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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**
  
  **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 70®, 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 ArcWhipper® medium voltage loadbreak SF₆ gas switch.

B. **Purpose**

The following information and instructions are to aid the user in the proper installation, operation, and maintenance of the ArcWhipper medium voltage loadbreak gas 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 ArcWhipper loadbreak gas 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 loadbreak gas switch
3. Instructions for installation and placing the loadbreak gas switch into service
4. Instructions for part replacement
5. Information for ordering renewal parts
6. Procedure for critical adjustments
7. Illustrations, photographs, and description of the loadbreak gas switch

The illustrations contained in this document may not represent the exact construction details of the particular type of replacement loadbreak gas 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.*

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**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 Service Division call 1.800.480.7273 or 713.944.6900, or email info@powellservice.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 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 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.

**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 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.

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 gas switch.*

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.

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 gas 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.

**NOTICE**

Warning and Caution labels are located in various places. Do not remove or deface any of these warning/caution labels.

**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.
Ch 3 Equipment Description

A. General

ArcWhipper® medium voltage loadbreak gas switches are designed to comply with C37.71 and C37.72. They serve as sectionalizer, isolators, and source transfer devices. They can be used in submersible, padmounted, and class 1 division 2 applications.

B. Pressure Testing

All ArcWhipper gas switches are factory pressure and leak tested to ensure integrity of welds and seals. If a leak is found, immediately contact Powell. For pressure gauges with the words “Temperature Compensated” written on the face plate if the pressure is below 6 PSIG contact Powell. For pressure gauges without the words “Temperature Compensated” written on the face plate, if the pressure is less than 6 PSIG, consult the Pressure/Temperature chart on the switch tank because the pressure will vary with temperature. If the pressure is less than the chart indicates at the ambient temperature, contact Powell.
Ch 4 Installation

A. RECEIVING/INSPECTION

NOTICE

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 ArcWhipper® was received in good working order by using the following checklist.

- If the pressure gauge has the words “Temperature Compensated” written on the face plate the tank pressure should be 6.5 PSIG ± 0.5 PSIG
- If the pressure gauge does not have the words “Temperature Compensated” on the face plate the tank pressure should be at least 6PSIG (41kPa) of pressure at 68°F (20°C). See pressure/temperature chart on switch for pressure at other temperatures.
- 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 removable lifting provisions on each end. Four (4) lift points 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 (4) 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 tank pressure will vary with temperature, refer to Table A, Fill Pressures at Various Ambient Temperatures for non-temperature compensated gauges.

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 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 1  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 manufacturers 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 1 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

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

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

ArcWhipper® 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.
G. **ANTI-SINGLE PHASE (TIMEMARK®) ADJUSTMENT IF APPLICABLE**

Remove the solenoid wires from the three phase power monitor. Energize the switch and complete the following steps:

1. Check for proper voltage on fuses F1, F2, & F3 (120V line to neutral).
2. If the tripped light comes on, then rotate the trip adjustment counterclockwise slowly until the light goes out. If the light does not go out, proceed to **Ch 4 Installation, H. ANTI-SINGLE PHASE (TIMEMARK®) ADJUSTMENT (LIGHT DOES NOT GO OUT), step 3.**
3. With the light out, replace the solenoid wires.

H. **ANTI-SINGLE PHASE (TIMEMARK®) ADJUSTMENT (LIGHT DOES NOT GO OUT)**

1. Using a fuse puller remove the three secondary fuses F1, F2, & F3.
2. Exchange places with two of the three phase wires on the three phase power monitor.
3. Using a fuse puller replace the secondary fuses F1, F2, & F3.
4. Rotate trip adjust clockwise until light comes on.
5. Rotate the trip adjust counterclockwise slowly until light goes out.
6. With the light out, replace the solenoid wires.

I. **INITIAL INSTALLATION CHECKLIST**

1. Record date
2. Record serial number
3. Record gauge pressure
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 ArcWhipper® 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 SF₆ filled.

A. Anti-Single Phase General Operation

The spring mechanism contains a Cock-N-Trip device. A solenoid attached to the Cock-N-Trip mechanism enables the 3-phase switch (when charged to open) to be opened through the operation of the solenoid. The Anti-single phase switch is designed to continuously monitor 3-phase power for abnormal power conditions. This is accomplished through the use of a 3-phase power monitor which consists of a solid state voltage and phase angle sensing circuit driving an electromechanical output relay. When correct voltage and phase sequence is applied, the internal relay will be energized. Low voltage, phase reversal, phase unbalance or phase loss will cause the relay to drop out. When this occurs, and after a 15 to 20 (5 optional) second time delay, the solenoid will operate opening the 3-phase switch to prevent a single phase condition to the load. When the load condition is corrected, the 3-phase switch must be manually closed and charged to open to protect the load from future single phase conditions.

B. Standard ArcWhipper Recommended Operating Procedure

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

DANGER

Do not attempt any operation while the switch is energized if the gas pressure 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.
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 (Figure 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 position to the one-line diagram.
11. Remove the handle and return it to its place of storage.

C. **Optional ArcWhipper® with Cock-N-Trip Recommended Operating Procedure**

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

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**DANGER**

*Do not attempt any operation while the switch is energized if the gas pressure 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.
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 (Figures 4-7).
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 is desired (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 indicate “Closed” or “Ground” position since the switchblades have not transferred yet, switch is charged (Figures 4-7).
10. Switch operation is achieved by rotating the Cock-N-Trip external handle (Figures 4-7).
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). For example, if the spring operating handle pointer were pointing to the “Charged to Open” position, the position plate in the viewing window would indicate “Open” position since the switchblades have now transferred, switch is discharged (Figures 4-7).
**Figure 2**  *Standard Gas Switch Recommended Operating Procedure*

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

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**Figure 3**  *Standard Gas Switch Recommended Operating Procedure Cont.*

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

- Viewing Window/Position Plate
- Spring Operator Pointer

Figure 5  Switch Open and Charged to Close

- Anti-Reverse Lever
- Cock-N-Trip Handle
Figure 6  Switch Closed and Discharged

Figure 7  Switch Closed and Charged to Open
Ch 6  Maintenance

A.  **SF₆ - Sulfur Hexafluoride Gas**

**DANGER**

ArcWhipper® loadbreak gas 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 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.

