



01.4IB.39300A

Powell Gas Type I Loadbreak Switch

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Signal Words

As stated in ANSI Z535.4-2011 (R2017), 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**

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.

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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 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 immediately at 1.800.480.7273.

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 1.800.480.7273.

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 Gas Type I Loadbreak Switch.

B. PURPOSE

The information in this instruction bulletin is intended to provide details required to properly operate and maintain the Powell Gas Type I Loadbreak Switch described in *Ch 1 General Information, A. Scope*.

This instruction bulletin provides:

1. Safety guidelines
2. General descriptions of the operation and maintenance of the loadbreak switch
3. Instructions for installation and placing the loadbreak switch into service
4. Procedure for critical adjustments
5. Illustrations, photographs, and description of the loadbreak switch

The illustrations contained in this document may not represent the exact construction details of the Powell Gas Type I Loadbreak Switch. The illustrations in this document are provided as general information to aid in showing component locations.

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**NOTICE**

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 Service Division call 1.800.480.7273, or email serviceinfo@powellind.com.

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



Ch 2 Safety

A. SAFE WORK CONDITION

The information in Section A is quoted from NFPA 70E 2018 - Article 120, 120.5 Establishing an Electrically Safe Work Condition.

120.5 Process or Establishing and Verifying an Electrically Safe Work Condition.

Establishing and verifying an electrically safe condition shall include all of the following steps, which shall be performed in the order presented, if feasible:

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. Release stored electrical energy.
5. Release or block stored mechanical energy.
6. Apply lockout/tagout devices in accordance with a documented and established procedure.
7. Use an adequately rated portable test instrument to test each phase conductor or circuit part to verify it is de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Before and after each test, determine that the test instrument is operating satisfactorily through verification on any known voltage source.

N *Exception No. 1: An adequately rated permanently mounted test device shall be permitted to be used to verify the absence of voltage of the conductors or circuit parts at the work location, provided it meets the all following requirements: (1) It is permanently mounted and installed in accordance with the manufacturer's instructions and tests the conductors and circuit parts at the point of work; (2) It is listed and labeled for the purpose of verifying the absence of voltage; (3) It tests each phase conductor or circuit part both phase-to-phase and phase-to-ground; (4) The test device is verified as operating satisfactorily on any known voltage source before and after verifying the absence of voltage.*

N *Exception No. 2: On electrical systems over 1000 volts, noncontact test instruments shall be permitted to be used to test each phase conductor.*

Informational Note No. 1: See UL 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements, for rating, overvoltage category, and design requirements for voltage measurement and test instruments intended for use on electrical system 1000 volts and below.

N *Informational Note No. 2: For additional information on rating and design requirements for voltage detectors, refer to IEC 61243-1, Live Working - Voltage Detectors - Part 1: Capacitive type to be used for voltages exceeding 1kV a.c., or IEC 61243-2, Live Working - Voltage Detectors - Part 2: Resistive type to be used for voltages of 1kV to 36kV a.c., or IEC 61243-3, Live Working - Voltage Detectors - Part 3: Two-pole voltage type.*

8. 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 de-energized could contact other exposed energized conductors or circuit parts, apply temporary protective grounding equipment in accordance with the following:

- a. *Placement.* Temporary protective grounding equipment shall be placed at such locations and arranged in such a manner as to prevent each employee from being exposed to a shock hazard (i.e., hazardous differences in electrical potential). The location, sizing, and application of temporary protective grounding equipment shall be identified as part of the employer's job planning.
- b. *Capacity.* Temporary protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault.

N *Informational Note: ATSM F855, Standard Specification for Temporary Protective Grounds to be Used on De-energized Electric Power Lines and Equipment, is an example of a standard that contains information on capacity of temporary protective grounding equipment.*

- c. *Impedance.* Temporary protective grounding equipment and connections shall have an impedance low enough to cause immediate operation of protective devices in case of unintentional energizing of the electric conductors or circuit parts.

