

Waters
SYNAPT G2-Si
Mass Spectrometer
Overview and Maintenance Guide

715004102/Revision C

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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, and consult your organization's standard operating procedures.

When you develop methods, follow the "Protocol for the Adoption of Analytical Methods in the Clinical Chemistry Laboratory," *American Journal of Medical Technology*, 44, 1, pages 30–37 (1978). This protocol addresses good operating procedures and the techniques necessary to validate system and method performance.

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.

Considerations specific to the SYNAPT G2-Si system

Power cord replacement hazard



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

Solvent leakage hazard

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



Warning:

- To confirm the integrity of the source exhaust system, renew the source O-rings at intervals not exceeding one year.
- To avoid chemical degradation of the source O-rings, which can withstand exposure only to certain solvents (see [“Solvents used to prepare mobile phases” on page 355](#)), determine whether any solvents you use that are not listed are chemically compatible with the composition of the O-rings.

Spilled solvents hazard



Warning: To avoid injury or equipment damage caused by spilled solvent, do not place reservoir bottles on top of the instrument or on the front ledge, unless in the bottle tray provided.

Flammable solvents hazard



Warning: To prevent ignition of flammable solvent vapors in the enclosed space of a mass spectrometer's ion source, ensure that nitrogen flows continuously through the source. The nitrogen supply pressure must not fall below 4 bar (400 kPa, 58 psi) during an analysis requiring the use of flammable solvents. Also a gas-fail device must be installed, to interrupt the flow of LC solvent should the nitrogen supply fail.

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

Overload hazard



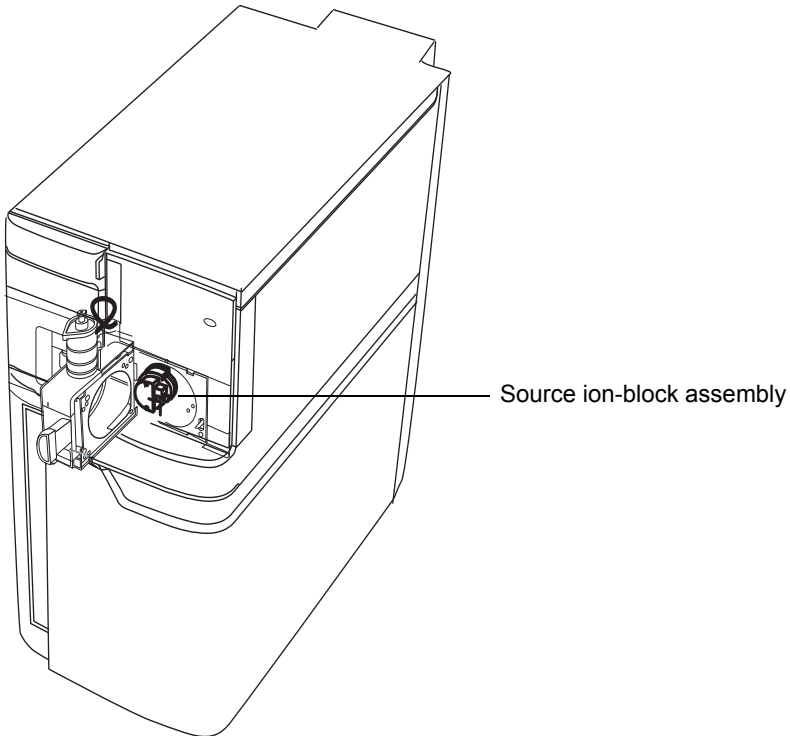
Warning: To avoid personal injury, ensure equipment placed on top of the instrument does not exceed 15 kg.

High temperature hazard



Warning: To avoid burn injuries, avoid touching the source enclosure when operating or servicing the instrument. Ensure the source heater is turned off and the ion block is cool before performing maintenance on these components.

Mass spectrometer high temperature hazard:



High voltage hazard



Warning:

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

Hazards associated with removing an instrument from service



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



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

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

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

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

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

Bottle placement prohibition



Prohibited: To avoid injury from electric shock or fire, and to prevent damage to the workstation and ancillary equipment, do not place objects filled with liquid—such as solvent bottles—on these items, or expose them to dripping or splashing liquids.

FCC radiation emissions notice

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

Electrical power safety notice

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

Equipment misuse notice

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





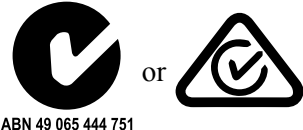




Safety advisories

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

Operating this instrument

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

Applicable symbols

Symbol	Definition
	Manufacturer
	Date of manufacture
	Authorized representative of the European Community
	Confirms that a manufactured product complies with all applicable European Community directives
 ABN 49 065 444 751	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.

Symbol	Definition
SN	Serial number
REF	Part number catalog number

Audience and purpose

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

Intended use of the SYNAPT G2-Si Mass Spectrometer

The instrument is a hybrid quadrupole/orthogonal acceleration, time-of-flight (oa-TOF) mass spectrometer.

Waters designed the SYNAPT[®] G2-Si Mass Spectrometer to be used as a research tool to deliver authenticated, exact-mass measurement. The SYNAPT G2-Si Mass Spectrometer is not intended for use in diagnostic applications.

Calibrating

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

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

Quality-control

Routinely run three QC samples that represent subnormal, normal, and above-normal levels of a compound. 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.

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 IEC CISPR 11 Industrial Scientific and Medical (ISM) instruments requirements. Group 1 products apply to intentionally generated and/or used conductively coupled radio-frequency energy that is necessary for the internal functioning of the equipment. Equipment defined as Class A is suitable for use in all establishments other than domestic establishments. Class A equipment can be directly connected to a low-voltage power-supply network that supplies buildings used for domestic purposes.

EC authorized representative



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1 System Overview

This chapter describes the SYNAPT[®] G2-Si Mass Spectrometry (MS) system, including its controls, sources, and IntelliStart[™] Fluidics system.

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Waters Mass Spectrometer

The SYNAPT G2-Si MS is a hybrid, quadrupole/orthogonal acceleration, time-of-flight (oa-ToF) mass spectrometer controlled by MassLynx[®] software.

One of the following high-performance, ZSpray[™], dual-orthogonal, API sources is fitted as standard equipment:

- LockSpray[™] ESI/APCI/ESCI[®] source (see [page 35](#)).
- NanoLockSpray[™] ESI source (see [page 36](#)).

You can also use the following optional sources:

- Dual-mode APPI/APCI (see *Waters Dual-Mode [APPI/APCI] Source for Xevo and SYNAPT G2-Si Instruments Operator's Guide*).
- MALDI (see the *Waters MALDI SYNAPT G2-Si Mass Spectrometry Overview and Maintenance Guide*).
- ionKey[™] Source (see [page 40](#), and the *ionKey/MS System Guide*, part number 715004028).

For the instrument specifications, see the *Waters SYNAPT G2-Si Site Preparation Guide*.

The instrument comprises several autonomous systems that work in conjunction:

- SYNAPT G2-Si UPLC[®]/MS/MS system.
- An embedded personal computer running several support and control applications.
- A workstation running MassLynx control software, including the IntelliStart fluidics system, which is the main user interface.
- Vacuum and backing pumps, source handling and supply equipment.

SYNAPT G2-Si UPLC/MS/MS systems

The Waters[®] SYNAPT G2-Si MS is compatible with the ACQUITY UPLC[®], ACQUITY UPLC[®] H-Class, ACQUITY UPLC[®] I-Class, and ACQUITY UPLC[®] M-Class systems. If you are not using any of those systems, refer to the documentation relevant to your LC system.

ACQUITY UPLC SYNAPT G2-Si UPLC/MS/MS system

The ACQUITY UPLC SYNAPT G2-Si MS UPLC[®]/MS/MS system includes an ACQUITY UPLC system and the Waters SYNAPT G2-Si fitted with the LockSpray ESI/APCI/ESCI source.

The ACQUITY UPLC system includes a binary solvent manager, sample manager, column heater, sample organizer, detectors, and a specialized ACQUITY UPLC column.

See also: The *ACQUITY UPLC System Operator's Guide* or *Controlling Contamination in UPLC/MS and HPLC/MS Systems* (part number 715001307). You can find the latter document online at <http://www.waters.com>; click Services & Support > Support Library.

ACQUITY UPLC H-Class SYNAPT G2-Si UPLC/MS/MS system

The ACQUITY UPLC H-Class SYNAPT G2-Si MS UPLC[®]/MS/MS system includes an ACQUITY H-Class UPLC system and the Waters SYNAPT G2-Si fitted with the LockSpray ESI/APCI/ESCI source.

The ACQUITY UPLC H-Class system includes a quaternary solvent manager, direct inject sampling, Auto Blend Plus technology, and SmartStart technology.

See also: The *ACQUITY UPLC H-Class System Operator's Guide* or *Controlling Contamination in UPLC/MS and HPLC/MS Systems* (part number 715001307). You can find the latter document online at <http://www.waters.com>; click Services & Support > Support Library.

ACQUITY UPLC I-Class SYNAPT G2-Si UPLC/MS/MS system

The ACQUITY UPLC I-Class SYNAPT G2-Si MS UPLC[®]/MS/MS system includes an ACQUITY I-Class UPLC system and the Waters SYNAPT G2-Si fitted with the LockSpray ESI/APCI/ESCI source.

The ACQUITY UPLC I-Class system includes binary high-pressure mixing, sample injection versatility, a sample organizer, and CORTECS UPLC columns.

See also: The *ACQUITY UPLC I-Class System Operator's Guide* or *Controlling Contamination in UPLC/MS and HPLC/MS Systems* (part number 715001307). You can find the latter document online at <http://www.waters.com>; click Services & Support > Support Library.

ACQUITY UPLC M-Class SYNAPT G2-Si UPLC/MS/MS system

The ACQUITY UPLC M-Class SYNAPT G2-Si MS UPLC[®]/MS/MS system includes an ACQUITY M-Class UPLC system and the Waters SYNAPT G2-Si fitted with the NanoFlow ESI, or NanoLockSpray, source.

The ACQUITY UPLC M-Class system includes direct automatic solvent flow control algorithms, non-reactive surfaces and flexible configurations for HDX technology, UV detection, and 2D analysis.

See also: The *ACQUITY UPLC M-Class System Operator's Guide* or *Controlling Contamination in UPLC/MS and HPLC/MS Systems* (part number 715001307). You can find the latter document online at <http://www.waters.com>; click Services & Support > Support Library.

Software

The software described here runs on the workstation PC.

IntelliStart

IntelliStart software monitors the mass spectrometer's status and reports when the instrument is ready for use. The software automatically mass calibrates the instrument and displays performance read backs. Integrated with MassLynx software and Instrument Console software, IntelliStart software enables simplified setup of the system for use in routine analytical and open-access applications. See the mass spectrometer's online Help for further details about IntelliStart technology.

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 reservoir bottles. The reservoir bottles can also deliver sample through direct or combined infusion so that you can optimize instrument performance at analytical flow rates. An additional reservoir contains solvent for the automated flushing of the solvent delivery system.

For further details, see [“IntelliStart Fluidics system” on page 31](#).

1. In this document, the term “fluidics” is used to describe plumbing components and fluid pathways within and between instruments and devices.

MassLynx

MassLynx software controls the mass spectrometer. A high-performance application, it acquires, analyzes, manages, and distributes mass spectrometry, ultraviolet (UV), evaporative light scattering, and analog data.

MassLynx enables these major operations:

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

See the MassLynx 4.1 user documentation and online Help for more information on using MassLynx software.

Instrument Console

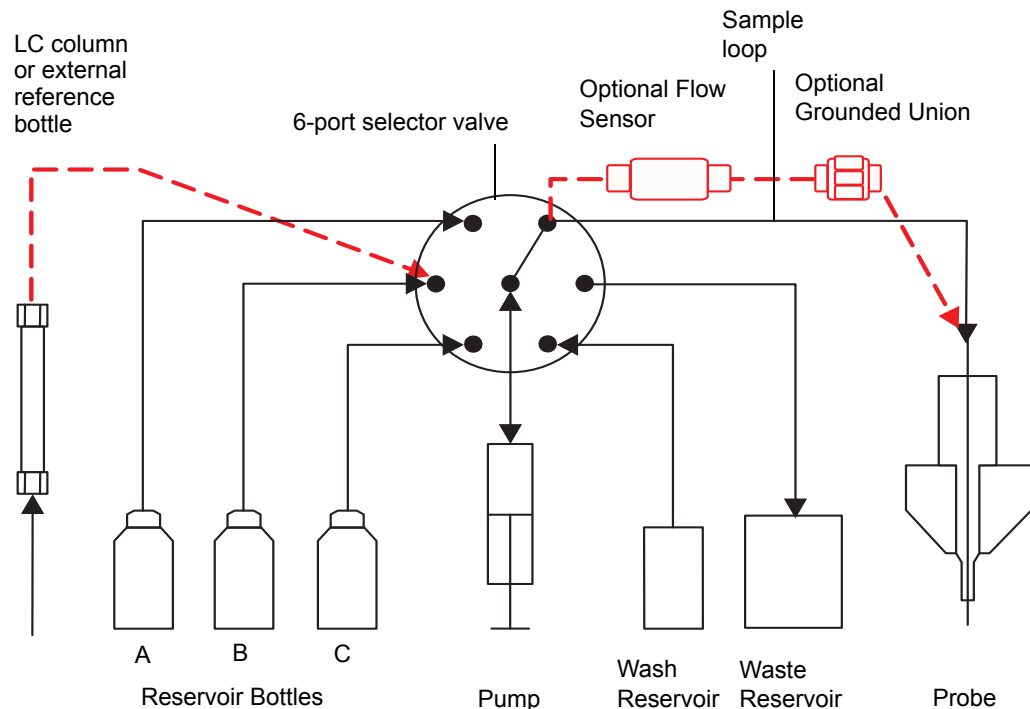
The Instrument Console is the main user interface of the SYNAPT G2-Si. Using Instrument Console software, you configure settings, monitor performance, run diagnostic tests, and maintain the system and its modules. The software functions independently of MassLynx software and does not recognize or control the data systems.

See the Instrument Console system online Help for details.

IntelliStart Fluidics system

Overview

IntelliStart Fluidics system:



The IntelliStart Fluidics system is built into the instrument; it controls how sample is delivered to the source. The figure above presents a simplified schematic; system connections differ according to whether you are using a LockSpray or NanoLockSpray ion source. See [page 242](#).

1 System Overview

For standard flow applications, the system delivers sample directly to the mass spectrometer source in one of three ways:

- From the LC column.
- From three integral reservoir bottles.
Tip: The reservoir bottles can also deliver sample through direct or combined infusion, to enable optimization at analytical flow rates.
- From a wash reservoir that contains solvent for flushing the instrument's solvent delivery system.

For nanoACQUITY UPLC and ACQUITY UPLC M-Class systems, the valves and pumps that make up the IntelliStart Fluidics system introduce dead volume, which causes unacceptable peak broadening. For this reason, the nanoACQUITY UPLC and ACQUITY UPLC M-Class systems are plumbed directly to the NanoFlow™ sprayer using a suitably short piece of silica tubing.

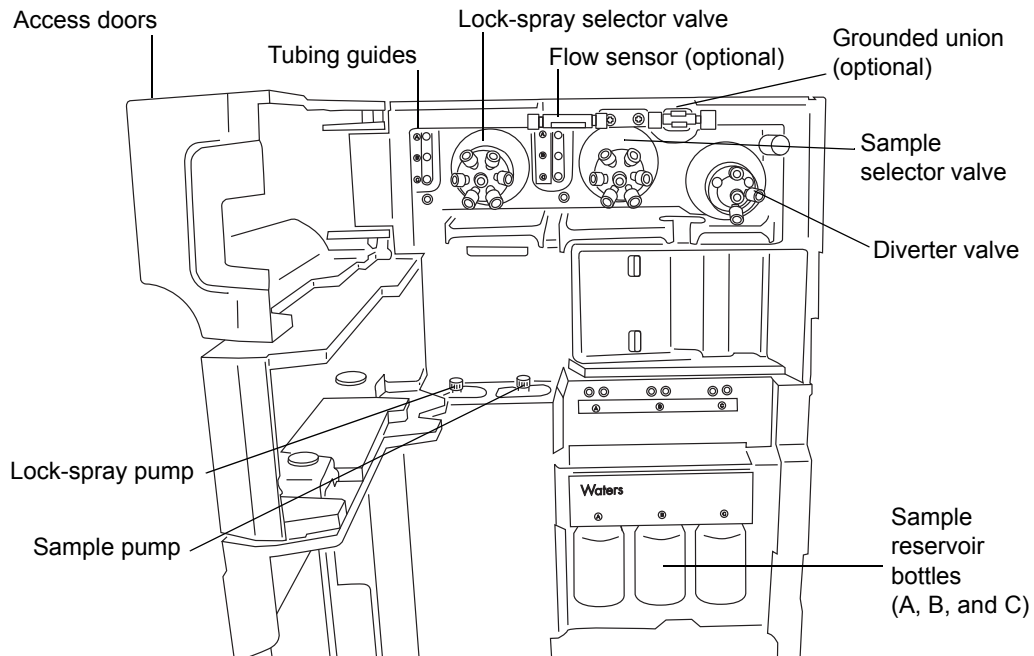
For reference flows for the LockSpray, NanoLockSpray, or ionKey source, the IntelliStart Fluidics system typically delivers reference solution from reservoir bottle B or, for extended operating hours, from a separate, external bottle of reference solution.

IntelliStart Fluidics physical layout

The IntelliStart Fluidics system comprises the components shown in the following figure.

Note: Tubing connections are omitted for clarity.

System components and configuration:



The IntelliStart Fluidics system consists of these components:

- A sample delivery system, with a rate pump, sample-selector valve and diverter valve used for LC and probe connections.
- A lock-spray system, with a pump capable of ultra-low flow rates, a lock-spray selector valve, flow sensor, and grounded union. The grounded union protects the flow sensor from probe voltages. The flow sensor regulates flow rate, reducing it to accommodate the very low volumes required by the NanoLockSpray source.
Note: The flow sensor and grounded union are optional fittings with LockSpray, but standard fittings if you use the NanoLockSpray source.
- Three shared, 30 mL sample reservoir bottles: A, B, and C.
- Plumbing for shared wash and waste bottles.

Sample reservoir bottles A, B, and C are mounted on the instrument's front panel. When you select a solvent in the Instrument Console software, its reservoir bottle is illuminated. You can simultaneously illuminate all three reservoir bottles, or extinguish the illumination when you are using light-sensitive samples. Generally, reservoir bottle A contains the sample solution, reservoir bottle B the reference solution, and reservoir bottle C the calibrant solution.

The wash reservoir and (optionally) the reservoir containing reference solution are external to the instrument. The waste reservoir is normally a bottle stored under the instrument bench.

Requirement: During normal operation, the IntelliStart Fluidics system's access doors must be closed.

Instrument sources

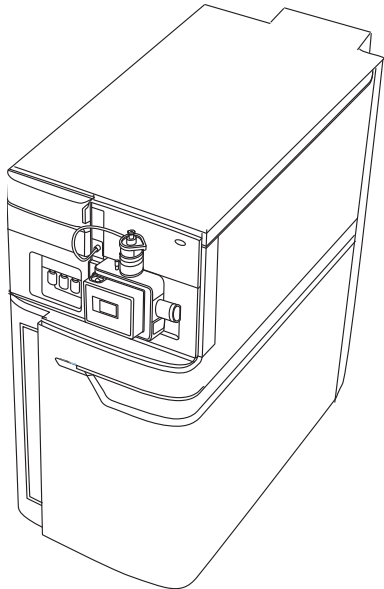
LockSpray source and ionization modes

The LockSpray source uses lock-mass correction to acquire exact-mass data. The sample is introduced into the source through a probe. A lock-spray flow, containing a compound of known mass, flows through a separate ESI probe (the LockSpray sprayer). An oscillating baffle allows the sprays to be analyzed as two separate data functions. The lock-mass correction, calculated from the lock-spray data, is then applied to the sample data set.

You can use the LockSpray source with the following ionization modes:

- ESI
- APCI
- ESCi
- NanoLockSpray

SYNAPT G2-Si fitted with LockSpray source:



Electrospray ionization

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.

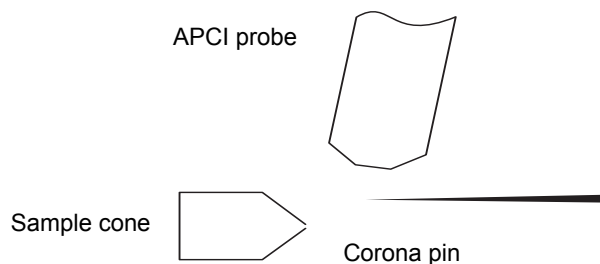
To operate the LockSpray source in ESI mode, you fit the source enclosure with an ESI probe. The standard ESI probe capillary accommodates flow rates of up to 2 mL/min making it suitable for LC applications in the range 100 μ L/min to 2 mL/min. To reduce peak broadening for lower flow rate LC applications, such as 1 mm UPLC columns, choose the small-bore capillary option that can best accommodate a maximum flow rate of up to 200 μ L/min.

Atmospheric pressure chemical ionization

Atmospheric pressure chemical ionization (APCI) produces singly charged protonated or deprotonated molecules for a broad range of nonvolatile samples.

To operate the LockSpray source in APCI mode, you fit the source enclosure with a corona pin and an APCI probe. Mobile phase from the LC column enters the probe, where it is pneumatically converted to an aerosol, rapidly heated, and vaporized or gasified at the probe tip.

APCI mode:



Hot gas from the APCI probe passes between the sample cone and the corona pin. Mobile phase molecules rapidly react with ions generated by the corona discharge to produce stable reagent ions. Sample 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.

Combined electrospray and atmospheric pressure chemical ionization

In combined electrospray and atmospheric pressure chemical ionization (ESCI) mode, the standard ESI probe is used in conjunction with a corona pin to allow alternating acquisition of ESI and APCI ionization data, facilitating high-throughput processing and wider compound coverage.

NanoLockSpray source

The NanoLockSpray source performs electrospray ionization in the flow rate range of 5 to 1000 nL/min.

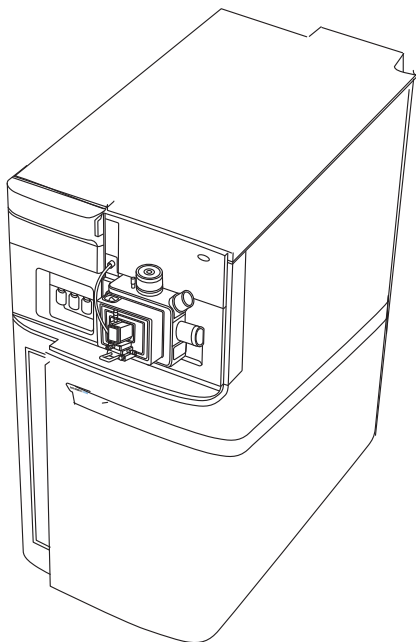
For a given sample concentration, the ion currents for similar experiments approximate those in normal flow rate electrospray. Because sample consumption is greatly reduced however, the sensitivity gains are significant when you adopt similar scan parameters. Lock-mass correction with the NanoLockSpray source works in the same way as the LockSpray source does with ESI.

The NanoLockSpray source enclosure consists of a universal, borosilicate glass capillary sprayer mounted on a ZSpray, three-axis manipulator.

The combined unit is mounted on the NanoFlow stage, which runs on a pair of guide rails, with two defined positions.

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.

SYNAPT G2-Si fitted with NanoLockSpray source:



The following options are available for the spraying capillary:

- Universal NanoFlow nebulizer sprayer.
This option, for flow injection or coupling to the nanoACQUITY UPLC and ACQUITY UPLC M-Class systems, uses a pump to regulate the flow rate as low as 100 nL/min.
- Borosilicate glass capillary NanoFlow (nano reservoir bottles).
This option uses metal-coated glass capillaries, which allow the lowest flow rates. Usable for one sample only, they must then be discarded.

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 electrospray or IonSABRE™ II 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* for further details.

Dual-mode ionization source

Atmospheric pressure photoionization (APPI) uses photons generated by a discharge UV lamp (~10.2 eV) to produce sample ions from vaporized LC eluent. Direct photoionization of the sample molecule occurs when the photon energy exceeds the ionization potential of the sample molecule.

The optional dual-mode (APPI/APCI) ionization source incorporates an APPI source enclosure used in conjunction with a standard APCI probe. You can operate the source in APPI, APCI, or dual-mode, which switches rapidly between ionization modes, facilitating high-throughput analyses.

See also: The *Waters SYNAPT G2-Si Dual-mode Ionization Source Operator's Guide*.

Matrix-assisted laser desorption ionization

The matrix-assisted laser desorption ionization (MALDI) interface enables rapid, tool-free switching between API and MALDI modes. A motorized stage moves the MALDI source into position.

See also: The *Waters MALDI SYNAPT G2-Si Overview and Maintenance Guide*.

ionKey source

The ionKey source performs UPLC separation inside the source of the mass spectrometer.

The source precisely positions the iKey™ separation device and integral emitter in the mass spectrometer. All fluid, electronic connections (heater and electrospray high voltage), and gas connections (sheath gas) are made inside the source, eliminating the need to manually connect electronic cables and tubing.

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

Tip: The ionKey source is also compatible with nanoACQUITY UPLC systems.

See also: [“Installing and removing the ionKey source”](#).

System operation

The mass spectrometer consists of four principal components:

- Source with StepWave™ ion guide
- Quadrupole
- Triwave® device
- TOF mass analyzer

Ionized sample produced in the source travels through the quadrupole and Triwave device. The TOF detector system records mass spectra as its output.

Using MassLynx and the instrument control software, you control, configure, and operate the instrument.

You use the console software to configure the IntelliStart Fluidics system. You can edit the parameters, frequency, and extent of the automation. Consult the mass spectrometer's online Help for detailed information about IntelliStart software and operating the IntelliStart Fluidics system.

During auto-calibration, the software automatically controls reference solution and sample delivery.

Ion optics

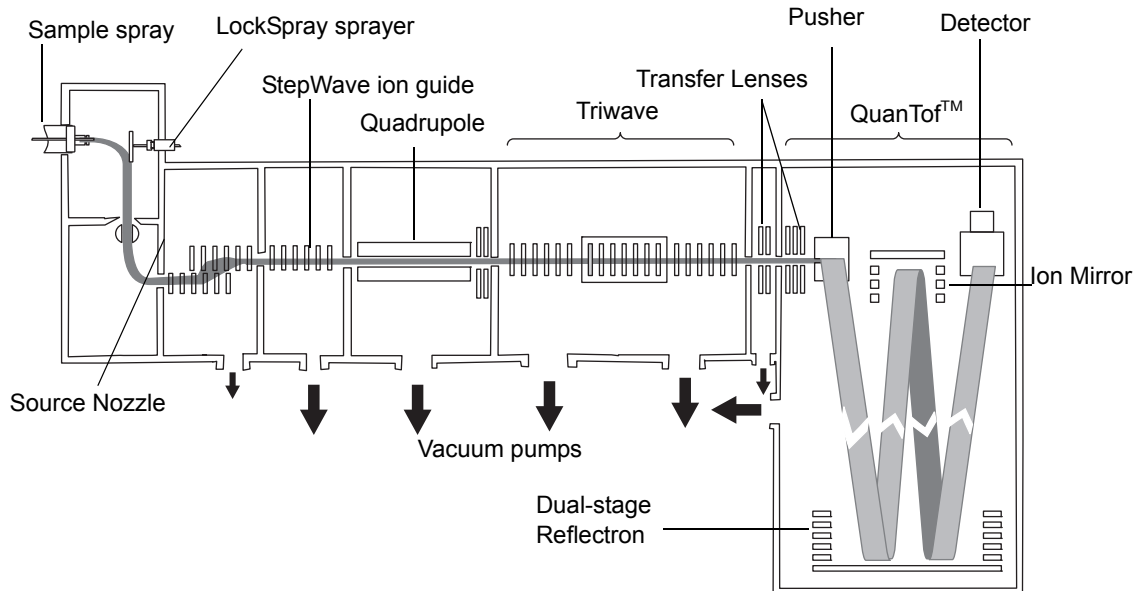
The mass spectrometer's ion optics operate as follows:

1. Samples from the LC or instrument's solvent delivery system are introduced at atmospheric pressure into the ionization source.
2. The resulting ion beam passes through the source sampling orifice and, in doing so, undergoes expansion.
3. 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 and directs it to the second stage, a narrow bore ion guide. The off-axis design ensures that any neutral materials entering the source sampling orifice are actively extracted from the system.
4. The focussed ions then enter the quadrupole, where they are separated (filtered) according to mass-to-charge ratio.

1 System Overview

5. The mass-separated ions pass into the Triwave region, where they can undergo collision-induced dissociation (CID).
6. The ions then pass into the time-of-flight (TOF) analyzer. A high-voltage pulse orthogonally accelerates the ions down the flight tube, where the dual-stage reflectron reflects them towards the ion mirror, which, in turn, reflects the ions back to the dual-stage reflectron. The dual-stage reflectron then reflects the ions to the detector. Ions of different mass-to-charge ratios arrive at the detector at different times, hence a mass spectrum can be created.
7. The signal from the detector is amplified, digitized, and sent to the MassLynx software.

Ion optics overview:



Analyzers

The system uses both quadrupole and time-of-flight (TOF) mass analyzers.

Quadrupole

The quadrupole is available with 4, 8, and 32 kDa mass range options, and you can operate it in the following modes:

- Without applying the resolving DC voltage – a broad mass-to-charge range of ions passes through, and the TOF analyzer accurately measures their mass (MS acquisition).
- Applying the resolving dc voltage and selecting a specific mass.
- With the instrument automatically switching between MS and MS/MS modes – known as Data Directed Analysis (DDA[™]), this operation depends on the ions detected in an MS scan.

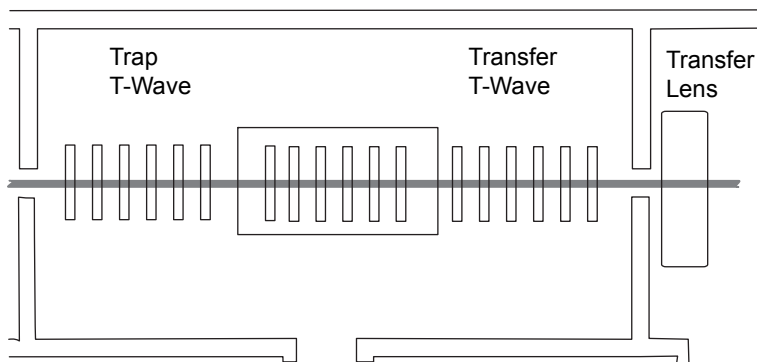
Triwave device

The Triwave device consists of three T-Wave™ ion guides. It transfers ions from the quadrupole to the ToF with optimum efficiency, and it provides two separate collision-cell regions (TRAP and TRANSFER T-Waves) for optimized fragmentation of compounds of interest. The collision energy, and hence the degree of fragmentation, is manually or automatically controllable.

Triwave technology incorporates three T-Wave™ devices, each performing a distinct function:

- The first T-Wave ion guide (Trap) is automatically configured. It transfers ions to the second T-Wave ion guide and can function as a collision cell.
- The second T-Wave ion guide transfers ions to the third T-Wave ion guide.
- The third T-Wave ion guide (Transfer) can function as a collision cell and transfers ions via the transfer lens to the oa-ToF™ for mass analysis.

Triwave technology:



Consult the mass spectrometer's online Help for details.

TOF analyzer

With its associated detector, the TOF records mass spectra derived from the ions' time of flight. A high voltage pulse orthogonally accelerates the ions by pushing them out across their direction of travel, into a flight tube. A reflectron reflects the ions back toward the detector.

Ions of different mass-to-charge ratios evidence different flight times. When the detector records the time an ion arrives, that time is converted to mass and plotted against abundance to create a mass spectrum.

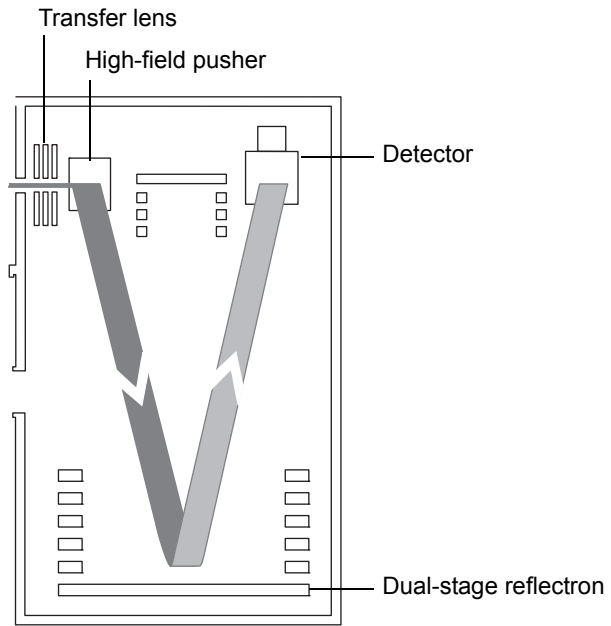
Users can define recorded mass-to-charge ratios up to 100,000 Da in single-pass mode, or 32,000 Da in double-pass mode.

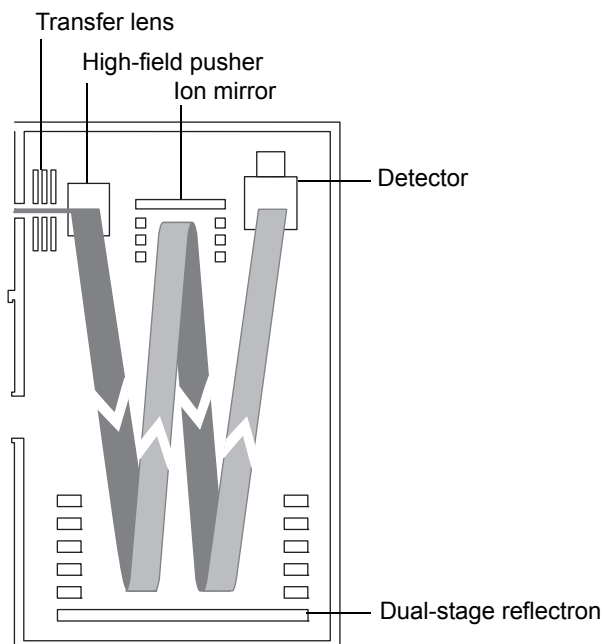
The orthogonal-acceleration, dual-reflectron geometry of the TOF analyzer provides high resolution and exact-mass capabilities. You can operate the analyzer in the modes described in this table.

TOF analyzer operating modes:

Resolving mode	Description
Sensitivity	Maximum sensitivity using single-pass TOF. In this mode, the ions travel from the high-field pusher to the dual-stage reflectron and then to the detector (see the figure on page 46).
Resolution	Highest resolution using single-pass TOF.
High-resolution	This double-pass TOF mode offers higher resolution than the single-pass resolution mode. Ions travel between the analyzer components in the following sequence: <ul style="list-style-type: none"> • From the high-field pusher to the dual-stage reflectron. • From the dual-stage reflectron to the ion mirror. • From the ion mirror back to the dual-stage reflectron. • From the dual-stage reflectron to the detector. See the figure on page 47 .
Enhanced-resolution	This double-pass TOF mode offers the highest resolution.

Sensitivity and Resolution mode:



High Resolution mode:**High Resolution and Enhanced Resolution modes:**

Leak sensors

Leak sensors in the drip trays of the SYNAPT G2-Si continuously monitor the instrument's IntelliStart Fluidics system for liquid leaks. A leak sensor stops system flow when it detects about 1.5 mL of accumulated leaked liquid in its surrounding reservoir. At the same time, the Instrument Console software displays an error message alerting you that a leak has developed.

See also: *Waters ACQUITY UPLC Leak Sensor maintenance instructions* (part number 71500082506).

Vacuum system

The vacuum system consists of two backing pumps (optional, dry or wet) and six turbomolecular pumps that pump down (evacuate) these regions of the system:

- Source StepWave ion guide

1 System Overview

- Triwave device (two)
- Quadrupole
- Transfer lenses
- Time-of-flight (TOF) analyser

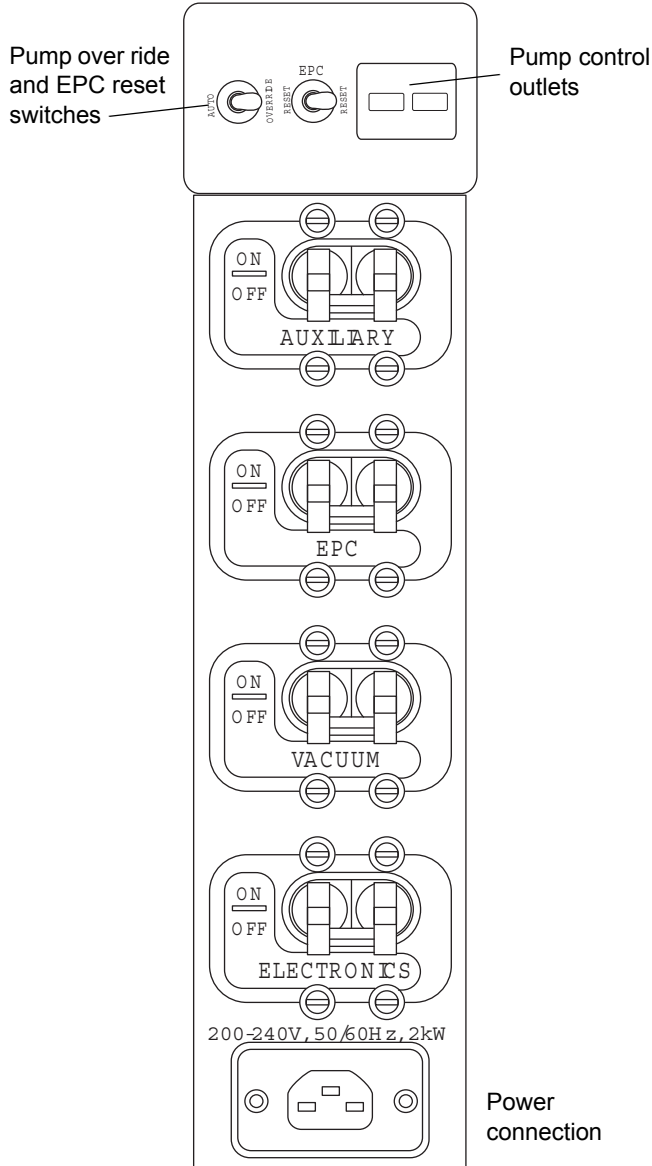
Protective interlocks guard against vacuum leaks and electrical or vacuum pump failure. The system monitors the turbomolecular pump speeds and continuously measures vacuum pressure with built-in gauges. The gauges also serve as switches, stopping operation when vacuum loss is sensed.

A vacuum isolation valve isolates the sample cone from the mass analyzer, allowing the sample cone to be cleaned without venting the instrument.

Controls on the instrument's rear panel

The main power switches are on the instrument's rear panel. For other external connections see the figure on [page 318](#).

Main power switches:



Main power switches:

Switch	Description
Pump override	Used during servicing, this control must remain in the Auto position at all other times.
EPC reset	Used to reboot the embedded PC (EPC). Requirement: The electronics and EPC switches must be switched on.
Auxiliary	This switch provides a spare power source for the MALDI option if fitted and for future needs.
EPC	This switch controls the power supply to the embedded PC. It allows the PC to be isolated without affecting power to other instrument electronics fed from the electronics switch.
Vacuum	This switch controls the power supply to the vacuum pumps and system vents.
Electronics	This switch controls the power supply to the main control electronics, the embedded PC and auxiliary components.

Connections on the instrument's rear panel

Details of system connections made via the instrument rear panel are provided in [Appendix B](#).

2 Starting Up and Shutting Down the Mass Spectrometer

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

Contents:

Topic	Page
Starting the mass spectrometer	52
Preparing the IntelliStart Fluidics system	56
Stopping the mass spectrometer	60
Rebooting the embedded PC	62

Note: The Startup, Shutdown and Edit Startup/Shutdown buttons on the MassLynx Instrument console are not for general use. They are associated with programming lengthy automatic tasks that may start or continue outside normal working hours.

Starting the mass spectrometer

The Waters[®] SYNAPT G2-Si MS is compatible with the ACQUITY UPLC[®], ACQUITY UPLC[®] H-Class, ACQUITY UPLC[®] I-Class, and ACQUITY UPLC[®] M-Class systems. If you are not using any of those systems, refer to the documentation relevant to your LC system.

- ! **Notice:** To avoid causing severe damage to the instrument, use only compatible solvents. For more details, refer to the following sources:
- [Appendix C, “Materials of construction and compliant solvents”](#), for mass spectrometer solvent information.
 - Appendix C of the *ACQUITY UPLC System Operator’s Guide* (part number 71500082502), for solvent compatibility with ACQUITY UPLC devices.

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

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

See the mass spectrometer’s online Help for details about MassLynx and IntelliStart applications.



Warning: To avoid ignition of flammable solvents, never let the nitrogen supply pressure fall below 4 bar (400 kPa, 58 psi).

To start the mass spectrometer:

1. Ensure that all the mass spectrometer’s external connections are in place (see [Appendix B, “External Connections”](#)) and gas supplies are available.
2. Power-on the MassLynx PC and log in before powering-on the other instruments.

3. If using the ACQUITY UPLC, turn on power to the ACQUITY[®] module containing the Ethernet switch (for example the high temperature heater/cooler or the column manager).

Requirement: The ACQUITY UPLC module that contains the Ethernet switch must be turned on first to allow communications to be established.

4. On the instrument's rear panel, ensure that the pump override switch is in the auto position, and the EPC, vacuum, and electronics main power switches are switched on (see [page 49](#)).

Result: Each system component runs a series of startup tests. The illuminated strip at the front of the instrument flashes white until communication with the control system is established.


5. Allow four minutes for the embedded PC to initialize.

6. Start the MassLynx software.

Tip: You can monitor the Instrument Console for messages and LED indications.

7. 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.

8. Click Operate  and wait a minimum of two hours for the instrument to fully pump down (become evacuated) and for heater temperatures to stabilize.

Result: When the mass spectrometer is ready to operate, IntelliStart software displays "Ready" in the Instrument Console. The Operate button changes from red to green.

- ! **Notice:** To avoid damaging the iKey separation device (where fitted), set the capillary voltage to zero when you leave the mass spectrometer in Operate mode and solvent is not flowing.

SYNAPT G2-Si illumination strip

The illumination strip on the front panel displays information regarding the power and instrument status.

Strip LED Indications:

Event	Color	Notes
Power on	Flashing white	Occurs from power-on until initiation files are loaded
EPC is booted and communication established	Solid white	Stops flashing when boot sequence is completed
MassLynx starts	Blue	Instrument software is running
MassLynx is closed	Solid white	Software is disconnected
Reboot EPC when MassLynx is connected	Flashes white then solid white	Flashes until the .ini file reloads; changes to solid white when rebooting ends
Reboot EPC when MassLynx is not running	Solid white changes to flashing white	Indicates power is on
Alert	Red	Error indicated in MassLynx. Intellistart indicates reason

Calibration information

You must calibrate the mass spectrometer prior to use. You can perform this task using IntelliStart software. See the mass spectrometer's online Help.

Flow rates for the ACQUITY UPLC SYNAPT G2-Si UPLC/MS/MS system

The ACQUITY UPLC system can run at high flow rates. To optimize desolvation, and thus sensitivity, run the ACQUITY UPLC SYNAPT G2-Si UPLC/MS/MS system at appropriate gas flows and desolvation temperatures.

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	100	200	800

Flow rate versus temperature and gas flow:

Flow rate (mL/min)	Source temperature (°C)	Desolvation temperature (°C)	Desolvation gas flow (L/h)
0.020 to 0.100	120	350	800
0.101 to 0.300	120	450	800
0.301 to 0.500	150	500	1000
>0.500	150	600	1200

Preparing the IntelliStart Fluidics system

For additional information, see [“Connecting the liquid waste line” on page 339](#).

Installing the reservoir bottles

Use standard reservoir bottles (30-mL) for instrument setup and calibration. To infuse relatively small volumes, use low-volume reservoir bottles with the Low-volume Adaptor Kit (included). The volume of the low-volume reservoir bottles is 1.5 mL.



Warning: To avoid injury or equipment damage caused by spilled solvent, do not place reservoir bottles on top of the instrument, unless in the bottle tray provided.



Notice: When the waste bottle(s) are not secured they should be visible to the operator so they can not be accidentally knocked over.

Required materials:

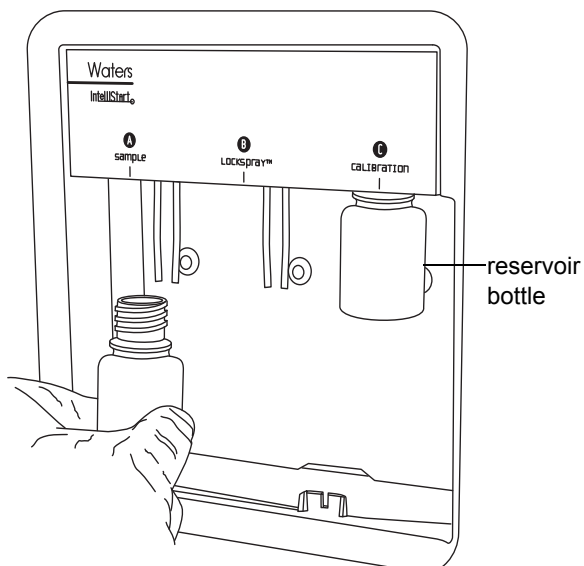
Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure.

To install the reservoir bottles:

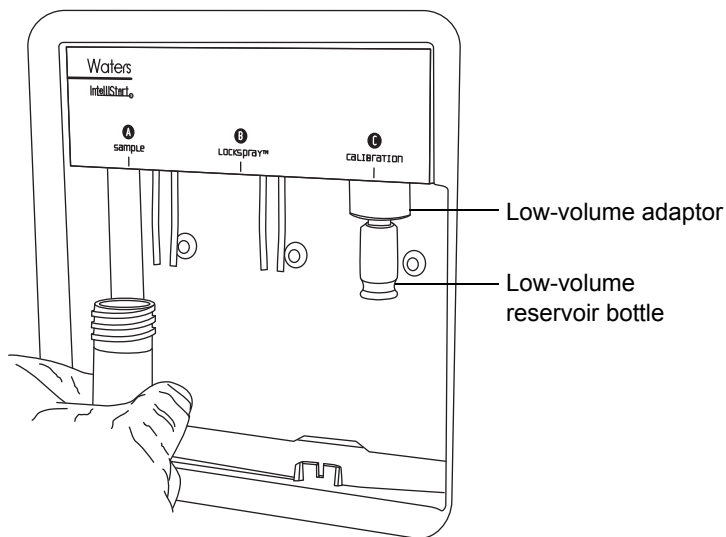
1. Remove the reservoir bottle caps.
2. Screw the reservoir bottles onto the mass spectrometer, as shown below.



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure.

To install the low-volume reservoir bottles:

1. Remove the standard reservoir bottles if fitted.
2. Screw the low-volume adaptors into the manifold and finger-tighten them.
3. Remove the low-volume reservoir bottle cap.



Warning: To avoid shattering the low-volume reservoir bottles and possibly lacerating fingers, do not grip the bottles tightly when screwing them into the adaptors.

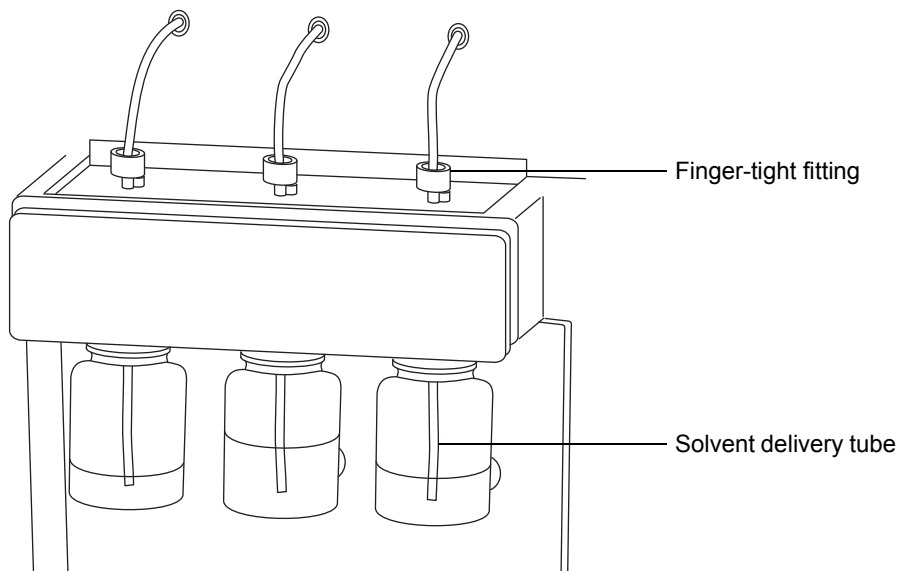
4. Carefully screw the low-volume reservoir bottles into the adaptors.

Adjusting the solvent delivery tube positions

For correct operation of the IntelliStart Fluidics system, you must adjust each solvent delivery tube so that its end is close to, but does not touch, 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 (see the [figure “System components and configuration:”](#) on page 33).
2. Loosen the finger-tight fitting for the solvent delivery tube you are adjusting.



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

Purging the pump

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

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

Tip: Depending on the solutions used, the system can require more than one purge cycle to minimize carry over.

Stopping the mass spectrometer

You can stop the system by putting it in Source Standby mode or by fully shutting it down.

Put the mass spectrometer in the Source Standby mode in the following cases:

- When performing routine maintenance.
- When changing the source.
- When leaving the mass spectrometer unused for any period such as work breaks, overnight, or holiday.

Putting the mass spectrometer in Source Standby mode


In the Tune window, click .

Result: Doing so turns off the capillary voltages, gas flows, Intellistart Fluidics system, and LC system.

Tip: Vacuum and some heaters remain operational to enable quick restart.

Fully shutting down the mass spectrometer

To fully shut down the mass spectrometer:

1. In the Tune window, click .
2. Click Vacuum > Vent.
3. Select Vent Instrument.
Result: A message confirms the vent command.
4. Click OK.
Result: The instrument automatically vents. After approximately five minutes, the turbomolecular pumps slow to half their normal operating speed.
5. Exit the MassLynx software.
6. Shut down the PC.
7. Switch off all the peripherals.
8. Switch off the vacuum, electronics, the embedded PC and auxiliary breakers located on the rear panel.

Rebooting the embedded PC

Reboot the embedded PC when any of these conditions applies:

- The MassLynx software fails to initialize.
- The MassLynx does not respond to user actions.
- Immediately following a software upgrade.

When rebooting, do not switch off power to the instrument, doing so vents the instrument.

To reboot the embedded PC:

1. In the MassLynx software, close the Tune window.
2. On the instrument's rear panel, toggle the EPC Reset switch (see chapter 1 "[Main power switches:](#)").
3. Wait four minutes to allow full reboot.

Result: The LED strip turns solid white.

4. Start the MassLynx software and monitor the instrument console for messages and indications.

3 Configuring the LockSpray Source

This chapter explains how to configure the Electrospray source for the following ionization modes:

- ESI
- APCI
- ESCi

Contents:

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Configuring the LockSpray source.....	63
Configure for ESI mode	64
Installing the ESI small bore capillary option	70
APCI mode	76
Combined APPI/APCI source	80
Configuring for ESCi mode.....	87

Configuring the LockSpray source

The following table summarizes how you configure the LockSpray source for the various ionization modes.

Configuring the LockSpray source:

Ionization mode	Probe type	Corona pin fitted?
ESI	ESI	No
APCI	APCI	Yes
ESCI	ESI	Yes

Configure for ESI mode

To operate in ESI mode, you must fit the ESI probe to the LockSpray source enclosure. For more information on using ESI mode, see the SYNAPT G2-Si system online Help.

Installing the ESI probe

Required materials:

- Chemical-resistant, powder-free gloves
- PEEK™ tubing



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure.



Warning: To avoid electric shock, prepare the instrument for working on the source (see [page 120](#)), before you begin the following procedure.

To install the ESI probe:

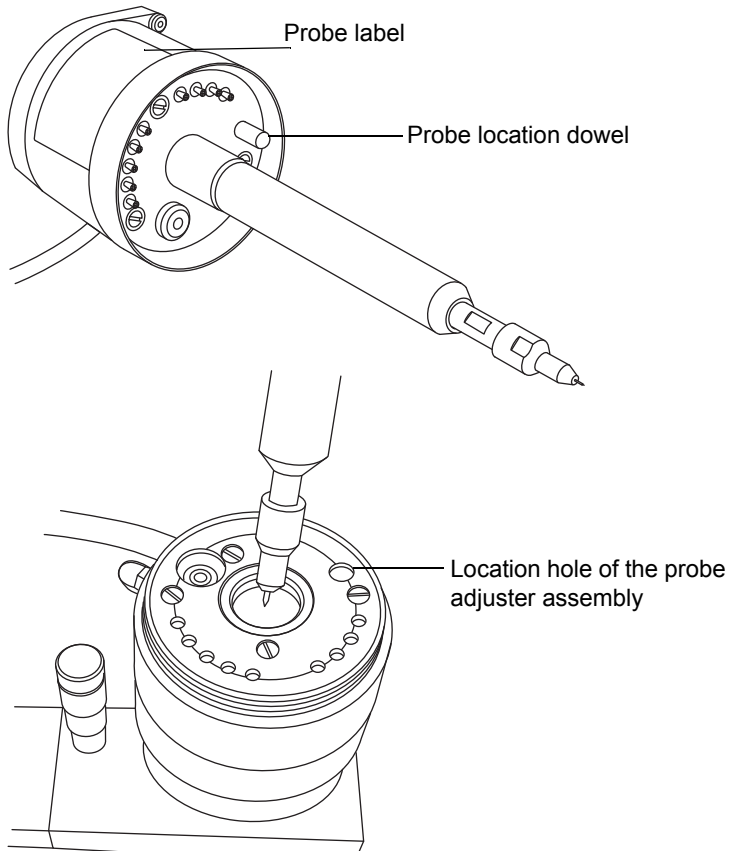
1. Prepare the instrument for working on the source (see [page 120](#)).



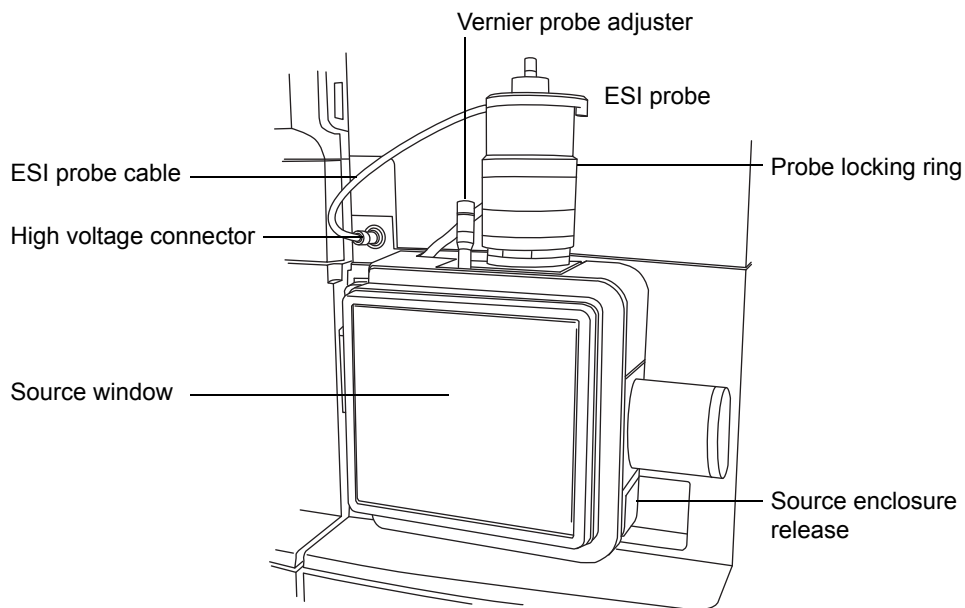
Warning: To avoid puncture wounds, handle the ESI probe with care. The probe tip is sharp.

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

3. With the probe label facing you, carefully slide the ESI probe into the hole in the probe adjuster assembly, ensuring that the probe location dowel aligns with the location hole in the probe adjuster assembly.



