station operation. It is recommended that the record include the following information: reports of tests performed, the condition of circuit breakers, and any repairs or adjustments that were performed.

CAUTION

PRIOR TO BEGINNING ANY MAINTENANCE PROCEDURES, MAKE CERTAIN THAT THE CONTROL CIRCUITS ARE DE-ENERGIZED. ALL HIGH-VOLTAGE COMPONENTS SHALL BE DEENERGIZED, DISCONNECTED BY MEANS OF A VISIBLE BREAK, AND SECURELY GROUNDED. DO NOT WORK ON A CLOSED CIRCUIT BREAKER OR A CIRCUIT BREAKER WITH THE MAIN CLOSING SPRING CHARGED.

IMPORTANT

FOR ASSISTANCE IN PERFORMING MAINTENANCE OR SETTING UP A MAINTENANCE PROGRAM, CONTACT POWELL APPARATUS SERVICE DIVISION AT WWW.POWELLIND.COM, OR CALL 1-800-480-7273.

IMPORTANT

BEFORE ATTEMPTING ANY MAINTENANCE WORK, IT IS IMPORTANT TO STUDY AND FULLY UNDERSTAND THE SAFETY PRACTICES OUTLINED IN SECTION II. SAFETY, OF THIS INSTRUCTION BULLETIN. IF THERE IS REASON TO BELIEVE THERE ARE ANY DISCREPANCIES IN THE DESCRIPTIONS CONTAINED IN THIS INSTRUCTION BULLETIN, OR IF THEY ARE DEEMED TO BE CONFUSING AND/OR NOT FULLY UNDERSTOOD, CONTACT POWELL ELECTRICAL SYSTEMS, INC. IMMEDIATELY.
The maintenance record should include information starting with tests performed at the time of installation and energizing. All data should be graphed as a function of time to ensure a proper maintenance cycle is being scheduled.

Because of extensive quality control tests made at the factory, the operations counter on a new circuit breaker will normally register over one hundred operations. The reading of the operations counter should be recorded when the circuit breaker is placed into service and when any maintenance work is performed.

PRIOR TO PERFORMING ANY ADJUSTMENT OR MAINTENANCE PROCEDURE, ALL HIGH-VOLTAGE COMPONENTS SHALL BE DEENERGIZED, DISCONNECTED BY MEANS OF A VISIBLE BREAK, AND SECURELY GROUNDED.

WHEN CLEANING THE CIRCUIT BREAKER INSULATING SUPPORTS AND BUS INSULATION, USE ONLY DENATURED ALCOHOL OR ISOPROPYL ALCOHOL TO REMOVE FOREIGN MATERIAL. FAILURE TO DO SO MAY DAMAGE THE DIELECTRIC AND/OR THE MECHANICAL PROPERTIES OF THE INSULATION.

Visually check the circuit breaker for loose or damaged parts. Tighten or replace loose or missing hardware. Any damaged parts that will interfere with the normal operation of the circuit breaker should be replaced. This inspection will be much easier if the front cover and interphase barrier assembly are removed.

Clean the circuit breaker by removing any loose dust and dirt. Do not use compressed air to clean the circuit breaker. This may result in loose dirt or grit being blown into bearings or other critical parts, thus causing excessive wear. Use a vacuum cleaner, or wipe with a dry lint-free cloth or an industrial-type wiper to clean the circuit breaker. Do not use solvents, de-greasers, or any aerosol products to clean in the area of any mechanisms. Refer to Section V. MAINTENANCE, B. MECHANISM AREA, 2) Lubrication, for instructions on cleaning the lubricated areas for the stored-energy mechanism and other specified parts.
Primary insulation, including the vacuum interrupter supports and the operating pushrods, should be cleaned. Wipe clean with a dry lint-free cloth or an industrial type wiper. If dirt adheres and cannot be removed by wiping, remove it with a clean cloth and distilled water or a mild solvent such as denatured alcohol. Be sure that the circuit breaker is dry before returning it to service. Do not use any type of detergent to wash the surface of the insulators as detergent may leave an electrically conducting residue on the surface as it dries.

B. MECHANISM AREA

1) Mechanical Operation

Remove the circuit breaker front cover to expose the stored-energy mechanism. Make a careful visual inspection of the mechanism for loose, damaged, or excessively worn parts.

NOTE: If timing tests under Section D. OPTIONAL MAINTENANCE PROCEDURES are to be performed do not operate the circuit breaker until these tests are completed. Operation of the mechanism may alter the "as found" operating condition of the circuit breaker’s stored-energy mechanism.

2) Lubrication

BEFORE APPLYING ANY TYPE OF LUBRICATION TO THE CIRCUIT BREAKER, THE STORED-ENERGY MECHANISM SHOULD BE IN THE OPEN POSITION, AND ALL SPRINGS DISCHARGED.

Powell offers a complete lubrication kit (Powlube-102) which contains all the lubricants required for maintaining the circuit breakers. Powlube-102 contains Rheolube 368A grease, Anderol 456 oil, and Mobilgrease 28. Rheolube 368A grease should be lightly applied to those bearing surfaces that are accessible. Inaccessible surfaces such as bearings may be lubricated with a light synthetic machine oil such as Anderol 456 oil. Lubricate the stored-energy mechanism and other specified parts in accordance with Lubrication Table B. Refer to Table B, Figure 9, and Figure 10 for lubrication sites and specifications.

