

# **Waters Xevo TQ MS**

## **Operator's Overview and Maintenance Guide**

71500130002 / Revision D

**Waters**  
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# General Information

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We seriously consider every customer comment we receive. You can reach us at [tech\\_comm@waters.com](mailto:tech_comm@waters.com).

## Contacting Waters

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Contact Waters<sup>®</sup> with enhancement requests or technical questions regarding the use, transportation, removal, or disposal of any Waters product. You can reach us via the Internet, telephone, or conventional mail.

### Waters contact information:

Contacting medium	Information
Internet	The Waters Web site includes contact information for Waters locations worldwide. Visit <a href="http://www.waters.com">www.waters.com</a> .
Telephone and fax	From the USA or Canada, phone 800 252-HPLC, or fax 508 872 1990. For other locations worldwide, phone and fax numbers appear in the Waters Web site.
Conventional mail	Waters Corporation 34 Maple Street Milford, MA 01757 USA

## Safety considerations

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Some reagents and samples used with Waters instruments and devices can pose chemical, biological, or radiological hazards (or any combination thereof). You must know the potentially hazardous effects of all substances you work with. Always follow Good Laboratory Practice, and consult your organization's safety representative for guidance.

### Considerations specific to the Xevo TQ MS

#### Solvent leakage hazard

The source exhaust system is designed to be robust and leak-tight. Waters recommends you perform a hazard analysis, assuming a maximum leak into the laboratory atmosphere of 10% LC eluate.



**Warning:**

- To confirm the integrity of the source exhaust system, renew the source O-rings at intervals not exceeding one year.
- To avoid chemical degradation of the source O-rings, which can withstand exposure only to certain solvents (see [“Solvents used to prepare mobile phases” on page 213](#)), determine whether any solvents you use that are not listed are chemically compatible with the composition of the O-rings.

#### Flammable solvents hazard



**Warning:** To prevent ignition of flammable solvent vapors in the enclosed space of a mass spectrometer's ion source, ensure that nitrogen flows continuously through the source. The nitrogen supply pressure must not fall below 690 kPa (6.9 bar, 100 psi) during an analysis requiring the use of flammable solvents. Also a gas-fail device must be installed, to interrupt the flow of LC solvent should the nitrogen supply fail.

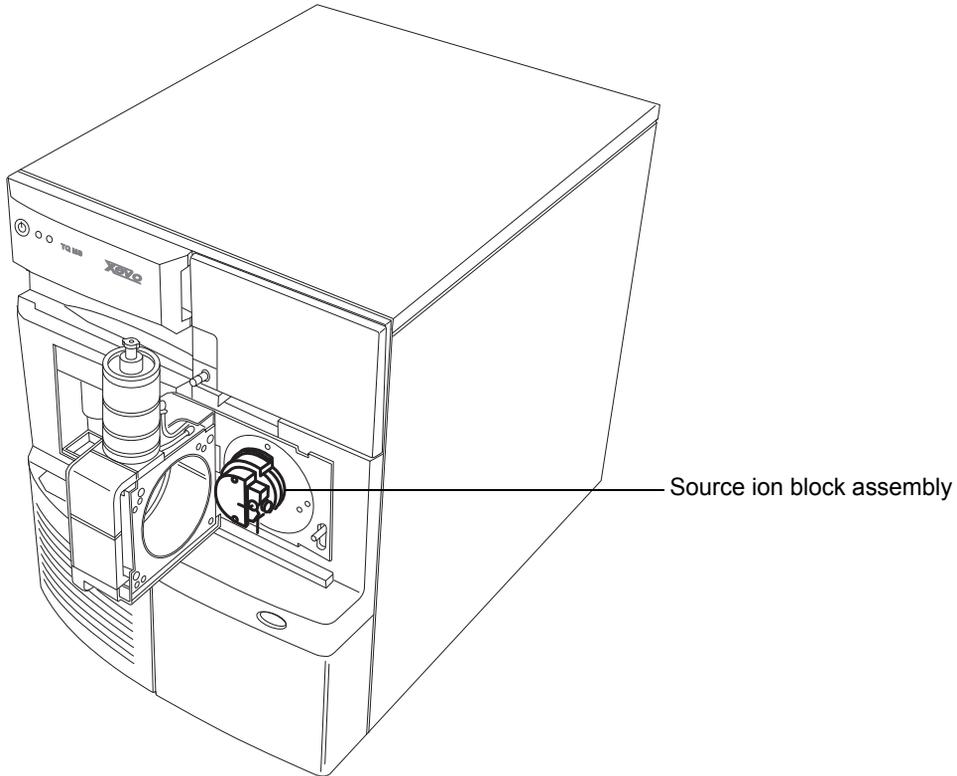
When using flammable solvents, ensure that a stream of nitrogen continuously flushes the instrument's source, and the nitrogen supply pressure remains above 690 kPa (6.9 bar, 100 psi). You must also install a gas-fail device that interrupts the solvent flowing from the LC system in the event the supply of nitrogen fails.

## High temperature hazard



**Warning:** To avoid burn injuries, avoid touching the source ion block assembly when operating or servicing the instrument.

### Xevo TQ MS high temperature hazard:



## Hazards associated with removing an instrument from service



**Warning:** To avoid personal contamination with biohazards, toxic materials, and corrosive materials, wear chemical-resistant gloves during all phases of instrument decontamination.



**Warning:** To avoid puncture injuries, handle syringes, fused silica lines, and borosilicate tips with extreme care.

When you remove the instrument from use to repair or dispose of it, you must decontaminate all of its vacuum areas. These are the areas in which you can expect to encounter the highest levels of contamination:

- Source interior
- Waste tubing
- Exhaust system
- Rotary pump oil (where applicable)

The need to decontaminate other vacuum areas of the instrument depends on the kinds of samples the instrument analyzed and their levels of concentration. Do not dispose of the instrument or return it to Waters for repair until the authority responsible for approving its removal from the premises specifies the extent of decontamination required and the level of residual contamination permissible. That authority must also prescribe the method of decontamination to be used and the appropriate protection for personnel undertaking the decontamination process.

You must handle items such as syringes, fused silica lines, and borosilicate tips used to carry sample into the source area in accordance with laboratory procedures for contaminated vessels and sharps. To avoid contamination by carcinogens, toxic substances, or biohazards, you must wear chemical-resistant gloves when handling or disposing of used oil.

## FCC radiation emissions notice

Changes or modifications not expressly approved by the party responsible for compliance, could void the users authority to operate the equipment. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## Canada spectrum management emissions notice

This class A digital product apparatus complies with Canadian ICES-003.  
Cet appareil numérique de la classe A est conforme à la norme NMB-003.

## Electrical power safety notice

Do not position the instrument so that it is difficult to operate the disconnecting device.

## Safety hazard symbol notice

Documentation needs to be consulted in all cases where the  symbol is used to find out the nature of the potential hazard and any actions which have to be taken.

## Equipment misuse notice

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

## Safety advisories

Consult [Appendix A](#) for a comprehensive list of warning and caution advisories.

## Operating this instrument

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When operating this instrument, follow standard quality-control (QC) procedures and the guidelines presented in this section.

### Applicable symbols

Symbol	Definition
	Manufacturer
	Authorized representative of the European Community
	Confirms that a manufactured product complies with all applicable European Community directives
	Australia C-Tick EMC compliant
	Confirms that a manufactured product complies with all applicable United States and Canadian safety requirements
	Consult instructions for use
	Contact Waters Corporation for the correct disposal and recycling instructions

### Audience and purpose

This guide is for operators of varying levels of experience. It gives an overview of the instrument, and explains how to prepare it, change its modes of operation, and maintain it.

## Intended use of the Xevo TQ MS

Waters designed the tandem quadrupole Xevo<sup>®</sup> TQ MS for use as a research tool to deliver authenticated mass measurement in both MS and MS/MS modes.

## Calibrating

To calibrate LC systems, follow acceptable calibration methods using at least five standards to generate a standard curve. The concentration range for standards should include the entire range of QC samples, typical specimens, and atypical specimens.

When calibrating mass spectrometers, consult the calibration section of the operator's guide for the instrument you are calibrating. In cases where an overview and maintenance guide, not operator's guide, accompanies the instrument, consult the instrument's online Help system for calibration instructions.

## Quality-control

Routinely run three QC samples that represent subnormal, normal, and above-normal levels of a compound. Ensure that QC sample results fall within an acceptable range, and evaluate precision from day to day and run to run. Data collected when QC samples are out of range might not be valid. Do not report these data until you are certain that the instrument performs satisfactorily.

When analyzing samples from a complex matrix such as soil, tissue, serum/plasma, whole blood, and other sources, note that the matrix components can adversely affect LC/MS results, enhancing or suppressing ionization. To minimize these matrix effects, Waters recommends you adopt the following measures:

- Prior to the instrumental analysis, use appropriate sample pretreatment such as protein precipitation, liquid/liquid extraction (LLE), or solid phase extraction (SPE) to remove matrix interferences.
- Whenever possible, verify method accuracy and precision using matrix-matched calibrators and QC samples.
- Use one or more internal standard compounds, preferably isotopically labeled analytes.

## ISM classification

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### ISM Classification: ISM Group 1 Class A

This classification has been assigned in accordance with IEC CISPR 11 Industrial Scientific and Medical (ISM) instruments requirements. Group 1 products apply to intentionally generated and/or used conductively coupled radio-frequency energy that is necessary for the internal functioning of the equipment. Class A products are suitable for use in commercial (that is, nonresidential) locations and can be directly connected to a low voltage, power-supply network.

## EC authorized representative

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Waters Corporation (Micromass UK Ltd.)  
Floats Road  
Wythenshawe  
Manchester M23 9LZ  
United Kingdom

Telephone: +44-161-946-2400  
Fax: +44-161-946-2480  
Contact: Quality manager



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# 1

## Waters Xevo TQ MS Overview

This chapter describes the instrument, including its controls and connections for gas and plumbing.

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## Waters Xevo TQ MS

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The Waters<sup>®</sup> Xevo<sup>®</sup> TQ MS is a tandem quadrupole, atmospheric pressure ionization (API) mass spectrometer. Designed for routine HPLC/MS/MS and UPLC<sup>®</sup>/MS/MS analyses in quantitative and qualitative applications, it can operate at fast acquisition speeds compatible with UltraPerformance LC<sup>®</sup>.

You can use the Xevo TQ MS with the following high-performance ZSpray<sup>™</sup> dual-orthogonal API sources:

- Standard multi-mode electrospray ionization/atmospheric pressure chemical ionization/combined electrospray ionization and atmospheric pressure chemical ionization (ESI/APCI/ESCI<sup>®</sup>) source.

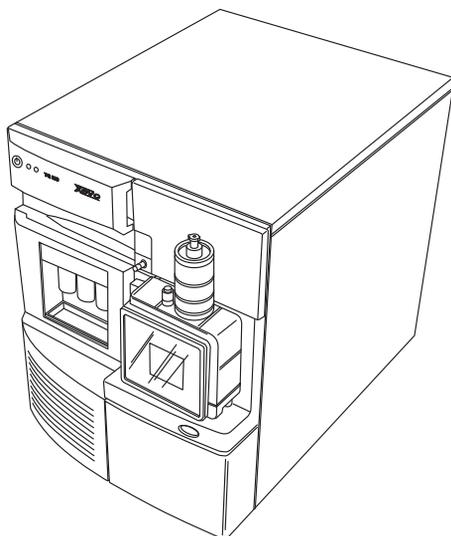
**Note:** Dedicated APCI operation requires an additional probe.

- Optional dual-mode APPI/APCI source
- Optional NanoFlow<sup>™</sup> ESI source.

**Note:** Available source options can vary depending on the software used to operate the Xevo TQ MS. Refer to the MassLynx<sup>®</sup> or UNIFI<sup>®</sup> online Help for more information about supported sources.

For mass spectrometer specifications, see the *Waters Xevo TQ MS Site Preparation Guide*.

## Waters Xevo TQ MS:



### IntelliStart technology

IntelliStart™ technology monitors LC/MS/MS performance and reports when the mass spectrometer is ready for use.

The software automatically tunes and mass calibrates the mass spectrometer, displays performance readbacks, and enables simplified setup of the system for use in routine analytical and open access applications. (See [page 26](#).)

The IntelliStart Fluidics system is built into the mass spectrometer. It delivers sample directly to the MS probe from the LC column or from three integral reservoirs. The integral reservoirs can also deliver sample through direct or combined infusion so that you can optimize instrument performance at analytical flow rates.

**Recommendation:** Use reservoir A for the calibrant solution, reservoir B for tuning compounds, and reservoir C for analyte/optimization solution.

A fourth reservoir contains solvent for automated flushing of the solvent delivery system.

See the mass spectrometer's online Help for further details on IntelliStart technology.

## ACQUITY Xevo TQ MS UPLC/MS systems

The Waters Xevo TQ MS is compatible with the ACQUITY UPLC<sup>®</sup> systems; if you are not using an ACQUITY UPLC system, refer to the documentation relevant to your LC system. See “Non-ACQUITY devices for use with the Xevo TQ MS” on page 25.

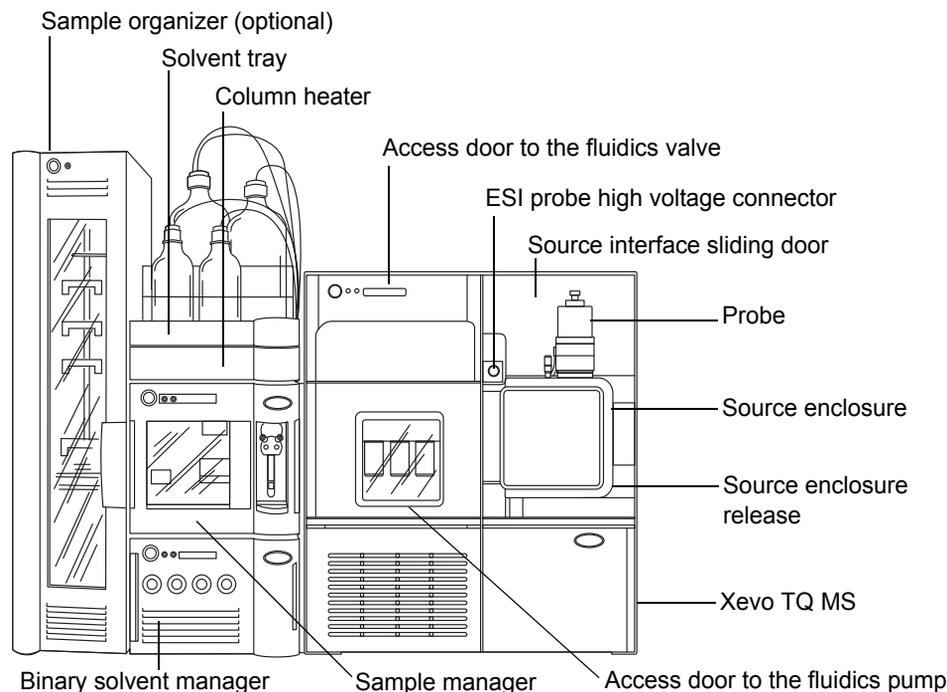
The ACQUITY<sup>®</sup> Xevo TQ MS UPLC/MS system includes an ACQUITY UPLC system and the Waters Xevo TQ MS.

### ACQUITY UPLC system

The ACQUITY UPLC system includes a binary solvent manager, sample manager, column heater, optional sample organizer, optional detectors, a specialized ACQUITY UPLC column, and software to control the system.

For further instruction, see the *ACQUITY UPLC System Operator's Guide or Controlling Contamination in LC/MS Systems* (part number 715001307). You can find these documents on <http://www.waters.com>; click Services and Support > Support.

### Waters ACQUITY Xevo TQ MS UPLC/MS system:



## nanoACQUITY UPLC Xevo TQ MS UPLC/MS system

Similar to the ACQUITY UPLC system, the nanoACQUITY uses the optional NanoFlow source on the Xevo TQ MS. It is designed for capillary-to-nano-scale separations. Its sensitivity, resolution, and reproducibility well suit it for biomarker discovery and proteomics applications, including protein identification and characterization.

This system is optimized for high-resolution separations at precise nanoflow rates. With closed loop control, those rates range between 0.20 and 5.00  $\mu\text{L}/\text{min}$ . With open loop control and nanoACQUITY UPLC<sup>®</sup> columns of internal diameters ranging from 75  $\mu\text{m}$  to 1 mm, the flow rates can extend to 100  $\mu\text{L}/\text{min}$ . The column hardware and the matched outlet tubing can withstand pressure of as much as 69,000 kPa (690 bar, 10,000 psi). The column dimensions allow optimal MS-compatible flow rates, and matched outlet tubing minimizes the effect of extra-column volume.

For further instruction, see the *nanoACQUITY UPLC System Operator's Guide* or *Controlling Contamination in LC/MS Systems* (part number 715001307). You can find these documents on <http://www.waters.com>; click Services and Support > Support.

## Non-ACQUITY devices for use with the Xevo TQ MS

The following non-ACQUITY LC devices are validated for use with the Xevo TQ MS:

- Waters Alliance 2695 separations module
- Waters Alliance 2795 separations module
- Waters 2998 PDA detector
- Waters 2487 UV detector
- Waters 1525 $\mu$  binary gradient pump + 2777 autosampler
- Spark Holland Symbiosis

## Software and data system

MassLynx v4.1 or UNIFI software can control the mass spectrometer. See [page 26](#) for more information about those applications.

Both MassLynx and UNIFI software enable these major operations:

- Configuring the instrument.
- Creating LC and MS/MS methods that define operating parameters for a run.
- Using IntelliStart software to tune and mass calibrate the mass spectrometer.
- Running samples.
- Monitoring the run.
- Acquiring data.
- Processing data.
- Reviewing data.
- Printing data.

### MassLynx v4.1

MassLynx software acquires, analyzes, manages, and distributes mass spectrometry, ultraviolet (UV), evaporative light scattering, and analog data. OpenLynx™ and TargetLynx™ application managers are included as standard software with MassLynx.

See the MassLynx v4.1 user documentation and online Help for information about using MassLynx software.

You configure settings, monitor performance, run diagnostic tests, and maintain the system and its modules via the MassLynx Instrument Console application.

The Instrument Console software, which functions independently of MassLynx software, does not recognize or control data systems.

### UNIFI v1.6

UNIFI software integrates mass spectrometry, UPLC chromatography, and informatics data work flows.

See UNIFI v1.6 user documentation and online Help for more information about using UNIFI software.

## Ionization techniques and source probes

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**Note:** Available source options can vary depending on the software used to operate the Xevo TQ MS. Refer to the MassLynx or UNIFI online Help for more information about supported sources.

### Electrospray ionization (ESI)

In electrospray ionization (ESI), a strong electrical charge is applied to the eluent as it emerges from a nebulizer. The droplets that compose the resultant aerosol undergo a reduction in size (solvent evaporation). As solvent continues to evaporate, the charge density increases until the droplet surfaces eject ions (ion evaporation). The ions can be singly or multiply charged.

The instrument can accommodate eluent flow rates of up to 2 mL/min.

### Combined electrospray ionization and atmospheric pressure chemical ionization (ESCI)

Combined electrospray ionization and atmospheric pressure chemical ionization (ESCI) is supplied as standard equipment on the mass spectrometer. In ESCI, the standard ESI probe is used in conjunction with a corona pin to allow alternating acquisition of ESI and APCI ionization data, facilitating high throughput and wider compound coverage.

See “[ESCI mode](#)” on [page 57](#) for further details.

### Atmospheric pressure chemical ionization (APCI)

A dedicated high-performance atmospheric pressure chemical ionization (APCI) probe is offered as an option. APCI produces singly charged protonated or deprotonated molecules for a broad range of nonvolatile analytes.

The APCI interface consists of the ESI/APCI/ESCI enclosure fitted with a corona pin and an APCI probe.

See “[APCI mode](#)” on [page 57](#) for further details.

## Dual-mode APPI/APCI source

The optional, combined atmospheric pressure photoionization/atmospheric pressure chemical ionization (APPI/APCI) source comprises an APCI probe and the APPI lamp drive assembly. The APPI lamp drive assembly, which itself comprises a UV lamp and a repeller electrode. In addition, a specially-shaped, dual, APPI/APCI corona pin can be used. You can operate the source in APPI, APCI, or dual mode, which switches rapidly between APPI and APCI ionization modes.

## NanoFlow ESI source

NanoFlow is the name given to several techniques that use low flow rate electrospray ionization (ESI). The NanoFlow source allows electrospray ionization in the flow rate range 5 to 1000 nL/min. For a given sample concentration, the ion currents observed approximate those seen in normal flow rate electrospray. However, for similar experiments, NanoFlow's significant reduction in sample consumption accompanies significant increases in sensitivity.

The following options are available for the spraying capillary:

- Universal nebulizer sprayer (Nano-LC).  
This option is for flow injection or for coupling to nano-UPLC and uses a pump to regulate the flow rate downward to 100 nL/min. If a syringe pump is used, a gas-tight syringe is necessary to effect correct flow rates without leakage. A volume of 250  $\mu$ L is recommended.
- Borosilicate glass capillaries (nanovials).  
Metal-coated, glass capillaries allow the lowest flow rates. Usable for one sample, they must then be discarded.
- Capillary Electrophoresis (CE) or Capillary Electrochromatography (CEC) sprayer.  
This option uses a make-up liquid at the capillary tip, which allows a stable electrospray to occur. The make-up flow rate is less than 1  $\mu$ L/min.

# IntelliStart Fluidics system

## Overview

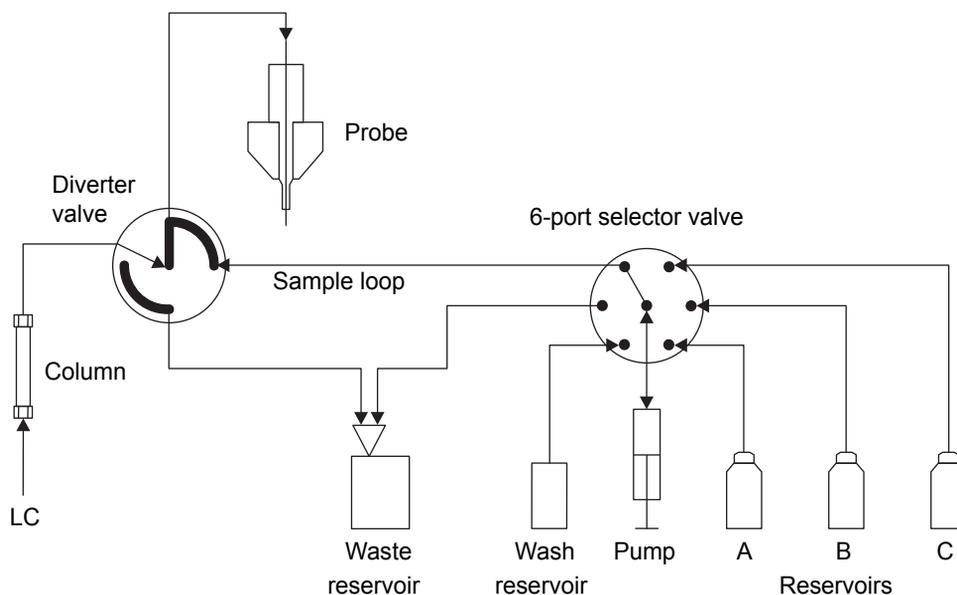
The IntelliStart Fluidics system is a solvent delivery system built into the mass spectrometer. It delivers sample directly to the MS probe in one of three ways:

- From the LC column.
- From three integral reservoirs. Use standard reservoir bottles (30 mL) for instrument setup and calibration. Use low-volume vials (1.5 mL) to infuse smaller volumes. See [“Installing the reservoir bottles” on page 47](#).

**Tip:** The reservoirs can also deliver sample through direct or combined infusion to enable optimization at analytical flow rates.

- From a wash reservoir, which contains solvent for automated flushing of the instrument’s solvent delivery system.

### Fluidics system:



## System components

The onboard system incorporates a 6-port selector valve, a multi-position diverter valve, a pump, and three sample reservoirs.

The sample reservoirs are mounted on the instrument's front panel. When you select a solvent from the Instrument Console, a light-emitting diode (LED) illuminates the appropriate reservoir. You can simultaneously illuminate all three reservoirs or extinguish the LEDs for light-sensitive samples.

**Recommendation:** Use reservoir A for the calibrant solution, reservoir B for tuning compounds, and reservoir C for analyte/optimization solution.

## System operation

The software automatically controls solvent and sample delivery during auto-tuning, auto-calibration, and method development.

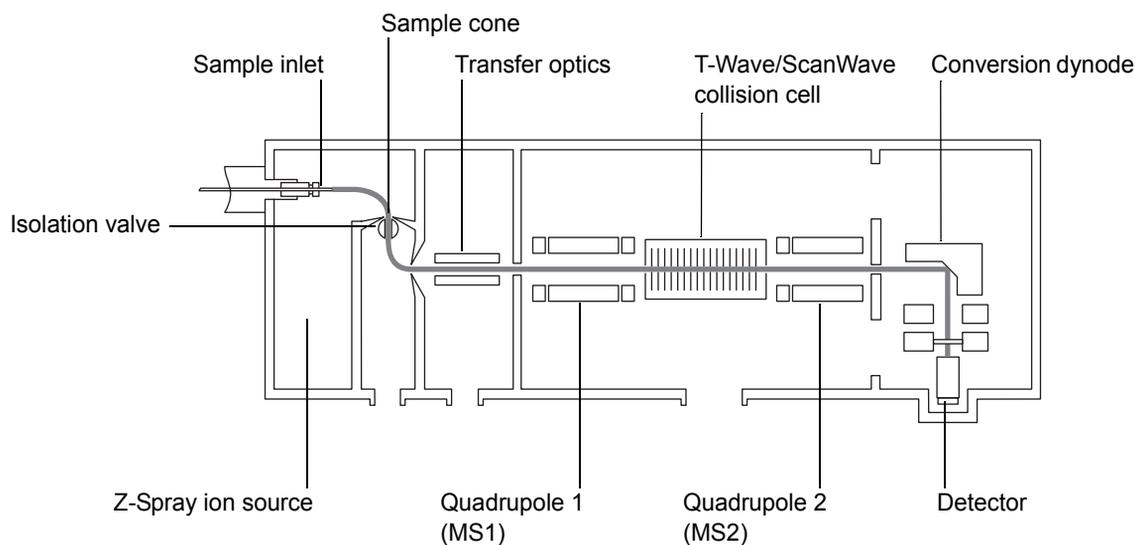
You can set IntelliStart configuration requirements in the Instrument Console. You can edit the parameters, frequency, and extent of the automation. See the mass spectrometer's online Help for further details on IntelliStart software and operation of the instrument's solvent delivery system.

## Ion optics

The mass spectrometer's ion optics operate as follows:

1. Samples from the LC or instrument's solvent delivery system are introduced at atmospheric pressure into the ionization source.
2. The ions pass through the sample cone into the vacuum system.
3. The ions pass through the transfer optics to the first quadrupole where they can be filtered according to their mass-to-charge ratio ( $m/z$ ).
4. The mass-separated ions pass into the collision cell (T-Wave™/ScanWave™) where they undergo collision-induced dissociation (CID) or pass to the second quadrupole. Any fragment ions can then be mass-analyzed by the second quadrupole.
5. The transmitted ions are detected by the photomultiplier detection system.
6. The signal is amplified, digitized, and sent to the mass spectrometry software.

### Ion optics:



## MS operating modes

---

The following table shows the MS operating modes.

### MS operating modes:

Operating mode	MS1	Collision cell	MS2
MS	Pass all masses		Resolving (scanning)
SIR	Pass all masses		Resolving (static)

In MS mode, the instrument can acquire data at scan speeds up to 10,000 Da/s. Use this mode for instrument tuning and calibration before MS/MS analysis. See the mass spectrometer's online Help for further information.

Use the selected ion recording (SIR) mode for quantitation when you cannot find a suitable fragment ion to perform a more specific multiple reaction monitoring (MRM) analysis. See [“MS/MS operating modes” on page 33](#).

**Note:** In SIR and MRM modes, neither quadrupole is scanned, therefore no spectrum (intensity versus mass) is produced. The data obtained from SIR or MRM analyses derive from the chromatogram plot (specified mass intensity versus time).

## MS/MS operating modes

---

**Note:** In SIR and MRM modes, neither quadrupole is scanned, so no spectrum (intensity versus mass) is produced.

The following table shows the MS/MS operating modes.

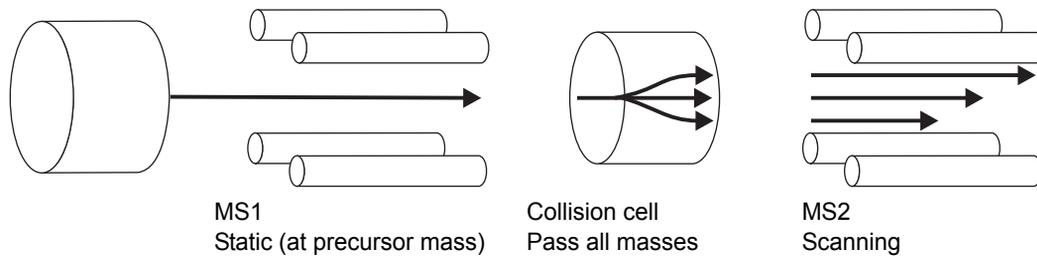
### MS/MS operating modes:

Operating mode	MS1	Collision cell	MS2
Product (daughter) ion spectrum	Static (at precursor mass)	Pass all masses	Scanning
Precursor (parent) ion spectrum	Scanning		Static (at product mass)
MRM	Static (at precursor mass)		Static (at product mass)
Constant neutral loss spectrum	Scanning (synchronized with MS2)		Scanning (synchronized with MS1)
ScanWave daughter scan	Static (at precursor mass)	ScanWave enabled	Scanning (synchronized with collision cell)

## Product (daughter) ion mode

Product ion mode is the most commonly used MS/MS operating mode. You can specify an ion of interest for fragmentation in the collision cell, thus yielding structural information.

### Product ion mode:



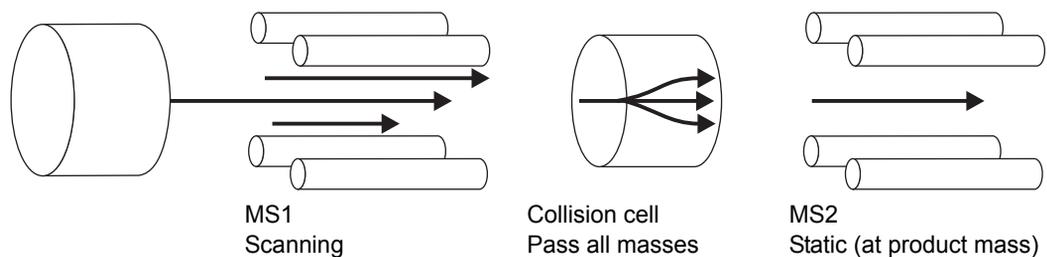
### Typical applications

You typically use product ion mode for the following applications:

- Method development for MRM screening studies:
  - Identifying product ions for use in MRM transitions.
  - Optimizing CID tuning conditions to maximize the yield of a specific product ion to be used in MRM analysis.
- Structural elucidation (for example, peptide sequencing).

## Precursor (parent) ion mode

### Precursor ion mode:



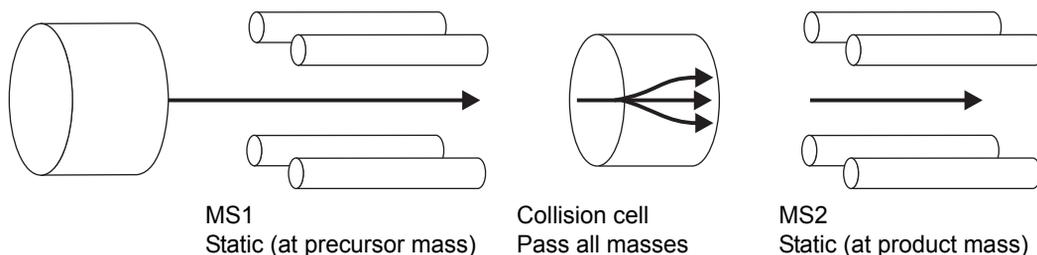
## Typical application

You typically use the precursor ion mode for structural elucidation—that is, to complement or confirm product scan data—by scanning for all the precursors of a common product ion.

## Multiple reaction monitoring mode

Multiple reaction monitoring (MRM) mode is a highly selective MS/MS equivalent of SIR. Because both MS1 and MS2 are static, greater dwell time on the ions of interest is possible and so the sensitivity achieved is better compared with scanning-mode MS/MS. This mode is the most commonly used acquisition mode for quantitative analysis, allowing the compound of interest to be isolated from the chemical background noise.

### Multiple reaction monitoring mode:



## Typical application

You typically use MRM mode to quantify known analytes in complex samples:

- Drug metabolite and pharmacokinetic studies.
- Environmental, for example, pesticide and herbicide analysis.
- Forensic or toxicology, for example, screening for target drugs in sport.

MRM mode does not produce a spectrum, because only one transition is monitored at a time. As in SIR mode, a chromatogram is produced.

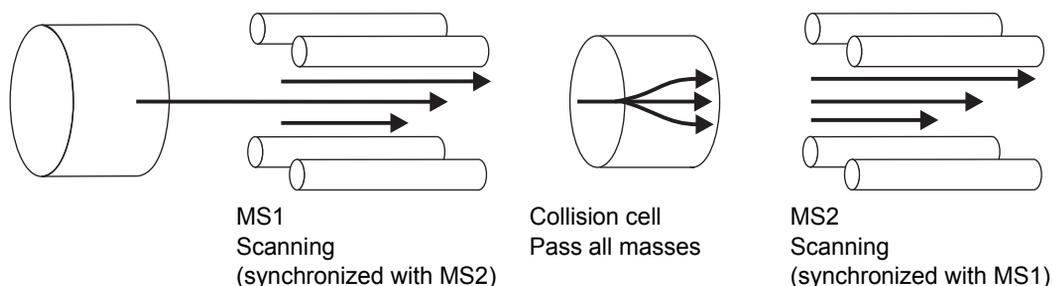
## Constant neutral loss mode

Constant neutral loss mode detects the loss of a specific neutral fragment or functional group from an unspecified precursor(s).

The scans of MS1 and MS2 are synchronized. When MS1 transmits a specific precursor ion, MS2 “looks” to see whether that precursor loses a fragment of a certain mass. If it does, the loss registers at the detector.

In constant neutral loss mode, the spectrum shows the masses of all precursors that actually lost a fragment of a certain mass.

### Constant neutral loss mode:



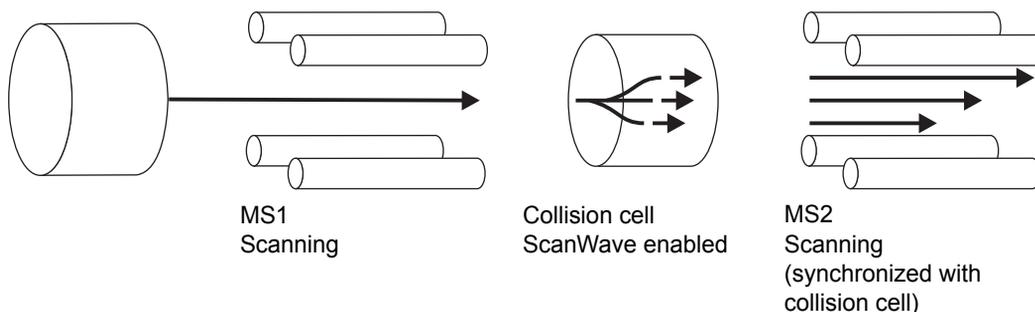
### Typical application

You typically use constant neutral loss mode to screen mixtures for a specific class of compound that is characterized by a common fragmentation pathway, indicating the presence of compounds containing a common functional group.

## ScanWave daughter scan mode

This mode is very similar to conventional product ion mode in that you can specify an ion of interest for fragmentation in the collision cell, thus yielding structural information. However, in this ScanWave mode the cell accumulates ions (intact or fragments) and then releases them, according to their mass, in synchrony with the second quadrupole mass analyzer. This mode of operation results in a significant increase in the signal intensity of full scan spectra.

### ScanWave daughter scan mode:



### Typical application

See [“Product \(daughter\) ion mode”](#) on page 34.

## Leak sensors

---

Leak sensors in the drip trays of the Xevo TQ MS continuously monitor the instrument for leaks. A leak sensor stops system flow when its optical sensor detects about 1.5 mL of accumulated leaked liquid in its surrounding reservoir. At the same time, the ACQUITY UPLC Console or UNIFI software displays an error message alerting you that a leak has developed.

See *Waters ACQUITY UPLC Leak Sensor maintenance instructions* for complete details.

## Vacuum system

---

An external roughing (rotary vane) pump (a dry-pump option is available) and two internal turbomolecular pumps create the source vacuum. The turbomolecular pumps evacuate the analyzer and ion transfer region.

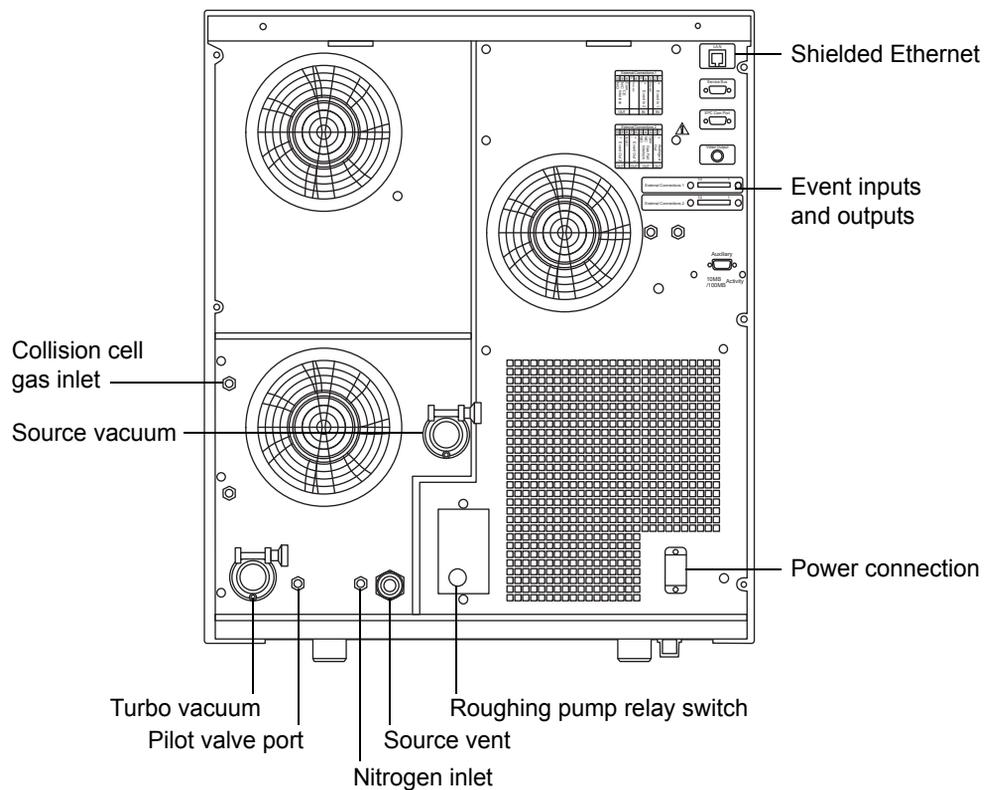
Vacuum leaks and electrical or vacuum pump failures cause vacuum loss, which protective interlocks guard against. The system monitors the turbomolecular pump speeds and continuously measures vacuum pressure with built-in Pirani and Penning gauges. The gauges also serve as switches, stopping operation when vacuum loss is sensed.

A vacuum isolation valve isolates the source from the mass analyzer, allowing routine source maintenance without venting.

## Rear panel

The following figure shows the rear panel locations of the connectors used to operate the mass spectrometer with external devices.

### Mass spectrometer rear panel:





# 2

## Preparing the Mass Spectrometer for Operation

This chapter describes how to start and shut down the mass spectrometer.

### Contents

Topic	Page
Starting the mass spectrometer .....	42
Preparing the IntelliStart Fluidics system.....	47
Rebooting the mass spectrometer .....	49
Leaving the mass spectrometer ready for operation.....	50
Emergency shutdown of the mass spectrometer .....	50

## Starting the mass spectrometer

---

This instrument is compatible with the ACQUITY UPLC system; if you are not using an ACQUITY UPLC system, refer to the documentation relevant to the system you are using. See “[Non-ACQUITY devices for use with the Xevo TQ MS](#)” on page 25.



**Caution:** To avoid causing severe damage to the instrument, use only compatible solvents. For more details, refer to the following sources:

- [Appendix B, “Materials of Construction and Compliant Solvents”](#), for mass spectrometer solvent information.
- Appendix C of the *ACQUITY UPLC System Operator’s Guide* for solvent compatibility with ACQUITY devices.

Starting the mass spectrometer entails powering-on the workstation, logging in, powering-on the mass spectrometer and all other instruments, and starting the MassLynx or UNIFI software.

**Requirement:** You must power-on and log in to the workstation first to ensure that it obtains the IP addresses of the system instruments.

See the mass spectrometer’s online Help for details on MassLynx, IntelliStart, and UNIFI software.

### To start the mass spectrometer:



**Warning:** To avoid ignition of flammable solvents, never let the nitrogen supply pressure fall below 690 kPa (6.9 bar, 100 psi).

1. On the rear panel, ensure the nitrogen supply is connected to the instrument’s nitrogen inlet connection (see the figure on [page 39](#)).

**Requirement:** The nitrogen must be dry and oil-free, with a purity of at least 95%. Regulate the supply at 600 to 690 kPa (6.0 to 6.9 bar, 90 to 100 psi).

2. Ensure that the collision gas supply is connected to the instrument’s collision cell gas inlet.

**Requirement:** The collision gas is argon; it must be dry and of high purity (99.9%). Regulate the supply at 50 kPa (0.5 bar, 7 psi).

3. Power-on the workstation, and log in before powering-on the other instruments.

4. Press the power switch on the top, left-hand side of the mass spectrometer and ACQUITY instruments.  
**Result:** Each system instrument “beeps” and runs a series of startup tests.
5. Allow 3 minutes for the embedded PC to initialize. An audible alert sounds when the PC is ready.  
**Tip:** The power and operate LEDs change as follows:
  - During initialization, the binary solvent manager’s and sample manager’s status LED flashes green.
  - After the instruments are successfully powered-on, all power LEDs show steady green. The binary solvent manager’s flow LED, the sample manager’s run LED, and the mass spectrometer’s Operate LED remain off.
6. Start the MassLynx or UNIFI software, and monitor the Instrument Console software for messages and LED indications.
7. To evacuate (pump down) the mass spectrometer, follow the procedure below for MassLynx software or UNIFI software.

**MassLynx software:**

- a. Click IntelliStart in the MassLynx main window’s lower left-hand corner.  
**Result:** The mass spectrometer’s console appears. The mass spectrometer is in Standby mode.
- b. Click Control > Pump, to start the roughing pump.  
**Note:** The Operate LED remains off.
- c. Wait a minimum of 2 hours for the instrument to be fully pumped down (evacuated).  
**Tip:** In the Instrument Console, the System Ready indicator shows green when the instrument is fully pumped down (evacuated).

