

ACQUITY UPLC H-Class

Quaternary Solvent Manager Operator's Overview and Maintenance Information

Revision B

Waters

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Overview

The quaternary solvent manager (QSM) is a high-pressure pump that can simultaneously pump four degassed solvents (A, B, C, and D) through the ACQUITY UPLC® H-Class system. The pump can deliver gradients in eleven curve shapes (linear, two step, four convex, and four concave). When the optional solvent selection valve is installed, it is plumbed to solvent channel D, enabling solvent selections D₁ through D₆ in addition to A, B, and C (a total of nine solvents to select from).

Features

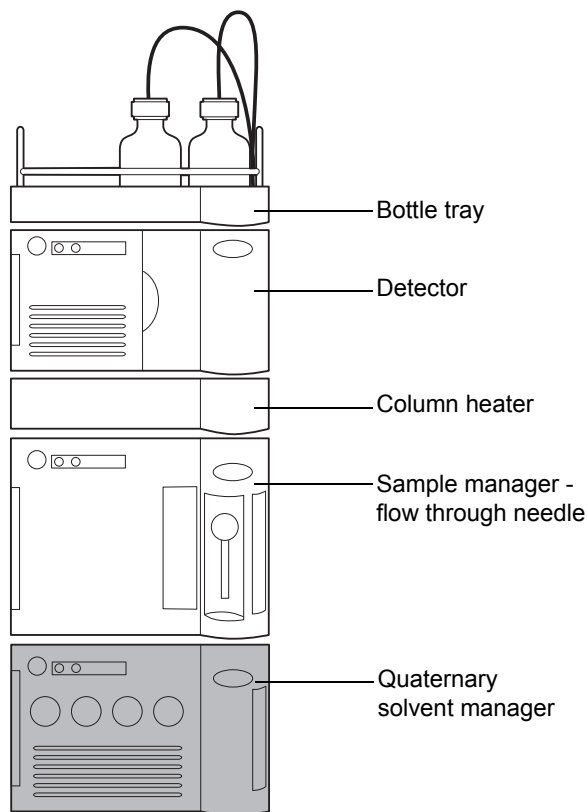
- A gradient proportioning valve (GPV), to dynamically blend solvents in any specified combination. The GPV produces predictable gradient segments regardless of solvent compressibility and system backpressure. Solvent selection and proportioning occur on the low-pressure (intake) side of the solvent delivery system, and solvents continue to blend under high pressure in each piston chamber.
- An integrated degasser that operates up to the maximum flow rate, with an independent channel for each solvent and an additional channel to accommodate the sample manager - flow through needle (SM-FTN) purge solvent.
- An automatic, programmable, seal wash. The pump's Wash Plungers function prevents the build-up of precipitates on the pump plungers by washing them with seal wash solvent at user-specified intervals.
- An electronically controlled Intelligent Intake Valve (*i²Valve*), to speed system priming and reduce startup times. The *i²Valve* minimizes solvent flow disturbances in the inlet lines by closely synchronizing the valve performance with pump operation.
- A vent valve that automatically switches to waste for priming and rapid solvent changeover.

Pressure flow envelope

The QSM, a single pump with a proportioning valve, has a maximum operating pressure of 103,421 kPa (1034 bar, 15,000 psi) at flow rates up to 1 mL/min that decreases linearly to 62,053 kPa (621 bar, 9000 psi) at flow rates up to 2 mL/min.

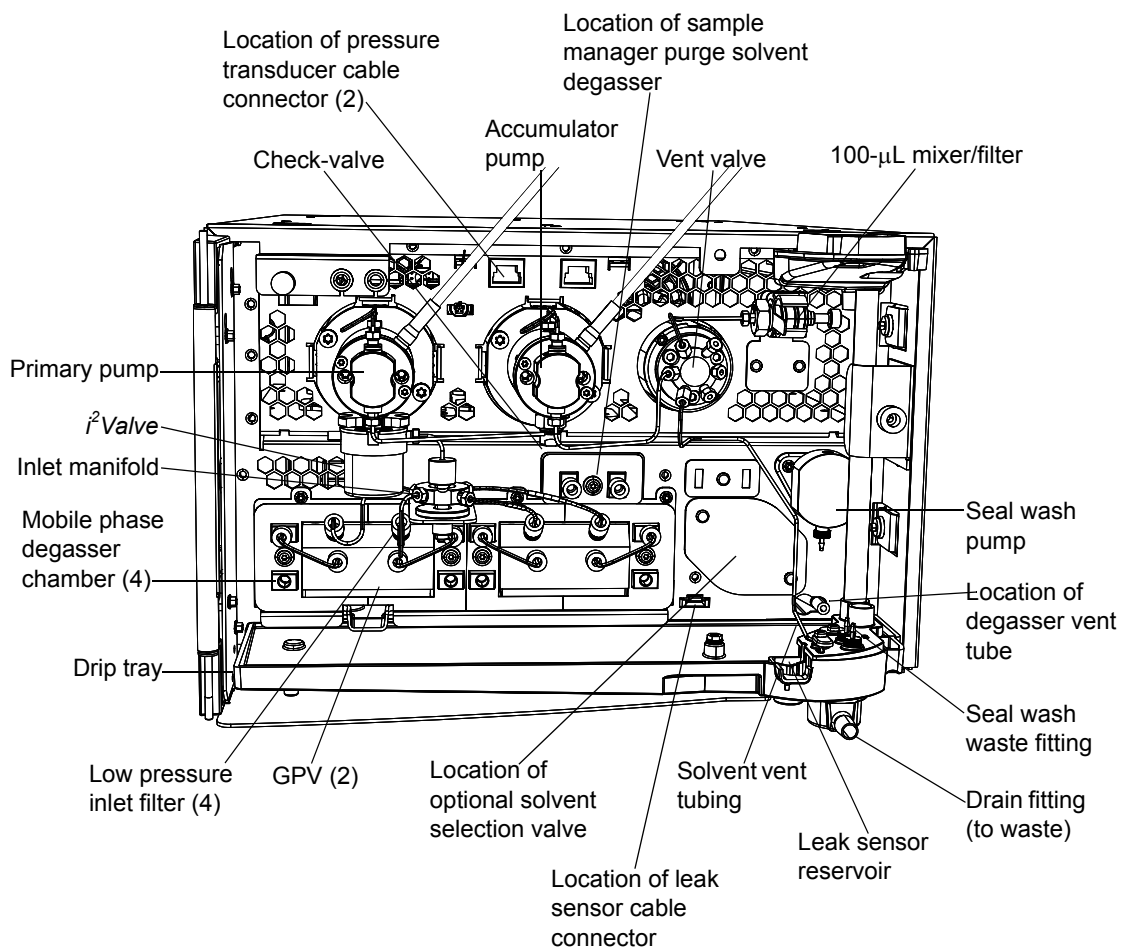
Location of quaternary solvent manager in the ACQUITY UPLC H-Class system

The following diagram shows the location of the quaternary solvent manager in the ACQUITY UPLC H-Class system.



Major components

The following diagram shows the quaternary solvent manager's major components.



Quaternary solvent manager's major components:

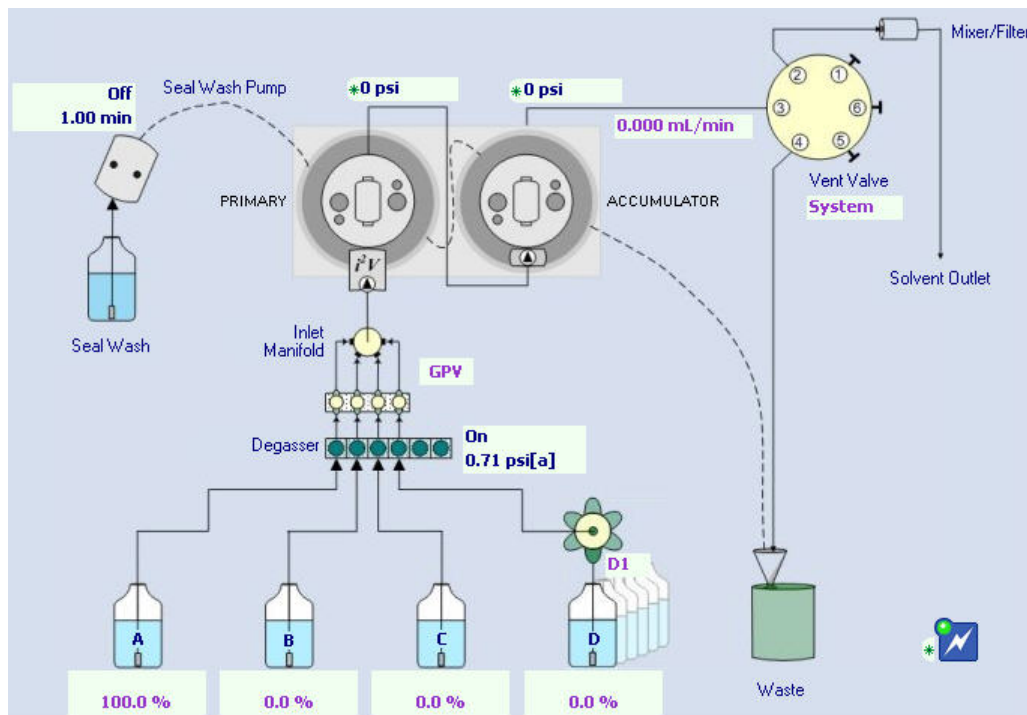
Component	Description
100-μL mixer/filter	Mixes and filters the solvent before it reaches the pump outlet.
Accumulator pump	Receives solvent from the primary pump and delivers it to the vent valve.
Check-valve	A ball check-valve that allows flow in only one direction.
Degasser vent tube	Vents exhaust from the degasser pump.
Drain fitting (to waste)	Connects the waste tubing to the leak management system.
Drip tray	Collects fluid leaks.
Gradient proportioning valve (GPV)	Blends solvents to create accurate gradients, regardless of solvent compressibility and system backpressure. The system includes two gradient proportioning valves, one for solvent channels A and B, and one for solvent channels C and D.
<i>i</i> ² Valve	An electronically controlled ball check-valve that allows flow in only one direction.
Inlet manifold	A component that combines the solvents upstream of pumps.
Leak sensor	Continuously monitors the quaternary solvent manager for leaks and stops the system flow when its optical sensor detects about 1.5 mL of accumulated, leaked liquid in its surrounding reservoir.
Low pressure inlet filters (A, B, C, and D)	A filter that removes particulates from the incoming solvent.
Mobile phase degasser chambers	Removes dissolved gasses from mobile phase solvents and exhausts them, and any condensates, through waste tubing. Note: Vacuum degassing can change the composition of mixed solvents.

Quaternary solvent manager's major components: (Continued)

Component	Description
Pressure transducer cable connectors	The electrical connections for the pressure transducers located on the front of the actuators.
Primary pump	Draws solvent, transferring it to the accumulator pump and system as part of the serial flow design.
Sample manager purge solvent degasser	Degasses the sample manager purge solvent. Note: Vacuum degassing can change the composition of mixed solvents.
Seal wash pump	The pump that circulates solvent, to keep the actuator's high pressure seals and plungers free of contaminants.
Seal wash waste fitting	Directs seal wash waste to the drip tray.
Solvent vent tubing	Tubing that vents solvent to waste during priming.
Optional solvent selection valve	Selects up to six different solvents for isocratic and gradient applications. When present, the valve is plumbed to solvent channel D, enabling solvent selections D ₁ through D ₆ .
Vent valve	A valve that automatically switches to waste during priming and a block position during the leak test.

Flow path through the solvent management system

The following screen shows the quaternary solvent manager's flow.



Solvent flow sequence:

1. The in-line vacuum degasser degasses the solvent.
2. The gradient proportioning valve meters the solvents, prior to pressurization in the pump heads.
3. The inlet manifold blends the metered solvents.
4. The blended solvents flow through the i^2 Valve check-valve and into the primary piston chamber.
5. The primary piston delivers solvent to the accumulator, the vent valve, and the in-line mixer/filter during transfer.

6. The accumulator piston delivers solvent, under pressure, to the vent valve and the in-line mixer/filter.
7. From the in-line mixer/filter, the solvent flows to the sample management system.

Preparing for operation

For optimal performance of the ACQUITY UPLC H-Class system, you must prepare the quaternary solvent manager for operation.

To do so, you must perform a seal wash prime, and then prime the quaternary solvent manager. Be sure to prime all four solvent tubes, the seal wash tubing, and the solvent selection valve tubes (if installed).



Warning: Observe Good Laboratory Practice when you handle solvents. See the Material Safety Data Sheets for the solvents you use.

Requirement: To maintain the efficiency of the quaternary solvent manager and to obtain accurate, reproducible chromatograms, use only MS-grade solvents, water, and additives. For details, see the Solvent Considerations information and *Controlling Contamination in Ultra Performance LC/MS and HPLC/MS Systems* (part number 715001307) on this CD.



Caution: To avoid damaging quaternary solvent manager components

- do not use chloroform, methylene chloride, ethyl acetate, or toluene.
- do not use hexane or tetrahydrofuran (THF) without the hexane/THF compatibility kit for ACQUITY UPLC systems.
- do not pressure solvent reservoirs above 34.5 kPa (0.34 bar, 5 psi).

Recommendation: For optimal quaternary solvent manager performance, ensure that solvent bottles are elevated above the pump inlet and vented.

Installing the leak sensor



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Warning: The leak sensor can be contaminated with biohazardous and/or toxic materials. Always wear clean, chemical-resistant, powder-free gloves when performing this procedure.

Required materials

- Gloves: clean, powder-free, chemical-resistant
- Leak sensor

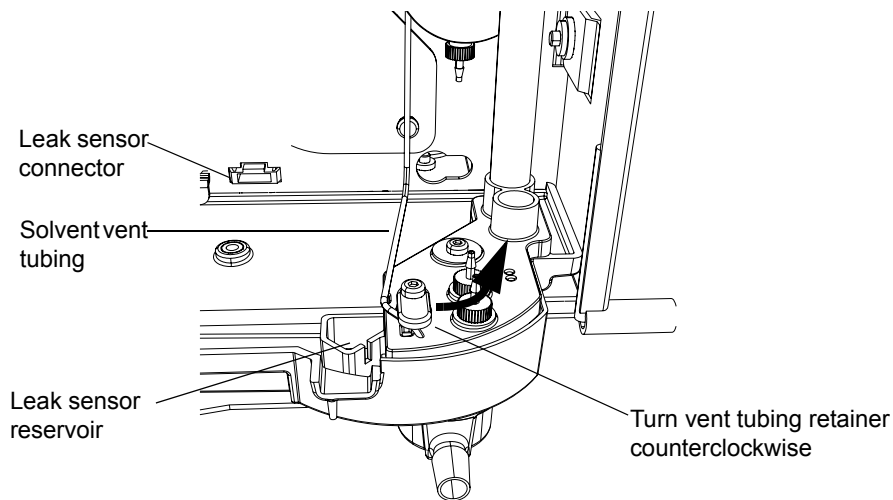
To install the leak sensor:



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

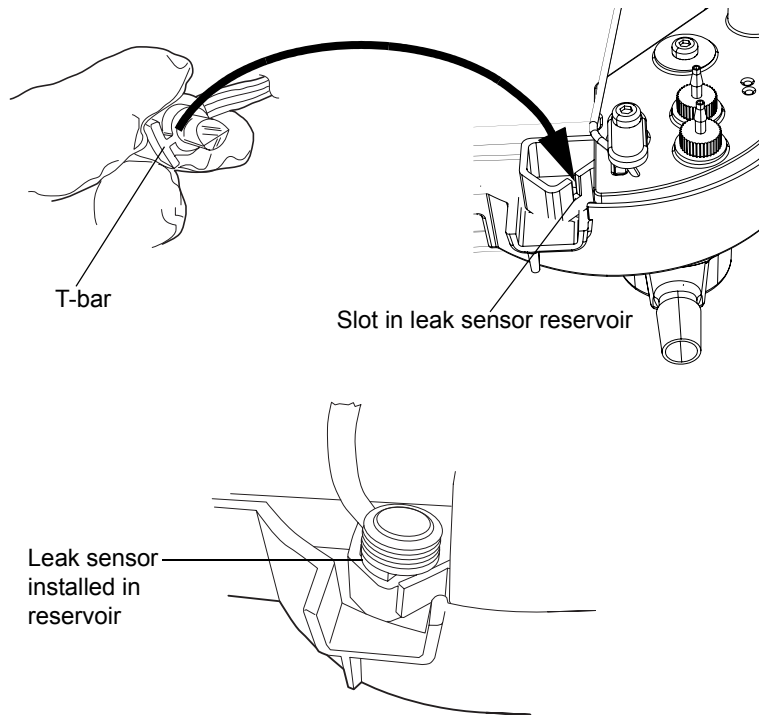
1. Power-off the quaternary solvent manager.
2. Open the quaternary solvent manager's door, gently pulling its right-hand edge toward you.

3. Turn the vent tubing retainer counterclockwise, and then lift the vent tubing from the drip tray by pulling upward on it and moving it to the left-hand side of the leak sensor.



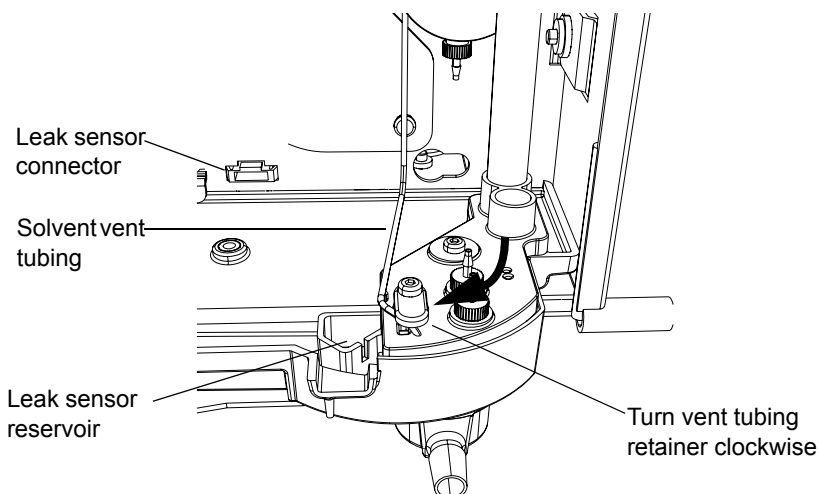
4. Unpack the new leak sensor.

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. Reinsert the vent tubing into the drip tray.

7. Turn the vent tubing retainer, which holds the vent tubing in place, clockwise.



8. Attach the leak sensor connector to the front of the device.
9. Power-on the quaternary solvent manager.
10. In the ACQUITY UPLC Console, select **Quaternary Solvent Manager** from the system tree.
11. Click **Control > Reset QSM**, to reset the quaternary solvent manager.

Installing the waste and degasser vent tubing

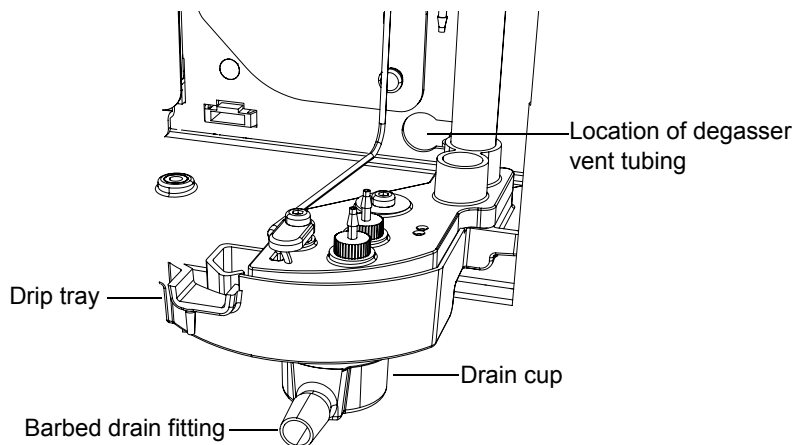
To install the waste and degasser vent tubing:



Caution:

- To prevent contamination, wear clean, chemical-resistant, powder-free gloves when installing or removing the waste and degasser vent tubing.
 - To avoid distorting the drip tray or causing the drain cup to leak, restrain the drain cup when attaching or removing the waste tubing.
1. Wet the barbed drain fitting located at the bottom of the quaternary solvent manager with methanol.

2. Hold the back of the drain cup, slide the waste tubing over the barbed drain fitting, and route the tubing to a suitable waste container.



Warning: To avoid releasing solvent vapors into the room, route the degasser vent tubing to a fume hood or other suitable exhaust system, or to a suitable waste container, ensuring the tubing's discharge end is at all times elevated above the fluid level.



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

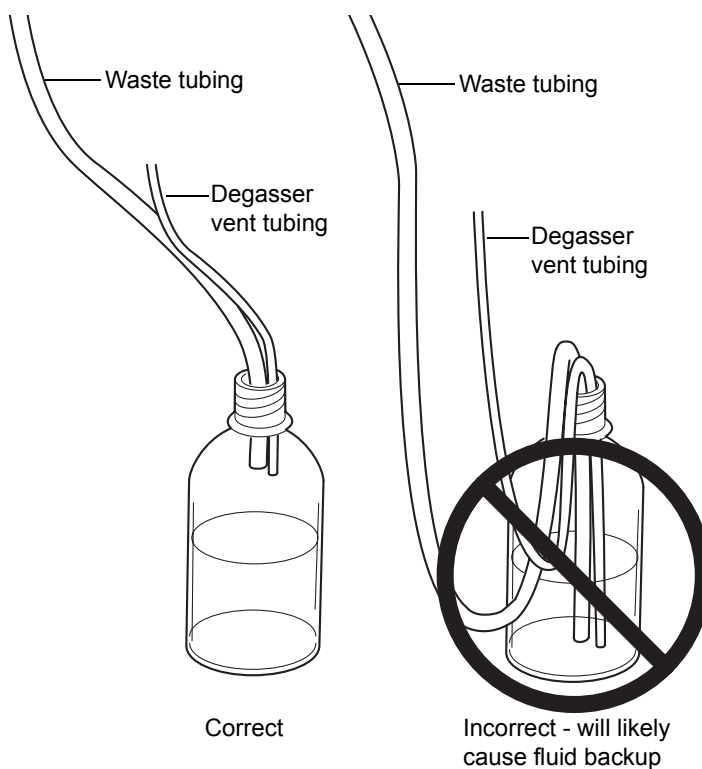


Caution: To avoid fluid backup, you must ensure proper drainage of waste:

- Place the waste container below the system stack.
- Ensure that the waste and degasser vent tubes do not crimp or bend. A crimp or bend can impede flow to the waste container.
- Ensure the exit of the waste and degasser vent tubes is not immersed in waste solvent. If necessary, shorten each tube so that no portion of it drops below the top of the waste container (see next figure).

3. Route the degasser vent tubing to a suitable waste container.

Correct positioning of waste and degasser vent tubes:



Priming the seal wash system

Prime the seal wash in the quaternary solvent manager to lubricate the plungers, fill the tubing paths with solvent, and flush away solvent and/or any precipitated salts that have been dragged past the plunger seals from the high-pressure side of the piston chambers.

Prime the plunger seal wash

- after using buffered mobile phase.
- when the quaternary solvent manager has been inactive for a few hours or longer.
- when the quaternary solvent manager is dry.

**Caution:**

- To avoid damaging the solenoid valve seats and seals in the solvent path, do not use a nonvolatile buffer as the seal wash solvent.
- To avoid clogging system tubing, ensure the seal wash solvent is 100% compatible with the mobile phase conditions.
- To prevent contamination, do not recycle seal wash.

Tip: The seal wash is self-priming, but you can use a syringe to hasten the priming process.

Recommendations:

- The composition of seal wash includes at least 10% organic solvent, a concentration that prevents microbial growth and ensures that the seal wash can solubilize the mobile phase.
- Before priming the plunger seals, ensure the volume of seal wash is adequate for priming.

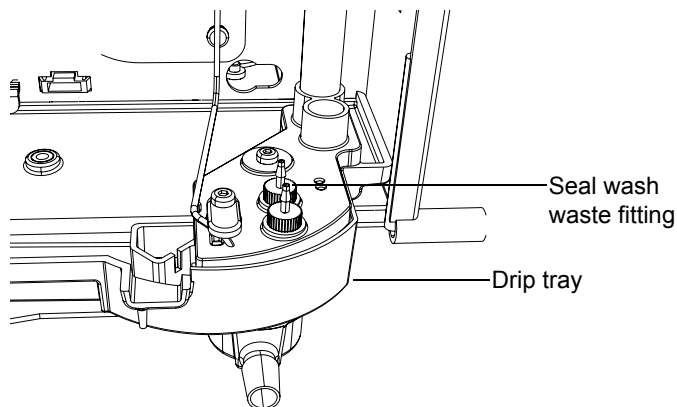
See also: *Controlling Contamination in Ultra Performance LC/MS and HPLC/MS Systems* (part number 715001307) on the ACQUITY UPLC System Bookshelf CD.

Required materials

- 30-mL syringe (startup kit)
- Seal wash solution
- Tubing adapter (startup kit)

To perform a seal wash prime:

1. Ensure the seal wash inlet tubing is immersed in the wash solvent.
2. Remove the seal wash outlet tubing from the seal wash waste fitting (on the right-hand side of the drip tray).



3. Push the syringe plunger fully into the syringe barrel.
4. Connect the tubing adapter to the syringe, and then connect the syringe assembly to the seal wash system's outlet tubing.
5. In the ACQUITY UPLC Console, from the system tree, select Quaternary Solvent Manager.
6. Click Control > Prime seal wash, and then click Yes to begin the seal wash priming process.
7. Slowly draw back on the syringe plunger, to pull solvent through the system.
8. When the seal wash solution begins to flow into the syringe with relatively few air bubbles, click Control > Prime seal wash, to stop the priming process.
9. Disconnect the tubing from the syringe assembly, and reconnect it to the fitting on the drip tray.

Priming the quaternary solvent manager

Priming prepares a new system or quaternary solvent manager for use, a change in reservoirs or solvents, or when restarting a system after it has been idle for more than 4 hours. During priming, the vent valve moves to the vent

position, ensuring minimal backpressure and directing the flow to waste. The flow rate during priming is 4 mL/min.

Tip: If you are priming a dry quaternary solvent manager, using a syringe shortens the time required for priming.



Caution: To prevent salts from precipitating in the system, introduce an intermediate solvent, such as water, when changing from buffers to high-organic-content solvents. Be sure to consult the solvent miscibility tables in the Solvent Considerations section.

Ensure the solvent reservoirs contain sufficient solvent for adequate priming and that the waste container can hold all the used solvent. For example, at 4 mL/min, priming for 5 minutes uses about 20 mL of each solvent.



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

Requirement: So that the degasser functions properly, prime all solvent lines with solvent.

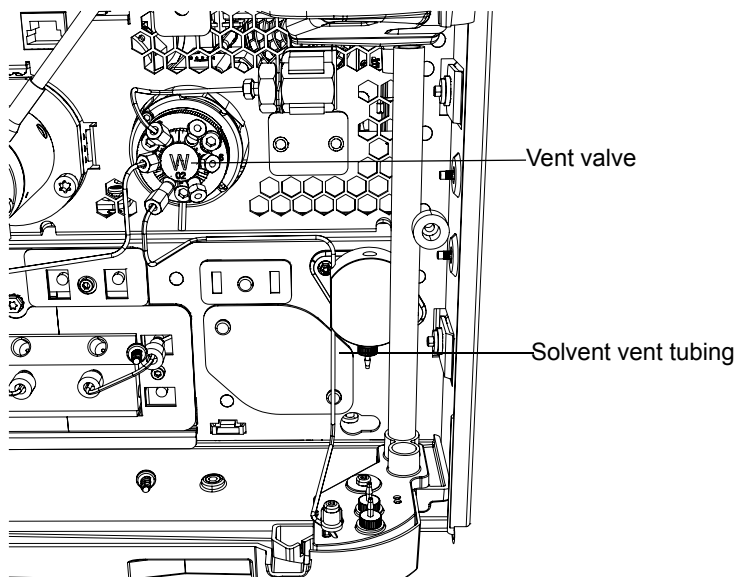
Priming a dry quaternary solvent manager via the console

To prime the quaternary solvent manager:

1. Open the device's front door.
2. Locate the appropriate solvent vent tubing.
3. In the ACQUITY UPLC Console, select Quaternary Solvent Manager from the system tree.
4. In the quaternary solvent manager information window, click Control > Prime solvents.
5. In the Prime Solvents dialog box, select solvent A, B, C, D, or (instead of D) D₁ through D₆.
6. In the Time box, specify the number of minutes from 0.1 through 60.0.

Default: 2.0 minutes

Recommendation: Prime the quaternary solvent manager until a steady flow exits the vent tubing (typically 7 to 10 minutes per solvent).



7. Click Start.

Tip: When solvent flows out the vent tubing without bubbles, the path is primed.

Requirement: All tubing must contain solvent, for the degasser to function correctly.

Priming a dry quaternary solvent manager using a syringe



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



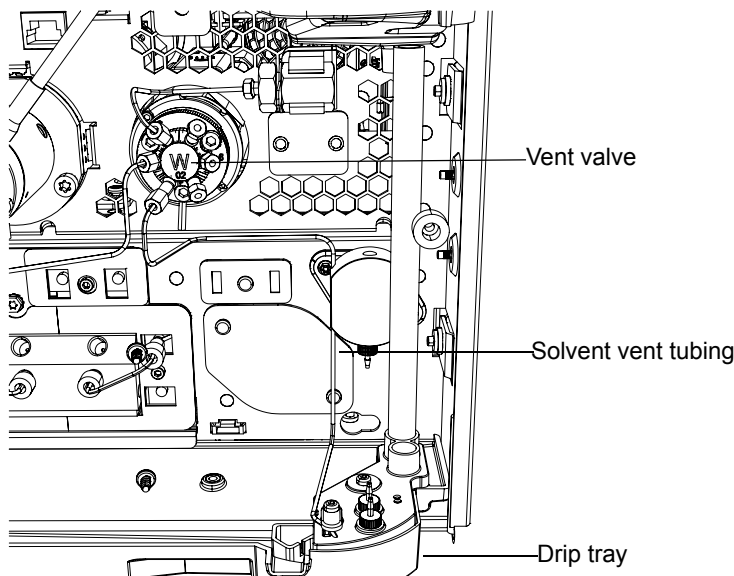
Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when priming a dry quaternary solvent manager using a syringe.

