

Waters Xevo TQ-S Mass Spectrometry System

Overview and Maintenance Guide

General information

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Internet	The Waters Web site includes contact information for Waters locations worldwide. Visit www.waters.com
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Safety considerations

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 (GLP), and consult your organization's standard operating procedures as well as your local requirements for safety.

Considerations specific to the device

Power cord replacement hazard



Warning: To avoid electric shock, use SVT-type power cords in the United States and HAR-type (or better) cords in Europe. The power cords must be replaced only with ones of adequate rating. For information regarding which cord to use in other countries, contact your local Waters distributor.

Solvent leakage hazard

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



Warning: To avoid exposure to toxic substances and biohazards from O-ring leaks in the source exhaust system, observe these precautions:

- Replace the source O-rings at intervals not exceeding one year.
- Prevent chemical degradation of the source O-rings, which can withstand exposure only to certain solvents, by determining whether any solvents you use are chemically compatible with the composition of the O-rings.

Bottle placement prohibition



Warning: To avoid injury from electrical shock or fire, and damage to the equipment, follow these guidelines:

- Do not expose the workstation or ancillary equipment to dripping or splashing liquids.
- Do not place objects filled with liquid, such as solvent bottles, on top of the workstation or ancillary equipment.

Spilled solvents hazard



Prohibited: To avoid equipment damage caused by spilled solvent, do not place reservoir bottles directly atop an instrument or device or on its front ledge. Instead, place the bottles in the bottle tray, which serves as secondary containment in the event of spills.

Flammable solvents hazard



Warning: To prevent the ignition of flammable solvent vapors in the enclosed space of a mass spectrometer's ion source, ensure that these conditions are met:

- Nitrogen flows continuously through the source.
- A gas-fail device is installed, to interrupt the flow of LC solvent should the nitrogen supply fail.
- The nitrogen supply pressure does not fall below 400 kPa (4 bar, 58 psi) during an analysis requiring the use of flammable solvents.

When using flammable solvents, ensure that a stream of nitrogen continuously flushes the instrument's source, and the nitrogen supply pressure remains above 400 kPa (4 bar, 58 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.

Glass breakage hazard

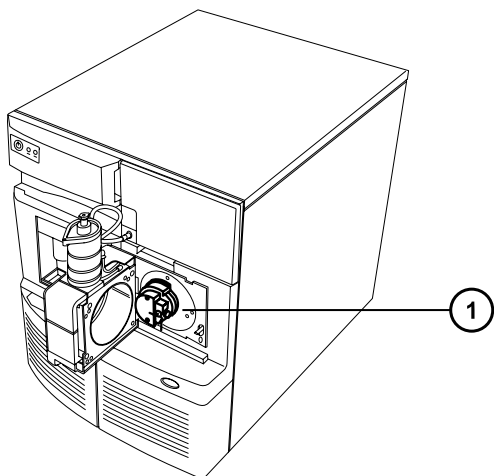
Warning: To avoid injuries from broken glass, falling objects, or exposure to biologically hazardous, toxic, or corrosive substances, never place containers on top of the instrument or on its front covers.

High temperature hazard



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

Mass spectrometer high temperature hazard



① Source ion block assembly

Hazards associated with removing an instrument from service



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



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



Warning: To avoid eye injury from broken fused silica lines, use eye protection when performing this procedure.

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.

Electrical power safety notice

Do not position the instrument so that it is difficult to disconnect the power cord.

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 equipment is used in a manner not specified by its manufacturer, protections against personal injury inherent in the equipment's design can be rendered ineffective.

Safety advisories

Consult the "Safety advisories" appendix in this publication for a comprehensive list of warning advisories and notices.

Operating the device

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

Applicable symbols

The following symbols can be present on the device, system, or packaging.

Symbol	Definition
	Manufacturer
	Date of manufacture

Symbol	Definition
	Authorized representative of the European Community
	Confirms that a manufactured product complies with all applicable European Community directives
	Australia EMC compliant
	Confirms that a manufactured product complies with all applicable United States and Canadian safety requirements
	Consult instructions for use
	Alternating current
	Electrical and electronic equipment with this symbol may contain hazardous substances and should not be disposed of as general waste. For compliance with the Waste Electrical and Electronic Equipment Directive (WEEE) 2012/19/EU, contact Waters Corporation for the correct disposal and recycling instructions.
	Serial number
	Part number, catalog number

Audience and purpose

This guide provides instructions for preparing for operation, changing modes of operation, and maintaining the Xevo TQ-S mass spectrometer. This guide is intended for operators of various levels of experience with Waters products and should be used in conjunction with instruction and training provided by Waters personnel.

Intended use

Waters designed the Xevo TQ-S for use as a research tool to accurately, reproducibly, and robustly quantify target compounds present at the lowest possible levels in highly complex sample matrices. It is not for use in diagnostic procedures.

Calibrating

To calibrate LC systems, adopt acceptable calibration methods using at least five standards to generate a standard curve. The concentration range for standards must 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 an 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. If sample trays are the same or very similar, vary the location of the QC samples in the trays. 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.

Analyzing samples

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 that 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 minimize 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.
- To ensure data integrity, Waters recommends that you run QC samples before and after test samples within a single analysis. Additionally, you can periodically run known samples as unknowns to verify assay results for a single analysis.

Instrument maintenance frequency also depends on the complexity of the matrix and the number of samples being analyzed. To maintain performance levels, you must conduct routine cleaning of user-serviceable components. Waters Performance Maintenance Services are available and can be scheduled as required, based on the combined sample throughput and sample complexity.

EMC considerations

Canada spectrum management emissions notice

This class A digital product apparatus complies with Canadian ICES-001.

Cet appareil numérique de la classe A est conforme à la norme NMB-001.

ISM classification: ISM group 1 class A

This classification has been assigned in accordance with 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 all establishments other than residential locations and those directly connected to a low voltage power supply network supplying a building for domestic purposes.

There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbances.

EMC emissions

Do not use the equipment in close proximity to sources of strong electromagnetic radiation (for example, unshielded intentional RF sources). The radiation can interfere with the equipment's proper operation.

This equipment complies with the emission and immunity requirements described in the relevant parts of IEC/EN 61326: Electrical equipment for measurement, control, and laboratory use — EMC requirements.

FCC radiation emissions notice

Changes or modifications not expressly approved by the party responsible for compliance, could void the user's 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.

EC authorized representative



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1 Waters Xevo TQ-S overview

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

1.1 Waters Xevo TQ-S

The Xevo TQ-S is a tandem quadrupole, atmospheric pressure ionization (API) mass spectrometer. It is designed for routine HPLC/MS/MS and UPLC/MS/MS analyses in quantitative and qualitative applications, and can operate at fast acquisition speeds compatible with UltraPerformance LC.

You can use the Xevo TQ-S with the following high-performance ZSpray dual-orthogonal API sources:

- Standard multi-mode electrospray ionization/atmospheric pressure chemical ionization/combined electrospray ionization and atmospheric pressure chemical ionization (ESI/APCI/ESCI)

Requirement: Dedicated APCI operation requires an additional probe (IonSABRE II).

- Optional dual-mode atmospheric pressure photoionization (APPI)/APCI
- Optional low-flow ESI
- Optional NanoFlow ESI
- Optional atmospheric solids analysis probe (ASAP)
- Optional atmospheric pressure gas chromatography (APGC)
- Optional TRIZAIC UPLC
- Optional ionKey source
- Optional UniSpray source

Note: For information on installing and removing the optional APGC, ASAP, and TRIZAIC sources, refer to the operator's guide supplements supplied with them.

You can also use the Xevo TQ-S with the following optional third-party sources:

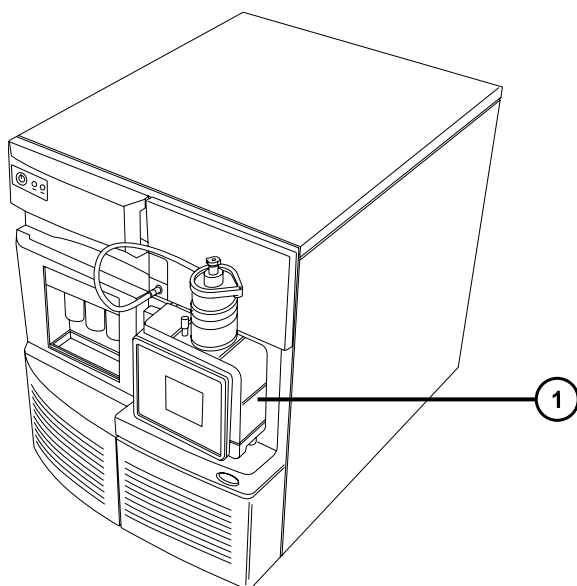
- Direct analysis in real time (DART)
- Desorption electrospray ionization (DESI)
- Laser diode thermal desorption (LDTD)

For additional details, refer to the appropriate manufacturer's documentation.

Available source options can vary, depending on the software you use to operate the Xevo TQ-S. Refer to the MassLynx or UNIFI online Help for more information about supported sources.

For mass spectrometer specifications, see the *Waters Xevo TQ-S Site Preparation Guide* (715002440).

Figure 1–1: Xevo TQ-S



① Source enclosure

1.2 IntelliStart technology

IntelliStart technology monitors instrument performance and indicates when the instrument is ready for use.

The IntelliStart software automatically tunes and mass calibrates the mass spectrometer and displays performance readbacks. Integrated with MassLynx mass spectrometry software and Instrument Console software, IntelliStart software enables simplified setup of the system for use in routine analytical and open-access applications. See [Software and data system](#) for further information.

The IntelliStart fluidics system¹ 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, enabling you to optimize instrument performance at analytical flow rates.

¹ In Waters documents, the term “fluidics” refers to the IntelliStart Fluidics system, which is the instrument’s onboard system that delivers sample and solvent to the probe of the mass spectrometer. It can also denote plumbing components and fluid pathways within and between system modules.

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.

1.3 ACQUITY UPLC/MS Xevo TQ-S systems

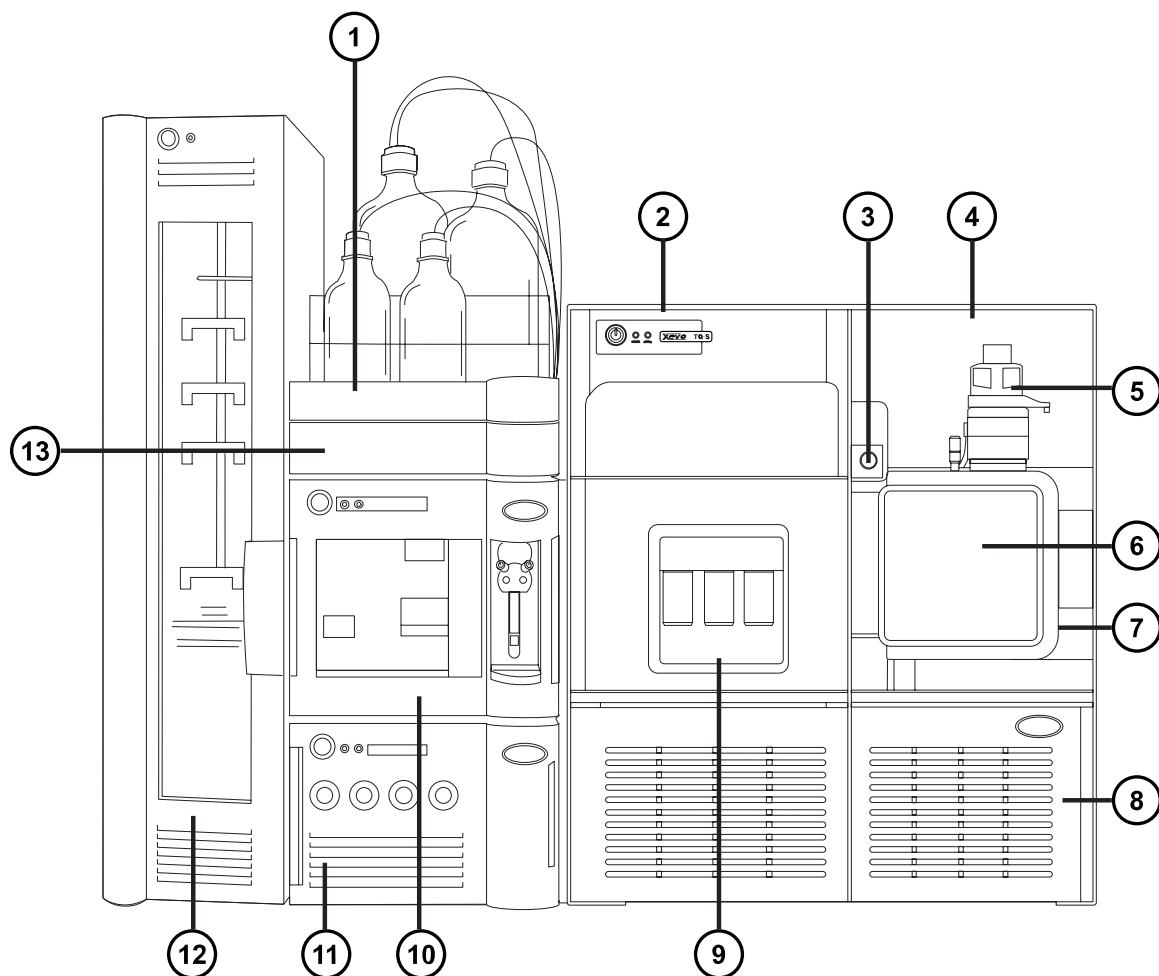
The Waters Xevo TQ-S is compatible with the ACQUITY UPLC systems. If you are not using an ACQUITY UPLC system, refer to the documentation relevant to your LC system.

1.3.1 ACQUITY UPLC system

The ACQUITY UPLC system includes a binary or quaternary solvent manager, sample manager, column heater, sample organizer, detectors, and a specialized ACQUITY UPLC column. Waters Informatics software controls the system.

For further information, see the *ACQUITY UPLC System Operator's Guide* (71500082502) or *Controlling Contamination in LC/MS Systems* (715001307). You can find the latter document on www.waters.com; click **Services & Support > Support Library**.

Figure 1–2: Waters ACQUITY Xevo TQ-S UPLC/MS system:



- ① Solvent tray
- ② Access door to the fluidics valve
- ③ ESI probe high-voltage connector
- ④ Source interface sliding door
- ⑤ Probe
- ⑥ Source enclosure
- ⑦ Source enclosure release
- ⑧ Xevo TQ-S
- ⑨ Access door to the fluidics pump

- ⑩ Sample manager
- ⑪ Binary solvent manager
- ⑫ Sample organizer (optional on ACQUITY UPLC system)
- ⑬ Column heater

1.3.2 ACQUITY UPLC M-Class system

The ACQUITY UPLC M-Class system is designed for nano-scale and micro-scale separations.

M-Class system components are optimized for use with sub-2µm particle liquid chromatography and use reduced fluid volumes. The supported flow rate for a gradient elution ranges from 200 nL/min to 100 µL/min at 15,000 psi.

For further information, see the *ACQUITY UPLC M-Class System Operator's Guide* or *Controlling Contamination in LC/MS Systems* (part number 715001307). You can find these documents on www.waters.com by clicking **Services and Support > Support Library**.

1.3.3 Non-ACQUITY devices for use with the Xevo TQ-S

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

- Waters Alliance 2695 separations module
- Waters Alliance 2795 separations module
- Waters 2998 PDA detector
- Waters 2487 UV detector
- Waters 1525µ binary gradient pump + 2777 autosampler

1.3.4 Software and data system

MassLynx or UNIFI software can control the mass spectrometer. See [MassLynx software](#) and [UNIFI software](#) for more information about those applications. Both MassLynx and UNIFI software enable these major operations:

- Configuring the system.
- Creating LC and MS methods that define operating parameters for a run.
- Using IntelliStart software to automatically tune and mass calibrate the mass spectrometer.
- Running samples.
- Monitoring the run.

- Acquiring data.
- Processing data.
- Reviewing data.
- Printing data.

1.3.4.1 MassLynx software

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

See the MassLynx software 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 Control application.

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

See the online Help for the Instrument Console system for additional details.

1.3.4.2 UNIFI software

UNIFI software integrates mass spectrometry, UPLC chromatography, and informatics data workflows into one system.

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

1.4 Ionization techniques and source probes

Note: Available source options can vary depending on the software used to operate the Xevo TQ-S. Refer to the instrument software's online Help for more information about supported sources.

1.4.1 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 standard ESI probe (or tool-free ESI probe) assembly accommodates flow rates of up to 2 mL/min, making it suitable for LC applications in the range of 100 μ L/min to 2 mL/min.

See also: [ESI mode](#) for further details.

1.4.2 Combined ESI and APCI (ESCI)

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

See [ESCI mode](#) for further details.

1.4.3 Atmospheric pressure chemical ionization (APCI)

An optional, dedicated, high-performance APCI interface is available. 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 IonSABRE II or tool-free APCI probe.

See [APCI mode](#) for further details.

1.4.4 Dual-mode APPI/APCI source

The optional, combined APPI/APCI source comprises an IonSABRE II or tool-free APCI probe and the APPI lamp drive assembly. The APPI lamp drive assembly 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.

See [Combined APPI/APCI source](#) for details.

1.4.5 UniSpray source

The UniSpray source enables the detection of a wide range of compounds in a single analysis. In contrast to Electrospray ionization, UniSpray uses a grounded capillary, and the resulting spray is directed at an impactor pin held at a voltage, creating smaller charged droplets amenable to easy desolvation.

See [UniSpray standard source](#) for further details.

1.4.6 Low-flow ESI probe

The optional low-flow ESI probe is fitted with a narrow bore capillary suitable for use with flow rates from 5 $\mu\text{L}/\text{min}$ to 100 $\mu\text{L}/\text{min}$. Its probe tip is optimized for this capillary.

The low-flow ESI probe replaces the standard ESI probe in the instrument's source housing.

See the *Low-flow ESI Probe Operator's Guide* for further details.

1.4.7 NanoFlow ESI source

NanoFlow is the name given to several techniques that use low flow rate ESI. The NanoFlow source allows ESI in the flow rate range of 5 to 1,000 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. It 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 μ L is recommended.
- Borosilicate glass capillaries (nanovials).
Metal-coated, glass capillaries allow the lowest flow rates. They are usable for one sample, and then must be discarded.
- Capillary Electrophoresis (CE) or Capillary Electrochromatography (CEC) sprayer.
This option uses a make-up liquid at the capillary tip that provides a stable electrospray. The make-up flow rate is less than 1 μ L/min.
See [NanoFlow ESI source](#) for further details.

1.4.8 Atmospheric solids analysis probe (ASAP)

The ASAP facilitates rapid analysis of volatile and semivolatile compounds in solids, liquids, and polymers. It is particularly suited to analyzing low-polarity compounds. The ASAP directly replaces the ESI or APCI probe in the instrument's source housing and has no external gas or electrical connections.

See the *Atmospheric Solids Analysis Probe Operator's Guide Supplement* (715002034) for further details.

1.4.9 APGC

The Waters APGC couples an Agilent GC with the Xevo TQ-S. Doing so enables you to perform LC and GC analyses in the same system, without compromising performance. The APGC provides complementary information to the LC/MS instrument, enabling analysis of compounds of low molecular weight and low-to-intermediate polarity.

See the *Atmospheric Pressure GC Version 2.0 Operator's Guide Supplement* for further details.

1.4.10 ionKey source

The ionKey source integrates UPLC separation into the source of the mass spectrometer. The source accepts an iKey Separation Device, which contains the fluidic connections, electronics, ESI interface, heater, e-cord, and chemistry. Inserting the iKey simultaneously engages the electronic and fluidic connections. This technology eliminates the need to manually connect electronic cables and tubing, and simplifies the user experience.

See the *ACQUITY UPLC M-Class System Guide* (part number 715003588) and the *ionKey/MS System Guide* (part number 715004028) for further details.

See also: [ionKey source](#).

1.5 IntelliStart Fluidics system

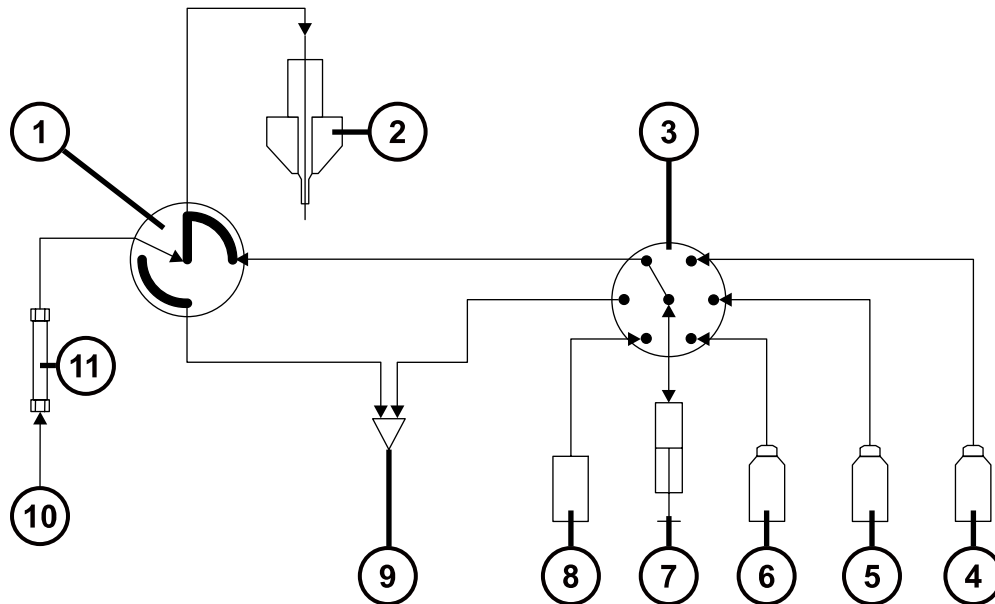
1.5.1 Overview

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 these ways:

- From the LC column.
- From three integral reservoirs. (The reservoirs can also deliver sample, by direct or combined infusion, to enable optimization at analytical flow rates.)
- From a wash reservoir that contains solvent for automated flushing of the instrument's solvent delivery system.

For further information on the IntelliStart fluidics system, see [Plumbing the IntelliStart Fluidics system](#).

Figure 1–3: IntelliStart fluidics system



- ① Diverter valve
- ② Probe
- ③ 6-port selector valve
- ④ Reservoir C
- ⑤ Reservoir B
- ⑥ Reservoir A
- ⑦ Pump
- ⑧ Wash reservoir
- ⑨ Waste reservoir
- ⑩ LC
- ⑪ Column

1.5.2 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, an 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.

1.5.3 System operation

The software automatically controls solvent and sample delivery during auto-tuning, auto-calibration, and method development. The selector valve systematically makes connections between the fluidics components to carry out the operations processed by the software.

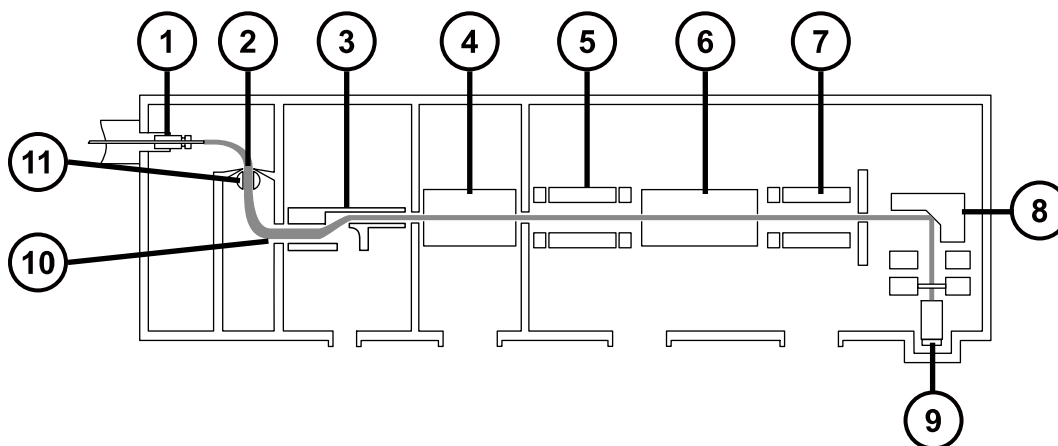
You can set IntelliStart fluidics configuration requirements in the system console. You can edit the parameters, frequency, and extent of the automation. See the mass spectrometer's online Help for further details on IntelliStart software and operation of the solvent delivery system.

For information on plumbing the IntelliStart Fluidics system, see [Plumbing the IntelliStart Fluidics system](#).

1.6 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, where they are ionized.
2. The ions pass through the sample cone into the vacuum system.
3. The resulting ion beam passes through the source sampling orifice, undergoing a certain amount of expansion.
4. The ion beam then passes into the entrance of the StepWave transfer optics. The entrance is large enough to efficiently capture ions in the expanded beam. The StepWave transfer optics comprise two stages. The first stage (conjoined ion guide) focuses the ion beam and directs it to the second stage (T-Wave ion guide). The off-axis design ensures that any neutral materials entering the source sampling orifice are actively extracted from the system.
5. The ions then pass to the first quadrupole, where they can be filtered according to their mass-to-charge ratio (m/z).
6. The mass-separated ions pass into the T-Wave/ScanWave collision cell, 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.
7. The transmitted ions are detected by the photomultiplier detection system.
8. The signal is amplified, digitized, and sent to the mass spectrometry software:



- ① Z-Spray ion source - Sample inlet
- ② Z-Spray ion source - Sample cone
- ③ StepWave - Conjoined ion guide
- ④ StepWave - T-Wave ion guide
- ⑤ Quadrupole 1 (MS1)
- ⑥ T-Wave/ScanWave collision cell
- ⑦ Quadrupole 2 (MS2)
- ⑧ Detector assembly - Conversion dynode
- ⑨ Detector assembly - Detector
- ⑩ Z-Spray ion source - Source sampling orifice
- ⑪ Z-Spray ion source - Isolation valve

1.7 MS operating modes

The following table shows the MS operating modes.

Table 1–1: MS operating modes:

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

Table 1–1: MS operating modes: (continued)

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

In MS mode, the instrument can acquire data at scan speeds as high as 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](#) for further details). 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).

1.8 MS/MS operating modes

The following table shows the MS/MS operating modes.

Table 1–2: MS/MS operating modes:

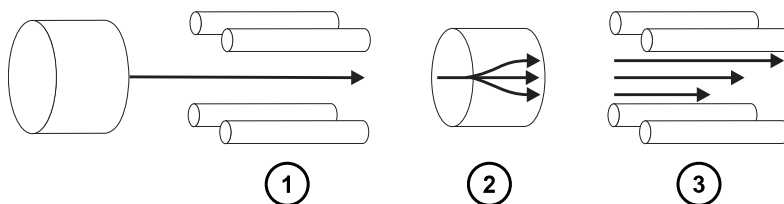
Operating mode	MS1	Collision cell	MS2
Product (daughter) ion spectrum	Static (at precursor mass)	Pass all masses	Scanning
Precursor (parent) ion spectrum	Scanning		Static (at product mass)
MRM	Static (at precursor mass)		Static (at product mass)
Constant neutral loss spectrum	Scanning (synchronized with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

RADAR is an additional mode with which you simultaneously collect data from the MRM and full scan MS modes. RADAR mode can also acquire all detectable ions in both positive and negative full scan MS.

1.8.1 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, yielding structural information.

Figure 1–4: Product ion mode



- ① MS1–Static (at precursor mass)
- ② Collision cell–Fragment precursor ions and pass all masses
- ③ MS2–Scanning

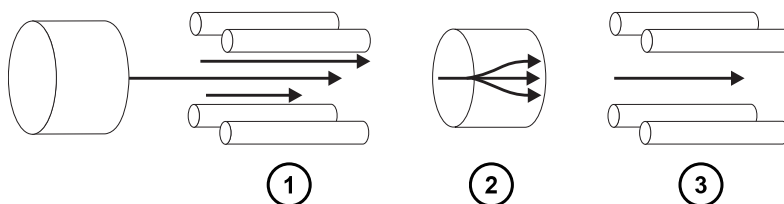
1.8.1.1 Typical applications

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).

1.8.2 Precursor (parent) ion mode

Figure 1–5: Precursor ion mode



- ① MS1–Scanning
- ② Collision cell–Fragment precursor ions and pass all masses
- ③ MS2–Static (at product mass)

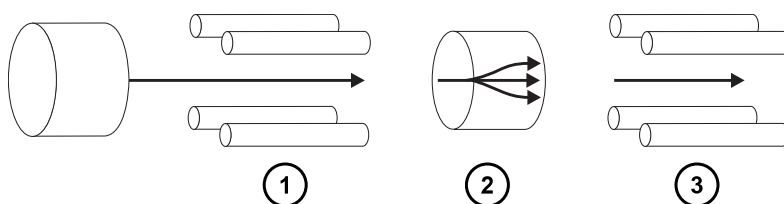
1.8.2.1 Typical application

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.

1.8.3 MRM mode

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

Figure 1–6: MRM mode



- ① MS1–Static (at precursor mass)
- ② Collision cell–Fragment precursor ions and pass all masses
- ③ MS2–Static (at product mass)

1.8.3.1 Typical application

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

- drug metabolite and pharmacokinetic studies
- environmental studies; for example, pesticide and herbicide analysis
- forensic or toxicology studies; for example, screening for target drugs in sports testing

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

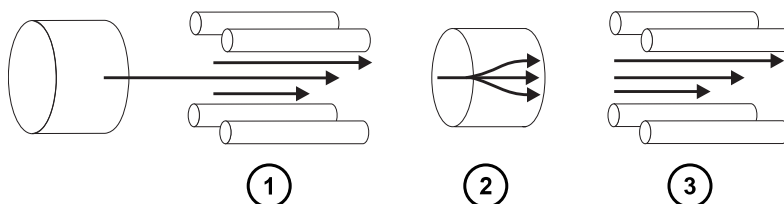
1.8.4 Constant neutral loss mode

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

The scans of MS1 and MS2 are synchronized. When MS1 transmits a specific precursor ion, MS2 determines 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 lost a fragment of a certain mass.

Figure 1–7: Constant neutral loss mode



- ① MS1–Scanning (synchronized with MS2)
- ② Collision cell–Fragment precursor ions and pass all masses
- ③ MS2–Scanning (synchronized with MS1)

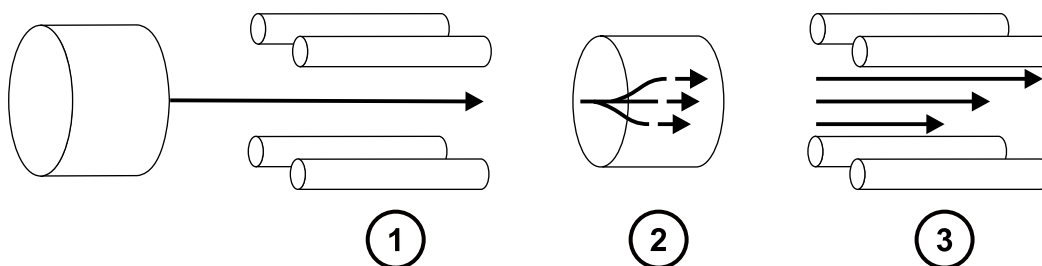
1.8.4.1 Typical application

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.

1.8.5 ScanWave daughter scan mode

This operating mode is very similar to the conventional product ion mode in that you can specify an ion of interest for fragmentation in the collision cell, thus yielding structural information. 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 results in a significant increase in the signal intensity of full scan spectra.

Figure 1–8: ScanWave daughter scan mode:



- ① MS1–Scanning
- ② Collision cell ScanWave enabled
- ③ MS2–Scanning (synchronized with collision cell)

1.8.5.1 Typical application (product daughter ion mode)

See [Product \(daughter\) ion mode](#) for more information.

1.9 Leak sensors

Leak sensors in the instrument's drip trays continuously monitor for liquid 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 software displays an error message alerting you that a leak has developed. Consult the *Waters ACQUITY UPLC Leak Sensor Maintenance Instructions* (71500082506) for complete details.

1.10 Vacuum system

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

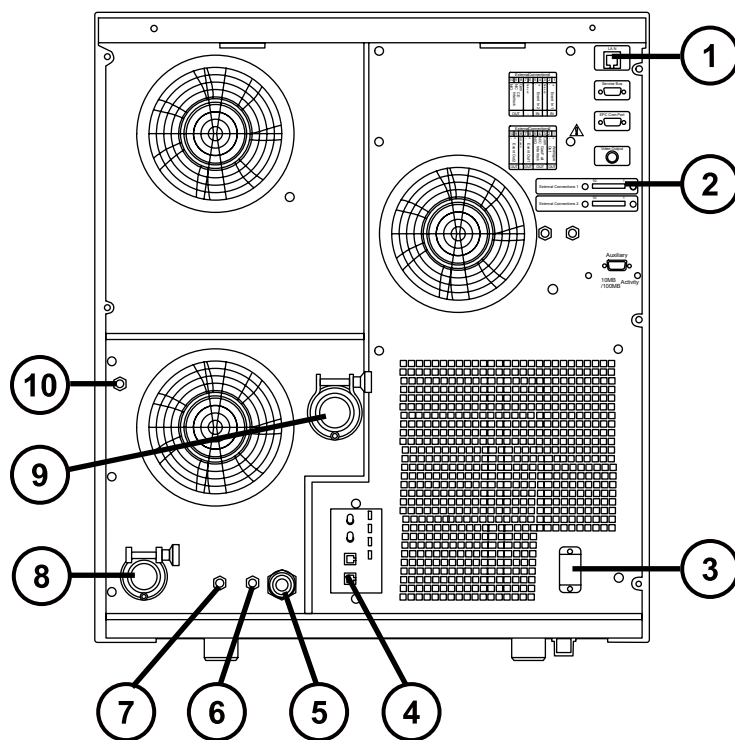
Vacuum leaks and electrical or vacuum pump failures cause vacuum loss, which protective interlocks guard against. The system monitors the turbomolecular pump speeds and continuously measures vacuum pressure with built-in Pirani and Penning gauges. The gauges also serve as switches, stopping operation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

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

1.11 Rear panel

The following figure shows the rear panel locations of the connectors used to operate the mass spectrometer with external devices. For further details, see [External connections](#).

Figure 1–9: Mass spectrometer rear panel



- ① Shielded Ethernet
- ② Event inputs and outputs
- ③ Power connection
- ④ Roughing pump connections
- ⑤ Source vent
- ⑥ Nitrogen inlet
- ⑦ Pilot valve port
- ⑧ Turbo vacuum
- ⑨ Source vacuum
- ⑩ Collision cell gas inlet

2 Preparing the mass spectrometer for operation

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

2.1 Starting the mass spectrometer

The Xevo TQ-S 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. If you do not use one of these systems, refer to the documentation for your LC system.

! **Notice:** To avoid causing severe damage to the instrument, use only compatible solvents.

Note: For more details, refer to the following sources:

- Appendix [Materials of Construction and Compatible Solvents](#) of this guide for mass spectrometer solvent information.
- Appendix C of the *ACQUITY UPLC System Operator's Guide (71500082502)* 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 then 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.

2.1.1 To start the mass spectrometer



Warning: To avoid igniting flammable solvents, never let the nitrogen supply pressure fall below 400 kPa (4.0 bar, 58 psi).

1. On the rear panel, ensure that the nitrogen supply is connected to the instrument's nitrogen inlet connection (see the figure [Connecting the nitrogen gas supply](#)).

Requirement: The nitrogen must be dry and oil-free, with a purity of at least 95% or, for APGC use, at least 99.999%. 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 (99.997%). Regulate the supply at 50 kPa (0.5 bar, 7 psi).

3. Power-on the workstation and log in.
4. Press the power switch on the top right-hand side of the mass spectrometer and the switches on the top left-hand sides of the ACQUITY instruments.

Note: Each system instrument runs a series of start-up tests.

5. Allow 3 minutes for the embedded PC (located inside the mass spectrometer) to initialize and sound an alert indicating that the PC is ready.

Tip: The power and status LEDs change as follows:

- Each system instrument's power LED shows green.
 - During initialization, the binary or quaternary solvent manager's and sample manager's status LED flashes green.
 - After the instruments successfully power-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 pump down (evacuate) the mass spectrometer, follow the procedure below for 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.

Tip: After a 20-second delay, during which the turbopump is starting, the roughing pump starts. IntelliStart displays `Instrument in standby` 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 Console, the **System Ready** indicator shows green when the instrument is fully evacuated (pumped down).

- d. Click **Resolve**  or **Operate** .

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

8. To evacuate the mass spectrometer, follow the procedure below for UNIFI software.

a. From the **Xevo TQD 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 evacuated.

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

d. Click **Instrument Operate Mode** .

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

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

2.1.2 Verifying the instrument's state of readiness

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

2.1.3 Monitoring the mass spectrometer LEDs

LEDs on the mass spectrometer indicate its operational status.

2.1.3.1 Power LED

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

2.1.3.2 Operate LED

The Operate LED, located 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.

2.1.4 Tuning and calibration information

You must tune and, if necessary, calibrate the instrument prior to use. You can perform these tasks using IntelliStart software.

For further instruction, see the mass spectrometer's online Help topic "Instrument Setup."

2.1.5 Running the mass spectrometer at higher flow rates

The ACQUITY UPLC system runs at high flow rates. To optimize desolvation and sensitivity, run the ACQUITY Xevo TQ-S system at appropriate gas flows and desolvation temperatures. When you specify a flow rate, IntelliStart software automatically specifies the settings shown in the following table.

Table 2–1: Flow rate versus temperature and gas flow:

Flow rate (mL/min)	Source temperature (°C)	Desolvation temperature (°C)	Desolvation gas flow (L/h)
0.000 to 0.020	150	200	800
0.021 to 0.100	150	300	800
0.101 to 0.500	150	500	1,000
>0.500	150	600	1,000

If you are using an APCI interface, IntelliStart software automatically sets the parameters according to the following table.

Table 2–2: Flow rate versus IonSABRE II probe temperature and gas flow:

Flow rate (mL/min)	IonSABRE II probe temperature (°C)	Desolvation gas flow (L/h)
0.000 to 0.020	400	800
0.021 to 0.500	500	1,000
>0.500	600	1,000

2.2 Preparing the IntelliStart Fluidics system

This section contains information for preparing the IntelliStart Fluidics system. For additional information, see [Connecting liquid waste lines](#) and [Plumbing the IntelliStart Fluidics system](#).



Prohibited: To avoid equipment damage caused by spilled solvent, do not place reservoir bottles directly atop an instrument or device or on its front ledge. Instead, place the bottles in the bottle tray, which serves as secondary containment in the event of spills.

2.2.1 Installing the reservoir bottles

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

Required materials

Chemical-resistant, powder-free gloves

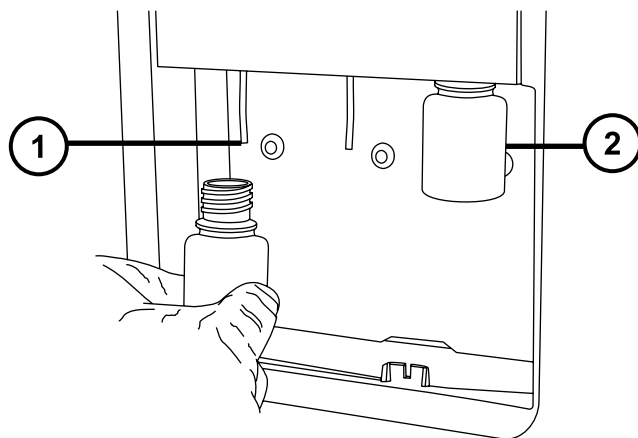
To install the reservoir bottles:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

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

Figure 2–1: Installing the reservoir bottles



① Solvent delivery tube

② Reservoir bottle

3. For each reservoir bottle, ensure that the ends of the solvent delivery tubes are positioned so that they are close to, but not touching, the bottom of the bottle (see [Adjusting the solvent delivery tube positions](#)).

2.2.2 Installing the low-volume vials

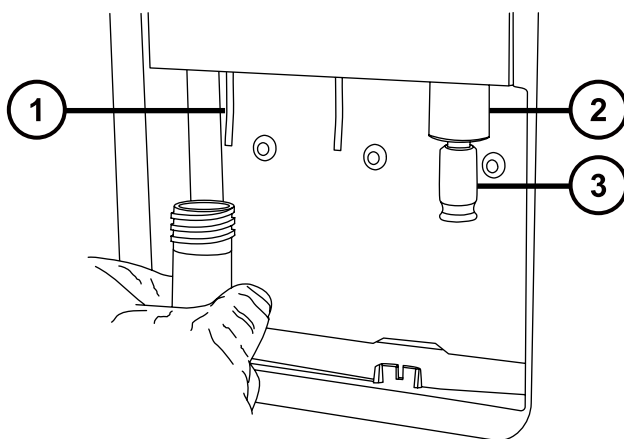


Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

To install low-volume vials:

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

Figure 2-2: Installing the low-volume vials



- ① Solvent delivery tube
- ② Low-volume adaptor
- ③ Low-volume vial



Warning: To avoid laceration injuries caused by the shattering of fragile, low-volume, glass vials, take care when screwing them in and never use force.

3. Screw the low-volume vials into the adapters.
4. For each low-volume vial, ensure that the ends of the solvent delivery tubes are positioned so that they are close to, but not touching, the bottom of the vial (see [Adjusting the solvent delivery tube positions](#)).

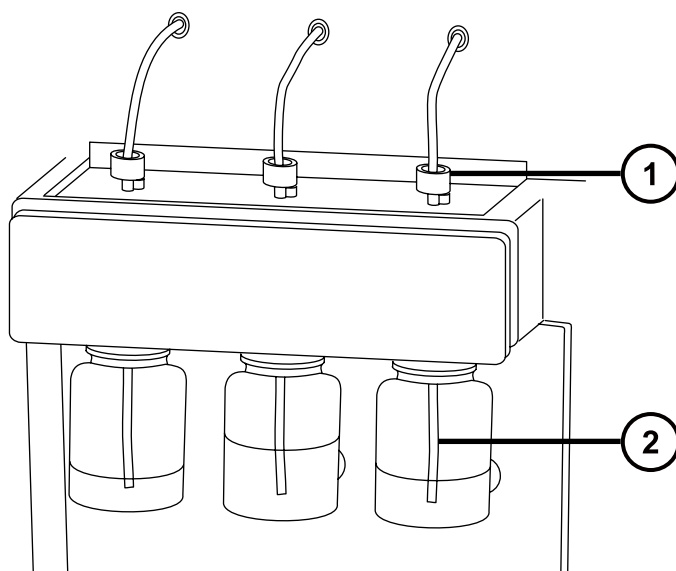
2.2.3 Adjusting the solvent delivery tubing positions

For correct operation of the IntelliStart Fluidics system, you must adjust each solvent delivery tube so that its end is close to, but not touching, the bottom of the reservoir bottle or low-volume vial.

To adjust the position of a solvent delivery tube:

1. Open the access door to the fluidics pump.
2. Loosen the finger-tight fitting for the solvent delivery tube you are adjusting.

Figure 2–3: Solvent delivery tubes



① Finger-tight fitting

② Solvent delivery tube

3. Move the solvent delivery tube so that its end is close to, but not touching, the bottom of the reservoir bottle or low-volume vial.
4. Tighten the finger-tight fitting.
5. Close the access door.

2.2.4 Purging the infusion pump

Whenever you replace a solution bottle, purge the infusion pump with the solution you are going to use next (see the mass spectrometer's online Help for details). Depending on the solutions used, the instrument's solvent delivery system can require more than one purge cycle to minimize carryover.

Requirement: Ensure that the end of the tubing is fully submerged in the solvent in the wash reservoir.

2.3 Rebooting the mass spectrometer

Pressing the reset button powers-off the electronics momentarily and causes the mass spectrometer to reboot.

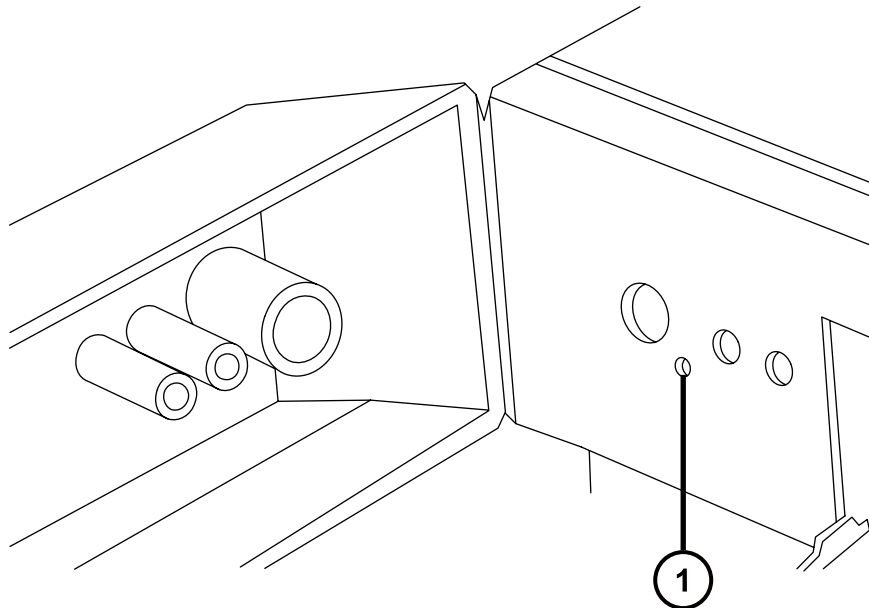
Reboot the mass spectrometer when either of these conditions applies:

- The software fails to establish communication or loses communication with the mass spectrometer.
- You perform a software upgrade.

To reboot the mass spectrometer:

1. Ensure that the mass spectrometer software is closed.
2. Open the mass spectrometer's front, left-hand door.
3. Insert a short length (7.5 cm) of PEEK tubing, or similar object, into the reset button aperture to operate the reset button.

Figure 2–4: Reset button aperture



① Reset button aperture

4. Remove the PEEK tubing from the reset button aperture.

5. Close the mass spectrometer's door.
6. Wait until the reboot sequence completes before powering-on the mass spectrometer software.

Tip: An audible alert sounds when the reboot sequence completes.

2.4 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).



Notice: For ionKey operation, to protect the iKey when you leave the mass spectrometer in **Operate mode** with no flow, set the capillary voltage to zero.

2.5 Emergency shutdown of the mass spectrometer



Warning: To avoid electric shock, observe the following procedure to isolate the instrument from the main power supply. The instrument's power switch does not isolate it from the main power supply.



Notice: To avoid losing data, use the following procedure only in an emergency. To reboot the mass spectrometer, follow the procedure in the section "Rebooting the mass spectrometer".

To shut down the mass spectrometer in an emergency:

1. Press the power button on the front of the mass spectrometer.
2. Disconnect the power cable from the rear panel.

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)
- UniSpray
- NanoFlow ESI
- ionKey source

For details about other Waters and third-party source options, refer to the documentation supplied with the source.

3.1 ESI mode

The following sections explain how to install and remove an ESI probe. For further details on running ESI applications, see [Electrospray ionization \(ESI\)](#).

Note: If you are using a tool-free ESI probe, to install or remove the probe, see the *Waters Tool-Free Probe Maintenance Guide Supplement* (715005492).