Table B includes the location of all surfaces that should be lubricated together with the type of lubricant and method of application. The guiding rule in lubrication is to lubricate regularly, use lubricant sparingly, and remove all excess lubricant. The mechanism does not require to be disassembled for lubrication. Tilting the circuit breaker will facilitate the entry of the lubricant to the bearing surfaces.
<table>
<thead>
<tr>
<th>Location</th>
<th>Ref. Figure</th>
<th>Lubricant</th>
<th>Method</th>
</tr>
</thead>
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<tr>
<td>Mechanical Parts</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Spring Yoke Pin</td>
<td>Fig. 9, a</td>
<td>Rheolube 368A Grease</td>
<td></td>
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<tr>
<td>Trip Shaft Bearing</td>
<td>Fig. 9, b</td>
<td>Anderol 456 Oil</td>
<td></td>
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<tr>
<td>Jackshaft Support</td>
<td>Fig. 9, c</td>
<td>Rheolube 368A Grease</td>
<td></td>
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<td>Crank Pin</td>
<td>Fig. 9, d</td>
<td>Rheolube 368A Grease</td>
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<tr>
<td>Jackshaft Lever Pins Passing Through</td>
<td>Fig. 9, e</td>
<td>Rheolube 368A Grease</td>
<td>Avoid lubricant on operating pushrods.</td>
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<tr>
<td>Operating Pushrods</td>
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<tr>
<td>Motor Drive Shaft Roller Needle Bearings</td>
<td>Fig. 9, f</td>
<td>Anderol 456 Oil</td>
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<tr>
<td>Pawls</td>
<td>Fig. 9, g</td>
<td>Anderol 456 Oil</td>
<td></td>
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<tr>
<td>Close Latch Shaft Face</td>
<td>Fig. 9, h</td>
<td>Rheolube 368A Grease</td>
<td>Apply a light coating of grease and remove all excess.</td>
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<td>Ratchet Wheel</td>
<td>Fig. 9, i</td>
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<td>Pawl Support Arm</td>
<td>Fig. 9, j</td>
<td>Anderol 456 Oil</td>
<td></td>
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<tr>
<td>Fundamental Linkage Pin</td>
<td>Fig. 9, k</td>
<td>Anderol 456 Oil</td>
<td></td>
</tr>
<tr>
<td>Main Closing Spring Guide Rod</td>
<td>Fig. 9, l</td>
<td>Rheolube 368A Grease</td>
<td></td>
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<tr>
<td>Primary Trip Prop</td>
<td>Fig. 10, m</td>
<td>Anderol 456 Oil</td>
<td></td>
</tr>
<tr>
<td>Open-Close Flag Drive Lever Pin at Jackshaft</td>
<td>Fig. 10, n</td>
<td>Anderol 456 Oil</td>
<td></td>
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<tr>
<td>Jackshaft Outer Bearings Support</td>
<td>Fig. 10, o</td>
<td>Anderol 456 Oil</td>
<td></td>
</tr>
<tr>
<td>Flag Support Pin</td>
<td>Fig. 10, p</td>
<td>Anderol 456 Oil</td>
<td></td>
</tr>
<tr>
<td>Motor Drive Shaft Support Bearing</td>
<td>Fig. 10, q</td>
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<tr>
<td>Motor Cutoff Cam</td>
<td>Fig. 10, r</td>
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<td>Apply to peripheral surface only.</td>
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<tr>
<td>Close Shaft Support Bearing</td>
<td>Fig. 10, u</td>
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<tr>
<td>Fundamental Linkage</td>
<td>Fig. 10, v</td>
<td>Anderol 456 Oil</td>
<td>Apply to penetrate where pins pass through lines.</td>
</tr>
</tbody>
</table>
Figure 9. Lubrication: Circuit Breaker Front with Cover Removed (1 of 2)
Lubrication: Locations for Figure 9

- a. Spring Yoke Pin
- b. Trip Shaft Bearing
- c. Jackshaft Support
- d. Crank Pin
- e. Jackshaft Lever Pin
- f. Motor Shaft Roller Needle Bearing
- g. Pawls
- h. Close Latch Shaft Face
- i. Rachet Wheel
- j. Pawl Support Arm
- k. Fundamental Linkage Pin
- l. Main Closing Spring Guide Rod
Figure 10. Lubrication: Circuit Breaker Front with Cover Removed (2 of 2)
Lubrication: Locations for Figure 10

m. Primary Trip Prop  
n. Open-Closed Flag Drive Lever Pin at Jackshaft  
o. Jackshaft Outer Bearings Support  
p. Flag Support Pin

q. Motor Drive Shaft Support Bearings  
r. Motor Cutoff Cam  
s. Motor Drive Shaft Support Coupling

t. Cam shaft Needle Bearings  
u. Close Shaft Support Bearing  
v. Fundamental Linkage
3) Main Closing Spring Removal

Although main closing spring removal is not necessary for lubrication, it may be necessary for performing adjustments or major overhaul tasks. Furthermore, removal of the main closing spring permits slow closing of the mechanism and the vacuum interrupter contacts. For details, see Section V. MAINTENANCE B. MECHANISM AREA, 4) Slow Closing of Mechanism.

The procedure for spring removal is as follows:

1. With the main closing spring discharged and the circuit breaker contacts OPEN, remove the screw at the top of the spring rod together with the flat washer, and lock washer.

2. Remove the right-angled bracket, by unfastening the two attachment screws.

3. Remove the spacer from below the bracket.

4. Turn the bracket 90°, and replace it on top of the spring yoke.

5. Place the spacer on top of the bracket with the flat washer above it.

6. Insert the screw and tighten until the tension is taken off the connecting rods.

7. With a slight rocking motion of the main closing spring assembly, the connecting rods (Figure 11) can now be unhooked from the spring yoke pins and the main closing spring assembly can be removed.

