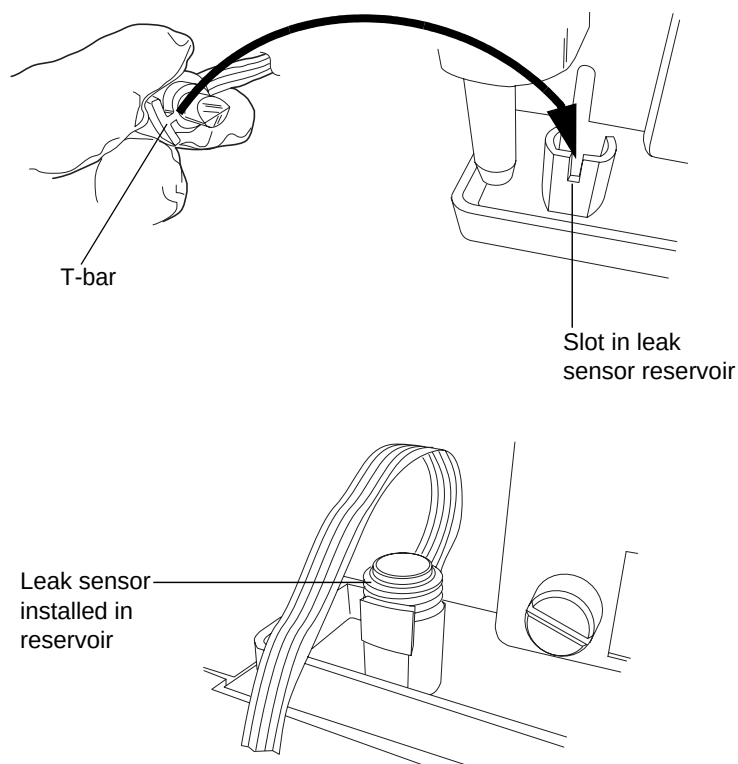


5. Align the leak sensor's T-bar with the slot in the side of the leak sensor reservoir, and slide the leak sensor into place.



6. Plug the leak sensor connector into the front of the instrument.
7. In the ACQUITY UPLC Console, select your detector from the system tree.
8. In the detector information window, click Control > Reset, to reset the detector.

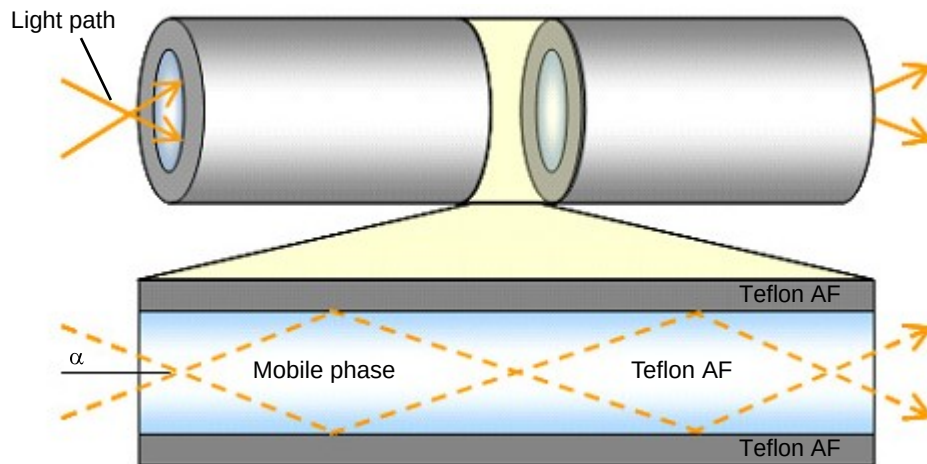
Maintaining the flow cell

Waters light-guiding flow cell overview

Waters light-guiding flow cells transport light and sample via Teflon AF tubing. The tubing transmits energy through low-volume flow cells, resulting in heightened analytical sensitivity. The mechanism by which light is efficiently transmitted through the sample tube is known as total internal reflection (TIR); light is confined within the fluid stream because the

refractive index of the fluid is greater than that of the tubing material (Teflon AF).