3.1.1 Installing the ESI probe

Required materials

- Chemical-resistant, powder-free gloves
- Utility knife or PEEK tubing cutter

To install the ESI probe:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid harmless, static-like electric shock, before you touch any external surfaces marked with the high-voltage warning symbol, ensure that the mass spectrometer is in Standby mode.

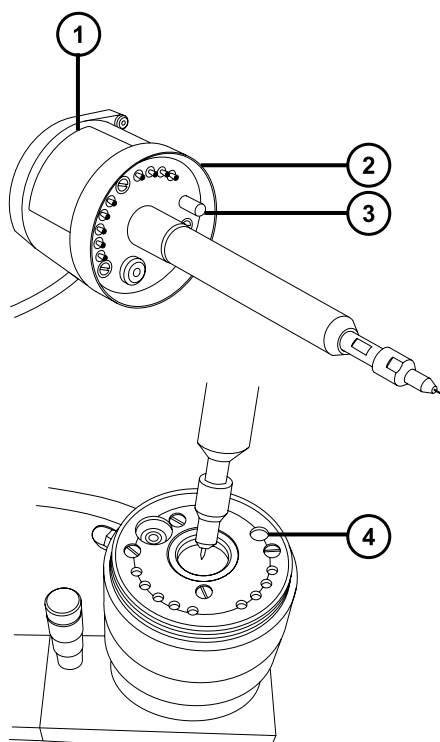
1. Prepare the instrument so you can work safely on the source (see [Preparing the instrument for working on the source](#)).



Warning: To avoid puncture wounds, handle the probe with care.

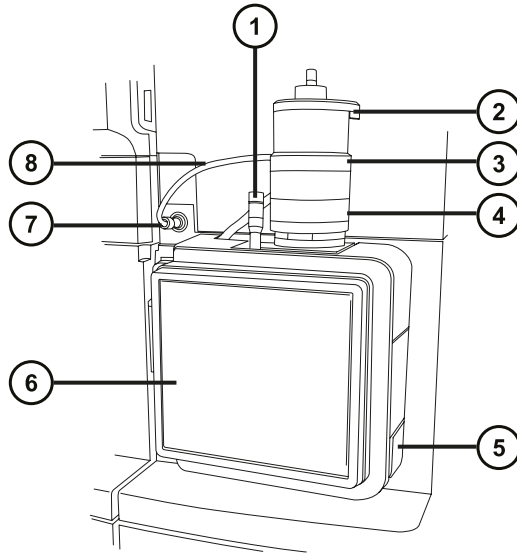
2. Remove the protective sleeve, if fitted, from the ESI probe tip.
3. With the probe label facing you, carefully slide the ESI probe into the hole in the probe adjuster assembly, ensuring that the probe location dowel aligns with the location hole in the probe adjuster assembly.

Figure 3–1: Fitting the ESI probe



- ① Probe label
- ② Probe locking ring
- ③ Probe location dowel
- ④ Location hole of the probe adjuster assembly

Figure 3–2: ESI probe, mounted on the source enclosure



- ① Vernier probe adjuster
- ② ESI probe
- ③ Probe locking ring
- ④ Vertical probe adjuster
- ⑤ Source enclosure release
- ⑥ Source window
- ⑦ High-voltage connector
- ⑧ ESI probe cable



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

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

Tip: An automatic pressure test is performed when the probe is correctly seated in position.

5. Connect the ESI probe's cable to the high-voltage connector.



Warning: To avoid harmless, static-like electric shock, do not use stainless steel tubing to connect the divert valve to the probe; use the PEEK tubing supplied with the instrument.

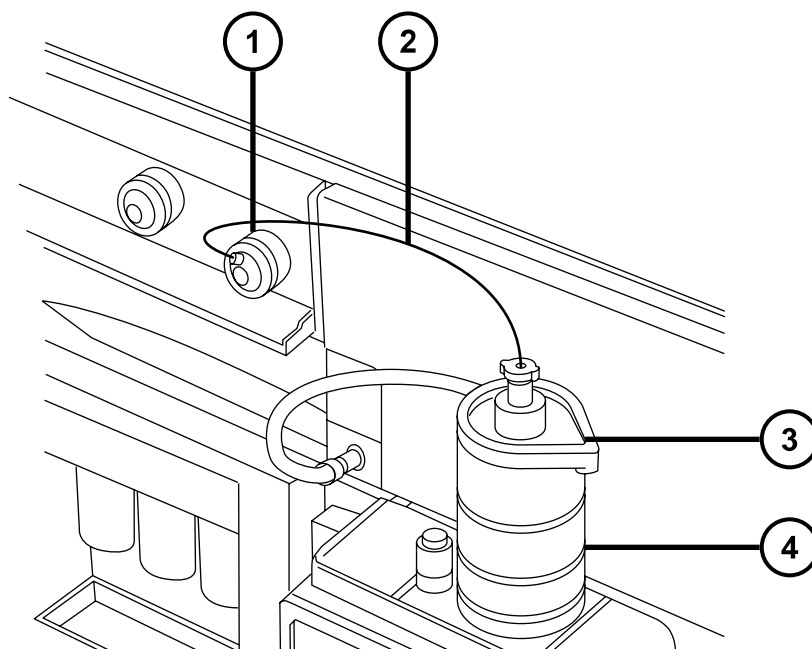
6. Open the access door to the fluidics valves (see the figure in [ACQUITY UPLC/MS Xevo TQ-S systems](#)).
7. Using PEEK tubing greater than or equal to 0.004-inch ID, connect port 2 (the top port) of the diverter valve to the ESI probe.

Note: To reduce peak broadening, use 0.004-inch ID tubing for sample flow rates ≤ 1.2 mL/min; use 0.005-inch ID tubing for sample flow rates > 1.2 mL/min.

Requirements:

- 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.
- When cutting the tubing to length, cut it squarely.

Figure 3–3: Tubing connection between the diverter valve and the ESI probe



- ① Diverter valve
- ② Tubing connection
- ③ ESI probe
- ④ Probe adjuster assembly



Notice: 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 to the fluidics valves.

3.1.2 Removing the ESI probe

Required materials

- Chemical-resistant, powder-free gloves

To remove the ESI probe:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid harmless, static-like electric shock, before you touch any external surfaces marked with the high-voltage warning symbol, ensure that the mass spectrometer is in Standby mode.



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

1. Prepare the instrument so that you can work safely on the source (see [Preparing the instrument for working on the source](#)).
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.

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

3.2 ESCi mode

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

See [Installing the ESI probe](#), [Installing the corona pin in the source](#), and [IntelliStart Fluidics system](#).

3.2.1 Optimizing the ESI probe for ESCi operation

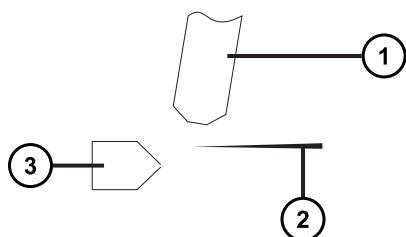
See the mass spectrometer's online Help for details on how to optimize the ESI probe for ESCi operation.

3.3 APCI mode

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 IonSABRE II or tool-free 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.

Figure 3–4: APCI mode



- ① Probe
- ② Corona pin
- ③ Sample cone

Hot gas from the probe passes between the sample cone and the corona pin, which is typically operated with a discharge current of 5 μ 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.

Note: If you are using a tool-free APCI probe, to install or remove the probe, see the *Waters Tool-Free Probe Maintenance Guide Supplement* (715005492).

3.3.1 Installing the IonSABRE II probe

Required materials

- Chemical-resistant, powder-free gloves
- Utility knife or PEEK tubing cutter



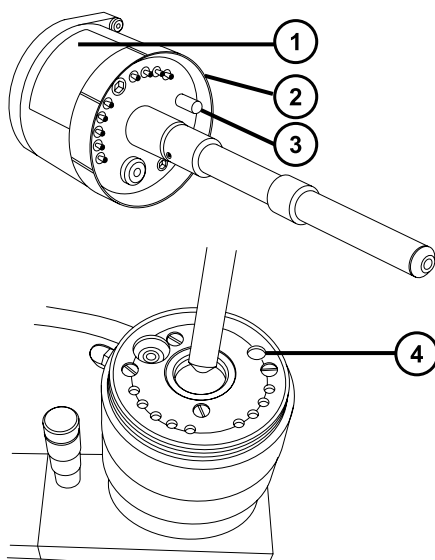
Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid harmless, static-like electric shock, ensure that the instrument is in Standby mode before beginning this procedure.

To install the IonSABRE II probe:

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

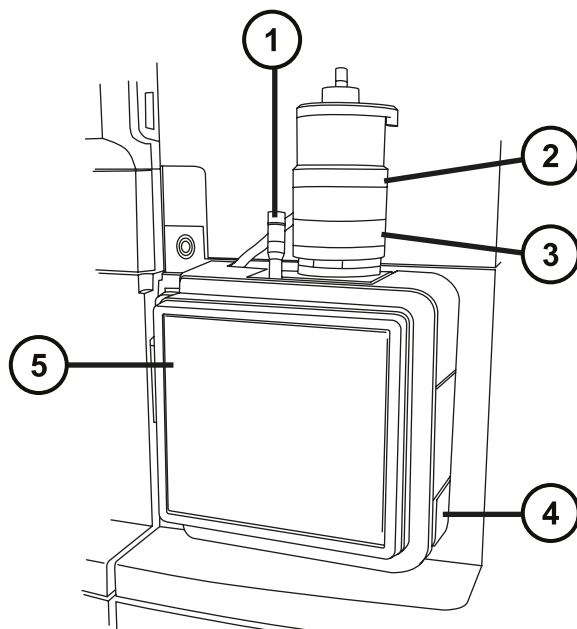


- ① Probe label
- ② Probe locking ring
- ③ Probe location dowel
- ④ Location hole of the probe adjuster assembly

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

Tip: An automatic pressure test is performed when the probe is correctly seated in position.

Figure 3–5: IonSABRE II probe, mounted on the source enclosure



- ① Vernier probe adjuster
- ② Probe locking ring
- ③ Vertical probe adjuster
- ④ Source enclosure release
- ⑤ Source window

4. Open the access door to the fluidics valves (see the figure in [ACQUITY UPLC/MS Xevo TQ-S systems](#)).



Warning: To avoid harmless, static-like electric shock, do not use stainless steel tubing to connect parts; use the PEEK tubing supplied with the instrument.

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

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

Requirements:

- 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.
 - When cutting the tubing to length, cut it squarely.
6. Close the access door to the fluidics valves.
 7. Install the corona pin (see [Installing the corona pin in the source](#)).

3.3.2 Removing the IonSABRE II probe

Required materials

- Chemical-resistant, powder-free gloves

To remove the IonSABRE II probe:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid harmless, static-like electric shock, before you touch any external surfaces marked with the high-voltage warning symbol, ensure that the mass spectrometer is in Standby mode.



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

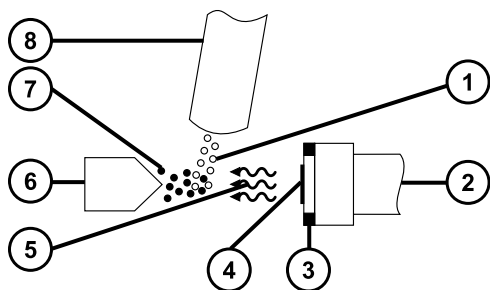
1. Prepare the instrument so you can work safely on the source (see [Preparing the instrument for working on the source](#)).
2. Remove the corona pin (see [Removing the corona pin from the source](#)).
3. Disconnect the divert valve tubing from the IonSABRE II probe.
4. Unscrew the probe locking ring.
5. Carefully remove the probe from the probe adjuster assembly.

3.4 Combined APPI/APCI source

The combined APPI/APCI source uses an optional, replacement source enclosure. You can operate the source in APPI mode, APCI mode, or dual-mode APPI/APCI. Dual-mode APPI/APCI performs rapid switching between ionization modes.

3.4.1 APPI operation

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

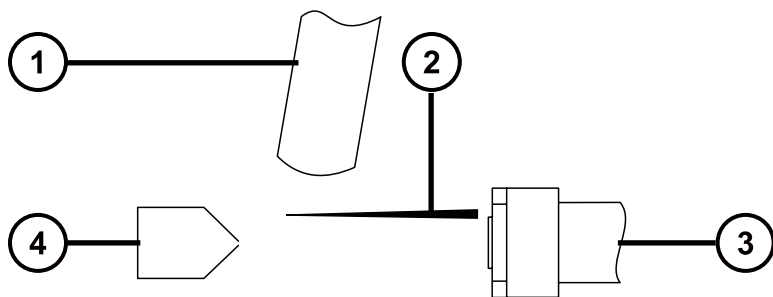


- ① Sample molecules
- ② APPI lamp drive assembly
- ③ Repeller electrode
- ④ UV lamp
- ⑤ Photons from the UV lamp
- ⑥ Sample cone
- ⑦ Sample ions
- ⑧ Probe

The probe introduces vaporized sample into the source where photons generated by an ultraviolet (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 toward the sample cone.

3.4.2 APCI operation



- ① Probe
- ② APCI corona pin
- ③ Retracted APPI lamp drive assembly
- ④ Sample cone

The 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 μA . 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.

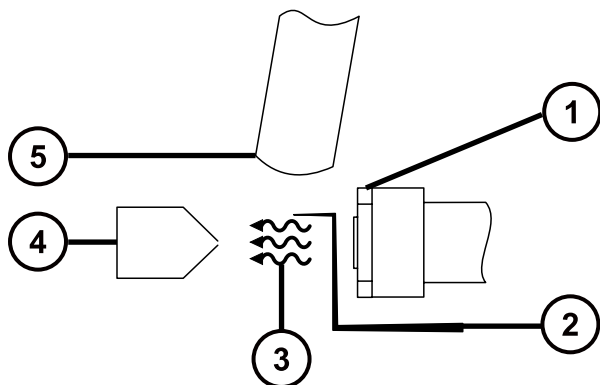
3.4.3 Dual-mode operation

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.

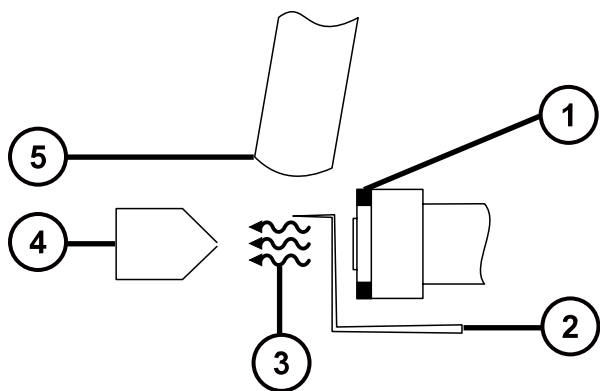
Figure 3–6: Dual operation in APCI mode



- ① Repeller electrode inactive
- ② Corona pin with current applied
- ③ Photons from the UV lamp
- ④ Sample cone
- ⑤ Probe

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.

Figure 3–7: Dual operation in APPI mode



- ① Repeller electrode with voltage applied
- ② Corona pin inactive
- ③ Photons from the UV lamp

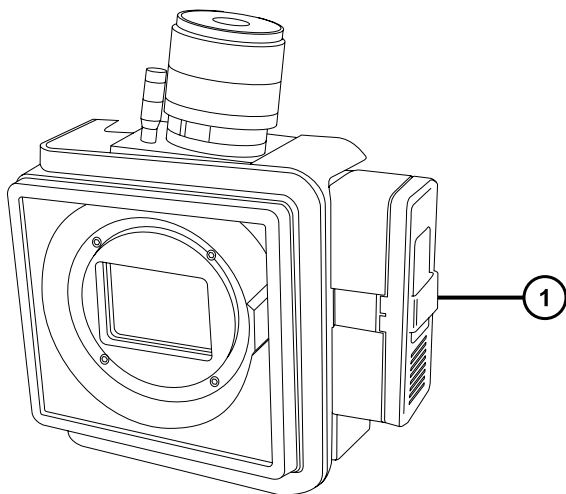
④ Sample cone

⑤ Probe

3.4.4 The combined APPI/APCI source components

The combined APPI/APCI source comprises the standard IonSABRE II or tool-free APCI probe and a source enclosure with an APPI lamp drive incorporated.

Figure 3–8: The combined APPI/APCI source enclosure

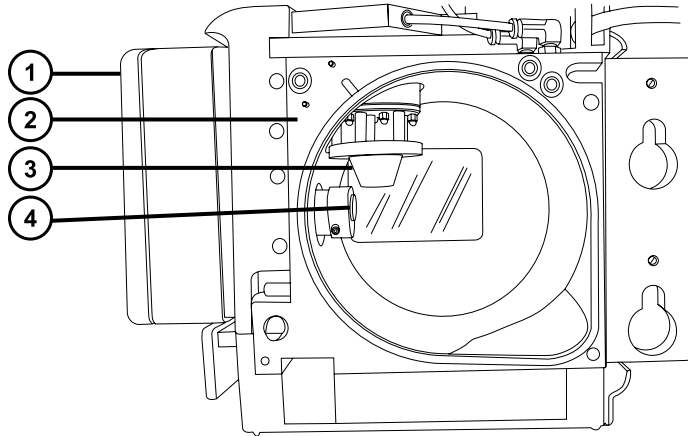


① APPI lamp drive assembly

! **Notice:** 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.

The UV lamp, which you ignite via a control in 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.

Figure 3–9: APPI lamp drive assembly inside the source enclosure



- ① APPI lamp drive assembly
- ② Source enclosure
- ③ Probe
- ④ UV lamp and repeller electrode

3.4.5 Installing the combined APPI/APCI source

Required materials

- Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid harmless, static-like electric shock, ensure that the instrument is in Standby mode before beginning 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 its source](#)).



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](#).
 - If you are removing an IonSABRE II probe, see [Removing the IonSABRE II probe](#).
 - If you are removing a tool-free ESI or APCI probe, see the *Waters Tool-Free Probe Maintenance Guide Supplement* (715005492).
3. Remove the existing source enclosure (see [Removing and refitting the source enclosure](#)).
4. Install the combined APPI/APCI source enclosure (see [Fitting the source enclosure to the instrument](#)).
5. Install the corona pin (see [Installing and removing the corona pin](#)).
6. Connect the APPI drive cable to the instrument's front panel connector.
7. Connect the HT cable to the instrument's front panel connector.



Notice: 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. Install the IonSABRE II probe on the source and ensure that it is working correctly (see [Installing the IonSABRE II probe](#)).

Tip: An automatic pressure test runs each time you close the source enclosure and when the instrument starts.

3.4.6 Removing the IonSABRE II probe and APPI/APCI source enclosure

Required material

- Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid harmless, static-like electric shock, ensure that the instrument is in Standby mode before beginning 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 its source](#)).



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

2. Remove the IonSABRE II probe (see [Removing the IonSABRE II probe](#)).

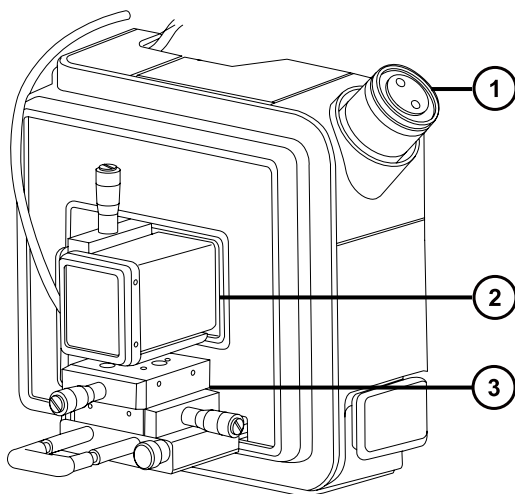
Note: If you are removing a tool-free probe, see the *Waters Tool-Free Probe Maintenance Guide Supplement* (715005492).

3. Disconnect the HT cable from the instrument's front panel.
4. Disconnect the APPI drive cable from the instrument's front panel.
5. Remove the source enclosure (see [Removing and refitting the source enclosure](#)).
6. Remove the corona pin (see [Installing and removing the corona pin](#)).
7. Fit the blanking plug to the pin's mounting contact.

3.5 NanoFlow ESI source

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

Figure 3–10: NanoFlow source, stage and microscope camera



- ① Microscope camera
- ② Sprayer enclosure
- ③ X, Y, Z stage

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.

3.5.1 Installing the NanoFlow source

Required materials

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid harmless, static-like electric shock, ensure that the instrument is in Standby mode before beginning this procedure.



Warning: To avoid burn injuries, before performing maintenance operations that involve handling components inside the mass spectrometer's ion source, allow the source interior to cool.

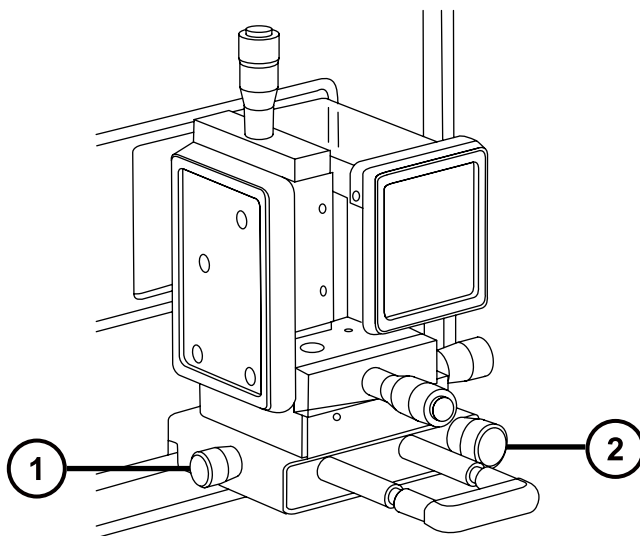
To install the NanoFlow source:

1. Prepare the instrument for working on the source (see [Preparing the instrument for working on the source](#)).
2. Remove the probe from the currently installed source.
 - If you are removing an ESI probe, see [Removing the ESI probe](#).
 - If you are removing an IonSABRE II probe, see [Removing the IonSABRE II probe](#).
 - If you are removing a tool-free ESI or APCI probe, see the *Waters Tool-Free Probe Maintenance Guide Supplement* (715005492).
3. Remove the existing source enclosure (see [Removing the source enclosure from the instrument](#)).



Notice: To prevent damage to the instrument, 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.



① Stop screw

② Retaining screw

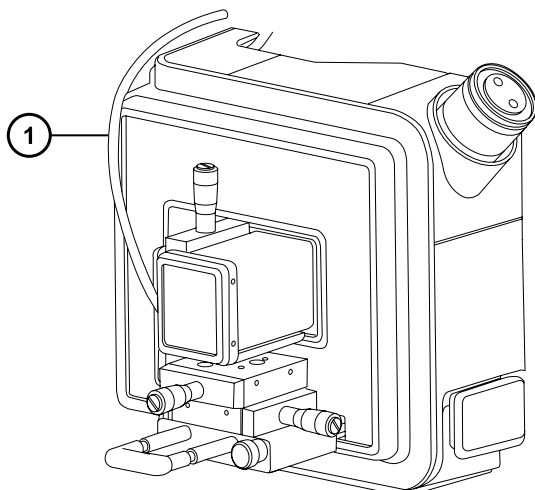
5. Use both hands to fit the NanoFlow source enclosure to the two supporting studs on the source adapter housing.
6. Close the source enclosure door.
7. Connect a 1/16-inch PTFE tube between the mass-flow controller output (mounted beneath the stage on the front of the NanoFlow source) and your sprayer.

Tip: For instructions on how to fit each sprayer, see the corresponding reference:

- *Universal NanoFlow Sprayer Installation and Maintenance Guide* (71500110107)
- [Fitting a borosilicate glass capillary \(nanovial\)](#)
- *Capillary Electrophoresis and Capillary Electrochromatography Sprayer Operator's Guide*

8. Connect the probe cable to the high-voltage connector.
9. Connect the high-voltage cable to the instrument's HV connection.

Note: The NanoFlow stage contains a high-voltage interlock, so 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.



① High-voltage cable

10. Close the instrument's source interface door.

3.5.2 Fitting a borosilicate glass capillary (nanovial)

Required materials

- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- Borosilicate glass capillary
- Fused silica syringe needle or GELoader tip
- Fused silica tubing cutter

To fit a borosilicate glass capillary (nanovial):



Warning: To avoid lacerations, puncture injuries, and possible contamination with biologically hazardous and toxic materials, do not touch the sharp end of the capillary.



Warning: To avoid eye injury from broken fused silica lines, use eye protection when performing this procedure.



Notice: To avoid damaging capillaries, take great care when handling them; they are extremely fragile. Always hold the blunt end, never the sharp end.

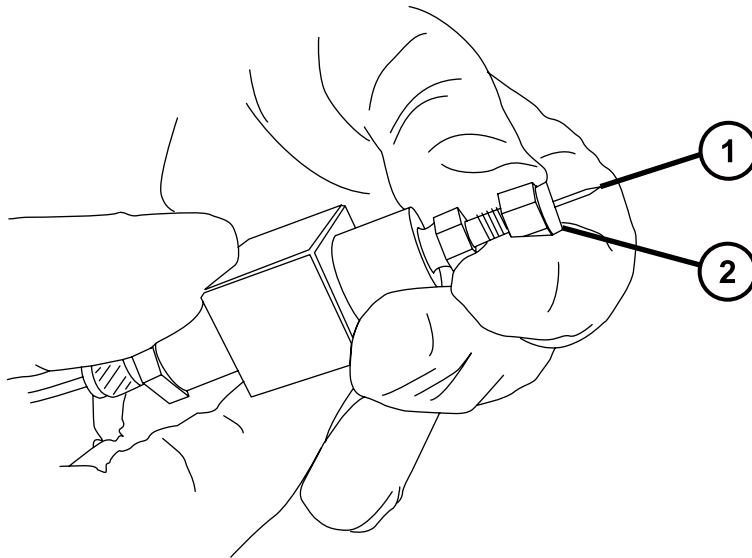


Warning: To avoid static-like electric shock, ensure that the NanoFlow stage is fully retracted from the source before beginning this procedure.



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

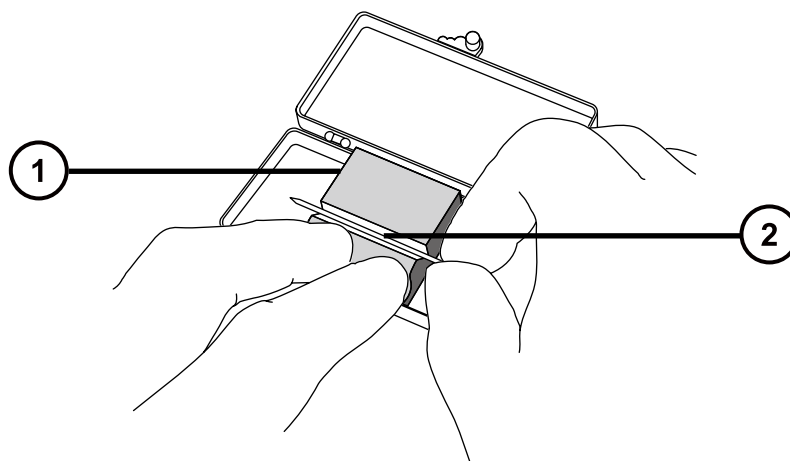
1. Loosen the stage retaining screw.
2. Pull the stop screw to release the stage.
3. Slide the stage out of the NanoFlow source enclosure and remove the magnetic cover.
4. Unscrew the retaining screw and lift the sprayer from the stage.
5. Unscrew the union from the end of the sprayer assembly.



① Capillary

② Union

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



① Foam

② Capillary

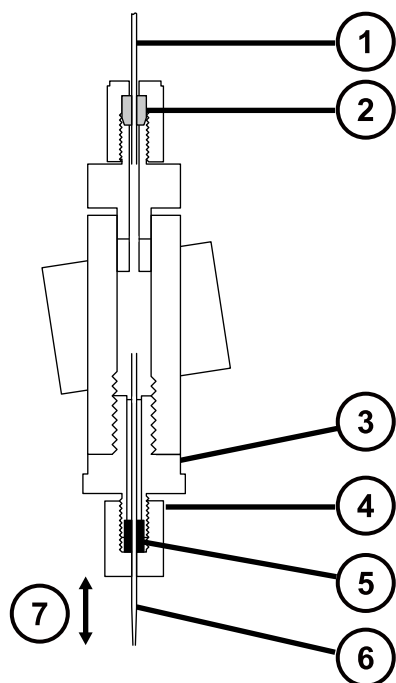
8. Load sample into the capillary using a fused silica syringe needle or a GELoader tip, minimizing any bubbles between the capillary tip and the sample.

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 five 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 five mm of glass capillary protrudes from its end.

Tip: Measure the protrusion from the end of the nut to the shoulder of the glass capillary.

Figure 3–11: Sprayer Assembly



- ① PTFE tubing
- ② Ferrule
- ③ Union
- ④ Knurled nut
- ⑤ Blue conductive elastomer
- ⑥ Glass capillary
- ⑦ 5-mm protrusion

12. Screw the sprayer back into the assembly.
13. Replace the sprayer cover.
14. On the MassLynx MS Tune window, ensure that the Capillary parameter on the ES+/- Source tab is set to 0 kV.



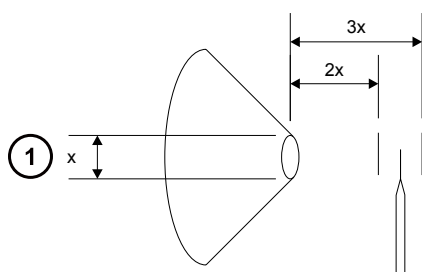
Notice: To avoid damage to the capillary tip, adjust the sprayer tip position before you push the sprayer inside the NanoFlow source enclosure. Ensure that the capillary tip does not collide with the cone or the side of the source.

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

3.5.3 Positioning the borosilicate glass capillary tip

Having obtained a signal, you must adjust the tip position to maximize it. Using the three-axis manipulator, you can adjust the tip position up and down, left and right, forward and backward. 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 distance is approximately 2 mm.

Figure 3–12: Capillary tip position



① Cone aperture diameter

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

3.6 ionKey source

The ionKey source integrates UPLC separation into the source of the mass spectrometer. For a complete description, see [ionKey source](#).

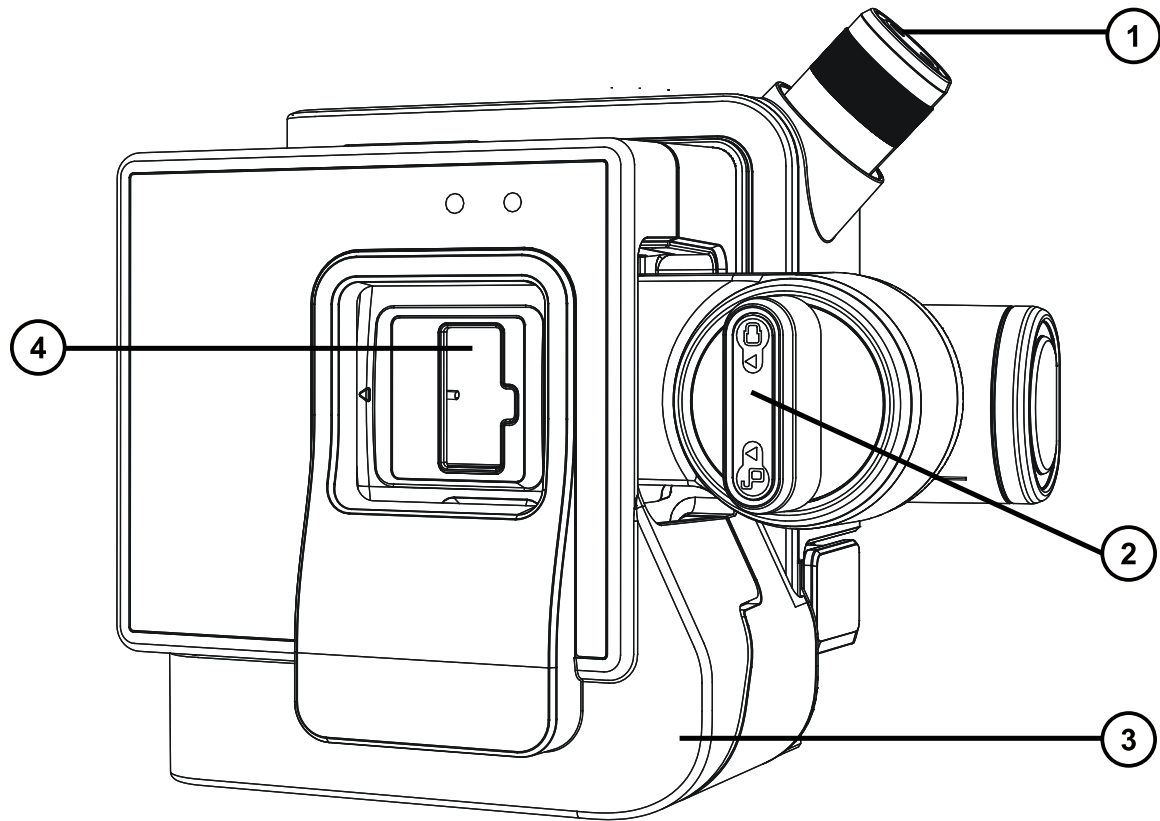
The following sections explain how to install or remove an ionKey source.

For additional information, see the *ACQUITY UPLC M-Class System Guide* (part number 715003588) and the *ionKey/MS System Guide* (part number 715004028).

3.6.1 Installing the ionKey source

The ionKey source enclosure comprises the iKey docking port, the iKey locking handle, the sprayer enclosure, and a microscope camera.

Figure 3–13: ionKey source:



- ① Microscope camera
- ② Handle for locking and unlocking the iKey separation device
- ③ Front cover
- ④ Docking port for the iKey separation device

Required materials

- Chemical-resistant, powder-free gloves
- Flat-blade screwdriver
- 1/4-inch open-end wrench



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid static-like electric shock, ensure that the instrument is prepared for working on the source before starting this procedure.

To install the ionKey source:

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



Warning: To avoid burn injuries, exercise care when handling the components of the source enclosure heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.

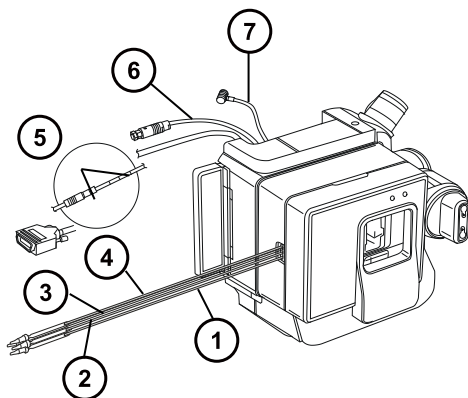
2. Remove the probe from the currently installed source.
 - If you are removing an ESI probe, see [Removing the ESI probe](#).
 - If you are removing an IonSABRE II probe, see [Removing the IonSABRE II probe](#).
 - If you are removing a tool-free ESI or APCI probe, see the *Waters Tool-Free Probe Maintenance Guide Supplement* (715005492).
3. Remove the existing source enclosure (see [Removing the source enclosure from the instrument](#)).
4. Use two hands to fit the ionKey source enclosure to the two supporting studs on the source adapter housing.
5. Swing the source enclosure to the closed position, ensuring that it locks into place.



Notice: To avoid damaging the μ Sample manager or mass spectrometer,

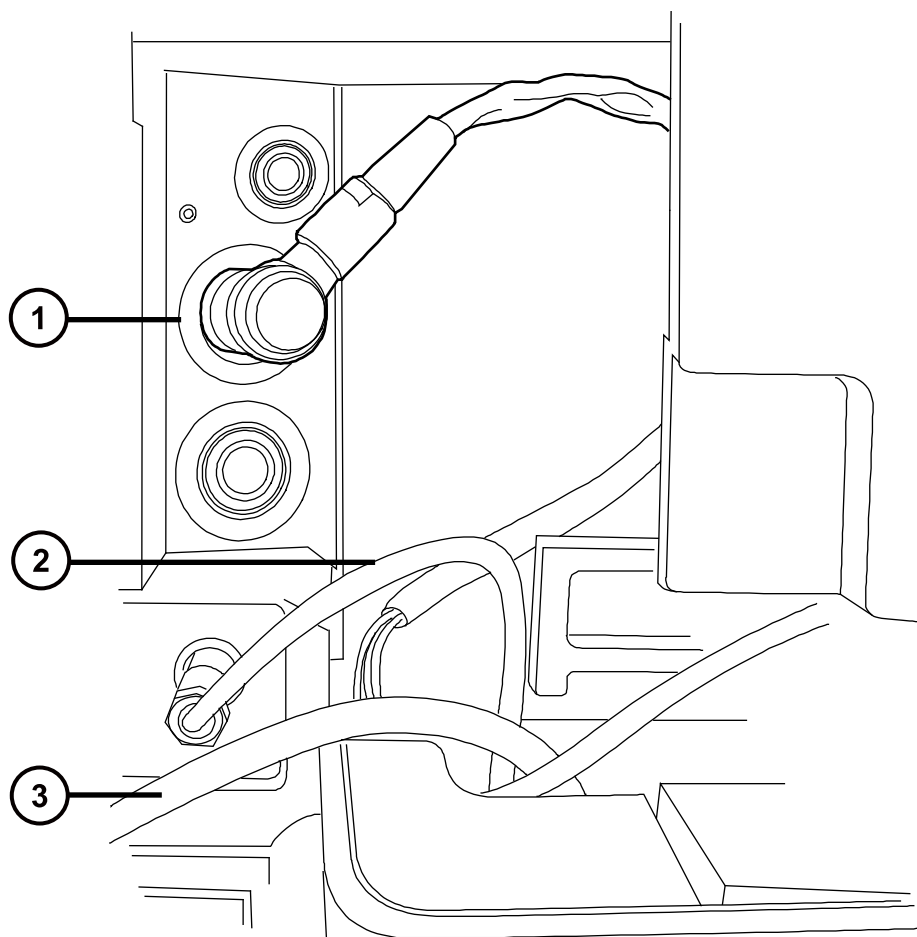
- ensure that the μ Sample manager's power is off before connecting the data/power cable;
- ensure that the mass spectrometer is in Standby mode before beginning any installation or maintenance.

Figure 3–14: ionKey source connections:



- ① Fluid waste line
 - ② Optional post-column addition (PCA) line
 - ③ Fluid infusion line
 - ④ Fluid inlet line
 - ⑤ Data/power cable to PSPI connector on μ Sample manager
 - ⑥ High-voltage cable
 - ⑦ Options cable
6. Connect the data/power cable to the PSPI connector on the rear of the μ Sample manager, and use a screwdriver to firmly tighten the connector screws.

Figure 3–15: Source connections to mass spectrometer:

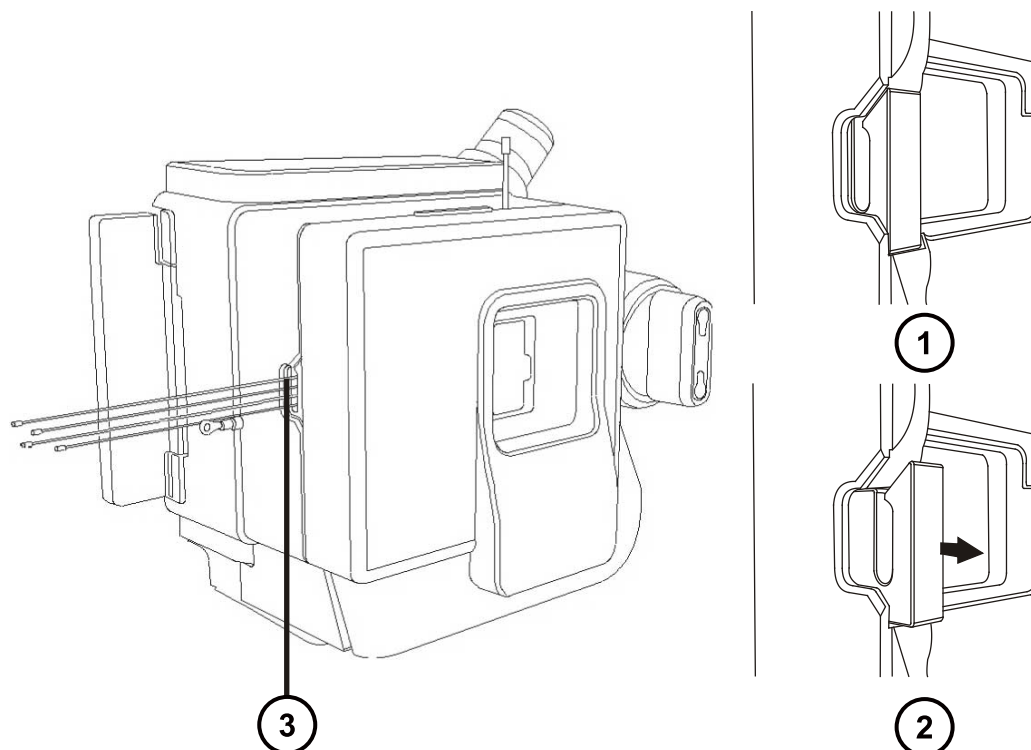


- ① Options cable
 - ② High-voltage cable
 - ③ Data/power cable to PSPI connector on μ Sample manager
7. Connect the high-voltage cable (white) to the high-voltage supply outlet on the mass spectrometer.
 8. Connect the options cable (blue) to the options port on the mass spectrometer.
 9. Identify each fluid line by the part numbers printed on their shrink-wrap tubing.

Table 3–1: ionKey tubing assemblies:

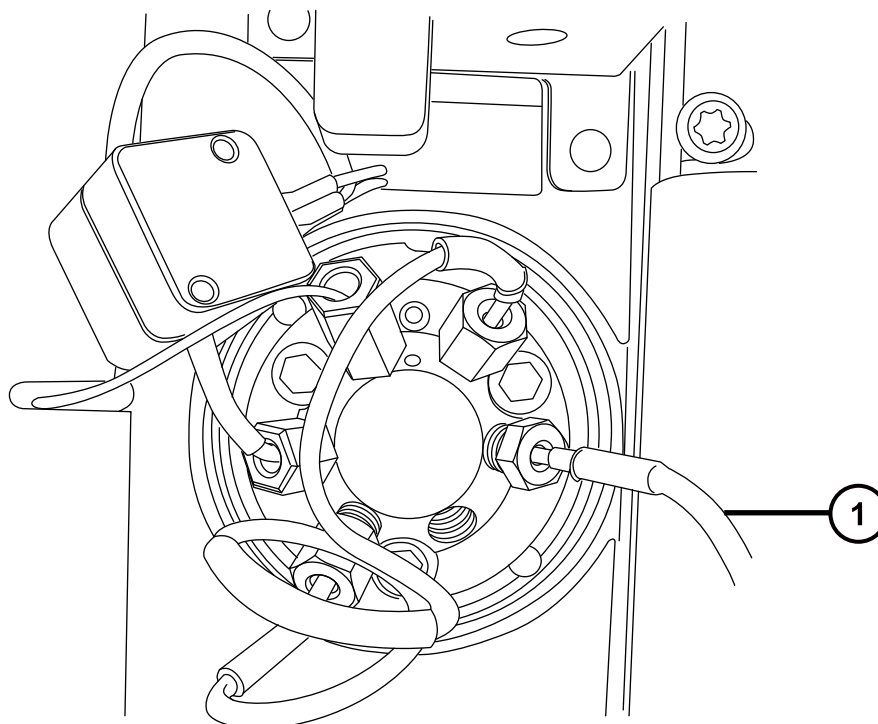
Part Number	Order Number	Description
430004188	700010399	Inlet tube
430004190	700010400	Infusion tube
430004212	700010401	Waste tube
430004476	700010470	Optional, post-column addition tube

Figure 3–16: Fluid line aperture:



- ① Aperture closed
- ② Aperture open (spring-loaded)
- ③ Fluid line aperture

Figure 3–17: μ Sample manager injection valve:



- ① Fluid inlet line connected to injection valve port 6

10. Connect the fluid inlet line to port 6 on the injection valve of the μ Sample manager.
11. Connect the fluid infusion line to port 2 on the fluidics divert valve.
12. Connect the optional post-column addition line to outlet B on the flow control module of the auxiliary solvent manager.
13. Connect the waste line to a suitable waste container.

3.6.2 Installing ionKey source software

If you are installing an ionKey source on your Xevo TQ-S for the first time, you must install the appropriate MassLynx software SCN and the ACQUITY UPLC M-Class driver pack. For further details, see the following documents:

- *ACQUITY UPLC M-Class Driver Pack Installation and Configuration Guide (715004448)* for detailed installation procedures and information on using the ACQUITY Inlet Switch Utility.
- MassLynx software and related SCN release notes for detailed information about installing MassLynx software and SCNs.

3.6.3 Installing the camera in the ionKey source

To install the camera in the ionKey source:

1. Connect the camera cable from the video output connector on the mass spectrometer's rear panel to the video-to-USB converter box.



Notice: To avoid damaging the video converter, make sure the workstation is powered-off before connecting the converter to the workstation in the next step.

2. Connect the video-to-USB converter box to a USB port on the mass spectrometer's workstation.
3. On the Tune page, click **Camera Viewer** .
4. In Device settings dialog box, specify the parameter settings according to the following table, and then click **OK**.

Tip: After you install the camera software, when you select the ionKey camera viewer for the first time, the device settings dialog box opens. To subsequently open the device settings dialog box, in the camera viewer, click **View > Camera Options**.

Table 3–2: Device settings for the camera:

Parameter	Setting
Video norm	PAL_B
Video format	Y800 (768 x 576)
Frame rate (FPS)	25
Input channel	00 Video: Composite

3.6.4 Removing an ionKey source

You can remove the ionKey source, and replace it with a conventional interface.

Alternative: If you are using the ionKey source with an ACQUITY UPLC M-Class system mounted on an M-Class cart fitted with an ionKey or universal source holder, you can secure the source enclosure to the holder. Doing so keeps the enclosure close to the Xevo TQ-S, for when it is next needed. Securing the source enclosure also assists with managing the ionKey source's fluid lines and helps prevent contamination of the fluid lines.

See the ACQUITY M-Class documentation for additional information about installing the ionKey source holder on the M-Class cart, and securing the source enclosure to the holder.

See *Installing and Using the Universal Source Holder* (part number 715004884) for additional information about installing and using the universal source holder on the M-Class cart, and securing the source enclosure to the holder.

See also:: The *ionKey/MS System Guide* (part number 715004028).

Required materials

- Chemical-resistant, powder-free gloves
- 1/4-inch open-end wrench



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid static-like electric shock, ensure that the instrument is prepared for working on the source before starting this procedure.

To remove the ionKey source:

1. Prepare the instrument for working on its source (see [Preparing the instrument for working on the source](#)).



Warning: To avoid burn injuries, exercise care when handling the column or other components heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.

