01.4IB.39000A Medium Voltage Loadbreak Oil Switch

Powered by Safety®
Contact Information

Powell Electrical Systems, Inc.
powellind.com
info@powellind.com

Service Division
PO Box 12818
Houston, Texas 77217-2818

Tel: 713.944.6900
Fax: 713.948.4569
Signal Words

As stated in ANSI Z535.4-2007, the signal word is a word that calls attention to the safety sign and designates a degree or level of hazard seriousness. The signal words for product safety signs are “Danger”, “Warning”, “Caution” and “Notice”. These words are defined as:

**DANGER**

\[DANGER\] indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING**

\[WARNING\] indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION**

\[CAUTION\], used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

\[CAUTION\] used without the safety alert symbol, is used to address practices not related to personal injury.

**NOTICE**

\[NOTICE\] is used to address practices not related to personal injury.

Qualified Person

For the purposes of this manual, a qualified person, as stated in NFPA 70E®, is one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved. In addition to the above qualifications, one must also be:

1. trained and authorized to energize, deenergize, clear, ground, and tag circuits and equipment in accordance with established safety practices.
2. trained in the proper care and use of personal protective equipment (PPE) such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety practices.
3. trained in rendering first aid if necessary.
This page left blank intentionally.
Contents

Ch 1 General Information ........................................................................................................ 1
   A. SCOPE .............................................................................................................................. 2
   B. PURPOSE ...................................................................................................................... 2
   C. INSTRUCTION BULLETINS AVAILABLE ELECTRONICALLY ........................................ 2

Ch 2 Safety ............................................................................................................................ 3
   A. SAFE WORK CONDITION ............................................................................................ 3
   B. SAFETY GUIDELINES .................................................................................................... 3
   C. SAFETY LABELS ............................................................................................................. 4

Ch 3 Equipment Description ................................................................................................ 5
   A. GENERAL ....................................................................................................................... 5
   B. SECTIONALIZER .......................................................................................................... 5
   C. ISOLATOR ..................................................................................................................... 5
   D. SOURCE TRANSFER .................................................................................................... 5
   E. PRESSURE TESTING ..................................................................................................... 5

Ch 4 Installation .................................................................................................................... 6
   A. RECEIVING/INSPECTION ............................................................................................ 6
   B. HANDLING .................................................................................................................. 6
   C. STORAGE ..................................................................................................................... 6
   D. SWITCH SITE ................................................................................................................ 7
   E. POWER DISTRIBUTION CONNECTOR INSTALLATION ................................................ 7
   F. OIL FILLING ................................................................................................................ 7
   G. TESTING ...................................................................................................................... 8
   H. INITIAL INSTALLATION CHECKLIST .......................................................................... 8

Ch 5 Oil Switch General Operation ....................................................................................... 10
   A. STANDARD OIL SWITCH RECOMMENDED OPERATING PROCEDURE ......................... 10
   B. OPTIONAL OIL SWITCH WITH COCK-N-TRIP™ RECOMMENDED OPERATING PROCEDURE .............................................................. 10
Contents

Ch 6  Maintenance .......................................................................................................................... 15
  A.  Oil .............................................................................................................................................. 15
  B.  Approved Insulating Oils ........................................................................................................ 15
  C.  Contacts .................................................................................................................................. 15
  D.  Removing Oil .......................................................................................................................... 16
  E.  Replacement Parts and Repairs ............................................................................................. 16
  F.  Powell Required Maintenance Schedule ............................................................................... 16
  G.  Maintenance Records .............................................................................................................. 18
  H.  Annually or Every 30 Loadbreak Operations Records Whichever Occurs First ...................... 18
  I.  Every 100 Loadbreak Operations Records ........................................................................... 19
  J.  Every Fault Closing Operations Record ............................................................................... 19

Ch 7  Recommended Renewal Parts and Replacement Procedures ............................................. 20
  A.  Dry Well Fuse Replacement .................................................................................................... 20
  1)  Remove Fuse from Tank ........................................................................................................ 20
  2)  Install into Tank ..................................................................................................................... 20
  B.  Stud Bushing Compartments (3-1/C and 1-3/C Cable) ............................................................ 23
  1)  Entrance Types ..................................................................................................................... 23
  2)  Precautions .......................................................................................................................... 23
  3)  Installation Sequence ............................................................................................................ 23
  C.  Compound Filing of Stud Bushing Compartments & Potheads .............................................. 26
  1)  Filing Procedure ................................................................................................................... 26
  2)  Compound Troubleshooting Guide ....................................................................................... 27
Figures

Figure 1  Power Distribution Connector Diagram ......................................................... 9
Figure 2  Standard Oil Switch Recommended Operating Procedure ......................... 12
Figure 3  Standard Oil Switch Recommended Operating Procedure Cont. ............... 12
Figure 4  Switch Open and Discharged ...................................................................... 13
Figure 5  Switch Open and Charged to Close ............................................................. 13
Figure 6  Switch Closed and Discharged ................................................................... 14
Figure 7  Switch Open and Charged To Close ............................................................ 14
Figure 8  Fuse Replacement Instructions .................................................................. 20
Figure 9  Replacement Parts ...................................................................................... 21
Figure 10 Stud Bushing .............................................................................................. 25
Tables

Table A  Approved Brand of Insulating Oil ................................................................. 15
Table B  Metal to Metal Joint .................................................................................... 17
Table C  Gasket Joint ................................................................................................. 17
Table D  Tapered Pipe Thread (NPT) ...................................................................... 17
Table E  Initial Installation Maintenance Records .................................................. 18
Table F  Annually/Every 30 Loadbreak Operations Maintenance Records ............. 18
Table G  Every 100 Loadbreak Operations Maintenance Records ............................ 19
Table H  Every Fault Closing Operations Maintenance Records ............................. 19
Table I  Replacement Parts ......................................................................................... 22
Table J  Solder Type Connector ................................................................................ 26
Table K  Copper Press Type Connector .................................................................... 26
Ch 1  General Information

⚠️ WARNING

The equipment described in this document may contain high voltages and currents which can cause death or serious injury.