B. SAFETY GUIDELINES

Study this instruction bulletin and all other associated documentation before installing the loadbreak gas 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.

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 gas switch.

**C. GENERAL**

1. Only supervised and qualified personnel trained in the usage, installation, operation, and maintenance of the loadbreak gas 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 gas switch reliability and safety.
3. Service conditions and gas 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.

D. 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 gas switch is handled, operated, or maintained.

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 Gas Type I switches are designed to comply with C37.74-2014. They serve as sectionalizer, isolators, and source transfer devices. They can be used in submersible, padmounted, and Class 1 Division 2 applications.

Powell Gas Type I switches (*Figure 1*) are loadbreak switches up to 600A that are a blade based contact assembly and use SF₆ as the insulation media to break the load.

B. PRESSURE TESTING

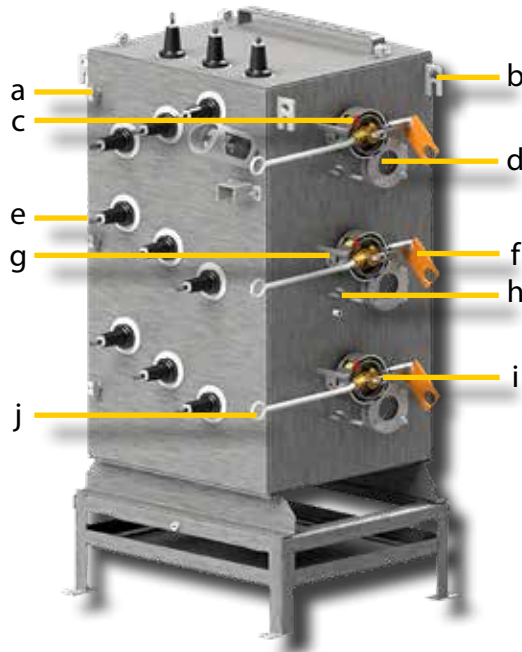
All Powell gas switches are factory pressure and leak tested to ensure integrity of welds and seals. If a leak is found, immediately contact Powell. If the pressure is in the “Red”, between 0 - 3 PSIG, or “Yellow”, between 3 -5 PSIG (*Figure 2*), contact Powell.

WARNING

Do not attempt any operation while the switch is energized if the gas pressure is below the minimum recommended operating level. If below recommended operating level the device could fail to interrupt causing personnel injury and/or equipment damage.

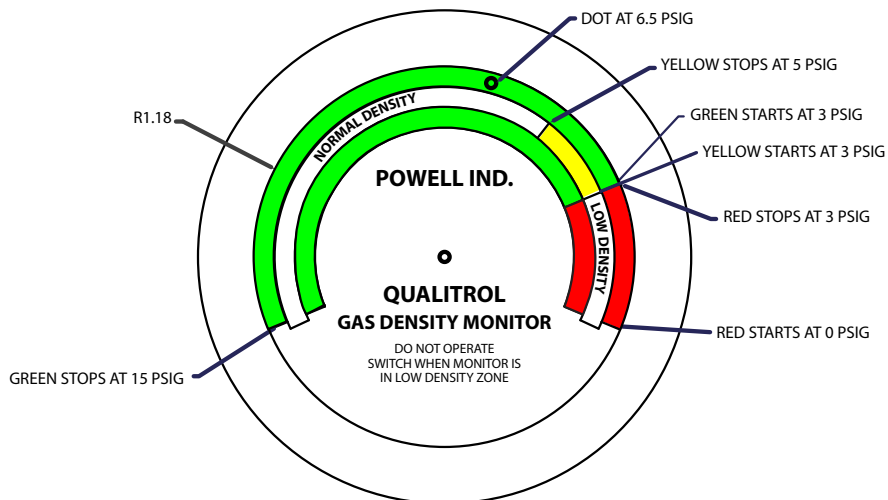


Figure 1 Powell Gas Type I Loadbreak Switch



- a. Ground Boss
- b. Lifting Point
- c. External Position Indicator
- d. Internal Position Indicator Window
- e. Bushing
- f. Anti-Reverse Handle
- g. Upper Handle Stop
- h. Lower Handle Stop
- i. Operator Handle Retainer Pin
- j. Operator Handle

Figure 2 Pressure Gauge



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 damage found, the switch tank and all attachments should be closely examined. Verify that the Powell Gas Type I switch was received in good working order by using the following checklist.