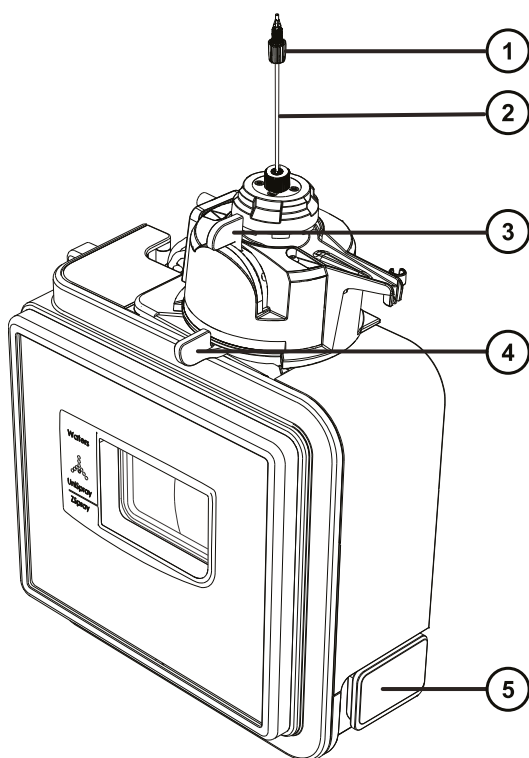
2. Remove the iKey from the docking port (see the *ionKey/MS System Guide*, part number 715004028).
3. Close the MassLynx software.
4. Power-off the μ Sample manager.
5. Disconnect the PSPI cable.
6. Use the 1/4-inch open-end wrench to loosen and disconnect the fluid waste line and fluid inlet lines from the μ Sample manager.
7. Disconnect the optional post-column addition line from the flow control module of the auxiliary solvent manager.
8. Swing open the ionKey source enclosure unit from the source mounting on the mass spectrometer.
9. Disconnect the high-voltage cable (white) from the high-voltage supply outlet on the mass spectrometer.

10. Disconnect the options cable (blue) from the options port on the mass spectrometer.
11. Disconnect the fluid infusion line from the onboard IntelliStart Fluidics system on the mass spectrometer.
12. Carefully remove the ionKey source module, and store safely.

3.7 UniSpray standard source

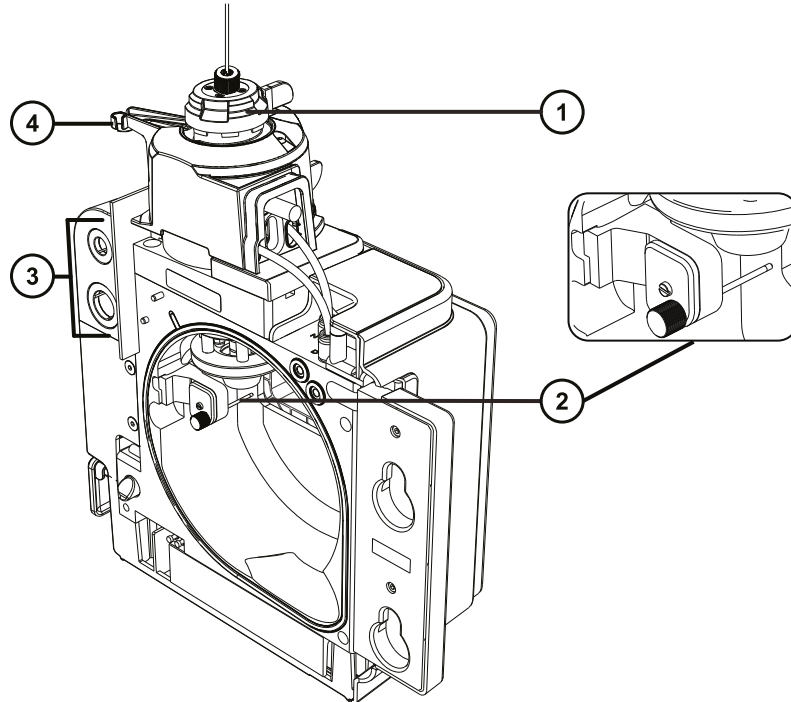
The UniSpray source standard version is available for use on quadrupole-based mass spectrometers.

Figure 3–18: UniSpray standard source – front



- ① Probe PEEK fitting
- ② Probe assembly
- ③ Vertical probe adjuster
- ④ Horizontal probe adjuster
- ⑤ Source enclosure door release-handle

Figure 3–19: UniSpray standard source – rear



- ① Capillary adjuster
- ② Impactor pin
- ③ Cable storage sockets
- ④ Probe adjuster overflow spur and probe storage clip

See also: Topics about maintaining the source components:

- [Replacing the UniSpray probe assembly](#)
- [Maintaining the impactor pin](#)

3.7.1 Installing the UniSpray source

3.7.1.1 Installing the UniSpray standard source

Required materials

- Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

Important: Before installing the UniSpray standard source, inspect the UniSpray source's impactor pin to determine whether it requires cleaning or replacement according to the maintenance schedule. For instructions about cleaning or replacing the impactor pin, see [Cleaning or replacing the UniSpray impactor pin](#).

To install the UniSpray source:

1. To prepare the instrument for working on the source, stop solvent flow, ensure that the instrument is in Standby mode, and stop desolvation gas flow.



Warning: To avoid harmless, static-like electric shock, ensure that the instrument is in Standby mode before beginning this procedure.



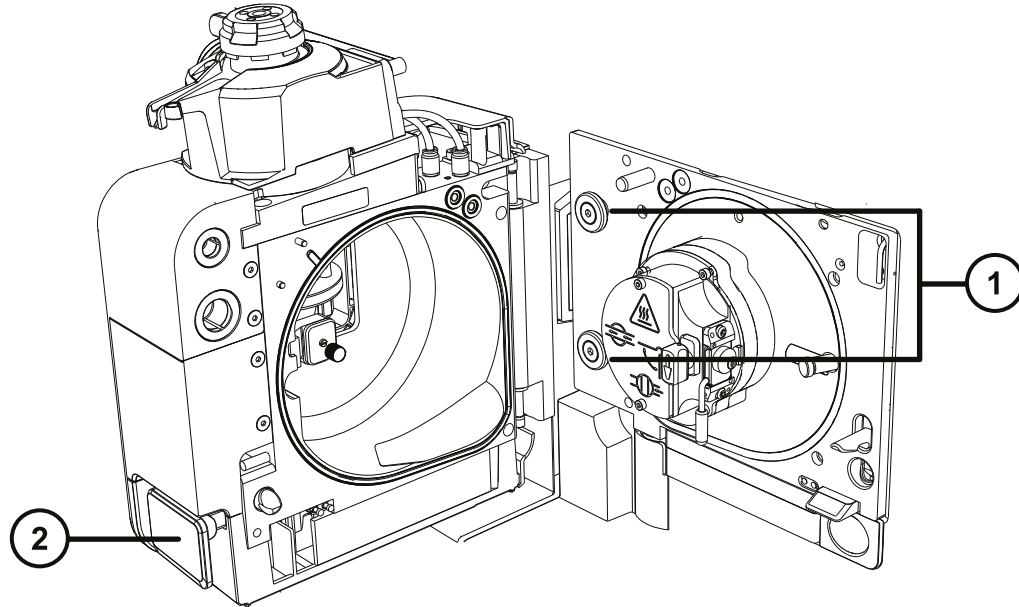
Warning: To avoid burn injuries, exercise care when handling the components of the source enclosure heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.

2. Remove the existing source enclosure (see your instrument's overview and maintenance guide for details about removing another source).
3. Ensure that the probe assembly is connected to the UniSpray source before you fit the source to the mass spectrometer.

See also: [Installing the UniSpray probe assembly](#).

4. Use two hands to fit the UniSpray source enclosure to the two supporting studs on the adapter housing.

Figure 3–20: Fitting the source

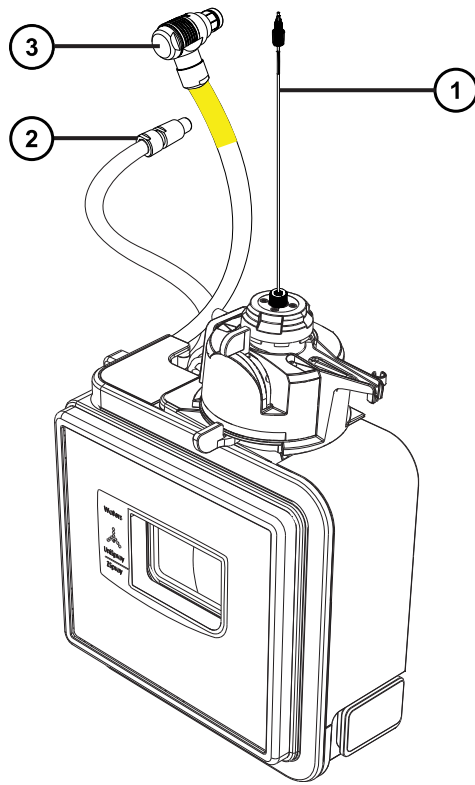


① Supporting studs

② Source enclosure door release handle

5. Slide open the instrument's source control panel door.
6. Connect the impactor pin high-voltage cable to the impactor pin high-voltage cable socket on the mass spectrometer.

Figure 3–21: UniSpray standard source connections



- ① Probe assembly
- ② Impactor pin high-voltage cable
- ③ Probe adjuster cable (yellow)

7. Connect the probe adjuster cable (yellow) to the probe adjuster cable socket (yellow) on the mass spectrometer.
8. Screw the probe assembly's PEEK fitting into the appropriate fluidics port according to your instrument until it is finger tight.
9. Close source interface door, ensuring that it locks into place.

Result: The source pressure test initiates.



Notice: To avoid damaging the seals within the probe adjuster, do not adjust the probe position during the source pressure test. The pressure test runs each time you close the source door and takes approximately 30 seconds to complete.

3.7.2 Removing the UniSpray source

3.7.2.1 Removing the UniSpray standard source

You can remove the UniSpray source and replace it with another compatible interface.

Required materials

- Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid harmless, static-like electric shock, ensure that the instrument is in Standby mode before beginning this procedure.

To remove the UniSpray source:

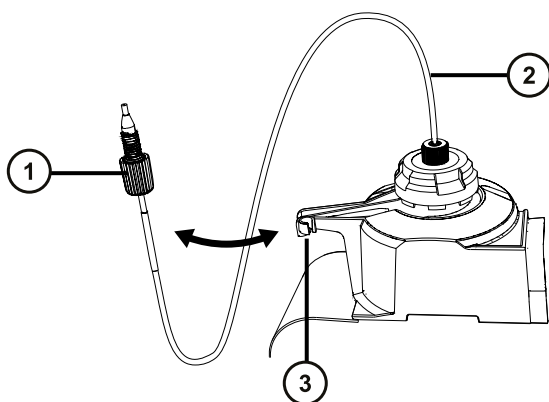
1. To prepare the instrument for working on the source, stop solvent flow, ensure that the instrument is in Standby mode, and stop desolvation gas flow.



Warning: To avoid burn injuries, exercise care when handling the components of the source enclosure heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.

2. Unscrew the probe assembly's PEEK fitting to disconnect the probe from the instrument's diverter valve, and fit the probe to the storage clip at the end of the source probe adjuster overflow spur.

Figure 3–22: Fitting the UniSpray probe to the storage clip on the source probe adjuster



- ① Probe assembly PEEK fitting
 - ② Probe assembly
 - ③ Storage clip on the overflow spur
3. Swing open the UniSpray source enclosure unit from the source mounting on the mass spectrometer.
 4. Disconnect the probe adjuster cable (yellow) from the instrument source interface panel.
 5. Disconnect the impactor pin high-voltage cable from the instrument source interface panel.
 6. Return the cable fittings to their storage slots on the source enclosure.
 7. Carefully lift the UniSpray source off the instrument's supporting studs and store it safely.

4 Maintenance procedures

This section provides the maintenance guidelines and procedures necessary to maintain the mass spectrometer's performance.

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

4.1 Maintenance Schedule

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

The maintenance frequencies shown apply to instruments that normally receive moderate use.

Table 4–1: Maintenance schedule

Procedure	Frequency	For information...
Clean the instrument case.	As required.	See Cleaning the instrument case .
Empty the exhaust trap bottle in the instrument exhaust line.	Inspect daily, empty as required.	See Emptying the nitrogen exhaust trap bottle .
Gas ballast the Oerlikon Leybold roughing pump.	When any of the following conditions apply: • With ESI operation, weekly. • The roughing pump oil appears cloudy. • Vacuum pressure is higher than normal. • Condensate forms in the roughing pump exhaust line. • You change the roughing pump oil.	See Gas ballasting the roughing pump .

Table 4–1: Maintenance schedule (continued)

Procedure	Frequency	For information...
Inspect and adjust the Oerlikon Leybold roughing pump oil levels.	Daily.	See Checking the roughing pump oil level .
Replace the Oerlikon Leybold roughing pump oil and oil mist filters.	Annually.	Maintaining the Oerlikon Leybold oil-filled roughing pump .
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 Cleaning the source components .
Clean or replace the ESI probe tip and gasket, or the tool-free ESI probe.	When sensitivity decreases to unacceptable levels.	See Replacing the ESI probe tip and gasket or, to maintain the tool-free ESI probe, see the <i>Waters Tool-Free Probe Maintenance Guide Supplement</i> .
Replace the ESI probe capillary or tool-free ESI probe capillary.	When sensitivity decreases to unacceptable levels or sample flow is inconsistent.	See Replacing the ESI probe capillary or, to maintain the tool-free ESI probe, see the <i>Waters Tool-Free Probe Maintenance Guide Supplement</i> .
Clean the IonSABRE II probe tip or the tool-free APCI probe tip (options using the IonSABRE II probe or tool-free APCI probe only).	When sensitivity decreases to unacceptable levels or significant chemical interference is present.	See Cleaning the IonSABRE II probe tip or, to maintain the tool-free APCI probe, see the <i>Waters Tool-Free Probe Maintenance Guide Supplement</i> .
Replace the IonSABRE II probe capillary or tool-free APCI probe capillary (options using the IonSABRE II probe or tool-free APCI probe only).	When sensitivity decreases to unacceptable levels or sample flow is inconsistent.	See Replacing the IonSABRE II probe sample capillary or, to maintain the tool-free APCI probe, see the <i>Waters Tool-Free Probe Maintenance Guide Supplement</i> .
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 Cleaning or replacing the corona pin .

Table 4–1: Maintenance schedule (continued)

Procedure	Frequency	For information...
Clean or replace the UniSpray impactor pin.	When the impactor pin is corroded or black, or the sensitivity decreases to unacceptable levels.	See Maintaining the UniSpray impactor pin .
Replace the UniSpray probe assembly.	When the UniSpray probe becomes irreversibly blocked, contaminated, or damaged.	See Replacing the UniSpray probe assembly .
Replace the IonSABRE II probe heater (options using the IonSABRE II probe only).	If the heater fails to heat when the instrument is pumped-down (evacuated).	See Replacing the IonSABRE II probe heater .
Replace the ion block heater cartridge.	If the heater fails to heat when the instrument is pumped-down (evacuated).	See Replacing the ion block source heater .
Replace the source assembly seals.	Annually.	See Replacing the source assembly seals .
Replace the oil-free (scroll) pump's seals.	Annually.	See Edwards document <i>XDS35i and XDS35iC Scroll Pumps Instruction Manual</i> .
Replace the instrument's air filters.	Annually.	See Replacing the air filter .
Change the roughing pump oil.	Annually.	See Adding oil to the roughing pump .
Replace the turbo pump oil reservoir.	Once every four years.	Completed as part of a Waters product performance maintenance service plan. For more information, see Contacting Waters .
Replace the fan filters on the side panels.	Annually.	Completed as part of a Waters product performance maintenance service plan. For more information, see Contacting Waters .
Replace or clean the Penning gauge body.	When the gauge fails.	Completed as part of a Waters product performance maintenance service plan. For more information, see Contacting Waters .

Table 4–1: Maintenance schedule (continued)

Procedure	Frequency	For information...
Replace the turbo pump oil cartridge.	Every two years.	Completed as part of a Waters product performance maintenance service plan. For more information, see Contacting Waters .
Clean the APPI/APCI source UV lamp window.	When the window becomes visibly dirty or the sensitivity decreases to unacceptable levels.	See APPI/APCI source—cleaning the lamp window .
Change the APPI/APCI source UV lamp bulb.	When the bulb fails.	See APPI/APCI source—changing the UV lamp bulb .
Replace the APPI lamp drive assembly O-rings.	Annually.	See APPI/APCI source—replacing the APPI lamp drive seals .
Replace an ionKey source fluid line.	As required or during periodic maintenance.	See Replacing the fluidics lines of the ionKey source .
Clean the ionKey source surface, fluid connectors, or electronic connectors.	As required or during periodic maintenance.	See Cleaning the ionKey source and connectors .

4.2 Spare parts

To ensure that your system operates as designed, use only Waters Quality Parts. Visit www.waters.com/wqp for information about Waters Quality Parts, including how to order them.

4.3 Troubleshooting with Connections INSIGHT

Connections INSIGHT is an intelligent device management (IDM) Web service that enables Waters to provide proactive service and support for a system. To use Connections INSIGHT, you must install its service agent software on the same PC as the chromatography data software. In a client/server system, you must also install the service agent on the computer that controls the system. The service agent software automatically and securely captures and sends information about the support needs of a system directly to Waters.

If you encounter a performance problem when using the console software, manually submit a Connections INSIGHT request to Waters Technical Service. Alternatively, use **Remote Desktop**, a real-time collaboration option that controls the two-way connection with the system by enabling the Connections INSIGHT iAssist service level.

These sources, available on the Waters website, provide more information about Connections INSIGHT and Connections INSIGHT iAssist:

- *Connections INSIGHT Quick Start Guide* (715003037)
- *Connections INSIGHT User's Guide* (715003036)

4.3.1 Submitting an iHelp request

1. Open the Connections INSIGHT software tray application, and select the **iHelp** tab.
2. On the **iHelp** tab, describe the problem or question, and provide your contact information.
3. Select the data to include with your inquiry, or upload files such as a plot or chromatogram.
4. Click **Submit iHelp Request**.

Result: The iHelp request is created and sent to the Connections INSIGHT enterprise server. The file uploading process triggers an email alert to the Waters Expert Center, who contact you after reviewing the service profile.

4.4 Safety and handling

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



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: Observe Good Laboratory Practice (GLP) at all times, particularly when working with hazardous materials. Consult the Material Safety Data Sheets regarding the solvents you use. Additionally, consult the safety representative for your organization regarding its protocols for handling such materials.



Warning: To avoid electric shock, observe these precautions:

- Do not remove the mass spectrometer's protective panels. The components they cover are not user-serviceable.
- When the instrument is in Operate mode, avoid touching the areas marked with the high voltage warning symbol. To touch external areas marked with the symbol, first put the instrument in Standby mode.



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's tip is sharp).
- A corona pin is fitted (the pin's tip is sharp).



Warning: To avoid injury, ensure that these criteria are met when performing maintenance operations 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.



Notice: To avoid damaging the iKey:

- Handle it with care. The component parts are fragile.
- For recommendations regarding the maximum pressure to subject the device to, see the *iKey Separation Device Care and Use Manual* (720004897EN).
- Do not apply electrospray potential to the emitter without flow.
- Do not drop it.
- Do not immerse it in liquid.
- Do not freeze or overheat it. Keep the iKey within the allowed temperature ranges during operation and in storage.
- Use the iKey sheath to protect the device when it is not in use.
- Do not bend or pull the capillary connection tubing at the ionKey source module coupling.
- Avoid excess voltage, which can erode the emitter over time.
- Do not touch the electrospray emitter, for it can bend.
- Decompress the iKey before you remove it from the source.

See [Safety advisories](#) for safety advisory information.

4.5 Preparing the instrument for working on the source

For safety reasons, you must follow this procedure before working on the source (for example, when changing the probe, installing or removing the corona pin, or operating the source isolation valve), and when maintaining the source.

Follow the procedure for the software that controls your mass spectrometer:

4.5.1 Using MassLynx software to prepare the instrument for operations on or inside its source

To use MassLynx software to prepare the instrument for operations on or inside its source:

1. In the Instrument Console, click **Stop Flow**  to stop the LC flow.
Note: If column flow is required, divert the LC flow to waste:
 - a. In the Instrument Console system tree, expand Xevo TQ-S 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 three 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.

4.5.2 Using UNIFI software to prepare the instrument for working on the source

You can use UNIFI software to prepare the instrument for operations on or inside the source.

To prepare the instrument for working on the source:

1. On the System Console tool bar, click **Stop Flow**  to stop the LC flow or, if column flow is required, divert the LC flow to waste as follows:
 - 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 three minutes to allow the desolvation gas flow to cool the probe and source.
4. Click  to stop the API gas.

Note: If the API gas is already stopped,  is shown on the toolbar.

4.6 Removing and refitting the source enclosure

Before performing certain maintenance procedures, or fitting the optional sources to the instrument, you must remove the source enclosure that is currently fitted to the instrument.

Note: The following procedures apply to both the standard and optional source enclosures.

4.6.1 Removing the source enclosure from the instrument

Required materials

- Chemical-resistant, powder-free gloves

To remove the source enclosure:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

1. Prepare the instrument so you can work safely on the source (see [Preparing the instrument for working on the source](#)).



Warning: To avoid burn injuries, take great care while performing this procedure.

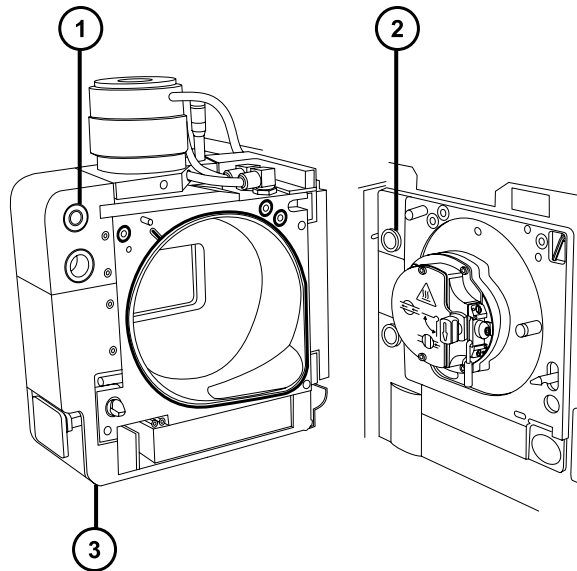
2. Remove the probe from the source:
 - If you are removing an ESI probe, see [Removing the ESI probe](#).
 - If you are removing an IonSABRE II probe, see [Removing the IonSABRE II probe](#).
 - If you are removing a tool-free ESI or APCI probe, see the *Waters Tool-Free Probe Maintenance Guide Supplement* (715005492).
3. Slide open the instrument's source interface door (see the figure in [ACQUITY UPLC/MS Xevo TQ-S systems](#)).
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 one or both of these conditions apply:

- An ESI probe is fitted (the probe's tip is sharp).
 - A corona pin is fitted (the pin's tip is sharp).
5. Pull the source enclosure release (located at the bottom, right-hand side) outward, and swing open the enclosure.

6. Use both hands to grasp the source enclosure and lift it vertically off the 2 supporting studs on the source adaptor housing.



- ① Cable storage positions
- ② Supporting stud
- ③ Source enclosure

7. Store the cables neatly by plugging them into the cable-storage positions on the rear of the source enclosure.

4.6.2 Fitting the source enclosure to the instrument

Required materials

Chemical-resistant, powder-free gloves

To fit the source enclosure to the instrument:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



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

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



Notice: To prevent the sprayer from colliding with the cone and, consequently, breaking when you use the NanoFlow source, always retract the stage before closing the source enclosure door.

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

4.7 Installing and removing the corona pin

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

4.7.1 Installing the corona pin in the source

Required materials

Chemical-resistant, powder-free gloves

To install the corona pin in the source:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



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

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



Warning: To avoid burn injuries, take great care while working with the source enclosure open.

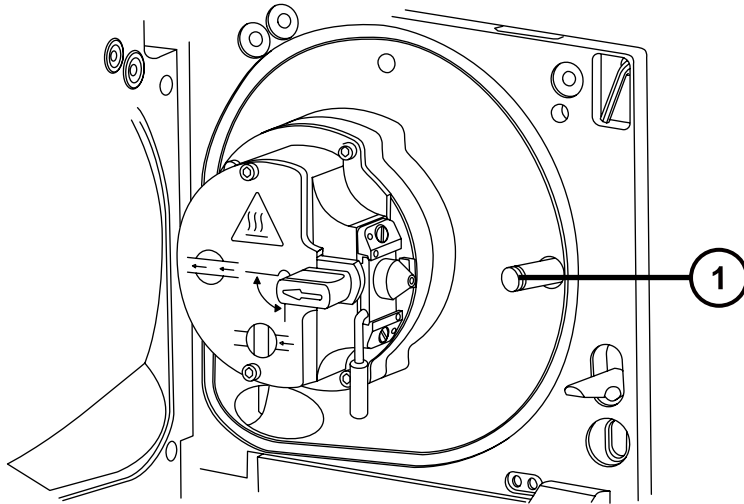


Warning: To avoid puncture wounds, handle sharp parts and materials with care.

2. Pull the source enclosure release (located at the bottom, right-hand side) outward, and then swing open the enclosure.
3. Remove the blanking plug from the corona pin mounting contact.

Tip: Store the blanking plug in a safe location.

Figure 4–1: Corona pin mounting contact



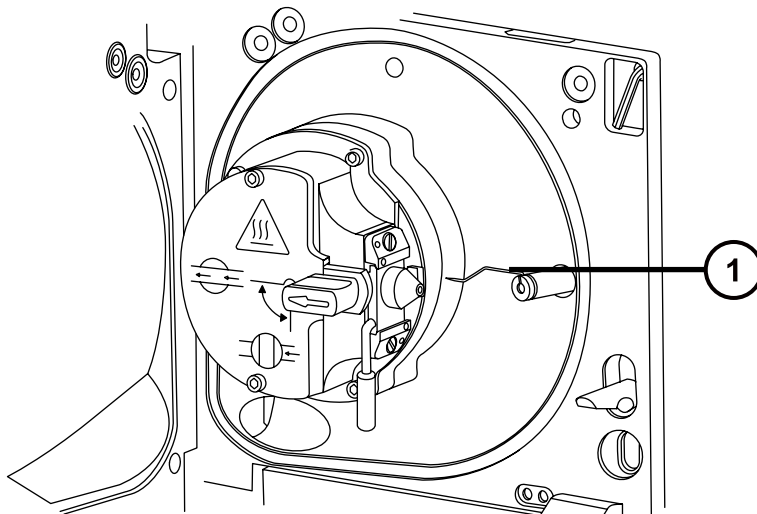
- ① Corona pin mounting contact blanking plug



Warning: To avoid puncture wounds, handle sharp parts and materials with care.

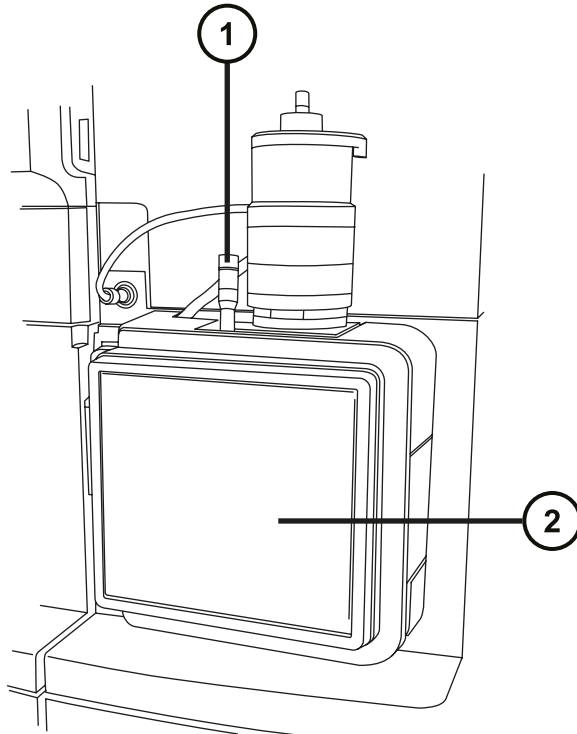
4. Fit the corona pin to the corona pin mounting contact, ensuring that the corona pin is securely mounted and that its tip aligns with the sample cone orifice.

Figure 4–2: Corona pin



- ① Corona pin

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



① Vernier probe adjuster

② Source window

4.7.2 Removing the corona pin from the source

Required materials

Chemical-resistant, powder-free gloves

To remove the corona pin from the source:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid static-like electric shock, ensure that the instrument is prepared for working on the source before starting this procedure.

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



Warning: To avoid burn injuries, take great care while performing this procedure.



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) outward, and swing open the enclosure.
 3. Remove the corona pin from its mounting contact (see the figure in [Installing the corona pin in the source](#)).
- Tip:** Store the corona pin in a safe location.
4. Fit the blanking plug to the corona pin mounting contact (see the figure in [Installing the corona pin in the source](#)).
 5. Close the source enclosure.

4.8 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

4.8.1 Closing the source isolation valve

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



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

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

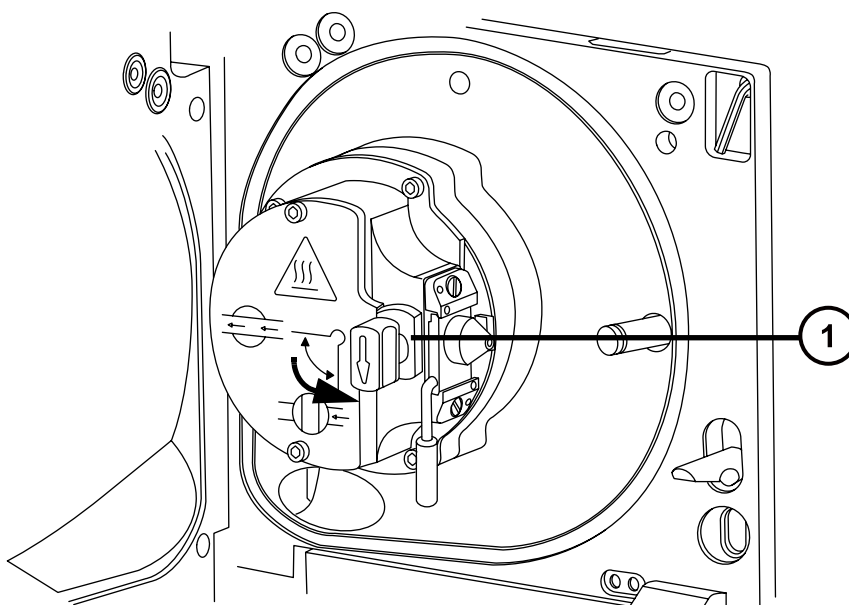


Warning: To avoid burn injuries, take great care while working with the source enclosure open.



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's tip is sharp).
 - A corona pin is fitted (the pin's tip is sharp).
2. Pull the source enclosure release (located at the bottom, right-hand side) outward and swing open the enclosure.
 3. Close the source isolation valve by turning its handle counterclockwise to the vertical position.



① Isolation valve handle in closed position

4.8.2 Opening the source isolation valve

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



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

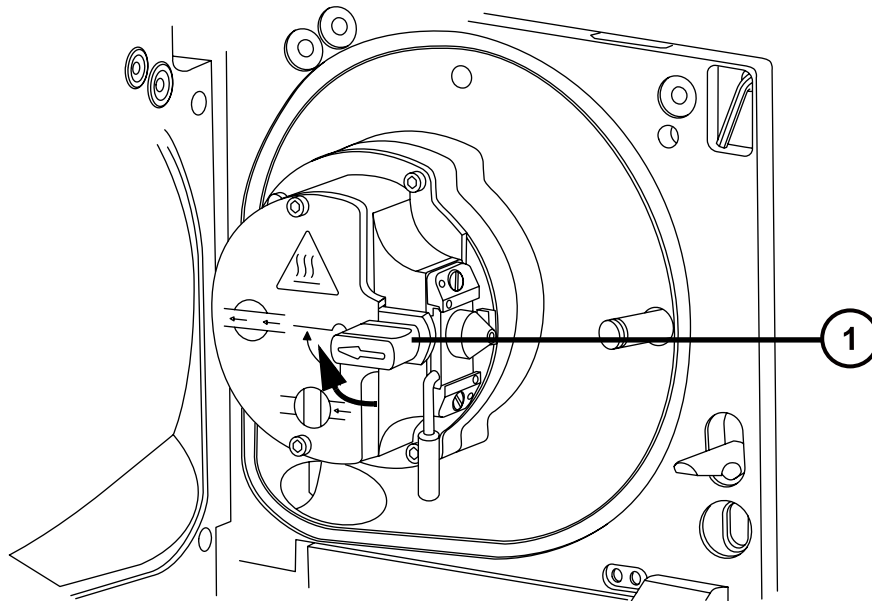


Warning: To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

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

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

Figure 4–3: Source isolation valve opened



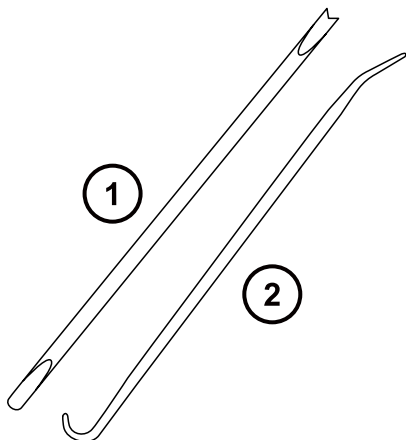
- ① Isolation valve handle in open position

2. Close the source enclosure.

4.9 Removing O-rings and seals

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

Figure 4–4: O-ring removal kit



① Tool 1

② Tool 2

To remove an O-ring:

! **Notice:** To avoid damaging the component when removing an O-ring or seal from it, ensure that you do not scratch the component with the removal tool.

Use the tools as aids to pull the O-ring or seal from its groove.

Tip: If you do not plan to reuse the O-ring or seal, you can use the forked end of tool 1 to impale the O-ring or seal to remove it.



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

4.10 Cleaning the instrument case

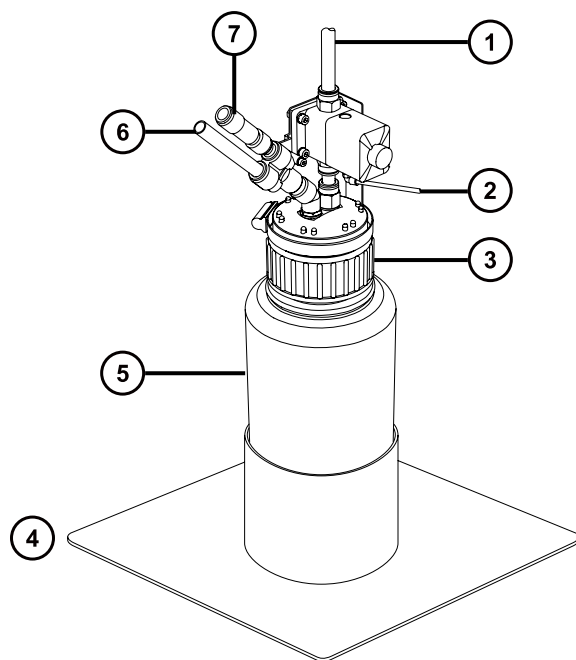
! **Notice:** To avoid abrading the surfaces of the instrument, do not use abrasives or solvents when cleaning them.

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

4.11 Emptying the nitrogen exhaust trap bottle

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

Figure 4–5: Nitrogen exhaust trap bottle



- ① To laboratory exhaust port
- ② From instrument pilot valve port
- ③ Cap
- ④ Bottle support
- ⑤ Nitrogen exhaust trap bottle
- ⑥ From instrument exhaust connection
- ⑦ One-way valve

Required materials

Chemical-resistant, powder-free gloves

To empty the nitrogen exhaust trap bottle:

1. To stop the LC flow, follow the action specified below, according to 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) outward, and swing open the enclosure.



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

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



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

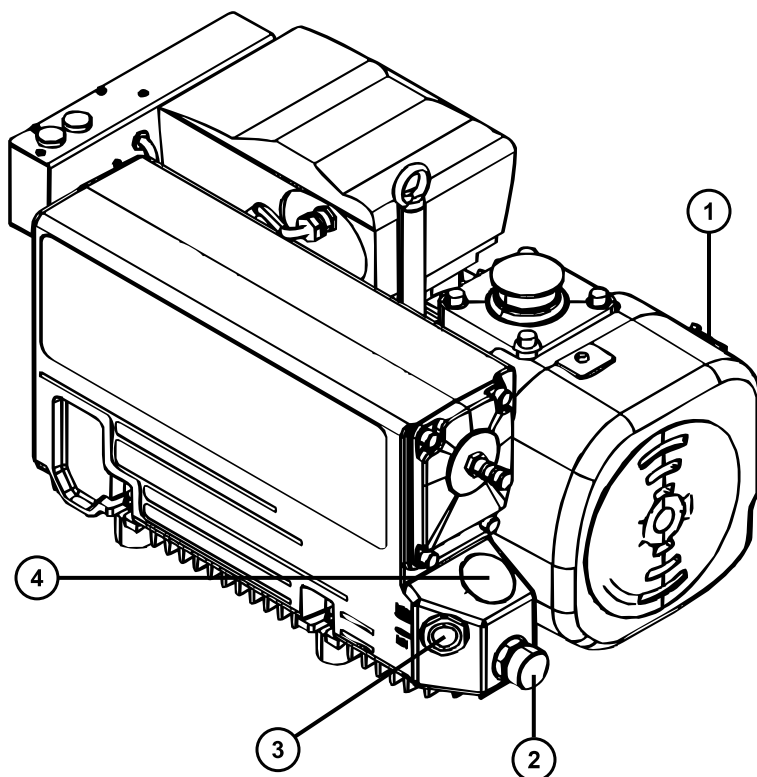
4. Dispose of the waste liquid in accordance with local environmental regulations.
5. Fit and tighten the nitrogen exhaust trap bottle to the cap.
6. Secure the nitrogen exhaust trap bottle in the upright position.
7. Close the source enclosure.

Tip: An automatic pressure test is performed.

4.12 Maintaining the Oerlikon Leybold oil-filled roughing pump

Requirement: In addition to the roughing pump maintenance requirements detailed here, refer to the manufacturer's documentation provided with the instrument.

Figure 4–6: Oerlikon Leybold roughing pump



- ① Gas ballast valve
- ② Oil drain
- ③ Oil level sight glass
- ④ Oil filler plug

4.12.1 Gas ballasting the Oerlikon Leybold roughing pump

! **Notice:** To avoid shortening oil life and the useful life of the roughing pump, routinely gas ballast the pump.

The roughing pump draws large quantities of solvent vapors that condense in the pump oil, diminishing pumping efficiency. Gas ballasting purges condensed contaminants from the oil.

Gas ballast the roughing pump when these conditions apply:

- With ESI operation, once a week.
- When the roughing pump oil appears cloudy.
- When the vacuum pressure is higher than normal.

- When condensate forms in the roughing pump exhaust line.
- When you change the roughing pump oil.

To gas ballast the roughing pumps:



Warning: To avoid burn injuries, take great care while working with the roughing pump.



Notice: To avoid damage:

- Do not vent the instrument when the roughing pump is gas ballasting.
 - Do not gas ballast the roughing pump while the instrument is in Operate mode.
 - Avoid gas ballasting the roughing pump for more than two hours.
1. Open the gas ballast valve.
 2. Allow the pump to operate for 30 to 60 minutes.

Tip: It is normal for the roughing pump temperature to increase during ballasting. To maintain an ambient temperature of <40 °C (104 °F) where the pump is located, ensure that there is adequate ventilation.

3. Close the gas ballast valve.

4.12.2 Inspecting the roughing pump oil level



Notice: To ensure correct operation of the roughing pumps, do not operate them with the oil level at less than the minimum level, as indicated in the pumps' sight glasses.

Note: This procedure does not apply to an oil-free roughing pump.

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

For each roughing pump, the oil level appears in the roughing pump's oil level sight glass. Inspect the oil level weekly. You must maintain the oil level at or near the indicated maximum level when the pump is not operating.

Tip: The oil level in the sight glass is lower when the roughing pump is running than when it is stopped. When the pump is running, the oil level is typically at 30% to 60% of the maximum level.

4.12.3 Adding oil to the roughing pump

If the roughing pump's oil level is low (see [Inspecting the roughing pump oil level](#)), you must add oil to the pump.

Required materials

- Chemical-resistant, powder-free gloves
- 12-mm hex wrench
- 6-mm hex wrench
- Funnel
- Anderol GD 32 vacuum pump oil

To add oil to the roughing pump:

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



Warning: To avoid personal injury, as well as damage to the roughing pump and mass spectrometer, disconnect the power cords for the mass spectrometer and roughing pump from the main power source.

2. Disconnect the power cords for the mass spectrometer and roughing pump from the main power source.
3. Allow the oil to settle in the pump.



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid burn injuries, exercise care when handling the column or other components heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.

4. Use the 12-mm hex wrench to unscrew and remove the pump's oil filler plug.
5. Using the funnel, add Anderol vacuum oil, type GD32, into the oil filler aperture until the oil reaches the maximum level ("MAX"), as indicated in the pump's oil level sight glass.

Requirement: Use only Anderol vacuum oil, type GD32.



Notice: To avoid oil leakage when fitting the oil filler plug to the roughing pump:

- Inspect the O-ring on the plug and verify that it is free of particles.
 - Ensure that the plug is not cross threaded.
 - Do not overtighten the plug.
6. Use the 12mm hex wrench to refit the oil filler plug.

Tip: When the plug is tightened, it seals against 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.

7. Connect the power cords for the mass spectrometer and the roughing pump to the main power source.
8. Power-up the mass spectrometer (see [Starting the mass spectrometer](#)).

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.
- After running the pump for 12 to 48 hours, it is common to see a few drops of oil near the filler plug. Excess oil around the lip of the filler plug will run down and drip off the pump once the pump reaches operating temperature.
- When the pump begins to run at normal operating temperature, spilled oil becomes slightly odorous.

4.12.4 Replacing the roughing pump's oil and oil demister elements

Replace the roughing pump's oil and oil demister elements annually.

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

Required materials

- Chemical-resistant, powder-free gloves
- 12-mm hex wrench
- 10-mm open-end wrench
- Waste container
- Anderol GD 32 vacuum pump oil
- Funnel

4.12.4.1 Preparing for replacement of roughing pumps' oil and oil demister elements

To prepare for replacing the roughing pumps' oil and oil demister elements:

1. Gas ballast the roughing pump for one hour (see [Gas ballasting the Oerlikon Leybold roughing pump](#)).

Rationale: Gas ballasting helps circulate and mix the oil through the pump before draining.

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



Warning: To avoid personal injury, as well as damage to the roughing pump and mass spectrometer, disconnect the power cords for the mass spectrometer and roughing pump from the main power source.

3. Disconnect the power cords for the mass spectrometer and the roughing pump from the main power source.
4. Allow the roughing pump to cool.

4.12.4.2 Draining the roughing pump's oil

To drain the roughing pump's oil:

Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid burn injuries, exercise care when handling the column or other components heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.

1. Place the container for catching used oil under the pump's drain plug (see the figure in [Maintaining the Oerlikon Leybold oil-filled roughing pump](#)).
2. Use the 12 mm Allen wrench to unscrew and remove the roughing pump's oil filler plug.
3. Use the 12 mm Allen wrench to remove the oil drain plug.
4. Tip the pump toward the drain plug aperture, and allow the oil to drain completely into the container.



Warning: To avoid contaminating uncontaminated surfaces with biologically hazardous, toxic, or corrosive materials, dispose of all waste materials according to local environmental regulations.

5. Dispose of the roughing pump oil in accordance with local environmental regulations.
6. Ensure that the O-ring on the oil drain plug is clean and properly seated.



Notice: To avoid oil leakage when fitting the oil drain plug or 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 overtighten the plug.
7. Use the 12 mm Allen wrench to refit the oil drain plug.

Tip: When the plug is tightened, it seals against 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.

4.12.4.3 Filling the roughing pump with oil

To fill the roughing pump with oil:

1. Using the funnel, pour one liter of Anderol vacuum oil, type GD32, into the oil filler aperture.

Requirement: Use only Anderol vacuum oil, type GD32.

Tip: After you add the oil, the level appearing in the sight glass can be above the maximum indication. This apparent excess does not suggest a problem. During the first few days of operation, the oil level falls to within the normal operating range.

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



Notice: To avoid oil leakage when fitting the oil drain plug or 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 overtighten the plug.

3. Use the 12-mm hex wrench to refit the oil filler plug.

Tip: When the plug is tightened, it seals against 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.

4.12.4.4 Removing the roughing pump's oil demister element

Required materials

- Chemical-resistant, powder-free gloves
- 6-mm hex wrench
- 10-mm open-end wrench

To remove the roughing pump oil demister element:

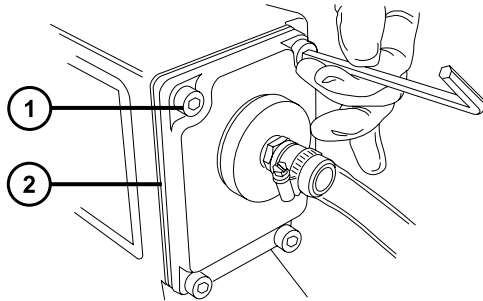
1. Vent and shut down the instrument (see the mass spectrometer's online Help for details).
2. Allow the roughing pump to cool.



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



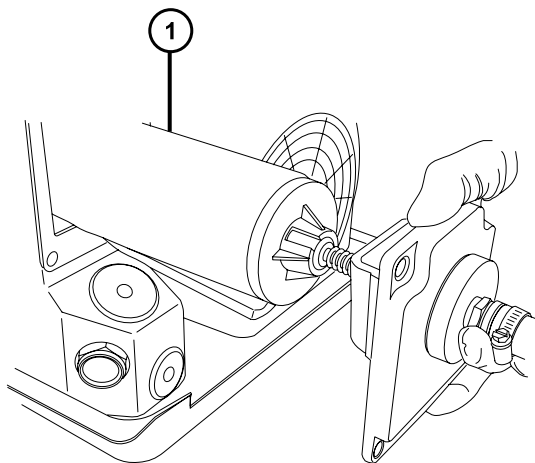
Warning: To avoid burn injuries, take great care while working with the roughing pump.



① Securing bolt

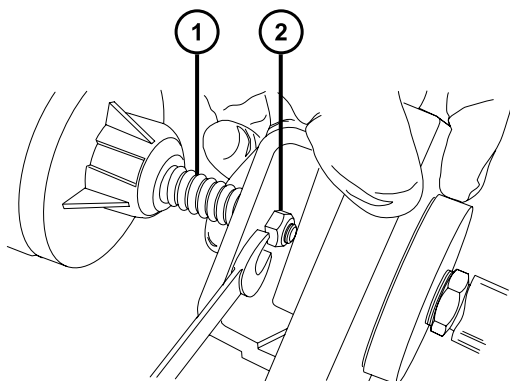
② Exhaust flange

3. Use the 6-mm hex wrench to remove the 4 bolts securing the exhaust flange to the roughing pump.
4. Carefully remove the exhaust flange and oil demister element from the roughing pump.



① Oil demister element

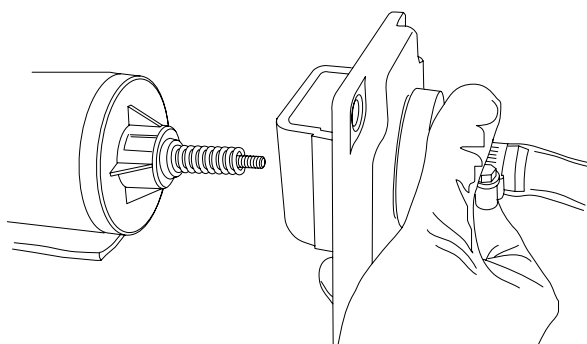
5. Use the 10-mm wrench to remove the nut that secures the oil demister element to the exhaust flange.