- d. Click Resolve  or Operate  .

**Result:** When the mass spectrometer is in good operating condition, IntelliStart software displays “Ready” in the Instrument Console.

**Tip:** If clicking Resolve fails to put the instrument into Operate mode, IntelliStart software displays corrective actions in the Instrument Console.

### UNIFI software:

- a. From the Xevo TQ MS console, in the Maintain pane, click Vacuum.  
b. On the status page, click Pump.

**Tip:** After a 20-second delay, during which the turbopump is starting, the roughing pump starts. The Instrument System pane shows that the instrument is in Standby mode, and the Operate LED remains off.

- c. Wait a minimum of 2 hours for the instrument to be fully pumped down (evacuated).

**Tip:** In the Instrument Summary pane, the Status indicator shows green when the instrument is fully pumped down (evacuated).

- d. Click Instrument Operate Mode  .

**Result:** When the mass spectrometer is in good operating condition, UNIFI software displays status “Running” in the Instrument Summary pane.

**Tip:** If clicking Instrument Operate Mode fails to put the instrument into Operate mode, UNIFI software displays corrective actions.

## Verifying the instrument's state of readiness

When the mass spectrometer is in good operating condition, the power and Operate LEDs show constant green. You can view any error messages in IntelliStart software (MassLynx), or UNIFI software.

## Monitoring the mass spectrometer LEDs

Light-emitting diodes on the mass spectrometer indicate its operational status.

### Power LED

The power LED, to the top, left-hand side of the mass spectrometer's front panel, indicates when the mass spectrometer is powered-on or powered-off.

### Operate LED

The Operate LED, on the right-hand side of the power LED, indicates the operating condition.

See the mass spectrometer's online Help topic "Monitoring the mass spectrometer LEDs" for details on the Operate LED indications.

## Tuning and calibration information

You must tune and calibrate the mass spectrometer prior to use. You can perform these tasks using IntelliStart (MassLynx software) or UNIFI software.

For further instruction, see the mass spectrometer's online Help.

## Running the mass spectrometer at high flow rates

The ACQUITY UPLC system runs at high flow rates. To optimize desolvation, and thus sensitivity, run the ACQUITY Xevo TQ MS system at appropriate gas flows and desolvation temperatures. IntelliStart software automatically sets these parameters when you enter a flow rate, according to the following table.

### Flow rate versus temperature and gas flow:

Flow rate (mL/min)	Source temp (°C)	Desolvation temp (°C)	Desolvation gas flow (L/h)
0.000 to 0.020	150	200	800
0.020 to 0.100	150	300	800
0.101 to 0.300	150	400	800
0.301 to 0.500	150	500	1000
> 0.500	150	600	1000

## Preparing the IntelliStart Fluidics system

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For additional information, see [“Connecting the liquid waste line”](#) on page 234.



**Caution:** To avoid accidental spillage damaging the instrument, do not store large volume solvent reservoirs on top of the instrument.

### Installing the reservoir bottles

Use standard reservoir bottles (30 mL) for instrument setup and calibration. Use the Low-volume Adaptor Kit (included) to infuse smaller volumes. The low-volume vials have a volume of 1.5 mL.

#### Required materials

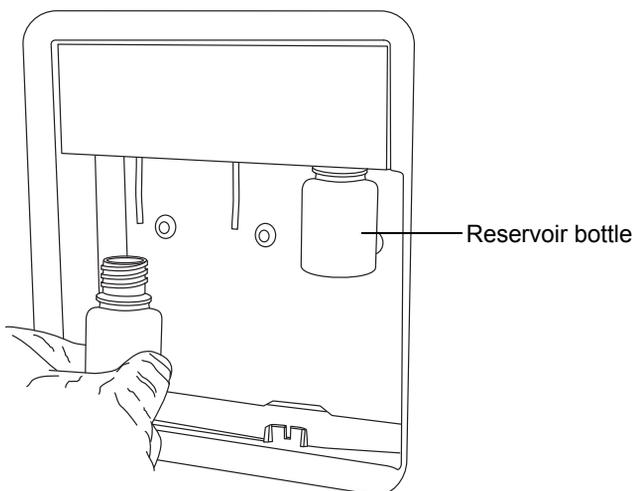
Chemical-resistant, powder-free gloves



**Warning:** To avoid becoming contaminated with biohazards or toxic compounds, always wear chemical-resistant, powder-free gloves while performing this procedure.

#### To install the reservoir bottles:

1. Remove the reservoir bottle caps.
2. Screw the reservoir bottles onto the mass spectrometer as shown below.

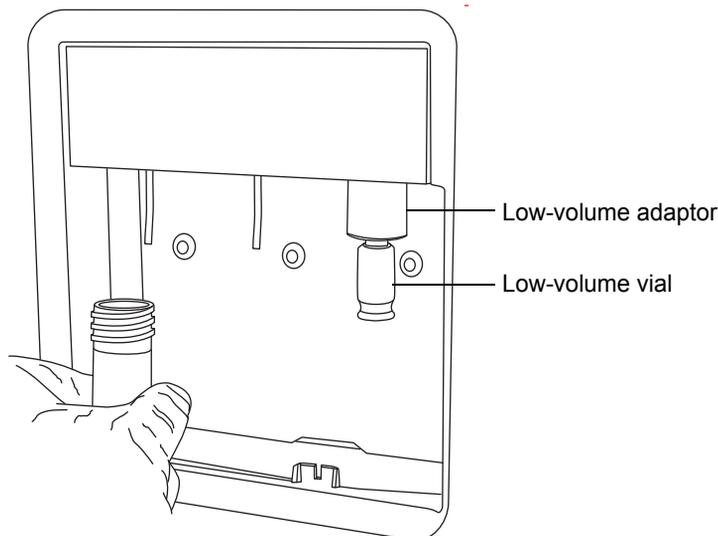




**Warning:** To avoid becoming contaminated with biohazards or toxic compounds, always wear chemical-resistant, powder-free gloves while performing this procedure.

### To install the low-volume vials:

1. If a standard reservoir bottle is fitted, remove it.
2. Screw the low-volume adaptors into the manifold, and finger tighten them.



3. Screw the low-volume vials into the adaptors.

## Purging the infusion pump

Whenever you replace a solution bottle, purge the infusion pump with the solution that you are going to use next. See the mass spectrometer's online Help for details.

**Tip:** Depending on the solutions used, the instrument's solvent delivery system can require more than one purge cycle to minimize carryover.

## Rebooting the mass spectrometer

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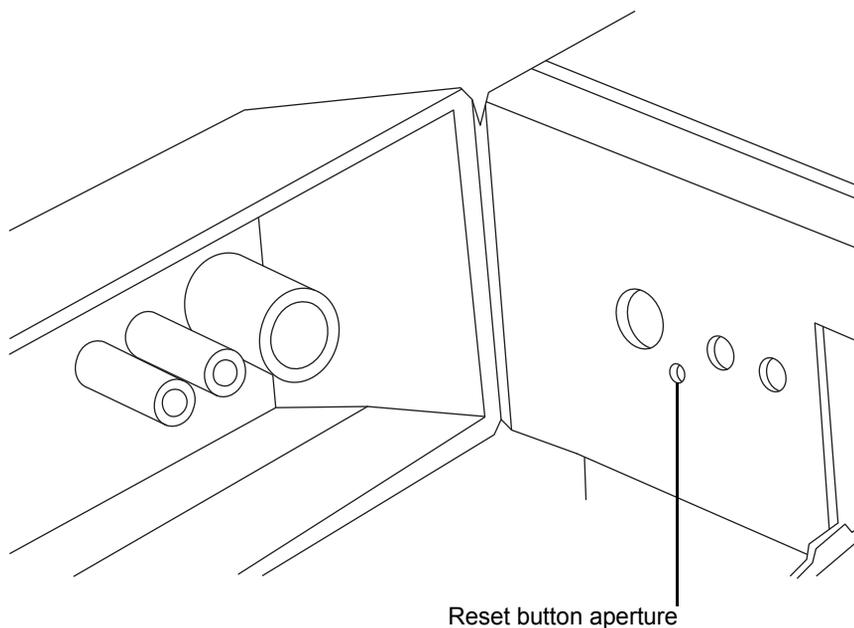
The reset button shuts down the electronics momentarily and causes the mass spectrometer to reboot.

Reboot the mass spectrometer when either of these conditions applies:

- The mass spectrometer software fails to initialize.
- Immediately following a software upgrade.

### To reboot the mass spectrometer:

1. Open the mass spectrometer's front, left-hand door.
2. Insert a short length (7.5 cm) of PEEK™ tubing, or similar object, into the reset button aperture to operate the reset button.
3. Remove the PEEK tubing from the reset button aperture.
4. Close the mass spectrometer's door.



## Leaving the mass spectrometer ready for operation

---

Leave the mass spectrometer in Operate mode except in the following cases:

- When performing routine maintenance
- When changing the source
- When leaving the mass spectrometer unused for a long period

In these instances, put the mass spectrometer in Standby mode, see the online Help for details.

## Emergency shutdown of the mass spectrometer

---



**Warning:** To avoid electric shock, isolate the instrument observing the procedure outlined below. The instrument's power switch does not isolate it from the main power supply.



**Caution:** To avoid losing data, reboot the instrument as described on [page 49](#).

### To shut down the mass spectrometer in an emergency:

1. Operate the power button on the front of the mass spectrometer.
2. Disconnect the power cable from the back of the mass spectrometer.

# 3

## Changing the Mode of Operation

This chapter describes how to prepare the mass spectrometer for the following modes of operation:

- ESI (electrospray ionization)
- ESCi (combined electrospray and atmospheric pressure chemical ionization)
- APCI (atmospheric pressure chemical ionization)
- Combined Atmospheric Pressure Photoionization (APPI)/APCI
- NanoFlow ESI.

**Note:** Available source options can vary depending on the software used to operate the Xevo TQ MS. Refer to the MassLynx or UNIFI online Help for more information about supported sources.

### Contents:

Topic	Page
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ESCi mode .....	57
APCI mode.....	57
Combined APPI/APCI source .....	61
NanoFlow ESI source.....	69

## ESI mode

---

To run ESI, you must fit the ESI probe to the ESI/APCI/ESCI source enclosure. The following sections explain how to install and remove the ESI probe.

### Installing the ESI probe

#### Required material

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The LC system connections, ESI probe, and source can be contaminated.



**Warning:** To avoid electric shock, ensure that the instrument is prepared for working on the source before commencing this procedure.

#### To install the ESI probe:

1. Prepare the instrument for working on the source (see [“Preparing the instrument for working on the source”](#) on page 85).

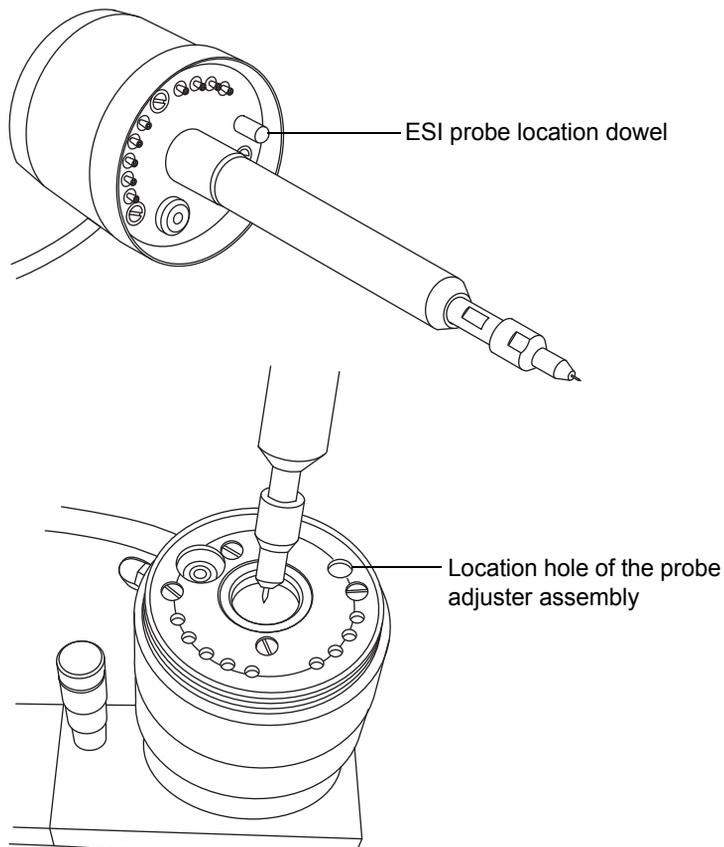


**Warning:** To avoid puncture wounds, handle the ESI probe with care; the probe tip is sharp.

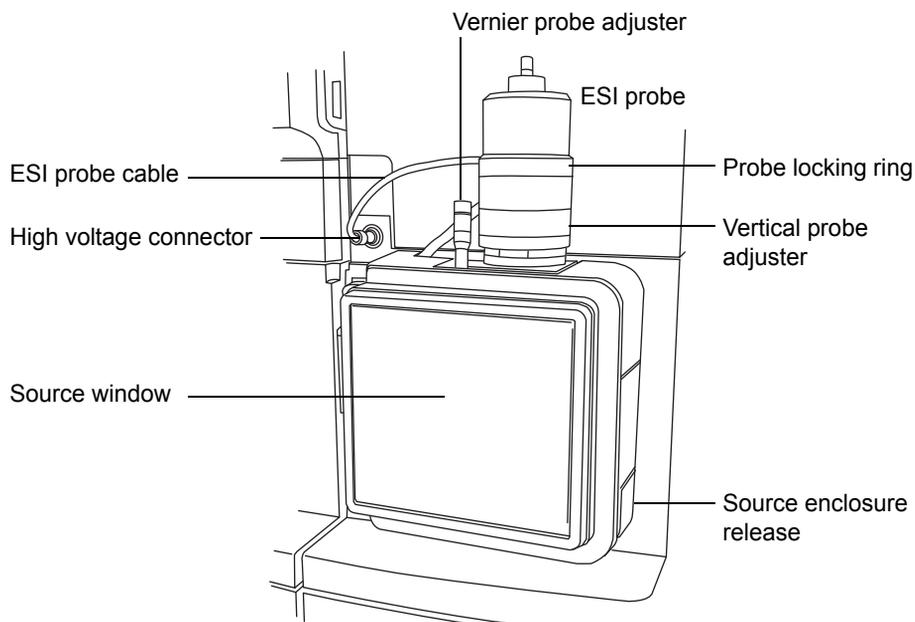
2. Remove the protective sleeve, if fitted, from the ESI probe tip.

3. With the probe label facing you, carefully slide the ESI probe into the hole in the probe adjuster assembly.

**Requirement:** The probe location dowel must align with the location hole of the probe adjuster assembly.



### ESI probe, mounted on the source enclosure:



**Caution:** To avoid nitrogen leakage, fully tighten the probe locking ring.

4. Tighten the probe locking ring to secure the probe in place.
5. Connect the ESI probe's cable to the high voltage connector.
6. Open the access door to the fluidics valve (see the figure on [page 24](#)).



**Warning:** To avoid electric shock, do not use stainless steel tubing to connect the diverter valve to the ESI probe; use the PEEK tubing supplied with the instrument.

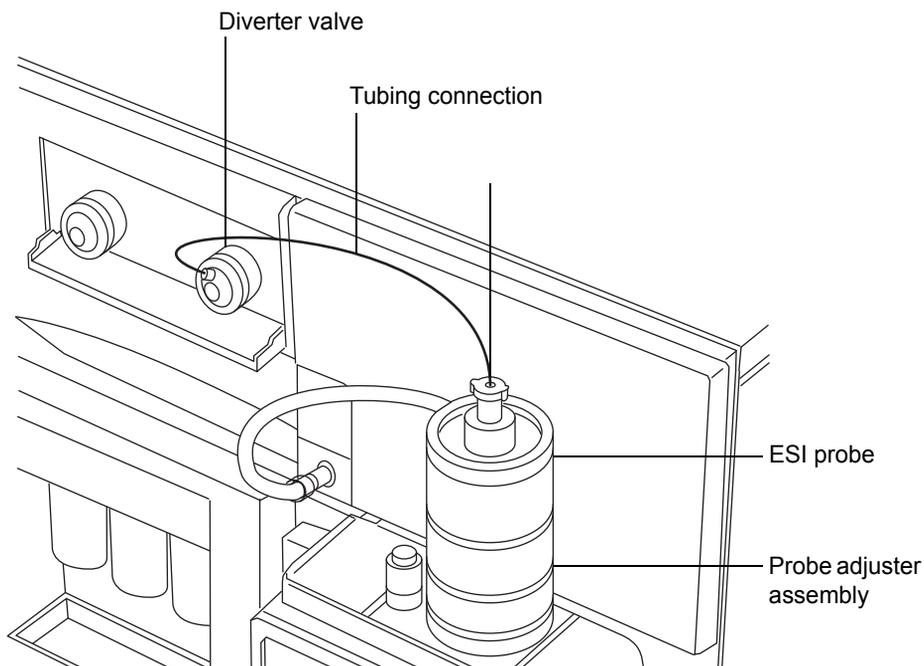
7. Using tubing greater than or equal to 0.004-inch ID, connect port 2 (the top port) of the diverter valve to the ESI probe.

**Recommendation:** To reduce peak broadening, use 0.004-inch ID tubing for sample flow rates  $\leq 1.2$  mL/min; use 0.005-inch ID tubing for sample flow rates  $> 1.2$  mL/min.

**Requirement:** If you are replacing the tubing supplied with the instrument, you must minimize the length of the tube connecting the

diverter valve to the ESI probe. Doing so minimizes delays and dispersion.

### Tubing connection between the diverter valve and the ESI probe:



**Tip:** The other plumbing connections are omitted for clarity.



**Caution:** To prevent damage to the tubing, ensure that it does not become trapped when closing the access door to the fluidics valve.

8. Close the access door.

## Removing the ESI probe

### Required material

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The LC system connections, ESI probe, and source can be contaminated.



**Warning:** To avoid electric shock, ensure that the instrument is prepared for working on the source before commencing this procedure.

### To remove the ESI probe:

1. Prepare the instrument for working on the source (see [“Preparing the instrument for working on the source” on page 85](#)).
2. Disconnect the tubing from the ESI probe.
3. Disconnect the ESI probe’s cable from the high voltage connector.
4. Unscrew the probe locking ring.



**Warning:** To avoid puncture wounds, handle the probe with care; the ESI probe tip is sharp.

5. Carefully remove the ESI probe from the probe adjuster assembly.
6. If available, fit the protective sleeve to the ESI probe tip.

## ESCI mode

---

To run ESCi, you must fit an ESI probe and corona pin to the ESI/APCI/ESCI source enclosure.

See [“Installing the ESI probe” on page 52](#), [“Installing the corona pin in the source” on page 90](#), and [“Combined electrospray ionization and atmospheric pressure chemical ionization \(ESCI\)” on page 27](#).

## Optimizing the ESI probe for ESCi operation

See the mass spectrometer’s online Help for details on how to optimize the ESI probe for ESCi operation.

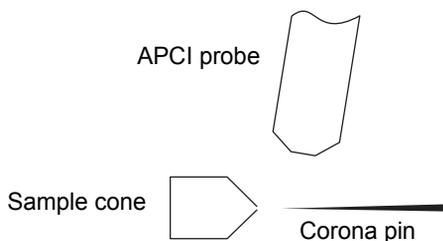
## APCI mode

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APCI mode, an option for the mass spectrometer, produces singly-charged protonated or deprotonated molecules for a broad range of nonvolatile analytes.

The APCI interface consists of the ESI/APCI/ESCI enclosure fitted with a corona pin and an APCI probe. Mobile phase from the LC column enters the probe, where it is pneumatically converted to an aerosol, rapidly heated, and vaporized or gasified at the probe tip.

### APCI mode:



Hot gas from the APCI probe passes between the sample cone and the corona pin, which is typically operated with a discharge current of 5  $\mu\text{A}$ . Mobile phase molecules rapidly react with ions generated by the corona discharge to produce stable reagent ions. Analyte molecules introduced into the mobile phase react with the reagent ions at atmospheric pressure and typically become protonated (in the positive ion mode) or deprotonated (in the negative ion mode). The sample and reagent ions then pass through the sample cone and into the mass spectrometer.

## Installing the APCI probe

**Required material:** Chemical-resistant, powder-free gloves



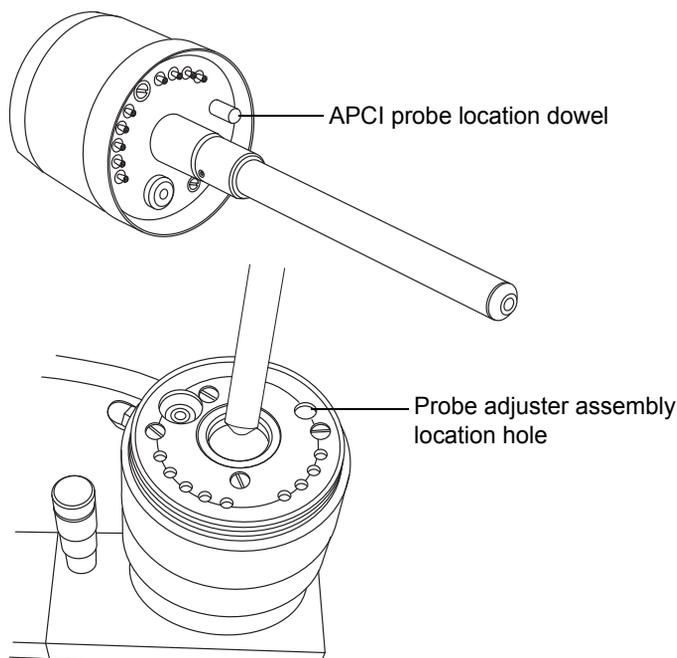
**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The LC system connections, APCI probe, and source can be contaminated.



**Warning:** To avoid electric shock, ensure that the instrument is prepared for working on the source before commencing this procedure.

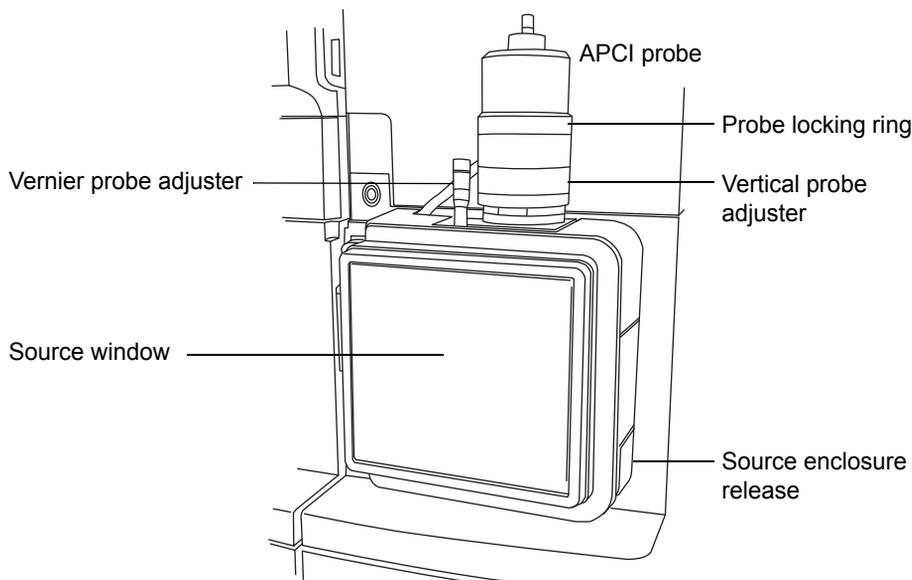
### To install the APCI probe:

1. Prepare the instrument for working on the source (see [“Preparing the instrument for working on the source”](#) on page 85).
2. With the probe label facing towards you, carefully slide the APCI probe into the hole in the probe adjuster assembly, ensuring that the probe location dowel aligns with the probe adjuster assembly location hole.



- Tighten the probe locking ring to secure the probe in place.

#### APCI probe mounted on the source enclosure:



- Open the access door to the fluidics valve (see the figure on [page 24](#)).



**Warning:** To avoid electric shock, do not use stainless steel tubing to connect the diverter valve to the APCI probe; use the PEEK tubing supplied with the instrument.

- Using tubing greater than or equal to 0.004-inch ID, connect port 2 (the top port) of the diverter valve to the APCI probe.

**Recommendation:** To reduce peak broadening, use 0.004-inch ID tubing for sample flow rates  $\leq 1.2$  mL/min; use 0.005-inch ID tubing for sample flow rates  $> 1.2$  mL/min.

**Requirement:** If you are replacing the tubing supplied with the instrument, minimize the length of the tube connecting the diverter valve to the APCI probe. Doing so minimizes delays and dispersion.

- Close the access door.
- Install the corona pin (see [“Installing the corona pin in the source” on page 90](#)).

## Removing the APCI probe

### Required material

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The LC system connections, APCI probe, and source can be contaminated.



**Warning:** To avoid electric shock, ensure that the instrument is prepared for working on the source before commencing this procedure.

### To remove the APCI probe:

1. Prepare the instrument for working on the source (see [“Preparing the instrument for working on the source”](#) on page 85).
2. Remove the corona pin (see [“Removing the corona pin from the source”](#) on page 93).
3. Disconnect the diverter valve tubing from the APCI probe.
4. Unscrew the probe locking ring.
5. Carefully remove the probe from the probe adjuster assembly.

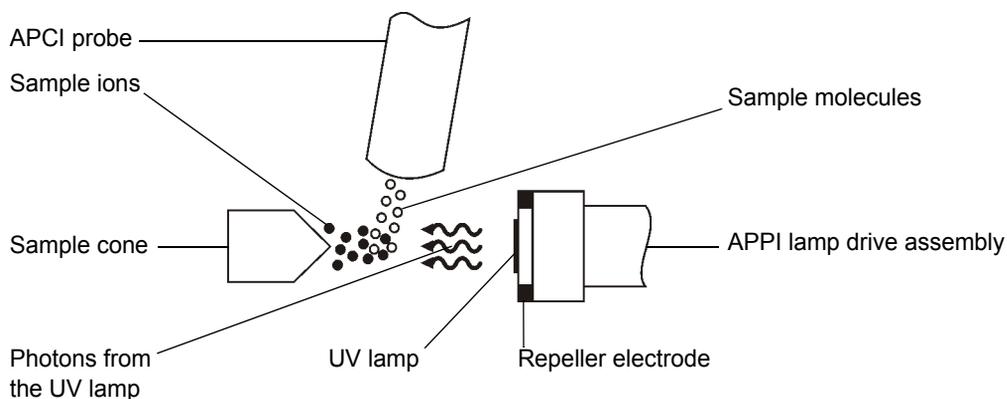
## Combined APPI/APCI source

This optional, replacement source-enclosure can be operated as APPI, APCI or dual-mode APPI/APCI. Where, dual-mode APPI/APCI performs rapid switching between ionization modes.

### APPI operation

In atmospheric pressure photoionization (APPI) mode, the source is fitted with an APCI probe, and the APPI lamp drive assembly is advanced into the source.

#### APPI mode:



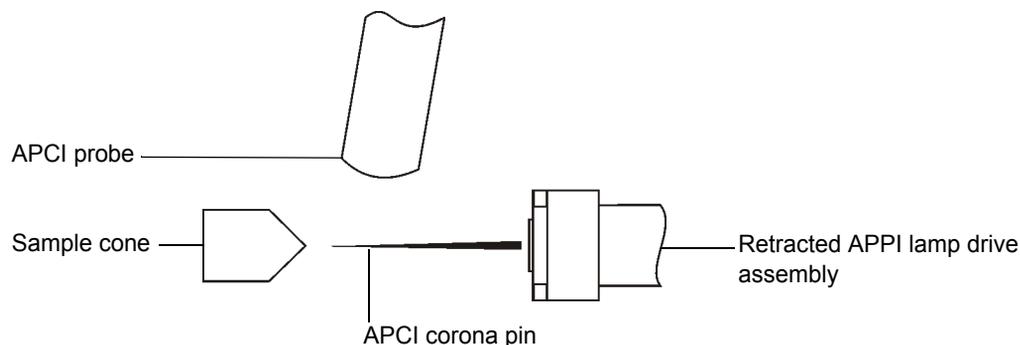
The APCI probe introduces vaporized sample into the source where photons generated by an ultra-violet (UV) lamp (mounted in the APPI lamp drive assembly) produce sample ions. Direct photoionization of a sample molecule occurs when the photon energy exceeds the ionization potential of the sample molecule.

A repeller electrode (mounted on the APPI lamp drive assembly) deflects and focuses the sample ions towards the sample cone.

## APCI operation

Atmospheric pressure chemical ionization (APCI) produces singly-charged protonated or deprotonated molecules for a large range of nonvolatile analytes. In APCI mode, the source is fitted with an APCI corona pin. Unused, the APPI lamp drive assembly is retracted from the source.

### APCI mode:



The APCI probe introduces vaporized sample into the source. The sample passes between the sample cone and the corona pin, which typically operates with a discharge current of 5  $\mu\text{A}$ . The corona discharge generates ions that react with the mobile phase molecules to produce stable reagent ions. Analyte molecules in the mobile phase react with the reagent ions at atmospheric pressure and become protonated (in the positive ion mode) or deprotonated (in the negative ion mode). The sample and reagent ions pass through the sample cone.

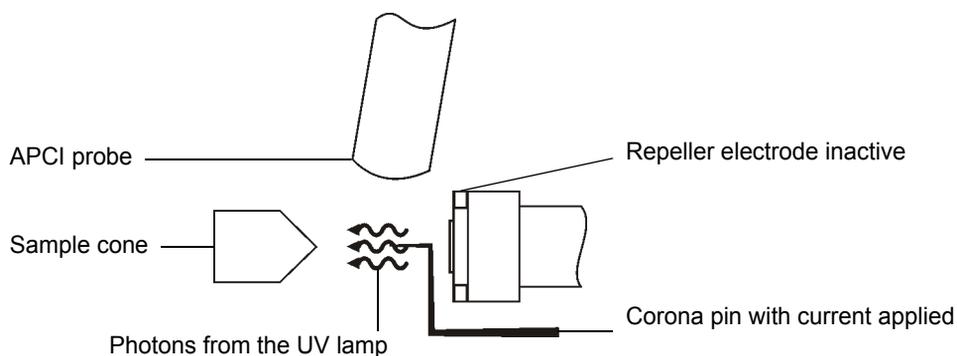
## Dual-mode operation

Dual-mode operation enables rapid switching between APPI and APCI ionization modes and allows high-throughput operations (for example, for sample screening).

You replace the standard corona pin with a specially shaped APPI/APCI corona pin, so that the APPI lamp holder can be advanced into the source for dual operation.

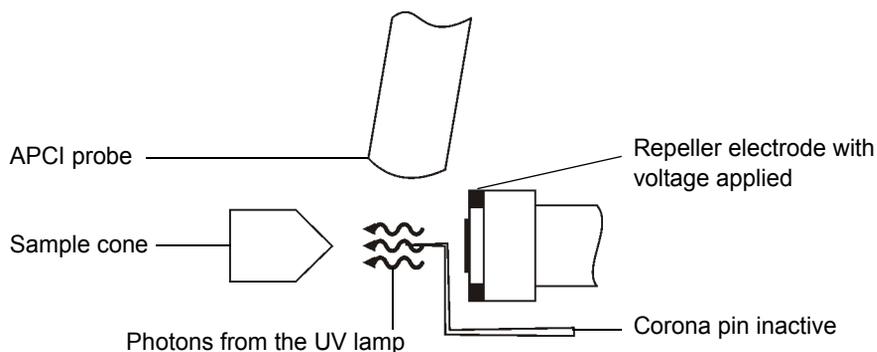
When the source is configured for dual operation in APCI mode, current is applied to the corona pin, but the repeller electrode is inactive.

### Dual operation in APCI mode:



When the source is configured for dual operation in APPI mode, the corona pin is inactive, and a voltage is applied to the repeller electrode.

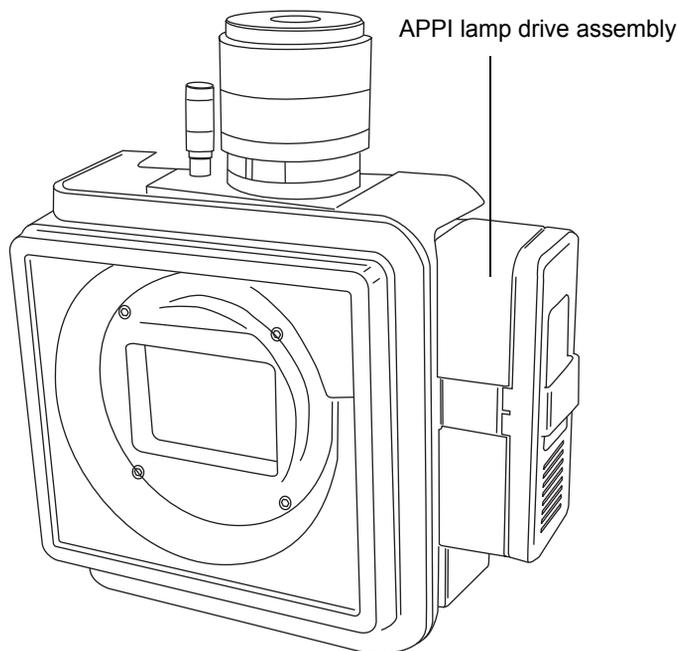
### Dual operation in APPI mode:



## The combined APPI/APCI source components

The Combined APPI/APCI source comprises the standard APCI probe and a source enclosure with an APPI lamp drive incorporated.

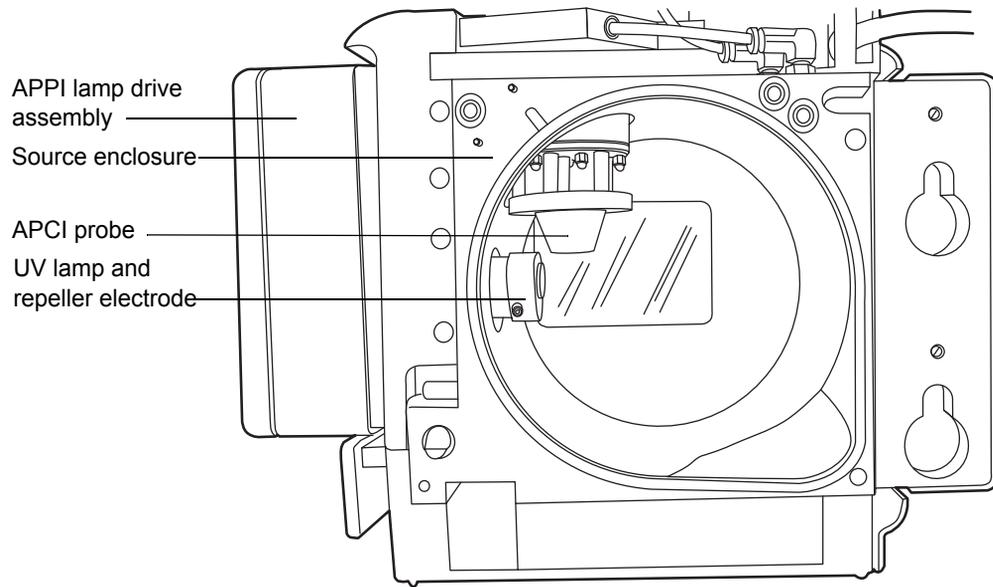
### The combined APPI/APCI source enclosure:



**Caution:** To prevent damage to the corona pin and lamp assembly, ensure that the lamp assembly does not touch the corona pin when the source enclosure door is closed.

Switching on the UV lamp (from the MassLynx Tune window) provides a constant photon output. You vary the intensity of incident radiation upon the sample molecules by adjusting the distance between the UV lamp and probe tip.

**APPI lamp drive assembly inside the source enclosure:**



## Installing the Combined APPI/APCI Source software

If the Combined APPI/APCI Source is not installed on the instrument, insert the Software Upgrade CD-ROM into the MassLynx workstation CD drive, and follow the on-screen instructions.

**Tip:** If this software upgrade is not installed, the APPI options will not be available in the Tune window's Ion Mode menu.

### Required materials

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The source components can be contaminated.



**Warning:** To avoid electric shock, ensure that the instrument is suitably prepared before commencing this procedure.

### To install the combined APPI/APCI source:

1. Prepare the instrument for working on the source (see [“Preparing the instrument for working on the source”](#) on page 85).



**Warning:** To avoid burn injuries, take great care while working with the probe and source; these components can be hot.

2. Remove the probe from the currently installed source.
  - If you are removing an ESI probe, see [“Removing the ESI probe”](#) on page 56.
  - If you are removing an APCI probe, see [“Removing the APCI probe”](#) on page 60.
3. Remove the existing source enclosure (see [“Removing the source enclosure from the instrument”](#) on page 87).
4. Install the combined APPI/APCI source-enclosure (see [“Fitting the source enclosure to the instrument”](#) on page 89).
5. Install the specially shaped corona pin (see [“Installing the corona pin in the source”](#) on page 90).

6. Connect the APPI drive cable, to the instrument front panel.
7. Connect the HT cable, to the instrument front panel.



**Caution:** To prevent damage to the corona pin and lamp assembly, ensure that the lamp assembly does not touch the corona pin when the source enclosure door is closed.

8. Close the instrument's front access door.
9. Install the APCI probe to the source and ensure that it is working correctly (see [“Installing the APCI probe” on page 58](#)).

**Tip:** An automatic pressure test is performed each time the source-enclosure is closed and when the instrument starts.

## Removing the APCI probe and APPI source enclosure

### Required materials

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The source components can be contaminated.



**Warning:** To avoid electric shock, ensure that the instrument is suitably prepared before commencing this procedure.

### To remove the combined APPI/APCI source:

1. Prepare the instrument for working on the source (see [“Preparing the instrument for working on the source”](#) on page 85).



**Warning:** To avoid burn injuries, take great care while working with the probe and source; these components can be hot.

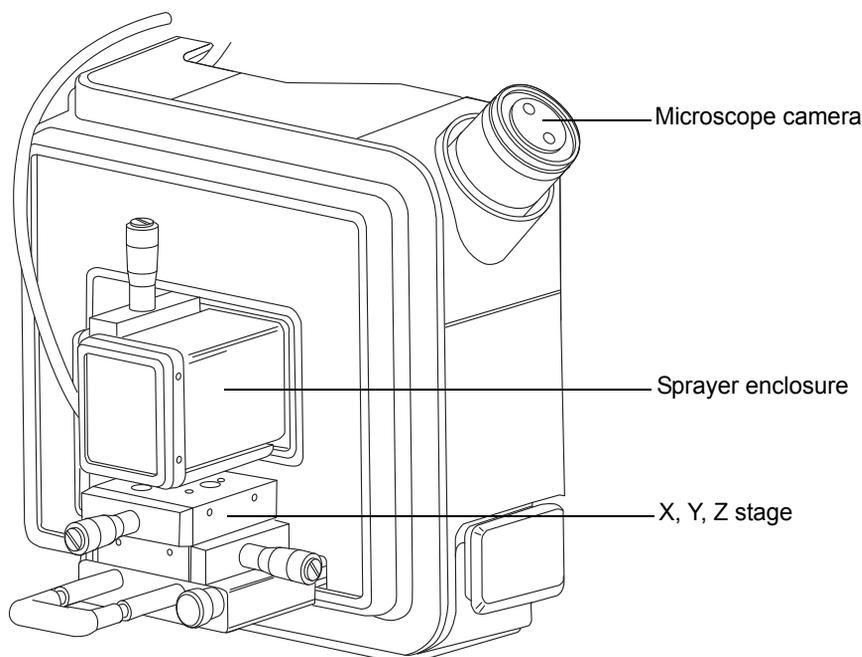
2. Remove the APCI probe (see [“Removing the APCI probe”](#) on page 60).
3. Disconnect the HT cable, from the instrument front panel.
4. Disconnect the APPI drive cable, from the instrument front panel.
5. Remove the source enclosure (see [“Removing the source enclosure from the instrument”](#) on page 87).
6. Remove the corona pin (see [“Removing the corona pin from the source”](#) on page 93).
7. Fit the blanking plug to the pin’s mounting contact.

## NanoFlow ESI source

---

The NanoFlow source enclosure comprises the NanoFlow stage (for  $x$ -,  $y$ -,  $z$ -axis adjustment), the sprayer-enclosure, and a microscope camera.

### NanoFlow source, stage and microscope camera:



A sprayer is mounted on an X, Y, Z stage (three-axis manipulator) which slides on a pair of guide rails that allow its withdrawal from the source-enclosure for maintenance and changes.

A light within the source provides illumination for the spray, which you can observe using the video camera mounted on the corner of the source housing.

The low flow rates involved with operating the NanoFlow source prohibit its use with the instrument's solvent delivery system.

## Installing the NanoFlow source

### Required materials

- Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The source components can be contaminated.



**Warning:** To avoid electric shock, ensure that the instrument is suitably prepared before commencing this procedure.



**Warning:** To avoid burn injuries, ensure that the source heater is turned off and the ion block is cool before opening the source. The ion block, which can be hot, is exposed when you fit the NanoFlow source.

### To install the NanoFlow source:

1. Prepare the instrument for working on the source (see [“Preparing the instrument for working on the source”](#) on page 85).



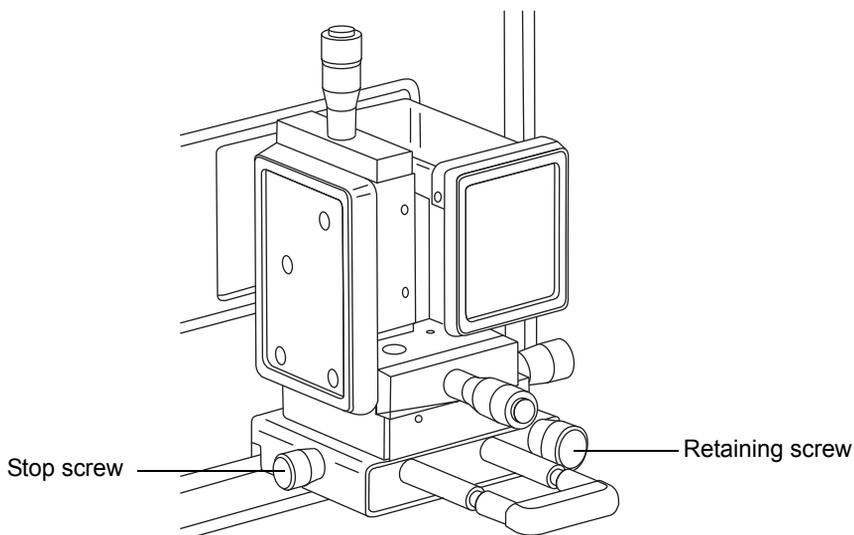
**Warning:** To avoid burn injuries, take great care while working with the probe and source; these components can be hot.

2. Remove the probe from the currently installed source.
  - If you are removing an ESI probe, see [“Removing the ESI probe”](#) on page 56.
  - If you are removing an APCI probe, see [“Removing the APCI probe”](#) on page 60.
3. Remove the existing source enclosure (see [“Removing the source enclosure from the instrument”](#) on page 87).



**Caution:** To prevent the sprayer colliding with the cone and breaking, always retract the stage before installing the source enclosure or closing the door.

