Daya Bay Near Experiment Hall

RPC Gas System

Procedure for replacement of the SF6 and R134A cylinder

(1/31/2011)

DocDB #6072-V3

Changguo Lu, Princeton University

Procedure for replacement of the SF6 and R134A cylinder

1. Purpose

Under normal operation mode a full SF6/R134A cylinder is expected to be depleted in 70/10 days. By the time the weight of the SF6/R134A cylinder drops below the preset limit (1kg) the cylinder needs to be replaced. Detector Control System (DCS) monitors the weight of the cylinder, when it hits the low limit, a warning sign will occur on the DCS screen to remind the shifter it is the time for replacement. This procedure is for the member of the gas team only, the steps listed in this procedure must be strictly followed to keep the RPC system running safely and continuously without interruption.

2. Scope

This document covers the routine procedure for replacing the SF6/R134A cylinder in the gas room.

3. Policy

Princeton University has provided the RPC gas system, is responsible for the safely running this system, however the Daya Bay experiment needs a team to operate and maintain the normal operation of this system. The procedure mentioned in this document should be the routine task for this team.

4. References

The RPC gas system user's manual (DocDB #5441 http://dayabay.ihep.ac.cn/DocDB/0054/005441/001/DayaBayGasSystemUserManual.pdf) is the most comprehensive resource for those who want to know the details of the RPC gas system. It also includes detailed description of the gas switchover panel for the SF6/R134A. If there is any question about the gas switchover panel this manual should be the first place to be consulted.

5. Definitions

6. Precautions and Limitations

This procedure involves two instruments: gas switchover panel and digital scale, while practice this procedure the steps mentioned in this document have to be strictly followed, otherwise wrong digital scale reading and/or interruption of the gas flow may occur that in turn could cause the gas system to halt. The special SF6 cylinder handling and storage precaution can be found in the endnote[i].

7. Parts and Equipment:

ResTek leak detector, see "Procedure for the RPC gas system routine leak check"; wrenches.

8. Procedure

1. Use the cylinder transport cart to bring a full SF6/R134A cylinder to the gas room. Be sure to check cylinder's valve for any leak when the valve is fully closed with the ResTek leak detector and secure the cylinder on the cart before transporting;
2. Push the interlock BYPASS button on the Gas flowmeters crate to temporarily disable the interlock mechanism, buzz should be heard from the Flowmeters crate, the BYPASS timer will last for 5 minutes, at any time push this button again will restart the timer for 5 minutes;
3. Read the mechanical scale of the backup cylinder, make sure this cylinder has enough SF6/R134A in it. If the net weight is less than 1 kg, go to step #4 to replace this cylinder first, otherwise proceed to step #5. Be advised that always check the replaced cylinder's fitting with ResTek before going to next step;
4. To replace the backup cylinder follow the steps below: Close the backup cylinder's valve, disconnect the fitting from cylinder, remove the depleted cylinder, replace a full SF6/R134A cylinder on the mechanical scale, tighten the cylinder fitting, open the cylinder's valve, use ResTek to check the gas tightness of the cylinder fitting to make sure there is no any detectable leak at the fitting, slowly open the ventilation valve #6 for 5 seconds to flush the inlet tube, then close the valve #6;
5. On the gas switchover panel close the valves on the primary supply side (valve#1 and #2) by turning the handle to OFF position; open the valves on the backup supply side (valve#3 and #4) by turning the handle perpendicular to OFF position;

