

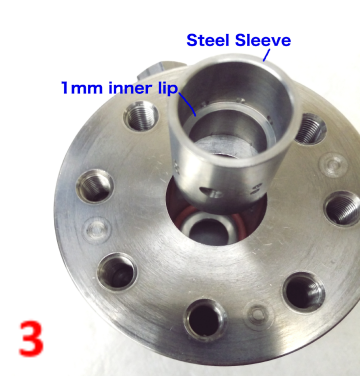
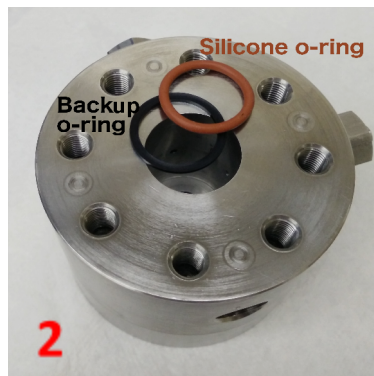
## NIST HP-BioSANS McHugh Cell Assembly Instructions

### GENERAL RULES

1. ALWAYS wear safety goggles and gloves when working with this pressure cell.
2. NEVER look directly into the ends of the cell when it is under pressure. Use a mirror.
3. ALWAYS use brass, wood, or plastic tools when working near the windows.
4. ALWAYS push against the o-ring. NEVER push or pry against the windows or the cell body.
5. CLEAN, CLEAN, CLEAN - Have a clean workspace and have lint-free towels at hand. To hold pressure, the sealing surfaces must not be marred or dirty. Remember that your hands are also a major source of contamination.
6. ALWAYS use equipment that is rated for the maximum operating pressure (60 000 psi for LIPSS), even if you plan to only use lower pressures.

### CELL ASSEMBLY

#### Steps



- Set up a clean space on the bench, covered with paper towels so you can work on a dry clean area, where the sapphire windows will not get scratched.
- Set the cell body on one of the end caps, but don't bolt anything down (the cell bodies and end caps have engraved markings to let you know which end goes on what side). (step 1)
- Insert one backup o-ring<sup>1</sup> into the cell body. Push it down until it meets the support face of the end cap. The backup ring should have the cupped side facing up (step 2)
- Insert a silicone o-ring on top of the backup o-ring.
- Insert the steel sleeve (with a 1-mm inner lip) into the body, and push it down until it is fully seated against the two o-rings (step 3)
- Put an o-ring around one of the sapphire windows, about one-third of the way from one end. Gently slide the window into the steel sleeve, without tilting the window<sup>2</sup>. Don't force it, or you will chip the window. The o-ring will ride at the top of the cell body: it should be pulled into the body with the window.
- Insert a backup o-ring on top of the first o-ring, with the cupped side down. Push it down, past the bevel on the window.
- Place the second end cap on top (gently, since the window will not be fully seated yet). Be sure the alignment marks between the body and end cap are matched.
- Tighten the bolts<sup>3</sup> slowly in a cross pattern with a minimum of pressure to seat the window evenly. Bolt the end cap down in a cross pattern. Just snug the bolts at this point. Do not torque them down yet.
- Flip the assembly over, being careful to hold the loose bottom cap. Remove the unattached end cap and the two o-rings on this side.
- Put an o-ring near the middle of the second window. Slowly insert the window into the metal sleeve. Then alternately push the window down and tuck the o-ring into the body. Seat the o-ring with an extra sleeve if needed.
- Place the backup o-ring with the cupped side facing the silicone o-ring, and push it down, past the bevel on the window.
- Place the end cap on top (gently, since the window will not be fully seated yet). Be sure the alignment marks between the body and end cap are matched.
- Tighten the bolts slowly in a cross pattern with a minimum of pressure to seat the window evenly. Bolt the end cap down in a cross pattern. Just snug the bolts at this point. Do not torque them down yet.

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<sup>1</sup> The best backup o-ring to use depends on the range of pressures you will need. For broader pressure ranges, the white teflon solid o-rings are a good choice.

<sup>2</sup> Ask your local contact to provide test sapphire windows if you want to practice this step ahead of time.

<sup>3</sup> The bolts should have intact threads and heads; do not use damaged bolts. The bolts should be lightly greased to prevent galling.

The McHugh cell has 4 ports, and one of the window cones is coated with a layer of cadmium to reduce cell activation during alignment. The coated window cone will face the incoming neutron beam, while the opposite window will face the detector.

Place the McHugh cell in front of you, with the side of the coated window cone facing you. The top, bottom, and right-side ports need to be plugged: there are 3 glands and 3 plugs available for this purpose. One of the plugs is shorter: this is the bottom plug. Hand tighten the glands at this point. The left-side port needs to be fitted with the adaptor for the nitrogen pressure line.

Place the McHugh cell on a vice, using the half-moon adaptors, so that one end cap of the cell will be facing up. Torque the bolts down in a three-step process. Always use the torque wrench, and tighten the bolts in a cross pattern. Alternate between ends of the cell. The torque specifications for the three steps are 8 ft-lb., 16 ft-lb., then 25 ft-lb (96 in-lb., 192 in-lb., and 300 in-lb, respectively).

After torquing the bolts, you can place the McHugh cell sideways on the vice (remove the half-moon adaptors) and torque the glands on the cell ports (25ft-lb). Now it is necessary to seat the windows by pressurizing the sample with nitrogen, which also provides a quick-check for leaks.

### **SEATING THE WINDOWS WITH NITROGEN. WEAR GOGGLES!**

- Connect the high outlet pressure regulator to the nitrogen tank.
- Connect the McHugh cell to the line and valve that is fitted to the regulator. Use 2 wrenches to hand-tighten the gland on the pressure line (do not torque it).
- The valve near the cell should be closed at this point. Be sure the regulator is closed, and open the tank. With the valve to the cell now open, use the regulator to slowly increase the pressure in the line and cell to 500 psig.
- Close the nitrogen tank (main valve).
- Allow approximately 5 minutes for the o-ring seals to seat (check the pressure readings on the regulator, which should not go down if the cell is holding pressure)
- Crack the smaller valve near the regulator to vent the pressure from the regulator and line.
- Close the regulator valves.
- Vent the cell by SLOWLY opening the valve near it, while listening for the (very small) rush of nitrogen, confirming that the cell was holding pressure.
- Disconnect the line from the pressure cell.
- With the cell back on the vice, unplug the adaptor for the nitrogen pressure line.
- The cell is ready to be connected to the LIPSS system at this point.

### **NOTES ON DISASSEMBLING THE CELL AND CLEANING**

The end caps will likely seem stuck, but can be gently lifted using two 1/4-28 bolts in the threaded holes of the end caps. Insert the two bolts just until they touch the body. Tighten each bolt 1/8 turn, alternating to lift the cap straight up until it is free.

The caps, sleeve and cell body can be placed in a sonicator hot water bath for deeper cleaning, but the sapphire windows must be cleaned by hand (deionised water and ethanol should be sufficient). The last rinse should always be with deionized water. Keep any material that will be in contact with the sample free from grease.

**NOTE ON ASSEMBLY FOR OTHER PATHLENGTHS – 5 mm EXAMPLE**

The procedure is very similar to the one described above, except a steel sleeve with 5 mm inner lip is used. The inner lip will push each of the windows out by an extra 2mm. To accommodate for this, two 2 mm spacer plates must be added to extend the length of the center body, adding one plate to each side (even if the spacers are labeled with their sizes, it is always best to verify the thickness of the spacers you use).