UCD CSN Technical Information #402C

Gas Cylinder Change

Chemical Speciation Network
Air Quality Research Center
University of California, Davis

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DOCUMENT HISTORY

Revision	Release Date	Initials	Section/s Modified	Brief Description of Modifications
1.2	5/11/2021	RY, AB, JG	9	Updated the procedure used for installing/uninstalling gas cylinders
1.3	10/31/2022	AB, YL	9	Added “Auto-Zero” procedure to be used after air gas cylinder replacement

TABLE OF CONTENTS

1. PURPOSE AND APPLICABILITY

The subject of this technical information (TI) concerns changing gas cylinders for carbon analysis of quartz fiber filters.

2. SUMMARY OF THE METHOD

Carbon content is measured from quartz fiber filters using thermal/optical transmission-reflectance spectrometry. These instruments, referred to as carbon analyzers, are prepared for each day of analysis. Punches from quartz filters are inserted into the carbon analyzers, where they undergo a specified heating protocol. The thermograms generated during analysis provide the means for carbon content quantification.

3. DEFINITIONS

- **He+Ox:** Oxygen premixed with helium gas.
- **Helium (He):** Gas used for carbon analysis.
- **Hydrogen (H):** Gas used for carbon analysis.

4. HEALTH AND SAFETY WARNINGS

4.1 Gas Cylinders

It is recommended that the lab technicians use caution when handling all support gas cylinders and regulators, and always have cylinders properly chained to a safety rack.

NOTE: Hydrogen is a flammable gas and extra precautions should be used with the hydrogen gas lines from the supply cylinder to ensure all fittings are connected and must be leak tested each time a new cylinder is installed. The pressure of the hydrogen gas line should be kept under 15 psi at all times.

5. CAUTIONS

Not applicable.

6. INTERFERENCES

Not applicable.

7. PERSONNEL QUALIFICATIONS, DUTIES, AND TRAINING

Only trained lab personnel designated by the Laboratory Manager may change gas cylinders.

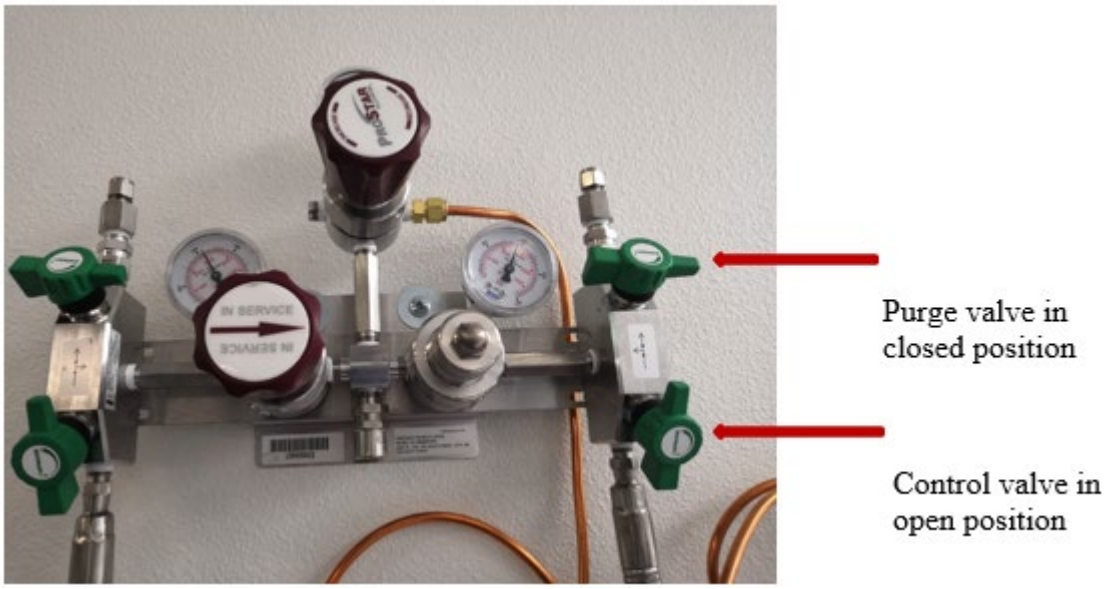
8. EQUIPMENT AND SUPPLIES

- Helium gas tank, ultra-high purity
- Hydrogen gas tank, ultra-high purity
- Oxygen (10%) in helium, premixed, purified
- Methane (5%) in helium, premixed, purified
- Air, ultra-zero