① Spring

② Securing nut

6. Holding the oil demister element slightly elevated to prevent the loss of the spring, remove the exhaust flange from the oil demister element.



7. Remove the spring from the oil demister element.



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

8. Dispose of the oil demister element in accordance with local environmental regulations.

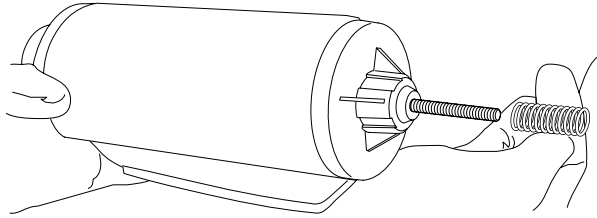
4.12.4.5 Fitting the new oil demister element

Required materials

- Chemical-resistant, powder-free gloves
- 6-mm hex wrench
- 10-mm open-end wrench

To fit the new roughing pump oil demister element:

1. Place the spring onto the new oil demister element.

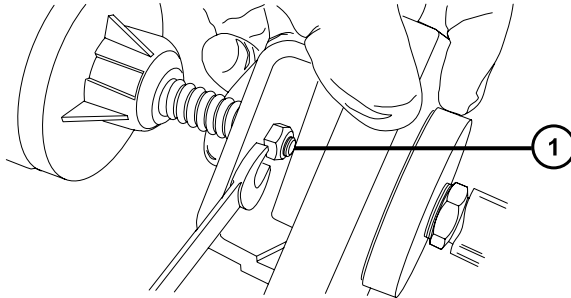


2. Holding the oil demister element slightly elevated to prevent the loss of the spring, fit the exhaust flange to the oil demister element.



Notice: To avoid damage, do not overtighten the nut that secures the oil demister element onto the exhaust flange. Ensure that only approximately 1 mm of thread is exposed beyond the nut when it is tightened.

3. Use the 10-mm open-end wrench to fit and tighten the nut that secures the oil demister element to the exhaust flange.



① 1-mm exposed thread after tightening

4. Ensure that the inscription "TOP" is at the top of the oil demister element and use both hands to carefully fit the oil demister element and exhaust flange to the roughing pump.
5. Use the 6-mm hex wrench to sequentially and incrementally tighten the four bolts securing the exhaust flange to the roughing pump until they are all fully tight.

4.12.4.6 Preparing for operation after changing the roughing pump's oil and oil demister element

To prepare for operation after changing the roughing pump's oil and oil demister element:

1. Connect the power cords for the mass spectrometer and the roughing pump to the main power source.
2. Start the mass spectrometer (see [Starting the mass spectrometer](#)).
3. Gas-ballast the roughing pump (see [Gas ballasting the Oerlikon Leybold roughing pump](#)).

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 downward and drips from the pump when it reaches operating temperature.
- When the pump approaches operating temperature, any oil spilled becomes odorous.

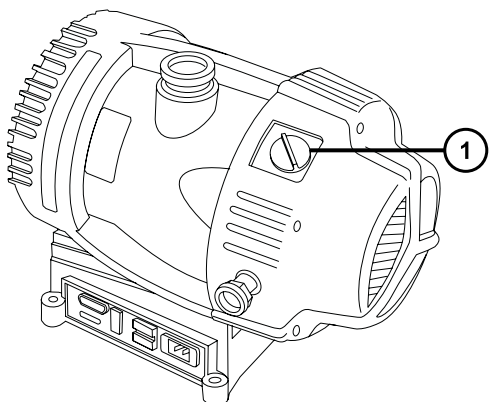
4.13 Gas ballasting the Edwards XDS35i oil-free roughing pump

Requirement: In addition to the roughing pump gas ballasting procedure detailed here, please refer to the manufacturer's documentation provided with the instrument.

Important: Failure to routinely gas ballast the roughing pump shortens pump life.

Note: The following procedure applies only to the Edwards XDS35i roughing pump. The XDS100B roughing pump is not fitted with a gas ballast control.

The roughing pump draws large quantities of solvent vapor that condense inside the pump, contaminating it, and resulting in an unusually high backing pressure. Gas ballasting prevents this condensation.



① Gas ballast control



Warning: To avoid burn injuries, take great care while working with the roughing pump.



Notice: To avoid damage:

- Do not vent the instrument when the roughing pump is gas ballasting.
- Do not gas ballast the roughing pump while the instrument is in Operate mode.
- Avoid gas ballasting the roughing pump for more than two hours.

4.13.1 Use of the gas ballast control

In normal use, the gas ballast control should be off (no-gas ballast).

To select no-gas ballast, turn the control position to 0. Doing so pumps gases fully, achieving ultimate vacuum.

To select low-flow gas ballast, turn the control to position I for approximately one hour. Use this position when the backing pressure reading is higher than usual.

Important: High-flow gas ballast position II is not recommended because it accelerates tip-seal wear.

4.14 Maintaining the EBARA oil-free roughing pump

There are no user maintenance procedures for the EBARA EV-SA20 pump.

To replace the pump, contact Waters Technical Support. For more information, see [Contacting Waters](#).

4.15 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 are dismissed.

See [Cleaning the sampling cone assembly](#).

If cleaning the sample cone and cone gas nozzle fails to increase signal sensitivity, clean the ion block and isolation valve (see [Cleaning the ion block assembly](#)).

If cleaning the ion block and isolation valve fails to increase signal sensitivity, clean the StepWave assembly (see [Cleaning the StepWave ion guide assembly](#)).

4.16 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.

4.16.1 Removing the sampling cone assembly from the source

Required materials

Chemical-resistant, powder-free gloves

To remove the sampling cone assembly from the source:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid harmless, static-like electric shock, before you touch any external surfaces marked with the high-voltage warning symbol, ensure that the mass spectrometer is in Standby mode.



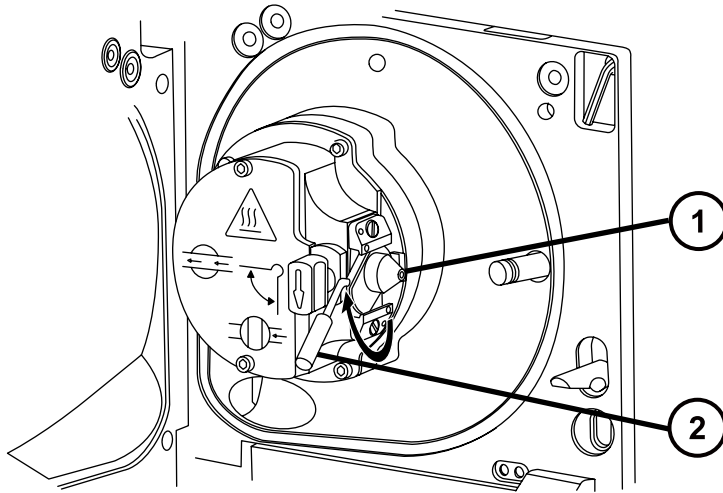
Warning: To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

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



Warning: To avoid burn injuries, take great care while working with the source enclosure open.

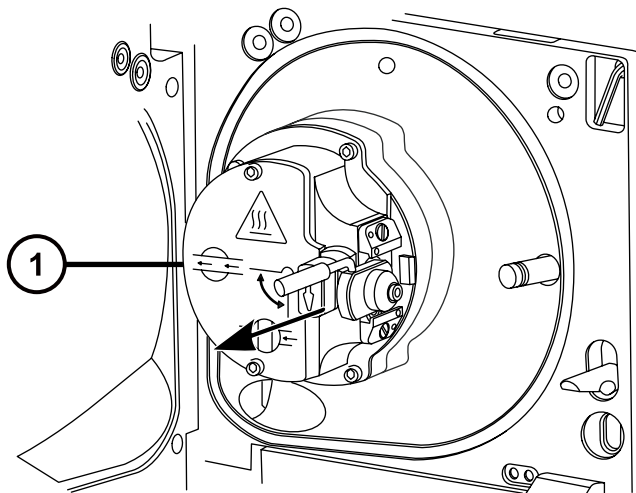
1. Close the source isolation valve (see [Closing the source isolation valve](#)).
2. Grasp the cone gas nozzle handle, and use it to rotate the sampling cone assembly 90 degrees, moving the handle from the vertical position to the horizontal position.



① Sampling cone assembly, comprising the cone gas nozzle, sampling cone, and O-ring

② Cone gas nozzle handle

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



① Ion block assembly



Notice: To avoid damage, do not open the source isolation valve before fitting the sampling cone assembly to the ion block assembly.

4.16.2 Disassembling the sampling cone assembly

Required materials

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

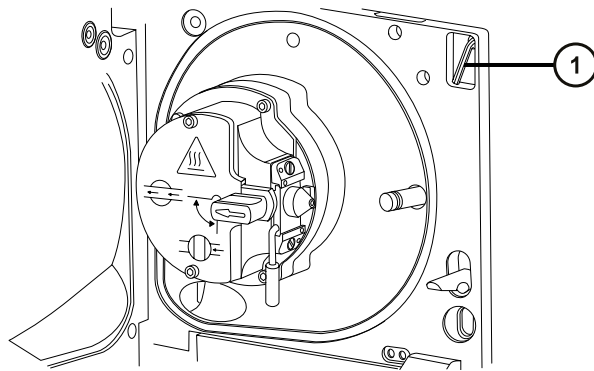
To disassemble the sampling cone assembly:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

1. Retrieve the combined 2.5-mm hex wrench and cone extraction tool from its storage location behind the source enclosure.

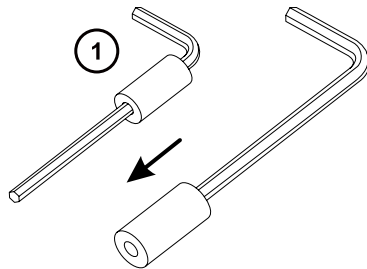
Figure 4–7: Cone extraction tool location



① Combined 2.5-mm hex wrench and cone extraction tool

2. Slide the collar to the end of the tool.

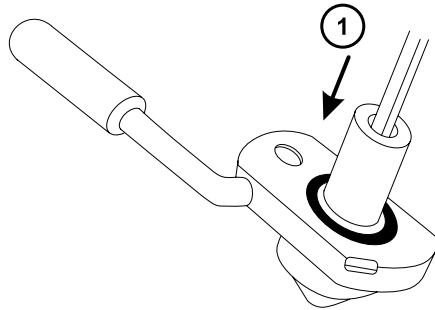
Figure 4–8: Cone extraction tool



① Collar

3. Insert the collar in the sample cone.

Figure 4–9: Inserting the cone extraction tool



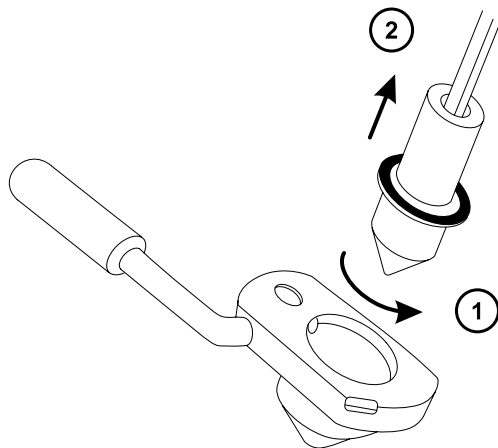
- ① Insert the collar



Notice: To avoid damaging the sampling cone, which is fragile, do not place it on its tip. Always place it on its flanged base.

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

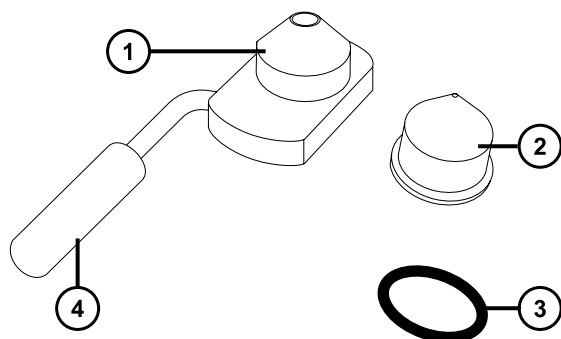
Figure 4–10: Removing the sample cone



- ① Rotate the tool
- ② Remove the sample cone

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

Figure 4–11: O-ring removed from the sample cone



- ① Cone gas nozzle
- ② Sample cone
- ③ O-ring
- ④ Cone gas nozzle handle



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

6. If the O-ring shows signs of deterioration or damage, dispose of it in accordance with local environmental regulations.

4.16.3 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
- Oil-free argon gas or Oil-free nitrogen gas

- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water
- Large beaker

To clean the sample cone and cone gas nozzle:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid injury when working with formic acid, which is extremely corrosive and toxic, take extreme care handling it, and use a fume hood and suitable protective equipment.

! **Notice:** To avoid damaging the sampling cone, which is fragile, do not place it on its tip. Always place it on its flanged base.

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

Note: The handle on earlier versions of the cone gas nozzle assembly is removable, although the cone gas nozzle can be cleaned without detaching the handle.

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 components by immersing them in separate glass vessels containing methanol, and then placing the vessels in the ultrasonic bath for 10 minutes.



Notice: To avoid recontaminating the components, wear clean, chemical-resistant, powder-free gloves.

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.



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

7. Inspect each component for persisting contamination.

Requirement: If contamination is present, clean the component again. If contamination is still present, dispose of the component, according to local environmental regulations, and obtain a new one before reassembling the sampling cone assembly.

4.16.4 Assembling the sampling cone assembly

Required materials

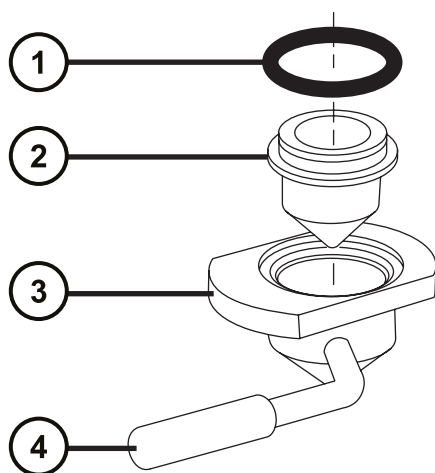
Chemical-resistant, powder-free gloves

To assemble the sampling cone assembly:

- ! **Notice:** To avoid recontaminating the components, wear clean, chemical-resistant, powder-free gloves.
- ! **Notice:** To avoid damaging the sampling cone, which is fragile, do not place it on its tip. Always place it on its flanged base.

1. Carefully fit the sample cone into the cone gas nozzle.

Figure 4–12: Sampling cone assembly



- ① O-ring
- ② Sample cone
- ③ Cone gas nozzle
- ④ Cone gas nozzle handle

Note: The PEEK handle is removable on earlier models of the cone gas nozzle assembly. If you detached the handle from the cone gas nozzle for cleaning, replace the handle and tighten it.

2. Fit the O-ring (a new one, if you disposed of the old O-ring) into the groove created between the sample cone and cone gas nozzle.

4.16.5 Fitting the sampling cone assembly to the source

Required materials

Chemical-resistant, powder-free gloves

To fit the sampling cone assembly to the source:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



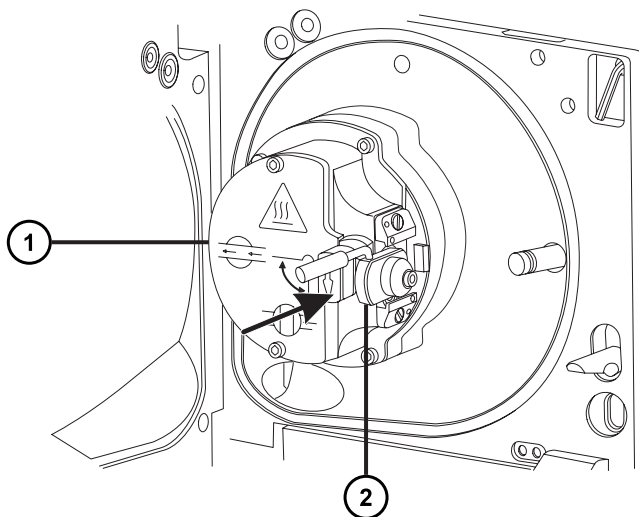
Warning: To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

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



Notice: To avoid damage, do not open the source isolation valve before fitting the sampling cone assembly to the ion block assembly.

1. Ensure that the source isolation valve is in the closed position (see [Closing the source isolation valve](#)).
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.



① Ion block assembly

② Sampling cone 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 [Opening the source isolation valve](#)).
5. Close the source enclosure.

4.17 Cleaning the ion block assembly

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

4.17.1 Removing the ion block assembly from the source assembly

Required materials

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

To remove the ion block assembly:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

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



Warning: To avoid personal injury, as well as damage to the roughing pump and mass spectrometer, disconnect the power cords for the mass spectrometer and roughing pump from the main power source.

2. Disconnect the power cords for the mass spectrometer and the roughing pump from the main power source.



Warning: To avoid burn injuries, allow a hot source to cool for at least 30 minutes before proceeding.



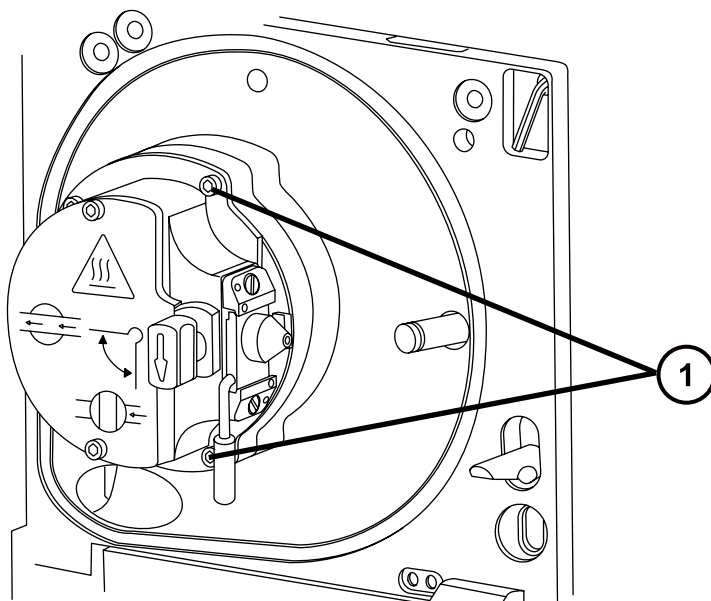
Warning: To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

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

3. Remove the source enclosure (see [Removing and refitting the source enclosure](#)).

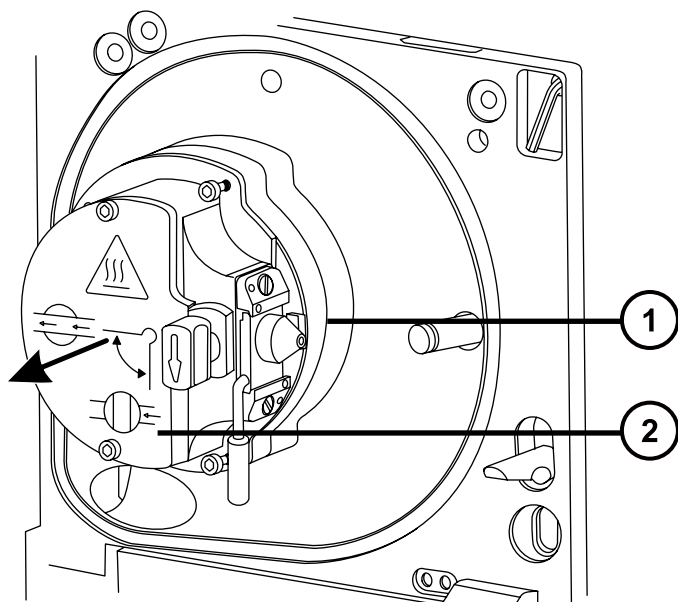
Rationale: Removing the source enclosure aids access to the ion block assembly.

4. Close the source isolation valve (see [Closing the source isolation valve](#)).
5. Use the combined 2.5-mm hex wrench and cone extraction tool to unscrew the four captive ion block assembly securing screws.



① Ion block assembly securing screws

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



① PEEK ion block support

② Ion block assembly

4.17.2 Disassembling the source ion block assembly

Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm hex wrench and cone extraction tool
- O-ring removal kit

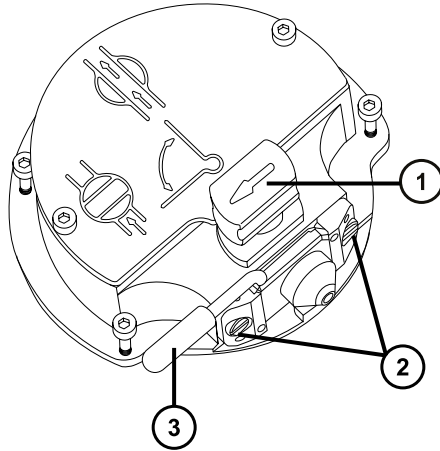
To disassemble the ion block assembly:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

1. Ensure that the source isolation valve is closed.

Figure 4–13: Source ion block assembly



① Source isolation valve handle in closed position

② Sampling cone assembly retaining blocks

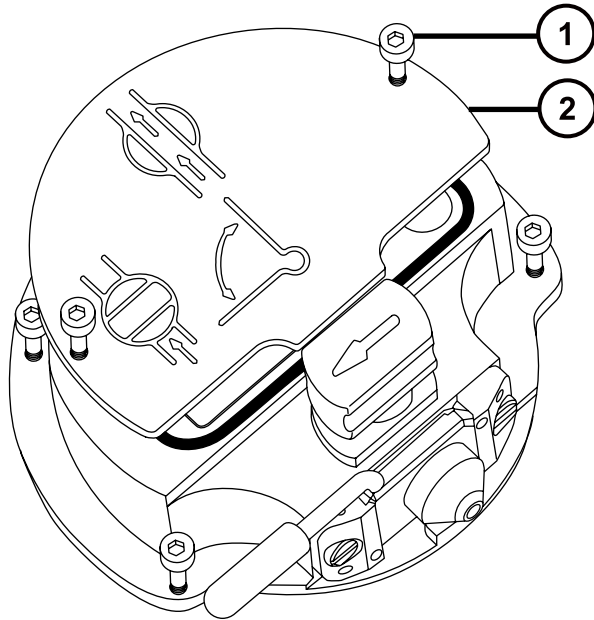
③ Cone gas nozzle handle

2. Grasp the cone gas nozzle handle, and use it to rotate the sampling cone assembly through 90 degrees.
3. Slide the sampling cone assembly out of the ion block assembly.
4. Use the combined 2.5-mm hex wrench and cone extraction tool to loosen the 2 captive screws securing the ion block cover plate.

Important: 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.

Figure 4–14: Source ion block cover plate

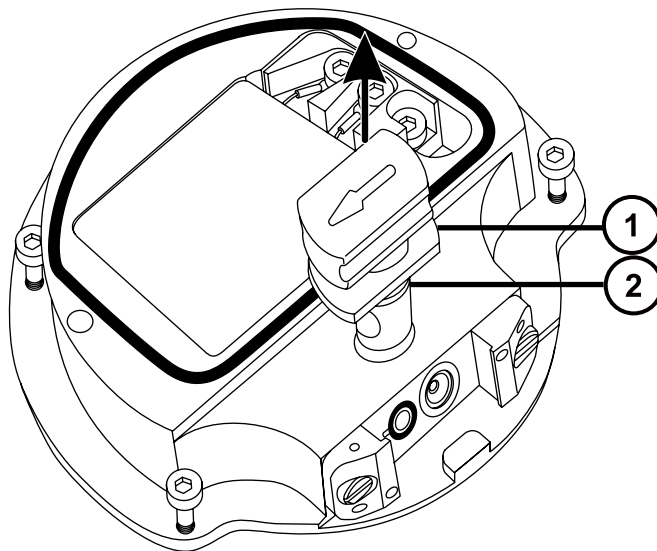


① Ion block cover plate securing screw

② Ion block cover plate

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

Figure 4–15: Removing the isolation valve from the ion block



① Isolation valve

② O-ring

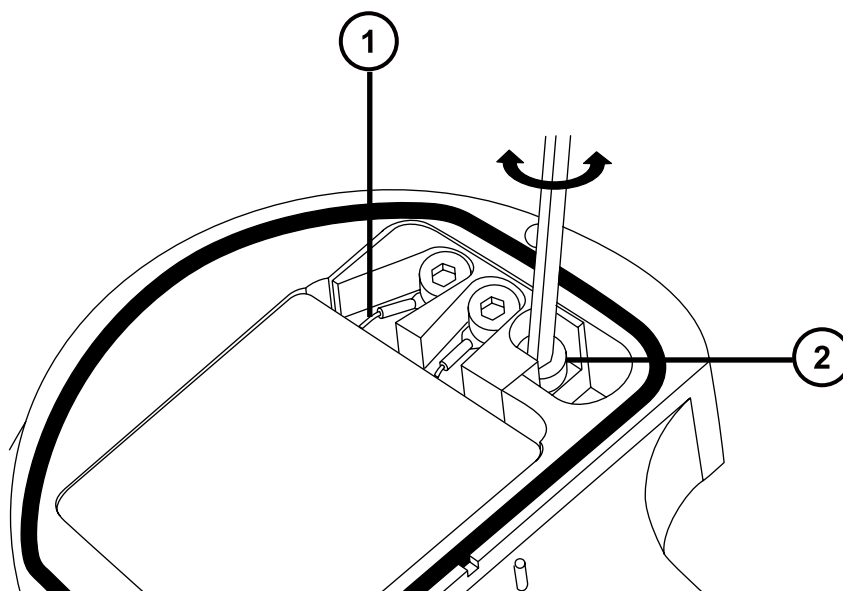
7. Use the O-ring removal kit to carefully remove the isolation valve O-ring (see [Removing O-rings and seals](#)).



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

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

Figure 4–16: Loosening the PEEK terminal block securing screw



① Heater cartridge assembly wires

② PEEK terminal block securing screw

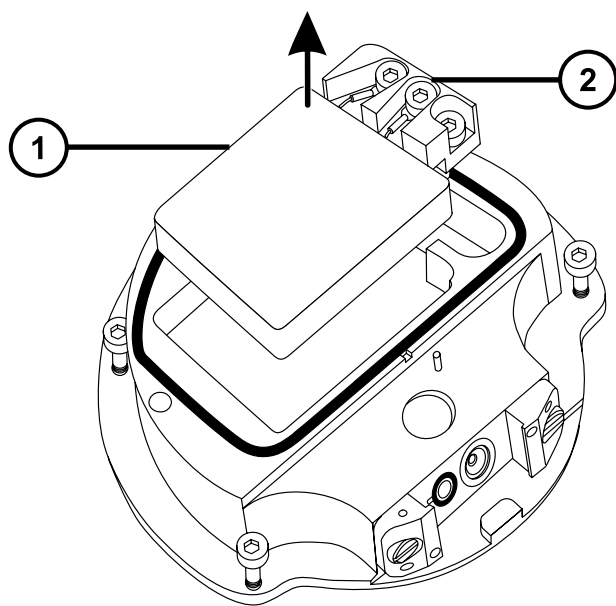


Notice: To avoid damaging the heater cartridge assembly wires, do not bend or twist them when removing the assembly and ceramic heater mounting block from the ion block.

10. Carefully remove the PEEK terminal block and ceramic heater mounting block, complete with heater cartridge assembly, from the ion block.

Tip: You can invert the ion block assembly to facilitate this process.

Figure 4-17: Removing the PEEK terminal block and ceramic heater mounting block

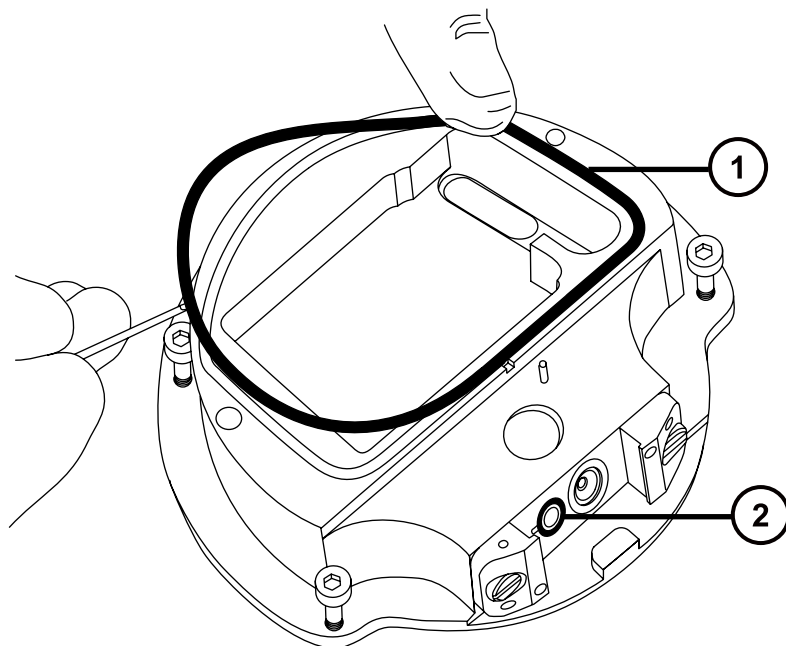


① Ceramic heater mounting block

② PEEK terminal block

11. Use the O-ring removal kit to carefully remove the cover seal from the ion block (see also [Removing O-rings and seals](#)).

Figure 4-18: Removing the cover seal from the ion block



① Cover seal

② Cone gas O-ring

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



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

13. If the cover seal or cone gas O-ring shows signs of deterioration or damage, dispose of it in accordance with local environmental regulations.

4.17.3 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
- Oil-free nitrogen gas for drying (air-drying optional)
- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water
- Large beaker

To clean the ion block components:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid injury when working with formic acid, which is extremely corrosive and toxic, take extreme care handling it, and use a fume hood and suitable protective equipment.

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. Remove residual water from the components by immersing them in separate glass vessels containing methanol, and then placing the vessels in the ultrasonic bath for 10 minutes.



Notice: To avoid recontaminating the components, wear clean, chemical-resistant, powder-free gloves.

4. Carefully remove the components from the vessels and blow-dry them using inert, oil-free gas.
5. Inspect each component for persisting contamination.

Requirement: 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 using inert, oil-free gas.



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to 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.

4.17.4 Assembling the source ion block assembly

Required materials

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

- HPLC-grade (or better) 1:1 methanol/water
- Lint-free cloth

To assemble the ion block assembly:

! **Notice:** To avoid recontaminating the components, wear clean, chemical-resistant, powder-free gloves.

! **Notice:** To avoid damaging the heater cartridge assembly wires, do not bend or twist them when removing the assembly and ceramic heater mounting block from the ion block.

1. Carefully fit the PEEK terminal block and ceramic heater mounting block, complete with heater cartridge assembly, to the ion block.
2. Use the combined 2.5-mm hex wrench and cone extraction tool to tighten the captive PEEK terminal block securing screw.
3. 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.

4. Fit the cover seal (a new one if you disposed of the old seal) to the ion block, ensuring that it is correctly seated.
5. Fit the cone gas O-ring (a new one if you disposed of the old O-ring) to the ion block, ensuring that it is correctly seated.
6. Fit the O-ring to the isolation valve.

Tip: If you use a new O-ring, first soak it for several minutes in isopropyl alcohol, so that it better fits the isolation valve.

7. Fit the isolation valve to the ion block assembly, so that it is in the closed position.
8. Fit the ion block cover plate to the ion block assembly, and then use the combined 2.5-mm hex wrench and cone extraction tool to tighten the 2 captive securing screws for the ion block cover plate.
9. 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.
10. Grasp the sampling cone assembly handle, and use it to rotate the sampling cone assembly through 90 degrees.

4.17.5 Fitting the ion block assembly to the source assembly

Required materials

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

To fit the ion block assembly to the source assembly:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing 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's tip is sharp).
- A corona pin is fitted (the pin's tip is sharp).



Notice: To avoid recontaminating the components, wear clean, chemical-resistant, powder-free gloves.

1. Fit the ion block assembly to the PEEK ion block support.
2. Use the combined 2.5-mm hex wrench and cone extraction tool to fit, and then slowly tighten, the four ion block assembly securing screws sequentially and in small increments.
3. Open the source isolation valve (see [Opening the source isolation valve](#)).
4. Fit the source enclosure (see [Fitting the source enclosure to the instrument](#)).
5. Close the source enclosure.
6. Connect the power cords for the mass spectrometer and the roughing pump to the main power source.

4.18 Cleaning the StepWave ion guide assembly

Clean the StepWave ion guide assembly if cleaning the ion block and isolation valve fails to increase signal sensitivity.

4.18.1 Handling the StepWave ion guide assembly

- ! **Notice:** To avoid damaging the StepWave ion guide assembly, handle it and its components carefully throughout the cleaning procedure.
In particular, to avoid damaging the wiring on assemblies fitted with an externally wired printed circuit board (PCB), do not touch the wiring.
- ! **Notice:** To avoid damaging assemblies fitted with a flexible PCB, which is not externally wired, do not touch the PCB.

4.18.2 Removing the ion block support from the source assembly

Required materials

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

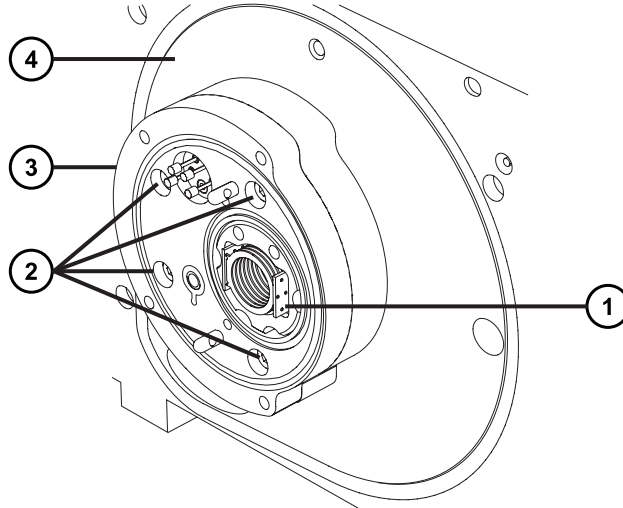
To remove the ion block support from the source assembly:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

1. Remove the source enclosure from the instrument (see [Removing and refitting the source enclosure](#)).
2. Remove the ion block assembly from the PEEK ion block support (see [Removing the ion block assembly from the source assembly](#)).
3. Use the 3-mm hex wrench to unscrew and remove the four screws securing the PEEK ion block support to the adapter housing.

Figure 4–19: Removing the securing screws



- ① StepWave Assembly
- ② Securing screws
- ③ PEEK ion block support
- ④ Adapter housing

4. Remove the PEEK ion block support from the adapter housing.
5. 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](#)).



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

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

4.18.3 Removing the StepWave assembly from the source assembly

Required materials

- Chemical-resistant, powder-free gloves
- Seal-breaker and locator tool
- StepWave assembly removal and insertion tool

Recommendation: When not in use, store the seal breaker and locator tool on the end of the StepWave assembly removal and insertion tool.

To remove the StepWave assembly from the source assembly:



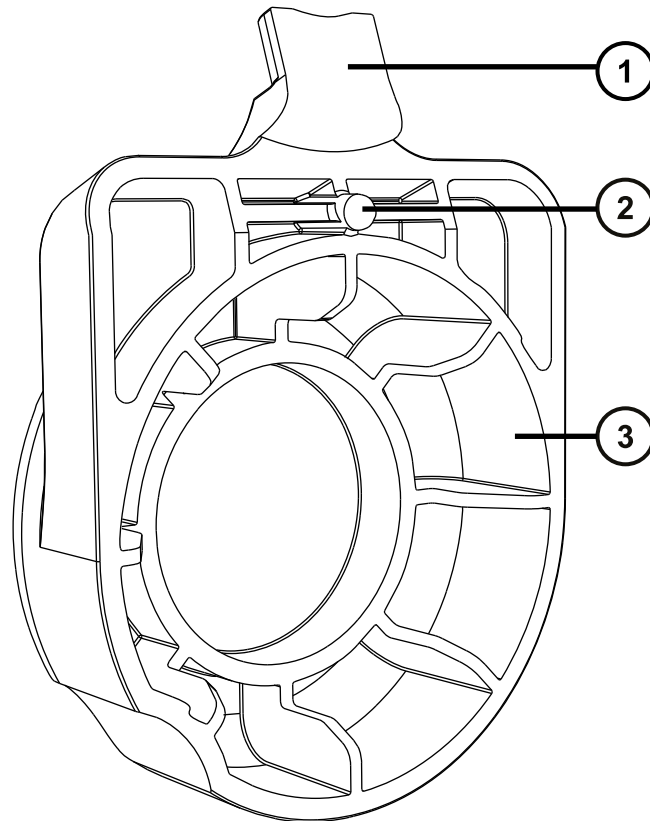
Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

! **Notice:** To avoid damaging the StepWave ion guide assembly when removing it from the source assembly, use only these tools:

- Seal-breaker and locator tool
- StepWave assembly removal and insertion tool

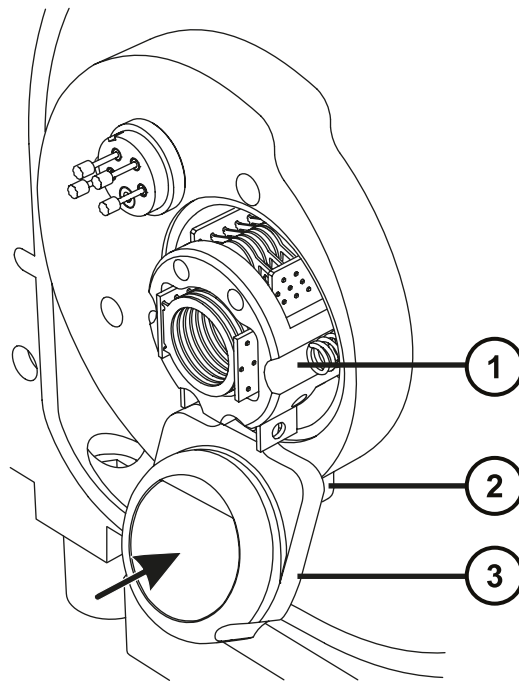
1. Position the seal breaker and locator tool so that it engages as follows:
 - Its pin with the hole on the adapter housing is directly under the end of the StepWave ion guide assembly.
 - Its lip is behind the StepWave ion guide assembly's ion guide cap.

Figure 4–20: Seal breaker and locator tool



- ① Lip
- ② Pin
- ③ Handle

Figure 4–21: Seal breaker and locator tool positioned on the adapter housing



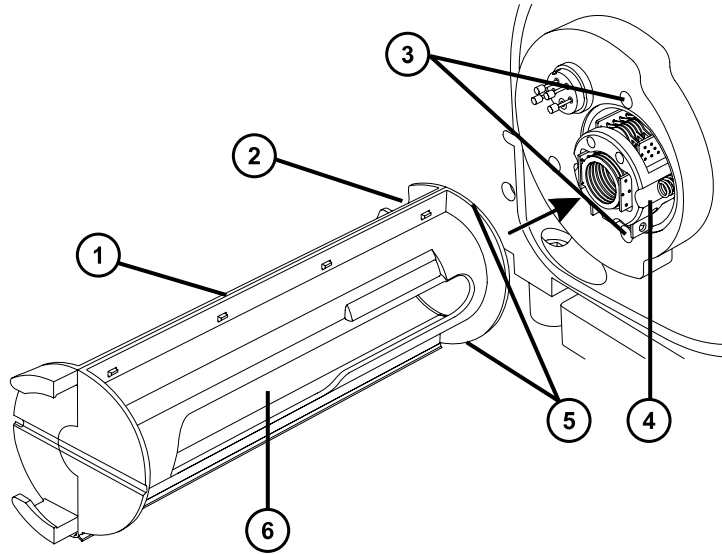
- ① Adapter housing
- ② Ion guide cap
- ③ Seal breaker and locator tool

2. Push firmly on the seal breaker and locator tool's handle to lever the StepWave assembly slightly out of the adapter housing.

Rationale: Moving the assembly in this manner releases it from a seal located inside the instrument.

3. With the StepWave removal and insertion tool's cutout uppermost, insert the tool's pins into the ion block support screw holes above and below the aperture in the pumping block assembly.

Figure 4–22: StepWave assembly removal and insertion tool



- ① StepWave assembly removal and insertion tool
- ② Cutout
- ③ Ion block support screw holes
- ④ Brown PEEK ion guide cap
- ⑤ Pins
- ⑥ Slot



Notice: To avoid damage when removing the StepWave ion guide assembly from the adapter housing, handle only the brown PEEK ion guide cap.

4. Inserting your thumbs through the slots in the StepWave removal and insertion tool, pull the StepWave ion guide assembly from the pumping block assembly and into the StepWave removal and insertion tool.



Notice: To avoid damaging the StepWave ion guide assembly, handle it and its components carefully throughout the cleaning procedure. In particular, to avoid damaging the wiring on assemblies fitted with an externally wired printed circuit board (PCB), do not touch the wiring.

5. Remove the StepWave ion guide assembly from the StepWave removal and insertion tool.

6. Using both hands, fit the source enclosure to the two supporting studs on the source adapter housing.
7. Close the source enclosure.

Rationale: Fitting and closing the source enclosure prevents debris from entering the instrument while you are working on the StepWave ion guide assembly.

4.18.4 Disassembling the StepWave ion guide assembly



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

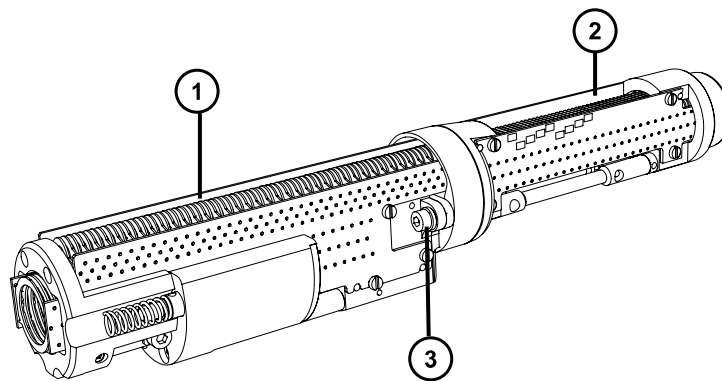
Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm hex wrench and cone extraction tool
- O-ring removal kit

To disassemble the StepWave ion guide assembly:

1. Use the combined 2.5-mm hex wrench and cone extraction tool to remove the two screws securing the first ion guide assembly to the second ion guide assembly.

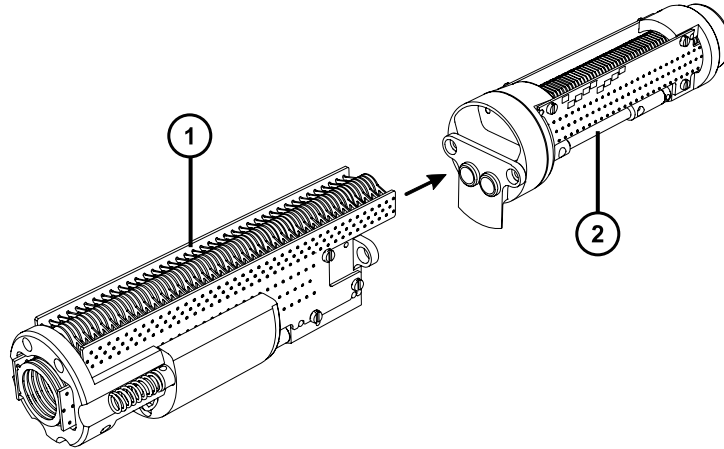
Figure 4–23: StepWave ion guide assembly



- ① First ion guide assembly
- ② Securing screw
- ③ Second ion guide assembly

2. Separate the first and second ion guide assemblies.

Figure 4–24: StepWave ion guide assembly separated

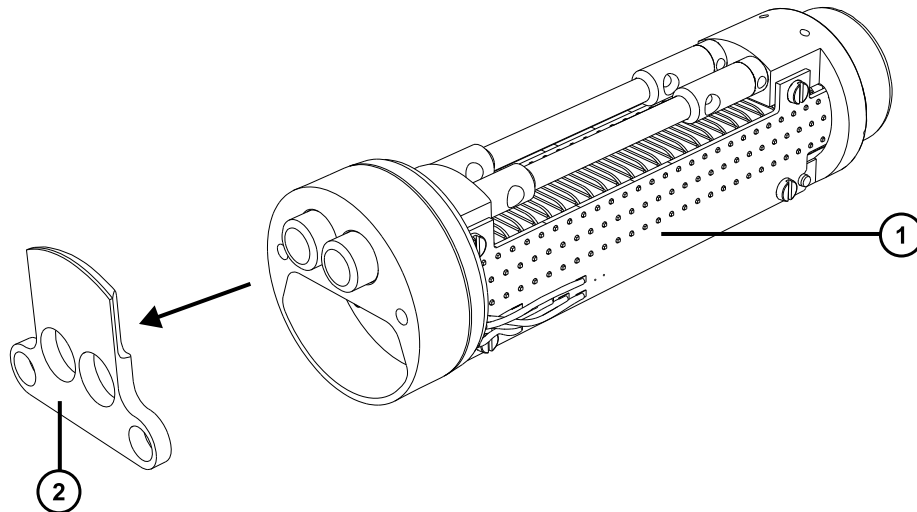


① First ion guide assembly

② Second ion guide assembly

3. Remove the brown PEEK gasket from the second ion guide assembly.

Figure 4–25: StepWave second ion guide assembly

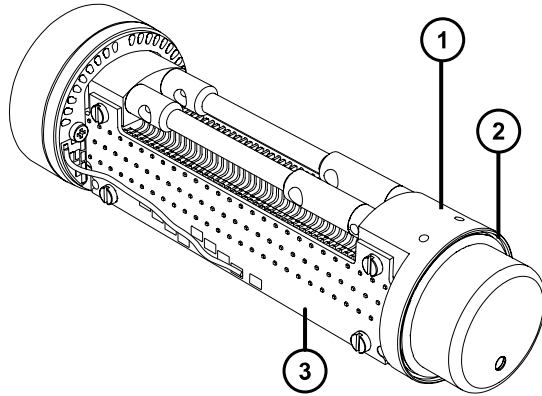


① Second ion guide assembly

② Brown PEEK gasket

4. Remove the O-ring from the differential pumping aperture on the second ion guide assembly (see [Removing O-rings and seals](#)).

Figure 4–26: StepWave second ion guide assembly



- ① Differential pumping aperture
- ② O-ring
- ③ Second ion guide assembly



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

5. If the O-ring shows signs of deterioration or damage, dispose of it in accordance with local environmental regulations.



Notice: To avoid misalignment of the StepWave ion guide, do not remove the differential pumping aperture or any further components from the assembly.

4.18.5 Cleaning the StepWave ion guide assembly



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Notice: To avoid damaging the StepWave ion guide assembly, handle it and its components carefully throughout the cleaning procedure.

In particular, to avoid damaging the wiring on assemblies fitted with an externally wired printed circuit board (PCB), do not touch the wiring.