4. On the NanoFlow source, release the stage retaining-screw, pull the stop screw and slide the stage fully out of the enclosure.



5. Using both hands, fit the NanoFlow source enclosure to the two supporting studs on the source adaptor housing.
6. Close the source enclosure door.
7. Connect a 1/16 inch PTFE tube between the mass-flow controller output (mounted beneath the stage on the front of the NanoFlow source) and your sprayer.

**Tip:** For details regarding how to fit each sprayer, see the corresponding reference:

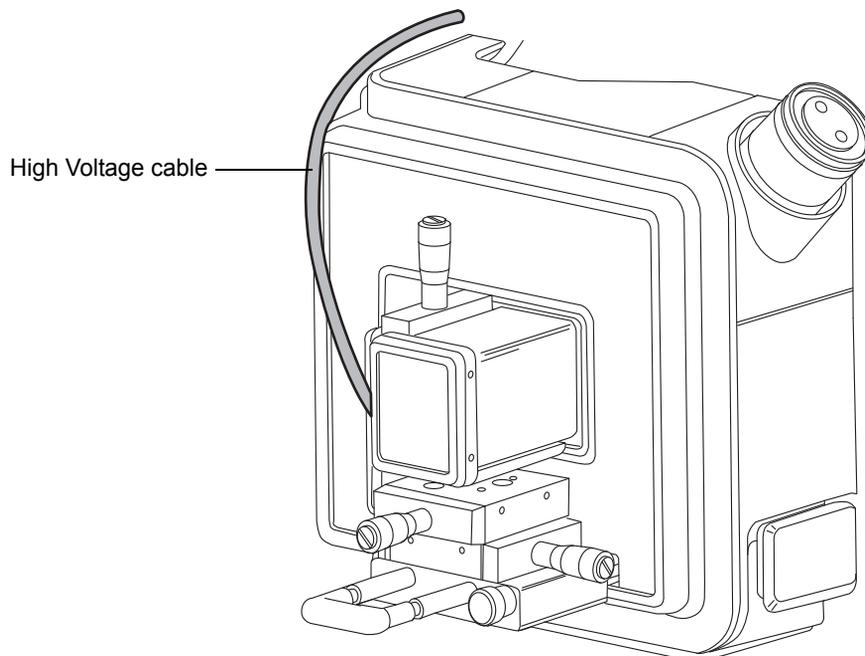
- *Waters Universal NanoFlow Sprayer Installation and Maintenance Guide* (part number 71500110107)
- [“Fitting a borosilicate glass capillary \(nanovial\)” on page 73](#)
- *Capillary Electrophoresis/ Capillary Electrochromatography Sprayer User’s Guide* (part number 6666522)

### 3 Changing the Mode of Operation

8. Connect the probe cable to the instrument's PROBE connection.

**Note:** The NanoFlow stage contains a high voltage interlock so that unless the sprayer is pushed fully forward in the source, the capillary voltage (the voltage applied to the sprayer assembly) and the sampling cone voltage are disabled.

9. Connect the high voltage cable to the instrument's HV connection.



## Fitting a borosilicate glass capillary (nanovial)

### Required materials

- Chemical-resistant, powder-free gloves
- Needle-nose pliers



**Warning:** To avoid lacerations, puncture injuries, and possible contamination with biohazardous and toxic samples, do not touch the sharp end of the capillary.



**Caution:** To avoid damaging capillaries, take great care when handling them. Capillaries are extremely fragile; always hold their blunt end, never the sharp end, which can easily be damaged.



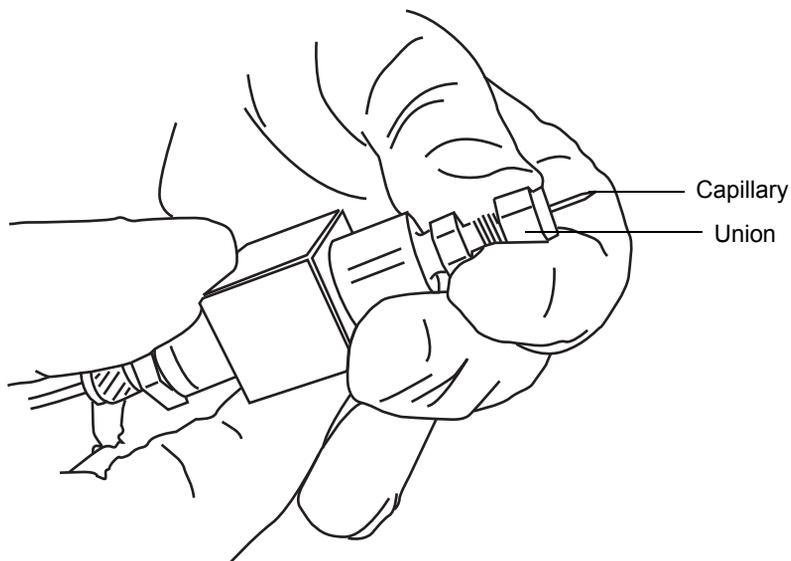
**Warning:** To avoid electric shock, ensure that the NanoFlow stage is fully retracted from the source before beginning this procedure.

### To fit a borosilicate glass capillary (nanovial):

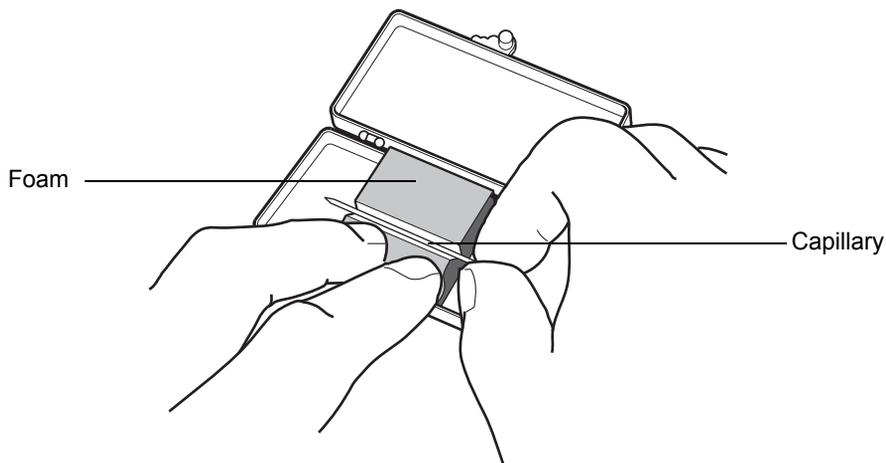
1. Loosen the stage retaining screw.
2. Pull the stop screw to release the stage.
3. Slide the stage out of the NanoFlow source enclosure and remove the magnetic cover.
4. Unscrew the retaining screw, and lift the sprayer from the stage.

### 3 Changing the Mode of Operation

5. Unscrew the union from the end of the sprayer assembly.



6. Remove the existing capillary from the sprayer.
7. Carefully remove the new borosilicate glass capillary from its case by lifting vertically while pressing down on the foam with two fingers.



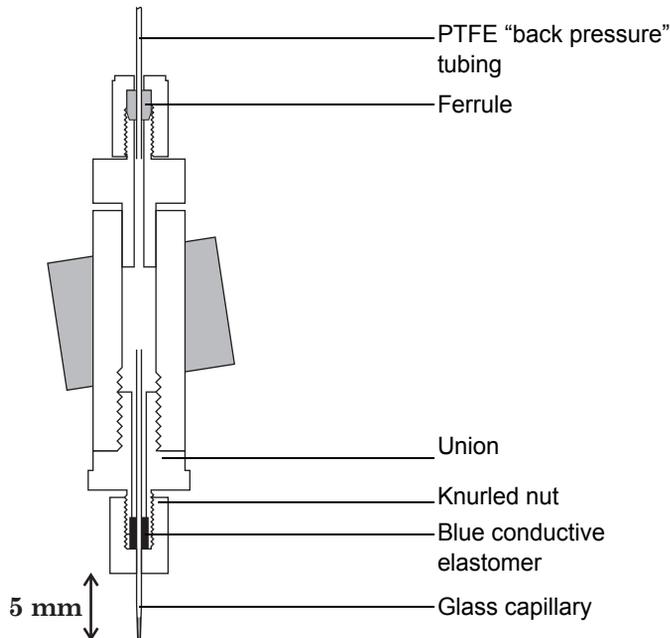
8. Load sample into the capillary using either a fused silica syringe needle or a GELoader<sup>®</sup> tip, minimizing any bubbles between the capillary tip and the sample.

**Recommendation:** When using a GELoader tip, break the glass capillary in half, scoring it with a fused silica cutter so that the GELoader can reach the capillary's tip.

9. Thread the knurled nut and approximately 5 mm of conductive elastomer over the blunt end of the capillary.
10. Fit the capillary into the holder (probe).
11. Finger tighten the nut so that 5 mm of glass capillary is protruding from its end.

**Tip:** This distance is measured from the end of the nut to the shoulder of the glass capillary.

### Sprayer Assembly:



12. Screw the sprayer back into the assembly.
13. Replace the sprayer cover.

### 3 Changing the Mode of Operation

14. On the MassLynx MS Tune window, ensure that the Capillary (kV) parameter on the ES+/- Source tab is set to 0.



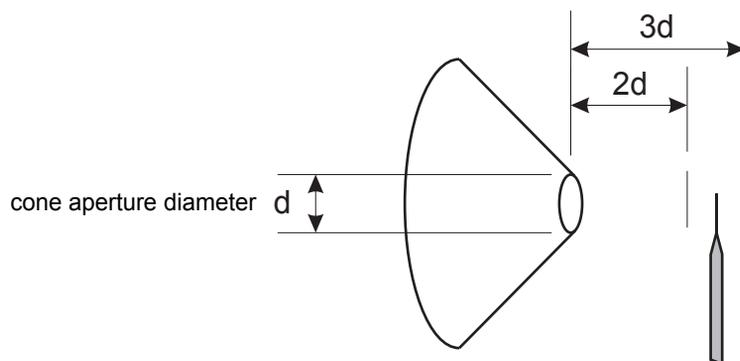
**Caution:** To avoid damage to the capillary tip, adjust the sprayer tip position before you push the sprayer inside the NanoFlow source enclosure. Ensure that the capillary tip does not collide with the cone or the side of the source.

15. Carefully push the stage back into the NanoFlow source enclosure, using the stop and handle.

## Positioning the borosilicate glass capillary tip

Once a signal is obtained, you must adjust the tip position to maximize the signal. Using the three-axis manipulator, you can adjust the tip position up and down, left and right, forwards and backwards. As a starting point, set the tip so that it is on the center line of the sampling cone and at a distance between two and three times the diameter of the cone aperture. Typically this is approximately 2 mm.

### Capillary tip position:



For tuning instructions, see the MassLynx, Xevo TQ online help, “Tuning manually for NanoFlow operation”.

## Restarting a stalled borosilicate glass capillary electrospray

Should the spray stop, you can restart it. Set the Tune window’s Capillary (kV) parameter to 0, and adjust the three-axis manipulator so that, viewed under magnification, the capillary tip touches the sample cone and a small piece of the borosilicate glass capillary shears off.

You may also need to apply some NanoFlow gas pressure to force a drop of liquid from the capillary. To do so, apply as much as 1.4 bar (20 psi), which induces the drop’s appearance, unless the capillary is blocked.

### 3 Changing the Mode of Operation

# 4 Maintenance Procedures

This chapter provides the maintenance guidelines and procedures necessary to maintain the instrument's performance.

Keep to a maintenance schedule, and perform maintenance as required and described in this chapter.

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## Maintenance schedule

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The following table lists periodic maintenance schedules that ensure optimum instrument performance.

### Maintenance schedule:

Procedure	Frequency	For information...
Clean the instrument case.	As required.	See <a href="#">page 98</a> .
Empty the nitrogen exhaust trap bottle.	Check daily, empty as required.	See <a href="#">page 98</a> .
Inspect and adjust the roughing pump oil level.	Weekly.	See <a href="#">page 101</a> .
Replace the roughing pump oil and oil mist filter.	Annually.	See <a href="#">page 104</a> .
Clean the source components.	When they are visibly fouled, the background or high-peak contaminants are unacceptably high or sensitivity decreases to unacceptable levels.	See <a href="#">page 110</a> .
Replace the ESI probe tip.	When sensitivity decreases to unacceptable levels.	See <a href="#">page 146</a> .
Replace the ESI probe capillary.	When sensitivity decreases to unacceptable levels or sample flow is inconsistent.	See <a href="#">page 150</a> .
Clean the APCI probe tip. (Options using the APCI probe only.)	When sensitivity decreases to unacceptable levels.	See <a href="#">page 158</a> .
Replace the APCI probe capillary.	When sensitivity decreases to unacceptable levels or sample flow is inconsistent.	See <a href="#">page 159</a> .

**Maintenance schedule: (Continued)**

<b>Procedure</b>	<b>Frequency</b>	<b>For information...</b>
Clean or replace the corona pin (APCI and ESCi modes).	When the corona pin is corroded or black, or the sensitivity decreases to unacceptable levels.	See <a href="#">page 165</a> .
Replace the APCI probe heater.	If the heater fails when the instrument is pumped down (evacuated).	See <a href="#">page 166</a> .
Replace the ion block heater cartridge.	If the heater fails to heat when the instrument is pumped down (evacuated).	See <a href="#">page 170</a> .
Replace the source assembly seals.	Annually.	See <a href="#">page 174</a> .
Replace the oil-free (scroll) pump seals.	Annually.	See Edwards document <i>XDS35i Instruction Manual A730-01-880</i> .
Replace the air filter.	Annually.	See <a href="#">page 179</a> .
Clean the UV lamp window.	When the window becomes visibly dirty, or when the sensitivity decreases to unacceptable levels.	See <a href="#">page 184</a> .
Change the UV lamp bulb.	When the bulb fails.	See <a href="#">page 181</a> .
Replace the APPI lamp drive assembly O-rings.	Annually.	See <a href="#">page 185</a> .

**Spare parts**

Replace only the parts mentioned in this document. For spare parts details, see the Waters Quality Parts<sup>®</sup> Locator on the Waters Web site's Services/Support page.

## Troubleshooting with Connections INSIGHT

---

Connections INSIGHT<sup>®</sup> is an intelligent device management (IDM) Web service that enables Waters to provide proactive service and support for the ACQUITY UPLC system. To use Connections INSIGHT, a Waters technician must install its service agent software on your workstation. In a client/server system, the service agent must also be installed on the computer from which you control the system. The service agent software automatically and securely captures and sends information about the support needs of your system directly to Waters.

If you encounter a performance issue as you are using the Instrument Console, you can also manually submit a Connections Insight request to Waters customer support.

As an option, Remote Desktop is a real-time collaboration tool, a service that controls two-way connection with the ACQUITY UPLC system by enabling the Connections INSIGHT iAssist service level.

Consult these sources for more information about Connections INSIGHT and Connections INSIGHT iAssist:

- <http://www.waters.com>.
- Your sales representative.
- Your local Waters subsidiary.
- Waters Customer Support, see [page iv](#).

### To submit a Connections Insight request:

1. Open the Connections Insight software tray application, and select the iHelp tab.
2. In the Connections INSIGHT Request dialog box, type your name, telephone number, e-mail address, and a description of the problem.
3. Click Submit. Allow approximately 5 minutes to save the service profile.

**Result:** A .zip file containing your Connections INSIGHT profile is forwarded to Waters customer support for review. Saving a service profile or plot file from the Instrument Console can require up to 150 MB of file space.

## Safety and handling

---

Bear in mind the following safety considerations when performing maintenance procedures:



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while handling instrument components.



**Warning:** To prevent injury, always observe Good Laboratory Practice when handling solvents, changing tubing, or operating the instrument. Know the physical and chemical properties of the solvents used (see the Material Safety Data Sheets for the solvents in use).



**Warning:** To avoid electric shock,

- do not remove the instrument's panels. There are no user-serviceable items inside the instrument.
- ensure that the instrument is in Standby mode before commencing any maintenance.



**Warning:** To avoid burn injuries, take great care while working with the probe and source; these components can be hot.



**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).



**Warning:** To avoid injury, ensure that these criteria are met when performing maintenance inside the source enclosure:

- The instrument is in Standby mode.
- LC flow is diverted to waste or set to Off.
- Desolvation gas flow is stopped.

See [Appendix A](#) for safety advisory information.

## Preparing the instrument for working on the source

---

For safety reasons, you must follow the procedure described below before working on the source (for example, when operating the source isolation valve).

Follow the procedure for the software that controls your mass spectrometer: MassLynx software, or UNIFI software.

### To use MassLynx software to prepare the instrument for working on the source:

1. In the Instrument Console, click Stop Flow  to stop the LC flow or.  
**Note:** If column flow is required, divert the LC flow to waste:
  - a. In the Instrument Console system tree, expand Xevo TQ MS Detector, Interactive Fluidics.
  - b. Click Control .
  - c. Select Waste as the flow state.
2. In the Instrument Console, click Standby , and confirm that the Operate indicator is not illuminated.
3. Wait 3 minutes to allow the desolvation gas flow to cool the probe and source.
4. In the Instrument Console, click API , to stop the desolvation gas flow.

**To use UNIFI software to prepare the instrument for working on the source:**

1. On the System Console tool bar, click Stop Flow  to stop the LC flow.  
**Note:** If column flow is required, divert the LC flow to waste:
  - a. On the Setup pane, click Fluidics.
  - b. On the Sample Fluidics page, from the Flow Path menu, select Waste.
2. Click Instrument Standby Mode , and confirm that the Operate indicator is not illuminated.
3. Wait 3 minutes to allow the desolvation gas flow to cool the probe and source.
4. Stop the API gas by clicking .  
  
(If the API gas is already stopped,  is shown on the tool bar.)

## Removing and refitting the source enclosure

---

The optional combined APPI/APCI and NanoFlow sources are supplied as a complete source enclosure. To fit them, you must first remove the standard source enclosure.

### Removing the source enclosure from the instrument

#### Required materials

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The source components can be contaminated.

#### To remove the source enclosure:

1. Prepare the instrument for working on the source (see [page 85](#)).



**Warning:** To avoid burn injuries, take great care while working with the probe and source; these components can be hot.

2. Remove the probe from the source.
  - If you are removing an ESI probe, see [page 56](#).
  - If you are removing an APCI probe, see [page 60](#).
3. Slide open the instrument's source interface door (see the figure on [page 24](#)).
4. Disconnect the probe adjuster and options cables from the instrument's connectors.

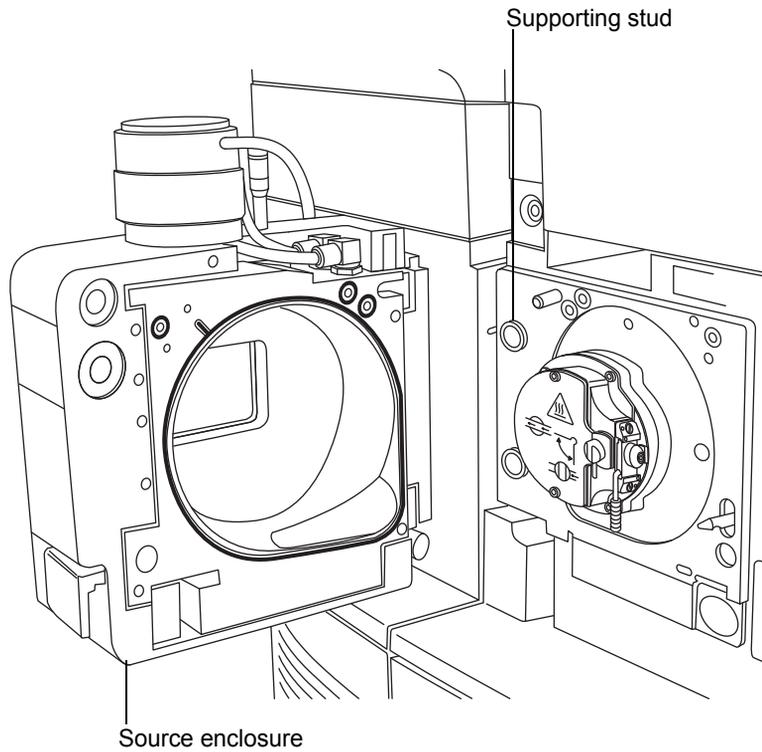


**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if a corona pin is fitted; the corona pin tip is sharp.

5. Pull the source enclosure release (located at the bottom, right-hand side) outwards, and swing open the enclosure.

## 4 Maintenance Procedures

6. Using both hands, grasp the source enclosure, and lift it vertically off the two supporting studs on the source adaptor housing.



## Fitting the source enclosure to the instrument

### Required materials

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The source components can be contaminated.



**Warning:** To avoid puncture wounds, take great care while fitting the source enclosure to the source if a corona pin is fitted (the pin tip is sharp).

### To fit the source enclosure:

1. Using both hands, fit the source enclosure to the two supporting studs on the source adaptor housing.



**Caution:** To prevent the NanoFlow source sprayer colliding with the cone and breaking, always retract the stage before closing the source enclosure door.

2. Close the source enclosure.
3. Connect the probe adjuster and options cables to the instrument's connectors.
4. Slide closed the instrument's source interface door.

## Installing and removing the corona pin

---

For ESCi, APCI and dual-mode APCI/APPI operation, you must fit a corona pin.

### Installing the corona pin in the source

#### Required materials

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The LC system connections, ESI probe, and source can be contaminated.



**Warning:** To avoid electric shock, ensure that the instrument is prepared for working on the source when commencing this procedure.

#### To install the corona pin in the source:

1. Prepare the instrument for working on the source (see [page 85](#)).



**Warning:** To avoid burn injuries, take great care while working with the source enclosure open; the source can be hot.



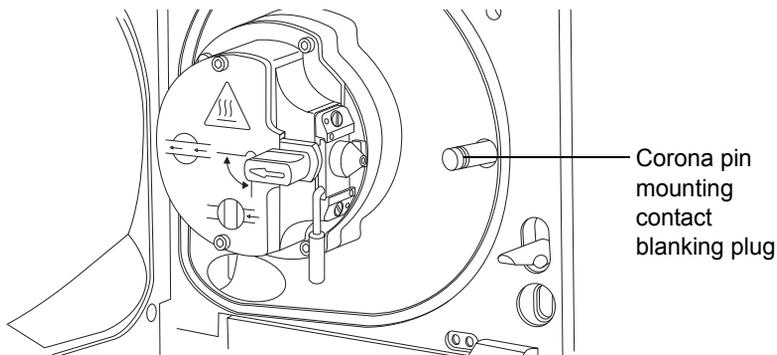
**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if an ESI probe is fitted; the ESI probe tip is sharp.

2. Pull the source enclosure release (located at the bottom, right-hand side) outwards, and swing open the enclosure.

3. Remove the blanking plug from the corona pin mounting contact.

**Tip:** Store the blanking plug in a safe location.

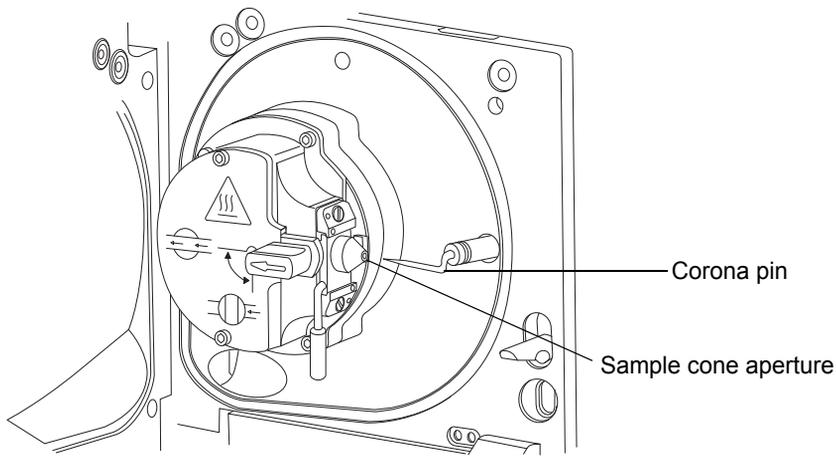
**Corona pin mounting contact:**



**Warning:** To avoid puncture wounds, handle the corona pin with care; the pin tip is sharp.

4. Fit the corona pin to the mounting contact, ensuring that the corona pin is securely mounted and that its tip aligns with the sample cone aperture.

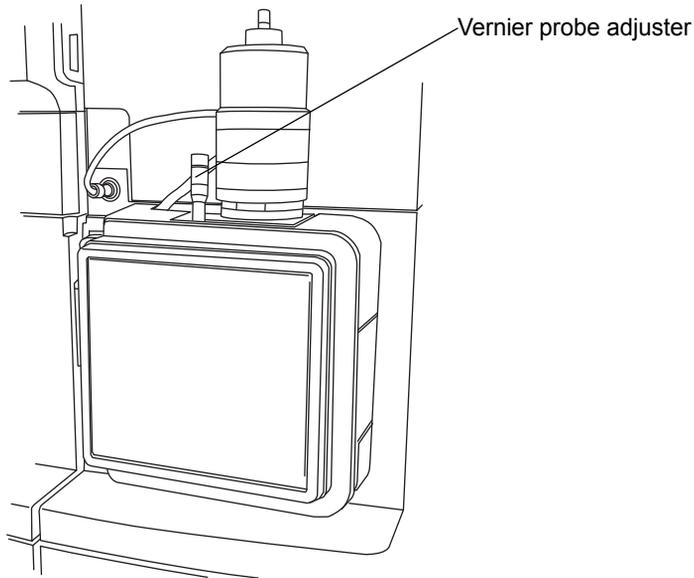
**Corona pin:**



5. Close the source enclosure.

## 4 Maintenance Procedures

6. Look through the source window and use the vernier probe adjuster to position the ESI probe tip so that it is pointing approximately midway between the tips of the sample cone and corona pin.



## Removing the corona pin from the source

### Required materials

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The LC system connections, ESI probe, and source can be contaminated.



**Warning:** To avoid electric shock, ensure that the instrument is prepared for working on the source when commencing this procedure.

### To remove the corona pin from the source:

1. Prepare the instrument for working on the source (see [page 85](#)).



**Warning:** To avoid burn injuries, take great care while working with the instrument's source enclosure open; the source can be hot.



**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if an ESI probe is fitted; the ESI probe tip is sharp.

2. Pull the source enclosure release (located at the bottom, right-hand side) outwards, and swing open the enclosure.
3. Remove the corona pin from its mounting contact (see the figure on [page 91](#)).  
**Tip:** Store the corona pin in a safe location.
4. Fit the blanking plug to the corona pin mounting contact (see the figure on [page 91](#)).
5. Close the source enclosure.

## Operating the source isolation valve

---

You must close the source isolation valve to isolate the source from the instrument vacuum system for certain maintenance procedures.

### Required materials

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The source components can be contaminated.



**Warning:** To avoid electric shock, ensure that the instrument is suitably prepared before commencing this procedure.

### To close the source isolation valve before starting a maintenance procedure:

1. Prepare the instrument for working on the source (see [page 85](#)).



**Warning:** To avoid burn injuries, take great care while working with the instrument's source enclosure open; the source can be hot.

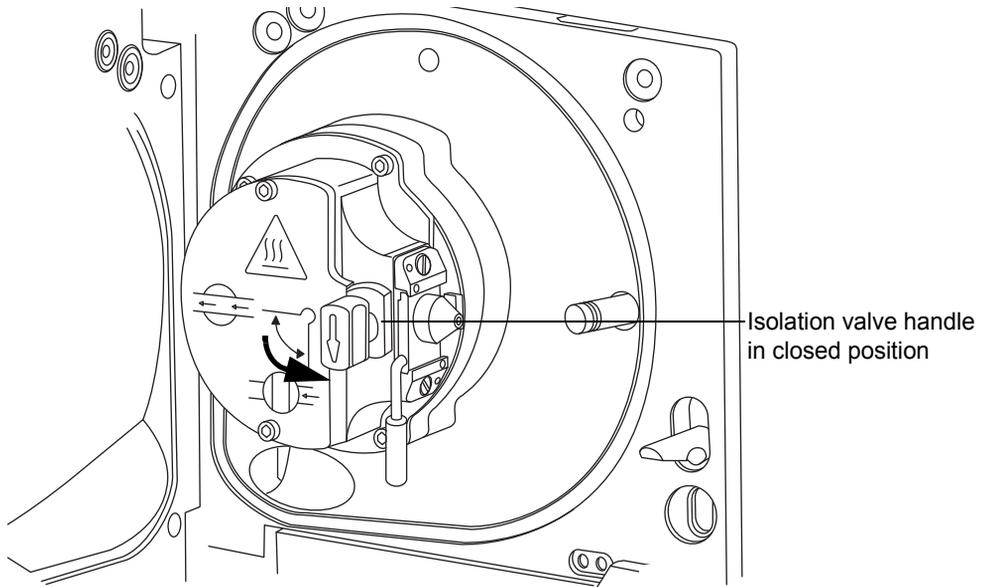


**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).

2. Pull the source enclosure release (located at the bottom, right-hand side) outwards and swing open the enclosure.

3. Close the source isolation valve by moving its handle counterclockwise, to the vertical position.





**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while performing this procedure. The source components can be contaminated.

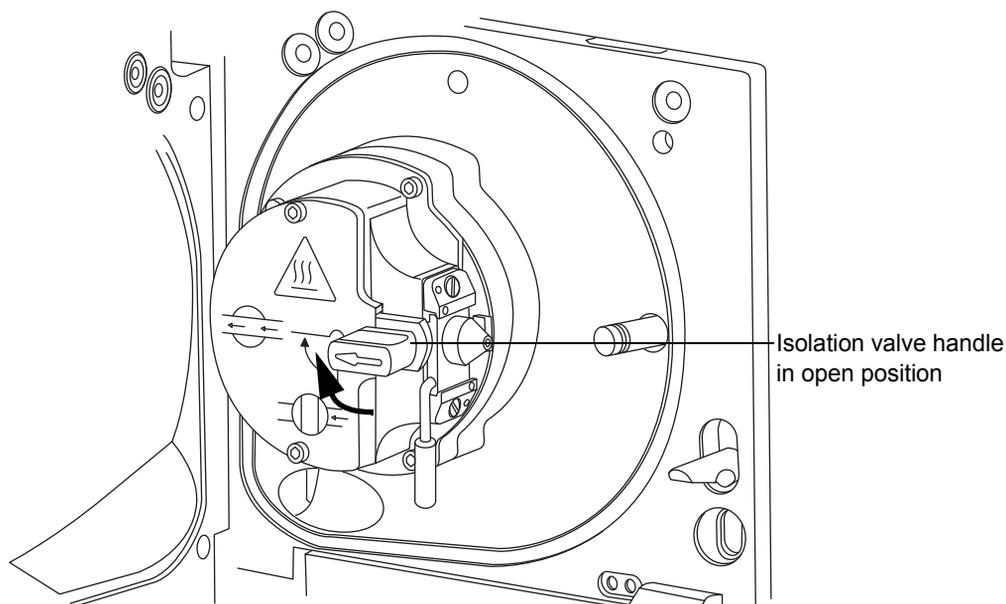


**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).

**To open the source isolation valve after completing a maintenance procedure:**

1. Open the source isolation valve by moving its handle clockwise to the horizontal position.



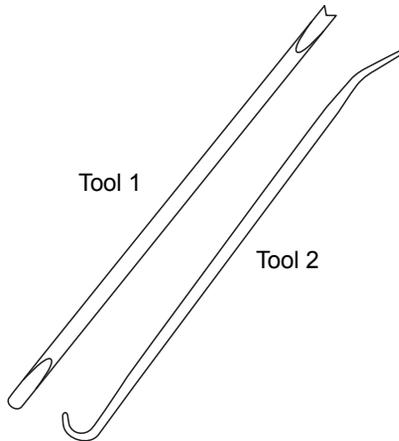
2. Close the source enclosure.

## Removing O-rings and seals

---

When performing certain maintenance procedures, you must remove O-rings or seals from instrument components. An O-ring removal kit is provided with the instrument.

### O-ring removal kit:



### To remove an O-ring:

 **Caution:** To avoid damage, be careful not to scratch components with the removal tool when removing an O-ring or seal.

1. Use the forked end of tool 1 to impale the O-ring or seal.
2. Pull the O-ring or seal from its groove; if necessary, use tool 2 as an aid.

  **Warning:** To avoid spreading contamination, dispose of the O-ring or seal according to local environmental regulations; O-rings and seals can be contaminated with biohazards or toxic materials.

3. Dispose of the O-ring or seal in accordance with local environmental regulations.

## Cleaning the instrument case

---



**Caution:** To avoid damage, do not use abrasives or solvents to clean the instrument's case.

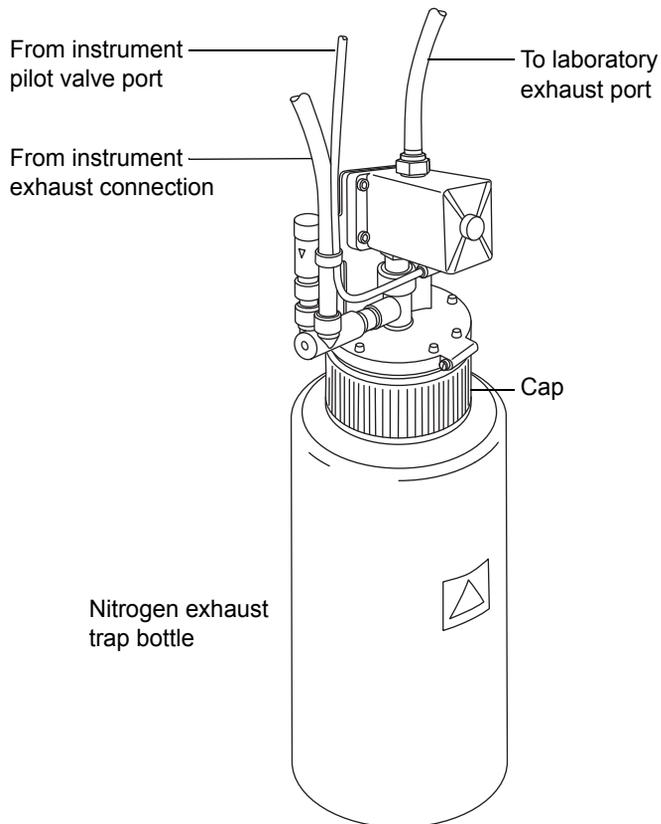
Use a soft cloth, dampened with water, to clean the outside surfaces of the mass spectrometer.

## Emptying the nitrogen exhaust trap bottle

---

Inspect the nitrogen exhaust trap bottle in the instrument's exhaust line, daily and empty it before it is more than approximately 10% full.

### Nitrogen exhaust trap bottle:



## Required materials

Chemical-resistant, powder-free gloves

### To empty the nitrogen exhaust trap bottle:

1. To stop the LC flow, follow the action below for your software:

Software	Action
MassLynx	In the instrument console, click Stop Flow  .
UNIFI	On the System Console tool bar, click Stop Flow  .

2. Pull the source enclosure release (located at the bottom, right-hand side) outwards, and swing open the enclosure.



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves while handling the nitrogen exhaust trap bottle. The waste liquid in the nitrogen exhaust trap bottle comprises ACQUITY UPLC solvents and analytes.

3. Unscrew and remove the nitrogen exhaust trap bottle from the cap and associated fittings.



**Warning:** To avoid spreading contamination, dispose of waste liquid according to local environmental regulations. The waste liquid can be contaminated with biohazards or toxic materials.

4. Dispose of the waste liquid in accordance with local environmental regulations.
5. Fit and tighten the nitrogen exhaust trap bottle to the cap.
6. Secure the nitrogen exhaust trap bottle in the upright position.
7. Close the source enclosure.

**Tip:** An automatic leak test will now be performed.

#### 4 Maintenance Procedures

8. To start the LC flow, follow the action below for your software:

<b>Software</b>	<b>Action</b>
MassLynx	In the instrument console, click Start Flow  .
UNIFI	On the System Console tool bar, click Start Flow  .

## Inspecting the Varian roughing pump oil level

---



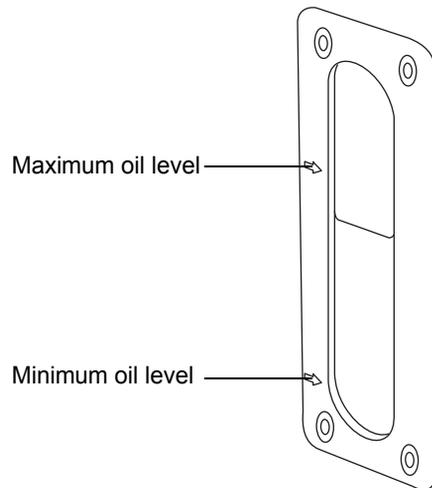
**Caution:** To ensure correct operation of the Varian™ roughing pump, do not operate the pump with the oil level at less than 30% of the MAX level.

**Note:** This procedure is not required for an Edwards oil-free roughing pump.

**Requirement:** You must inspect the oil level while the roughing pump is running.

The roughing pump oil level appears in the roughing pump's oil level sight glass. Inspect the oil level at weekly intervals; with the pump running, the oil level is typically at approximately 30% to 60% of the maximum oil level. This corresponds to approximately the maximum oil level when the pump is not operating. If the oil level is below these values, add oil to the pump (see [“Adding oil to the Varian roughing pump” on page 102](#)).

### Roughing pump oil level sight glass:

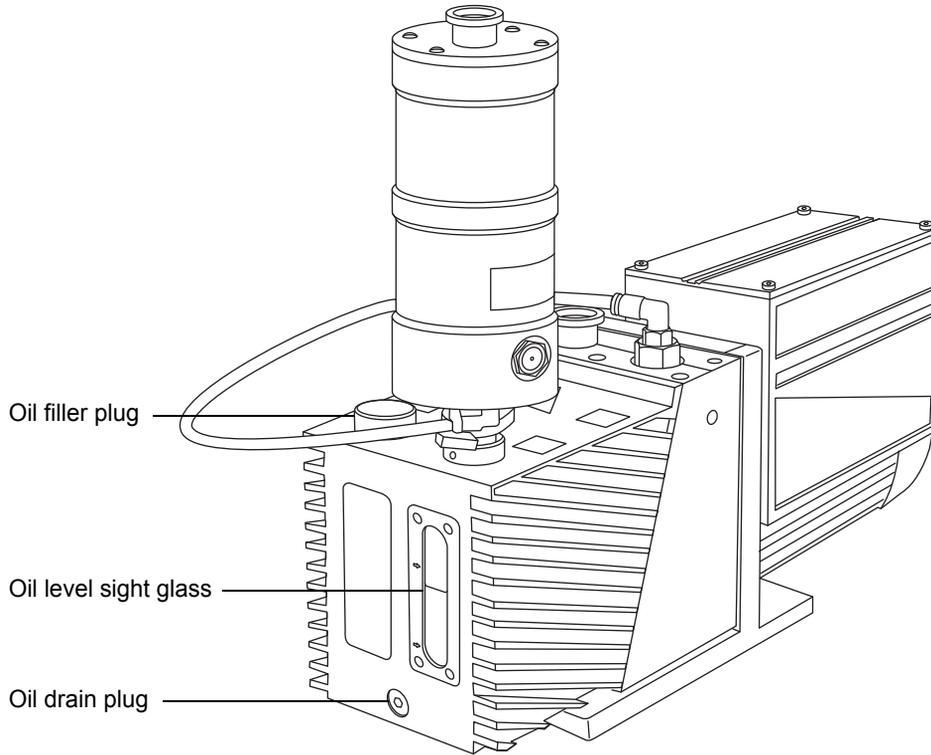


## Adding oil to the Varian roughing pump

---

If the roughing pump oil level is found to be low, you must add oil to the roughing pump. See [“Inspecting the Varian roughing pump oil level”](#) on page 101.

### Varian roughing pump:



### Required materials

- Chemical-resistant, powder-free gloves
- Funnel
- Varian GP45 oil

**To add oil to the roughing pump:**

1. Vent and shut down the mass spectrometer (see the mass spectrometer's online Help for details).
2. Allow the oil to settle in the pump.



**Warning:** To avoid personal contamination with biohazards or toxic materials, always wear chemical-resistant, powder-free gloves when adding or replacing pump oil. The oil can be contaminated with analyte accumulated during normal operation.



**Warning:** To avoid burn injuries, take great care while working with the roughing pump: it can be hot.

3. Unscrew and remove the roughing pump's oil filler plug.  
**Important:** To maintain pump performance, use only Varian GP45 oil.
4. Using the funnel, slowly add Varian GP45 oil into the oil filler aperture until the oil reaches the oil level sight glass maximum level.



**Caution:** To avoid oil leakage, when fitting the oil filler plug to the roughing pump,

- ensure that the plug is not cross threaded.
- do not over-tighten the plug.

5. Fit and tighten the roughing pump's oil filler plug.
6. Start the mass spectrometer (see [“Starting the mass spectrometer” on page 42](#)).

**Tips:** After you add oil to the pump, the following situations can occur:

- The oil level drops slightly during the first month of operation.
- The oil changes color (darkens) over time.
- When the pump approaches operating temperature, any oil spilled becomes odorous.

## Replacing the Varian roughing pump oil and oil mist filter

Change the roughing pump oil and oil mist filter annually.

This procedure is not required for an Edwards oil-free roughing pump.

### Emptying the roughing pump oil

#### Required materials

- Chemical-resistant, powder-free gloves
- 8-mm Allen wrench
- Container to catch used oil
- Lint-free cloth

#### To empty the roughing pump oil:

1. Vent and shut down the mass spectrometer (see the mass spectrometer's online Help for details).
2. Allow the roughing pump to cool.



**Warning:** To avoid personal contamination with biohazards or toxic materials, always wear chemical-resistant, powder-free gloves when adding or replacing pump oil. The oil can be contaminated with analyte accumulated during normal operation.



**Warning:** To avoid burn injuries, take great care while working with the roughing pump: it can be hot.

3. Place the container for capturing the used oil under the pump's drain plug (see the figure on [page 102](#)).
4. Unscrew and remove the oil filler plug.
5. Use the 8-mm Allen wrench to remove the oil drain plug.

6. Tip the pump toward the drain plug aperture and allow the oil to drain completely into the container.



**Warning:** To avoid spreading contamination, dispose of roughing pump oil according to local environmental regulations. The oil can be contaminated with biohazards or toxic materials.

7. Dispose of the roughing pump oil in accordance with local environmental regulations.
8. Use the lint-free cloth to remove loose particles from the magnetic tip of the oil drain plug.

## Replacing the oil mist filter

### Required materials

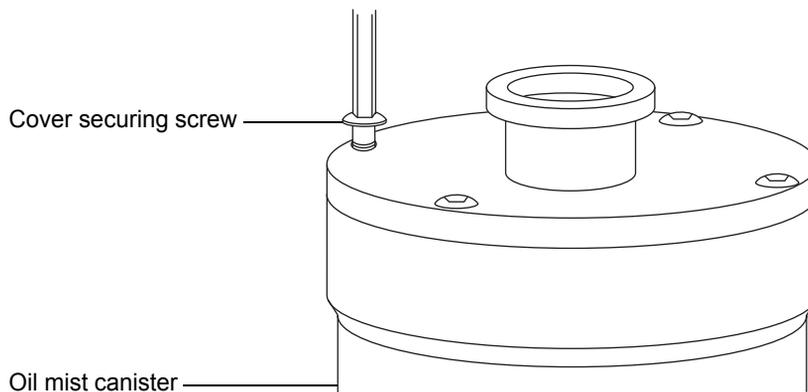
- Chemical-resistant, powder-free gloves
- 3-mm Allen wrench
- New oil mist filter



**Warning:** To avoid personal contamination with biohazards or toxic materials, always wear chemical-resistant, powder-free gloves when performing this procedure. The oil mist filter and canister components can be contaminated with analyte accumulated during normal operation.