The equipment is designed for use, installation, and maintenance by qualified 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 immediately at 1.800.222.6234.

⚠️ WARNING

Prior to adjustments, servicing, maintenance, or any act requiring the operator to make physical contact with the equipment, the power source must be disconnected and the equipment grounded. Failure to do so may result in death or serious injury.

NOTICE

The information in this instruction bulletin is not intended to explain all details or variations of the Powell equipment, 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 at 1.800.222.6234.

NOTICE

Powell reserves the right to discontinue and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.
A. **Scope**

The information in this instruction bulletin describes the Powell medium voltage loadbreak oil switch.

B. **Purpose**

The following information and instructions are to aid the user in the proper installation, operation, and maintenance of the Powell medium voltage loadbreak oil switch. This bulletin does not claim to cover all details or variations in equipment or to provide for all possible conditions to be met, concerning installation, operation, or maintenance of the equipment. If further information is desired or if a particular problem is encountered which is not sufficiently covered in this bulletin please contact Powell.

Equipment covered by this instruction bulletin should be selected, installed and serviced by competent personnel who understand proper safety procedures. This instruction bulletin is written for such personnel and is not a substitute for adequate training and experience in safety procedures regarding this type of equipment.

The Powell loadbreak oil switch is completely assembled, adjusted, tested, and sealed at the factory. When properly handled, it will not require field adjustments.

This instruction bulletin provides:
1. Safety guidelines
2. General descriptions of the operation and maintenance of the medium voltage loadbreak oil switch.
3. Instructions for part replacement
4. Information for ordering renewal parts
5. Procedure for critical adjustments
6. Illustrations, photographs, and description of the loadbreak oil switch

The illustrations contained in this document may not represent the exact construction details of each particular type of replacement loadbreak oil switch. The illustrations in this document are provided as general information to aid in showing component locations only.

All illustrations and photos are shown using deenergized equipment.

---

**WARNING**

Follow the appropriate safety precautions while handling any of the equipment. Failure to do so may result in death or serious injury.

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 which may vary greatly.

C. **Instruction Bulletins Available Electronically**

Changes to the instruction bulletin may be implemented at any time and without notice. Go to powellind.com to ensure use of the current instruction bulletin for Powell equipment.

For more information visit powellind.com. To contact the Powell Sales, Parts, and Service call 1.800.222.6234 or 330.966.1750, or email ncdsalesinfo@powellind.com.

For specific questions or comments pertaining to this instruction bulletin email documents@powellind.com with the instruction bulletin number in the subject line.
Ch 2 Safety

A. Safe Work Condition

The information in Section A is quoted from NFPA 70E 2012 - 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 loadbreak oil switch 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.

Informational Note: See ANSI/ISA-61010-1 (82.02.01)/UL 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements, for rating and design requirements for voltage measurement and test instruments intended for use on electrical systems 1000 V and below.

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 installing the loadbreak oil switch.

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. Furthermore, each user has the responsibility of establishing a safety program for each type of equipment encountered.

It is mandatory that the following rules be observed to ensure the safety of personnel associated with usage, installation, operation, and maintenance of this equipment.

The safety rules in this instruction bulletin are not intended to be a complete safety program. The rules are intended to cover only some of the important aspects of personnel safety related to the loadbreak oil switch.

1. Only supervised and qualified personnel trained in the usage, installation, operation, and maintenance of the loadbreak oil switch 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 instruction bulletin(s). A well planned and executed routine maintenance program is essential for loadbreak oil switch reliability and safety.

3. Service conditions and loadbreak oil switch applications shall also be considered in the development of safety programs. Variables include ambient temperature; humidity; actual continuous current; thermal cycling; number of operations; interrupting duty; and any adverse local conditions including excessive dust, ash, corrosive atmosphere, vermin and insect infestations.

C. Safety Labels

The equipment described in this document has DANGER, WARNING, CAUTION, and instruction labels attached to various locations. All equipment DANGER, WARNING, CAUTION, and instruction labels shall be observed when the loadbreak oil switch is handled, operated, or maintained.

⚠️ WARNING

Before installing, operating, maintaining, or testing this equipment, carefully read, understand, and follow the contents of this bulletin. Improper operation, handling, or maintenance can result in death, severe personal injury, and equipment damage.

⚠️ WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury, and equipment damage.

⚠️ WARNING

Power distribution and transmission equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install, or maintain power distribution and transmission equipment can result in death, severe personal injury, and equipment damage.

⚠️ DANGER

Hazardous voltage. Contact with hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high and low voltage lines and equipment.

⚠️ NOTICE

Warning and Caution labels are located in various places. Do NOT remove or deface any of these warning/caution labels.
Ch 3 Equipment Description

A. General

Powell medium voltage loadbreak oil switches are designed to comply with C37.71 and C37.74. They serve as sectionalizer, isolators, and source transfer devices. They can be used in submersible, padmounted, and class 1 division 2 applications.

