Hazards associated with the gas system and how to mitigate them

Do not enter the gas shack if the rotating red light at the entrance is on. This warns of an oxygen deficiency.

In General the Gas Mixing shack can be a hazardous place – BE AWARE OF YOUR ENVIRONMENT.

There are hazardous gas detectors that will cut off any gas flow at 10% of the lower explosive limit and oxygen deficiency monitors that will alarm if there is a less than 19% oxygen level.

Gas bottles are a hazard to move. Breaking the stem on a gas bottle can cause flying debris

Never move a bottle without the cap fastened. Always earthquake brace bottles at two points in the place they are to be used or stored. Always keep control of the bottle with two hands while moving.

The gases used in the calibration routine present a cryogenic hazard.

Be certain that the bottle is plumbed into the correct gas circuit and the fittings are tight before opening. When removing a bottle be certain to valve off the gas; At the bottle first, at the gas panel second. Slowly bleed the lines before disconnecting.

There is a marked step up both on to the gas pad and into the gas shack.

Be aware. It easy to tripp while making a step into empty space when coming out of either one.

Side of racks must be removed.
To access some of the valves the side of the rack should be removed. This can fall rapidly and cause alarm or an injury. The rack side panel should be supported by one hand while turning the locking screw. Two hands should be used to lift and carry the side panel out of the way.
Calibration of HAD and O2 Sensors in Return Line

Name: ________________________________
Date ________________________________

This procedure requires access to rack B620D-10 to permit the chamber to be bypassed, and 2 operators in the gas shack at times during the purge procedure.

- Inform BaBar shift leader of planned activity.
- Record current readings. The DPM is located in the bottom of rack B636-04.

<table>
<thead>
<tr>
<th>Initial Reading</th>
<th>Reading on HAD (%LEL)</th>
<th>Reading on DPM (%LEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return Line HAD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Bypass chamber and flush lines**
- Put chamber in Rest mode.
- Set all flowmeters to 0.
- Close VVM-38 (rack 10)
- Close VVM-40
- Open VVM-39
- Close VVM-45 (circulation flow return to chamber)
- Open VVM-46 (circulation line exhaust)
- Close VVM-101 (purifier input)
- Close VVM-65 and VVM-69 (purifier valves)
- Turn off heater.
- Open VVM-44 (purifier bypass)
- Increase Helium regulator pressure to 1400 mbar.
- Select VME mode
- Open VVPC-2, 3, 4, 6 and 7.
- Select “Output” sample point.
- Set “Circulation” flowmeter to 4 lt/min.
- Set compressor to “Manual”, 30%.

**Note: 2 operators are required at this point.**

- One operator: Open Helium high flow rotameter in rack 4 one turn.
- Second operator: Start compressor on pump panel in EPICS and immediately go to the front of rack 2 to adjust circulation flowmeter to keep circulation pressure in allowed range.
- First operator: In concert with the other operator, open the He high flow rotameter until the maximum flow is achieved.
- Flow helium until isobutane <0.05% on gas analyzer and HAD sensor reads < 5% LEL.
- Reduce Helium regulator pressure to 800 mbar.
- Select REST mode.
- Close helium rotameter.
- Close circulation mass flowmeter.

**Check calibration of O2 Meter**
- Disconnect O2 meter inlet line at the check valve. Connect air pump to inlet line.
- Turn on air pump and adjust outlet pressure so that flow registers on O2 meter flowmeter. Operate for 5 minutes. Reading on Display unit: ________________
- If reading is not 20.9 ± 1.5 %, adjust calibration knob so that reading is 20.9%
- Disconnect air pump and reconnect O2 meter inlet line to check valve.
- Remove HAD sensor from return line.
- Disconnect sensors, and replace sensors with calibrated units obtained from Ron Badger at the EFD electronics shop, Bldg. 104, X 2757.

**Check zero of HAD sensors:**
- Expose the new HADs to air for at least 2 minutes, record the values below.
- Adjust the zero of the sensor or DPM ONLY if the magnitude of the reading is greater than 2% of LEL.

<table>
<thead>
<tr>
<th>“Zero” Reading</th>
<th>Reading on HAD</th>
<th>Zero Adjusted?</th>
<th>Reading on DPM</th>
<th>Zero Adjusted?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return Line HAD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Record hardware tracking numbers of new and old sensors:

<table>
<thead>
<tr>
<th>Tracking # (new)</th>
<th>Tracking # (old)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAD9 (front bulkhead flush)</td>
<td></td>
</tr>
<tr>
<td>HAD10 (rear bulkhead flush)</td>
<td></td>
</tr>
</tbody>
</table>

- Pressurize lines with Helium to check for leaks.
- Select VME mode
- Open VVPC-2, 3, 4 and 7.
- Set helium low-flow rotameter to 2 lt/min.
- Flow gas until DCH inlet pressure is 10 mbar.
- Select REST mode.
- Close helium low-flow rotameter.
- Check for leaks near HAD and O2 sensors.
Flush lines with Helium.

Select VME mode

Open VVPC-2, 3, 4, 6, 7

Set compressor controller to MANUAL, 27%.

Set circulation flowmeter to 6 lt./min.

Note: 2 operators are required at this point.

One operator: Open Helium high flow rotameter in rack 4 one turn.

Second operator: Start compressor on pump panel in EPICS and immediately go to the front of rack 2 to adjust circulation flowmeter to keep circulation pressure in allowed range.

First operator: In concert with the other operator, open the He high flow rotameter until the maximum flow is achieved.

Use “Output” sample point to monitor gas composition.

Flush for ~1 volume change, approximately 10 minutes.

Select Rest mode

Close helium rotameter.

Flush lines with Helium-Isobutane.

Open VVM-101

Open VVM-69 or 65

Turn on heater

Close VVM-44

Set Helium High-flow mass flowmeter to 8 lt/min (for 80:20 mixture).

Set Isobutane High-flow mass flowmeter to 1.99 lt/min.

Select VME mode.

Open VVPC-3, 4, 6, 7 & 8.

Start Compressor.

If necessary, adjust circulation flowmeter to keep circulation pressure in allowed range.

Verify that the input mixture is 80:20 using the “Fresh Gas” sample point.

Select “Output” sample point.

Flush until Isobutane concentration is 20.0 ± 1.0%.

Select REST mode.

Set all flowmeters to 0.

Set compressor to Automatic.

Open VVM-45.

Close VVM-46.

Open VVM-38.

Open VVM-40.
- Close VVM-39.
- Restart gas system using the “Rest(isobutane) to Running Mode” procedure.
- File this checklist in the calibration section of the drift chamber binder in the gas hut.
- Enter HAD data in the BaBar Hardware Tracking Database.