8. Care should be taken on reassembly to ensure correct location of the flat washer, lock washer and spacer. See Figure 12.

![Figure 11. Main Closing Spring Assembly Compressed for Removal](image)

- a. Spacer
- b. Bracket
- c. Screw
- d. Flat Washer
- e. Connecting Rod

![Figure 12. Main Closing Spring Assembly Installed](image)

- a. Bracket
- b. Screw
- c. Spacer
- d. Flat Washer
- e. Lock Washer
4) Slow Closing of Mechanism

The slow closing of mechanism procedure is not required for routine maintenance; however, it may be a useful procedure for troubleshooting circuit breaker misoperation. For slow closing of mechanism, perform the following steps:

1. With the main closing spring assembly removed, rotate the cam shaft so that the crank arms are pointing downward. The fundamental linkage will now move into the reset position.

2. Push the manual CLOSE operator inward and hold in while operating the manual charging handle to rotate the cam shaft.

3. Once the CLOSE release latch arm is past the CLOSE shaft latch plate, release the manual close operator.

   As the main closing cam engages the main cam roller, the jackshaft will commence to rotate.

4. Continue to operate the manual charging handle until the crank arms point upward.

5. The circuit breaker will now be closed and there will be a gap between the operating pushrod lock nuts and the contact spring yokes.

6. Return the circuit breaker to the OPEN position by depressing the manual trip operator.

7. To install the main closing spring assembly reverse the removal procedure.

5) Mechanism Adjustments

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHEN ANY MAINTENANCE PROCEDURE REQUIRES THE OPENING OR CLOSING OF THE CIRCUIT BREAKER OR THE CHARGING OF ANY OF THE STORED ENERGY MECHANISM SPRINGS, EXERCISE EXTREME CAUTION TO MAKE SURE THAT ALL PERSONNEL, TOOLS, AND OTHER OBJECTS ARE KEPT WELL CLEAR OF THE MOVING PARTS OR THE CHARGED SPRINGS. FAILURE TO DO THIS MAY CAUSE SERIOUS DAMAGE OR INJURY TO THE CIRCUIT BREAKER OR PERSONNEL.</td>
</tr>
</tbody>
</table>

Several factory adjustments in the stored-energy mechanism are described below. **NO ADJUSTMENT OF THESE SETTINGS IS REQUIRED FOR ROUTINE MAINTENANCE** but they may need to be adjusted after major overhaul or removal of the mechanism.

**NOTE:** **DO NOT ADJUST THESE SETTINGS UNNECESSARILY, AS DAMAGE TO THE CIRCUIT BREAKER MAY OCCUR.**

a) Adjustment of Ratchet Wheel Holding Pawl

The holding pawl support arm (Figure 4, x) is adjusted by the holding pawl adjusting eccentric (Figure 4, y).

If the pawl is not properly adjusted, there will be a "knocking" noise when the ratchet mechanism is operating or the stored-energy mechanism will not ratchet at all.

To adjust the pawl perform the following steps:

1. Remove the escutcheon to gain access to the head of the bolt holding the adjusting eccentric.
2. Loosen the bolt slightly.

3. Grip the eccentric with a pair of slip-joint pliers or a similar tool and rotate the stop slightly.

4. Tighten the holding bolt with the eccentric in the new position.

5. While charging the main closing spring, using the charging motor to drive the mechanism observe the ratcheting operation for improvement.

6. If the ratcheting operation has not improved, repeat the preceding sequence until the ratcheting operation is smooth. This may require several charging cycles.

7. When the eccentric is properly set replace the escutcheon.

Be sure that the escutcheon is reinstalled on the proper circuit breaker, since the escutcheon contains the nameplate with the circuit breaker’s rating and serial number information. The serial number of the circuit breaker is also attached to the circuit breaker frame near the ground connection on a stamped metal plate. The serial number found on the nameplate must match the number affixed to the frame.

b) Adjustment of Primary Trip Prop

Perform the following procedures to adjust the primary trip prop.

1. Remove the main closing spring. Refer to Section V, MAINTENANCE, B. MECHANISM AREA, Main Closing Spring Removal and Slow Closing of Mechanism.

2. Adjust the primary trip prop adjusting screw (Figure 13, a) so that with the fundamental linkage in the reset position, the clearance between the primary trip prop roller and the secondary trip prop is 0.005” to 0.015”. The primary trip prop adjusting screw is accessible from the rear of the stored-energy mechanism and is located between the legs of the lower center main insulator (wishbone). (See Figure 13, b).

3. Replace the main closing spring.

![](image)

**Figure 13. Primary Trip Prop Adjusting Screw**

a. Primary Trip Prop Adjusting Screw

b. Wishbone
c) Tripping System Adjustment

To adjust the PowlVac® Tripping System perform the following steps:

1. Prior to performing this adjustment procedure, all high-voltage components shall be de-energized, disconnected by means of a visible break and securely grounded, and ensure that the control circuits are de-energized.

2. Remove the circuit breaker front cover.

3. Loosen the secondary trip prop adjusting screw (Figure 14) locking nut several full turns.

4. Manually charge the circuit breaker main spring.

5. Manually CLOSE the circuit breaker.

6. Slowly turn the secondary trip prop adjusting screw clock-wise in 1/8 turn (45º) increments until the breaker trips (OPEN). Carefully note the rotational position of the tool used to turn the adjusting screw at the moment the breaker operates. DO NOT turn the screw any further clockwise after the breaker operates!