ESI probe, mounted on the LockSpray source enclosure:

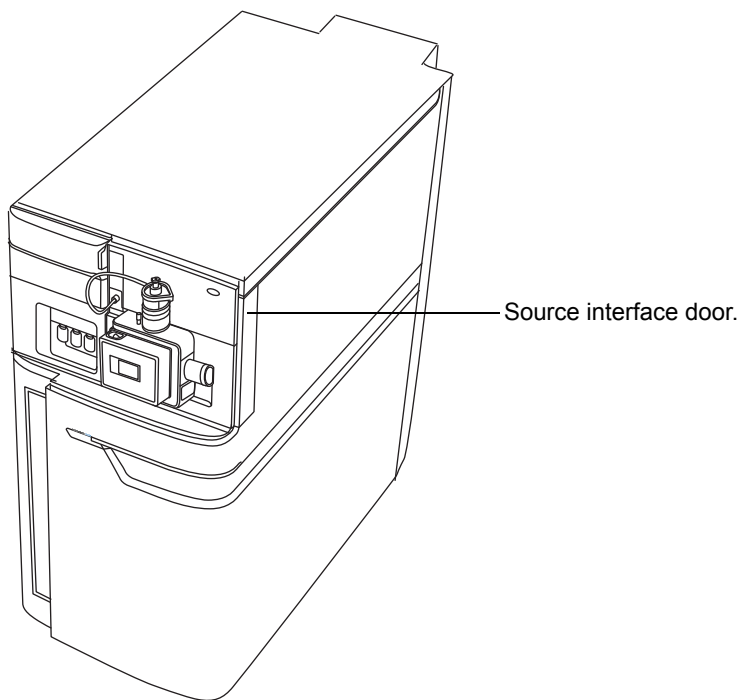


! **Notice:** To avoid nitrogen leakage, fully tighten the probe locking ring.

4. Tighten the probe locking ring to secure the probe in place.
5. Connect the ESI probe's cable to the high voltage connector.

- Slide open the instrument's source interface door.

Source interface door:



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

- 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.

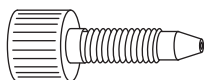
Recommendation: To reduce peak broadening,

- 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.

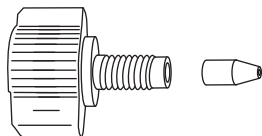
Requirement: When replacing tubing supplied with the instrument, minimize the length connecting the diverter valve to the ESI probe. Doing so minimizes delays and dispersion.

3 Configuring the LockSpray Source

- At the diverter valve, use a long "finger tight" PEEK fitting.



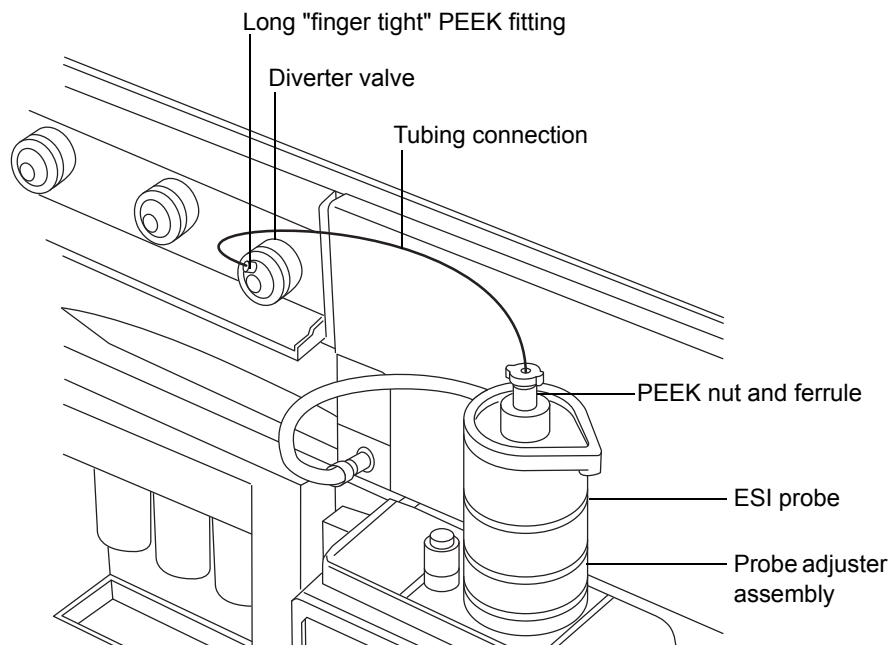
- At the probe, use a PEEK nut and ferrule, finger tightened, to connect to the PEEK union.



Warning: To avoid electric shock, only use natural (beige) PEEK fittings at the top of the probe.

Tubing connection between the diverter valve and the ESI probe:

Tip: The other connections are omitted for clarity.



8. Slide closed the instrument's source interface door.

Important: Ensure that the tubing does not become trapped when closing the source interface door.

Removing the ESI probe

Required materials

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure.



Warning: To avoid electric shock, prepare the instrument for work performed on its source before commencing this procedure.

To remove the ESI probe:

1. Set the instrument to Standby (see [page 60](#)).
2. Disconnect the fluidics tubing from the ESI probe.
3. Disconnect the ESI probe's cable from the high voltage connector.
4. Unscrew the probe locking ring.



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

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

Installing the ESI small bore capillary option

Use the ESI small-bore capillary option with 1-mm UPLC columns running at flow rates of 100 to 200 $\mu\text{L}/\text{min}$. The materials needed for this task are in the Small-Bore Capillary kit.

- ! **Notice:** To avoid damage from excessive pressure, do not exceed flow rates of 200 $\mu\text{L}/\text{min}$ through the ESI probe when using the small-bore capillary.

Required materials

- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool
- 10-mm wrench
- 8-mm wrench
- 7-mm wrench (2)
- LC pump
- HPLC-grade (or better) 1:1 acetonitrile:water
- Sharp knife or PEEK tubing cutter
- From the Small-Bore Capillary kit:
 - Capillary
 - Small-bore, UNF coupler (slide port)
 - Collar nut (thumb nut)
 - PTFE liner tube
 - Conductive sleeve
 - 1/16-inch ferrule (2)
- Metal gasket for the probe tip
- Safety goggles



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure.



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

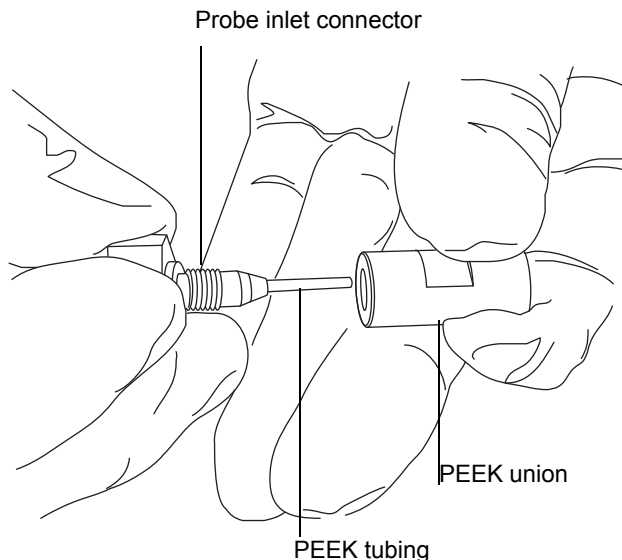
To install the capillary:

1. Remove the existing capillary.
2. Using the sharp knife or PEEK tubing cutter, cut an approximately 60-cm length of red PEEK tubing.

Requirement: To minimize dead volume, cut the ends of the tubing perpendicular to the tube's horizontal axis.

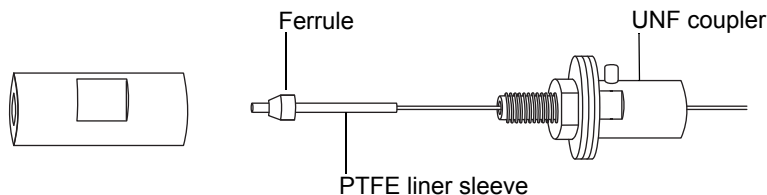
3. Insert one end of the red PEEK tubing in the probe inlet connector, and finger tighten the connector in the PEEK union.

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

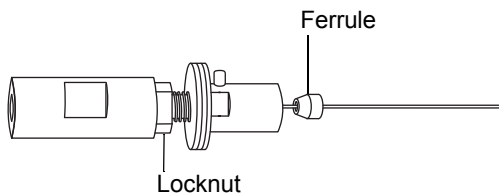


3 Configuring the LockSpray Source

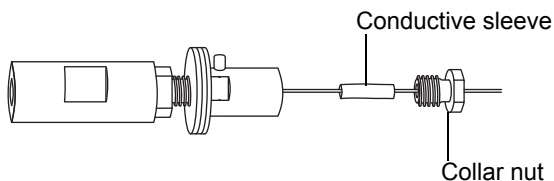
- Using the needle-nose pliers, slide the UNF coupler, PTFE liner sleeve, and a ferrule onto the capillary.



- Insert the capillary in the PEEK union, and ensure that it is fully seated.
- Finger-tighten the UNF coupling into the PEEK union.
- Gently tug on the capillary, testing to ensure that it stays in place.
- Using the 7-mm wrench for the locknut and the 8-mm wrench for the PEEK union, tighten the locknut against the PEEK union until the union can no longer be twisted.
- Using the needle-nose pliers, slide another 1/16 inch ferrule over the capillary, and seat it in the UNF coupler over the exposed end of the PTFE liner sleeve.



- Slide a new conductive sleeve and the collar nut over the capillary.

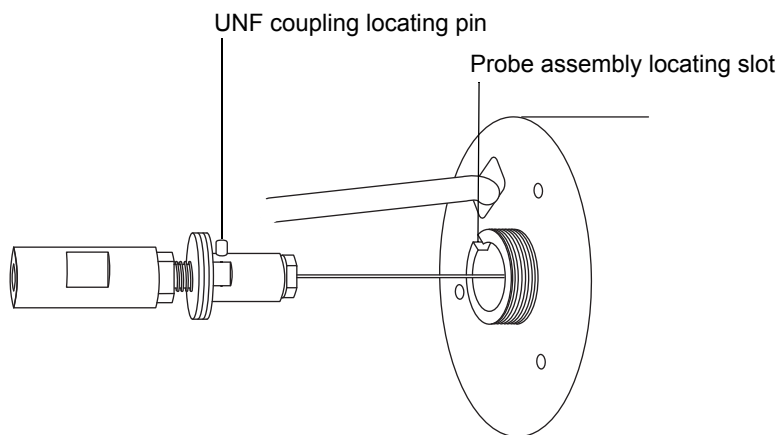


- Using two 7-mm wrenches, tighten the collar nut to the UNF coupling.



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

12. Perform a leak test by attaching the free end of the PEEK tubing to an LC pump and pumping mobile phase through it, at 200 $\mu\text{L}/\text{min}$.
 - If leakage occurs, disassemble and remake the connection, and repeat the leak test.
 - If the backpressure on the LC pump is high, replace the capillary, and repeat the leak test.
13. When no leakage occurs, and the backpressure on the LC pump is normal, disconnect the PEEK tubing from the LC pump.
14. Remove the probe inlet connector and red PEEK tubing from the PEEK union.
15. Carefully thread the capillary through the probe assembly.
16. Carefully push the PEEK union/UNF coupling assembly and capillary into the probe assembly so that the locating pin on the UNF coupling is fully engaged in the locating slot at the head of the probe assembly.

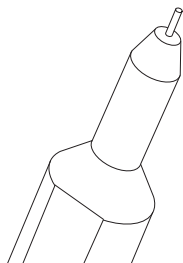


17. Fit the nebulizer adjuster knob to the PEEK union/UNF coupling assembly.
18. Finger-tighten the nebulizer adjuster knob onto the probe assembly.

3 Configuring the LockSpray Source

19. Fit the new metal gasket to the probe tip.

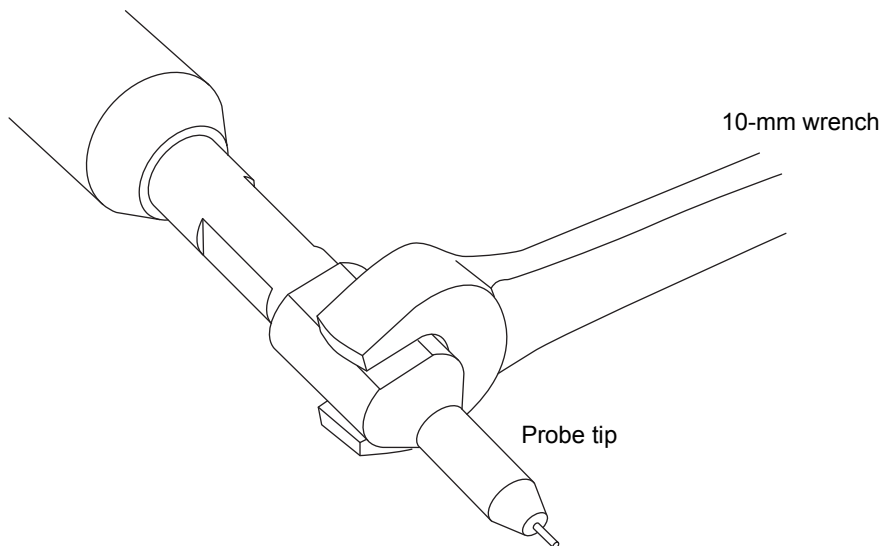
Metal gasket



20. Fit the probe tip over the capillary, and screw the tip onto the probe assembly.

! **Notice:** To prevent gas leakage, fully tighten the probe tip.

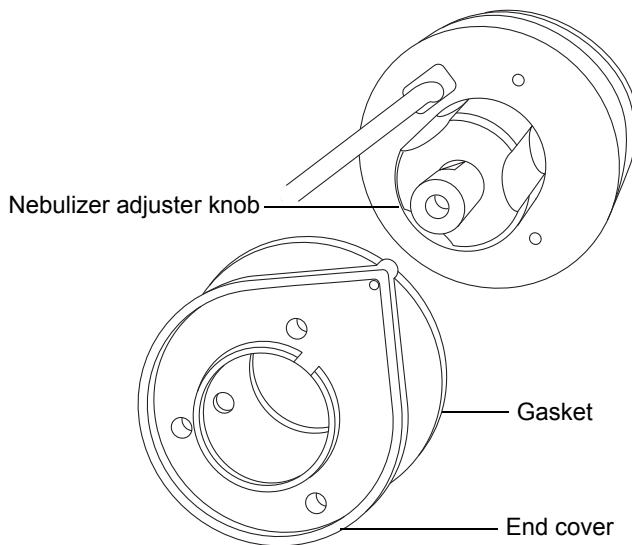
21. Using the 10-mm wrench, tighten the probe tip.



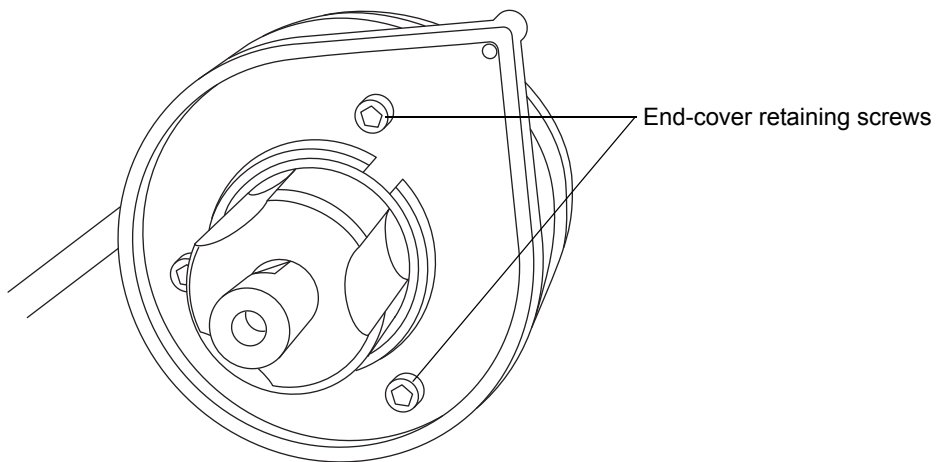
22. Using the nebulizer adjuster knob, adjust the capillary so that it protrudes by approximately 0.5 mm from the end of the probe tip.

Tip: During normal operation, the adjuster knob relies on gas pressure to retract the capillary. To retract the capillary in the absence of gas pressure, invert the probe, and use gravity.

23. Fit the end cover and gasket to the probe assembly.



24. Using the combined, 2.5-mm Allen wrench, fit and tighten the three screws that retain the end cover.



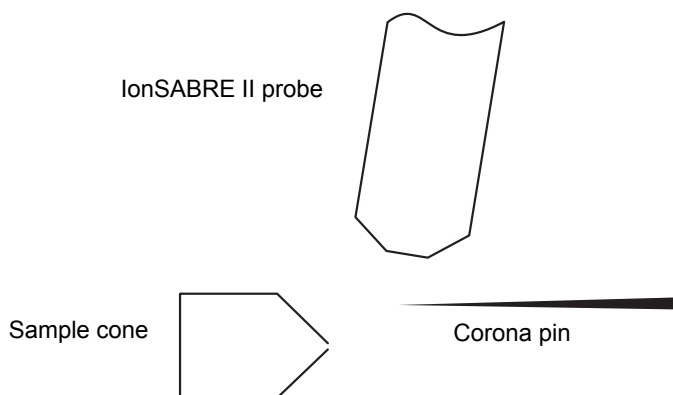
25. Replace the combined, 2.5-mm Allen wrench and cone extraction tool in its storage location on the source adaptor housing.
26. Fit the ESI probe to the source (see [page 64](#)).

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 probe. Mobile phase from the LC column enters the probe, where it is pneumatically converted to an aerosol, rapidly heated, and vaporized or gasified at the probe tip.

APCI mode:



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

Installing the IonSABRE II probe

Required materials

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



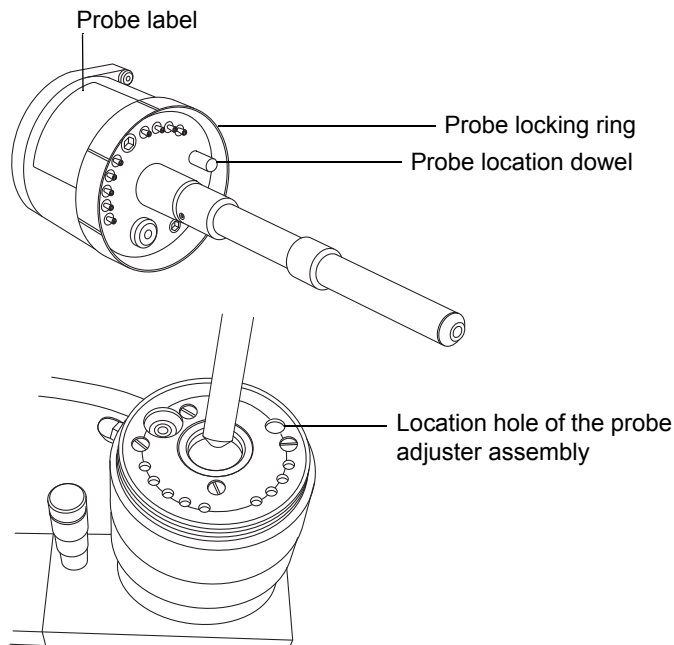
Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure.



Warning: To avoid electric shock, prepare the instrument for working on the source (see [page 120](#)), before you begin the following procedure.

To install the IonSABRE II probe:

1. Prepare the instrument for work performed on its source (see [page 120](#)).
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's location dowel aligns with the location hole of the probe adjuster assembly.



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

3 Configuring the LockSpray Source

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



Warning: To avoid electric shock, do not use stainless steel tubing or stainless steel finger-tight screws to connect the selector valve to the IonSABRE II probe; use the PEEK tubing and natural (beige) colored PEEK finger-tight screws supplied with the instrument.

4. Using tubing equal to 0.004-inch ID, connect port S of the selector 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 between the selector valve and the probe, minimize its length, to reduce peak broadening.
 - When cutting the tubing to length, cut it squarely (that is, perpendicular to its horizontal axis).
5. Install the corona pin (see [page 124](#)).

Removing the IonSABRE II probe

Required material

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure.



Warning: To avoid electric shock, prepare the instrument for working on the source ([page 120](#)) before you begin the following procedure.

To remove the IonSABRE II probe:

1. Prepare the instrument for working on the source (see [page 120](#)).
2. Remove the corona pin (see [page 126](#)).
3. Disconnect the selector valve tubing from the IonSABRE II probe.
4. Unscrew the probe locking ring.
5. Carefully remove the probe from the probe adjuster assembly.

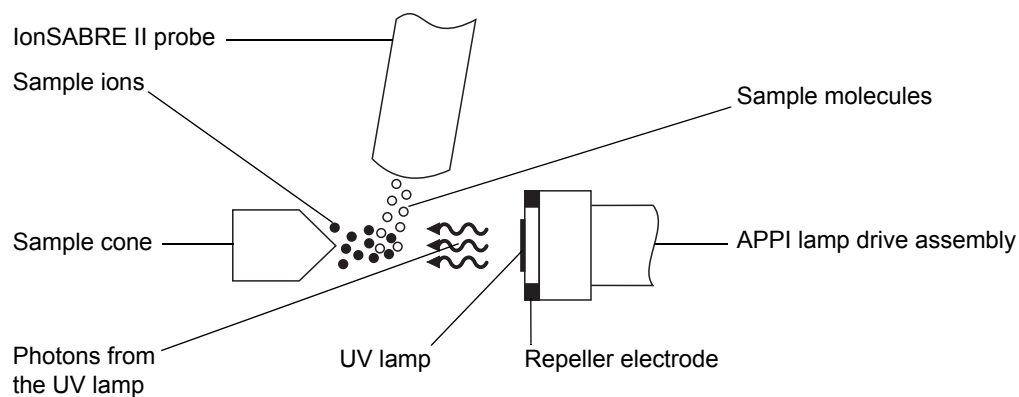
Combined APPI/APCI source

Operate this optional, source-enclosure replacement in APPI, APCI, or dual APPI/APCI mode. Dual-mode APPI/APCI rapidly switches between ionization modes.

APPI operation

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

APPI mode:



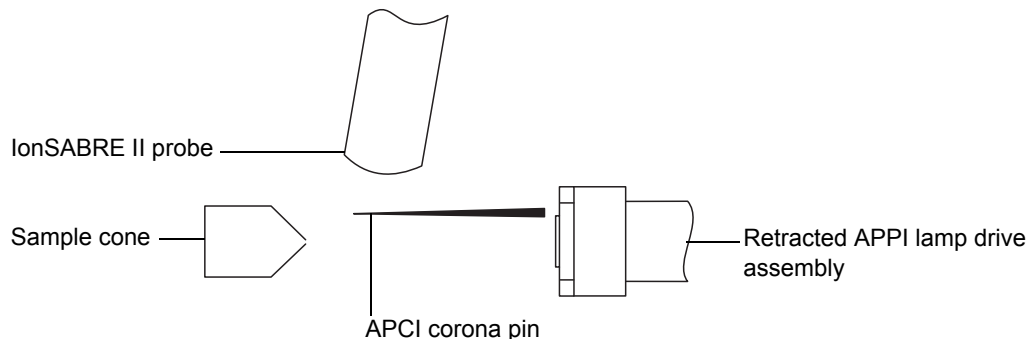
The IonSABRE II probe introduces vaporized sample into the source where photons generated by an ultraviolet (UV) lamp (mounted in the APPI lamp drive assembly) produce sample ions. Direct photoionization of a sample molecule occurs when the photon energy exceeds the ionization potential of the sample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

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

APCI operation

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

APCI mode:



The IonSABRE II 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.

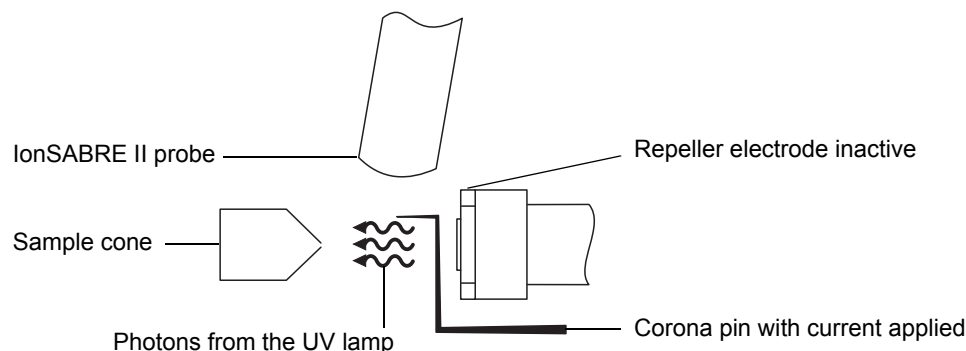
Dual-mode operation

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

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

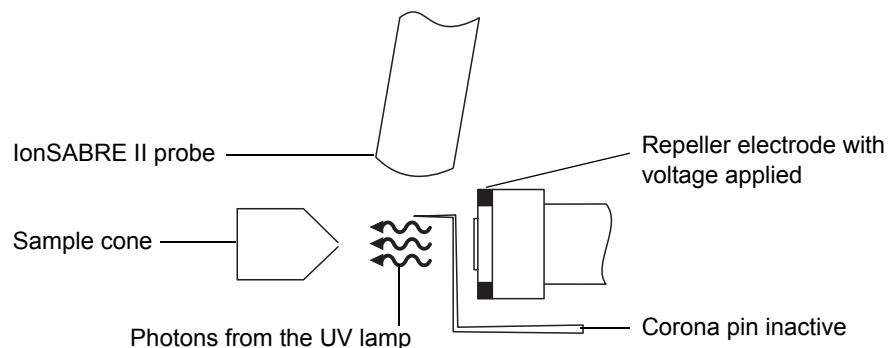
When the source is configured for dual operation in APCI mode, current is applied to the corona pin, but the repeller electrode is inactive.

Dual operation in APCI mode:



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

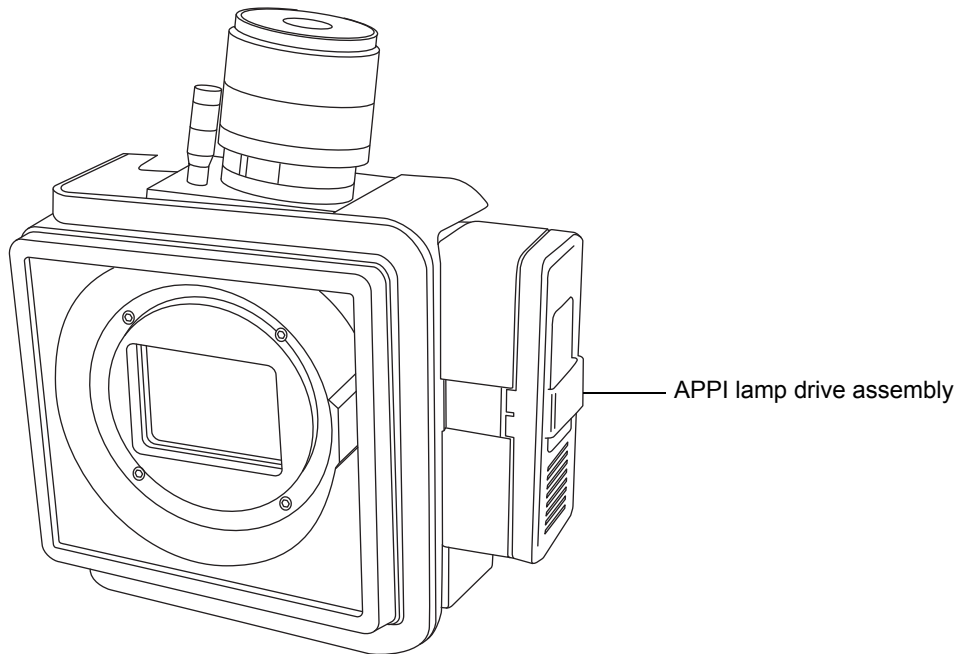
Dual operation in APPI mode:



The combined APPI/APCI source components

The combined APPI/APCI source comprises the standard IonSABRE II probe and a source enclosure that incorporates an APPI lamp drive.

The combined APPI/APCI source enclosure:

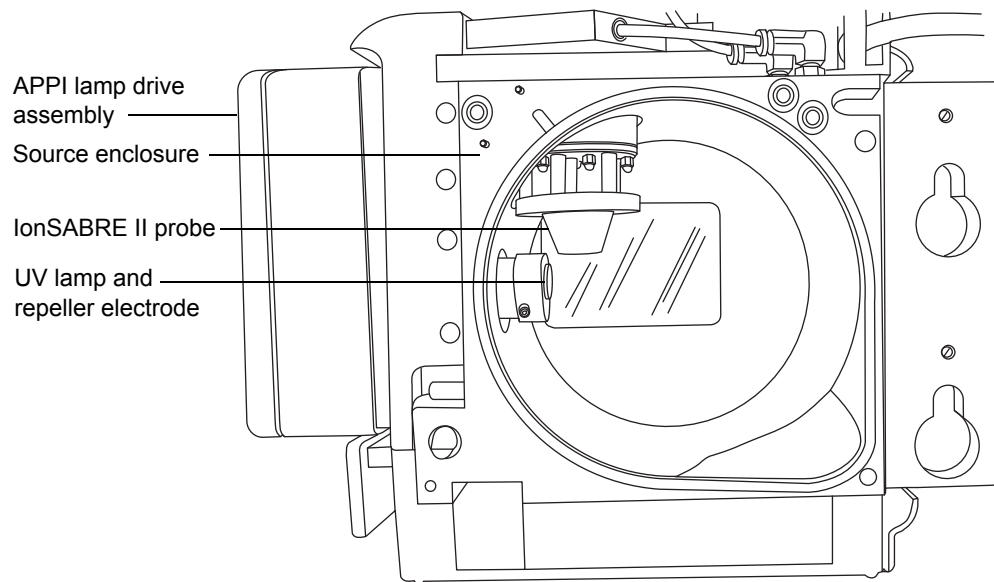


- ! **Notice:** To prevent damage to the corona pin and lamp assembly, ensure that the lamp assembly does not touch the corona pin when the source enclosure door is closed.

3 Configuring the LockSpray Source

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.

APPI lamp drive assembly inside the source enclosure:



Installing the combined APPI/APCI source

Required material

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure.



Warning: To avoid electric shock, prepare the instrument for working on the source ([page 120](#)) before you begin the following procedure.

To install the combined APPI/APCI source:

1. Prepare the instrument for working on the source (see [page 120](#)).



Warning: To avoid burn injuries, take great care while working with these components.

2. Remove the probe from the currently installed source.
 - If you are removing an ESI probe, see [page 69](#).
 - If you are removing an IonSABRE II probe, see [page 79](#).
3. Remove the existing source enclosure (see [page 121](#)).
4. Install the combined APPI/APCI source enclosure (see [page 123](#)).
5. Install the corona pin (see [page 124](#)).
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 to the source, and ensure that it is working correctly (see [page 77](#)).

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

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 or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure.



Warning: To avoid electric shock, prepare the instrument for working on the source ([page 120](#)) before you begin the following procedure.

To remove the combined APPI/APCI source:

1. Prepare the instrument for working on the source (see [page 120](#)).



Warning: To avoid burn injuries, take great care while working with these components.

2. Remove the IonSABRE II probe (see [page 79](#)).
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 [page 121](#)).
6. Remove the corona pin (see [page 126](#)).
7. Fit the blanking plug to the pin's mounting contact.

Configuring for ESCi mode

To operate in ESCi mode, you must fit the ESI probe and corona pin to the LockSpray source enclosure.

The system, with the ESI probe installed and corona discharge pin fitted, can alternate between ESI and ESCi modes, facilitating data acquisition in ESI and ESCi modes in parallel. For more information on using dual ESI and ESCi modes, see the SYNAPT G2-Si system online Help. When fitting the ESI probe to the LockSpray source enclosure, follow the procedure on [page 64](#).

Optimizing the ESI probe for ESCi operation

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

Installing the corona pin in the source

Install the corona pin according to the procedure on [page 124](#).

Removing the corona pin from the source

Remove the corona pin according to the procedure on [page 126](#).

3 Configuring the LockSpray Source

4 Configuring the NanoLockSpray source

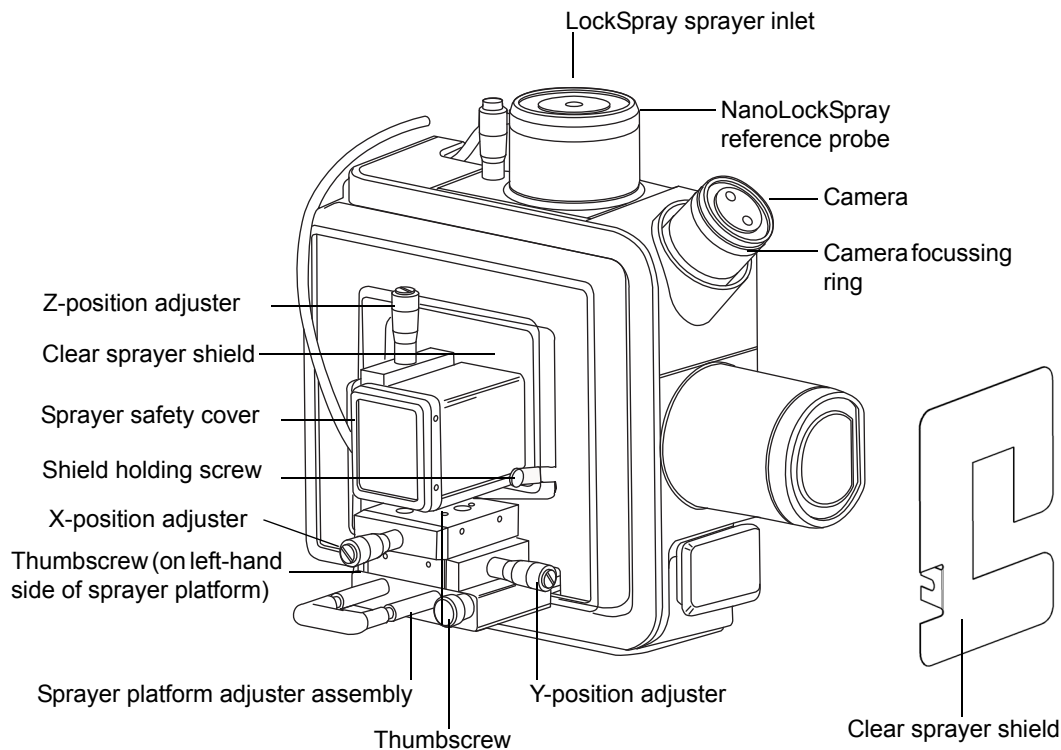
The Waters NanoLockSpray dual ion source, enables the optimized co-introduction of sample and lock-mass reference compound directly into the ion source. At low flow rates, this feature provides authenticated, exact-mass measurement in both MS and MS/MS modes.

Contents:

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Selecting and configuring the NanoLockSpray source	93
Deploying the sprayer platform adjuster assembly	94
Adjusting the sprayer tip position.....	95
Setting up the camera	96

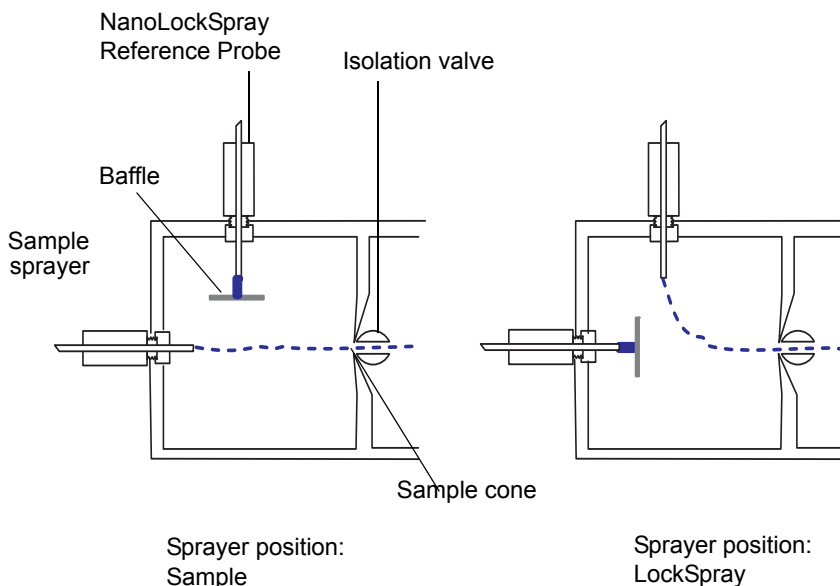
Overview of the NanoLockSpray source

NanoLockSpray source:



The NanoLockSpray source enclosure holds two NanoFlow sprayers positioned orthogonally with respect to each other. The sample flows through one sprayer and the lock-mass reference solution through the other. A motorized baffle rotates to admit spray from either sprayer to the sampling cone.

Schematic of the NanoLockSpray source:



Spray indexing permits acquisition of sample and lock-spray data in separate data channels, and the baffle design ensures negligible cross-talk between the two sprays. The lock-spray data are used to calculate a correction factor for the mass-scale calibration, which is then applied to the sample data, providing exact-mass information.

Sample sprayer

You can use the NanoLockSpray source with different NanoFlow sprayers. For instructions explaining how to set up these sprayers, see [page 93](#).

LockSpray sprayer

The LockSpray sprayers for the NanoLockSpray source operate as part of the instrument's IntelliStart Fluidics system. Fitted with a 500 μL pump, the LockSpray sprayer operates at 0.5 $\mu\text{L}/\text{min}$. You must choose the concentration of the lock-spray reference solution that gives a suitable ion intensity. For an overview of the IntelliStart Fluidics system, see [page 31](#).

NanoFlow gas supply

The gas pressure for the sprayer's nebulizer is electronically controlled from 0 to 2 bar. Though sprayer-dependant, the optimum pressure usually lies in the range 0.3 bar and 1.0 bar.

Purge gas

The purge gas typically flows at 100 L/h. It provides a positive pressure in the source enclosure that reduces the chemical background interference caused by contaminants in the laboratory air. You can adjust this flow via the Tune window's Source tab. See the mass spectrometer's online Help for further details.

Sprayer platform adjuster assembly

The sprayer platform adjuster assembly allows precise X-, Y-, and Z-positioning of the sprayer tip. You can also withdraw the sprayer from the source to obtain access to the sprayer tip.

Using the two thumbscrews on the base of the adjuster assembly, you can move the platform in and out of the source (see [“Deploying the sprayer platform adjuster assembly” on page 94](#)).

Selecting and configuring the NanoLockSpray source

The Universal NanoFlow sprayer is installed as standard equipment on the NanoLockSpray source. For installation and maintenance details, see the *Waters Universal NanoFlow Sprayer Installation and Maintenance Guide* (part number 71500110107).

When fitted, the NanoLockSpray source is automatically recognized by the MassLynx software.

The following table summarizes how you configure the NanoLockSpray source for the various ionization modes.

Tip: A corona pin is not used with the NanoLockSpray source.

NanoLockSpray source configuration:

Sprayer type	Used for
Universal NanoFlow sprayer. See the <i>Universal NanoFlow Sprayer Installation and Maintenance Guide</i> (part no. 71500110107)	For coupling to nanoACQUITY UPLC and ACQUITY UPLC M-Class systems with regulated flow rates down to 100 nL/min.
Borosilicate glass capillary NanoFlow (see page 96). For details, see the <i>Borosilicate Glass Capillary Sprayer User's Guide</i> (part no. 715003371)	Suitable for single-shot analyses. This option yields lower flow rates (<30 nL/min) than the Universal Sprayer and hence a smaller sample consumption for a given spectral quality.

Deploying the sprayer platform adjuster assembly

To move the sprayer platform out of the source:



Warning: To avoid electrical shock, ensure the safety cover is in place over the sprayer.

1. Confirm that the sprayer's safety cover is installed (see the figure on [page 90](#)).
2. Unscrew the thumbscrew on the front of the sprayer platform.
3. Pull out the side thumbscrew, and withdraw the sprayer platform from the source.
4. Release the side thumbscrew, locking the platform in the withdrawn position.

To move the sprayer platform into the source:



Warning: To avoid electrical shock, ensure the safety cover is in place over the sprayer.

1. Confirm the clear sprayer shield is in place and secured (see the figure on [page 90](#)).
2. Confirm that the sprayer's safety cover is installed.
3. Pull out the side thumbscrew, and push the sprayer platform into the source.
4. Release the side thumbscrew, locking the platform in position.
5. Tighten the front thumbscrew, securing the adjuster assembly rigidly to the source.

Adjusting the sprayer tip position

To adjust the tip position:


1. Adjust the X, Y, and Z controls on the adjuster assembly to move the sprayer tip close to the sampling cone and baffle.
2. Adjust the height of the sprayer so that its tip is level with the center of the sampling cone, using the index mark on the adjuster.
3. Adjust the horizontal position of the sprayer so that the tip points toward the left-hand side of the baffle.

Tips:

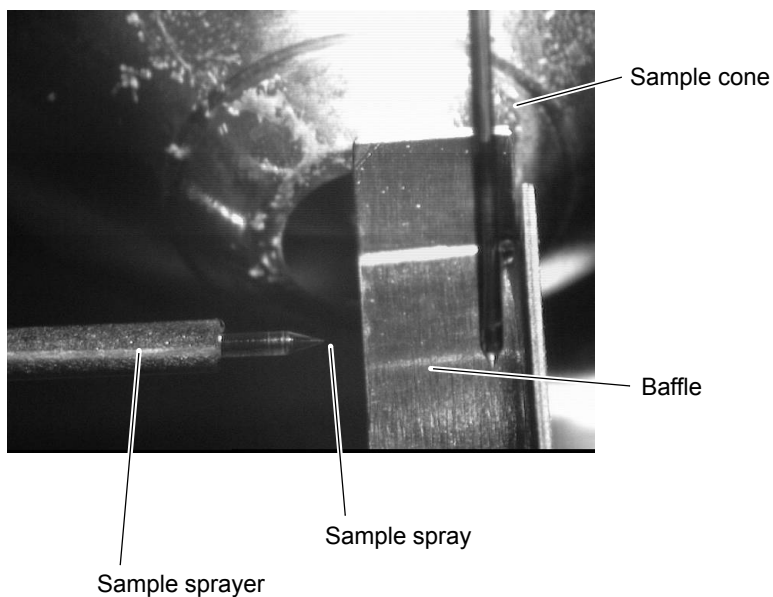
- If you observe an electrical discharge between the sprayer tip and baffle, move the tip farther from the baffle, or reduce the capillary voltage. Note, however, that the capillary voltage must be high enough to maintain a good spray.
- Fine tune the position of the sprayer while acquiring a spectrum of a standard compound. Small adjustments to the sprayer position can make large differences to the source sensitivity.

Setting up the camera

To set up the camera:

1. On the Tune window click Source > Nanoflow.
2. Click  to open the Camera Control dialog box.

Camera Control view of sprayers and sample cone:



3. Rotate the camera's focusing ring to focus on the sample sprayer (see the figure on [page 90](#)).

5 Installing and removing the ionKey source

The ionKey source performs UPLC separation inside the source of the mass spectrometer. (See “ionKey source” on page 40.) For further information, see the *ACQUITY UPLC M-Class System Guide* (part number 715003588) and the *ionKey/MS System Guide* (part number 715004028).

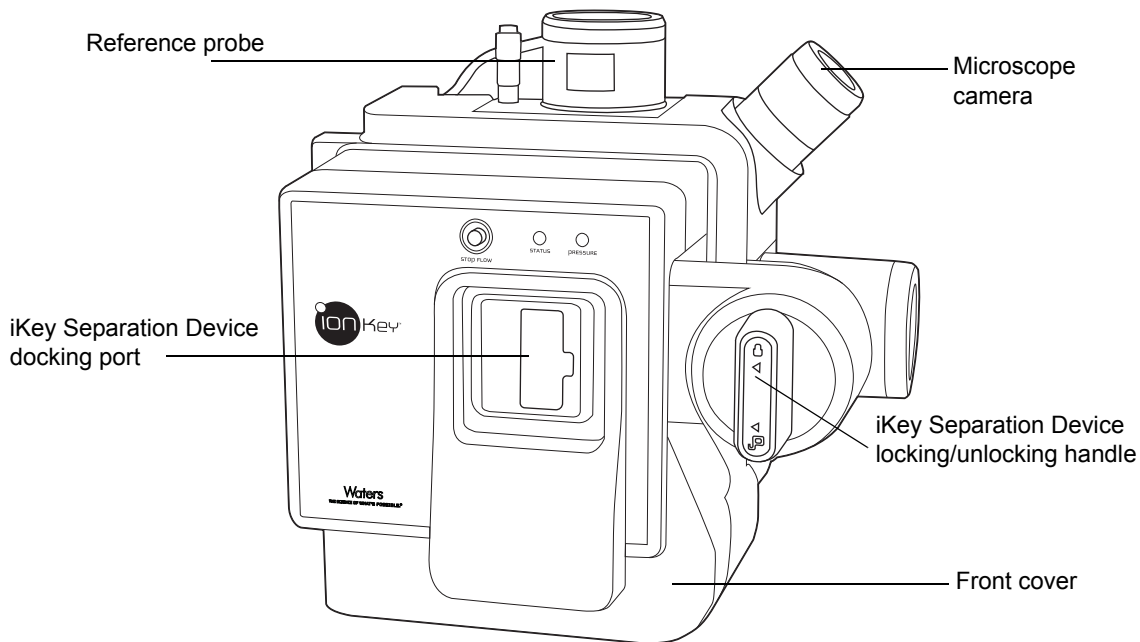
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Installing the ionKey source

The ionKey source enclosure comprises the iKey Separation Device docking port, the iKey Separation Device locking handle, a reference probe, and a microscope camera.

ionKey source:



Required materials

- Chemical-resistant, powder-free gloves
- Screwdriver
- ¼-inch wrench



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



Warning: To avoid electric shock, prepare the instrument for work performed on its source before beginning this procedure.

To install the ionKey source:

1. Prepare the instrument for working on its source (see [page 120](#)).

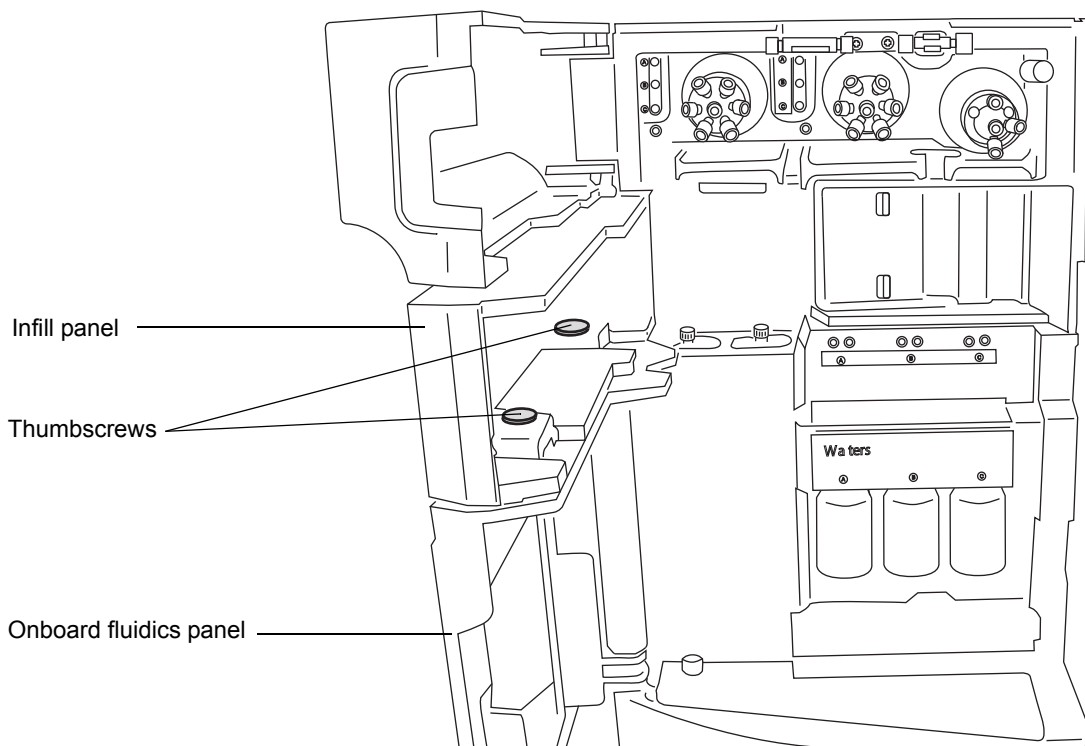


Warning: To avoid burn injuries, take great care while working with the instrument's source enclosure open; the source can be hot.

2. Remove the probe from the currently installed source:
 - If you are removing an ESI probe, see [page 69](#).
 - If you are removing an IonSABRE II probe, see [page 79](#).
3. Remove the existing source enclosure (see [page 121](#)).
4. Open the access doors to the IntelliStart Fluidics system.

5 Installing and removing the ionKey source

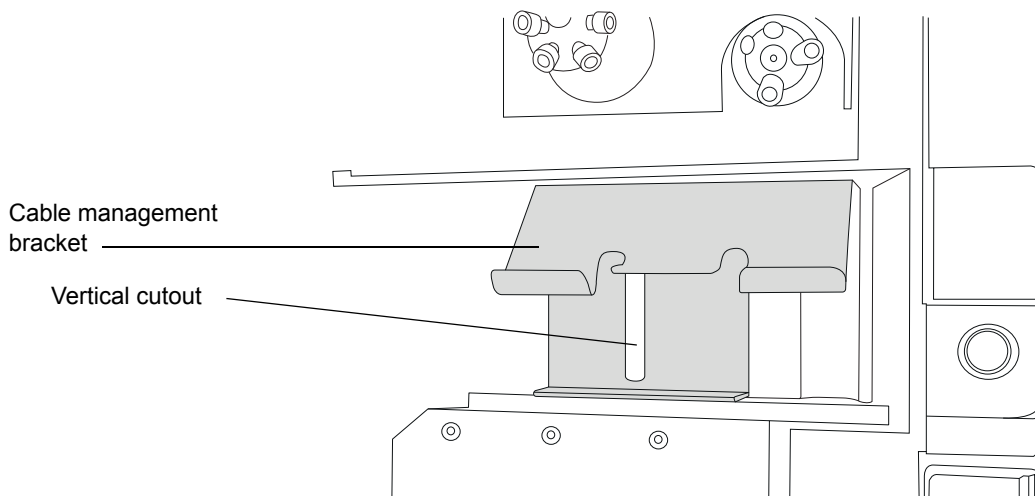
5. Loosen the two thumbscrews that secure the infill panel to the onboard fluidics panel.



6. Remove the infill panel from the instrument, and store it in a safe location.

7. Fit the cable management bracket to the instrument, as follows:
 - a. Position the bracket so that the vertical cutout aligns with the upper and lower tabs on the instrument.
 - b. Partially insert the upper-right hand section of the bracket into the corresponding slot in the instrument.
 - c. Carefully push the bracket into place.

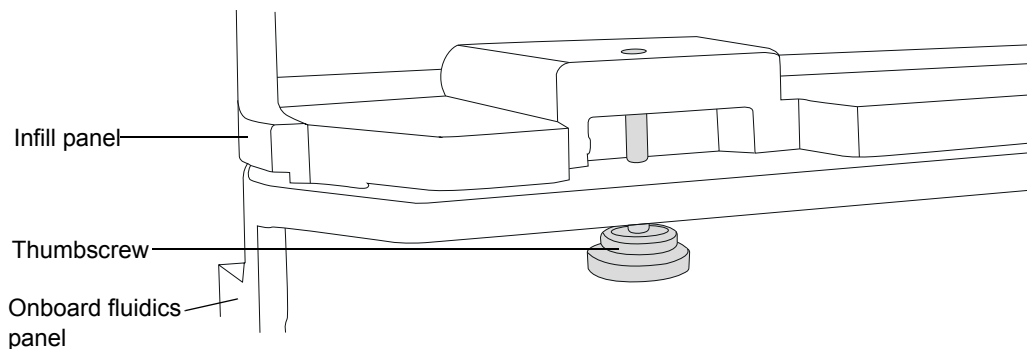
Tip: When aligned correctly, the cable management bracket snaps into position as you push it toward the instrument.



8. Remove the two thumbscrews from the replacement infill panel provided with the ionKey source.
9. Position the replacement infill panel above the onboard fluidics panel, and secure the panels to each other using the thumbscrews removed in [step 8](#).

5 Installing and removing the ionKey source

Requirement: The thumbscrews must be installed with the screw thread uppermost, as shown in the following figure.

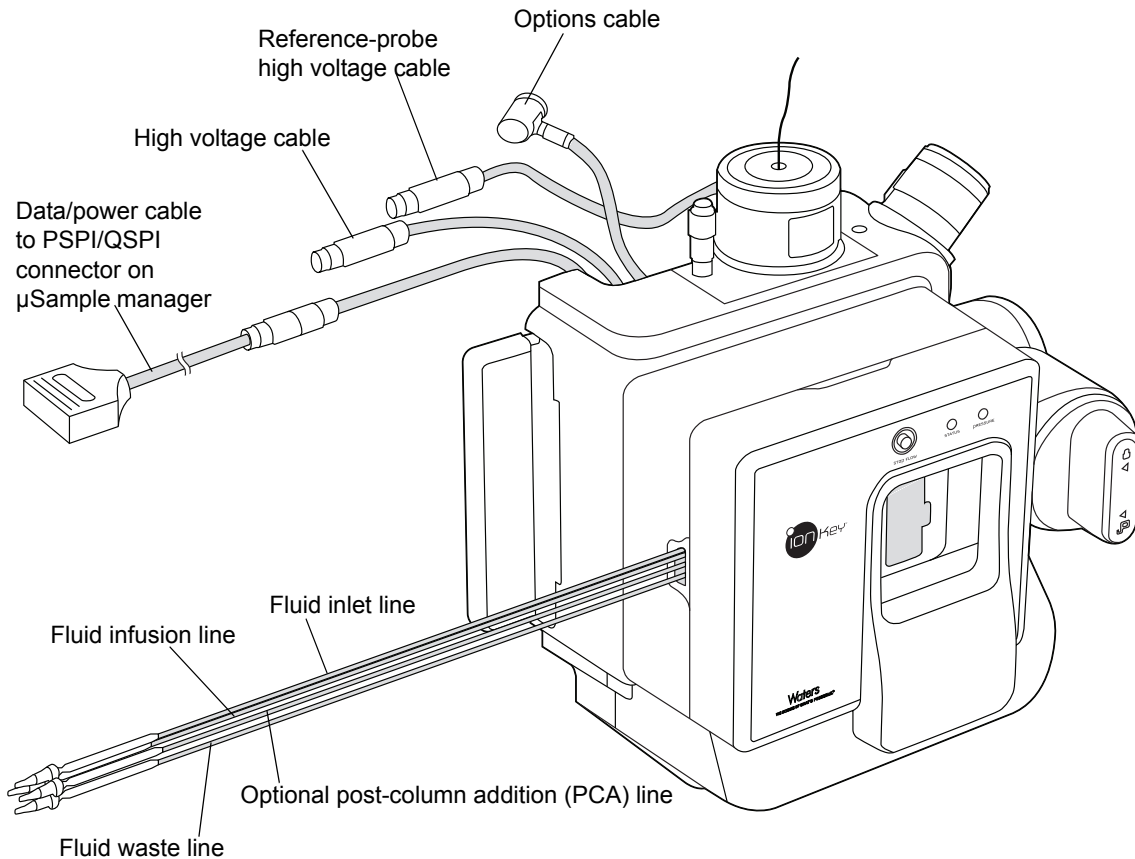


10. Using two hands, fit the ionKey source enclosure to the two supporting studs on the source adaptor housing.
11. Swing the source enclosure to the closed position, ensuring it locks into place.



