

Orbitrap Exploris Extended Maintenance Manual

Contents

- [Introduction](#) on page 1
- [Tools and Supplies](#) on page 1
- [Safety Guidelines](#) on page 2
- [Preparing the Instrument](#) on page 2
- [Removing the Quadrupole](#) on page 3
- [Removing the Bent Flatapole](#) on page 4
- [Cleaning the Quadrupole](#) on page 6
- [Cleaning the Bent Flatapole and the Bent Flatapole Lens](#) on page 7
- [Installing the Bent Flatapole and the Bent Flatapole Lens](#) on page 8
- [Installing the Quadrupole](#) on page 8
- [Restarting the Instrument](#) on page 9

Introduction

This document is an addendum to the *Orbitrap Exploris 480 Operating Manual*. It describes the maintenance for ion optic components that are accessible after removing the top cover of the instrument. This document is designated for customers who have received a special training about extended maintenance for the quadrupole and the bent flatapole.

Table 1. Maintenance schedule

Component	Frequency	See
Quadrupole	Check bi-weekly. Clean if quadrupole performance evaluation indicates contamination.	page 3
Bent flatapole	When you clean the quadrupole.	page 4

Tools and Supplies

Chemicals	Tools
• Isopropanol, LC grade^a • Water, LCMS grade or ultrapure deionized water (for example, Milli-Q™) • Nitrogen gas, clean and dry	• Quadrupole cleaning tool^b • Quadrupole holder^b • Magnifying device^b • Screwdriver, slot head^c • Screwdriver, hex, 3 mm^c • Screwdriver, hex, 4 mm^c • Air blow gun^c • Tweezers, plastic (or similar tool) • Gloves, lint-free and powder-free • Industrial tissues, lint-free • Chamois tipped swabs • Lint-free foam tip swabs

^a May be replaced by methanol or ethanol.

^b Shipped with the performance maintenance kit.

^c Shipped with the mass spectrometer.

Safety Guidelines

When you do extended maintenance on the Orbitrap Exploris 480 system, pay attention to the safety guidelines that follow. Also refer to the chapter “Safety” of the *Orbitrap Exploris 480 Operating Manual* for comprehensive information about machine safety.

WARNING

High Voltage. Hazardous electric voltage that can cause an electric shock is used in the instrument. To make sure that the instrument is free from all electric current, always disconnect the power cords of the *mass spectrometer and the forepumps* before you try any type of maintenance.

CAUTION

Crushing Hazard. The hinged lid of the quadrupole chamber might unexpectedly fall down when it is not in its resting position. Make sure that the lid is secure when you do work on the components inside.



Avoid exposure to potentially harmful materials. Read the MSDS or SDS for each chemical you use. Store and handle all chemicals in accordance with standard safety procedures. Always wear protective gloves and safety glasses when you use solvents or corrosives. Also, contain waste streams, use proper ventilation, and dispose of all laboratory reagents according to the directions in the MSDS or SDS.

NOTICE

When you do work within the system, you should wear clean, powder-free and lint-free gloves. When you handle solvents and chemicals, the glove material should at least provide temporary resistance to the solvents. Usage of nitrile gloves is recommended.

Dirty tools can contaminate your system. Keep the tools clean and use them exclusively for the maintenance of the ion optics.

Store the disassembled parts on a clean, lint-free surface (for example, lint-free tissue paper). Store the already cleaned optics under a closed hood or place them into the instrument as soon as possible and close the lid.

Preparing the Instrument

❖ To prepare the instrument

1. Shut down and vent the system:
 - a. Wait until data acquisition, if any, is complete.
 - b. Turn off the flow of sample solution from the LC (or other sample introduction device).
 - c. In the Tune window, click the **System Off** button to put the instrument in Off condition. All high voltages are shut off, as are the sheath and auxiliary gas.
 - d. Put the main power circuit breaker switch of the mass spectrometer in the Off position. The instrument is shut down and vented.
2. After five minutes, disconnect the power cords of the mass spectrometer and the forepumps from the wall outlets. This prevents the system from being switched on in the open state.
3. Wait for 15 minutes to make sure that the instrument is completely vented.
4. Prepare a clean surface on the bench or ideally in a fume hood, for example by placing some clean aluminum foil on the bench.
5. Disconnect and remove all items that are in the accessories cabinet (for example, the syringe pump). Make sure that nothing is plugged into the USB ports at the right side of the compartment.