B. Sectionalizer

As a sectionalizer it is used in conjunction with a source-side protection device, such as a re-closer or circuit breaker, to automatically isolate faulted sections of electrical distribution systems. Power to operate the control circuitry is provided by a capacitive device. Once the re-closer or circuit breaker interrupts the de-energized, faulted circuit for a preset period of time the sectionalizer opens to confine outages to smaller sections of line.

C. Isolator

As an isolator the Powell loadbreak oil switch provides a means of visual open contacts, and lock-out and or interlocking.

D. Source Transfer

As a source transfer device you can choose an operation scheme with such things as ability to do a manual close transition transfer or a scheme that would never allow a close transition transfer. You could choose to have an automatic close transition re-transfer or only an open transition re-transfer or no re-transfer at all. Powell can provide a source transfer in as little as 15 cycles when required by using our Cock-N-Trip mechanism in conjunction with a capacitive tripping device, or transfers in the second range by simply using a motor operator.

E. Pressure Testing

All Powell oil switches are factory pressure and leak tested using a Helium Mass Spectrometer to ensure the integrity of welds and seals. If a leak is found, immediately contact Powell.
Ch 4 Installation

A. Receiving/Inspection

 Upon receipt of each switch assembly, remove any packing or crating and inspect for possible shipping damage. If there is any evidence of rough handling, the switch tank and all attachments should be closely examined. Verify that your Powell oil switch was received in good working order by using the following checklist.

- Using the customer drawing locate the nitrogen fill/test valve. Use a standard tire pressure gauge to check that the tank pressure is 1 to 2 PSIG.
- External components have not been damaged.
- Paint coating has not been damaged.
- Cable terminations have not been damaged.
- Each switch can be operated through all positions

 NOTE: If any of the items above are not as described, or you have other concerns contact Powell at 1.800.222.6234 or 330.966.1750.

B. Handling

 CAUTION

Do not lift the switch by any means other than the lifting provisions on each end. A spreader bar is required to obtain a vertical lift without damaging the unit. Failure to do so could result in equipment damage or personnel injury.

CAUTION

Switches that will not be put into service immediately must be prepared for storage by performing a receiving inspection as described in Ch 4 Installation, A. Receiving/Inspection. Protection from weather elements should be provided. Each tank is equipped with a test valve to be used for pressure testing and pressurizing the tank. Pressure must be maintained during storage as a precaution against corrosion and possible degradation of the insulating materials. To prevent the ingress of moisture into the tank it must be pressurized to 1 to 2 PSIG with dry nitrogen.

To ensure that the tank seal has not been broken, a pressure reading should be taken periodically to confirm that positive pressure is being maintained. The tank pressure will vary with temperature.

Improper storage will void warranty. All ship loose materials, i.e., cable termination kits and spare parts must be stored in a clean dry location to prevent moisture contamination.
D. Switch Site

**CAUTION**

Anchor provisions to the foundation if the unit will be subject to flooding. The switch will float if not tied down. Buoyancy will occur when the water level raises to about 3/4 the height of the tank for a submersible switch without an enclosure. A padmount switch with an enclosure has about neutral buoyancy when completely submerged with water.

After the switch is installed in its final location, cable terminations should be made in accordance with the instructions furnished with the termination kits. To assure a proper ground connection, the ground bosses on the switch must be cleaned to bare metal. Provision must be made to prevent moisture contamination during installation of cable terminations. Ground bosses are located on the switch tank at each entrance way.

E. Power Distribution Connector Installation

**NOTICE**

This section is not intended to supersede the power distribution connector manufactures installation instructions, but is provided to assist Powell’s Customers.

After proper cable preparation, a spade terminal is crimped on the conductor. This is then inserted into the elbow housing. The housing is placed on the apparatus bushing and an epoxy plug with a voltage test point secures the connection using the supplied threaded stud assembly. Installation requires a torque wrench with a 1" hex socket attachment. Connectors must be torqued to a level of 60 ft-lb. A conductive cap placed over the plug completes the installation.

F. Oil Filling

**DANGER**

Before energizing the switch, it and any throats if applicable, must be filled to the proper level with Electrical Insulating Oil (see Table B) that tests at least 30kV when tested per ASTM D877. This can be done by venting the tank and pumping or pouring the oil into it through the fill provisions.

Before removing the fill or vent plug ensure that no moisture will be able to enter the openings. Once a dry environment is ensured remove the fill and vent plug and check the drain valve to ensure it is closed. Begin pumping or pouring properly tested oil through a clean and dry properly sized hose into switch tank. Closely observe the oil level indication device (either viewing window or magnetic level gauge) when oil level indication device indicates the switch is at normal level stop filling. Allow switch to set without fill and vent plug for 5 minutes to allow air bubbles to escape. Replace fill and vent plug and torque to Table D, Tapered Pipe Thread (NPT). The switch should be pressurized to approximately 1 to 2 PSIG with dry nitrogen. To do so add nitrogen through the air check valve provided in the vent plug stopping to check the pressure often with hand held pressure gauge similar to that used to check tire air pressure. Once the switch has a proper nitrogen blanket replace air check valve cap.

The tank is to be pressurized to 1 to 2 PSIG with dry nitrogen after the tank has been filled with oil. This pressure should be checked periodically and maintained using the pressure test valve.

Filling of throats when required are the same as with switches.
If the switch tank has been opened, a contaminant may have entered the tank. Before filling, flush the switch interior and parts with clean oil to remove possible contaminates. Failure to maintain a clean dry tank interior WILL VOID THE WARRANTY.