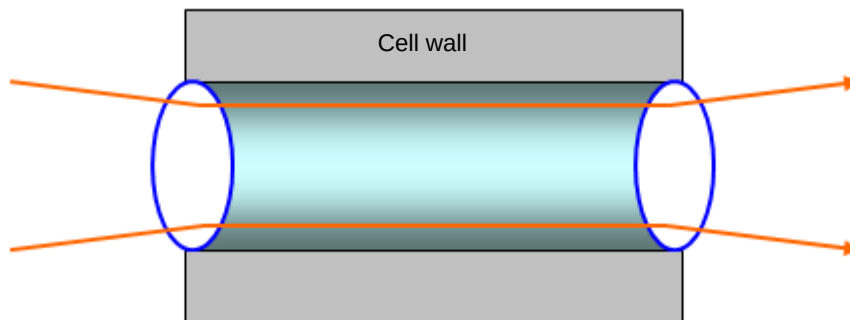
Light transmission through light guiding flow cell



In the figure, above, the light path through the cell is depicted by a pair of rays (dashed lines) that bounce off the cell wall. The energy carried by each ray is conserved after each bounce. One hundred percent of the light is reflected, hence the term “total internal reflection”. The Teflon AF tubing is an active component in the flow cell light path.

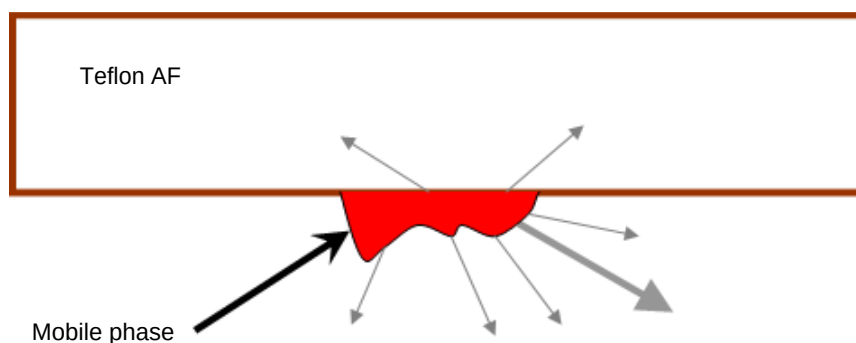
In contrast to the light-guiding flow cell, a conventional cell is typically an all-metal body with lenses at each end.

Light transmission through a conventional flow cell



The light path through a conventional flow cell is designed to avoid contact with the cell walls, primarily to prevent rays that encounter the walls from contributing to the measured signal. The energy associated with errant rays is highly variable depending on the mobile phase composition, quality of wall finish (which is never 100% reflective) or the slow build-up of contaminants. The Teflon AF surface, however, is mirror-like, and the relatively slight RI-dependence associated with a well-maintained cell is negligible. Surface contamination, depicted by the red, irregularly shaped object in the next figure can lead to undesirable beam effects like scattering (thin, gray arrows) or absorption (grey, thick arrow), both of which decrease reference energy.

Unwanted beam effects from a light guide flow cell



The operational differences between the light-guiding method, where light is transmitted through interactions with the cell wall, and the conventional method, which avoids such interactions, underscores these practical measures for maintaining the liquid core flow cell:

- Periodically determine flow cell transmission under conditions similar to those used to characterize a new cell. (Doing this typically means determining cell transmission with clean mobile phase.)
- Avoid fouling the flow cell by changing or disturbing upstream system components, as in the case when a new column is brought online.

Cleaning the flow cell

Clean the flow cell when it becomes contaminated with the residues of previous runs and also after each detector shutdown. A dirty flow cell can cause baseline noise, decreased sample energy levels, calibration failure, and other problems.