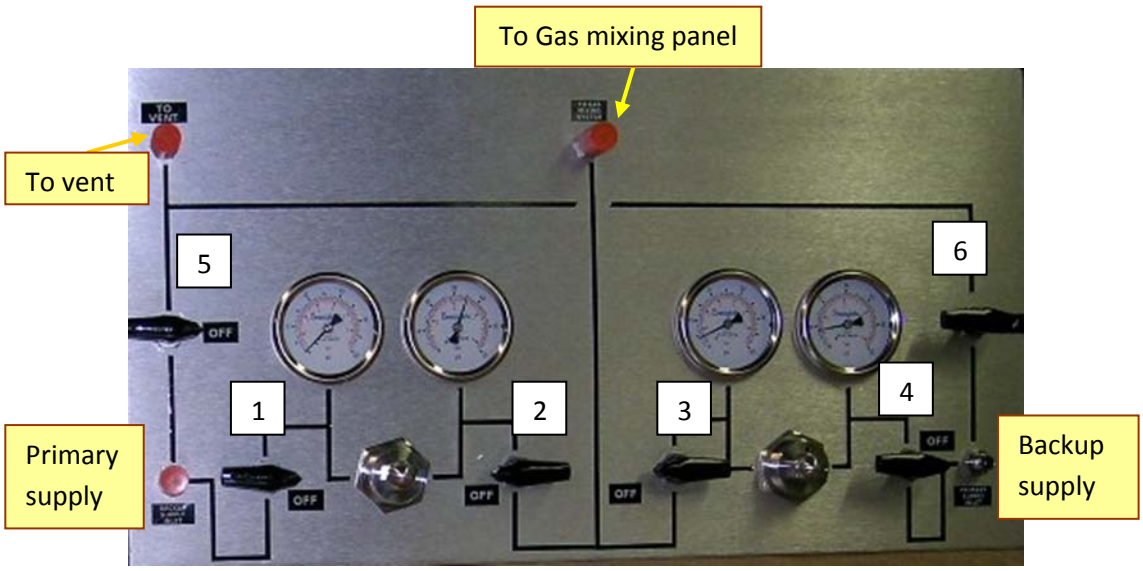

Figure 1. SF6/R134A gas switchover panel

6. Close the depleted SF6/R134A cylinder valve, disconnect the fitting from

cylinder, remove the depleted cylinder, replace a full SF6/R134A cylinder on the platform of the Scaletron digital scale, tighten the cylinder fitting. Make sure the cylinder is placed on the center of the platform;

7. Open the cylinder valve, leak check the cylinder fitting with the ResTek leak detector to make sure it is gas tight;
8. Slow open the ventilation valve #5 to flush the air contaminated gas pipe due to the replacement of the new cylinder, after 5 seconds, close valve #5;
9. Open valve #1, close valve #4;
10. Close valve #3, open valve #2;
11. Leak check the new cylinder fitting once again;
12. Wait until the BYPASS buzz to stop (in ~ 5 minutes);
13. Record the time, date and the digital scale reading on the Status crate for this replacement on the Gas System Record Book;
14. Use the cylinder transport cart to remove the empty gas cylinder from the gas room. Secure the cylinder on the cart, install the valve cap and bring it into the assigned empty cylinder returning area outside of SAB.

---

[i] **HANDLING and STORAGE of SF6**

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Sulfur Hexafluoride IN YOU.

Do not eat or drink while handling chemicals. Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of Sulfur Hexafluoride could occur without any significant warning symptoms.

STORAGE AND HANDLING PRACTICES: Sulfur Hexafluoride should be stored in dry, well-ventilated areas separate from incompatibles, such as strong oxidizing agents, and away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits. Post “No Smoking or Open Flames” signs in storage or use areas. Since Sulfur Hexafluoride is non-corrosive, any of the common structural metals may be used under ordinary conditions.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Store in cool, dry, well-ventilated fireproof area, away from flammable materials and corrosive atmospheres.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS (continued): Store away from heat and ignition sources and out of direct sunlight. Do not store near elevators, corridors or loading docks. Do not allow area where cylinders are stored to exceed 52° C (125° F). Use only storage containers and equipment (pipes, valves, fittings to relieve pressure, etc.) designed for the storage of Liquid Sulfur Hexafluoride. Do not store containers where they can come into contact with moisture. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over.

Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices. The following rules are applicable to situations in which cylinders are being used:

Before Use: Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap, if provided, in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap, if provided. Mark empty cylinders “EMPTY”.

NOTE: Use only DOT or ASME code containers. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-*2 "Oxygen Deficient Atmospheres*".
PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (e.g., Nitrogen) before attempting repairs.