- The pressure should be in the “Green” between 3 -15 PSIG (*Figure 2*).
- 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.

The switch is equipped with lifting provisions on each end. Four (4) lift points (*Figure 1, b*) shall always be used when lifting the switch. It is important to note that when a spreader bar is not being used that each lift chain/cable when loaded maintains at least a 45° angle from the horizontal plane.

Note: *At 45° the force on each lifting chain/cable is equal to the total load divided by four divided by 0.707 making each less efficient. Angles less than 45° can damage the switch.*

**C. STORAGE****⚠ 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 pressure gauge and a fill valve. Pressure must be maintained during storage as a precaution against corrosion and possible degradation of the insulating materials.

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

The switch should be stored in temperatures above -40°F/-40°C. The relative humidity should be kept below 60% or a dew point of 59°F/15°C. The equipment should be stored in such a manner as to make inspection accessible. The equipment must be inspected on a routine basis to assure operational integrity.

NOTICE

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.

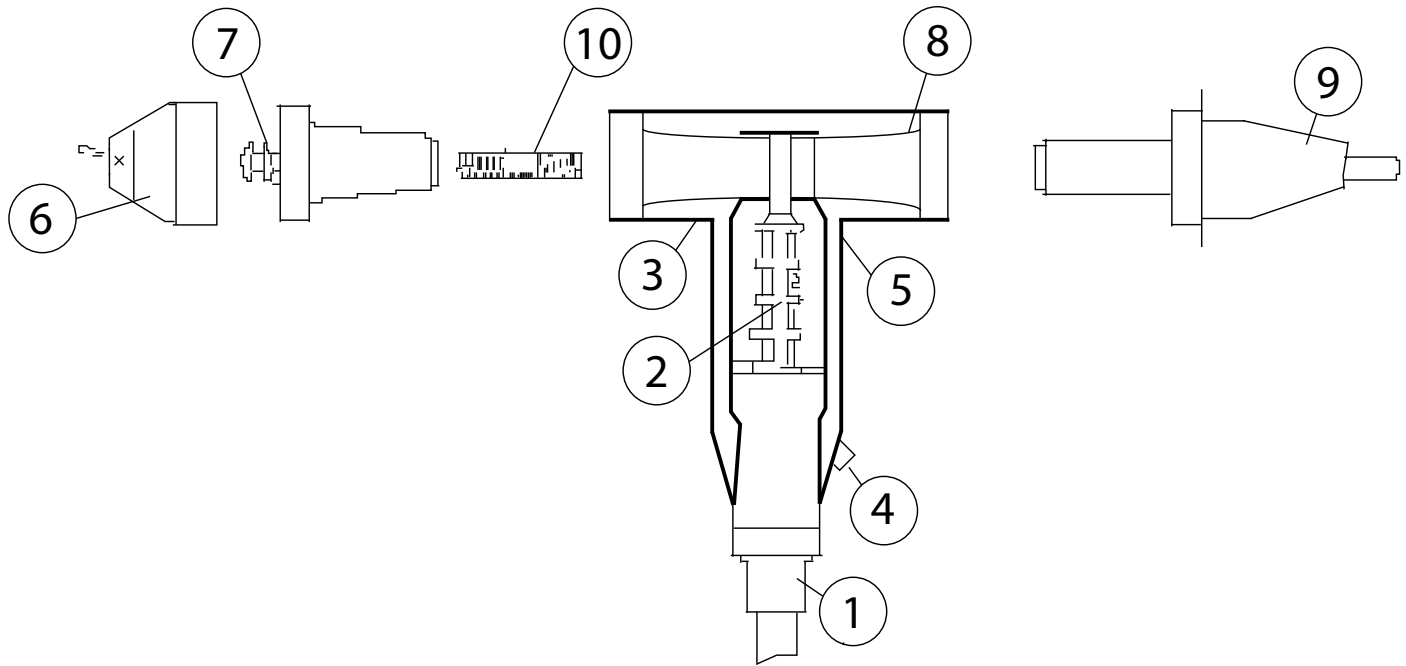
D. SWITCH SITE**⚠ CAUTION**

The switch will float if not tied down. Buoyancy will occur when the water level rises to about 3/4 the height of the tank for a submersible switch without an enclosure. A padmount switch with an enclosure has almost neutral buoyancy when completely submerged in water.

The switch site must provide firm support so the switch can be maintained in a level position, ample room for routing cable to the switch, and adequate cable supports to prevent stress on the cable or connections.

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 ensure a proper ground connection, the ground bosses (*Figure 1, a*) on the switch must be cleaned to bare metal. Provisions must be made to prevent moisture contamination during installation of cable terminations. Ground bosses are located on the switch tank at each entranceway.

Figure 3 Power Distribution Connector Diagram



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.

**E. POWER DISTRIBUTION CONNECTOR INSTALLATION****NOTICE**

This section is not intended to supersede the power distribution connector manufacturers installation instructions, but is provided to assist Powell's customers.