- Always flush the flow cell with mobile phase as your initial attempt to correct these problems.
- If there is still no improvement, flush the flow cell with 100% pure organic solution.

Recommendation: 100% acetonitrile.

- If the problems persist, flush the flow cell with 1% formic acid for 30 minutes, then flush with water until the formic acid is removed or until the Ph is neutral.
- If flushing with the 1% formic acid solution also fails, perform a system acid cleansing flush (see [“Performing a system acid cleansing flush” on page 6-224](#)).
- If there is still no improvement, call Waters Technical Service.



Caution:

- To prevent flow cell failure, do not connect any tubing or device that can create backpressure exceeding the flow cell’s maximum rating of 6895 kPa (69 bar, 1000 psi).
- The pressure through the flow cell must not exceed 6895 kPa (69 bar, 1000 psi). Increasing the flow rate usually increases the pressure. High-viscosity fluids generally increase the pressure through the flow cell and therefore require a lower flow rate. Allowable flow rates are based on the limit of pressure that each flow cell can withstand.



Warning: To avoid spills, empty the waste container at regular intervals.

Rule: Always use clean, well-degassed eluents.

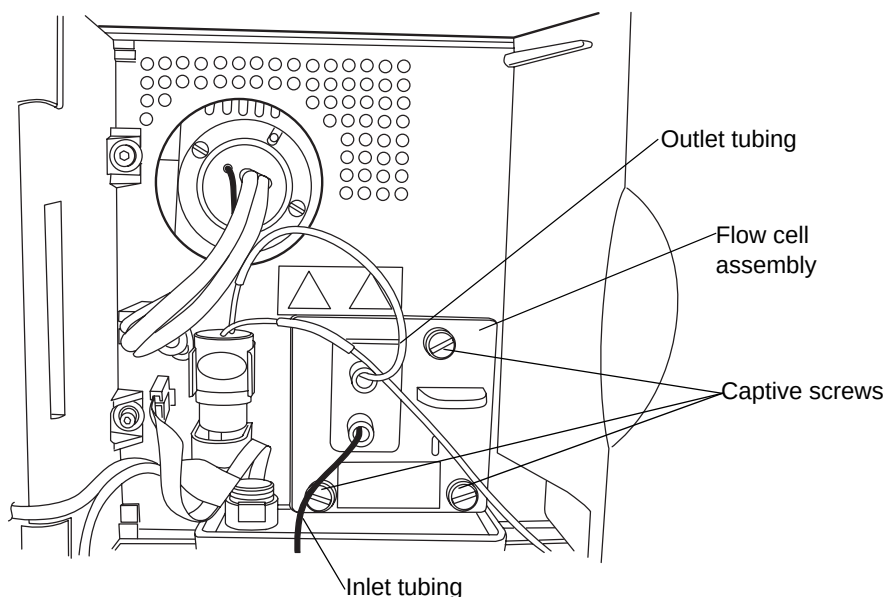
Required materials

- 1% formic acid
- Clean, chemical-resistant, powder-free gloves
- Water (for flushing buffers)
- Intermediate solvent that is miscible in both the mobile phase and water
- Stainless steel unions (to replace the column during flushing)
- Wrench suitable for removing and replacing the column

To clean the flow cell

1. In the detector control panel, click  (Lamp Off).
2. Stop the solvent flow and remove the column.
3. Replace the column with a union or piece of tubing.
4. If another instrument is downstream of the flow cell outlet, break the connection at the other instrument and route the outlet tubing to waste while flushing.

Rule: Do not flush while connected to a mass spectrometer.



5. Flush the detector with HPLC-grade water. If the mobile phase is not compatible with water, flush with an intermediate solvent first.
6. Pump an acid wash composition of 1.0% formic in water or 90% water/10% organic mixture. Flush the flow cell for minimum of 4 hours at a low flow of 0.05 to 0.1 ml/min. Do not exceed 6895 kPa (69 bar, 1000 psi).
7. Flush the detector with HPLC-grade water until the Ph is neutral. If the mobile phase is not compatible with water, flush with an intermediate solvent first.