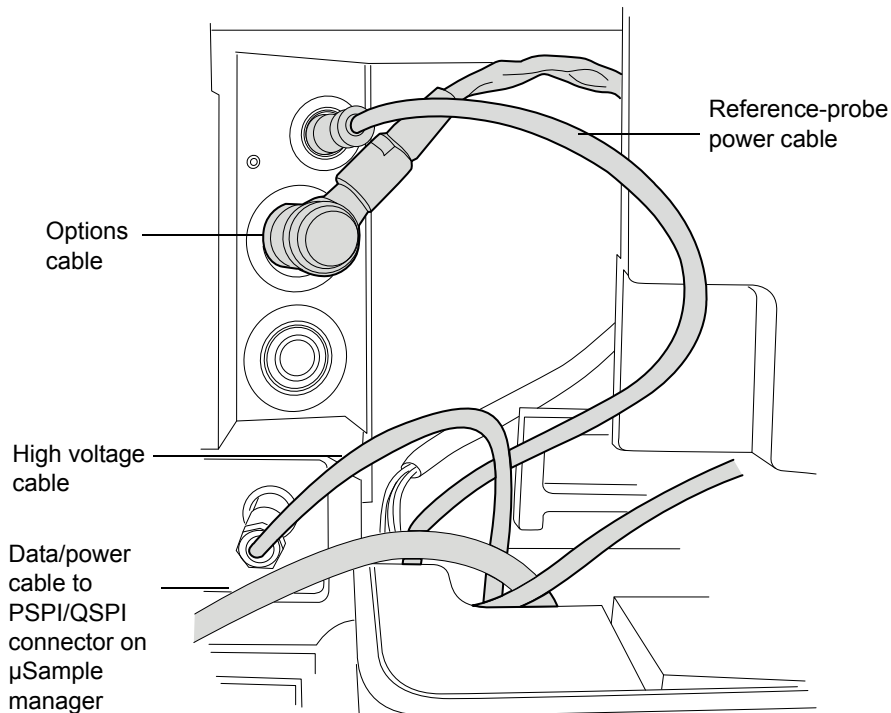
Notice: To avoid damaging the ionKey source or mass spectrometer,

- ensure that the mass spectrometer is in Standby mode;
 - ensure the μ Sample manager is powered-off before connecting the data/power cable
12. Power-off the sample manager, and ensure that the mass spectrometer is in Standby mode.
 13. Quit the MassLynx software.

ionKey source connections:

14. Connect the data/power cable to the PSPI (ACQUITY UPLC M-Class)/QSPI (nanoACQUITY UPLC) connector on the rear of the μ Sample manager, and use a screwdriver to firmly tighten the connector screws.

Source connections to mass spectrometer:

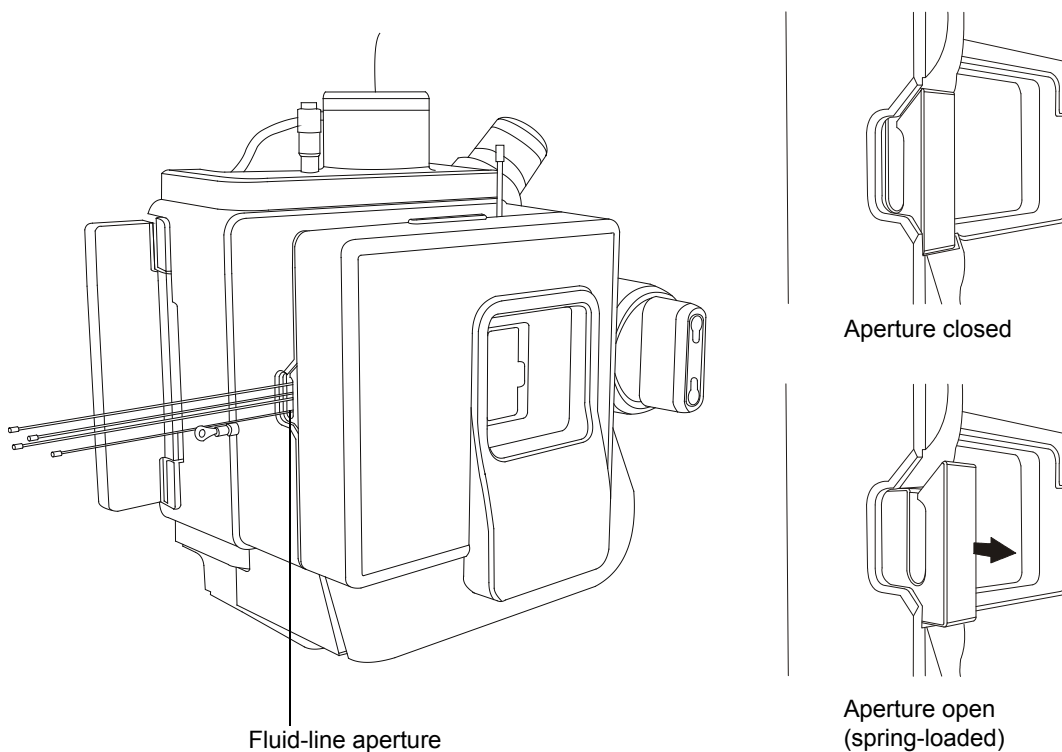


15. Connect the high voltage cable (white) to the high voltage supply outlet on the mass spectrometer.
16. Connect the reference-probe power cable (green) to the reference-probe power inlet on the mass spectrometer.
17. Connect the options cable (blue) to the options port on the mass spectrometer.
18. Identify each fluid line by the part numbers printed on their shrink-wrap tubing.

ionKey tubing assemblies:

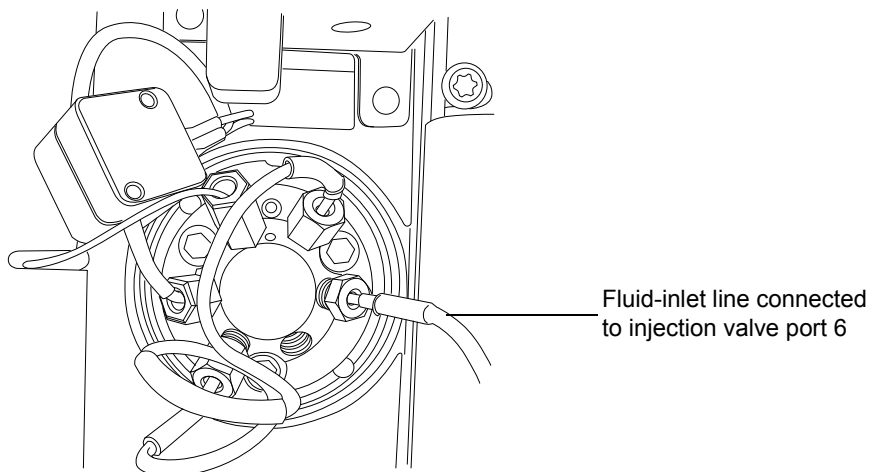
Part Number	Order Number	Description
430004188	700010399	Inlet tube
430004190	700010400	Infusion tube
430004212	700010401	Waste tube
430004476	700010470	Optional, post-column addition tube

19. Guide each fluid line through the fluid-line aperture.

Fluid line aperture:

Tip: In the following steps, when connecting the fluid lines for the ionKey source, use the cable management bracket to guide the fluid lines. Doing so helps to keep the fluidics plumbing tidy.

μ Sample manager injection valve:



20. Connect the fluid-inlet line to port 6 on the injection valve of the μ Sample manager.
21. Connect the fluid-infusion line to port 2 on the diverter valve of the mass spectrometer.
22. Connect the optional post-column addition line to outlet B on the flow control module of the auxiliary solvent manager.
23. Connect the waste line to a suitable waste container.
24. Connect the reference-probe PEEK capillary to the grounded union (which is connected to the reference valve on the mass spectrometer).

Rationale: Doing so provides lock-spray operation for the onboard IntelliStart Fluidics system. For an overview of the IntelliStart Fluidics system, see [page 31](#).

25. Close the IntelliStart Fluidics system access doors.
26. Power-on the sample manager.
27. Restart the MassLynx software.

See also: *ACQUITY UPLC M-Class System Guide* (part number 715003588).


Installing ionKey source software

If you are installing an ionKey source on your G2-Si for the first time, you must install the appropriate MassLynx software SCN and the ACQUITY UPLC M-Class driver pack. For details, see the following documents:

- *ACQUITY UPLC M-Class Driver Pack Installation and Configuration Guide* (part number 715004448) for detailed installation procedures and instructions explaining how to use the ACQUITY Inlet Switch Utility.
- MassLynx software v4.1 and related SCN release notes for detailed instructions explaining how to install MassLynx software and SCNs.

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. Power-on the workstation.
4. In the Tune window, click Camera Viewer .
5. In the 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.

Device settings for the camera:

Parameter	Setting
Video norm	PAL_B

5 Installing and removing the ionKey source

Device settings for the camera:

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

Removing the 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 source holder, you can secure the source enclosure to the holder. Doing so keeps the enclosure close to the G2-Si, for when it is next needed; assists with managing the ionKey source's fluid lines; and helps prevent contamination of the fluid lines.

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

Recommendation: The ionKey source is installed along with a cable-management bracket and a replacement infill panel. You can leave the bracket and infill panel in place when you replace the ionKey source with a conventional interface. If, however, you choose to remove the bracket and replace the original infill panel, reverse the installation instructions (step 5 to step 9) in “Installing the ionKey source” on page 98.

See also: “Installing the ionKey source” on page 98.

Required materials

- Chemical-resistant, powder-free gloves
- ¼-inch wrench



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



Warning: To avoid electric shock, prepare the instrument for work performed on its source before beginning this procedure.

To remove the ionKey source:

1. Prepare the instrument for working on its source (see page 120).



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

5 Installing and removing the ionKey source

2. Remove the iKey separation device from the docking port (see the *ionKey/MS System Guide*, part number 715004028).
3. Quit the MassLynx software.
4. Power-off the μ Sample manager.
5. Disconnect the PSPI (ACQUITY UPLC M-Class)/QSPI (nanoACQUITY UPLC) cable.
6. Using the 1/4-inch wrench, loosen and disconnect the fluid-waste line (if required) and fluid-inlet lines from the μ Sample manager.
7. Disconnect the fluid-infusion line from the onboard IntelliStart Fluidics on the mass spectrometer.
8. Disconnect the reference-probe PEEK capillary from the grounded union (which is connected to the reference valve on the mass spectrometer).
9. Disconnect the optional post-column addition line from the flow control module of the auxiliary solvent manager.
10. Swing open the ionKey source enclosure unit from the source mounting on the mass spectrometer.
11. Disconnect the high voltage cable (white) from the high voltage supply outlet on the mass spectrometer.
12. Disconnect the reference-probe high voltage cable (green) from the reference-probe power inlet on the mass spectrometer.
13. Disconnect the options cable (blue) from the options port on the mass spectrometer.
14. Carefully lift off the ionKey source module, and store it safely.

6

Maintenance Procedures

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

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

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Maintenance schedule

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

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

Maintenance schedule:

Procedure	Frequency	For information...
Clean the instrument case.	As required.	See page 131 .
Empty the nitrogen exhaust trap bottle.	Check daily, empty as required.	See page 277 .
Maintain the Oerlikon Leybold roughing pumps.	As required. Minimum period is monthly.	See page 279 .
Gas ballast the Oerlikon Leybold roughing pumps.	As required. Minimum period is monthly.	See page 280 .
Replace the Oerlikon Leybold roughing pumps' oil and oil de-mister elements.	Annually.	See page 284 .
Gas ballast the Edwards roughing pump.	As required. Minimum period is monthly.	See page 292 .
Replace the oil-free (scroll) pump's seals.	Annually.	See Edwards document <i>XDS46i Instruction Manual A730-01-880</i> .
Clean the source components.	When sensitivity decreases to unacceptable levels.	See page 131 .
Clean the StepWave ion guide.	When sensitivity is not improved by cleaning source components.	See page 152 .
Replace the ESI probe tip.	When sensitivity decreases to unacceptable levels.	See page 172 .
Replace the ESI probe capillary.	When sensitivity decreases to unacceptable levels or sample flow is inconsistent.	See page 176 .

Maintenance schedule:

Procedure	Frequency	For information...
Clean the IonSABRE II probe tip. (Options using the APCI probe only.)	When sensitivity falls to unacceptable levels, or when significant chemical interference is present.	See page 192 .
Replace the IonSABRE II probe capillary. (Options using the APCI probe only.)	When sensitivity falls to unacceptable levels or sample flow is inconsistent.	See page 193 .
Replace the LockSpray probe capillary.	Annually.	See page 208 .
Replace the NanoLockSpray reference-probe capillary.	Annually.	See page 217 .
Replace the Lockspray source assembly seals.	Annually.	See page 227 .
Replace the mass spectrometer air filters.	Annually.	See page 217 .
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 page 227 .
Replace the APCI probe heater.	If the heater fails to heat the probe.	See page 201 .
Replace the ion-block heater cartridge.	If the heater fails to heat the ion block.	See page 203 .
Replace the IntelliStart Fluidics tubing.	If blockage occurs in tubing connections between the IntelliStart Fluidics system components.	See page 242 .
Replace an ionKey source fluid line.	As required or during periodic maintenance.	See page 294 .
Clean the ionKey source surface, fluid connectors, or electronic connectors.	As required or during periodic maintenance.	See page 299 .

Note: The turbo molecular pumps inside the instrument also require a regular oil cartridge change. The turbo molecular pumps are not user serviceable; contact Waters Customer Support for more information.

Spare parts

Replace only the parts mentioned in this document.

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.

Troubleshooting with Connections INSIGHT

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

If you encounter a performance issue when using the Instrument Console, you can manually submit a Connections Insight request to Waters customer support. Alternatively, you can use Remote Desktop, a real-time collaboration option that controls the two-way connection with the ACQUITY UPLC system by enabling the Connections INSIGHT iAssist service level.

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

- <http://www.waters.com>
- *Connections INSIGHT Installation-guide* (part number 715001399)
- *Connections INSIGHT User's Guide* (part number 715001400)
- Your sales representative
- Your local Waters subsidiary
- Waters Customer Support

To submit a Connections Insight request:

1. Select Troubleshoot > Submit Connections Insight request.
2. In the Connections Insight Request dialog box, type your name, telephone number, e-mail address, and a description of the problem.
3. Click Submit, and allow approximately 5 minutes to save the service profile.

Result: A .zip file containing your Connections Insight profile is forwarded to Waters customer support for review.

Tip: Saving a service profile or plot file from the Instrument Console can require as much as 150 MB of file space.

Safety and handling

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



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



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



Warning: To avoid electric shock,

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



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



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



Notice: When performing maintenance inside the source enclosure, ensure that the following criteria are met:

- Instrument is in Standby mode.
- LC flow is diverted to waste or set to Off.
- Desolvation gas flow is turned off.



Warning: To avoid injury or equipment damage caused by spilled solvent, do not place reservoir bottles on top of the instrument, unless in the bottle tray provided.

! **Notice:** To avoid damaging the iKey separation device, observe these precautions:




- Handle the device 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*.
- Do not apply electrospray potential to the emitter for an extended period when no solvent is flowing.
- Do not drop the device.
- Do not immerse the device in liquid.
- Do not freeze or overheat the device. Keep it within the allowed temperature ranges during operation and in storage.
- Use the device's sheath to protect it when it is not in use.
- Do not bend or pull the capillary connection tubing where it couples to the ionKey source.
- Avoid excess voltage, which can erode the emitter over time.
- Decompress the device before you remove it from the source.
- Do not touch the electrospray emitter. Doing so can cause it to bend.
- For storage, flush the device with 100% acetonitrile before you remove it from the source. For further details, see the *iKey Separation Device Care and Use Manual*.

See Appendix A “[Safety Advisories](#)” for safety advisory information.

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, operating the source isolation valve, and when maintaining the source).

To prepare the instrument:

1. In the Instrument Console, click Stop Flow .
If column flow is required, divert the LC flow to waste as follows:
 - a. In the Instrument Console system tree, expand SYNAPT G2-Si Detector, Interactive Fluidics.
 - b. Click Control .
 - c. Select Waste as the flow state.
2. In the Instrument Console, click Standby .
3. Set the source temperature to 30 °C.
4. Wait 30 minutes to allow the desolvation gas flow to cool the probe and source.
5. In the Instrument Console, ensure that the API desolvation gas flow is stopped.

Removal and refitting of the source enclosure

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

You must remove the LockSpray or NanoLockSpray source enclosure from the instrument before performing certain maintenance procedures or fitting the optional dual-mode APPI/APCI or ionKey sources.

Removing the source enclosure from the instrument

Required materials

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



Warning: To avoid electric shock, prepare the instrument for work performed on its source before starting the following procedure.

To remove the source enclosure:

1. Prepare the instrument for work performed on its source (see [page 120](#)).



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

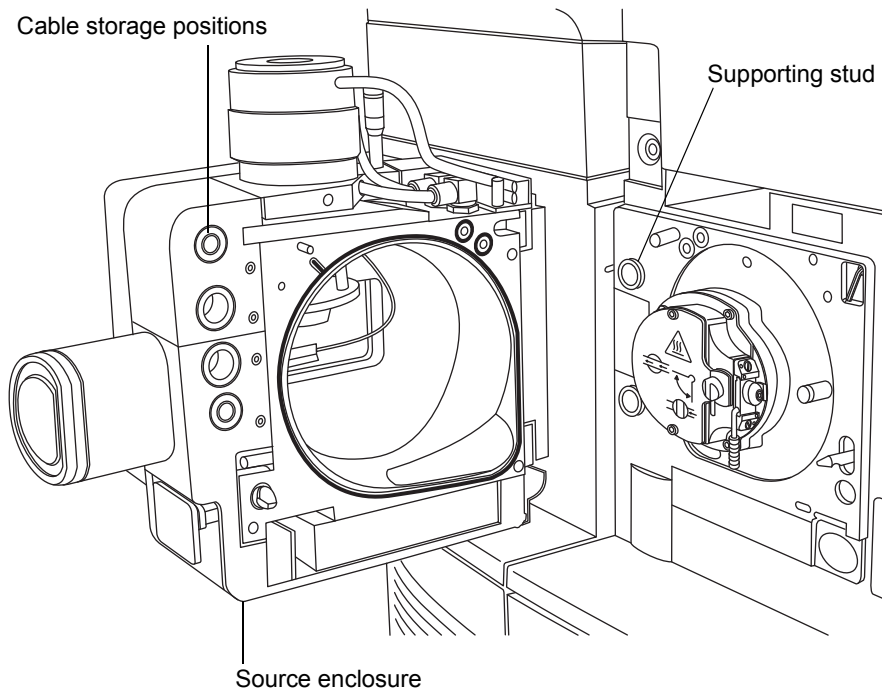
2. Remove the probe from the source:
 - If you are removing an ESI probe, see [page 69](#).
 - If you are removing an APCI probe, see [page 86](#).
3. Slide open the instrument's source interface door (see the figure on [page 67](#)).
4. Disconnect the source enclosure cables from the instrument's connectors.



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

! **Notice:** To avoid damaging the sample inlet when removing a NanoLockSpray source enclosure, move the sprayer platform out of the source enclosure before opening it (see [page 94](#)).

5. Pull the source enclosure release (located at the bottom, right-hand side) outwards, and swing open the enclosure.
6. Using two hands, grasp the source enclosure, and lift it vertically off the two supporting studs on the source adaptor housing.



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

Fitting the source enclosure to the instrument

Required materials

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following 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 tip is sharp).

To fit the source enclosure to the instrument:

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



Notice: To avoid damaging the sample inlet when fitting a NanoLockSpray source enclosure, move the sprayer platform out of the source enclosure before closing it (see [page 94](#)).

2. Close the source enclosure.
3. Connect the source enclosure cables to the instrument's connectors.

Tip: The cables and connectors are color coded; the blue-sleeved cable connects to the blue connector and the yellow-sleeved cable to the yellow connector.

4. Slide closed the instrument's source interface door.

Installing and removing the corona pin

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

Installing the corona pin in the source

Required materials

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



Warning: To avoid electric shock, prepare the instrument for work performed on its source before starting the following procedure.

To install the corona pin in the source:

1. Prepare the instrument for work performed on its source (see [page 120](#)).



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

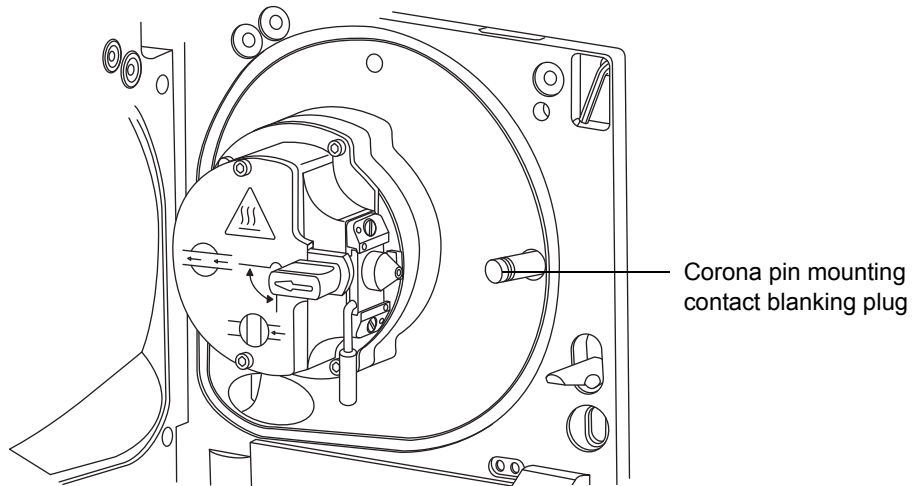


Warning: To avoid puncture wounds, take great care while working with the source enclosure open if an ESI probe is fitted. The ESI probe tip is sharp.

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

Tip: Store the blanking plug in a safe location.

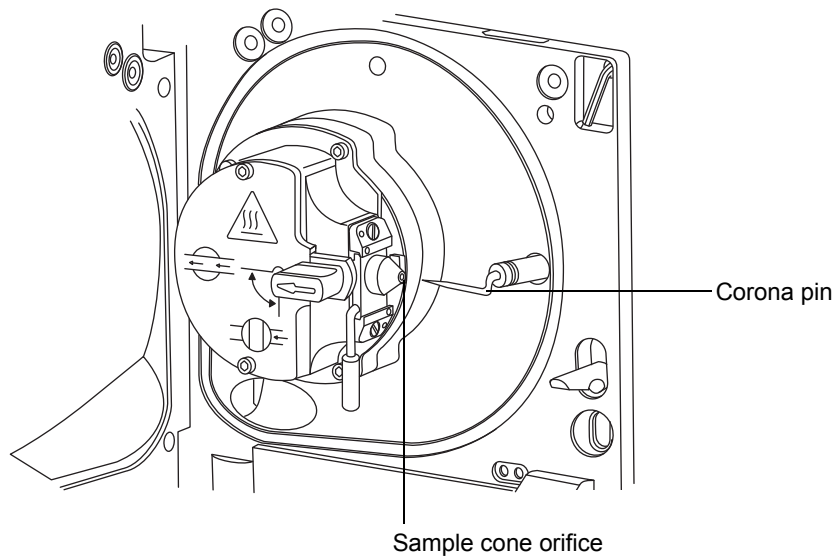
Corona pin mounting contact:



4. Fit the corona pin to the corona pin mounting contact.

Requirement: Ensure that the corona pin is securely mounted and that its tip aligns with the sample cone orifice.

Corona pin:



5. Close the source enclosure.

6. Look through the source window, and using the vernier probe adjuster (see the figure on [page 66](#)), position the ESI probe tip so that it is pointing, approximately, midway between the tips of the sample cone and corona pin.

Removing the corona pin from the source

Required materials

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



Warning: To avoid electric shock, prepare the instrument for work performed on its source before starting the following procedure.

To remove the corona pin from the source:

1. Prepare the instrument for work performed on its source (see [page 120](#)).



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



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

2. Pull the source enclosure release (located at the bottom, right-hand side) outwards, and swing open the enclosure.
3. Remove the corona pin from its mounting contact (see the figure on [page 125](#)).
Tip: Store the corona pin in a safe location.
4. Fit the blanking plug to the corona pin mounting contact.
5. Close the source enclosure.

Operating the source isolation valve

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

Required materials

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



Warning: To avoid electric shock, prepare the instrument for work performed on its source before starting the following procedure.

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

1. Prepare the instrument for work performed on its source (see [page 120](#)).



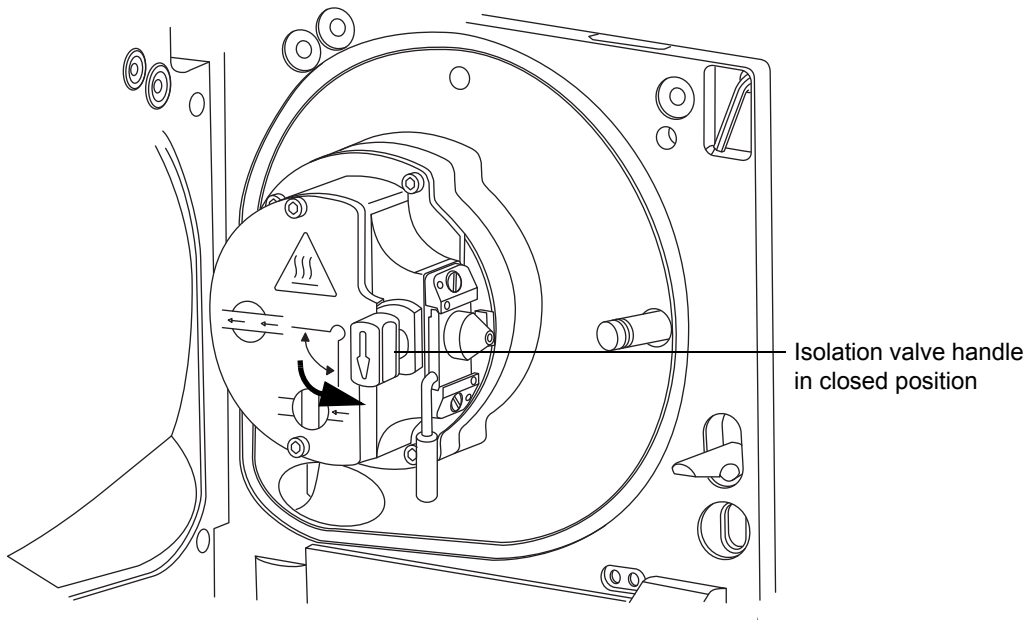
Warning: To avoid burn injuries, take great care while working with the instrument's source enclosure open. The source can be hot.



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

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

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



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

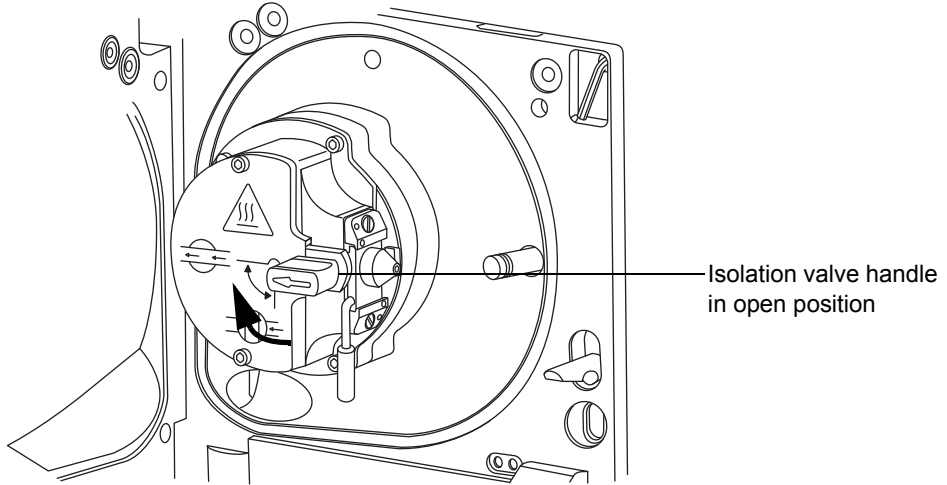


Warning: To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

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

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

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

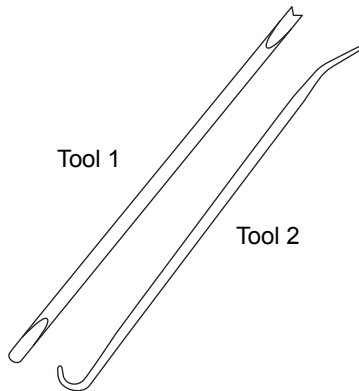


2. Close the source enclosure.

Removing O-rings and seals

When performing certain maintenance procedures, you must remove O-rings or seals from instrument components. An O-ring removal kit is available from your Waters supplier.

O-ring removal kit:



To remove an O-ring:

- ! **Notice:** To avoid scratching components with the removal tool. Carefully remove O-ring and seals.

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

Tip: If the O-ring or seal is not going to be reused, you can use the forked end of tool 1 to impale the O-ring or seal, and aid its removal.

Cleaning the source components

Clean the sample cone and cone gas nozzle (see [page 131](#)) when these conditions apply:

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

If cleaning the sample cone and cone gas nozzles fails to increase signal sensitivity, clean the ion block and isolation valve (see [page 140](#)).

If cleaning the ion block and isolation valve fails to increase signal sensitivity, also clean the StepWave ion-guide assembly (see [page 152](#)).

Cleaning the sampling cone assembly

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

Removing the sampling cone assembly from the source

Required materials

Chemical-resistant, powder-free gloves.



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



Warning: To avoid electric shock, ensure that the instrument is in Standby mode before starting the following procedure.



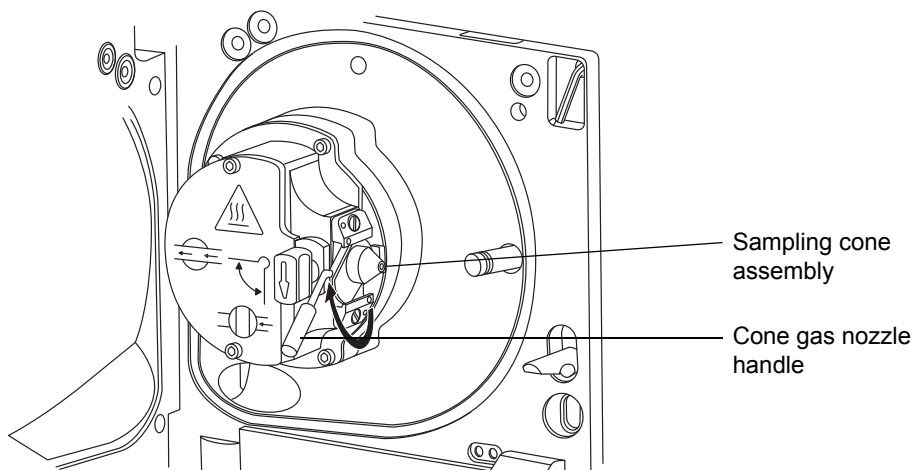
Warning: To avoid puncture wounds, take great care while working with the source enclosure open if an ESI probe is fitted. The probe tip is sharp.



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

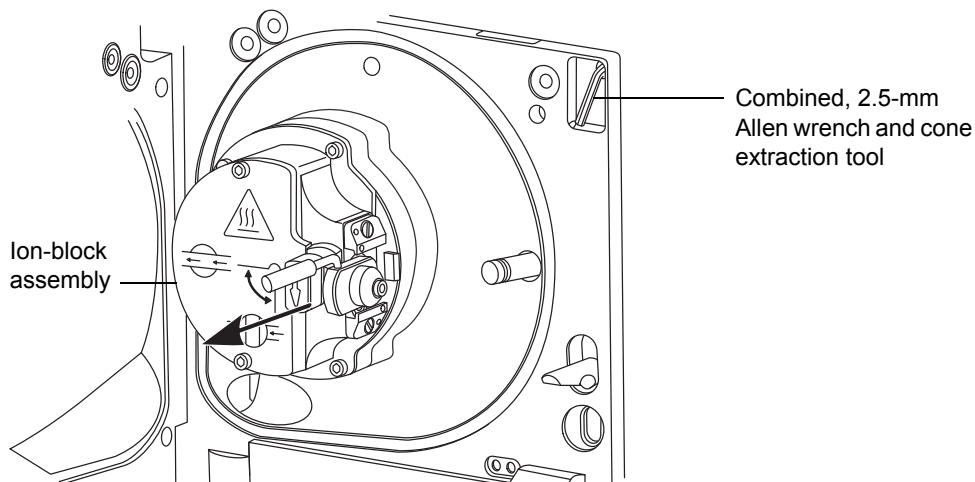
To remove the sampling cone assembly from the source:

1. Close the source isolation valve (see [page 126](#)).
2. Grasp the cone gas nozzle handle, and use it to rotate the sampling cone assembly 90 degrees, moving the handle from the vertical to the horizontal position.



! **Notice:** To avoid inadvertently venting the instrument. Do not open the isolation valve at any time when the sampling cone assembly has been removed from the ion-block assembly.

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



Disassembling the sampling cone assembly

Required materials

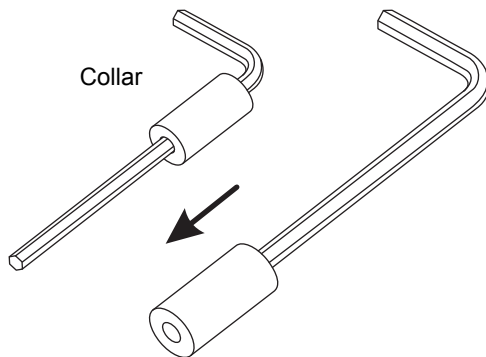
- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool



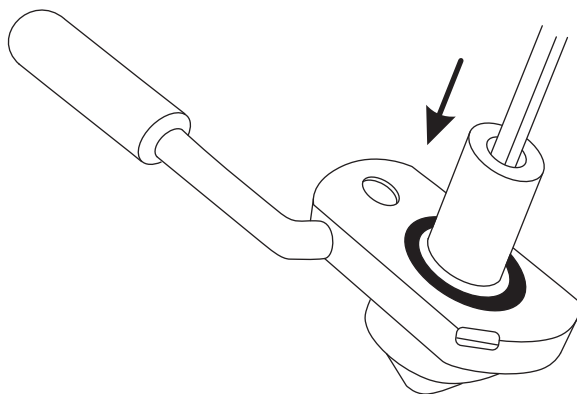
Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

To disassemble the sampling cone assembly:

1. Retrieve the combined, 2.5-mm Allen wrench and cone extraction tool from its storage location on the source adaptor housing.
2. On the combined, 2.5-mm Allen wrench and cone extraction tool, slide the collar to the end of the tool.

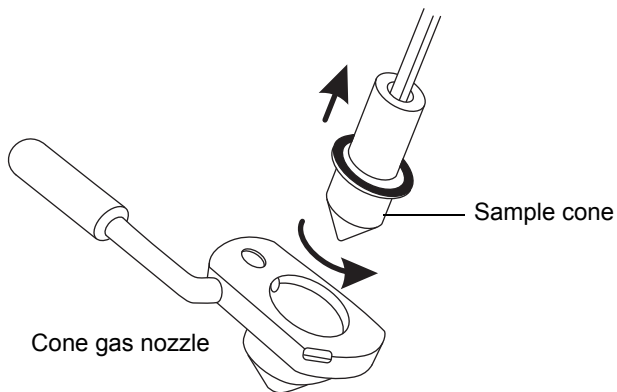


3. Insert the collar in the sample cone.



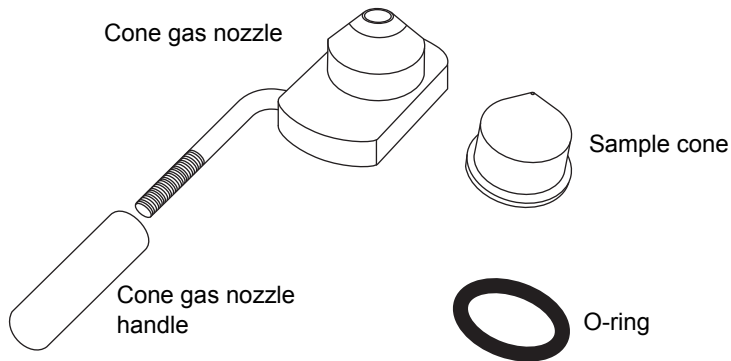
! **Notice:** To avoid damaging the fragile sample cone, do not place it on its tip; instead, place it on its flanged base.

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



5. Remove the sample cone from the combined, 2.5-mm Allen wrench and cone extraction tool.
6. Replace the combined, 2.5-mm Allen wrench and cone extraction tool in its storage location on the source adaptor housing.

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



Warning: To avoid contaminating the disposal area with biologically hazardous or toxic materials, dispose of the O-ring according to local environmental regulations.

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

Cleaning the sample cone and cone gas nozzle

Required materials

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



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



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



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

To clean the sample cone and cone gas nozzle:

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

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

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

Requirement: If you used formic acid in the cleaning solution, do as follows:

- Rinse the components by immersing them in separate glass vessels containing water and then placing the vessels in the ultrasonic bath for 20 minutes.

- 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 for the remainder of this procedure.

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

Requirement: If contamination persists, repeat the cleaning procedure. If, after cleaning a second time, contamination persists, dispose of the component, and obtain a new one before reassembling the sampling cone assembly.

Assembling the sampling cone assembly

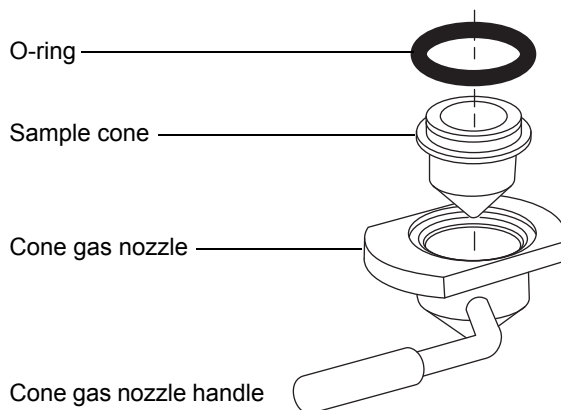
Required materials

Chemical-resistant, powder-free gloves

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

To assemble the sampling cone assembly:

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



2. Carefully fit the sample cone into the cone gas nozzle.
3. Fit the O-ring into the groove created between the sample cone and cone gas nozzle.

Requirement: Fit a new O-ring, if necessary.

Fitting the sampling cone assembly to the source

Required materials

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



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

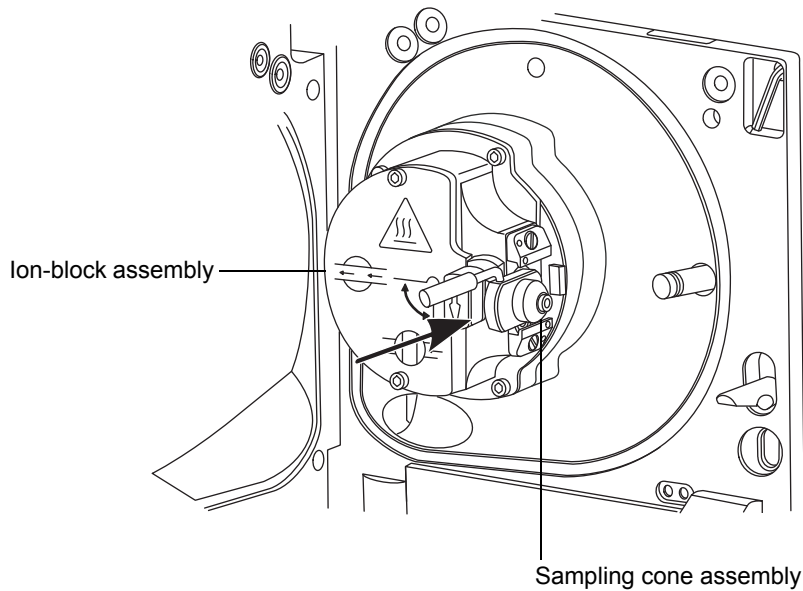


Notice: To avoid distorting, denting, puncturing, or otherwise damaging the sample cone assembly, do not open the source isolation valve before fitting the sampling cone assembly to the ion-block assembly.

To fit the sampling cone assembly to the source:

1. Ensure that the source isolation valve is in the closed position (see [page 127](#)).

2. Hold the sampling cone assembly so that the cone gas nozzle handle is oriented horizontally and at the top, and then slide the sampling cone assembly into the ion-block assembly.



3. Grasp the cone gas nozzle handle, and use it to rotate the sampling cone assembly 90 degrees, moving the handle downward from the horizontal to the vertical position.
4. Open the source isolation valve (see [page 129](#)).
5. Close the source enclosure.

Cleaning the ion-block assembly

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

Removing the ion-block assembly from the source assembly

Required materials

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



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

To remove the ion-block assembly:

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



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

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



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



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

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

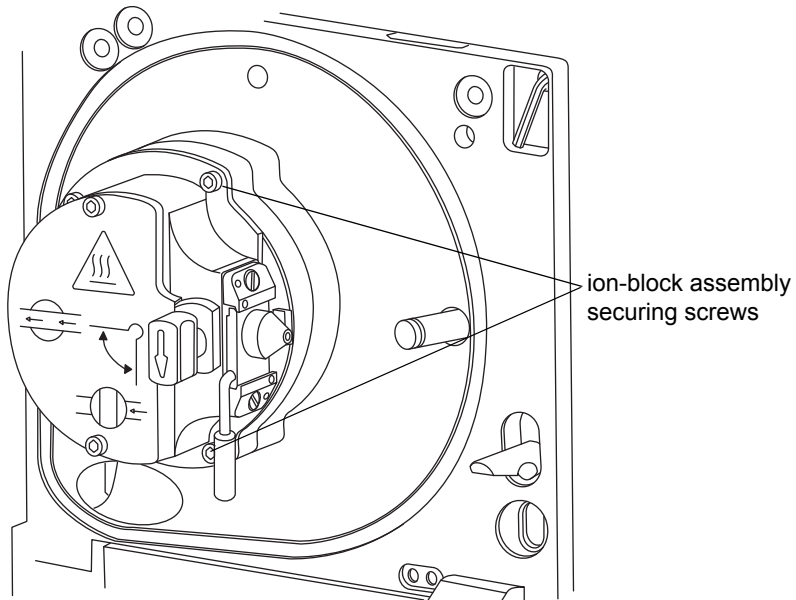


Warning: To avoid puncture wounds, take great care while working with the source enclosure open if an ESI probe is fitted.

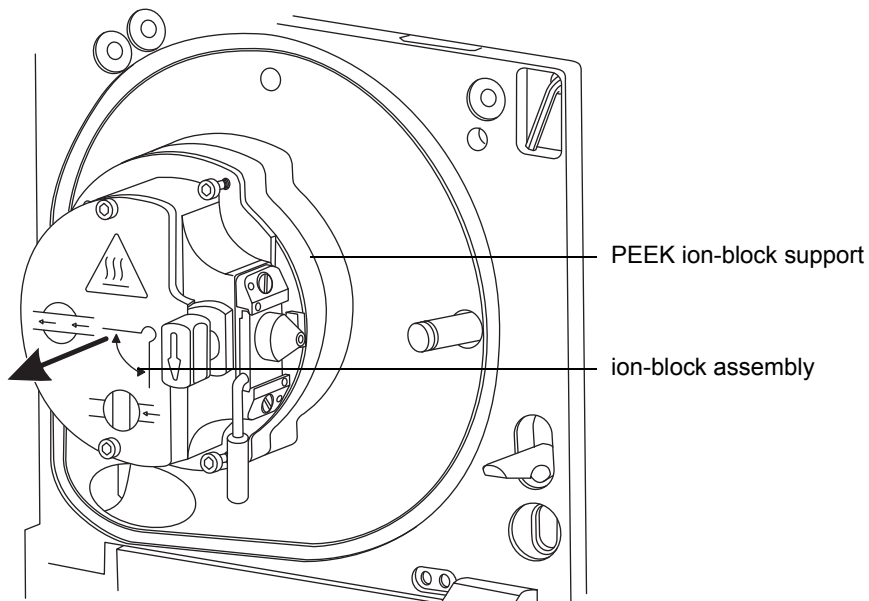
3. Remove the source enclosure (see [page 121](#)).

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

4. Close the source isolation valve (see [page 124](#)).
5. Use the combined, 2.5-mm Allen wrench and cone extraction tool to unscrew the four captive, ion-block assembly securing screws.



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



Disassembling the source ion-block assembly

Required materials

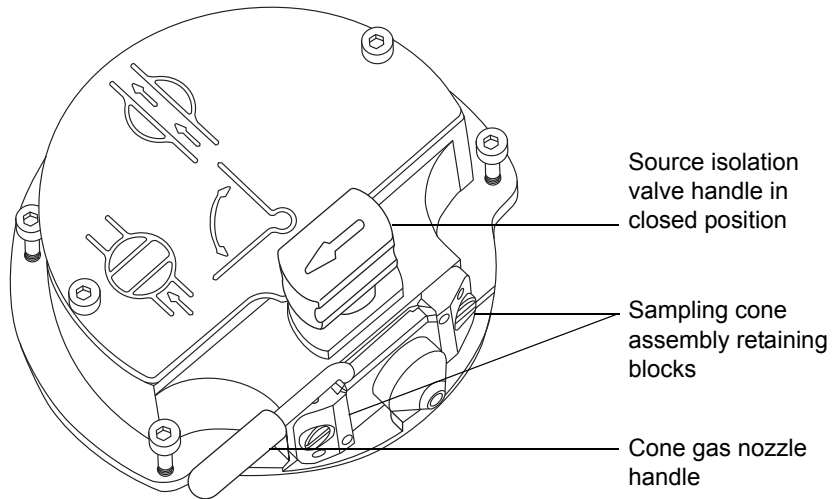
- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool
- O-ring removal kit



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

To disassemble the ion-block assembly:

1. Ensure that the source isolation valve is closed.



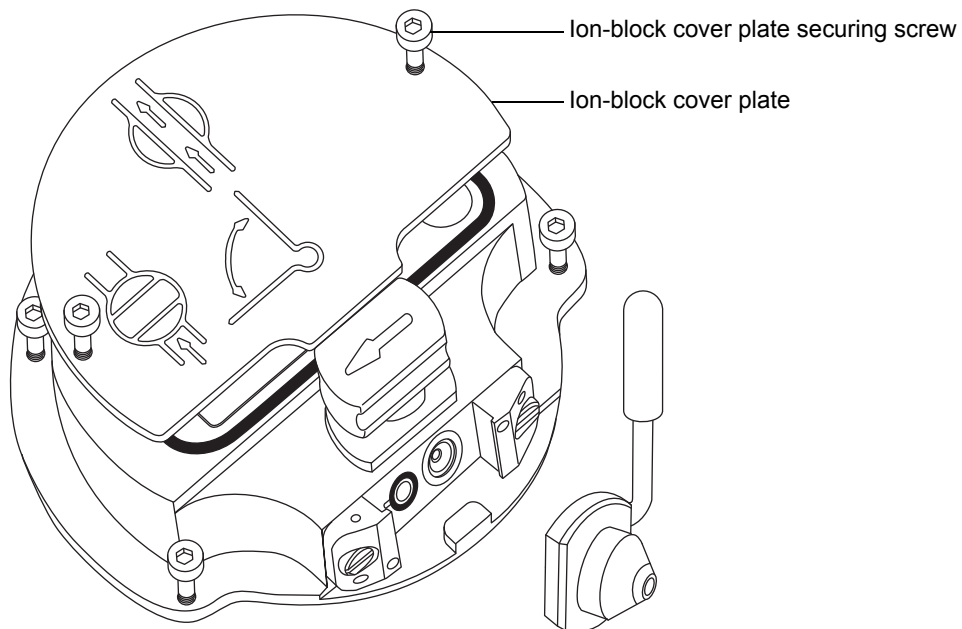
2. Grasp the cone gas nozzle handle, and use it to rotate the sampling cone assembly through 90 degrees.

! **Notice:** To avoid improper operation of the ion-block assembly after its reassembly,

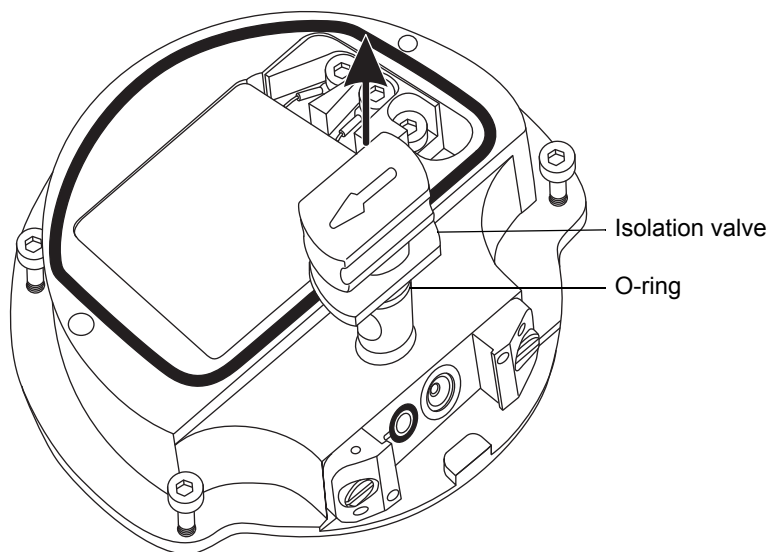
- do not remove the sampling cone assembly retaining blocks.
 - do not adjust the screws securing the retaining blocks for the sampling cone assembly.
3. Slide the sampling cone assembly out of the ion-block assembly.

6 Maintenance Procedures

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



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



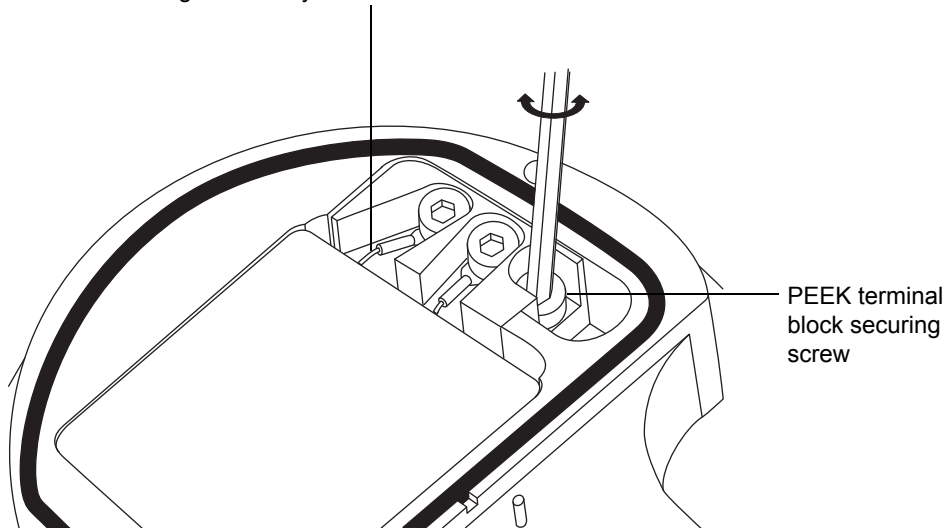
7. Use the O-ring removal kit to carefully remove the isolation valve O-ring (see [page 130](#)).



Warning: To avoid spreading contamination, dispose of the isolation valve O-ring in accordance with 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 Allen wrench and cone extraction tool to loosen the captive PEEK terminal block securing screw.

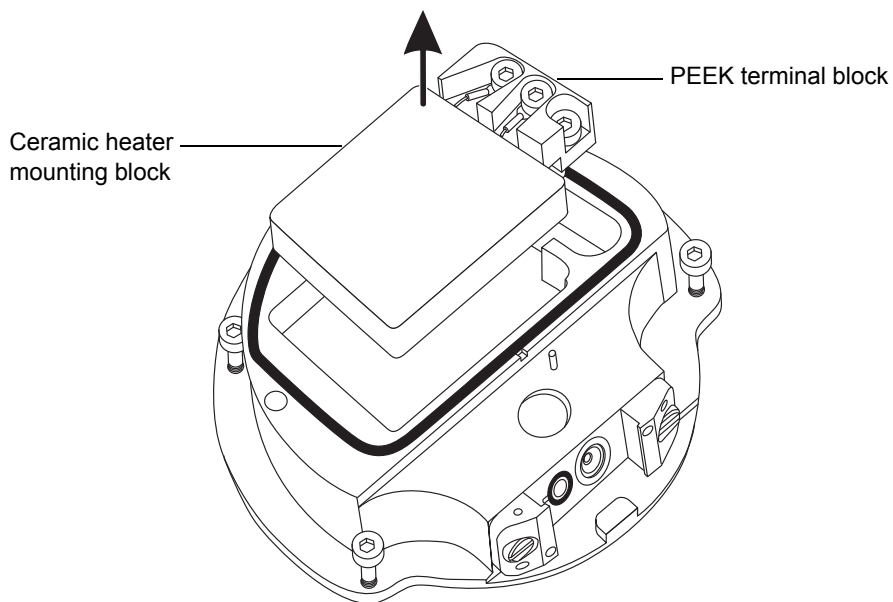
Heater cartridge assembly wires



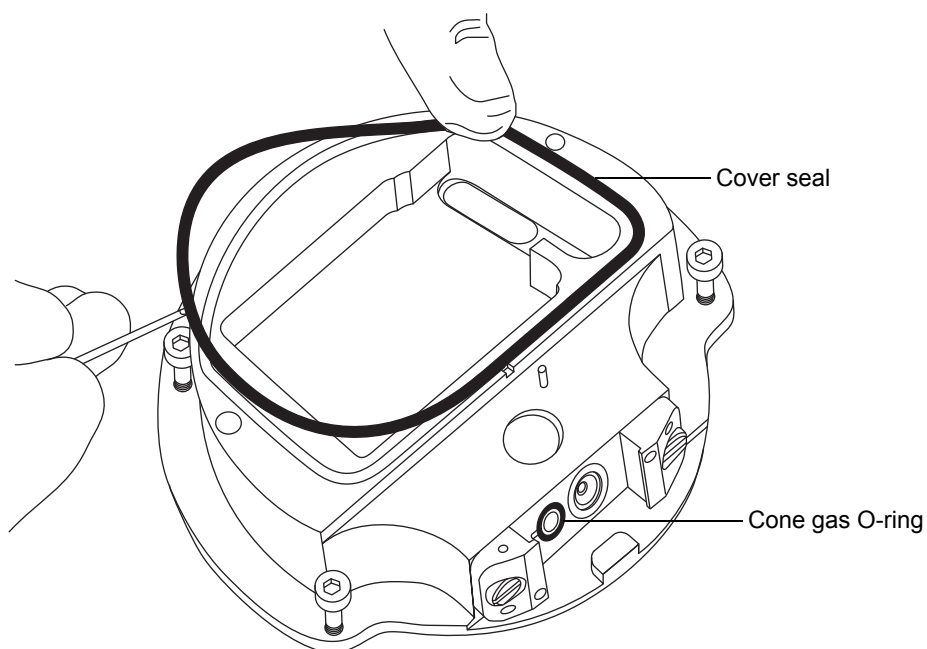
Notice: To avoid damaging the heater cartridge assembly wires, do not bend or twist them when removing the assembly and ceramic heater mounting block from the ion block.

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.



11. Use the O-ring removal kit to carefully remove the cover seal from the ion block (see also [“Removing O-rings and seals”](#) on page 130).



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



Warning: To avoid spreading contamination, dispose of the cover seal and cone gas O-ring in accordance with 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.

Cleaning the ion-block components

Required materials

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



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



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

To clean the ion-block components:



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

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

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

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

! **Notice:** To avoid recontaminating the components, wear clean, chemical-resistant, powder-free gloves for the remainder of this procedure.
4. Carefully remove the components from the vessels, and blow-dry them using inert, oil-free gas.
5. Inspect each component for persisting contamination. If contamination is present, do as follows:
 - a. Use the wash bottle containing 1:1 methanol/water to rinse the component over the large beaker.
 - b. Blow-dry the component using inert, oil-free gas.

  **Warning:** To avoid spreading contamination, dispose of the components in accordance with local environmental regulations.
6. Inspect each component for persisting contamination. If contamination is present, dispose of the component, and obtain a new one before reassembly.

Assembling the source ion-block assembly

Required materials

- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool
- Isopropyl alcohol in small container
- 1:1 methanol/water
- Lint-free cloth

! Notice:

- To avoid recontaminating the ion-block assembly, wear clean, chemical-resistant, powder-free gloves during the following procedure.
- To avoid damaging the heater cartridge assembly wires, do not bend or twist them when fitting the assembly and ceramic heater mounting block to the ion block.

To assemble the ion-block assembly:

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 Allen wrench and cone extraction tool to tighten the captive PEEK terminal block securing screw.
3. Ensure that the grooves that will receive 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 Allen 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.

Fitting the ion-block assembly to the source assembly

Required materials

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



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



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

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



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



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

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

1. Fit the ion-block assembly to the PEEK ion-block support.
2. Use the combined, 2.5-mm Allen wrench and cone extraction tool to fit and then sequentially and in small increments, slowly tighten the 4 securing screws that hold the ion-block assembly.
3. Open the source isolation valve (see [page 124](#)).
4. Fit the source enclosure (see [page 121](#)).
5. Close the source enclosure.
6. Connect the power cords for the mass spectrometer and both roughing pumps to the main power source.

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.

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. To avoid damaging assemblies fitted with a flexible PCB, which is not externally wired, do not touch the PCB.