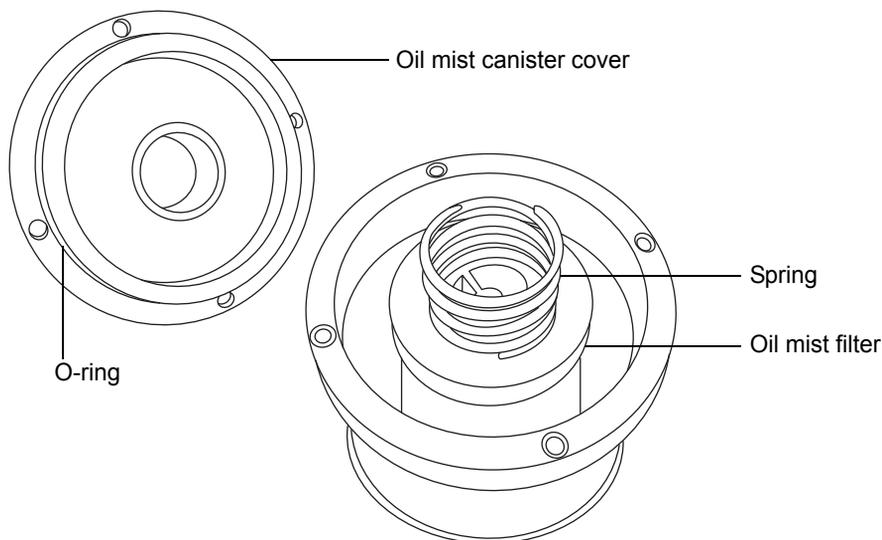
### To replace the oil mist filter:

1. Use the 3-mm Allen wrench to remove the 4 screws securing the oil mist canister cover to the oil mist canister.



2. Remove the oil mist canister cover from the oil mist canister.

**Tip:** The cover can be tight and difficult to remove.



3. Remove the spring and oil mist filter from the canister.



**Warning:** To avoid spreading contamination, ensure that the oil mist filter is correctly disposed of according to local environmental regulations. The oil mist filter can be contaminated with biohazards or toxic materials.

4. Dispose of the oil mist filter in accordance with local environmental regulations.
5. Install the new oil mist filter in the canister.  
**Requirement:** To seat the new filter properly, press it down firmly when installing it in the canister.
6. Ensure that the O-ring on the oil mist canister cover is correctly seated.
7. Center the spring on top of the oil mist filter.
8. Fit the spring over the collar on the oil mist canister cover, and then fit the cover to the oil mist canister.
9. Use the 3-mm Allen wrench to fit and tighten the 4 screws securing the oil mist canister cover to the oil mist canister.

## To refill the pump with oil

### Required materials

- Chemical-resistant, powder-free gloves
- 8-mm Allen wrench
- Funnel
- 1-L bottle of Varian GP45 oil

### Refilling the pump with oil:



**Warning:** To avoid personal contamination with biohazards or toxic materials, always wear chemical-resistant, powder-free gloves when adding or replacing oil. The roughing pump components can be contaminated with analyte accumulated during normal operation.

1. Ensure that the O-ring on the pump's oil drain plug is clean and properly seated.



**Caution:** To avoid oil leakage when fitting the oil drain plug to the roughing pump,

- ensure that the plug is not cross threaded.
- ensure that the O-ring is not pinched.
- do not overtighten the plug.

2. Use the 8-mm Allen wrench to fit and tighten the roughing pump's oil drain plug.

**Tip:** When the oil drain plug is tightened, the plug seals with an O-ring. Compression is controlled by the O-ring groove depth in the plug. Increased torque does not improve the plug seal; it only makes the plug difficult to remove later.

**Important:** To maintain pump performance, use Varian GP45 oil.

3. Using the funnel, pour 1 L of Varian GP45 oil into the oil filler aperture.

**Tip:** The oil level may be above the sight-glass MAX level, but should drop to the MAX level or below during the first few days of operation.

4. Ensure that the O-ring on the oil filler plug is clean and properly seated.



**Caution:** To avoid oil leakage when fitting the oil filler plug to the roughing pump,

- ensure that the plug is not cross threaded.
- ensure that the O-ring is not pinched.
- do not over tighten the plug.

5. Fit and tighten the oil filler plug.
6. Start the mass spectrometer (see [“Starting the mass spectrometer” on page 42](#)).

**Tip:** After you add oil to the pump, the following situations can occur:

- The oil level drops slightly during the first month of operation.
- The oil changes color (darkens) over time.
- After running the pump for 12 to 48 hours, a few drops of oil sometimes appear near the filler plug. Excess oil around the lip of the filler plug flows downwards and drips from the pump when it reaches operating temperature.
- When the pump approaches operating temperature, any oil spilled becomes odorous.

## Cleaning the source components

---

Clean the sample cone and cone gas nozzle when these conditions apply:

- The sample cone and cone gas nozzle are visibly fouled.
- LC and sample-related causes for decreased signal intensity have been dismissed.

See [“Cleaning the sampling cone assembly” on page 111](#).

If cleaning the sample cone and cone gas nozzles fails to increase signal sensitivity, also clean the extraction cone. See [“Cleaning the extraction cone” on page 120](#).

If cleaning the extraction cone fails to increase signal sensitivity, clean the ion block and isolation valve. See [“Cleaning the ion block assembly” on page 128](#).

If cleaning the ion block and isolation valve fails to increase signal sensitivity, also clean the source hexapole assembly. See [“Cleaning the source hexapole assembly” on page 140](#).

## Cleaning the sampling cone assembly

---

You can remove the sampling cone assembly (comprising the sample cone, O-ring, and cone gas nozzle) for cleaning without venting the instrument.

### Removing the sampling cone assembly from the source

#### Required materials

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when performing this procedure. The source components can be contaminated.



**Warning:** To avoid electric shock, ensure that the instrument is in Standby mode before commencing this procedure.



**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

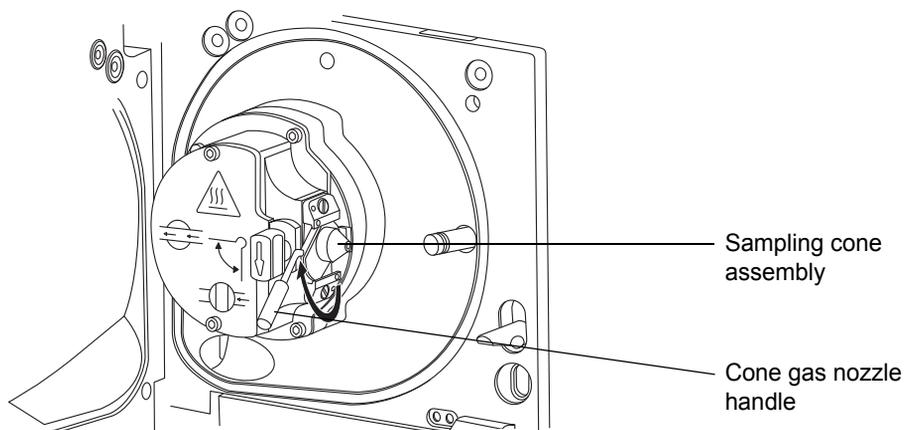
- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).



**Warning:** To avoid burn injuries, take great care while working with the source enclosure open; the source can be hot.

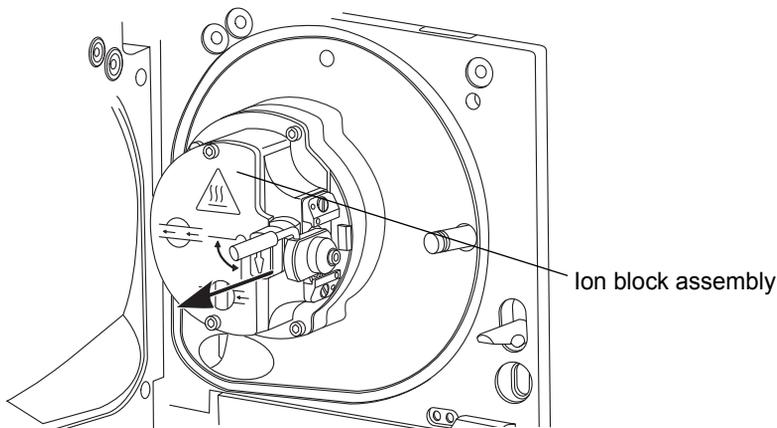
**To remove the sampling cone assembly from the source:**

1. Close the source isolation valve (see “To close the source isolation valve before starting a maintenance procedure:” on page 94).
2. Grasp the cone gas nozzle handle, and use it to rotate the sampling cone assembly 90 degrees, moving the handle from the vertical to the horizontal position.



 **Caution:** To avoid damaging the instrument by sudden venting, do not open the isolation valve at any time while the sampling cone assembly is removed from the ion block assembly.

3. Slide the sampling cone assembly out of the ion block assembly.



## Disassembling the sampling cone assembly

### Required materials

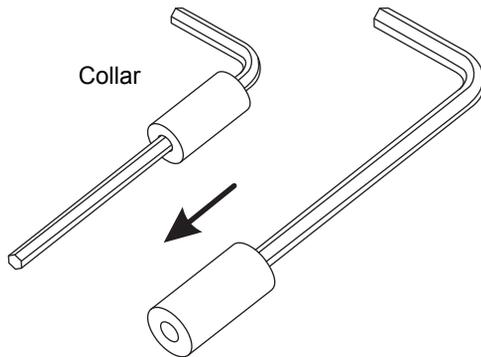
- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool



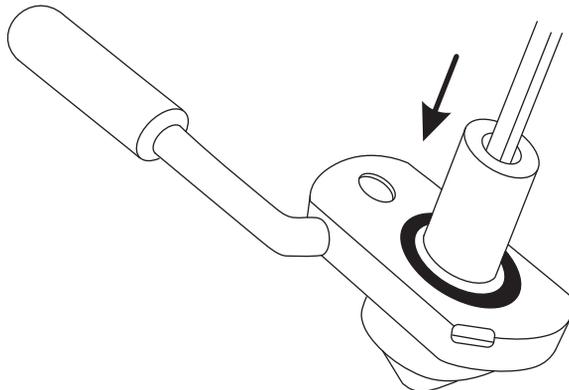
**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the sampling cone assembly.

### To disassemble the sampling cone assembly:

1. On the combined 2.5-mm Allen wrench and cone extraction tool, slide the collar to the end of the tool.

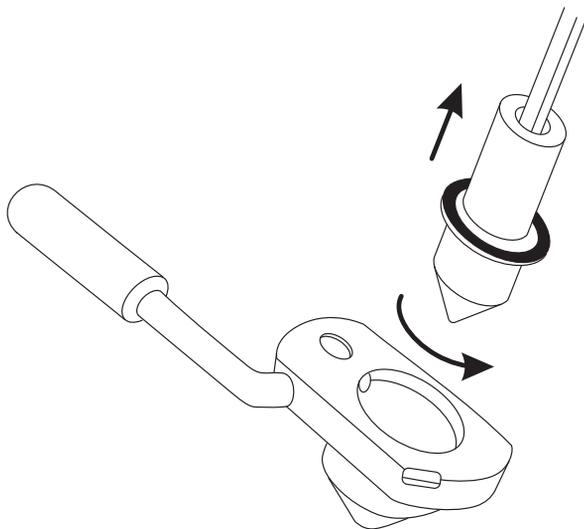


2. Insert the collar in the sample cone.

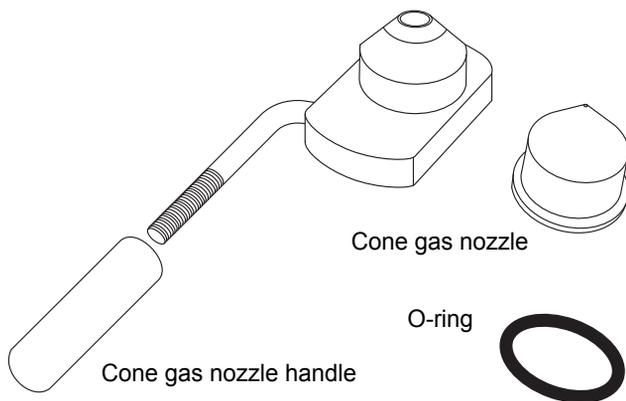


 **Caution:** To avoid damaging the fragile sample cone, do not place it on its tip; instead, place it on its flanged base.

3. Rotate and lift the tool and collar to remove the sample cone from the cone gas nozzle.



4. Remove the O-ring from the sample cone.



5. If the O-ring shows signs of deterioration or damage, dispose of it in accordance with local environmental regulations.
6. Unscrew and remove the PEEK cone gas nozzle handle from the cone gas nozzle.

## Cleaning the sample cone and cone gas nozzle

### Required materials

- Chemical-resistant, powder-free gloves.
- Appropriately sized glass vessels in which to completely immerse components when cleaning. Use only glassware not previously cleaned with surfactants.
- HPLC-grade (or better) methanol.
- HPLC-grade (or better) water.
- Formic acid.
- Ultrasonic bath.
- Source of oil-free, inert gas (nitrogen or argon) for drying (air-drying optional).
- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water.
- Large beaker.



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the sample cone and cone gas nozzle.



**Warning:** To avoid injury, work with extreme care. Use a fume hood, and suitable protective equipment. Formic acid is extremely corrosive and toxic.



**Caution:** To avoid damaging the fragile sample cone, do not place it on its tip; instead, place it on its flanged base.

### To clean the sample cone and cone gas nozzle:

1. If the sample cone contains debris, place a drop of formic acid on its aperture.
2. Immerse the sample cone, cone gas nozzle, and cone gas nozzle handle in separate glass vessels containing 1:1 methanol/water.

**Tip:** If the components are obviously contaminated, use 45:45:10 methanol/water/formic acid.

3. Place the vessels in the ultrasonic bath for 30 minutes.
4. If you used formic acid in the cleaning solution, do as follows:
  - a. Rinse the components by immersing them in separate glass vessels containing water and then placing the vessels in the ultrasonic bath for 20 minutes.
  - b. Remove any residual water from the extraction cone by immersing it in a glass vessel containing methanol and then placing the vessel in the ultrasonic bath for 10 minutes.



**Caution:** To avoid recontaminating the components, wear clean, chemical-resistant, powder-free gloves for the rest of this procedure.

5. Carefully remove the components from the vessels, and blow-dry them with inert, oil-free gas.
6. Inspect each component for persisting contamination. If contamination is present, do as follows:
  - a. Use the wash bottle containing 1:1 methanol/water to rinse the component over the large beaker.
  - b. Blow-dry the component with inert, oil-free gas.
7. Inspect each component for persisting contamination. If contamination is present, dispose of the component, and obtain a new one before reassembling the sampling cone assembly.

## Assembling the sampling cone assembly

### Required materials

Chemical-resistant, powder-free gloves

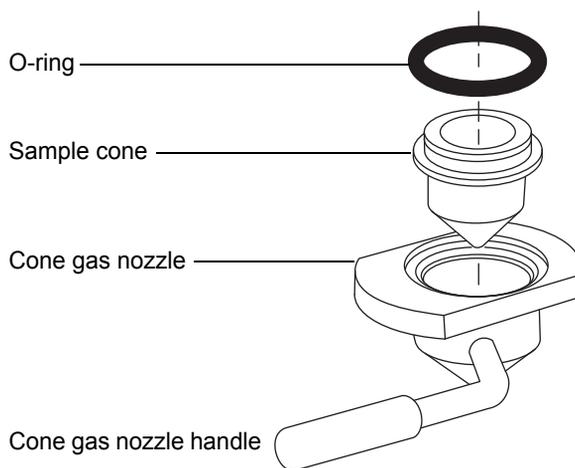


#### Caution:

- To avoid recontaminating the sampling cone assembly, wear clean chemical-resistant, powder-free gloves during this procedure.
- To avoid damaging the fragile sample cone, do not place it on its tip; instead, place it on its flanged base.

### To assemble the sampling cone assembly:

1. Fit the cone gas nozzle handle to the cone gas nozzle and turn the handle clockwise to tighten.



2. Carefully fit the sample cone into the cone gas nozzle.
3. Fit the O-ring into the groove created between the sample cone and cone gas nozzle. (Fit a new O-ring if the old one has been disposed of.)

## Fitting the sampling cone assembly to the source

### Required material

Chemical-resistant, powder-free gloves



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the source components.



**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

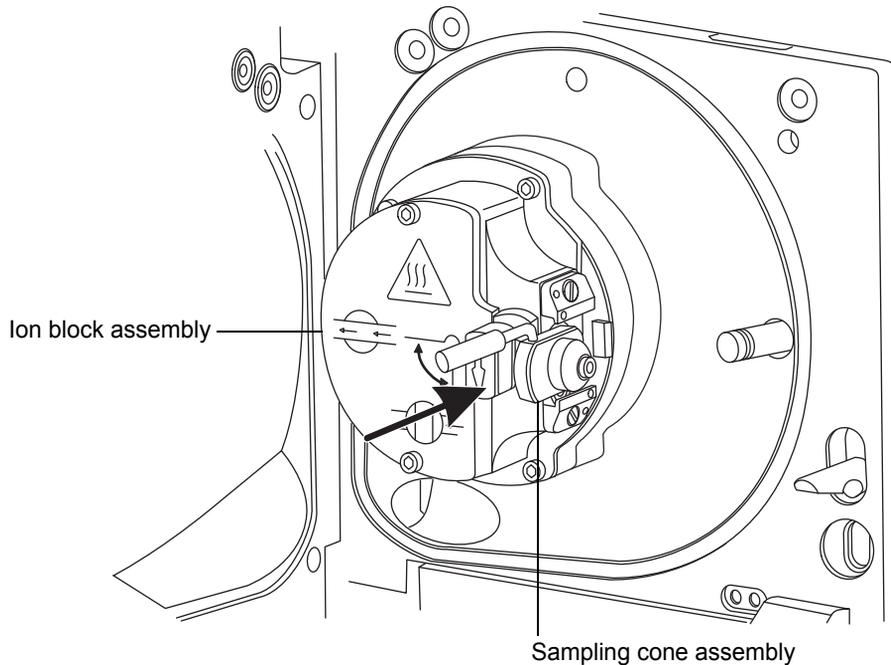
- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).



**Caution:** To avoid damaging the instrument by sudden venting, do not open the source isolation valve before fitting the sampling cone assembly to the ion block assembly.

**To fit the sampling cone assembly to the source:**

1. Ensure that the source isolation valve is in the closed position (see [“To close the source isolation valve before starting a maintenance procedure:”](#) on page 94).
2. Hold the sampling cone assembly so that the cone gas nozzle handle is oriented horizontally and at the top, and then slide the sampling cone assembly into the ion block assembly.



3. Grasp the cone gas nozzle handle and use it to rotate the sampling cone assembly 90 degrees, moving the handle downward from the horizontal to the vertical position.
4. Open the source isolation valve (see [“To open the source isolation valve after completing a maintenance procedure:”](#) on page 96).
5. Close the source enclosure.

## Cleaning the extraction cone

---

Clean the ion block and extraction cone when cleaning the sample cone and cone gas nozzle fails to increase signal sensitivity. You must remove the ion block assembly from the source assembly to clean the extraction cone.

### Removing the ion block assembly from the source assembly

#### Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the source components.

#### To remove the ion block assembly:

1. Vent and shut down the mass spectrometer (see the mass spectrometer's online Help for details).



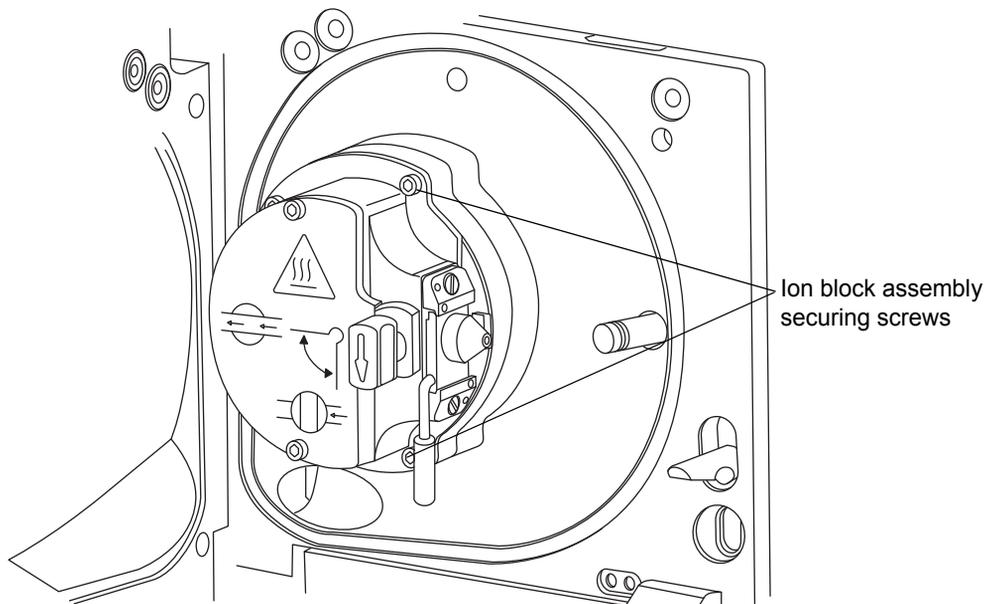
**Warning:** To avoid burn injuries, allow the source to cool for at least 30 minutes before proceeding; the source can be hot.



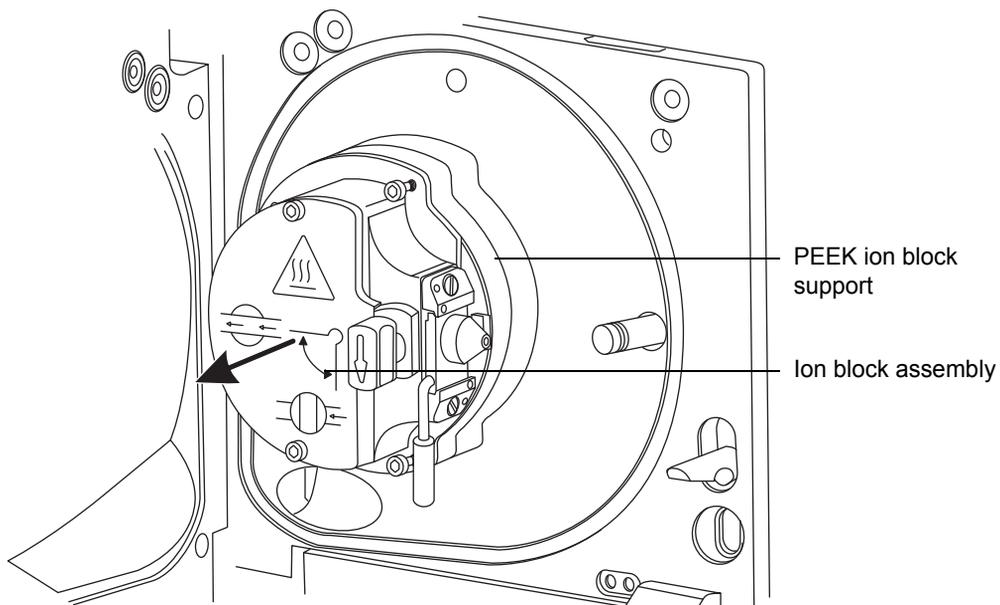
**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

- An ESI probe is fitted (the probe tip is sharp).
  - A corona pin is fitted (the pin tip is sharp).
2. Close the source isolation valve (see [“To close the source isolation valve before starting a maintenance procedure:”](#) on page 94).

3. Use the combined 2.5-mm Allen wrench and cone extraction tool to unscrew the 4 captive ion block assembly securing screws.



4. Remove the ion block assembly from the PEEK ion block support.



## Removing the extraction cone from the ion block

### Required materials

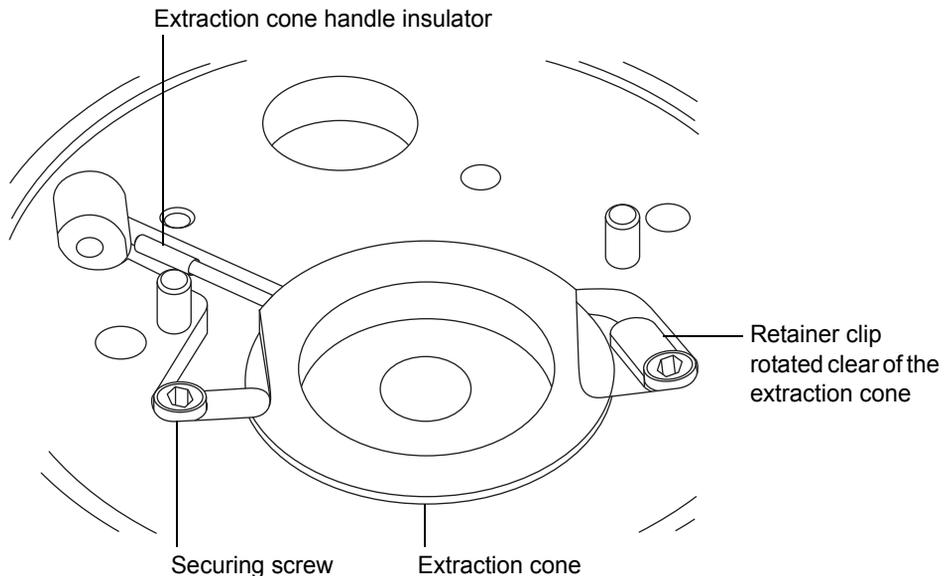
- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the ion block components.

### To remove the extraction cone from the ion block:

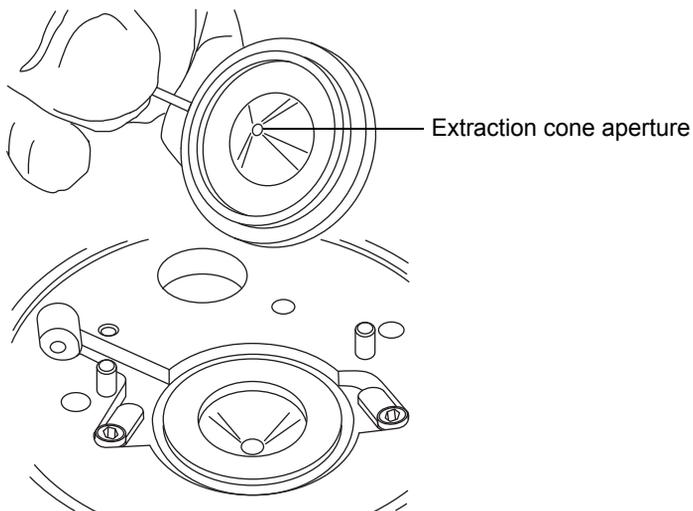
1. On the rear of the ion block, use the combined 2.5-mm Allen wrench and cone extraction tool to loosen the captive screws securing the 2 PEEK extraction cone retainer clips, and then rotate the retainer clips clear of the extraction cone.



**Caution:**

- To avoid damaging the extraction cone aperture, take great care when removing the extraction cone from the ion block.
- To avoid damaging the fragile extraction cone, do not place it on its tip; instead, place it on its flanged base.

2. Remove the extraction cone from the ion block.



3. Remove the extraction cone handle insulator from the extraction cone handle.

## Cleaning the extraction cone

### Required materials

- Chemical-resistant, powder-free gloves.
- Appropriately sized glass vessel in which to completely immerse the extraction cone when cleaning. Use only glassware not previously cleaned with surfactants.
- HPLC-grade (or better) methanol.
- HPLC-grade (or better) water.
- Formic acid.
- Ultrasonic bath.
- Source of oil-free, inert gas (for example, nitrogen) for drying (air-drying optional).
- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water.
- Large beaker.



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the extraction cone.



**Warning:** To avoid injury, work with extreme care. Use a fume hood, and suitable protective equipment. Formic acid is extremely corrosive and toxic.



**Caution:** To avoid damaging the fragile extraction cone, do not place it on its tip; instead, place it on its flanged base.

### To clean the extraction cone:

1. Immerse the extraction cone in the glass vessel containing 1:1 methanol/water.

**Tip:** If the extraction cone is obviously contaminated, use 45:45:10 methanol/water/formic acid.

2. Place the vessel in the ultrasonic bath for 30 minutes.

3. If you used formic acid in the cleaning solution, do as follows:
  - a. Rinse the extraction cone by immersing it in a glass vessel containing water and then placing the vessel in the ultrasonic bath for 20 minutes.
  - b. Dry the components by immersing them in separate glass vessels containing methanol and then placing the vessels in the ultrasonic bath for 10 minutes.



**Caution:** To avoid recontaminating the extraction cone, wear clean, chemical-resistant, powder-free gloves for the rest of this procedure.

4. Carefully remove the extraction cone from the vessel, and blow-dry it using inert, oil-free gas.
5. Inspect the extraction cone for persisting contamination. If contamination is present, do as follows:
  - a. Use the wash bottle containing 1:1 methanol/water to rinse the extraction cone over the large beaker.
  - b. Blow-dry the extraction cone with inert, oil-free gas.



**Warning:** To avoid spreading contamination, dispose of the extraction cone in accordance with local environmental regulations.

6. Inspect the extraction cone for persisting contamination. If contamination is present, dispose of the extraction cone, and obtain a new one.

## Fitting the extraction cone to the ion block

### Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the ion block.

### To fit the extraction cone to the ion block:

1. Fit the extraction cone handle insulator to the extraction cone handle.
2. Fit the extraction cone to the ion block.
3. Rotate the 2 PEEK extraction cone retainer clips to secure the extraction cone, then use the combined 2.5-mm Allen wrench and cone extraction tool to tighten the retainer clip securing screws.

## Fitting the ion block assembly to the source assembly

### Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the source components.



**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).



**Caution:** To avoid recontaminating the ion block assembly, wear clean chemical-resistant, powder-free gloves during this procedure.

**To fit the ion block assembly to the source assembly:**

1. Fit the ion block assembly to the PEEK ion block support.
2. Use the combined 2.5-mm Allen wrench and cone extraction tool to fit and then slowly tighten the 4 ion block assembly securing screws sequentially and in small increments.
3. Open the source isolation valve (see [“Operating the source isolation valve” on page 94](#)).
4. Close the source enclosure.

## **Cleaning the ion block assembly**

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Clean the ion block assembly if cleaning the sample cone, cone gas nozzle, and extraction cone fails to increase signal sensitivity.

### **Disassembling the source ion block assembly**

#### **Required materials**

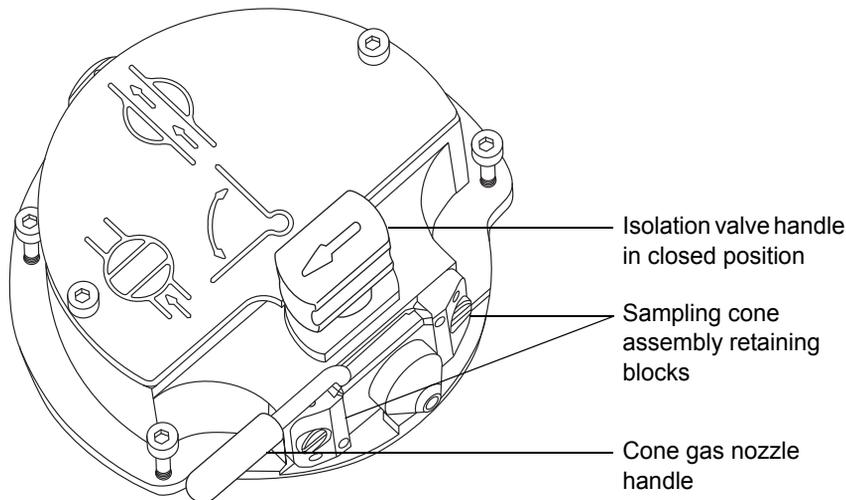
- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool
- O-ring removal kit
- Needle-nose pliers



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the ion block assembly.

### To disassemble the ion block assembly:

1. Remove the ion block assembly from the source assembly (see [“Removing the ion block assembly from the source assembly”](#) on page 120).
2. Ensure that the isolation valve is closed.



3. Grasp the cone gas nozzle handle and use it to rotate the sampling cone assembly through 90 degrees.



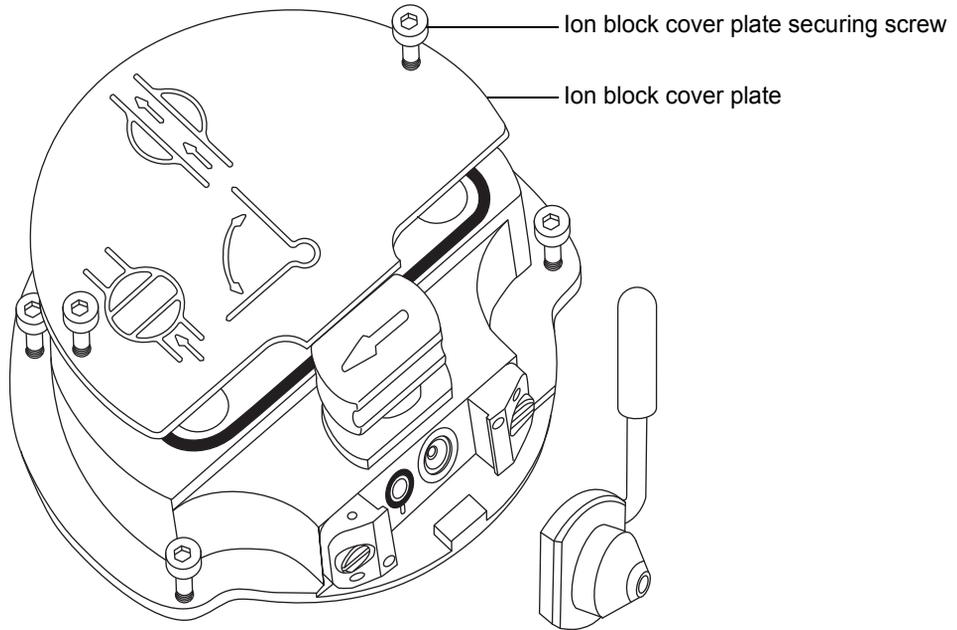
**Caution:** To ensure correct operation of the ion block assembly after reassembly,

- do not remove the sampling cone assembly retaining blocks.
- do not adjust the screws securing the sampling cone assembly retaining blocks.

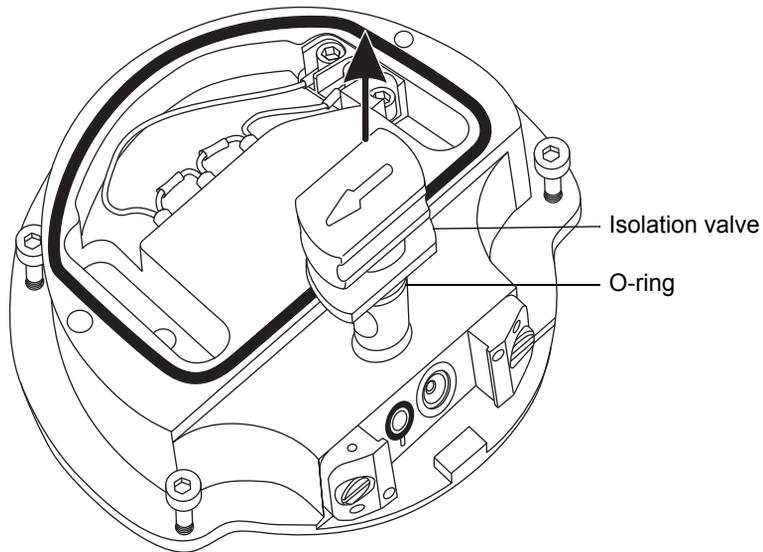
4. Slide the sampling cone assembly out of the ion block assembly.

## 4 Maintenance Procedures

5. Use the combined 2.5-mm Allen wrench and cone extraction tool to loosen the 2 ion block cover plate captive securing screws.



6. Remove the ion block cover plate.
7. Grasp the isolation valve and pull it out of the ion block.

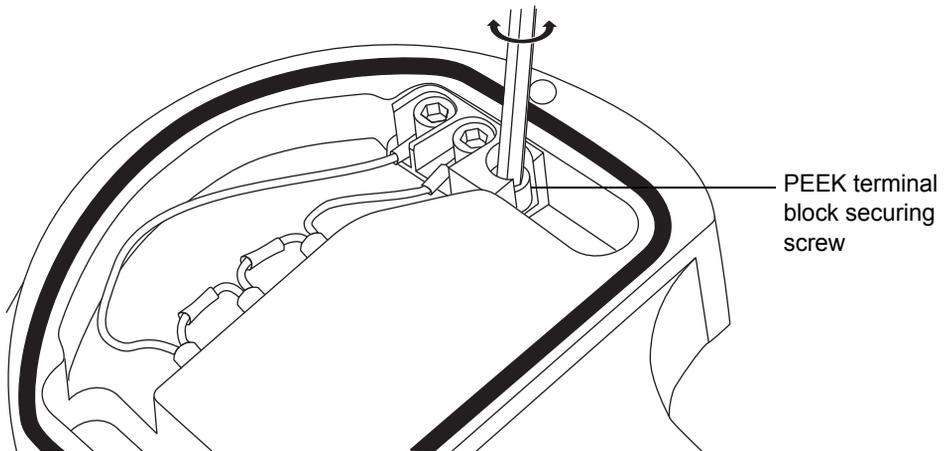


- Use the O-ring removal kit to carefully remove the isolation valve O-ring (see [“Removing O-rings and seals” on page 97](#)).



**Warning:** To prevent spreading contamination, dispose of the isolation valve O-ring according to local environmental regulations. The O-ring can be contaminated with biohazards or toxic materials.

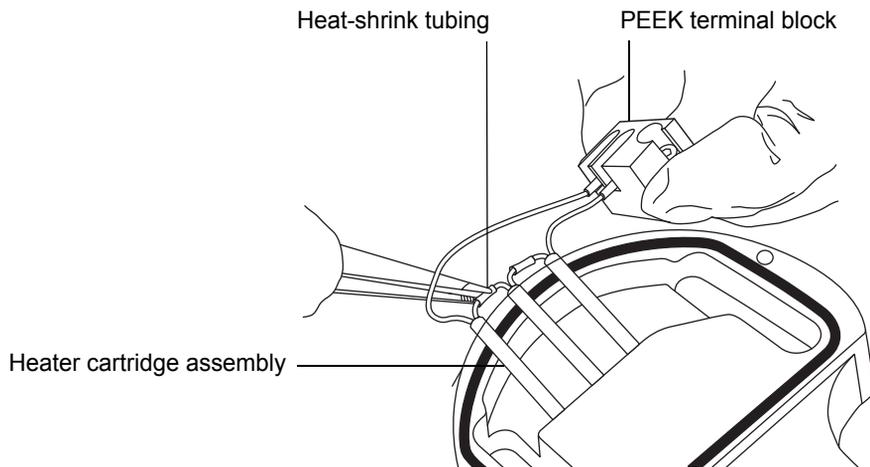
- If the isolation valve O-ring shows signs of deterioration or damage, dispose of it in accordance with local environmental regulations.
- Use the combined 2.5-mm Allen wrench and cone extraction tool to loosen the captive PEEK terminal block securing screw.



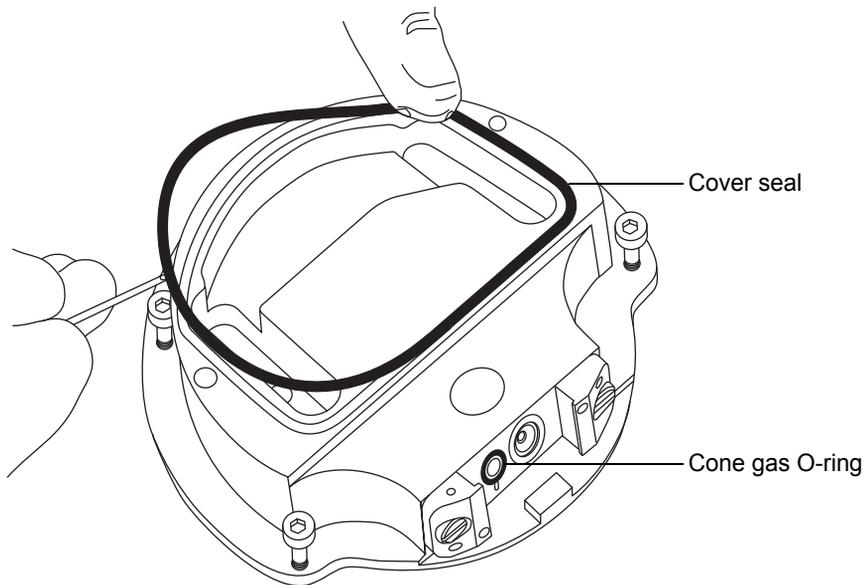
**Caution:** To avoid damaging the heater cartridge assembly wires, do not bend or twist them when removing the assembly from the ion block.

- Use the needle-nose pliers to grasp the PEEK terminal block and partially lift it out of the ion block.

12. Holding the PEEK ion block gently, use the needle-nose pliers to gently grasp the heat-shrink tubing on the heater cartridge assembly, and carefully slide it and the PEEK terminal block out of the ion block.



13. Use the O-ring removal kit to carefully remove the cover seal from the ion block (see also [“Removing O-rings and seals” on page 97](#)).

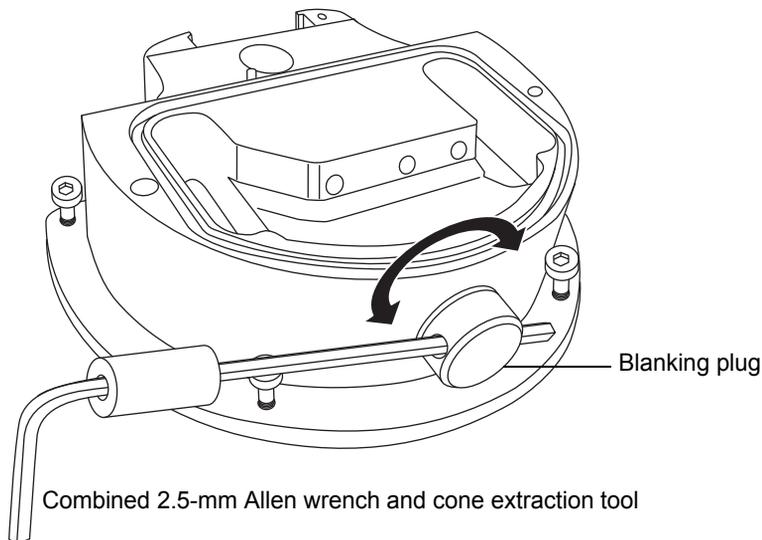


14. Use the O-ring removal kit to carefully remove the cone gas O-ring from the ion block.



**Warning:** To avoid spreading contamination, dispose of the cover seal and cone gas O-ring according to local environmental regulations. They can be contaminated with biohazards or toxic materials.