Removing the Quadrupole

❖ To remove the quadrupole

1. With the accessory compartment open, loosen the five 3 mm hex screws in the accessories cabinet that connect the top cover to the instrument frame. See the red circles in [Figure 1](#).



Figure 1. Top cover screws

2. Grab the front of the top cover of the instrument with both hands and push it a small distance toward the rear side of the instrument. Then grab the Orbitrap-shaped handles of the cover with both hands and lift it off. Store the cover in a safe place.



Figure 2. Removing the top cover

3. The hinged lid of the quadrupole chamber is visible. Grab the handle rail on the right side of the lid and pull it upwards. The quadrupole chamber opens. Open the lid all the way ($>90^\circ$) until it rests on the hinges.

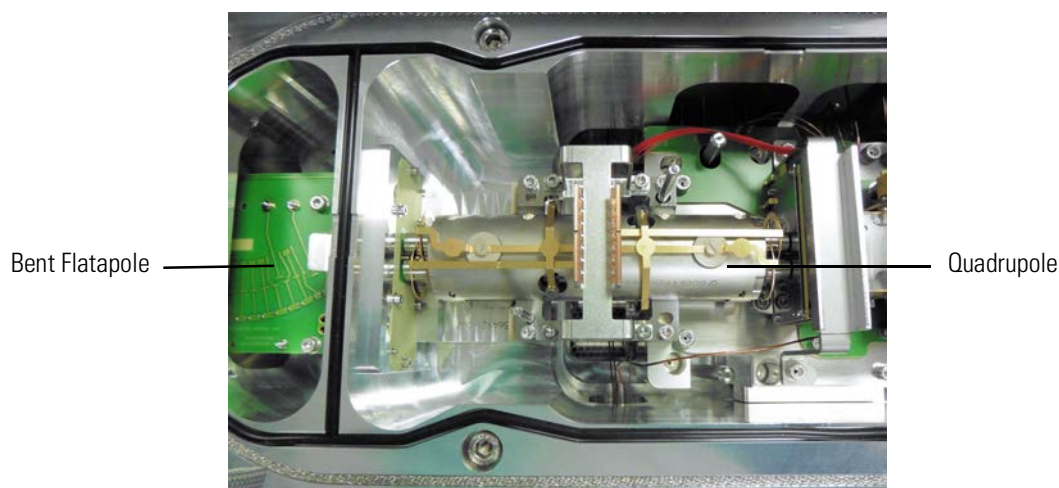


Figure 3. Inside of quadrupole chamber (customer accessible parts)

- Put on a new pair of lint- and powder-free gloves.

NOTICE

The interior of the quadrupole chamber must stay free of any contamination. Make sure that the chamber is open only when you do work on the components inside. When you lean over the quadrupole chamber, make sure that no particles or fibers from your clothing fall into it. We recommend that you wear the bouffant cap that is shipped with the performance maintenance kit.

- Loosen the four 3 mm hex screws in the corners of the quadrupole holder. See red circles and arrows in Figure 4. The screws should be moving freely by a few millimeters, but remain in the holder. See also Figure 5 on page 4. (The other four hex screws hold the EMC bracket on the quadrupole holder.)