Tip: Remove any other active detectors or instruments from the system.

8. Reattach the column.
9. Resume pumping mobile phase. If the mobile phase is not miscible in water, first flush with an intermediary solvent.

Performing a system acid cleansing flush

System contamination can cause the flow cell to become contaminated. If the system becomes contaminated, perform a system acid cleansing flush. This procedure cleans the binary solvent manager, solvent manager, and flow cell.



Caution: If you are running an MS detector, do not perform the system acid cleansing flush. Instead, call Waters Technical Service.

To prepare the solvent

1. Prepare a mixture of 50:50 (v/v) methanol:water as follows:
 - a. Measure 500 mL of water in a graduated cylinder.
 - b. In a separate graduated cylinder, measure 500 mL of methanol.
 - c. Add methanol to water and mix for 5 minutes.
2. Prepare a mixture of 30:70 (v/v) phosphoric acid:water as follows:
 - a. Measure 700 mL of water in a graduated cylinder.
 - b. In a separate graduated cylinder, measure 300 mL of phosphoric acid.
 - c. Add phosphoric acid to water and mix for 5 minutes.
3. Fill a 1L mobile phase reservoir with 100% water.
4. Fill a 1L mobile phase reservoir with 100% isopropanol.

Note: The cleaning procedure takes approximately 6 hours once the solvents are prepared to remove flow cell contaminants.

To perform the system acid cleansing flush



Caution: Failure to remove the Hastalloy bottle filters will contaminate the flow path.

1. Remove the sample and solvent manager bottle filters.

2. Place all lines A1, A2, B1, B2 seal wash, weak needle wash and strong needles in 50:50 methanol:water.
3. Prime the solvent lines for 5 minutes each.
4. Prime the seal wash.
5. Prime the wash syringes and sample syringe for 4 cycles.
6. Connect a pressure restrictor in the fluid path after the injector, to create 13,790 kPa (138 bar, 2000 psi) backpressure in the system.
7. Transfer 1 mL of mobile phase to an autosampler vial and place in position 1:A,1.
8. Create an instrument method with the following parameters:
 - a. Flow rate = 0.5 mL/min
 - b. Gradient composition 50% A1:50% B1
 - c. Full loop injection
9. Make 30 full loop injections from the vial containing the mobile phase. Set the run time to 0.5 minutes.

Notes: This step should take approximately 30 minutes.
10. Repeat steps 1 through 8 using 100% isopropanol as the solvent. Do not pass effluent through optical detector for this wash step. Restrictor should be routed to waste.
11. Repeat steps 1 through 8 using 100% water as the solvent.

Note: Remove the Seal wash line from the mobile phase bottle prior to performing the Phosphoric Acid Wash.
12. Repeat steps 1 through 8 using 30:70 (v/v) phosphoric acid:water as the solvent.
13. To completely remove all contaminants from the flow cell, continue pumping the phosphoric acid mixture for an additional 3 hours.
14. Repeat steps 1 through 8 using 100% water as the solvent.
15. Repeat steps 1 through 8 using 50:50 (v/v) methanol:water as the solvent.
16. Replace the sample and solvent manager bottle filters.

Replacing the flow cell



Caution:

- To avoid contaminating the flow cell, wear clean, chemical-resistant, powder-free gloves when handling, removing, or replacing it.
- To avoid damaging the flow cell, handle it with care. Do not disassemble the flow cell.

See also: *Controlling Contamination in Ultra Performance LC/MS and HPLC/MS Systems* (part number 715001307) on the ACQUITY UPLC System Bookshelf CD.