**G. Testing**

All completed switch installations must be field tested prior to energizing in accordance with applicable ANSI/IEEE/NEC standards and local governing code authorities. To ensure personnel safety and to maintain the Powell switch products warranty, an appropriate field power frequency test must be conducted.

**CAUTION**

If the switch contains internal control power or potential transformers, field power frequency (Hi Pot) testing is not available. Field power frequency testing will damage the internal transformers.

**DANGER**

Powell loadbreak switches are assigned a fault close rating; however, they are not designed to be fault interrupting devices. Do not attempt to use this apparatus to interrupt current that exceeds the loadbreak rating of the switch as designed on the assembly nameplate. Terminations may be the limiting factor with regard to voltage or current ratings. Equipment shall be applied only to circuits within the limits of its capability as denoted on the nameplate.

**H. Initial Installation Checklist**

1. Record date
2. Record Serial Number
3. Oil Dielectric Test
4. Filled With Oil
5. Check Pressure
6. Field Power Frequency Check
1. STRESS RELIEF ADAPTER
Molded rubber adapter is sized to the cable insulation and provides a stress for the terminated shield. The radial pressure exerted on the cable shield by the adapter precludes the presence of air at the start of the stress surface. Suitable for installation on both extruded-shield cable and tape-type shield cable.

2. SPADE TERMINAL
Semi-permanent, crimped-bolted connector sized for the specific conductor. Crimped on with standard tools and dies. Also used in 650Y splice.

3. MOLDED CONDUCTIVE SHIELD
Outer jacket of 1/8" thick molded conductive peroxide-cured EPDM provides a virtually indestructible ground shield for true dead-front construction. A patented ELASTIMOLD feature.

4. GROUNDING EYE
Hole provides a convenient point to connect a ground wire to the mold conductive shield, placing the molded shield at ground potential.

5. WRAP-AROUND CONDUCTIVE INSERTS
Inner shield of molded conductive peroxide-cured EPDM precludes subjecting entrapped air to electrical stress. A Patented ELASTIMOLD feature.

6. VOLTAGE TEST POINT CAP
Molded conductive rubber cap fits over the test point and onto the connector housing.

7. VOLTAGE TEST POINT
The 1” hex nut located on the top of the insulating plug allows the circuit to be tested without disturbing the connection. The nut is fully insulated from the conductor and picks up capacitance voltage. A torque wrench with a 1” hex socket attachment is required during installation.

8. INTERFERENCE KIT
Molded insulating peroxide-cured EPDM exerts uniform concentric pressure on insulation of making parts to provide required creep-path length and water seal.

9. APPARATUS BUSHING
Epoxy product normally supplied on manufactures equipment. Can be welded or clamped to the apparatus.

10. THREADED STUD
A removable threaded stud is included with every 655LR and K655LR.
Ch 5  Oil Switch General Operation

The Powell loadbreak switch contains a spring mechanism attached to a 3-phase switch. The spring mechanism and 3-phase switch are enclosed in a tank, which is oil filled.

A. Standard Oil Switch Recommended Operating Procedure

1. Visually inspect the equipment for good working condition and proper ground connections.
2. Check the oil level at the gauge on the switch and ensure that it corresponds to the recommended operating level.
3. Locate, identify, and confirm the switch way to be operated.
4. Inspect all cable connections to the switch, particularly those connected to the circuits to be switched.
5. Identify the position to which the switch way is to be moved. Confirm this position with the one-line diagram on the switch and by visually observing the position indicators.
6. Determine the direction in which the handle must be rotated to operate the switch to the desired position. The handle can be installed at 45° increments; be sure the handle is positioned to get the 45° travel needed to operate the switch.
7. Attach the removable operating handle to the operating shaft and insert the retaining pin.
8. Rotate the anti-reverse lever to point in the desired direction of rotation. See figures 2 & 3.

9. Rotate the switch handle in the desired direction until the switch transfer is complete (approximately a 45° rotation). This operation may also be accomplished by using a lanyard tied to the ring on the end of the handle or with a hot stick.
10. Check for successful operation by visually observing the position indicators. Compare the position to the one-line diagram.
11. Remove the handle and return it to its place of storage.

B. Optional Oil Switch with Cock-N-Trip™ Recommended Operating Procedure

1. Visually inspect the equipment for good working condition and proper ground connections.
2. Check the oil level at the gauge on the switch and ensure that it corresponds to the recommended operating level.
3. Locate, identify, and confirm the switch way to be operated.
4. Inspect all cable connections to the switch, particularly those connected to the circuits to be switched.
5. Identify the position to which the switch way is to be moved. Confirm this position with the one-line diagram on the switch and by visually observing the position indicators.
6. Determine the direction in which the handle must be rotated to operate the switch to the desired position. The handle can be installed at 45° increments; be sure the handle is positioned to get the 45° travel needed to operate the switch.

DANGER

Do not attempt any operation while the switch is energized if the oil level is below the minimum recommended operating level.

3. Locate, identify, and confirm the switch way to be operated.
4. Inspect all cable connections to the switch, particularly those connected to the circuits to be switched.
5. Identify the position to which the switch way is to be moved. Confirm this position with the one-line diagram on the switch and by visually observing the position indicators.
6. Determine the direction in which the handle must be rotated to operate the switch to the desired position. The handle can be installed at 45° increments; be sure the handle is positioned to get the 45° travel needed to operate the switch.

DANGER

Do not attempt any operation while the switch is energized if the oil level is below the minimum recommended operating level.
7. Attach the removable operating handle to the operating shaft and insert the retaining pin.