Required materials

- 30-mL syringe (startup kit)
- Gloves: clean, powder-free, chemical-resistant
- Seal wash solution
- Tubing adapter (startup kit)

To prime a dry quaternary solvent manager:

1. Open the device's front door.
2. Follow the stainless steel solvent vent tubing from port 4 on the vent valve, and lift it from the drip tray.



3. Push the syringe plunger fully into the syringe barrel.
4. Connect the tubing adapter to the syringe.
5. Connect the syringe assembly to a short length of tubing, and then connect the short length of tubing to the solvent vent tubing you lifted from the drip tray in [step 2](#).
6. In the ACQUITY UPLC Console, select Quaternary Solvent Manager from the system tree.

7. In the quaternary solvent manager information window, click Control > Prime solvents.
8. In the Prime Solvents dialog box, select the line you want to prime.
9. In the Time box, specify the number of minutes, from 0.1 through 60.0.
Recommendation: The default setting is 2.0 minutes. Nevertheless, prime the quaternary solvent manager until a steady flow exits the vent tubing (typically 3 minutes).
10. Click Start.
11. Slowly withdraw the syringe plunger.
Tip: When solvent flows out the vent tubing without bubbles, the path is primed.
12. Remove the syringe from the vent tubing, and reconnect the vent tubing to the drip tray.
13. Repeat [step 2](#) through [step 12](#) for the remaining solvents, including any solvent lines plumbed to the optional solvent selection valve.
Requirement: All tubing must contain solvent for the degasser to function correctly.

Washing the plungers

The plunger wash function washes the plungers with seal wash solvent. It is designed to prevent the build-up of precipitates on the pump plungers, which can cause damage to the high-pressure seals.

The cycle starts by filling and then slowly emptying the primary and accumulator chambers with the current solvent composition while performing a high-speed and high-volume seal wash.

Recommendation: Perform this procedure after using buffered solvents.

In addition, the plunger wash routine runs when the solvent manager is idle. The seal wash solvent washes the plungers, moving them backward and

forward, so most of the surface is washed. The plunger wash routine continues for two minutes performing these operations:

- Starts the seal wash pump
- Slowly empties and fills the syringes, with the vent valve set to waste, thus moving the plungers through the seal wash flow.
- Repeats the emptying and filling of syringes for a total of two cycles.

To wash the plungers:

In the console, select the solvent manager > Maintain > Wash plungers.

Using the quaternary solvent manager

Vacuum degasser overview

Quaternary solvent managers are equipped with an absolute pressure transducer (APT), which is unaffected by altitude or barometric changes. The following table lists the attributes of APT-equipped separations modules.

Absolute pressure transducer attributes:

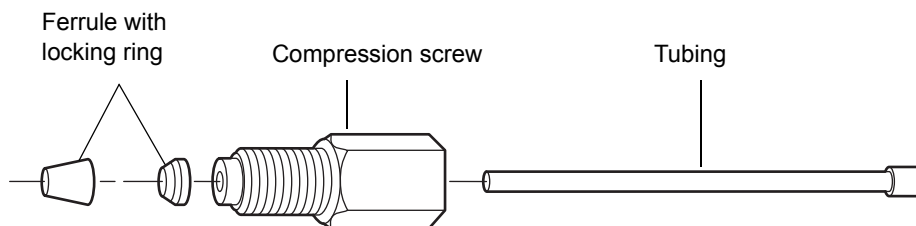
Item	Absolute pressure transducer
Units displayed	kPa, bar, psia
Sign of displayed unit	Positive
Theoretical maximum vacuum (based on 1 atm, at sea level)	0.0 psia
Operating range	0.00 to 1.54 psia
“Typical” value	0.70 to 1.20 psia

Installation recommendations for fittings



Warning: Fittings can be contaminated with biohazardous and/or toxic materials. Always wear clean, chemical-resistant, powder-free gloves when reinstalling fittings.

The system uses gold-plated compression screws and two-piece ferrules. See the diagram below for assembly orientation.



Recommendations:

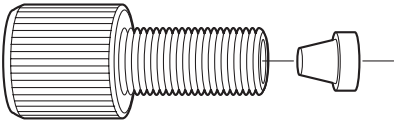
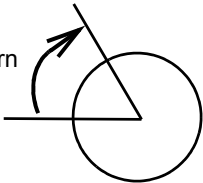
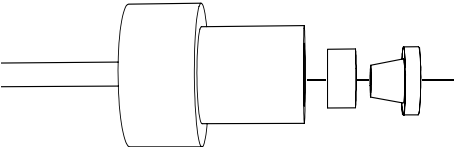
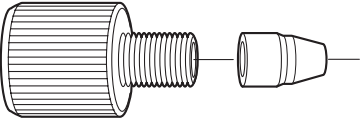
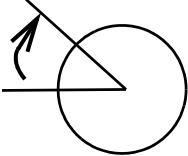
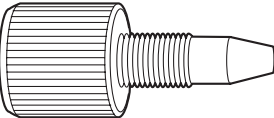
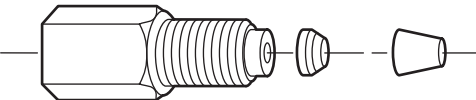
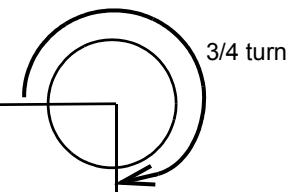
- To prevent bandspreading, ensure the tubing is fully bottomed in the fitting hole before tightening the compression screw.
- For easier accessibility, use long compression screws to attach tubes to the injector and vent valve.
- Perform the solvent manager leak test whenever you replace or loosen fittings during maintenance (see the ACQUITY UPLC online Help).
- Whenever you loosen fittings during maintenance, examine for cracks, stripped threads, and deformations.
- Do not reuse stainless steel fittings more than six times.

Required material

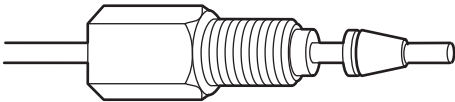
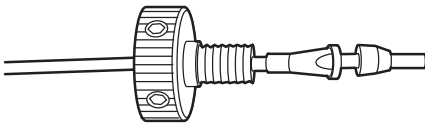
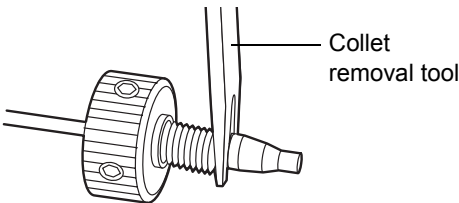
Gloves: clean, powder-free, chemical-resistant

When tightening system fittings, consult the following table.

Installation recommendations for ACQUITY UPLC fittings:


Fitting	Recommended tightening
1/4-28 flangeless with ferrule 	Snug, plus 1/6-turn 
1/4-28 flangeless with 2-piece ferrule 	Snug, plus 1/6-turn
10-32 LT135 PEEK with ferrule 	Snug, plus 1/6-turn; if leaking, tighten another 1/8-turn 
10-32 one-piece PEEK 	Finger-tight
Stainless steel (gold plated) with 2-piece stainless steel ferrule (first use) 	Finger-tight, plus 3/4-turn using wrench 



Installation recommendations for ACQUITY UPLC fittings: (Continued)

Fitting	Recommended tightening
Stainless steel (gold plated) with 2-piece stainless steel ferrule (re-installed) 	Finger-tight, plus up to 1/6-turn using wrench
Reusable finger-tight (first use) 	Snug, plus 1/6-turn
Reusable finger-tight (re-installed) 	Snug, plus up to 1/6-turn; if leaking, tighten another 1/8-turn

Resolving leak sensor errors

After approximately 1.5 mL of liquid accumulates in the leak sensor reservoir, an alarm sounds indicating that the leak sensor detected a leak.

 **Warning:** To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.

  **Warning:** The leak sensor can be contaminated with biohazardous and/or toxic materials. Always wear clean, chemical-resistant, powder-free gloves when performing this procedure.



Caution: To avoid scratching or damaging the leak sensor

- do not allow buffered solvents to accumulate and dry on it.
- do not submerge it in a cleaning bath.

Required materials

- Cotton swabs
- Gloves: clean, powder-free, chemical-resistant
- Nonabrasive, lint-free wipes

To resolve a leak sensor error:

1. In the ACQUITY UPLC Console's Leak Sensors dialog box, confirm that the quaternary solvent manager leak sensor detected a leak.

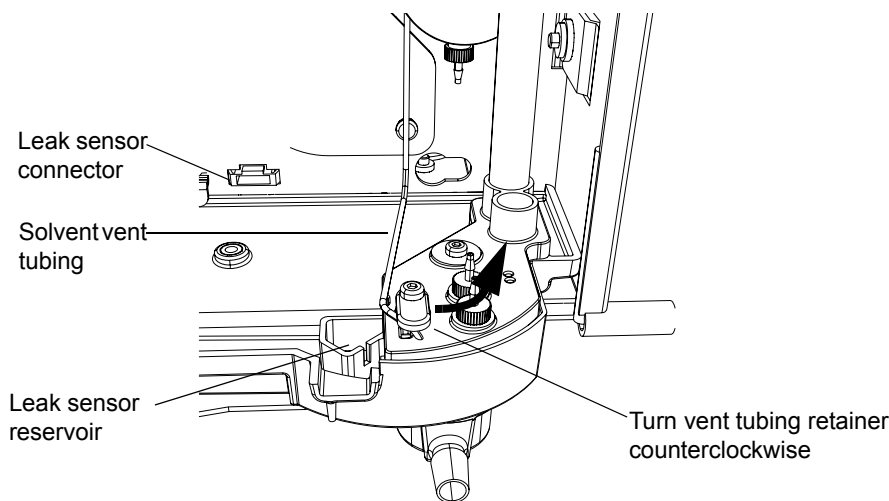
Tip: When a leak is detected, a "Leak Detected" error message appears.



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

2. Power-off the quaternary solvent manager.
3. Open the quaternary solvent manager's door, gently pulling its right-hand edge toward you.
4. Locate the source of the leak, and make the repairs necessary to stop the leak.

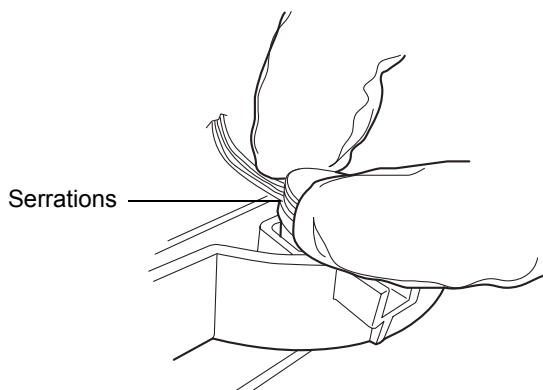
5. Turn the vent tubing retainer counterclockwise, and then lift the vent tubing from the drip tray by pulling up on it and then moving it to the left-hand side of the leak sensor.



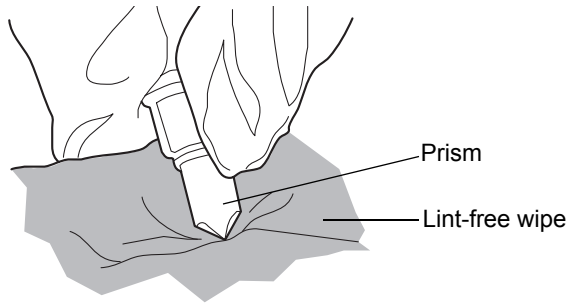
Caution: To avoid damaging the leak sensor, do not grasp it by the ribbon cable.

6. Remove the leak sensor from its reservoir, grasping it by its serrations, and pull upward on it.

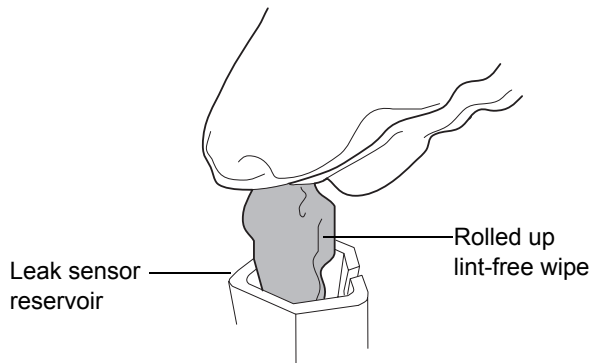
Tip: If you cannot easily manipulate the leak sensor after removing it from its reservoir, detach the connector from the front of the device (see [page 33](#)).



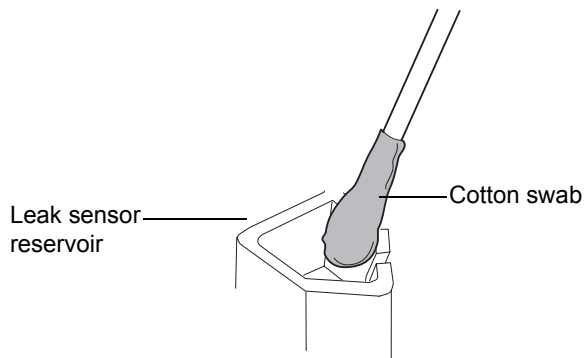
7. Use a nonabrasive, lint-free wipe to dry the leak sensor prism.



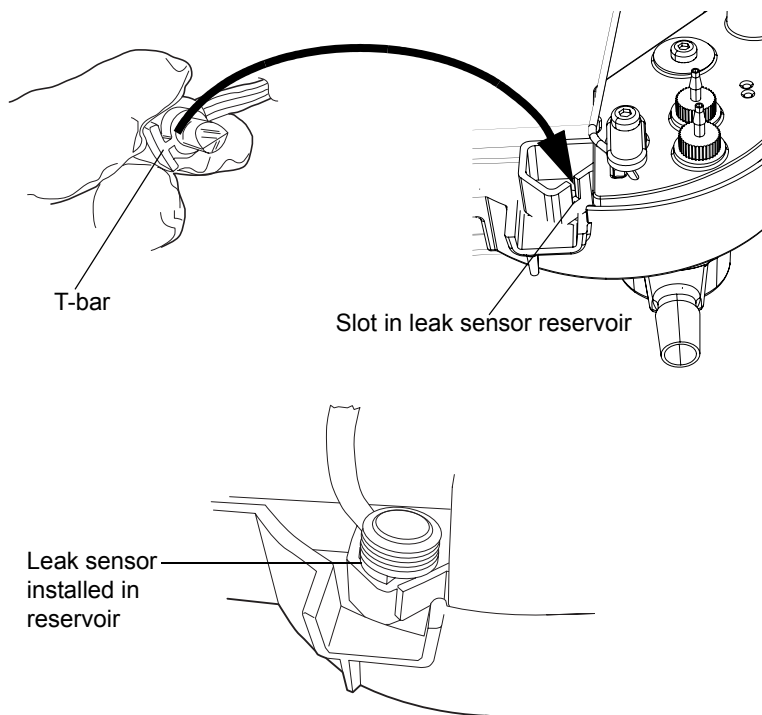
8. Roll up a nonabrasive, lint-free wipe, and use it to absorb the liquid from the leak sensor reservoir and its surrounding area.



9. With a cotton swab, absorb any remaining liquid from the corners of the leak sensor reservoir and its surrounding area.

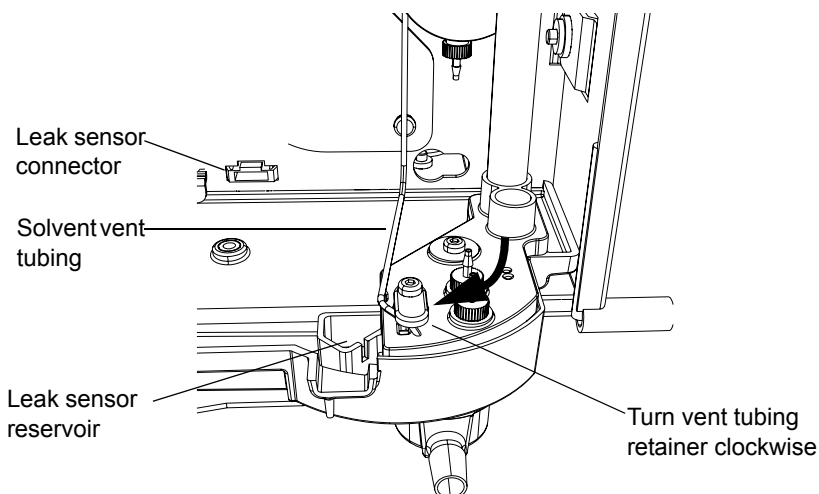


10. Align the leak sensor's T-bar with the slot in the side of the leak sensor reservoir, and slide the leak sensor into place.



11. Reinsert the vent tubing into the drip tray.

12. Turn the vent tubing retainer, which holds the vent tubing in place, clockwise.



13. If you detached the connector from the front of the device, reattach it.
14. Power-on the quaternary solvent manager.
15. In the ACQUITY UPLC Console, select **Quaternary Solvent Manager** from the system tree.
16. In the quaternary solvent manager information window, click **Control > Reset QSM**, to reset the quaternary solvent manager.

Maintaining the quaternary solvent manager

Perform the procedures in this section when you discover a problem with a quaternary solvent manager component or during routine maintenance. For information about isolating problems in the quaternary solvent manager, consult the ACQUITY UPLC Console online Help.

Contacting Waters technical service

If you are located in the USA or Canada, report malfunctions or other problems to Waters Technical Service (800 252-4752). Otherwise, phone the Waters corporate headquarters in Milford, Massachusetts (USA), or contact your local Waters subsidiary. Waters' site includes phone numbers and e-mail addresses for Waters locations worldwide. Visit www.waters.com.

When you contact Waters, be prepared to provide this information:

- Error message (if any)
- Nature of the symptom
- Instrument serial numbers and firmware version
- Flow rate
- Operating pressure
- Solvent(s)
- Detector settings (sensitivity and wavelength)
- Type and serial number of column(s)
- Sample type and diluent
- Data software version and serial number
- ACQUITY UPLC H-Class system workstation model and operating system version

For complete information on reporting shipping damages and submitting claims, see the document *Waters Licenses, Warranties, and Support Services*.

Locating system serial numbers

The serial number on the system's instruments and devices facilitates service and support. Serial numbers also provide a way to create single log entries for each module so that you can review the usage history of only that instrument or device.

Be prepared to provide the serial numbers of the instruments or devices in your system when you contact Waters customer support.

To view the information for an instrument or device:

1. In the ACQUITY UPLC Console, select an instrument or device from the system tree.
2. Click Configure > View module information.

Result: The Module Information dialog box displays this information:

- Serial number
- Firmware version

- Firmware checksum
- Component software version

Alternatives:

- From the main window, place the pointer over the visual representation of the system instrument or device you want information for.
- Obtain the serial number from the printed labels on the rear panels of instruments and devices or inside their front doors.

Maintenance schedule

Perform the following routine maintenance on the quaternary solvent manager to ensure reliable operation and accurate results. When using the system throughout the day (and on nights and weekends), or when using aggressive solvents such as buffers, perform these maintenance tasks more frequently.

Recommended routine maintenance schedule:

Maintenance procedure	Frequency	For information...
Replace the leak sensor	As needed	See page 32 .
Replace the inlet manifold	As needed	See page 37 .
Replace the <i>i</i> ² Valve actuator	Five years from the date of manufacture or as needed	See page 40 .
Replace the <i>i</i> ² Valve cartridge	During scheduled routine maintenance or as needed	See page 50 .
Replace the accumulator check-valve	During scheduled routine maintenance or as needed	See page 59 .
Replace solvent filters	During scheduled routine maintenance or as needed	See page 62 .
Clean the air filter in the door	As needed	See page 63 .
Replace the air filter in the door	During scheduled routine maintenance or as needed	See page 64 .

Recommended routine maintenance schedule: (Continued)

Maintenance procedure	Frequency	For information...
Replace the head seals	During scheduled routine maintenance or as needed	See page 65 and page 83 .
Replace the plungers	During scheduled routine maintenance or as needed	See page 96 and page 116 .
Replace the vent valve cartridge	As needed	See page 131 .
Replace the optional solvent selection valve cartridge	As needed	See page 136 .
Replace the low-pressure inlet filters on the GPV outlet	During scheduled routine maintenance or as needed	See page 136 .
Replace the 100- μ L mixer/filter	During scheduled routine maintenance or as needed	See page 138 .
Replace the optional 250- μ L mixer/filter	During scheduled routine maintenance or as needed	See page 139 .
Clean the device's exterior with a soft, lint-free cloth, or paper dampened with water	As needed	See page 140 .

Maintenance considerations

Safety and handling

Observe these warning and caution advisories when you perform maintenance operations on your system.



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Warning: To avoid electric shock, do not remove the device's protective panels. The components within are not user-serviceable.



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

Proper operating procedures

To ensure a system runs efficiently, see [“Preparing for operation” on page 7](#).

Configuring maintenance warnings

Maintenance counters provide real-time usage status information that can help you determine when to schedule routine maintenance for specific components. You can set usage thresholds and maintenance warnings that alert you when a component reaches the designated threshold limit. By setting threshold limits and monitoring these usage counters regularly, you can minimize unexpected failures and unscheduled downtime during important work. For information on setting maintenance warnings, consult the ACQUITY UPLC Console online Help.

Replacing the leak sensor



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Warning: The leak sensor can be contaminated with biohazardous and/or toxic materials. Always wear clean, chemical-resistant, powder-free gloves when performing this procedure.

Required materials

- Gloves: clean, powder-free, chemical-resistant
- Leak sensor

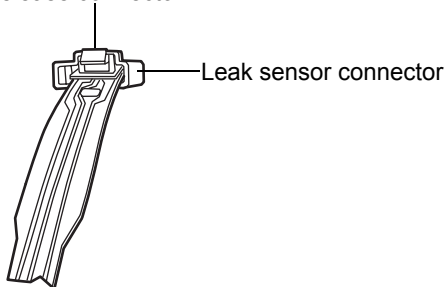
To replace the leak sensor:



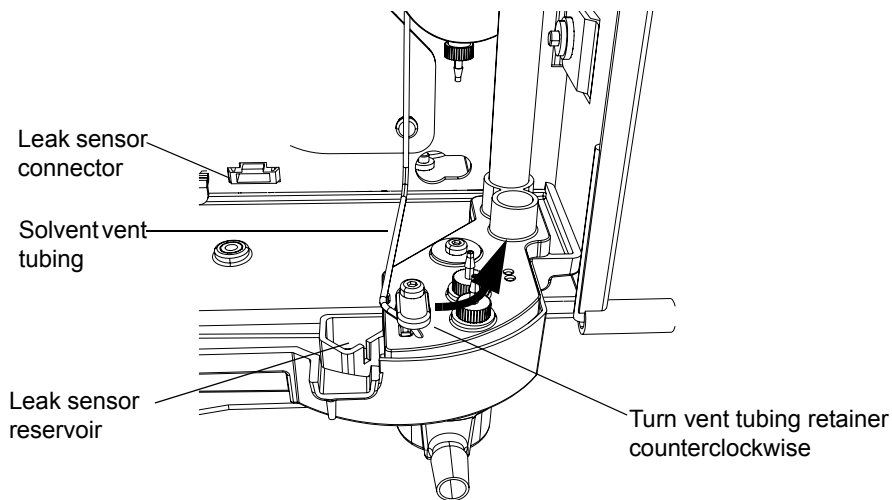
Caution: To avoid damaging electrical parts, never disconnect an electrical assembly while power is applied to an instrument or device. To completely interrupt power, set the power switch to Off, and then unplug the power cord from the AC source. Wait 10 seconds thereafter before you disconnect an assembly.

1. Power-off the quaternary solvent manager.
2. Open the quaternary solvent manager's door, gently pulling its right-hand edge toward you.
3. Press down on the tab to detach the leak sensor connector from the front of the device.

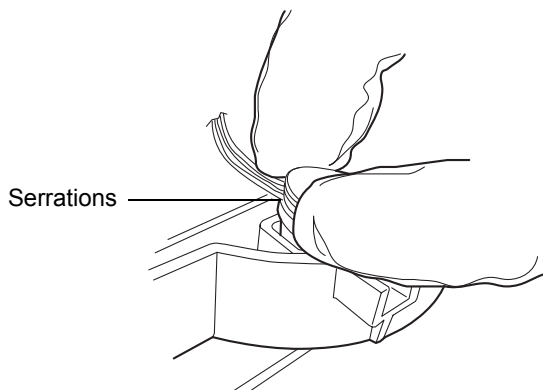
Press down on tab to
release connector



4. Turn the vent tubing retainer counterclockwise, and then lift the vent tubing from the drip tray by pulling upward on it and moving it to the left-hand side of the leak sensor.

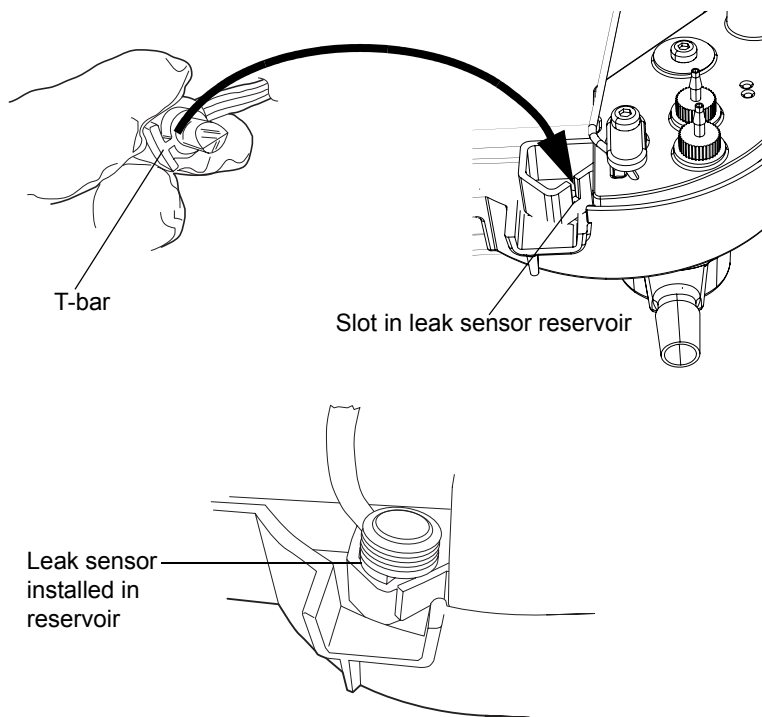


5. Remove the leak sensor from its reservoir, grasping it by its serrations, and pull upward on it.



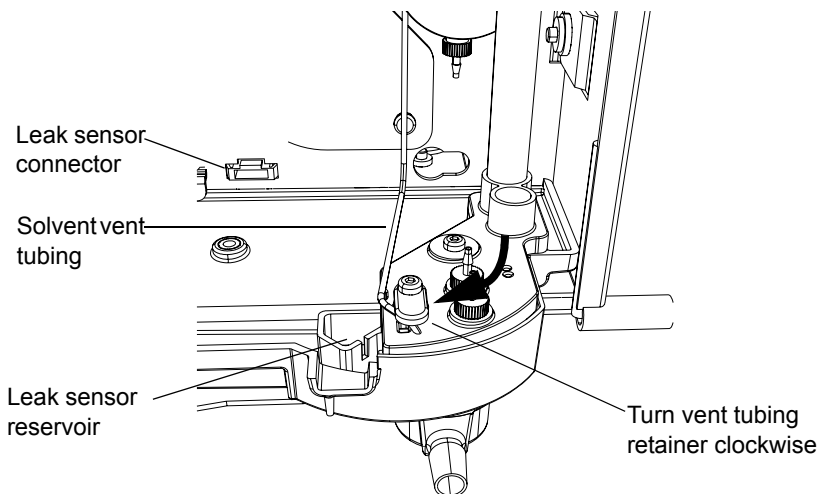
6. Unpack the new leak sensor.

7. 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.



8. Reinsert the vent tubing into the drip tray.

9. Turn the vent tubing retainer, which holds the vent tubing in place, clockwise.



10. Connect the leak sensor connector to the front of the device.
11. Power-on the quaternary solvent manager.
12. In the ACQUITY UPLC Console, select Quaternary Solvent Manager from the system tree.
13. In the quaternary solvent manager information window, click Control > Reset QSM, to reset the quaternary solvent manager.

Replacing the inlet manifold



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



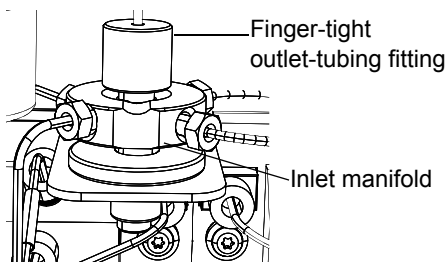
Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when replacing the inlet manifold.

Required materials

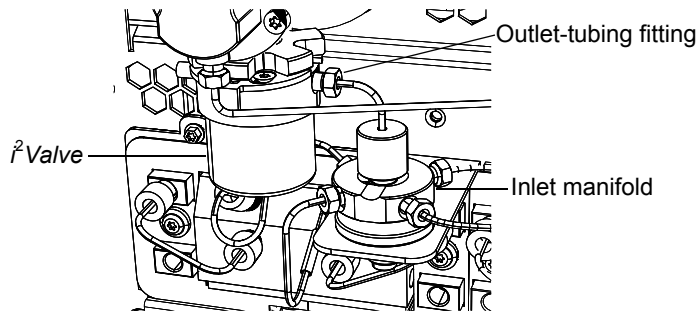
- 1/4-inch open-end wrench
- Gloves: clean, powder-free, chemical-resistant
- Inlet manifold

To replace the inlet manifold:

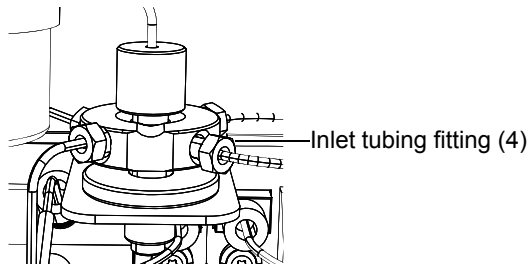
1. Power-off the quaternary solvent manager.
2. Open the quaternary solvent manager's door, gently pulling its right-hand edge toward you.
3. Disconnect the finger-tight outlet-tubing fitting from the inlet manifold outlet.