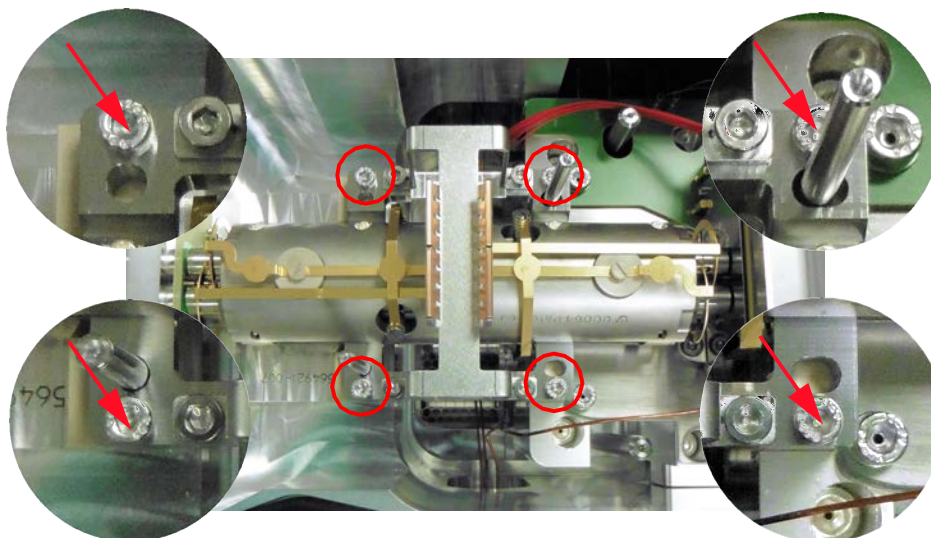


Figure 4. Quadrupole screws

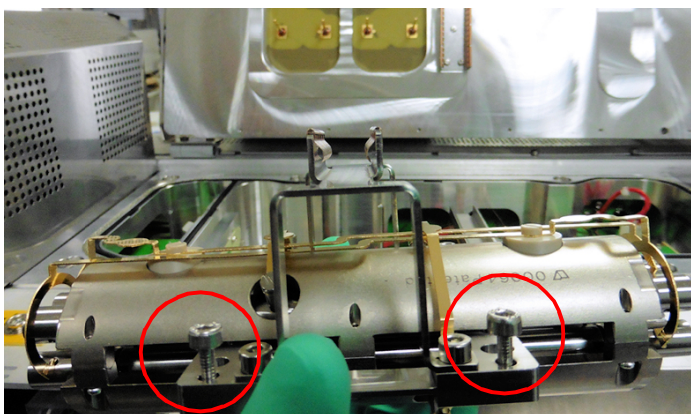


Figure 5. Quadrupole removed

- Grab the quadrupole with both hands and lift the quadrupole straight up. If it does not move freely, make sure that none of the screws is still catching on the threads below.

NOTICE

Do not bump the ends of the quadrupole on any adjacent parts.

- Put the quadrupole gently into the holder that comes with the cleaning kit.

Clean the bent flatapole when you clean the quadrupole. You can remove the bent flatapole after you have removed the quadrupole.

❖ To remove the bent flatapole

- Loosen the two 4 mm hex screws that attach the metal retainer to the side wall of the analyzer chamber. The screws remain in the analyzer chamber. See Figure 6.

Removing the Bent Flatapole

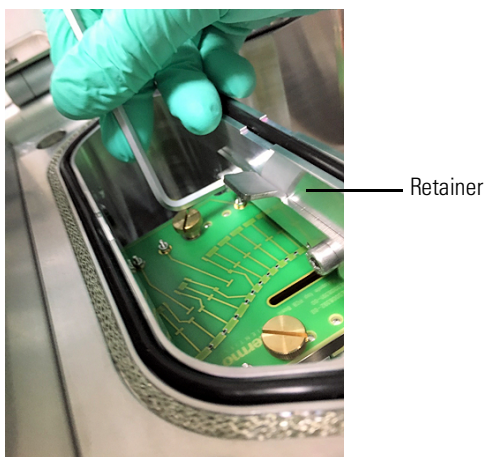


Figure 6. Loosening the screws of the bent flatapole

2. Remove the retainer and put it on a clean, lint-free surface.
3. Slide the complete assembly straight toward the C-trap until the metal holder of the exit lens has cleared the separation.
4. Lift up the assembly until the bent flatapole is clear of the analyzer chamber. Put it on a clean, lint-free surface.

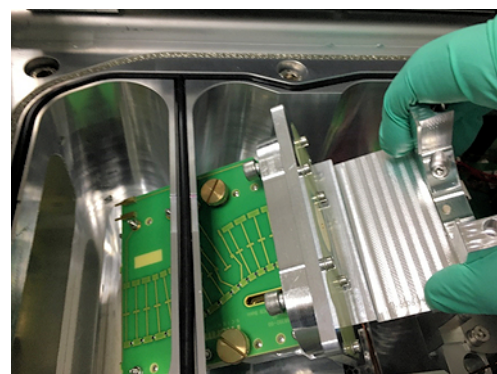
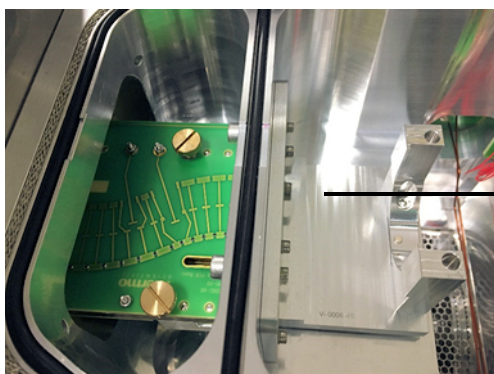


Figure 7. Sliding out the bent flatapole

5. Close the lid of the quadrupole chamber to prevent contamination of the chamber.

❖ **To remove the bent flatapole exit lens**

1. Grab the two latches at the other side of the assembly with your fingers. Pull them out slightly and turn them in opposite directions to release the metal lens and the insulator behind it. Be careful with the little holder pins below the latches.