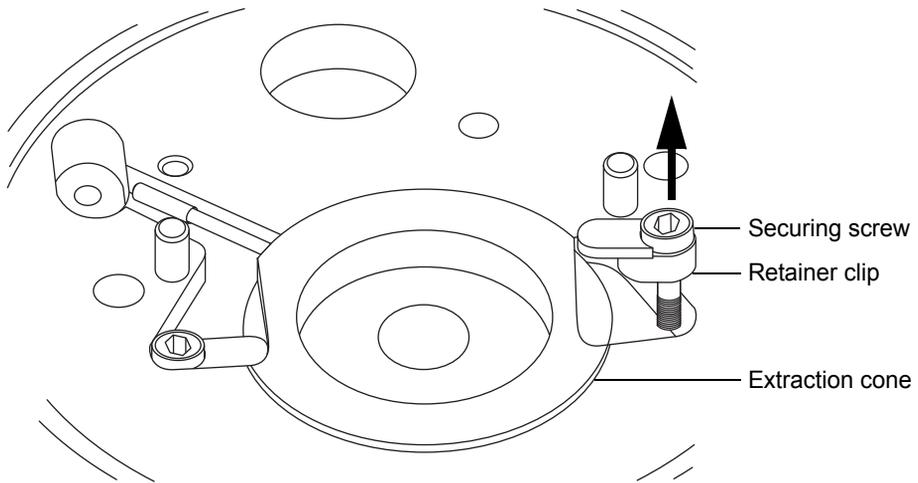
15. If the cover seal or cone gas O-ring shows signs of deterioration or damage, dispose of it in accordance with local environmental regulations.
16. Insert the combined 2.5-mm Allen wrench and cone extraction tool through the hole in the ion block blanking plug, and then unscrew and remove the ion block blanking plug and associated seal.



**Warning:** To avoid spreading contamination, dispose of the blanking plug seal according to local environmental regulations. It can be contaminated with biohazards or toxic materials.

17. If the blanking plug seal shows signs of deterioration or damage, dispose of it in accordance with local environmental regulations.

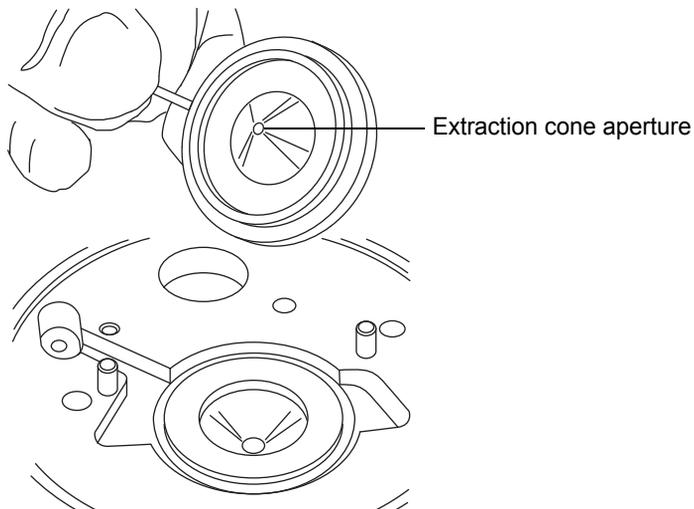
18. Use the combined 2.5-mm Allen wrench and cone extraction tool to remove the captive screws securing the 2 PEEK extraction cone retainer clips.



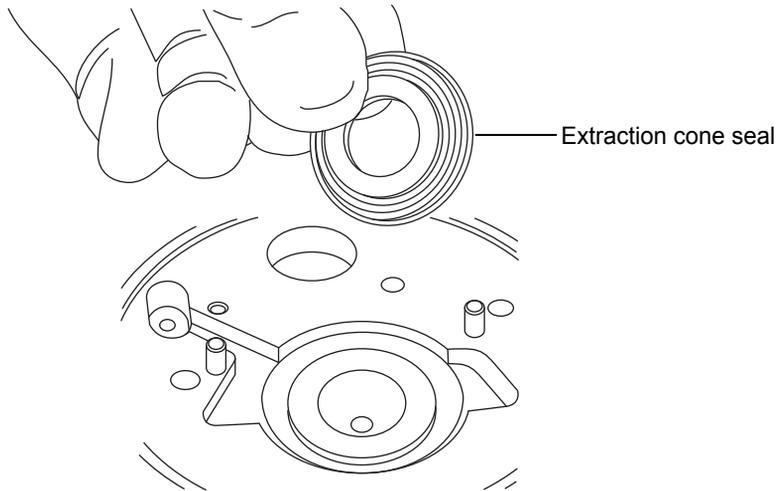
**Caution:**

- To avoid damaging the extraction cone aperture, take great care when removing the extraction cone from the ion block.
- To avoid damaging the fragile extraction cone, do not place it on its tip; instead, place it on its flanged base.

19. Remove the extraction cone from the ion block.



20. Remove the extraction cone handle insulator from the extraction cone handle.
21. Remove the extraction cone seal from the ion block.



## Cleaning the ion block components

### Required materials

- Chemical-resistant, powder-free gloves.
- Appropriately sized glass vessels in which to completely immerse components when cleaning. Use only glassware not previously cleaned with surfactants.
- HPLC-grade (or better) methanol.
- HPLC-grade (or better) water.
- Formic acid.
- Ultrasonic bath.
- Source of oil-free, inert gas (for example, nitrogen) for drying (air-drying optional).
- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water.
- Large beaker.



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the ion block components.



**Warning:** To avoid injury, work with extreme care. Use a fume hood, and suitable protective equipment. Formic acid is extremely corrosive and toxic.

### To clean the ion block components:

1. Immerse the ion block and isolation valve in separate glass vessels containing 1:1 methanol/water.

**Tip:** If the components are obviously contaminated, use 45:45:10 methanol/water/formic acid.

2. Place the vessels in the ultrasonic bath for 30 minutes.

3. If you used formic acid in the cleaning solution, do as follows:
  - a. Rinse the components by immersing them separately in glass vessels containing water and then placing the vessels in the ultrasonic bath for 20 minutes.
  - b. Dry the components by immersing them in separate glass vessels containing methanol and then placing the vessels in the ultrasonic bath for 10 minutes.



**Caution:** To avoid recontaminating the components, wear clean, chemical-resistant, powder-free gloves for the rest of this procedure.

4. Carefully remove the components from the vessels, and blow-dry them using inert, oil-free gas.
5. Inspect each component for persisting contamination. If contamination is present, do as follows:
  - a. Use the wash bottle containing 1:1 methanol/water to rinse the component over the large beaker.
  - b. Blow-dry the component with inert, oil-free gas.



**Warning:** To avoid spreading contamination, dispose of the components in accordance with local environmental regulations.

6. Inspect each component for persisting contamination. If contamination is present, dispose of the component, and obtain a new one before reassembly.

## Assembling the source ion block assembly

### Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool
- Needle-nose pliers
- Isopropyl alcohol in small container



#### Caution:

- To avoid recontaminating the ion block assembly, wear clean chemical-resistant, powder-free gloves during this procedure.
- To avoid damaging the fragile extraction cone, do not place it on its tip; instead, place it on its flanged base.

### To assemble the ion block assembly:

1. Fit the extraction cone seal to the ion block.



**Caution:** To avoid damaging the extraction cone aperture, take great care when fitting the extraction cone to the ion block.

2. Fit the extraction cone handle insulator to the extraction cone handle.
3. Fit the extraction cone to the ion block.
4. Fit the 2 PEEK extraction cone retainer clips to the ion block.
5. Use the combined 2.5-mm Allen wrench and cone extraction tool to tighten the captive screw securing each extraction cone retainer clip to the ion block.
6. Fit the blanking plug seal to the ion block blanking plug. (Fit a new seal if the old one has been disposed of.)
7. Fit the blanking plug to the ion block and finger tighten it.
8. Insert the combined 2.5-mm Allen wrench and cone extraction tool through the hole in the blanking plug and use it to fully tighten the plug.



**Caution:** To avoid damaging the heater cartridge assembly wires, do not bend or twist them when fitting the assembly to the ion block.

9. Using the needle-nose pliers to gently grasp the heat-shrink tubing on the heater cartridge assembly, slide the assembly and the PEEK terminal block into the ion block.
10. Use the combined 2.5-mm Allen wrench and cone extraction tool to tighten the captive PEEK terminal block securing screw.
11. Ensure that the grooves for the cover seal, cone gas O-ring, and isolation valve O-ring are free from dirt and debris.  
**Tip:** If contamination is present, use 1:1 methanol/water, applied to a lint-free cloth, to carefully clean the grooves.
12. Fit the cover seal to the ion block, ensuring that it is correctly seated. (Fit a new seal if the old one has been disposed of.)
13. Fit the cone gas O-ring to the ion block, ensuring that it is correctly seated. (Fit a new O-ring if the old one has been disposed of.)
14. If the old isolation valve O-ring has been disposed of, soak a new O-ring in isopropyl alcohol for a few minutes.  
**Rationale:** Doing so lubricates the O-ring and aids your fitting the O-ring to the isolation valve.
15. Fit the O-ring to the isolation valve.
16. Fit the isolation valve to the ion block assembly, so that it is in the closed position.
17. Fit the ion block cover plate to the ion block assembly, and then use the combined 2.5-mm Allen wrench and cone extraction tool to tighten the 2 ion block cover plate captive securing screws.
18. Hold the sampling cone assembly so that the cone gas nozzle handle is oriented horizontally and at the top, and then slide the sampling cone assembly into the ion block assembly.
19. Grasp the sampling cone assembly handle, and use it to rotate the sampling cone assembly through 90 degrees.
20. Fit the ion block assembly to the source assembly (see [“Fitting the ion block assembly to the source assembly” on page 126](#)).

## Cleaning the source hexapole assembly

---

Clean the source hexapole assembly if cleaning the ion block, isolation valve, and extraction cone fails to increase signal sensitivity.

### Removing the ion block assembly, ion block support, and hexapole from the source assembly

#### Required materials

- Chemical-resistant, powder-free gloves
- 3-mm Allen wrench
- O-ring removal kit

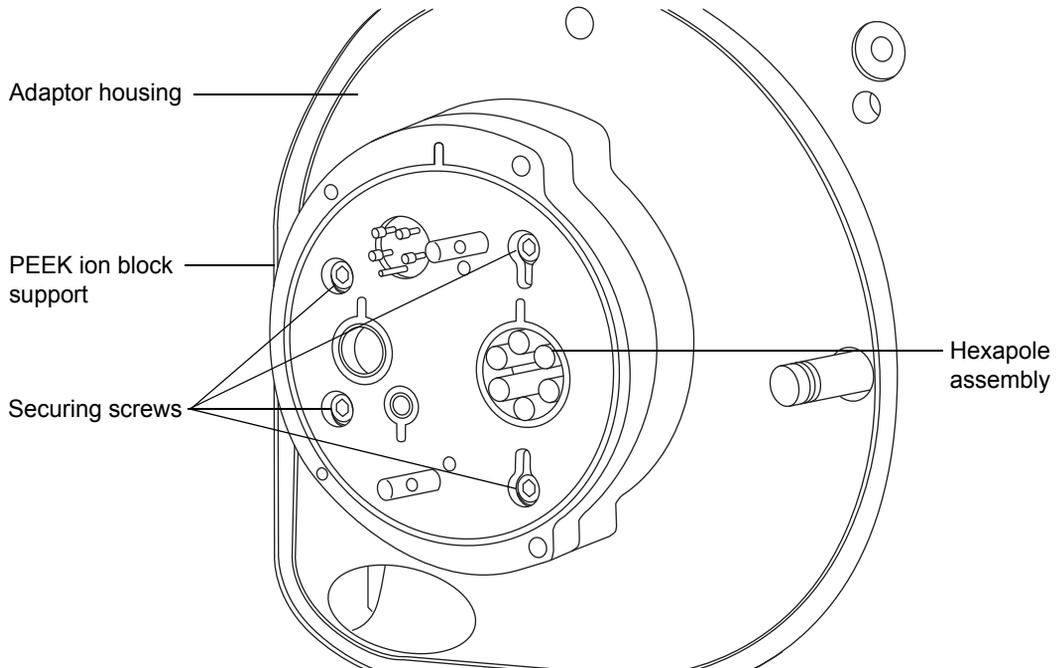


**Warning:** To avoid personal contamination with biohazards or compounds that are toxic or corrosive, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the source components.

#### To remove the ion block assembly, ion block support, and hexapole:

1. Remove the ion block assembly from the PEEK ion block support (see [“Removing the ion block assembly from the source assembly”](#) on page 120).

2. Use the 3-mm Allen wrench to unscrew and remove the 4 screws securing the PEEK ion block support to the adaptor housing.



3. Remove the PEEK ion block support from the adaptor housing.
4. Use the O-ring removal kit to carefully remove all the O-rings from the PEEK ion block support (see [“Removing O-rings and seals”](#) on page 97).



**Warning:** To avoid contaminating uncontaminated surfaces with biohazards or compounds that are toxic or corrosive, dispose of the O-rings according to local environmental regulations.

5. If any of the O-rings show signs of deterioration or damage, dispose of them in accordance with local environmental regulations.



**Caution:** To avoid damage when removing the hexapole assembly from the adaptor housing:

- avoid scratching the internal surfaces of the adaptor block.
- do not compress the hexapole rods.

6. Carefully grasp the source hexapole assembly and remove it from the adaptor housing.

## Cleaning the hexapole assembly

### Required materials

- Chemical-resistant, powder-free gloves.
- 500-mL measuring cylinder or appropriately sized glass vessel in which to completely immerse the hexapole when cleaning. Use only glassware not previously cleaned with surfactants.
- Length of small diameter PEEK or Teflon<sup>®</sup> tubing appropriately sized for suspending the hexapole in the glass vessel when cleaning.
- HPLC-grade (or better) methanol.
- Ultrasonic bath.
- Source of oil-free, inert gas (for example, nitrogen) for drying (air-drying optional).
- HPLC-grade (or better) 1:1 methanol/water.
- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water.
- Large beaker.
- Small, flat-blade screwdriver.



**Warning:** To avoid personal contamination with biohazards or compounds that are toxic or corrosive, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the source hexapole assembly.

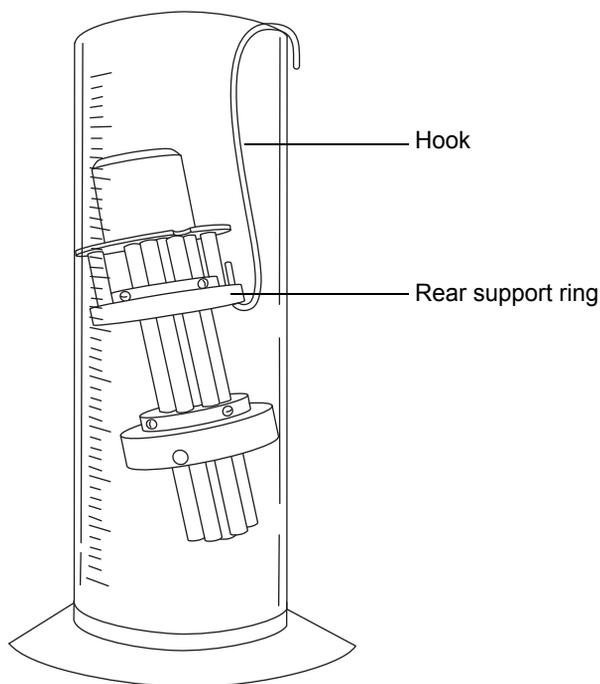
### To clean the source hexapole assembly:

1. Bend the PEEK or Teflon tube into a hook shape.
2. Insert one end of the hook into one of the holes on the hexapole assembly's rear support ring.



**Caution:** To avoid vibration damage to the hexapole assembly, ensure that the bottom of the assembly is not in contact with the bottom of the glass vessel.

3. Use the hook to carefully suspend the hexapole assembly in the glass vessel so that the bottom of the assembly does not touch the bottom of the vessel.



4. Add 1:1 methanol/water to the glass vessel until the hexapole assembly is immersed completely.
5. Place the vessel in the ultrasonic bath for 30 minutes.



**Caution:** To avoid recontaminating the hexapole assembly, wear clean, chemical-resistant, powder-free gloves for the rest of this procedure.

6. Carefully remove the hexapole assembly from the vessel, and blow-dry it using inert, oil-free gas.
7. Inspect the hexapole assembly for persisting contamination, If contamination is present, do as follows:
  - a. Use the wash bottle containing methanol to rinse the source hexapole assembly over the large beaker.
  - b. Blow-dry the hexapole assembly with inert, oil-free gas.
8. Use the small flat-blade screwdriver to ensure that the hexapole assembly screws are tight.

## Fitting the hexapole assembly, PEEK ion block support, and ion block assembly to the source assembly

### Required materials

- Chemical-resistant, powder-free gloves
- 3-mm Allen wrench
- Lint-free cloth
- HPLC-grade (or better) 1:1 methanol/water
- New seals and O-rings



**Caution:** To avoid recontaminating the source, wear clean, chemical-resistant, powder-free gloves during this procedure.

### To fit the hexapole assembly and PEEK ion block support to the source:



**Caution:** To avoid damage when fitting the hexapole assembly into the adaptor housing:

- avoid scratching the internal surfaces of the adaptor block.
  - do not compress the hexapole rods.
1. Carefully fit the source hexapole assembly into the adaptor housing, aligning the notches in the differential aperture at its rear with the two bottom support rails on the analyzer assembly. Then carefully slide the assembly fully into place.
  2. Ensure that the grooves for the PEEK ion block support O-rings are free from dirt and debris.

**Tip:** If contamination is present, use 1:1 methanol/water, applied to a lint-free cloth, to carefully clean the grooves.

3. Fit the O-rings to the PEEK ion block support. Fit new O-rings if any of the old O-rings were disposed of.

**Tip:** To fit an O-ring in its groove, start fitting the O-ring at the notch in the groove, and then progressively work the ring into the groove, in either direction from the notch.

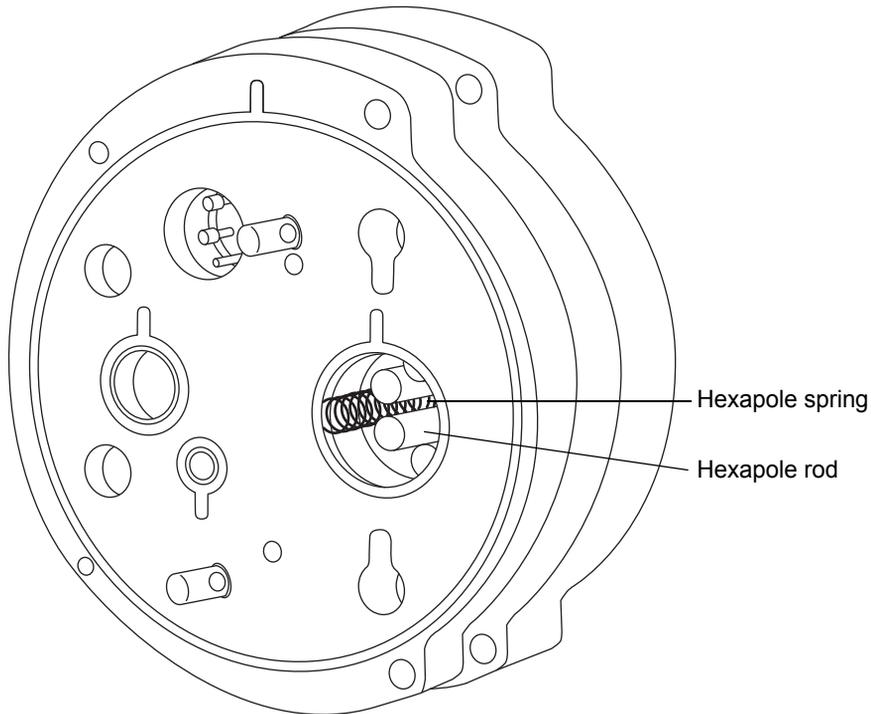
4. Fit the PEEK ion block support to the instrument's housing.



**Caution:** To ensure correct operation of the instrument, the hexapole springs must not touch a hexapole rod.

5. Use the 3-mm Allen wrench to fit and tighten the 4 PEEK ion block support securing screws.

**Tip:** Look through the PEEK ion block support as you tighten the securing screws. Ensure that the hexapole springs do not buckle and touch a hexapole rod.



6. Fit the ion block assembly to the PEEK ion block support (see [“Cleaning the source hexapole assembly” on page 140](#)).

## Replacing the ESI probe tip and gasket

---

Replace the ESI probe tip if a blockage occurs in the internal metal sheathing through which the stainless steel capillary passes or if the probe tip is damaged.

### Removing the ESI probe tip and gasket

#### Required materials

- Chemical-resistant, powder-free gloves
- 7-mm wrench
- 10-mm wrench



**Warning:** To avoid personal contamination with biohazards or compounds that are toxic or corrosive, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the probe and source components.



**Warning:** To avoid burn injuries, take great care while performing this procedure; the probe and source can be hot.

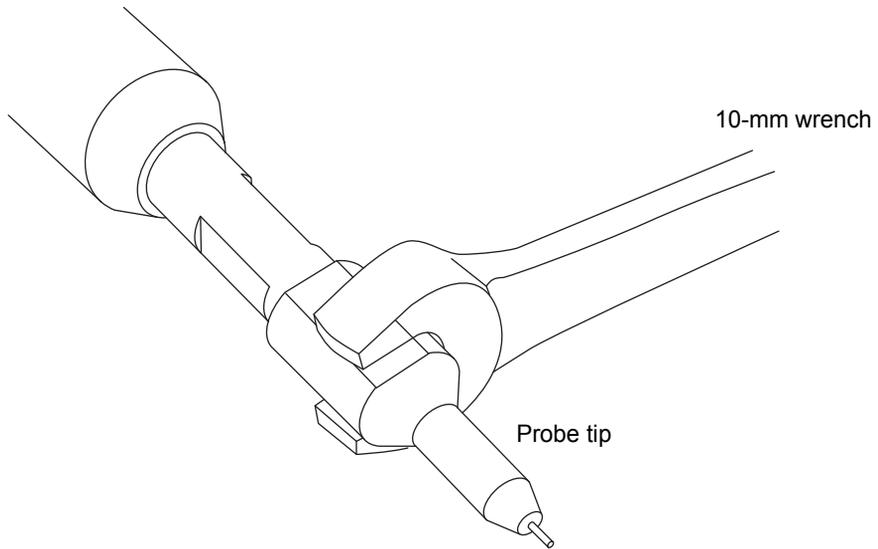


**Warning:** To avoid puncture wounds, handle the probe with care; the ESI probe tip is sharp.

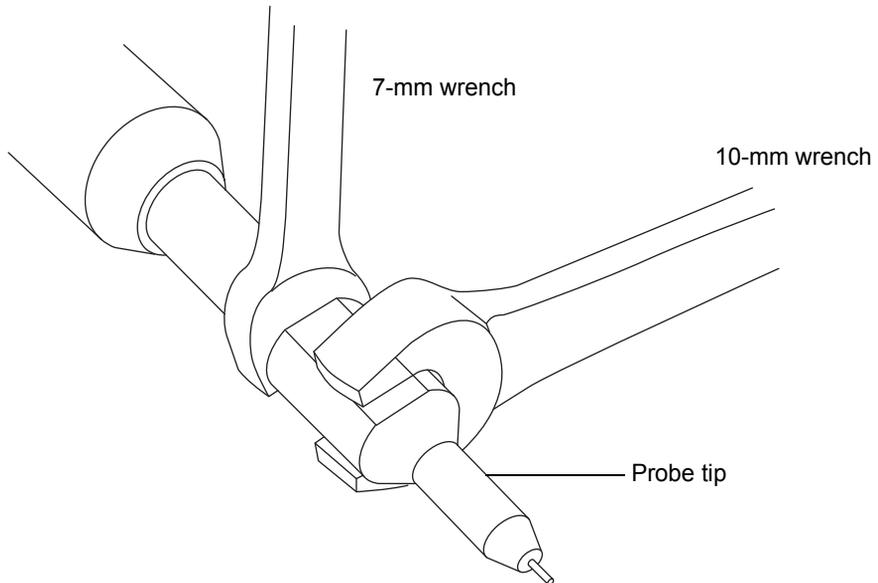
#### To remove the ESI probe tip and gasket:

1. Remove the ESI probe from the source (see [“Removing the ESI probe” on page 56](#)).

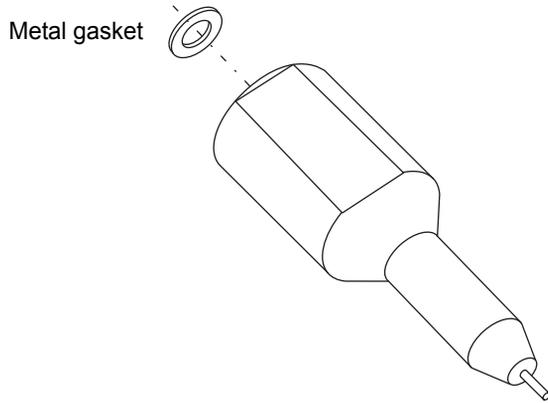
2. Use the 10-mm wrench to remove the probe tip.



**Tip:** If the probe tip is difficult to remove, use the 7-mm wrench in conjunction with the 10-mm wrench.



3. Remove the metal gasket from the probe tip.



**Warning:** To avoid spreading contamination, dispose of the probe tip and metal gasket according to local environmental regulations. They can be contaminated with biohazards or toxic materials.

4. Dispose of the metal gasket in accordance with local environmental regulations.
5. If the probe tip is damaged, dispose of it in accordance with local environmental regulations.

## Fitting the ESI probe tip and gasket

### Required materials

- Chemical-resistant, powder-free gloves
- 10-mm wrench



**Warning:** To avoid personal contamination with biohazards or compounds that are toxic or corrosive, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the probe and source components.



**Warning:** To avoid puncture wounds, handle the probe with care; the ESI probe tip is sharp.

### To fit the ESI probe tip and gasket:

1. Fit the metal gasket into the probe tip. Use a new metal gasket or probe tip if the old ones were disposed of.
2. Fit the probe tip over the capillary, and screw the tip onto the probe assembly.



**Caution:** To avoid gas leakage, fully tighten the probe tip.

3. Use the 10-mm wrench to tighten the probe tip.
4. Use the nebulizer adjuster knob to adjust the capillary so that it protrudes by approximately 0.5 mm from the end of the probe.
5. Fit the ESI probe to the source (see [“Installing the ESI probe”](#) on page 52).

## Replacing the ESI probe sample capillary

---

Replace the stainless steel sample capillary in the ESI probe if it becomes blocked and cannot be cleared, or if it becomes contaminated or damaged.

### Removing the existing capillary

#### Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool
- 7-mm wrench
- 8-mm wrench
- 10-mm wrench
- Needle-nose pliers



**Warning:** To avoid personal contamination with biohazards or compounds that are toxic or corrosive, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the probe and source components.



**Warning:** To avoid burn injuries, take great care while performing this procedure; the probe and source can be hot.

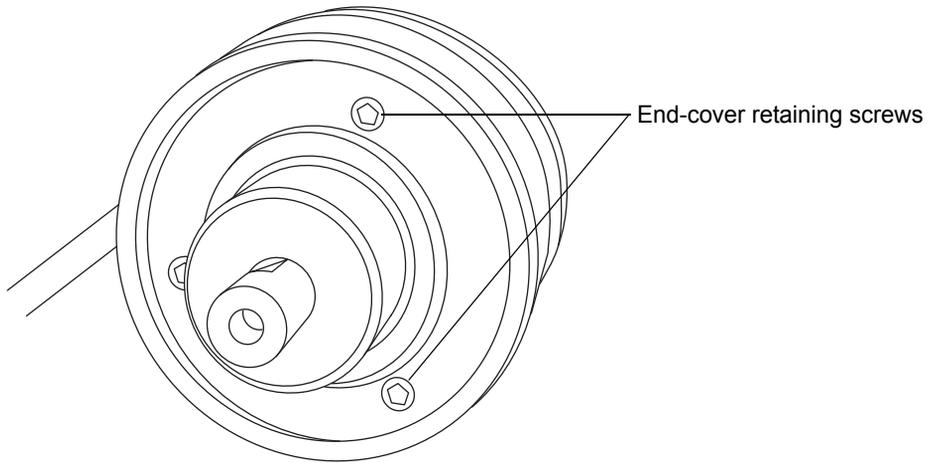


**Warning:** To avoid puncture wounds, handle the probe with care; the ESI probe tip is sharp.

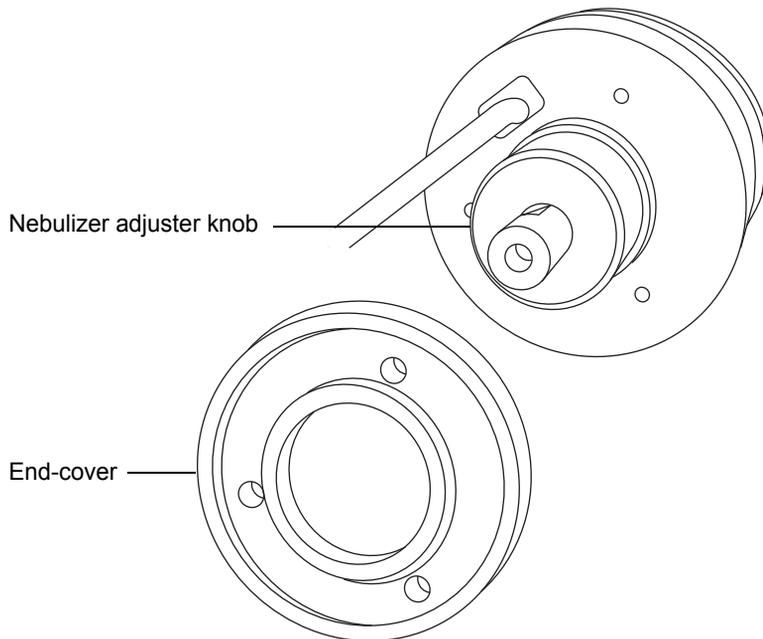
#### To remove the existing capillary:

1. Remove the probe from the source (see [“Removing the ESI probe” on page 56](#)).

2. Use the combined 2.5-mm Allen wrench and cone extraction tool to remove the 3 probe end-cover retaining screws.

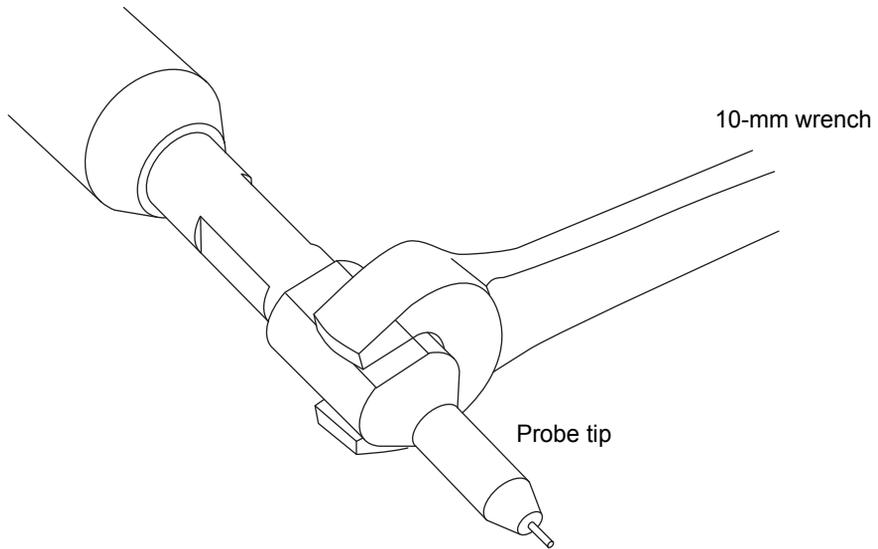


3. Remove the end-cover from the probe assembly.

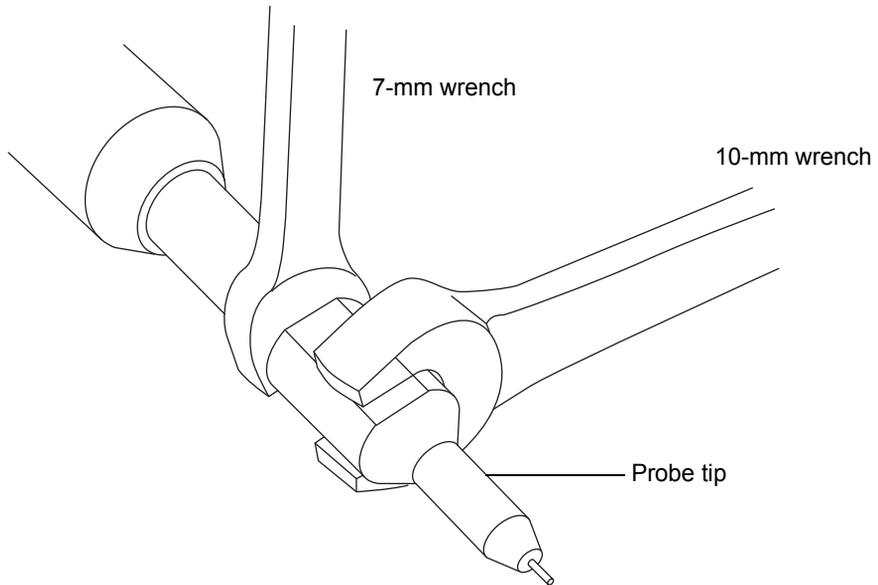


4. Unscrew and remove the nebulizer adjuster knob.

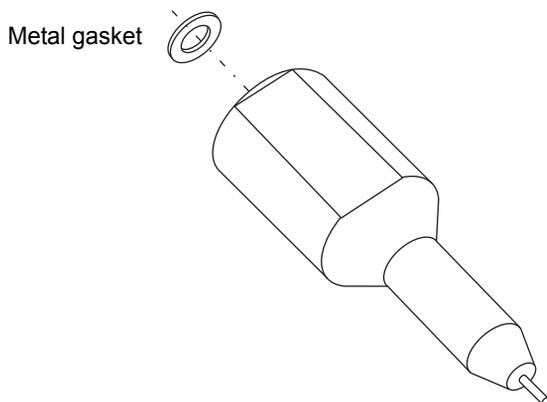
5. Use the 10-mm wrench to remove the probe tip.



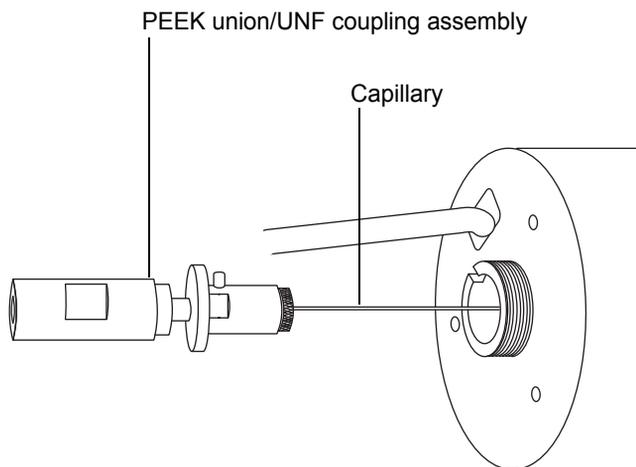
**Tip:** If the probe tip is difficult to remove, use the 7-mm wrench in conjunction with the 10-mm wrench.



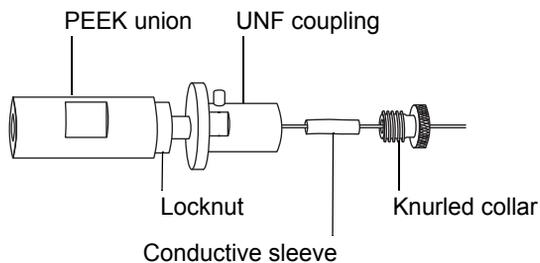
- Remove the metal gasket from the probe tip.



- Remove the PEEK union/UNF coupling assembly and capillary from the probe.



- Unscrew and remove the knurled collar from the UNF coupling.

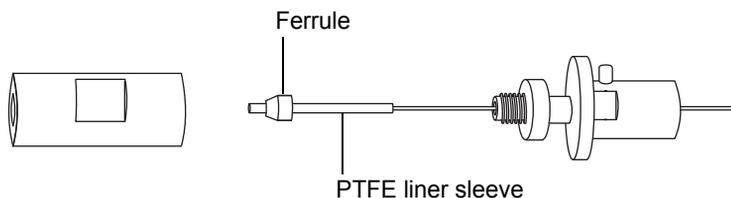


- Remove the knurled collar and conductive sleeve from the capillary.

10. Use the 7-mm wrench to loosen the locknut.

**Tip:** Use the 8-mm wrench, to steady the UNF coupling when loosening the locknut.

11. Unscrew the PEEK union from the UNF coupling (this connection is finger-tight only).



12. Remove the ferrule and PTFE liner sleeve from the capillary.

13. Remove the capillary from the UNF coupling.



**Warning:** To avoid spreading contamination, dispose of the capillary, PTFE liner sleeve, and ferrule according to local environmental regulations. They can be contaminated with biohazards or toxic materials.

14. Dispose of the capillary, PTFE liner sleeve, and ferrule in accordance with local environmental regulations.

## Installing the new capillary

### Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool
- 10-mm wrench
- Needle-nose pliers
- LC pump
- HPLC-grade (or better) 1:1 acetonitrile/water
- Capillary
- Ferrule
- Seal
- PTFE liner tube
- Conductive sleeve
- Red, PEEK tubing
- Sharp knife



**Warning:** To avoid personal contamination with biohazards or compounds that are toxic or corrosive, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the probe and source components.

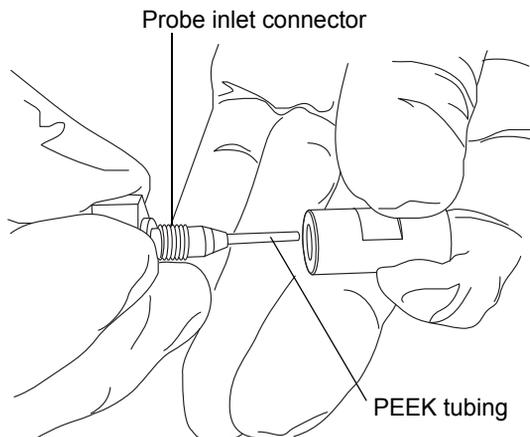


**Warning:** To avoid puncture wounds, handle the probe with care; the ESI probe tip is sharp.

### To install the new capillary:

1. Use the sharp knife to cut an approximately 60 cm (24 inches) piece of red, PEEK tubing squarely (that is, perpendicular to its horizontal axis).
2. Insert one end of the red, PEEK tubing in the probe inlet connector, and screw the connector, finger-tight, into the PEEK union.

**Rationale:** Doing so ensures a minimum dead volume when fitting the capillary.



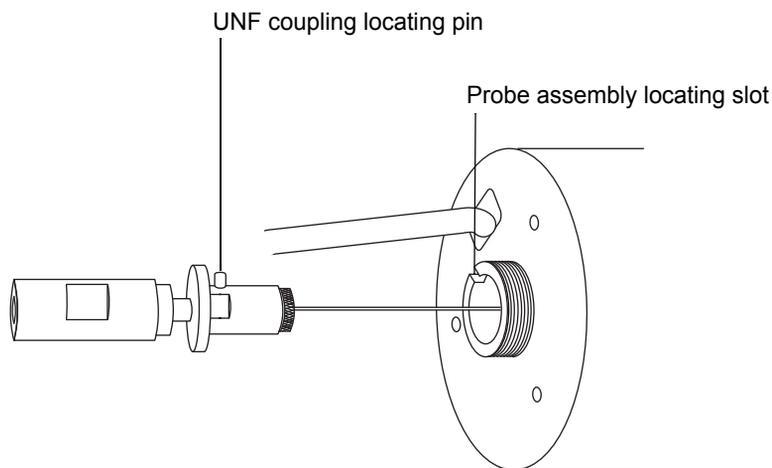
3. Fit the UNF coupling to the new capillary.
4. Use the needle-nose pliers to slide a new liner sleeve and ferrule onto the capillary.
5. Insert the capillary in the PEEK union, and ensure that it is fully seated.
6. Screw the UNF coupling into the PEEK union, finger-tight only.
7. Gently tug on the capillary, testing to ensure that it stays in place.
8. Use the 7-mm wrench to tighten the locknut against the PEEK union until the union can no longer be twisted.
9. Slide a new conductive sleeve and the knurled collar over the capillary.
10. Tighten the knurled collar to the UNF coupling.



**Warning:** To avoid high-pressure liquid jet spray, wear safety goggles when performing the leak test.

11. Perform a leak test by attaching the free end of the PEEK tubing to an LC pump and pumping 50:50 acetonitrile/water through it, at 1 mL/min.
  - If leakage occurs, disassemble and remake the connection, and repeat the leak test.
  - If the backpressure on the LC pump is high, replace the capillary, and repeat the leak test.
12. When no leakage occurs and the backpressure on the LC pump is normal, disconnect the PEEK tubing from the LC pump.

13. Remove the probe inlet connector and PEEK tubing from the PEEK union.
14. Carefully thread the capillary through the probe assembly.
15. Carefully push the PEEK union/UNF coupling assembly and capillary into the probe assembly so that the locating pin on the UNF coupling is fully engaged in the locating slot at the head of the probe assembly.



16. Fit the nebulizer adjuster knob to the PEEK union/UNF coupling assembly.
17. Finger-tighten the nebulizer adjuster knob onto the probe assembly.
18. Fit the end-cover to the probe assembly.
19. Use the combined 2.5-mm Allen wrench and cone extraction tool to fit and tighten the 3 probe end-cover retaining screws.
20. Fit the metal gasket to the probe tip.
21. Fit the probe tip over the capillary, and screw the tip onto the probe assembly.



**Caution:** To avoid gas leakage, fully tighten the probe tip.

22. Use the 10-mm wrench to tighten the probe tip.
23. Use the nebulizer adjuster knob to adjust the capillary so that it protrudes by approximately 0.5 mm from the end of the probe tip.
24. Fit the ESI probe to the source (see also [“Installing the ESI probe” on page 52](#)).

## Cleaning the APCI probe tip

---

Clean the APCI probe tip when you detect buffer buildup on the probe tip or when the signal intensity weakens. See the mass spectrometer's online Help for further details.

### To clean the APCI probe tip:

1. On the Instrument Console system tree, click Xevo TQ MS > Manual optimization.
2. On the manual optimization page, click  to stop the liquid flow.
3. Click Gas  to start the desolvation gas.
4. Set Desolvation Gas to 650 L/hr.
5. Set APCI Probe Temp to 650 °C.
6. Click Operate  .
7. Wait 10 minutes.  
**Rationale:** The high APCI probe heater temperature removes any chemical contamination from the probe tip.
8. Click Standby  .

## Replacing the APCI probe sample capillary

Replace the stainless steel sample capillary in the APCI probe if it becomes blocked and you cannot clear it, or if it becomes contaminated or damaged.