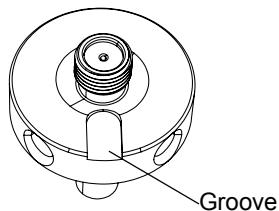
4. Use the 1/4-inch open-end wrench to disconnect the inlet manifold outlet-tubing fitting on the side of the *i*² Valve and remove the tubing.



5. Use the 1/4-inch open-end wrench to disconnect the inlet-tubing fittings from the inlet manifold.

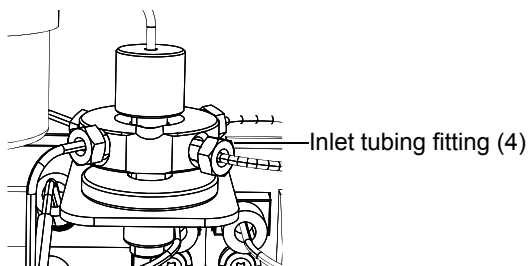


6. Remove the inlet manifold from the mounting bracket.
7. Ensuring its groove faces forward, place the new inlet manifold in the mounting bracket.



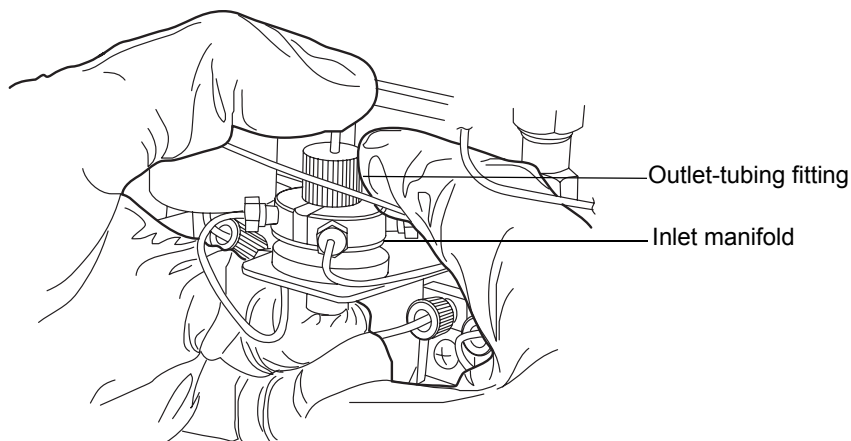
8. Reinstall the outlet-tubing fitting on the side of the *i*² Valve, and loosely finger-tighten it.

9. Reattach the inlet-tubing fittings to the inlet manifold, and tighten them finger-tight plus up to an additional 1/6-turn, for existing fittings, or 3/4-turn for new fittings.

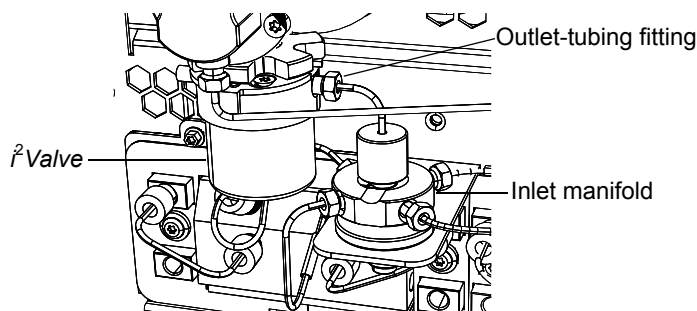


10. Reattach the outlet-tubing fitting to the inlet manifold, and finger-tighten it to the extent possible.

Requirement: Ensure the outlet-tubing is fully engaged by raising the inlet manifold while attaching the outlet-tubing fitting.



11. Tighten the outlet-tubing fitting, on the side of the i^2 Valve, finger-tight plus up to an additional 1/6-turn, for existing fittings, or 3/4-turn for new fittings.



12. Power-on the quaternary solvent manager.
13. Prime the quaternary solvent manager (see [page 15](#)).

Replacing the i^2 Valve actuator



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Caution:

- To avoid damaging the i^2 Valve actuator, do not attempt to push or pull liquid or gas through the valve's inlet or outlet ports.
- To prevent contamination, wear clean, chemical-resistant, powder-free gloves when replacing the i^2 Valve actuator.

Required materials

- T8 TORX[®] driver
- 1/4-inch open-end wrench
- 5/16-inch open-end wrench
- Gloves: clean, powder-free, chemical-resistant

- i^2 Valve actuator
- i^2 Valve cartridge (recommended)

To replace the i^2 Valve actuator:



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

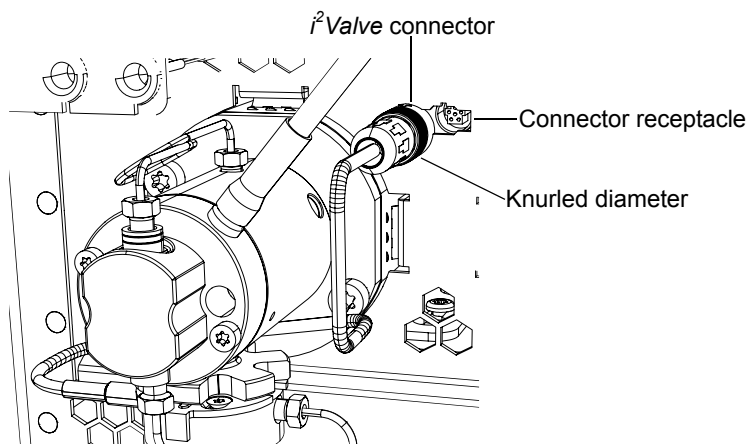
1. Flush the quaternary solvent manager with nonhazardous solvent.
2. Power-off the quaternary solvent manager.

Tip: The quaternary solvent manager is referred to as “pump” on the warning label affixed to the i^2 Valve actuator.

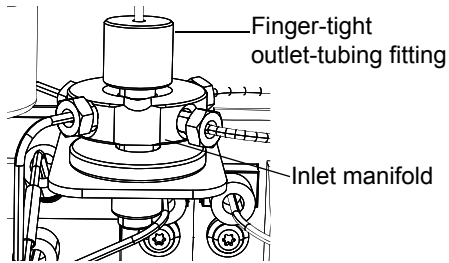


Caution: To avoid damage to the connector or cable, grasp the i^2 Valve connector by the knurled diameter.

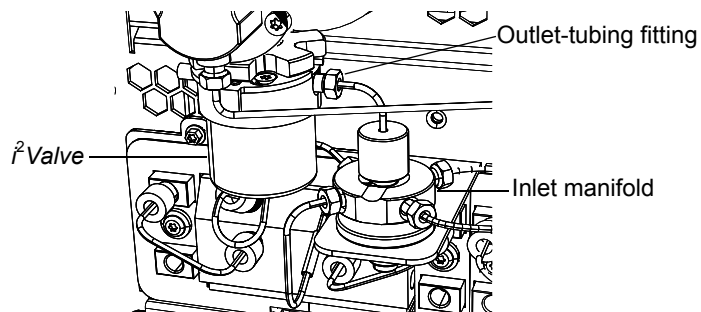
3. Grasp the i^2 Valve connector by the knurled diameter, and pull it toward you, disconnecting it from its receptacle.



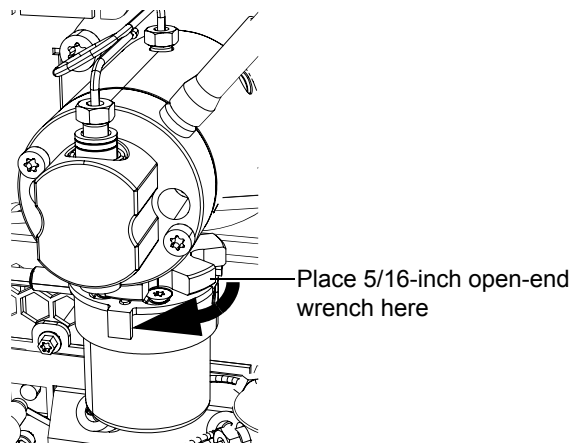
4. Loosen the finger-tight outlet-tubing fitting on the inlet manifold outlet.



5. Use the 1/4-inch open-end wrench to disconnect the inlet manifold outlet-tubing fitting on the side of the i^2 Valve and remove the tubing.



6. Use the 5/16-inch open-end wrench to loosen the shell nut, and then fully unscrew it.

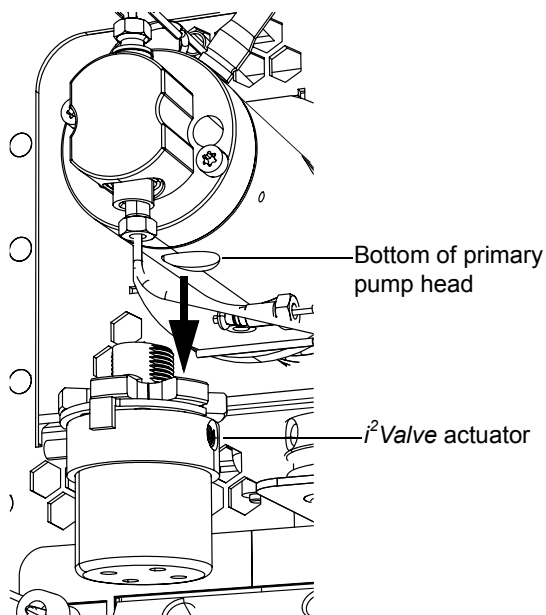




Caution:

- When you remove the valve assembly, ensure the PEEK washer, which is normally on the top face of the *i*²Valve cartridge, does not remain in the head (see [page 44](#)).
- Never place the actuator assembly or electrical connector in the drip tray.

7. Remove the *i*²Valve actuator from the bottom of the primary pump head.

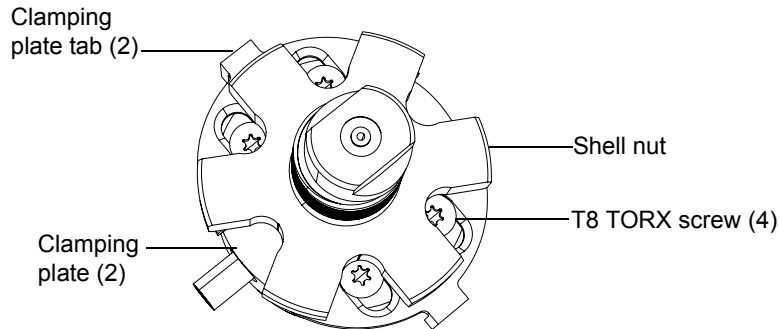


8. Use the T8 TORX driver to loosen 1/2-turn the 4 screws that secure the clamping plates.

9. Ensure the shell nut remains free to rotate and that the plates slide open.

Tips:

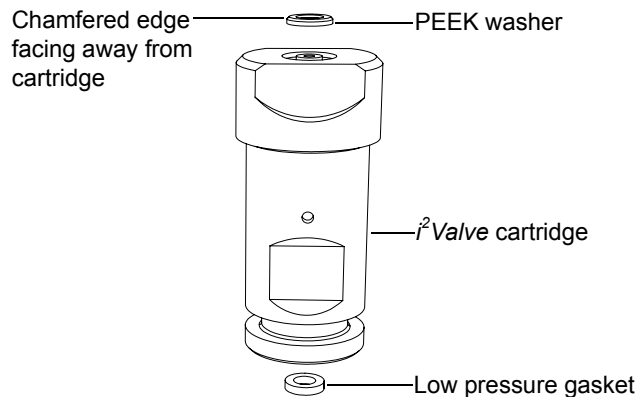
- Avoid touching the clamping plate tabs when loosening the screws.
- You can rotate the shell nut to gain access to all 4 screws.



10. Remove the cartridge from the *i*² Valve actuator when both plates are in the maximum open position, ensuring the low pressure gasket is also removed.

Tip: If you cannot remove the cartridge from the valve actuator, rotate the cartridge 1/2-turn, and then remove it.

11. Ensure the PEEK washer is inserted into the cartridge so that its chamfered edge faces away from the cartridge.



12. Use the T8 TORX driver to loosen 1/2-turn the 4 screws that secure the clamping plates on the new *i*² Valve actuator.

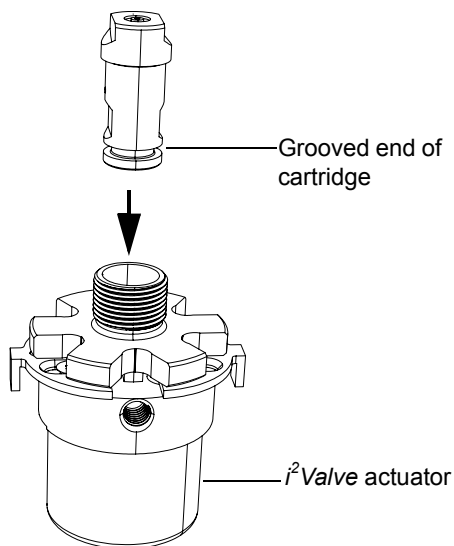
13. Ensure the plates are loose and in their maximum open position.

Tips:

- Avoid touching the clamping plate tabs when loosening the screws.
- You can rotate the shell nut to gain access to all 4 screws.

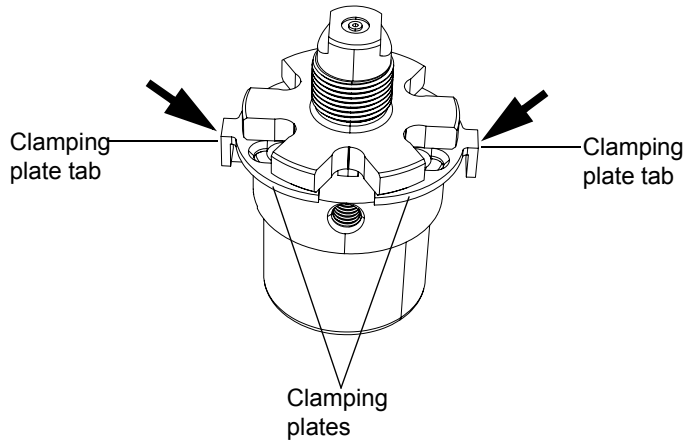
14. Insert the cartridge you removed from the old *i*²Valve actuator into the new actuator, grooved end first.

Recommendation: Replace the cartridge whenever you replace the *i*²Valve actuator. See [step 12](#) on [page 54](#).



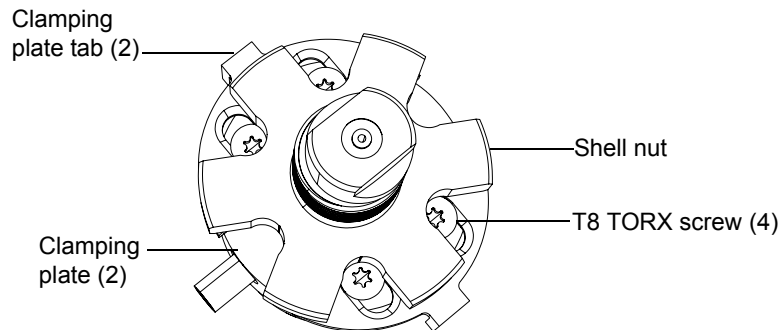
15. With one hand, squeeze the 2 clamping plate tabs on the *i²Valve* actuator, to hold the clamping plates against the cartridge.

Requirement: The clamping plates must be fully engaged in the cartridge groove.

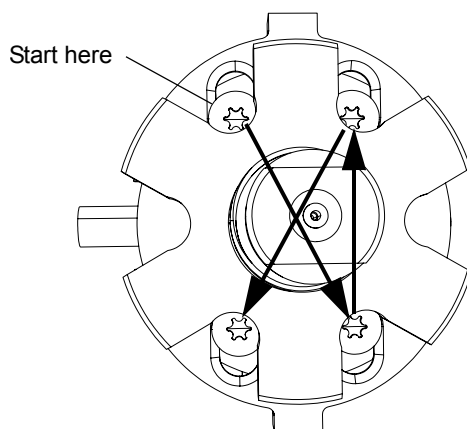


16. While squeezing the clamping plate tabs, use the T8 TORX driver to tighten the 4 screws that secure the plates, following the torquing pattern shown in [step 17](#), below.

Tip: You can rotate the shell nut to gain access to all 4 screws.



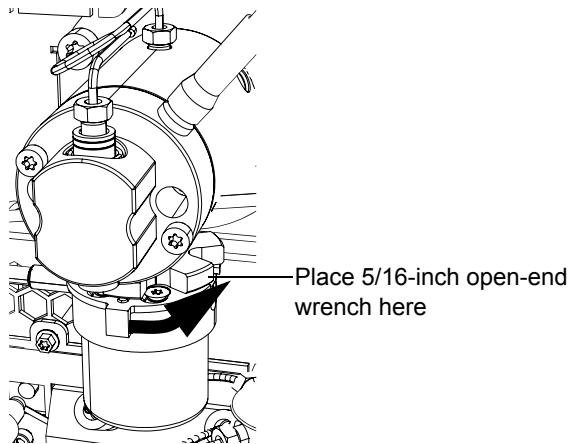
17. Follow the pattern shown below when tightening the screws that secure the plates, and repeat it at least 3 times, gradually increasing the torque until the screws are uniformly tight.



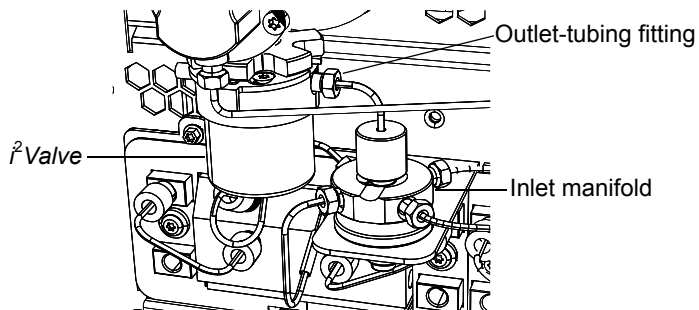
18. Orient the i^2 Valve assembly so that the cable exits from the left-hand side.
19. Insert the i^2 Valve assembly into the bottom of the primary pump head, and route the cable behind the valve actuator.
20. Finger-tighten the shell nut to secure the valve.

Tip: Expect to be able to rotate the shell nut approximately 5 full turns before it is finger-tight.

21. Use the 5/16-inch open-end wrench to tighten the nut an additional 1/8-turn.

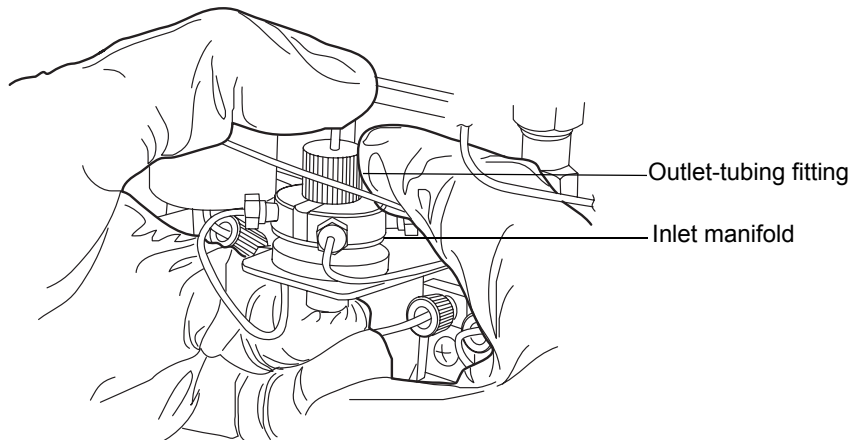


22. Reinstall the outlet-tubing fitting on the side of the i^2 Valve, and loosely tighten it.

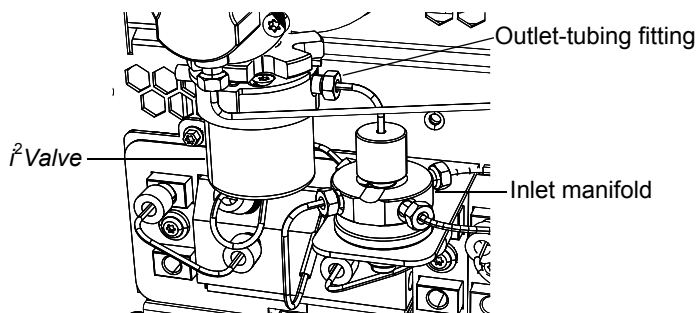


23. Reattach the outlet-tubing fitting to the inlet manifold, and finger-tighten it to the extent possible.

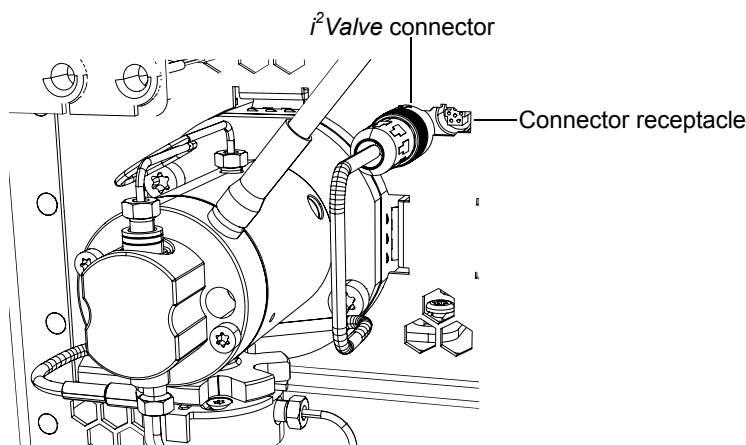
Requirement: Ensure the outlet-tubing is fully engaged by raising the inlet manifold while attaching the outlet-tubing fitting.



24. Tighten the outlet-tubing fitting, on the side of the i^2 Valve, finger-tight plus up to an additional 1/6-turn, for existing fittings, or 3/4-turn for new fittings.



25. Align the white arrow on the *i*²Valve connector with the white arrow on the receptacle, in the 12 o'clock position, and insert the connector into the receptacle.



26. Power-on the quaternary solvent manager.
27. Prime the quaternary solvent manager (see [page 15](#)).

Replacing the *i*²Valve cartridge



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Caution:

- To avoid damaging the *i*²Valve actuator, do not attempt to push or pull liquid or gas through the valve's inlet or outlet ports.
- To prevent contamination, wear clean, chemical-resistant, powder-free gloves when replacing the *i*²Valve cartridge.

Required materials

- T8 TORX driver
- 1/4-inch open-end wrench
- 5/16-inch open-end wrench

- Gloves: clean, powder-free, chemical-resistant
- *i*²Valve cartridge

To replace the *i*²Valve cartridge:

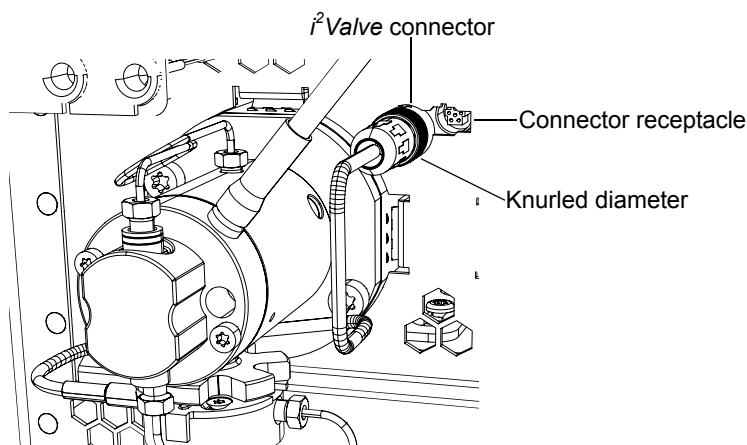


Caution: To avoid damaging electrical parts, never disconnect an electrical assembly while power is applied to an instrument or device. To completely interrupt power, set the power switch to Off, and then unplug the power cord from the AC source. Wait 10 seconds thereafter before you disconnect an assembly.

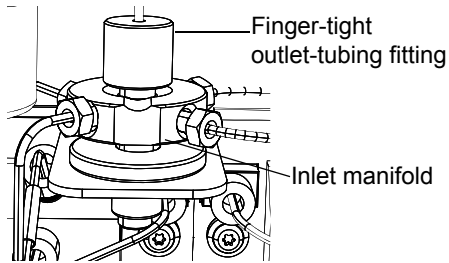
1. Flush the quaternary solvent manager with nonhazardous solvent.
2. Power-off the quaternary solvent manager.

Tip: The quaternary solvent manager is referred to as “pump” on the warning label affixed to the *i*²Valve actuator.

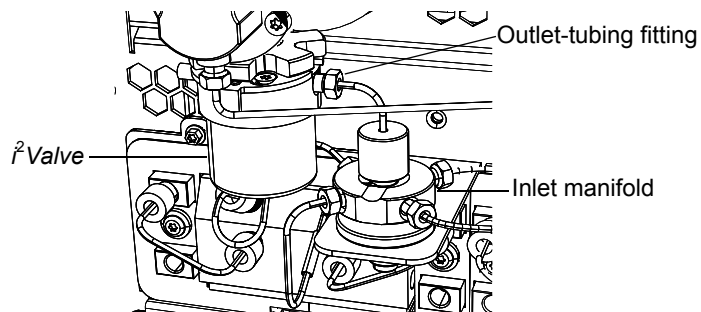
3. Grasp the *i*²Valve connector by the knurled diameter, and pull it toward you, disconnecting it from its receptacle.



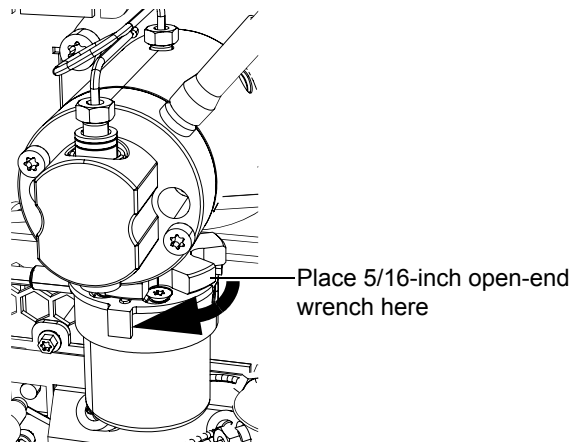
4. Loosen the finger-tight outlet-tubing fitting on the inlet manifold outlet.



5. Use the 1/4-inch open-end wrench to disconnect the inlet manifold outlet-tubing fitting on the side of the i^2 Valve and remove the tubing.



6. Use the 5/16-inch open-end wrench to loosen the shell nut, and then fully unscrew it.

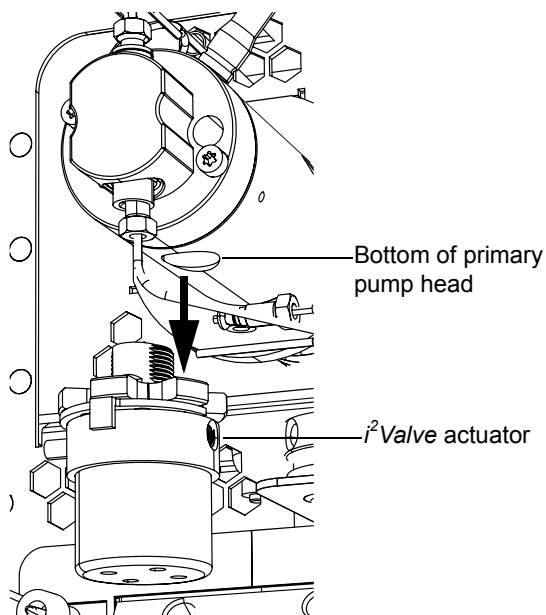




Caution:

- When you remove the valve assembly, ensure the PEEK washer, which is normally on the top face of the *i*²Valve cartridge, does not remain in the head. See [page 54](#).
- Never place the actuator assembly or electrical connector in the drip tray.

7. Remove the *i*²Valve actuator from the bottom of the primary pump head.



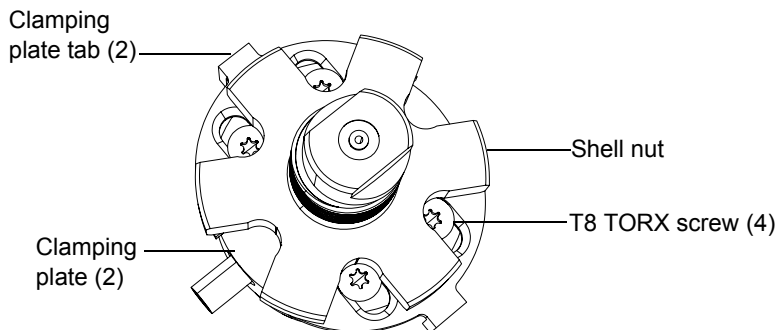
Caution: To avoid damaging the *i*²Valve actuator, do not back the screws out fully.

8. Use the T8 TORX driver to loosen 1/2-turn the 4 screws that secure the plates.

9. Ensure the shell remains free to rotate and that the plates slide open.

Tips:

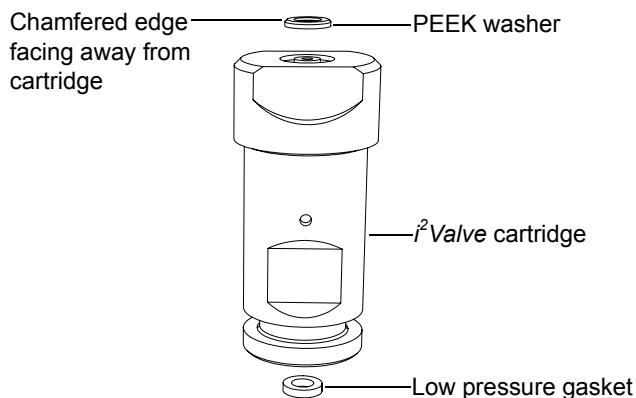
- Avoid touching the clamping plate tabs when loosening the screws.
- You can rotate the shell nut to gain access to all 4 screws.