7. Turn the secondary trip prop adjusting screw counter-clockwise 1-1/2 full turns from the position noted in step 6.

8. While holding the secondary trip prop adjusting screw from turning, securely tighten the secondary trip prop adjusting screw locking nut.

9. Manually charge the main closing spring using the manual charge handle per Section IV. INSTALLATION, D. PLACING THE CIRCUIT BREAKER INTO SERVICE, 4) Mechanical Operation Check.

10. Manually CLOSE the circuit breaker.

---

**CAUTION**

PRIOR TO PERFORMING ANY ADJUSTMENT OR MAINTENANCE PROCEDURE, ALL HIGH-VOLTAGE COMPONENTS SHALL BE DEENERGIZED, DISCONNECTED BY MEANS OF A VISIBLE BREAK, AND SECURELY GROUNDED.
11. Using leaf type feeler gauges with a total of .090" thickness selected, position the feeler gauge as shown in Figure 15.

12. Slowly depress the trip coil armature using the manual charge handle. Position the handle as shown in Figure 15. Depress the handle until the armature contacts the feeler gauges. The circuit breaker should not trip.

**NOTE:** It is important to position the manual handle as shown in the illustration to avoid “tilting” the trip coil armature. Tilting the armature by applying a load to the right of the feeler gauges will produce incorrect results.

13. Choose one of the following steps according to the **TRIP** status.

   a) If the circuit breaker **TRIPPED** during the test performed in step 12, increase the gap between the trip coil armature and the trip lever by bending the lever downwards slightly using a channel lock pliers or small crescent wrench. Repeat steps 9 through 12.

   **NOTE:** Bend the trip lever in very small increments. This process may take several attempts.

   b) If the circuit breaker did not **TRIP** during the test performed in step 12, reset the feeler gauges with .030" selected and position the feeler gauge as shown in Figure 15.

14. Slowly depress the trip coil armature using the manual charge handle. Position the handle as shown in Figure 15. Depress the handle until the armature contacts the feeler gauges. The circuit breaker should trip.

**NOTE:** It is important to position the manual handle as shown in the illustration to avoid “tilting” the trip coil armature. Tilting the armature by applying a load to the right of the feeler gauges will produce incorrect results.

15. If the circuit breaker did not **TRIP** during the test performed in step 14, remove the feeler gauges and trip the breaker. Decrease the gap between the trip coil armature and the trip lever by bending the trip lever upwards slightly using a channel lock pliers or small crescent wrench. Repeat steps 9, 10, and 14.

**NOTE:** Bend the trip lever in very small increments. This process may take several attempts.

16. Repeat steps 9 through 15 until the breaker does not trip with the .090" gauge inserted in the trip coil armature gap and does trip with the .030" gauge inserted into the trip coil armature gap.

17. Perform the latch check switch adjustment per the procedure found in Section V. MAINTENANCE, B. MECHANISM AREA, 4) Mechanism Adjustments, d). Latch Check Switch Adjustment.

18. Replace circuit breaker front cover.
d) Latch Check Switch Adjustment

The latch check switch adjustment (Figure 16) described is not required for routine maintenance; however, the latch check switch may need to be adjusted after major overhaul, removal of the mechanism, or tripping system adjustment.

Insert a 0.045" gauge between the secondary trip prop adjusting screw and latch check operator. Rotate the latch check switch upwards until the contacts are closed. (An audible click of the contacts will be heard.) At the position where the click is heard hold the switch and retighten the two screws which secure the latch check switch. Remove the gauge.

To confirm that the latch check switch is properly set, slowly depress and release the manual trip operator to verify that the latch check switch OPEN and CLOSES properly. An audible click of the contacts will be heard. The latch check switch contacts will OPEN as the latch check operator is moved by the manual trip operator away from the secondary trip prop adjusting screw. Slowly withdraw the manual trip operator and the latch check switch contacts should close when the latch check operator is between 0.045" to .015” away from the secondary trip prop adjusting screw.

Depress the manual close operator and rotate the crank arm until resistance is felt.

Depress and hold the manual trip operator inward and rotate the crank arms until the spring charge indicator displays, CLOSING SPRING DISCHARGED.

Reinstall the circuit breaker main closing spring.

---

Figure 16. Latch Check Switch Adjustment

a. Latch Check Switch
b. Latch Check Operator
c. Secondary Trip Prop Adjusting Screw

To adjust the latch check switch perform the following steps:

1. Remove the main closing spring as described in this section.

2. Rotate the crank arms until the spring charge indicator displays, CLOSING SPRING CHARGED.

3. Loosen the two screws which secure the latch check switch and rotate the latch check switch about the pivot screw downward to the lowest position allowed. The latch check switch contacts are now OPEN.

4. Insert a 0.045” gauge between the secondary trip prop adjusting screw and latch check operator. Rotate the latch check switch upwards until the contacts are closed. (An audible click of the contacts will be heard.) At the position where the click is heard hold the switch and retighten the two screws which secure the latch check switch. Remove the gauge.

5. To confirm that the latch check switch is properly set, slowly depress and release the manual trip operator to verify that the latch check switch OPEN and CLOSES properly. An audible click of the contacts will be heard. The latch check switch contacts will OPEN as the latch check operator is moved by the manual trip operator away from the secondary trip prop adjusting screw. Slowly withdraw the manual trip operator and the latch check switch contacts should close when the latch check operator is between 0.045" to .015” away from the secondary trip prop adjusting screw.