After proper cable preparation, a spade terminal is crimped on the conductor. Refer to [Figure 3](#) for power distribution connector diagram. 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. TESTING

Prior to shipment from the Powell factory, all functions are thoroughly checked. The user must verify functions after receipt of the equipment.

Powell recommends that the tests be performed in the following sequence:

1. High Voltage Insulation Integrity
2. Mechanical Operation Check

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

Switches do not require a field Hi-Pot test. However, if a field Hi-Pot test is to be conducted the potential transformer primary fuses must be removed.

DANGER

Powell Gas Type I 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.

G. INITIAL INSTALLATION CHECKLIST

1. Record date
2. Record serial number
3. Record that gauge pressure is in the "Green" between 3 - 15 PSIG ([Figure 2](#))
4. Record ambient temperature

Ch 5 Operation

WARNING

Switch access shall be permitted ONLY to "Qualified Person", as defined in NFPA 70E, using "approved safe work practice" and "appropriate PPE". Failure to do so could result in death or serious injury.

The Powell Gas Type I 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 SF₆ filled.

A. STANDARD POWELL GAS TYPE I SWITCH RECOMMENDED OPERATING PROCEDURE

1. Visually inspect the equipment for good working condition and proper ground connections.
2. Check the gas pressure gauge on the switch and ensure that it corresponds to the recommended operating level.

WARNING

Do not attempt any operation while the switch is energized if the gas pressure is below the minimum recommended operating level. If below recommended operating level the device could fail to interrupt causing personnel injury and/or equipment damage.

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 in two locations, in contact with the upper handle stop for counterclockwise rotation, and in contact with the lower handle stop for clockwise rotation. Refer to *Figures 4-7* for the remaining steps.
7. Attach the operator handle on the operator shaft in the proper location for the desired operation rotation and insert the operator handle retainer pin.
8. Rotate the anti-reverse handle to the desired operator handle rotation direction. Position the anti-reverse handle "up" for clockwise rotation or "down" for counterclockwise rotation.
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 position to the one-line diagram on the switch.
11. Remove the handle and return it to its place of storage.



