

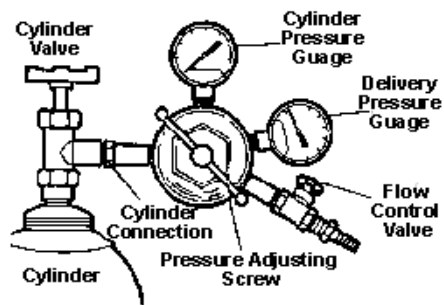
## M-Braun Glovebox System Operation Procedure

- This instruction manual includes four parts:
  1. [Touch panel operation](#)
  2. [Sample transferring in/out of glovebox](#)
  3. [Maintenance of glovebox](#)
  4. [O<sub>2</sub> sensor maintenance](#)
- Before you start to use the glovebox, put on gloves. Also, covering the gloves with baby powder helps to remove moisture on the gloves.

### 1. Touch panel operation:

-The touch panel is located at top left of the chamber box (right side box for double, left side for triple)

- 1.1. Always check the gas cylinder pressure, as well as O<sub>2</sub> readings on O<sub>2</sub> analyzer and box pressure on the screen before you use the glovebox.
  - N<sub>2</sub> cylinder pressure should read at least 150 psi before use. The tank should be replaced if pressure drops below this threshold value.
  - N<sub>2</sub> delivery pressure should optimally read 80 psi and, at minimum, 60 psi. Pressure readings below 60 psi will cause circulation to shut off. Generally, the pressure adjusting valve should not be moved.
  - Cylinder and flow control valves should be fully open. Partially closed valves could interfere with optimal performance of the glovebox.
  - A Teledyne O<sub>2</sub> sensor is located on top of either box. O<sub>2</sub> concentration should read ~0.2 ppm for triple box and ~0.5 ppm for the double. Always check charge status of sensor before glovebox use (see [4.1](#)).
  - Box pressure varies between 0.3 and 13.5 psi. Before inserting hands, use foot pedal to decrease box pressure if above 5 psi.



#### Note:

-If the pressure is too high in the box, a fail-safe mechanism will turn off circulation. Most often this occurs when you insert your hands too quickly into the box. See [1.2](#) to turn circulation back on.

### 1.2. Circulation ON/OFF:

-The circulation should always be on during normal operation. Only during system maintenance should the circulation be shut down. (Example: glove change, oil change, quick purge, or regeneration, etc.)

- Turning circulation off  
-Main screen → touch “Function” → touch “Circulation” (green=on → red=off)
- Turning circulation on

-Main screen → touch “Function” → touch “Circulation” (red=off → green=on)

### 1.3. Quick Purge:

-Main goal: decrease the high O<sub>2</sub> level of the glovebox if O<sub>2</sub> concentration is above 50 ppm. Normally, it takes at least 20 to 30 minutes to bring O<sub>2</sub> back from 100 ppm to 50 ppm. Several tanks will be required if the box was recently crashed.

- Step 1: turn off the circulation (see [1.2](#))
- Step 2: Main screen → touch “Function” → touch “Quick purge” (red=off → green=on).

## 2. Sample transfer (including small/large antechamber)

- Small antechamber location: on either side of boxes, with two doors attached

### 2.1. *Small antechamber operation*

- Eppendorf and Falcon tubes should be wrapped with parafilm at least once to make sure no liquid will come out during the refill/evacuation process. Eppendorfs should be placed in container to minimize bouncing. Falcon tubes should be left standing upright, otherwise liquid will be pulled out during evacuation cycles.
- Step 1: Ensure large antechamber is not currently in use (see [2.2](#)).
- Step 2: Check pressure gauge (attached on the top of the small antechamber) The pressure should be always at -30 in Hg when the antechamber is not in use.
- Step 3: Break vacuum by turning the valve from the “Close” position to the “Refill” position. Wait until the pressure gauge reading becomes zero. Turn the valve from “Refill” back to “Close.”
- Step 4: Open the outside door → load the sample → close the door by rotating the door handle until you feel it become tight, then go a quarter turn further. Make sure the locating tabs on the door are rotated from the entrance slots.