6. Depress the manual close operator and rotate the crank arm until resistance is felt.

7. Depress and hold the manual trip operator inward and rotate the crank arms until the spring charge indicator displays, CLOSING SPRING DISCHARGED.

8. Reinstall the circuit breaker main closing spring.
e) Adjustment of Close Latch Shaft

The close latch shaft (Figure 4, ai) passes through the side sheets of the stored-energy mechanism frame at the front of and below the cam shaft. The left end of the shaft is shaped to make a latch face and interferes with the close latch arm (Figure 4, aj), which is fixed to the cam shaft. The other end of the close latch shaft is on the right side of the mechanism and a small lever attached to it is positioned by a close bar adjusting screw (Figure 4, r). To adjust the close latch shaft perform the following procedures:

1. Remove the escutcheon.

2. Loosen the locking nut from the close bar adjusting screw while holding the position of the close bar adjusting screw with a screw driver.

3. Back out the close bar adjusting screw by turning the screw counterclockwise 2 full turns.

4. Manually charge the circuit breaker main closing spring with a manual charging handle until the spring charge indicator displays CLOSING SPRING CHARGED.

5. Turn the close bar adjusting screw clockwise until the main closing spring discharges, then depress the manual trip operator to OPEN the circuit breaker.

6. Turn the close bar adjusting screw 3 to 3-1/2 full turns counterclockwise. Retighten the locking nut holding the screw.

7. Repeat step 5. Then CLOSE and OPEN the circuit breaker to ensure proper operation.

8. Replace the escutcheon.

C. VACUUM INTERRUPTER AND CONTACT AREA

1) Vacuum Interrupter and Contact Erosion

At each inspection the vacuum interrupters should be checked for contact erosion. The circuit breaker must be CLOSED for this check. Each new vacuum interrupter is set with a gap of about 1/4" to 5/8" between the contact loading spring yoke and the lock nut on the operating pushrod stud. As the contacts erode with use, this gap will decrease. Because the factory setting of the lock nut gap varies for each vacuum interrupter, a label is provided on the lower part of each vacuum interrupter. The original factory setting of the gap and the end-of-life measurement of this gap is recorded on the label. When the gap measurement reaches the end-of-life value given on this label, the vacuum interrupter should be replaced.

2) Vacuum Integrity

Refer to the Section IV. INSTALLATION, D. PLACING THE CIRCUIT BREAKER INTO SERVICE, 2) Vacuum Integrity for information on vacuum integrity and testing of vacuum interrupters.

3) Mechanical Adjustment of Vacuum Interrupters

There are no adjustments required for routine maintenance of a vacuum interrupter assembly. There are several factory adjustments which will vary over the operating life of the vacuum interrupter. ADJUSTMENTS OF THESE SETTINGS IS ONLY NECESSARY WHEN REPAIR REQUIRES THE REMOVAL OR REPLACEMENT OF THE VACUUM INTERRUPTER. DO NOT ADJUST THESE SETTINGS UNNECESSARY AS DAMAGE TO THE CIRCUIT BREAKER MAY RESULT. When it is necessary to remove or replace the vacuum interrupter refer to Section VI. RECOMMENDED RENEWAL PARTS AND REPAIR PROCEDURES, C. REPLACEMENT PROCEDURES, 1) Vacuum Interrupter Assembly for further details.
D. OPTIONAL MAINTENANCE PROCEDURES

1) High Potential Tests

High potential tests are not required for routine maintenance but are recommended after a heavy fault interruption, any major circuit breaker repair that involves the primary current path, or when the circuit breaker has been in storage for an extended time, especially in a damp location or other adverse environment. In these cases, both the High Voltage Insulation Integrity and Control Voltage Insulation Integrity tests should be performed. For testing instructions, see Section IV. INSTALLATION, D. PLACING THE CIRCUIT BREAKER INTO SERVICE.

2) Timing

At normal control voltage, operate the test source to the CLOSE position to CLOSE the circuit breaker and record the closing time. The closing time from energizing the closing coil to vacuum interrupter contact touch should not exceed the values in the Table C. Timing. Again, at normal control voltage, operate the test source to the OPEN position to OPEN the circuit breaker and record the opening time. The opening time from energizing the shunt trip coil to vacuum interrupter contact part should not exceed the values in the Table C. Timing.

3) Primary Resistance Check

This check is not required for routine maintenance but it is recommended after any major maintenance that requires disassembly of any part of the primary current path.

To check the resistance, pass a minimum of 100A DC through the circuit breaker pole, with the circuit breaker CLOSED. Measure the voltage drop across the primary contacts and calculate the resistance. The resistance should not exceed the values provided in this instruction bulletin for the specific type and rating of the circuit breaker being measured. Refer to Table D.