Removing the ion-block support from the source assembly

Required materials

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

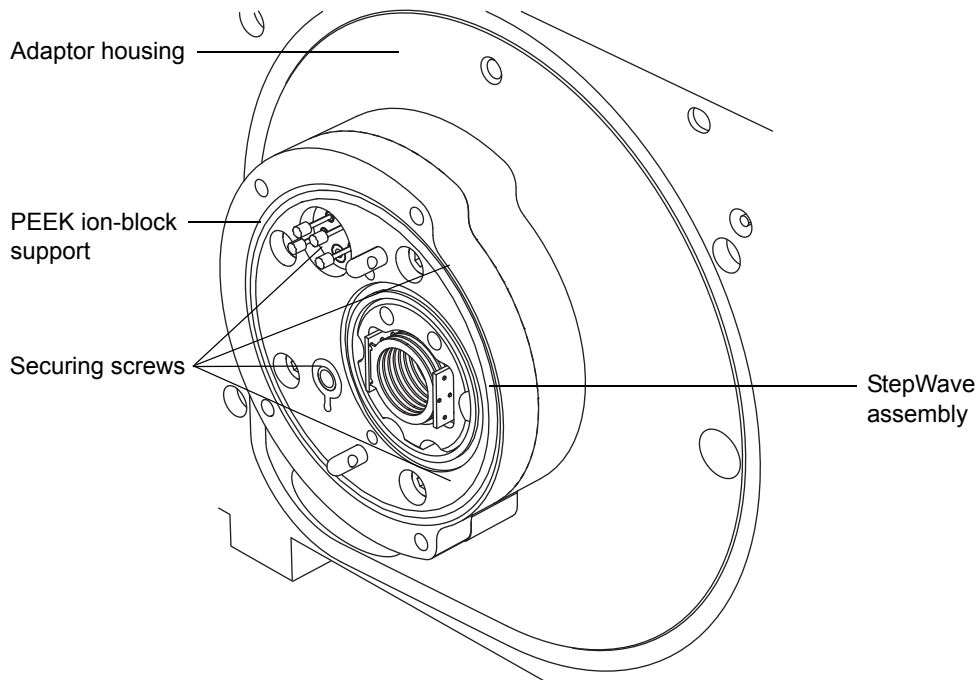


Warning: To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the probe and source components.

To remove the ion-block support from the source assembly:

1. Remove the source enclosure from the instrument (see [page 121](#)).
2. Remove the ion-block assembly from the PEEK ion-block support (see [page 140](#)).

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



4. Remove the PEEK ion-block support from the adaptor 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” in your instrument’s Operator’s Overview and Maintenance Guide).



Warning: To avoid contaminating uncontaminated surfaces with biologically hazardous, toxic, or corrosive materials, dispose of the O-rings 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.

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.



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

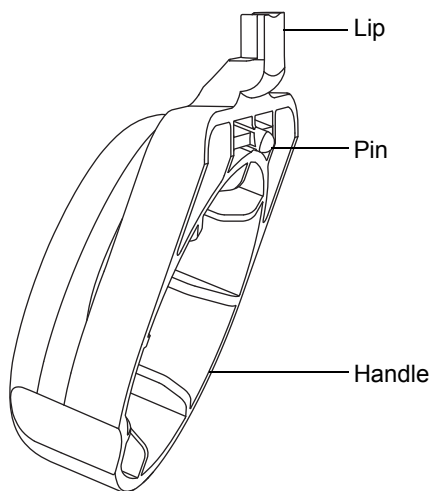
! **Notice:** To avoid damaging the StepWave ion-guide assembly when removing it from the source assembly, use only these tools:

- Seal breaker and locator tool.
- StepWave assembly removal and insertion tool.
- Do not use any other tool.

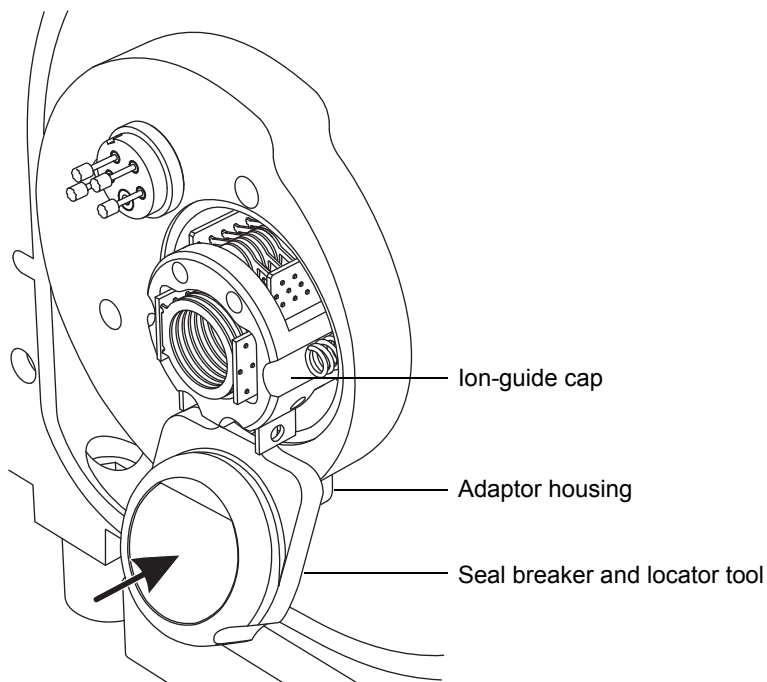
To remove the StepWave assembly from the source assembly:

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

Seal break and locator tool:



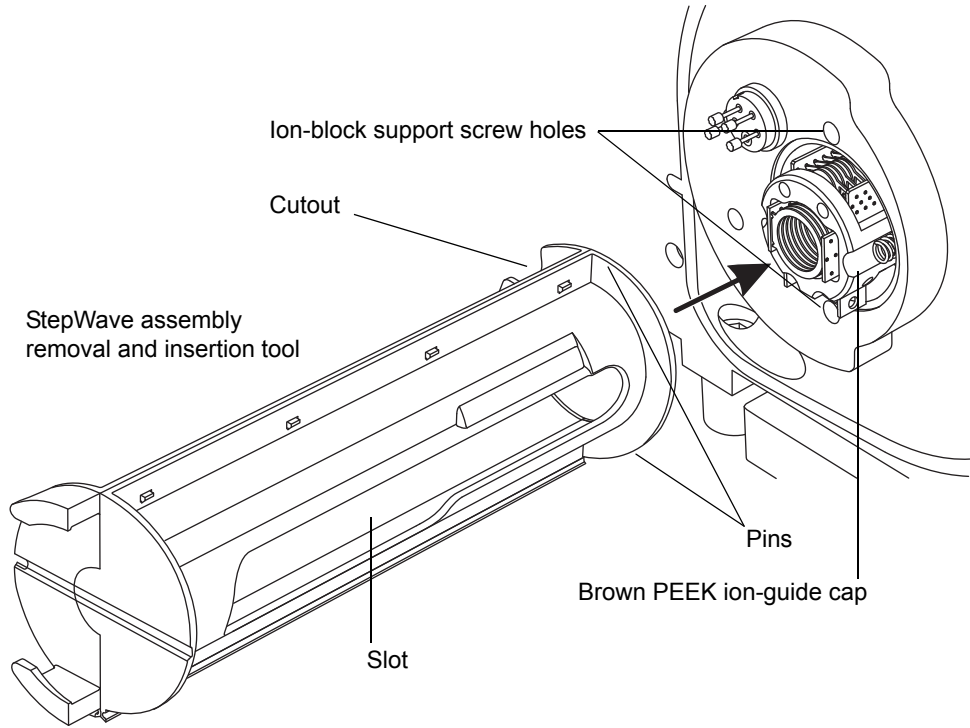
Seal breaker and locator tool positioned on the adaptor housing:



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



! **Notice:** To avoid breaking the wires and bending the vanes of the ion guides when removing the StepWave ion-guide assembly from the adaptor 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 breaking the wires and bending the vanes of the StepWave ion-guide assembly, handle it and its components carefully throughout the cleaning procedure.

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 adaptor housing.
7. Close the source enclosure.

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

Disassembling the StepWave ion-guide assembly



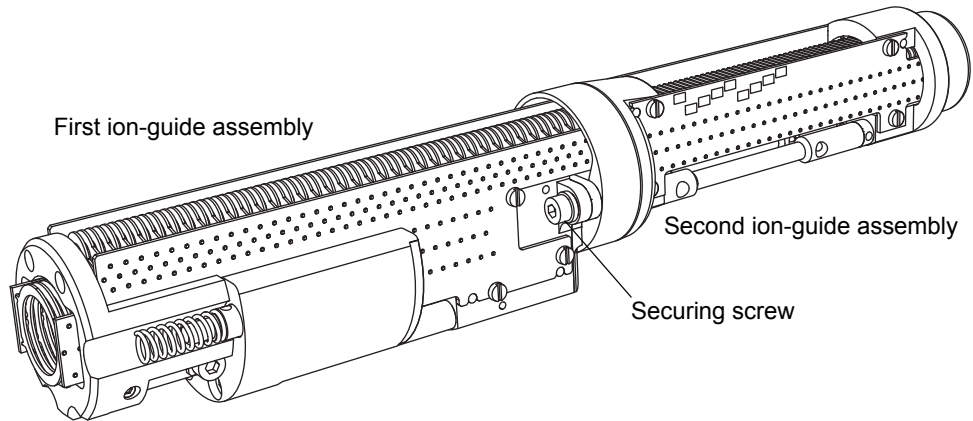
Warning: To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the probe and source components.

Required materials

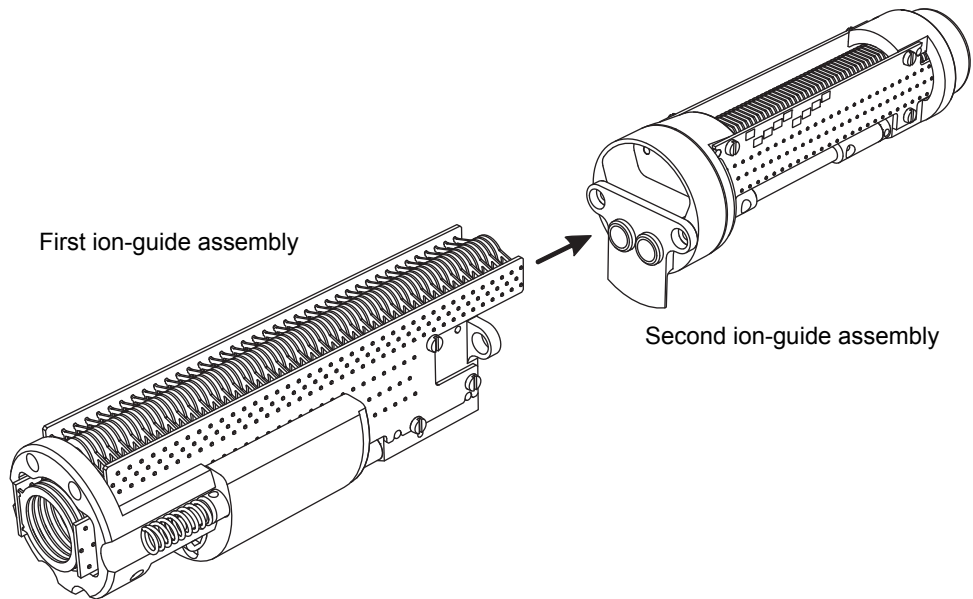
- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool
- O-ring removal kit

To disassemble the StepWave ion-guide assembly:

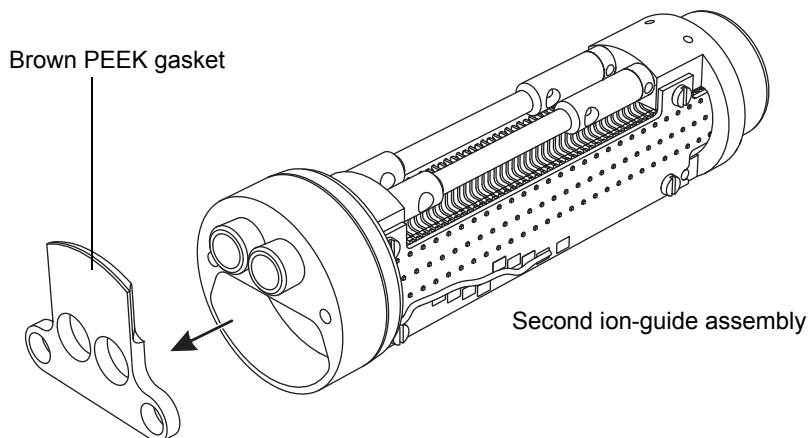
1. Use the combined, 2.5-mm Allen wrench and cone extraction tool to remove the 2 screws securing the first ion-guide assembly to the second ion-guide assembly.



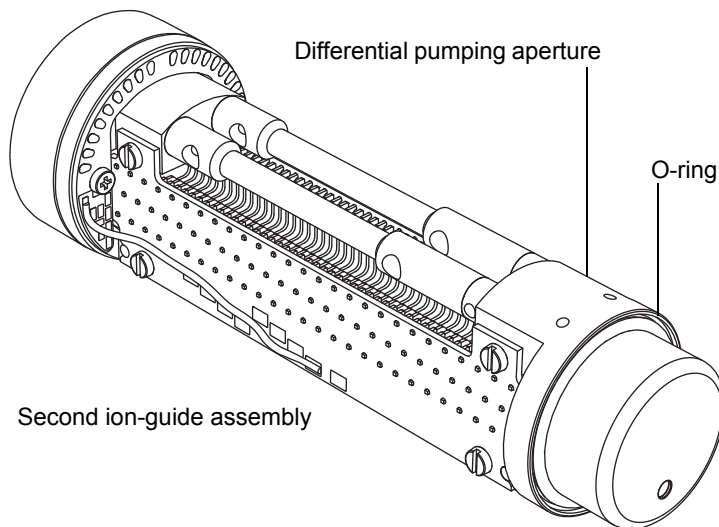
2. Separate the first and second ion-guide assemblies.



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



4. Remove the O-ring from the differential pumping aperture on the second ion-guide assembly (see [page 130](#)).



Warning: To avoid contaminating uncontaminated surfaces with biologically hazardous, toxic, or corrosive materials, dispose of the O-ring 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 misaligning the StepWave ion guide, do not remove the differential pumping aperture or any further components from the assembly.

Cleaning the StepWave ion-guide assembly



Warning: To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the first ion-guide and second ion-guide assemblies.

! **Notice:**

- To avoid damaging the first ion-guide and second ion-guide PCB assemblies, handle them carefully throughout the following procedure.
- 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 the following procedure.

Required materials

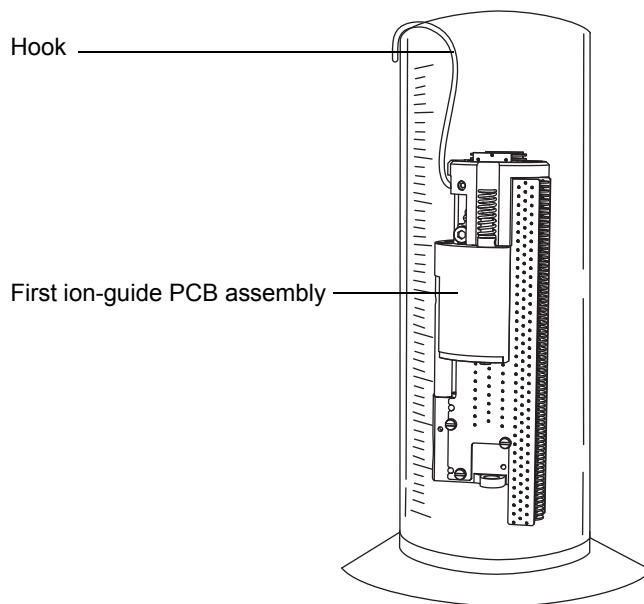
- Chemical-resistant, powder-free gloves.
- Two 250-mL measuring cylinders in which to completely immerse the first ion-guide and second ion-guide assemblies when cleaning.
- Two lengths of small-diameter PEEK or PTFE tubing appropriately sized for suspending the first ion-guide and second ion-guide assemblies in the glass vessels when cleaning.
- HPLC-grade deionized water.
- Waters MS Cleaning Solution.
- Holding container for used Waters MS Cleaning Solution.
- HPLC-grade isopropyl alcohol.
- Ultrasonic bath.
- Source of oil-free, inert gas (for example, nitrogen) for drying.

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

1. Bend a PEEK or PTFE tube into a hook shape.

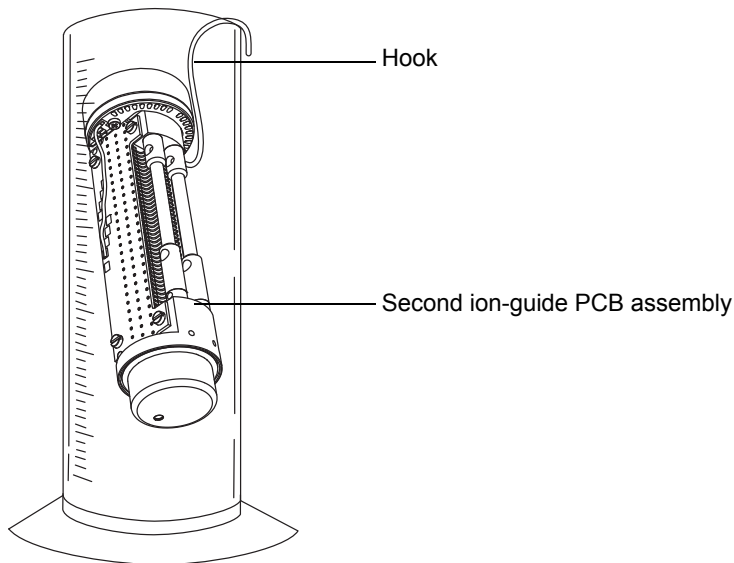
! **Notice:** To avoid vibration-caused damage to the ion guide, ensure that the bottom of the ion guide does not touch the bottom of the glass vessel.

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.



3. Add Waters MS Cleaning Solution to the glass vessel until the first ion-guide PCB assembly is immersed completely.

- Repeat [step 1](#) through [step 3](#) for the second ion-guide PCB assembly, placing the hook through one of the support rod holes.



- Place the vessels containing the first ion-guide and second ion-guide PCB assemblies in the ultrasonic bath for 20 minutes.
- 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.
- Fill the vessel with deionized water, to rinse the first ion-guide PCB assembly, then discard the water.
- Refill the vessel with deionized water, to rinse the first ion-guide PCB assembly a second time, and then discard the water.
- Repeat [step 6](#) through [step 8](#) for the second ion-guide PCB assembly.
- Fill both vessels with deionized water, ensuring that each ion-guide PCB assembly is immersed completely.
- Place the vessels containing the first ion-guide and second ion-guide PCB assemblies in the ultrasonic bath for 20 minutes.
- Carefully pour away 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.

Assembling the StepWave ion-guide assembly

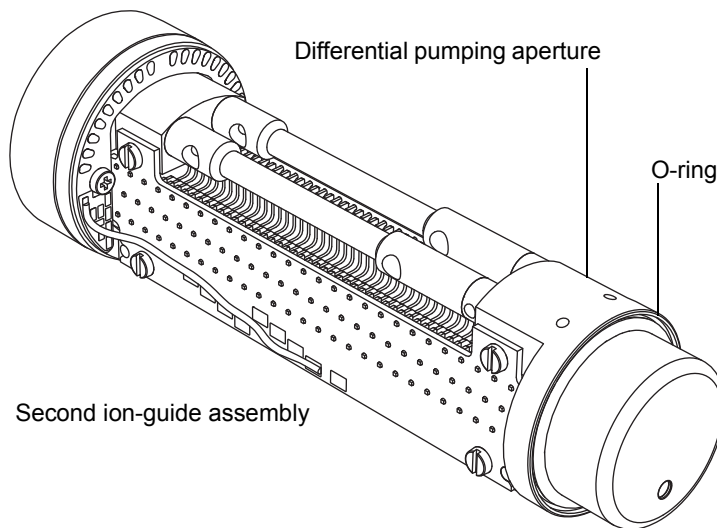
Required materials

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

! **Notice:** To avoid damaging the StepWave ion-guide assembly, handle it and its components carefully when performing the following procedure.

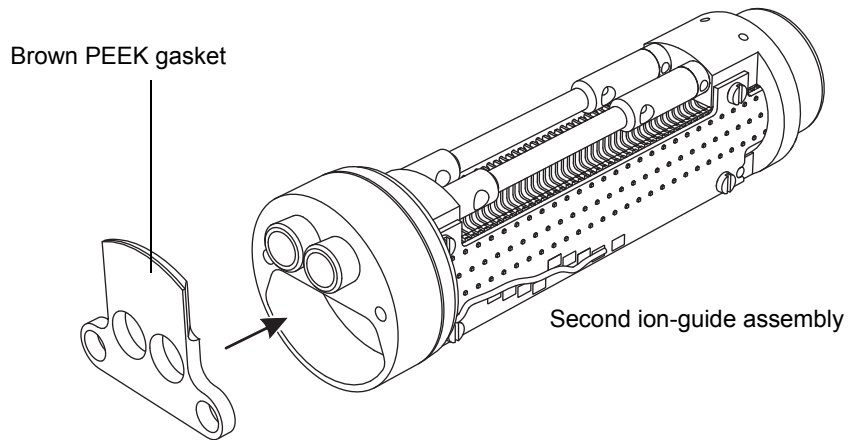
To assemble the StepWave ion-guide assembly:

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



2. Fit the brown PEEK gasket to the second ion-guide assembly.

Important: Ensure that the gasket is orientated correctly.



3. Align the first ion-guide assembly with the second ion-guide assembly.
4. Use the combined, 2.5-mm Allen wrench and cone extraction tool to fit and tighten the 2 screws securing the first ion-guide assembly to the second ion-guide assembly.

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



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

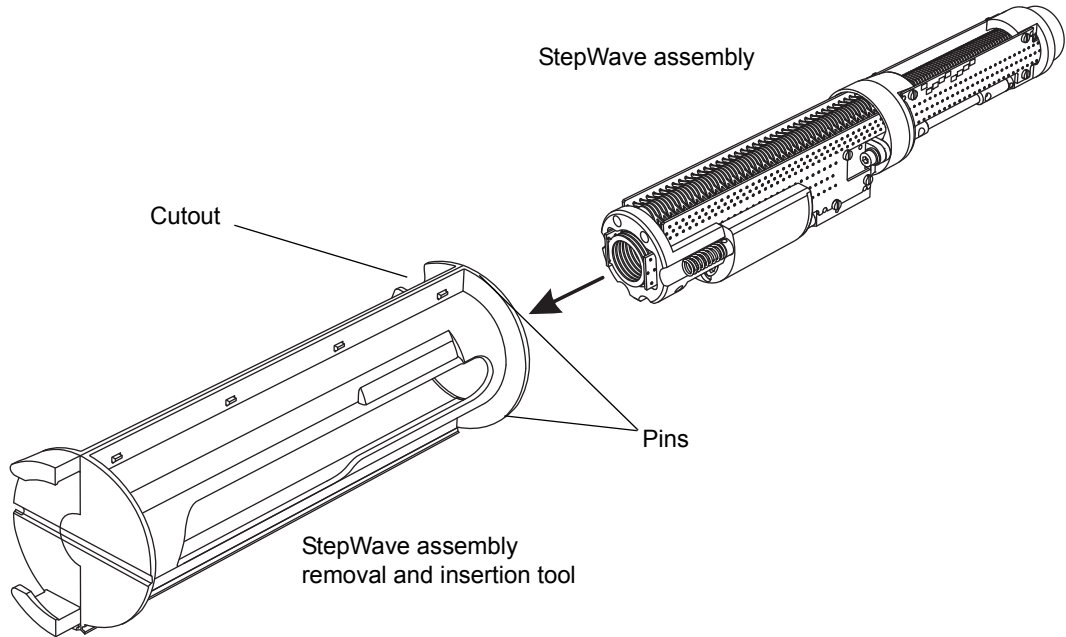
! **Notice:** To avoid damaging the StepWave ion-guide assembly when fitting it to the source assembly, use only the seal breaker, the locator, and the assembly's removal and insertion tools.

To fit the StepWave assembly to the source assembly:

1. Disconnect the probe adjuster and options cables from the instrument's connectors.
2. Pull the source enclosure release (located at the bottom, right-hand side) outwards, and swing open the enclosure.
3. Using both hands, grasp the source enclosure, and lift it vertically off the two supporting studs on the source adaptor housing.

- 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.



- 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.

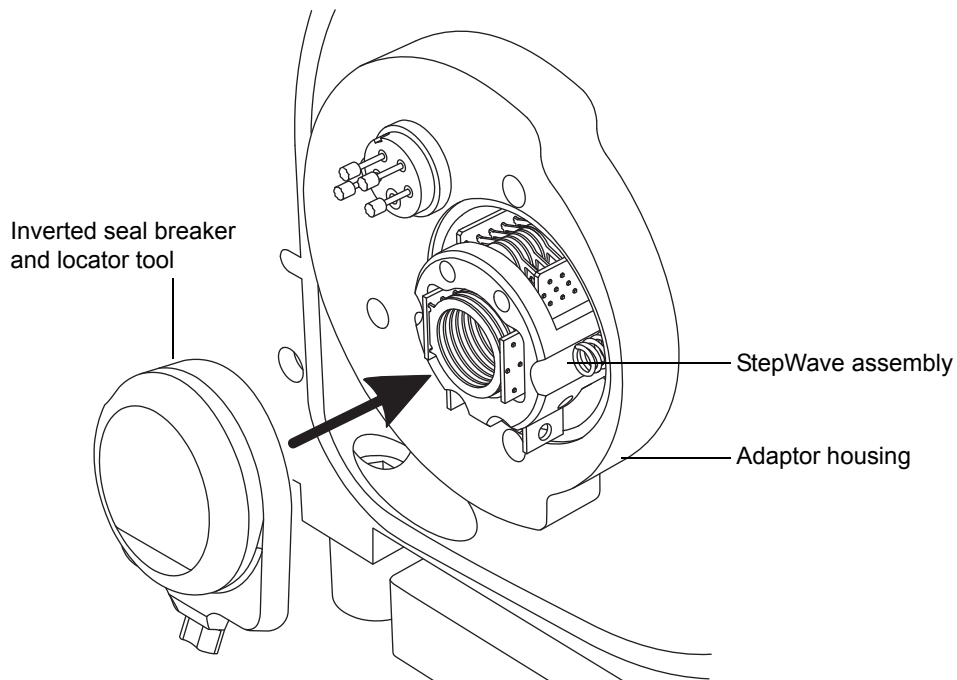
! **Notice:** To avoid damage to wires and vanes when fitting the StepWave ion-guide assembly to the adaptor housing, handle only the brown PEEK ion-guide cap.

- 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.

Note: Expect some resistance to motion when the StepWave assembly encounters the seal inside the instrument. Nevertheless, continue pushing until you detect further resistance.

- Remove the StepWave removal and insertion tool.

8. Invert the seal breaker and locator tool, and locate it over the end of the StepWave assembly.



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

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

10. Remove the seal breaker and locator tool.

Fitting the ion-block support to the source

Required materials

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



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

To fit the PEEK ion-block support to the source:

1. Ensure that the grooves that will receive 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 Allen wrench to fit and tighten the 4 securing screws that hold the PEEK ion-block support.
5. Fit the ion-block assembly to the PEEK ion-block support (see [page 152](#)).
6. Fit the source enclosure to the instrument (see [page 123](#)).

Maintaining the ESI probe

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

Part number	Name
700004207	ESI probe tip
700004208	Nickel gasket
700000640	PTFE liner tube
700000343	Ferrule
700000969	Conductive sleeve
700004206	Capillary

If the ESI probe tip is damaged or blocked, follow the procedure “Replacing the probe tip and gasket”, on [page 172](#).

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”, on [page 176](#).

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 wrench
- 10 mm wrench



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



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



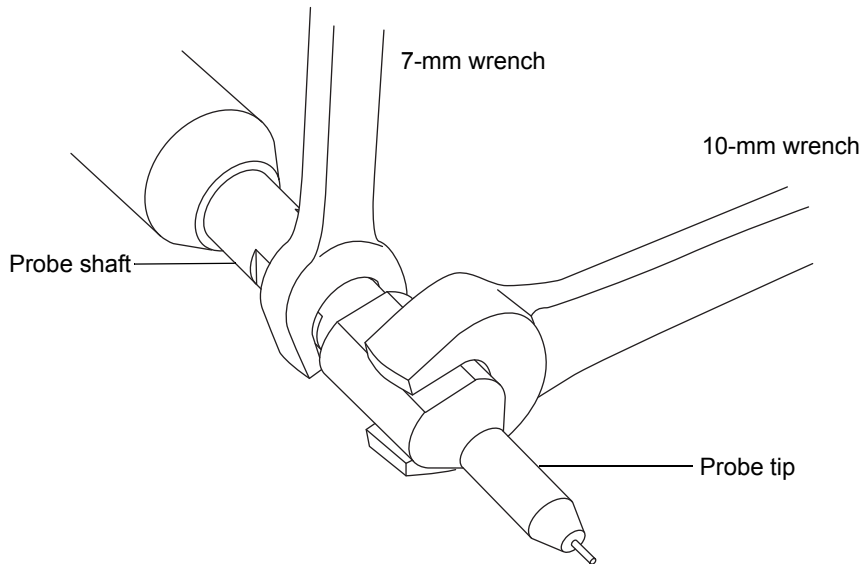
Warning: To avoid puncture wounds, handle the probe with care; the ESI probe tip is sharp.



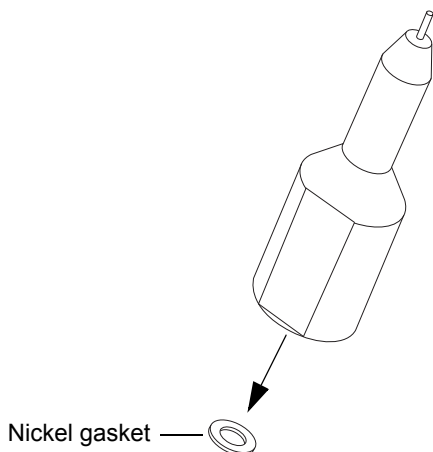
Warning: To avoid eye injury from the sharp capillary, wear safety goggles when performing the leak test.

To replace the ESI probe tip and gasket:

1. Remove the ESI probe from the source (see [page 69](#)).
2. 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:

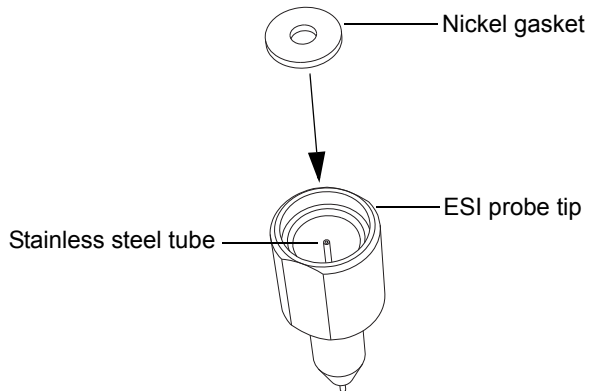


3. Remove the nickel gasket from the probe tip.



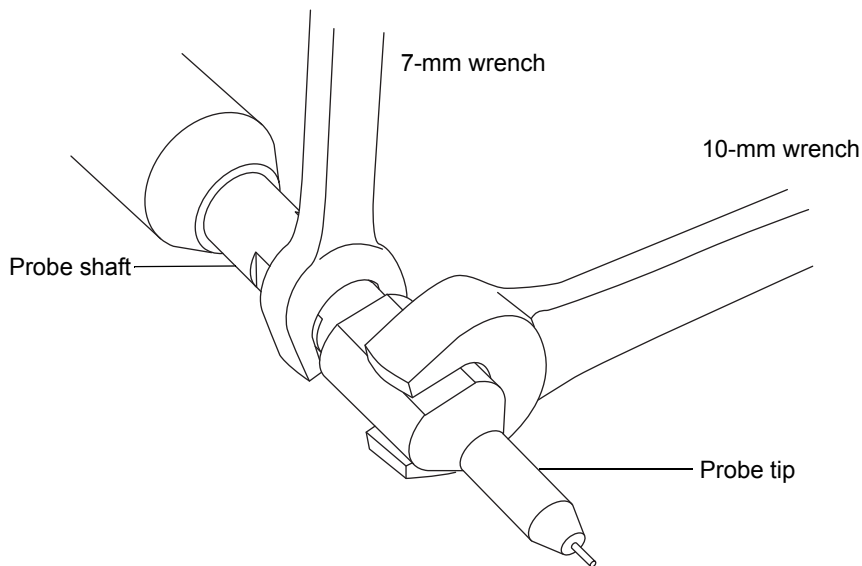
Warning: To avoid spreading biohazardous, toxic, or corrosive contamination, dispose of the probe tip and nickel gasket in accordance with local environmental regulations. They can be contaminated with biohazards or toxic materials.

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 that the gasket is seated around the narrow, stainless steel tube inside the probe tip.



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-mm wrench and the 10-mm wrench, as shown in the following figure:



Important: Fully tighten the probe tip, to compress the nickel gasket and avoid gas leakage.

10. Fit the ESI probe to the source enclosure (see [page 64](#)).
11. Use the nebulizer adjuster knob to fine tune the capillary length to suit your application (see the instrument's online Help file).

Replacing the ESI probe capillary

Replace the stainless steel 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 Allen wrench and cone extraction tool
- 7-mm wrench
- 8-mm wrench
- 10-mm 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 tube cutter or sharp knife
- Safety goggles



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



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

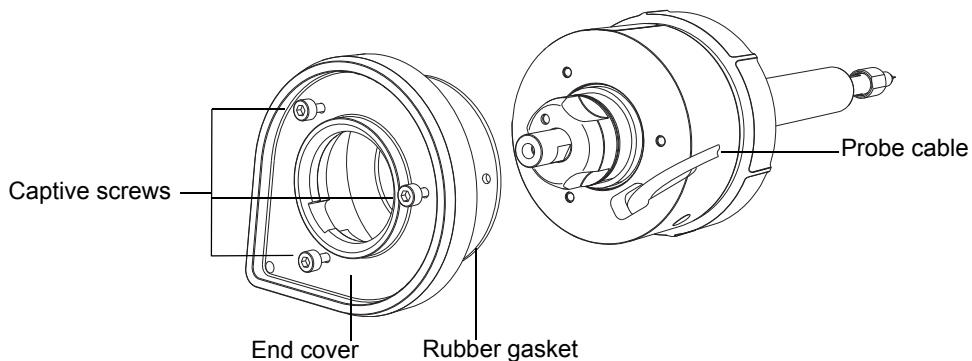


Warning: To avoid puncture wounds, handle the probe with care; the ESI probe tip is sharp.

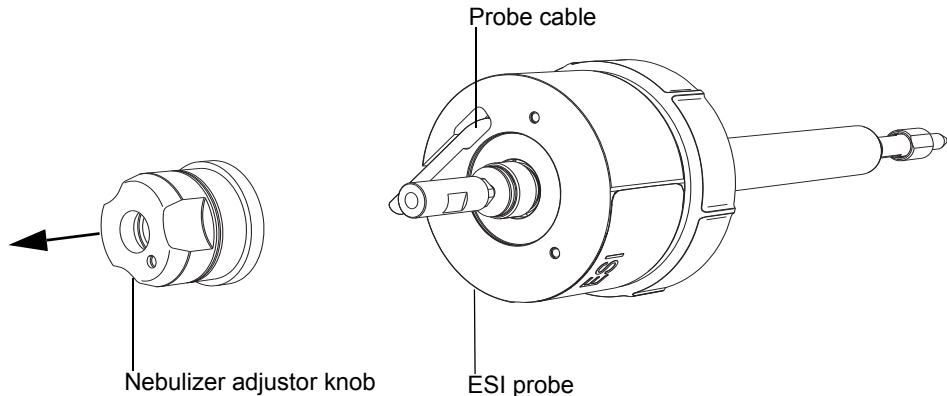
To remove the existing capillary:

1. Remove the probe from the source enclosure (see [page 69](#)).
2. Use the 2.5-mm Allen wrench to loosen the three captive screws securing the probe's end cover in place, and then remove the end cover and rubber gasket.

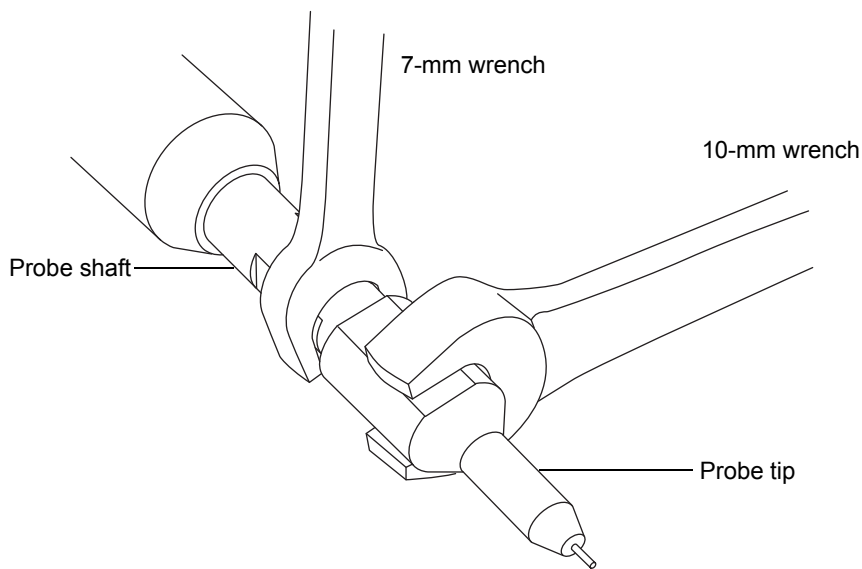
Tip: The end cover is secured by captive screws that you need not remove from the end cover of the probe. Simply loosen them to remove the end cover.



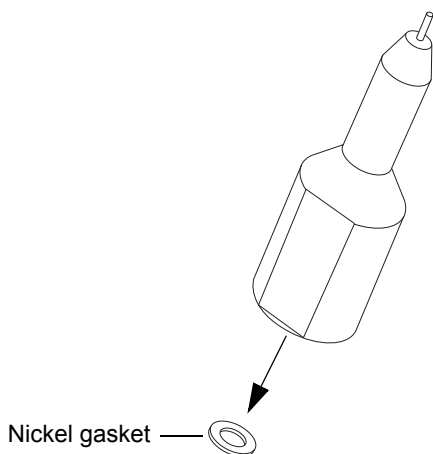
3. Unscrew and remove the nebulizer adjuster knob.



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:



5. Remove the nickel gasket from the probe tip.



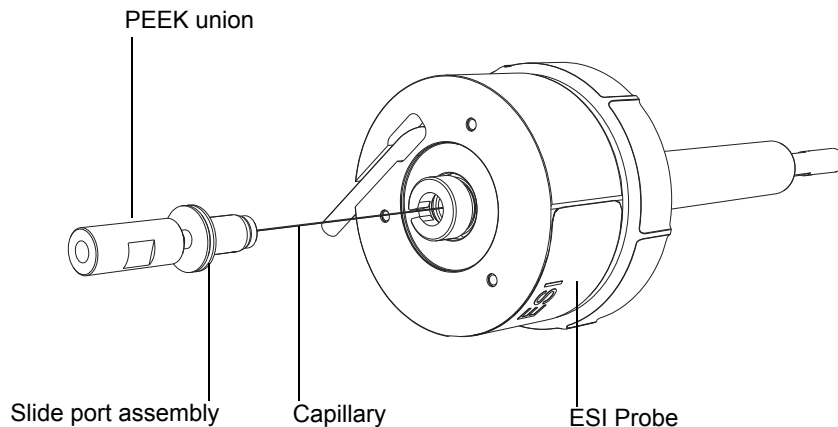
Warning: To avoid spreading biohazardous, toxic, or corrosive contamination, dispose of the probe tip and nickel gasket in accordance with local environmental regulations. They can be contaminated with biohazards or toxic materials.

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



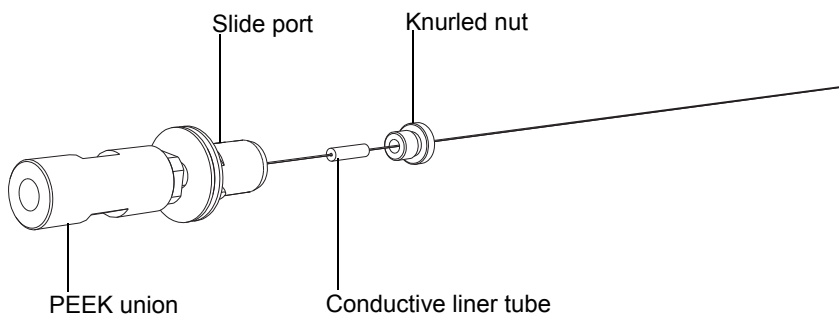
Warning: To avoid puncture wounds, handle the sharp capillary with care.

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



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

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

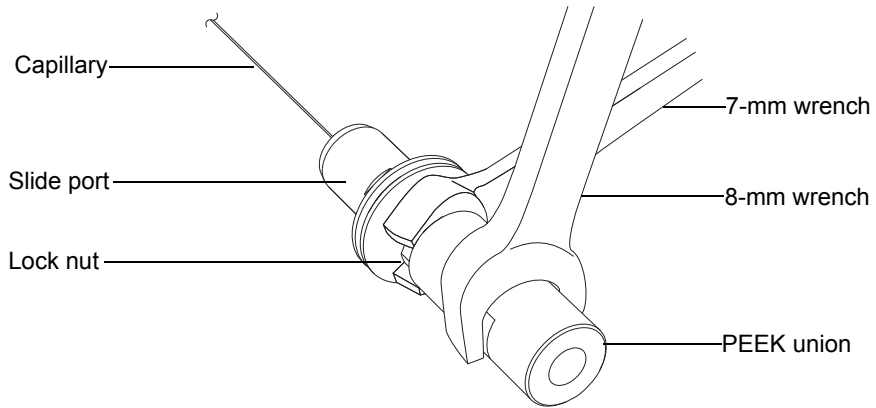


Important: Retain the knurled nut, which is required to reassemble the ESI probe.

- Dispose of the conductive liner tubing in accordance with local environmental regulations.

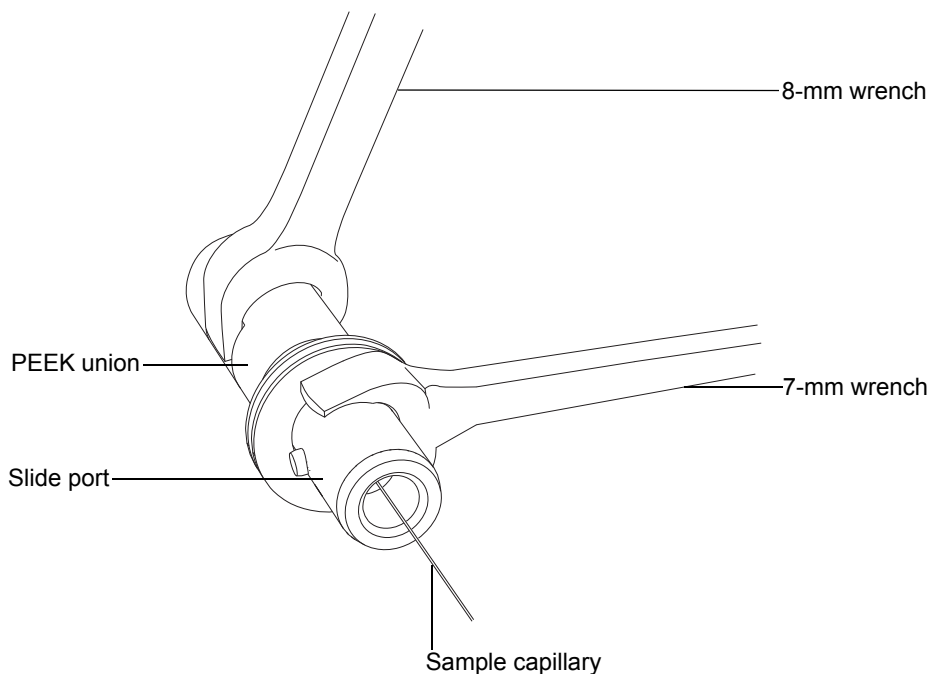
6 Maintenance Procedures

10. Loosen the lock nut at the base of the PEEK union using both the 7-mm and 8-mm wrenches.



Note: Use the 8-mm wrench to hold the PEEK union 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.



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.



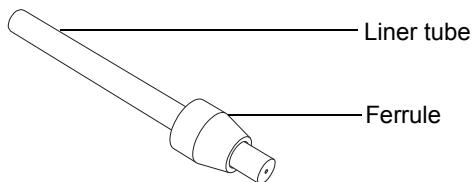
Warning: To avoid spreading biohazardous, toxic, or corrosive contamination, dispose of capillary, PTFE liner tube, and ferrule, in accordance with local environmental regulations. They can be contaminated with biohazards or toxic materials.

14. Dispose of the capillary, PTFE liner tube, and ferrule according to local environmental regulations.

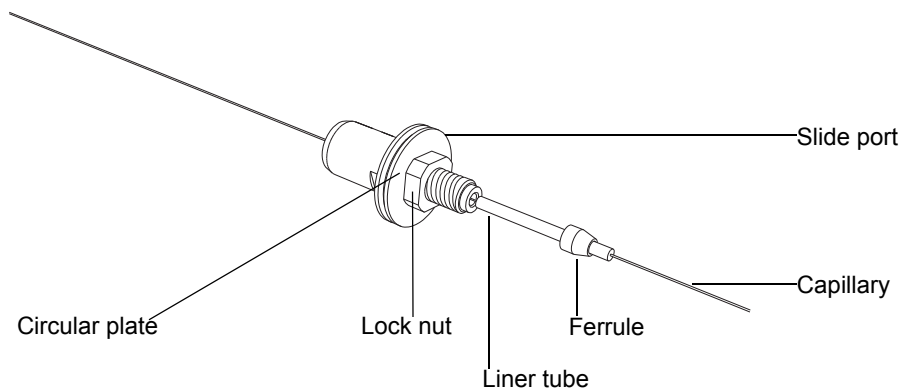
To install the new capillary:

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.

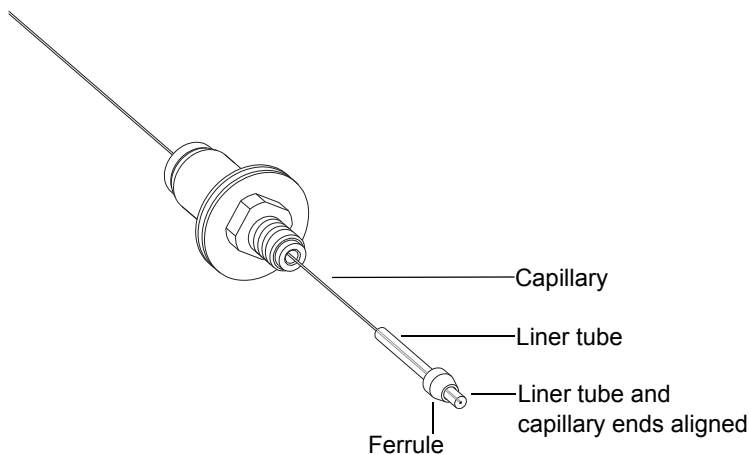


2. Slide the PTFE liner tube and ferrule assembly onto the new capillary.
3. Slide the capillary into the slide port until the liner tube reaches the slide port's narrow, threaded end, as shown in the following figure.



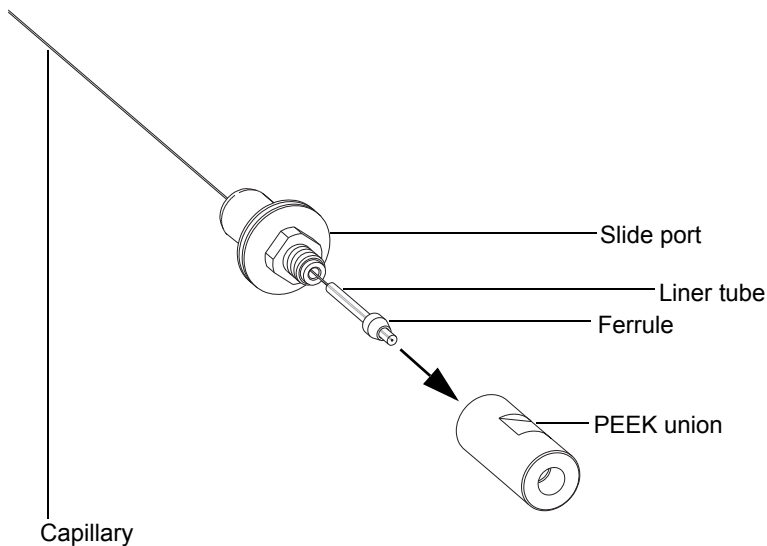
4. Ensure that the slide port's lock nut is screwed fully toward the slide port's circular plate, as shown in the figure above.

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.

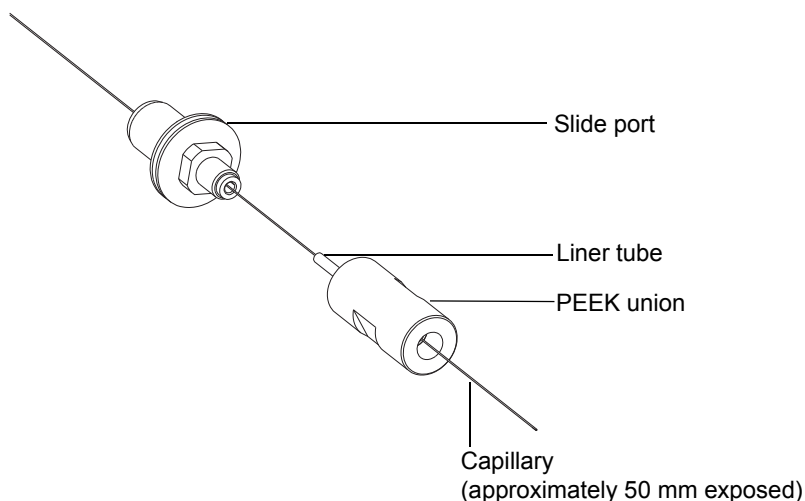


6. Insert the capillary and liner tube fully into the PEEK union, ensuring that the capillary end is flush with the liner tube end.

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

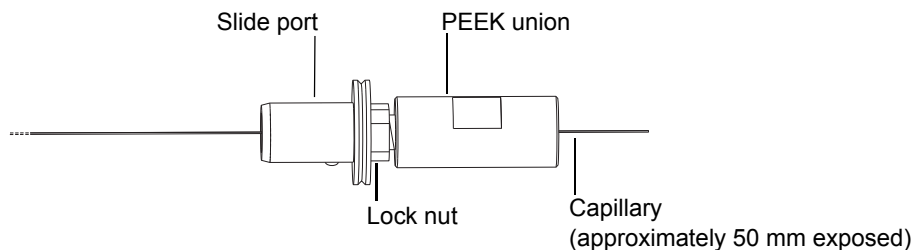


7. Feed the capillary through the liner tube and PEEK union, to expose approximately 50 mm of capillary on the opposite side of the union.



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

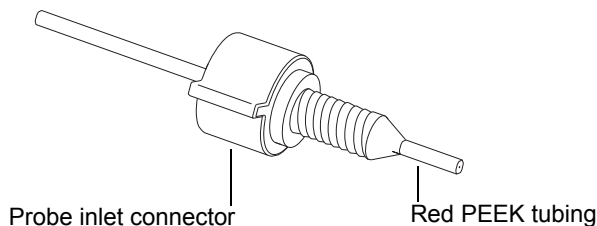
Requirement: Ensure that you can still slide the capillary within the slide port and PEEK union. If the capillary is trapped and cannot move, loosen the PEEK union slightly.



9. Use the sharp 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 perpendicular to its horizontal axis. 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.

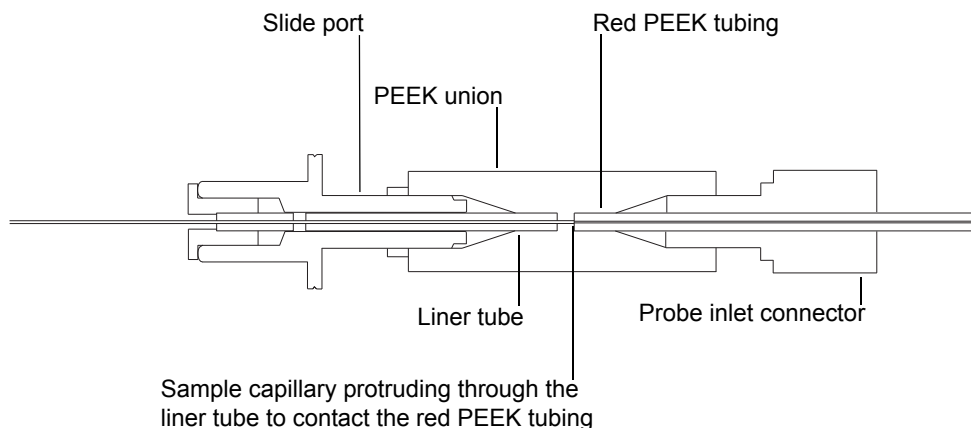


11. Using the end of the red PEEK tubing, push the capillary into the PEEK union until the red PEEK tubing is inserted as far as possible into the PEEK union.

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

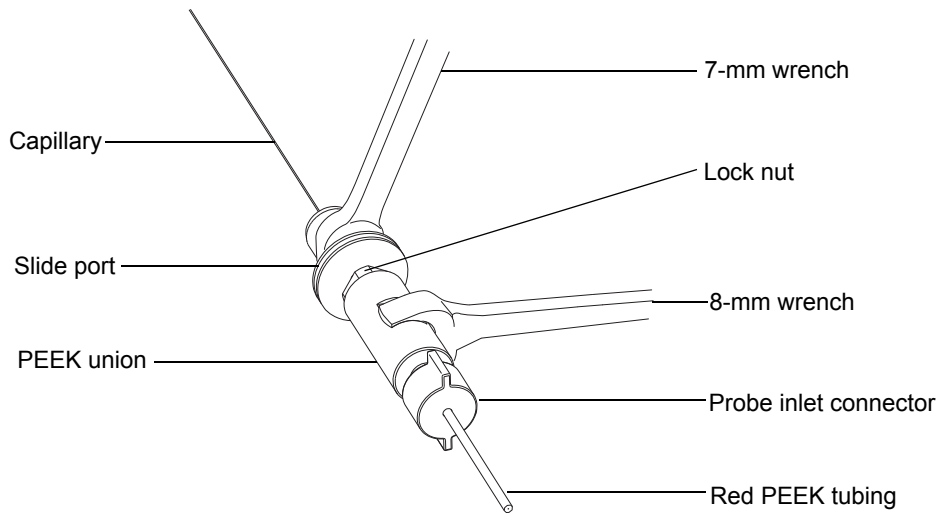
12. Maintaining slight pressure on the red PEEK tubing, to ensure that it remains in contact with the capillary, screw and fully tighten the inlet connector into the PEEK union.

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. Note that 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.



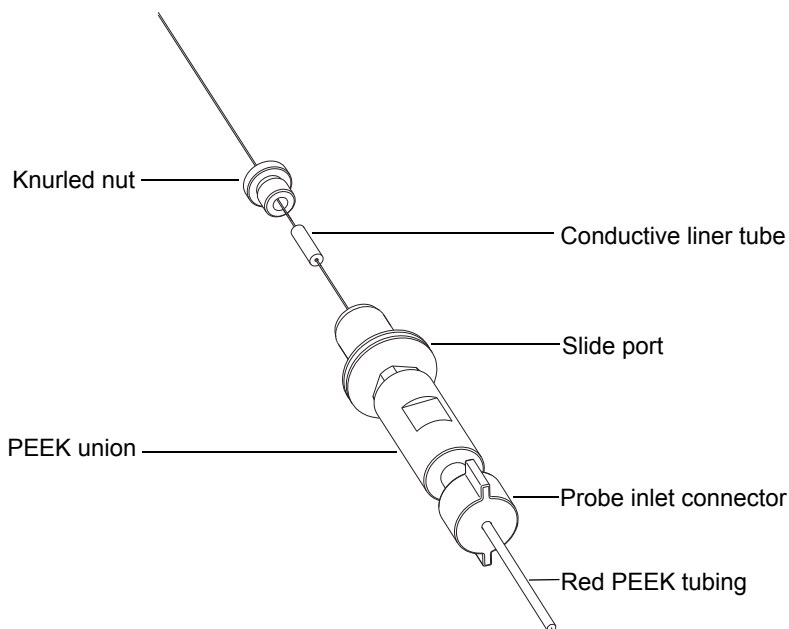
! **Notice:** To prevent damage to the ferrule, do not overtighten the PEEK union onto the slide port.

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



14. Finger-tighten the lock nut onto the PEEK union, and then, using the 7-mm and 8-mm wrenches, tighten by an additional quarter-turn.