**Note:** Over tightening of the door may cause damage.

- Step 5: Turn the valve from the “Close” position to “Evacuate” position. Wait until the pressure gauge reading become -30 in Hg. (at least 3 seconds at pressure -30 in Hg) Then turn the valve from “Evacuate” back to “Close.”
- Step 6: Repeat step 5 at least two more times to ensure complete O<sub>2</sub> removal.

**Note:** Three evacuation cycles is the minimum. If pressure gauge does not pull to -30 in Hg, at least one more evacuation cycle is required.

- Step 6: After three evacuate/refill cycles, bring the valve back to the close position. (Now the pressure should be zero). Open the inside door. Unload your samples. Close the inside door. Bring the small antechamber back to vacuum.

**Note:** Do not turn the door handle too hard.

### 2.2. *Large antechamber operation for sample/equipment/utilities transferring*

- Buffers should be thoroughly degassed on Schlenk line with last step using long vacuum cycle before bringing through antechamber. Buffer bottle lids should be left off. Nothing should be brought in wet, otherwise water can enter vacuum pump.
- Step 1: Ensure small antechamber is not currently in use (see [2.1](#)).

- Step 2: Check the pressure gauge (attached on the top of the big antechamber). The pressure should be always at -30 in Hg when the antechamber is not in use.
- Step 3: Break vacuum: touch the blue box on the top right of the touch panel display. The page will change to the operation mode of the large antechamber. Operation screen → touch “Refill” (red=off → green=on). Wait until the pressure gauge reading becomes zero. → touch “Refill” (green=on → red=off).
- Step 4: Open the large antechamber by rotating the door handle counterclockwise and load your materials.
- Step 5: Close the large antechamber by rotating the door handle clockwise.

**Note:** Do not close the door too tight. Only go another quarter of turn when you rotate and feel the door is tight.

- Step 6: Evacuate: Operation screen → touch “Evacuate” (red=off → green=on). Wait until the pressure gauge reads -30 in Hg. → touch “Evacuate” (green=on → red=off)
- Step 7: Repeat Steps 3 and 6 at least 4 times to reduce O<sub>2</sub>.
- Step 8: Refill large antechamber after fourth evacuation cycle. Turn off refill. Open inside door. Pull tray into box, unload samples (reload samples if necessary), and close the inside door when finished.

**Note:** Do not close door too tight. Turn until the door feels tight and then rotate an additional quarter turn.

- Step 9: If necessary, open outside door and unload tray. Close door. Repeat Step 5 to evacuate the large antechamber.

### 3. Maintenance of glovebox

#### *3-1 Regeneration of the glovebox*

- Preparation and required equipment
  1. Instructional guide located [here](#).
  2. N<sub>2</sub> and H<sub>2</sub> tanks with >1000 and >100 psi, respectively, located in hall closet.

#### *3-2 Vacuum pump oil change of the antechamber*

- Preparation and required equipment
  1. Wrench
  2. 4 mm T-handle Allen wrench
  3. 5 L plastic beaker as oil pan
  4. New oil (VWR No. 19)/old oil bottle for disposal
  5. Odor element & mist filter (change ~once per year)
  6. Gloves

**Note:** Pump oil should be changed on vacuum pumps once oil changes color (from yellow to reddish) or after a regeneration (see [3.1](#)). No exceptions.

- Step 1: Turn off vacuum pump
  - 1.1 Shut down circulation (see [1.2](#))

1.2 On same page (when circulation is red), touch vacuum pump (green=on → red/off) to turn off vacuum for large antechamber. For small antechambers, ensure valve is switched to “Close” (see [2.1](#))