Table D. Primary Resistance

<table>
<thead>
<tr>
<th>Breaker Type</th>
<th>Rated kV</th>
<th>Rated Continuous Current A</th>
<th>Resistance Micro-ohms</th>
</tr>
</thead>
<tbody>
<tr>
<td>15PV63</td>
<td>15.00</td>
<td>5000</td>
<td>40</td>
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</tbody>
</table>

Table C. Timing

<table>
<thead>
<tr>
<th>Interrupting Time</th>
<th>Closing Time</th>
<th>Tripping Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 cycle</td>
<td>50 ms – 80 ms Max.</td>
<td>&lt; 35 ms</td>
</tr>
</tbody>
</table>
VI. RECOMMENDED RENEWAL PARTS AND REPAIR PROCEDURES

A. ORDERING INSTRUCTIONS

1) To order parts please contact Powell Electrical Systems, Inc. by one of the following methods:

   Powell Web site:  http://www.powellind.com
   Email: info@powlservice.com
   Telephone:  713-944-6900
   Fax:  713-947-4453

2) Always specify complete nameplate information, including:

   • Breaker Type
   • Serial Number
   • Rated Voltage
   • Rated Amps
   • Impulse Withstand
   • Control Voltage (for control devices and coils)

3) Specify the quantity and description of the part and the instruction bulletin number. If the part is in any of the recommended renewal parts tables, specify the catalog number. If the part is not in any of the tables, a description should be accompanied by a marked illustration from this instruction bulletin, a photo or simply submit a sketch showing the part needed.

B. RECOMMENDED RENEWAL PARTS

A sufficient amount of renewal parts should be stored to enable the prompt replacement of any worn, broken, or damaged part. A sufficient amount of stocked parts minimizes service interruptions caused by breakdowns and saves time and expense. When continuous operation is a primary consideration, a greater amount of renewal parts should be stocked, the quantity depending on the severity of the service and the time required to secure replacements.

Spare or replacement parts which are furnished may not be identical to the original parts since improvements are made from time to time. The parts which are furnished, however, will be interchangeable. Parts tables found in this instruction bulletin list the recommended spare parts to be carried in stock by the user. The recommended quantity is not specified. The user must determine the quantity based on the application. As a minimum, it is recommended that one set of parts be stocked per ten circuit breakers or fraction thereof.

Powell Electrical Systems, Inc. recommends that only qualified technicians perform maintenance on these units. If these circuit breakers are installed in a location where they are not maintained by a qualified technician, a spare circuit breaker should be on site ready for circuit breaker replacement. The malfunctioning circuit breaker can then be returned to the factory for reconditioning.
Table E. Primary Current Path

<table>
<thead>
<tr>
<th>Breaker Type k factor = 1</th>
<th>Rated kV</th>
<th>Rated Continuous Current</th>
<th>Operating Pushrod Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>15PV63</td>
<td>15.00</td>
<td>5000A</td>
<td>50934G21P</td>
</tr>
</tbody>
</table>

Figure 17. Primary Current Path - Operating Pushrod Assembly

a. Casting
b. Contact Loading Spring
c. Spring Yolk
d. Lock Nut
e. Stud
Table F. Control Devices (1)

<table>
<thead>
<tr>
<th>Control Voltage</th>
<th>Closing Coil Assembly</th>
<th>Primary Shunt Trip Coil Assembly</th>
<th>Secondary Shunt Trip Coil Assembly (3)</th>
<th>Undervoltage Device Assembly (4)</th>
<th>Charging Motor Assembly</th>
<th>Anti-Pump Relay (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 cycle</td>
<td>5 cycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24VDC</td>
<td>N/A</td>
<td>50027G05P</td>
<td>50041G08P</td>
<td>50042G06P</td>
<td>50028G04P</td>
<td>N/A</td>
</tr>
<tr>
<td>48VDC</td>
<td>50026G01P</td>
<td>50027G01P</td>
<td>50041G01P</td>
<td>50042G01P</td>
<td>50028G03P</td>
<td>50960G06P</td>
</tr>
<tr>
<td>125VDC</td>
<td>50026G03P</td>
<td>50027G02P</td>
<td>50041G02P</td>
<td>50042G03P</td>
<td>50028G01P</td>
<td>50960G04P</td>
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<tr>
<td>250VDC</td>
<td>50026G04P</td>
<td>50027G03P</td>
<td>50041G03P</td>
<td>50042G04P</td>
<td>50028G02P</td>
<td>50960G05P</td>
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<tr>
<td>120VAC</td>
<td>50026G01P</td>
<td>50027G01P</td>
<td>50041G05P</td>
<td>50042G01P</td>
<td>N/A</td>
<td>50960G04P</td>
</tr>
<tr>
<td>240VAC</td>
<td>50026G02P</td>
<td>50027G06P</td>
<td>50041G06P</td>
<td>50042G02P</td>
<td>N/A</td>
<td>50960G05P</td>
</tr>
<tr>
<td>Capacitor Trip (6)</td>
<td>N/A</td>
<td>50027G04P</td>
<td>50041G04P</td>
<td>50042G05P</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Notes for Table F: The numbers in ( ) indicate that there is a reference note from below.

1. One required per circuit breaker if the circuit breaker was originally equipped with this item. All circuit breakers have a closing coil, primary shunt trip coil, charging motor, and an anti-pump relay. Secondary shunt trip coils and undervoltage device assemblies are optional. See note 2-7.

2. Primary shunt trip coil is available as a 3-cycle and 5-cycle control device.

[A CIRCUIT BREAKERS MAY BE EQUIPPED WITH EITHER A 5-CYCLE TRIP COIL OR A 3-CYCLE TRIP COIL. TO AVOID SEVERE DAMAGE TO THE CIRCUIT BREAKER, DO NOT REPLACE A 5-CYCLE TRIP COIL WITH A 3-CYCLE TRIP COIL.]