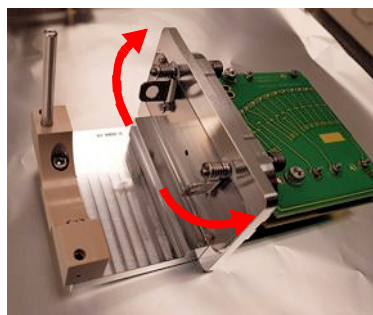


Figure 8. Releasing the bent flatapole exit lens

2. Grab the exit lens and pull it away from the holder. Do not cause damage to the two metal cylinders (neutral collectors) that are attached to the other side of the lens. See [Figure 9](#). Put the lens on a clean, lint-free surface. The white insulator rings will stay in place.

Cleaning the Quadrupole

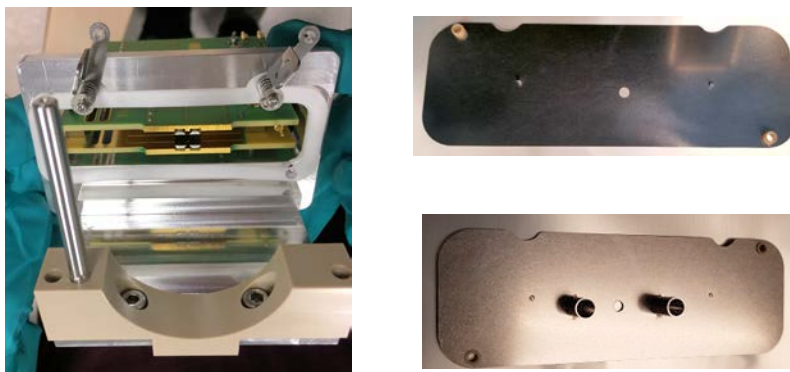


Figure 9. Bent flatpole holder and exit lens

❖ To clean the quadrupole

1. Mount the quadrupole in the supplied holder. The orientation is given by the blocked hole, which will not allow it to go onto the alignment bolts.
2. Make sure that you have sufficient space on the bench to pull the quad cleaning tool all the way through the quadrupole.
3. Assemble the quadrupole cleaning tool by attaching the cleaning tool to the handle.
4. Place the quadrupole cleaning tool into the holder recess.

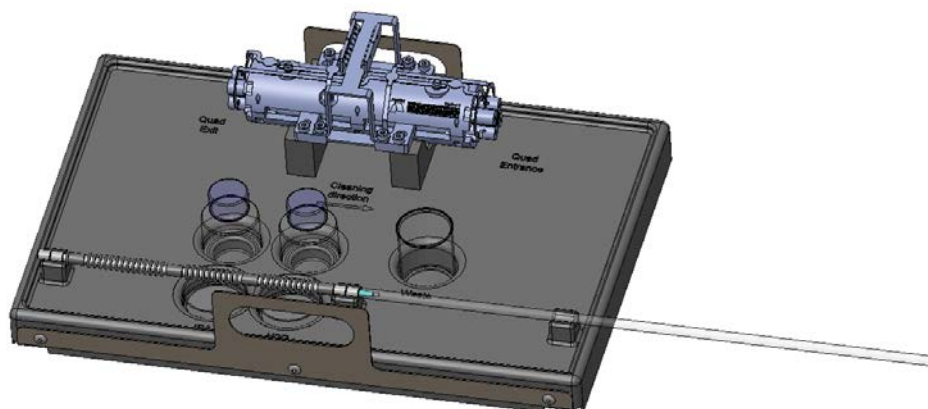


Figure 10. Quadrupole mounted on holder

5. Fill one drip bottle with isopropanol and the other with water. Put labels on the bottles.
6. Prepare the quadrupole cleaning tool with isopropanol and water. See [Figure 11](#).
 - a. Wet the first section (left) of the cleaning tool with water. Use only a few drops of water. Otherwise, the water will be pressed out of the tool and possibly drip into the quadrupole.
 - b. Wet the second section (center) of the cleaning tool with isopropanol.

