Daya Bay Near Experiment Hall

RPC Gas System

Procedure for replacement of the argon cylinder

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1. Purpose

Under normal operation mode 5 full argon cylinder is expected to be depleted in 17 days. By the time the pressure of the primary argon cylinders drops below the preset limit (100 psig) the auto-switchover panel for the argon gas will automatically switch to backup side of the cylinders. Detector Control System (DCS) monitors the pressure of the argon cylinders, 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, 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 argon cylinders.

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 automatic gas switchover panel for the argon cylinders. If there is any question about the automatic gas switchover panel this manual should be the first place to be consulted.

5. Definitions

6. Precautions and Limitations

This procedure involves the automatic gas switchover panel and high pressure gas cylinders, while practice this procedure the steps mentioned in this document have to be strictly followed, otherwise personal injury and/or interruption of the gas flow may occur that in turn could cause the gas system to halt. The general compressed argon cylinder handling and storage rules can be found in the endnote[i]. The person who performs this procedure must have taken and passed compressed gas training.

7. Parts and Equipment:

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

8. Procedure

1. Secure 5 full argon cylinders with caps on the transport cart and bring them to the gas room, check their valves for any leak when the valve is fully closed with the ResTek leak detector;
2. Just for the purpose of preventing any unnecessary gas system interruption due to the cylinder replacement, push the interlock BYPASS button to temporarily disable the interlock mechanism, buzz should be heard from the Status Crate. If within 5 minutes you won’t be able to finish replace all 5 cylinders, you may push this button again at the end of 5 minutes;
3. Identify the depleted gas cylinders, either on left side or on right side of the cylinder batch by checking the primary pressure gauge, for example the left side has been depleted, thus the primary gauge of left side should show ~100psig, the right side gauge should show much higher pressure. The internal valve has already switched the gas supply side to the right automatically. By turning the arrow of the knob #5 from left to the right, this automatic switch valve will re-establish the differential pressure trigger mechanism for the right side cylinders and make it ready for the next action when the right side cylinders are depleted. Close the depleted side inlet valve #2;

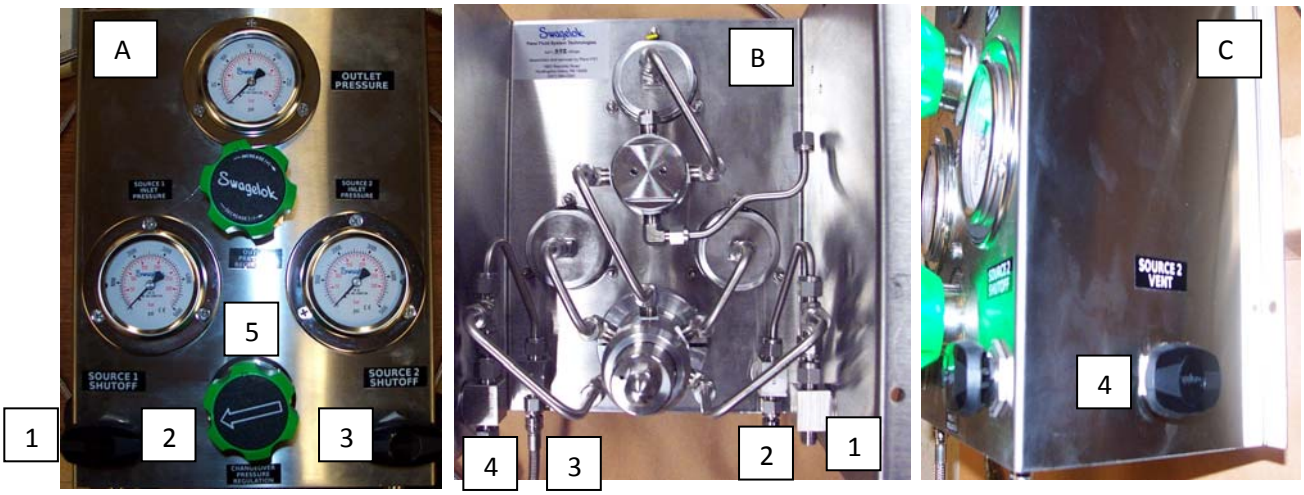

Figure 1. Argon automatic gas switchover panel, (A) front view; (B) rear view; (C) right side view.

4. Close all 5 depleted argon cylinder’s valves and the valves on the manifold, disconnect the fittings from cylinders, remove the depleted cylinders, put cylinder caps back on, replace the full argon cylinders, tighten the cylinder fittings and secure these new cylinders;

5. Open the cylinder valve one by one, leak check the cylinder fittings with the ResTek leak detector to make sure they are gas tight;
6. Slow open the ventilation valve #1 to flush the air contaminated gas pipe due to the replacement of the new cylinders for a few seconds, then close valve #1;
7. Open valve #2, now left side is ready to supply gas if the right side cylinders should deplete later;
8. Leak check the new cylinder fittings once again;
9. Wait until the BYPASS buzz to stop (in ~ 5 minutes) and the entire gas system returns to normal operation mode;
10. Record the time and date of this replacement on the Gas System Record Book;
11. Put the empty cylinders' cap on, remove them from the gas room, secure them on the transporting cart, bring them into the assigned empty cylinder returning area outside of SAB;
12. After about 17 days the right side argon cylinders will be depleted, and right side primary pressure will drop to ~100 psig, the switchover panel will automatically swap the gas supply from right to left. To replace the right side depleted cylinders we need to repeat the above procedure again, only difference is changing the above operation on left side to right side (valve #1 ←→ valve #4 and valve #2 ←→ valve #3).

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

Follow the instructions in the Compressed Gas Association (CGA) publication P-1, "Safe Handling of Compressed Gases in Cylinders." Don't tamper with safety devices.

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.