Required materials

- 1/4-inch, flat-blade screwdriver
- Clean, chemical-resistant, powder-free gloves
- Flow cell

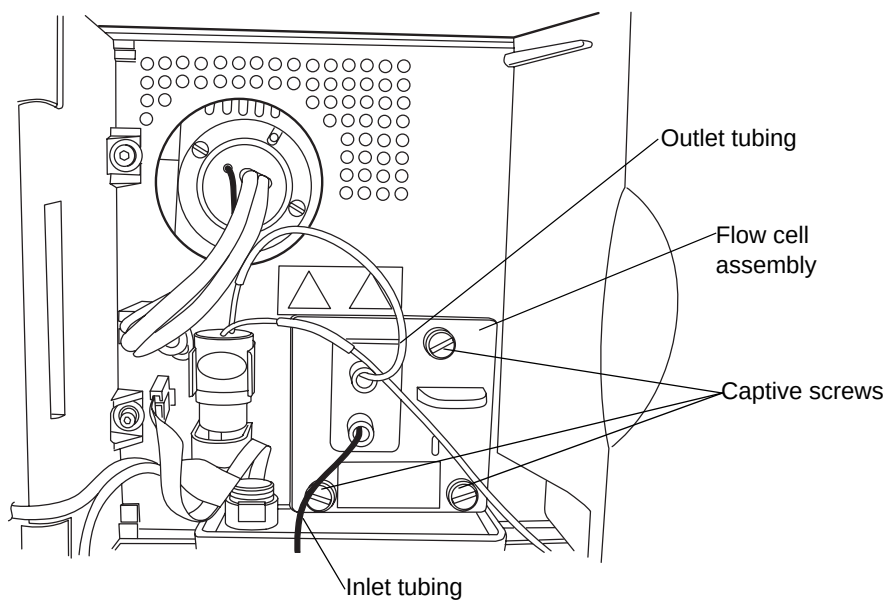
To replace the flow cell



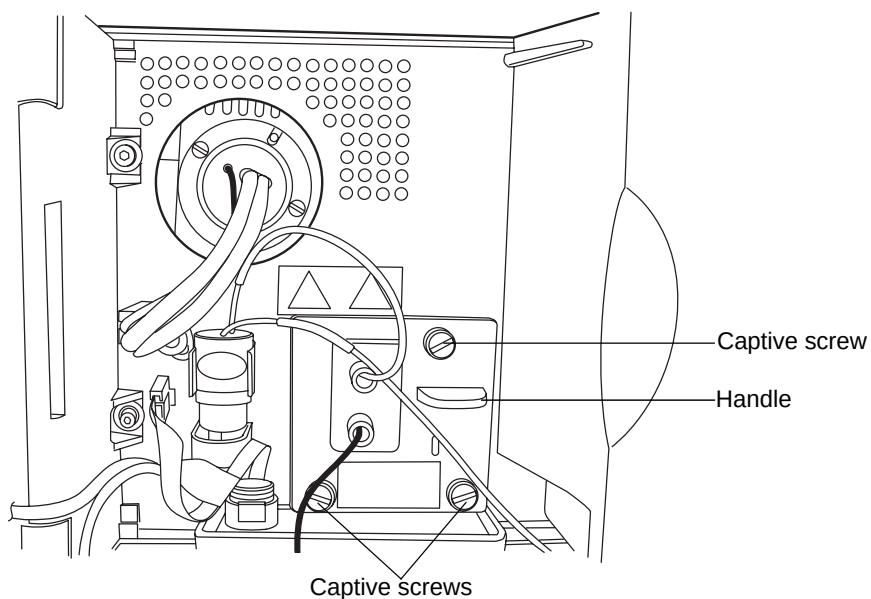
Caution: To avoid damaging electrical parts, never disconnect an electrical assembly while power is applied to an instrument. To completely interrupt power to an instrument, set the power switch to Off, and then unplug the power cord from the AC outlet. After power is removed, wait 10 seconds thereafter before you disconnect an assembly.

1. Power-off the detector.
2. Stop the solvent flow.
3. Open the detector door, gently pulling its right-hand edge toward you.