Figure 4 Switch Open Handle Set for Operation to Closed Position

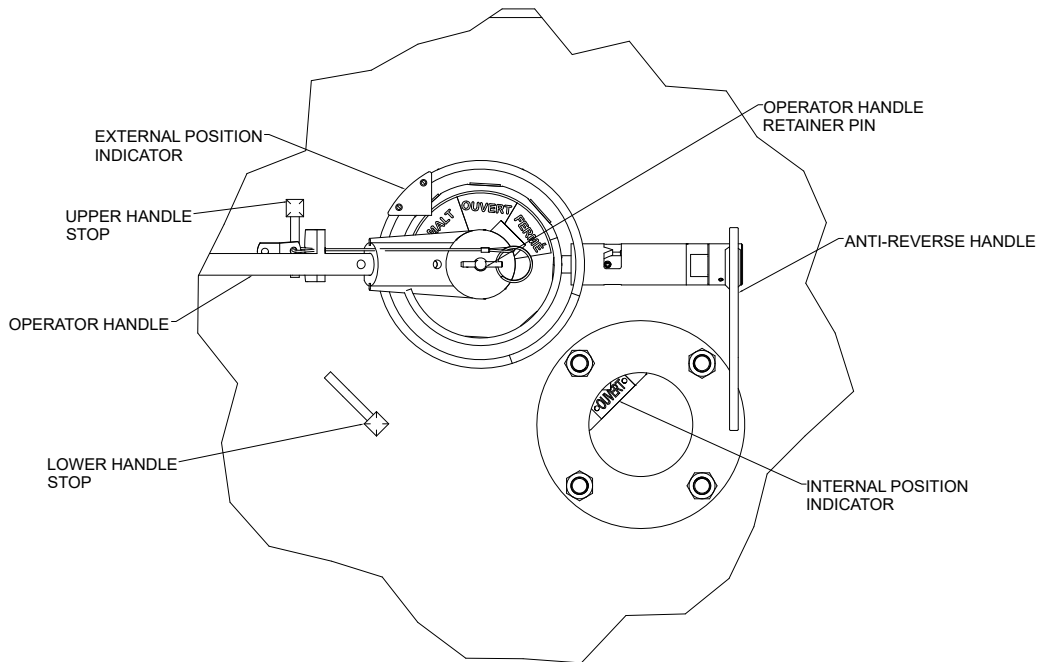


Figure 5 Switch Open Handle Set for Operation to Ground Position