### Removing the existing capillary

#### Required materials

- Chemical-resistant, powder-free gloves
- 7-mm wrench
- Combined 2.5-mm Allen wrench and cone extraction tool



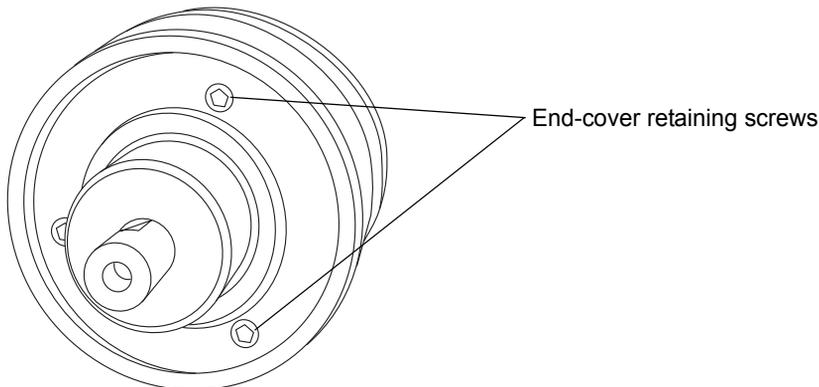
**Warning:** To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the probe and source components.



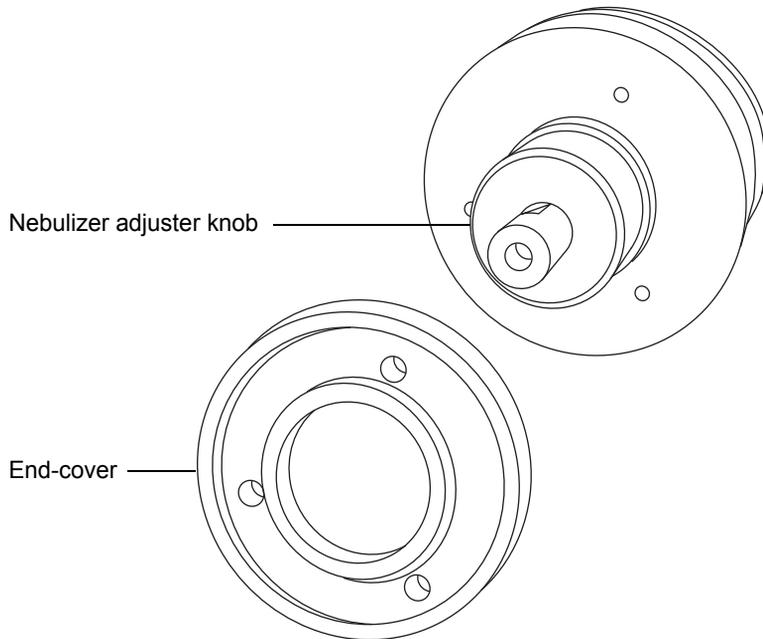
**Warning:** To avoid burn injuries, take great care while performing this procedure; the probe and source can be hot.

#### To remove the existing capillary:

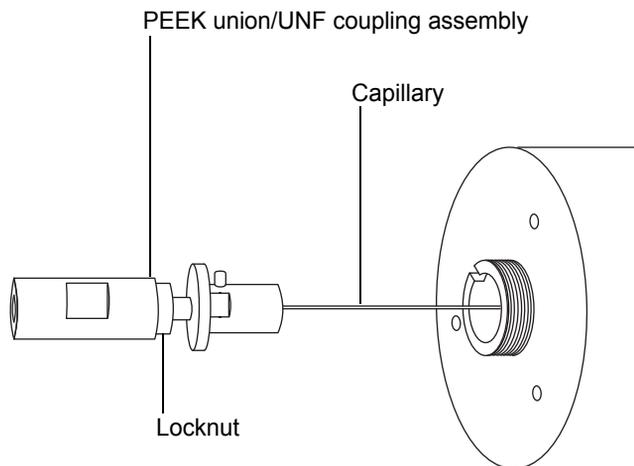
1. Remove the probe from the source (see [“Removing the APCI probe” on page 60](#)).
2. Use the combined 2.5-mm Allen wrench and cone extraction tool to remove the 3 probe end-cover retaining screws.



3. Remove the end-cover.

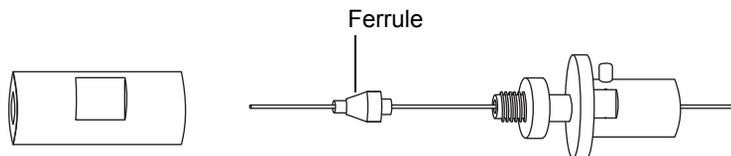


4. Unscrew and remove the nebulizer adjuster knob.
5. Remove the PEEK union/UNF coupling assembly and capillary from the probe.



6. Use the 7-mm wrench to loosen the locknut.

7. Unscrew the PEEK union from the UNF coupling (this connection is finger-tight).



8. Remove the ferrule from the capillary.
9. Remove the capillary from the UNF coupling.



**Warning:** To avoid spreading contamination, dispose of the capillary and ferrule according to local environmental regulations. They can be contaminated with biologically hazardous, or corrosive materials.

10. Dispose of the capillary and ferrule in accordance with local environmental regulations.

## Installing the new capillary

### Required materials

- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- 7-mm wrench
- Combined 2.5-mm Allen wrench and cone extraction tool
- Red, PEEK tubing
- LC pump
- HPLC-grade (or better) 1:1 acetonitrile/water
- Capillary
- Sharp knife

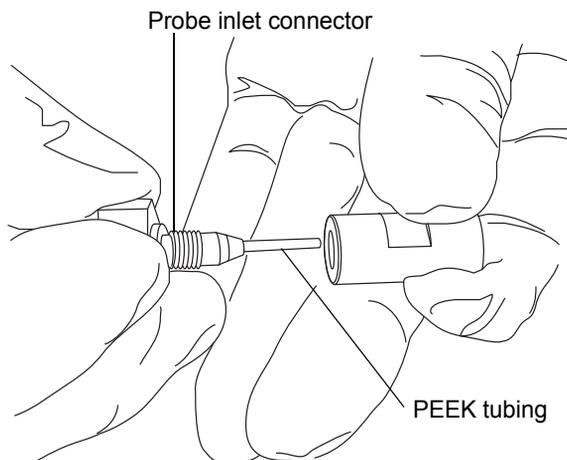


**Warning:** To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the probe and source components.

### To install the new capillary:

1. Use the sharp knife to cut an approximately 60 cm (24 inches) piece of red, PEEK tubing squarely (that is, perpendicular to its horizontal axis).
2. Insert one end of the red, PEEK tubing in the probe inlet connector, and screw the connector, finger-tight, into the PEEK union.

**Rationale:** Doing so ensures a minimum dead volume when fitting the capillary.



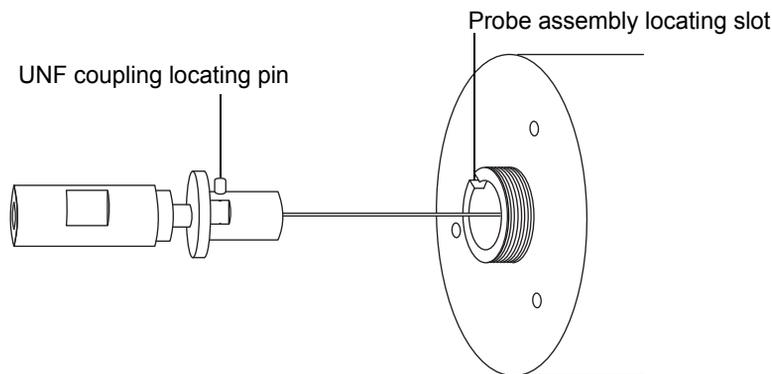
3. Fit the UNF coupling to the new capillary.
4. Use the needle-nose pliers to slide a new ferrule onto the capillary.
5. Insert the capillary in the PEEK union, and ensure that it is fully seated.
6. Screw the UNF coupling into the PEEK union, finger-tight only.
7. Gently tug on the capillary, testing to ensure that it stays in place.
8. Use the 7-mm wrench to tighten the locknut against the PEEK union.



**Warning:** To avoid high-pressure liquid jet spray, wear safety goggles when performing the leak test.

9. Perform a leak test by attaching the free end of the PEEK tubing to an LC pump and pumping 50:50 acetonitrile/water through it at 1 mL/min.
  - If leakage occurs, disassemble and remake the connection, and repeat the leak test.
  - If the backpressure on the LC pump is high, replace the capillary, and repeat the leak test.
10. When no leakage occurs and the backpressure on the LC pump is normal, disconnect the PEEK tubing from the LC pump.
11. Remove the probe inlet connector and PEEK tubing from the PEEK union.
12. Remove the probe heater (see [“Replacing the APCI probe heater”](#) on page 166, step 2 through step 4).

13. Fit the PEEK union/UNF coupling assembly to the nebulizer adjuster knob.
14. Carefully thread the capillary through the probe assembly.
15. Carefully push the PEEK union/UNF coupling assembly and capillary into the probe assembly so that the locating pin on the UNF coupling is fully engaged in the locating slot at the head of the probe assembly.



16. Fit the nebulizer adjuster knob to the PEEK union/UNF coupling assembly.
17. Finger tighten the nebulizer adjuster knob onto the probe assembly.
18. Fit the probe end-cover to the probe assembly.
19. Use the combined 2.5-mm Allen wrench and cone extraction tool to fit and tighten the 3 end-cover securing screws.



**Caution:**

- To avoid damaging the probe heater's electrical wiring, grip the heater with great care.
  - To avoid damaging the probe heater's electrical connections, capillary sleeve, or capillary, take great care when fitting the heater over the capillary sleeve.
20. Fit the probe heater (see [“Replacing the APCI probe heater”](#) on page 166, [step 1](#) through [step 5](#)).
  21. Fit the probe to the instrument (see [“Installing the APCI probe”](#) on page 58).
  22. In the Instrument Console, click API  to start the probe and desolvation gas flows.

## Cleaning or replacing the corona pin

---

### Required materials

- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- HPLC-grade (or better) methanol
- Lint-free tissue
- Lapping film
- Corona pin



**Warning:** To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the probe and source components.



**Warning:** To avoid burn injuries, take great care while performing this procedure; the probe and source can be hot.



**Warning:** To avoid electric shock, ensure that the instrument is in Standby mode before commencing this procedure.



**Warning:** To avoid puncture wounds, handle the corona pin with care; the corona pin tip is sharp.

### To clean or replace the corona pin:

1. Remove the corona pin from the source (see [“Removing the corona pin from the source”](#) on page 93).
2. Replace the corona pin if it is deformed or otherwise damaged. Otherwise clean its tip with the lapping film, and then wipe it clean with a methanol-saturated tissue.
3. Install the corona pin in the source (see [“Installing the corona pin in the source”](#) on page 90).

## Replacing the APCI probe heater

---

Replace the APCI probe heater if it fails to heat.

### Removing the APCI probe heater

#### Required materials

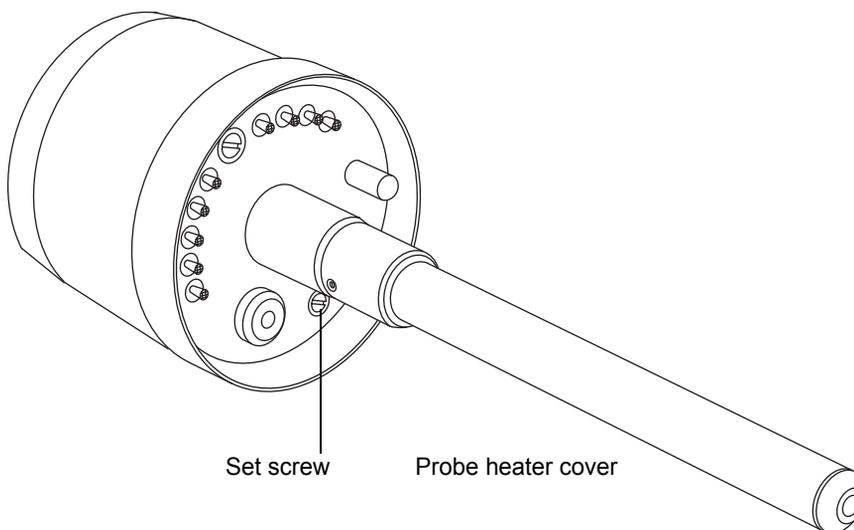
- Chemical-resistant, powder-free gloves
- Flat-blade, jeweler's screwdriver



**Warning:** To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the probe and source components.

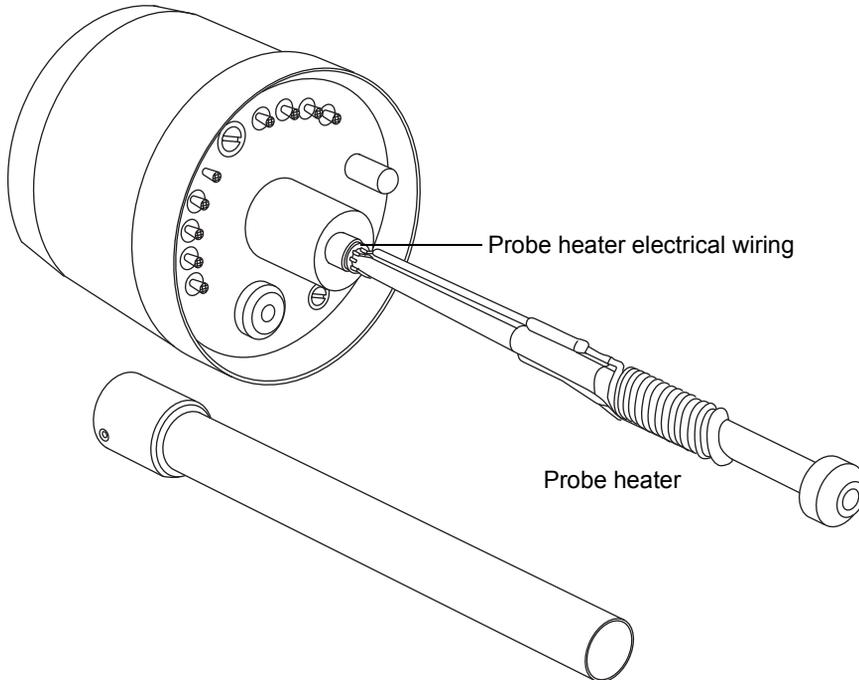
#### To remove the APCI probe heater:

1. Remove the probe from the source (see [“Removing the APCI probe” on page 60](#)).
2. Use the jeweler's screwdriver to loosen the 2 set screws securing the probe heater cover to the probe.



 **Caution:** To avoid damaging the probe heater's electrical wiring, take great care when removing the probe heater cover or while the probe heater is exposed.

3. Carefully pull the probe heater cover off the probe.

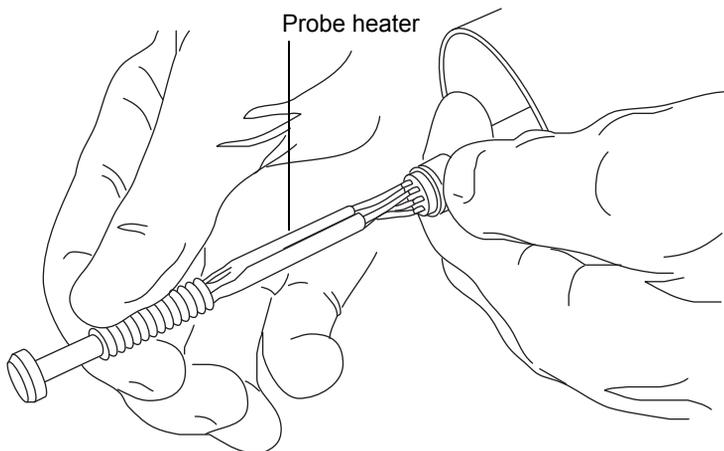




**Caution:**

- To avoid damaging the probe heater's electrical wiring, take great care when gripping and handling the heater.
- To avoid damaging the probe heater's electrical connections, do not twist the heater when removing it from the probe assembly.

4. Gripping the probe heater as shown, carefully pull it off the probe assembly.



**Warning:** To avoid spreading contamination, dispose of the probe heater according to local environmental regulations. It can be contaminated with biohazardous, or toxic materials.

5. Dispose of the probe heater in accordance with local environmental regulations.

## Fitting the new APCI probe heater

### Required materials

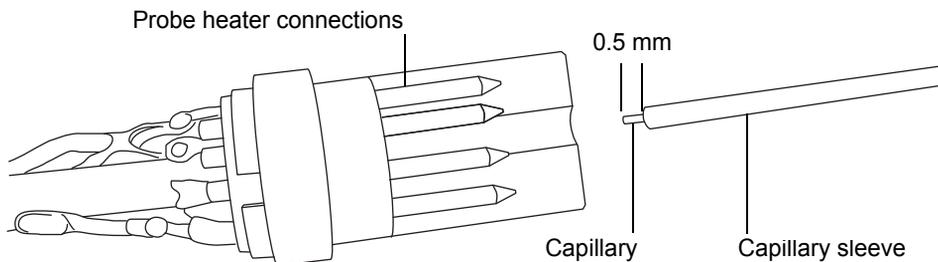
- Chemical-resistant, powder-free gloves
- Flat-blade, jeweler's screwdriver
- APCI probe heater

### To fit the new APCI probe heater:



#### Caution:

- To avoid damaging the probe heater's electrical wiring, take great care when gripping and handling the heater.
  - Take great care not to damage the probe heater's electrical connections, capillary sleeve, or capillary when fitting the heater over the capillary sleeve.
1. Use the probe adjuster knob to adjust the capillary so that it protrudes approximately 0.5 mm from the end of the probe.



2. Carefully slide the probe heater over the capillary sleeve on the probe assembly.



**Caution:** To avoid damaging the probe heater's electrical connections, do not twist the heater when fitting it to the probe assembly.

3. Fit the probe heater to the probe assembly, ensuring that the heater is fully seated on the probe assembly.
4. Fit the probe heater cover to the probe assembly.

5. Use the jeweler's screwdriver to tighten the 2 set screws securing the probe heater cover to the probe.
6. Fit the probe to the instrument (see [“Installing the APCI probe” on page 58](#)).
7. In the Instrument Console, click API  to start the desolvation gas.

## Replacing the ion block source heater

---

Replace the ion block source heater if it fails to heat when the instrument is pumped down (evacuated).

### Required materials

- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- Combined 2.5-mm Allen wrench and cone extraction tool
- Ion block source heater

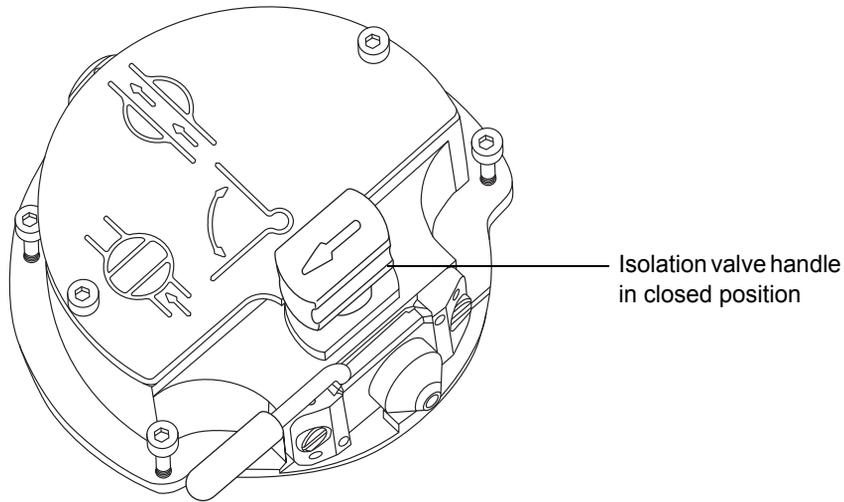


**Warning:** To avoid personal contamination with biohazards or compounds that are toxic or corrosive, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the ion block assembly.

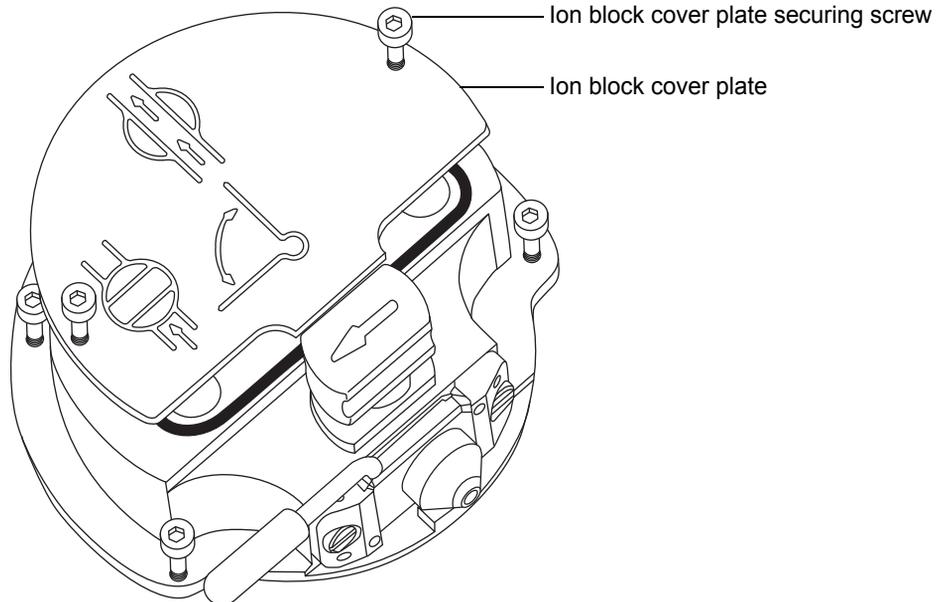
### To replace the ion block source heater:

1. Remove the ion block assembly from the instrument (see [“Removing the ion block assembly from the source assembly” on page 120](#)).

2. Ensure that the isolation valve is closed.



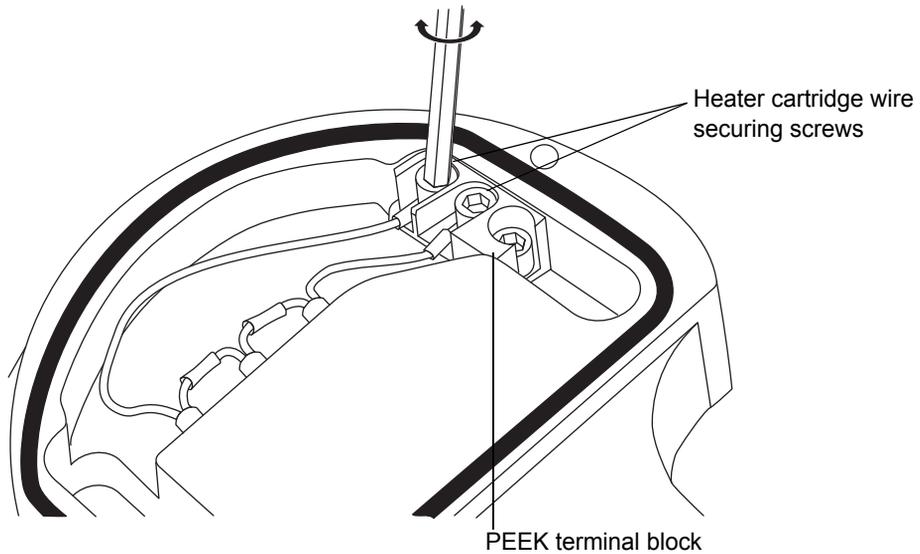
3. Use the combined 2.5-mm Allen wrench and cone extraction tool to loosen the 2 captive screws securing the ion block cover plate.



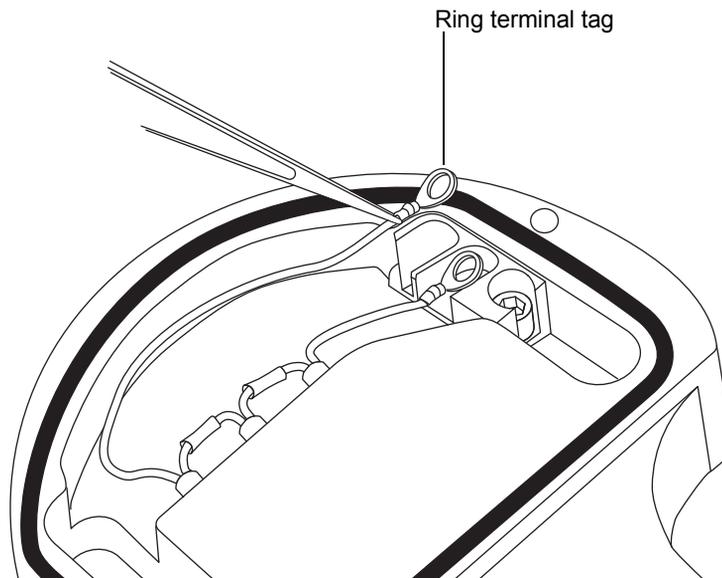
4. Remove the ion block cover plate.

#### 4 Maintenance Procedures

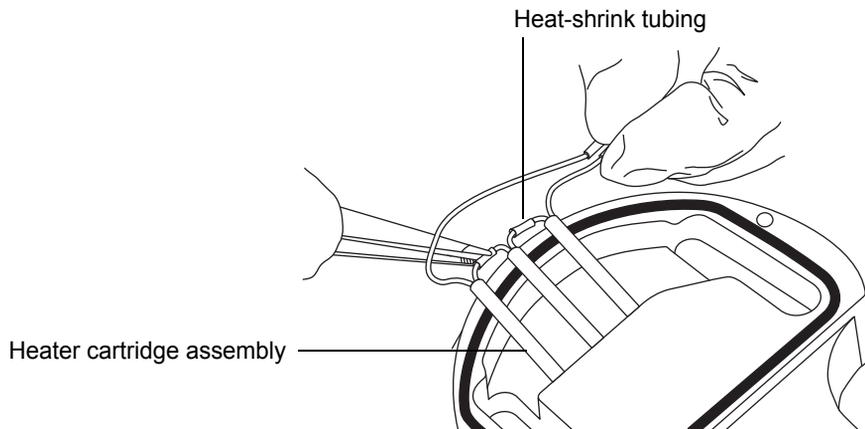
5. Use the combined 2.5-mm Allen wrench and cone extraction tool to remove the 2 screws securing the heater wires to the PEEK terminal block.



6. Use the needle-nose pliers to carefully swing the ring terminal tags out of the terminal block.



7. Use the needle-nose pliers to gently grasp the heat-shrink tubing on the heater cartridge assembly and slide the assembly out of the ion block.



8. Dispose of the heater cartridge assembly.



**Caution:** To avoid damaging the heater cartridge assembly wires, do not bend or twist them when fitting the assembly to the ion block.

9. Use the needle-nose pliers to gently grasp the heat-shrink tubing on the new heater cartridge assembly and slide the assembly into the ion block.



**Caution:** To avoid a short circuit to the ion block cover, ensure that the 2 heater cartridge ring tags are pushed fully down on the PEEK block terminals.

10. Use the needle-nose pliers to position the 2 heater wire ring tags fully down on the PEEK block terminals.
11. Use the combined 2.5-mm Allen wrench and cone extraction tool to fit and tighten the 2 screws securing the heater wires to the PEEK terminal block.
12. Fit the ion block cover plate to the ion block assembly, and then use the combined 2.5-mm Allen wrench and cone extraction tool to tighten the 2 captive screws securing ion block cover plate.
13. Fit the ion block assembly to the instrument (see [“Cleaning the source hexapole assembly”](#) on page 140).

## Replacing the source assembly seals

---



**Warning:** To avoid excessive leakage of solvent vapor into the laboratory atmosphere, the seals listed below must be renewed, at intervals of no greater than 1 year, exactly as described in this section.

To avoid excessive leakage of solvent vapor into the laboratory atmosphere, the following seals must be renewed at intervals of no greater than 1 year:

- Probe adjuster assembly probe seal
- Probe adjuster assembly nebulization gas seal
- Source enclosure seal
- Source enclosure nebulizer gas seal
- Source enclosure desolvation gas seal
- Source enclosure pressure test gas seal

## Removing the probe adjuster assembly probe and source enclosure seals

### Required materials

- Chemical-resistant, powder-free gloves
- O-ring removal kit

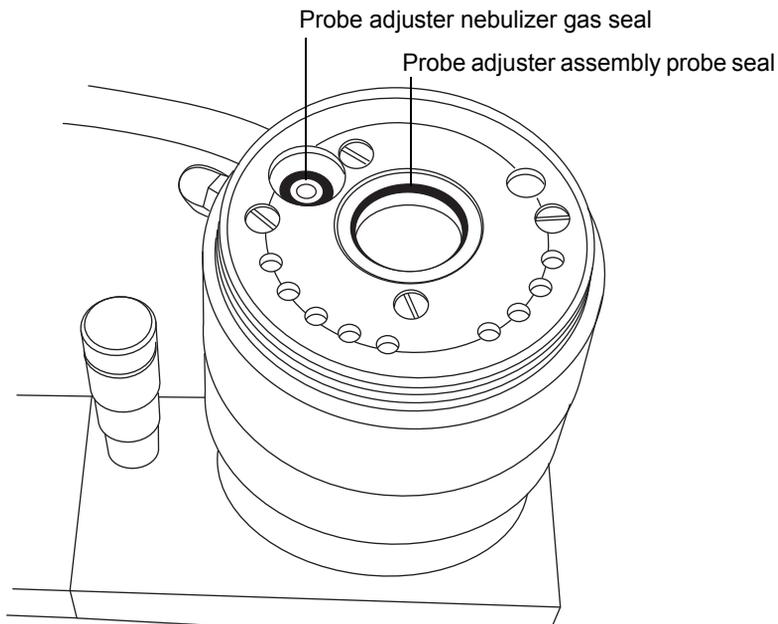


**Warning:** To avoid personal contamination with biohazards or compounds that are toxic or corrosive, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the source components.

**To remove the probe adjuster assembly probe and source enclosure seals:**

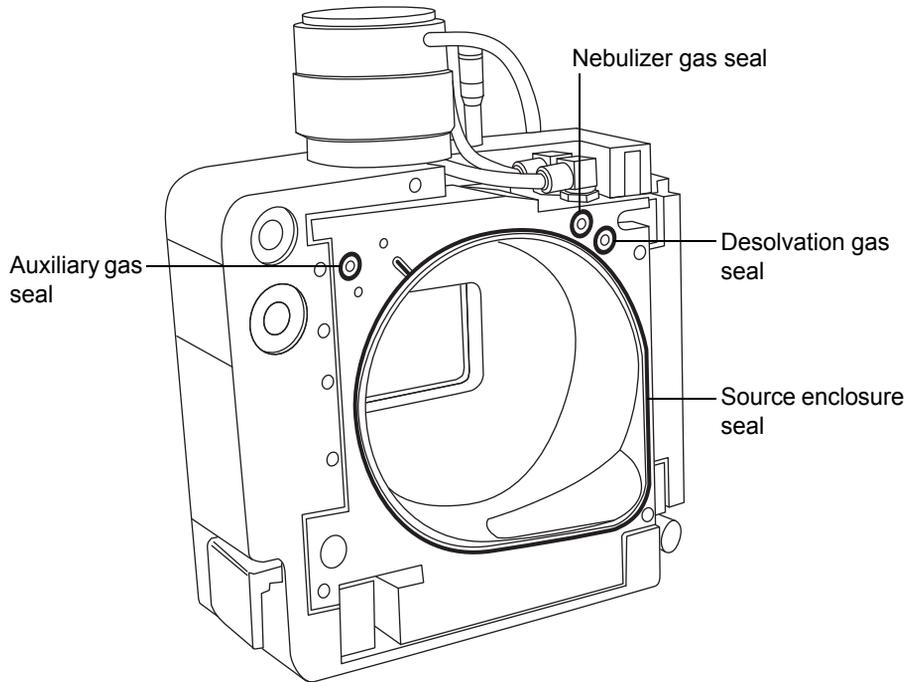
1. Remove the source enclosure from the instrument (see [“Removing the source enclosure from the instrument”](#) on page 87).
2. Use the O-ring removal kit to carefully remove the following seals from the probe adjuster assembly:
  - Probe seal
  - Nebulizer gas seal

See [“Removing O-rings and seals”](#) on page 97.



3. Use the O-ring removal kit to carefully remove the following seals from the source enclosure:

- Source enclosure seal
- Nebulizer gas seal
- Desolvation gas seal
- Auxiliary gas seal



**Warning:** To avoid spreading contamination, dispose of all the seals according to local environmental regulations. The seals can be contaminated with biohazards or toxic materials.

4. Dispose of all the seals in accordance with local environmental regulations.

## Fitting the new source enclosure and probe adjuster assembly probe seals

### Required materials

- Chemical-resistant, powder-free gloves
- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water
- New seals



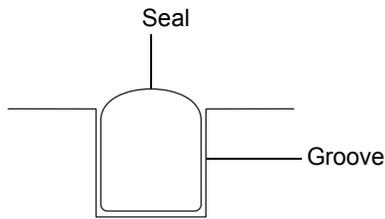
**Warning:** To avoid personal contamination with biohazards or compounds that are toxic or corrosive, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the source components.

### To fit the new source enclosure and probe adjuster assembly probe seals:

1. Ensure that all the grooves for seals are free from dirt and debris.  
**Tip:** If contamination is present, use 1:1 methanol/water, applied to a lint-free cloth, to carefully clean the grooves.  
**Requirement:** Ensure that the tails of the source enclosure seals are correctly located in the groove when fitting them to the source enclosure.
2. Fit the new source enclosure seal to the source enclosure and start by feeding the seal into the groove at the bottom right-hand corner, working around the seal in a counterclockwise direction.
3. Fit the following new seals to the source enclosure:
  - Nebulizer gas seal
  - Desolvation gas seal
  - Auxiliary gas seal

## 4 Maintenance Procedures

**Requirement:** These seals have a special cross-section; fit them in the groove as shown.



4. Fit the following new seals to the probe adjuster assembly:
  - Probe seal
  - Nebulizer gas seal
5. Refit the source enclosure to the instrument (see [“Fitting the source enclosure to the instrument”](#) on page 89).

## Replacing the air filter

---

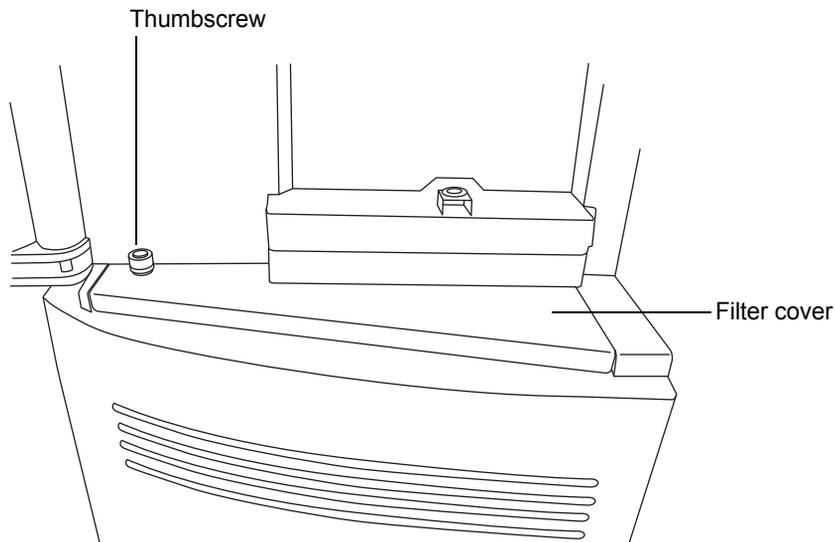
You must replace the air filter annually.

### Required materials

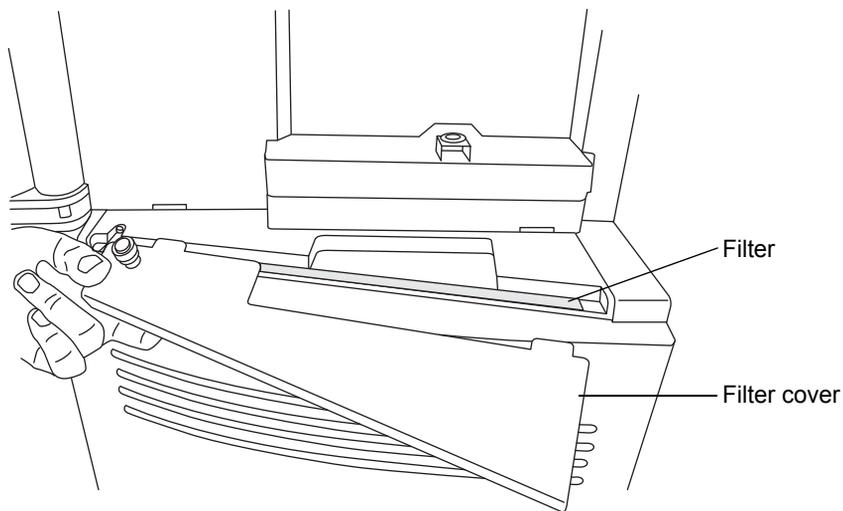
- Needle-nose pliers
- New filter

### To replace the air filter:

1. Open the access door to the fluidics pump.
2. Unscrew the captive thumbscrew on the filter cover.

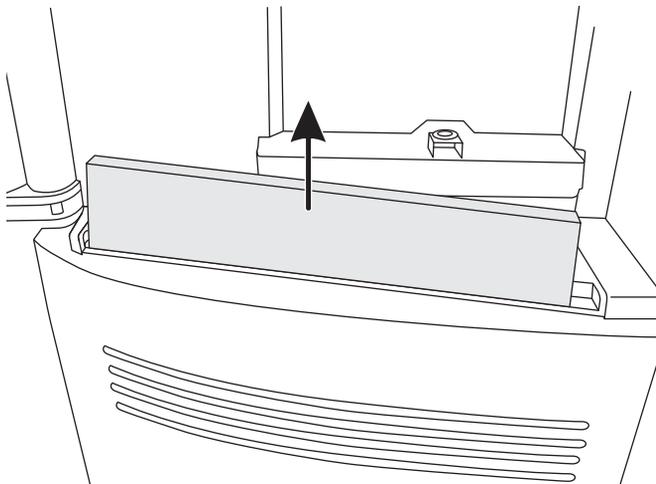


3. Remove the filter cover from the instrument.



4. Lift the filter, vertically, from its slot in the instrument.

**Tip:** If necessary, use the needle-nose files to grasp the filter.



5. Dispose of the filter.
6. Fit the new filter into the instrument.
7. Fit the filter cover to the instrument.
8. Tighten the thumbscrew on the filter cover.
9. Close the access door to the fluidics pump.

## APPI/APCI source—changing the UV lamp bulb

---

### Required materials

- Chemical-resistant, powder-free gloves
- 2.5-mm Allen wrench
- Small, Phillips<sup>®</sup> (cross-head) screwdriver
- 20-cm (8-inch) length of 4-mm nylon tube



**Warning:** To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the source components.



**Warning:** To avoid electric shock, ensure that the instrument is suitably prepared before commencing this procedure.

### To change the UV lamp bulb:

1. Prepare the instrument for working on the source (see [“Preparing the instrument for working on the source”](#) on page 85).



**Warning:** To avoid burn injuries, take great care while working with the probe, source and lamp bulb; these components can be hot.

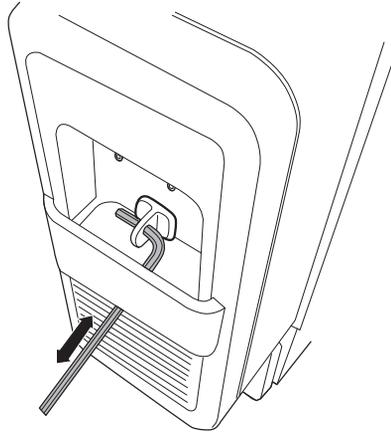


**Warning:** To avoid eye injury from UV radiation, ensure that the APPI lamp is off before carrying out this procedure.

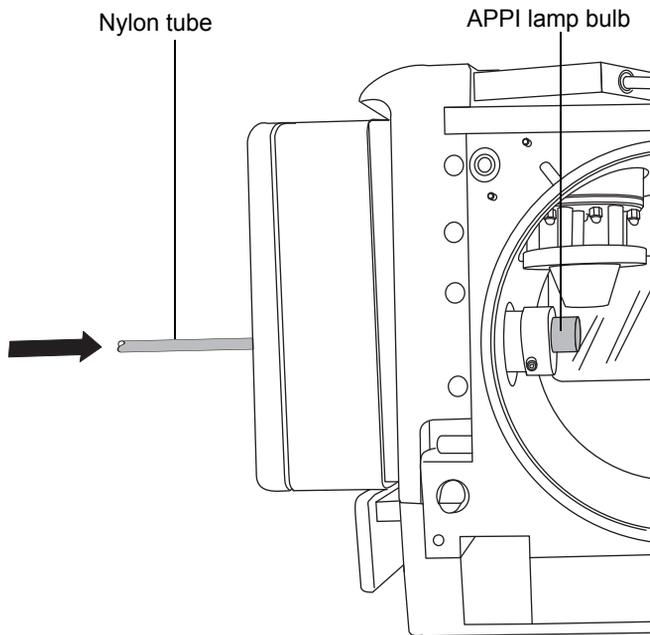
2. Pull the source enclosure release (located at the bottom, right-hand side) outwards, and swing open the enclosure.
3. Retrieve the 2.5 mm Allen wrench from its storage recess at the top, right-hand side of the source (enclosure open).

## 4 Maintenance Procedures

4. Hook the short-end of the Allen wrench through the ring on the back of the bulb extraction plug, and tug to remove it.



5. Insert the length of 4-mm nylon tube through the back of the lamp drive assembly, and push the bulb forward.





**Caution:** To avoid breaking the bulb, do not use a screwdriver to push the bulb out of the lamp drive assembly.

6. Pull the bulb out of the lamp drive assembly.
7. Insert the new bulb into the lamp drive assembly.  
**Tip:** The lamp glass is magnesium fluoride. Avoid touching it because dirt or other contaminants on the window significantly reduce UV transmission.
8. Refit the lamp-bulb access plug.
9. Close the source enclosure.
10. Slide closed the instrument's source interface door.

## APPI/APCI source—Cleaning the lamp window

---

The transmission of the high-energy photons responsible for APPI relies on the cleanliness of the magnesium fluoride lamp window. Clean the window to keep the surface clear of contamination, and thus avoid reduced sensitivity.

### Required materials

- Chemical-resistant, powder-free gloves
- Lint-free cloth
- Methanol or Isopropanol



**Warning:** To avoid burn injuries, take great care while working with the probe, source, and lamp bulb. These components can be hot.



**Warning:** To avoid eye injury from UV radiation, ensure that the APPI lamp is off before carrying out this procedure.

### To clean the lamp window:

1. Prepare the instrument for working on the source (see [“Preparing the instrument for working on the source”](#) on page 85).
2. Pull the source enclosure release (located at the bottom, right-hand side) outwards and swing open the enclosure
3. Use methanol or isopropyl alcohol, applied to the lint-free cloth, to carefully clean the lamp window.
4. Close the source enclosure.
5. Slide closed the instrument’s source interface door.