4. Disconnect the detector's inlet and outlet tubing from the main column connection.



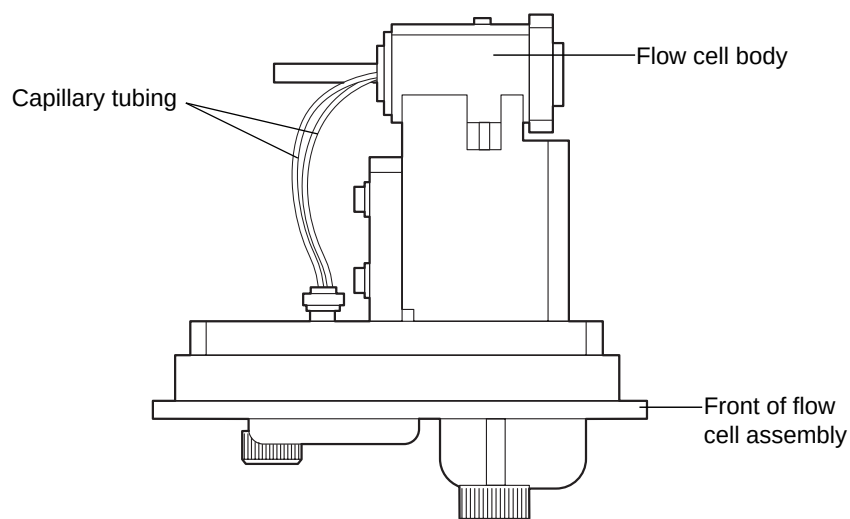
5. Remove the flow cell:
 - Using a 1/4-inch, flat-blade screwdriver, loosen the 3 captive screws on the flow cell assembly's front plate.
 - Grasp the handle and gently pull the assembly toward you.



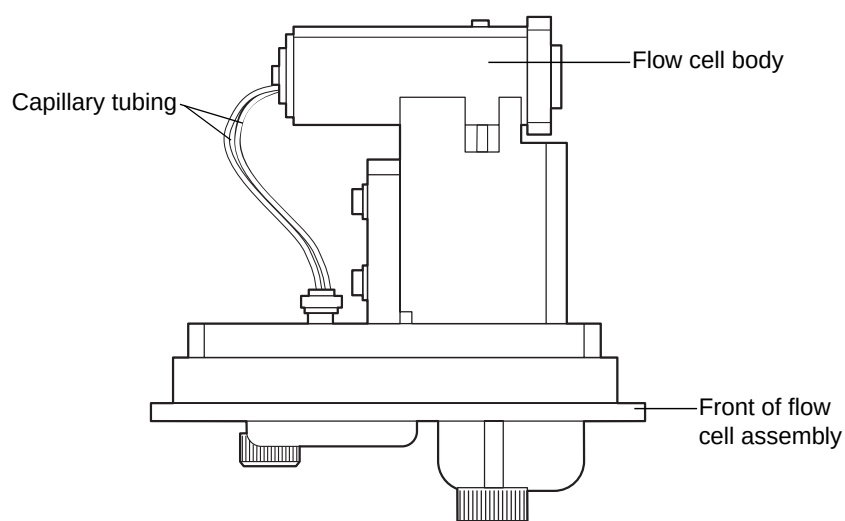
 **Caution:** To avoid damaging the capillary tubing, do not touch it.

6. Unpack and inspect the new flow cell. Ensure that the flow cell type (analytical or high sensitivity) suits your application.

Top view of the analytical flow cell assembly



Top view of the high sensitivity flow cell assembly



7. Insert the new flow cell assembly into the detector, and then tighten the captive screws.
8. Connect the inlet tubing to the main column connection and flow cell inlet, and connect the outlet tubing to the flow cell outlet.

9. Close the detector door.
10. Before you power-on the detector, ensure the flow cell is filled with degassed, transparent solvent (acetonitrile or water) and free of air bubbles. The detector will not initialize correctly if the cell contains air.