**DANGER**

Only high quality electrical grade SF₆ gas in accordance with ASTM D 2472-92 should be used in the ArcWhipper 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 ARCWIPPER 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**

1)  **Temperature Compensated Pressure Gauge**

This switch has been factory filled with SF₆. If this switch has maintained a positive pressure, but it is less than 6 PSIG, add SF₆ to bring the pressure up to 6 to 7 PSIG. If the switch has not maintained a positive pressure, it must be completely refilled in accordance with procedures listed in **Ch 6 Maintenance, C. Topping off the Switch (Switch Energized)** and **D. Field Filling of Gas Switch.**

2)  **Non-Temperature Compensated Pressure Gauge**

This switch has been factory filled with SF₆. If this switch has maintained a positive pressure, but it is less than the recommended pressure listed in Table A, Fill Pressures at Various Ambient Temperatures and on the nameplate attached to the switch, add SF₆ to bring the pressure up to the recommended value. Refer to **Ch 6 Maintenance, C. Topping Off the Switch (Switch Energized).** If the switch has not maintained a positive pressure, it must be completely refilled in accordance with procedures listed in **Ch 6 Maintenance, C. Topping Off the Switch (Switch Energized)** and **D. Field Filling of Gas Switch.**
C. **Topping Off 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 and open valve.
4. For pressure gauges with the words “Temperature Compensated” written on the face plate, fill to 6 to 7 PSIG. For pressure gauges without the words “Temperature Compensated” written on the face plate slowly fill the switch to the proper pressure level for the existing ambient temperature.
5. Close the valve and replace the protective cap.

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

| Table A Fill Pressures at Various Ambient Temperatures |
|---------------------------------------------|-----------------------|
| Temperatures °C | Pressure kPa | Temperatures °F | Pressure PSIG |
| -40          | 10         | -40          | 1.5           |
| -30          | 16         | -22          | 2.3           |
| -20          | 21         | -4           | 3.0           |
| -10          | 26         | 14           | 3.8           |
| 0            | 31         | 32           | 4.5           |
| 10           | 36         | 50           | 5.3           |
| 20           | 41         | 68           | 6.0           |
| 30           | 46         | 86           | 6.7           |
| 40           | 51         | 104          | 7.5           |
| 50           | 57         | 122          | 8.2           |

If the switch has been exposed to brief negative gas pressures (gauge pressure below zero PSIG) when the ambient temperature has dipped to extremely low overnight levels (minus 30°C to minus 40°C) and has returned to a positive pressure as the ambient temperature rises in the daytime, it is unlikely that the switch has lost any of its dielectric strength. If the gas level is low as described in **Ch 6 Maintenance, B. Gas Pressure Maintenance**, it my be topped off with SF₆ using the procedure in **Ch 6 Maintenance, D. Field Filling of Gas Switch**.

If the switch is exposed to extended periods of negative gas pressure and has not recovered to a positive pressure above 2 PSIG, it must be assumed that the tank has a leak and that the gas has become contaminated with moisture.

**CAUTION**

Do not exceed 90kPa (13 PSIG).

**WARNING**

Do not operate an energized switch if the SF₆ pressure is in the red zone on the pressure gauge, which is provided with the switch. Check gauge pressure before operating.

**CAUTION**

A switch with an extended period of negative pressure SHOULD NOT BE OPERATED. It should be deenergized, and examined for repair as soon as possible.
Since it is not usually possible to repair a switch in the field, units that have developed a leak and lost a significant portion of their gas charge and/or have been subjected to extended periods of negative pressure should be returned to Powell for examination and repair. Contact your nearest Powell representative for assistance.

D. **FIELD FILLING OF GAS SWITCH**

If the switch has been opened for internal maintenance such as CPT fuse replacement, the exposure to the atmosphere should be limited. To limit exposure replace covers as soon as possible. To prepare for refilling, replace the covers and torque to 10 ft-lbs. Attach a vacuum pump to the fill valve and vacuum the switch to 10mm of Hg for two hours then fill switch with SF₆ that meets standard ASTM D 2472-92.

E. **EQUIPMENT REQUIRED FOR MAINTENANCE**

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

F. **SF₆ GAS SUPPLIERS**

Contact Powell for SF₆ gas suppliers.
F. MAINTENANCE RECORDS

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

Table B Initial Installation Maintenance Records

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<tr>
<td>Gauge Pressure</td>
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<tr>
<td>Ambient Temperature</td>
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<td>Comments</td>
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G. ANNUAL MAINTENANCE RECORDS

Table C Annual Maintenance Records

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Ch 7 Replacement Procedures

A. Dry Well Fuse Replacement

NOTICE

The equipment covered in 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 tap switch.
b. Release the seal by pulling the fuseholder latch ring with a shotgun-type stick or hookstick.
c. Remove the fuse by slowly pulling out on the latch ring.

2) Replace Blown Fuse

a. Check the fuse for continuity.
b. Loosen the four (4) set screws (two at each end).
c. Remove the end fittings from the blown fuse.
d. Install end fittings onto a new fuse.
e. Tighten the set screws.

3) 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 deenergizing, 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.
01.4IB.39100
ArcWhipper® Medium Voltage Loadbreak SF₆ Gas Switch

October 2015