8. Rotate the anti-reverse lever to point in the desired direction of rotation.
   See figures 4, 5, 6, & 7.

9. Rotate the switch handle in the desired direction until the handle is latched (approximately a 45° rotation). The spring operator pointer should now be pointing to the Charged to Open, Charged to Close or Charged to Ground position depending on which position you are desiring to travel to.

   **Note:** *The position plate in the viewing window will be indicating actual positions, which at this time will indicate a different position than the operator pointer.*

   For example if the spring operating handle pointer were pointing to the Charged To Open position, the position plate in the viewing window would be indicating Open position. This is due to the fact that the switchblades have now transferred, switch is discharged. See figures 4, 5, 6, & 7.

If excessive pressure is applied to the operating handle while the Anti-Reverse handle is in the incorrect position the Anti-Reverse Housing can be twisted. The twisting of this housing will cause the Cock-N-Trip feature to operate incorrectly. The reason for this is that the Anti-Reverse Pin must engage the Mechanism Claw to hold the mechanism Cocked.

If damage has occurred due to improper operation, contact Powell.

10. Switch operation is achieved by rotating the Cock-N-Trip™ external handle.
    See figures 4, 5, 6, & 7.

11. Confirm the status of the switch by looking through the viewing window and checking the position plate and position of the switch blades.

   **Note:** *The position plate in the viewing window will be indicating actual positions, which at this time will indicate the same position as the operator pointer.*
Figure 2 Standard Oil Switch Recommended Operating Procedure

Anti-Reverse lever in position to allow operation to the closed position.

Internal Position Indicator

CLOSED

OPEN

Figure 3 Standard Oil Switch Recommended Operating Procedure Cont.

External Position Indicator

OPEN

CLOSED

Anti-Reverse lever in position to allow operation to the open position.
Figure 4 Switch Open and Discharged

Figure 5 Switch Open and Charged to Close
Figure 6 Switch Closed and Discharged

Figure 7 Switch Open and Charged To Close
Ch 6 Maintenance

A. Oil

**DANGER**

Powell loadbreak oil switches are designed for many years of trouble-free operation. They are built and tested in accordance with ANSI C37.71 and C37.72. Under normal conditions, the only requirement is periodic inspections to ensure that switches are filled to the proper level with clean, dry oil. Visual inspection of the switch should include the condition of the tank finish, terminations and ground connections.

**DANGER**

The oil must be tested annually or after 30 loadbreak operations, whichever occurs first. If the oil in the switch tests below 22,000 volts for 0.1” gap per ASTM D877, it must be filtered or replaced with oil which tests 30,000 volts or higher.

**DANGER**

The entire switch must be de-energized before performing any maintenance or internal inspection.

B. Approved Insulating Oils

Powell is providing this list to assist our customers in obtaining suitable insulating oil. Although these oils have been approved, follow the steps in Ch 6 Maintenance, D. Removing Oil prior to filling or replacing oil in the switch.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Product</th>
<th>Phone Number</th>
<th>Web Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross Oil Refining &amp; Marketing, Inc.</td>
<td>CrosTran 206</td>
<td>(870) 725-3611 Ext. 163</td>
<td>Crossoil.com</td>
</tr>
<tr>
<td>Exxon Mobil</td>
<td>Univolt 52</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Chevron</td>
<td>Chevron Insulating Oil</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Texaco</td>
<td>Transformer Oil 55</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Shell</td>
<td>Diala AX</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Formil</td>
<td>Transvolt</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

C. Contacts

**WARNING**

Contacts must be inspected after each 100 loadbreak operations and following each fault closing. If pitting greater than 1/32 of an inch on the flat surface of the contacts is detected, it is suggested that a Powell field service representative make further inspection. Please contact Powell for available schedule and current rates.
D. REMOVING OIL

**WARNING**

To remove oil from the switch, remove the filler cap and open the drain valve, using suitable liquid handling apparatus in accordance with EPA and local guidelines.

E. REPLACEMENT PARTS AND REPAIRS

**WARNING**

Only a qualified Powell field service representative should perform repair, replacement, or adjustment of internal switch parts such as operating mechanisms, contacts, etc.

The switch blade assembly is factory set and self-aligning. Field adjustments are not recommended.

Parts may be ordered for field replacement of broken or damaged external items. See Table I, Replacement Parts, for part number and nomenclature. Order parts by specifying the item number, part name, and the serial number of the switch involved.

F. POWELL REQUIRED MAINTENANCE SCHEDULE

Powell recommendations for maintenance is as follows:

Annually or every 30 loadbreak operations, whichever occurs first

1. Record date
2. Record Serial Number
3. Oil Dielectric Test
4. Replace oil if required. Must test to 22kV per ASTM D877
5. Inspect switch tank, stand and control enclosures for corrosion
6. Visual inspection of voltage terminations for cracked connections, any items that may be causing stress on connections and proper ground connections

Every 100 Loadbreak Operations:

1. Record date
2. Record Serial Number
3. De-energize switch
4. Oil Dielectric Test
5. Remove Oil
6. Inspect switch contacts
7. Replace oil if required
8. Inspect switch tank, stand and control enclosures for corrosion
9. Visual inspection of voltage terminations for cracked connections, any items that may be causing stress on connections and proper ground connections

Every Fault Closing Operation:

1. Record date
2. Record Serial Number
3. De-energize switch
4. Oil Dielectric Test
5. Remove Oil. Must test to 22kV per ASTM D877
6. Inspect switch contacts*
7. Replace oil if required
8. Inspect switch tank, stand and control enclosures for corrosion
9. Visual inspection of voltage terminations for cracked connections, any items that may be causing stress on connections and proper ground connections