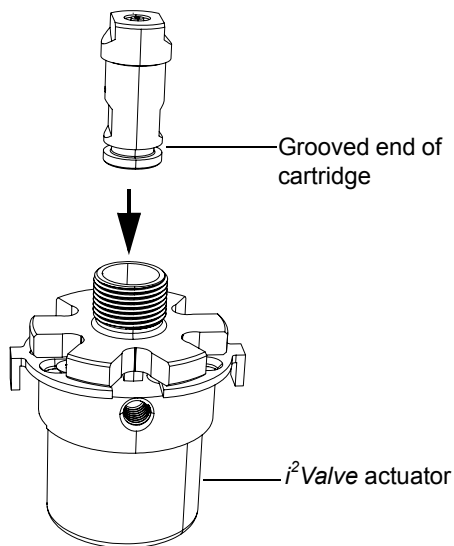
10. Remove the cartridge from the *i*²Valve actuator when both plates are in the maximum open position, ensuring that the low pressure gasket is also removed (see [page 54](#)).

Tip: If you cannot remove the cartridge from the valve actuator, rotate the cartridge 1/2-turn, and then remove it.

11. Unpack the new cartridge.
12. Ensure the PEEK washer is inserted into the cartridge so that its chamfered edge faces away from the cartridge.

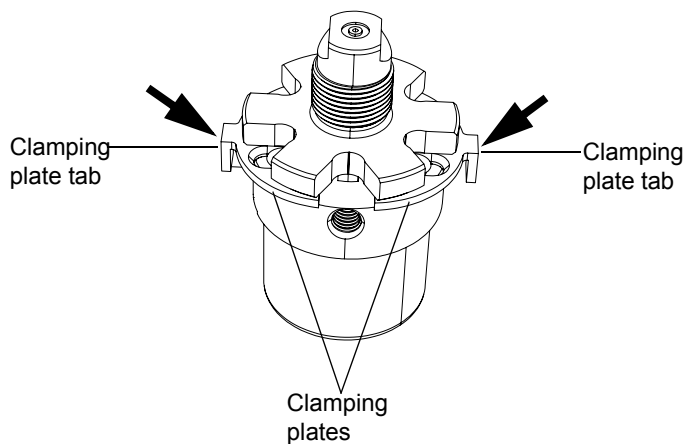


13. With the clamping plates still open, insert the cartridge into the *i*²Valve actuator, grooved end first.



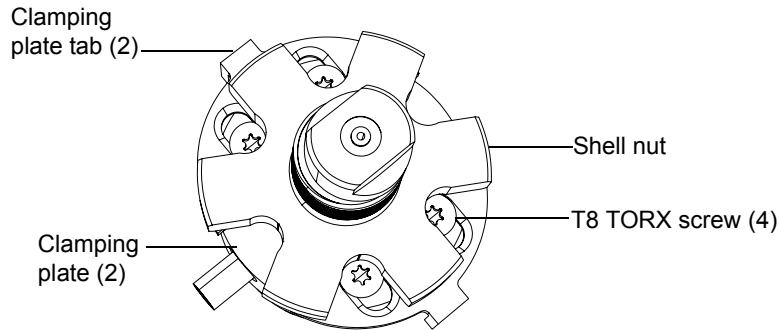
14. With one hand, squeeze the 2 clamping plate tabs on the *i*²Valve actuator, to hold the clamping plates against the cartridge.

Requirement: The clamping plates must be fully engaged in the cartridge groove.

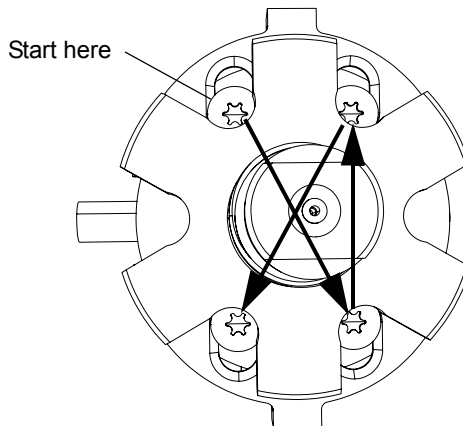


15. While squeezing the clamping plate tabs, use the TORX driver to tighten the 4 screws that secure the plates, following the torquing pattern shown in [step 16](#).

Tip: You can rotate the shell nut to gain access to all 4 screws.



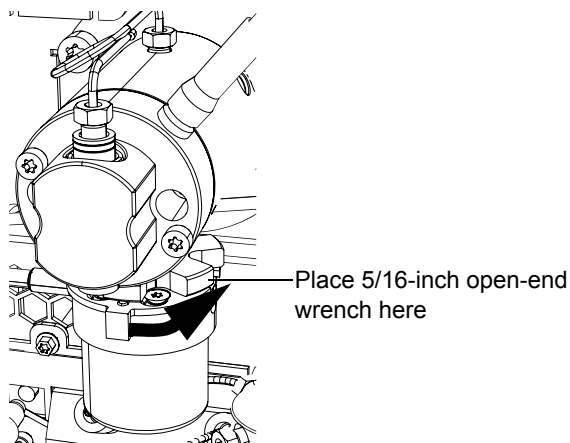
16. Follow the pattern shown below when tightening the screws that secure the plates, and repeat it at least 3 times, gradually increasing the torque until the screws are tight.



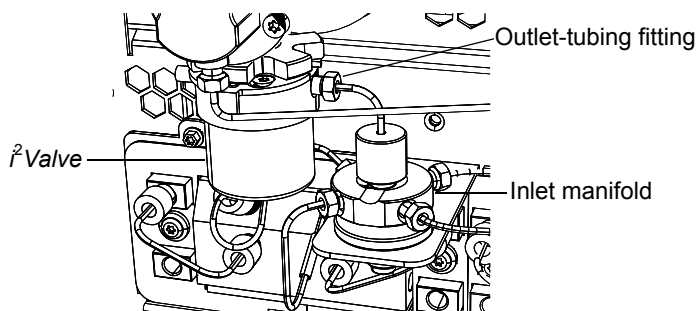
17. Orient the *i*²Valve assembly so that the cable exits from the left-hand side. Insert the *i*²Valve assembly into the bottom of the primary pump head, and route the cable behind the valve actuator.
18. Finger-tighten the shell nut to secure the valve.

Tip: Expect to be able to rotate the shell nut approximately 5 full turns before it is finger-tight condition.

19. Use the 5/16-inch open-end wrench to tighten the nut an additional 1/8-turn.

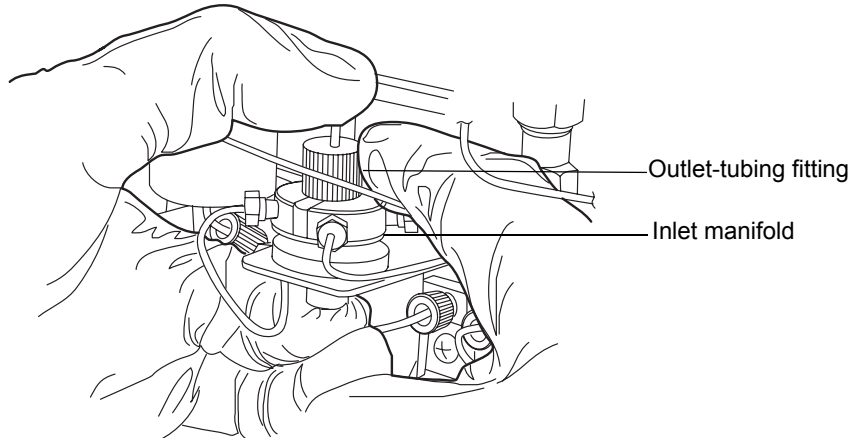


20. Reinstall the outlet-tubing fitting on the side of the i^2 Valve, and loosely tighten it.

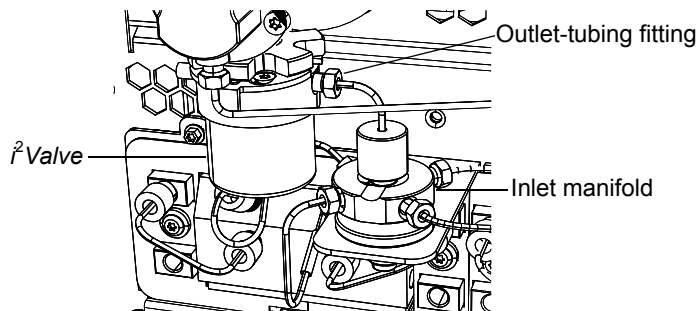


21. Reattach the outlet-tubing fitting to the inlet manifold, and finger-tighten it to the extent possible.

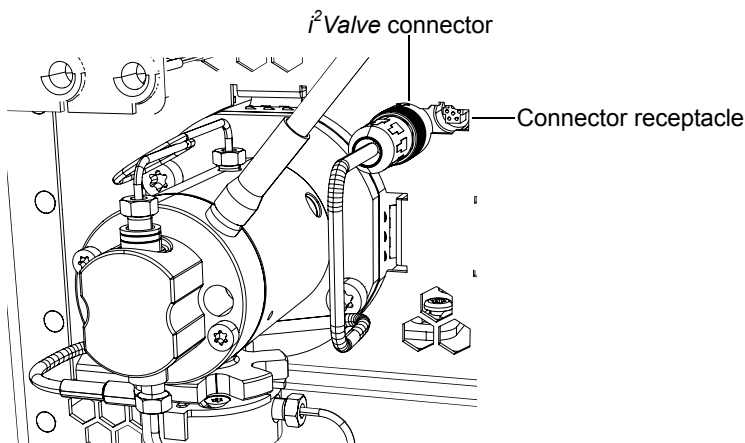
Requirement: Ensure the outlet-tubing is fully engaged by raising the inlet manifold while attaching the outlet-tubing fitting.



22. Tighten the outlet-tubing fitting, on the side of the i^2 Valve, finger-tight plus up to an additional 1/6-turn, for existing fittings, or 3/4-turn for new fittings.



23. Align the white arrow on the *i*²Valve connector with the white arrow on the receptacle, in the 12 o'clock position, and insert the connector into the receptacle.



24. Power-on the quaternary solvent manager.
25. Prime the quaternary solvent manager (see [page 15](#)).

Replacing the accumulator check-valve



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when replacing the check-valve.

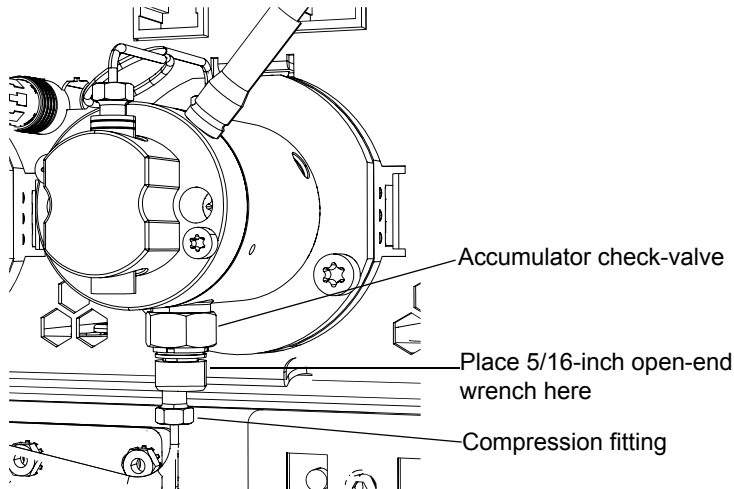
Required materials

- 1/2-inch open-end wrench
- 1/4-inch open-end wrench
- 5/16-inch open-end wrench
- Accumulator check-valve assembly
- Gloves: clean, powder-free, chemical-resistant

To replace the accumulator check-valve:

! **Caution:** To avoid damaging electrical parts, never disconnect an electrical assembly while power is applied to an instrument or device. To completely interrupt power, set the power switch to Off, and then unplug the power cord from the AC source. Wait 10 seconds thereafter before you disconnect an assembly.

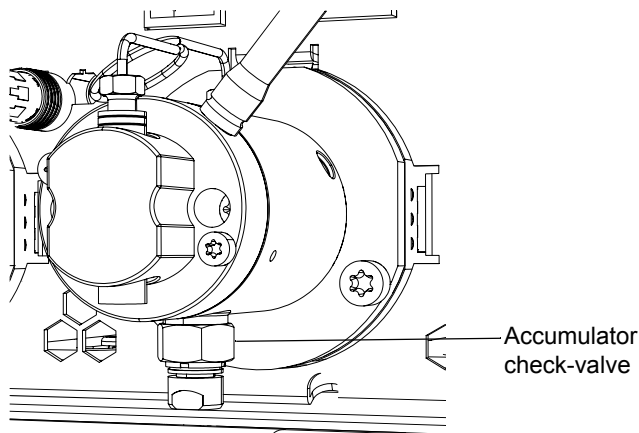
1. Flush the quaternary solvent manager with nonhazardous solvent.
2. Power-off the quaternary solvent manager.
3. While holding the check-valve in place using the 5/16-inch open-end wrench, use the 1/4-inch open-end wrench to disconnect the compression fitting.





Caution: When you remove the valve assembly, ensure the PEEK washer, which is normally on the top face of the check-valve, does not remain in the head (see [page 61](#)).

4. Use the 1/2-inch open-end wrench to loosen the check-valve, and then remove the check-valve assembly from the head.

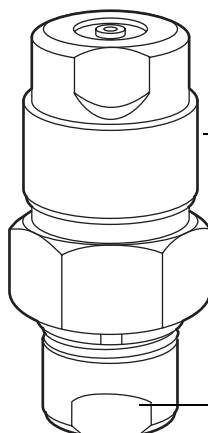


5. Unpack the new check-valve.
6. Make sure the new PEEK washer is inserted into the new check-valve so that its chamfered edge faces away from the check-valve.

Chamfered edge
facing away from
check-valve



PEEK washer



Check-valve

1/2-inch Hex nut

5/16-inch open-end wrench flat

7. Insert the check-valve assembly into the head, and use the 1/2-inch wrench to tighten the check-valve nut 1/8-turn beyond finger-tight.
8. Use the 5/16-inch open-end wrench to hold the check-valve in place, and then reattach the compression fitting to the check-valve.

Tip: Use the 1/4-inch wrench to tighten the compression screw up to 1/6-turn beyond finger-tight for existing stainless steel tubing assembly, or 3/4-turn beyond finger-tight for new stainless steel tubing assembly.

9. Power-on the quaternary solvent manager.
10. Prime the quaternary solvent manager (see [page 15](#)).

Replacing solvent filters



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Caution: Wear clean, chemical-resistant, powder-free gloves when handling the solvent filter. Oil from your hands can contaminate the solvent filter.

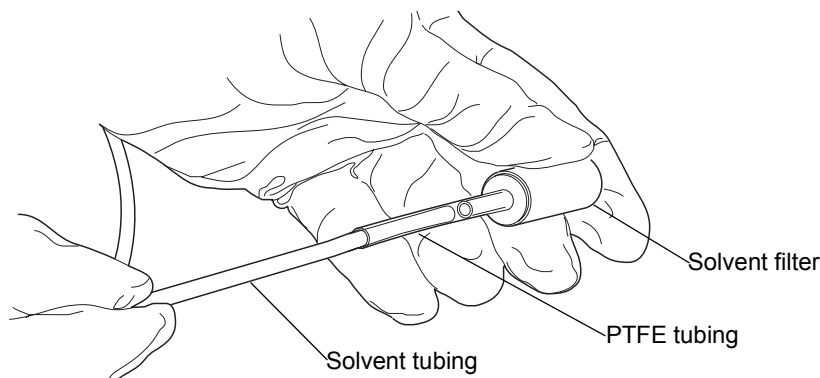
Required materials

- Gloves: clean, powder-free, chemical-resistant
- New solvent filter

To replace a solvent filter:

1. Remove the filtered end of the solvent tubing from the solvent bottle.
2. Remove the old solvent filter from the short piece of PTFE tubing.

3. Insert the new solvent filter into the PTFE tubing, pushing until it contacts the solvent tubing.



4. Insert the filtered end of the solvent tubing into the solvent bottle.
5. Shake the filter to remove any air from it.
6. Prime the quaternary solvent manager (see [page 15](#)).

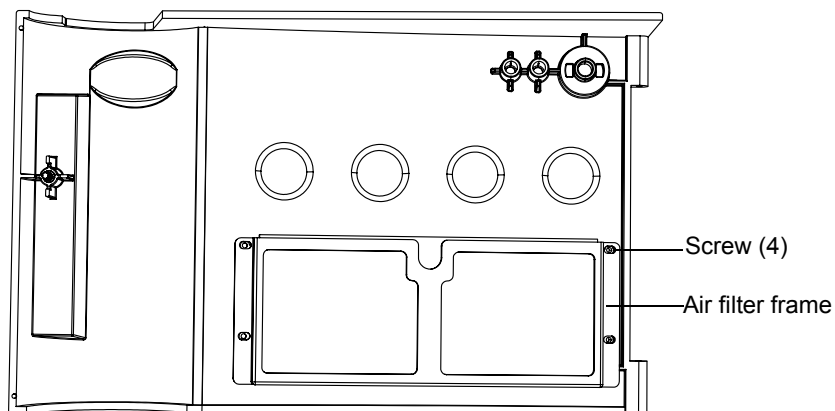
Cleaning the air filter in the quaternary solvent manager door

Required materials

- T10 TORX driver
- Mild detergent and water

To clean the air filter:

1. Using the T10 TORX driver, remove the 4 screws that secure the air filter frame and air filter to the inside of the quaternary solvent manager door.



2. Remove the air filter from the air filter frame.
3. Clean the air filter using a mild detergent, and then dry the filter.
4. Align the air filter with the air filter frame.
5. Using the T10 TORX driver, attach the air filter and frame to the inside of the quaternary solvent manager door with the 4 screws.

Replacing the air filter in the quaternary solvent manager door

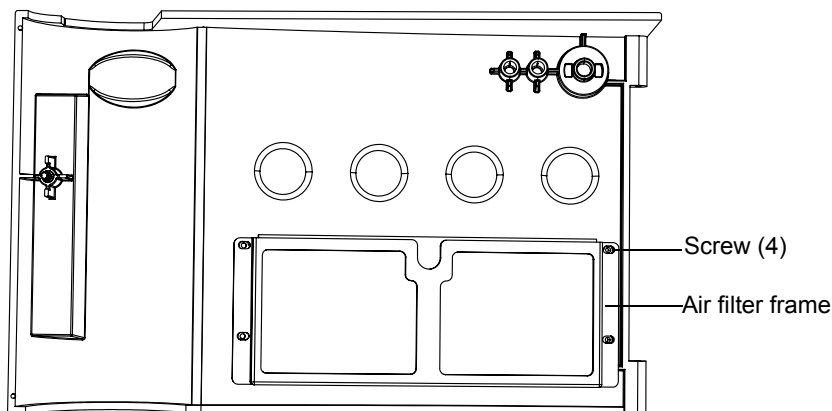
If you cannot clean the air filter by washing, replace it with a new filter.

Required materials

- T10 TORX[®] driver
- Quaternary solvent manager air filter

To replace the air filter:

1. Using the T10 TORX driver, remove the 4 screws that secure the air filter frame and air filter to the inside of the quaternary solvent manager door.



2. Remove the old air filter from the air filter frame, and discard it.
3. Align the new air filter with the air filter frame.
4. Using the T10 TORX driver, attach the air filter and frame to the inside of the quaternary solvent manager door with the 4 screws.

Removing the primary head and replacing its seals

See the ACQUITY UPLC online Help to help determine whether you need to replace the primary head seals.



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when removing and replacing the head seals.

Required materials

- 1/4-inch open-end wrench
- 5/16-inch open-end wrench

- T27 TORX driver (startup kit)
- Gloves: clean, powder-free, chemical-resistant
- Head seal and seal wash spacer
- Methanol
- PTFE O-ring
- Seal extraction tool
- Seal wash seal
- Sharp tool
- Plunger (recommended)

To remove the primary head:

1. Flush the quaternary solvent manager with nonhazardous solvent.
2. In the ACQUITY UPLC Console, select Quaternary Solvent Manager from the system tree.
3. In the quaternary solvent manager information window, click Maintain > Heads.
4. In the Head Maintenance dialog box, select the primary head.
5. Click Move Backward, and then wait for the plunger to stop.



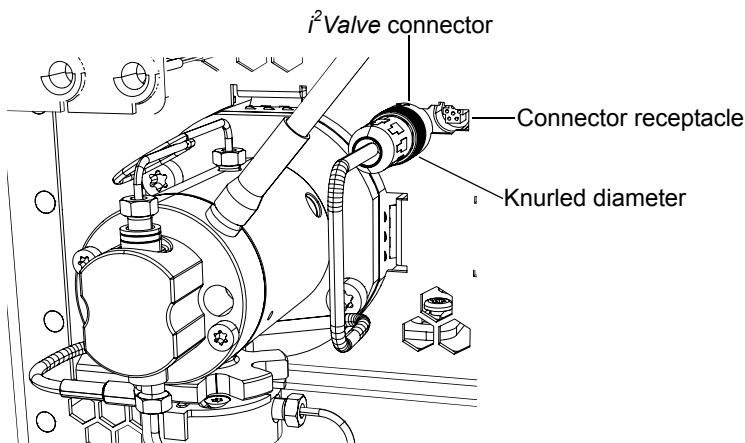
Caution: To avoid damaging electrical parts, never disconnect an electrical assembly while power is applied to an instrument or device. To completely interrupt power, set the power switch to Off, and then unplug the power cord from the AC source. Wait 10 seconds thereafter before you disconnect an assembly.

6. Power-off the quaternary solvent manager.

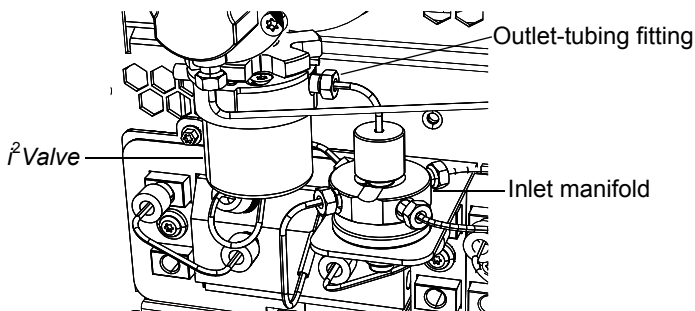
Tip: The quaternary solvent manager is referred to as “pump” on the warning label affixed to the *i*²Valve actuator.

! Caution: To avoid damage to the connector or cable, grasp the *i*²Valve connector by the knurled diameter.

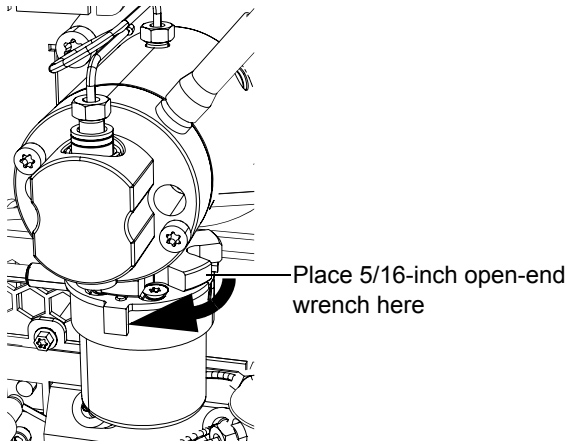
7. Grasp the *i*²Valve connector by the knurled diameter, and pull it toward you, disconnecting it from its receptacle.



8. Use the 1/4-inch open-end wrench to disconnect the inlet manifold outlet-tubing fitting on the side of the *i*²Valve and remove the tubing.



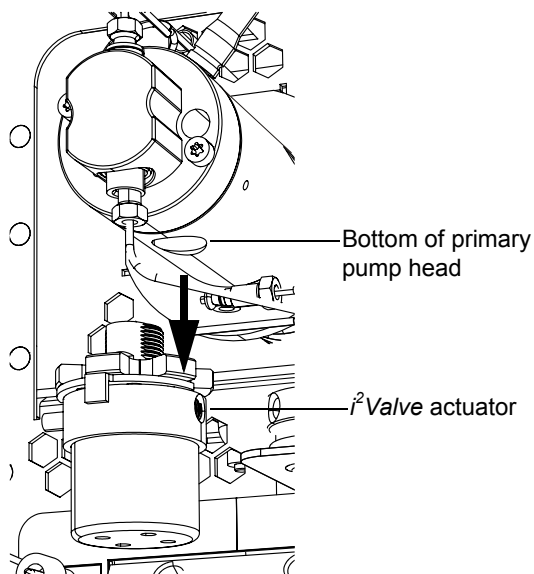
9. Use the 5/16-inch open-end wrench to loosen the shell nut, and then fully unscrew it.



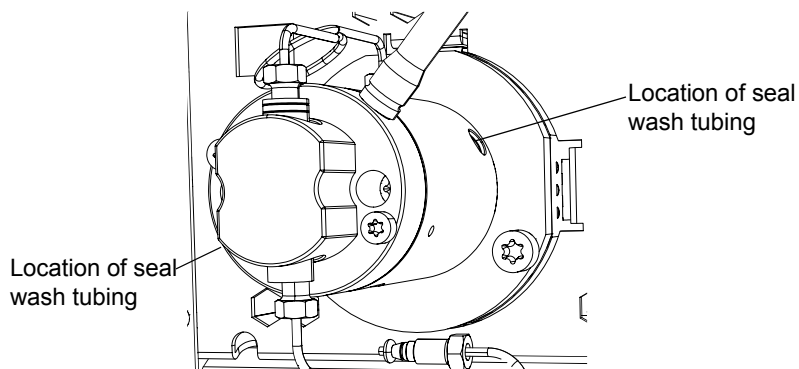
Caution:

- When you remove the valve assembly, ensure the PEEK washer, which is normally on the top face of the *i²Valve* cartridge, does not remain in the head (see [page 54](#)).
- Never place the actuator assembly or electrical connector in the drip tray.

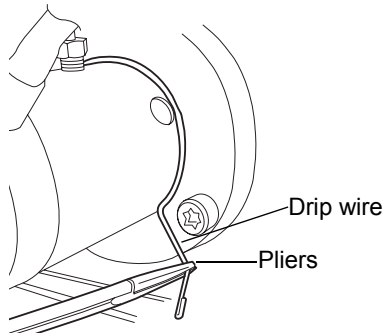
10. Remove the i^2 Valve actuator from the bottom of the primary pump head.



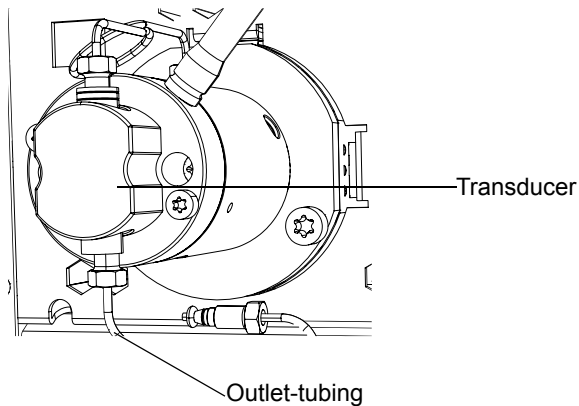
11. Remove the seal wash tubing secured to the seal wash housing by barbed fittings, using a tool or by pulling on the tubing as close to the head as possible.



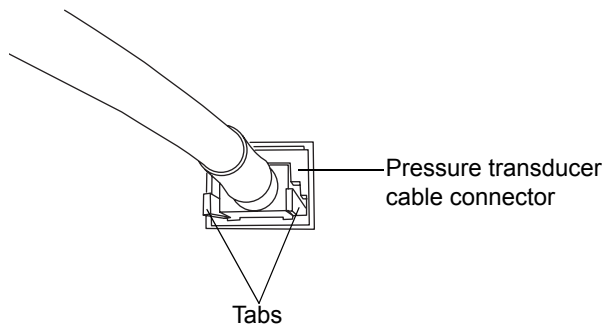
12. Using a pliers, remove the drip wire from the head assembly.



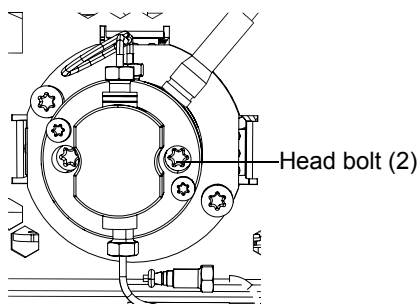
13. Use the 1/4-inch open-end wrench to disconnect the outlet-tubing from the transducer.



14. Disconnect the pressure transducer cable from the bulkhead by squeezing on the tabs and pulling gently.

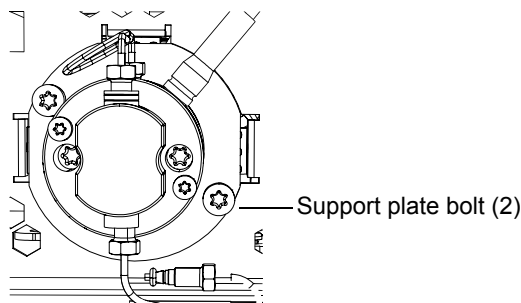


15. Using the T27 TORX driver, loosen the 2 head bolts 1/2-turn. The bolts are accessible from the front of the pressure transducer.

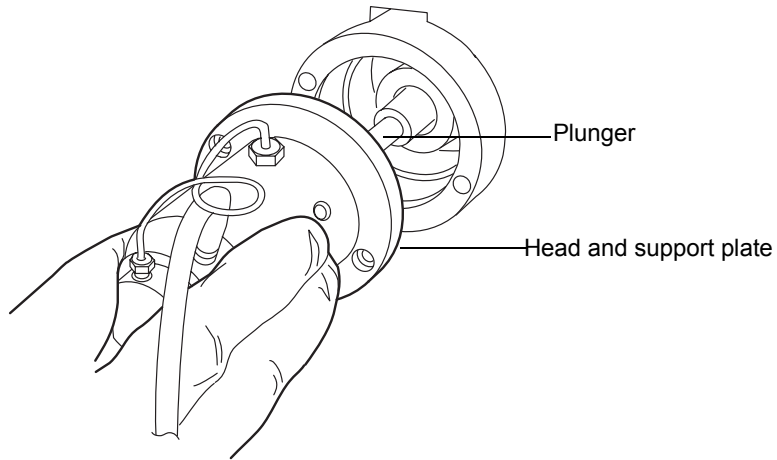


! Caution: To avoid damaging the plunger, support the head from below as you remove it.