9. PROCEDURAL STEPS

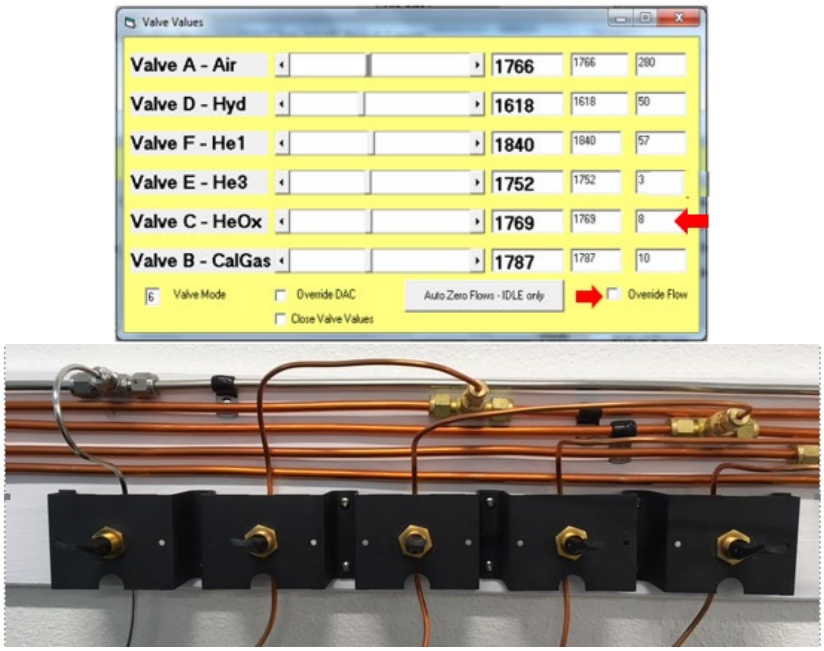
Uninstalling the empty cylinder:

1. If the pressure reading on the cylinder pressure gauge is below 100 psi, the cylinder is ready to be changed.
2. For gases with a backup cylinder inlet, which are Air and Helium, close the control valve and main gas cylinder valve on the top of the cylinder being changed by turning them clockwise. Then open the main valve and control valve of the backup cylinder and change the regulator sign to “in service” direction.



3. For the gases with no backup cylinder inlet, which are Helium + Oxygen, Helium + Methane, and Hydrogen, put the carbon analyzers on “Standby” mode before any of these gas tanks need to be changed.

   NOTE: When changing He+Ox tank, while the instruments are on “Standby” mode, open the “Valve Values” window from the “status” page of the instrument’ software. Click on “Override Flow”. Set the flows Set the flow for HeOx to 0 cc/min when changing He+Ox (this will prevent the software from closing).



4. Turn the control valve to the "Closed" position for all instruments for the gas to be changed.

5. Close the main gas cylinder valve on the top of the cylinder being changed by turning it clockwise when viewed from above.

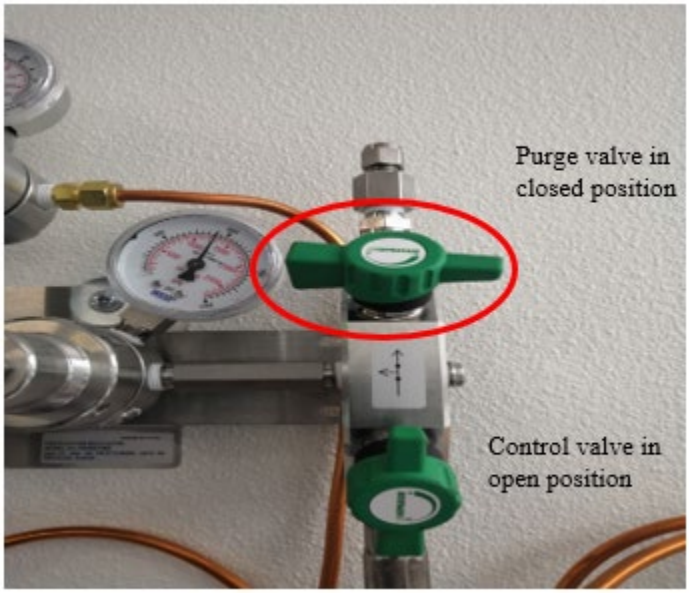
6. To remove the regulator, loosen the regulator fitting that is threaded into the neck of the compressed gas cylinder with a 1-1/8 inch wrench. Turn the wrench in the directions shown for left-hand and right-hand threads respectively.