! **Notice:** To avoid damaging the StepWave ion guide assembly, do not use acetone, chlorinated solvents, or acid as solvents when cleaning it. Use only the solvents specified in this procedure.

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.
- Two lengths of PEEK, PTFE, or stainless steel tubing, appropriately sized for suspending the first ion guide and second ion guide assemblies in the glass vessels when cleaning.
- HPLC-grade deionized water
- Waters MS Cleaning Solution (186006846)
- Waste container
- HPLC-grade isopropyl alcohol
- Ultrasonic bath
- Source of Oil-free argon gas or Oil-free nitrogen gas for drying.

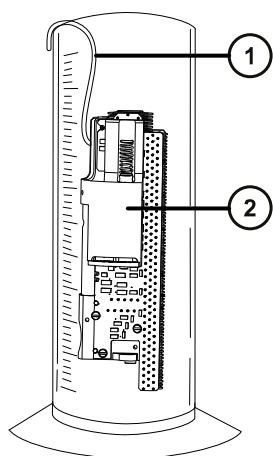
To clean the first ion guide and second ion guide PCB assemblies:

1. Bend the PEEK, PTFE, or stainless steel tubing into a hook shape.

! **Notice:** To avoid damage to the ion guide caused by vibration, ensure that the bottom of the ion guide does not touch the bottom of the glass vessel.

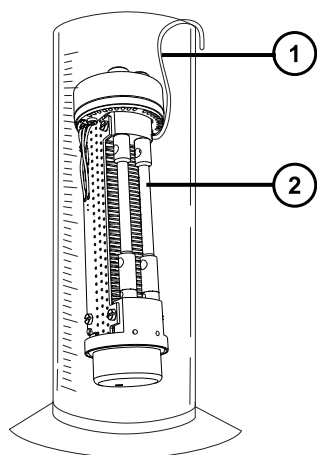
2. Use the hook to carefully suspend the first ion guide PCB assembly in the glass vessel so that the bottom of the assembly does not touch the bottom of the vessel.

Figure 4–27: Cleaning the first ion guide PCB assembly



- ① First ion guide PCB assembly
 - ② Hook
3. Add Waters MS Cleaning Solution to the glass vessel until the first ion guide PCB assembly is immersed completely.
 4. Repeat step 1 through step 3 for the second ion guide PCB assembly, placing the hook through one of the support rod holes.

Figure 4–28: Cleaning the second ion guide PCB assembly



- ① Hook
 - ② Second ion guide PCB assembly
5. Place the vessels containing the first ion guide and second ion guide PCB assemblies in the ultrasonic bath for 20 minutes.
 6. Carefully pour the cleaning solution from the vessel holding the first ion guide PCB assembly into the holding container, retaining the ion guide in the vessel.
- Tip:** You can reuse the cleaning solution for one subsequent cleaning.
7. Fill the vessel with deionized water, to rinse the first ion guide PCB assembly, and then discard the water.
 8. Refill the vessel with deionized water to rinse the first ion guide PCB assembly a second time, and then discard the water.
- Note:** Ensure that you remove all of the cleaning solution.
9. Repeat step 6 through step 8 for the second ion guide PCB assembly.
 10. Fill both vessels with deionized water, ensuring that each ion guide PCB assembly is immersed completely.
 11. Place the vessels containing the first ion guide and second ion guide PCB assemblies in the ultrasonic bath for 20 minutes.

12. Carefully pour out and discard the deionized water from both vessels, retaining the ion guide PCB assemblies in each vessel.
13. Fill both vessels with isopropyl alcohol, ensuring that each ion guide PCB assembly is immersed completely.
14. Place the vessels containing the first ion guide and second ion guide PCB assemblies in the ultrasonic bath for 20 minutes.
15. Carefully remove each ion guide PCB assembly from its vessel and blow-dry each assembly using inert, oil-free gas.
16. Discard the used isopropyl alcohol using an appropriate waste container.

4.18.6 Assembling the StepWave ion guide assembly

Required materials

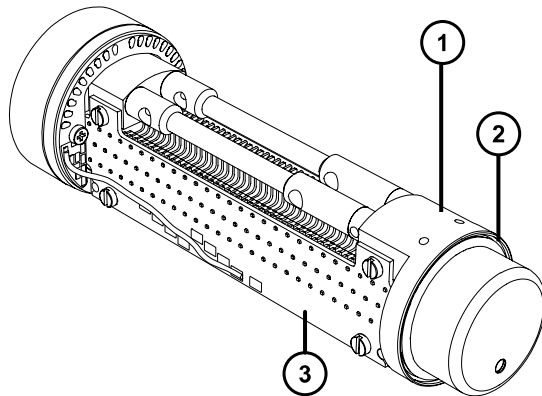
- Chemical-resistant, powder-free gloves
- Combined 2.5-mm hex wrench and cone extraction tool
- New O-ring
- PEEK gasket
- StepWave assembly securing screws (2)

To assemble the StepWave ion guide assembly:

! **Notice:** To avoid damaging the StepWave ion guide assembly, handle it and its components carefully throughout the cleaning procedure. In particular, to avoid damaging the wiring on assemblies fitted with an externally wired printed circuit board (PCB), do not touch the wiring.

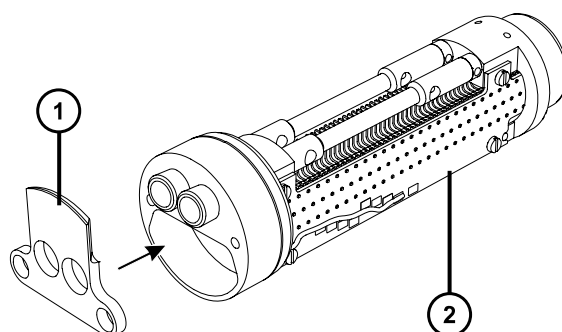
1. Fit the new O-ring to the differential pumping aperture on the second ion guide assembly.

Figure 4–29: Fitting the new O-ring to the differential pumping aperture



- ① Differential pumping aperture
 - ② O-ring
 - ③ Second ion guide assembly
2. Fit the brown PEEK gasket to the second ion guide assembly.
- Important:** Ensure that the gasket is oriented correctly.

Figure 4–30: Fitting the brown PEEK gasket



- ① Brown PEEK gasket
 - ② Second ion guide assembly
3. Align the first ion guide assembly with the second ion guide assembly.
 4. Use the combined, 2.5-mm, hex wrench and cone extraction tool to fit and tighten the two screws securing the first ion guide assembly to the second ion guide assembly.

4.18.7 Fitting the StepWave assembly to the source assembly

Required materials

- Chemical-resistant, powder-free gloves
- Seal-breaker and locator tool
- StepWave assembly removal and insertion tool

To fit the StepWave assembly to the source assembly:



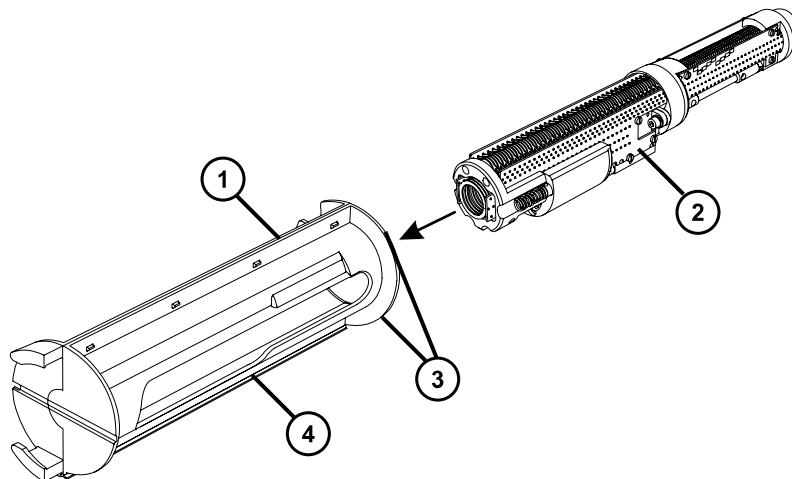
Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

! **Notice:** To avoid damage to the StepWave ion guide assembly when fitting it to the source assembly, use only the seal breaker and locator, and the assembly's removal and insertion tools.

1. Pull the source enclosure release (located at the bottom, right-hand side) outward and swing open the enclosure.
2. Using both hands, grasp the source enclosure and lift it vertically off the two supporting studs on the source adapter housing.
3. Slide the first ion guide assembly end of the StepWave assembly into the StepWave removal and insertion tool.

Tip: The StepWave assembly can only be inserted in the correct orientation in the StepWave removal and insertion tool.

Figure 4–31: Sliding the StepWave assembly into the StepWave removal and insertion tool



① StepWave assembly removal and insertion tool

② StepWave assembly

③ Pins

④ Cutout

4. With the StepWave removal and insertion tool's cutout uppermost, insert the StepWave removal and insertion tool's pins into the ion block support screw holes above and below the aperture in the pumping block assembly.

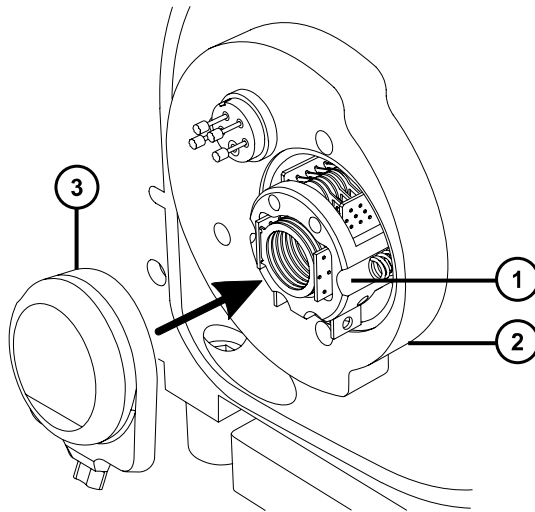
! **Notice:** To avoid damage when removing the StepWave ion guide assembly from the adapter housing, handle only the brown PEEK ion guide cap.

5. Inserting your thumbs through the slots in the StepWave removal and insertion tool, firmly push the StepWave ion guide assembly into the pumping block assembly.

Tip: You will detect some resistance to motion when the StepWave assembly encounters the seal inside the instrument. Continue pushing until you detect further resistance.

6. Remove the StepWave removal and insertion tool.
7. Invert the seal breaker and locator tool and locate it over the end of the StepWave assembly.

Figure 4–32: Fitting the seal breaker and locator tool



- ① StepWave assembly
- ② Adapter housing
- ③ Inverted seal breaker and locator tool

8. Push firmly on the seal breaker and locator tool until the tool's face contacts the adapter housing.

Rationale: This fully locates the StepWave assembly in the adapter housing.

9. Remove the seal breaker and locator tool.

4.18.8 Fitting the ion block support to the source

Required materials

- Chemical-resistant, powder-free gloves
- 3-mm hex wrench
- New seals and O-rings

To fit the PEEK ion block support to the source:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

1. 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.

2. Fit the O-rings (new ones if you disposed of the old) to the PEEK ion block support.

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.

3. Fit the PEEK ion block support to the instrument's housing.
4. Use the 3-mm hex wrench to fit and tighten the four PEEK ion block support securing screws.
5. Fit the ion block assembly to the PEEK ion block support (see [Fitting the ion block assembly to the source assembly](#)).
6. Fit the source enclosure to the instrument (see [Fitting the source enclosure to the instrument](#)).

4.19 Maintaining the ESI probe

Maintaining the ESI probe involves replacing the following components of the probe when required.

Note: To maintain a tool-free ESI probe, see the *Waters Tool-Free Probe Maintenance Guide Supplement* (715005492).

Table 4–2: ESI probe consumables

Component	Name	Part number
1	ESI probe tip	700004207
2	Nickel gasket	700004208
3	PTFE liner tube	700000640
4	Ferrule	700000343
5	Conductive sleeve	700000969
6	Capillary	700004206

If the ESI probe tip is damaged or blocked, follow the procedure [Replacing the probe tip and gasket](#).

If replacing the ESI probe tip and gasket fails to increase sensitivity, or if a performance issue can be traced to capillary blockage, contamination, or damage, follow the procedure [Replacing the ESI probe capillary](#).

4.19.1 Replacing the probe tip and gasket

Replace the probe tip if it becomes blocked or damaged.

Required materials

- Chemical-resistant, powder-free gloves
- New nickel gasket
- 7-mm open-end wrench
- 10-mm open-end wrench



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



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



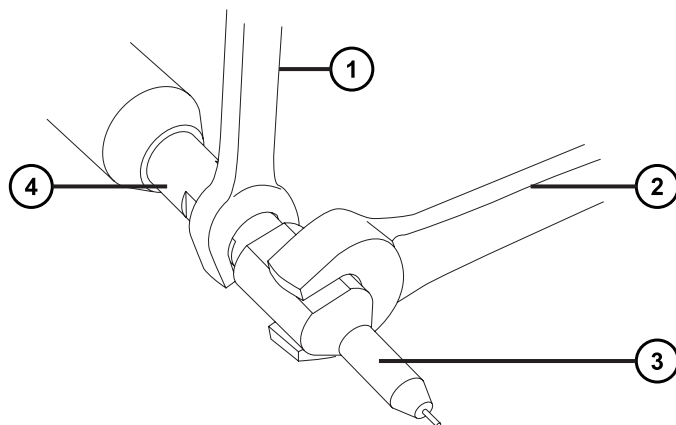
Warning: To avoid puncture wounds, handle the probe with care; the ESI probe tip is sharp.



Warning: To avoid eye injury from the sharp capillary, wear safety goggles when performing the leak test.

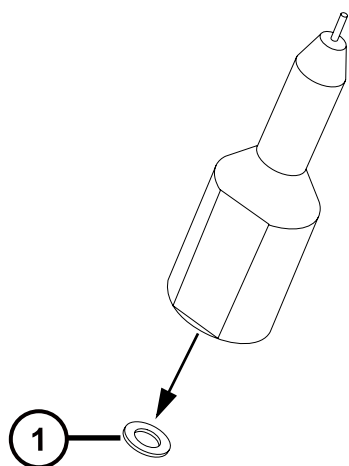
To replace the ESI probe tip and gasket:

1. Remove the ESI probe from the source (see [Removing the ESI probe](#)).
2. Use the 7-mm wrench to hold the probe shaft steady, and then use the 10-mm wrench to unscrew and remove the ESI probe tip:



- ① 7-mm wrench
- ② 10-mm wrench
- ③ Probe tip
- ④ Probe shaft

3. Remove the nickel gasket from the probe tip.



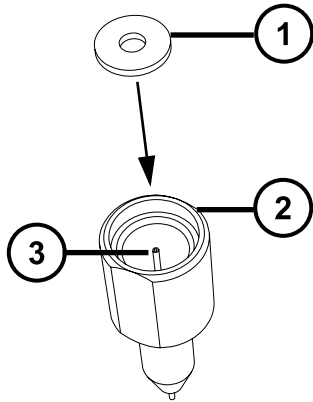
- ① Nickel gasket



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

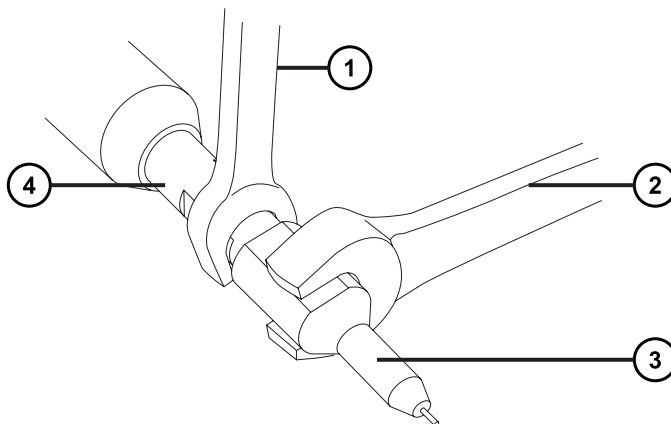
4. Dispose of the nickel gasket in accordance with local environmental regulations.

5. If the probe tip is damaged, dispose of it in accordance with local environmental regulations, and continue this procedure with a new ESI probe tip.
6. Insert the new nickel gasket into the ESI probe tip so the gasket is seated around the narrow, stainless steel tube inside the probe tip.



- ① Nickel gasket
- ② ESI probe tip
- ③ Stainless steel tube

7. Carefully slide the probe tip onto the ESI probe, ensuring that the capillary feeds through the stainless steel tube inside the probe tip.
8. Screw the probe tip onto the ESI probe assembly.
9. Tighten the probe tip using the 7- and 10-mm wrenches, as shown in the following figure:



- ① 7-mm wrench
- ② 10-mm wrench

③ Probe tip

④ Probe shaft

10. Fit the ESI probe to the source enclosure (see [Installing the ESI probe](#)).
11. Use the nebulizer adjuster knob to fine tune the capillary length to suit your application (see the instrument's online Help file).

4.19.2 Replacing the ESI probe capillary

Replace ESI probe capillary if it becomes irreversibly blocked, or if it becomes contaminated or damaged.

Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm hex wrench and cone extraction tool
- 7-mm open-end wrench
- 8-mm open-end wrench
- 10-mm open-end wrench
- Needle-nose pliers
- LC pump
- HPLC-grade (or better) 1:1 acetonitrile/water
- New capillary
- Ferrule
- Seal PTFE liner tubing
- Conductive sleeve
- Red PEEK tubing
- New nickel gasket
- PEEK tubing cutter or Utility knife
- Protective eyewear



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



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



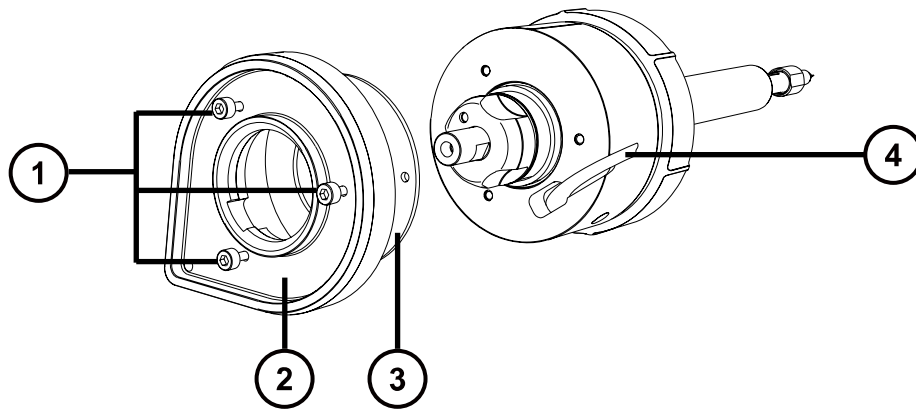
Warning: To avoid puncture wounds, handle the probe with care; the ESI probe tip is sharp.

4.19.2.1 Removing the capillary

To remove the capillary:

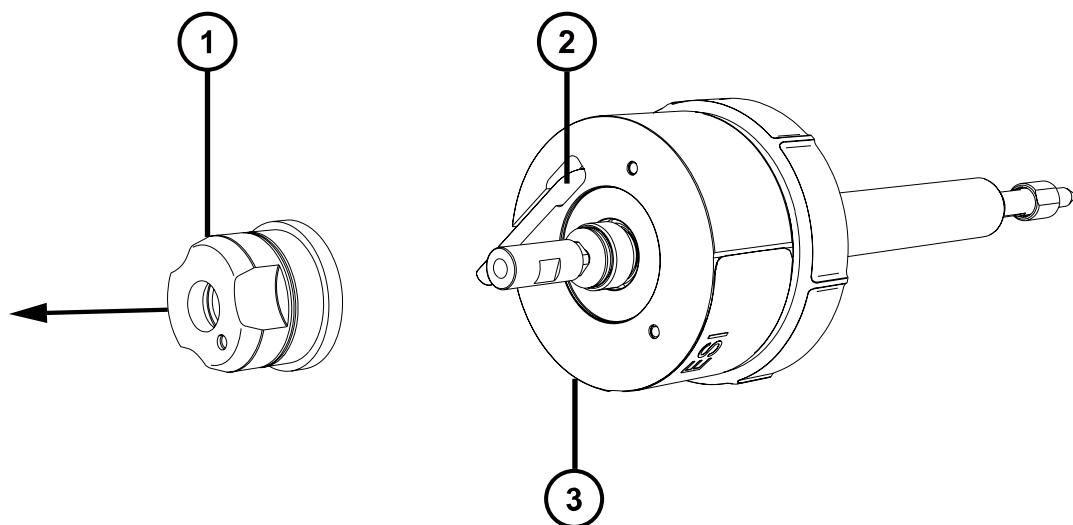
1. Remove the probe from the source enclosure (see [Removing the ESI probe](#)).
2. Use the combined 2.5-mm Allen wrench and cone extraction tool to loosen the three captive screws securing the probe's end cover in place, and then remove the end cover and rubber gasket.

Tip: The end cover is secured by captive screws that you need not remove from the end cover of the probe. Simply loosen them to remove the end cover.



- ① Captive screws
- ② End cover
- ③ Rubber gasket
- ④ Probe cable

3. Unscrew and remove the nebulizer adjuster knob.

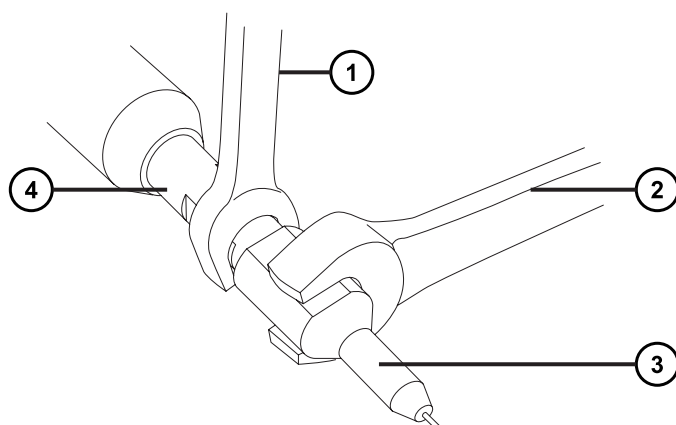


① Nebulizer adjuster knob

② Probe cable

③ ESI probe

4. Unscrew and remove the ESI probe tip by holding the probe shaft steady using the 7-mm wrench and unscrewing the probe tip using the 10-mm wrench, as shown in the following figure:



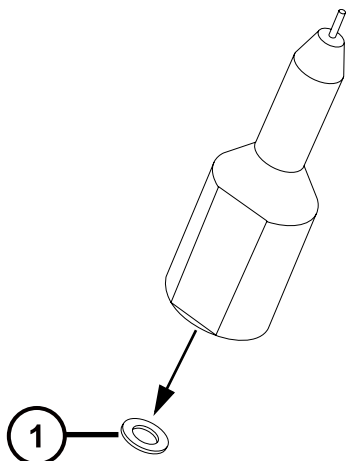
① 7-mm wrench

② 10-mm wrench

③ Probe tip

④ Probe shaft

5. Remove the nickel gasket from the probe tip.



① Nickel gasket



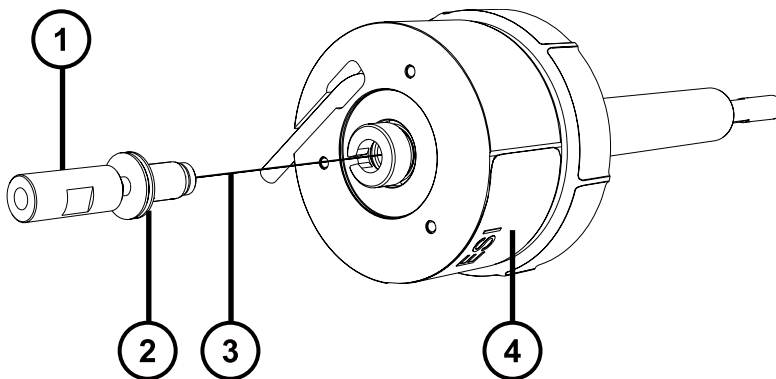
Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

6. Dispose of the nickel gasket in accordance with local environmental regulations.



Warning: To avoid puncture wounds, handle sharp parts and materials with care.

7. Remove the slide port assembly from the probe assembly by pulling the PEEK union.



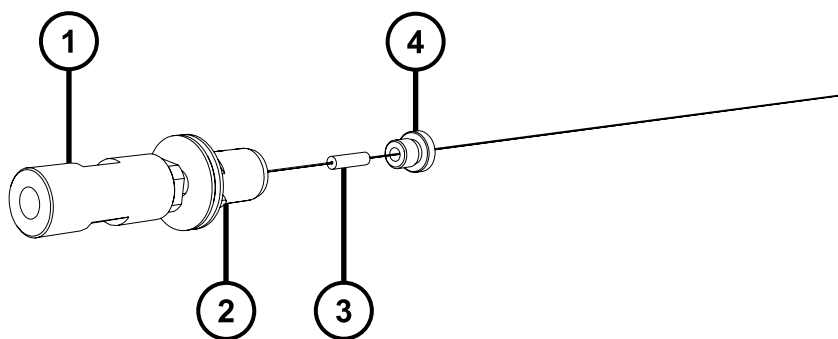
① PEEK union

② Slide port assembly

- ③ Capillary
- ④ ESI Probe

Note: The capillary is attached to the slide port, and is removed with the coupling.

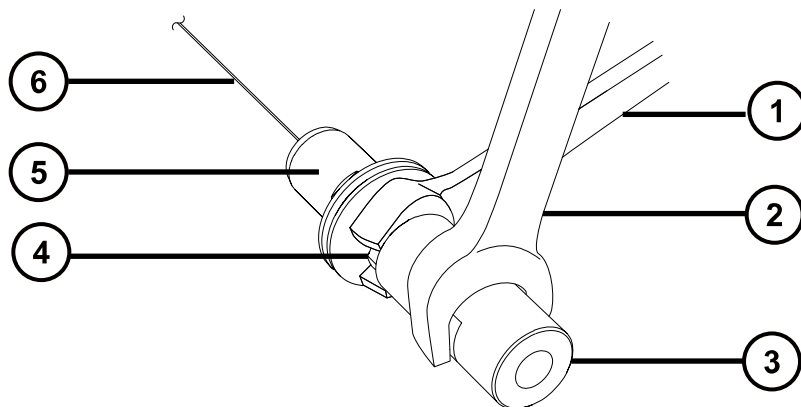
8. Unscrew and remove the knurled nut from the slide port, and remove the conductive liner tube from inside the knurled nut.



- ① PEEK union
- ② Slide port
- ③ Conductive liner tube
- ④ Knurled nut

Important: Retain the knurled nut, which is required to reassemble the ESI probe.

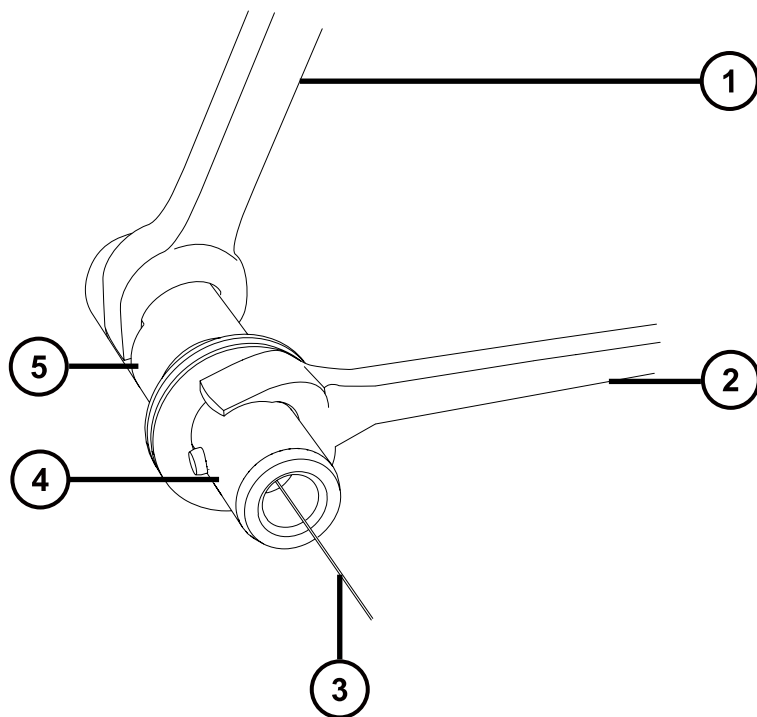
9. Dispose of the conductive liner tubing in accordance with local environmental regulations.
10. Loosen the lock nut at the base of the PEEK union using both the 7-mm and 8-mm wrenches.



- ① 7-mm wrench
- ② 8-mm wrench
- ③ PEEK union
- ④ Lock nut
- ⑤ Slide port
- ⑥ Capillary

Note: Use the 8-mm wrench to hold the PEEK union in place while you loosen the lock nut using the 7-mm wrench.

11. Unscrew and remove the PEEK union from the slide port using both the 7-mm and 8-mm wrenches.



- ① 8-mm wrench
- ② 7-mm wrench
- ③ Sample capillary

- ④ Slide port
- ⑤ PEEK union

Note: Hold the slide port steady by attaching the 7-mm wrench to the flattened grooves on the slide port's collar, as shown in the figure.

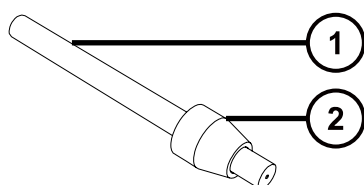
12. Remove the capillary, PTFE liner tube and ferrule from the slide port.
13. Dispose of the capillary, PTFE liner tube, and ferrule according to local environmental regulations.

4.19.2.2 Installing the new capillary

To install the new capillary:

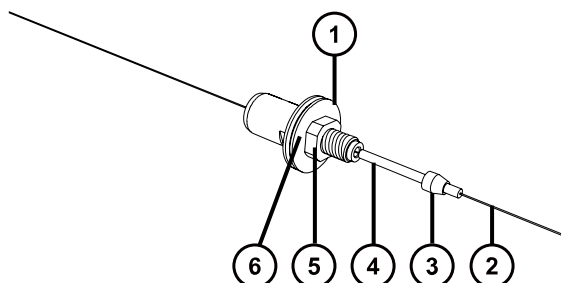
1. Slide the new ferrule onto the new PTFE liner tube so that approximately 2 mm of liner tubing is exposed beyond the tapered end of the ferrule.

Note: Ensure that the ferrule is oriented as shown in the figure.



- ① Liner tube
- ② Ferrule

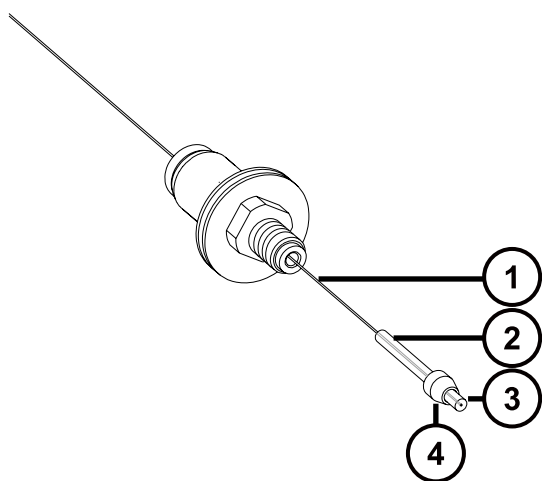
2. Slide the PTFE liner tube and ferrule assembly onto the new capillary.
3. Slide the capillary into the slide port until the liner tube reaches the slide port's narrow, threaded end, as shown in the following figure.



- ① Slide port
- ② Capillary

- ③ Ferrule
- ④ Liner tube
- ⑤ Lock nut
- ⑥ Circular plate

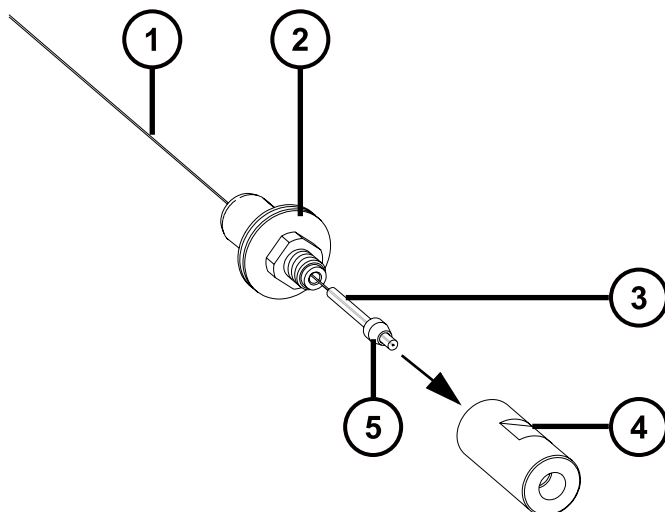
4. Ensure that the slide port's lock nut is screwed fully toward the slide port's circular plate, as shown in the figure above.
5. Pull the capillary through the slide port so that the end of the capillary aligns with the end of the PTFE liner tube, as shown in the figure.



- ① Capillary
- ② Liner tube
- ③ Liner tube and capillary ends aligned
- ④ Ferrule

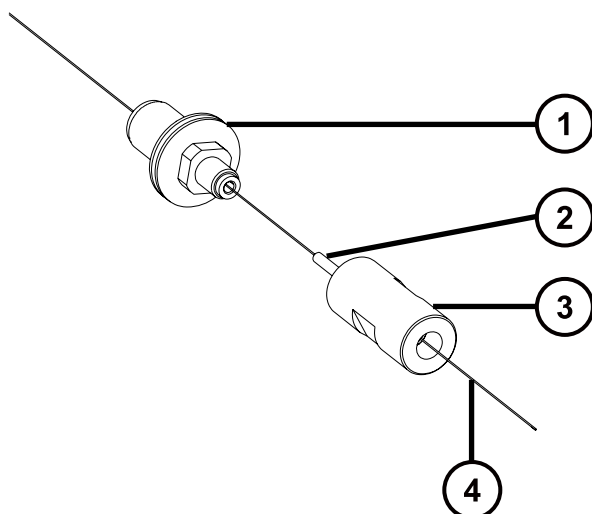
6. Insert the capillary and liner tube fully into the PEEK union, ensuring that the capillary end is flush with the liner tube end.

Rationale: Doing so ensures that the capillary correctly aligns with the PEEK union.



- ① Capillary
- ② Slide port
- ③ Liner tube
- ④ PEEK union
- ⑤ Ferrule

7. Feed the capillary through the liner tube and PEEK union, to expose approximately 50 mm of capillary on the opposite side of the union.



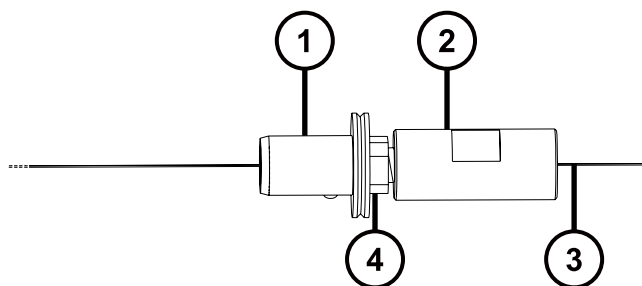
- ① Slide port
- ② Liner tube

③ Peek union

④ Capillary

8. Screw the PEEK union onto the slide port, ensuring that the union is not fully tightened.

Requirement: Ensure that you can still slide the capillary within the slide port and PEEK union. If the capillary is trapped and cannot move, loosen the PEEK union slightly.



① Slide port

② PEEK union

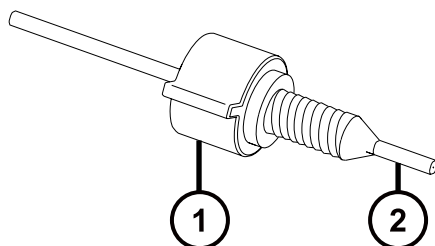
③ Capillary (approximately 50 mm exposed)

④ Lock nut

9. Use the utility knife or PEEK tubing cutter to cut a length of red (0.005-inch, inner-diameter) PEEK tubing suitable to connect the slide port and PEEK union assembly to the LC pump.

Requirement: Cut the tubing squarely. Doing so ensures that the capillary sits in position correctly.

10. Insert the red PEEK tubing into the probe inlet connector, to expose approximately 25 mm of tubing beyond the narrow end of the inlet connector.



① Probe inlet connector

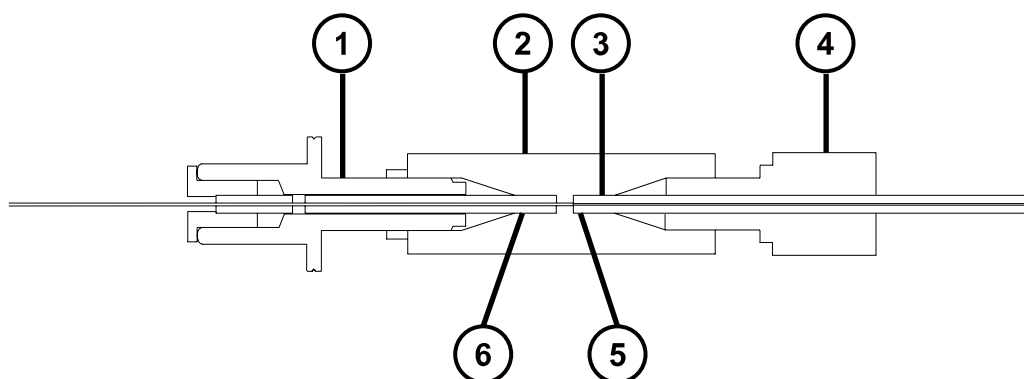
② Red PEEK tubing

11. Use the end of the red PEEK tubing to push the capillary into the PEEK union until the red PEEK tubing is inserted as far as possible into the PEEK union.

Rationale: Doing so ensures that the capillary and red PEEK tubing make contact inside the PEEK union.

12. Maintaining slight pressure on the red PEEK tubing, to ensure that it remains in contact with the capillary, screw and fully tighten the inlet connector into the PEEK union.

Tip: The following cross-sectional diagram shows the importance of pushing the capillary into place using the red PEEK tubing, rather than using the PTFE liner tube. The capillary extends slightly beyond the end of the PTFE liner tube, and contacts the red PEEK tubing. This positioning is best achieved by pushing the capillary into place using the red PEEK tubing.

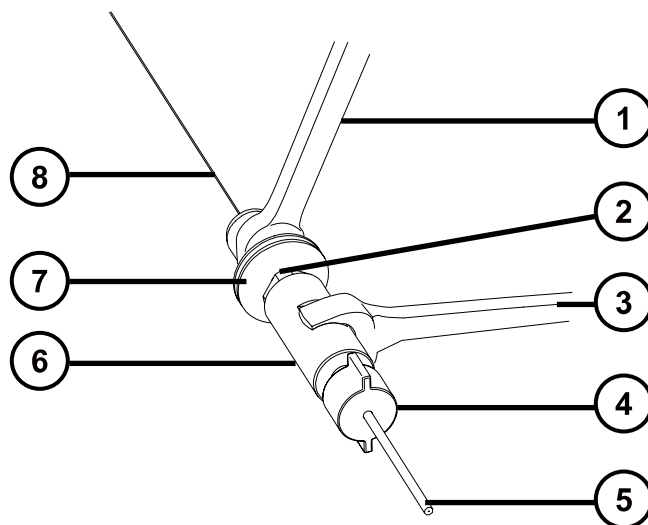


- ① Liner tube
- ② PEEK union
- ③ RED PEEK tubing
- ④ Probe inlet connector
- ⑤ Sample capillary protruding through the liner tube to contact the red PEEK tubing
- ⑥ Slide port



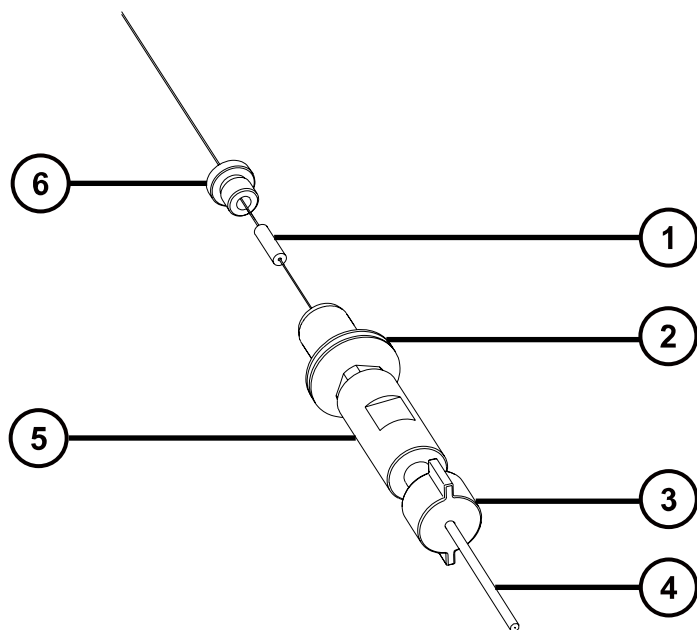
Notice: To prevent damage to the ferrule, do not overtighten the PEEK union onto the slide port.

13. Finger-tighten the PEEK union onto the slide port, and then use the 7- and 8-mm wrenches to tighten by an additional quarter-turn.



- ① 7-mm wrench
- ② Lock nut
- ③ 8-mm wrench
- ④ Probe inlet connector
- ⑤ Red PEEK tubing
- ⑥ PEEK union
- ⑦ Slide port
- ⑧ Capillary

14. Finger-tighten the lock nut onto the PEEK union, and then use the 7- and 8-mm wrenches to tighten by an additional quarter-turn.
15. Slide the new conductive liner tube and knurled nut onto the capillary, and then tighten the knurled nut.



- ① Conductive liner tube
- ② Slide port
- ③ Probe inlet connector
- ④ Red PEEK tubing
- ⑤ PEEK union
- ⑥ Knurled nut



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

16. Perform a leak test on the PEEK union and slide port assembly by attaching the free end of the red PEEK tubing to an LC pump and pumping 50:50 acetonitrile/water through it, at 1 mL/min, ensuring that fluid can be seen leaving the free capillary end.

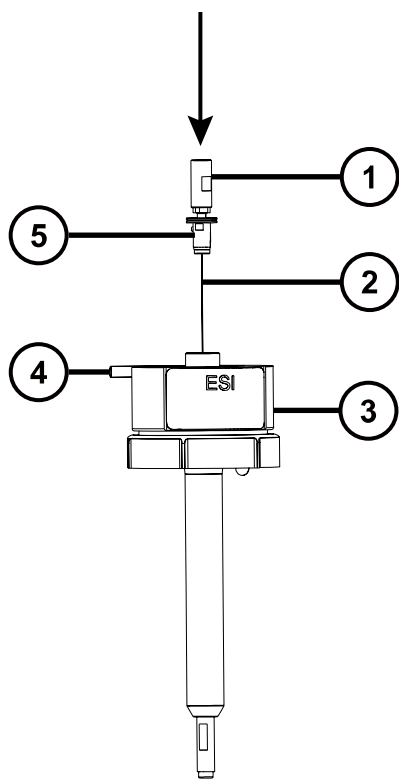
Important: Ensure that no fluid is leaking from the joints on the PEEK union. If leakage occurs, repeat this assembly procedure, and then repeat the leak test.

17. Disconnect the probe inlet connector and red PEEK tubing from the PEEK union.



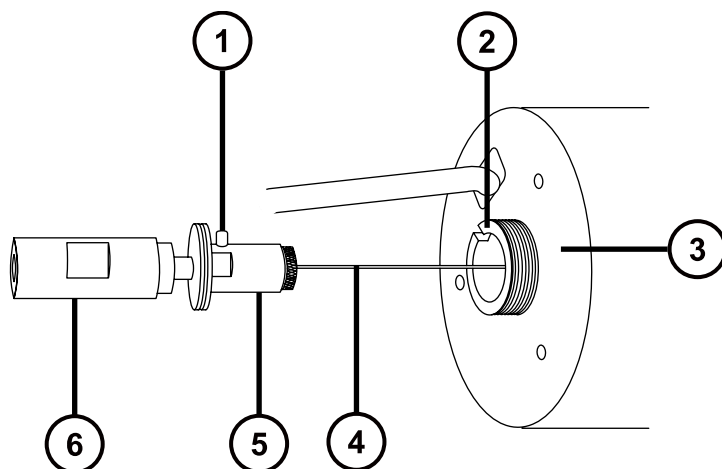
Notice: To avoid bending or damaging the protruding end of the capillary after you thread it through the ESI probe, take care when handling the probe assembly during the remainder of the procedure.

18. Carefully thread the capillary through the probe assembly until the slide port and PEEK union assembly reach the top of the probe assembly.



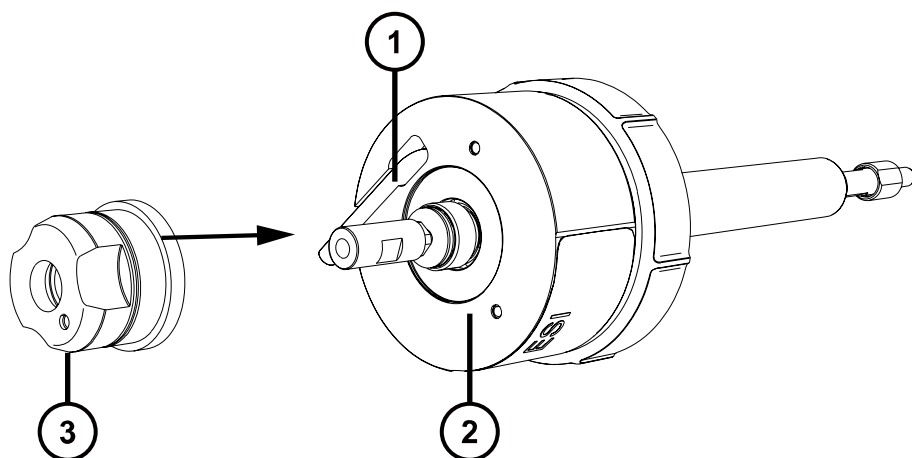
- ① PEEK union
- ② Capillary
- ③ ESI probe assembly
- ④ Probe cable
- ⑤ Slide port

19. Push the slide port and PEEK union assembly into the probe assembly so the dowel on the slide port is fully engaged in the locating slot at the head of the probe assembly.



- ① Dowel
- ② Locating slot
- ③ ESI probe assembly
- ④ Capillary
- ⑤ Slide port
- ⑥ PEEK union

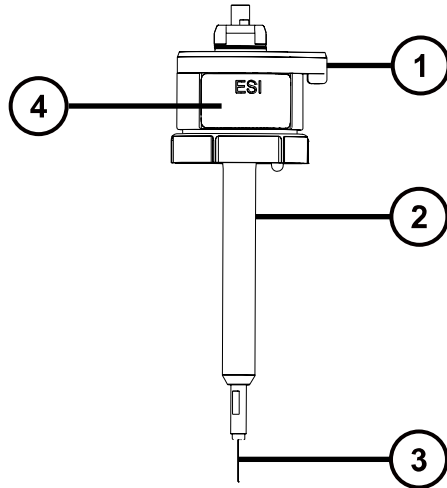
20. Fit the nebulizer adjuster knob to the PEEK union and fully tighten the knob.