16. Using the T27 TORX driver, loosen and remove the 2 support plate bolts, and then gently pull the head and support plate off the actuator housing, making sure not to tilt the head during the extraction.

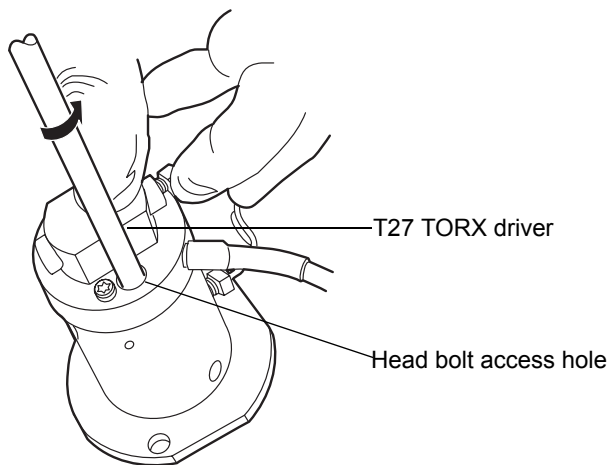


Pulling head and support plate off actuator housing:

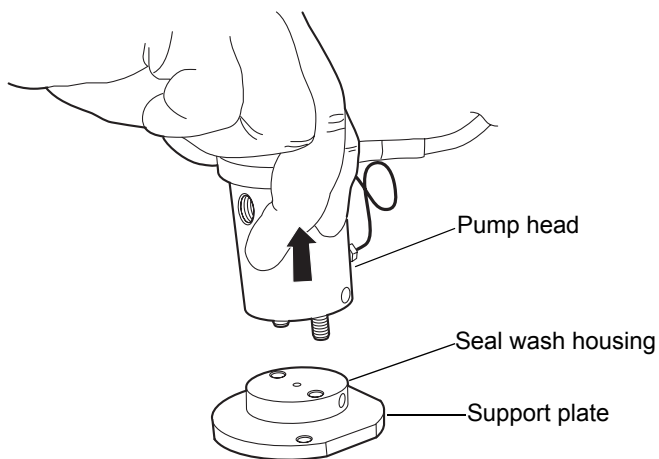


To remove the primary head seals:

1. Stand the head upright on a clean surface.
2. Using the T27 TORX driver, completely loosen the 2 head bolts to release the support plate from the pump head.

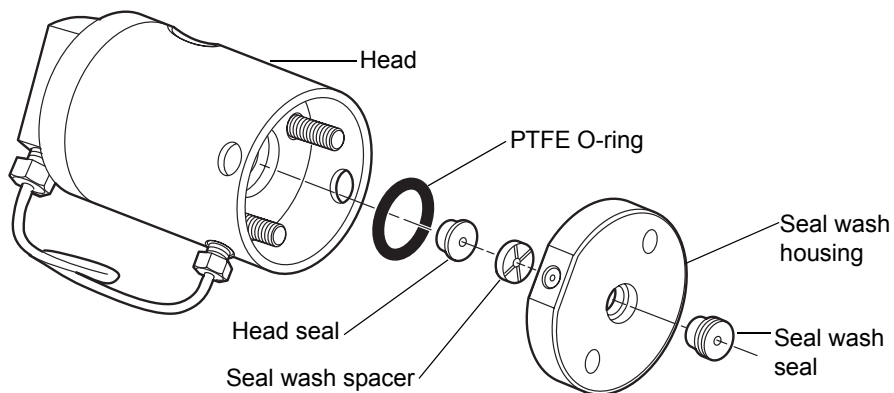


3. Lift the pump head from the support plate.

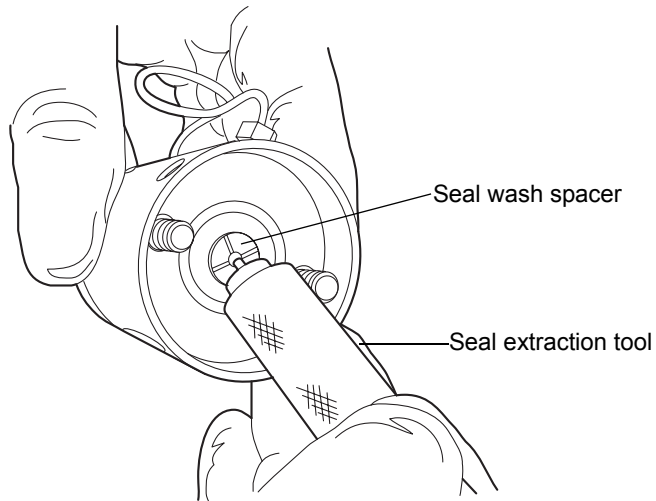


4. Remove the old seal wash seal and discard it.

Head seals:

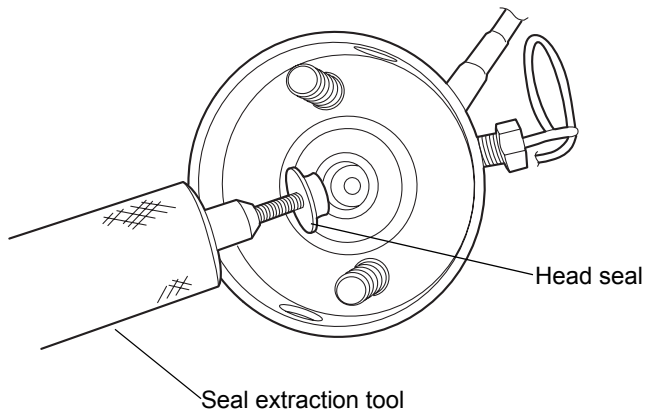


5. Using the smooth end of the seal extraction tool, remove the seal wash spacer from the head.



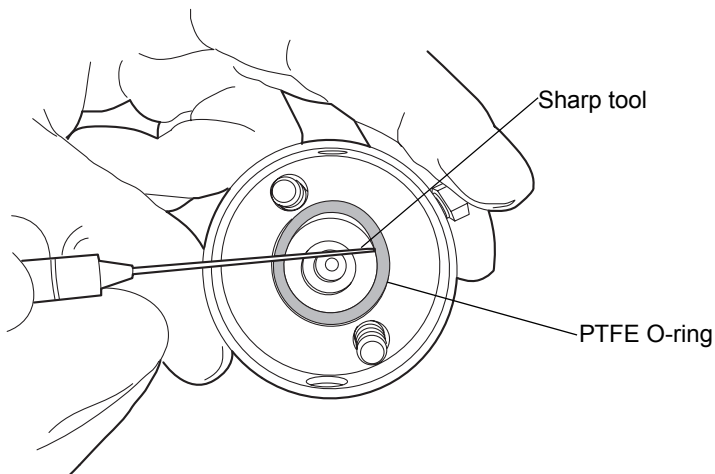
Caution: To avoid scratching any metal surfaces, use care when screwing the threaded end of the seal extraction tool into the head seal.

6. Taking care not to scratch any surfaces, screw the threaded end of the seal extraction tool into the head seal and carefully withdraw the seal from the head.



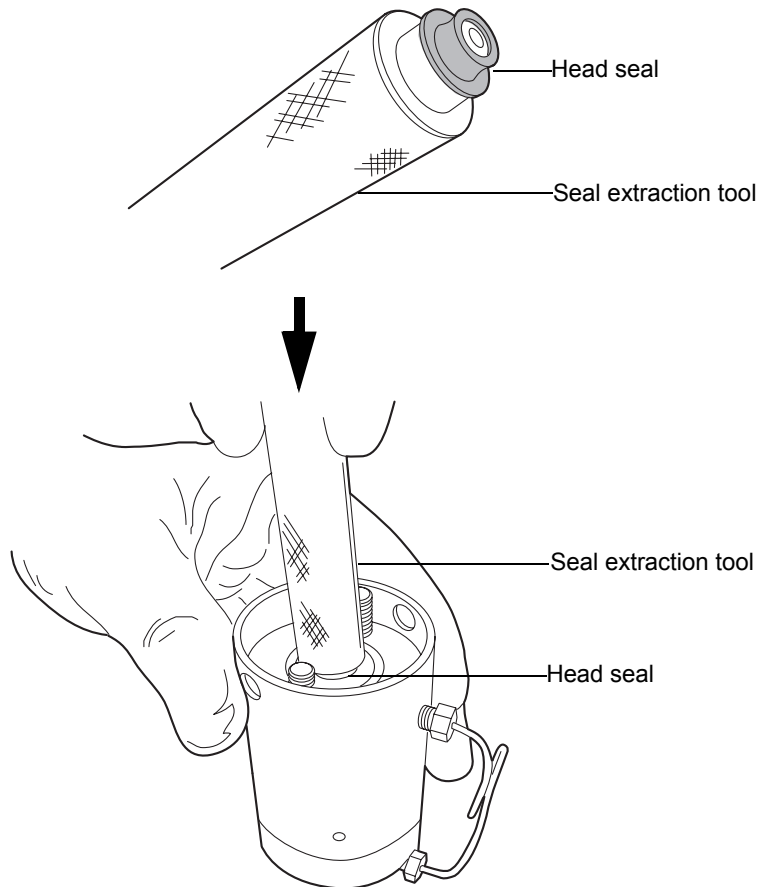
! **Caution:** To avoid scratching any metal surfaces, use care when using a sharp tool to remove the PTFE O-ring.

7. Taking care not to scratch any surfaces, use a sharp tool to remove the PTFE O-ring.

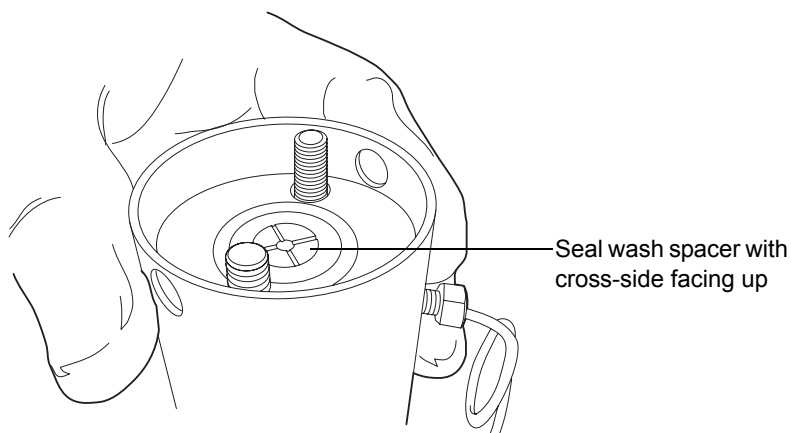


8. Lubricate the new PTFE O-ring with methanol, and press the O-ring into its seat with your thumbs.

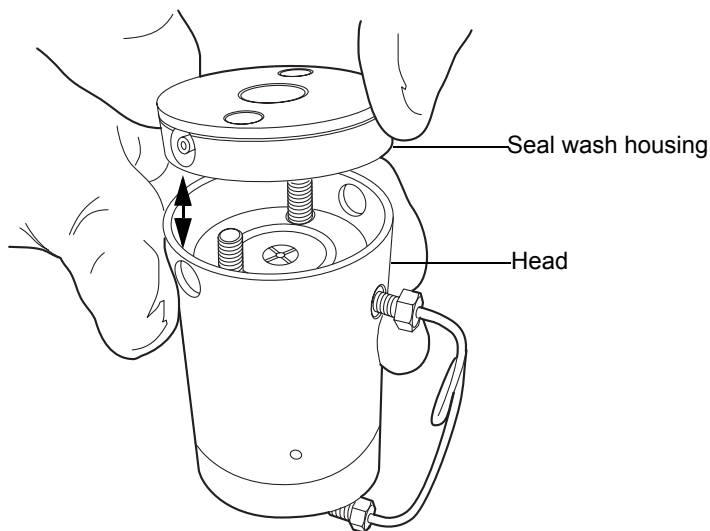
9. Lubricate the new head seal with methanol, and use the smooth end of the seal extraction tool to place it in the head.



10. Center the new seal wash spacer over the head seal so that the cross-side faces upward.

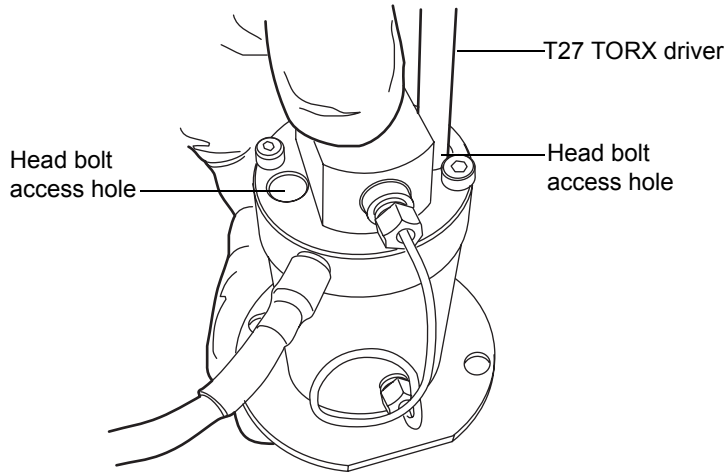


11. Orient the seal wash housing so that the holes on its side align with the holes on the side of the head, and then guide it into place.



12. Install the new seal wash seal in the seal wash housing.
13. Place the support plate on top of the head.

14. Holding the assembly together, use the T27 TORX driver to minimally tighten the 2 head bolts.



Recommendation: Replace the plunger whenever you replace the head seal (see [page 110](#)).

To reattach the primary head:

1. Lubricate the seals and plunger with methanol.

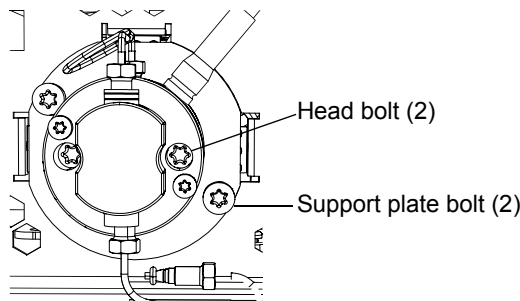


Caution: To avoid damaging the plunger, ensure that the head assembly is not tilted relative to the plunger when you position it on the mechanism.

2. Carefully slide the head assembly and support plate over the sapphire plunger, making sure not to tilt the head.

! Caution: To avoid damaging the plunger, alternately tighten the the support plate screws 1/4-turn so that they are uniformly torqued.

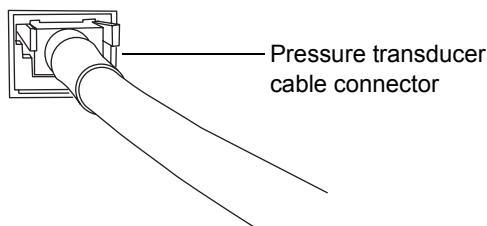
3. Hold the head assembly securely against the actuator housing, and then use the T27 TORX driver to tighten the support plate bolts securely.



4. Alternately tighten the head bolts so that they are uniformly torqued.

! Caution: To avoid pinching the drip wire between the head assembly and support plate, be sure to install the drip wire after tightening the head bolts.

5. Reinstall the drip wire around the head assembly, ensuring that the tip is in the 6 o'clock position.
6. Connect the pressure transducer cable to the bulkhead.

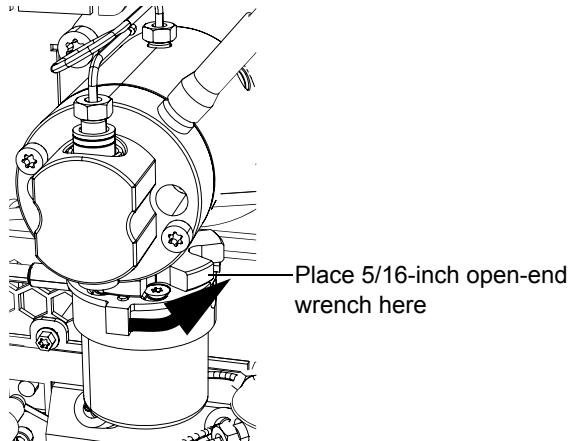


7. Orient the *i*²Valve assembly so that the cable exits from the left-hand side.
8. Insert the *i*²Valve assembly into the bottom of the primary pump head, and route the cable behind the valve actuator.

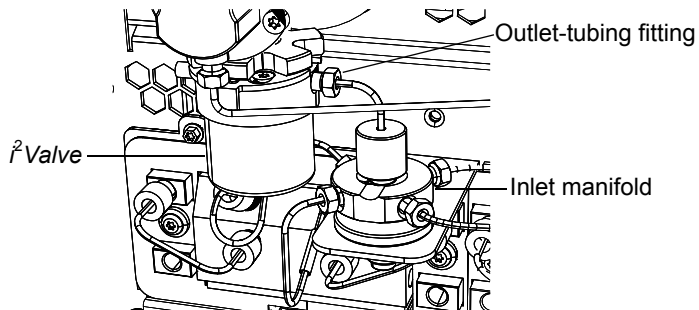
9. Finger-tighten the shell nut to secure the valve.

Tip: Expect to be able to rotate the shell nut approximately 5 full turns before it is finger-tight.

10. Use the 5/16-inch open-end wrench to tighten the nut an additional 1/8-turn.

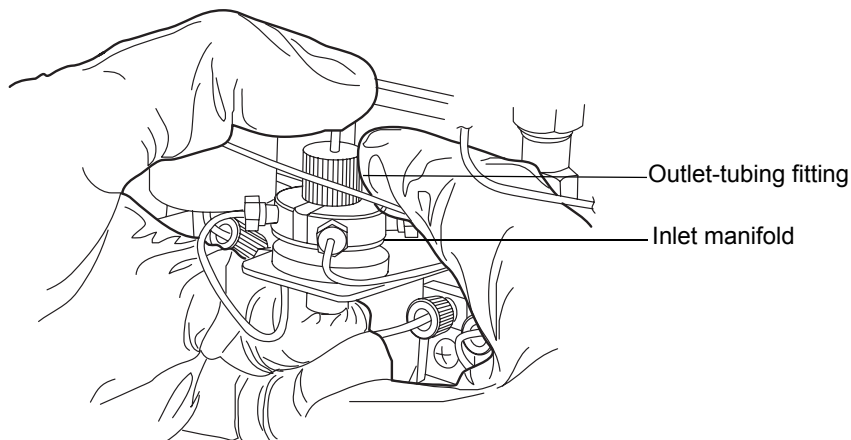


11. Reinstall the outlet-tubing fitting on the side of the *i*² Valve, and loosely tighten it.

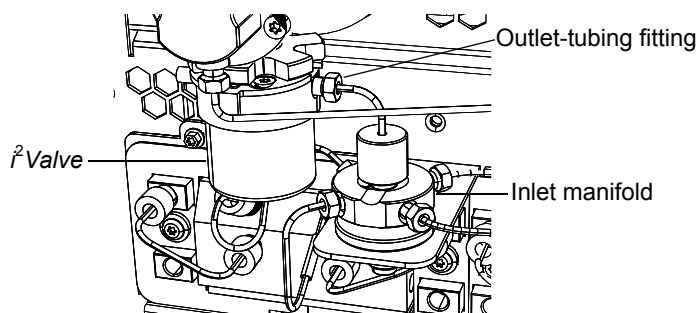


12. Reattach the outlet-tubing fitting to the inlet manifold, and finger-tighten it to the extent possible.

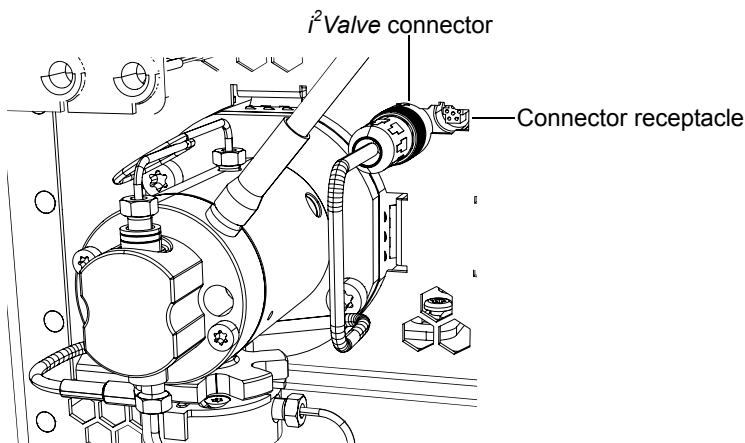
Requirement: Ensure the outlet-tubing is fully engaged by raising the inlet manifold while attaching the outlet-tubing fitting.



13. Tighten the outlet-tubing fitting, on the side of the i^2 Valve, finger-tight plus up to an additional 1/6-turn, for existing fittings, or 3/4-turn for new fittings.



14. Align the white arrow on the *i*²Valve connector with the white arrow on the receptacle, in the 12 o'clock position, and insert the connector into the receptacle.



15. Reattach all fittings and seal wash tubing.
Tip: When reattaching the outlet-tubing to the transducer, tighten the outlet-tubing fitting finger-tight plus up to an additional 1/6-turn for existing fittings, or 3/4-turn for new fittings.
16. Power-on the quaternary solvent manager.
17. Prime the quaternary solvent manager (see [page 15](#)).
18. Perform the solvent manager leak test (see the ACQUITY UPLC online Help).
Tip: If the leak test results are not satisfactory, try pressurizing the head plunger seals to properly seat them. To pressurize the seals, perform one of the following:
 - Run the quaternary solvent manager at 96,527 kPa (965 bar, 14,000 psi) for a half-hour.
 - Run the leak test until results are satisfactory.

Removing the accumulator head and replacing its seals

See the ACQUITY UPLC online Help to help determine whether you need to replace the accumulator head seals.



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when removing and replacing the head seals.

Required materials

- 1/4-inch open-end wrench
- 5/16-inch open-end wrench
- T27 TORX driver (startup kit)
- Gloves: clean, powder-free, chemical-resistant
- Head seal and seal wash spacer
- Methanol
- Plunger (recommended)
- Plunger removal tool (recommended)
- PTFE O-ring
- Seal extraction tool
- Seal wash seal
- Sharp tool

To remove the accumulator head:

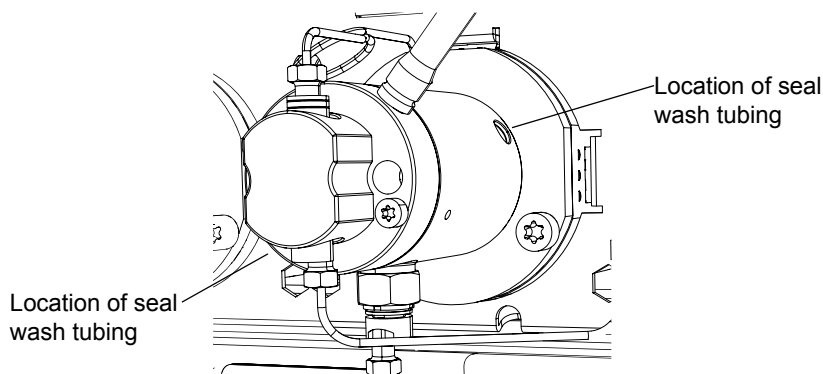
1. Flush the quaternary solvent manager with nonhazardous solvent.
2. In the ACQUITY UPLC Console, select Quaternary Solvent Manager from the system tree.
3. In the quaternary solvent manager information window, click Maintain > Heads.
4. In the Head Maintenance dialog box, select the accumulator head.

5. Click Move Backward, and then wait for the plunger to stop.

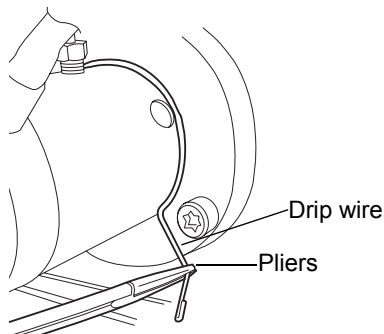


Caution: To avoid damaging electrical parts, never disconnect an electrical assembly while power is applied to an instrument or device. To completely interrupt power, set the power switch to Off, and then unplug the power cord from the AC source. Wait 10 seconds thereafter before you disconnect an assembly.

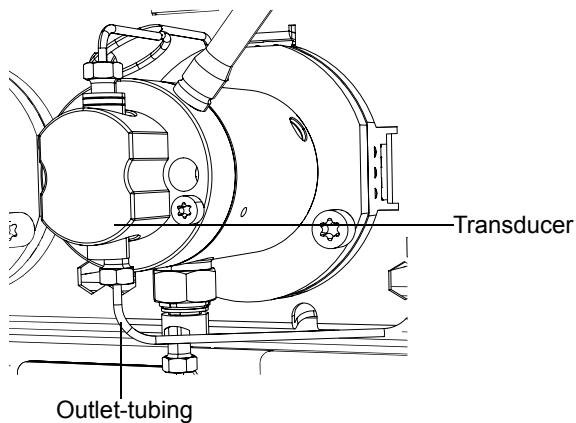
6. Power-off the quaternary solvent manager.
7. Remove the seal wash tubing, secured to the seal wash housing by barbed fittings, using a tool or by pulling on the tubing as close to the head as possible.



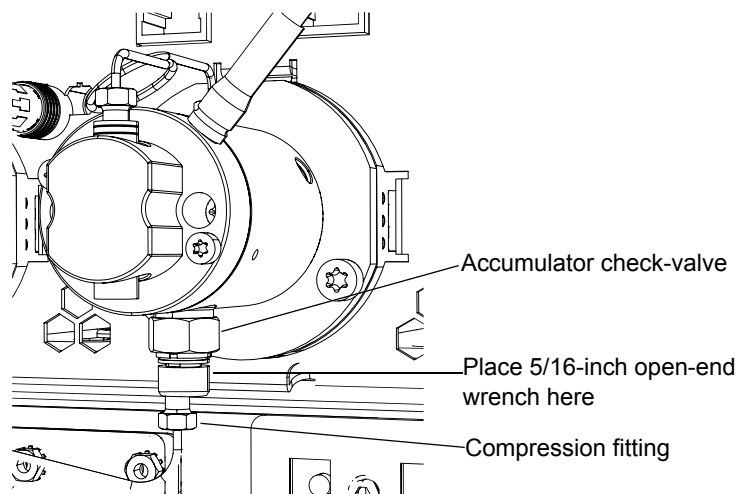
8. Using a pliers, remove the drip wire from the head assembly.



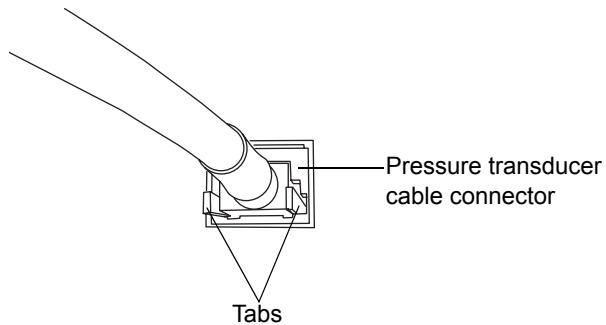
9. Use the 1/4-inch open-end wrench to disconnect the outlet-tubing from the transducer.



10. Using the 5/16-inch open-end wrench to hold the check-valve cartridge in place, disconnect the tubing connection from the check-valve with the 1/4-inch open-end wrench.

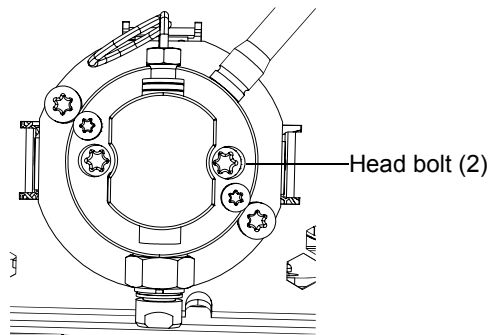


11. Disconnect the pressure transducer cable from the bulkhead by squeezing on the tabs and pulling gently.



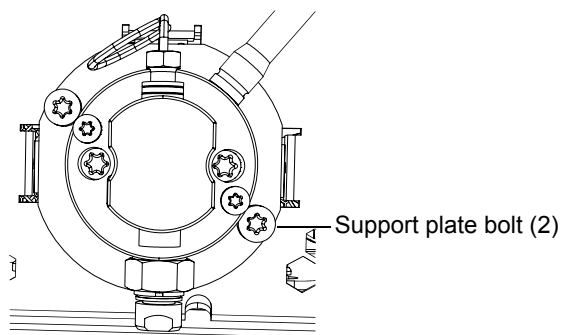
12. Using the T27 TORX driver, loosen the 2 head bolts 1/2-turn.

Tip: The bolts are accessible from the front of the pressure transducer.

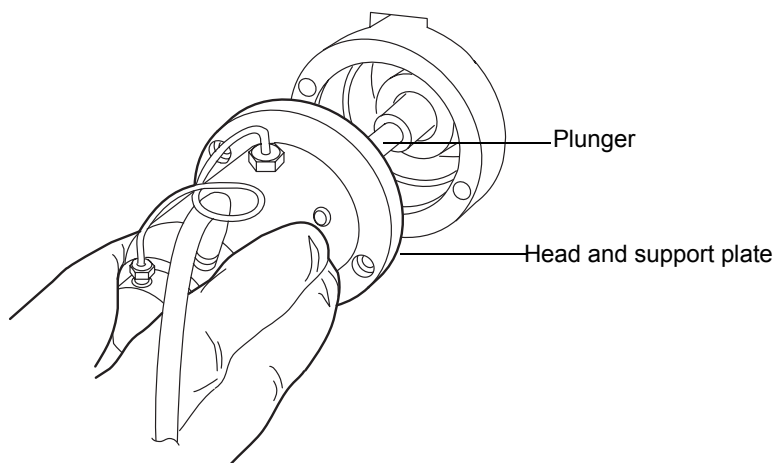


Caution: To avoid damaging the plunger, support the head from below as you remove it.

13. Using the T27 TORX driver, loosen and remove the 2 support plate bolts, and then gently pull the head and support plate off the actuator housing, making sure not to tilt the head during the extraction.