**NOTE:** *Contact Powell for contact replacement if there is pitting on the flat contact surface greater than 1/32 of an inch.*
### Table B  Metal to Metal Joint

<table>
<thead>
<tr>
<th>Bolt Size (inches)</th>
<th>SAE Grade 5 and Stainless Steel</th>
<th>Brass Bolt or Stainless Bolt with Brass Nut</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Torque (ft-lbs)</strong></td>
<td><strong>Torque (ft-lbs)</strong></td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>.313</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>.375</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>.5</td>
<td>85</td>
<td>87</td>
</tr>
<tr>
<td>.625</td>
<td>170</td>
<td>172</td>
</tr>
</tbody>
</table>

### Table C  Gasket Joint

<table>
<thead>
<tr>
<th>Item Name</th>
<th>Torque (ft-lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>Bolts that fasten insulating angle to support</td>
<td>8</td>
</tr>
<tr>
<td>Elastimold bolt in Apparatus bushing</td>
<td>10</td>
</tr>
<tr>
<td>G &amp; W and Colt bolt in Apparatus bushing</td>
<td>5</td>
</tr>
<tr>
<td>All bolt on cover plates</td>
<td>10</td>
</tr>
<tr>
<td>Oil level gauge</td>
<td>10</td>
</tr>
<tr>
<td>Cock-N-Trip™ Housing</td>
<td>10</td>
</tr>
</tbody>
</table>

### Table D  Tapered Pipe Thread (NPT)

<table>
<thead>
<tr>
<th>Pipe Size (NPT) (inches)</th>
<th>Cast Steel and Brass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Torque (ft-lbs)</strong></td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>.25</td>
<td>30</td>
</tr>
<tr>
<td>.5</td>
<td>40</td>
</tr>
<tr>
<td>.75</td>
<td>40</td>
</tr>
<tr>
<td>1</td>
<td>40</td>
</tr>
</tbody>
</table>
G. **Maintenance Records**

After completion of suggested service, make copies of sections G-J and fill in the boxes provided then keep for records.

<table>
<thead>
<tr>
<th>Table E  Initial Installation Maintenance Records</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

H. **Annually or Every 30 Loadbreak Operations Records Whichever Occurs First**

<table>
<thead>
<tr>
<th>Table F  Annually/Every 30 Loadbreak Operations Maintenance Records</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
## I. Every 100 Loadbreak Operations Records

### Table G Every 100 Loadbreak Operations Maintenance Records

<table>
<thead>
<tr>
<th>Date</th>
<th>Serial Number</th>
<th>De-Energize Switch</th>
<th>Oil Dielectric Test (per ASTM D877)</th>
<th>Remove Oil</th>
<th>Inspect Switch Contacts (per Ch 6 Maintenance, C. Contacts)</th>
<th>Replace Oil if Required</th>
<th>Inspect Switch Tank, Stand and Control for Corrosion</th>
<th>Visual inspection of voltage terminations for cracked connections</th>
<th>Comments</th>
</tr>
</thead>
</table>

## J. Every Fault Closing Operations Record

### Table H Every Fault Closing Operations Maintenance Records

<table>
<thead>
<tr>
<th>Date</th>
<th>Serial Number</th>
<th>De-Energize Switch</th>
<th>Oil Dielectric Test (per ASTM D877)</th>
<th>Remove Oil</th>
<th>Inspect Switch Contacts (per Ch 6 Maintenance, C. Contacts)</th>
<th>Replace Oil if Required</th>
<th>Inspect Switch Tank, Stand and Control for Corrosion</th>
<th>Visual inspection of voltage terminations for cracked connections</th>
<th>Comments</th>
</tr>
</thead>
</table>
Ch 7 Recommended Renewal Parts and Replacement Procedures

A. Dry Well Fuse Replacement

**NOTICE**

The equipment covered by this instruction bulletin should be selected, installed and serviced by competent personnel who understand proper safety procedures. This instruction bulletin is written for such personnel and is not a substitute for adequate training and experience in safety procedures regarding this type of equipment.

1) Remove Fuse from Tank

**DANGER**

Do not remove fuse without first opening the tap switch. The fuse is not a loadbreak device.

a. Open the switch attached to the fuse requiring removal. See one-line diagram.
b. Lock the switch in the open position using key interlock.
c. Remove key from switch interlock and insert into fuse cover interlock.

d. Unlock the fuse cover interlock and open fuse cover.
e. Release the seal on the fuse holders by pulling slowly on the latch ring with a shotgun-type stick or hookstick.
f. Slowly pull out on the latch ring with shotgun-type stick or hookstick to remove the fuse.

2) Install into Tank

a. With a shotgun-type stick or hookstick, carefully position the fuse assembly and slowly slide it back into the tube until it is firmly seated.
b. Seal the fuse tube by pushing the latch ring into the lock position.

**NOTE:** Parallel fuses must be of the same manufacturer and rating.

**DANGER**

Fuse holders contain internal energized parts even when the switch is in the open position. **DO NOT** attempt to clean or probe the inside of the fuseholder without first completely de-energizing, isolating, and grounding the switch.