3. Secondary shunt trip coil cannot be furnished with an undervoltage device assembly.

4. Where furnished, cannot be present with secondary shunt trip coil assembly.

5. For 250V DC applications, a dropping resistor 50747G02P is required in series with the anti-pump relay.

6. For use with capacitor trip units with 240V AC input. Consult factory for other circuit breaker ratings.

7. All control devices are available with push-on terminals. Consult factory for control devices with screw terminals.
Figure 18. Control Devices

a. Secondary Shunt Trip Coil Assembly  
b. Primary Shunt Trip Coil Assembly (3 cycle)  
c. Closing Coil Assembly  
d. Charging Motor Assembly  
e. Anti-Pump Relay  
f. Undervoltage Device Assembly
### Table G. Miscellaneous Parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalog No.</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary Switch</td>
<td>102116Lh</td>
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</tr>
<tr>
<td>Push-On Terminals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latch Check Switch</td>
<td>BA-2RV2-A2</td>
<td><img src="image" alt="Latch Check Switch" /></td>
</tr>
<tr>
<td>Motor Cutoff Switch Assembly</td>
<td>50756G03P</td>
<td><img src="image" alt="Motor Cutoff Switch Assembly" /></td>
</tr>
<tr>
<td>PowlVac® Hardware Kit</td>
<td>60500G24</td>
<td><img src="image" alt="PowlVac® Hardware Kit" /></td>
</tr>
<tr>
<td>PowlVac® Lubrication Kit</td>
<td>Powlube-102</td>
<td><img src="image" alt="PowlVac® Lubrication Kit" /></td>
</tr>
</tbody>
</table>
C. REPLACEMENT PROCEDURES

This section includes instructions for replacing the parts recommended as renewal parts. Before attempting any maintenance repair work, take note of the safety practices outlined in Section II. of this instruction bulletin.

2) Closing Coil Assembly

The closing coil assembly is located center and beneath the circuit breaker mechanism. See Figure 4, z and Figure 19.

Figure 19. Closing Coil Assembly

To replace the closing coil assembly, perform the following steps:

1. Remove the front cover of the circuit breaker.
2. Disconnect the closing coil assembly from the wire harness.
3. Remove the two bolts which hold the closing coil assembly to the base pan, and drop the closing coil assembly out of the bottom of the circuit breaker.
4. Insert the new closing coil assembly into the circuit breaker from below and bolt it in place. Reconnect the closing coil assembly to the wiring harness. No adjustment is required.
5. CLOSE the circuit breaker several times electrically to ensure that the closing coil assembly is functioning properly.
6. Replace the circuit breaker front cover.

1) Vacuum Interrupter Assembly

The vacuum interrupter assembly should only be replaced by a qualified technician or a PAS service technician. For further assistance, please contact Powell Electrical Systems, Inc. 1-800-480-7273.

---

ENSURE THAT THE CONTROL CIRCUITS ARE DEENERGIZED AND THE CIRCUIT BREAKER IS DEENERGIZED, DISCONNECTED BY MEANS OF A VISIBLE BREAK, AND SECURELY GROUNDED. DO NOT START TO WORK ON A CLOSED CIRCUIT BREAKER OR A CIRCUIT BREAKER WITH THE MAIN CLOSING SPRING CHARGED. WHEN ANY MAINTENANCE PROCEDURE REQUIRES THE OPENING OR CLOSING OF THE CIRCUIT BREAKER OR THE CHARGING OF ANY OF THE STORED-ENERGY MECHANISM SPRINGS, EXERCISE EXTREME CAUTION TO ENSURE THAT ALL PERSONNEL, TOOLS, AND OTHER OBJECTS ARE KEPT CLEAR OF THE MOVING PARTS OF THE CHARGED SPRINGS.
3) Primary Shunt Trip Coil Assembly

The primary shunt trip coil assembly is located at the top left side of the mechanism, just left of the main closing spring. See Figure 4, d and Figure 20.

![Figure 20. Primary Shunt Trip Coil Assembly](image)

To replace the primary shunt trip coil assembly, perform the following steps:

1. Remove the front cover of circuit breaker.
2. Remove the two bolts which holds the primary shunt trip coil assembly to the circuit breaker frame and remove the assembly.
3. Bolt the new primary shunt trip coil assembly in place and reconnect it to the wiring harness.
4. Perform the Tripping System Adjustment in Section V. MAINTENANCE, MECHANISM AREA, 4) Tripping System.
5. Trip the circuit breaker electrically several times to ensure that the primary shunt trip coil assembly is functioning properly.
6. Replace the circuit breaker front cover.

4) Secondary Shunt Trip Coil Assembly

The secondary shunt trip coil assembly is located at the top right side of the mechanism, just to the right of the main closing spring. See Figure 21.

![Figure 21. Secondary Shunt Trip Coil Assembly](image)

The replacement procedure is identical to that of the primary shunt trip coil assembly, with the following additional information:

**NOTE:** It is be easier to remove the secondary shunt trip coil assembly if the right connecting rod is removed. To remove the connecting rod see Section V. MAINTENANCE, A. General Description, 3) Main Closing Spring Removal, Slow Closing Mechanism, and Latch Check Switch Adjustment.

1. Remove the front cover of circuit breaker.
2. Disconnect the secondary shunt trip coil assembly wiring from the wiring harness.
3. Remove the two bolts which holds the secondary shunt trip coil Assembly to the frame, and remove the secondary shunt trip coil Assembly.
4. Bolt the new secondary shunt trip coil Assembly in place and reconnect it to the wiring harness. No adjustment is required.
5. Reassemble the connecting rod and main closing spring, if previously removed.
6. Trip the circuit breaker several times electrically to ensure that secondary shunt trip coil assembly is functioning properly.