1.3 Turn off vacuum pump (switch from I to O). Unplug wire.

**Note:** Important! Oil change must be done under no power supply.

- Step 2: Drain and replace oil. Clean mist filter.
  - 2.1 Remove vacuum line by loosening butterfly nut. Remove oil cap (either) and oil cap on drain.
  - 2.2 Place oil beaker under drain. Open and drain oil.
  - Note:** Oil will be hot.
  - 2.3 Close drain and add new oil (no more than eighth full). Drain again.
  - Note:** Used oil must be properly disposed. Place into appropriately labeled chemical waste disposal bottle.
  - 2.4 While oil is draining, remove oil mist filter from pump. Remove C-clamp by unscrewing red nut. Disconnect tubing running to oil ballast.
  - Note:** Tubing and mist filter will contain oil; take care to avoid spilling oil.
  - 2.5 Open mist filter using T-handle Allen wrench. Be careful with the rubber O-ring seal between caps.
  - 2.6 Take out odor element and mist filter, in order. Clean top and bottom caps with tissue wipes.
  - 2.7 Replace odor element or mist filter if necessary. Reassemble.
  - 2.8 Close valve on drain. Refill until oil level is full.
  - 2.9 Reconnect drain plug, oil cap, and vacuum line. Put the mist-filter box back on pump. Reconnect drain line from oil ballast to mist-filter. Ensure all joints are tight.
  - 2.10 Reconnect power cable. Turn on pump (switch from O to I). Turn on vacuum pump by touching vacuum on operation screen.
  - 2.11 Check O<sub>2</sub> level. If less than 15 ppm, turn on circulation. If above 50 ppm, perform quick purge (see [1.3](#)) until O<sub>2</sub> is below 15 ppm.

### **3-3 Glove change**

- Equipment required:
  1. Sealing cap (inside box)
  2. New gloves
- Step 1: Seal the end of the glove with the sealing cap from inside of the box
- Step 2: Take off the two O-rings from top of the glove
- Step 3: Replace the old glove with a new glove.
  - Note:** Try to remove as much air as possible from the new glove
- Step 4: Replace the two O-rings over the new gloves
- Step 5: Slowly open the sealing cap until the new glove is pressurized
- **Note:**
  1. O<sub>2</sub> level: A quick purge ([1.3](#)) is necessary if O<sub>2</sub> level is higher than 50 ppm.
  2. Make sure the antechambers are under vacuum after use.

### **4. O<sub>2</sub> electrode maintenance**

- The Teledyne O<sub>2</sub> sensor on top of either box gives an accurate analog readout of O<sub>2</sub> concentration in the box. In principle, O<sub>2</sub> diffuses into an electrochemical device which produces an electrical signal that is linearly proportional to O<sub>2</sub> concentration. We have

found the standard MBraun O<sub>2</sub> sensors give false O<sub>2</sub> readings due to cross-reactivity with water vapor in the box. This sensor does have that problem.

- The sensor has 7 settings:
  - “x1” – Default setting. O<sub>2</sub> concentration scale on readout is times 1.
  - “x10” – O<sub>2</sub> concentration scale on readout is times 10. After catalyst regeneration, oxygen concentration is in this range.
  - “100” – O<sub>2</sub> concentration scale on readout is times 100. Typically only this high when a glove is changed.
  - “x1000” – O<sub>2</sub> concentration scale on readout is times 1000. This concentration requires immediate attention.
  - “Cal” – For calibration purposes. Sensors are only required to be calibrated if electrochemical device is replaced or motherboard replaced.
  - “OFF” – Self-explanatory. Required to be placed on this setting while charging.
  - “BATT TEST” – Self-explanatory. Switch to this position to determine charge left on battery. A battery test with readout between 8 and 10 gives accurate readings; anything below 8 will require a charge.
- The sensor operates solely on battery power. A fully charged battery should provide accurate O<sub>2</sub> readings for about a month. Symptoms of a drained battery include high readings and/or quickly changing readings.

- ***4-1 Recharging O<sub>2</sub> sensor***

- Step 1: Twist outer-most knob clockwise. A reading below 8 requires a recharge. Switch knob into the “OFF” position.

**Note:** Caution! The sensor must be switched to the “OFF” position before charging. Failure to do this will result in short-circuiting the motherboard.

- Step 2: Plug the recharge cable into male end of sensor. An orange light will light up indicating the sensor is charging.

**Note:** The sensor will not give a reading during the charge. Leave a note on the sensor indicating a charge is occurring.

- Step 3: Leave charging overnight for optimum charge, although a short 4 hour charge is sufficient if absolutely necessary.
  - Step 4: Unplug the charging cable. Switch knob from “OFF” to “BATT TEST” to determine battery capacity. Return to “OFF.”
  - Step 5: Switch knob from “OFF” to “x1.” O<sub>2</sub> concentration readout should appear in a few seconds.

**Note:** Occasionally, the needle will remain at zero. Switching the knob from “x1” to “x10” and then back will alleviate this issue.