- ① Probe cable
- ② ESI probe
- ③ Nebulizer adjuster knob

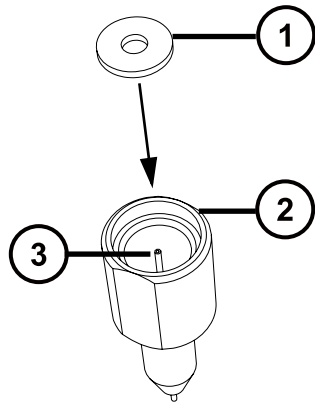
21. Fit the end cover and gasket around the nebulizer adjuster knob.

Important: Ensure that the end cover's drip point is orientated so that the probe's warning label is directly to the left-hand side of the drip point when viewed head-on, as shown in the figure below.



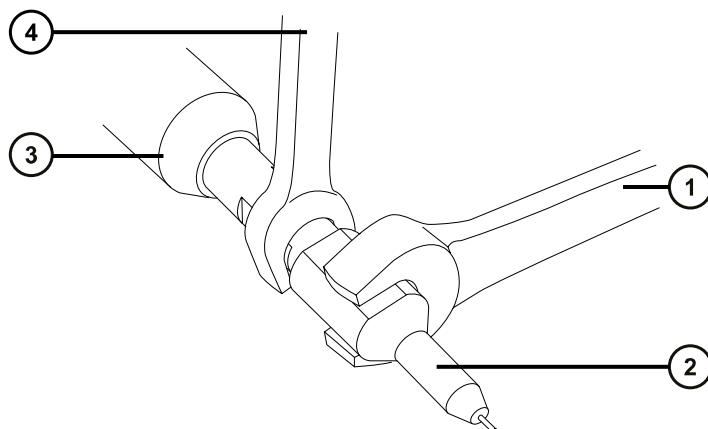
- (1) Drip point
- (2) ESI probe assembly
- (3) Capillary
- (4) Warning label

22. Secure the end cover and gasket to the ESI probe by tightening the 3 captive screws using the 2.5-mm hex wrench.
23. Insert the new nickel gasket into the ESI probe tip so the gasket is seated around the narrow, stainless steel tube inside the probe tip.



- ① Nickel gasket
- ② ESI probe tip
- ③ Stainless steel tube

- 24. Carefully slide the probe tip onto the ESI probe, ensuring that the capillary feeds through the stainless steel tube inside the probe tip.
- 25. Screw the probe tip onto the ESI probe assembly.
- 26. Tighten the probe tip using the 7- and 10-mm wrenches, as shown in the following figure:



- ① 10-mm wrench
- ② Probe tip
- ③ ESI probe
- ④ 7-mm wrench

Important: Fully tighten the probe tip to avoid gas leakage.

- 27. Fit the ESI probe to the source enclosure (see [Installing the ESI probe](#)).
- 28. Use the nebulizer adjuster knob to fine tune the capillary length for your application (see the instrument's online Help file).

4.20 Maintaining the IonSABRE II probe

Maintaining the IonSABRE II probe involves cleaning the probe tip or replacing the probe capillary when required.

Note: To maintain a tool-free APCI probe, see the *Waters Tool-Free Probe Maintenance Guide Supplement*.

4.20.1 Cleaning the IonSABRE II probe tip

Clean the IonSABRE II 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 IonSABRE II probe tip:

1. On the Instrument Console system tree, click **Xevo TQD > 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 **IonSABRE II probe Temp** to 650 °C.
6. Click **Operate** .
7. Wait 10 minutes.

Rationale: The high IonSABRE II probe heater temperature removes any chemical contamination from the probe tip.

8. Click **Standby** .

4.20.2 Replacing the IonSABRE II probe sample capillary

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

4.20.2.1 Removing the existing capillary

Required materials

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

To remove the existing capillary:

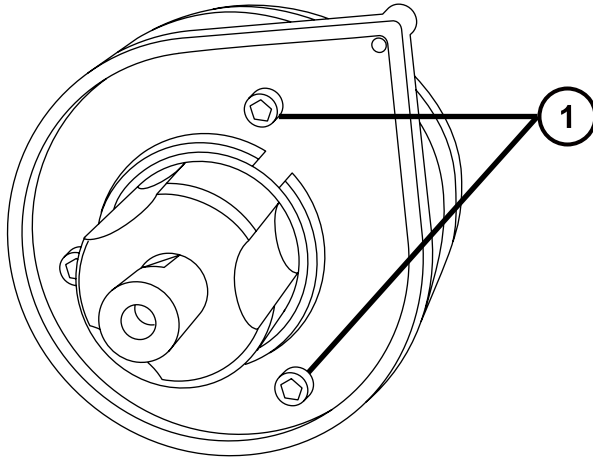


Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



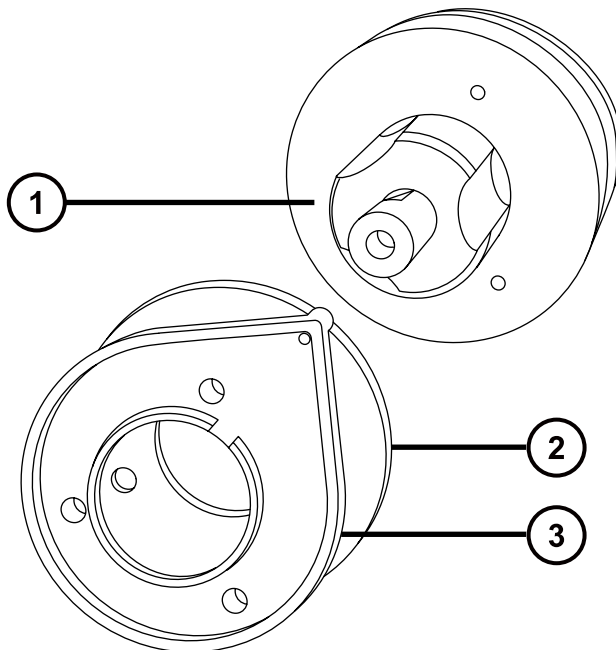
Warning: To avoid burn injuries, take great care while working with the probe and source; these components can be hot.

1. Remove the probe from the source (see [Removing the IonSABRE II probe](#)).
2. Retrieve the combined 2.5-mm hex wrench and cone extraction tool from its storage location on the source adapter housing.
3. Use the combined 2.5-mm hex wrench and cone extraction tool to remove the three probe end-cover retaining screws.



① End-cover retaining screws

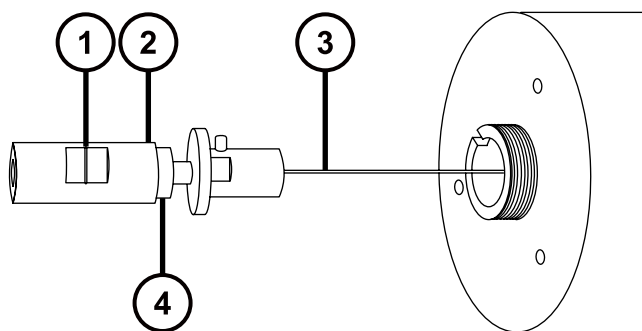
4. Remove the end cover and gasket.



- ① Nebulizer adjuster knob
- ② Gasket
- ③ End cover

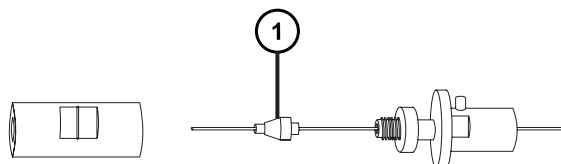
5. Unscrew and remove the nebulizer adjuster knob.
6. Remove the PEEK union/UNF coupling assembly and capillary from the probe.

Tip: The PEEK union used with the IonSABRE II probe is notched on one of its flats, a feature that distinguishes it from the PEEK union used with the ESI probe.



- ① Notch
- ② PEEK union/UNF coupling assembly
- ③ Capillary
- ④ Locknut

7. Use the 7-mm wrench to loosen the locknut.
8. Unscrew the finger-tight PEEK union from the UNF coupling.



- ① Ferrule

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



Warning: To avoid contaminating uncontaminated surfaces with biologically hazardous, toxic, or corrosive materials, dispose of the capillary and ferrule according to local environmental regulations.

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

4.20.2.2 Installing the new capillary

Required materials

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

To install the new capillary:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

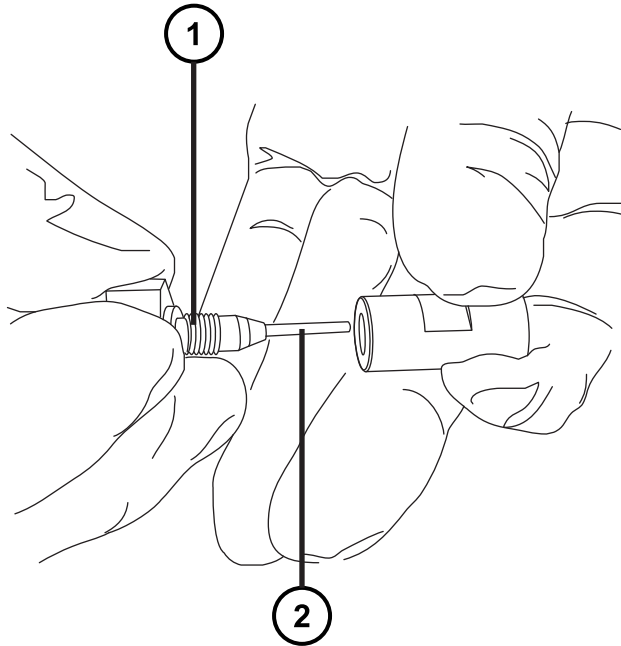
1. Use the utility knife or PEEK tubing cutter to cut an approximately 60-cm (24-inch) length of red PEEK tubing.

Requirement: Cut the tubing squarely.

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.

Figure 4–33: Screwing the inlet connector into the PEEK union



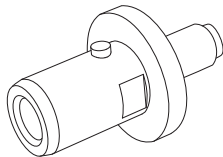
① Probe inlet connector

② PEEK tubing

3. Fit the UNF coupling to the new capillary.

Requirement: Use a UNF coupling with no grooves, which is appropriate for the IonSABRE II probe.

Figure 4–34: UNF coupling



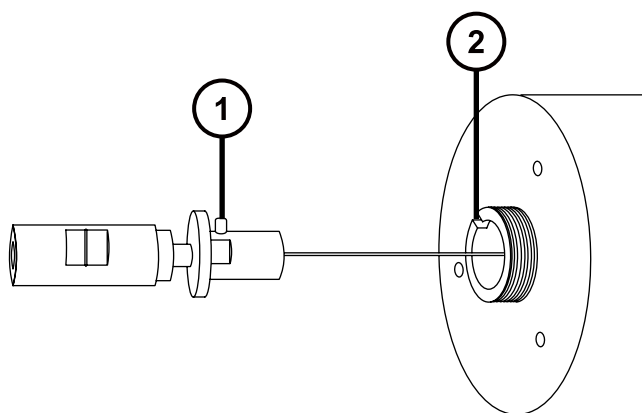
4. Use the needle-nose pliers to slide a new ferrule onto the capillary.
5. Insert the capillary in the PEEK union and ensure that it is fully seated.
6. Screw the UNF coupling into the PEEK union finger-tight.
7. Gently tug on the capillary, testing to ensure that it stays in place.
8. Use the 7-mm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



Warning: To avoid eye injury from 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 back pressure on the LC pump is high, replace the capillary and repeat the leak test.
10. When no leakage occurs and the back pressure 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 [Removing the IonSABRE II probe heater](#)).
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 the locating pin on the UNF coupling is fully engaged in the locating slot at the head of the probe assembly.

Figure 4–35: Pushing the PEEK union/UNF coupling assembly and capillary into the probe assembly



- ① UNF coupling locating pin
- ② Probe assembly locating slot

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 gasket and end-cover to the probe assembly.
19. Use the combined 2.5-mm hex wrench and cone extraction tool to fit and tighten the three end-cover securing screws.
20. Replace the combined 2.5-mm hex wrench and cone extraction tool in its storage location on the source adapter housing.



Notice:

- To avoid damaging the probe heater's electrical connections, do not handle them. Hold the probe heater only by its body.
 - Take great care not to damage the electrical connections, capillary sleeve, or capillary when fitting the heater over the capillary sleeve.
21. Fit the probe heater (see [Fitting the new IonSABRE II probe heater](#)).
 22. Fit the probe to the instrument (see [Installing the ESI probe](#)).
 23. In the Instrument Console, click **API**  to start the probe and desolvation gas flows.

4.21 Cleaning or replacing the corona pin

Required materials

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

To clean or replace the corona pin:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid burn injuries, exercise care when handling the column or other components heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.



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

1. Remove the corona pin from the source (see [Removing the corona pin from the source](#)).
2. Replace the corona pin if it is deformed or damaged. Otherwise clean its tip with the lapping film, and then wipe it clean with a methanol-saturated tissue.



Warning: To avoid contaminating uncontaminated surfaces with biologically hazardous, toxic, or corrosive materials, dispose of all waste materials according to local environmental regulations.

3. If you are replacing the corona pin, dispose of the old pin in accordance with local environmental regulations.
4. Install the corona pin in the source (see [Installing the corona pin in the source](#)).

4.22 Replacing the IonSABRE II probe heater

Replace the IonSABRE II probe heater if it fails to heat the probe.

4.22.1 Removing the IonSABRE II probe heater

Required materials

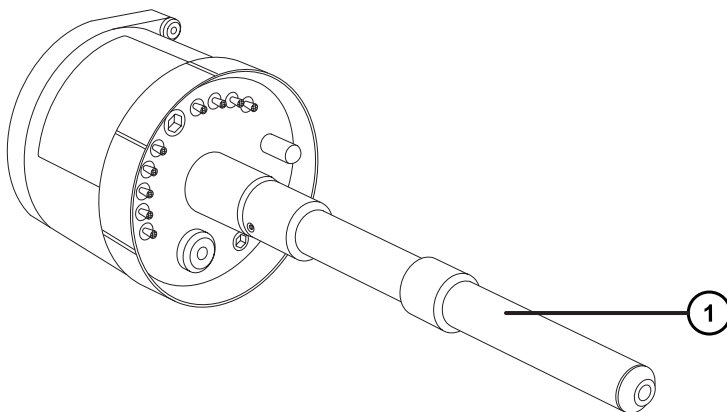
- Chemical-resistant, powder-free gloves

To remove the IonSABRE II probe heater:



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

1. Remove the probe from the source (see [Removing the IonSABRE II probe](#)).

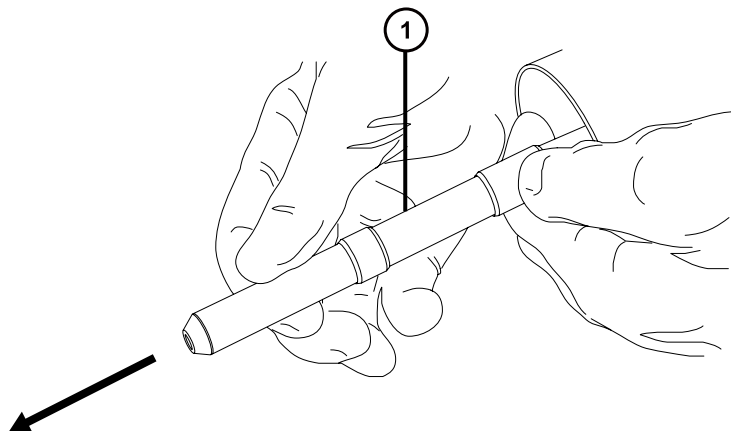


① Probe heater



Notice: To avoid damaging the probe heater's electrical connections, do not twist the heater when removing it from or fitting it to the probe assembly.

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



① Probe heater



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

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

4.22.2 Fitting the new IonSABRE II probe heater

Required materials

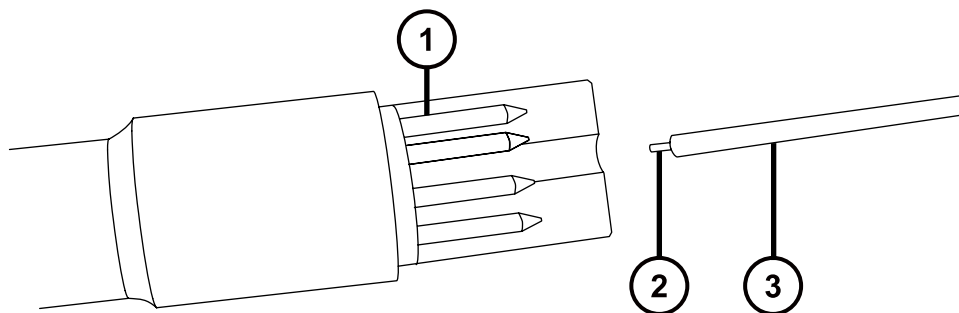
- Chemical-resistant, powder-free gloves
- IonSABRE II probe heater

To fit the new IonSABRE II probe heater:



Notice: The probe heater is easily damaged. Take care not to bend, crush, or distort 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 it protrudes slightly from the end of the capillary sleeve.



① Probe heater connections

② Capillary

③ Capillary sleeve

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



Notice: To avoid damaging the probe heater's electrical connections, do not twist the heater when removing it from or 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 to the instrument (see [Installing the IonSABRE II probe](#)).
5. In the Instrument Console, click **API** , to start the desolvation gas.

4.23 Replacing the ion block source heater

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

Required materials

- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- Combined 2.5-mm hex wrench and cone extraction tool
- New ion block source heater assembly

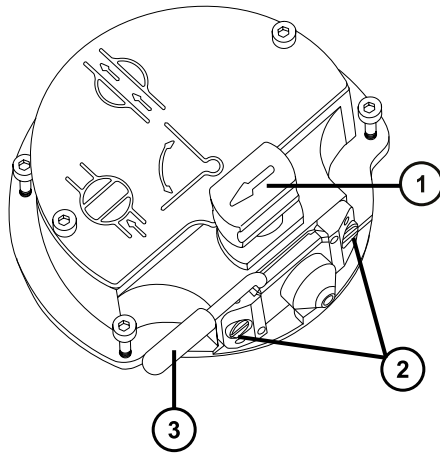
To replace the ion block source heater:



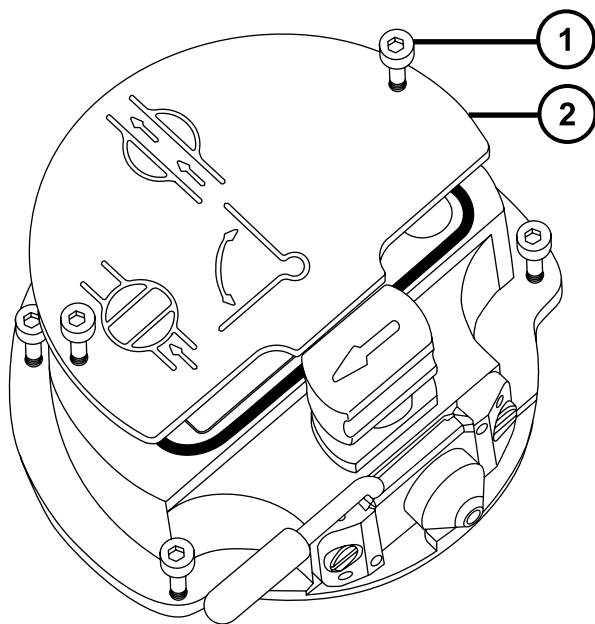
Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

1. Remove the ion block assembly from the instrument (see [Removing the ion block assembly from the source assembly](#)).
2. Ensure that the isolation valve is closed.

Figure 4–36: Ion block isolation valve closed



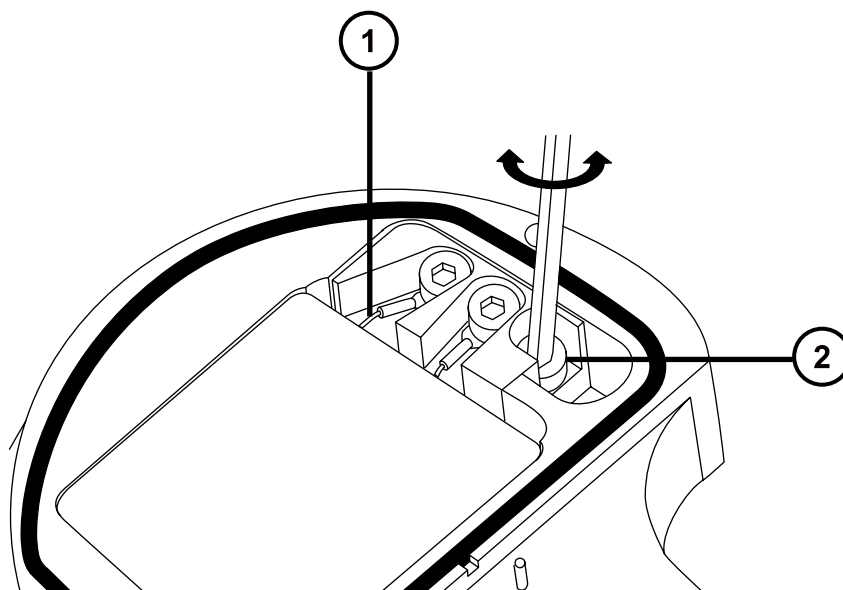
- ① Source isolation valve handle in closed position
 - ② Sampling cone assembly retaining blocks
 - ③ Cone gas nozzle handle
3. Use the combined 2.5-mm hex wrench and cone extraction tool to loosen the two captive screws securing the ion block cover plate.



① Ion block cover plate securing screw

② Ion block cover plate

4. Remove the ion block cover plate.
5. Use the combined 2.5-mm hex wrench and cone extraction tool to loosen the captive PEEK terminal block securing screw.



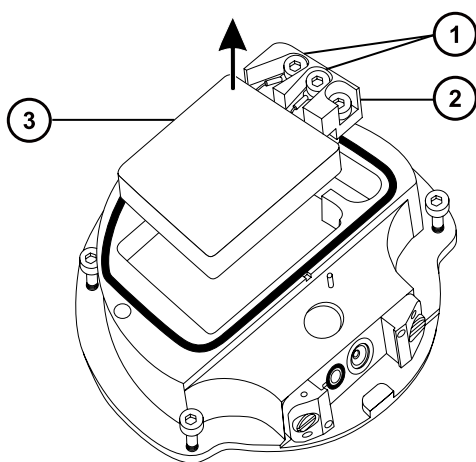
- ① Heater cartridge assembly wires
- ② PEEK terminal block securing screw



Notice: To avoid damaging the heater cartridge assembly wires, do not bend or twist them when removing the assembly and ceramic heater mounting block from the ion block.

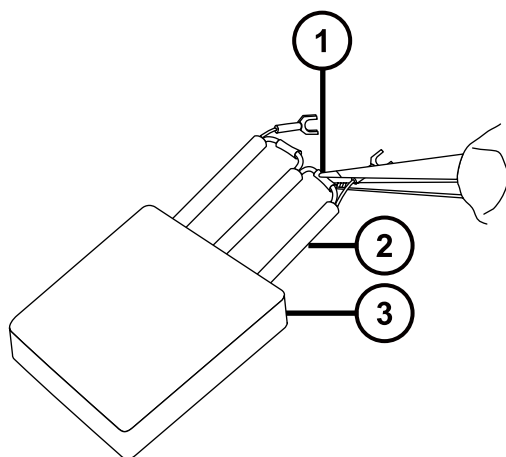
- 6. Carefully remove the PEEK terminal block and ceramic heater mounting block, complete with heater cartridge assembly, from the ion block.

Tip: You can invert the ion block assembly to facilitate this process.



- ① Heater wire securing screws
- ② PEEK terminal block
- ③ Ceramic heater mounting block

- 7. Use the combined 2.5-mm hex wrench and cone extraction tool to loosen the two screws securing the heater wires to the PEEK terminal block.
- 8. Disconnect the heater cartridge wires from the PEEK terminal block.
- 9. Use the needle-nose pliers to gently grasp the heat-shrink tubing on the heater cartridge assembly and slide the assembly out of the ceramic heater mounting block.



- ① Ceramic heater mounting block
- ② Heat-shrink tubing
- ③ Heater cartridge assembly

10. Dispose of the heater cartridge assembly.



Notice: To avoid damaging the heater cartridge assembly wires, do not bend or twist them when removing the assembly and ceramic heater mounting block from the ion block.

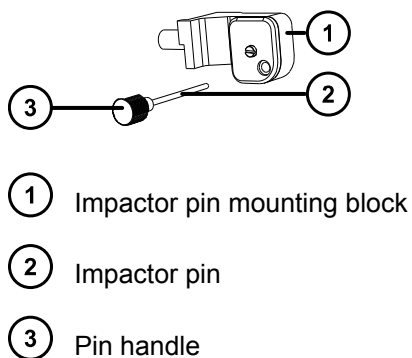
- 11. Use the needle-nose pliers to gently grasp the heat-shrink tubing on the new heater cartridge assembly and slide the assembly into the ceramic heater mounting block.
- 12. Use the needle-nose pliers to position the heater cartridge's wiring ring tags fully under their securing screws.
- 13. Use the combined 2.5-mm hex wrench and cone extraction tool to tighten the two wire-securing screws.
- 14. Fit the PEEK terminal block and ceramic heater mounting block, complete with heater cartridge assembly, to the ion block.
- 15. Use the combined 2.5-mm hex wrench and cone extraction tool to tighten the captive PEEK terminal block securing screw.
- 16. Fit the ion block cover plate to the ion block assembly, and then use the combined 2.5-mm hex wrench and cone extraction tool to tighten the two captive screws securing the ion block cover plate.
- 17. Fit the ion block assembly to the instrument (see [Fitting the ion block assembly to the source assembly](#)).

4.24 Maintaining the UniSpray source

4.24.1 Maintaining the UniSpray impactor pin

UniSpray directs the spray at an impactor pin held at a voltage, creating smaller charged droplets, amenable to easy desolvation. This section provides details about removing, cleaning, and installing the UniSpray impactor pin.

Figure 4–37: UniSpray Impactor pin



4.24.1.1 Cleaning or replacing the UniSpray impactor pin

Required materials

- Chemical-resistant, powder-free gloves
- Lapping film
- HPLC-grade (or better) methanol
- Lint-free tissue
- Impactor pin



Warning: To avoid personal contamination with toxic materials, wear clean, chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid burn injuries, exercise care when handling the components of the source enclosure heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.



Warning: To avoid puncture wounds, handle sharp parts and materials with care.

To clean the impactor pin:

1. Remove the impactor pin from the UniSpray source (see [Removing and installing the UniSpray impactor pin](#)).
2. Inspect the impactor pin and replace it if it is deformed or damaged.
3. Clean the pin by polishing it along its length using 1- μ m lapping film, and then wiping it clean with a methanol-saturated, lint-free tissue.



Notice: To avoid damaging the impactor pin, do not rotate the pin when polishing it with the lapping film or when wiping it clean.

4. Install the impactor pin in the UniSpray source (see [Removing and installing the UniSpray impactor pin](#)).

4.24.1.2 Removing and installing the UniSpray impactor pin

Required materials

- Chemical-resistant, powder-free gloves
- UniSpray impactor pin



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

To install the UniSpray impactor pin in the source:

1. To prepare the instrument for working on the source, stop solvent flow, ensure that the instrument is in Standby mode, and stop desolvation gas flow.



Warning: To avoid burn injuries, exercise care when handling the components of the source enclosure heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.



Warning: To avoid puncture wounds, handle sharp parts and materials with care.

2. Pull open the source enclosure release handle and swing open the enclosure.
3. Unscrew the pin handle and withdraw the pin from the mounting block.
4. Dispose of the used pin in accordance with local environmental regulations.

Important: When you install a new impactor pin, or you clean the existing pin based on the maintenance schedule, clean the pin before you insert it into the source, as specified in [Cleaning or replacing the UniSpray impactor pin](#).

5. While holding the pin handle, insert the pin through the inlet on the mounting block and screw the pin handle into the mounting block until it is finger tight.
6. Close the source enclosure.
7. For details about aligning and optimizing the source, refer to the quick reference card supplied with the source, or refer to the online Help if it is available with your instrument's software.

4.24.2 Replacing the UniSpray probe assembly

Replace the probe assembly on the UniSpray source if it becomes irreversibly blocked, or if it becomes contaminated or damaged.

4.24.2.1 Installing the UniSpray probe assembly

Required materials

- Chemical-resistant, powder-free gloves
- UniSpray probe assembly



Warning: To avoid lacerations, puncture injuries, and possible contamination with biologically hazardous and toxic materials, do not touch the sharp end of the capillary.

! **Notice:** To avoid damaging capillaries, take great care when handling them; they are extremely fragile. Always hold the blunt end, never the sharp end.

! **Notice:** Ensure that you install the correct probe capillary assembly for your probe type. Using the incorrect probe capillary assembly for the probe type can compromise instrument performance.

To install the UniSpray probe assembly:

1. To prepare the instrument for working on the source, stop solvent flow, ensure that the instrument is in Standby mode, and stop desolvation gas flow.



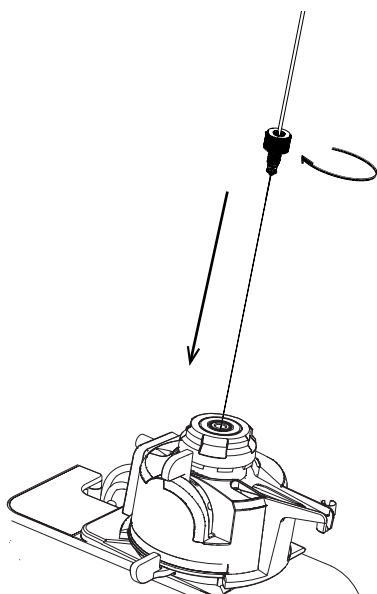
Warning: To avoid harmless, static-like electric shock, ensure that the instrument is in Standby mode before beginning this procedure.



Warning: To avoid burn injuries, exercise care when handling the components of the source enclosure heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.

2. Remove the existing probe assembly from the source (see [Removing the UniSpray probe assembly](#)).
3. Carefully insert the probe assembly into the probe inlet shaft on top of the source enclosure and tighten the probe fitting.

Figure 4–38: Inserting the UniSpray probe assembly into the source



Notice: To avoid damaging the capillary on instruments where the source is situated above eye level, remove the source from the device and move it to a lower position before inserting the probe assembly into the probe.

See also: [Removing the UniSpray source](#).

4. If you removed the source enclosure from the device to fit the probe assembly, reinstall the source enclosure.

See also: [Installing the UniSpray source](#).

5. Screw the probe assembly's PEEK fitting into the appropriate fluidics port for your instrument until it is finger tight.

4.24.2.2 Removing the UniSpray probe assembly

Required materials

- Chemical-resistant, powder-free gloves

To remove the UniSpray probe assembly:

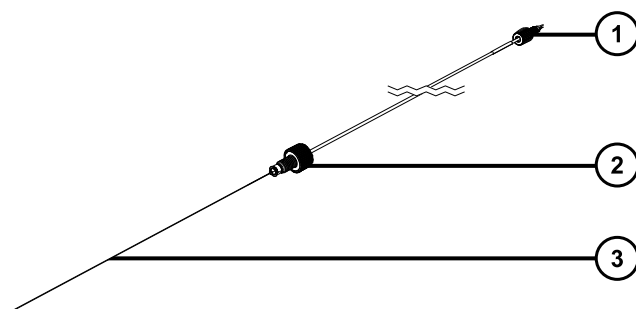
1. To prepare the instrument for working on the source, stop solvent flow, ensure that the instrument is in Standby mode, and stop desolvation gas flow.



Warning: To avoid burn injuries, exercise care when handling the components of the source enclosure heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.

2. Unscrew the probe's PEEK fitting to disconnect the probe assembly's input from the fluidics.

Figure 4–39: UniSpray probe assembly



- ① PEEK fitting
- ② Probe fitting
- ③ Probe capillary

3. Unscrew the probe fitting and pull the probe assembly out of the shaft inlet on top of the source enclosure.



Warning: To avoid lacerations, puncture injuries, and possible contamination with biologically hazardous and toxic materials, do not touch the sharp end of the capillary.

4. Dispose of the probe and fittings in accordance with local environmental regulations.
5. Install a replacement UniSpray probe assembly (see [Installing the UniSpray probe assembly](#)).

4.25 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 one 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 one year:

- Probe adjuster assembly probe seal
- Probe adjuster assembly nebulization gas seal
- Source enclosure seal
- Nebulizer gas seal
- Desolvation gas seal

4.25.1 Removing the probe adjuster assembly probe and source enclosure seals

Required materials

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

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

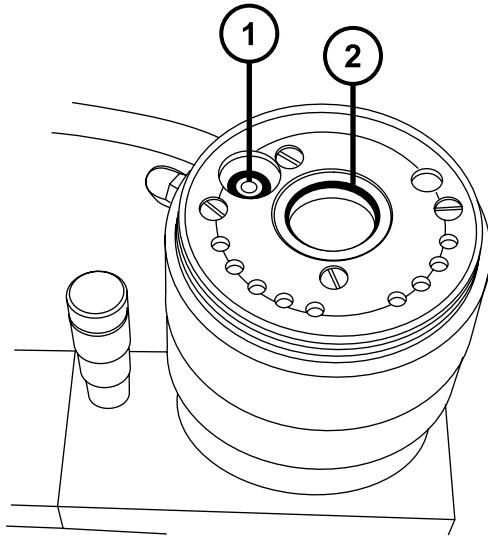


Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

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

See also: [Removing O-rings and seals.](#)

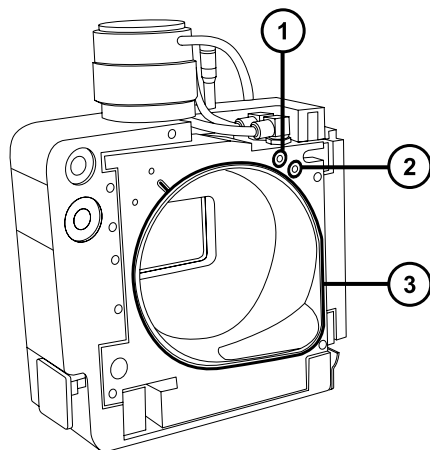
Figure 4–40: Probe adjuster assembly seals



- ① Probe adjuster nebulizer gas seal
- ② Probe adjuster assembly probe seal

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

Figure 4–41: Source enclosure seals



- ① Nebulizer gas seal
- ② Desolvation gas seal
- ③ Source enclosure seal



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

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

4.25.2 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
- Lint-free cloth

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



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

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.

2. Fit the new source enclosure seal to the source enclosure by feeding the seal into the groove in the bottom right-hand corner, and then working around the seal in the counterclockwise direction.

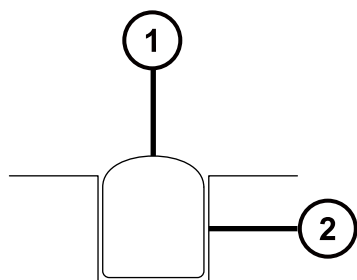
Important: Ensure that the tails of the source enclosure seals are correctly located in the groove when fitting them to the source enclosure.

3. Fit the following new seals to the source enclosure:

- Nebulizer gas seal
- Desolvation gas seal

Requirement: Fit the seals, which incorporate a special cross-section, into grooves, as shown.

Figure 4–42: Cross-section of the source enclosure probe seal in the groove of the source



- ① Seal
- ② Groove

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

4.26 Replacing the air filter

You must replace the air filter annually.

Required material

New air filter

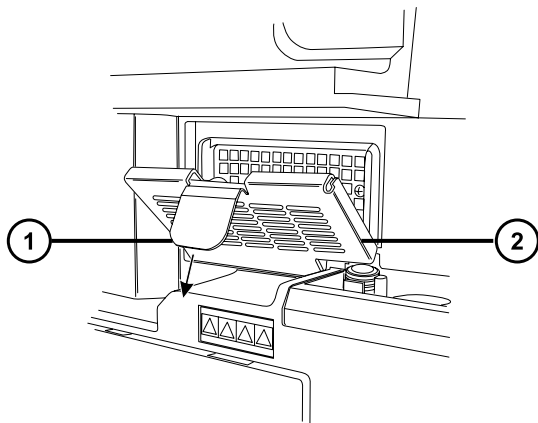
To replace the air filter:

1. Lift the instrument's visor so the source probe is fully exposed.
2. Fully open the source enclosure.
3. Disconnect the probe cable from the high-voltage connector, and leave the cable in a position that does not obstruct the air filter grill.

① Air filter grill

② Probe cable

4. Open the air filter grill by pulling the tab at the top of the grill toward you.



① Air filter tab

② Air filter grill

5. Remove and dispose of the old filter.
6. Place the new filter flat on the inside part of the grill, with its edges beneath the metal lip.
7. Close the air filter grill.
8. Connect the probe cable to the high-voltage connector.
9. Close the source enclosure.
10. Lower the instrument's visor.

4.27 Maintaining the APPI/APCI source

4.27.1 APPI/APCI source - changing the UV lamp bulb

Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm hex wrench and cone extraction tool
- Phillips screwdriver
- 20-cm (8-inch) length of 4-mm nylon tube



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid static-like electric shock, ensure that the instrument is prepared for working on the source before starting this procedure.

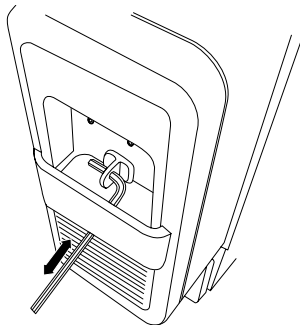
To change the UV lamp bulb:

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



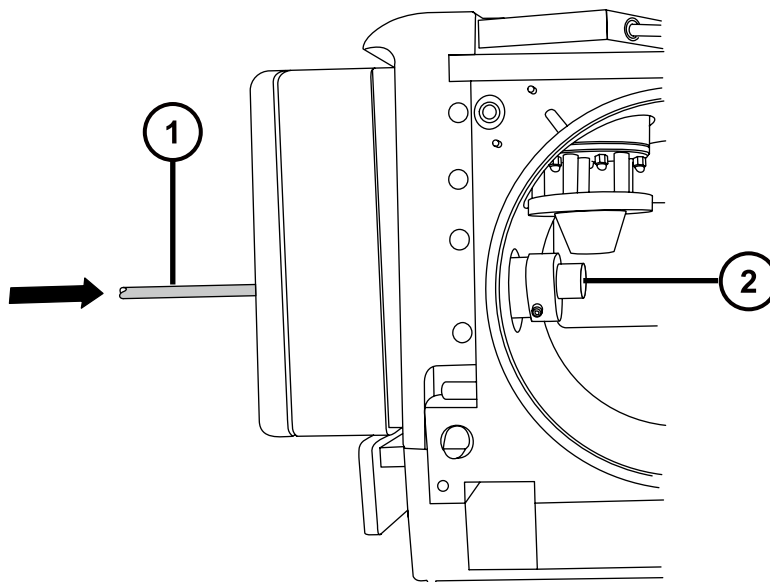
Warning: To avoid burn injuries, take great care while working with the probe and source; these components can be hot.

2. Pull the source enclosure release (located at the bottom, right-hand side) outward, and swing open the enclosure.
3. Retrieve the combined 2.5-mm hex wrench and cone extraction tool from its storage location on the source adapter housing.
4. Hook the short end of the hex wrench through the ring on the back of the lamp-bulb access plug and tug to remove it.



Notice: To avoid breaking the bulb, do not use a screwdriver to push the bulb forward in the lamp drive assembly.

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



① Nylon tube

② APPI lamp bulb

6. Remove the bulb from 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. Return the combined 2.5-mm hex wrench and cone extraction tool to its storage location on the source adapter housing.

10. Close the source enclosure.

11. Slide closed the instrument's source interface door.

4.27.2 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 avoid reduced sensitivity.

Required materials

- Chemical-resistant, powder-free gloves
- Lint-free cloth
- Methanol or isopropyl alcohol



Warning: To avoid burn injuries, take great care while performing this procedure.



Warning: To avoid eye injury from UV radiation, ensure that the APPI lamp is extinguished 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](#)).
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.

4.27.3 APPI/APCI source - replacing the APPI lamp drive seals



Warning: To avoid exposure to toxic substances and biohazards from O-ring leaks in the source exhaust system, observe these precautions:

- Replace the source O-rings at intervals not exceeding one year.
- Prevent chemical degradation of the source O-rings, which can withstand exposure only to certain solvents, by determining whether any solvents you use are chemically compatible with the composition of the O-rings.

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.

4.27.3.1 Removing the APPI lamp drive assembly seals

Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm hex wrench and cone extraction tool
- 3-mm hex wrench
- Phillips screwdriver
- #0 POZIDRIV screwdriver
- 20-cm (8-inch) length of 4-mm nylon tube
- O-ring removal kit
- 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, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid harmless, static-like electric shock, ensure that the instrument is in Standby mode before beginning this procedure.

To remove the APPI lamp drive assembly seals:

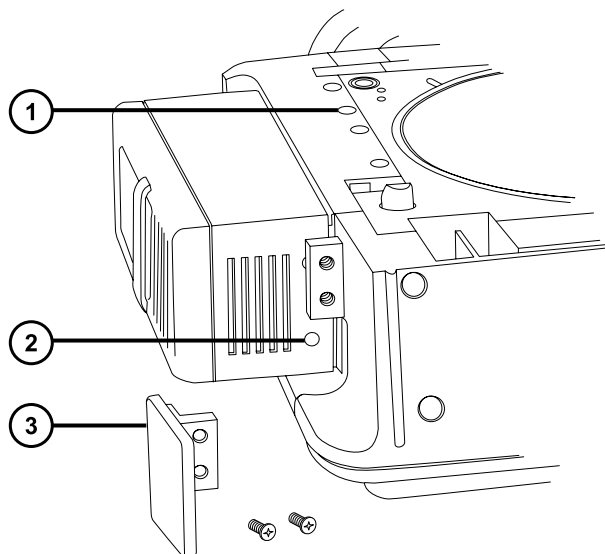
1. Remove the IonSABRE II probe and APPI/APCI source enclosure (see [Removing the IonSABRE II probe and APPI/APCI source enclosure](#)).

Note: 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 in a secure place (see [APPI/APCI source -- changing the UV lamp bulb](#)).
3. Retrieve the combined 2.5-mm hex wrench and cone extraction tool from its storage location on the source adapter housing.
4. Use the combined 2.5-mm hex wrench and cone extraction tool to remove the two lamp-drive cover screws (located above the bulb-extraction plug aperture).

Note: 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.

5. Clear an area, lay out the soft cloth or mat, and lay the source enclosure on its face.
6. Use the Phillips (cross-head) screwdriver to remove the two source enclosure, release-handle screws, and remove the handle.



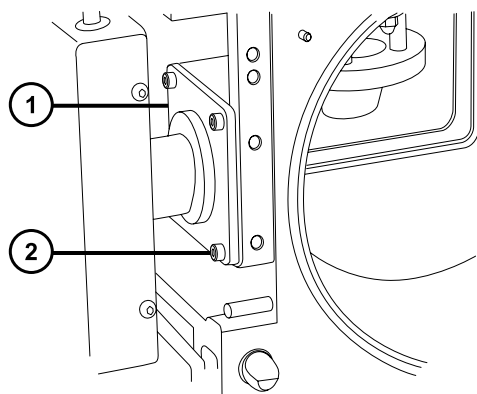
① Source enclosure cover screws

② Lamp drive cover screws

③ Release handle

7. Use the combined 2.5-mm hex wrench and cone extraction tool to remove the remaining two lamp-drive cover screws, which were hidden by the release handle.
8. Slide the cover off the lamp drive.
9. Use the 3-mm hex wrench to remove the four source enclosure cover screws.
10. Ease the source enclosure cover over the lamp drive assembly.
11. Use the combined 2.5-mm hex wrench and cone extraction tool to unscrew the four mounting-flange screws.

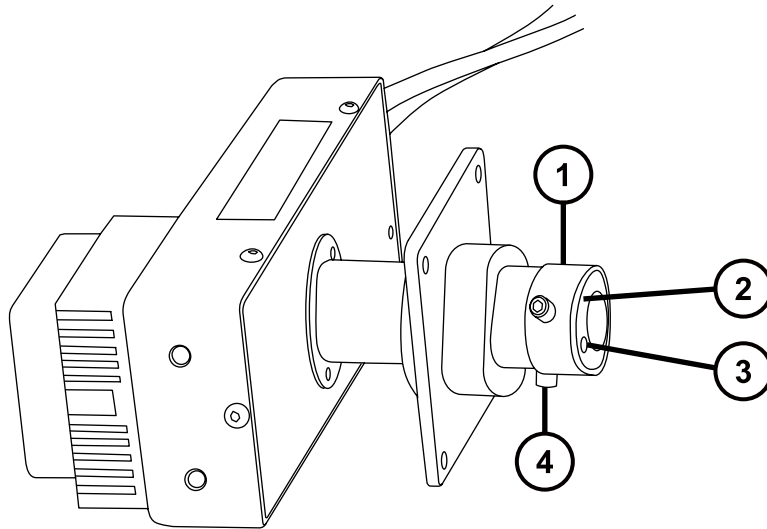
Tip: Take care not to drop the screws inside the lower cover.



- ① Lamp mounting flange
- ② Mounting-flange screw

12. 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.



- ① PEEK insulator
- ② Repeller electrode
- ③ Electrode screw
- ④ Insulator retaining screw

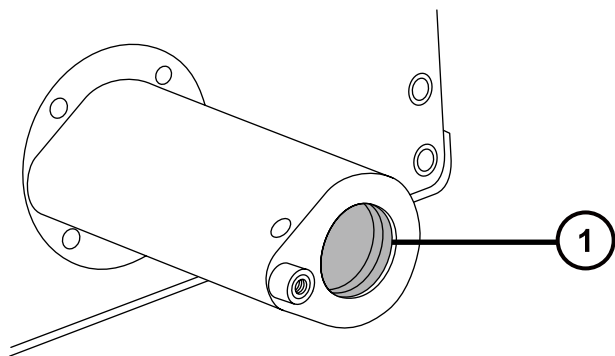
13. Use the small Phillips screwdriver to remove the electrode screw and repeller electrode.

14. Use the combined 2.5-mm hex wrench and cone extraction tool to remove the two insulator screws.

15. Remove the PEEK insulator from the end of the mounting shaft.

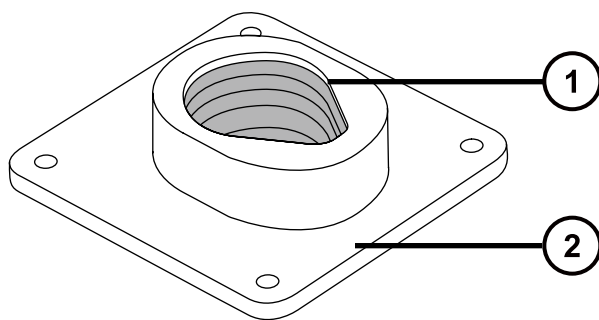
16. Slide the shaft mounting flange off the shaft and note the correct orientation for its reassembly.

17. Use the O-ring removal kit to carefully remove the O-ring sealing the lamp bulb from inside the bulb holder (see [Removing O-rings and seals](#)).