## APPI/APCI source—Replacing the APPI lamp drive seals

---



**Warning:** To ensure the integrity of the source exhaust system, the APPI lamp drive assembly O-rings listed below must be renewed at intervals not exceeding one year, exactly as described in this section.

The following APPI lamp drive assembly O-rings must be renewed at intervals of no greater than one year:

- UV lamp bulb sealing O-ring
- Mounting shaft O-rings
- UV lamp mounting flange O-ring

**Tip:** An automatic pressure test is performed each time the source-enclosure is closed and when the instrument starts.

## Removing the APPI lamp drive assembly seals

### Required materials

- Chemical-resistant, powder-free gloves
- 2.5-mm Allen wrench (from storage recess inside the source door)
- Small Phillips (cross-head) screwdriver
- 20-cm (8-inch) length of 4-mm nylon tube
- O-ring removal kit
- The mounting-shaft insertion tool
- A suitable clear working area on a bench
- A soft cloth or mat to protect the source enclosure window as it is laid on its face



**Warning:** To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the probe and source components.



**Warning:** To avoid electric shock, ensure that the instrument is in Standby mode before commencing this procedure.

### To remove the APPI lamp drive assembly seals:

1. Remove the APCI probe and combined APPI/APCI source enclosure (see [“To remove the combined APPI/APCI source:” on page 68](#)).



**Caution:** To avoid damaging the UV bulb, handle it with care; the bulb is fragile.

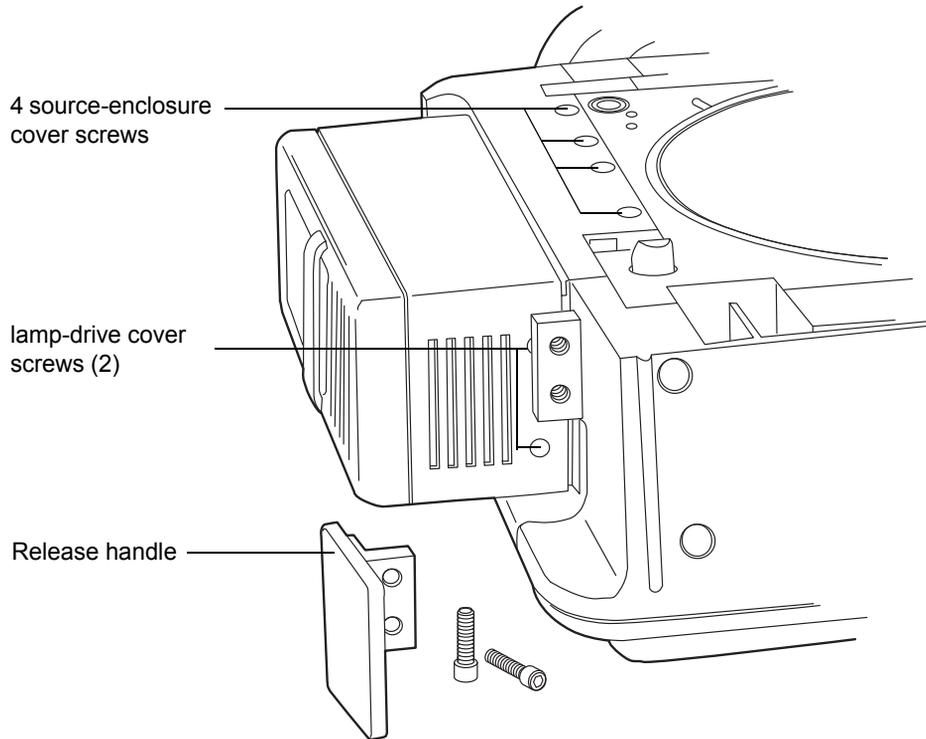
2. Remove the UV bulb from the lamp drive assembly and store it safely (see [“To change the UV lamp bulb:” on page 181](#)).
3. Remove the 2 lamp-drive cover screws, above the bulb-extraction plug-aperture.



**Caution:** To avoid damaging the source enclosure, take care to lay it on a smooth surface. Laying the source enclosure face-first on a hard object or other protrusion can smash the glass window.

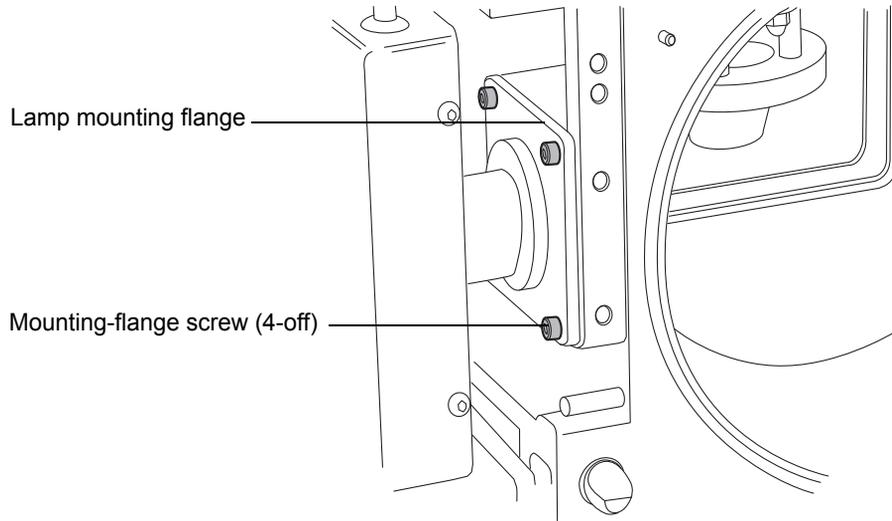
4. Clear an area, lay out the soft cloth or mat, and lay the source-enclosure on its face.

5. Remove the 2 source enclosure, release-handle screws, and remove the handle.



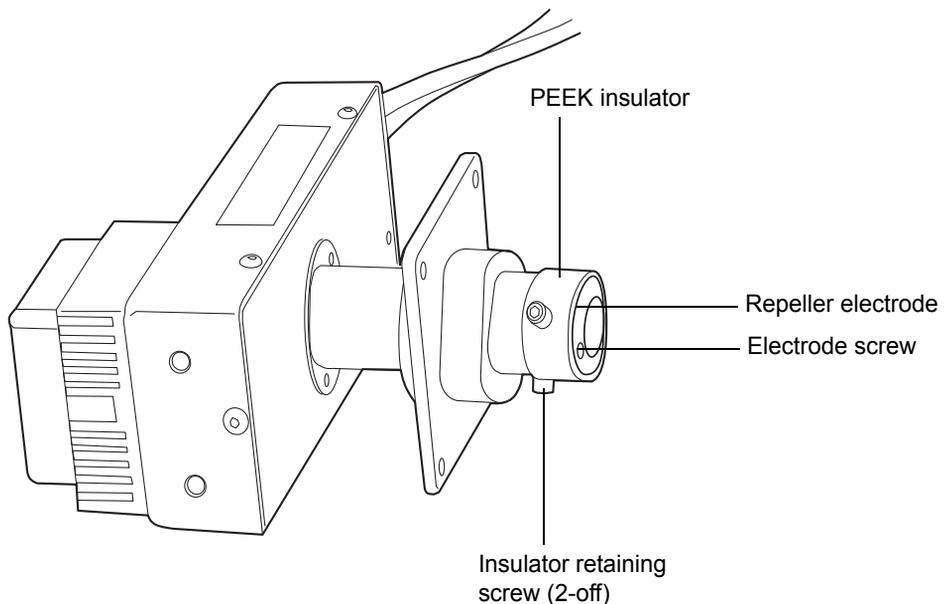
6. Remove the remaining 2 screws, which are hidden by the release handle.
7. Slide the cover off the lamp-drive.
8. Remove the 4 source-enclosure cover screws.
9. Ease the source-enclosure cover over the lamp drive assembly.
10. Use the 2.5-mm Allen wrench to unscrew the 4 mounting-flange screws.

**Tip:** Take care not to drop the screws inside the lower cover.

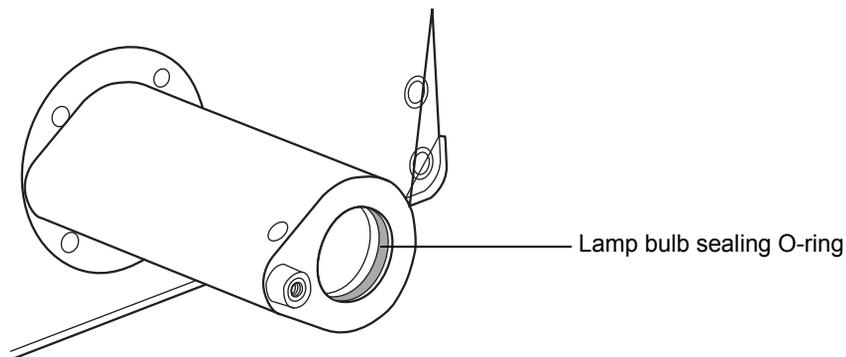


11. Slide the lamp assembly, shaft, and flange out of the APPI source enclosure.

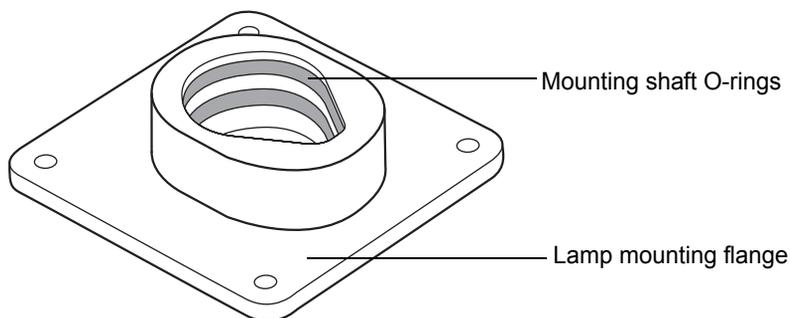
**Tip:** The cables remain attached to the shaft, which you fully withdraw and lay on the bench beside the source enclosure.



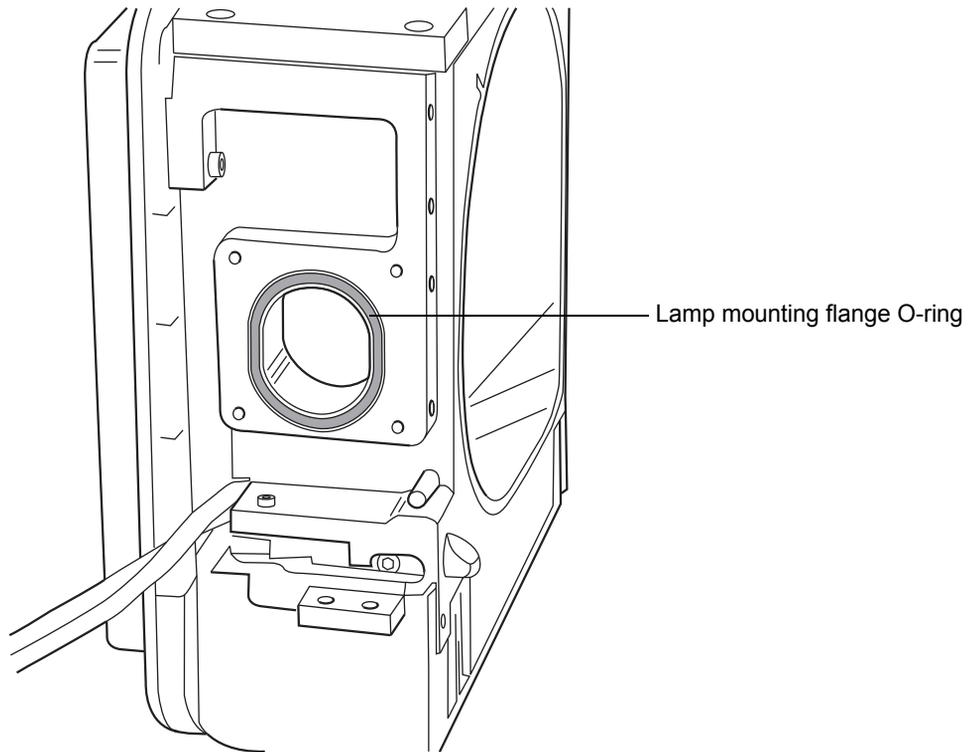
12. Using the small, Phillips screwdriver, remove the electrode screw and repeller electrode.
13. Use the 2.5-mm Allen wrench to remove the two insulator screws.
14. Remove the PEEK insulator from the end of the mounting shaft.
15. Slide the shaft mounting flange all the way off the shaft taking care to note the correct orientation for reassembly.
16. Use the O-ring removal kit to carefully remove the lamp-bulb sealing O-ring from inside the bulb holder (see [“Removing O-rings and seals” on page 97](#)).



17. Use the O-ring removal kit to carefully remove the two O-rings from inside the lamp mounting flange (see [“Removing O-rings and seals” on page 97](#)).



18. Use the O-ring removal kit to carefully remove the shaft mounting flange O-ring from the APPI source enclosure side (see [“Removing O-rings and seals”](#) on page 97).



**Warning:** To avoid spreading contamination, ensure that the O-rings are correctly disposed of according to local environmental regulations. They can be contaminated with biohazardous, or toxic materials.

19. Dispose of the O-rings in accordance with local environmental regulations.

## Fitting the new APPI lamp drive assembly O-rings

### Required materials

- Chemical-resistant, powder-free gloves
- 2.5-mm Allen wrench
- 1:1 methanol/water
- Lint-free cloth



**Warning:** To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the lamp drive assembly components.



**Caution:** To avoid damaging the APPI lamp drive assembly O-rings, take care when fitting them. Small nicks, tears, dirt, and dust can compromise their performance, leading to rapid deterioration in the assembly's operation.

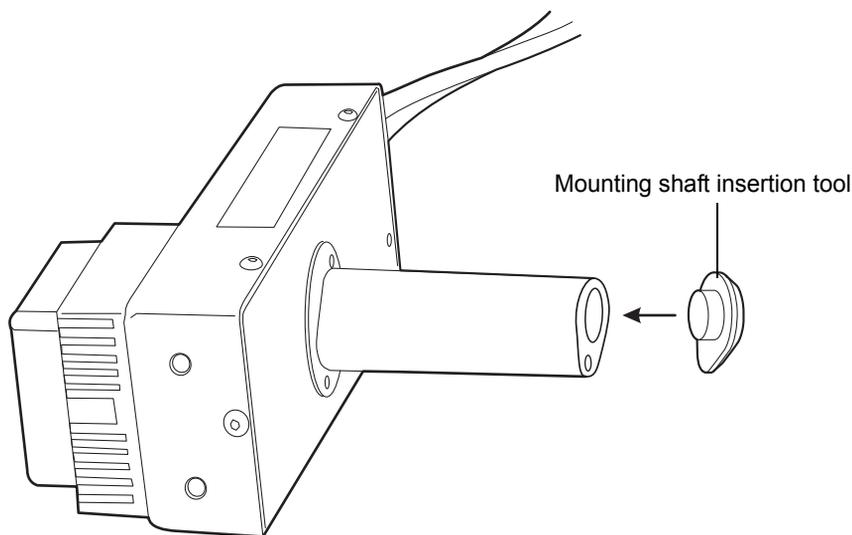
### To fit the new APPI lamp drive assembly O-rings:

1. Ensure that all the grooves for the O-rings are free from dirt and hairs.

#### Tips:

- If contamination is present, use 1:1 methanol/water, applied to the lint-free cloth, to carefully clean the grooves.
  - For the asymmetric O-ring seals, first seat the O-ring in the small radius at the bottom of the groove. Then use a suitable tool, one with a circular cross-section, to “roll” the remainder of the O-ring into the groove.
2. Fit the lamp bulb sealing O-ring in the lamp aperture.
  3. Fit the two new O-rings inside the lamp mounting flange.
  4. Fit the new lamp mounting flange O-ring to the APPI source enclosure side.

5. Fit the mounting shaft insertion tool to the mounting shaft.



 **Caution:** To prevent damage to the mounting shaft O-rings, fit the mounting shaft insertion tool to the mounting shaft before fitting the shaft to the lamp mounting flange.

6. Slide the lamp mounting flange back over the shaft taking care to get the correct orientation.
7. Reinsert that shaft through the side of the source enclosure, and fit the lamp mounting flange to the APPI source enclosure side.

**Requirement:** Tighten the securing screws sequentially and by small increments until they are all fully tight. Doing so ensures that the lamp mounting flange is uniformly seated on the APPI source enclosure side plate.

8. Use the 2.5-mm Allen wrench to tighten the four mounting-flange securing screws.
9. Remove the mounting shaft insertion tool from the mounting shaft.
10. Fit the PEEK insulator to the end of the mounting shaft.
11. Use the 2.5-mm Allen wrench to fit and tighten the two insulator retaining screws.
12. Fit the repeller electrode to the PEEK insulator.

13. Use the small Phillips screwdriver to fit and tighten the repeller electrode retaining screw.
14. Insert the UV bulb into the lamp drive assembly and push it fully home.
15. Fully retract the lamp mounting shaft from the source enclosure.
16. Refit the lamp-assembly collar-cover, and secure it on its base with the 4 screws.
17. Refit the lamp assembly cover, and secure it on its base (2 screws) and above the bulb extraction aperture (2 screws).
18. Refit the source enclosure release handle, and secure it with the 2 screws.
19. Refit and reconnect the source-enclosure to the machine, refit the corona pin and probe. Refer to [“To install the combined APPI/APCI source:” on page 66](#) for instructions.



# A Safety Advisories

Waters<sup>®</sup> instruments and devices display hazard symbols that alert you to the hidden dangers associated with a product's operation and maintenance. The symbols also appear in product manuals where they accompany statements describing the hazards and advising how to avoid them. This appendix presents the safety symbols and statements that apply to all of the products that Waters offers.

## Contents:

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Warnings that apply to all Waters instruments and devices .....	201
Warnings that address the replacing of fuses .....	206
Electrical and handling symbols .....	208

## Warning symbols

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Warning symbols alert you to the risk of death, injury or seriously adverse physiological reactions associated with an instrument's use or misuse. Heed all warnings when you install, repair, or operate any Waters instrument or device. Waters accepts no liability in cases of injury or property damage resulting from the failure of individuals to comply with any safety precaution when installing, repairing, or operating any of its instruments or devices.

The following symbols warn of risks that can arise when you operate or maintain a Waters instrument or device, or a component of an instrument or device. When one of these symbols appear in a manual's narrative sections or procedures, an accompanying statement identifies the applicable risk and explains how to avoid it.



**Warning:** (General risk of danger. When this symbol appears on an instrument, consult the instrument's user documentation for important safety-related information before you use the instrument.)



**Warning:** (Risk of burn injury from contacting hot surfaces.)



**Warning:** (Risk of electric shock.)



**Warning:** (Risk of fire.)



**Warning:** (Risk of sharp-point puncture injury.)



**Warning:** (Risk of hand crush injury.)



**Warning:** (Risk of exposure to ultraviolet radiation.)



**Warning:** (Risk of contacting corrosive substances.)



**Warning:** (Risk of exposure to a toxic substance.)



**Warning:** (Risk of personal exposure to laser radiation.)



**Warning:** (Risk of exposure to biological agents that can pose a serious health threat.)



**Warning:** (Risk of tipping.)



**Warning:** (Risk of explosion.)



**Warning:** (Risk of eye injury.)

## Specific warnings

The following warnings (both symbols and text) can appear in the user manuals of particular instruments and devices and on labels affixed to them or their component parts.

### Burst warning

This warning applies to Waters instruments and devices fitted with nonmetallic tubing.



**Warning:** To avoid injury from bursting, nonmetallic tubing, heed these precautions when working in the vicinity of such tubing when it is pressurized:

- Wear eye protection.
- Extinguish all nearby flames.
- Do not use tubing that is, or has been, stressed or kinked.
- Do not expose nonmetallic tubing to incompatible compounds like tetrahydrofuran (THF) and nitric or sulfuric acids.
- Be aware that some compounds, like methylene chloride and dimethyl sulfoxide, can cause nonmetallic tubing to swell, significantly reducing the pressure at which the tubing can rupture.

## Mass spectrometer shock hazard

The following warning applies to all Waters mass spectrometers.



**Warning:** To avoid electric shock, do not remove the mass spectrometer's protective panels. The components they cover are not user-serviceable.

The following warning applies to certain mass spectrometers when they are in Operate mode.



**Warning:** To avoid nonlethal electric shock, ensure the mass spectrometer is in Standby mode before you touch any of its external surfaces that are marked with this high voltage warning symbol.

## Mass spectrometer flammable solvents warning

This warning applies to mass spectrometers performing an analysis that requires the use of flammable solvents.



**Warning:** To prevent ignition of flammable solvent vapors in the enclosed space of a mass spectrometer's ion source, ensure that nitrogen flows continuously through the source. The nitrogen supply pressure must not fall below 690 kPa (6.9 bar, 100 psi) during an analysis requiring the use of flammable solvents. Also a gas-fail device must be installed, to interrupt the flow of LC solvent should the nitrogen supply fail.

## Biohazard warning

The following warning applies to Waters instruments and devices that can process material containing biohazards, which are substances that contain biological agents capable of producing harmful effects in humans.



**Warning:** To avoid infection with potentially infectious, human-sourced products, inactivated microorganisms, and other biological materials, assume that all biological fluids that you handle are infectious.

Specific precautions appear in the latest edition of the US National Institutes of Health (NIH) publication, *Biosafety in Microbiological and Biomedical Laboratories* (BMBL).

Observe Good Laboratory Practice (GLP) at all times, particularly when working with hazardous materials, and consult the biohazard safety representative for your organization regarding the proper use and handling of infectious substances.

## Biohazard and chemical hazard warning

This warning applies to Waters instruments and devices that can process biohazards, corrosive materials, or toxic materials.



**Warning:** To avoid personal contamination with biohazards, toxic materials, or corrosive materials, you must understand the hazards associated with their handling.

Guidelines prescribing the proper use and handling of such materials appear in the latest edition of the National Research Council's publication, *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*.

Observe Good Laboratory Practice (GLP) at all times, particularly when working with hazardous materials, and consult the safety representative for your organization regarding its protocols for handling such materials.

## Caution advisory

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Caution advisories appear where an instrument or device can be subject to use or misuse that can damage it or compromise a sample's integrity. The exclamation point symbol and its associated statement alert you to such risk.



**Caution:** To avoid damaging the instrument's case, do not clean it with abrasives or solvents.

## Warnings that apply to all Waters instruments and devices

---

When operating this device, follow standard quality-control procedures and the equipment guidelines in this section.



**Attention:** Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**Important:** Toute modification sur cette unité n'ayant pas été expressément approuvée par l'autorité responsable de la conformité à la réglementation peut annuler le droit de l'utilisateur à exploiter l'équipement.

**Achtung:** Jedwede Änderungen oder Modifikationen an dem Gerät ohne die ausdrückliche Genehmigung der für die ordnungsgemäße Funktionstüchtigkeit verantwortlichen Personen kann zum Entzug der Bedienungsbefugnis des Systems führen.

**Avvertenza:** qualsiasi modifica o alterazione apportata a questa unità e non espressamente autorizzata dai responsabili per la conformità fa decadere il diritto all'utilizzo dell'apparecchiatura da parte dell'utente.

**Atencion:** cualquier cambio o modificación efectuado en esta unidad que no haya sido expresamente aprobado por la parte responsable del cumplimiento puede anular la autorización del usuario para utilizar el equipo.

**注意:** 未經有關法規認證部門允許對本設備進行的改變或修改,可能會使使用者喪失操作該設備的權利。

**注意:** 未經有關法規認證部門明確允許對本設備進行的改變或改裝,可能會使使用者喪失操作該設備的合法性。

**주의:** 규정 준수를 책임지는 당사자의 명백한 승인 없이 이 장치를 개조 또는 변경할 경우, 이 장치를 운용할 수 있는 사용자 권한의 효력을 상실할 수 있습니다.

**注意:** 規制機関から明確な承認を受けずに本装置の変更や改造を行うと、本装置のユーザーとしての承認が無効になる可能性があります。



**Warning:** Use caution when working with any polymer tubing under pressure:

- Always wear eye protection when near pressurized polymer tubing.
- Extinguish all nearby flames.
- Do not use tubing that has been severely stressed or kinked.
- Do not use nonmetallic tubing with tetrahydrofuran (THF) or concentrated nitric or sulfuric acids.
- Be aware that methylene chloride and dimethyl sulfoxide cause nonmetallic tubing to swell, which greatly reduces the rupture pressure of the tubing.

**Attention:** Manipulez les tubes en polymère sous pression avec précaution:

- Portez systématiquement des lunettes de protection lorsque vous vous trouvez à proximité de tubes en polymère pressurisés.
- Eteignez toute flamme se trouvant à proximité de l'instrument.
- Evitez d'utiliser des tubes sévèrement déformés ou endommagés.
- Evitez d'utiliser des tubes non métalliques avec du tétrahydrofurane (THF) ou de l'acide sulfurique ou nitrique concentré.
- Sachez que le chlorure de méthylène et le diméthylesulfoxyde entraînent le gonflement des tuyaux non métalliques, ce qui réduit considérablement leur pression de rupture.

**Vorsicht:** Bei der Arbeit mit Polymerschläuchen unter Druck ist besondere Vorsicht angebracht:

- In der Nähe von unter Druck stehenden Polymerschläuchen stets Schutzbrille tragen.
- Alle offenen Flammen in der Nähe löschen.
- Keine Schläuche verwenden, die stark geknickt oder überbeansprucht sind.
- Nichtmetallische Schläuche nicht für Tetrahydrofuran (THF) oder konzentrierte Salpeter- oder Schwefelsäure verwenden.
- Durch Methylenchlorid und Dimethylsulfoxid können nichtmetallische Schläuche quellen; dadurch wird der Berstdruck des Schlauches erheblich reduziert.



**Attenzione:** fare attenzione quando si utilizzano tubi in materiale polimerico sotto pressione:

- Indossare sempre occhiali da lavoro protettivi nei pressi di tubi di polimero pressurizzati.
- Spegnere tutte le fiamme vive nell'ambiente circostante.
- Non utilizzare tubi eccessivamente logorati o piegati.
- Non utilizzare tubi non metallici con tetraidrofurano (THF) o acido solforico o nitrico concentrati.
- Tenere presente che il cloruro di metilene e il dimetilsolfossido provocano rigonfiamenti nei tubi non metallici, riducendo notevolmente la pressione di rottura dei tubi stessi.

**Advertencia:** se recomienda precaución cuando se trabaje con tubos de polímero sometidos a presión:

- El usuario deberá protegerse siempre los ojos cuando trabaje cerca de tubos de polímero sometidos a presión.
- Si hubiera alguna llama las proximidades.
- No se debe trabajar con tubos que se hayan doblado o sometido a altas presiones.
- Es necesario utilizar tubos de metal cuando se trabaje con tetrahidrofurano (THF) o ácidos nítrico o sulfúrico concentrados.
- Hay que tener en cuenta que el cloruro de metileno y el sulfóxido de dimetilo dilatan los tubos no metálicos, lo que reduce la presión de ruptura de los tubos.

**警告:** 當在有壓力的情況下使用聚合物管線時，小心注意以下幾點。

- 當接近有壓力的聚合物管線時一定要戴防護眼鏡。
- 熄滅附近所有的火焰。
- 不要使用已經被壓癟或嚴重彎曲管線。
- 不要在非金屬管線中使用四氫呋喃或濃硝酸或濃硫酸。
- 要了解使用二氯甲烷及二甲基亞楓會導致非金屬管線膨脹，大大降低管線的耐壓能力。



**警告:** 当有压力的情况下使用管线时, 小心注意以下几点:

- 当接近有压力的聚合物管线时一定要戴防护眼镜。
- 熄灭附近所有的火焰。
- 不要使用已经被压瘪或严重弯曲的管线。
- 不要在非金属管线中使用四氢呋喃或浓硝酸或浓硫酸。
- 要了解使用二氯甲烷及二甲基亚砜会导致非金属管线膨胀, 大大降低管线的耐压能力。

**경고:** 가압 폴리머 튜브로 작업할 경우에는 주의하십시오.

- 가압 폴리머 튜브 근처에서는 항상 보호 안경을 착용하십시오.
- 근처의 화기를 모두 끄십시오.
- 심하게 변형되거나 꼬인 튜브는 사용하지 마십시오.
- 비금속(Nonmetallic) 튜브를 테트라히드로푸란(Tetrahydrofuran: THF) 또는 농축 질산 또는 황산과 함께 사용하지 마십시오.
- 염화 메틸렌(Methylene chloride) 및 디메틸설폭시드(Dimethyl sulfoxide)는 비금속 튜브를 부풀려 튜브의 파열 압력을 크게 감소시킬 수 있으므로 유의하십시오.

**警告:** 圧力のかかったポリマーチューブを扱うときは、注意してください。

- 加圧されたポリマーチューブの付近では、必ず保護メガネを着用してください。
- 近くにある火を消してください。
- 著しく変形した、または折れ曲がったチューブは使用しないでください。
- 非金属チューブには、テトラヒドロフラン(THF)や高濃度の硝酸または硫酸などを流さないでください。
- 塩化メチレンやジメチルスルホキシドは、非金属チューブの膨張を引き起こす場合があります、その場合、チューブは極めて低い圧力で破裂します。



**Warning:** The user shall be made aware that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

**Attention:** L'utilisateur doit être informé que si le matériel est utilisé d'une façon non spécifiée par le fabricant, la protection assurée par le matériel risque d'être défectueuses.

**Vorsicht:** Der Benutzer wird darauf aufmerksam gemacht, dass bei unsachgemäßer Verwendung des Gerätes die eingebauten Sicherheitseinrichtungen unter Umständen nicht ordnungsgemäß funktionieren.

**Attenzione:** si rende noto all'utente che l'eventuale utilizzo dell'apparecchiatura secondo modalità non previste dal produttore può compromettere la protezione offerta dall'apparecchiatura.

**Advertencia:** el usuario deberá saber que si el equipo se utiliza de forma distinta a la especificada por el fabricante, las medidas de protección del equipo podrían ser insuficientes.

**警告:** 使用者必須非常清楚如果設備不是按照製造廠商指定的方式使用，那麼該設備所提供的保護將被削弱。

**警告:** 使用者必須非常清楚如果設備不是按照製造廠商指定的方式使用，那麼該設備所提供的保護將被削弱。

**경고:** 제조업체가 명시하지 않은 방식으로 장비를 사용할 경우 장비가 제공하는 보호 수단이 제대로 작동하지 않을 수 있다는 점을 사용자에게 반드시 인식시켜야 합니다.

**警告:** ユーザーは、製造元により指定されていない方法で機器を使用すると、機器が提供している保証が無効になる可能性があることに注意して下さい。

## Warnings that address the replacing of fuses

---

The following warnings pertain to instruments equipped with user-replaceable fuses.

### If the fuse types and ratings appear on the instrument:



**Warning:** To protect against fire, replace fuses with those of the type and rating printed on panels adjacent to instrument fuse covers.



**Attention:** pour éviter tout risque d'incendie, remplacez toujours les fusibles par d'autres du type et de la puissance indiqués sur le panneau à proximité du couvercle de la boîte à fusible de l'instrument.



**Vorsicht:** Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert auf den Tafeln neben den Sicherungsabdeckungen des Geräts gedruckt sind.



**Attenzione:** per garantire protezione contro gli incendi, sostituire i fusibili con altri dello stesso tipo aventi le caratteristiche indicate sui pannelli adiacenti alla copertura fusibili dello strumento.



**Advertencia:** Para evitar incendios, sustituir los fusibles por aquellos del tipo y características impresos en los paneles adyacentes a las cubiertas de los fusibles del instrumento.



**警告:** 為了避免火災，更換保險絲時，請使用與儀器保險絲蓋旁面板上所印刷之相同類型與規格的保險絲。



**警告:** 为了避免火灾，应更换与仪器保险丝盖旁边面板上印刷的类型和规格相同的保险丝。



**경고:** 화재의 위험을 막으려면 기기 퓨즈 커버에 가까운 패널에 인쇄된 것과 동일한 타입 및 정격의 제품으로 퓨즈를 교체하십시오.



**警告:** 火災予防のために、ヒューズ交換では機器ヒューズカバー脇のパネルに記載されているタイプおよび定格のヒューズをご使用ください。

### If the fuse types and ratings do not appear on the instrument:



**Warning:** To protect against fire, replace fuses with those of the type and rating indicated in the “Replacing fuses” section of the Maintenance Procedures chapter.



**Attention:** pour éviter tout risque d'incendie, remplacez toujours les fusibles par d'autres du type et de la puissance indiqués dans la rubrique "Remplacement des fusibles" du chapitre traitant des procédures de maintenance.



**Vorsicht:** Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert im Abschnitt "Sicherungen ersetzen" des Kapitels "Wartungsverfahren" angegeben sind.



**Attenzione:** per garantire protezione contro gli incendi, sostituire i fusibili con altri dello stesso tipo aventi le caratteristiche indicate nel paragrafo "Sostituzione dei fusibili" del capitolo "Procedure di manutenzione".



**Advertencia:** Para evitar incendios, sustituir los fusibles por aquellos del tipo y características indicados en la sección "Sustituir fusibles".



**警告:** 為了避免火災，更換保險絲時，應使用「維護步驟」章節中「更換保險絲」所指定之相同類型與規格的保險絲。



**警告:** 为了避免火灾，应更换“维护步骤”一章的“更换保险丝”一节中介绍的相同类型和规格的保险丝。



**경고:** 화재의 위험을 막으려면 유지관리 절차 단원의 “퓨즈 교체” 절에 설명된 것과 동일한 타입 및 정격의 제품으로 퓨즈를 교체하십시오.



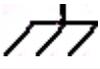
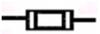
**警告:** 火災予防のために、ヒューズ交換ではメンテナンス項目の「ヒューズの交換」に記載されているタイプおよび定格のヒューズをご使用ください。

## Electrical and handling symbols

---

### Electrical symbols

The following electrical symbols and their associated statements can appear in instrument manuals and on an instrument's front or rear panels.

	Electrical power on
	Electrical power off
	Standby
	Direct current
	Alternating current
	Protective conductor terminal
	Frame, or chassis, terminal
	Fuse

## Handling symbols

The following handling symbols and their associated statements can appear on labels affixed to the packaging in which instruments, devices, and component parts are shipped.

	Keep upright!
	Keep dry!
	Fragile!
	Use no hooks!



# B Materials of Construction and Compliant Solvents



**Warning:** To confirm the integrity of the source exhaust system, you must address any safety issues raised by the contents of this Appendix.

## Contents

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Items exposed to solvent .....	212
Solvents used to prepare mobile phases .....	213

## Preventing contamination

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For information on preventing contamination, refer to *Controlling Contamination in LC/MS Systems* (part number 715001307). Visit [www.waters.com](http://www.waters.com).

## Items exposed to solvent

---

The items that appear in the following table can be exposed to solvent. You must evaluate the safety issues if the solvents used in your application differ from the solvents typically used with these items. See [“Solvents used to prepare mobile phases” on page 213](#) for details about the most common ingredients used to prepare mobile phases.

### Items exposed to solvent:

Item	Material
Autotune reservoirs	High-density polyethylene
Corona discharge pin mounting contact	PEEK™
Gas exhaust port	Stainless steel
Ion block assembly	Stainless steel and PEEK
Ion block screws	Gold-plated stainless steel
Ion block support	PEEK
Isolation valve	Stainless steel and PEEK
O-rings	Viton® or PTFE-encapsulated Viton
Probe adjuster bellows	Viton
Probe adjuster assembly	Anodized aluminium, glass filled acetal, Xylan®, and stainless steel
Probe shaft	PEEK
Pumping block	Alochromed aluminium and Xylan
Solvent waste/leak management	Tygon tubing
Source enclosure	Alochromed aluminium
Source enclosure view port	Toughened plate glass
Trap bottle	Polypropylene

**Items exposed to solvent: (Continued)**

<b>Item</b>	<b>Material</b>
Trap bottle push-in fittings	Nitrile butadiene rubber, stainless steel, polybutylene terephthalate, and polyoxymethylene
APPI lamp drive assembly:	
Mounting shaft	Stainless steel
Repeller electrode	Stainless steel
Insulator	PEEK
Lamp window	Magnesium fluoride

## Solvents used to prepare mobile phases

---

These solvents are the most common ingredients used to prepare mobile phases for reverse-phase LC/MS (API):

- Water
- Methanol
- Acetonitrile
- Formic acid (<0.1%)
- Acetic acid (<0.1%)
- Trifluoroacetic acid (<0.1%)
- Ammonium acetate (<10 mM)
- Ammonium formate (<10 mM)

These solvents are not expected to cause any problems with the materials identified in [“Items exposed to solvent” on page 212](#).

## B Materials of Construction and Compliant Solvents

# C External Connections

This appendix describes the mass spectrometer's external connections.



**Warning:** To avoid skeletal or muscle injury associated with lifting heavy objects, use suitable machinery and the supplied harness to lift the mass spectrometer.



**Caution:** To avoid damaging the mass spectrometer, observe the following precautions:

- Contact Waters Technical Service before moving it.
- If you must transport the instrument, or remove it from service, contact Waters Technical Service for recommended cleaning, flushing, and packaging procedures.

See [“Troubleshooting with Connections INSIGHT”](#) on page 83.

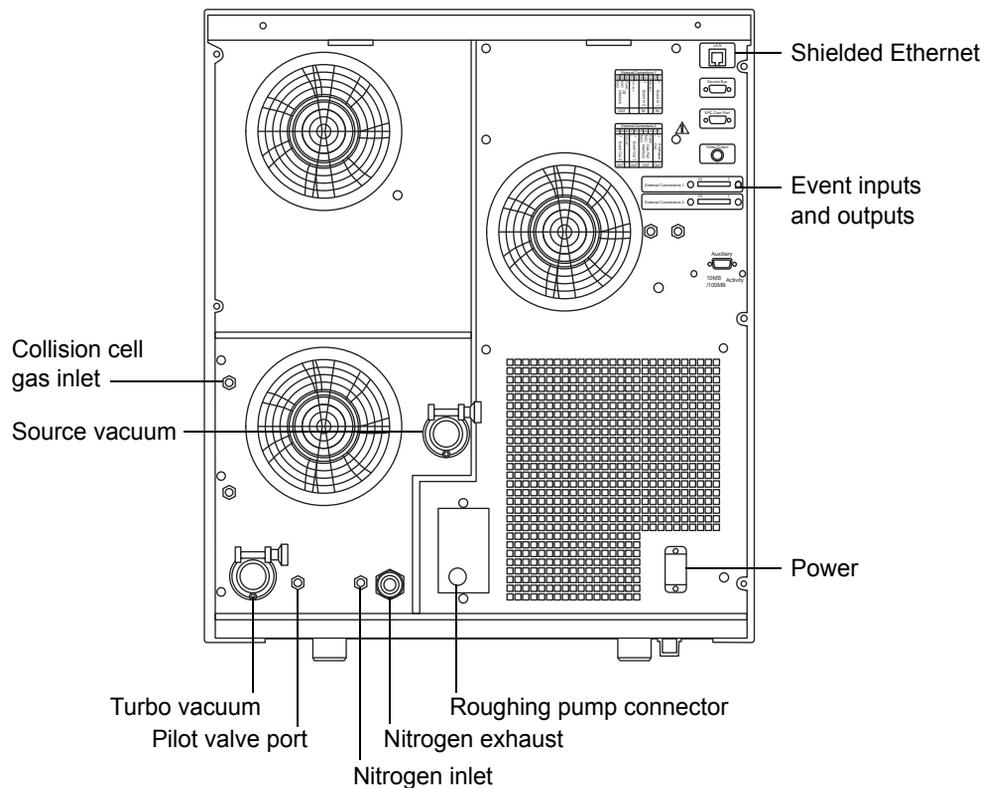
## Contents

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## External wiring and vacuum connections

The instrument's rear panel connectors are shown below.

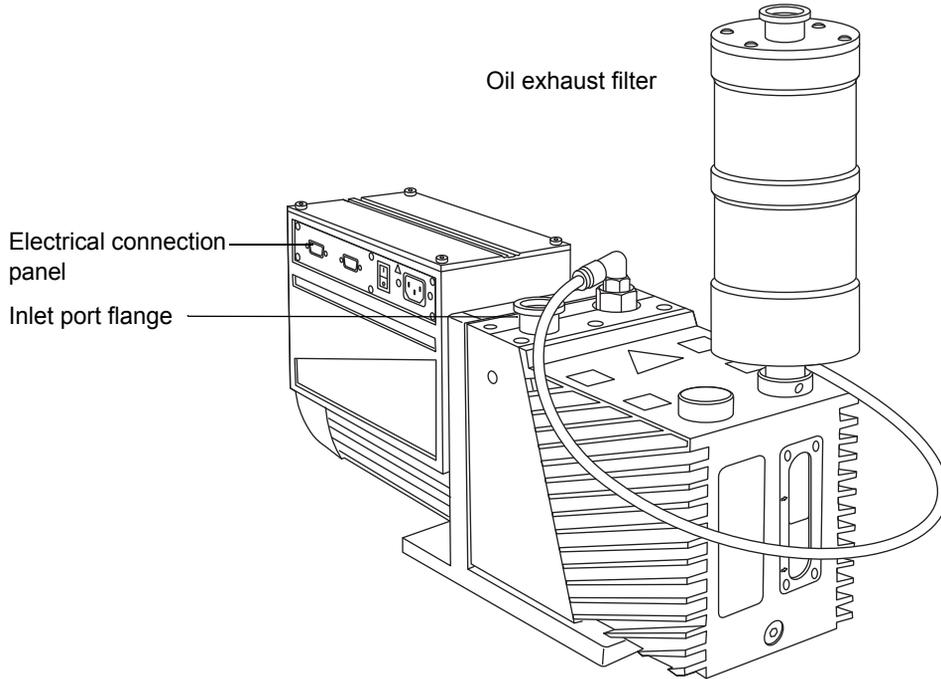
### Mass spectrometer rear panel connectors:



## Connecting the Varian oil-filled roughing pump

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**Note:** To connect the alternative, oil-free roughing pump, see [“Connecting the Edwards oil-free roughing pump”](#) on page 223.