Figure 8 Fuse Replacement Instructions

**FUSE CHANGEOUT:** Disassemble by loosening 4 set screws. Replace blown fuse with new fuse and reassemble with parts oriented as per above sketch. Retighten the 4 set of screws.
Figure 9 Replacement Parts

SEE DETAIL A
TYPE I & II SHOWN

DETAIL A
### Table I Replacement Parts

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
<th>Total Quantity</th>
<th>Recommended Stock Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39320G00001000</td>
<td>Mechanism</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>39313G0000009</td>
<td>3 Pole Unitized Switch Assembly</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>39302P00000450</td>
<td>Plexiglas View Window</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>39302P00000451</td>
<td>View Window Gasket (2 Req.)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>39302P00001470</td>
<td>Thru Tank Gasket</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>39302P00002001</td>
<td>O-Ring</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>39302P00001723</td>
<td>Plexiglas Oil Level Window</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>B80510019</td>
<td>Oil Level Window Gasket (2 Req.)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>39302G00000405</td>
<td>Handle Extension</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>372007-03</td>
<td>Brass Drain Valve 1/2&quot;</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>645E6</td>
<td>Nitrogen Fill Valve</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
B. **Stud Bushing Compartments (3-1/C and 1-3/C Cable)**

1) **Entrance Types**
   
   a. Stuffing Box (DP)
   b. Wiping sleeve (WS)
   c. General

The switch assembly will be shipped with the stud bushing compartment assembled. The Powell stud bushing compartment is designed with an opening so only the stuffing box (wiping sleeve) and gasket must be installed over the cable before it is connected to the bushing.

The lettered dimensions used in the text are shown on the reference drawing (Figure 10). Additional information will be obtained from Table J Solder Type Connector and Table K Copper Press Type Connector.

2) **Precautions**

   a. DO NOT bend cable to a radius less than that recommended by the manufacture.
   b. Make all required reference markings using string or tape.
   c. Avoid damaging the cable insulation.
   d. Keep the cable insulation clean and dry.
   e. Gasket surfaces must be free of oil and dirt. DO NOT use adhesives or cement on the gaskets.

3) **Installation Sequence**

   a. Screw a Brass Jam Nut onto bushing stud hand tight, to stop See Figure 10.
   b. Screw Bushing Stud Connector (DA3143) till contact is made with Jam Nut. See Figure 10.
   c. Temporarily attach Cable Lug (DB-965) to Bushing Stud Connector with two .312" x .5" long Socket Head Cap Screws. See Figure 10.

   d. Train cables up alongside the stud bushing compartment.
   e. Measure the “X” Dimension with a stiff wire.
   f. Position the cable and mark the jacket or sheath at point (M).
      i. Make a second mark at point (J), (K) inches above mark (M).
      ii. Cut the cable “X” inches above point (M).
   g. Remove the stuffing box (wiping sleeve) and gasket.
   h. Slide the stuffing box (wiping sleeve) and stuffing box gasket over cable in the order listed. Slide these components down over the cable past mark (M).
   i. Remove jacket or sheath to mark (J).
   j. Remove cable shielding to within .75” from point (J).
   k. Remove all trace of semi-conducting material from the surface of the cable insulation.
   l. Taper the cable insulation (“P” dimension) as shown on Figure 10.
   m. Install appropriate connector per following instructions.

   a. **Solder Type:**
      
      • Use non-acid flux such as GE #1533 to prevent deterioration of the cable and terminating materials.
      • Measure the depth “L” of the connector socket and add “S” dimension to it. Bare the conductor for this distance from cable end.
      • Tin the exposed conductor strands and connector socket. Insert the conductor into the connector, making sure the strands enter the connector socket its full length. For small conductor sizes, bend the cable down and solder the conductor to the connector filling the strands completely with hot solder. For large conductor sizes,
wrap several turns of cotton tape over the exposed conductor hole in the connector. Allow solder to cool.

n. Apply a coating of NO-OX to both connector ends before bolting.
o. Bolt cable lug (DB965) to bushing stud connector (DA3143) using two .312”x .5” socket head cap screw.

**NOTE:** Bushing Stud Connector may require rotation counter clockwise to align with Cable Lug. This rotation should not exceed 360° See Figure 10.

p. Torque the .312” screws to 20 ft. lbs, see Figure 10.
q. Tighten Jam Nut Against Bushing Stud Connector. While holding Bushing Stud Connector with strap wrench torque Jam Nut to 40 ft. lbs. See Figure 10.
r. Build stress relief cone at the location shown on the drawing and per instructions included with stress cone kit.
   - Pack filler tape into all connector crevices and form a smooth taping surface. For compression connectors, file off flashing from press operation to blend with circular connector. Fill indent groves with filler tape to form a smooth cylindrical surface.
   - Clean the bushing, connector, and cable area.
   - Apply (1) coat of cement over the connector area. Allow cement to become tacky before applying tape. Do not apply cement between tape layers.
   - Apply (1) half-lapped layer of semi-conducting tape over the entire connector surface, starting at the conductor strands and wrap to bushing edge at top of connector.
   - Apply half-lapped layers of insulating tape to form the termination as dimensionally specified in kit. Start taping at the connector-conductor junction and fill in until the applied tape is even with the cable insulation. Complete the overall taping.
   - Apply (1) half-lapped layer of shielding braid down over the insulating tape and overlap the cable shielding .5”.
   - Tack solder the shielding braid to cable shielding and solder successive turns of braid together in three axial strips.

s. Secure the stuffing box (wiping sleeve) to the bottom of the compartment.
t. Install appropriate entrance as follows:

a. “DP” Entrances:
   - Raise the (2) entrance gaskets to the base of the compartment body and slip the ground strap between the two. Hold 1 “DP” plate tight against the entrance gasket and apply layers of .375” wide neoprene tape to a thickness of .375” around the conductor even with the countersunk area of the “DP” plate. Raise the second plate into position and bolt in place, attaching the ground strap under (1) of the bolt heads. Torque bolts to 10 ft. lbs.