Replacing the lamp

Change the lamp when it repeatedly fails to ignite or when the detector fails to calibrate.

Tip: Record the new lamp's serial number to properly track lamp life. If you do not record a new lamp's serial number in the ACQUITY UPLC Console, the date of the previous lamp installation remains in the detector's memory.



Warning: To prevent burn injuries, allow the lamp to cool for 30 minutes before removing it. The lamp housing becomes extremely hot during lamp operation.



Warning: To avoid eye injury from ultraviolet radiation exposure,

- power-off the detector before changing the lamp.
- wear eye protection that filters ultraviolet light.
- keep the lamp in the housing during operation.

Required material

Performance maintenance kit

To remove the lamp

1. Power-off the lamp.



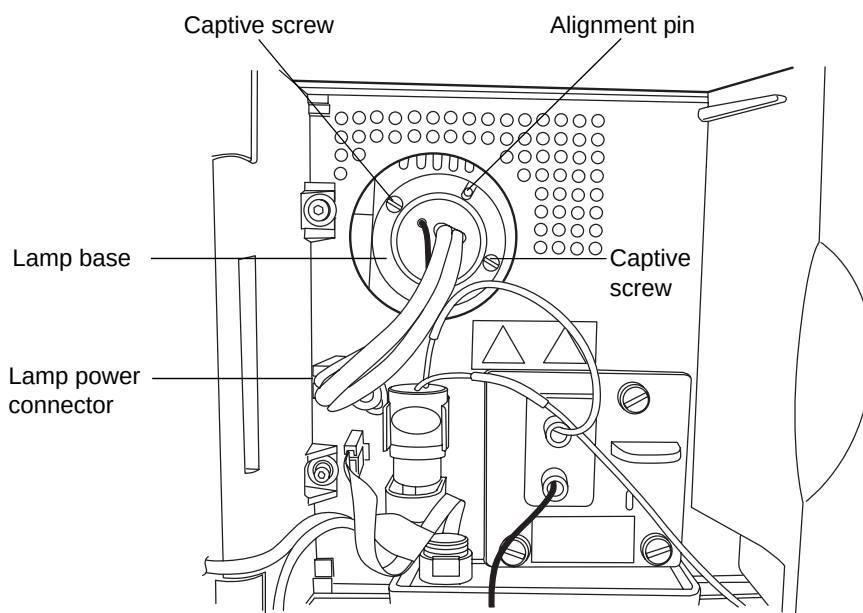
Caution: To avoid damaging electrical parts, never disconnect an electrical assembly while power is applied to an instrument. To completely interrupt power to an instrument, set the power switch to Off, and then unplug the power cord from the AC outlet. After power is removed, wait 10 seconds thereafter before you disconnect an assembly.

2. Power-off the detector and disconnect the power cable from the rear panel.



Warning: The lamp and lamp housing can be hot. Wait 30 minutes after powering off the detector for these components to cool before touching them.

3. Allow the lamp to cool for 30 minutes, and then open the door, gently pulling its right-hand edge toward you.
4. Detach the lamp's power connector from the detector.





Warning: Lamp gas is under slight negative pressure. To prevent shattering the glass, use care when disposing of the lamp.



Caution: Do not touch the glass bulb of the new lamp. Dirt or skin oils on the bulb adversely affect detector operation. If the bulb needs cleaning, gently rub it with ethanol and lens tissue. Do not use abrasive tissue. Do not apply excessive pressure.

5. Loosen the 2 captive screws in the lamp base. Pull the lamp assembly out of the lamp housing, and then gently withdraw the lamp.