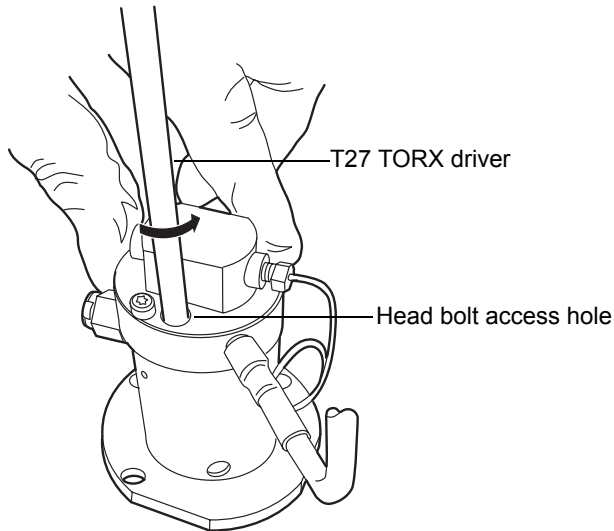


Pulling head and support plate off actuator housing:

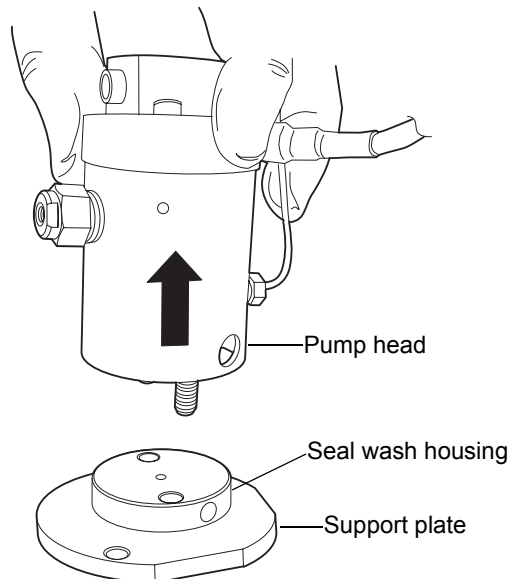


To remove the accumulator head seals:

1. Stand the head upright on a clean surface.
2. Using the T27 TORX driver, completely loosen the 2 head bolts to release the support plate from the pump head.

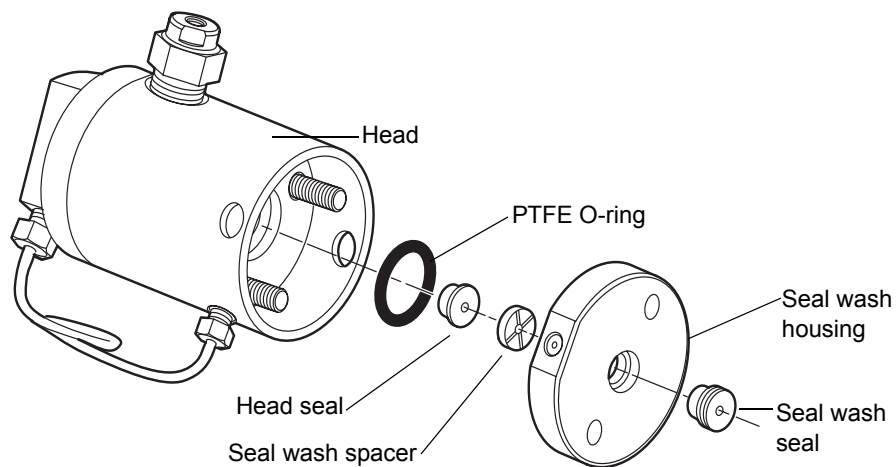


3. Lift the pump head from the support plate.

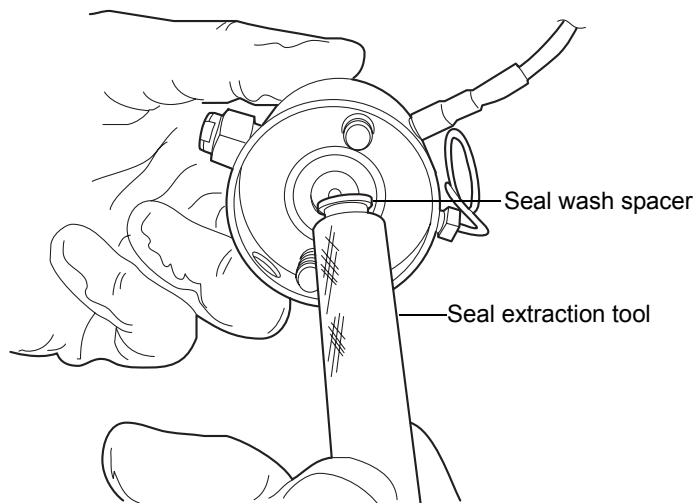


4. Remove the old seal wash seal and discard it.

Head seals:

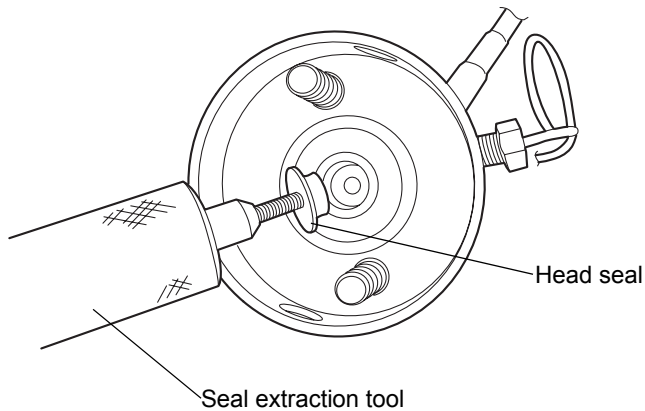


5. Using the smooth end of the seal extraction tool, remove the seal wash spacer from the head.



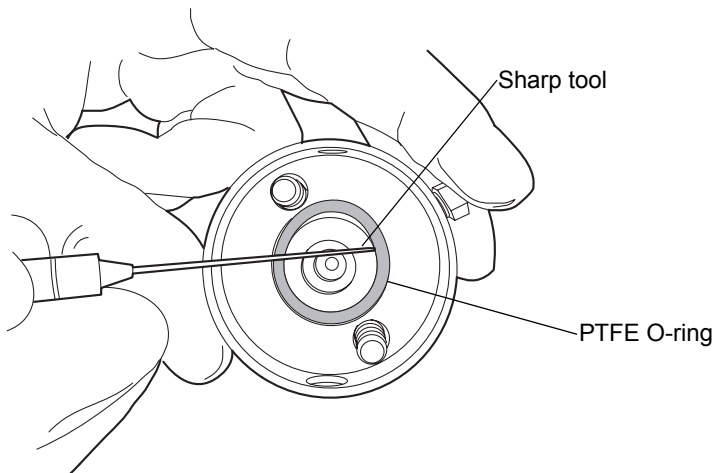
! **Caution:** To avoid scratching any metal surfaces, use care when screwing the threaded end of the seal extraction tool into the head seal.

6. Taking care not to scratch any surfaces, screw the threaded end of the seal extraction tool into the head seal, and carefully withdraw the seal from the head.



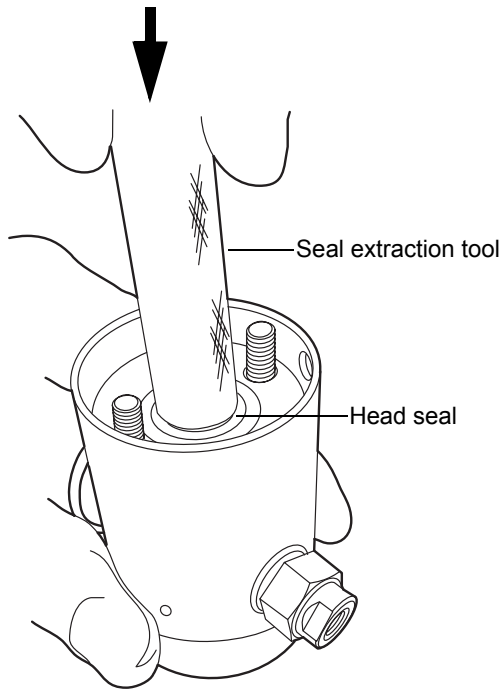
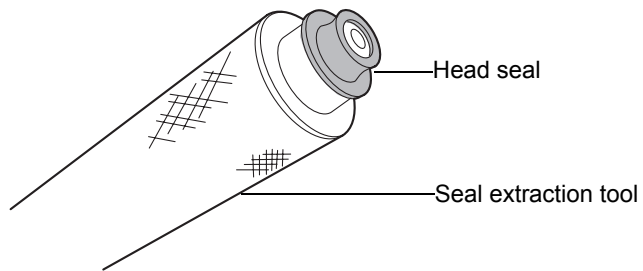
! **Caution:** To avoid scratching any metal surfaces, use care when using a sharp tool to remove the PTFE O-ring.

7. Use a sharp tool to remove the PTFE O-ring.

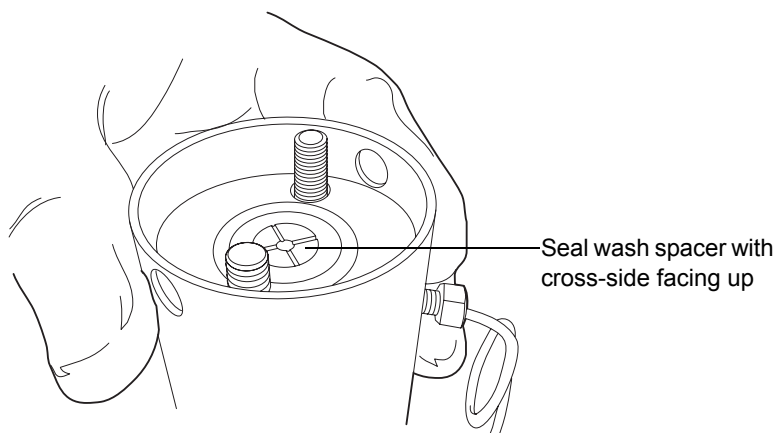


8. Lubricate the new PTFE O-ring with methanol, and press the O-ring into its seat with your thumbs.

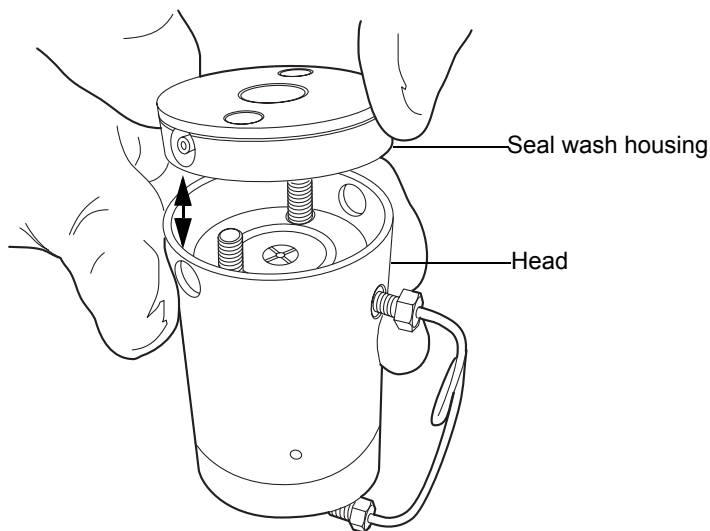
9. Lubricate the new head seal with methanol, and use the smooth end of the seal extraction tool to place it in the head.



10. Center the new seal wash spacer over the head seal so that the cross-side faces upward.

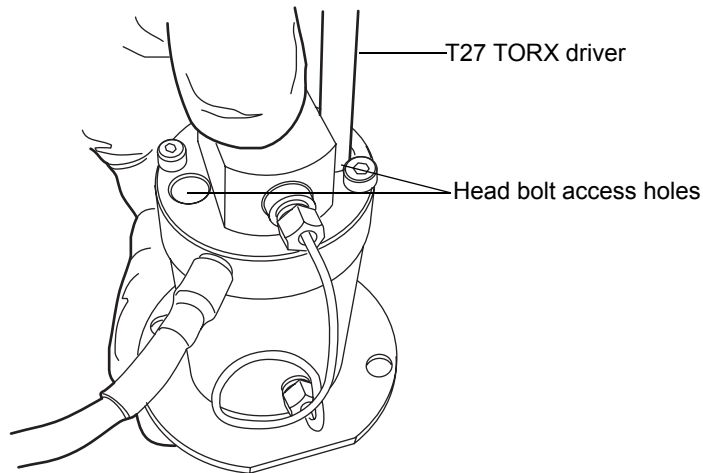


11. Orient the seal wash housing so that the holes on its side align with the holes on the side of the head, and then guide it into place.



12. Install the new seal wash seal in the seal wash housing.
13. Place the support plate on top of the head.

14. Holding the assembly together, use the T27 TORX driver to minimally tighten the 2 head bolts.



Recommendation: Replace the plunger whenever you replace the head seal (see [page 127](#)).

To reattach the accumulator head:

1. Lubricate the seals and plunger with methanol.

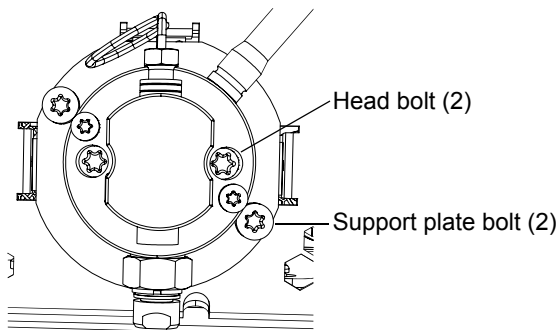


Caution: To avoid damaging the plunger, ensure that the head assembly is not tilted relative to the plunger when you position it on the mechanism.

2. Carefully slide the head assembly and support plate over the sapphire plunger, making sure not to tilt the head.

! Caution: To avoid damaging the plunger, alternately tighten the the support plate screws 1/4-turn so that they are uniformly torqued.

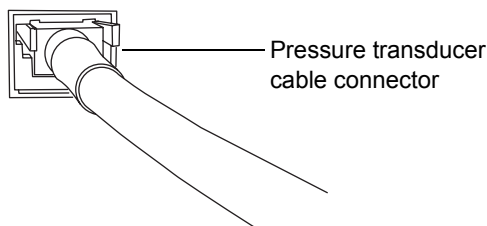
3. Hold the head assembly securely against the actuator housing, and then use the T27 TORX driver to tighten the support plate screws securely.



4. Alternately tighten the head bolts so that they are uniformly torqued.

! Caution: To avoid pinching the drip wire between the head assembly and support plate, be sure to install the drip wire after tightening the head bolts.

5. Reinstall the drip wire around the head assembly, ensuring that the tip is in the 6 o'clock position.
6. Connect the pressure transducer cable to the bulkhead.



7. Reattach all fittings and seal wash tubing.

Tip: When reattaching the outlet-tubing to the transducer, tighten the outlet-tubing fitting finger-tight plus up to an additional 1/6-turn for existing fittings, or 3/4-turn for new fittings.

8. Power-on the quaternary solvent manager.
9. Prime the quaternary solvent manager (see [page 15](#)).
10. Perform the solvent manager leak test (see the ACQUITY UPLC online Help).

Tip: If the leak test results are not satisfactory, try pressurizing the head plunger seals to properly seat them. To pressurize the seals, perform one of the following:

- Run the quaternary solvent manager at 96,527 kPa (965 bar, 14,000 psi) for a half-hour.
- Run the leak test until results are satisfactory.

Replacing the primary head plunger



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when replacing the plunger.

Required materials

- 1/4-inch open-end wrench
- 5/16-inch open-end wrench
- T27 TORX driver (startup kit)
- Gloves: clean, powder-free, chemical-resistant
- Head seal and seal wash spacer (recommended)
- Methanol
- Plunger removal tool
- PTFE O-ring (recommended)
- Replacement plunger
- Seal extraction tool (recommended)

- Seal wash seal (recommended)
- Sharp tool (recommended)

To remove the primary head:

1. Flush the quaternary solvent manager with nonhazardous solvent.
2. In the ACQUITY UPLC Console, select Quaternary Solvent Manager from the system tree.
3. In the quaternary solvent manager information window, click Maintain > Heads.
4. In the Head Maintenance dialog box, select the primary head.
5. Click Move Backward, and then wait for the plunger to stop.



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

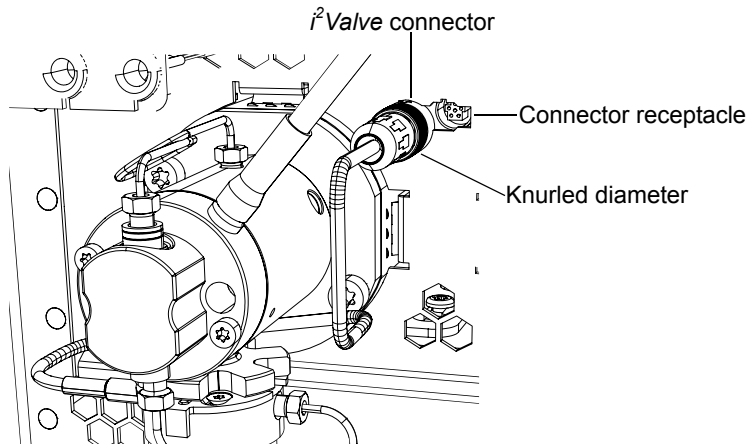
6. Power-off the quaternary solvent manager.

Tip: The quaternary solvent manager is referred to as “pump” on the warning label affixed to the *i*²Valve actuator.

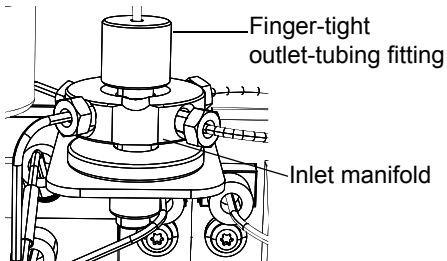


Caution: To avoid damage to the connector or cable, grasp the *i*²Valve connector by the knurled diameter.

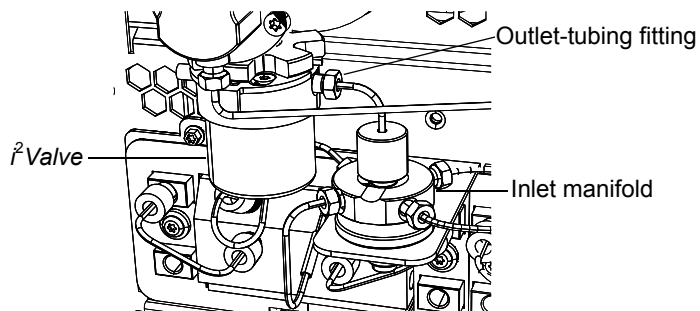
7. Grasp the *i*²Valve connector by the knurled diameter, and pull it toward you, disconnecting it from its receptacle.



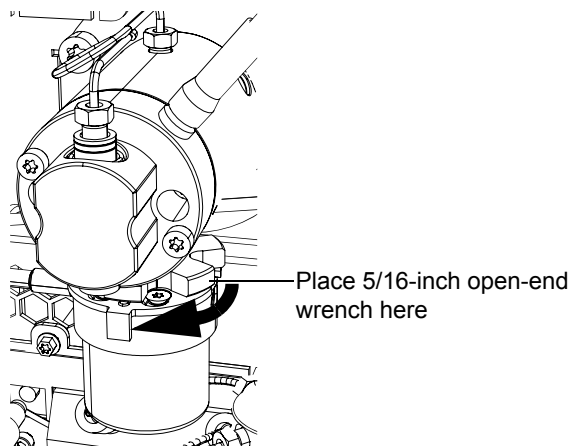
8. Loosen the finger-tight outlet-tubing fitting on the inlet manifold's outlet.



9. Use the 1/4-inch open-end wrench to disconnect the inlet manifold outlet-tubing fitting on the side of the *i*² Valve and remove the tubing.



10. Use the 5/16-inch open-end wrench to loosen the shell nut, and then fully unscrew it.

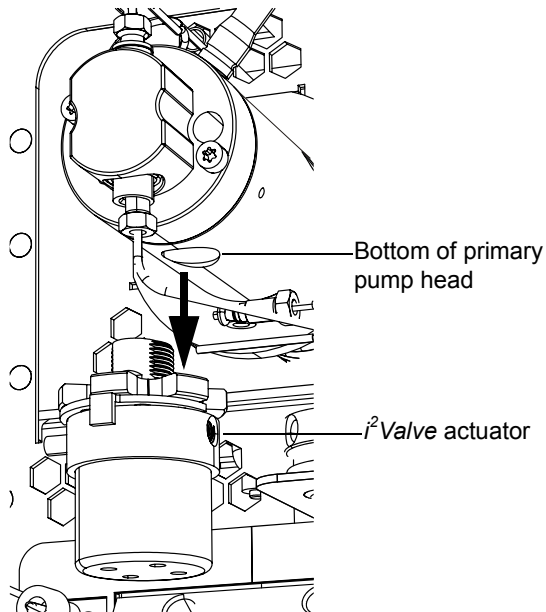




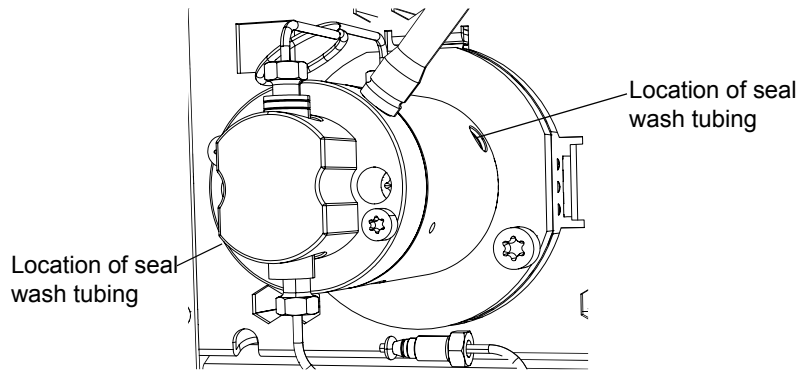
Caution:

- When you remove the valve assembly, ensure the PEEK washer, which is normally on the top face of the *i*²Valve cartridge, does not remain in the head (see [page 54](#)).
- Never place the actuator assembly or electrical connector in the drip tray.

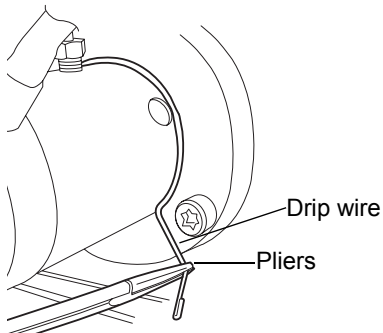
11. Remove the *i*²Valve actuator from the bottom of the primary pump head.



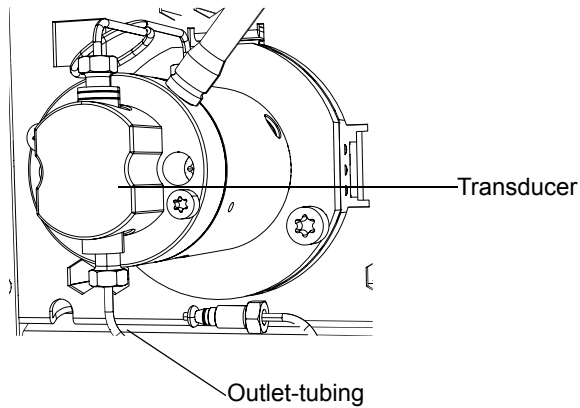
12. Remove the seal wash tubing, secured to the seal wash housing by barbed fittings, using a tool or by pulling on the tubing as close to the head as possible.



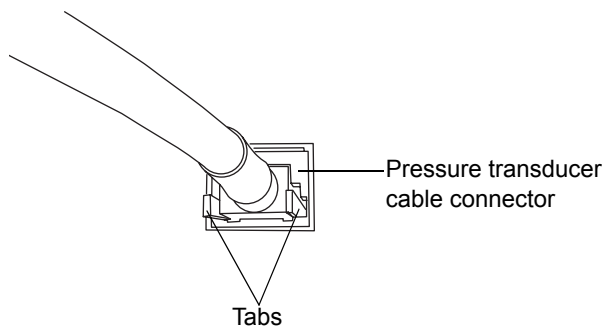
13. Using a pliers, remove the drip wire from the head assembly.



14. Use the 1/4-inch open-end wrench to disconnect the outlet-tubing from the transducer.

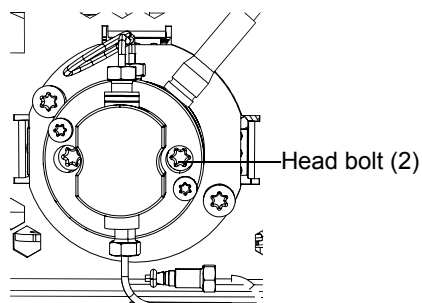


15. Disconnect the pressure transducer cable from the bulkhead by squeezing on the tabs and pulling gently.



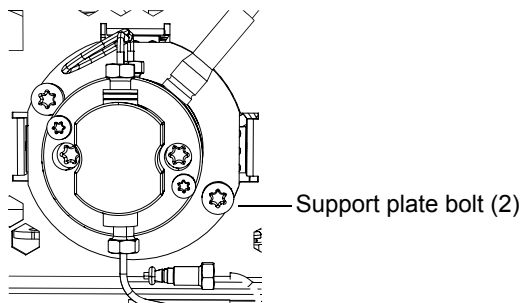
16. Using the T27 TORX driver, loosen the 2 head bolts 1/2-turn.

Tip: The bolts are accessible from the front of the pressure transducer.

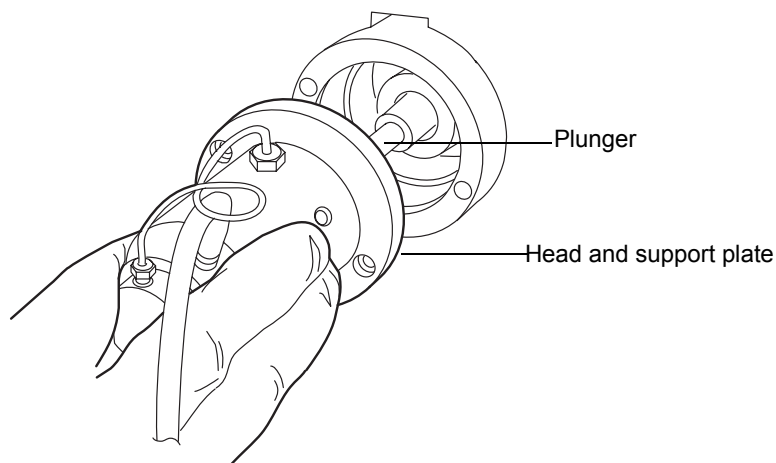


! Caution: To avoid damaging the plunger, support the head from below as you remove it.

17. Using the T27 TORX driver, loosen and remove the 2 support plate bolts, and then gently pull the head and support plate off the actuator housing, making sure not to tilt the head during the extraction.



Pulling head and support plate off actuator housing:

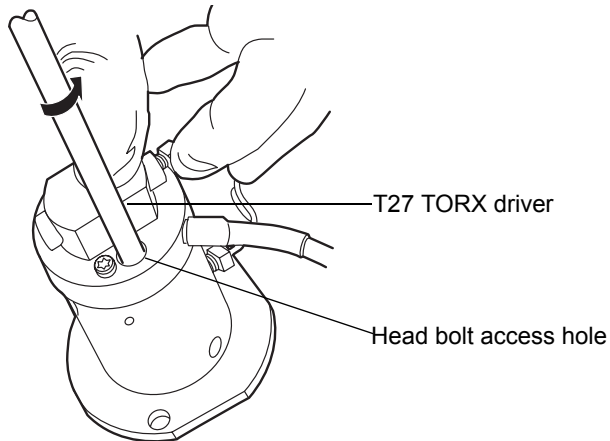


Recommendation: Waters strongly recommends that you replace the head seals when you replace the plunger.

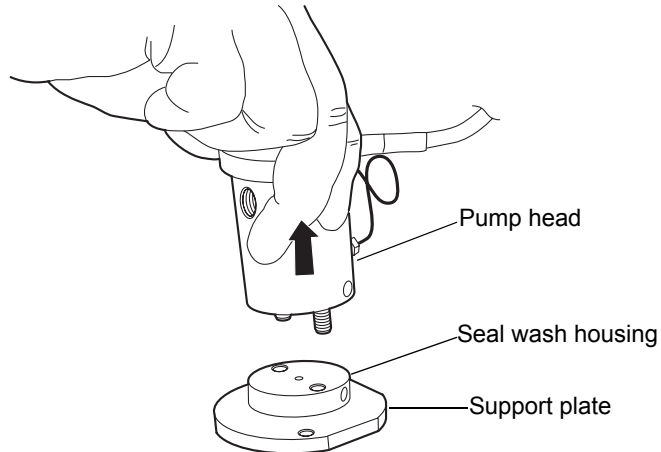
If you are not replacing any seals as part of this procedure, proceed to [page 110](#).

To remove the primary head seals:

1. Stand the head upright on a clean surface.
2. Using the T27 TORX driver, fully loosen the 2 head bolts, to release the support plate from the pump head.