- Slide the new conductive liner tube and knurled nut onto the capillary, and then tighten the knurled nut.



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

- 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 capillary tip.

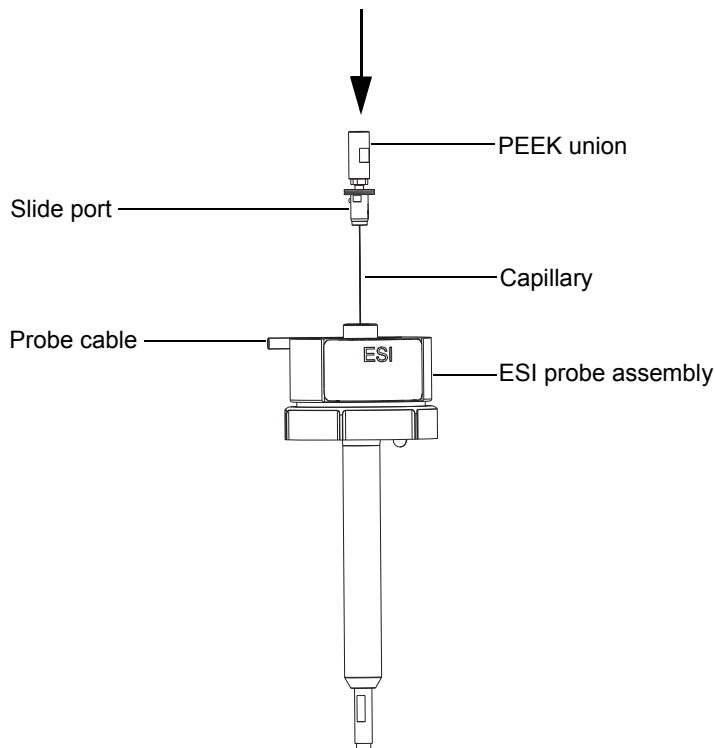
Important: Ensure that no fluid is leaking from the joints on the PEEK union. If leakage occurs, repeat this assembly procedure, and then repeat the leak test.

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

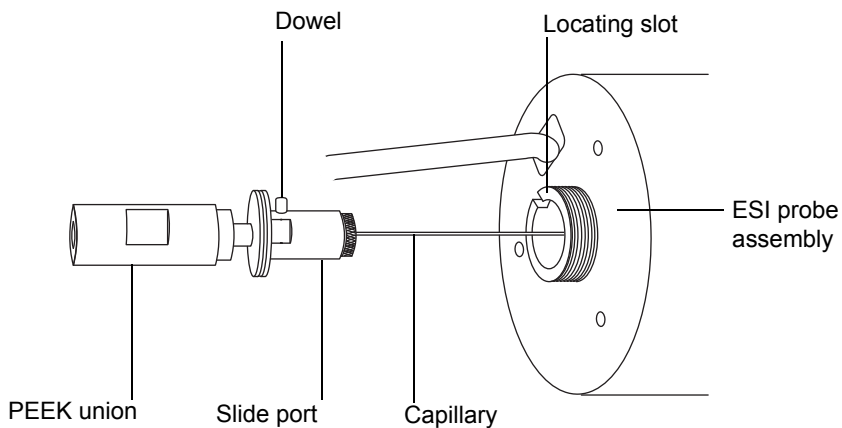


Notice: To avoid bending or damaging the protruding end of the capillary after you thread it through the ESI probe, take care when handling the probe assembly during the remainder of the procedure.

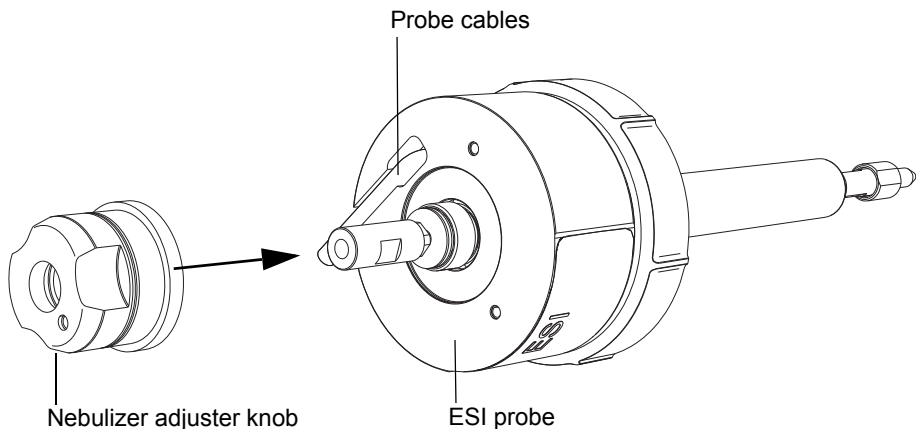
- Carefully thread the capillary through the probe assembly until the slide port and PEEK union assembly reach the top of the probe assembly.



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

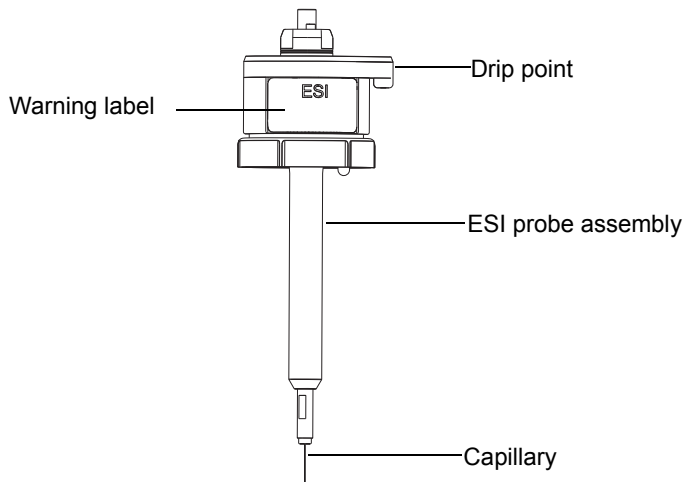


20. Fit the nebulizer adjuster knob to the PEEK union, and fully tighten the knob.

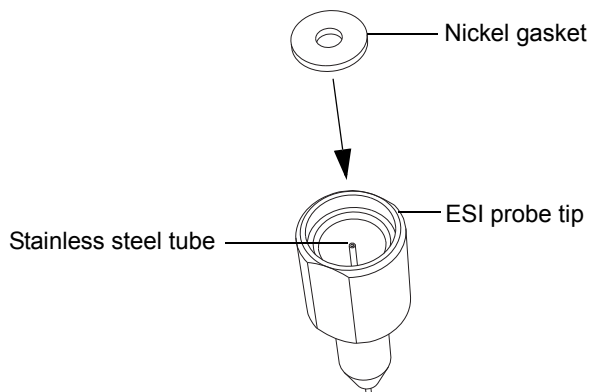


21. Fit the end cover and gasket around the nebulizer adjuster knob.

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

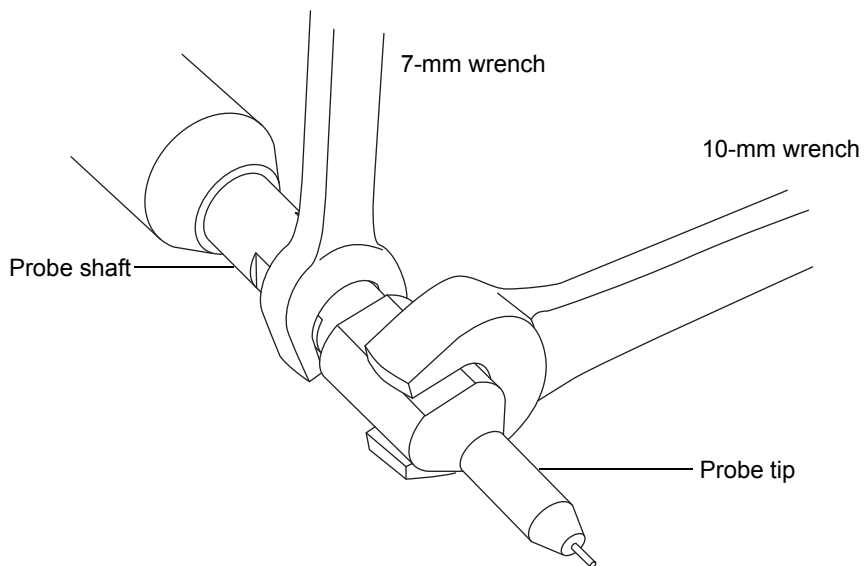


22. Secure the end cover and gasket to the ESI probe by tightening the three captive screws using the 2.5-mm Allen wrench.



23. Insert the new nickel gasket into the ESI probe tip so that the gasket is seated around the narrow, stainless steel tube inside the probe tip.
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-mm wrench and the 10-mm wrench, as shown in the following figure:







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

27. Fit the ESI probe to the source enclosure (see [page 64](#)).
28. Use the nebulizer adjuster knob to fine tune the capillary length for your application (see the instrument's online Help file).

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 SYNAPT G2-Si > Manual optimization.
2. On the Manual Optimization page, click  to stop the liquid flow.
3. Click Gas , to start the desolvation gas.
4. Specify a desolvation gas flow of 650 L/hr.
5. Specify the IonSABRE II probe temperature as 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 .

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.

Removing the existing capillary

Required materials

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



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing the following procedure.



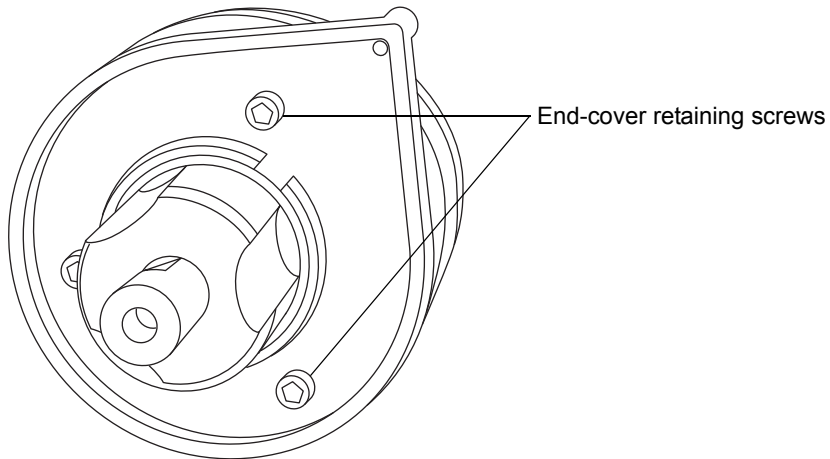
Warning: To avoid burn injuries, take great care while performing the following procedure. The probe and source can be hot.

To remove the existing capillary:

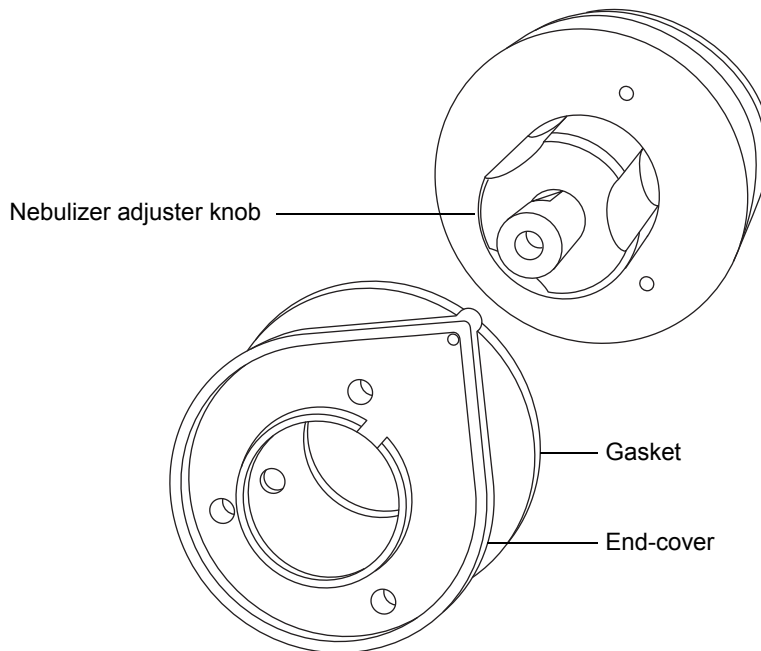
1. Remove the probe from the source (see [page 69](#)).
2. Retrieve the combined, 2.5-mm Allen wrench and cone extraction tool from its storage location on the source adaptor housing.

6 Maintenance Procedures

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

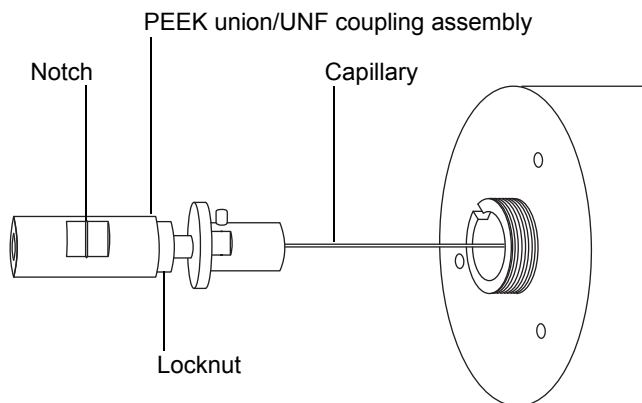


4. Remove the end cover and gasket.

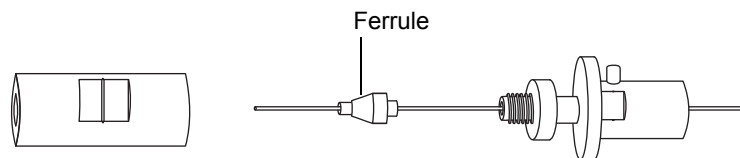


5. Unscrew and remove the nebulizer adjuster knob.
6. Remove the PEEK union/UNF coupling assembly and capillary from the probe.

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 (see “Replacing the ESI probe sample capillary” on [page 176](#)).



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



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



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, which can be present on the capillary and ferrule, dispose of those items in accordance with local environmental regulations.

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

Installing the new capillary

Required materials

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

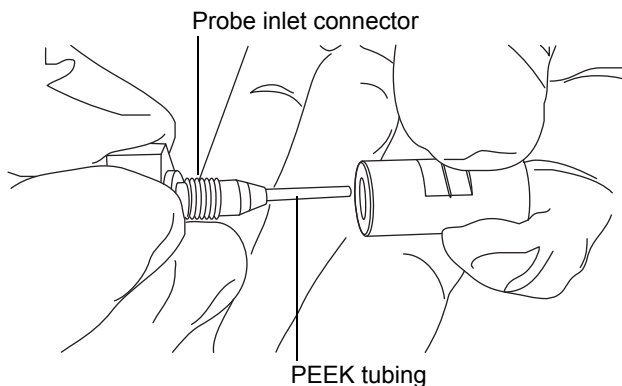


Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing the following procedure.

To install the new capillary:

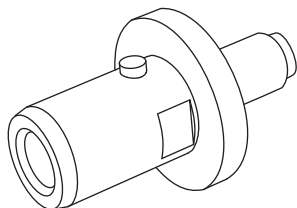
1. Use the sharp knife or PEEK tubing cutter to cut a 60 cm length of red, PEEK tubing.
Requirement: Cut the tubing squarely (that is, perpendicular to its horizontal axis).
2. Insert one end of the PEEK tubing into the probe inlet connector, and screw the connector, finger-tight, into the PEEK union.

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



3. Fit the UNF coupling to the new capillary.

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

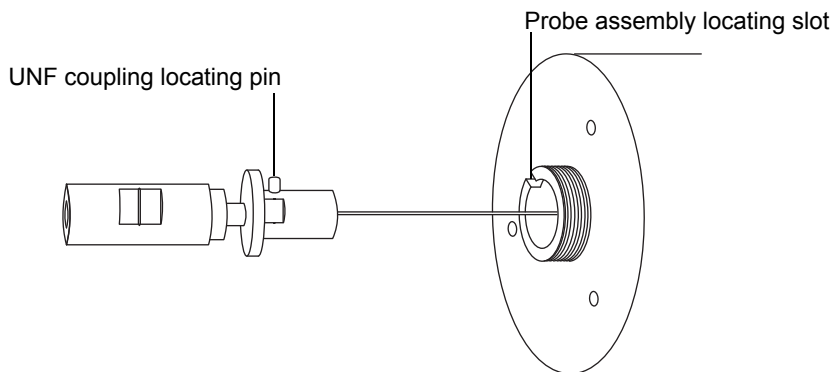


4. Use the needle-nose pliers to slide a new ferrule onto the capillary.
5. Insert the capillary in the PEEK union, and ensure that it is fully seated.
6. Screw the UNF coupling into the PEEK union, finger-tight only.
7. Gently tug on the capillary, testing to ensure that it stays in place.
8. Use the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



Warning: To avoid eye injury caused by 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 then repeat the leak test.
 - If the backpressure on the LC pump is high, replace the capillary, and repeat the leak test.
10. When no leakage occurs and the backpressure on the LC pump is normal, disconnect the PEEK tubing from the LC pump.
11. Remove the probe inlet connector and PEEK tubing from the PEEK union.
12. Remove the probe heater (see [page 202, step 2](#)).
13. Fit the PEEK union/UNF coupling assembly to the nebulizer adjuster knob.
14. Carefully thread the capillary through the probe assembly.
15. Carefully push the PEEK union/UNF coupling assembly and capillary into the probe assembly so that the locating pin on the UNF coupling is fully engaged in the locating slot at the head of the probe assembly.



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

20. Return the combined, 2.5-mm Allen wrench and cone extraction tool in its storage location on the source adaptor housing.

! **Notice:**

- To avoid damaging the electrical wiring, take great care when gripping the probe heater.
 - To avoid damaging the probe heater's electrical connections, capillary sleeve, or capillary, take great care when fitting the heater over the capillary sleeve.
21. Fit the probe heater (see [page 203](#), [step 1](#) through [step 3](#)).
 22. Fit the probe to the instrument (see [page 77](#)).
 23. In the Instrument Console, click API  to start the probe and desolvation gas flows.

Cleaning or replacing the corona pin

Required materials

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



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing the following procedure.



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



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



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

To clean or replace the corona pin:

1. Remove the corona pin from the source (see [page 126](#)) and inspect the pin for damage.
2. Replace the corona pin if it is damaged; otherwise clean its tip with the lapping film and a methanol-saturated tissue.
3. Install the corona pin in the source (see [page 124](#)).

Replacing the IonSABRE II probe heater

Replace the IonSABRE II probe heater if it fails to heat the probe.

Removing the IonSABRE II probe heater

Required material

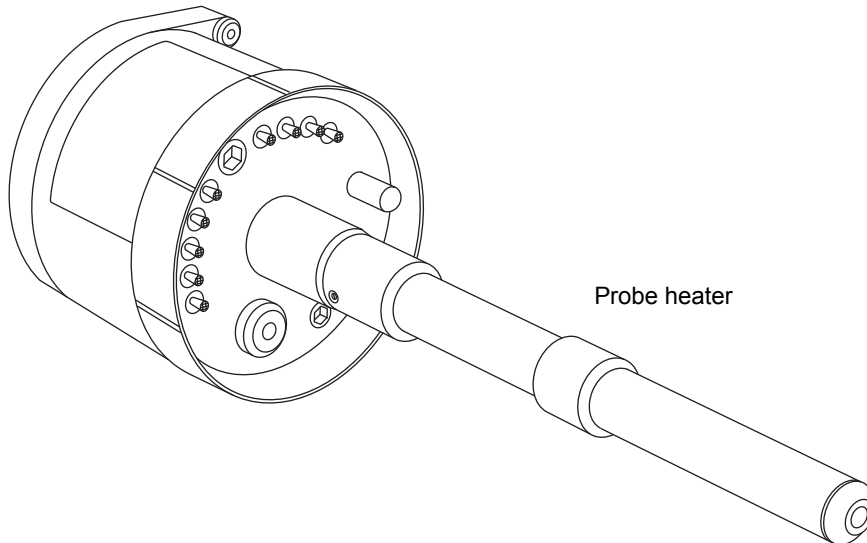
Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing the following procedure.

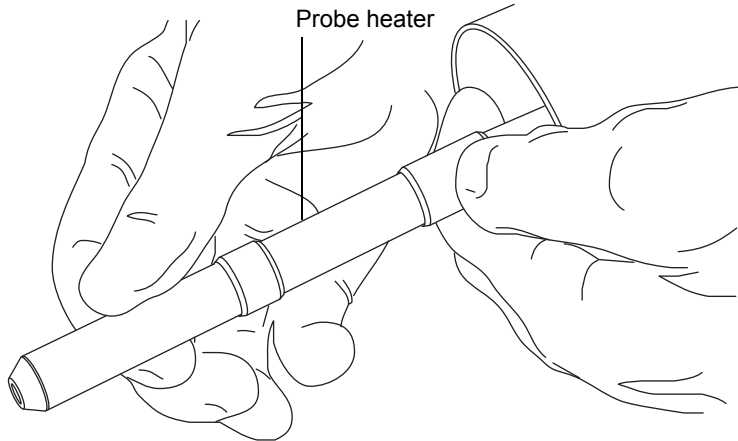
To remove the IonSABRE II probe heater:

1. Remove the probe from the source (see [page 79](#)).



! **Notice:** To avoid damaging the probe heater's electrical connections, do not twist the heater when removing it from the probe assembly.

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



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, which can be present on the probe heater, dispose of the heater in accordance with local environmental regulations.

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

Fitting the new IonSABRE II probe heater

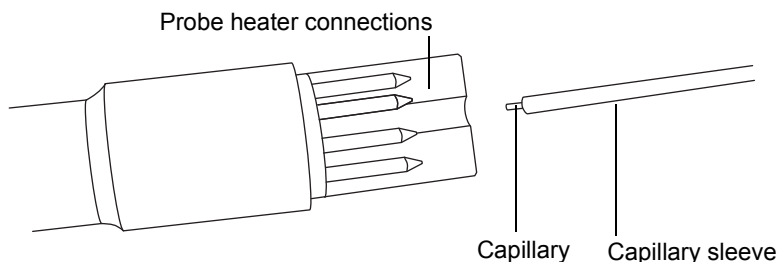
Required materials

- Chemical-resistant, powder-free gloves
- IonSABRE II probe heater

! **Notice:** To avoid damaging the probe heater's electrical connections, capillary sleeve, or capillary, take great care when fitting the heater over the capillary sleeve.


To fit the new IonSABRE II probe heater:

1. Use the probe adjuster knob to adjust the capillary so that it protrudes slightly from the end of the probe.



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 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 [page 77](#)).
5. In the Instrument Console, click API  to start the desolvation gas.

Replacing the ion-block source heater

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

Required materials

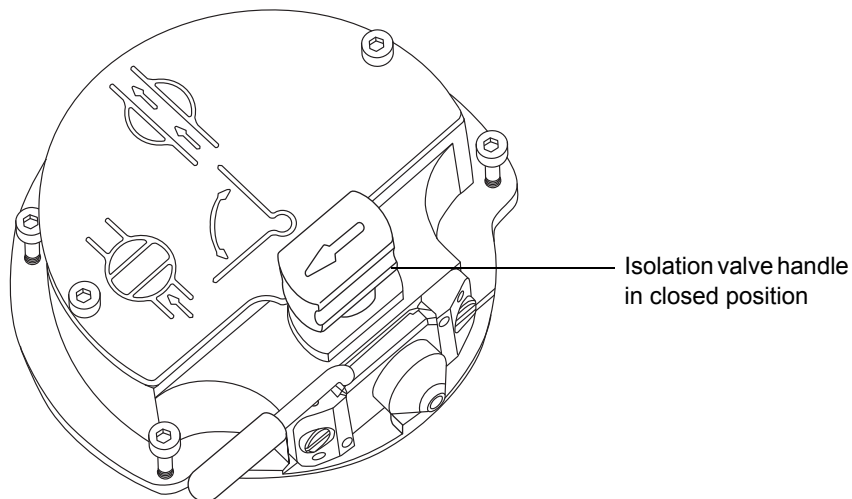
- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool
- Needle-nose pliers
- New ion-block heater cartridge assembly



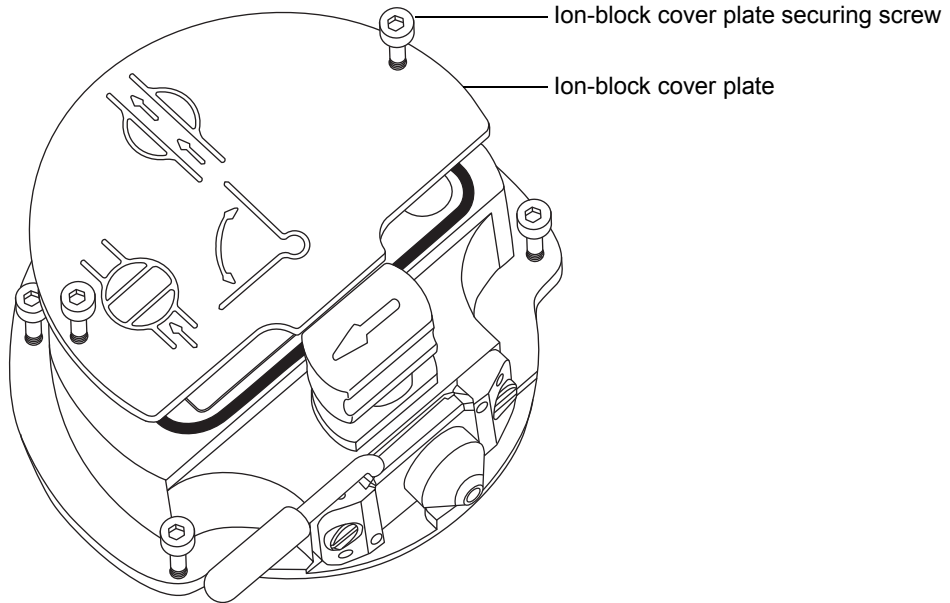
Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing the following procedure.

To replace the ion-block source heater:

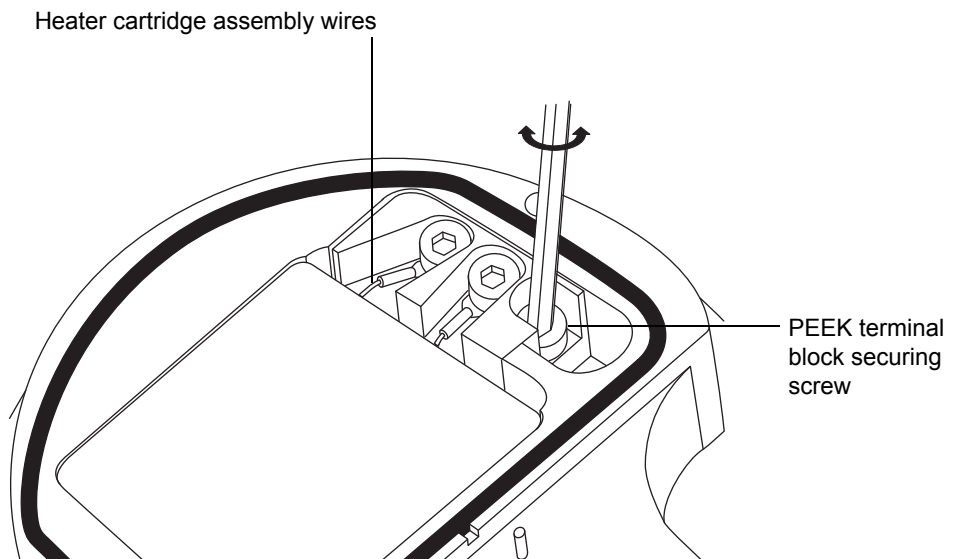
1. Remove the ion-block assembly from the instrument (see [page 140](#)).
2. Ensure that the isolation valve is closed.



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



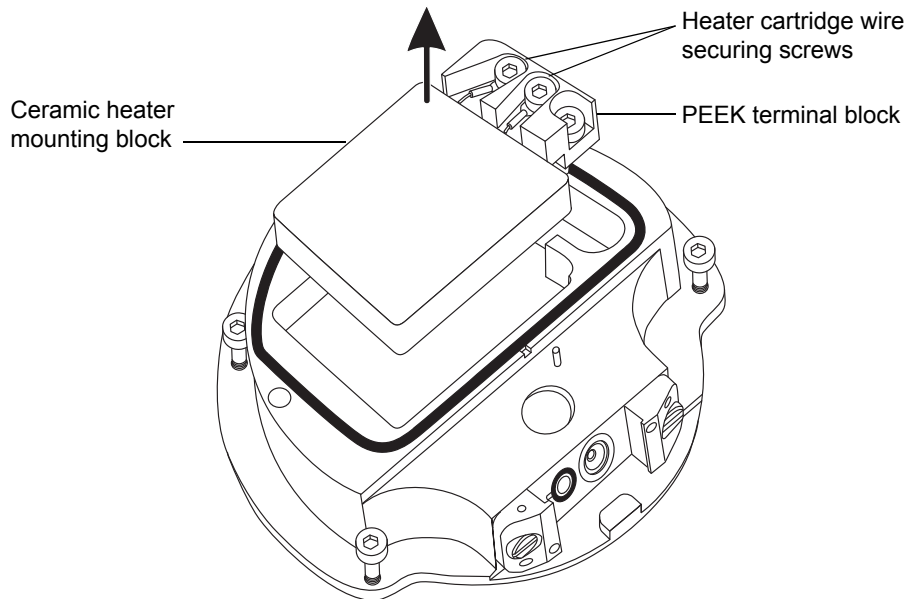
4. Remove the ion-block cover plate.
5. Use the combined, 2.5-mm Allen wrench and cone extraction tool to loosen the captive PEEK terminal block securing screw.



! **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.

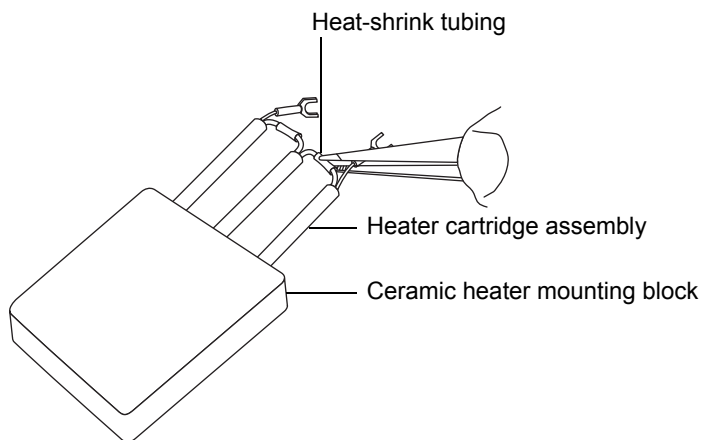
Tip: You can invert the ion-block assembly to facilitate this process.

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



7. Use the combined, 2.5-mm Allen 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.



10. Dispose of the heater cartridge assembly.

! **Notice:** To avoid damaging the heater cartridge assembly wires, do not bend or twist them when fitting the assembly to the ceramic heater mounting 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 Allen 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 Allen 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 Allen wrench and cone extraction tool to tighten the two captive screws securing ion-block cover plate.
17. Fit the ion-block assembly to the instrument (see [page 152](#)).

Replacing the LockSpray probe capillary

Replace the LockSpray probe capillary if it becomes blocked and you cannot clear it, or if it becomes contaminated or damaged.

Removing the existing capillary

Required materials

- Chemical-resistant, powder-free gloves
- 4-mm wrench
- 7-mm wrench
- SealTight™ nut tool



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

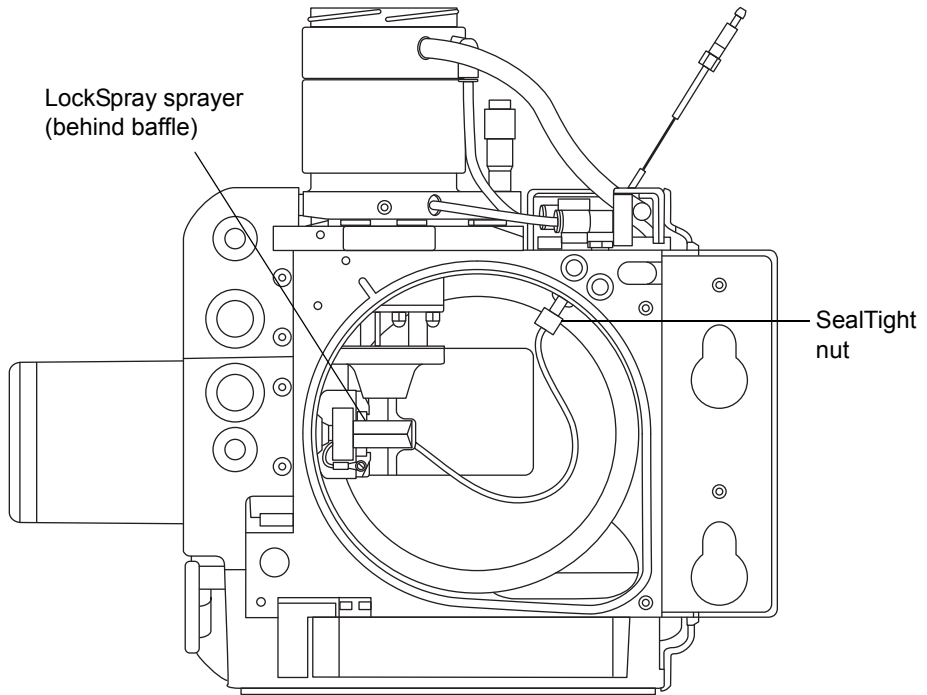


Warning: To avoid puncture wounds, if an ESI probe is fitted to the source, remove the probe before starting the following procedure. The ESI probe tip is sharp.

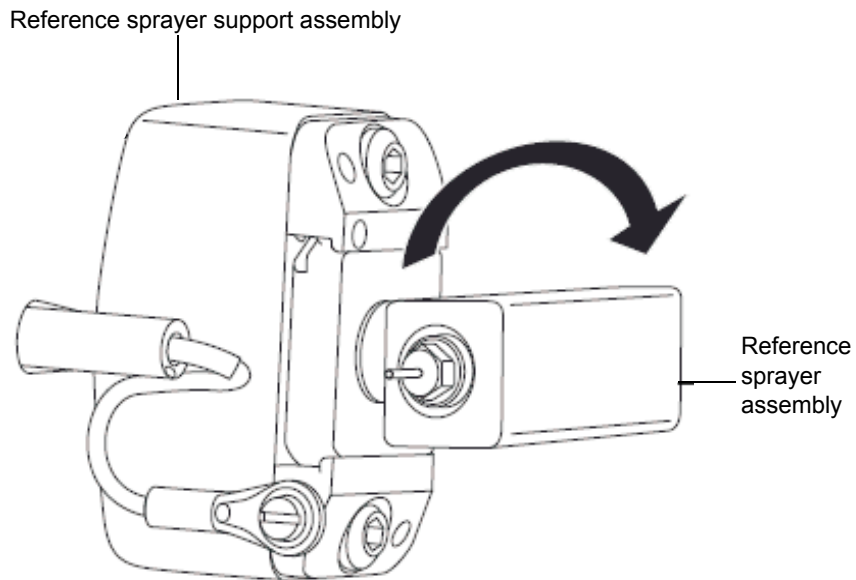
To remove the existing capillary:

1. Prepare the instrument for working on the source (see [page 120](#)).
2. If an ESI probe is fitted to the source, remove it from the source (see [page 69](#)).
3. Pull the source enclosure release (located at the bottom, right-hand side) outwards, and swing open the enclosure.
4. Wait 10 minutes, for the source ion block to cool.

5. Disconnect the SealTight nut on the inside of the source enclosure.



6. Rotate the LockSpray sprayer assembly clockwise through 90°, and remove it from the LockSpray sprayer support assembly.



7. Using the 4-mm wrench, unscrew and remove the LockSpray probe tip from the LockSpray sprayer assembly.
8. Using the 7-mm wrench, unscrew the compression fitting on the rear of the LockSpray sprayer assembly.
9. Remove the liner tubing and capillary from the LockSpray sprayer assembly.
10. Remove the capillary from the liner tubing.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, which can be present on the capillary, dispose of the capillary according to local environmental regulations.

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

Installing the new capillary

Required materials

- Chemical-resistant, powder-free gloves

- 4-mm wrench
- 7-mm wrench
- New capillary

To install the new capillary:

1. Fit the capillary into the liner tubing.
2. Fit the liner tubing and capillary to the LockSpray sprayer assembly.
3. Using the 4-mm wrench, fit and tighten the LockSpray probe tip to the LockSpray sprayer assembly.
4. Ensure that the end of the capillary protrudes 0.5 mm from the probe tip.
5. Using the 7-mm wrench, tighten the compression fitting on the rear of the LockSpray sprayer assembly.
6. Align the LockSpray sprayer assembly clockwise with the LockSpray sprayer support assembly and rotate the assembly through 90° counter clockwise to lock it in place.
7. Tighten the nut on the inside of the source enclosure using the special tool supplied.
8. Close the source enclosure.

Replacing the LockSpray source assembly seals

Note: You need not replace the NanoLockSpray source assembly seals; this section relates to the LockSpray source only.

Mechanical wear and solvent degradation of the source assembly seals can cause gas leakage from the source. Annual replacement of the following seals reduces the chance of these seals failing:

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

Removing the probe adjuster assembly probe and source enclosure seals

Required materials

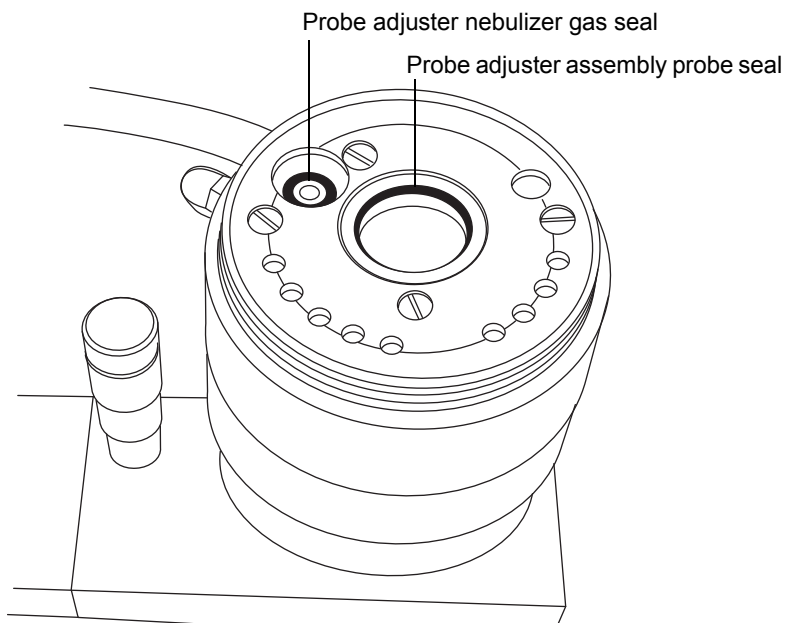
- Chemical-resistant, powder-free gloves
- O-ring removal kit



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing the following procedure.

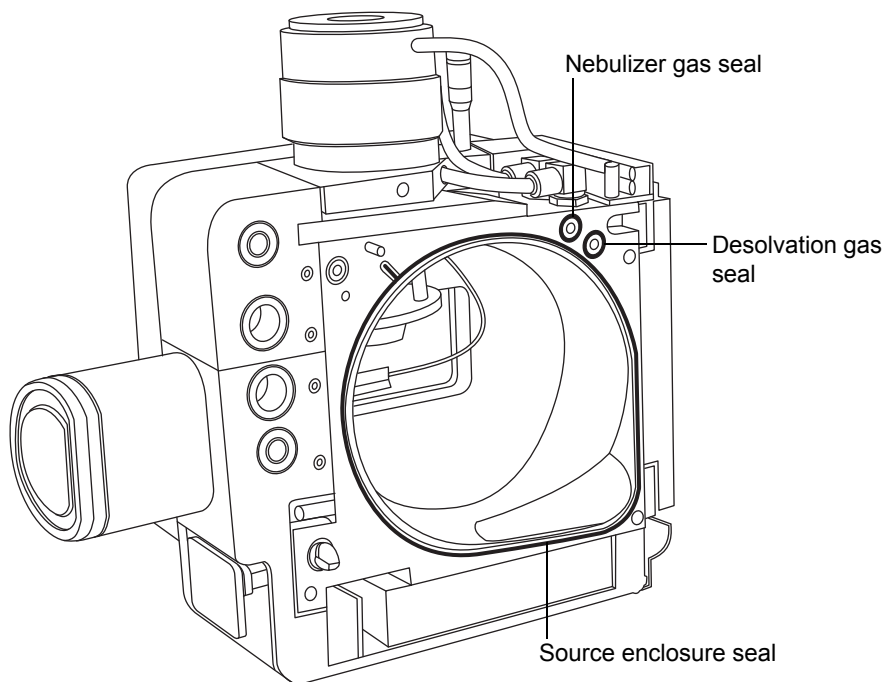
To remove the probe adjuster assembly probe and source enclosure seals:

1. Remove the source enclosure from the instrument (see [page 121](#)).
2. Using the O-ring removal kit, carefully remove the following seals from the probe adjuster assembly:
 - Probe seal
 - Nebulizer gas seal



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

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



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials which can be present on seals, dispose of seals according to local environmental regulations.

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

Fitting the new source enclosure seals

Required materials

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



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing the following procedure.

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

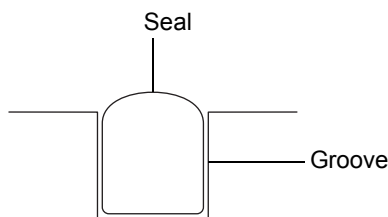
1. Ensure that all grooves that will receive seals are free from dirt and debris.

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:
 - a. Feed the seal into the groove at the bottom, right-hand corner.
 - b. Work around the seal in the counter clockwise direction, pressing it into the groove.

Important: Ensure that the tails of the source enclosure seals are correctly located in their grooves when fitting them to the source enclosure.

3. Fit the following new seals to the source enclosure:
 - Nebulizer gas seal
 - Desolvation gas seal

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



4. Fit the following new seals to the probe adjuster assembly:

6 Maintenance Procedures

- Probe seal
 - Nebulizer gas seal
5. Fit the source enclosure to the instrument (see [page 123](#)).

Replacing the NanoLockSpray reference-probe capillary

Replace the NanoLockSpray reference-probe TaperTip™ emitter or capillary if either is irreversibly blocked, contaminated, or damaged.

Removing the NanoLockSpray reference probe

Required materials

- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool
- 5-mm Allen wrench
- Source of oil-free, inert gas (nitrogen or argon) for drying (air-drying optional)
- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water
- Large beaker



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing the following procedure.

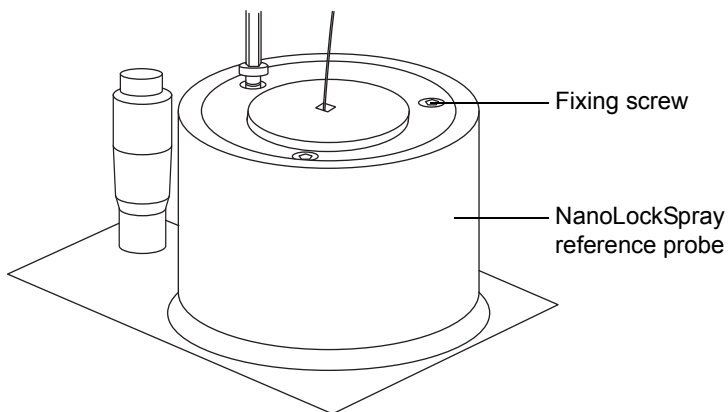


Warning: To avoid electric shock, prepare the instrument for work performed on its source before starting the following procedure.

To remove the NanoLockSpray reference probe:

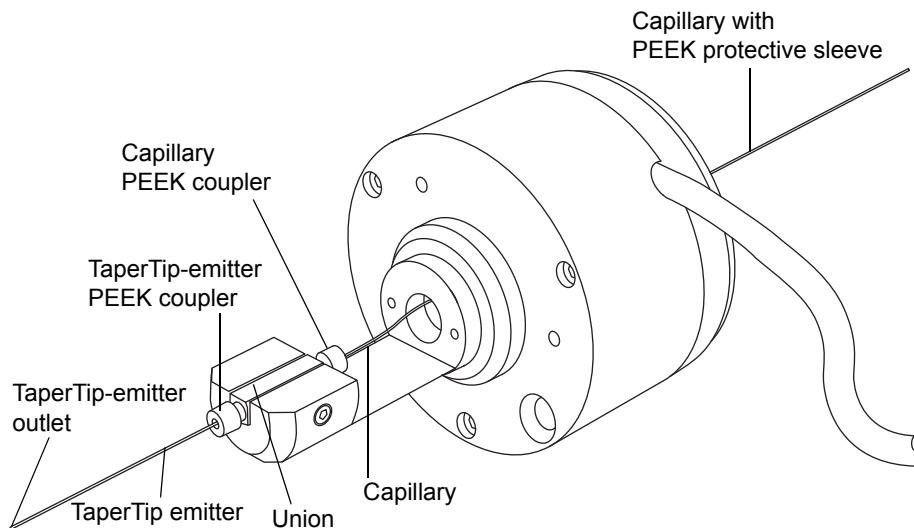
1. Prepare the instrument for work performed on its source (see [page 120](#)).
2. Disconnect the reference probe's cable from the instrument's high voltage connector.
3. Disconnect the capillary from the instrument's IntelliStart Fluidics system.
4. Remove the NanoLockSpray source enclosure from the instrument (see [page 121](#)).
5. Retrieve the combined, 2.5-mm Allen wrench and cone extraction tool from its storage location on the source adaptor housing.

- Using the combined, 2.5-mm Allen wrench and cone extraction tool, unscrew the three fixing screws from the top of the NanoLockSpray reference probe.



Warning: To avoid puncture wounds, handle the probe with care. The NanoLockSpray reference-probe tip consists of 5 cm of exposed, fused-silica TaperTip emitter, which is sharp and fragile.

- Remove the NanoLockSpray reference probe from the probe adjuster assembly.
- Unscrew the TaperTip-emitter PEEK coupler, and remove the TaperTip emitter from the union.



- Unscrew the capillary PEEK coupler, and remove the capillary from the union.

10. Where appropriate, remove the protective PEEK sleeve from the capillary for reuse.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, which can be present on the fused silica capillary dispose of the capillary in accordance with local environmental regulations.

11. Dispose of the capillary and TaperTip emitter, observing local environmental regulations.
12. Remove any shards of glass or other contaminants from the union as follows:
 - a. Using the wash bottle containing 1:1 methanol/water, rinse the union over the large beaker.
 - b. Blow-dry the union with inert, oil-free gas.

Installing the new TaperTip emitter and capillary

Required materials

- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool
- TaperTip emitter
- 375-mm length of 75- μ m PEEK-capillary tubing, sleeved for protection by 360- μ m ID PEEK tubing
- F-130 "finger tight" nut
- 1.5-mm Allen wrench

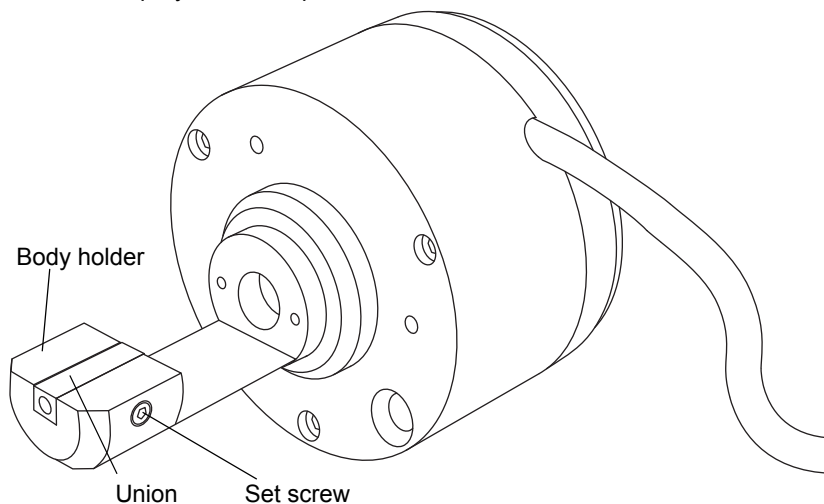
To install the new TaperTip emitter and capillary:

1. If the preset position of the union was not disturbed when you removed the TaperTip emitter and capillary, go to step 2.

If the position of the union was disturbed:

- a. Using the 1.5-mm Allen wrench, loosen the set screw.
- b. Reposition the union so that the surface is level with the bottom of the body holder.
- c. Using the 1.5-mm Allen wrench, tighten the set screw.

NanoLockSpray reference probe



2. Thread the sleeved PEEK capillary through the body of the NanoLockSpray reference probe.
3. Slide a PEEK coupler over the end of the 75- μ m PEEK capillary.
4. Locate the PEEK coupler in the top end of the union, and carefully slide the 75- μ m PEEK capillary into the union until it butts against the internal surface of the union.

Rationale: Doing so ensures a minimum dead volume.

5. Tighten the PEEK coupler to hold the capillary in place.



Warning: To avoid puncture wounds, handle the probe with care. The NanoLockSpray reference-probe tip is an exposed, fused-silica TaperTip emitter which is sharp and fragile.

6. Locate a second PEEK coupler in the bottom end of the union, and slide the TaperTip emitter into the union until it butts against the internal surface of the union.

Important: Ensure that you are inserting the square-cut end of the TaperTip emitter into the union and not the tapered tip.

! **Notice:** To avoid crushing the coupler on the TaperTip emitter, do not overtighten it; overtightening can cause blockages.

7. Finger-tighten the coupler to hold the TaperTip emitter securely, without crushing.

! **Notice:** To avoid breaking the fragile TaperTip emitter, take care when inserting the NanoLockSpray reference probe into the NanoLockSpray source enclosure.

8. Mount the NanoLockSpray reference probe on the NanoLockSpray source enclosure.
9. Using the combined, 2.5-mm Allen wrench and cone extraction tool, tighten the three screws that secure the NanoLockSpray reference probe.
10. Replace the combined, 2.5-mm Allen wrench and cone extraction tool in its storage location on the source adaptor housing.
11. Fit the NanoLockSpray source enclosure to the instrument (see [page 123](#)).
12. Using an F-130 "finger tight" nut, connect the 75- μ m sleeved PEEK capillary to the grounded union in the instrument's IntelliStart Fluidics system.
13. Connect the reference probe's cable to the instrument's high voltage connector.

Replacing the reference-probe capillary on the ionKey Source

Replace the reference-probe TaperTip emitter or capillary in the ionKey source if either is irreversibly blocked, contaminated, or damaged.

Removing the reference-probe from the ionKey source

Required materials

- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool
- 5-mm Allen wrench
- Source of oil-free, inert gas (nitrogen or argon) for drying (air-drying optional)
- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water
- Large beaker



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing the following procedure.

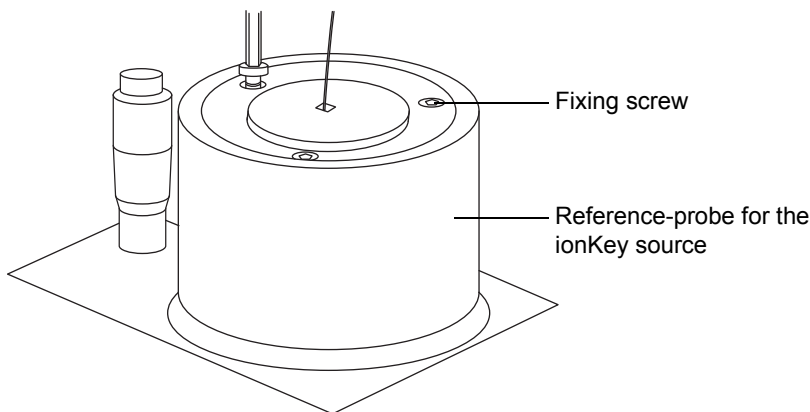


Warning: To avoid electric shock, prepare the instrument for work performed on its source before starting the following procedure.

To remove the reference-probe from the ionKey source:

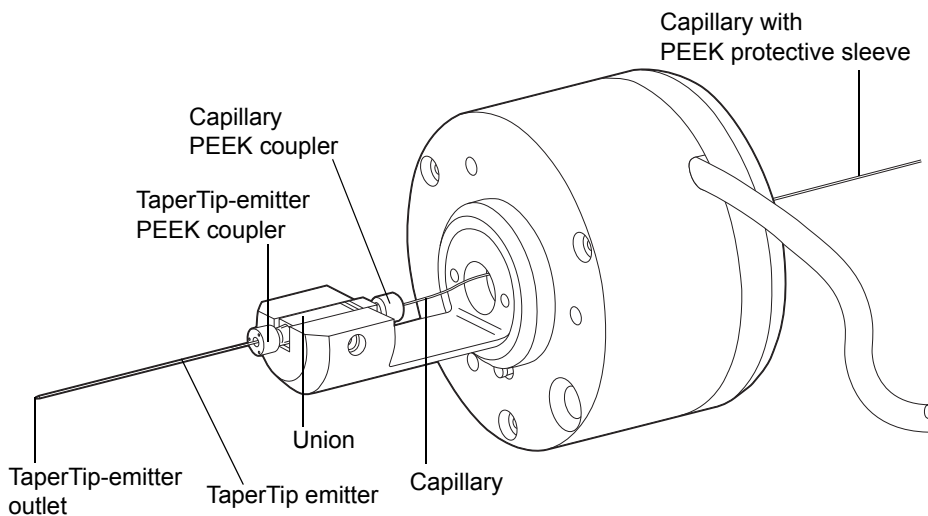
1. Prepare the instrument for work performed on its source (see [page 120](#)).
2. Disconnect the reference-probe's cable from the instrument's high voltage connector.
3. Disconnect the capillary from the instrument's IntelliStart Fluidics system.
4. Remove the ionKey source enclosure from the instrument (see [page 121](#)).
5. Retrieve the combined, 2.5-mm Allen wrench and cone extraction tool from its storage location on the source adaptor housing.

- Using the combined, 2.5-mm Allen wrench and cone extraction tool, unscrew the three fixing screws from the top of the reference probe for the ionKey source.



Warning: To avoid puncture wounds, handle the probe with care. The reference-probe tip for the ionKey source consists of 5 cm of exposed, fused-silica TaperTip emitter, which is sharp and fragile.

- Remove the reference probe for the ionKey source from the probe adjuster assembly.
- Unscrew the TaperTip-emitter PEEK coupler, and remove the TaperTip emitter from the union.



9. Unscrew the capillary PEEK coupler, and remove the capillary from the union.
10. Where appropriate, remove the protective PEEK sleeve from the fused silica capillary for reuse.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, which can be present on the fused silica capillary dispose of the capillary in accordance with local environmental regulations.

11. Dispose of the capillary and TaperTip emitter, observing local environmental regulations.
12. Remove any shards of glass or other contaminants from the union as follows:
 - a. Using the wash bottle containing 1:1 methanol/water, rinse the union over the large beaker.
 - b. Blow-dry the union with inert, oil-free gas.

Installing the new TaperTip emitter and capillary

Required materials

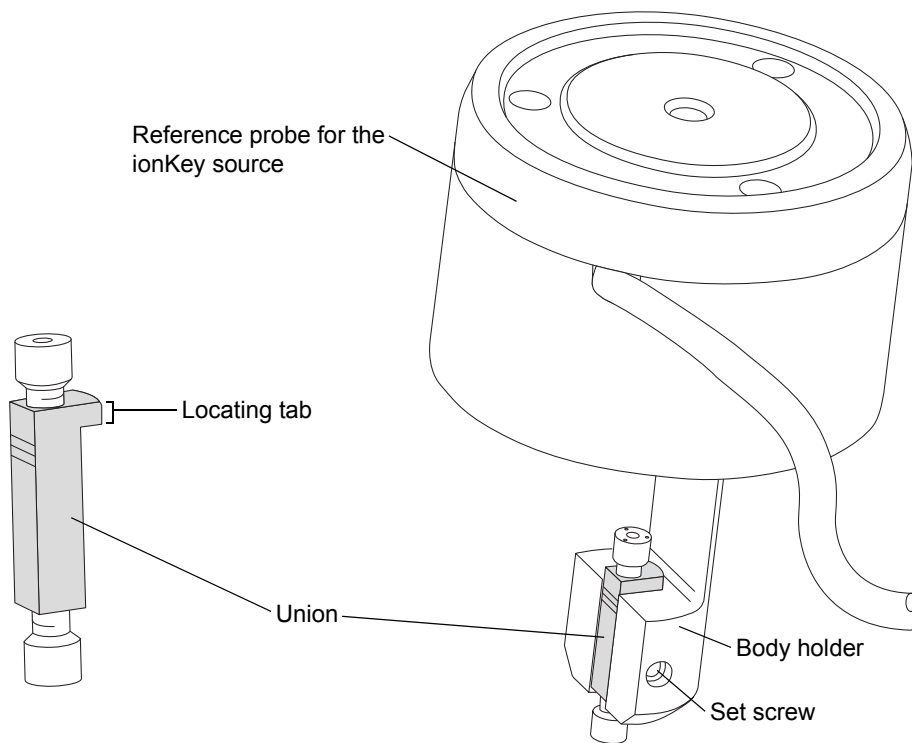
- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool
- TaperTip emitter
- 375-mm length of 75- μ m PEEK-capillary tubing, sleeved for protection by 360- μ m ID PEEK tubing
- F-130 "finger tight" nut
- 1.5-mm Allen wrench

To install the new TaperTip emitter and capillary:

1. If the preset position of the union was not disturbed when you removed the TaperTip emitter and capillary, go to step 2.