① Lamp bulb sealing O-ring

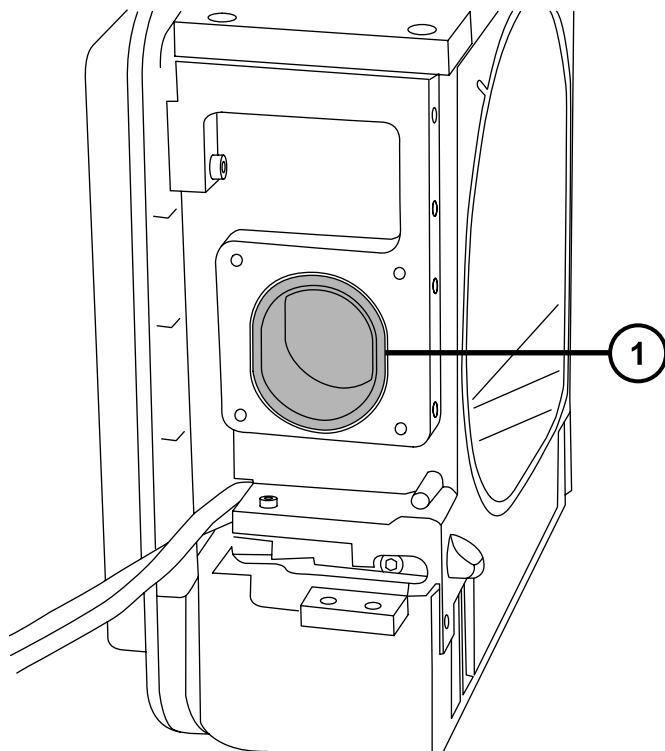
18. Use the O-ring removal kit to carefully remove the two O-rings from inside the lamp mounting flange.



① Mounting shaft O-rings

② Lamp mounting flange

19. Use the O-ring removal kit to carefully remove the shaft mounting flange O-ring from the APPI source enclosure side.



① Lamp mounting flange O-ring



Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

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

4.27.3.2 Fitting the new APPI lamp drive assembly O-rings

Required materials

- Chemical-resistant, powder-free gloves
- 3-mm hex wrench
- Phillips screwdriver
- #0 POZIDRIV screwdriver
- HPLC-grade (or better) 1:1 methanol/water
- Lint-free cloth



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

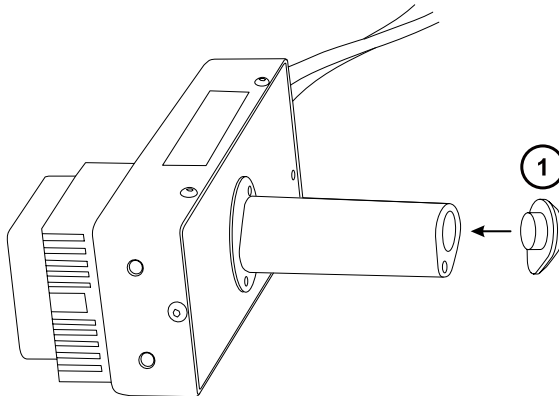
! **Notice:** To avoid damaging the APPI lamp drive assembly O-rings, take care when fitting them. Small nicks, tears, dirt, and dust can compromise their performance, leading to rapid deterioration in the assembly's operation.

1. Ensure that all the grooves for the O-rings are free from contamination.

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

Tip: For the asymmetric O-ring seals, first seat the O-ring in the small radius at the bottom of the groove. Then use a tool 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.



① Mounting shaft insertion tool

! **Notice:** 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 onto the shaft, taking care to align it correctly.
7. Reinsert the shaft through the side of the source enclosure and fit the lamp mounting flange to the APPI source enclosure side.
8. Use the combined 2.5-mm hex wrench and cone extraction tool to tighten the four mounting-flange securing screws.

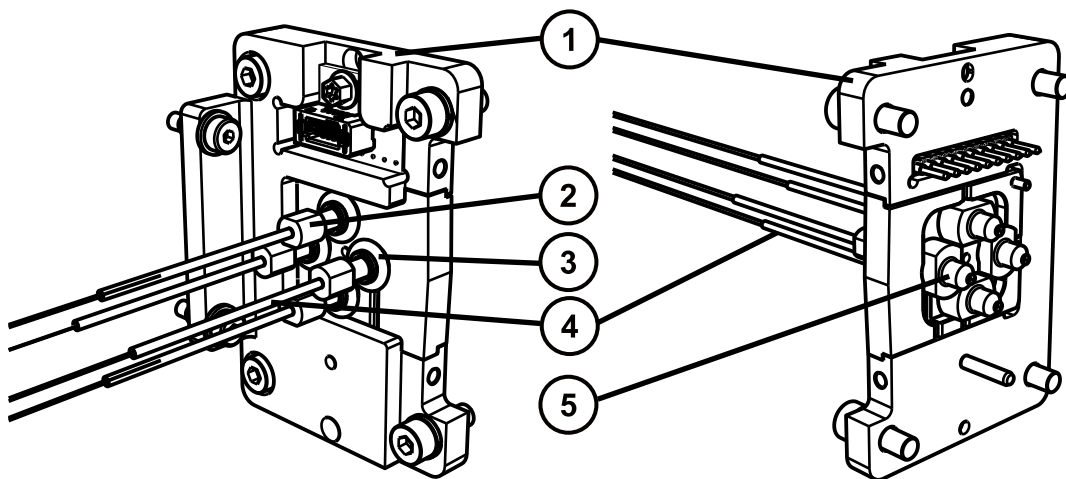
Requirement: Tighten the securing screws sequentially and by small increments until they are all fully tight. Doing so ensures that the lamp mounting flange is uniformly seated on the APPI source enclosure side plate.

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 combined 2.5-mm hex wrench and cone extraction tool 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 four screws.
17. Refit the lamp-assembly cover and secure it on its base (two screws) and above the bulb extraction aperture (two screws).
18. Refit the source enclosure release handle and secure it with the two screws.
19. Refit and reconnect the source enclosure to the machine, and then refit the corona pin and probe. Refer to [Installing the combined APPI/APCI source](#) for instructions.

4.28 Replacing the fluidic lines of the ionKey source

If a fluid line becomes damaged, replace it to ensure optimal performance. Each fluid line is pre-fitted with a PEEK connector assembly at the point where it connects to the ionKey source module. You must replace the capillary tubing and the PEEK assembly as a single unit. No parts of the fluid line are reusable once detached.

Figure 4–43: Fluidic lines of the ionKey source



- ① Connector plate
- ② Compression fitting
- ③ O-ring
- ④ Capillary tubing
- ⑤ PEEK fluid connector

To identify the correct tubing assembly for each fluid line, use the following table.

Part number	Order number	Description
430004188	700010399	Inlet tube
430004190	700010400	Infusion tube
430004212	700010401	Waste tube
430004476	700010470	Optional, post-column addition tube

Tip: Part numbers are embossed on the shrink-wrap below the ferrule assembly. You must disconnect the line from the source to see the part number.

4.28.1 Removing a fluidic line

Required Materials

- Chemical-resistant, powder-free gloves
- Flat-blade screwdriver
- T10 TORX driver



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid static-like electric shock, ensure that the instrument is prepared for working on the source before starting this procedure.

To remove a fluidic line:

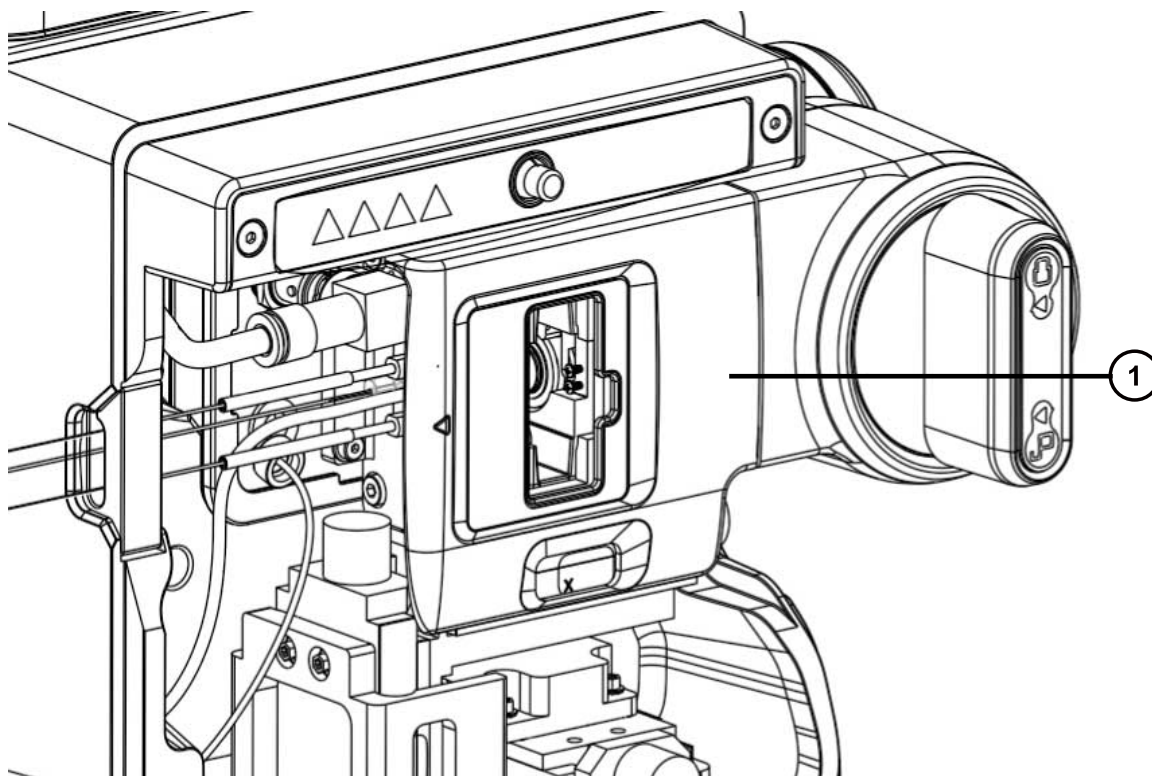
1. Prepare the instrument for working on its source (see [Prepare the instrument for working on the source](#)).



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

2. Unlock and remove any iKey installed in the iKey clamp.
3. Open the ionKey source front cover and remove the iKey surround.

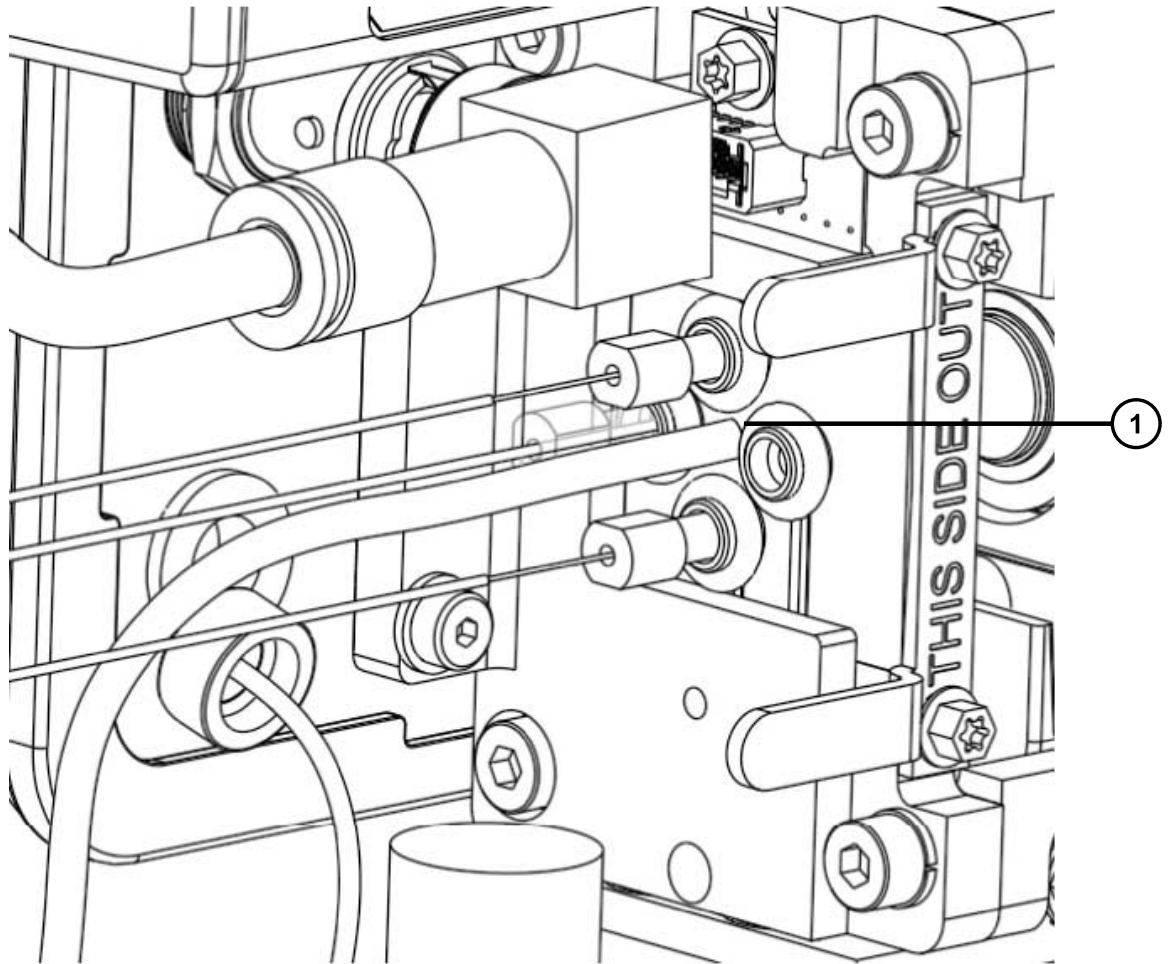
Figure 4-44:



① iKey surround

4. Unlock and remove any iKey installed in the iKey clamp.
5. Remove the gas line using a flat-blade screwdriver.

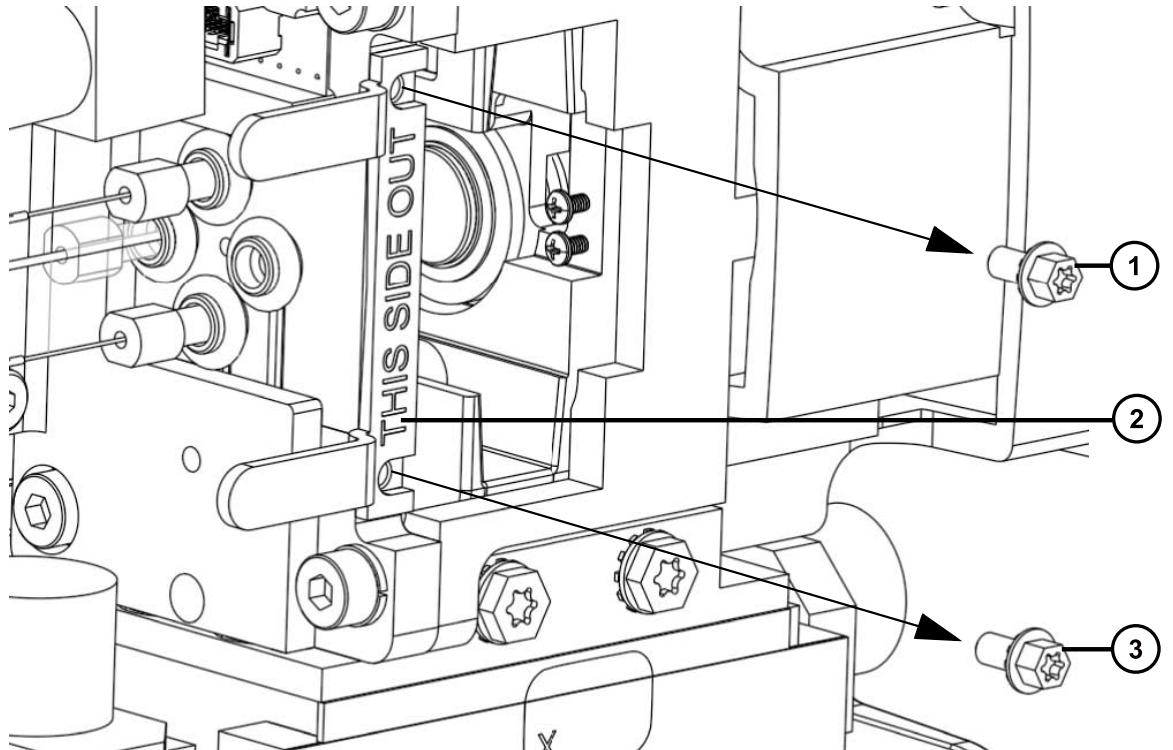
Figure 4-45:



① Gas line

6. Disconnect the fluidic line being replaced from its source.
7. Remove two T10 Torx screws securing the end plate bracket.

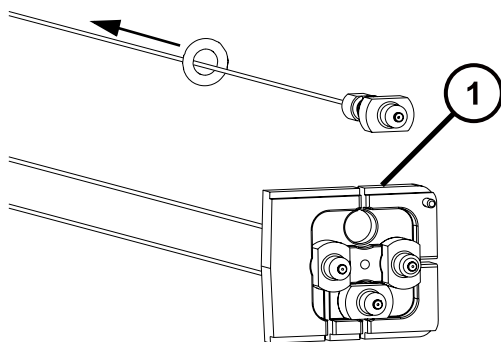
Figure 4-46:



- ① T10 Torx screw
- ② End plate bracket
- ③ T10 Torx screw

- 8. Slide the end plate, along with the capillary tubing, out of the iKey clamp.
- 9. Gently pull the O-ring from around the tube's fitting and slide the O-ring to the left.
- 10. Pull enough of the line being replaced to the right and allow the capillary line to slide through its channel to remove it.

Figure 4-47:



① Channel

11. Remove the O-ring from the tubing.
12. Dispose of the removed tubing in accordance with standard laboratory procedures for contaminated vessels and sharps.

4.28.2 Installing a fluidic line

Required materials

- Chemical-resistant, powder-free gloves
- Fluid line assembly



Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.



Warning: To avoid static-like electric shock, ensure that the instrument is prepared for working on the source before starting this procedure.

To install a fluidic line:

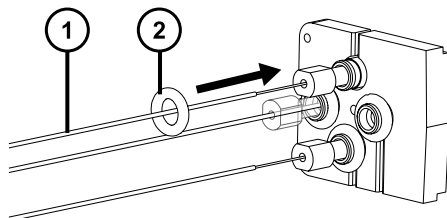
1. Prepare the instrument for working on its source (see [Prepare the instrument for working on the source](#)).



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

2. Slide the O-ring away from the end-plate fitting.
3. Insert the new fluidic line through the appropriate end-plate channel and seat the line's fitting into the end plate.

Figure 4–48: Inserting fluidic line



- ① New fluidic line
- ② O-ring
- 4. Secure the fitting with the O-ring.
- 5. Reinstall the end plate, end-plate bracket, and gas line.
- 6. Route the open end of the fluidic line through the fluid line aperture on the left of the source.
- 7. Reinstall the fitting, ferrule, and lock ring onto the end of the new fluidic line, and then connect it to the ACQUITY UPLC M-Class system, or to the onboard IntelliStart Fluidics on the mass spectrometer (see [Plumbing the IntelliStart Fluidics system](#)).
- 8. Reinstall and lock the iKey.
- 9. Reinstall the iKey surround.

4.29 Cleaning the ionKey source and connectors

Required materials

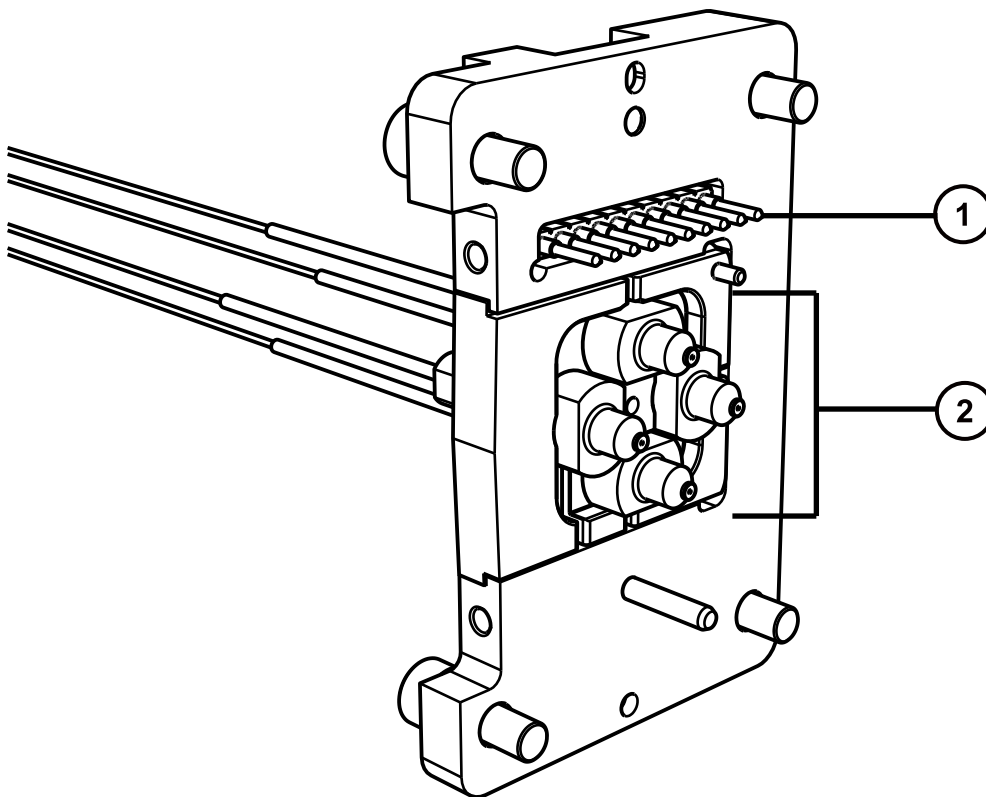
- Chemical-resistant, powder-free gloves
- Lint-free tissue
- Water
- Methanol or isopropyl alcohol
- Compressed air



Notice: To avoid damaging the iKey:

- Handle it with care. The component parts are fragile.
- For recommendations regarding the maximum pressure to subject the device to, see the *iKey Separation Device Care and Use Manual* (720004897EN).
- Do not apply electrospray potential to the emitter without flow.
- Do not drop it.
- Do not immerse it in liquid.
- Do not freeze or overheat it. Keep the iKey within the allowed temperature ranges during operation and in storage.
- Use the iKey sheath to protect the device when it is not in use.
- Do not bend or pull the capillary connection tubing at the ionKey source module coupling.
- Avoid excess voltage, which can erode the emitter over time.
- Do not touch the electrospray emitter, for it can bend.
- Decompress the iKey before you remove it from the source.

During normal operation, the ionKey source does not require cleaning. After repeated use material can accumulate around the fluid-line connectors or electronic connectors in the iKey docking port.



- ① Electronic connectors
- ② Fluid line connectors

To remove buildup from fluid-line connectors:

Gently swab the fluid-line connectors and outer edges of the docking port with a lint-free tissue saturated with isopropanol or methanol.

4.29.1 To remove buildup from electronic connectors

To remove buildup from fluid-line connectors:

1. Open the source door.
2. From the back, gently direct a stream of air from a clean source across the electronic connectors.

Note: To prevent contaminating the inside of the source, do not direct air into the source.

3. Close the source door.

4.29.2 To clean the outside surfaces of the ionKey source

To clean the outside surfaces of the ionKey source:

1. Use a lint-free tissue, dampened with water.
2. Clean the other system components according to the supplied documentation.

A Safety advisories

Waters products display safety symbols that identify hazards associated with the product's operation and maintenance. The symbols also appear in product manuals with statements that describe the hazards and advise how to avoid them. This appendix presents all safety symbols and statements that apply to Waters' product offerings. The symbols and statements can apply to a specific product, or apply to other products within the same system.

A.1 Warning symbols

Warning symbols alert you to the risk of death, injury, or seriously adverse physiological reactions associated with the misuse of an instrument or device. 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 component of an instrument or device. When one of these symbols appears 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 injury caused by moving machinery.)



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 high-pressure gas release.)

A.1.1 Specific warnings

A.1.1.1 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 compounds with which it is chemically incompatible: tetrahydrofuran, nitric acid, and sulfuric acid, for example.
- 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.

A.1.1.2 Mass spectrometer shock hazard

The following warning applies to all Waters mass spectrometers.



Warning: To avoid electric shock, do not remove protective panels from system modules. The components within are not user-serviceable.

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



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

A.1.1.3 Mass spectrometer flammable solvents warning

This warning applies to mass spectrometers performing an analysis that requires the use of flammable solvents.



Warning: To prevent the ignition of flammable solvent vapors in the enclosed space of a mass spectrometer's ion source, ensure that these conditions are met:

- Nitrogen flows continuously through the source.
- A gas-fail device is installed, to interrupt the flow of LC solvent should the nitrogen supply fail.
- The nitrogen supply pressure does not fall below 400 kPa (4 bar, 58 psi) during an analysis requiring the use of flammable solvents.

A.1.1.4 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.

A.1.1.5 Biohazard and chemical hazard warning

This warning applies to Waters instruments and devices that can process biohazards, corrosive materials, or toxic materials.



A.2 Notices

Notice advisories appear where an instrument, device, or component 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.



Notice: To avoid damaging the case of the instrument or device, do not clean it with abrasives or solvents.

A.3 Bottles Prohibited symbol

The Bottles Prohibited symbol alerts you to the risk of equipment damage caused by solvent spills.



Prohibited: To avoid equipment damage caused by spilled solvent, do not place reservoir bottles directly atop an instrument or device or on its front ledge. Instead, place the bottles in the bottle tray, which serves as secondary containment in the event of spills.

A.4 Required protection

The Use Eye Protection and Wear Protective Gloves symbols alert you to the requirement for personal protective equipment. Select appropriate protective equipment according to your organization's standard operating procedures.



Requirement: Use eye protection when performing this procedure.



Requirement: Wear clean, chemical-resistant, powder-free gloves when performing this procedure.

A.5 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.



Warning: 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.



Avertissement : 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.



Warnung: 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.



Advertencia: 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.



警告： 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。



警告： 未经有关法规认证部门明确允许对本设备进行的改变或改装,可能会使使用者丧失操作该设备的合法性。



경고: 규정 준수를 책임지는 당사자의 명백한 승인 없이 이 장치를 개조 또는 변경할 경우, 이 장치를 운용할 수 있는 사용자 권한의 효력을 상실할 수 있습니다.



警告: 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.



Avertissement : 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.



Warnung: 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.



Avvertenza: 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枫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 디메틸설폭사이드(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。

This warning applies to Waters instruments fitted with nonmetallic tubing. This warning applies to instruments operated with flammable solvents.



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.



Avertissement : 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.



Warnung: Der Benutzer wird darauf aufmerksam gemacht, dass bei unsachgemäßer Verwendung des Gerätes die eingebauten Sicherheitseinrichtungen unter Umständen nicht ordnungsgemäß funktionieren.



Avvertenza: 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 보호수단이 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。

A.6 Warnings that address the replacing of fuses

The following warnings pertain to instruments and devices equipped with user-replaceable fuses. Information describing fuse types and ratings sometimes, but not always, appears on the instrument or device.

Finding fuse types and ratings when that information appears on the instrument or device:



Warning: To protect against fire, replace fuses with those of the type and rating printed on panels adjacent to instrument fuse covers.



Avertissement : 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.



Warnung: Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert auf den Tafeln neben den Sicherungsabdeckungen des Geräts gedruckt sind.



Avvertenza: 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。

Finding fuse types and ratings when that information does not appear on the instrument or device:



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.



Avertissement : 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.



Warnung: Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert im Abschnitt "Sicherungen ersetzen" des Kapitels "Wartungsverfahren" angegeben sind.



Avvertenza: 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。

A.7 Electrical symbols

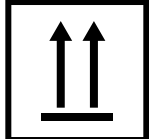
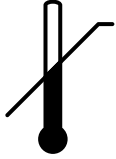
The following electrical symbols and their associated statements can appear in instrument manuals and on an instrument's front or rear panels.

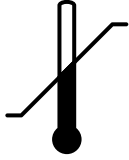
Symbol	Description
	Electrical power on
○	Electrical power off
⏻	Standby
≡	Direct current
~	Alternating current
3~	Alternating current (3 phase)
⏚	Safety ground

Symbol	Description
	Frame, or chassis, terminal
	Fuse
	Functional ground
	Input
	Output

A.8 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.

Symbol	Description
	Keep upright!
	Keep dry!
	Fragile!
	Use no hooks!
	Upper limit of temperature

Symbol	Description
	Lower limit of temperature
	Temperature limitation

B External connections

A Waters Technical Service representative must unpack and install your system modules.



Notice: To avoid damaging the mass spectrometer, observe the following precautions:

- Contact Waters Technical Service before moving the instrument.
- If you must transport the instrument, or remove it from service, contact Waters Technical Service for recommended cleaning, flushing, and packaging procedures.



Warning: To avoid skeletal or muscle injury associated with lifting heavy objects, use appropriate machinery and the supplied harness to lift the mass spectrometer.

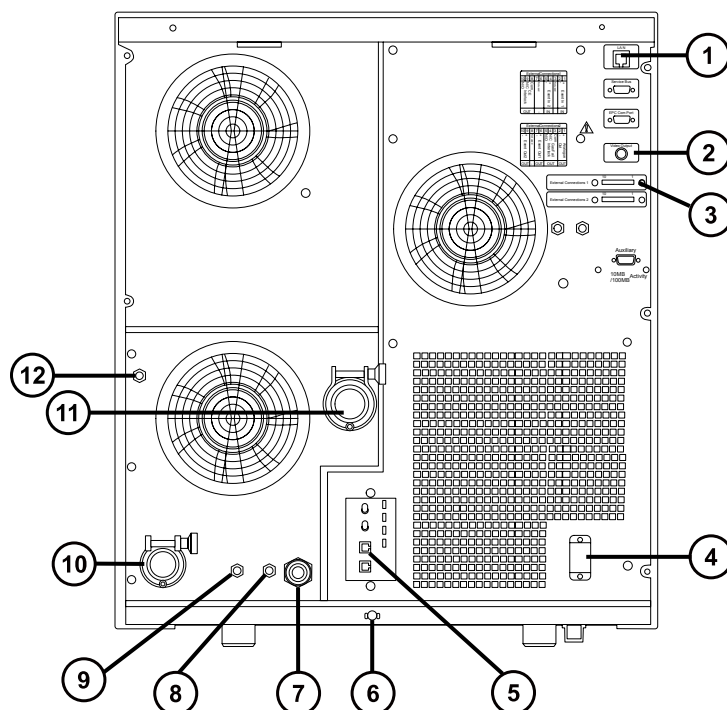


Warning: To avoid spinal and muscular injury, do not attempt to lift a system module without assistance.

B.1 External wiring and vacuum connections

Rear panel connections appear in the figure below. Note that the connectors and controls not identified are for use by Waters engineers only.

Figure B-1: Mass spectrometer rear panel connectors:



- ① Shielded Ethernet
- ② Video camera connection (for use with the optional NanoFlow ESI or IonKey source)
- ③ Event inputs and outputs
- ④ Power
- ⑤ Roughing pump connectors
- ⑥ Roughing pump grounding connection
- ⑦ Nitrogen exhaust
- ⑧ Nitrogen inlet
- ⑨ Pilot valve port
- ⑩ Turbo vacuum
- ⑪ Source vacuum
- ⑫ Collision cell gas inlet

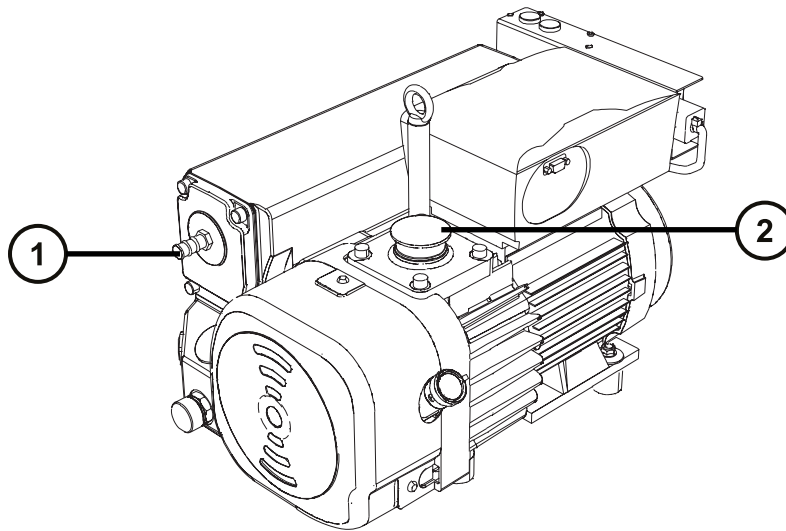
B.2 Connecting the Oerlikon Leybold oil-filled roughing pumps

This option requires the use of two identical Oerlikon Leybold oil-filled roughing pumps.

Note: To connect the alternative, oil-free roughing pumps, see the following topics:

- [Connecting the Edwards oil-free roughing pumps.](#)
- [Connecting the EBARA oil-free roughing pump.](#)

Figure B-2: Oerlikon Leybold oil-filled roughing pump



- ① Inlet port
- ② Exhaust port

Required materials

- Chemical-resistant, powder-free gloves
- 7-mm nut driver
- Utility knife

The following items are included in the Xevo TQ-S installation kit:

- NW40 flanged flexible tubing, 1-m long
- NW40 hose assembly, 1.5-m long
- NW25 hose assembly, 1.5-m long
- Two NW40 tees
- NW25/NW40 adapter

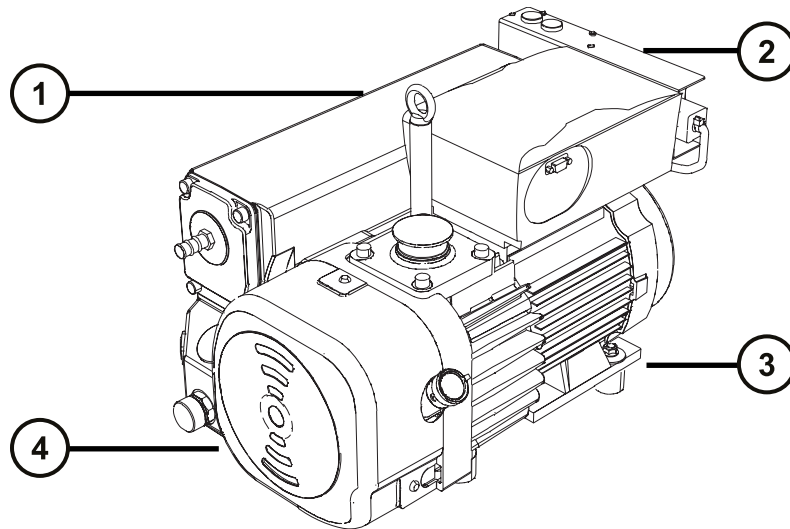
- NW25 center rings
- NW40 center rings
- NW25 clamps
- NW40 clamps
- 1/2-inch barbed tee
- 12-mm clear PVC exhaust tubing
- PVC hose clamps
- PTFE drip tray
- Oerlikon Leybold pump relay cable

Requirements for connecting the roughing pumps:

- Pumps must be horizontal or within ten degrees of horizontal.
- Ambient temperature of the area in which you place the pumps must be between 12 and 40 °C.
- Pumps must be oriented to permit easy access to the gas ballast valve and oil-level sight glass.

For proper ventilation, the following minimum clearances must apply:

Figure B-3: Oerlikon Leybold oil-filled roughing pump clearances



- ① Left side minimum clearance is 15.24 cm (6 inches)
- ② Rear minimum clearance is 15.24 cm (6 inches)

③ Right side minimum clearance is 15.24 cm (6 inches)

④ Front minimum clearance is 35.56 cm (14 inches)



Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.

To connect the roughing pumps:

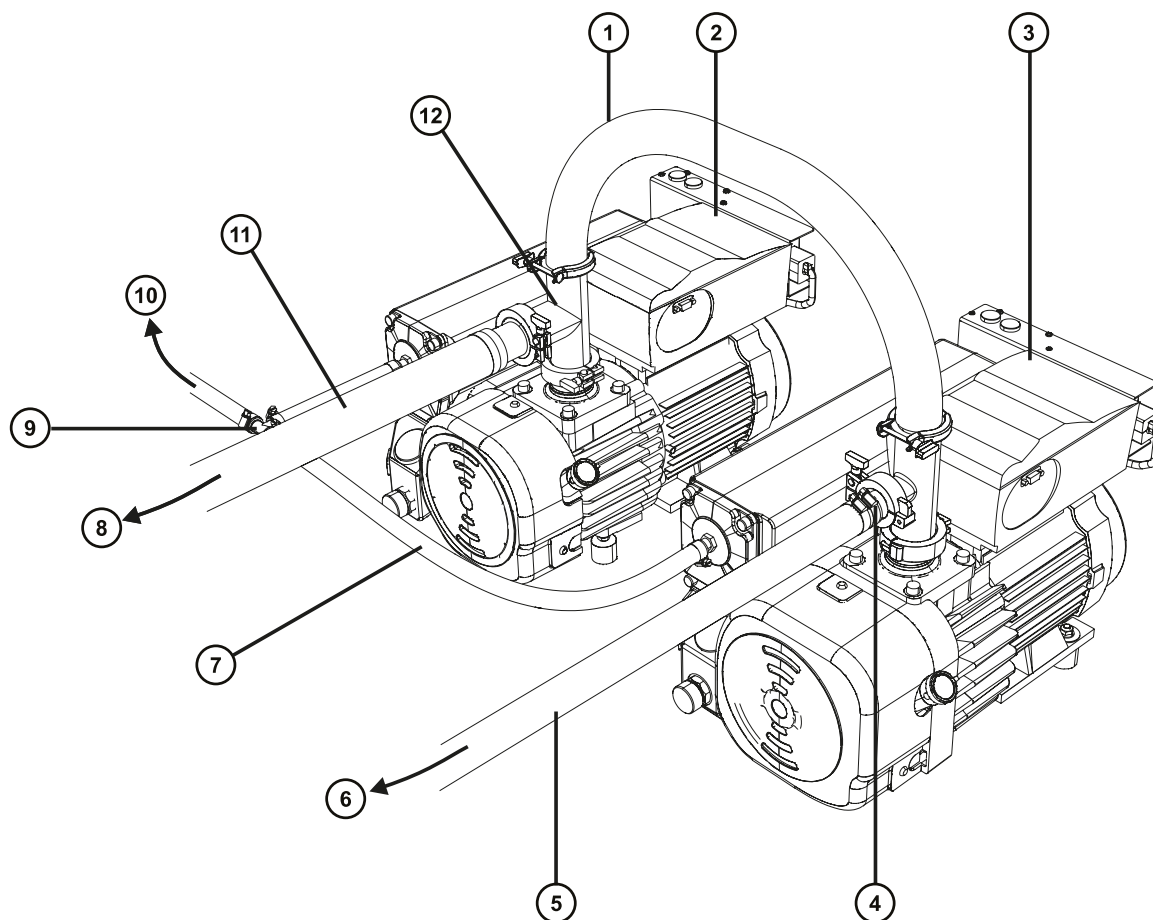
1. Place the PTFE drip tray on the floor within five feet of the instrument.



Warning: To avoid spinal and muscular injury, do not attempt to lift a system module without assistance.

2. Place the pumps on the PTFE drip tray, facing the same orientation.

Figure B-4: Connecting the roughing pumps



- ① NW40 flanged flexible tubing
 - ② Pump number 1
 - ③ Pump number 2
 - ④ NW25/NW40 adapter
 - ⑤ NW25 hose assembly
 - ⑥ To Xevo TQ-S source vacuum port
 - ⑦ PVC exhaust tubing
 - ⑧ To Xevo TQ-S turbo vacuum
 - ⑨ ½-inch barbed tee
 - ⑩ To exhaust vent
 - ⑪ NW40 hose assembly
 - ⑫ NW40 tee
- 3. Use an NW40 center ring to attach an NW40 tee to the inlet flange of each pump, and then secure the connection with an NW40 clamp.
 - 4. Use an NW40 center ring to attach one end of the 1-m length of NW40 flanged flexible tubing to the upper port of the NW40 tee fitted to pump number 1, and then secure the connection with an NW40 clamp.
 - 5. Use an NW40 center ring to attach the free end of the 1-m length of NW40 flanged flexible tubing to the upper port of the NW40 tee fitted to pump number 2, and then secure the connection with an NW40 clamp.
 - 6. Use an NW40 center ring to attach the NW25/NW40 adapter to the open port of the NW40 tee fitted to pump number 2, and then secure the connection with an NW40 clamp.
 - 7. Use an NW25 center ring to attach one end of the NW25 hose assembly to the NW25/NW40 adapter, and then secure the connection with an NW25 clamp.
 - 8. Use an NW40 center ring to attach one end of the NW40 hose assembly to the open port on the NW40 tee on pump number 1, and then secure the connection with an NW40 clamp.
 - 9. Make the connections between the NW25 and NW40 hose assemblies and the vacuum ports on the rear of the Xevo TQ-S (see [Making the roughing pump connections to the Xevo TQ-S](#)).



Notice: To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely.

10. Use the sharp knife to cut two lengths of 12-mm clear PVC exhaust tubing, one approximately 200-mm long, the other approximately 500-mm long.
11. Connect the 200-mm length of PVC exhaust tubing to the exhaust port on pump number 1 and secure the tubing with a hose clamp, tightening it with the 7-mm nut driver.
12. Connect the 500-mm length of PVC exhaust tubing to the exhaust port on pump number 2 and secure the tubing with a hose clamp.
13. Connect the free ends of the PVC exhaust tubing to two ports of the 1/2-inch barbed tee and secure the tubing with hose clamps.
14. Connect the remaining length of PVC exhaust tubing to the free port of the 1/2-inch barbed tee and secure the tubing with a hose clamp.



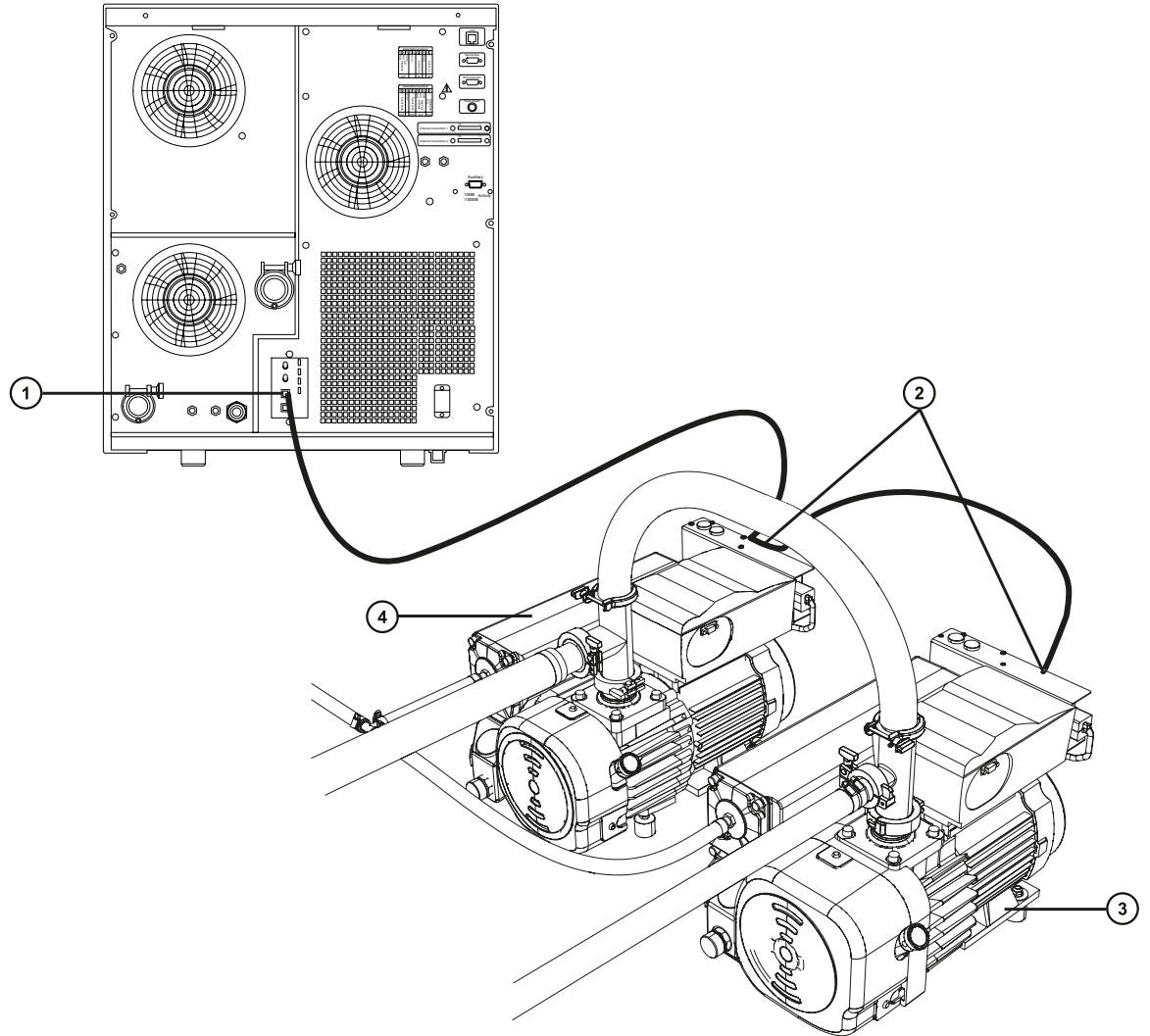
Notice: To prevent serious damage to the instrument, two separate exhaust systems are required: one for nitrogen, the other for the roughing pumps. Vent the exhausts to atmosphere through separate lines. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the roughing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

15. Route the open end of the PVC exhaust tubing to a suitable exhaust vent.
16. Inspect the oil level in the pumps (see [Inspecting the roughing pump oil levels](#) and, if necessary, [Adding oil to a roughing pump](#)).

Requirement: To ensure correct operation of the roughing pumps, do not operate the pumps with an oil level below minimum level as indicated in the sight glass.

17. Connect the roughing pumps' power cords to the main power source.
18. Connect the relay cable from the top roughing pump connector on the mass spectrometer's rear panel to the DC connector on roughing pump number 1, and then connect the looped cable to the DC connector on roughing pump number 2.