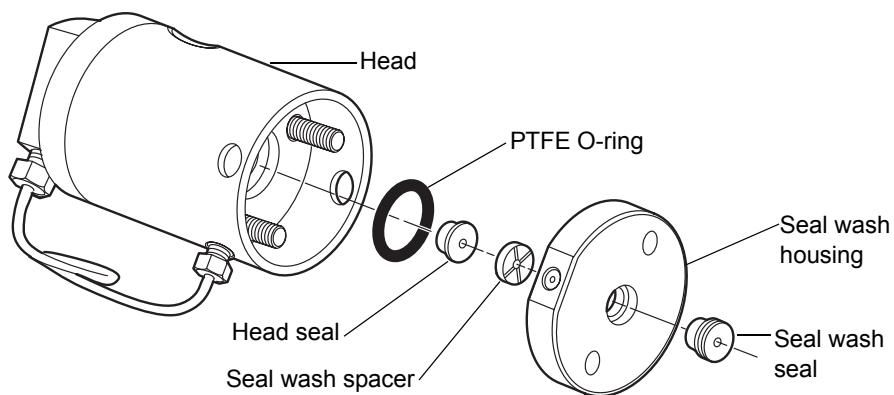


3. Lift the pump head from the support plate.

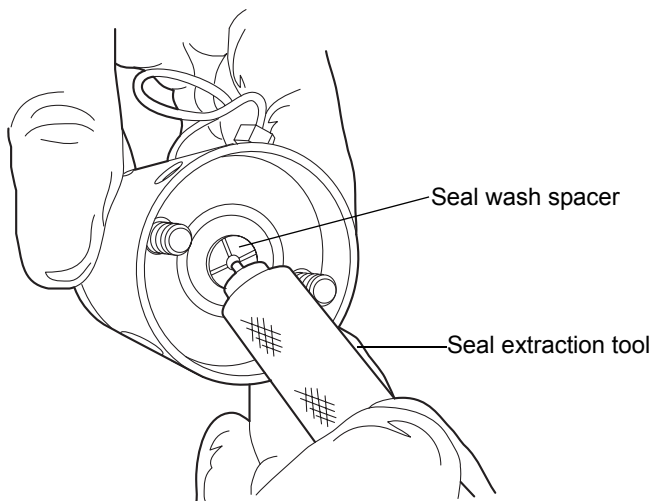


4. Remove the old seal wash seal, and discard it.

Head seals:

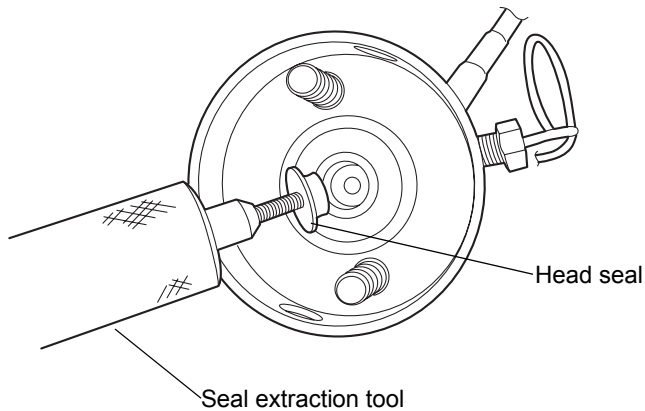


5. Using the smooth end of the seal extraction tool, remove the seal wash spacer from the head.



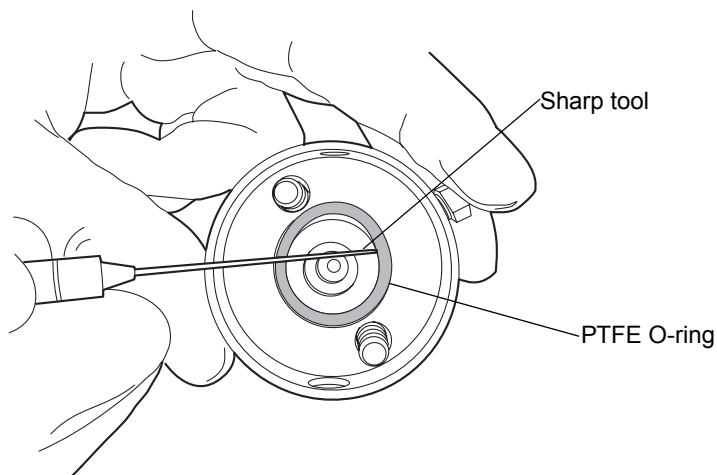
! **Caution:** To avoid scratching any metal surfaces, use care when screwing the threaded end of the seal extraction tool into the head seal.

6. Taking care not to scratch any surfaces, screw the threaded end of the seal extraction tool into the head seal, and carefully withdraw the seal from the head.



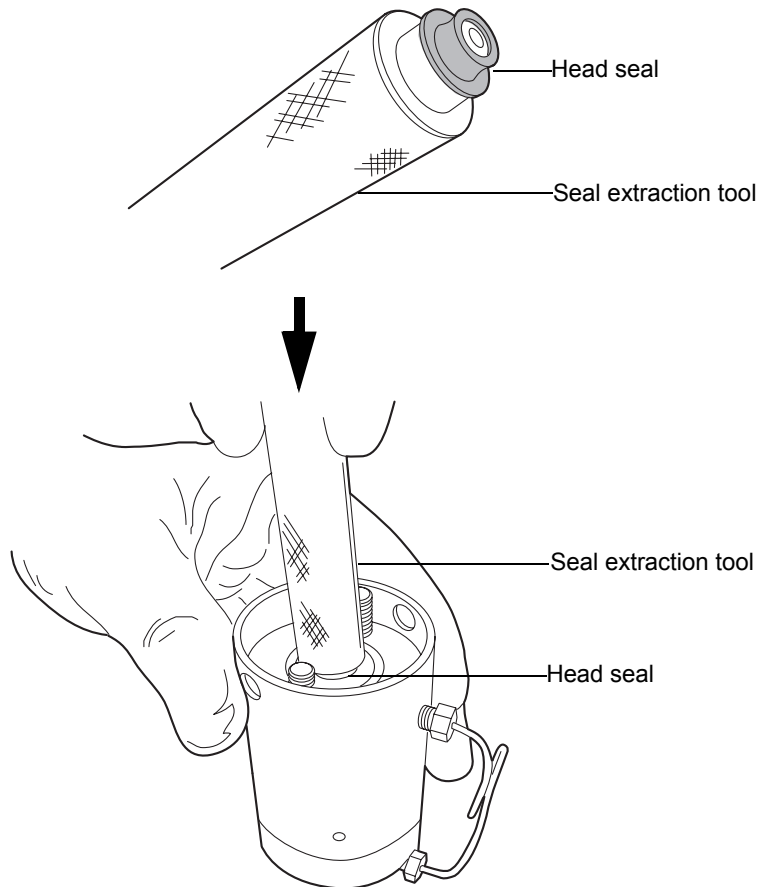
! **Caution:** To avoid scratching any metal surfaces, use care when using a sharp tool to remove the PTFE O-ring.

7. Use a sharp tool to remove the PTFE O-ring.

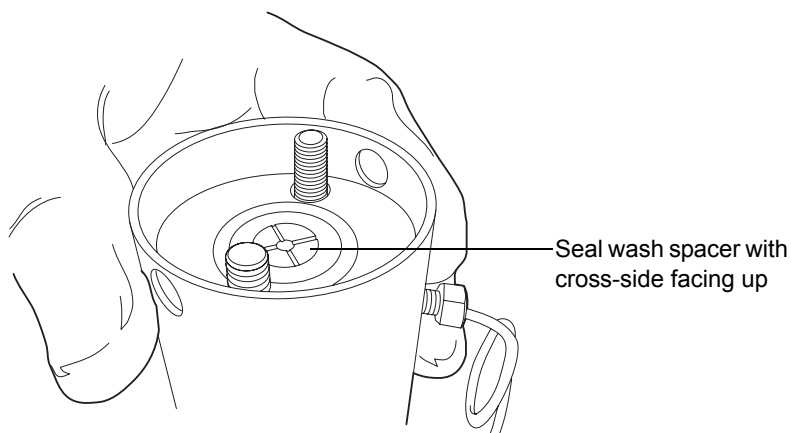


8. Lubricate the new PTFE O-ring with methanol, and press the O-ring into its seat with your thumbs.

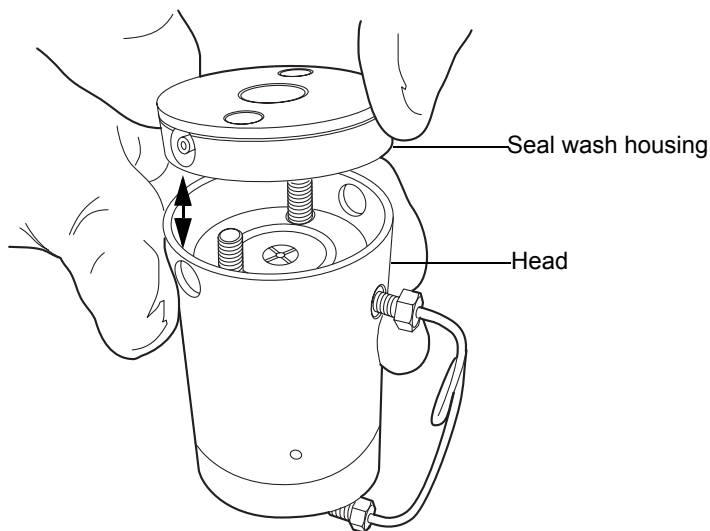
9. Lubricate the new head seal with methanol, and use the smooth end of the seal extraction tool to place it in the head.



10. Center the new seal wash spacer over the head seal so that the cross-side faces upward.

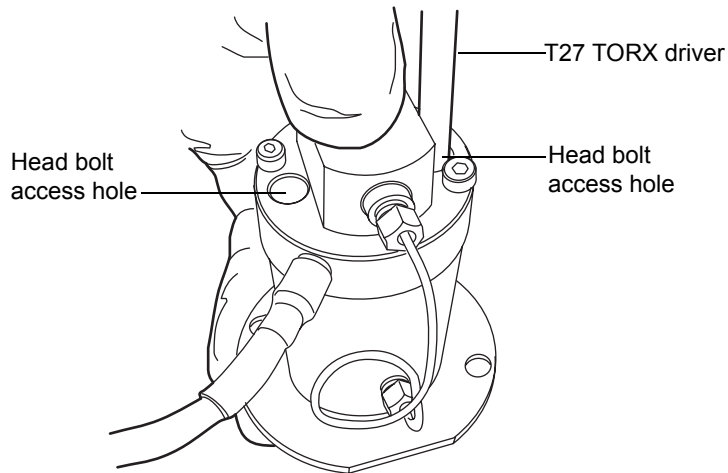


11. Orient the seal wash housing so that the holes on its side align with the holes on the side of the head, and then guide it into place.



12. Install the new seal wash seal in the seal wash housing.
13. Place the support plate on top of the head.

14. Holding the assembly together, use the T27 TORX driver to minimally tighten the 2 head bolts.

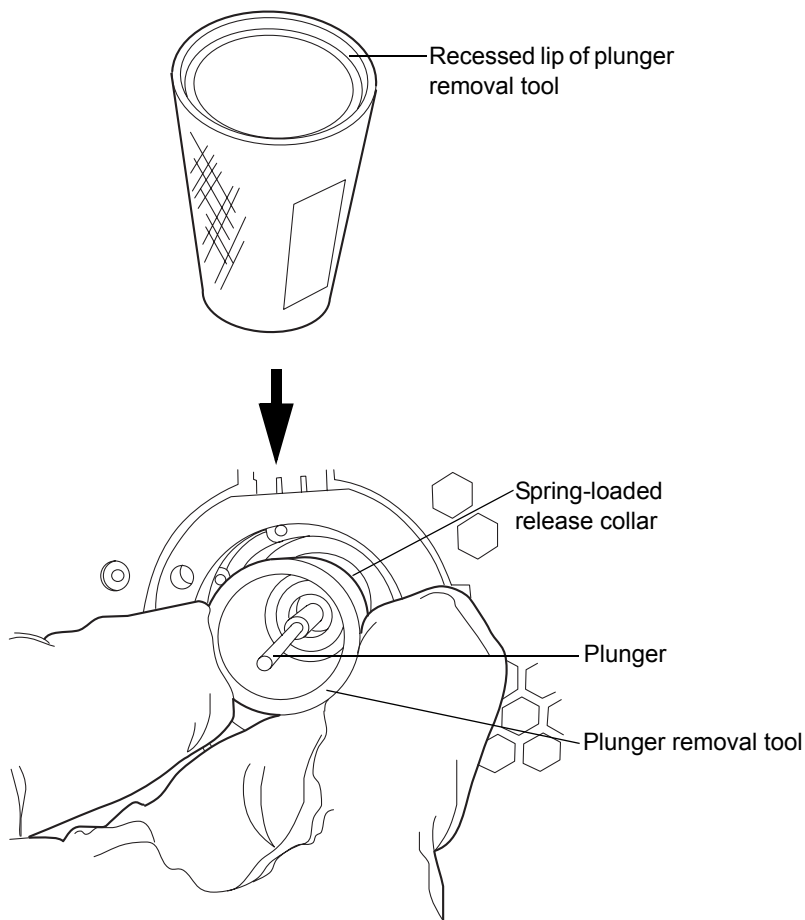


To replace the primary head plunger:

1. Stand the head assembly upright on a clean surface, and set it aside.

Recommendation: Waters strongly recommends that you replace the head seals when you replace the plunger.

2. Use the recessed side of the plunger removal tool to apply pressure to both sides of the release collar, and then remove the old plunger.



3. While applying pressure to the release collar with the plunger removal tool, grasp the new plunger with a clean, lint-free cloth, and insert it.
4. Remove the plunger removal tool from the release collar.
5. Grasp the new plunger by its metal portion, and make sure the plunger is securely in place.

To reattach the primary head:

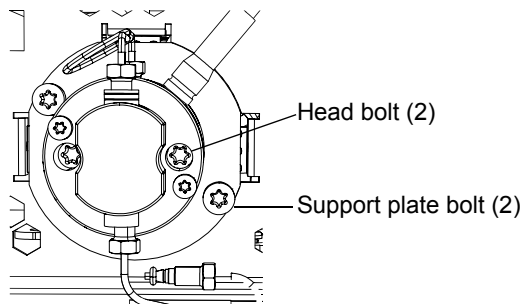
1. Lubricate the seals and plunger with methanol.

! **Caution:** To avoid damaging the plunger, ensure that the head assembly is not tilted relative to the plunger when you position it on the mechanism.

2. Carefully slide the head assembly and support plate over the sapphire plunger, making sure not to tilt the head.

! **Caution:** To avoid damaging the plunger, alternately tighten the the support plate screws 1/4-turn so that they are uniformly torqued.

3. Hold the head assembly securely against the actuator housing, and then use the T27 TORX driver to tighten the support plate screws securely.

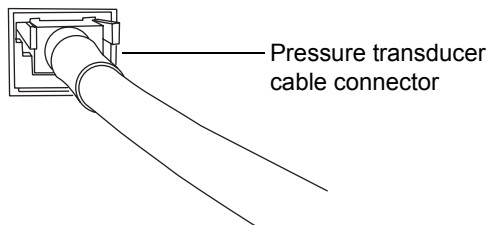


4. Alternately tighten the head bolts so that they are uniformly torqued.

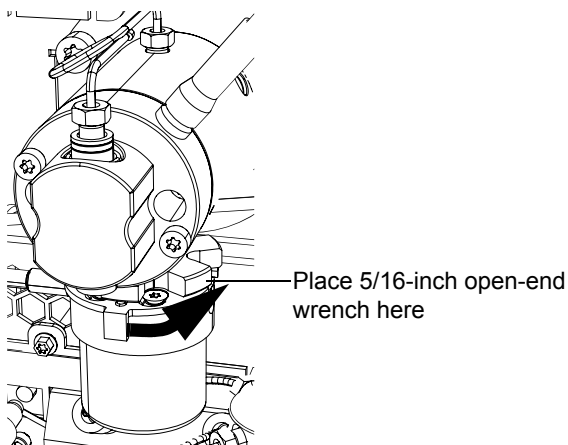
! **Caution:** To avoid pinching the drip wire between the head assembly and support plate, be sure to install the drip wire after tightening the head bolts.

5. Reinstall the drip wire around the head assembly, ensuring that the tip is in the 6 o'clock position.

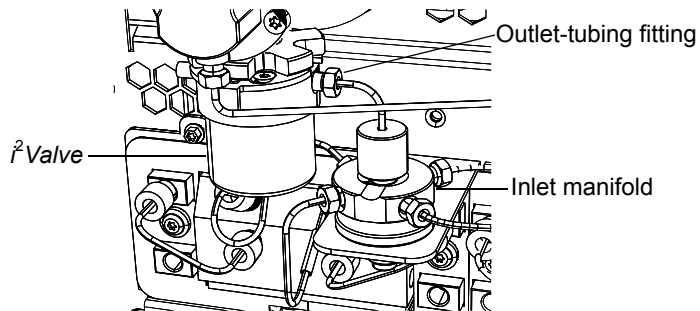
6. Connect the pressure transducer cable to the bulkhead.



7. Orient the *i*²Valve assembly so that the cable exits from the left-hand side.
8. Insert the *i*²Valve assembly into the bottom of the primary pump head, and route the cable behind the valve actuator.
9. Finger-tighten the shell nut to secure the valve.
Tip: Expect to be able to rotate the shell nut approximately 5 full turns to reach the finger-tight condition.
10. Use the 5/16-inch open-end wrench to tighten the nut an additional 1/8-turn.

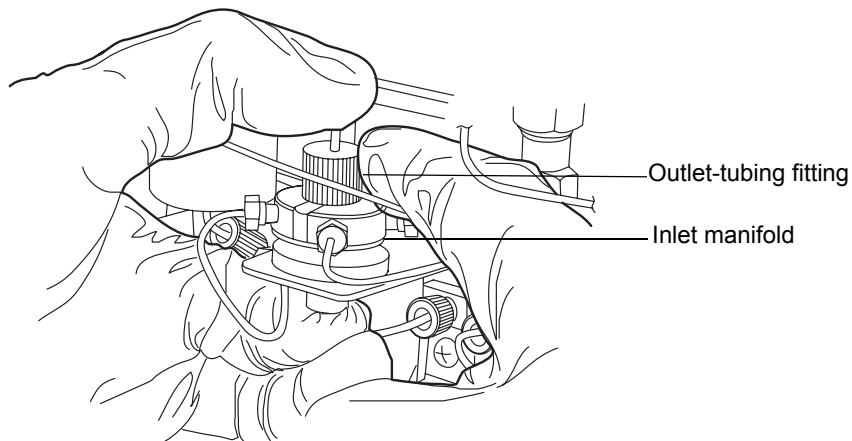


11. Reinstall the outlet-tubing fitting on the side of the i^2 Valve, and loosely tighten it.

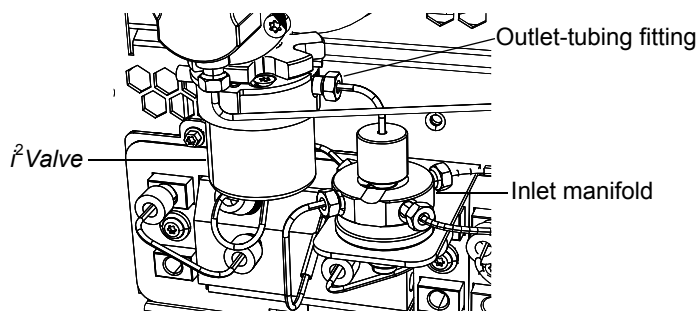


12. Reattach the outlet-tubing fitting to the inlet manifold, and finger-tighten it to the extent possible.

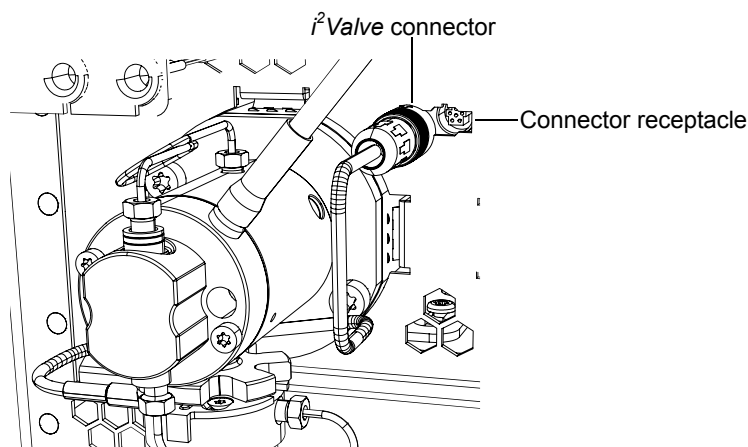
Requirement: Ensure the outlet-tubing is fully engaged by raising the inlet manifold while attaching the outlet-tubing fitting.



13. Tighten the outlet-tubing fitting, on the side of the i^2 Valve, finger-tight plus up to an additional 1/6-turn, for existing fittings, or 3/4-turn for new fittings.



14. Align the white arrow on the i^2 Valve connector with the white arrow on the receptacle, in the 12 o'clock position, and insert the connector into the receptacle.



15. Reattach all fittings and seal wash tubing.

Tip: When reattaching the outlet-tubing to the transducer, tighten the outlet-tubing fitting finger-tight plus up to an additional 1/6-turn for existing fittings, or 3/4-turn for new fittings.

16. Power-on the quaternary solvent manager.
17. Prime the quaternary solvent manager (see [page 15](#)).
18. Perform the solvent manager leak test (see the ACQUITY UPLC online Help).

Tip: If the leak test results are not satisfactory, try pressurizing the head plunger seals to properly seat them. To pressurize the seals, perform one of these procedures:

- Run the quaternary solvent manager at 96,527 kPa (965 bar, 14,000 psi) for a half-hour.
- Run the leak test until results are satisfactory.

Replacing the accumulator head plunger



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when replacing the plunger.

Required materials

- 1/4-inch open-end wrench
- 5/16-inch open-end wrench
- T27 TORX driver (startup kit)
- Gloves: clean, powder-free, chemical-resistant
- Head seal and seal wash spacer (recommended)
- Methanol
- Plunger removal tool
- PTFE O-ring (recommended)
- Replacement plunger
- Seal extraction tool (recommended)
- Seal wash seal (recommended)
- Sharp tool (recommended)

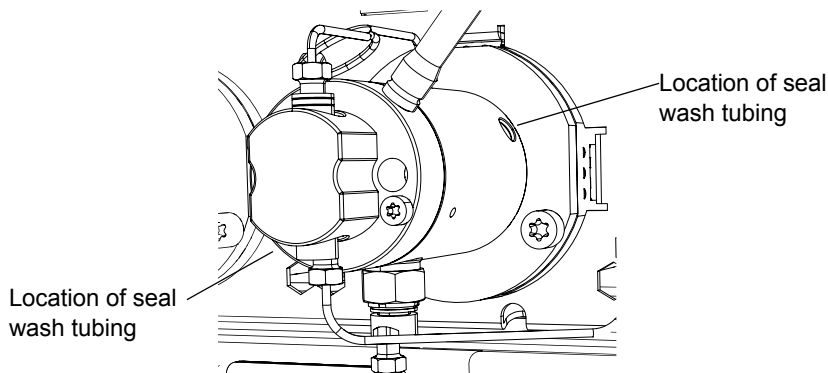
To remove the accumulator head:

1. Flush the quaternary solvent manager with nonhazardous solvent.
2. In the ACQUITY UPLC Console, select Quaternary Solvent Manager from the system tree.
3. In the quaternary solvent manager information window, click Maintain > Heads.
4. In the Head Maintenance dialog box, select the head (Accumulator) that you plan to perform maintenance on.
5. Click Move Backward, and then wait for the plunger to stop.

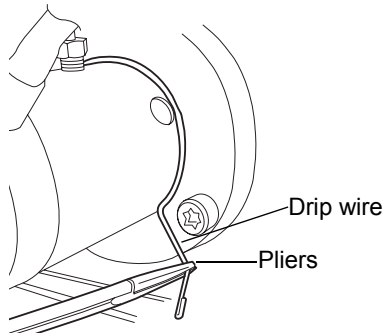


Caution: To avoid damaging electrical parts, never disconnect an electrical assembly while power is applied to an instrument or device. To completely interrupt power, set the power switch to Off, and then unplug the power cord from the AC source. Wait 10 seconds thereafter before you disconnect an assembly.

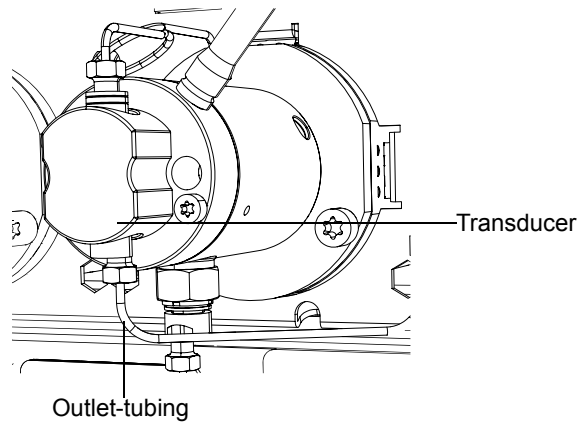
6. Power-off the quaternary solvent manager.
7. Remove the seal wash tubing secured to the seal wash housing by barbed fittings, using a tool or by pulling on the tubing as close to the head as possible.



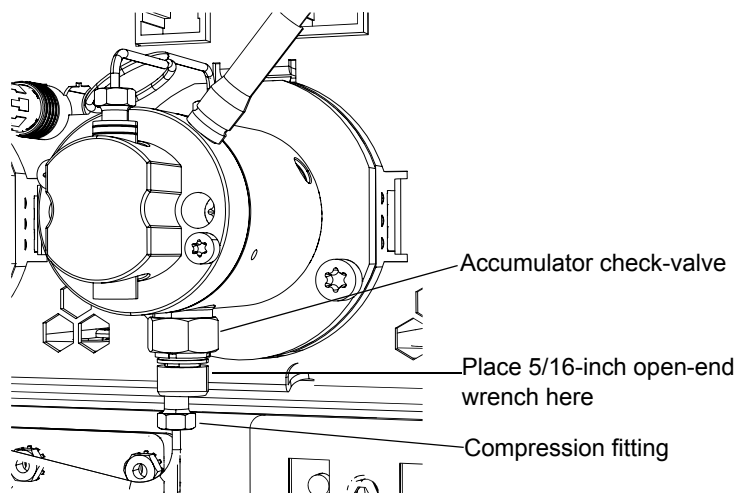
8. Using a pliers, remove the drip wire from the head assembly.



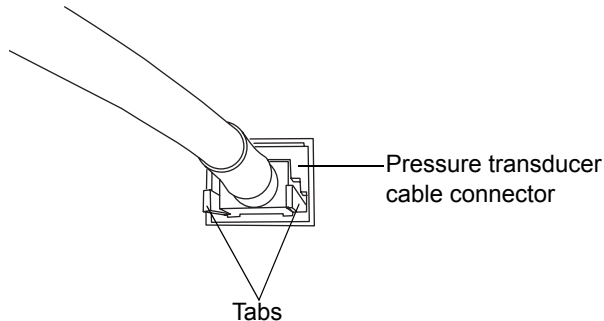
9. Use the 1/4-inch open-end wrench to disconnect the outlet-tubing from the transducer.



10. Using the 5/16-inch open-end wrench to hold the check-valve cartridge in place, disconnect the tubing connection from the check-valve with the 1/4-inch open-end wrench.

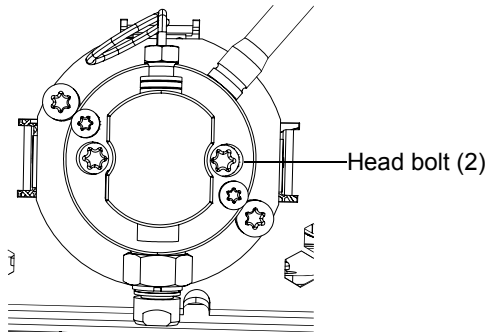


11. Disconnect the pressure transducer cable from the bulkhead by squeezing on the tabs and pulling gently.



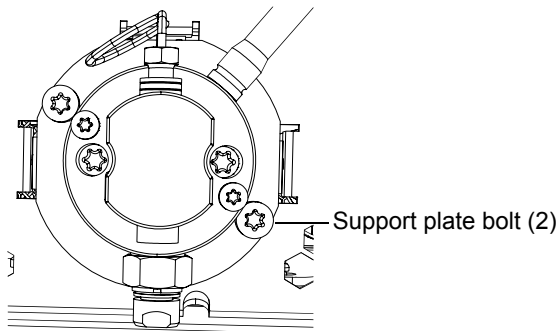
12. Using the T27 TORX driver, loosen the 2 head bolts 1/2-turn.

Tip: The bolts are accessible from the front of the pressure transducer.

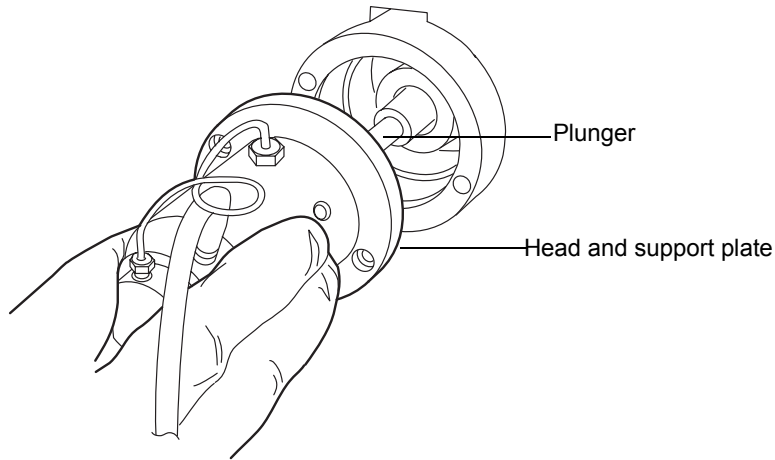


Caution: To avoid damaging the plunger, support the head from below as you remove it.

13. Using the T27 TORX driver, loosen and remove the 2 support plate bolts, and then gently pull the head and support plate off the actuator housing, making sure not to tilt the head during the extraction.



Pulling head and support plate off actuator housing:

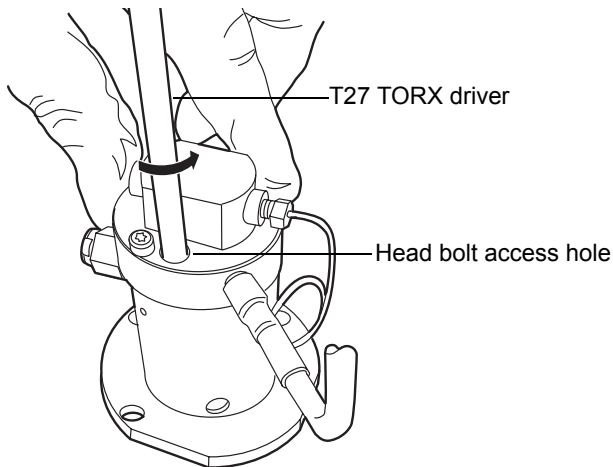


Recommendation: Waters strongly recommends that you replace the head seals when you replace the plunger.