If the position of the union was disturbed:

- a. Using the 1.5-mm Allen wrench, loosen the set screw.
- b. Reposition the union so that the locating tab rests against the top of the body holder.
- c. Using the 1.5-mm Allen wrench, tighten the set screw.



2. Thread the sleeved PEEK capillary through the body of the reference probe for the ionKey source.
3. Slide a PEEK coupler over the end of the 75- μ m PEEK capillary.

4. Locate the PEEK coupler in the top end of the union, and carefully slide the 75- μ m PEEK capillary into the union until it butts against the internal surface of the union.

Rationale: Doing so ensures a minimum dead volume.

5. Tighten the PEEK coupler to hold the capillary in place.



Warning: To avoid puncture wounds, handle the probe with care. The reference probe tip for the ionKey source is an exposed, fused-silica TaperTip emitter which is sharp and fragile.

6. Locate a second PEEK coupler in the bottom end of the union and slide the TaperTip emitter into the union until it butts against the internal surface of the union.

Important: Ensure that you are inserting the square-cut end of the TaperTip emitter into the union and not the tapered tip.



Notice: To avoid crushing the coupler on the TaperTip emitter, do not overtighten it; overtightening can cause blockages.

7. Finger-tighten the coupler to hold the TaperTip emitter securely, without crushing.



Notice: To avoid breaking the fragile TaperTip emitter, take care when inserting the reference probe for the ionKey source into the ionKey source enclosure.

8. Mount the reference probe on the ionKey source enclosure.
9. Using the combined, 2.5-mm Allen wrench and cone extraction tool, tighten the three screws that secure the reference probe for the ionKey source.
10. Replace the combined, 2.5-mm Allen wrench and cone extraction tool in its storage location on the source adaptor housing.
11. Fit the ionKey source enclosure to the instrument (see [page 123](#)).
12. Using an F-130 "finger tight" nut, connect 75- μ m PEEK capillary to the grounded union in the instrument's IntelliStart Fluidics system.
13. Connect the reference probe's cable to the instrument's high voltage connector.

APPI/APCI source: changing the UV lamp bulb

Required materials

- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool
- Small Phillips® (cross-head) screwdriver
- 20 cm (8-inch) length of 4 mm nylon tube



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing the following procedure.



Warning: To avoid electric shock, ensure that the instrument is suitably prepared before starting the following procedure.

To change the UV lamp bulb:

1. Prepare the instrument for working on the source (see [page 120](#)).



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



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

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 Allen wrench and cone extraction tool from its storage location on the source adaptor housing.
4. Hook the short-end of the Allen wrench through the ring on the back of the bulb extraction plug, and tug to remove it.



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.

6 Maintenance Procedures

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 Allen wrench and cone extraction tool to its storage location on the source adaptor housing.

10. Close the source enclosure.

11. Slide closed the instrument's source interface door.

APPI/APCI source: cleaning the lamp window

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

Required materials

- Chemical-resistant, powder-free gloves
- Lint-free cloth
- Methanol or isopropyl alcohol



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



Warning: To avoid eye injury from UV radiation, ensure that the APPI lamp is extinguished before performing the following procedure.

To clean the lamp window:

1. Prepare the instrument for working on the source (see [page 120](#)).
2. Pull the source enclosure release (located at the bottom, right-hand side) outward, and swing open the enclosure.
3. Use methanol or isopropyl alcohol, applied to the lint-free cloth, to carefully clean the lamp window.
4. Close the source enclosure.
5. Slide closed the instrument's source interface door.

APPI/APCI source: replacing the APPI lamp drive seals



Warning: To avoid leakage of biologically hazardous or toxic materials, maintaining the integrity of the source exhaust system is crucially important. Thus the O-rings that seal the APPI lamp-drive assembly must be renewed exactly in the manner described in this section and at intervals not exceeding 1 year in duration.

The following APPI lamp-drive-assembly O-rings must be renewed at intervals of no longer than 1 year:

- UV lamp-bulb-sealing O-ring
- Mounting-shaft O-rings
- Mounting flange O-ring for the UV lamp

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

Removing the seals from the APPI lamp drive assembly

Required materials

- Chemical-resistant, powder-free gloves
- Combined, 2.5-mm Allen wrench and cone extraction tool
- 3-mm Allen wrench
- Small Phillips (cross-head) screwdriver
- Small Pozidriv[®] screwdriver
- 20 cm (8-inch) length of 4 mm nylon tube
- O-ring removal kit
- The Mounting-shaft insertion tool
- A suitable, clear bench top to work on
- A soft cloth or mat to protect the source enclosure window as it is laid on its face
- UV lamp-bulb-sealing O-ring
- Mounting-shaft O-rings
- Mounting flange O-ring for the UV lamp



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing the following procedure.



Warning: To avoid electric shock, ensure that the instrument is in Standby mode before starting the following procedure.

To remove the seals:

1. Remove the IonSABRE II probe and combined APPI/APCI source enclosure (see [page 86](#)).



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

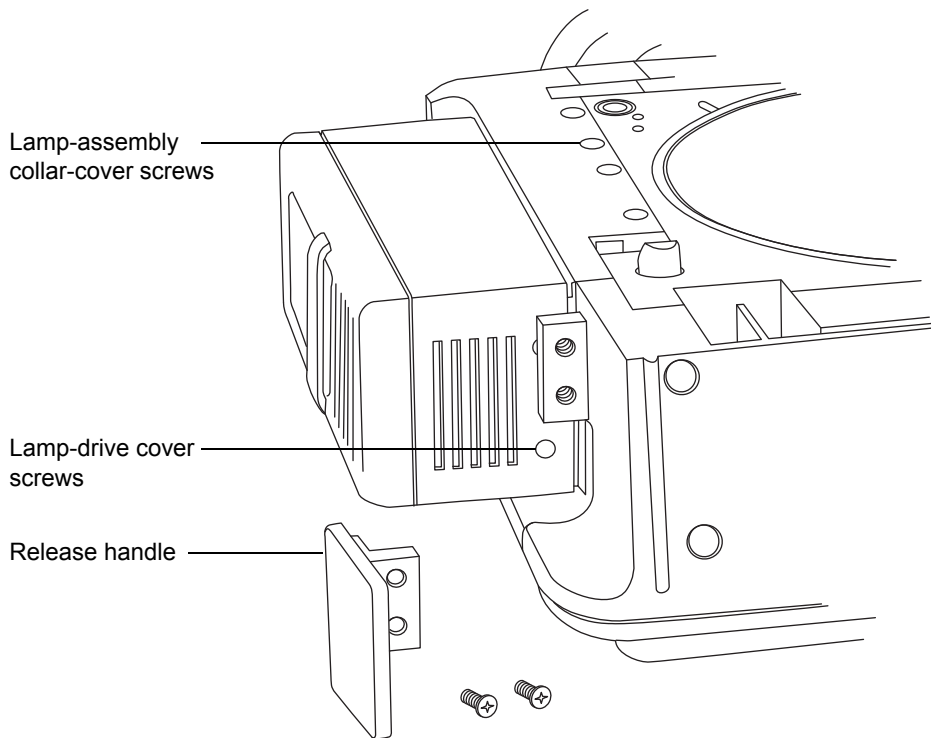
2. Remove the UV bulb from the lamp-drive assembly, and store it in a secure place (see [page 227](#)).
3. Retrieve the combined, 2.5-mm Allen wrench and cone extraction tool from its storage location on the source adaptor housing.
4. Use the combined, 2.5-mm Allen wrench and cone extraction tool to remove the two lamp-drive cover screws (located above the bulb-extraction plug-aperture).



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

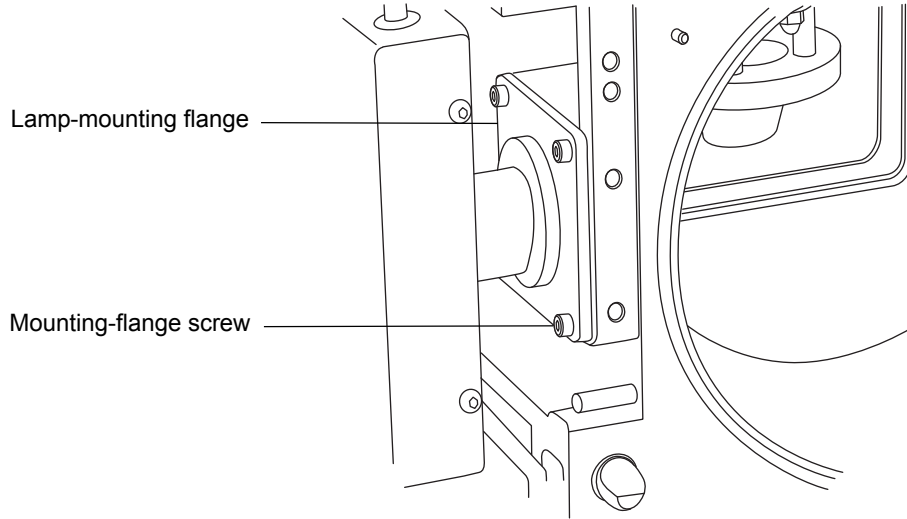
5. Clear an area, lay out the soft cloth or mat, and lay the source enclosure on its face.

6. Use the Phillips (cross-head) screwdriver to remove the 2 source enclosure, release-handle screws, and remove the handle.



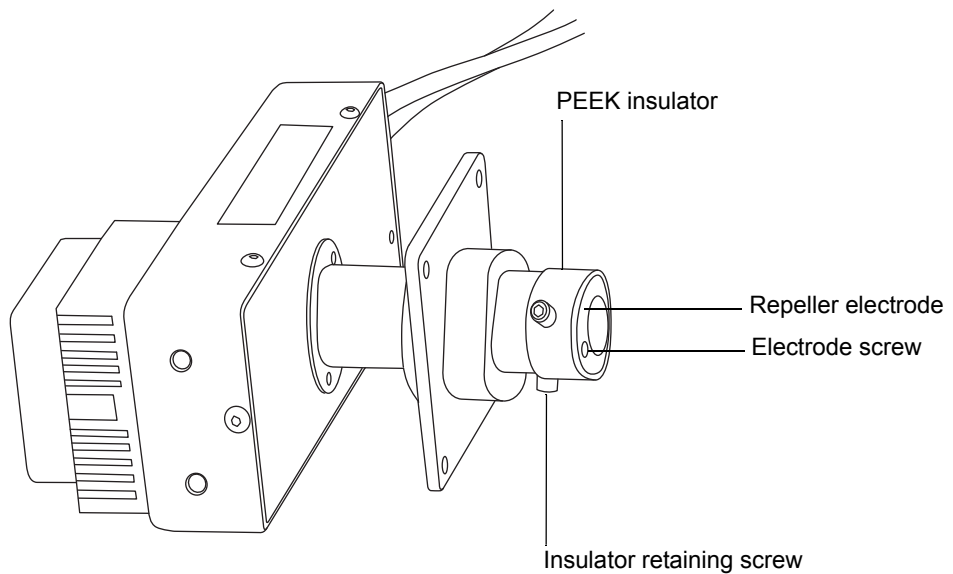
7. Use the combined, 2.5-mm Allen wrench and cone extraction tool to remove the remaining two lamp-drive cover screws, which were hidden by the release handle.
8. Slide the cover off the lamp drive.
9. Use the 3-mm Allen wrench to remove the 4 lamp-assembly collar-cover screws.
10. Ease the lamp-assembly collar-cover over the lamp drive assembly.
11. Use the combined, 2.5-mm Allen wrench and cone extraction tool to unscrew the 4 mounting-flange screws.

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

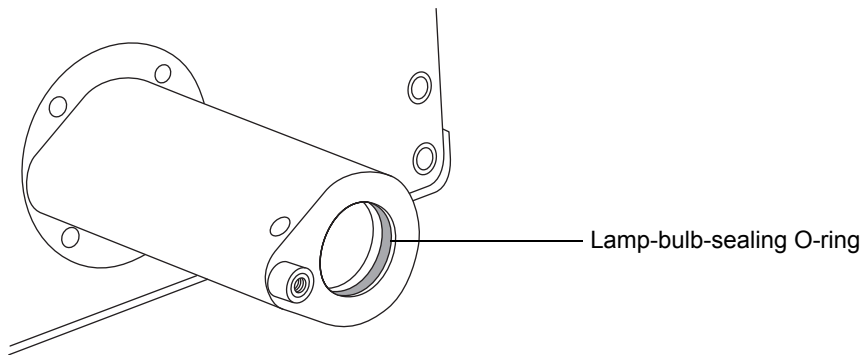


12. Slide the lamp assembly, shaft, and flange out of the APPI source enclosure.

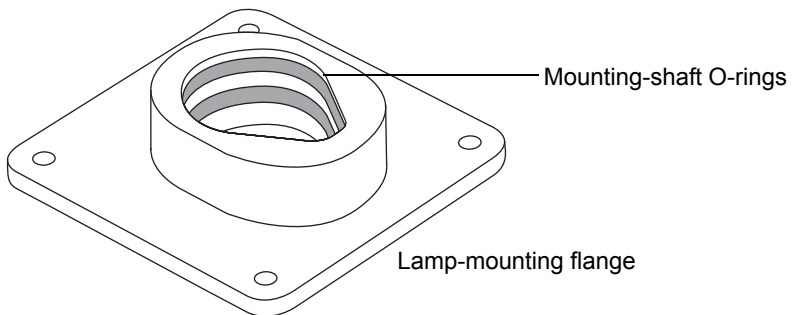
Tip: The cables remain attached to the shaft, which you fully withdraw and lay on the bench beside the source enclosure.



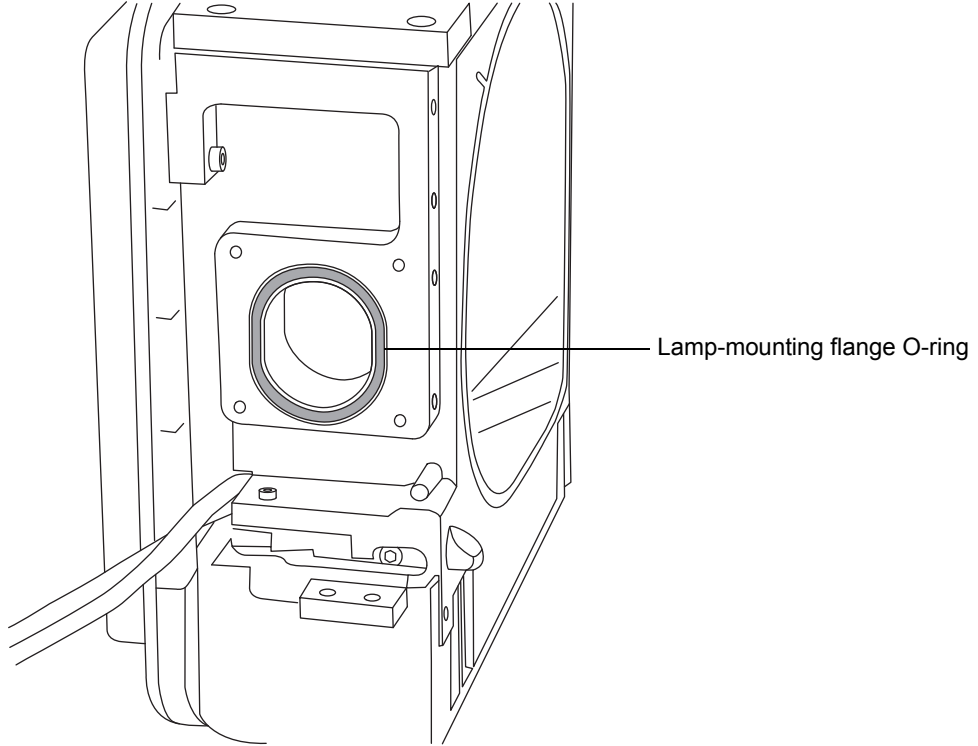
13. Using the small Phillips screwdriver, remove the electrode screw and repeller electrode.
14. Use the combined, 2.5-mm Allen wrench and cone extraction tool to remove the two insulator screws.
15. Remove the PEEK insulator from the end of the mounting shaft.
16. Slide the lamp-mounting flange off the shaft, and note the correct orientation, to aid in 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 [page 230](#)).



18. Use the O-ring removal kit to carefully remove the two O-rings from inside the lamp-mounting flange.



19. Use the O-ring removal kit to carefully remove the lamp-mounting flange O-ring from the APPI source enclosure side.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, which can be present on the O-rings, dispose of the O-rings in accordance with local environmental regulations.

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

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

Required materials

- Chemical-resistant, powder-free gloves
- 3-mm Allen wrench
- Small Phillips (cross-head) screwdriver
- Small Pozidriv screwdriver
- Solution of 1:1 methanol/water
- Lint-free cloth



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



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

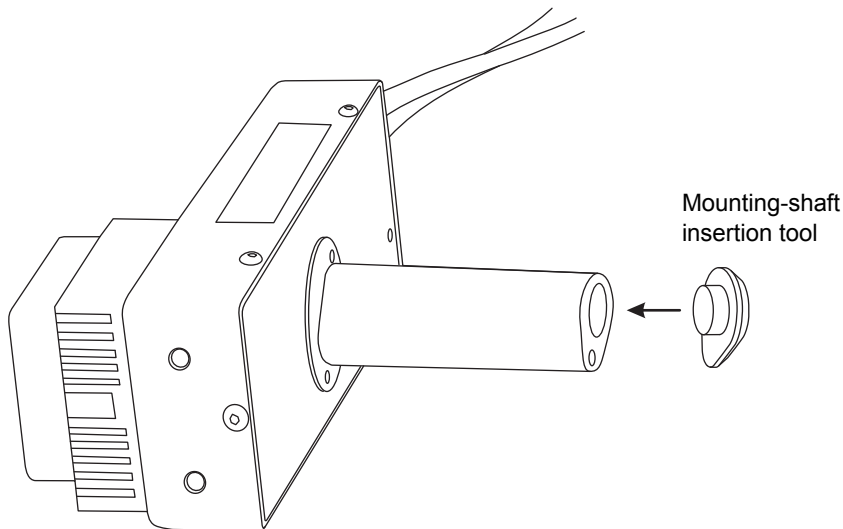
To fit the new APPI lamp drive assembly O-rings:

1. Ensure that the grooves that will receive the O-rings are free from dirt and other foreign matter.

Tips:

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

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



! **Notice:** To avoid damaging 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 Allen wrench and cone extraction tool to tighten the 4 mounting-flange securing screws.

Important: 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 Allen 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 4 screws.
17. Refit the lamp assembly cover, and secure it on its base (2 screws) and above the bulb extraction aperture (2 screws).
18. Refit the source enclosure release handle, and secure it with the two screws.
19. Refit and reconnect the source enclosure to the machine, and then refit the corona pin and probe. (See [page 123](#) for instructions.)

Replacing the instrument's fuses



Warning: To avoid electrical shock, disconnect the mass spectrometer from the power supply before replacing fuses.

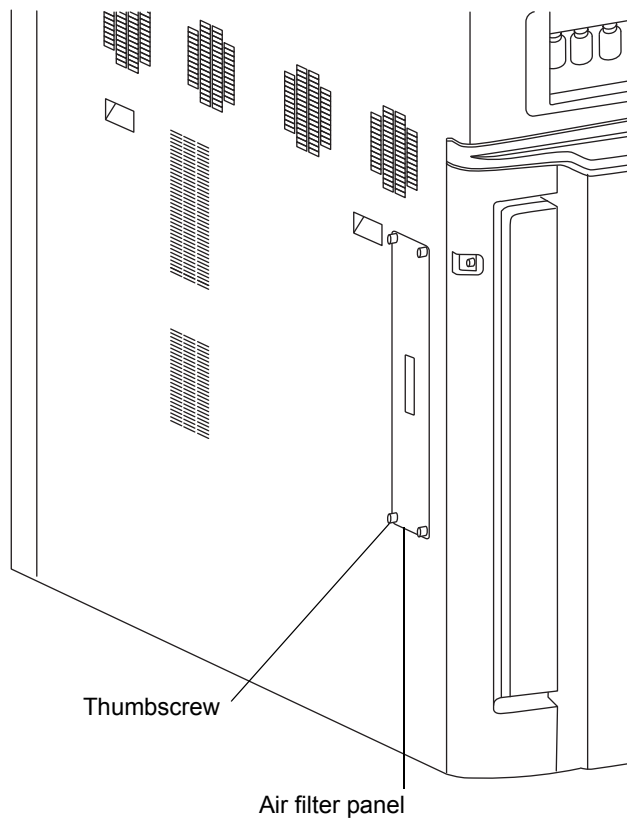


Warning: To protect against fire, replace fuses with those of the type and rating specified below and printed on panels adjacent to the instrument's fuse covers.

If one or both fuses fail, the instrument shuts down immediately. If such a shutdown occurs, disconnect the power cord from the instrument's rear panel, and replace the fuses, located at the bottom left-hand-side of the panel, with type T10AH250V, 6 x 32-mm fuses.

Replacing the mass spectrometer's air filter

An air filter is located on the left-hand side of the instrument, retained by a panel, which you must remove to access the filter.



Replacing the air filter

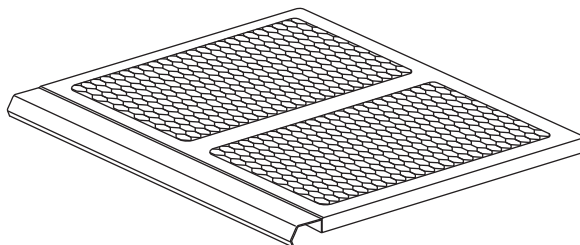
Required materials

- 2.5-mm Allen wrench
- New air filter

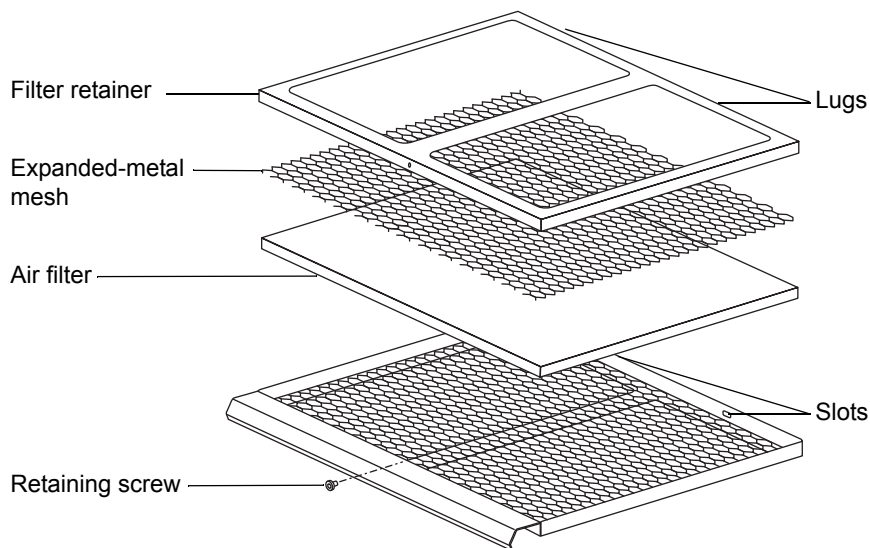
To replace the air filter:

1. Unscrew the thumbscrews securing the air filter panel to the instrument enclosure.
2. Remove the air filter panel from the instrument enclosure.
3. Remove the filter assembly from the instrument.

Air filter assembly:



Air filter assembly components:



4. Use the 2.5-mm Allen wrench to remove the screw securing the filter retainer to the filter assembly.
5. Remove the filter retainer and expanded-metal mesh from the filter assembly.

Tip: The filter retainer's two lugs engage with slots at the rear of the filter assembly.

6. Remove the air filter from the filter assembly.
7. Dispose of the air filter in accordance with local environmental regulations.
8. Fit the new air filter to the filter assembly.
9. Fit the expanded-metal mesh to the filter assembly.
10. Fit the filter retainer to the filter assembly.

Requirement: Ensure that the filter retainer lugs engage with the slots at the rear of the filter assembly.

11. Use the 2.5-mm Allen wrench to fit and tighten the screw securing the filter retainer to the filter assembly.
12. Insert the filter assembly in the instrument.
13. Fit the filter panel to the instrument enclosure.
14. Fit and tighten the thumbscrews securing the filter panel to the instrument enclosure.

Replacing the IntelliStart Fluidics tubing

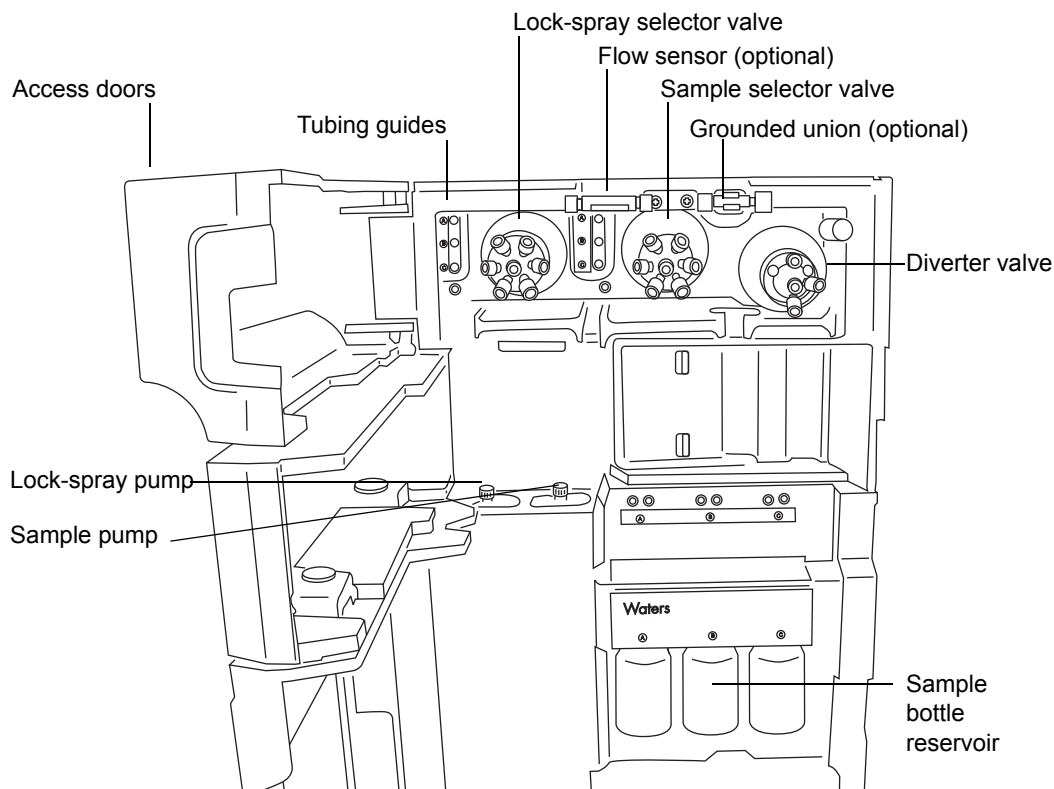
One of two plumbing schemes applies to your instrument:

- LockSpray 'standard' configuration
- NanoLockSpray configuration.

Replacing the IntelliStart tubing (LockSpray configuration)

In the event of a blockage in the tubing connections between the IntelliStart Fluidics system components, you must replace the tubing. The following procedures explain how to replace the tubing for the LockSpray and sample delivery systems. Note, however, that they exclude probe connections, which can vary according to your application. For probe connection instructions, see [page 64](#). No parts of the fluid line are reusable once detached.

The IntelliStart Fluidics system layout (tubing omitted for clarity):



Removing the IntelliStart Fluidics tubing

The following explains how to remove the IntelliStart Fluidics tubing and disconnect the probe tubing at the diverter valve or grounded union.

Required materials

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

To remove the tubing:

1. Open the access doors to the IntelliStart Fluidics system.
2. Unscrew and remove the PEEK thumbscrews and tubes from the LockSpray selector, sample-selector and diverter valves.
3. Unscrew and remove the PEEK thumbscrews and tubes from between the flow sensor and the grounded union.
4. Close the access doors to the IntelliStart Fluidics system.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, which can be present on the tubing and fittings associated with the IntelliStart Fluidics system, dispose of those items in accordance with local environmental regulations.

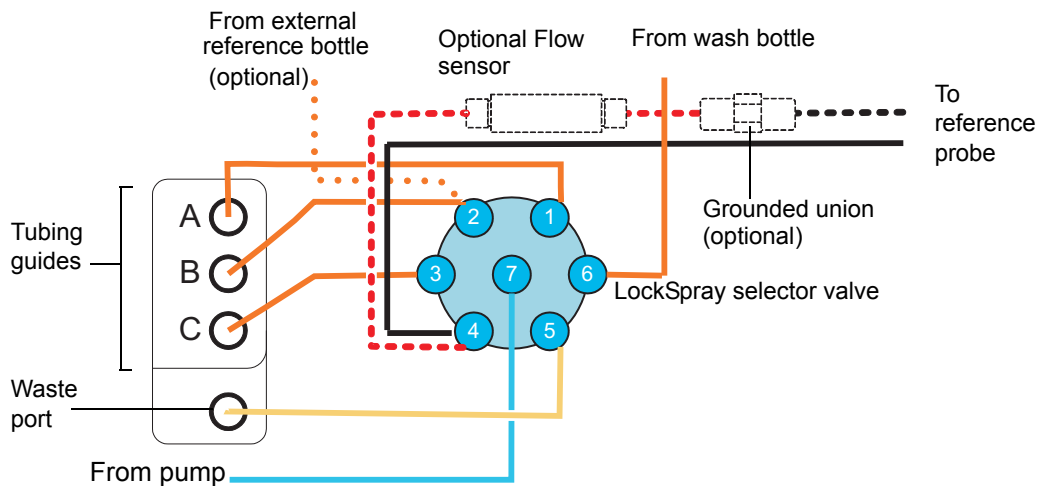
5. Dispose of the tubes and fittings in accordance with local environmental regulations.

Plumbing the IntelliStart Fluidics LockSpray system

This section describes how to plumb the lock-spray system.

Requirement: Finger tighten all PEEK fittings.

Tubing schematic — LockSpray system:



Tubing dimensions – LockSpray system:

Port number	Connection	ID (in.)	OD (in.)	Color	Length (mm)
1	Reservoir bottle A	0.020	1/16	Orange	680
2	Reservoir bottle B	0.020	1/16	Orange	680
3	Reservoir bottle C	0.020	1/16	Orange	680
4	Reference probe (Flow sensor if fitted)	0.005	1/32	Red	200
5	Waste reservoir	0.040	1/16	Natural	1000
6	Wash reservoir	0.020	1/16	Orange	1000
7	LockSpray selector pump	0.010	1/16	Blue	300
-	Flow sensor to grounded union (if used)	0.005	1/32	Red	60
-	Grounded union (if flow sensor is fitted) to reference probe	Probe and flow-rate dependent.			

Required materials

- Chemical-resistant, powder-free gloves

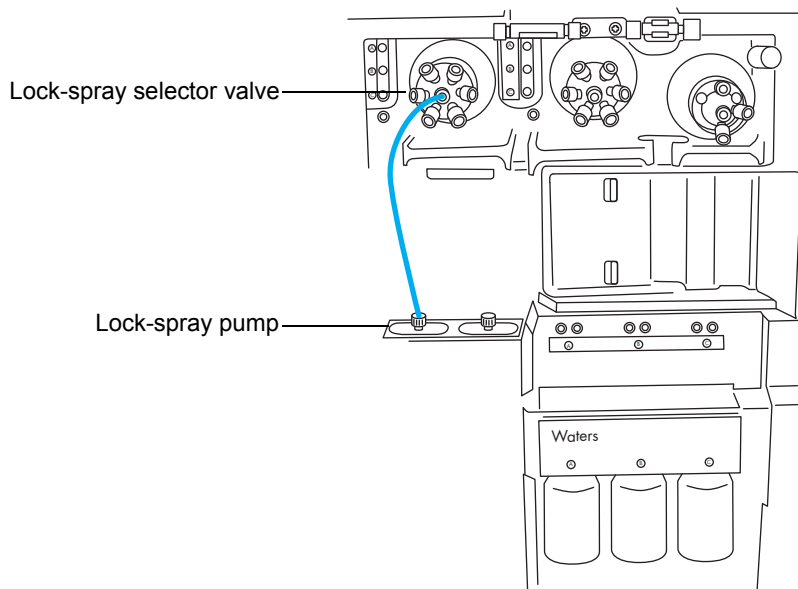
- SYNAPT G2-Si MS fluidics tubing and fitting kit
 - Tip:** This kit contains components for both the sample and LockSpray system plumbing.
- For the reference-probe connection
 - 375 mm of 0.005 inch ID red PEEK
 - Long "finger tight" fitting



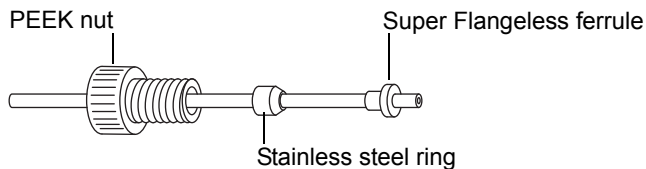
Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

To plum the LockSpray system:

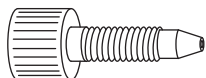
1. Open the access doors to the IntelliStart Fluidics system.
2. Using a PEEK nut, Super Flangeless™ ferrule, and stainless steel (SS) ring, connect the blue, 1/16 inch, 300 mm, PEEK tubing from the LockSpray pump to port 7 on the LockSpray selector valve, where you use the long "finger tight" fitting.



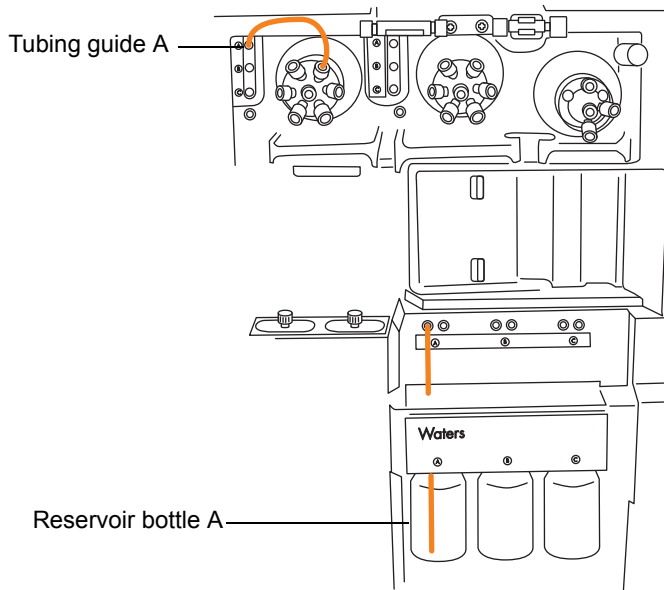
PEEK nut, Super Flangeless ferrule, and stainless steel (SS) ring:



Long "finger tight" fitting:



3. Using a long "finger tight" fitting, connect an orange, 1/16 inch, 680 mm, PEEK tubing from port 1 of the LockSpray selector valve through tubing guide A and into reservoir bottle A.



Requirement: As the tubing emerges from the tubing guide, thread a long "finger tight" fitting over it. Push the tubing through the left-hand hole, to the bottom of the reservoir bottle, and tighten the fitting.

Tips: Follow these suggestions if you find threading the tubes through the guides difficult:

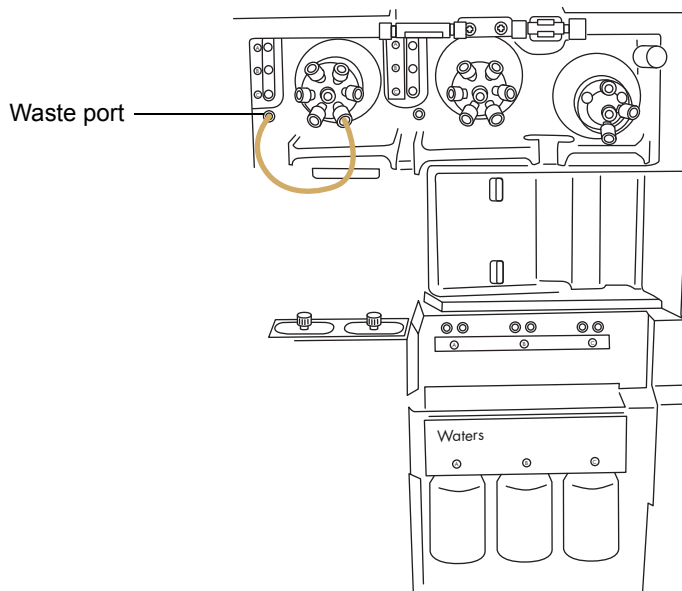
- Thread the tubes upward from the bottom hole.
 - Using needle-nose pliers, make a 20° bend, 10 mm from the end of the tubing. Then rotate the tubing, as necessary, as you thread it through the guide.
4. Using a long "finger tight" fitting, connect orange, 1/16 inch, 1000 mm, PEEK tubing from port 2 of the LockSpray selector valve to the reference reservoir bottle, or orange, 1/16-inch, 680 mm, PEEK tubing to the external reference bottle.
 - To use reservoir bottle B as the reference solution, thread the tubing through tubing guide B, and use a long "finger tight" fitting.
 - To use an external reference bottle, push the tubing to the bottom of the reference solution, and secure the tubing at the bottle neck to prevent it floating to the surface during use.
 5. Using a long "finger tight" fitting, connect orange, 1/16 inch, 680 mm, PEEK tubing from port 3 of the LockSpray selector valve, through tubing guide C and into reservoir bottle C.

Requirement: As the tubing emerges from the tubing guide, thread the long "finger tight" fitting over it, push the tubing through the left-hand hole, to the bottom of the reservoir bottle, and finger tighten the fitting.

6. Using a long "finger tight" fitting, connect orange, 1/16 inch, 1000 mm, PEEK tubing from port 6 of the LockSpray selector valve to the wash bottle.

Requirement: Push the tubing to the bottom of the wash solution, and secure the tubing to prevent it floating to the surface during use.

7. Using a long "finger tight" fitting, connect 1/16 inch, 1000-mm, natural-color PEEK tubing to port 5 of the LockSpray selector valve, and thread the tubing into the waste port.

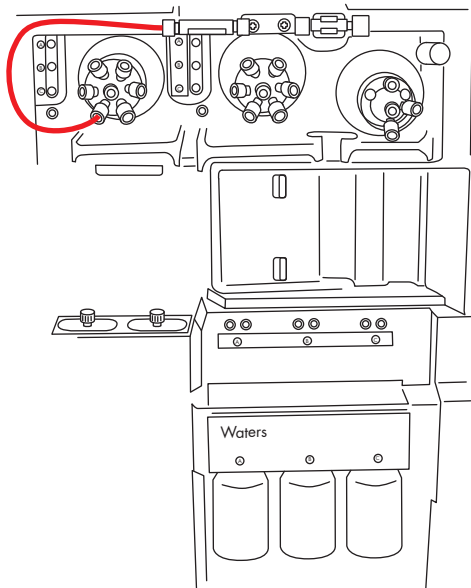


Tip: The liquid waste system collects waste without requiring a fitted connection. Waste drains through the connector at the base of the instrument and into a waste bottle (see [page 339](#)).

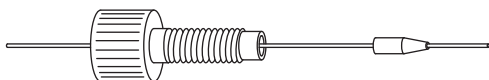
! **Notice:** To prevent the narrower, 1/32 inch tubing slipping out of the port, give the tubing a gentle tug once the fitting is tightened, to ensure it is gripped correctly.

6 Maintenance Procedures

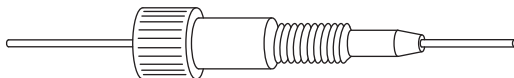
- Using a long "finger tight" PEEK nut and 1/32-inch, PEEK ferrule, connect the red, 1/32-inch, 200-mm, PEEK tubing from port 4 of the LockSpray selector valve to the left-hand side of the flow sensor, where you use the 1/32-inch, 6-40 Valco® compression fitting assembly.



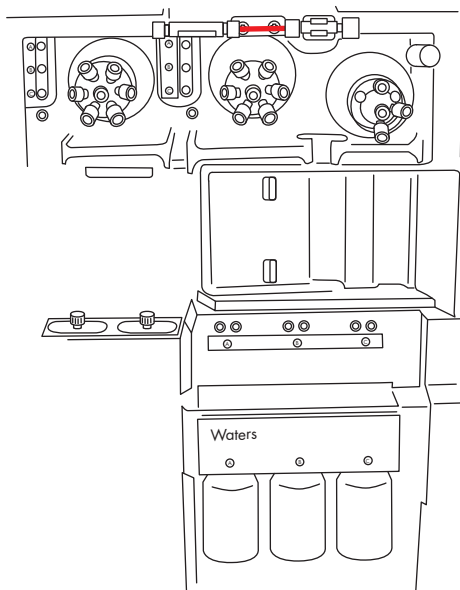
Long "finger tight" PEEK nut and 1/32-inch PEEK ferrule:



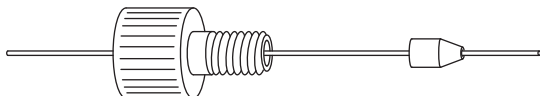
1/32-inch, 6-40 Valco compression fitting assembly:



- Using a 1/32-inch, Valco component fitting assembly, connect the red, 1/32-inch, 60-mm, PEEK tubing between the flow sensor and the grounded union, where you use a short "finger tight" nut and 1/32-inch ferrule.



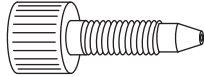
Short "finger tight" nut and 1/32-inch ferrule:



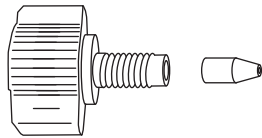


Warning: To avoid electric shock, do not use stainless steel tubing to connect the grounded union to the reference probe.

10. Connect the grounded union to the LockSpray source's reference probe.
 - For the LockSpray source, use 1/16-inch PEEK tubing connected as follows:
 - At the grounded union end, use a long "finger tight" fitting.



- At the source reference-probe connection, use the PEEK "finger tight" nut and ferrule.



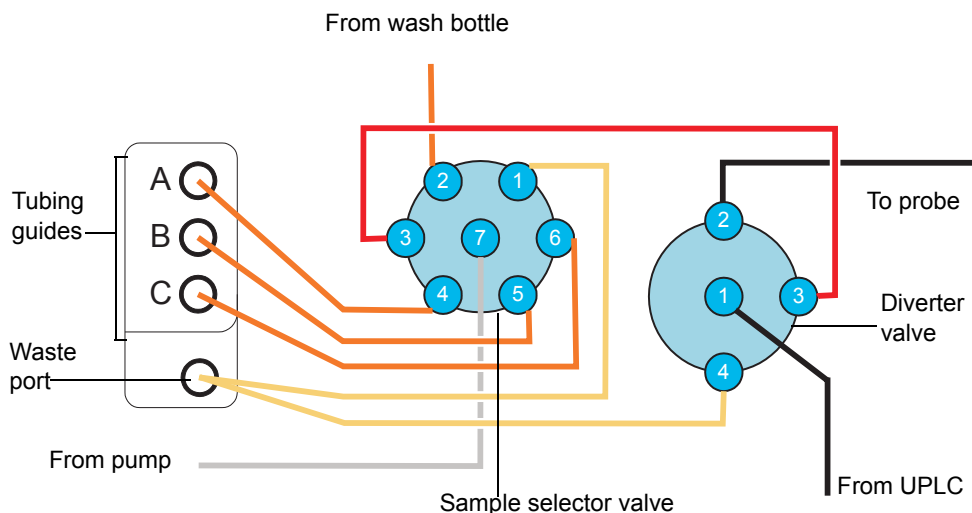
11. Close the access door to the IntelliStart Fluidics system.

Important: Ensure that the tubing does not become trapped when you close the access door to the IntelliStart Fluidics system.

Plumbing the IntelliStart Fluidics sample delivery system

This section explains how to plumb the sample delivery system for standard flow applications. For low flow, nanoACQUITY UPLC and ACQUITY UPLC M-Class applications, see [page 270](#).

IntelliStart Fluidics sample delivery tubing schematic:



All tubing is composed of PEEK except that which connects the pump and sample-selector valve, which is stainless-steel.

Tubing dimensions — sample delivery system:

Valve / Port	Connection	ID (inch)	OD (inch)	Color	Length (mm)
Sample / 1	Waste reservoir	0.040	1/16	Natural	1000
Sample / 2	Wash reservoir	0.020	1/16	Orange	1000
Sample / 3	Diverter valve	0.005	1/16	Red	200
Sample / 4	Reservoir bottle A	0.020	1/16	Orange	680
Sample / 5	Reservoir bottle B	0.020	1/16	Orange	680
Sample / 6	Reservoir bottle C	0.020	1/16	Orange	680
Sample / 7	Analyte pump	0.040	1/16	n/a	500
Diverter / 4	Waste	0.040	1/16	Natural	1000

Required materials

- Chemical-resistant, powder-free gloves
- SYNAPT G2-Si MS fluidics tubing and fitting kit

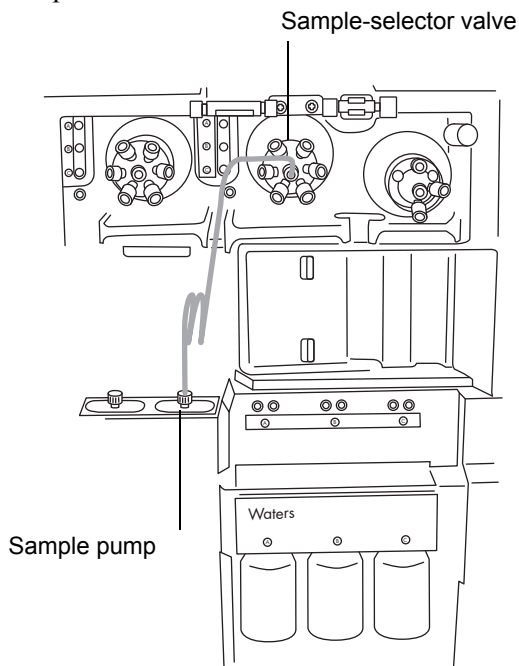
Tip: This kit contains components for both the sample and LockSpray system plumbing.



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

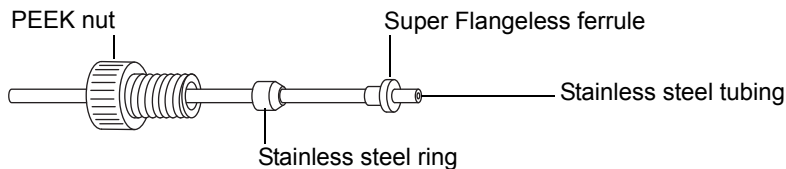
To plumb the analyte system:

1. Open the access doors to the IntelliStart Fluidics system.
2. Using the stainless-steel tubing, connect the sample pump to port 7 of the sample-selector valve:

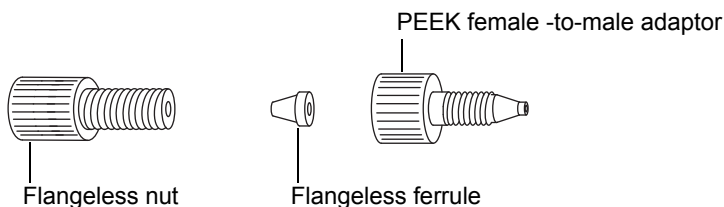


Replacing the IntelliStart tubing (LockSpray configuration)

- a. Slide the PEEK nut, Super Flangeless ferrule, and stainless steel ring over the pump end of the steel tubing.



- b. Insert the tubing in the pump, and tighten the fittings.
- c. At the sample-selector valve, screw the natural-color PEEK female-to-male adaptor into port 7.



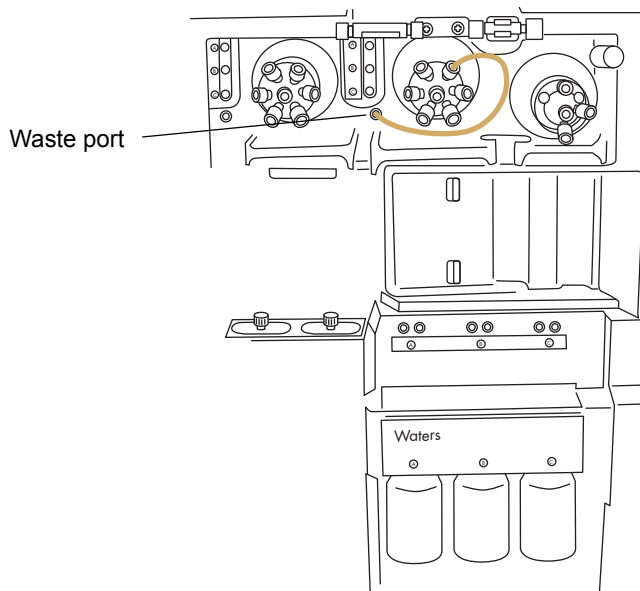
- d. Slide the transparent, 1/16 inch flangeless nut and blue, 1/16 inch flangeless ferrule over the tubing.

Rationale: These components provide fail-safe pressure relief in case of a blockage.

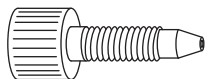
- e. Insert the tubing in the female-to-male adaptor in port 7, and tighten the fittings.

Important: The steel tubing requires high-pressure seals at each end. Ensure that you tighten the fittings appropriately.

- Using a long "finger tight" fitting, connect 1/16-inch, 1000-mm, natural-colored PEEK tubing to port 1 of the sample-selector valve, and thread the tubing into the waste port.



Long "finger tight" fitting:

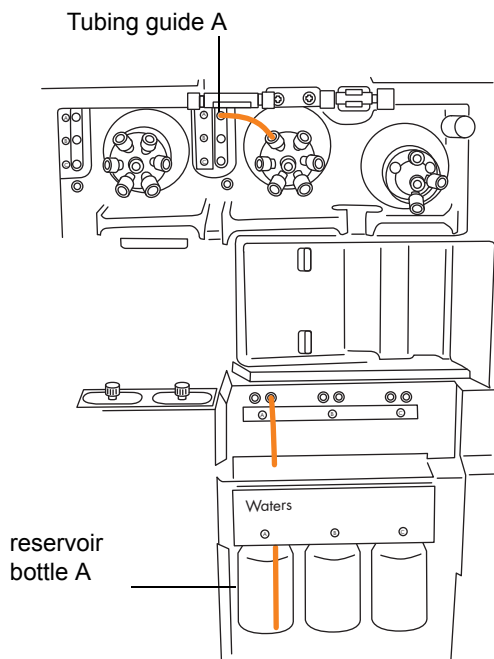


Tip: The liquid waste system collects waste without requiring a fitted connection. Waste drains through the connector on the left-hand side of the instrument and into the waste bottle (see [page 339](#)).

- Using a long "finger tight" fitting, connect orange, 1/16-inch, 1000-mm, PEEK tubing from port 2 of the sample-selector valve to the wash bottle.

Requirement: Push the tubing to the bottom of the wash solution, and secure it to prevent the tubing floating to the surface during use.

- Using a long "finger tight" fitting, connect orange, 1/16-inch, 680-mm, PEEK tubing from port 4 of the sample-selector valve, through tubing guide A and into reservoir bottle A.



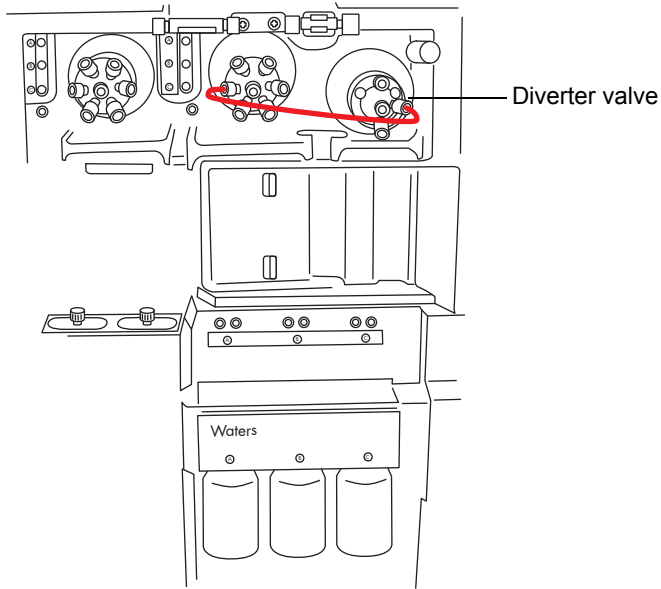
Requirement: As the tubing emerges from the tubing guide, thread the long "finger tight" fitting over it, push the tubing through the right-hand hole, to the bottom of the reservoir bottle and tighten the fitting.

Tips: Follow these suggestions if you find threading the tubes through the guides difficult:

- Thread the tubes upward from the bottom hole.
 - Using needle-nose pliers, make a 20° bend, 10-mm from the end of the tubing. Then rotate the tubing, as necessary, as you thread it through the guide.
- Repeat this procedure for port 5 to reservoir bottle B and port 6 to reservoir bottle C.

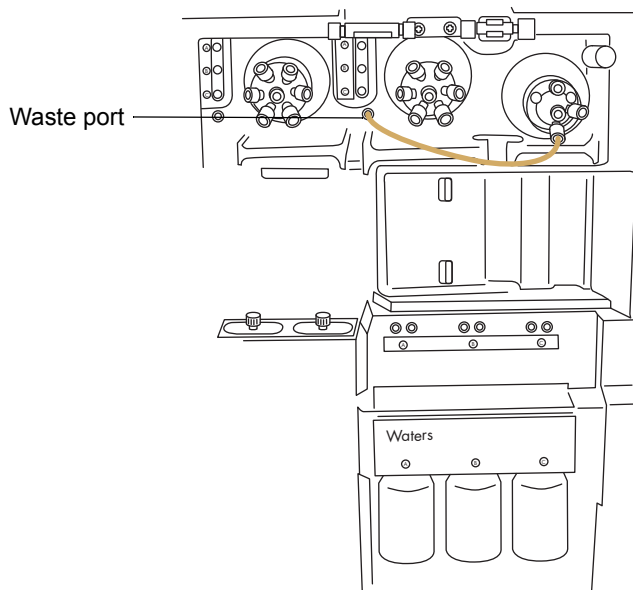
6 Maintenance Procedures

7. Using two long "finger tight" fittings, connect the red, 1/16-inch, 200-mm, PEEK tubing from port 3 of the sample selector valve to port 3 of the diverter valve.



- Using a long "finger tight" fitting, connect 1/16-inch, 1000-mm, natural-colored PEEK tubing to port 4 of the diverter valve, and thread it securely into the waste port.

Tip: This is the same waste port as used in [step 3](#).