To install the lamp

1. Without touching the bulb, unpack the new lamp from its packing material.
2. Inspect the new lamp and lamp housing for cleanliness.
3. Position the lamp so that the cut-out on its base plate is at the 1 o'clock position, in line with the alignment pin on the lamp housing, and then gently push the lamp forward until it bottoms into position. Ensure that it seats flush against the optics bench.
4. Tighten the 2 captive screws, and then reconnect the power connector.
5. Power-on the detector, and then wait about 30 minutes for the lamp to warm before resuming operations.

Tip: Cycling power to the detector (that is, powering-off and then powering-on the instrument) initiates the verification procedures.

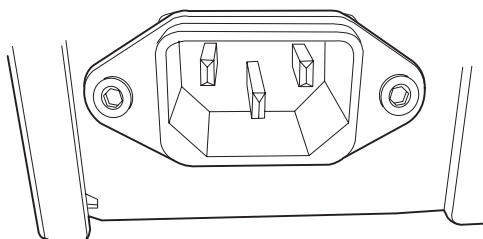
6. In the ACQUITY UPLC Console, select Maintain > Change Lamp.
7. In the Change Lamp dialog box, click New Lamp.
8. Type the serial number for the new lamp (see the label attached to the lamp's connector wire), and then click OK.

Replacing the fuses

Note: Recently manufactured instruments do not have fuses above the power entry module because the power supply is thermally protected. If your detector has the power entry module shown below and it fails to power-on, the

status LEDs are unlit, or the power supply fan does not operate, call Waters Technical Service (see [page 6-6](#)).

Power entry module on recently manufactured instruments



Warning: To avoid electric shock, power-off and unplug the TUV detector before examining the fuses. For continued protection against fire, replace fuses with those of the same type and rating only.

Required material

100 to 240 VAC, 50 to 60-Hz, F 3.15-A, 250-V (fast-blow), 5 × 20 mm (IEC) fuses (2)

Suspect a fuse is open or otherwise defective when

- the detector fails to power-on.
- the power supply fan does not operate.

To replace the fuses

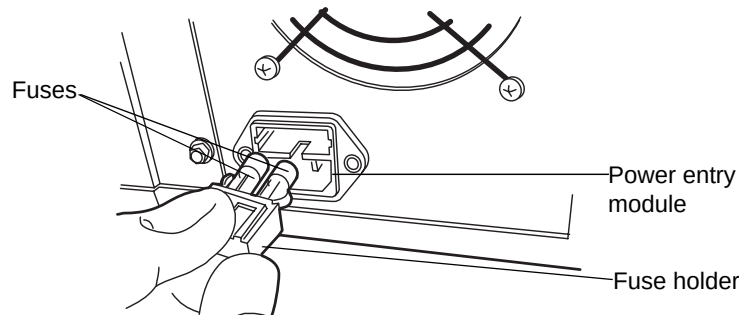
Requirement: Replace both fuses, even when only one is open or defective.



Caution: To avoid damaging electrical parts, never disconnect an electrical assembly while power is applied to an instrument. To completely interrupt power to an instrument, set the power switch to Off, and then unplug the power cord from the AC outlet. After power is removed, wait 10 seconds thereafter before you disconnect an assembly.

1. Power-off the detector and disconnect the power cord from the power entry module.

2. Pinch the sides of the spring-loaded fuse holder, located above the power entry module on the rear panel of the detector.
3. With minimum pressure, withdraw the spring-loaded fuse holder.



4. Remove and discard the fuses.
5. Make sure that the new fuses are properly rated for your requirements, and then insert them into the holder and the holder into the power entry module, gently pushing until the assembly locks into position.
6. Reconnect the power cord to the power entry module.

Cleaning the instrument's exterior

Use a soft cloth, dampened with water, to clean the outside of the TUV detector.

Maintaining the sample organizer



Caution: Never lubricate sample organizer components. Doing so will damage the instrument.

Maintaining the sample organizer consists of defrosting, cleaning its air filter, replacing fuses, and cleaning the outside of the instrument.

Defrosting the sample organizer

For information on defrosting the sample organizer, refer to [“Defrosting the sample compartment” on page 6-129](#).

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