Do not wet the third section (right) because this section is used for drying the quadrupole.

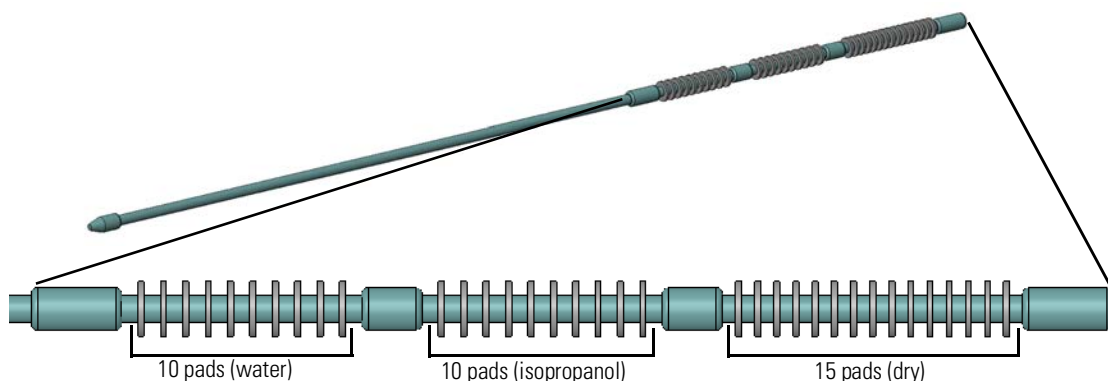


Figure 11. Preparing the cleaning tool

7. Insert the handle of the cleaning tool carefully into the exit side of the quadrupole until it emerges on the entrance side.



Figure 12. Inserting the quadrupole cleaning tool

8. Grip the handle and pull the tool through completely.

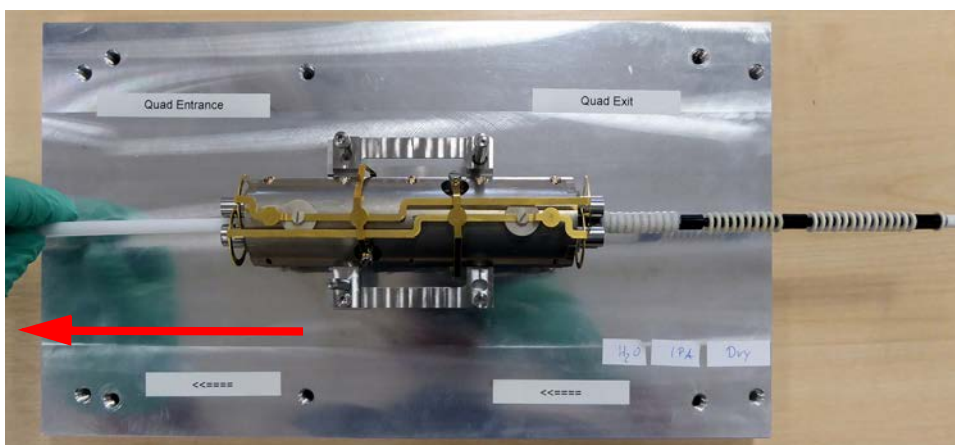


Figure 13. Cleaning the quadrupole

9. Repeat steps 7 and 8 four times.
10. Dry the quadrupole with a strong stream of oil-free nitrogen gas to make sure that the solvent evaporates completely.
11. With a magnifying device, inspect the quadrupole for any lint, particulates, and sample buildup or coatings. Use plastic tweezers or a similar tool to remove lint or particulates or purge again with nitrogen.

❖ **To clean the bent flatapole**

Purge the component from any particles with a strong stream of oil-free nitrogen gas.

❖ **To clean the bent flatapole exit lens**

1. Clean the inside of the orifice with a conical swab that is soaked with a 50:50 isopropanol:water solution.
2. Clean the neutral spot with a lint-free wipe that is soaked in a 50:50 isopropanol:water solution. The spot is on the right side of one of the metal cylinders.
3. Clean the lens orifice from both sides with a lint-free wipe that is soaked in a 50:50 isopropanol:water solution.
4. Clean the lens orifice from both sides with a lint-free wipe that is soaked in 100% isopropanol.
5. Dry the component with a strong stream of oil-free nitrogen gas to make sure that the solvent evaporates completely.