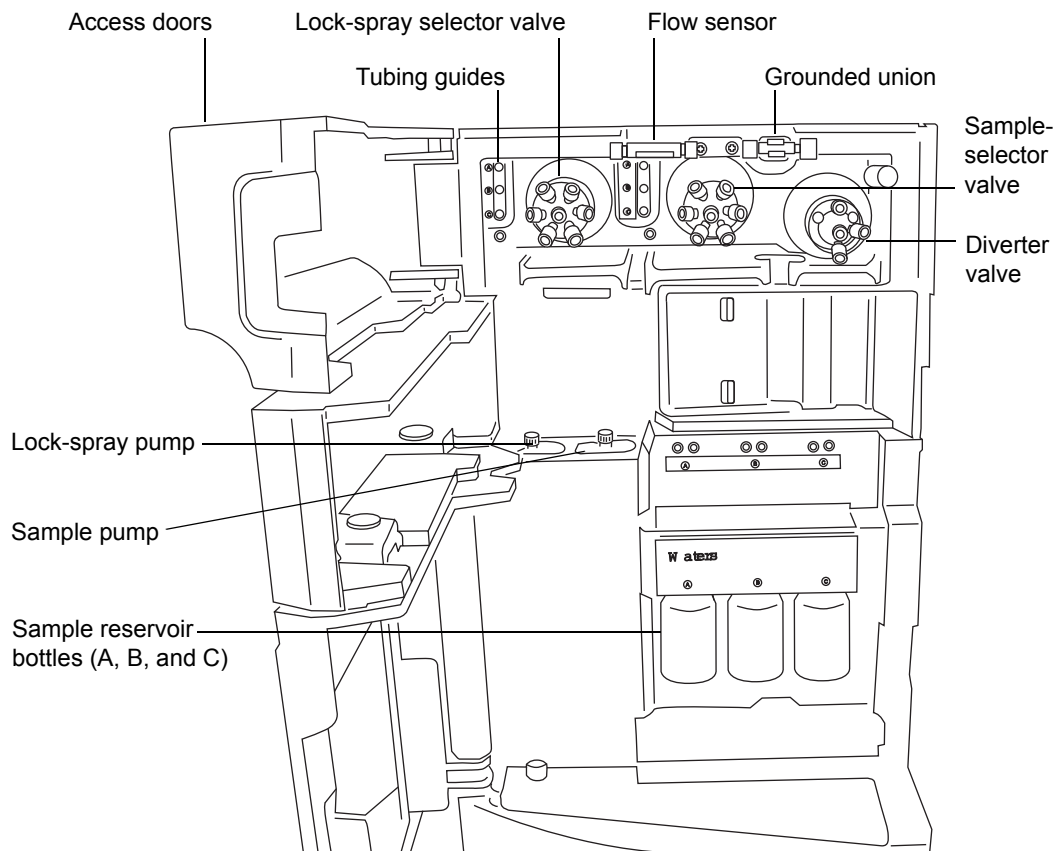
- Connect port 2 of the sample-selector valve to the source probe, observing the procedure (see [page 64](#)).
- Close the access doors to the IntelliStart Fluidics system.
Important: Ensure that the tubing does not become trapped when you close the access door to the IntelliStart Fluidics system.

Replacing the IntelliStart tubing (NanoLockSpray configuration)

You must replace the tubing between the components of the IntelliStart Fluidics system when the tubing or its connections become blocked. The following procedures explain how to replace the tubing for the NanoSpray and sample delivery systems. They do not, however, address probe connections, which vary according to your application (see [page 64](#)). No parts of the fluid line are reusable once detached.

IntelliStart Fluidics system physical layout:

Note: Connections are omitted for clarity.



Removing the IntelliStart Fluidics tubing

The following explains how to remove the IntelliStart Fluidics tubing and disconnect the probe tubing at the diverter valve or grounded union.

Required materials

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

To remove the tubing:

1. Open the access doors to the IntelliStart Fluidics system.
2. Unscrew and remove the PEEK thumbscrews and tubes from the lock-spray selector, sample-selector, and diverter valves.
3. Unscrew and remove the PEEK thumbscrews and tubes from between the flow sensor and the grounded union.
4. Close the access doors to the IntelliStart Fluidics system.



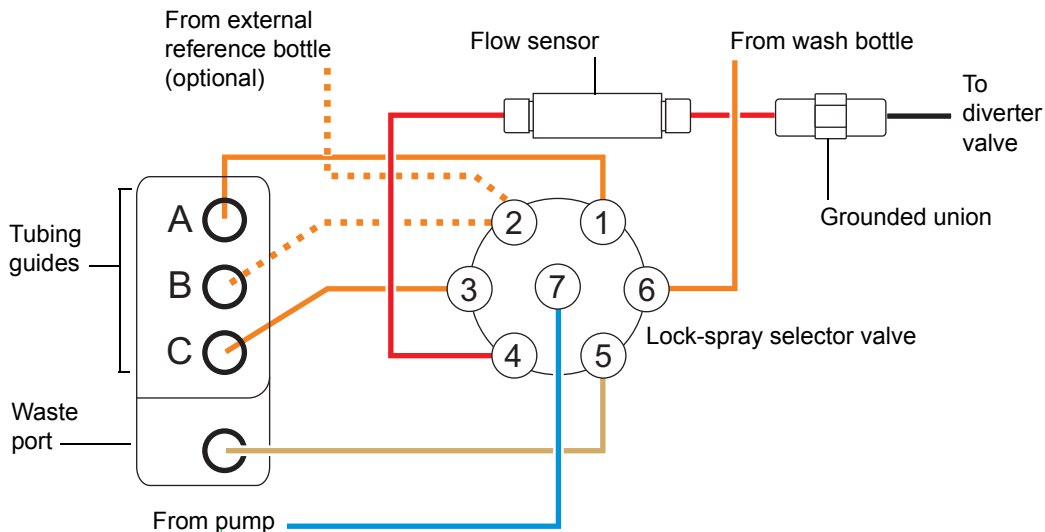
Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, which can be present on the tubing and fittings associated with the IntelliStart Fluidics system, dispose of those items in accordance with local environmental regulations.

5. Dispose of the tubes and fittings in accordance with local environmental regulations.

Plumbing the IntelliStart Fluidics NanoLockSpray system

This section explains how to plumb the NanoLockSpray system.

Tubing schematic for the system:



Tubing dimensions:

Port number	Connection	ID (inch)	OD (inch)	Color	Length (mm)
1	Reservoir bottle A	0.020	1/16	Orange	680
2	Reservoir bottle B	0.020	1/16	Orange	680
3	Reservoir bottle C	0.020	1/16	Orange	680
4	Flow sensor	0.005	1/32	Red	200
5	Waste reservoir	0.040	1/16	Natural	1000
6	Wash reservoir	0.020	1/16	Orange	1000
7	NanoSpray selector pump	0.010	1/16	Blue	300
-	Flow sensor to grounded union	0.005	1/32	Red	60
-	Grounded union to diverter valve	Probe and flow rate dependent.			

Required materials

- Chemical-resistant, powder-free gloves

- The SYNAPT G2-Si MS Fluidics Tubing and Fitting Kit
 - **Tip:** This kit contains components for both the sample and NanoSpray system plumbing.
- For the reference-probe connection:
 - 375 mm of 0.005 inch ID red PEEK
 - A long “finger-tight” fitting
- For the NanoLockSpray source reference-probe connection:
 - 375 mm of 25 μ L, fused-silica capillary (supplied in 1 m lengths)
 - A protective sleeve consisting of 0.015 inch ID PEEK tubing
 - An F-130 “finger-tight” nut
- Needle-nose pliers.

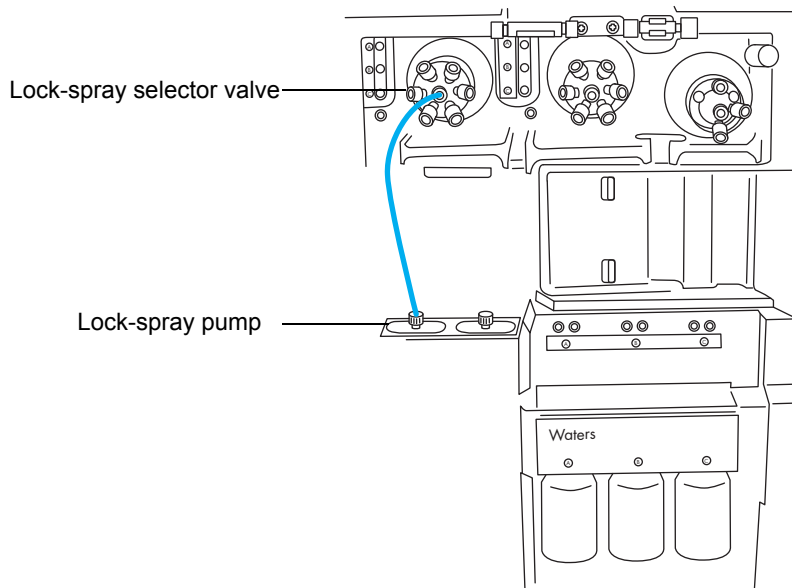


Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

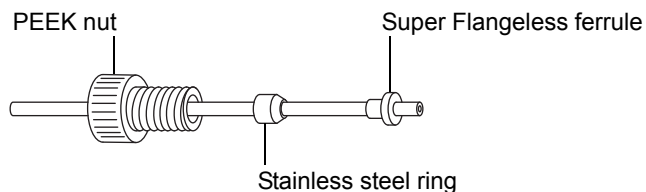
To plumb the lock-spray system:

Requirement: Finger tighten all PEEK fittings.

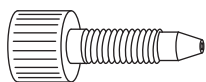
1. Open the access doors to the IntelliStart Fluidics system.
2. Using a PEEK nut, Super Flangeless ferrule, and stainless steel (SS) ring, connect the blue, 1/16-inch, 300-mm, PEEK tubing from the lock-spray pump to port 7 on the lock-spray selector valve, where you use a long “finger-tight” fitting.



PEEK nut, Super Flangeless ferrule, and stainless steel (SS) ring:

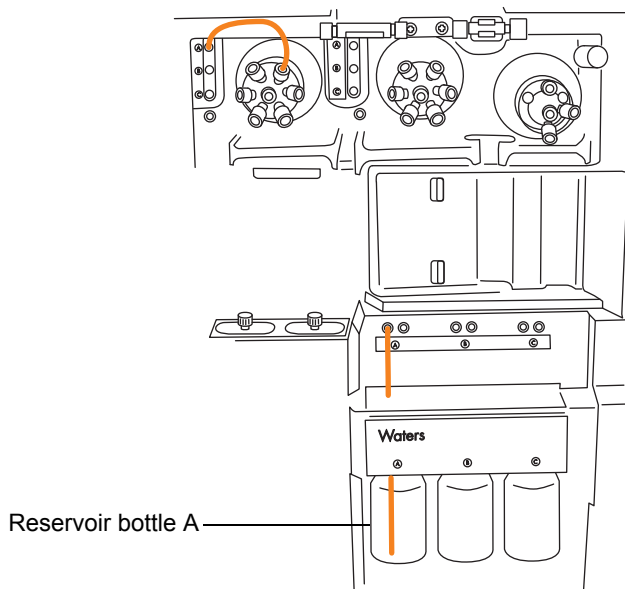


Long “finger-tight” fitting:



Replacing the IntelliStart tubing (NanoLockSpray configuration)

- Using a long “finger-tight” fitting, connect orange 1/16 inch, 680 mm, PEEK tubing from port 1 of the NanoSpray selector valve, through tubing guide A and into reservoir bottle A.



Requirement: As the tubing emerges from the tubing guide, thread a long “finger-tight” fitting over it. Push the tubing through the left-hand hole, to the bottom of the reservoir bottle, and tighten the fitting.

Tips: Follow these suggestions if you find threading the tubing through the guides difficult:

- Thread the tubing upward from the bottom hole.
- Using needle-nose pliers, make a 20° bend, 10 mm from the end of the tubing. Then rotate the tubing, as necessary, as you thread it through the guide.

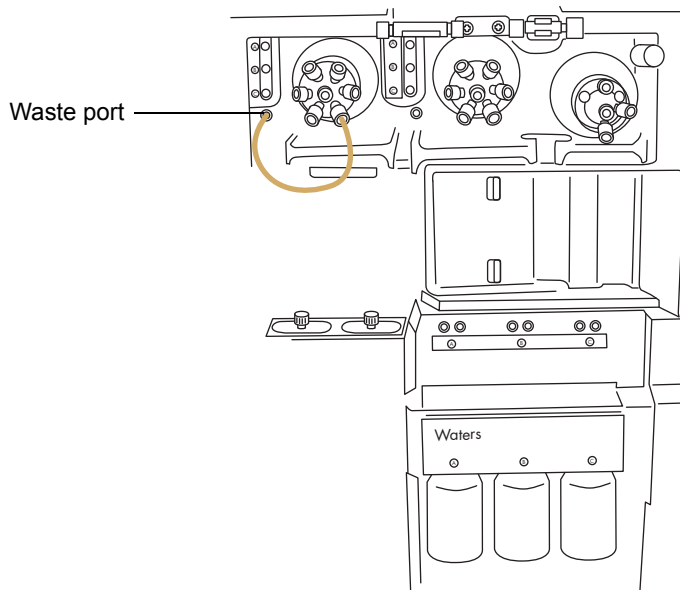
4. Using a long “finger-tight” fitting, connect orange, 1/16-inch, 680-mm, PEEK tubing from port 2 of the selector valve to the reference reservoir bottle or orange, 1/16-inch, 1000-mm, PEEK tubing to the external reference bottle.
 - To use reservoir bottle B as the reference solution, thread the tubing through tubing guide B, and secure it with a long “finger-tight” fitting.
 - To use an external reference bottle, push the tubing to the bottom of the reference solution, and secure the tubing at the bottle neck to prevent it floating to the surface during use.
5. Using a long “finger-tight” fitting, connect orange, 1/16-inch, 680-mm, PEEK tubing from port 3 of the NanoSpray selector valve selector valve through tubing guide C and into reservoir bottle C.

Requirement: As the tubing emerges from the tubing guide, thread the long “finger-tight” fitting over it, push the tubing through the left-hand hole to the bottom of the reservoir bottle, and finger tighten the fitting.

6. Using a long “finger-tight” fitting, connect orange 1/16-inch, 1000-mm, PEEK tubing from port 6 of the NanoSpray selector valve to the wash bottle.

Requirement: Push the tubing to the bottom of the wash solution, and secure the tubing to prevent it floating to the surface during use.

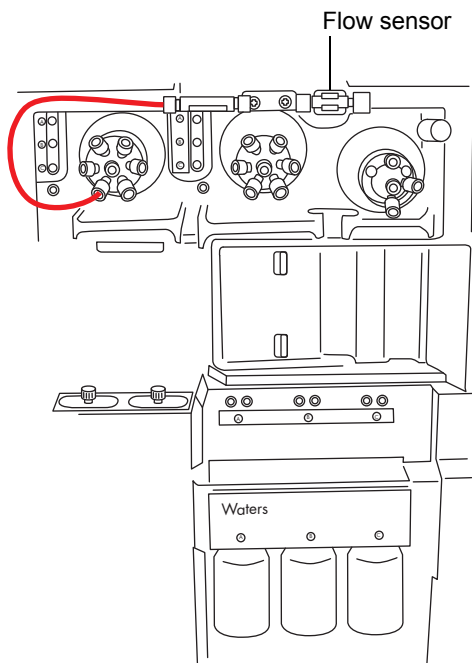
7. Using a long “finger-tight” fitting, connect 1/16-inch, 1000-mm, natural-color PEEK tubing to port 5 of the NanoSpray selector valve, and thread the tubing into the waste port.



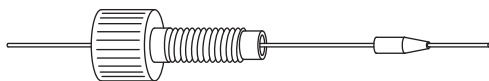
Tip: The liquid waste system collects waste without requiring a fitted connection. Waste drains through the connector at the base of the instrument and into a waste bottle (see [page 339](#)).

- Using a long “finger-tight” PEEK nut and 1/32-inch PEEK ferrule, connect the red, 1/32-inch, 200-mm, PEEK tubing from port 4 of the lock-spray selector valve to the left-hand side of the flow sensor, where you use the 1/32-inch, 6-40 Valco compression fitting assembly.

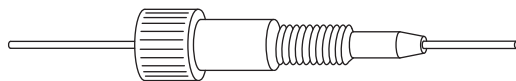
! **Notice:** To prevent the narrower, 1/32 inch tubing slipping out of the port, give the tubing a gentle tug once the fitting is tightened, to ensure it is gripped correctly.



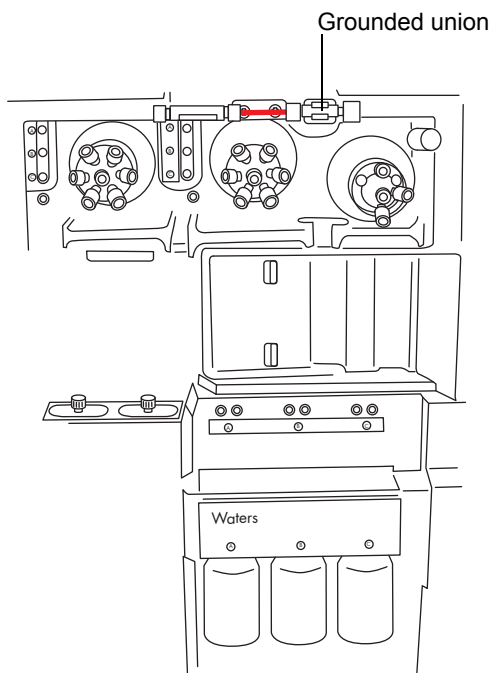
Long “finger-tight” PEEK nut and 1/32-inch, PEEK ferrule:



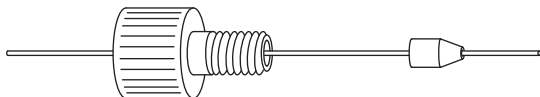
1/32-inch, 6-40 Valco compression fitting assembly:



- Using a 1/32-inch, Valco component fitting assembly, connect the red, 1/32-inch, 60-mm, PEEK tubing between the flow sensor and the grounded union, where you use a short “finger-tight” nut and 1/32-inch ferrule.



Short “finger-tight” nut and 1/32 inch ferrule:



Warning: To avoid electric shock, do not use stainless steel tubing to connect the grounded union to the reference probe.

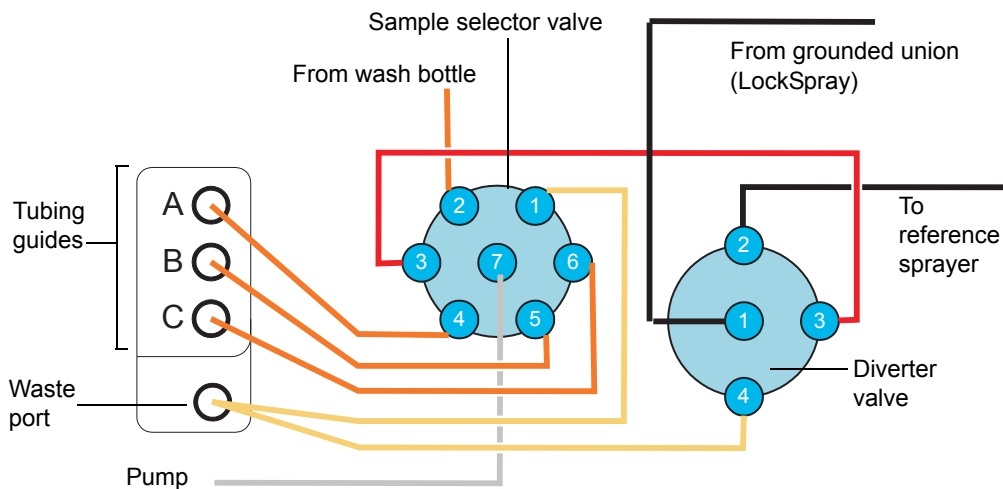
- Connect the grounded union to the source’s reference probe (see [page 219](#)).
- Close the access doors to the IntelliStart Fluidics system.

Important: Ensure that the tubing does not become trapped when you close the access door to the IntelliStart Fluidics system.

Plumbing the IntelliStart Fluidics sample delivery system

This section explains how to plumb the sample delivery system for low flow, nanoACQUITY UPLC and ACQUITY UPLC M-Class applications.

IntelliStart Fluidics sample delivery tubing schematic:



All tubing is composed of PEEK, except that which connects the pump and sample-selector valve, which is stainless steel.

Tubing dimensions — sample delivery system:

Valve/Port	Connection	ID (inch)	OD (inch)	Color	Length (mm)
Sample/1	Waste reservoir	0.040	1/16	Natural	1000
Sample/2	Wash reservoir	0.020	1/16	Orange	1000
Sample/3	Diverter valve	0.005	1/16	Red	200
Sample/4	Reservoir Bottle A	0.020	1/16	Orange	680
Sample/5	Reservoir Bottle B	0.020	1/16	Orange	680
Sample/6	Reservoir Bottle C	0.020	1/16	Orange	680
Sample/7	Analyte pump	0.040	1/16	n/a	500
Diverter/4	Waste	0.040	1/16	Natural	1000

Required materials

- Chemical-resistant, powder-free gloves
- The SYNAPT G2-Si Fluidics Tubing and Fitting Kit

Tip: This kit contains components for both the sample and NanoSpray system's plumbing.

- Needle-nose pliers

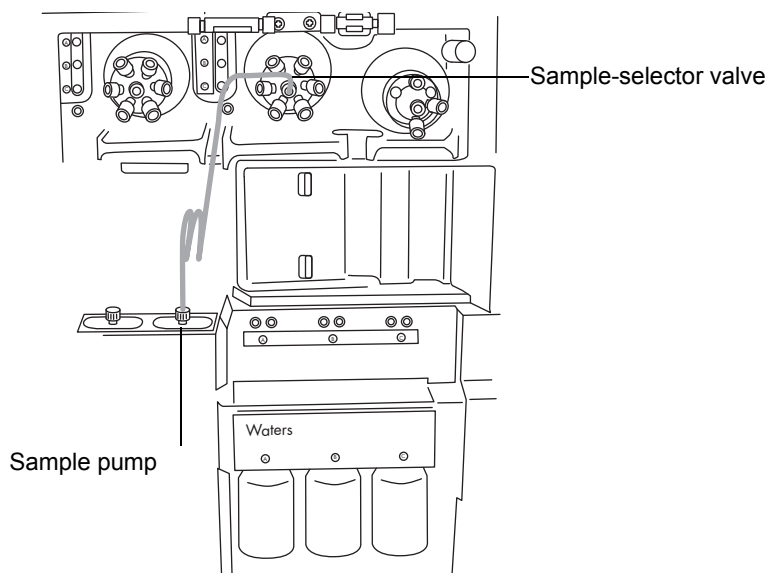


Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

To plumb the analyte system:

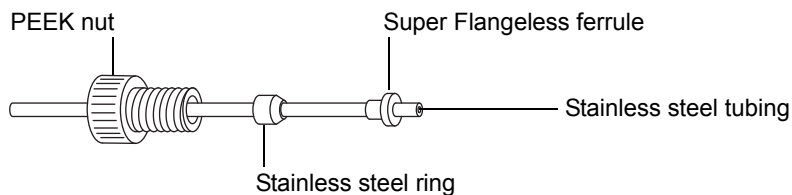
Requirement: Finger tighten all PEEK fittings.

1. Open the access door to the IntelliStart Fluidics system.
2. Using the stainless steel tubing, connect the sample pump to port 7 of the sample-selector valve.

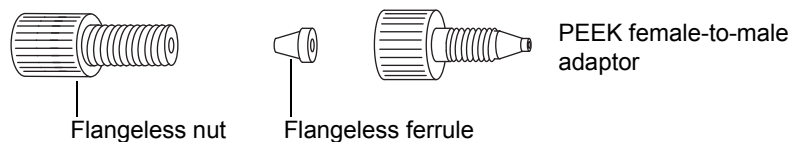


6 Maintenance Procedures

- a. Slide the PEEK nut, stainless steel ring, and Super Flangeless ferrule over the pump end of the steel tubing.



- b. Insert the tubing in the pump, and tighten the fittings.
- c. At the sample-selector valve, screw the natural-color PEEK female-to-male adaptor into port 7.



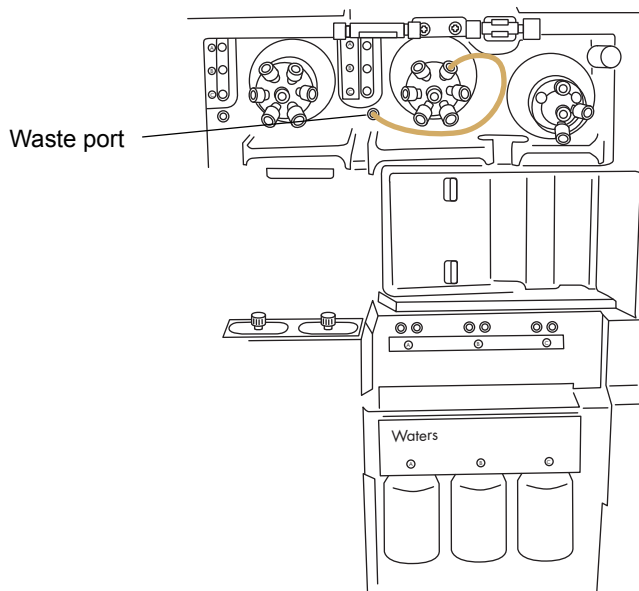
- d. Slide the transparent, 1/16-inch flangeless nut and blue 1/16-inch flangeless ferrule over the tubing.

Rationale: These components provide fail-safe pressure relief in case of a blockage.

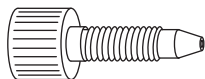
- e. Insert the tubing in the female-to-male adaptor in port 7, and tighten the fittings.

Important: The steel tubing requires high-pressure seals at each end. Ensure that you tighten the fittings appropriately.

- Using a long “finger-tight” fitting, connect 1/16-inch, 1000-mm, natural-colored PEEK tubing to port 1 of the sample-selector valve, and thread the tubing into the waste port.



Long “finger-tight” fitting:



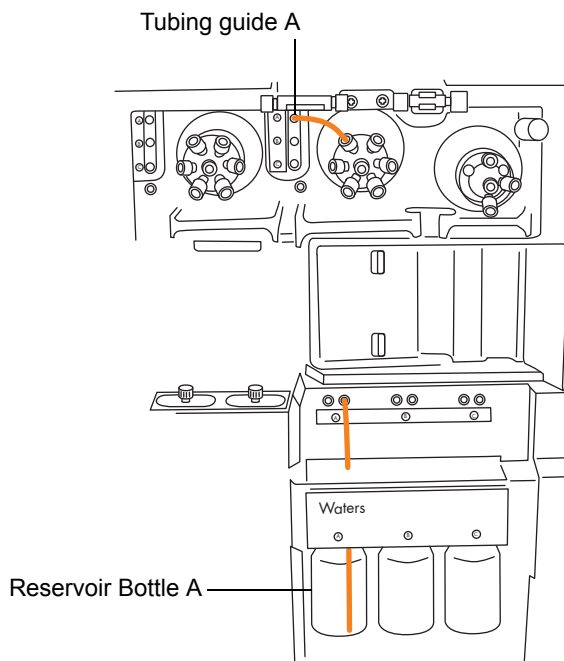
Tip: The liquid waste system collects waste without requiring a fitted connection. Waste drains through the connector at the base of the instrument and into the waste bottle (see [page 339](#)).

- Using a long “finger-tight” fitting, connect orange 1/16-inch, 1000-mm, PEEK tubing from port 2 of the sample selector valve to the wash bottle.

Requirement: Push the tubing to the bottom of the wash solution, and secure it to prevent the tubing floating to the surface during use.

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- Using a long “finger-tight” fitting, connect orange 1/16-inch, 680-mm, PEEK tubing from port 4 of the sample-selector valve, through tubing guide A and into reservoir bottle A.



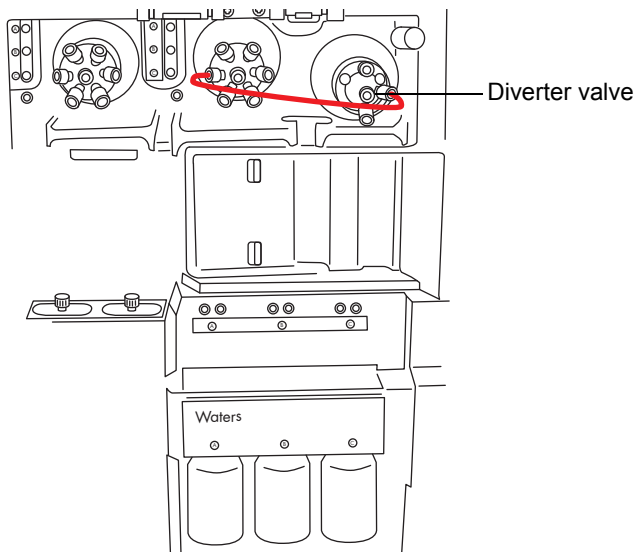
Requirement: As the tubing emerges from the tubing guide, thread the long “finger-tight” fitting over it, push the tubing through the right-hand hole to the bottom of the reservoir bottle, and tighten the fitting.

Tips: Follow these suggestions if you find threading the tubes through the guides difficult:

- Thread the tubes upward from the bottom hole.
 - Using needle-nose pliers, make a 20° bend, 10 mm from the end of the tubing. Then rotate the tubing, as necessary, as you thread it through the guide.
- Repeat this procedure for port 5 to reservoir bottle B and port 6 to reservoir bottle C.

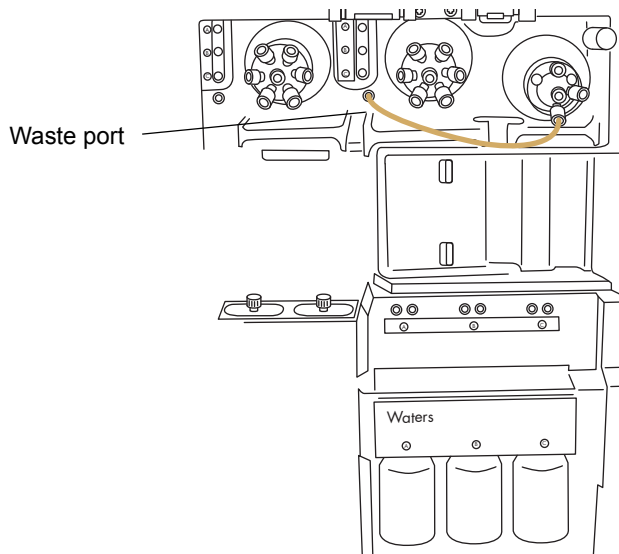
Replacing the IntelliStart tubing (NanoLockSpray configuration)

- Using two long “finger-tight” fittings, connect the red 1/16-inch, 200-mm, PEEK tubing from port 3 of the sample selector valve to port 3 of the diverter valve.



- Using a long “finger-tight” fitting, connect 1/16-inch, 1000-mm, natural-colored PEEK tubing to port 4 of the diverter valve, and thread it securely into the waste port.

Tip: This is the same waste port as used in [step 3](#).



9. Connect port 2 of the diverter valve to the source probe, observing the relevant procedure for the ESI probe (see [page 64](#)).
10. Close the access doors to the IntelliStart Fluidics system.

Important: Ensure that the tubing does not become trapped when you close the access door to the IntelliStart Fluidics system.

Cleaning the mass spectrometer external panels

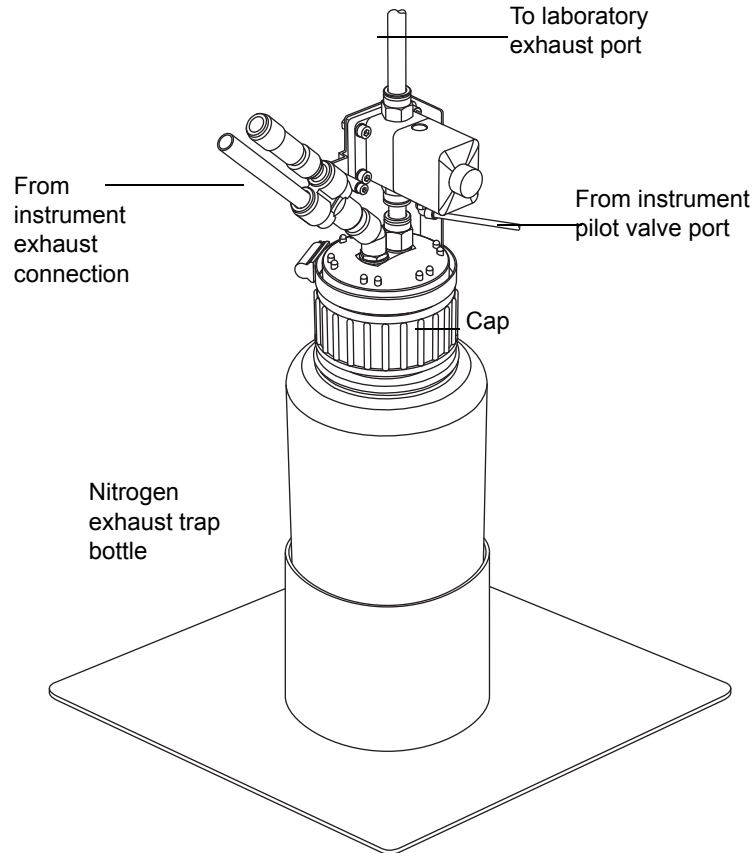
- ! **Notice:** To avoid scratching, abrading or otherwise damaging the instrument's case, do not use abrasives or solvents to clean it.

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

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.

Nitrogen exhaust trap bottle:




Required materials

Chemical-resistant, powder-free gloves



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

To empty the nitrogen exhaust trap bottle:

1. In the Instrument Console, click Stop Flow .
2. Pull the source enclosure release (located at the bottom, right-hand side) outwards, and swing open the enclosure.
3. Unscrew and remove the nitrogen exhaust trap bottle from the cap and associated fittings.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, which can be present in the waste liquid, dispose of waste liquid in accordance with 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 leak test is now performed. If the test results in failure, ensure that the nitrogen exhaust trap bottle is fully tightened to the cap.

8. In the Instrument Console, click Start Flow .

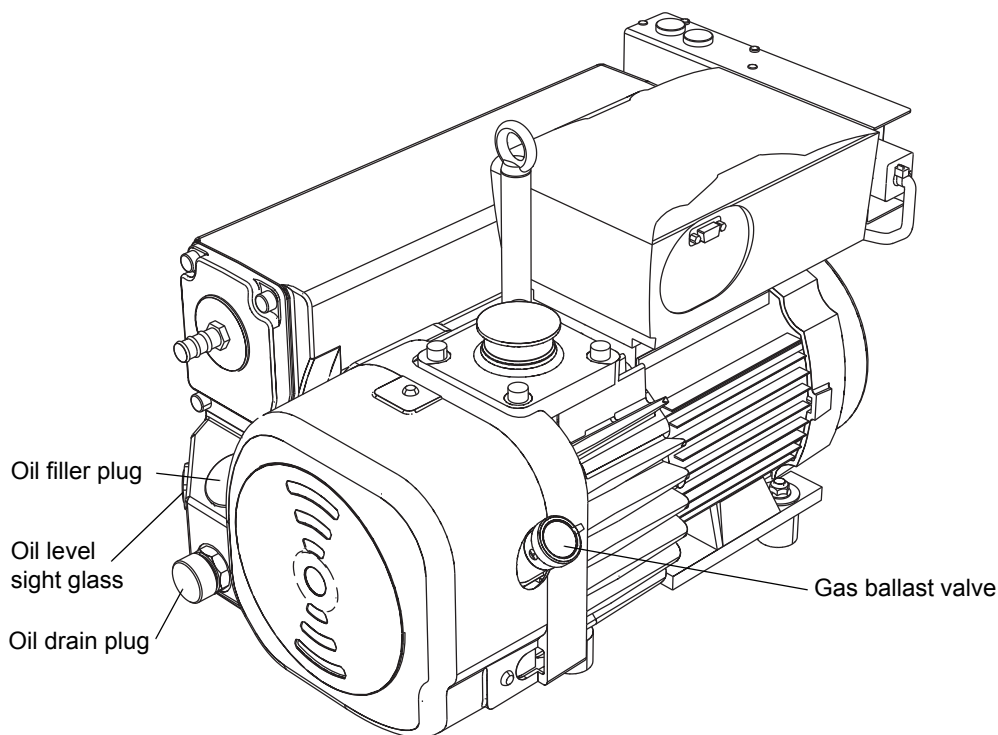
Maintaining the roughing pumps

The instrument is fitted with two roughing pumps, which can be of a wet or dry type, depending on your preference. A wet-pump instrument uses two Oerlikon-Leybold pumps, one each of models SV65BI FC and SV40BI FC. A dry-pump instrument uses two Edwards pumps, one each of models XDS100B and XDS35i.

Oerlikon Leybold oil-filled roughing pump

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

Oerlikon Leybold roughing pump:



Gas ballasting the Oerlikon Leybold roughing pumps

- ! **Notice:** To avoid shortening the oil life, and, consequently, the useful life of the roughing pumps, ensure that you routinely gas ballast the pumps.

The roughing pumps draw 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 pumps 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.



Warning: To avoid burn injuries, take great care while working with the roughing pumps: they can be hot.

- ! **Notice:** To avoid over-pressurization and internal sensor malfunction,
 - do not vent the instrument when the roughing pumps are gas ballasting.
 - do not gas ballast the roughing pumps while the instrument is in Operate mode.
 - avoid gas ballasting the roughing pumps for more than two hours.

To gas ballast the roughing pumps:

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 there is adequate ventilation.

3. Close the gas ballast valve.

Determining the oil level (Oerlikon Leybold, oil-filled roughing pumps)

! **Notice:** To ensure correct operation of the roughing pumps, do not operate them with the oil level at less than 30% of the maximum level, as indicated in the pumps' sight glasses.

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

Requirement: You must determine the oil levels of roughing pumps while the pumps are running.

The oil level appears in the oil-level sight glass of each roughing pump. Monitor the oil level weekly; you must maintain it 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.

Adding oil to an Oerlikon Leybold roughing pump

If a roughing pump's oil level is low, you must add oil to the pump.

Required materials

- Chemical-resistant, powder-free gloves
- 12-mm Allen wrench
- Funnel
- Hydrocracked Mineral Oil with Additives (Waters part number 700005038)



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



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

To add oil:

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 pumps and mass spectrometer, disconnect the power cords for the mass spectrometer and roughing pumps from the main power source.

2. Disconnect the power cords for the mass spectrometer and both roughing pumps from the main power source.
3. Allow the oil to settle in the pump.
4. Use the 12-mm Allen wrench to unscrew and remove the pump's oil filler plug.



Notice: To avoid seal and bearing problems within the pump, use only Hydrocracked Mineral Oil with Additives.

5. Using the funnel, add Hydrocracked Mineral Oil with Additives, into the oil filler aperture until the oil reaches the maximum level ("MAX"), as indicated in the pump's oil level sight glass.



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 12-mm Allen 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. Instead it makes the plug difficult to remove later.

7. Connect the power cords for the mass spectrometer and both roughing pumps to the main power source.

8. Start the mass spectrometer (see [page 52](#)).

Tips: After you add oil to the pump, the following conditions 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.

Replacing the roughing pumps' oil and oil de-mister elements

Replace the roughing pumps' oil and oil de-mister elements annually.

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

Required materials

- Chemical-resistant, powder-free gloves
- 12-mm Allen wrench
- 10-mm wrench
- Container to catch used oil
- Funnel
- Hydrocracked Mineral Oil with Additives (Waters part number 700005038)

To prepare for replacing the roughing pumps' oil and oil de-mister elements:

1. Gas ballast each roughing pump for 1 hour (see [page 280](#)).

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 pumps and mass spectrometer, disconnect the power cords for the mass spectrometer and roughing pumps from the main power source.

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



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.



Warning: To avoid burn injuries, take great care while working with the roughing pumps: they can be hot.

To drain the roughing pumps' oil:

1. Place the container for catching used oil under the pump's drain plug (see the figure on [page 279](#)).
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 prevent contaminating the environment with biologically hazardous or toxic materials, which can be present in the roughing-pump oil, dispose of the oil in accordance with 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 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.

To fill the roughing pumps with oil:

! **Notice:** To avoid damaging the pump, use only Hydrocracked Mineral Oil with Additives.

1. Using the funnel, pour one liter of Hydrocracked Mineral Oil with Additives, into the oil filler aperture.

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 filler plug to the roughing pump:

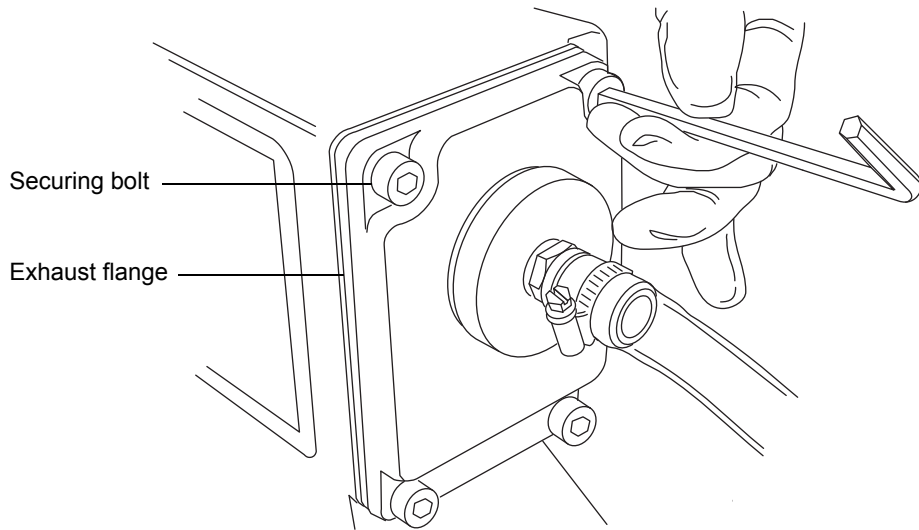
- Ensure that the plug is not cross threaded.
- Ensure that the O-ring is not pinched.
- Do not over tighten the plug.

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

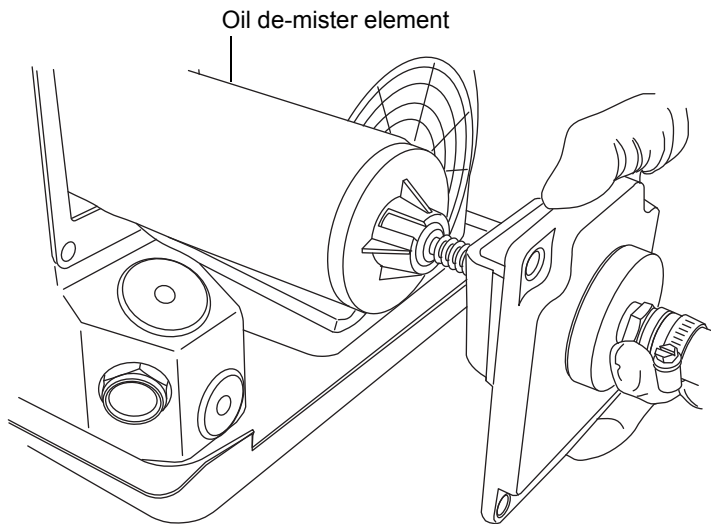
Tip: When the plug is tightened, it seals against an O-ring. Compression is controlled by the O-ring groove depth in the plug. Increased torque does not improve the plug seal; it only makes the plug difficult to remove later.

To remove the roughing pumps' oil de-mister elements:

1. Use the 6- mm Allen wrench to remove the four bolts securing the exhaust flange to the roughing pump.

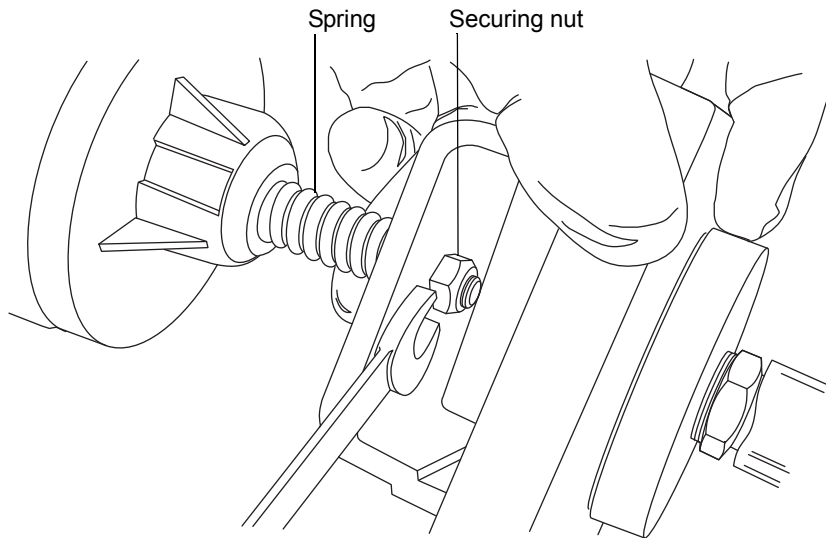


2. Using both hands, carefully remove the exhaust flange and oil de-mister element from the roughing pump.

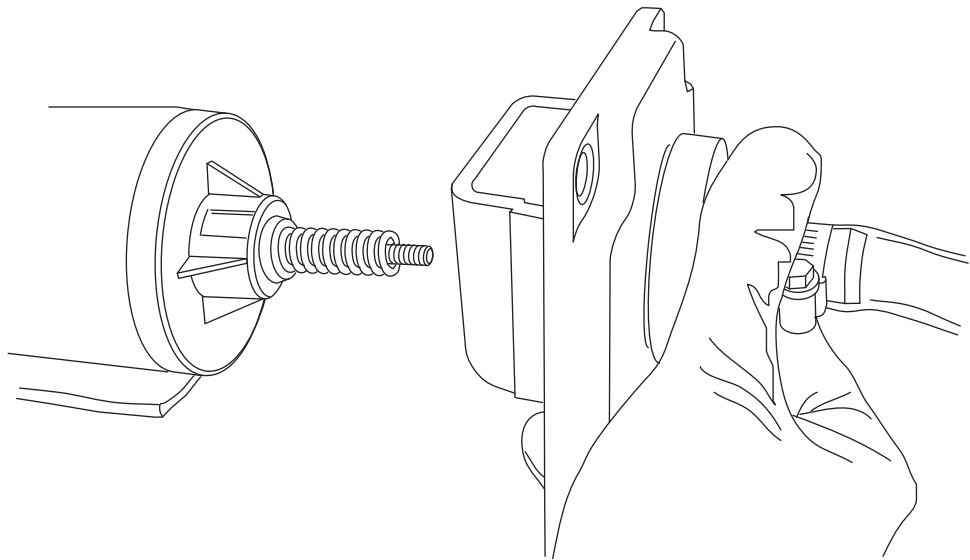


6 Maintenance Procedures

3. Use the 10-mm wrench to remove the nut that secures the oil de-mister element to the exhaust flange.



4. Holding the oil de-mister element slightly elevated, to prevent the loss of the spring, remove its flange.



5. Remove the spring from the oil de-mister element.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, which can be present on the oil de-mister element, dispose of the de-mister in accordance with local environmental regulations.

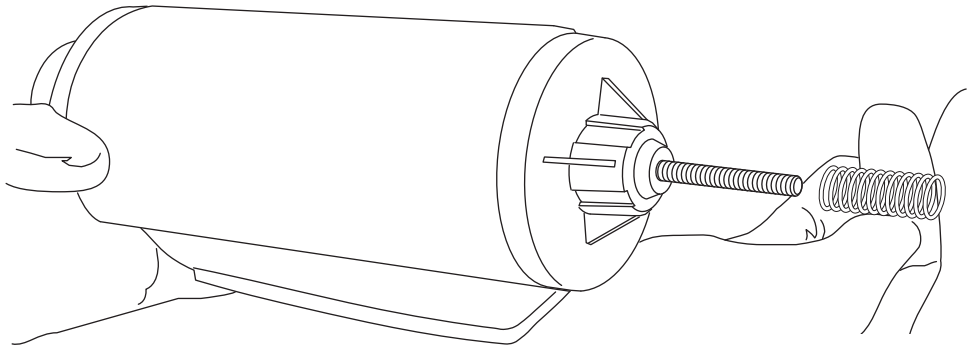
6. Dispose of the oil de-mister element in accordance with local environmental regulations.



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

To fit the new oil de-mister elements:

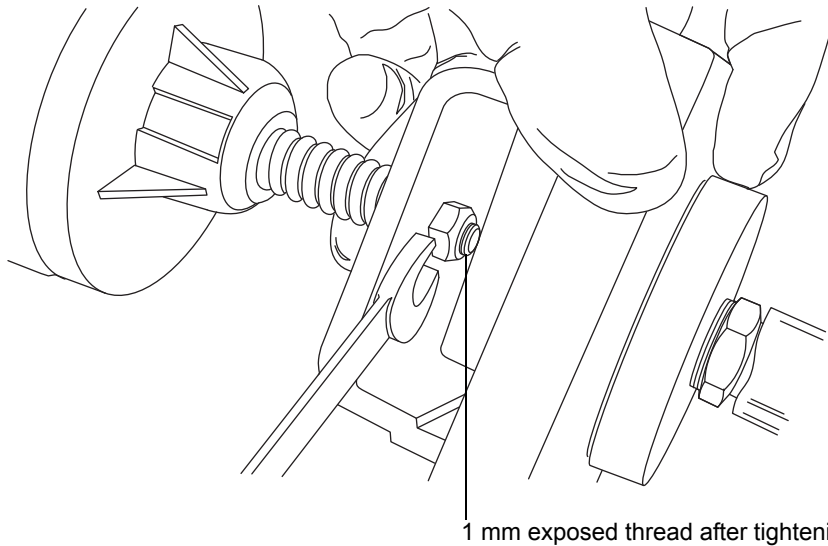
1. Fit the spring to the new oil de-mister element.



2. Holding the oil de-mister element slightly elevated, to prevent the loss of the spring, fit its exhaust flange.

! **Notice:** To avoid over-compressing the spring, do not overtighten the nut that secures the oil demister element to the exhaust flange. Ensure that only (approximately) 1 mm of exposed thread appears beyond the nut when it is tightened.

3. Use the 10-mm wrench to fit and tighten the nut that secures the oil de-mister element to the exhaust flange.



4. Ensure that the inscription “TOP” is at the top of the oil de-mister element, and, using both hands, carefully fit the oil de-mister element and exhaust flange to the roughing pump.
5. Use the 6-mm Allen wrench to fit the four bolts securing the exhaust flange to the roughing pump.

Important: Tighten the bolts securing the source exhaust flange to the roughing pump sequentially and by small increments until they are all fully tight.

To prepare for operation after changing the roughing pumps' oil and oil de-mister elements:

1. Connect the power cords for the mass spectrometer and both roughing pumps to the main power source.
2. Start the mass spectrometer (see [page 52](#)).
3. Gas-ballast the roughing pumps (see [page 281](#)).

Tip: After you add oil to a 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 slightly odorous.

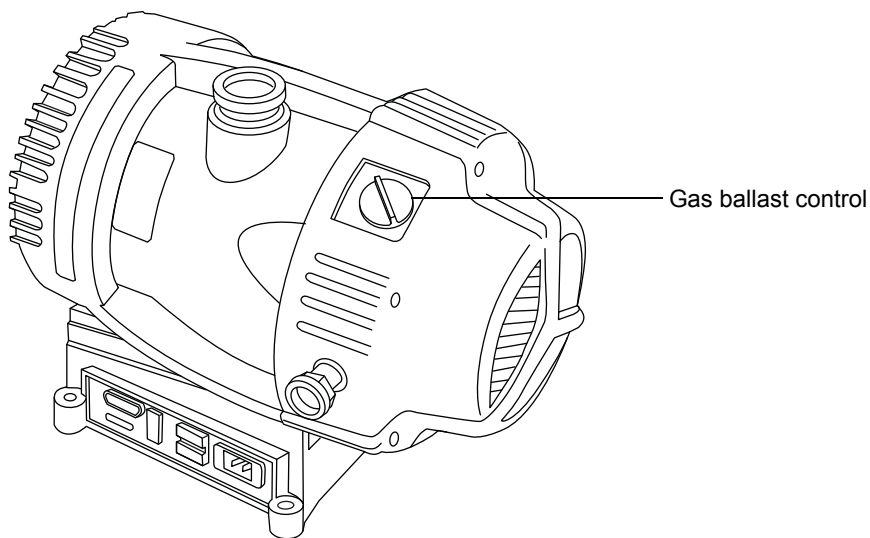
Gas ballasting the Edwards XDS35i oil-free roughing pump

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

In normal use the gas ballast control should be off (position 0).

Prolonged use of high LC solvent flow rates can lead to condensation inside the pump, which may affect the pump's ultimate performance, giving a higher than usual backing pressure reading. If this is observed, the pump should be run with the ballast set to position I for a short period (one hour should be sufficient). The use of ballast position II is not recommended.

! **Notice:** To avoid contaminating the instrument, never vent the instrument while the ballast control is on.



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

! **Notice:** To avoid over-pressurization and internal sensor malfunction within the pump,

- 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.

Using the gas ballast control

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

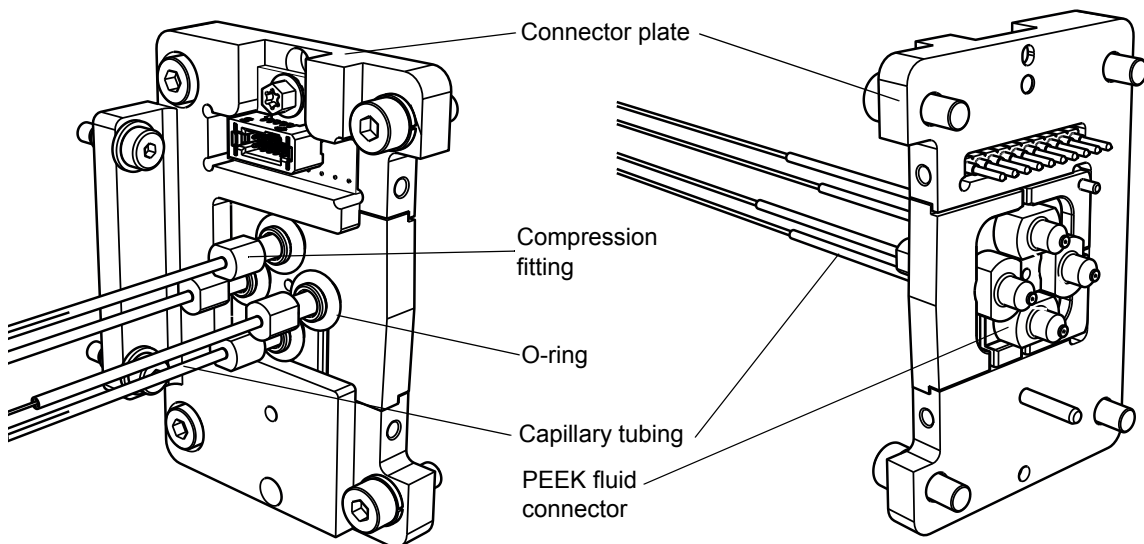
To select low-flow gas ballast, turn the control to position I. Use this position for these purposes:

- To pump low concentrations of condensable vapors.
- To decontaminate the pump.

Replacing the fluidic lines of the ionKey source

If a fluid line becomes damaged, replace it, to ensure optimal performance. Each fluid line is supplied with a pre-fitted 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.

Fluid line connections:



To identify the correct tubing assembly for each fluid line, use the following table.

Tubing assemblies for the ionKey source:

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: You can use these part numbers to identify each line when it is disconnected from the source. Part numbers are embossed on the shrink-wrap below the ferrule assembly.

Removing a fluidic line

Required materials

- Chemical-resistant, powder-free gloves
- Flat-blade screwdriver
- T10 Torx screwdriver



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



Warning: To avoid electric shock, prepare the instrument for work performed on its source before beginning this procedure.

To remove a fluidic line:

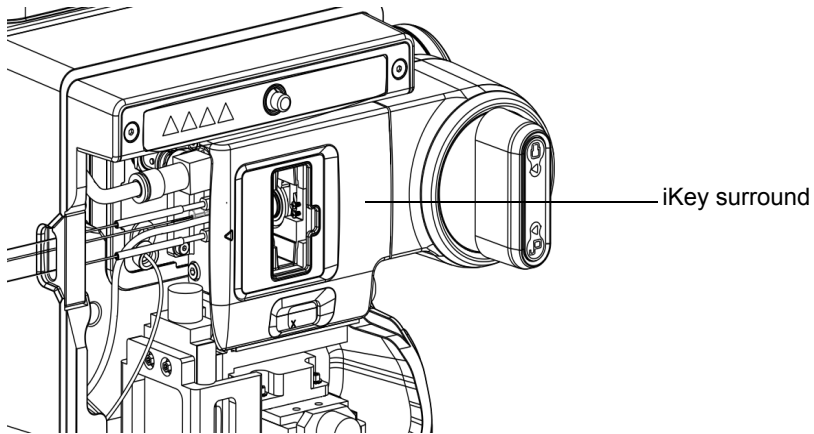
1. Prepare the instrument for work performed on its source (see [page 120](#)).