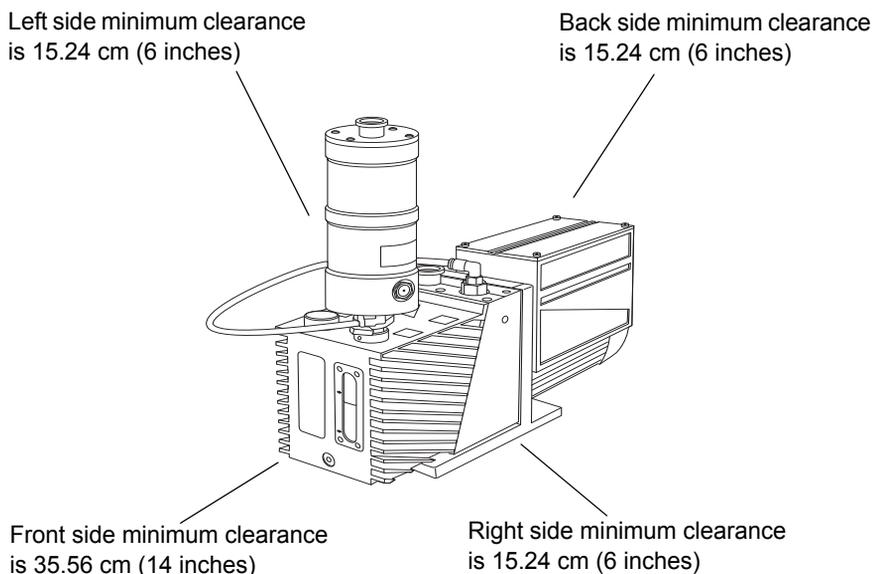
### **Required materials**

- Chemical-resistant, powder-free gloves
- 7-mm nut driver
- Sharp knife
- Elbow (included in the Waters Rotary Pump Kit)
- NW25 tee (included in the installation kit)
- NW25 center rings (included in the installation kit)
- NW25 clamps (included in the installation kit)
- 12.7-mm clear PVC exhaust tubing (included in the Waters Rotary Pump Kit)
- PVC hose clamps (included in the Waters Rotary Pump Kit)
- 1-inch ID vacuum hose (included in the Waters Rotary Pump Kit)
- PTFE drip tray

Bear in mind these requirements when connecting the roughing pump:

- The pump must be horizontal, or within one degree of horizontal.
- The ambient temperature of the area in which you place the pump must range between 12 and 40 °C (54 to 104 °F).
- The pump must be oriented so that it permits easy access to the oil exhaust filter and oil-level sight glass.

For proper ventilation, the following minimum clearances must apply:



**Warning:** To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the pumps and their connections.

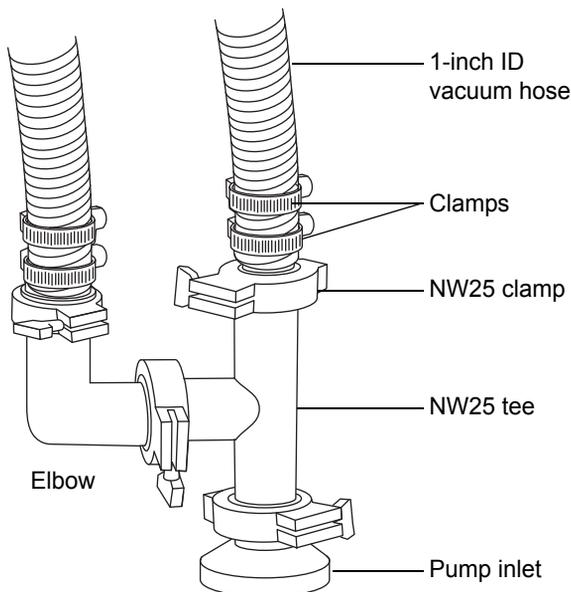
### To connect the roughing pump:

1. Place the PTFE drip tray on the floor, within 5 feet of the instrument.



**Warning:** To avoid skeletal or muscle injury, at least two people must lift the pump.

2. Place the pump on the PTFE drip tray.
3. Attach the NW25 tee to the roughing pump inlet flange using an NW25 center ring, and then secure the connection with an NW25 clamp, using the 7-mm nut driver to install the clamp.



4. Attach the elbow to one of the open ports on the NW25 tee using an NW25 center ring, and then secure the connection with an NW25 clamp, using the 7-mm nut driver to install the clamp.
5. Attach the flanged end of a length of 1-inch ID vacuum hose to the remaining open port on the NW25 tee using an NW25 center ring, and then secure the connection with an NW25 clamp, using the 7-mm nut driver to install the clamp.
6. Attach the flanged end of a second length of 1-inch ID vacuum hose to the open port on the elbow using an NW25 center ring, and then secure

the connection with an NW25 clamp, using the 7-mm nut driver to install the clamp.

7. Connect the free ends of the two lengths of vacuum hose to the two, 1-inch OD, straight, vacuum ports on the mass spectrometer's rear panel.
8. Install 2 clamps on each hose end.



**Caution:** To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

9. Connect the 12.7-mm clear PVC exhaust tubing to the roughing pump oil exhaust filter port NW25 nozzle fitting using an NW25 center ring, and then secure the connection with an NW25 clamp, using the 7-mm nut driver to install the clamp.



**Caution:** To prevent serious damage to the instrument, two separate exhaust systems are required: one for nitrogen, the other for the roughing pump. Vent the exhausts to atmosphere through separate lines. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the roughing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

10. Secure the exhaust tubing with a hose clamp.
11. Route the open end of the exhaust tubing to a suitable exhaust vent.
12. Inspect the oil level in the pump.



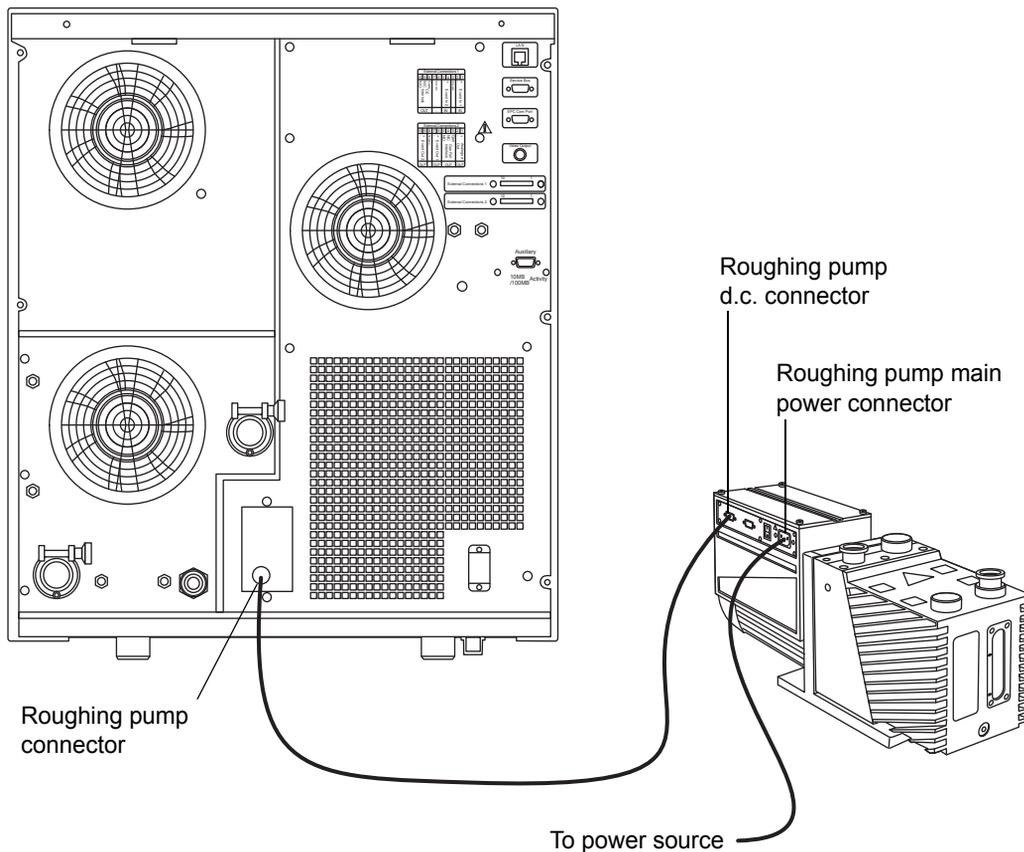
**Caution:** To ensure correct operation of the roughing pump, do not operate the pump with the oil level below 30% of the MAX level.

See [“Inspecting the Varian roughing pump oil level”](#) on page 101, and, if needed, [“Adding oil to the Varian roughing pump”](#) on page 102.

13. Make the electrical connections to the roughing pump.

## Making the electrical connections to the Varian oil-filled roughing pump

### Roughing pump connections:



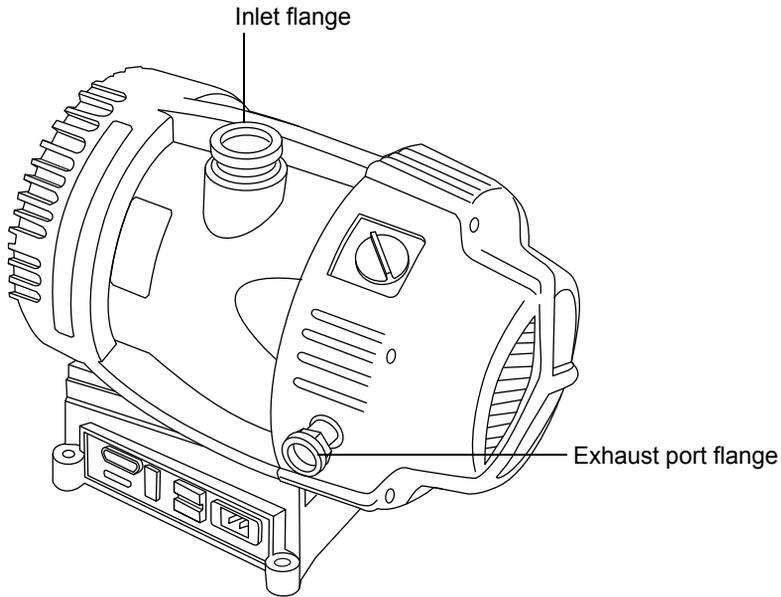
### To make the electrical connections to the oil-filled roughing pump:

1. Connect the roughing pump power cord to the main power source.
2. Connect the relay cable from the roughing pump d.c. connector to the pump connector on the mass spectrometer's rear panel.

## Connecting the Edwards oil-free roughing pump

---

The oil-free roughing pump is an alternative to the oil-filled roughing pump. To connect the oil-filled roughing pump, see “[Connecting the Varian oil-filled roughing pump](#)” on page 217.

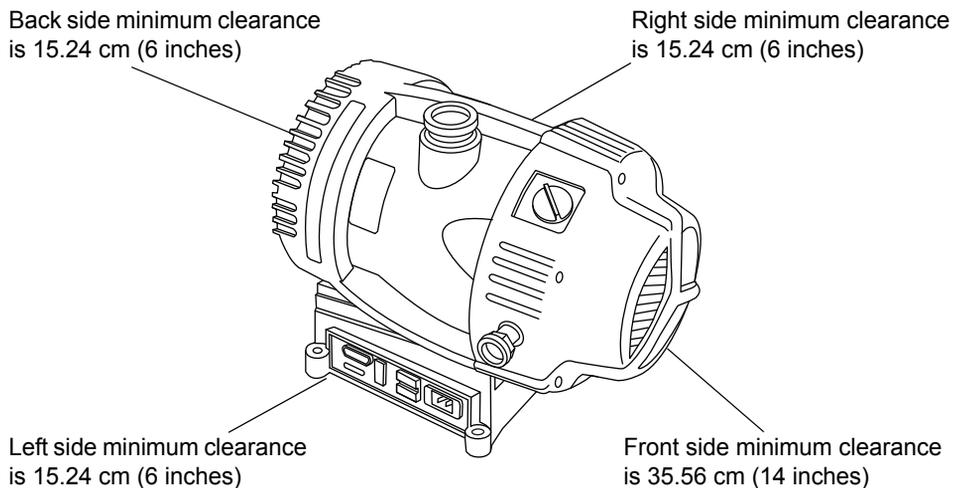


### Required materials

- Chemical-resistant, powder-free gloves
- 7-mm nut driver
- Sharp knife
- Elbow (included in the Waters Rotary Pump Kit)
- NW25 tee (included in the installation kit)
- NW25 center rings (included in the installation kit)
- NW25 clamps (included in the installation kit)
- NW40 center rings (included in the installation kit)
- NW40 clamps (included in the installation kit)
- NW25/NW40 adaptor (included in the installation kit)
- 12.7-mm clear PVC exhaust tubing (included in the Waters Rotary Pump Kit)
- PVC hose clamps (included in the Waters Rotary Pump Kit)
- 1-inch ID vacuum hose (included in the Waters Rotary Pump Kit)

Bear in mind these requirements when connecting the roughing pump:

- The pump must be horizontal, or within one degree of horizontal.
- The ambient temperature of area in which you place the pump must range between 12 and 40 °C (54 to 104 °F).
- To ensure proper ventilation, install the pump with the following minimum clearances:





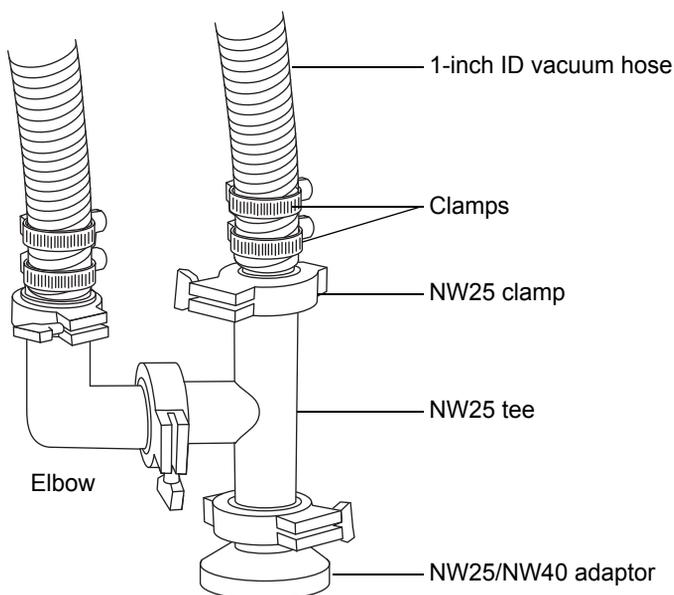
**Warning:** To avoid personal contamination with biohazards or toxic compounds, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the pump and its connections.



**Warning:** To avoid skeletal or muscle injury, at least two people must lift the pump.

### To connect the oil-free roughing pump:

1. Place the pump on the floor, within 1.5 m (5 feet) of the instrument.
2. Attach the NW25/NW40 adaptor to the roughing pump inlet flange using an NW40 center ring, and then secure the connection with an NW40 clamp, using the 7-mm nut driver to install the clamp.
3. Attach the NW25 tee to the NW25/NW40 adaptor using an NW25 center ring, and then secure the connection with an NW25 clamp, using the 7-mm nut driver to install the clamp.



4. Attach the elbow to one of the open ports on the NW25 tee using an NW25 center ring, and then secure the connection with an NW25 clamp, using the 7-mm nut driver to install the clamp.
5. Attach the flanged end of a length of 1-inch ID vacuum hose to the remaining open port on the NW25 tee using an NW25 center ring, and then secure the connection with an NW25 clamp, using the 7-mm nut driver to install the clamp.
6. Attach the flanged end of a second length of 1-inch ID vacuum hose to the open port on the elbow using an NW25 center ring, and then secure the connection with an NW25 clamp, using the 7-mm nut driver to install the clamp.
7. Connect the free ends of the two lengths of vacuum hose to the two, 1-inch OD, straight, vacuum ports on the mass spectrometer's rear panel.
8. Install 2 clamps on each hose end.



**Caution:** To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

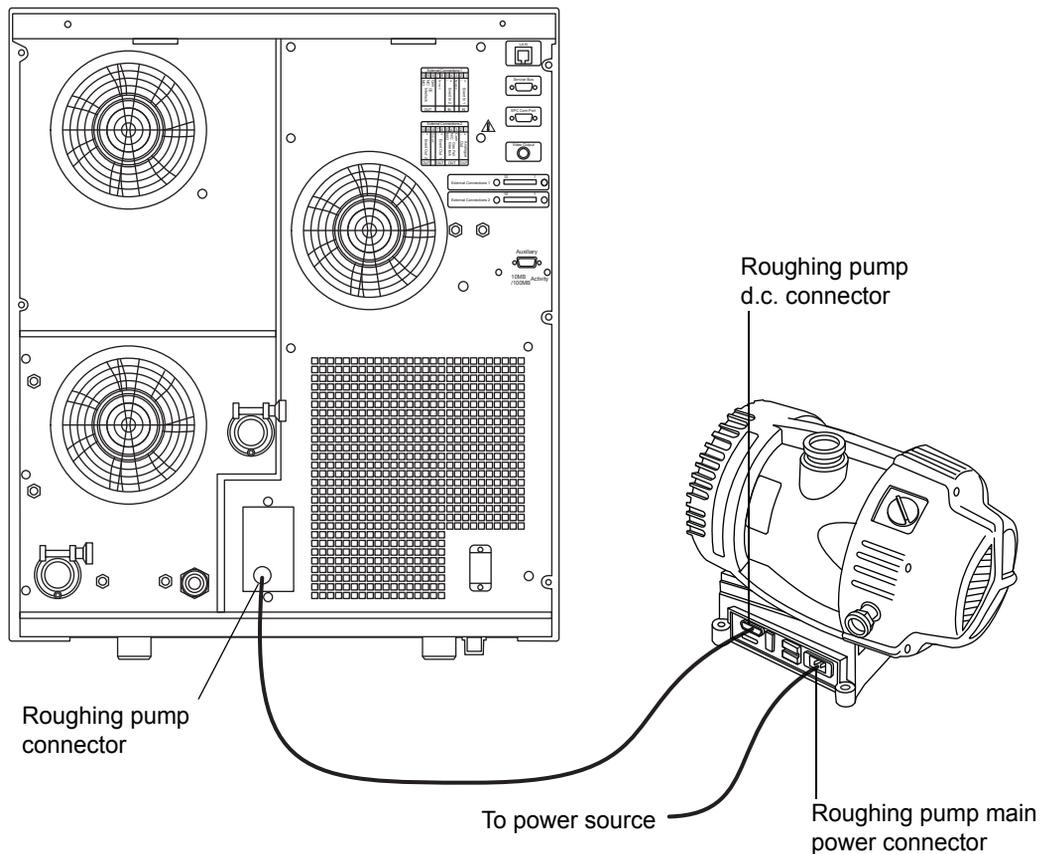
9. Connect the 12.7-mm clear PVC exhaust tubing to the roughing pump exhaust port NW25 nozzle fitting, and secure the tubing with a hose clamp.

**Caution:** To prevent serious damage to the instrument, two separate exhaust systems are required: one for nitrogen, the other for the roughing pump. Vent the exhausts to atmosphere through separate lines. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the roughing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

10. Route the open end of the exhaust tubing to a suitable exhaust vent.
11. Make the electrical connections to the roughing pump (see [“Making the electrical connections for the Edwards oil-free roughing pump”](#) on page 228).

## Making the electrical connections for the Edwards oil-free roughing pump

### Roughing pump connections:



### To make the electrical connections for the oil-free roughing pump:

1. Connect the roughing pump power cord to the main power source.
2. Connect the relay cable from the roughing pump d.c. connector to the pump connector on the mass spectrometer's rear panel.

## Connecting to the nitrogen gas supply

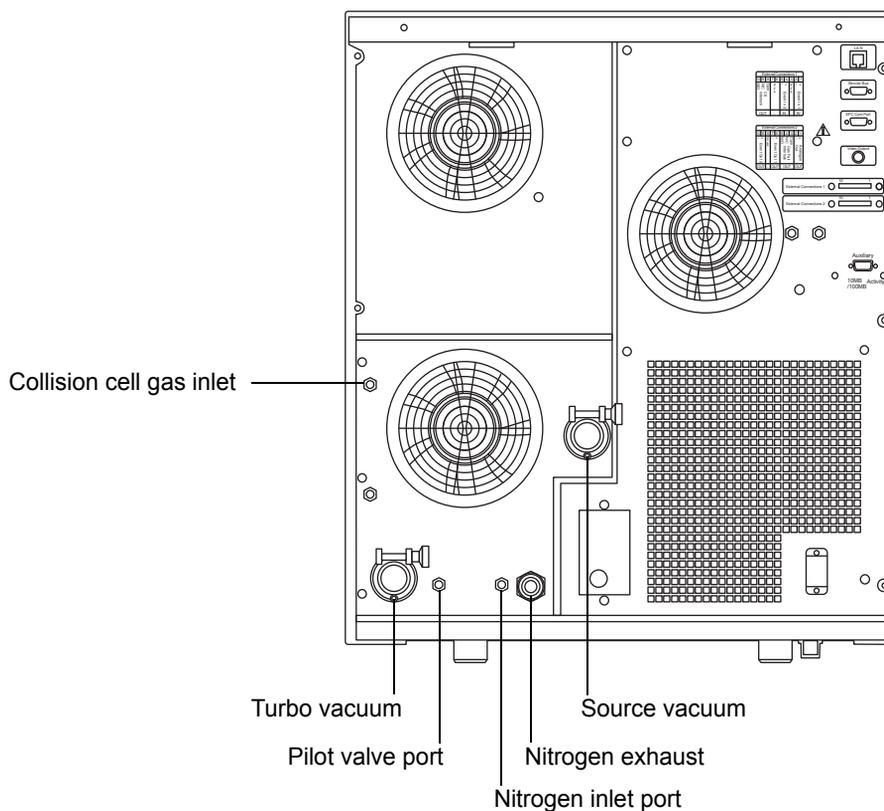
### Required materials

- Chemical-resistant, powder-free gloves
- 6-mm PTFE tubing (included in the Waters Rough Pump Connect Kit)
- Nitrogen regulator

### To connect the nitrogen gas supply:

1. Connect one end of the 6-mm PTFE tubing to the nitrogen inlet port on the rear of the instrument.

### Nitrogen and collision cell gas inlet, and vacuum connectors:



2. Attach a nitrogen regulator (not provided) to the nitrogen supply.

3. Connect the free end of the 6-mm PTFE tubing to the nitrogen regulator.  
**Requirement:** The nitrogen must be dry and oil-free, with a purity of at least 95%.
4. Set the nitrogen regulator to 600 to 690 kPa (6.0 to 6.9 bar, 90 to 100 psi).

## Connecting to the collision cell gas supply

---

### Required materials

- Chemical-resistant, powder-free gloves
- 11-mm wrench
- 1/8-inch Swagelok<sup>®</sup> nut and ferrule
- 1/8-inch stainless steel tube (supplied with the mass spectrometer)
- Argon regulator (not supplied)

### To connect the collision cell gas supply:

1. Use the 1/8-inch Swagelok nut and ferrule to connect the 1/8-inch stainless steel tube to the collision cell gas inlet on the rear of the mass spectrometer (see the figure on [page 229](#)).
2. Use the 11-mm wrench to tighten the 1/8-inch Swagelok nut.
3. Attach an argon regulator (not provided) to the argon supply.  
**Requirement:** The argon must be dry and of high purity (99.997%).
4. Connect the free end of the tube to the collision gas supply.
5. Set the argon regulator to 50 kPa (0.5 bar, 7 psi).

## Connecting the nitrogen exhaust line

---

### Required materials

- Chemical-resistant, powder-free gloves
- Sharp knife
- Nitrogen exhaust trap bottle
- 6-mm, 10-mm, and 12-mm PTFE tubing (included in the Waters Rough Pump Connect Kit)
- snoop<sup>®</sup> (or equivalent) leak detector liquid



**Warning:** To avoid exposure to biohazards or toxic LC solvents carried in the nitrogen exhaust, ensure that the nitrogen exhaust is vented via the nitrogen exhaust trap bottle and laboratory exhaust system. The laboratory exhaust system must provide a minimum vacuum of 0.20 kPa (2 mbar, 0.03 psi) below atmospheric pressure (negative pressure).



**Warning:** To avoid personal contamination with biohazards or toxic compounds, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the exhaust connections.



**Warning:** To avoid the buildup of hazardous gases, do not place the nitrogen exhaust trap bottle in an enclosed cabinet.

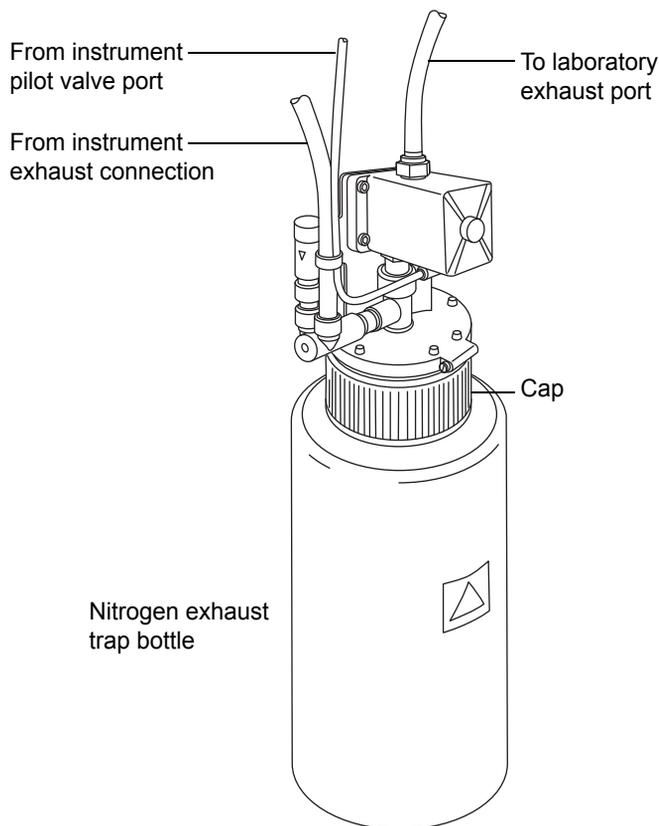


**Caution:** To prevent serious damage to the instrument, two separate exhaust systems are required: one for nitrogen, the other for the roughing pump. Vent the exhausts to atmosphere through separate exhaust lines. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the roughing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

### To connect the nitrogen exhaust line:

1. Locate the nitrogen exhaust trap bottle in an accessible area below the instrument.

#### Nitrogen exhaust trap bottle:



**Caution:** To avoid gas leaks, use the sharp knife to cut the PTFE tubing squarely (that is, perpendicular to its horizontal axis).

2. Cut a length of 6-mm tubing long enough to connect the instrument to the nitrogen exhaust trap bottle.
3. Connect one end of the tubing to the pilot valve port on the instrument's rear panel.
4. Connect the free end of the tubing to the pilot valve port on the nitrogen exhaust trap bottle.

5. Cut a length of 12-mm tubing long enough to connect the instrument to the nitrogen exhaust trap bottle.
6. Connect one end of the tubing to the exhaust port on the instrument's rear panel.
7. Connect the free end of the tubing to the inlet port on the nitrogen exhaust trap bottle.



**Caution:** To avoid gas leaks, use the sharp knife to cut the PTFE tubing squarely (that is, perpendicular to its horizontal axis).

8. Cut a second length of 10-mm tubing long enough to connect the nitrogen exhaust trap bottle to the exhaust vent.
9. Insert one end of the tubing into the outlet port on the nitrogen exhaust trap bottle.
10. Route the free end of the tubing to the exhaust vent.

**Requirement:** To confirm the integrity of the source exhaust system, perform the following leak test.



**Caution:** To avoid damage to the instrument, use snoop (or its equivalent) leak detector liquid only for the purpose described in the following step. Do not use it on any other part of the instrument.

11. Use snoop (or equivalent) leak detector liquid to ensure that there are no leaks at the instrument exhaust and laboratory exhaust system line connections.

## Connecting the liquid waste line

---

### Required materials

- Chemical-resistant, powder-free gloves
- Waste container



**Warning:** To prevent personal contamination with biohazards or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure. The waste line and connection can be contaminated.

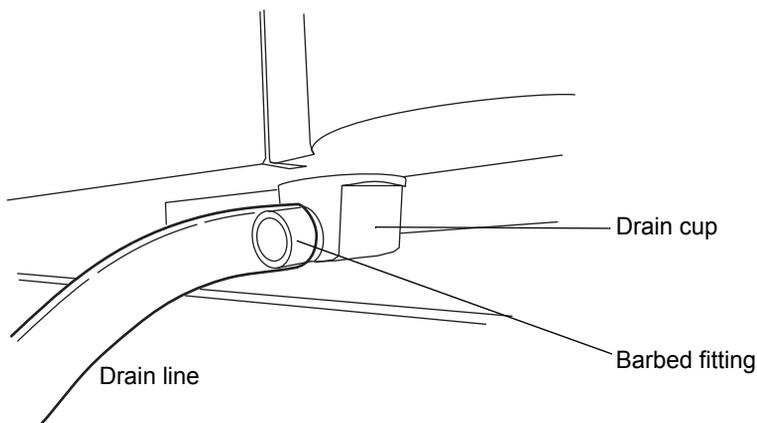
### To connect the liquid waste line:

1. Place a suitable waste container below the mass spectrometer.



**Caution:** To avoid distorting the drip tray or causing the drain cup to leak, restrain the drain cup when attaching or removing the waste line.

2. Slide a drain line over the barbed fitting of the drain (located at the bottom, left-hand side of the mass spectrometer).





**Warning:** To prevent leakage of biohazards or toxic materials, ensure that the,

- drain line does not crimp or bend, impeding flow to the waste container;
  - waste container is emptied before the lower end of the drain tube is covered by waste solvent.
3. Route the waste line to the waste container. If necessary, shorten the waste tube so that its end is above the surface of the waste solvent.

#### Positioning of drain tube:



## Connecting the workstation

---



**Warning:** To avoid injury from electric shock or fire, and to prevent damage to the workstation and ancillary equipment, do not place objects filled with liquid—such as solvent bottles—on these items, or expose them to dripping or splashing liquids.

Before connecting the workstation to the instrument, set up the workstation according to its accompanying instructions. Locate the workstation within 5 meters (16 feet) of the instrument.

**Requirement:** Use shielded network cables with the mass spectrometer to ensure compliance with FCC limits.

### To connect the workstation:

1. Connect the monitor to the PC.
2. Connect one end of the shielded network cable to the appropriate port on the rear panel of the mass spectrometer.
3. Connect the other end of the shielded network cable to the port labeled instrument LAN on the workstation rear panel.

### To connect the instrument to the power source:

**Requirement:** Do not connect the instrument's power supply cord until you complete the installation procedures in the previous sections.

1. Select the appropriate power cord for your location.
2. Connect the female end of the power cord to the power port on the rear panel of the instrument.

## Connecting Ethernet cables

---

**Requirement:** Use shielded network cables with the mass spectrometer to ensure compliance with FCC limits.

### To make Ethernet connections:

1. Connect one end of one shielded Ethernet cable to the network switch, and then connect the other end to the Ethernet card on the preconfigured ACQUITY<sup>®</sup> workstation.

**Tip:** On preconfigured systems, the Ethernet card is identified as the Instrument LAN card.

2. Connect one end of the other shielded Ethernet cable to the back of the mass spectrometer, and then connect the other end to the network switch.

## Input/output signal connectors

---



**Warning:** To avoid electric shock, all electrical connections to the rear panel must be separated from hazardous voltages by double or reinforced insulation. Circuits of this type are classified as safety extra low voltage (SELV). Examples of circuits that are typically SELV include contact closure inputs and outputs for auto-samplers, and UV, RI, and fluorescence mass spectrometer signal outputs for LC/MS systems. The electrical connections on the rear panel of this mass spectrometer are all SELV.

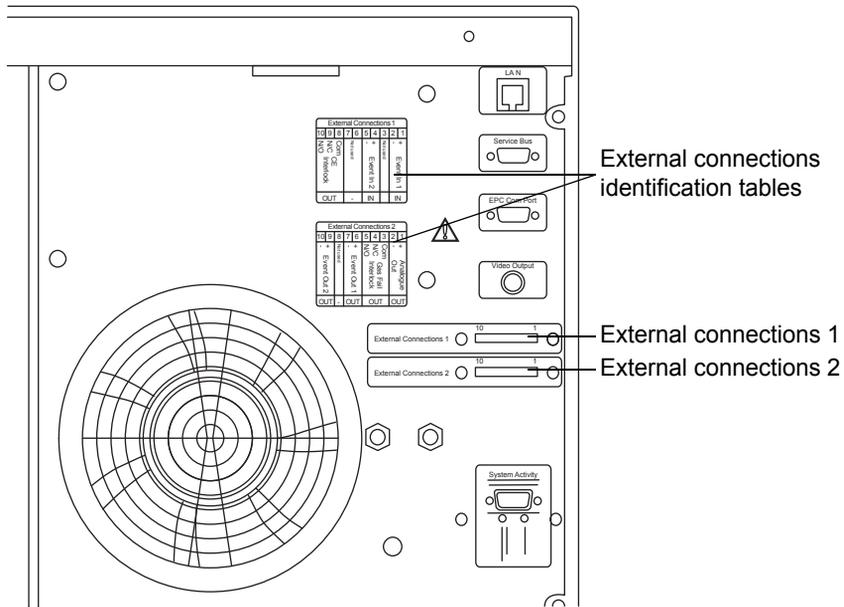


**Caution:** To avoid damaging the instrument,

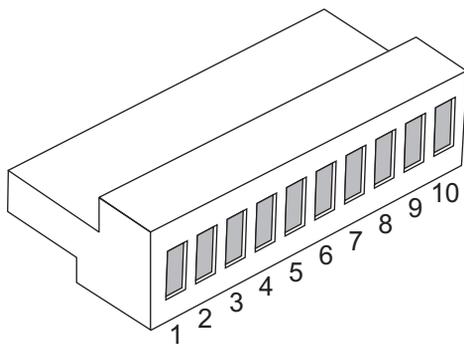
- never apply a voltage to the Analog (out) connectors; these are active connections driven by the instrument.
- do not apply voltages higher than those shown in the tables on [page 239](#).

Two removable connectors (designated External Connections 1 and External Connections 2) are on the mass spectrometer's rear panel; these connectors hold the screw terminals for input/output signals. The connectors are keyed so that they can receive a signal cable inserted only one way.

**Input and output connector locations:**



**Input/output signal connector configuration:**



**External connections 1:**

<b>Pin</b>	<b>Function</b>	<b>Rating</b>
1	Event In 1+, digital signal, optimum +3.3V max +5V	+5 V
2	Event In 1-, digital ground, 0V	0 V
3	Not used	
4	Event In 2+, digital signal, optimum +3.3V max +5V	+5 V
5	Event In 2-, digital ground, 0V	0 V
6	Not used	
7	Not used	
8	CE Interlock Out, common	+30 V d.c., 100 mA
9	CE Interlock Out, normally closed (N/C)	+30 V d.c., 100 mA
10	CE Interlock Out, normally open (N/O)	+30 V d.c., 100 mA

**External connections 2:**

<b>Pin</b>	<b>Function</b>	<b>Rating</b>
1	Analog Out +, instrument-driven electrical output	None
2	Analog Out -, ground	None
3	Gas Fail Interlock, common	+30 V d.c., 100 mA
4	Gas Fail Interlock, normally closed (N/C)	+30 V d.c., 100 mA
5	Gas Fail Interlock normally open (N/O)	+30 V d.c., 100 mA
6	Event Out 1 +	+30 V d.c., 100 mA
7	Event Out 1 -	+30 V d.c., 100 mA
8	Not used	
9	Event Out 2 +	+30 V d.c., 100 mA
10	Event Out 2 -	+30 V d.c., 100 mA

## Making signal connections

### Mass spectrometer signal connections:

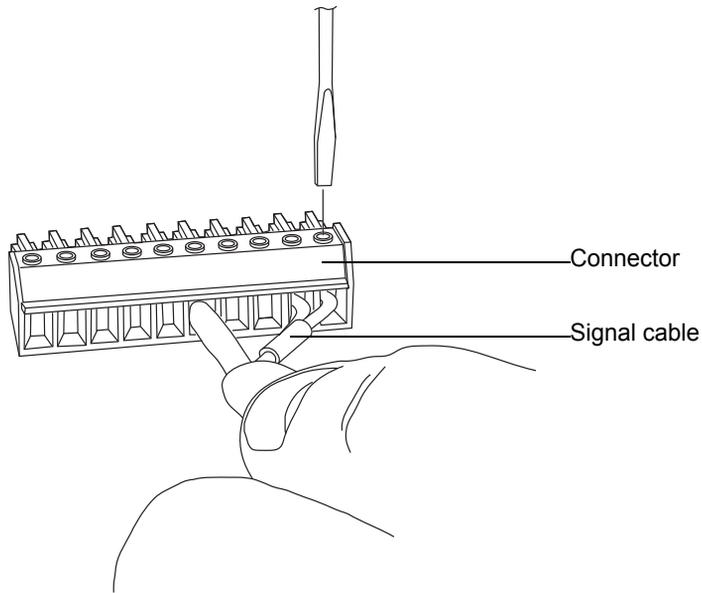
Signal connections	Description
Analog (Out)	Used for analog chart output functionality. The output voltage range is 0 to 2 V. The resolution of the voltage output is 12 bits.
Gas Fail Interlock (Out)	Used to stop the solvent flow if the nitrogen gas supply fails. Maximum 30 V, 0.5 A, 10 W.
Event (Out)	Allows the mass spectrometer to trigger an external event.
Event (In)	Allows an external device to start data acquisition. Maximum 30 V.
CE Interlock	Interfaces with a capillary electrophoresis power supply so that the instrument is safely interlocked against high voltages.

**Requirement:** To meet the regulatory requirements of immunity from external electrical disturbances, install connection covers over the signal connectors.

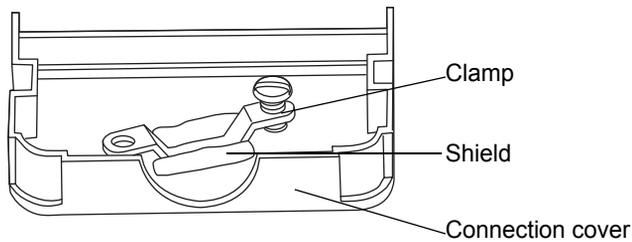
### To make signal connections:

1. Determine the signal connection location from the silk-screened label on the rear panel of each instrument.

2. Attach the positive and negative leads of the signal cable to the connector.

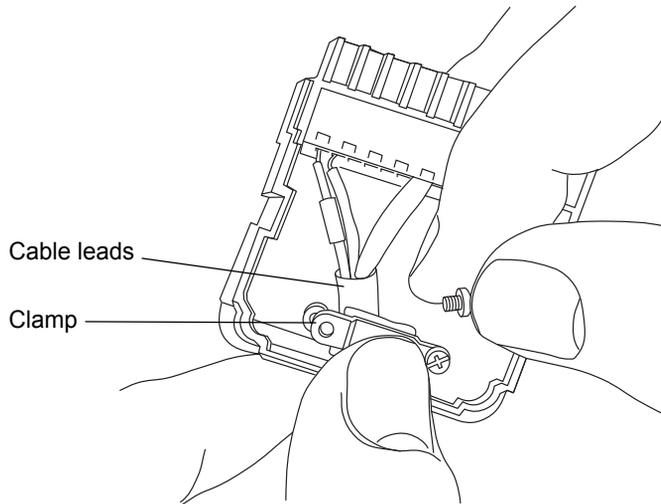


3. Slide the clamp (with the bend facing down) into the protective shield.
4. Insert the clamp and shield (with the bend facing down) into the connection cover, and loosely tighten with one self-tapping screw.

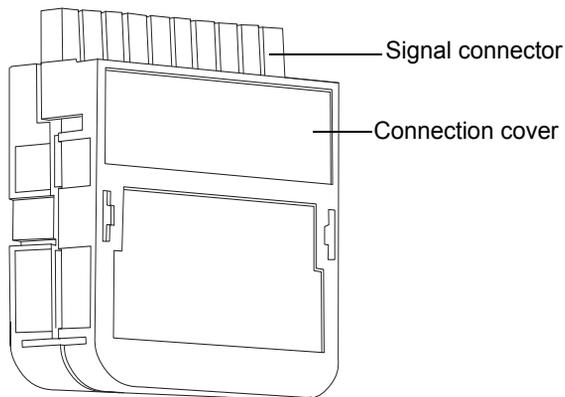


## C External Connections

5. Insert the connector with the signal cable into the connection cover, and position the clamp over the cable leads, and tighten the clamp into place with the second self-tapping screw.



6. Place the second connection cover over the first cover, and snap it into place.



## Connecting to the electricity source

---

The mass spectrometer requires a separate, grounded electricity source. The ground connection in the electrical outlet must be common and connected near the system.

**Recommendation:** Use a line conditioner or an uninterruptible power supply (UPS) for optimum long-term input voltage stability.



**Warning:** To avoid electrical shock, use the SVT-type power cord in the United States and HAR-type (or better) in Europe. The main power cord must only be replaced with one of adequate rating. For information regarding what cord to use in other countries, contact your local Waters distributor.

### To connect to the electricity source:

1. Connect the female end of the power cord to the receptacle on the rear panel of the mass spectrometer.
2. Connect the male end of the mass spectrometer power cord to a suitable 200 to 240 V a.c. wall outlet.



# D Plumbing the IntelliStart Fluidics System

This appendix provides reference information for replacing the tubing in the IntelliStart™ Fluidics system.



**Warning:** To avoid personal contamination with biohazards or toxic materials, always wear chemical-resistant, powder-free gloves while working on the IntelliStart Fluidics system.

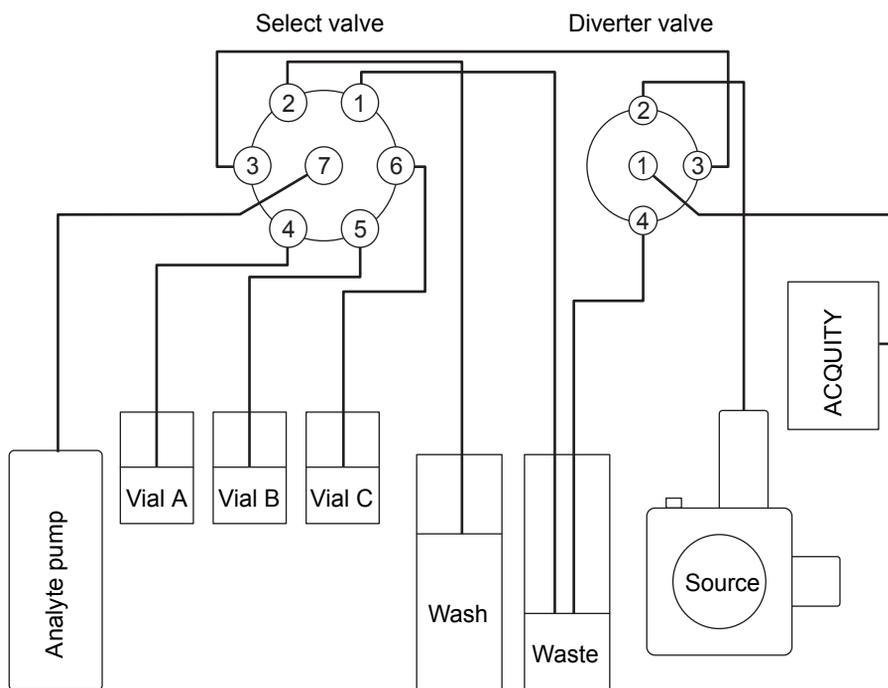
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## Preventing contamination

For information on preventing contamination, refer to *Controlling Contamination in LC/MS Systems* (part number 715001307). You can find this document on <http://www.waters.com>; click Services and Support > Support.

## Plumbing schematic



## Pipe specifications

---

The following table gives the internal dimensions (ID), external dimensions (ED), Color, Length, and Quantity for the IntelliStart Fluidics pipes.

### Replacement pipe specifications:

Connection	ID (inches)	ED (inches)	Color	Length (mm)	Quantity
Select to divert	0.005	1/16	Red	200	1
Vial	0.020	1/16	Orange	600	3
Wash	0.020	1/16	Orange	1000	1
Pump	0.040	1/16	Natural	500	1
Waste	0.040	1/16	Natural	1000	2

## D Plumbing the IntelliStart Fluidics System