b. “WS” Entrance:
   - Raise entrance with gasket to the base of the compartment body and bolt in place. Torque bolts to 10 ft. lbs. Seal entrance to lead sheath with field wipe made with 40/60 solder.

u. Hand tape “D” areas to the recommended diameter see chart.
v. After the compartment cover plate is installed torque nuts to 10 ft. lbs. It is ready to be filled with compound.
**Figure 10 Stud Bushing**

- **Stud Bushing Compartment Vent Opening**
- **This area to have hand applied insulation buildup to D dimension.**
- **Compound Fill Openings**
- **Cable Insulation**
- **Cable Shielding**
- **Cable Jacket**

Diagram elements include:
- **Switch Tank**
- **Bushing**
- **Dimensions**:
  - **S**: 2"
  - **C**: 1"
  - **P**: .75"
  - **J**: K
  - **M**: X
### Table J  Solder Type Connector

<table>
<thead>
<tr>
<th>Voltage</th>
<th>“C”</th>
<th>“D”</th>
<th>“K”</th>
<th>“P”</th>
<th>Conductor Size</th>
<th>“S”</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000</td>
<td>3”</td>
<td>2.75” DIA.</td>
<td>.5”</td>
<td>#6 To #23 AWG.</td>
<td>1.875”</td>
<td></td>
</tr>
<tr>
<td>7,500</td>
<td>4”</td>
<td>2.75” DIA.</td>
<td>.75”</td>
<td>#1 To 1/0 AWG.</td>
<td>1.562”</td>
<td></td>
</tr>
<tr>
<td>15,000</td>
<td>5”</td>
<td>2.75”</td>
<td>2.75”</td>
<td>1”</td>
<td>2/0 AWG.</td>
<td>1.375”</td>
</tr>
</tbody>
</table>

### Table K  Copper Press Type Connector

<table>
<thead>
<tr>
<th>Voltage</th>
<th>“C”</th>
<th>“D”</th>
<th>“K”</th>
<th>“P”</th>
<th>Conductor Size</th>
<th>“S”</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000</td>
<td>3”</td>
<td>2.75”</td>
<td>1.187”</td>
<td>.5”</td>
<td>#4 AWG. To MCM Comp.RD.</td>
<td>1”</td>
</tr>
<tr>
<td>7,500</td>
<td>4”</td>
<td>2.75”</td>
<td>.187”</td>
<td>.75”</td>
<td>350 To 1000 MCM</td>
<td>.875”</td>
</tr>
</tbody>
</table>

### C. Compound Filing of Stud Bushing Compartments & Potheads

1) **Filing Procedure**

   a. Connect a pipe nipple of sufficient length to extend from underneath the switch to the compound fill opening (see Figure 10).
   
   b. Connect a 90° Elbow to the nipple with the unattached end facing upward.
   
   c. Connect a short pipe nipple to the other end of the 90° Elbow.
   
   d. Connect a reducer fitting to the short pipe nipple (the unattached end of the reducer fitting must be one size larger than the other end).
   
   e. Connect a length of pipe to the other end of the reducer fitting. This length of pipe must be approximately 12” above the top of the bushing to provide a sufficient static pressure head.
All pipe threads must be coated with compound when assembling, and joints must be made up tight to prevent sucking in of air while stud bushing compartment or pothead is cooling.

f. Start heating compound in accordance with instructions on compound pail.

g. Remove vent opening plug to allow venting when pouring compound.

h. Preheat the complete stud bushing compartment or pothead assembly and pouring stand-pipe this can be done with a broad, soft flame from a large torch, moving to prevent local over-heating (which would damage insulation). Keep torch away from gaskets, depending upon the ambient temperature, this may take 15 to 30 minutes. Proper preheat temperature is approximately 165°F.

i. When stud bushing compartment or pothead is up to preheat temperature and when compound is up to pouring temperature, as indicated on the pail, pour compound slowly and continuously into the stand-pipe funnel until compound oozes from the vent hole. After the froth has escaped and the liquid is oozing out the vent hole, thread plug into vent and tighten. Continue pouring into the stand-pipe until the compound level in the stand-pipe is at least 6” to 8” above the top of the bushing. Then keep the stand-pipe hot with the torch until the entire stud bushing compartment or pothead body has cooled below 165°F then discontinue heating the stand-pipe. After 10 minutes, remove the stand-pipe and inspect compound inside filling hole for voids. Small voids may be filled with a piece of softened compound. Large voids indicate that compounding is unsatisfactory.

j. If unsatisfactory it must be done over (see Ch 7 Recommended Renewal Parts and Replacement Procedures, C. Compound Filing of Stud Bushing Compartments & Potheads, 2) Compound Troubleshooting Guide).

k. If compound is satisfactory clean compound from around filling plug seat. Install the plug in filling hole and tighten securely. This cooling-out operation may require an hour.

2) Compound Troubleshooting Guide

The presence of large voids indicates incorrect compounding procedure. The possible reasons are:

- Failure to keep stand-pipe hot, while the pothead is cooling will often result in air being sucked in at the compound filling hole.
- Having loose joints in the compound filling stand-pipe system will also allow air to be sucked in.
- Failure to keep compound level up in funnel may result in the entrapment of air in the stand-pipe.
- Excessive agitation of the compound, before or during pouring, can produce air bubbles in the compound.
01.4IB.39000A
Medium Voltage Loadbreak Oil Switch

April 2015