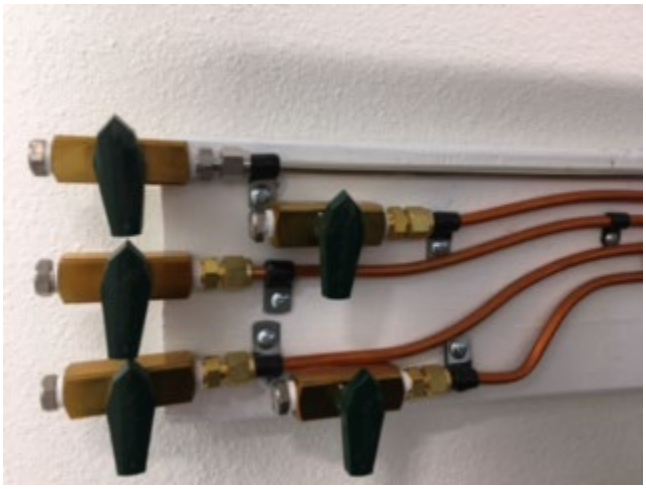
   NOTE: Regulators for different gases have different thread systems. Hydrogen, Air, Helium + Oxygen, and Helium + Methane use a **left-hand thread** while Helium uses a **right-hand thread**.

7. Turn the fitting until the regulator assembly can be removed from the cylinder. Leave the system supply line connected to the regulator assembly.
8. Hang the regulator assembly out of the way and carefully thread a protective cap on the cylinder until the cap is fully seated.
9. Label the empty cylinder, unchain it from the wall, and transfer it to the empty cylinder cage.

Installing a replacement cylinder:

1. Locate the replacement cylinder outside the cage and transfer it to the cylinder dolly.
2. Transfer the cylinder to the designated spot inside the lab and attach the safety chain.
3. Remove the protective cap from the gas cylinder.
4. Remove the plastic wrap and the cylinder outlet plug. Wipe the outlet with laboratory wipes and spray with compressed air to remove any debris.
5. Attach the regulator assembly by carefully threading the regulator coupling into the cylinder outlet. Tighten the fitting only finger tight.
6. Briefly open the cylinder valve on top of the cylinder for one second to flush out any leftover debris.
7. Continue tightening the fitting with the wrench until it is snug.
8. For the gases with backup cylinder inlet, which are air and helium, open the control valve. Slowly open the cylinder main valve on top of the cylinder turning in a counter clockwise direction when viewed from above until full pressure (~2000-3000 psi) is noted on the cylinder pressure gauge.
9. Close the main cylinder valve and open the purge valve (red circled valve in the image below) on top. Once the line is depressurized, close the purge valve and turn on the main cylinder valve again. Repeat Steps 9 two more times to flush the gas line.
10. For the gases without backup cylinder inlet, which are Helium + Oxygen, Helium+Methane, and Hydrogen, slowly open the green valve (see image below) at the end of the corresponding gas line on the wall to purge until the pressure gauge slowly reduce reading. Once the line is depressurized, close the purge valve and turn on the main cylinder valve again. Repeat Steps 9 two more times to flush the gas line.





11. If the tank change takes place in the middle of the day, skip the leak check. Open the gas line valves for the gas replaced.

    NOTE: If - Helium+Oxygen is replaced, uncheck the “Override Flow” in the Valve Values table before taking the analyzers out of standby.

Leak Check:

1. Perform a leak check when 1) a Hydrogen tank is replaced; and/or 2) at the end of day if any gas tank other than Hydrogen is replaced during the day.
2. Pressurize the gas line and then close the main cylinder valve. Meanwhile keep the gas line valves to the instruments closed.

3. Mark the cylinder pressure on the regulator.
4. Check the pressure reading in the morning of the following day. If the pressure is significantly lower than the original mark, there is a leak. Tighten the fittings and repeat the leak check for one hour.
5. Notify the Lab Supervisor if the leak persists.

Auto-Zero Procedure: "Auto-Zero" procedure is also performed after replacing gas tank for Helium+Oxygen or when the measured calibration areas of any instrument dramatically decrease. To perform "Auto Zero":

1. Create a copy of the instrument's active "InstrumentParameters.txt" file in "C:\SunsetOCEC\OCEC1153\OCECPAR", and save the file as "InstrumentParameters_mmddyy.txt" with that day's date (e.g., InstrumentParamaters_031521.txt).
2. When the analyzer in "Idle" status, open the "Valve Values" window by clicking on "Show Valve Value Table" box from the program.
3. Click on "Auto Zero Flows – IDLE only" tab.
4. After auto-zero procedure is done, compare the 'He1B3, He1B2, He1B1, He1A' values in active and saved Instrument Parameters files. Ideally, 'He1B3, He1B2' values should be zero and 'He1B1, He1A' values should be comparable between two files.
5. Perform "Auto-Zero" procedure two times when necessary.

10. QUALITY ASSURANCE AND QUALITY CONTROL

Not applicable.

11. REFERENCES

Not applicable.