7. Replace the circuit breaker front cover.

5) Undervoltage Device Assembly

Detailed instructions for replacing the undervoltage assembly are supplied with the replacement device. See Figure 22.

Figure 22. Undervoltage Device Assembly

6) Charging Motor Assembly

The charging motor assembly is located at the bottom right of the floor pan of the mechanism. See Figure 4, h and Figure 23.

Figure 23. Charging Motor Assembly

To replace the charging motor assembly, perform the following steps:

1. Remove the front cover of the circuit breaker.
2. Disconnect the charging motor assembly from the wiring harness.
3. Remove the two bolts which hold the charging motor mounting bracket to the base pan and slide the motor to the right, and disconnect the charging motor drive shaft from the mechanism’s eccentric drive shaft. Remove the charging motor from the circuit breaker.
4. Lubricate the end of the shaft of the new charging motor liberally with Rheolube 368A grease.
5. Position the new charging motor assembly in the circuit breaker. Verify that the pin on the end of the charging motor drive shaft engages the slot in the mechanism eccentric drive shaft.
6. Bolt the charging motor assembly to the base pan, and reconnect it to the wiring harness.
7. Operate the circuit breaker several times to ensure that the charging motor assembly operates smoothly.
8. Replace the circuit breaker front cover.
7) Anti-Pump Relay

The anti-pump relay is located on the circuit breaker frame, left of the connecting rod, near the top of the mechanism. See Figure 4, a and Figure 24.

![Figure 24. Anti-Pump Relay](image)

To replace the anti-pump relay, perform the following steps:

1. Remove the front cover of circuit breaker.
2. Loosen the lower mounting screw of the anti-pump relay.
3. Remove the upper mounting screw and lift the anti-pump relay off the lower screw.
4. Disconnect the leads from the anti-pump relay, being careful to identify each wire by the terminal number from which it was removed.
5. Reconnect all wires to the proper terminals of the relay.
6. Place the new anti-pump relay over the lower screw, and reinstall the upper screw, and tighten both screws.
7. Relays that are in 250VDC closing circuits are provided with voltage dropping resistors. The resistor is mounted adjacent to the relay. It may be replaced by disconnecting the resistor from the relay, unscrewing the mounting feet from the frame of the circuit breaker, then replacing the resistor. Reassemble the new resistor back to the original location.
8. Operate the circuit breaker several times to ensure the anti-pump relay functions properly.
9. Replace the circuit breaker front cover.

8) Latch Check Switch

The latch check switch is located at the left side of the main mechanism frame, near the bottom of the main closing spring. See Figure 4, o and Figure 25.

![Figure 25. Latch Check Switch](image)

To replace and adjust the latch check switch, see Section V. MAINTENANCE, A. General Description, 3) Main Closing Spring Removal, Slow Closing Mechanism, and Latch Check Switch Adjustment. In addition to those instructions, perform the following steps:

1. Remove the two screws that secure the latch check switch to the mechanism. Do not loose the nut plate into which these screws are threaded.
2. Disconnect the wires from the latch check switch.
3. Reconnect the wires to the new latch check switch and fasten the switch in place with the screws and the nut plate which was previously removed.
4. Adjust the latch check switch according to Section V. MAINTENANCE, B. MECHANISM AREA, 5) Mechanism adjustments, d) Latch Check Switch Adjustment.
5. Operate the circuit breaker electrically several times to ensure that the latch check switch is working.
9) Motor Cutoff Switch Assembly

The motor cutoff switch assembly is located at the bottom right of the base pan of the mechanism, just to the right of the main mechanism. See Figure 4, m and Figure 26.

![Figure 26. Motor Cutoff Switch Assembly](image)

To replace the motor cutoff switch assembly perform the following steps:

1. Remove the front cover of the circuit breaker.
2. Remove the two bolts that hold the motor cutoff switch assembly to the floor pan and remove the assembly.
3. Disconnect the wires from the motor cutoff switch assembly, being careful to identify each wire by the terminal number from which it was removed.
4. Reconnect the wiring to the terminal from which it was removed.
5. Install the new motor cutoff switch assembly and bolt it to the base pan.
6. Operate the circuit breaker electrically several times to ensure that the motor cutoff switch assembly is working.
7. Replace the circuit breaker front cover.

10) Auxiliary Switch

The auxiliary switch is located at the bottom left of the base pan of the mechanism area. See Figure 4, f and Figure 27.

![Figure 27. Auxiliary Switch](image)

To replace the auxiliary switch, perform the following steps:

1. Remove the front cover of the circuit breaker.
2. Disconnect the wires from the auxiliary switch, being careful to identify each wire by the terminal number from which it was removed.
3. Remove the “E-ring” securing the auxiliary switch operating arm to the operations counter linkage.
4. Remove the two screws holding the auxiliary switch to its mounting bracket, and remove the auxiliary switch. Notice of the orientation of the auxiliary switch terminals prior to removing the switch.
5. Insert the new auxiliary switch and attach it to the mounting bracket with the two screws removed in step d. Be certain to orient the switch as noted in step 4.
6. Insert the operating arm of the auxiliary switch into the hole in the end of the operations counter linkage and secure with the “E-ring” removed in step 3.
7. Reconnect the wiring. Be sure that the wires are connected to the same terminal numbers from which they were removed.
8. Operate the circuit breaker electrically several times to ensure that the auxiliary switch is working.
NOTES
IB-60320
PowlVac® 63kA 5000 AMP
Stationary Circuit Breaker

Model: 15PV63STA 5000A

August, 2005