Figure B–5: Roughing pump electrical connections



- ① Top roughing pump connector
- ② Roughing pump DC connectors
- ③ Pump number 1
- ④ Pump number 2

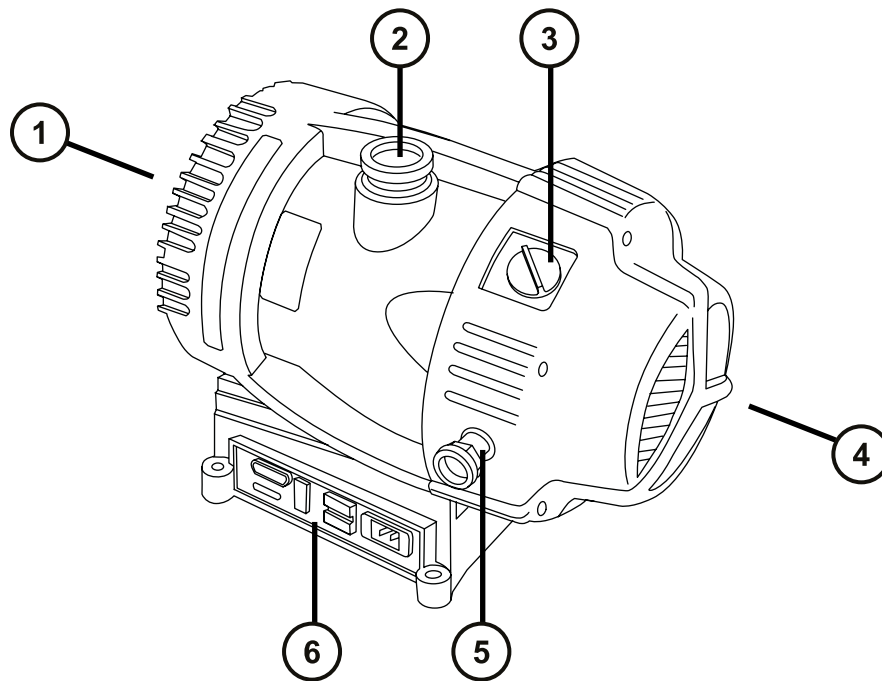
B.3 Connecting the Edwards oil-free roughing pump

The oil-free roughing pump option involving the Edwards pump uses two pumps: a type XDS35i (pump 1) and an XDS100B (pump 2).

Note:

- To connect to the EBARA oil-free roughing pump, see [Connecting the EBARA oil-free roughing pump](#).
- To connect the oil-filled roughing pumps, see [Connecting the Oerlikon Leybold oil-filled roughing pumps](#).

Figure B-6: Edwards oil-free roughing pump



- ① Rear
- ② Inlet flange
- ③ Gas ballast control (XD35i only) in the opened position
- ④ Front
- ⑤ Exhaust port flange
- ⑥ Electrical connections

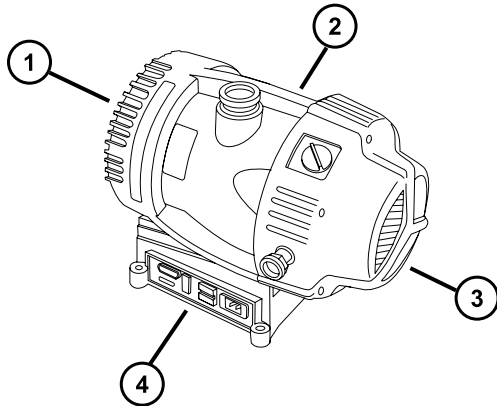


Warning: To avoid spinal and muscular injury, do not attempt to lift a system module without assistance.



Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.

Figure B-7: Minimum clearances

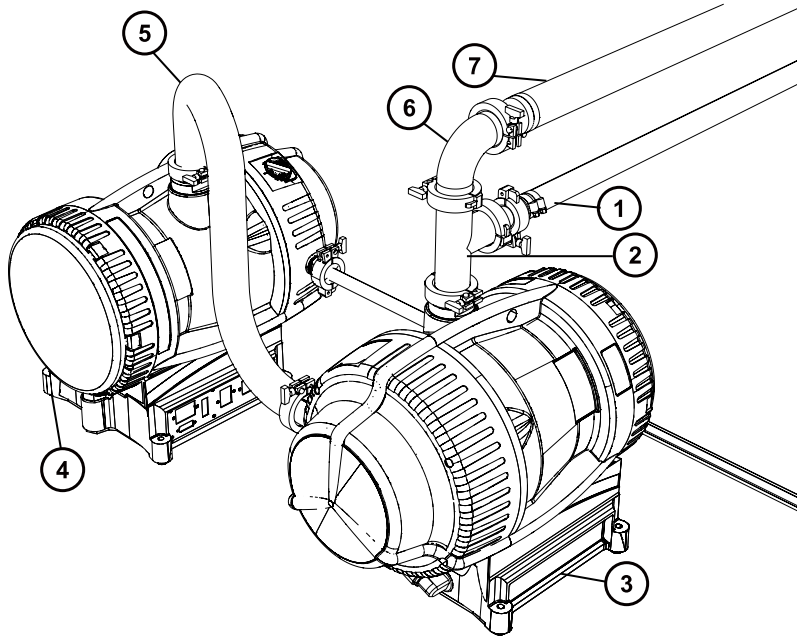


- ① Rear minimum clearance is 15 cm (6 inches)
- ② Right side minimum clearance is 15 cm (6 inches)
- ③ Front minimum clearance is 35 cm (14 inches)
- ④ Left side minimum clearance is 15 cm (6 inches)

Note: Before connecting tubing, ensure that the pump's ballast control is in the "off" position and that the pumps are positioned as follows:

- Pumps are installed within 10 degrees of horizontal.
- Pumps occupy an area where the ambient temperature is 12 °C to 40 °C.
- Installation allows for the minimum clearances shown in the figure above.

Figure B–8: Tubing configuration



- ① To instrument turbo vacuum
- ② Tee piece
- ③ Pump 2 (XDS100B)
- ④ Pump 1 (XDS35i)
- ⑤ NW40 flexible tubing
- ⑥ NW40 elbow
- ⑦ To instrument source vacuum port



Warning: To avoid spinal and muscular injury, do not attempt to lift a system module without assistance.

To connect tubing:

1. Place pump 1 relative to pump 2 so that the electrical connections of both pumps face each other.
2. Using an NW40 center ring, attach one end of the NW40 flanged flexible tubing to the inlet flange of pump 1, and then secure the connection with an NW32/40 ring clamp.
3. Using an NW40 center ring, attach the free end of the flexible tubing to the exhaust port of pump 2, and then secure the connections with an NW32/40 ring clamp.

4. Using an NW40 center ring, attach the NW40 tee to the inlet flange of pump 2, and then secure the connection with an NW40 swing clamp.
5. Using an NW40 center ring, attach the NW40/NW25 adapter to the horizontal vent on the tee piece, and then secure the adapter with an NW40 swing clamp.
6. Using an NW25 center ring, attach one end of the NW25 hose assembly to the open port of the NW40/NW25 adapter on pump number 2, and then secure the connection with an NW25 swing clamp.
7. Using an NW40 center ring, attach the NW40 elbow to the top port of the NW40/NW25 tee fitted to pump 2, and then secure the connection with an NW40 swing clamp.
8. Using an NW40 center ring, attach one end of the NW40 hose assembly to the NW40 elbow fitted to pump 2, and then secure the connection with an NW40 swing clamp.
9. Connect the NW25 and NW40 hose assemblies and the vacuum ports on the rear of the instrument referring to the figure following this procedure.



Notice: To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely.

10. Using an NW25 center ring, attach one end of the 12-mm, clear PVC exhaust tubing to the exhaust port on pump 1, and then secure the connection with an NW25 swing clamp.



Notice: To prevent serious damage to the instrument, two separate exhaust systems are required: one for nitrogen, the other for the roughing pumps. 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.

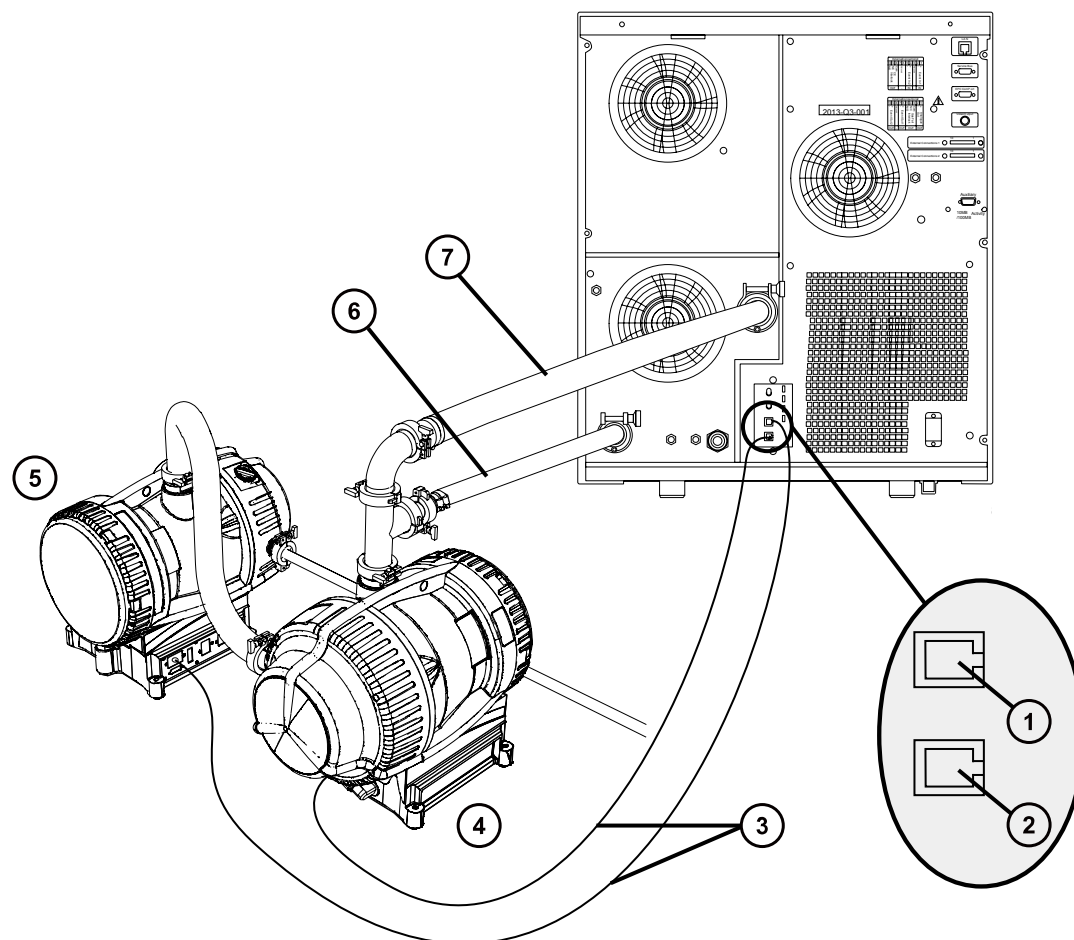
11. Route the open end of the exhaust tubing to a suitable exhaust vent.



Notice: When you attach the cables from the pumps to the mass spectrometer, ensure that the cables connect to the correct receivers on the instrument.

12. Attach the cables from the pumps to the mass spectrometer as follows:
 - The cable for pump 1 attaches to the upper receiver on the mass spectrometer.
 - The cable for pump 2 attaches to the lower receiver on the mass spectrometer.

Figure B–9: Roughing pump connections to mass spectrometer



- ① Backing pump control cable connection (Pump 1 - XDS35i)
- ② Delayed backing pump control cable connection (Pump 2 - XDS100B)
- ③ Pump connection cables to mass spectrometer
- ④ Pump 2 (XDS100B)
- ⑤ Pump 1 (XDS35i)
- ⑥ Vacuum hose to port A
- ⑦ Vacuum hose to port B

B.4 Connecting the EBARA oil-free roughing pump

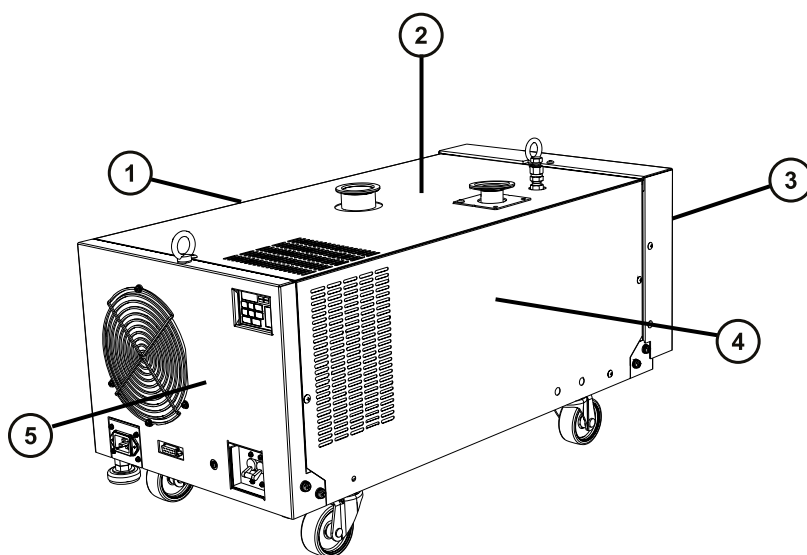
The oil-free roughing pump option involving the EBARA pump uses the EBARA SA-20.

Note:

- To connect to the Edwards oil-free roughing pump, see [Connecting the Edwards oil-free roughing pump](#).
- To connect the oil-filled roughing pumps, see [Connecting the Oerlikon Leybold oil-filled roughing pumps](#).

For proper ventilation, the following minimum clearances must apply:

Figure B-10: EBARA oil-free roughing pump clearances



- ① Right side minimum clearance is 50 mm (2 inches)
- ② Top minimum clearance is 100 mm (4 inches)
- ③ Front minimum clearance is 100 mm (4 inches)
- ④ Left side minimum clearance is 50 mm (2 inches)
- ⑤ Rear minimum clearance is 100 mm (4 inches)

Required materials

- Chemical-resistant, powder-free gloves
- 7-mm nut driver
- Sharp knife

The following items are included in the installation kit:

- NW25 center rings
- NW25 clamps
- NW40 center rings
- NW40 clamps
- NW40 elbow
- NW40 tee piece
- NW40 to NW16 reducer
- NW40 to NW25 reducer
- 12-mm ID, 18-mm OD, clear PVC exhaust tubing
- PVC hose clamps
- Vacuum hose

To connect the oil-free roughing pump:



Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.



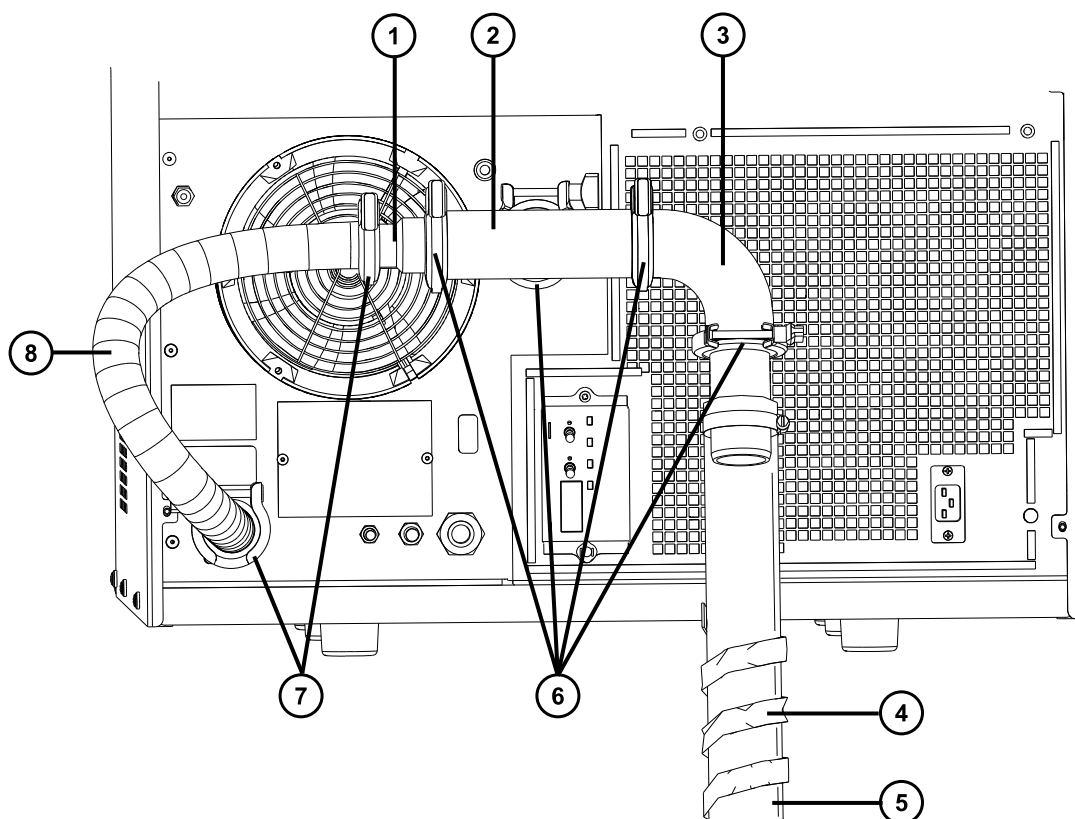
Warning: To avoid injury, do not lift the pump. To move the pump, use its wheels.

1. Connect the roughing pump's vacuum hoses according to the figures below.

Note: To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely.

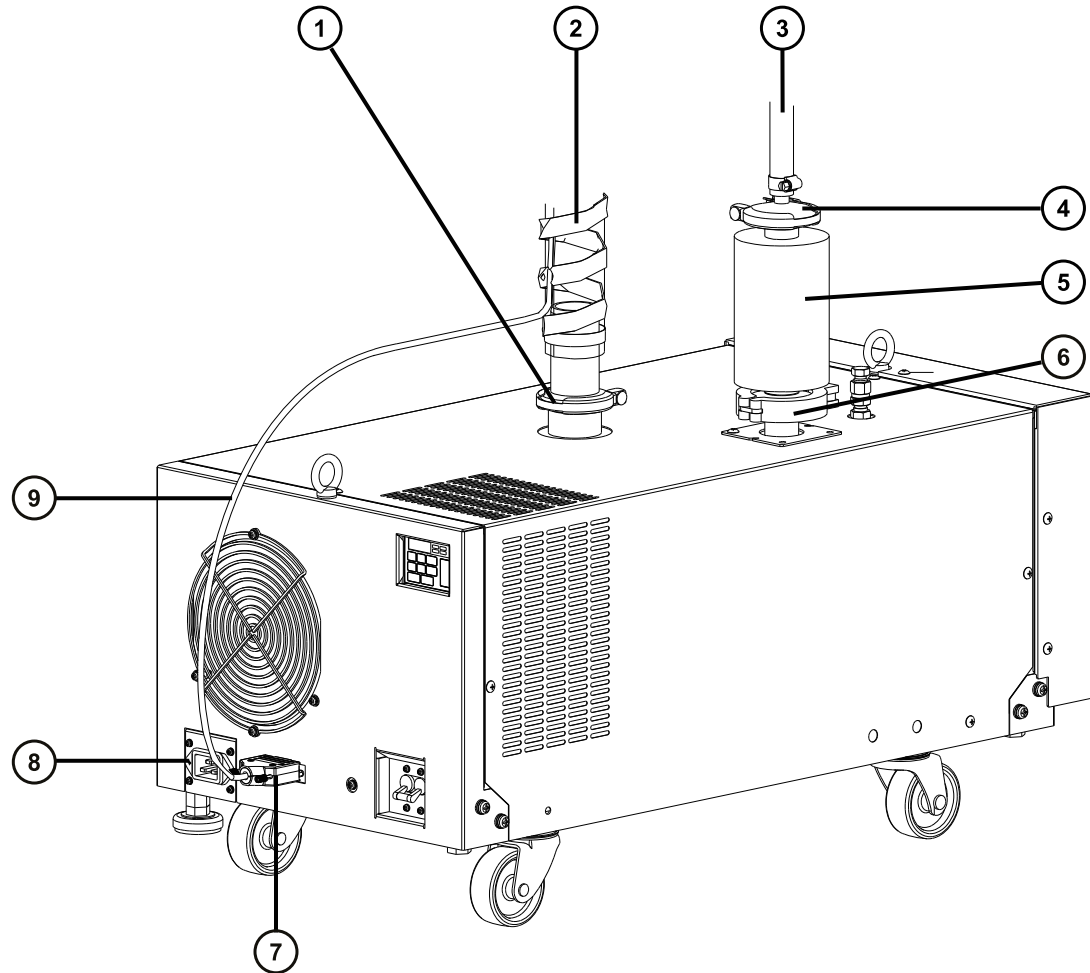
Recommendation: Use elbow connectors for fitting the vacuum and exhaust tubing to the pump to reduce the height so it fits under a workbench.

Figure B-11: Roughing pump tubing connections to rear of the Xevo TQ-S mass spectrometer



- ① NW40/NW25 reducer
- ② NW40 tee piece
- ③ NW40 elbow
- ④ Roughing pump electrical cable attached to vacuum hose
- ⑤ Vacuum hose to roughing pump
- ⑥ NW40 clamps
- ⑦ NW25 clamps
- ⑧ Flexible vacuum tubing

Figure B-12: Roughing pump tubing connections to the EBARA pump



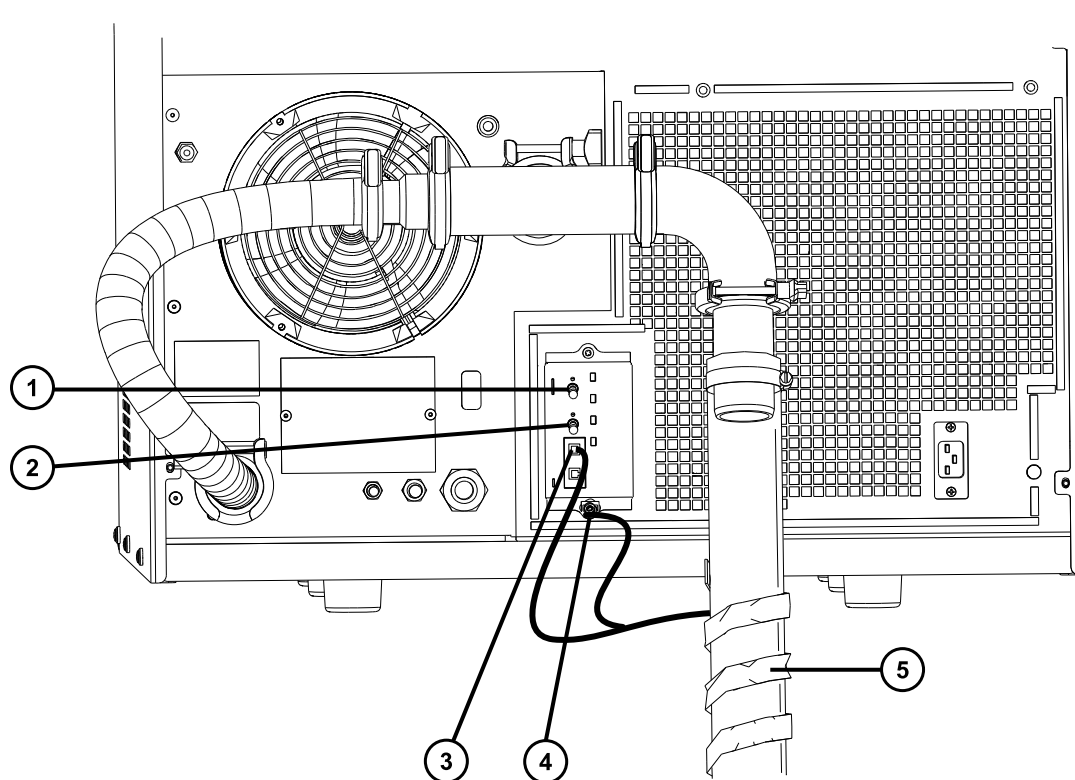
- ① NW40 clamp
- ② Vacuum hose (from the rear of the Xevo TQ-S)
- ③ Exhaust tubing
- ④ NW40 clamp
- ⑤ Exhaust silencer
- ⑥ NW40 clamp and exhaust filter (supplied with the EBARA roughing pump installation kit)
- ⑦ Control signal connector

- ⑧ Power connector
- ⑨ Pump control cable

2. Make the electrical connections to the roughing pump (see [Making connections to the EBARA oil-free roughing pump](#)).

B.5 Making the electrical connections to the Ebara oil-free roughing pump

Figure B–13: Roughing pump electrical connections to rear of the Xevo TQ-S mass spectrometer



- ① Pump override switch (for use by Waters engineers only)
- ② Electronics ON/OFF switch (for use by Waters engineers only)
- ③ Backing pump control connector

- ④ Grounding connector
- ⑤ Tape attaching electrical cables to the vacuum hose

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 pump control cable to the control signal connector at the rear of the pump and connect the other end of the cable to the upper backing pump control connector on the mass spectrometer's rear panel.

Tip: Use only the upper backing pump control connector. Leave the lower connector marked Delayed backing pump control, disconnected.

3. Connect the grounding cable to the grounding connector at the rear of the instrument.

B.6 Making the roughing pump connections to the Xevo TQ-S

Required materials

- Chemical-resistant, powder-free gloves
- 7-mm nut driver

The following items are included in the Xevo TQ-S installation kit:

- NW25 elbow
- NW40 elbow
- NW25 center rings
- NW40 center rings
- NW25 clamps
- NW40 clamps



Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.

To connect the roughing pumps:

1. Using an NW25 center ring, attach the NW25 elbow to the turbo vacuum port of the Xevo TQ-S, and then secure the connection with an NW25 clamp. See [Connecting to the nitrogen gas supply](#).
2. Using an NW40 center ring, attach the NW40 elbow to the source vacuum port of the Xevo TQ-S, and then secure the connection with an NW40 clamp.
3. Using an NW25 center ring, attach the free end of the NW25 hose assembly (attached to the roughing pump) to the NW25 elbow, and then secure the connection with an NW25 clamp.
4. Using an NW40 center ring, attach the free end of the NW40 hose assembly (attached to the roughing pump) to the NW40 elbow, and then secure the connection with an NW40 clamp.

B.7 Connecting to the nitrogen gas supply

Required materials

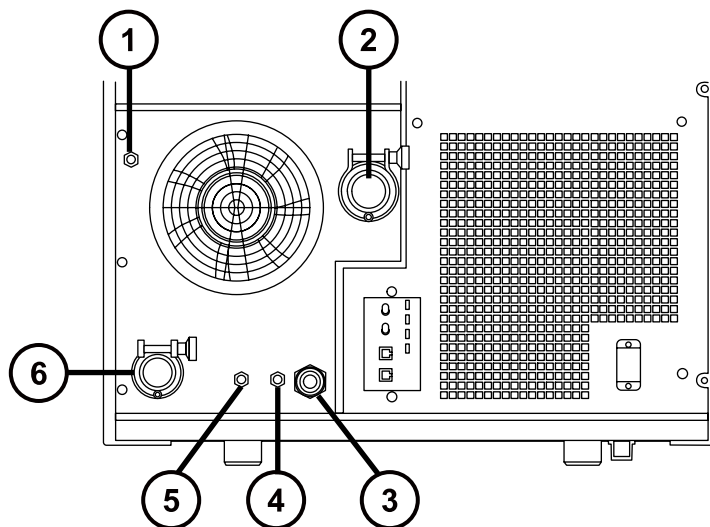
- Chemical-resistant, powder-free gloves
- 6-mm PTFE tubing (included in the Xevo TQ-S Installation Kit)
- Nitrogen regulator (not supplied)

To connect the nitrogen gas supply:

1. Connect one free end of the 6-mm PTFE tubing to the nitrogen inlet port on the rear of the instrument.

Requirement: Do not cut the 6-mm (¼-in) PTFE tubing to size. Use the entire 5-m (16-ft) length supplied.

Figure B–14: Nitrogen and collision cell gas inlet and vacuum connectors:



- ① Collision cell gas inlet
- ② Source vacuum
- ③ Nitrogen exhaust
- ④ Nitrogen inlet port
- ⑤ Pilot valve port
- ⑥ Turbo vacuum

2. Attach a nitrogen regulator to the nitrogen supply.

Requirement: The nitrogen must be dry and oil-free, with a purity of at least 95%.

3. Connect the free end of the 6-mm PTFE tubing to the nitrogen regulator.
4. Set the nitrogen regulator to 690 kPa (6.9bar, 100 psi).
5. Ensure that there are no gas leaks at any of the nitrogen gas supply fittings.

B.8 Connecting to the collision cell gas supply

Required materials

- Chemical-resistant, powder-free gloves
- 7/16-inch open-end wrench
- 1/8-inch Swagelok 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 in [Connecting to the nitrogen gas supply](#)).
2. Use the 7/16-inch wrench to tighten the 1/8-inch Swagelok nut.
3. Attach the argon regulator 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).

B.9 Connecting the nitrogen exhaust line

Required materials

- Chemical-resistant, powder-free gloves
- Utility knife
- Nitrogen exhaust trap bottle
- 4-mm PTFE tubing and 12-mm PTFE tubing (included in the Xevo TQ-S installation kit)

To connect the nitrogen exhaust line:



Warning: To prevent the escape of exhaust gases into the laboratory, carrying biologically hazardous, toxic, or corrosive LC solvents, you must use a source exhaust line connected to either a laboratory fume hood, or to an active laboratory exhaust system. A laboratory exhaust system must be capable of the following:

- Supporting a gas load of up to 2000 L/hour.
- Periodically draining off any liquid solvent that accumulates in the exhaust lines.
- Maintaining a pressure below atmosphere, no lower than -1 kPa (-10 mbar, -0.145 psi).



Warning: To avoid the buildup of hazardous gases, do not place the nitrogen exhaust trap bottle in an enclosed cabinet.

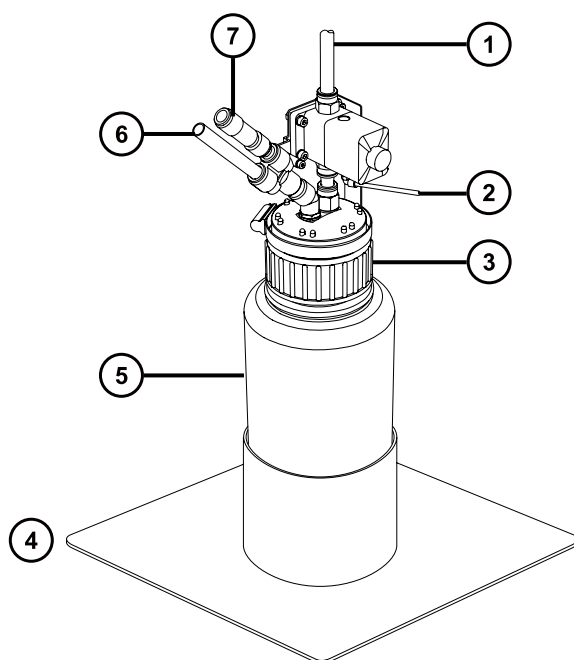


Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

! Notice: To prevent serious damage to the instrument, two separate exhaust systems are required: one for nitrogen, the other for the roughing pumps. 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.

1. Locate the nitrogen exhaust trap bottle in an accessible area below the instrument.

Figure B-15: Nitrogen exhaust trap bottle:



- ① To laboratory exhaust port
- ② From instrument pilot valve port
- ③ Cap
- ④ Bottle support
- ⑤ Nitrogen exhaust trap bottle
- ⑥ From instrument exhaust connection
- ⑦ One-way valve



Notice: To avoid gas leaks, use the sharp knife to cut the PTFE tubing squarely.

2. Cut a length of 4-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.



Notice: To avoid gas leaks, use the sharp knife to cut the PTFE tubing squarely.

8. Cut a second length of 12-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.

B.10 Connecting liquid waste lines

To ensure that waste materials are safely drained to the waste container, connect both the bottle tray and the mass spectrometer's drain cup to the waste container.

Required materials

- Chemical-resistant, powder-free gloves
- Waste container

To connect the liquid waste line:



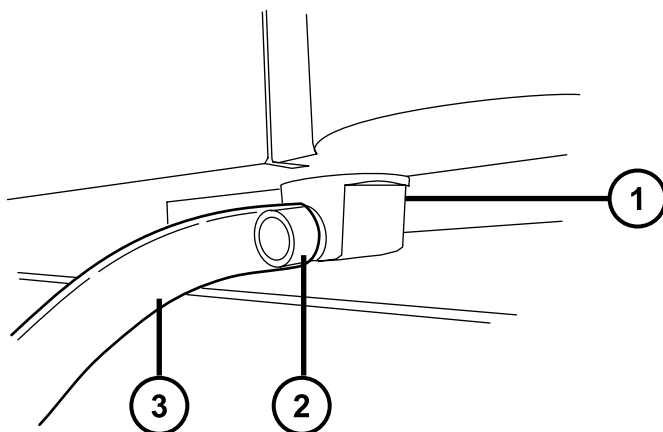
Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

1. Place a suitable waste container below the mass spectrometer.



Notice: 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 on the bottom, left-hand side of the mass spectrometer, and on the base of the bottle tray).



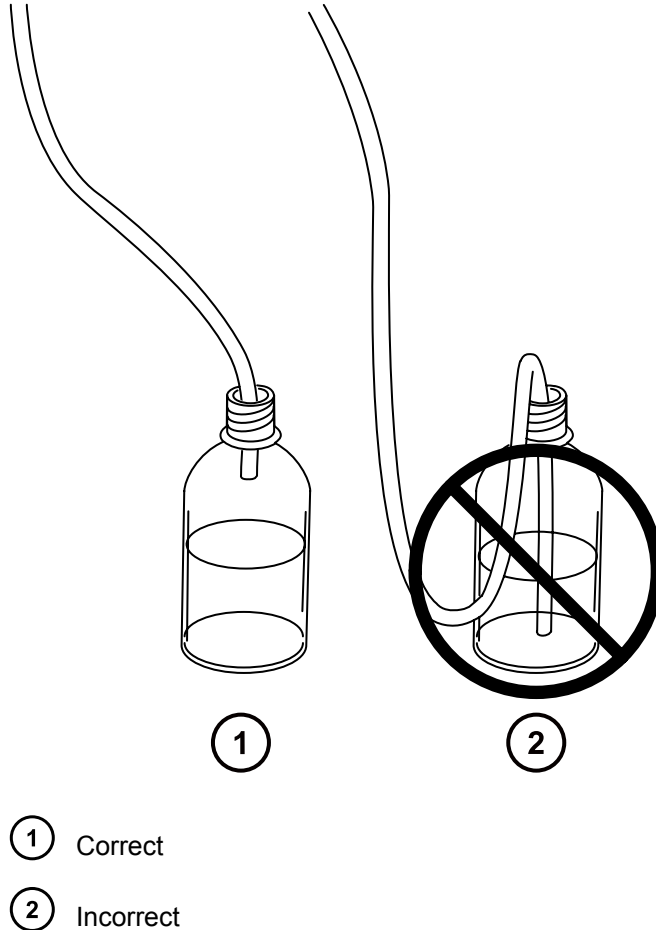
- ① Drain cup
- ② Barbed fitting
- ③ Drain line



Warning: To prevent leakage of biologically hazardous, toxic, or corrosive materials:

- Do not crimp or bend drain lines. A crimp or bend can impede flow to the waste container.
 - Empty the waste container before the lower ends of the drain tubes are covered by waste solvent.
3. Route the waste lines to the waste container. If necessary, shorten the waste tubes so their ends are above the surface of the waste solvent.

Figure B-16: Positioning of drain tube



B.11 Connecting to the workstation



Warning: To avoid injury from electrical shock or fire, and damage to the equipment, follow these guidelines:

- Do not expose the workstation or ancillary equipment to dripping or splashing liquids.
- Do not place objects filled with liquid, such as solvent bottles, on top of the workstation or ancillary equipment.

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 instrument to reduce susceptibility to radio and electrical frequency interference.

To connect the workstation:

1. Connect the monitor to the workstation PC.
2. Connect one end of the shielded, crossover, network cable to the port labeled instrument LAN on the workstation rear panel.
3. Connect the free end of the shielded, crossover, network cable to the Ethernet port in the top, right-hand corner of the mass spectrometer's rear panel.

B.12 Connecting Ethernet cables (systems with ACQUITY LC)

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 ACQUITY instrument's network switch, and then connect the free end to the Ethernet card on the preconfigured ACQUITY 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 Ethernet port in the top, right-hand corner of the mass spectrometer's rear panel, and then connect the free end to the ACQUITY instrument's network switch.

B.13 Input/output signal connectors



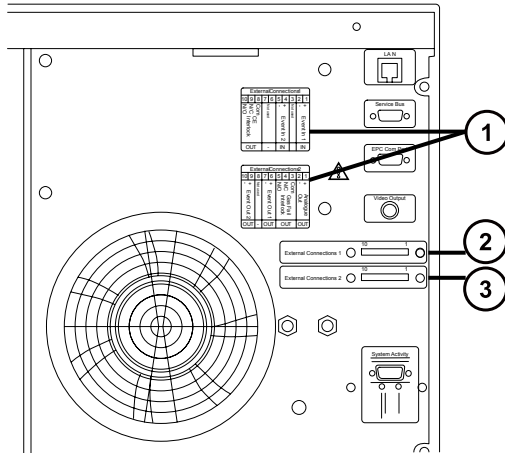
Warning: To avoid electric shock, all electrical connections to the rear panel must be separated from hazardous voltages by double or reinforced insulation. Circuits of this type are classified as safety extra low voltage (SELV). Examples of circuits that are typically SELV include contact closure inputs and outputs for auto-samplers, and UV, RI, and fluorescence detector signal outputs for LC/MS systems. The electrical connections on the rear panel of this mass spectrometer are all SELV.

Note: To avoid damaging the instrument,

- do not 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.

Two removable connectors (designated External Connections 1 and External Connections 2) on the mass spectrometer's rear panel hold the screw terminals for input/output signals. The connectors are keyed so that they can receive a signal cable inserted only one way.

Figure B–17: Input and output connector locations



- ① External connections identification tables
- ② External connections 1
- ③ External connections 2

Figure B–18: Input/output signal connector configuration

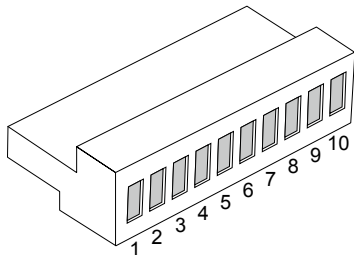


Table B–1: External connections 1:

Pin	Function	Rating
1	Event In 1+, digital signal, optimum +3.3 V max +5 V	+5 V
2	Event In 1-, digital ground, 0 V	0 V
3	Not used	
4	Event In 2+, digital signal, optimum +3.3 V max +5 V	+5 V
5	Event In 2-, digital ground, 0 V	0 V
6	Not used	
7	Not used	
8	CE Interlock Out, common	+30 V dc, 100 mA

Table B–1: External connections 1: (continued)

Pin	Function	Rating
9	CE Interlock Out, normally closed (N/C)	+30 V dc, 100 mA
10	CE Interlock Out, normally open (N/O)	+30 V dc, 100 mA

Table B–2: External connections 2:

Pin	Function	Rating
1	Analog Out +, instrument-driven electrical output	None
2	Analog Out -, ground	None
3	Gas Fail Interlock, common	+30 V dc, 100 mA
4	Gas Fail Interlock, normally closed (N/C)	+30 V dc, 100 mA
5	Gas Fail Interlock normally open (N/O)	+30 V dc, 100 mA
6	Event Out 1 +	+30 V dc, 100 mA
7	Event Out 1 -	+30 V dc, 100 mA
8	Not used	
9	Event Out 2 +	+30 V dc, 100 mA
10	Event Out 2 -	+30 V dc, 100 mA

B.14 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.

To connect to the electricity source:

Recommendation: Use a line conditioner or an uninterruptible power supply (UPS) for optimum long-term input voltage stability.



Warning: To avoid electric shock, use SVT-type power cords in the United States and HAR-type (or better) cords in Europe. The power cords must be replaced only with ones of adequate rating. For information regarding which cord to use in other countries, contact your local Waters distributor.

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 AC wall outlet.

C Materials of construction and compatible solvents



Warning: To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, you must address any safety issues raised by the contents of this Appendix. Doing so confirms the integrity of the source exhaust system.

C.1 Preventing contamination

For information on preventing contamination, refer to *Controlling Contamination in LC/MS Systems Best Practices* (715001307). You can find this document on www.waters.com; click **Services & Support > Support Library**.

C.2 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](#) for details about the most common ingredients used to prepare mobile phases.

Table C–1: 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

Table C–1: Items exposed to solvent: (continued)

Item	Material
Probe adjuster bellows	Viton
Probe shaft	PEEK
Pumping block	Aluminium and Xylan
Solvent waste/leak management	Tygon tubing 2375, polyurethane
Source enclosure	Aluminium
Source enclosure view port	Silica float glass
Trap bottle	Polypropylene
Trap bottle push-in fittings	Nitrile butadiene rubber, stainless steel, polybutylene terephthalate, and polyoxymethylene
APPI lamp drive assembly	
APPI lamp drive mounting shaft	Stainless steel
APPI lamp drive repeller electrode	Stainless steel
APPI lamp drive insulator	PEEK
APPI lamp window	Magnesium fluoride

C.3 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%)
- Ammonium acetate (<10 mM)
- Ammonium formate (<10 mM)

These solvents are not expected to adversely affect performance of the materials shown in the preceding table.

Note: Strong solvents used to prepare mobile phases for the normal-phase LC/MS (for example, hexane or tetrahydrofuran (THF)) will adversely affect the performance of the materials shown in the table [Items exposed to solvent](#) and must not be used. You must evaluate the safety issues if

these solvents are used as additives to the mobile phases at reduced concentration, or as sample diluents.

D Plumbing the IntelliStart Fluidics system

This section provides reference information for replacing the tubing in the IntelliStart Fluidics system.



Warning: To avoid electric shock, do not use stainless steel tubing or stainless steel finger-tight screws to connect the selector valve to the source probes; use the PEEK tubing and natural (beige) colored PEEK finger-tight screws.



Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

D.1 Preventing contamination

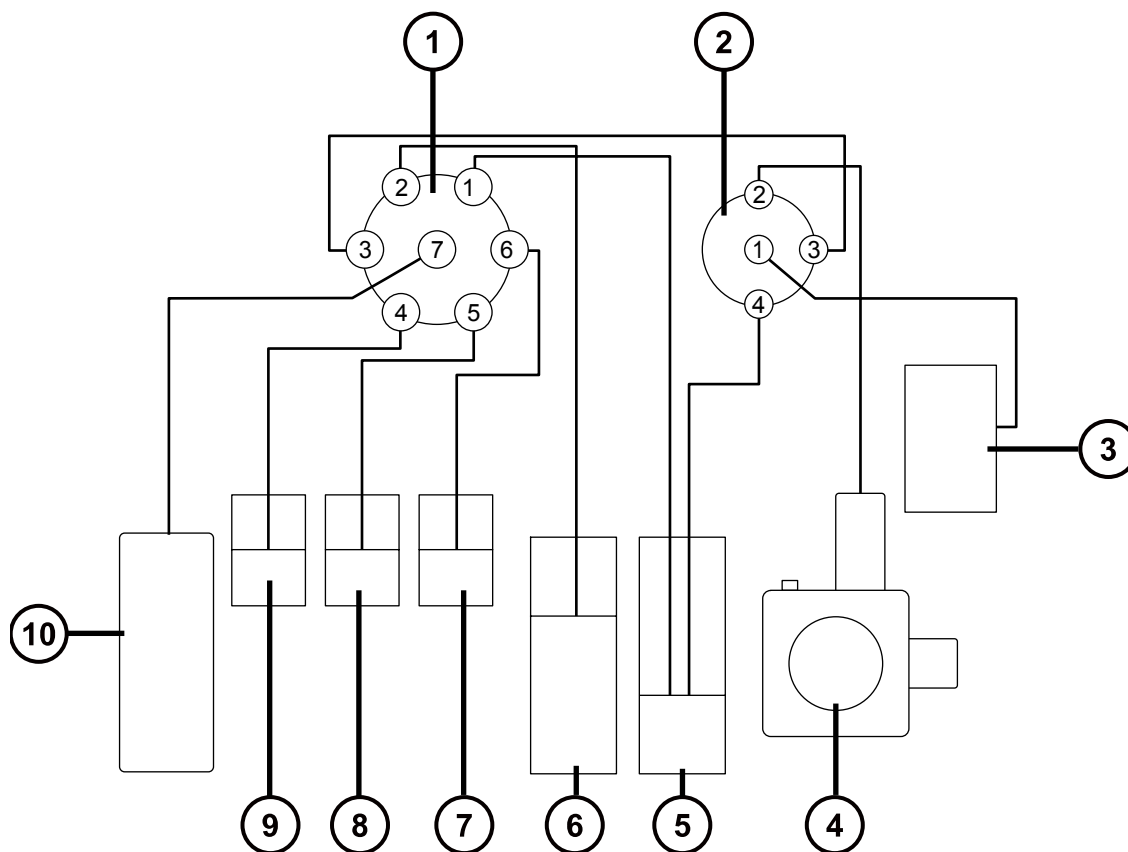
For information on preventing contamination, refer to *Controlling Contamination in LC/MS Systems Best Practices* (715001307). You can find this document on www.waters.com; click **Services & Support > Support Library**.

D.2 Plumbing schematic

For further information, refer to the diagram on the inside of the fluidics valve access door (see [Waters ACQUITY Xevo TQ-S UPLC/MS system](#)).

Requirement: Ensure that the end of the tubing is fully submerged in the solvent in the wash reservoir.

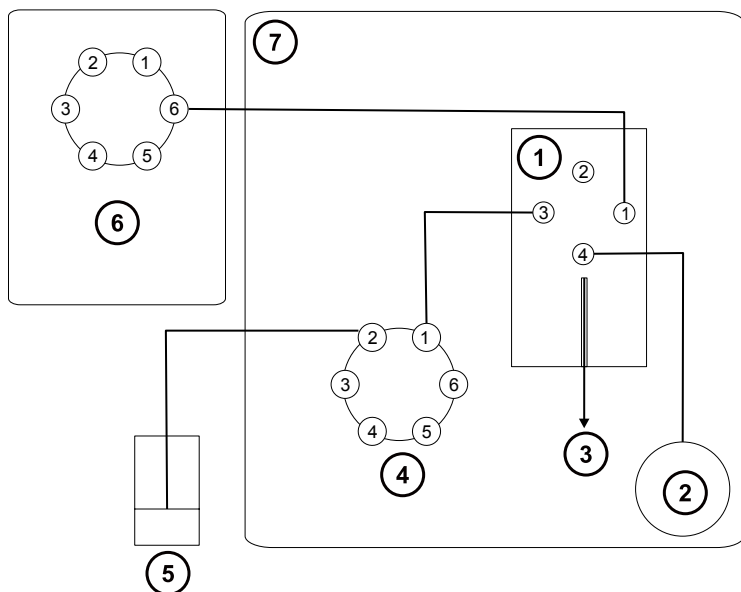
Figure D-1: Fluidics valve plumbing



- ① Selector valve
- ② Diverter valve
- ③ ACQUITY system
- ④ Source
- ⑤ Waste
- ⑥ Wash
- ⑦ Vial C
- ⑧ Vial B
- ⑨ Vial A
- ⑩ Analyte pump

D.3 ionKey and TRIZAIC source plumbing

Figure D–2: ionKey and TRIZAIC source plumbing



- ① TRIZAIC tile or iKey
- ② Syringe
- ③ Emitter
- ④ HTM trap valve (TRIZAIC only)
- ⑤ Waste
- ⑥ nanoACQUITY UPLC SM, AQUITY UPLC M-class μ SM, or trap device
- ⑦ ionKey or TRIZAIC source

D.4 Tubing specifications

The following table gives the internal diameter (ID), external diameter (ED), color, length, and quantity for the IntelliStart Fluidics tubing.

Table D–1: Replacement tubing specifications:

Connection	ID (inches)	ED (inches)	Color	Length (mm)	Quantity
Selector valve to diverter valve	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