Installing the Bent Flatapole and the Bent Flatapole Lens

Installing the Quadrupole

Reverse the steps described in the disassembly section. Ideally, purge each ion optic with nitrogen once more before you reinstall it.

❖ To install the bent flatapole

1. If it is closed, pull up the lid of the quadrupole chamber.
2. Put on a new pair of lint- and powder-free gloves.
3. Attach the flatapole exit lens to the bent flatapole holder and turn the two latches towards each other.
4. Insert the bent flatapole back into the chamber to the left side of the quadrupole.
5. Attach the retainer with the two 4 mm hex screws.

❖ To install the quadrupole

1. Place the quadrupole straight down onto the holders.

NOTICE

Do not to bump the ends of the quadrupole on any adjacent parts.

2. Make sure that the quadrupole seating is correct. Check the copper clips for a proper seating to make sure that they will not fall into the chamber.

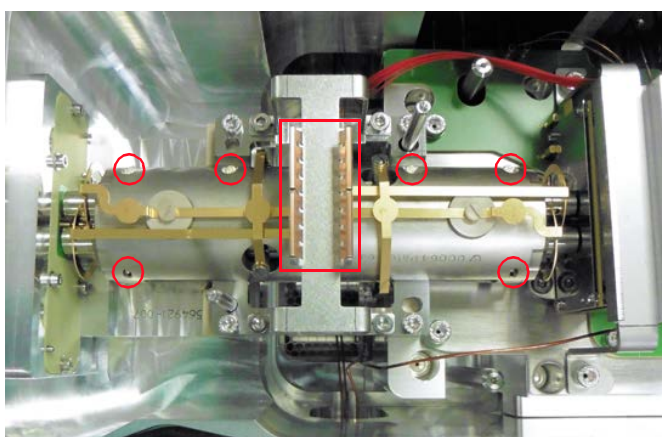


Figure 14. Checking the quadrupole seating

3. Tighten the four 3 mm hex screws.

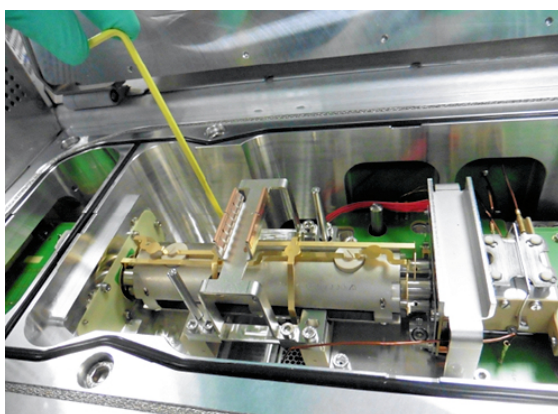


Figure 15. Re-installing the quadrupole

4. Close the analyzer chamber.
 - a. Make sure that there are no particles on the black sealing of the chamber lid. If necessary, remove them.
 - b. Use the handle to close the chamber lid.

Restarting the Instrument

Occasionally the weight of the lid will not provide an immediate seal. Therefore, leave the top cover off for this stage.

❖ To restart the instrument

1. Connect the power cords of the mass spectrometer and the forepumps to the wall outlets.
2. Put the main power circuit breaker switch of the mass spectrometer in the On position.
3. Listen for any excessive hissing noise or pump noise that comes from the analyzer chamber. It should become quiet after a few seconds. If it does not, push gently on each corner of the analyzer lid.
4. Now reinstall the top cover. Insert the two guides at the back of the cover first, and then lower it down. It can be easier to do this with two persons.
5. When the top cover rests on the instrument frame, pull it toward the front side of the instrument into the correct position.
6. Tighten the five 3 mm hex screws that attach the top cover to the instrument frame. See [Figure 1](#) on [page 3](#).
7. Put back the items that you have removed from the accessories cabinet. When you close the lid of the cabinet, make sure that it does not catch capillaries and cords.
8. After the turbomolecular pump has completely spun up, the instrument should automatically start a bakeout procedure. If the bakeout has not started after 15 minutes, trigger it manually from the diagnostics section in the Tune software.