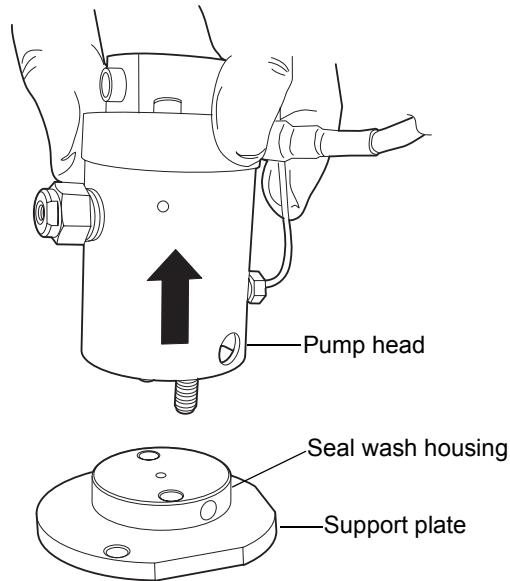
If you are not replacing any seals as part of this procedure, proceed to [page 127](#).

To remove the accumulator head seals:

1. Stand the head upright on a clean surface.
2. Using the T27 TORX driver, completely loosen the 2 head bolts to release the support plate from the pump head.

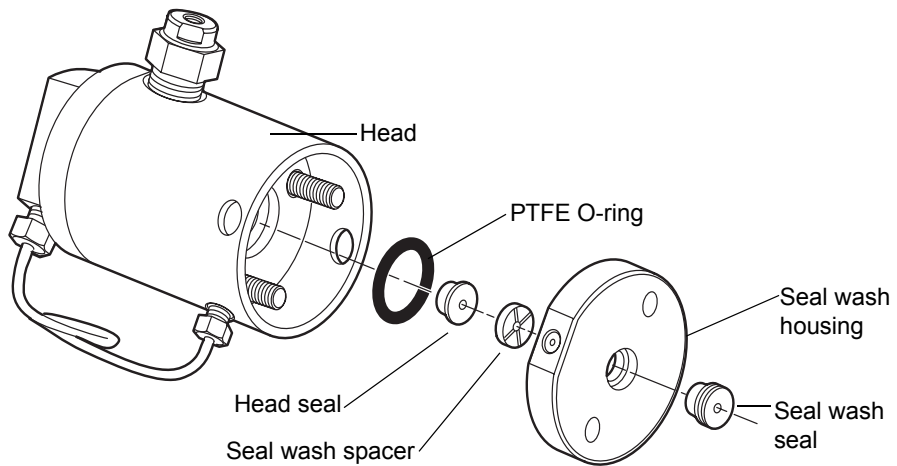


3. Lift the pump head from the support plate.

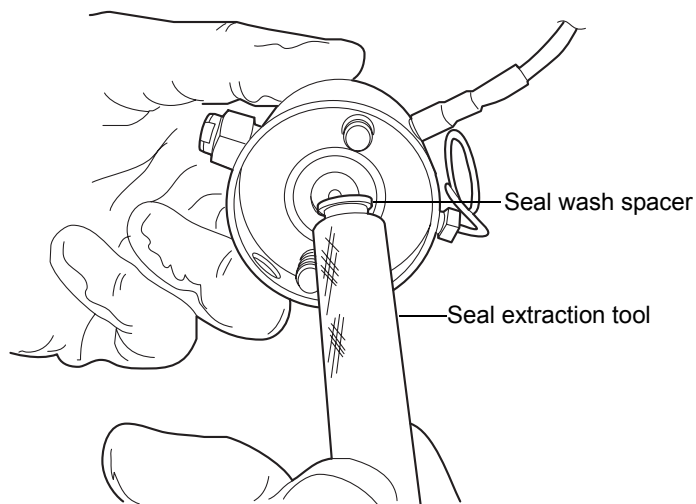


4. Remove the old seal wash seal, and discard it.

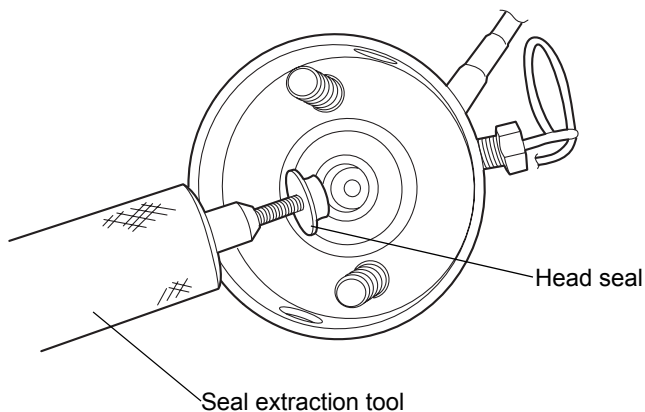
Head seals:




5. Using the smooth end of the seal extraction tool, remove the seal wash spacer from the head.

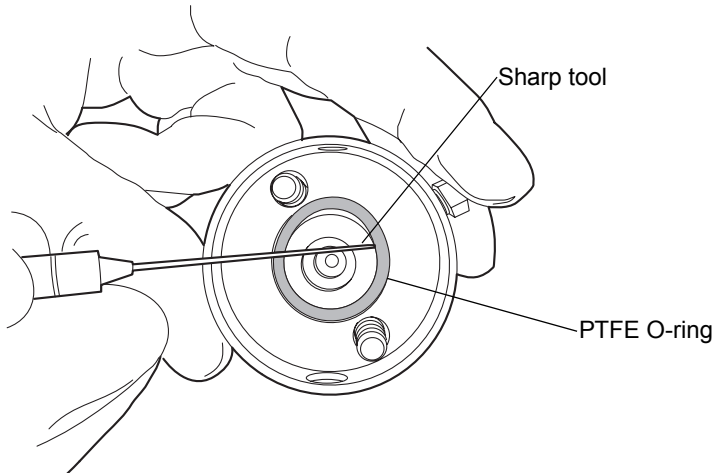


6. Taking care not to scratch any surfaces, screw the threaded end of the seal extraction tool into the head seal, and carefully withdraw the seal from the head.



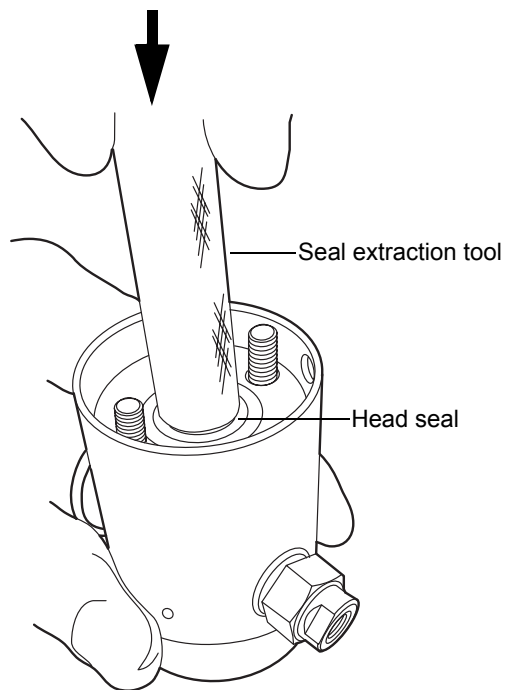
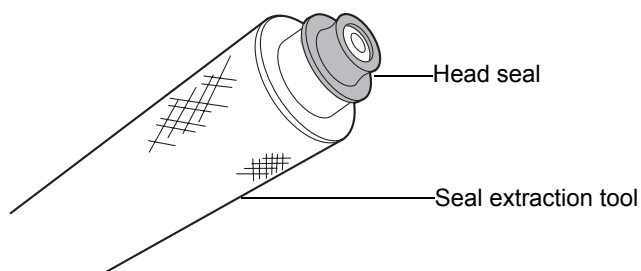
 **Caution:** To avoid scratching any metal surfaces, use care when using a sharp tool to remove the PTFE O-ring.

7. Use a sharp tool to remove the PTFE O-ring.

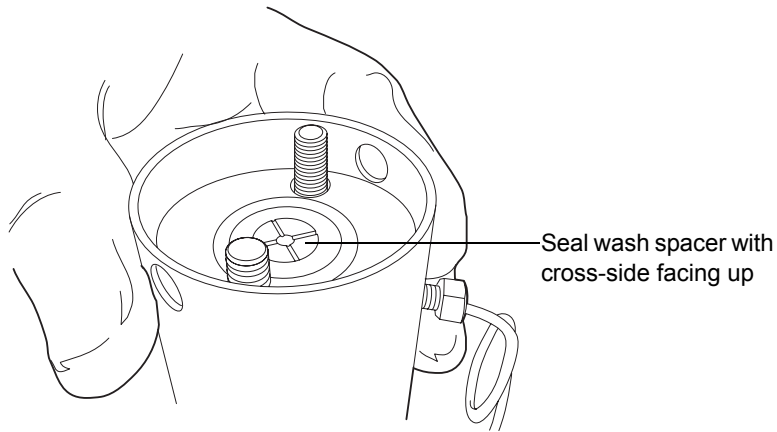


8. Lubricate the new PTFE O-ring with methanol, and press the O-ring into its seat with your thumbs.

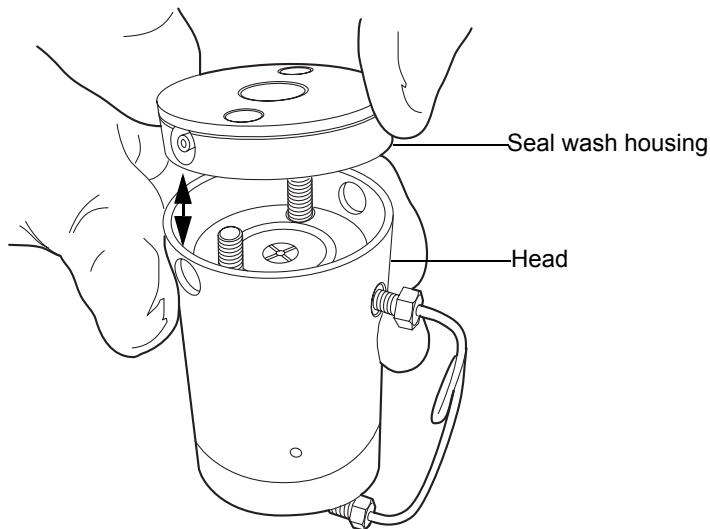
9. Lubricate the new head seal with methanol, and use the smooth end of the seal extraction tool to place it in the head.



10. Center the new seal wash spacer over the head seal so that the cross-side faces upward.

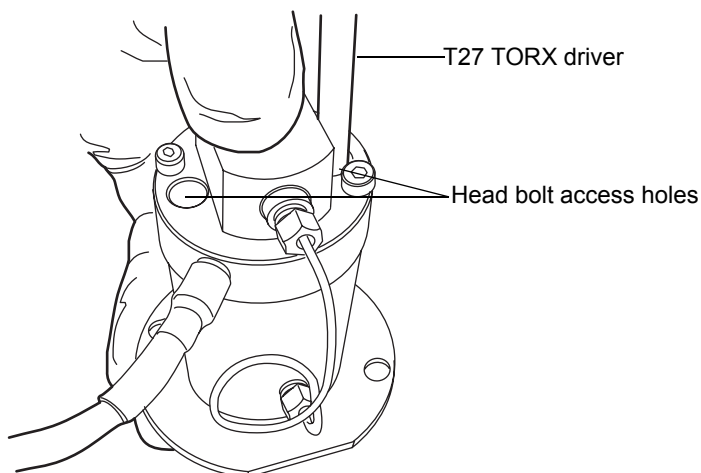


11. Orient the seal wash housing so that the holes on its side align with the holes on the side of the head, and then guide it into place.



12. Install the new seal wash seal in the seal wash housing.
13. Place the support plate on top of the head.

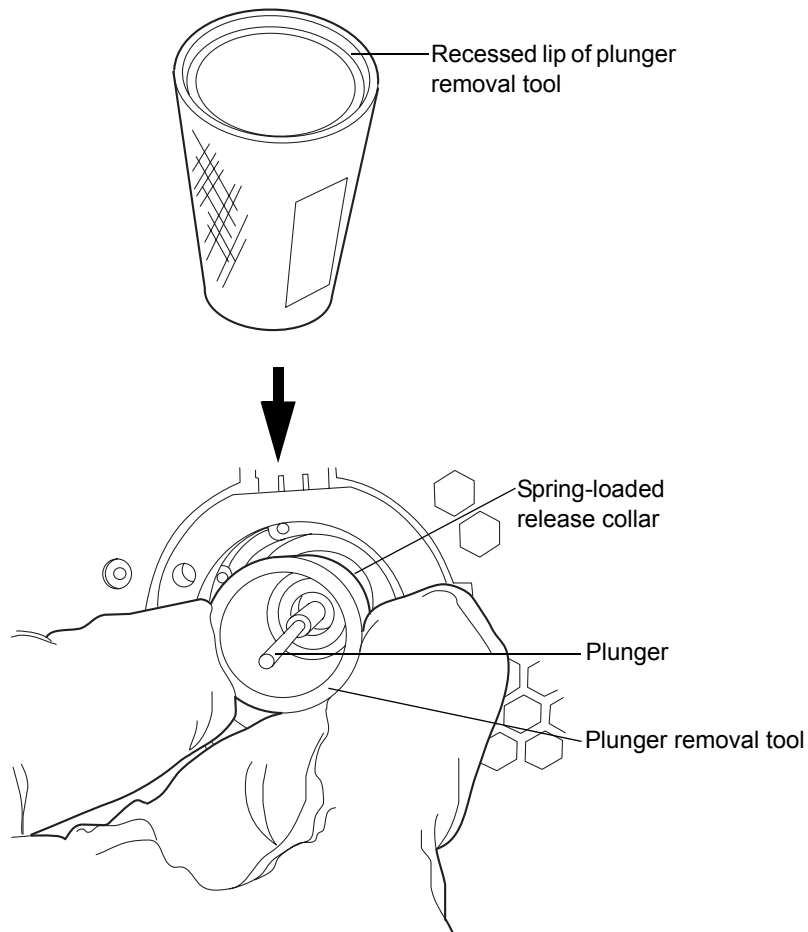
14. Holding the assembly together, use the T27 TORX driver to minimally tighten the 2 head bolts.



To replace the accumulator head plunger:

1. Stand the head assembly upright on a clean surface, and set it aside.
Recommendation: Waters strongly recommends that you replace the head seals when you replace the plunger.

2. Use the recessed side of the plunger removal tool to apply pressure to both sides of the release collar, and then remove the old plunger.



3. While applying pressure to the release collar with the plunger removal tool, grasp the new plunger with a clean, lint-free cloth, and insert it.
4. Remove the plunger removal tool from the release collar.
5. Grasp the new plunger by its metal portion, and make sure the plunger is securely in place.

To reattach the accumulator head:

1. Lubricate the seals and plunger with methanol.



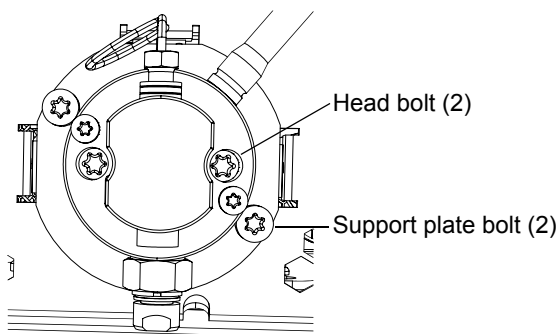
Caution: To avoid damaging the plunger, ensure that the head assembly is not tilted relative to the plunger when you position the assembly on the mechanism.

2. Carefully slide the head assembly and support plate over the sapphire plunger, making sure not to tilt the head.



Caution: To avoid damaging the plunger, alternately tighten the the support plate screws 1/4-turn so that they are uniformly torqued.

3. Hold the head assembly securely against the actuator housing, and then use the T27 TORX driver to tighten the support plate screws securely.



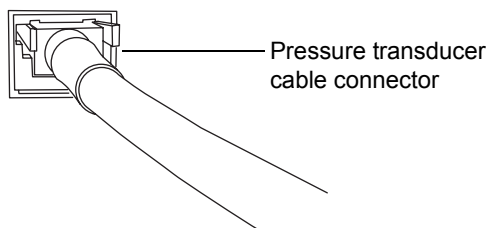
4. Alternately tighten the head bolts so that they are uniformly torqued.



Caution: To avoid pinching the drip wire between the head assembly and support plate, be sure to install the drip wire after tightening the head bolts.

5. Reinstall the drip wire around the head assembly, ensuring that the tip is in the 6 o'clock position.

6. Connect the pressure transducer cable to the bulkhead.



7. Reattach all fittings and seal wash tubing.
Tip: When reattaching the outlet-tubing to the transducer, tighten the outlet-tubing fitting finger-tight plus up to an additional 1/6-turn for existing fittings, or 3/4-turn for new fittings.
8. Return the solvent bottles to their original location.
9. Power-on the quaternary solvent manager.
10. Prime the quaternary solvent manager (see [page 15](#)).
11. Perform the solvent manager leak test (see the ACQUITY UPLC online Help).
Tip: If the leak test results are not satisfactory, try pressurizing the head plunger seals to properly seat them. To pressurize the seals, perform one of the following:
 - Run the quaternary solvent manager at 96,527 kPa (965 bar, 14,000 psi) for a half-hour.
 - Run the leak test until results are satisfactory.

Replacing the vent valve cartridge



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.




Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when replacing the vent valve cartridge.

Required materials

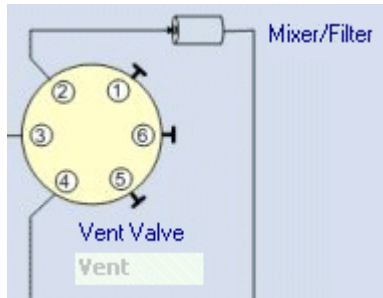
- 1/4-inch open-end wrench
- Allen wrench, 2-mm (startup kit)
- Gloves: clean, powder-free, chemical-resistant
- Vent valve cartridge

To replace the vent valve cartridge:

1. In the ACQUITY UPLC Console, select **Quaternary Solvent Manager** from the system tree.
2. In the quaternary solvent manager information window, click **Interactive Display**.
3. In the quaternary solvent manager interactive display dialog box, click **Control** .
4. Ensure the vent valve is set to **Vent**.

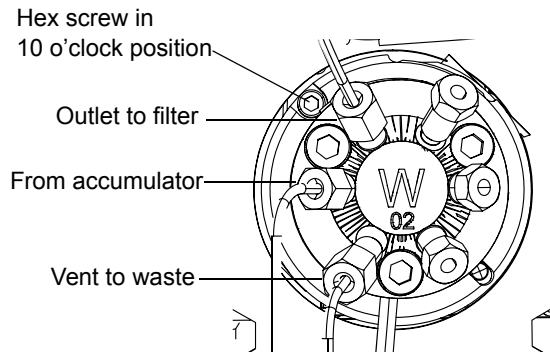
Tip: To change the setting to Vent, click the underlined vent valve position, and select Vent.

Interactive display showing vent valve setting:



5. Use the 1/4-inch wrench to remove the fittings attached to the vent valve cartridge.

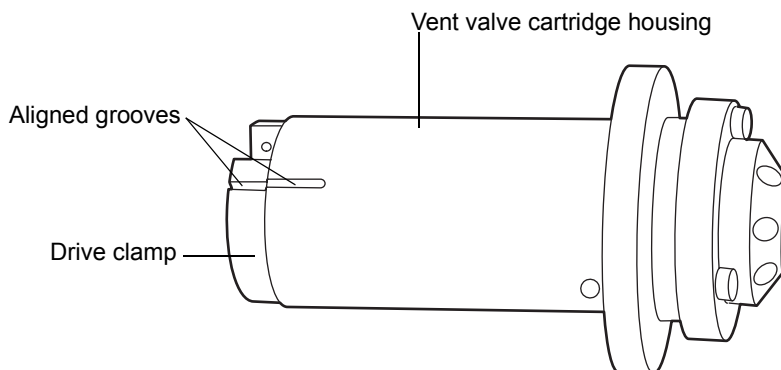
Vent valve cartridge:



6. Use the 2-mm Allen wrench to remove the hex screw at the 10 o'clock position on the vent valve cartridge.
7. Remove the vent valve cartridge from the vent valve assembly by pulling straight forward.
8. Unpack the replacement vent valve cartridge.
9. Ensure that the groove in the cartridge housing aligns with the groove on the drive clamp.

Tip: If the grooves fail to align, turn the drive clamp until they do.

Note: Be careful not to scratch the drive clamp or body.



10. Insert the new vent valve cartridge into the vent valve cartridge chamber.

Requirements:

- Orient the new cartridge exactly as the old one was oriented.
- The vent valve cartridge must slide fully into the vent valve assembly. If it does not, contact Waters Technical Service.

11. Insert the 2-mm hex screw at the 10 o'clock position on the vent valve cartridge.

Tip: Use the 2-mm Allen wrench to tighten it.

12. Use the 1/4-inch wrench to reattach all fittings and tighten them up to 1/6-turn beyond finger-tight for existing fittings, or 3/4-turn beyond finger-tight for new fittings.
13. Prime the quaternary solvent manager (see [page 16](#)).

Replacing the optional solvent selection valve cartridge



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when replacing the solvent selection valve cartridge.

Required materials

- Allen wrench, 2-mm (startup kit)
- Gloves: clean, powder-free, chemical-resistant
- Solvent selection valve cartridge

To replace the optional solvent selection valve cartridge:

1. In the ACQUITY UPLC Console, select Quaternary Solvent Manager from the system tree.
2. Ensure the solvent selection valve is set to 6.

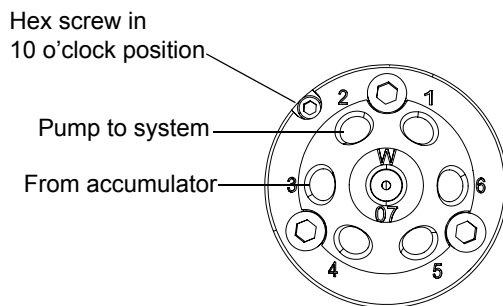


Warning: To avoid solvent spills, move the solvent bottles to a location below the quaternary solvent manager.

3. Move the solvent bottles to a location below the quaternary solvent manager.

4. Remove the finger-tight fittings attached to the solvent selection valve cartridge.

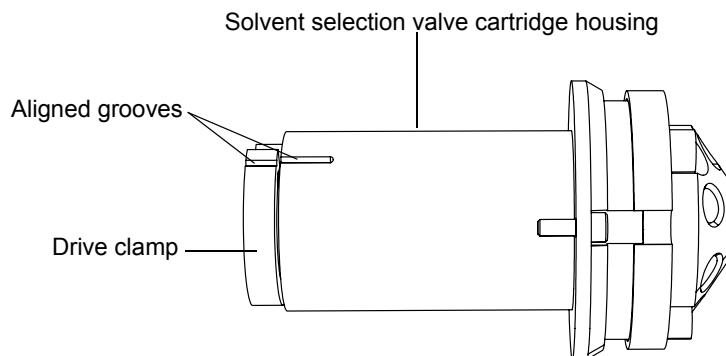
Solvent selection valve cartridge:



5. Use the 2-mm Allen wrench to remove the hex screw at the 10 o'clock position on the solvent selection valve cartridge.
6. Remove the solvent selection valve cartridge from the vent valve assembly by pulling straight forward.
7. Unpack the replacement solvent selection valve cartridge.
8. Ensure that the groove in the cartridge housing aligns with the groove on the drive clamp.

Tip: If the grooves fail to align, turn the drive clamp until they do.

Note: Be careful not to scratch the drive clamp or body.



9. Insert the new solvent selection valve cartridge into the solvent selection valve cartridge chamber.

Requirements:

- Orient the new cartridge exactly as the old one was oriented.
 - The solvent selection valve cartridge must slide fully into the solvent selection valve assembly. If it does not, contact Waters Technical Service.
10. Insert the 2-mm hex screw at the 10 o'clock position on the vent valve cartridge.
Tip: Use the 2-mm Allen wrench to tighten it.
 11. Reattach all fittings, and finger-tighten them.
 12. Return the solvent bottles to their original location.
 13. Prime the quaternary solvent manager. See [page 16](#).

Requirement: Be sure to prime all six D tubes.

Replacing the low-pressure inlet filters on the GPV outlet



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when replacing the low-pressure inlet filters.

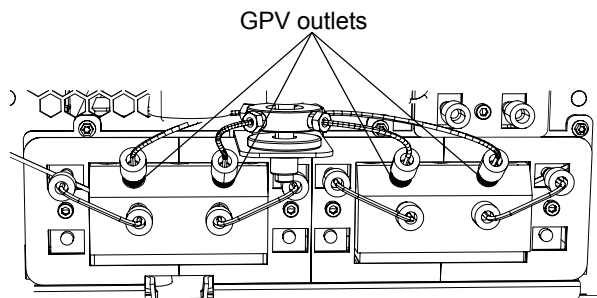
Required materials

- Gloves: clean, powder-free, chemical-resistant
- Low-pressure inlet filters (4)

To replace the low-pressure inlet filters on the GPV outlet:

1. Power-off the quaternary solvent manager.
2. Open the quaternary solvent manager's door, gently pulling its right-hand edge toward you.

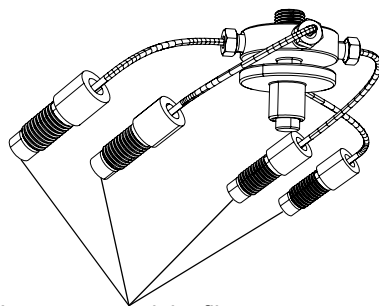
3. Disconnect the four inlet manifold tubes from the GPV outlets.



4. Remove the low-pressure inlet filters from the inlet manifold tubing.

Tip: If the filters are not on the ends of the inlet manifold tubing, use the tubing to retrieve them from the GPV outlets.

Low-pressure inlet filters on tubing:



5. Place the new filters on the inlet manifold tubes.
6. Connect the inlet manifold tubes (4) to the GPV outlets.
7. Power-on the quaternary solvent manager.
8. Prime the quaternary solvent manager (see [page 15](#)).

Replacing the 100- μ L mixer/filter



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



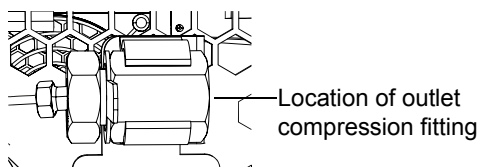
Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when replacing the 100- μ L mixer/filter.

Required materials

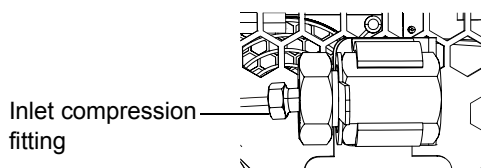
- 1/4-inch open-end wrench
- 5/8-inch open-end wrench
- 100- μ L mixer/filter
- Gloves: clean, powder-free, chemical-resistant

To replace the 100- μ L mixer/filter:

1. Flush the quaternary solvent manager with nonhazardous solvent.
2. Stop the solvent flow.
3. Holding the 100- μ L mixer/filter in place using the 5/8-inch open-end wrench, disconnect the outlet compression fitting using the 1/4-inch open-end wrench.



4. Holding the 100- μ L mixer/filter with the 5/8-inch open-end wrench, disconnect the inlet compression fittings using the 1/4-inch wrench.



5. Remove the old 100- μ L mixer/filter from the bracket.

6. Unpack the new 100- μ L mixer/filter.
7. Insert the new 100- μ L mixer/filter into the bracket.
8. Reattach the compression fittings to the 100- μ L mixer/filter, and tighten them finger-tight plus up to an additional 1/6-turn, for existing fittings, or 3/4-turn for new fittings.

Installing or replacing the optional 250- μ L mixer/filter



Warning: To prevent injury, always observe Good Laboratory Practice when you handle solvents, change tubing, or operate the quaternary solvent manager. Consult the Material Safety Data Sheets regarding the solvents you use.



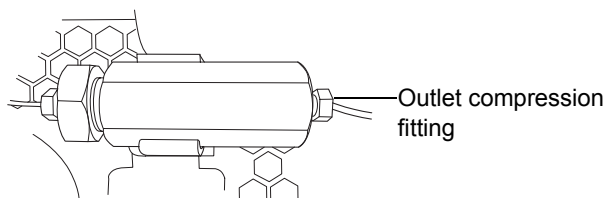
Caution: To prevent contamination, wear clean, chemical-resistant, powder-free gloves when installing or replacing the optional 250- μ L mixer/filter.

Required materials

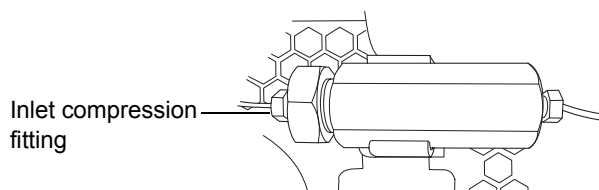
- 1/4-inch open-end wrench
- 5/8-inch open-end wrench
- 250- μ L mixer/filter
- Gloves: clean, powder-free, chemical-resistant

To install or replace the optional 250- μ L mixer/filter:

1. Flush the quaternary solvent manager with nonhazardous solvent.
2. Stop the solvent flow.
3. Holding the mixer/filter in place using the 5/8-inch open-end wrench, disconnect the outlet compression fitting using the 1/4-inch open-end wrench.



4. Holding the mixer/filter using the 5/8-inch open-end wrench, disconnect the inlet compression fittings using the 1/4-inch wrench.



5. Remove the 100- μ L or 250- μ L mixer/filter from the bracket.
6. Unpack the 250- μ L mixer/filter.
7. Insert the mixer/filter into the bracket.
8. Reattach the compression fittings to the mixer/filter, and tighten them finger-tight plus up to an additional 1/6-turn, for existing fittings, or 3/4-turn for new fittings.

Cleaning the device's exterior

Clean surfaces of the quaternary solvent manager using only a soft, lint-free paper or cloth dampened with water.

Observe these requirements when cleaning device surfaces:

- Always ensure the electrical power to the device is interrupted.
- Always use eye and hand protection during the cleaning process.
- Apply the water to a clean cloth only, and then wipe the device.
- Never spray or apply the water directly onto any device surface.