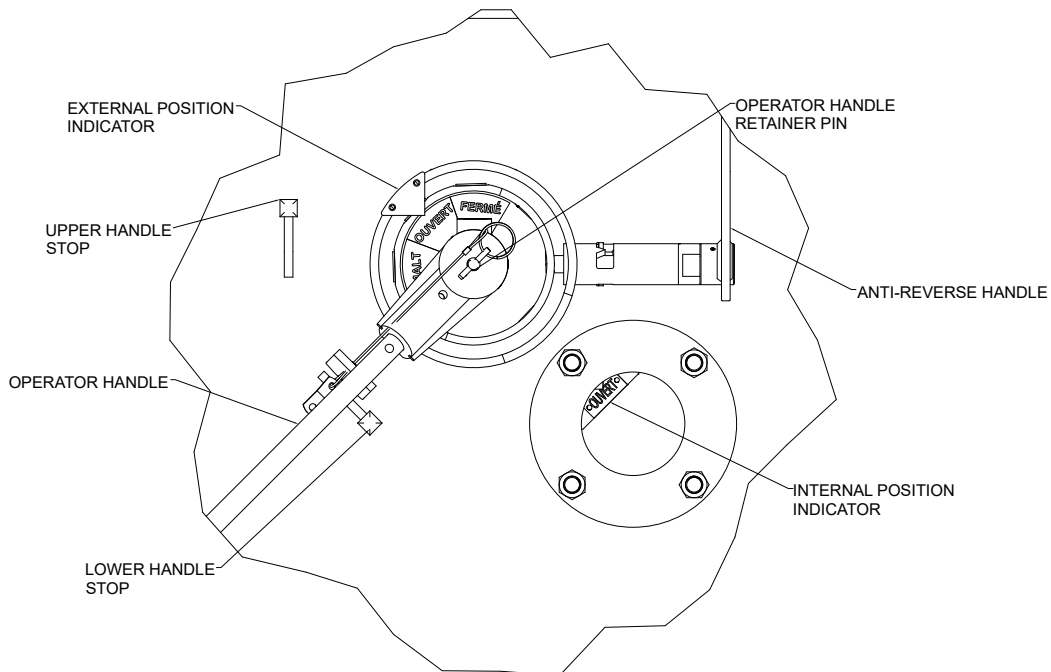


Figure 6 Switch Close Handle Set for Operation to Open Position

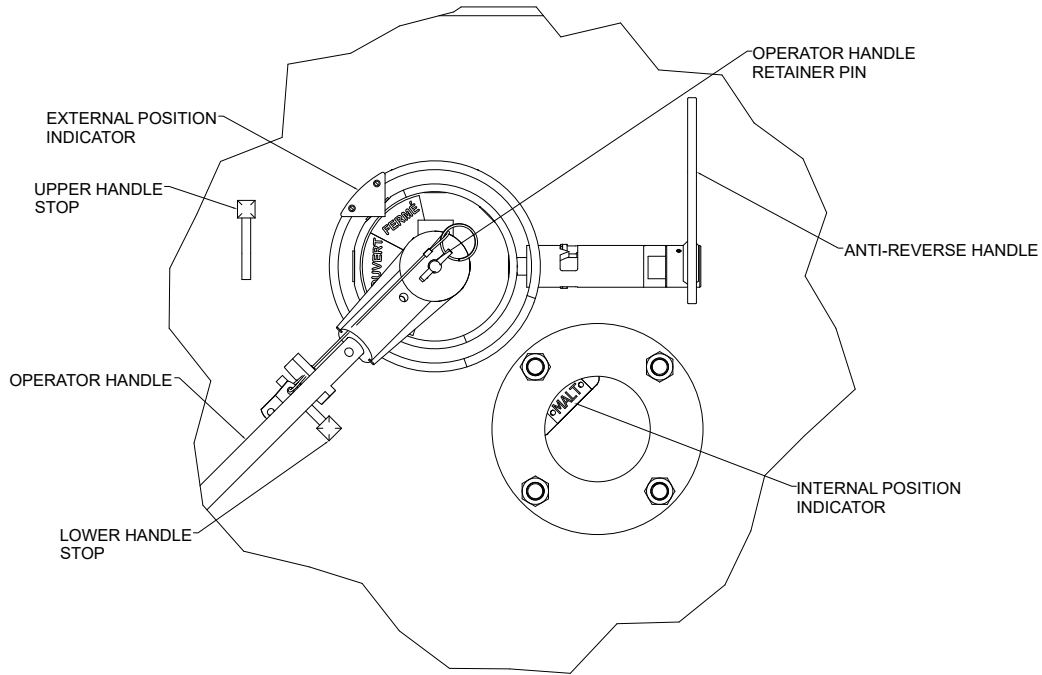
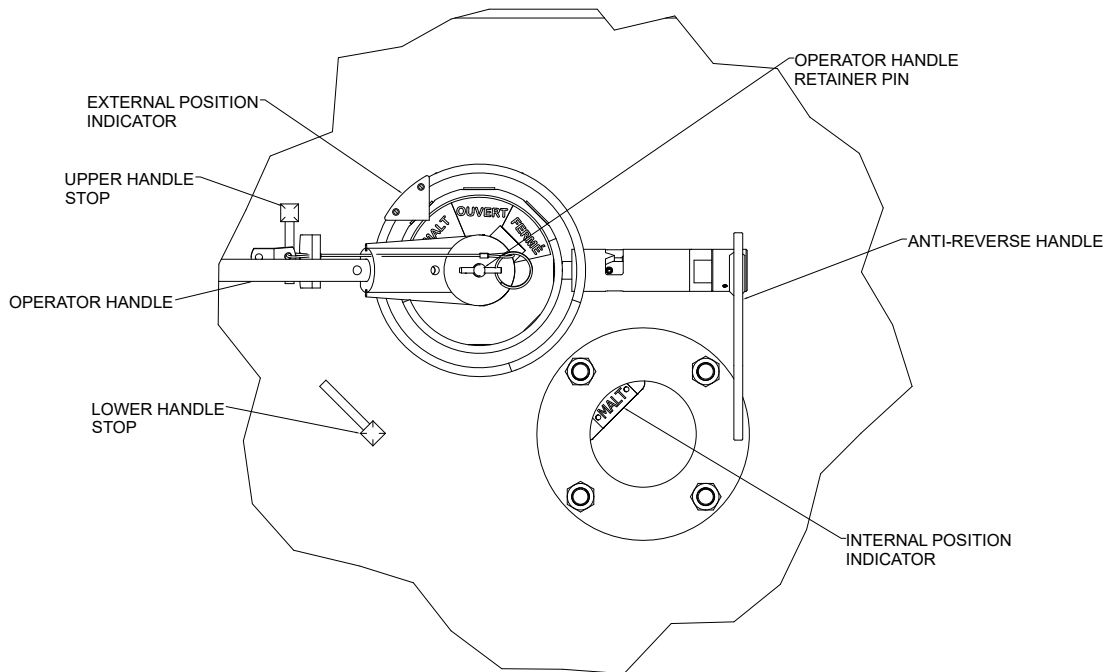


Figure 7 Switch Ground Handle Set for Operation to Open Position





Ch 6 Maintenance

NOTICE

Powell Gas Type I switches are designed for many years of trouble-free operation. They are built and tested in accordance with ANSI C37.74-2014. Under normal conditions, the only requirement is periodic inspections to ensure that the switch is charged to the proper pressure level with SF₆. Visual inspection of the switch should include the condition of the tank finish, pressure gauge, fill valve, termination and ground connections.

A. SF₆ - SULFUR HEXAFLUORIDE GAS

CAUTION

Only high quality electrical grade SF₆ gas in accordance with ASTM D 2472-92 should be used in the Powell gas switch.

Mixtures of SF₆ gas and other gases are sold for use as a leak detection agent. USE OF THESE LOW PURITY MIXTURES IN THE LOADBREAK SWITCH MAY LEAD TO DIELECTRIC FAILURE, DAMAGE TO THE SWITCH, AND POSSIBLE INJURY TO PERSONNEL.

DANGER

The entire switch must be deenergized before performing any maintenance or internal inspection.

B. GAS PRESSURE MAINTENANCE

This switch has been factory filled with SF₆. SF₆ may be added by following the steps in *Ch 6 Maintenance, C. Filling the Switch (Switch Energized)* and *D. Equipment Required for Maintenance*.

C. FILLING THE SWITCH (SWITCH ENERGIZED)

1. Remove the protective cap from the fill valve.
2. Purge the air from the supply line.
3. Connect the supply line.
4. Fill until the needle on the gauge points to "Black" dot on gauge in "Green" area (*Figure 2*).
5. Remove the supply line and replace the protective cap.

Note: Gas filling is not recommended when the ambient temperature is less than -20°C.

CAUTION

Do not exceed the "Green" area (*Figure 2*).

WARNING

Do not attempt any operation while the switch is energized if the gas pressure is below the minimum recommended operating level. If below recommended operating level the device could fail to interrupt causing personnel injury and/or equipment damage.

D. EQUIPMENT REQUIRED FOR MAINTENANCE

The only special equipment required to maintain SF₆ equipment is a Refill Kit. This kit may be purchased from Powell.

E. SF₆ GAS SUPPLIERS

Contact Powell for SF₆ gas suppliers.

F. MAINTENANCE RECORDS

After completion of suggested service, fill in the boxes provided.

<i>Table A Initial Installation Maintenance Records</i>	
Date	
Serial Number	
Gauge Pressure	
Ambient Temperature	
Comments	

G. ANNUAL MAINTENANCE RECORDS

<i>Table B Annual Maintenance Records</i>				
Date				
Serial Number				
Gauge Pressure				
Ambient Temperature				
Inspect Switch Tank, Stand and Control for Corrosion				
Comments				



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