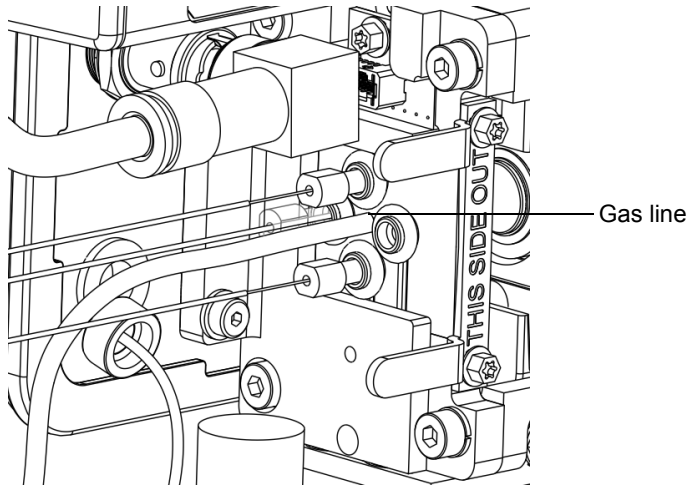
Warning: To avoid burn injuries, take great care while working with the instrument's source enclosure open. The source can be hot.

2. Unlock and remove any iKey installed in the iKey clamp.
3. Open the ionKey source front cover and remove the iKey surround.

iKey surround location:

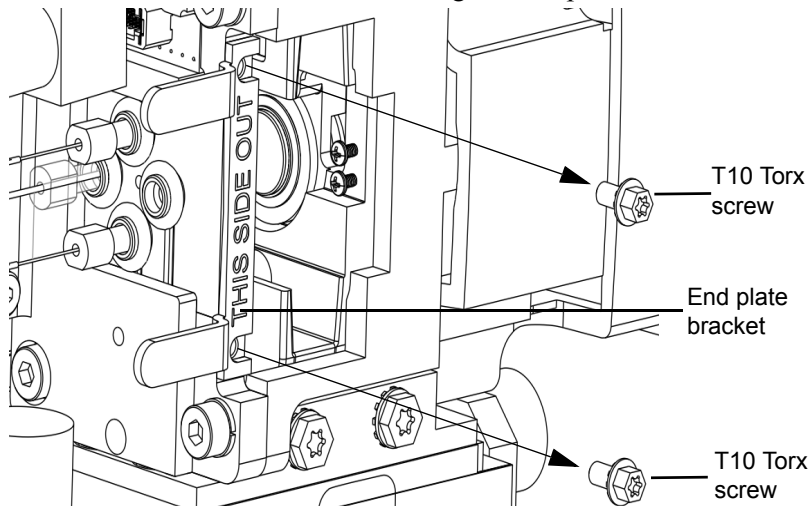


4. Remove the gas line using a flat-blade screwdriver.

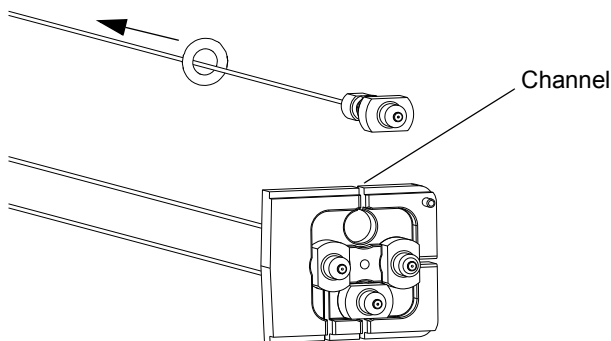


5. Disconnect the fluidic line being replaced from its source.

- Remove two T10 Torx screws securing the end plate bracket.



- Slide the end plate, along with the capillary tubing, out of the iKey clamp.
- Gently pull off the O-ring from around the tube's fitting and slide the O-ring to the left.
- Pull enough of the line being replaced to the right and allow the capillary line to slide through its channel to remove it.



- Dispose of the removed tubing in accordance with standard laboratory procedures for contaminated vessels and sharps.

Installing a fluidic line

Required materials

- Chemical-resistant, powder-free gloves

- Fluid line assembly



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



Warning: To avoid electric shock, prepare the instrument for work performed on its source before beginning this procedure.

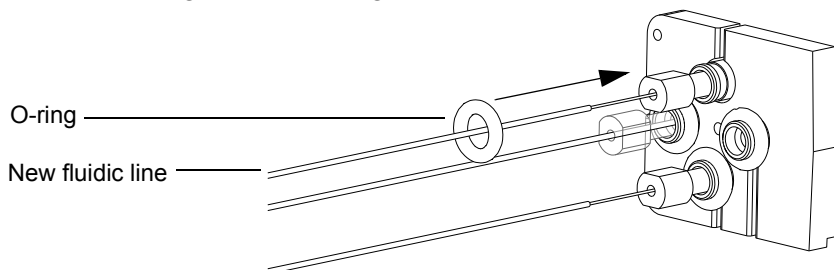
To install a fluidic line:

1. Prepare the instrument for work performed on its source (see [page 120](#)).



Warning: To avoid burn injuries, take great care while working with the instrument's source enclosure open. The source 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.
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. Connect the new fluidic line to the appropriate port on the ACQUITY UPLC M-Class system, or to the onboard IntelliStart Fluidics on the mass spectrometer (see [“IntelliStart Fluidics system” on page 31](#) for more information on plumbing the Intellistart Fluidics system).
8. Reinstall the iKey surround.
9. Reinstall and lock the iKey.

Cleaning the ionKey source and connectors

Required materials

- Chemical-resistant, powder-free gloves
- Lint-free tissue
- Water
- Isopropanol or methanol
- Source of clean, pressurized air

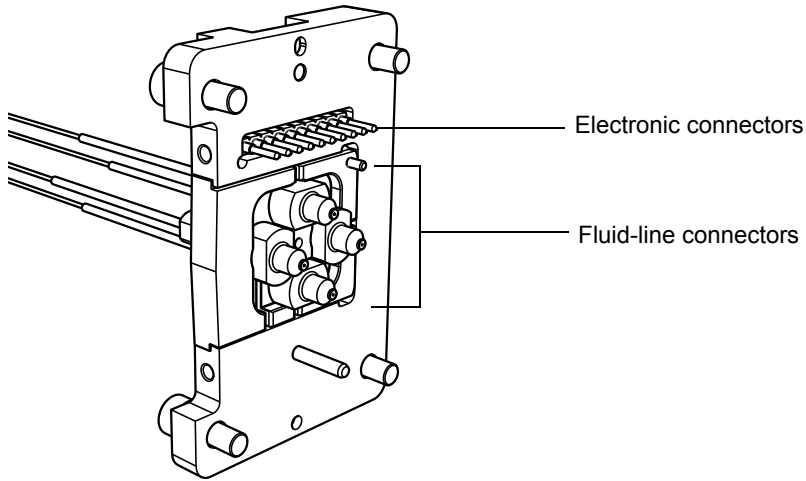


Notice: To avoid damaging the iKey:

- 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* (part number 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, however, material can accumulate around the fluid-line connectors or electronic connectors in the iKey Separation Device docking port.

Cleaning the fluid-line connectors and electronic 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.

To remove buildup from electronic 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.

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

Contents:

Topic	Page
Warning symbols	304
Notices	307
Warnings that apply to all Waters instruments and devices.....	308
Warnings that address the replacing of fuses.....	313
Electrical and handling symbols.....	315

Warning symbols

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

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



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



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



Warning: (Risk of electric shock.)



Warning: (Risk of fire.)



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



Warning: (Risk of hand crush injury.)



Warning: (Risk of 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 eye injury.)



Warning: (Risk of injury or equipment damage caused by spilled solvent.)

Specific warnings

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

Burst warning

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



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

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

Mass spectrometer shock hazard

The following warning applies to all Waters mass spectrometers.



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

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



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

Mass spectrometer flammable solvents warning

This warning applies to mass spectrometers performing an analysis that requires the use of flammable solvents.



Warning: To prevent ignition of flammable solvent vapors in the enclosed space of a mass spectrometer's ion source, ensure that nitrogen flows continuously through the source. The nitrogen supply pressure must not fall below 400 kPa (4 bar, 58 psi) during an analysis requiring the use of flammable solvents. Also a gas-fail device must be installed, to interrupt the flow of LC solvent should the nitrogen supply fail.

Biohazard warning

The following warning applies to Waters instruments and devices that can process material containing biohazards, which are substances that contain biological agents capable of producing harmful effects in humans.



Warning: To avoid infection with potentially infectious, human-sourced products, inactivated microorganisms, and other biological materials, assume that all biological fluids that you handle are infectious.

Specific precautions appear in the latest edition of the US National Institutes of Health (NIH) publication, *Biosafety in Microbiological and Biomedical Laboratories* (BMBL).

Observe Good Laboratory Practice (GLP) at all times, particularly when working with hazardous materials, and consult the biohazard safety representative for your organization regarding the proper use and handling of infectious substances.

Biohazard and chemical hazard warning

This warning applies to Waters instruments and devices that can process biohazards, corrosive materials, or toxic materials.



Warning: To avoid personal contamination with biohazards, toxic materials, or corrosive materials, you must understand the hazards associated with their handling.

Guidelines prescribing the proper use and handling of such materials appear in the latest edition of the National Research Council's publication, *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*.

Observe Good Laboratory Practice (GLP) at all times, particularly when working with hazardous materials, and consult the safety representative for your organization regarding its protocols for handling such materials.

Notices

Notices appear where an instrument or device can be subject to use or misuse that can damage it or compromise a sample's integrity. The exclamation point symbol and its associated statement alert you to such risk.

! **Notice:** To avoid damaging the instrument's case, do not clean it with abrasives or solvents.

Warnings that apply to all Waters instruments and devices

When operating this device, follow standard quality-control procedures and the equipment guidelines in this section.



Attention: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Important: Toute modification sur cette unité n'ayant pas été expressément approuvée par l'autorité responsable de la conformité à la réglementation peut annuler le droit de l'utilisateur à exploiter l'équipement.

Achtung: Jedwede Änderungen oder Modifikationen an dem Gerät ohne die ausdrückliche Genehmigung der für die ordnungsgemäße Funktionstüchtigkeit verantwortlichen Personen kann zum Entzug der Bedienungsbezugnis des Systems führen.

Avvertenza: qualsiasi modifica o alterazione apportata a questa unità e non espressamente autorizzata dai responsabili per la conformità fa decadere il diritto all'utilizzo dell'apparecchiatura da parte dell'utente.

Atencion: cualquier cambio o modificación efectuado en esta unidad que no haya sido expresamente aprobado por la parte responsable del cumplimiento puede anular la autorización del usuario para utilizar el equipo.

注意: 未經有關法規認證部門允許對本設備進行的改變或修改,可能會使使用者喪失操作該設備的權利。

注意: 未經有關法規認證部門明確允許對本設備進行的改變或改裝,可能會使使用者喪失操作該設備的合法性。

주의: 규정 준수를 책임지는 당사자의 명백한 승인 없이 이 장치를 개조 또는 변경할 경우, 이 장치를 운용할 수 있는 사용자 권한의 효력을 상실할 수 있습니다.

注意: 規制機関から明確な承認を受けずに本装置の変更や改造を行うと、本装置のユーザーとしての承認が無効になる可能性があります。



Warning: Use caution when working with any polymer tubing under pressure:

- Always wear eye protection when near pressurized polymer tubing.
- Extinguish all nearby flames.
- Do not use tubing that has been severely stressed or kinked.
- Do not use nonmetallic tubing with tetrahydrofuran (THF) or concentrated nitric or sulfuric acids.
- Be aware that methylene chloride and dimethyl sulfoxide cause nonmetallic tubing to swell, which greatly reduces the rupture pressure of the tubing.

Attention: Manipulez les tubes en polymère sous pression avec précaution:

- Portez systématiquement des lunettes de protection lorsque vous vous trouvez à proximité de tubes en polymère pressurisés.
- Eteignez toute flamme se trouvant à proximité de l'instrument.
- Evitez d'utiliser des tubes sévèrement déformés ou endommagés.
- Evitez d'utiliser des tubes non métalliques avec du tétrahydrofurane (THF) ou de l'acide sulfurique ou nitrique concentré.
- Sachez que le chlorure de méthylène et le diméthylesulfoxyde entraînent le gonflement des tuyaux non métalliques, ce qui réduit considérablement leur pression de rupture.

Vorsicht: Bei der Arbeit mit Polymerschläuchen unter Druck ist besondere Vorsicht angebracht:

- In der Nähe von unter Druck stehenden Polymerschläuchen stets Schutzbrille tragen.
- Alle offenen Flammen in der Nähe löschen.
- Keine Schläuche verwenden, die stark geknickt oder überbeansprucht sind.
- Nichtmetallische Schläuche nicht für Tetrahydrofuran (THF) oder konzentrierte Salpeter- oder Schwefelsäure verwenden.
- Durch Methylenchlorid und Dimethylsulfoxid können nichtmetallische Schläuche quellen; dadurch wird der Berstdruck des Schlauches erheblich reduziert.



Attenzione: fare attenzione quando si utilizzano tubi in materiale polimerico sotto pressione:

- Indossare sempre occhiali da lavoro protettivi nei pressi di tubi di polimero pressurizzati.
- Spegnerle tutte le fiamme vive nell'ambiente circostante.
- Non utilizzare tubi eccessivamente logorati o piegati.
- Non utilizzare tubi non metallici con tetraidrofurano (THF) o acido solforico o nitrico concentrati.
- Tenere presente che il cloruro di metilene e il dimetilsolfossido provocano rigonfiamenti nei tubi non metallici, riducendo notevolmente la pressione di rottura dei tubi stessi.

Advertencia: se recomienda precaución cuando se trabaje con tubos de polímero sometidos a presión:

- El usuario deberá protegerse siempre los ojos cuando trabaje cerca de tubos de polímero sometidos a presión.
- Si hubiera alguna llama las proximidades.
- No se debe trabajar con tubos que se hayan doblado o sometido a altas presiones.
- Es necesario utilizar tubos de metal cuando se trabaje con tetrahidrofurano (THF) o ácidos nítrico o sulfúrico concentrados.
- Hay que tener en cuenta que el cloruro de metileno y el sulfóxido de dimetilo dilatan los tubos no metálicos, lo que reduce la presión de ruptura de los tubos.

警告: 當在有壓力的情況下使用聚合物管線時，小心注意以下幾點。

- 當接近有壓力的聚合物管線時一定要戴防護眼鏡。
- 熄滅附近所有的火焰。
- 不要使用已經被壓癟或嚴重彎曲管線。
- 不要在非金屬管線中使用四氫呋喃或濃硝酸或濃硫酸。
- 要了解使用二氯甲烷及二甲基亞楓會導致非金屬管線膨脹，大大降低管線的耐壓能力。



警告: 当有压力的情况下使用管线时, 小心注意以下几点:

- 当接近有压力的聚合物管线时一定要戴防护眼镜。
- 熄灭附近所有的火焰。
- 不要使用已经被压瘪或严重弯曲的管线。
- 不要在非金属管线中使用四氢呋喃或浓硝酸或浓硫酸。
- 要了解使用二氯甲烷及二甲基亚砜会导致非金属管线膨胀, 大大降低管线的耐压能力。

경고: 가압 폴리머 튜브로 작업할 경우에는 주의하십시오.

- 가압 폴리머 튜브 근처에서는 항상 보호 안경을 착용하십시오.
- 근처의 화기를 모두 끄십시오.
- 심하게 변형되거나 꼬인 튜브는 사용하지 마십시오.
- 비금속(Nonmetallic) 튜브를 테트라히드로푸란(Tetrahydrofuran: THF) 또는 농축 질산 또는 황산과 함께 사용하지 마십시오.
- 염화 메틸렌(Methylene chloride) 및 디메틸설폭시드(Dimethyl sulfoxide)는 비금속 튜브를 부풀려 튜브의 파열 압력을 크게 감소시킬 수 있으므로 유의하십시오.

警告: 圧力のかかったポリマーチューブを扱うときは、注意してください。

- 加圧されたポリマーチューブの付近では、必ず保護メガネを着用してください。
- 近くにある火を消してください。
- 著しく変形した、または折れ曲がったチューブは使用しないでください。
- 非金属チューブには、テトラヒドロフラン(THF)や高濃度の硝酸または硫酸などを流さないでください。
- 塩化メチレンやジメチルスルホキシドは、非金属チューブの膨張を引き起こす場合があります、その場合、チューブは極めて低い圧力で破裂します。



Warning: The user shall be made aware that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Attention: L'utilisateur doit être informé que si le matériel est utilisé d'une façon non spécifiée par le fabricant, la protection assurée par le matériel risque d'être défectueuses.

Vorsicht: Der Benutzer wird darauf aufmerksam gemacht, dass bei unsachgemäßer Verwendung des Gerätes die eingebauten Sicherheitseinrichtungen unter Umständen nicht ordnungsgemäß funktionieren.

Attenzione: si rende noto all'utente che l'eventuale utilizzo dell'apparecchiatura secondo modalità non previste dal produttore può compromettere la protezione offerta dall'apparecchiatura.

Advertencia: el usuario deberá saber que si el equipo se utiliza de forma distinta a la especificada por el fabricante, las medidas de protección del equipo podrían ser insuficientes.

警告: 使用者必須非常清楚如果設備不是按照製造廠商指定的方式使用，那麼該設備所提供的保護將被削弱。

警告: 使用者必須非常清楚如果设备不是按照制造厂商指定的方式使用，那么该设备所提供的保护将被削弱。

경고: 제조업체가 명시하지 않은 방식으로 장비를 사용할 경우 장비가 제공하는 보호 수단이 제대로 작동하지 않을 수 있다는 점을 사용자에게 반드시 인식시켜야 합니다.

警告: ユーザーは、製造元により指定されていない方法で機器を使用すると、機器が提供している保証が無効になる可能性があることに注意して下さい。

Warnings that address the replacing of fuses

The following warnings pertain to instruments equipped with user-replaceable fuses.

If the fuse types and ratings appear on the instrument:



Warning: To protect against fire, replace fuses with those of the type and rating printed on panels adjacent to instrument fuse covers.



Attention: pour éviter tout risque d'incendie, remplacez toujours les fusibles par d'autres du type et de la puissance indiqués sur le panneau à proximité du couvercle de la boîte à fusible de l'instrument.



Vorsicht: Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert auf den Tafeln neben den Sicherungsabdeckungen des Geräts gedruckt sind.



Attenzione: per garantire protezione contro gli incendi, sostituire i fusibili con altri dello stesso tipo aventi le caratteristiche indicate sui pannelli adiacenti alla copertura fusibili dello strumento.



Advertencia: Para evitar incendios, sustituir los fusibles por aquellos del tipo y características impresos en los paneles adyacentes a las cubiertas de los fusibles del instrumento.



警告: 為了避免火災，更換保險絲時，請使用與儀器保險絲蓋旁面板上所印刷之相同類型與規格的保險絲。



警告: 为了避免火灾，应更换与仪器保险丝盖旁边面板上印刷的类型和规格相同的保险丝。



경고: 화재의 위험을 막으려면 기기 퓨즈 커버에 가까운 패널에 인쇄된 것과 동일한 타입 및 정격의 제품으로 퓨즈를 교체하십시오.



警告: 火災予防のために、ヒューズ交換では機器ヒューズカバー脇のパネルに記載されているタイプおよび定格のヒューズをご使用ください。

If the fuse types and ratings do not appear on the instrument:



Warning: To protect against fire, replace fuses with those of the type and rating indicated in the “Replacing fuses” section of the Maintenance Procedures chapter.



Attention: pour éviter tout risque d'incendie, remplacez toujours les fusibles par d'autres du type et de la puissance indiqués dans la rubrique "Remplacement des fusibles" du chapitre traitant des procédures de maintenance.



Vorsicht: Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert im Abschnitt "Sicherungen ersetzen" des Kapitels "Wartungsverfahren" angegeben sind.



Attenzione: per garantire protezione contro gli incendi, sostituire i fusibili con altri dello stesso tipo aventi le caratteristiche indicate nel paragrafo "Sostituzione dei fusibili" del capitolo "Procedure di manutenzione".



Advertencia: Para evitar incendios, sustituir los fusibles por aquellos del tipo y características indicados en la sección "Sustituir fusibles".



警告: 為了避免火災，更換保險絲時，應使用「維護步驟」章節中「更換保險絲」所指定之相同類型與規格的保險絲。



警告: 为了避免火灾，应更换“维护步骤”一章的“更换保险丝”一节中介绍的相同类型和规格的保险丝。



경고: 화재의 위험을 막으려면 유지관리 절차 단원의 “퓨즈 교체” 절에 설명된 것과 동일한 타입 및 정격의 제품으로 퓨즈를 교체하십시오.







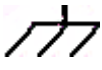
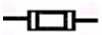


警告: 火災予防のために、ヒューズ交換ではメンテナンス項目の「ヒューズの交換」に記載されているタイプおよび定格のヒューズをご使用ください。

Electrical and handling symbols





Electrical symbols

The following electrical symbols and their associated statements can appear in instrument manuals and on an instrument's front or rear panels.

	Electrical power on
	Electrical power off
	Standby
	Direct current
	Alternating current
	Protective conductor terminal
	Frame, or chassis, terminal
	Fuse

Handling symbols

The following handling symbols and their associated statements can appear on labels affixed to the packaging in which instruments, devices, and component parts are shipped.

	Keep upright!
	Keep dry!
	Fragile!
	Use no hooks!

B External Connections

This appendix describes the mass spectrometer's external connections.



Warning: To avoid injury, use suitable machinery and the supplied harness to lift the mass spectrometer; the mass spectrometer is heavy.



Notice: To avoid damage,

- contact Waters Technical Service before moving the instrument.
- if you must transport the mass spectrometer, or remove it from service, contact Waters Technical Service for recommended cleaning, flushing, and packaging procedures.

See “[Troubleshooting with Connections INSIGHT](#)” on page 117.

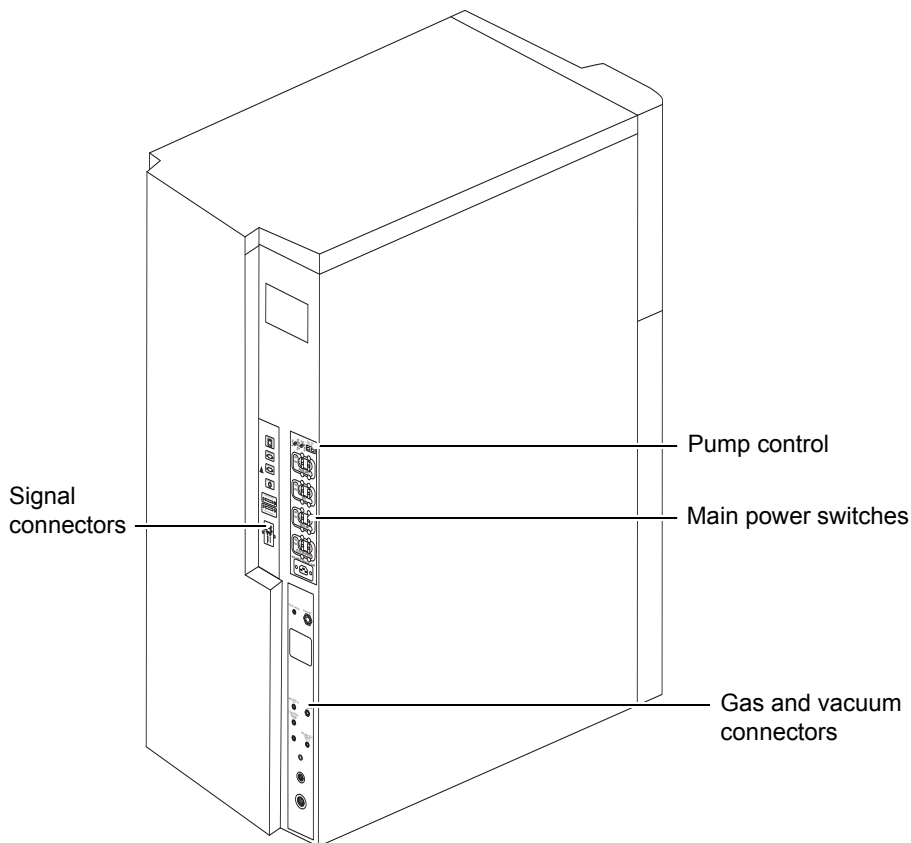
Contents:

Topic	Page
Mass spectrometer external wiring and vacuum connections	318
Connecting the Oerlikon Leybold oil-filled roughing pumps	319
Connecting the Edwards oil-free roughing pumps	326
Connecting to the nitrogen gas supply	333
Connecting to the collision cell gas supply	335
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Connecting the camera for a NanoLockSpray or ionKey source	350

Mass spectrometer external wiring and vacuum connections

The locations of the instrument's rear panel connectors are shown below.

Mass spectrometer rear panel connectors and switches:



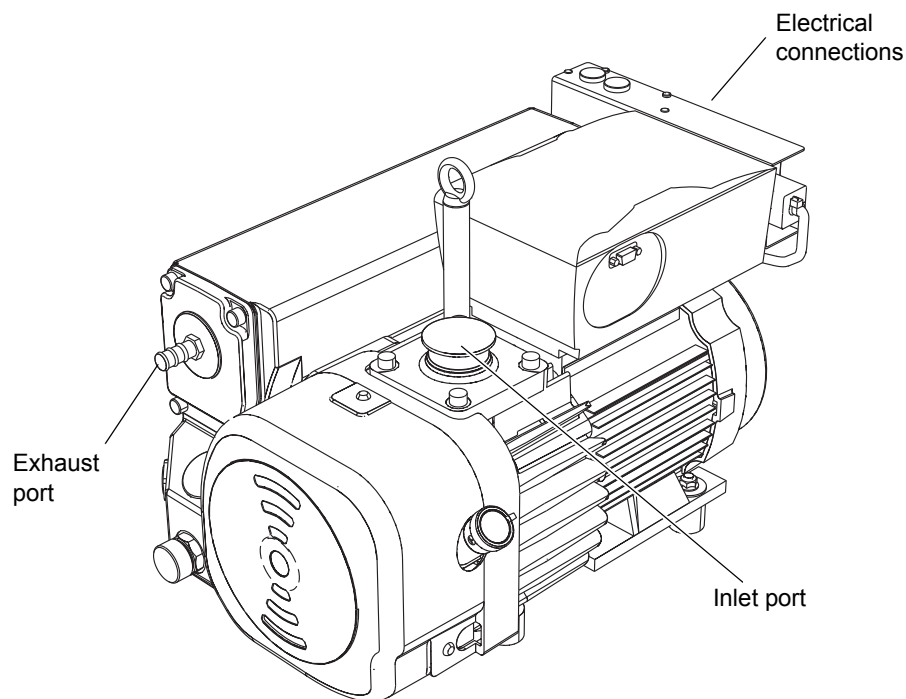
Electrical power and control connections to the vacuum backing pumps will vary according to your current installation.

Connecting the Oerlikon Leybold oil-filled roughing pumps

This option requires the use of two, Oerlikon[®] Leybold[™], oil-filled roughing pumps, a type SV65BI FC (pump 1), and an SV40BI FC (pump 2).

Note: To connect the alternative oil-free roughing pumps, see [page 326](#).

Oerlikon Leybold oil-filled roughing pump:



Warning: To avoid back strain and other injury, at least two persons must lift the pump.

Making tubing connections

Required materials:

- Chemical-resistant, powder-free gloves
- Sharp knife

The following items are included in the SYNAPT[®] G2-Si installation kit:

- NW40 flanged flexible tubing, 1 m long
- NW40 hose assembly, 1.5-m long
- NW25 hose assembly, 1.5-m long
- NW40 tee
- NW40/NW25 tee
- NW25 center rings
- NW40 center rings
- NW25 clamps
- NW40 clamps
- ½-inch barbed tee
- 12-mm clear PVC exhaust tubing
- PVC hose clamps
- PTFE drip tray

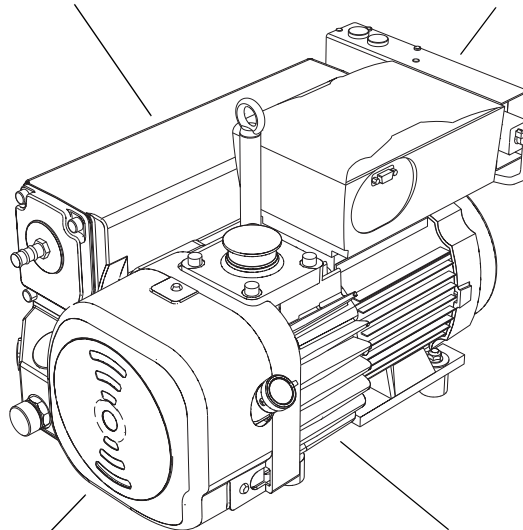


Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure.

To make the tubing connections:

Left side minimum clearance
is 15.24 cm (6 inches)

Back side minimum clearance
is 15.24 cm (6 inches)



Front side minimum clearance
is 35.56 cm (14 inches)

Right side minimum clearance
is 15.24 cm (6 inches)

Requirements:

- To ensure correct operation of the roughing pumps, install each pump within two degrees of horizontal.
- Locate the roughing pumps in an area where the ambient temperature is 12 to 40 °C.
- To ensure proper ventilation, install the pumps observing the minimum clearances shown in the figure above.
- Orient the pumps in a way that allows easy daily access to the oil-level sight glasses on the pumps.

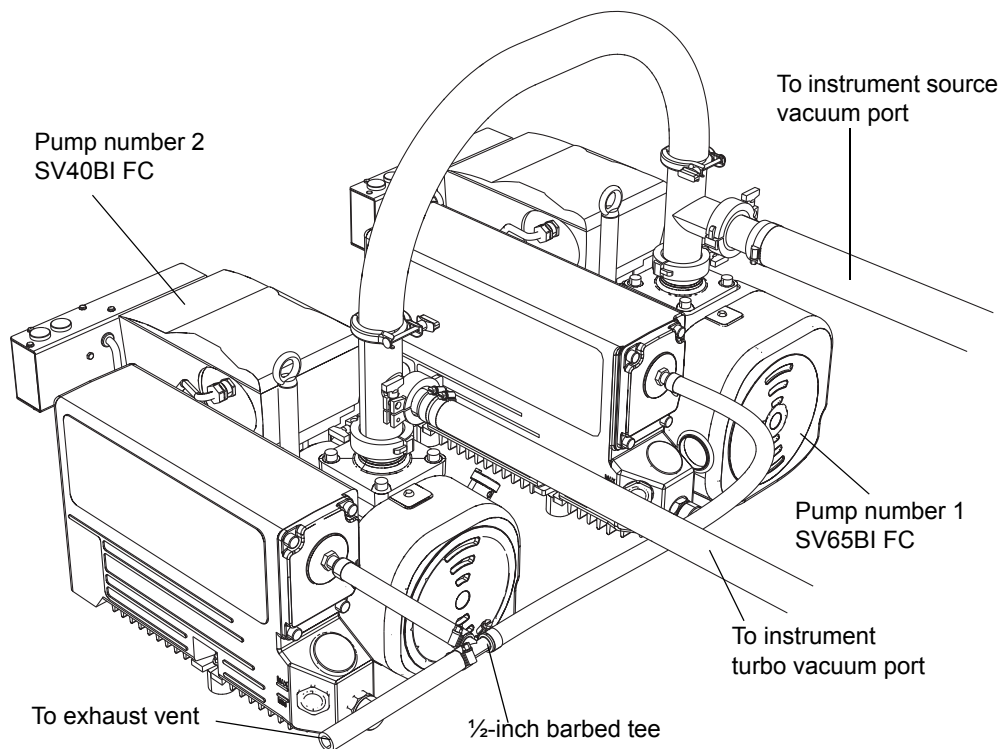
B External Connections

1. Place the PTFE drip tray on the floor within 5 feet of the instrument.



Warning: To avoid back strain and other injury, at least two persons must lift each pump.

2. Place the pumps on the PTFE drip tray, facing the same way.



3. Using an NW40 center ring, attach the NW40 tee to the inlet flange of the SV65BI FC pump, and then secure the connection with an NW40 clamp.
4. Using an NW40 center ring, attach the NW40/NW25 tee to the inlet flange of the SV40BI FC pump, and then secure the connection with an NW40 clamp.
5. Using an NW40 center ring, attach one end of the 1 m length of NW40 flanged flexible tubing to the top port of the NW40 tee fitted to pump number 1, and then secure the connection with an NW40 swing clamp.
6. Using an NW40 center ring, attach the free end of the 1-m length of NW40 flanged flexible tubing to the top port of the NW40/NW25 tee fitted to pump number 2, and then secure the connection with an NW40 swing clamp.

7. Using an NW25 center ring, attach one end of the NW25 hose assembly to the open port of the NW40/NW25 tee on pump number 2, and then secure the connection with an NW25 clamp.
8. Using an NW40 center ring, attach one end of the NW40 hose assembly to the open port of 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 instrument (see [page 334](#)).

! **Notice:** To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

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 2, and secure the tubing with a hose clamp.
12. Connect the 500-mm length of PVC exhaust tubing to the exhaust port on pump number 1, and secure the tubing with a hose clamp.
13. Connect the free ends of the PVC exhaust tubing to two ports of the ½-inch barbed tee, and secure the tubing with hose clamps.

B External Connections

14. Connect the remaining length of PVC exhaust tubing to the free port of the ½-inch barbed tee, and secure the tubing with a hose clamp.

! **Notice:** To avoid damaging the instrument, ensure that two separate exhaust systems are used: one for nitrogen, the other for the roughing pump. Vent them to atmosphere through separate exhaust lines. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the roughing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

15. Route the open end of the PVC exhaust tubing to a suitable exhaust vent.

! **Notice:** To ensure correct operation of the roughing pump, always operate the pump with an oil level between the minimum and maximum level as indicated in the sight glass.

16. Inspect the oil level in the pump.

See [“Determining the oil level \(Oerlikon Leybold, oil-filled roughing pumps\)”](#) on page 281, and, if necessary, [“Adding oil to an Oerlikon Leybold roughing pump”](#) on page 281.

Making electrical connections

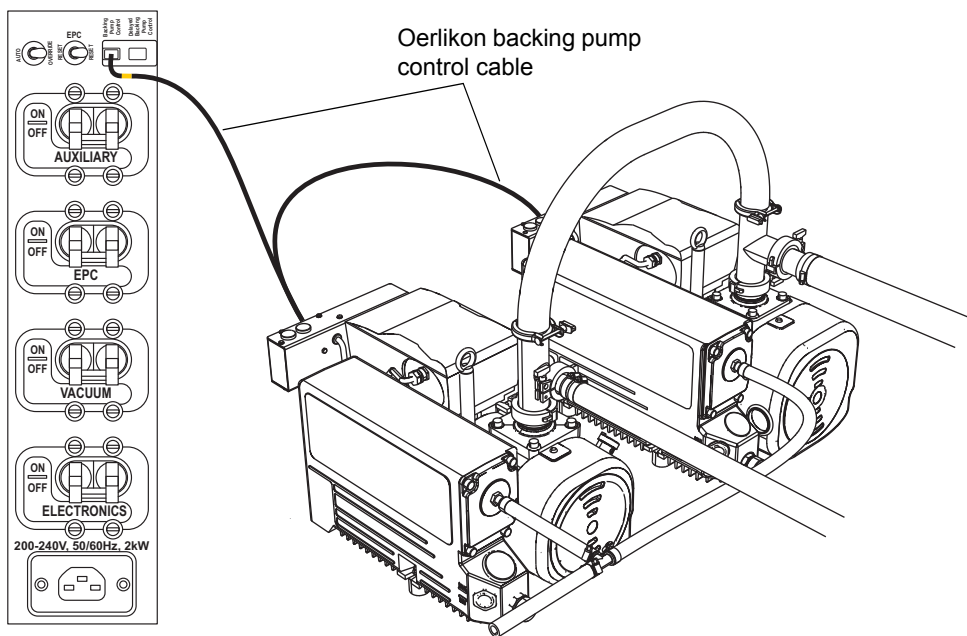
Required materials:

Oerlikon backing pump control cable

To make the electrical connections:

1. Connect the roughing pump power cords to the main power source.
2. Connect the RJ45 plug on the yellow-sleeved backing pump control cable to the left-hand Backing Pump Control port on the mass spectrometer's rear panel, above the main power switches.

Note: The right-hand Delayed Backing Pump Control port is not used.



3. Connect each backing pump control cable D-type connector to a backing pump.

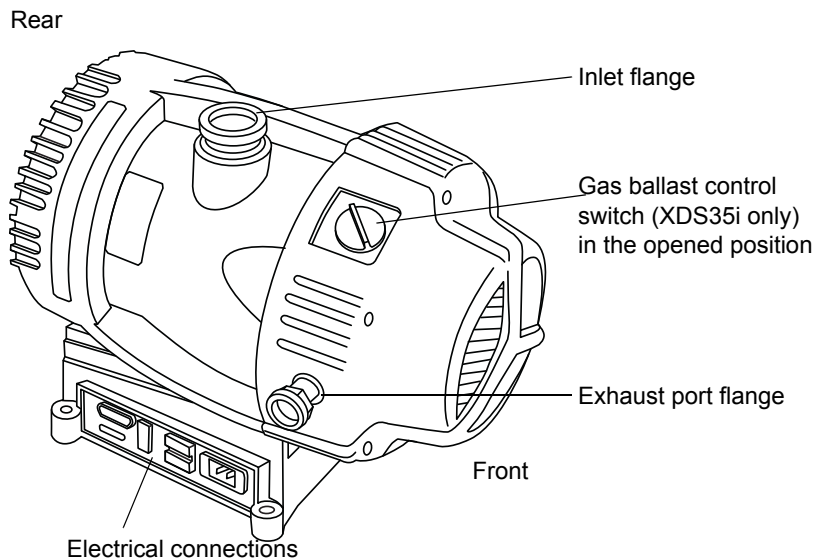
Tip: You can connect each D-type connector to either pump.

Connecting the Edwards oil-free roughing pumps

This option requires the use of two Edwards™ roughing pumps, a type XDS35i (pump 1), and an XDS100B (pump 2).

Note: To connect the alternative oil-filled roughing pumps, see [page 319](#).

Edwards oil-free roughing pump:



Warning: To avoid muscular and skeletal injury, at least two people must lift the pump.



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing the following procedure.

Minimum clearances:

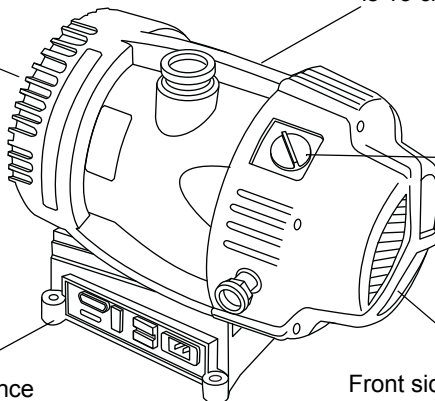
Back side minimum clearance is 15 cm (6 inches)

Right side minimum clearance is 15 cm (6 inches)

Ballast control switch in the opened position

Left side minimum clearance is 15 cm (6 inches)

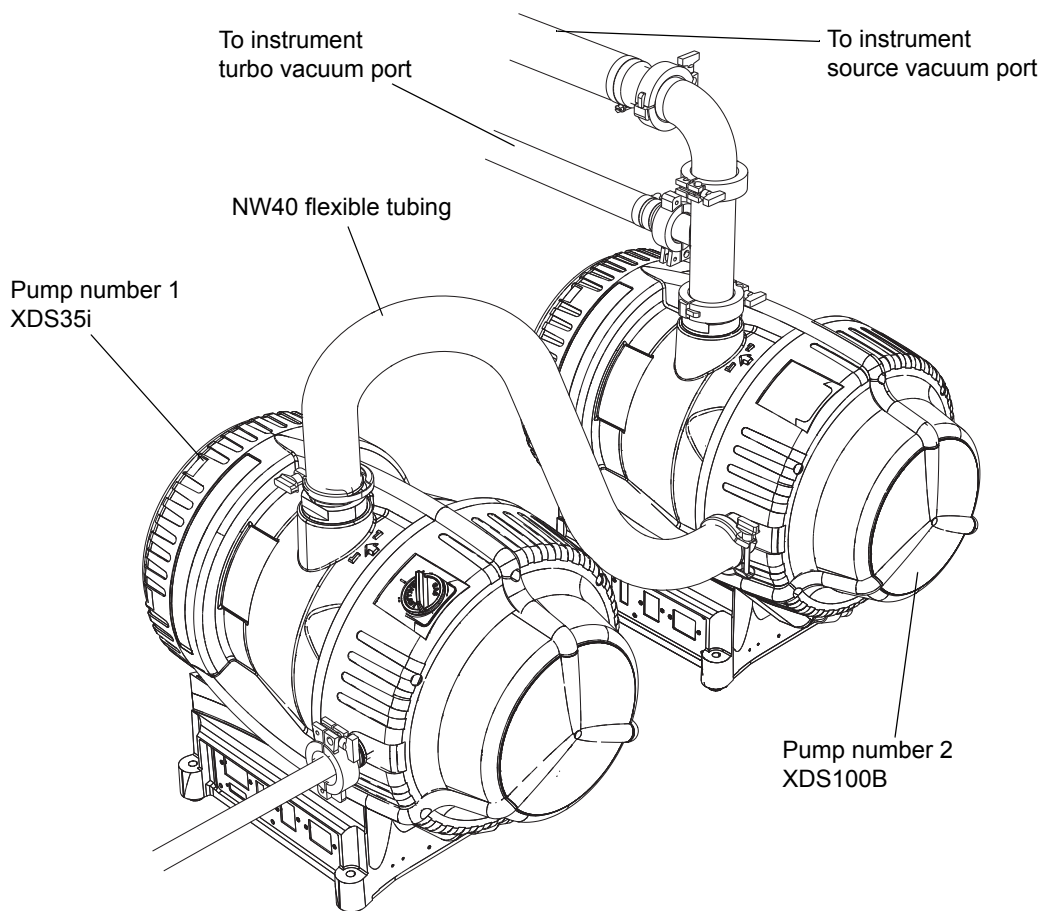
Front side minimum clearance is 35 cm (14 inches)



Before connecting tubing, ensure that the pump's ballast control is in the "off" position and that the pumps are positioned as follows:

- The pumps are installed within 10 degrees of horizontal.
- The pumps occupy an area where the ambient temperature is 12 °C to 40 °C.
- The installation allows for the minimum clearances shown in the figure above.

Tubing configuration:



Warning: To avoid muscular and skeletal injury, at least two people must lift the pump.

Required materials

- Chemical-resistant, powder-free gloves
- Sharp knife

The following items are included in the SYNAPT G2-*Si* installation kit:

- NW40 flanged flexible tubing, 1-m long
- NW40 hose assembly, 1.5-m long
- NW25 hose assembly, 1.5 m long
- NW40 elbow
- NW40/NW25 tee
- NW40 center rings
- NW40 swing clamps
- NW25 center rings
- NW25 swing clamps
- NW32/40 ring clamps
- 12.7-mm clear PVC exhaust tubing

To connect tubing:

1. Place the pumps on the floor, approximately 1 m from the instrument.
2. Using a NW40 center ring, attach one end of the NW40 flanged flexible tubing to the inlet flange of the XDS35i pump, and then secure the connection with an NW32/40 ring clamp.
3. Using a NW40 center ring, attach the free end of the flexible tubing to the exhaust port of the XDS100B pump, and then secure the connections with an NW 32/40 ring clamp.
4. Using a NW40 center ring, attach the NW40/NW25 tee to the inlet flange of the XDS100B pump, and then secure the connection with an NW40 swing clamp.
5. Using an NW25 center ring, attach one end of the NW25 hose assembly to the open port of the NW40/NW25 tee on pump number 2, and then secure the connection with an NW25 swing clamp.
6. Using a NW40 center ring, attach the NW40 elbow to the top port of the NW40/NW25 tee fitted to pump number 2, and then secure the connection with a NW40 swing clamp.
7. Using a NW40 center ring, attach one end of the NW40 hose assembly to the NW40 elbow fitted to pump number 2, and then secure the connection with a NW40 swing clamp.

B External Connections

8. Make the connections between the NW25 and NW40 hose assemblies and the vacuum ports on the rear of the instrument (see [page 334](#)).

! **Notice:** To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

9. Using an NW25 center ring, attach one end of the 12.7 mm clear PVC exhaust tubing to the exhaust port on pump number 1, and then secure the connection with an NW25 swing clamp.

! **Notice:** To avoid damaging the instrument, ensure that two separate exhaust systems are used: one for nitrogen, the other for the roughing pump. Your warranty does not cover damage caused by routing exhaust lines incorrectly. See also “[Connecting the nitrogen exhaust line](#)” on [page 336](#).

10. Route the open end of the exhaust tubing to a suitable exhaust vent.

See also: The *Waters SYNAPT G2-Si MS/HDMS Site Preparation Guide* (part number 715003115).

Making electrical connections

Required materials:

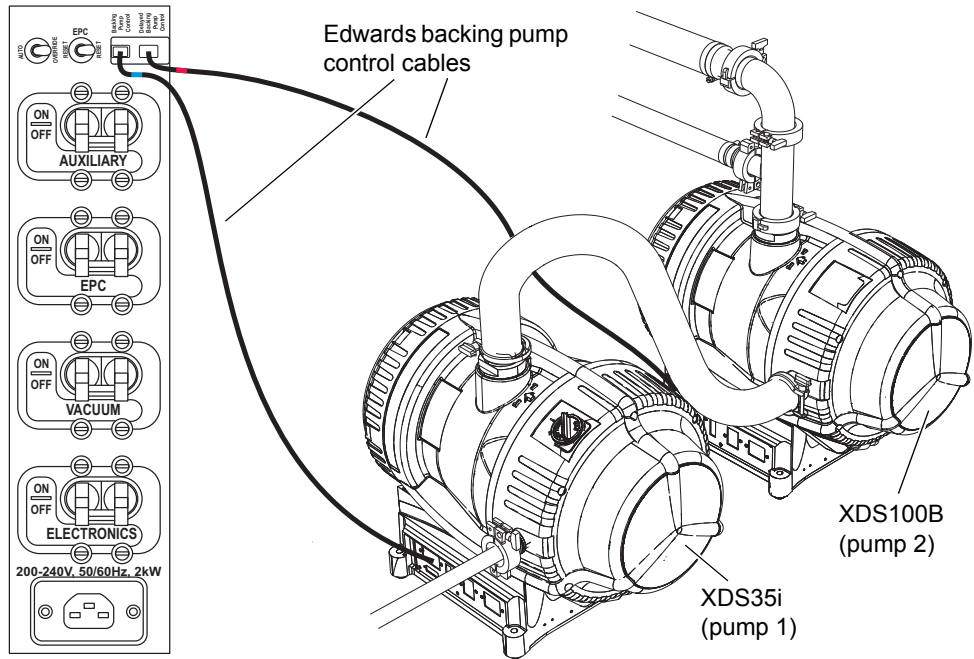
- Edwards backing-pump control cables

To make the electrical connections:

1. Connect the roughing pump power cords to the main power source.
2. Connect the RJ45 plug on the blue-sleeved backing-pump control cable to the left-hand, backing-pump control port (blue) on the mass spectrometer's rear panel, above the main power switches.
3. Connect the D-type connector at the other end of the cable to the XDS35i backing-pump (pump 1).
4. Connect the RJ45 plug on the red-sleeved backing-pump control cable to the right-hand, delayed backing-pump control port (red) on the mass spectrometer's rear panel, above the main power switches.
5. Connect the D-type connector at the other end of the cable to the XDS100B backing-pump (pump 2).

B External Connections

Note: Correct start-up and operation of the pumps relies on coordinated initiation. Ensure that the pump control connectors are connected to their correct instrument rear panel outlet.



Connecting to the nitrogen gas supply

Required materials

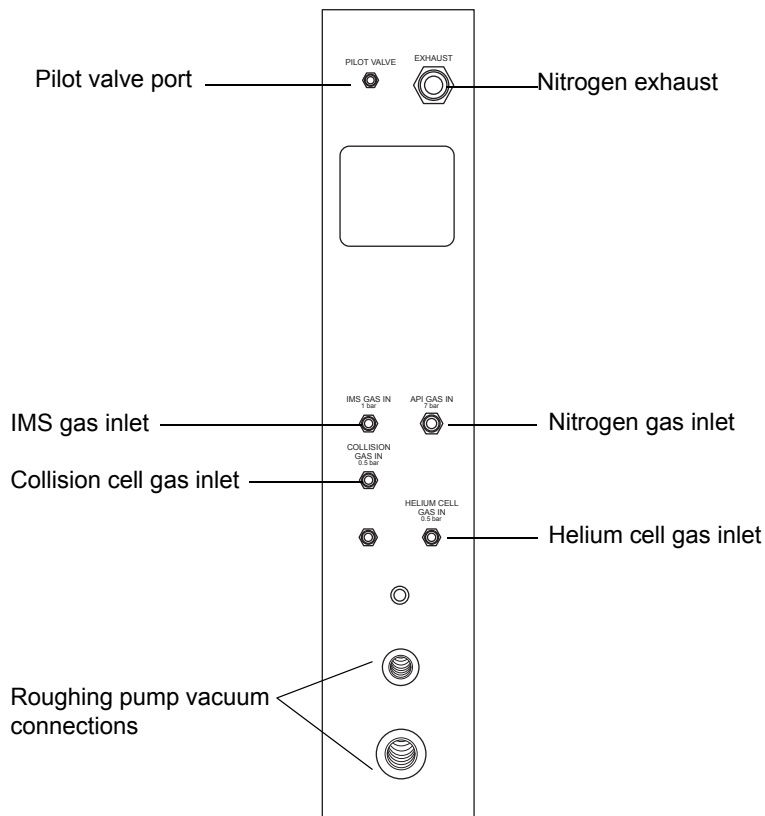
- Chemical-resistant, powder-free gloves
- 6-mm (1/4-inch) PTFE tubing (included in the SYNAPT G2-Si Installation Kit)
- Nitrogen regulator (not supplied)

To connect the nitrogen gas supply:

1. Connect one free end of the 6-mm PTFE tubing to the API gas in port on the rear of the instrument.

Important: The 6-mm (1/4-inch) PTFE tubing must not be cut to size; use the complete 5-m (16-ft) length as supplied.

Mass spectrometer gas and vacuum connectors:



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 700 kPa (7 bar, 102 psi).
5. Ensure that there are no gas leaks at any of the nitrogen gas supply fittings.

Connecting to the collision cell gas supply

Required materials

- Chemical-resistant, powder-free gloves
- 7/16 inch wrench
- 1/8 inch Swagelok[®] nut and ferrule
- 1/8 inch stainless steel tubing (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 tubing to the collision cell gas inlet on the rear of the mass spectrometer (see the figure on [page 334](#)).
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 tubing to the argon regulator.
5. Set the argon regulator to 0.5 bar (50 kPa, 7 psi).
6. Ensure that no gas leaks from any of the collision gas supply fittings.
-

Connecting the nitrogen exhaust line

Required materials

- Chemical-resistant, powder-free gloves
- Sharp knife
- Nitrogen exhaust trap bottle
- 4-mm and 12-mm PTFE tubing (included in the SYNAPT G2-Si MS installation kit)



Warning: To avoid hazards associated with improperly exhausted solvents, observe these requirements:

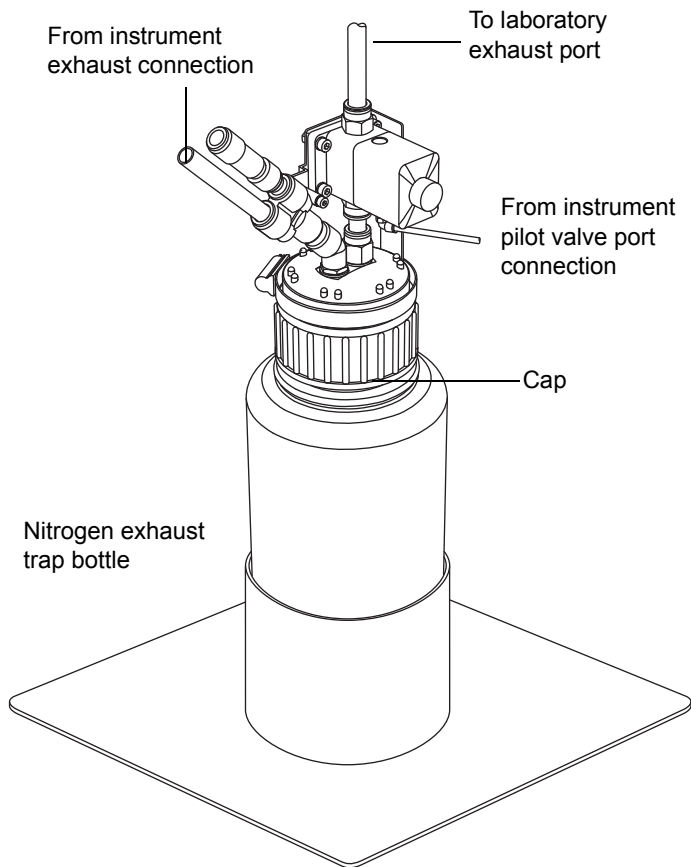
- Biologically hazardous or toxic LC solvents and samples can be carried in the nitrogen exhaust, which must be vented via the nitrogen exhaust trap bottle and laboratory exhaust system. The laboratory exhaust system must provide a minimum vacuum of 0.20 kPa (2 mbar, 0.03 psi) below atmospheric pressure (negative pressure).
- The exhaust connections can be contaminated with biologically hazardous or toxic materials. Always wear chemical-resistant, powder-free gloves when performing this procedure.
- To avoid the build up of hazardous gases, do not place the nitrogen exhaust trap bottle in an enclosed cabinet.



Notice: To avoid damaging the instrument, ensure that two separate exhaust systems are used: one for nitrogen, the other for the roughing pump. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the roughing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

To connect the nitrogen exhaust line:

1. Locate the nitrogen exhaust trap bottle in an accessible area below the instrument.

Nitrogen exhaust trap bottle:

! **Notice:** To avoid gas leaks, use the sharp knife to cut the PTFE tubing squarely (that is, perpendicular to its horizontal axis).

2. Cut a length of 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 (see the figure on [page 337](#)).

B External Connections

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. Cut a second length of 12-mm tubing long enough to connect the nitrogen exhaust trap bottle to the exhaust vent.
8. Insert one end of the tubing into the outlet port on the nitrogen exhaust trap bottle.
9. Route the free end of the tubing to the exhaust vent.



Warning: To confirm the integrity of the source exhaust system, perform the following test.



Notice: To avoid damage to the instrument, use snoop[®] (or its equivalent) leak detector liquid only for the purpose described in the following step. Do not use it on any other part of the instrument.

10. Use snoop (or equivalent) leak detector liquid to ensure that there are no leaks at the instrument exhaust and laboratory exhaust system line connections.

Connecting the liquid waste line

Required materials

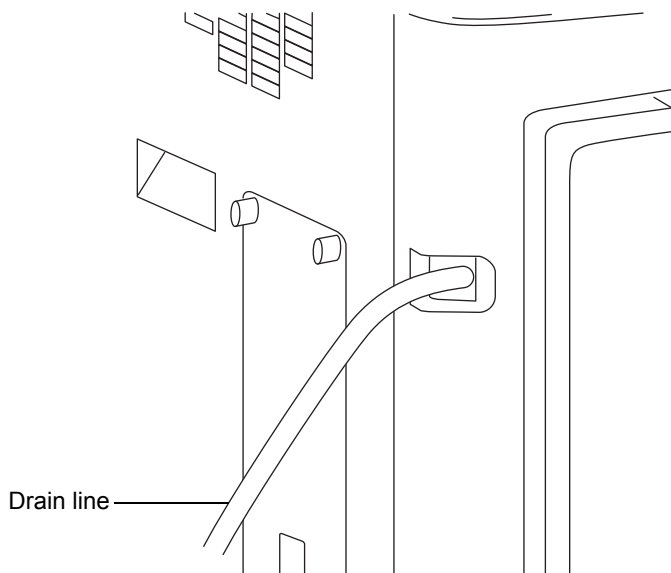
- Chemical-resistant, powder-free gloves
- Waste container



Warning: To avoid personal contamination with biologically hazardous or toxic materials, always wear chemical-resistant, powder-free gloves while performing this procedure.

To connect the liquid waste line:

1. Place a suitable waste container below the mass spectrometer.
2. Slide a drain line over the barbed fitting of the drain (located at the left-hand side of the mass spectrometer).





Warning: To prevent leakage of biologically hazardous or toxic materials:

- Do not crimp or bend the drain line. A crimp or bend can impede flow to the waste container.
 - Empty the waste container before the lower end of the drain tubing is covered by waste solvent.
3. Route the waste line to the waste container. If necessary, shorten the waste tubing so that its end is above the surface of the waste solvent.

Positioning of drain tubing:



Input/output signal connectors



Warning: To avoid electric shock, all electrical connections made to the rear panel must be separated from hazardous voltages by double or reinforced insulation. Circuits of this type are classified as safety extra low voltage (SELV). Examples of circuits that are typically SELV include contact closure inputs and outputs for auto-samplers, and UV, RI, and fluorescence mass spectrometer signal outputs for LC/MS systems. The electrical connections on the rear panel of this mass spectrometer are all SELV.



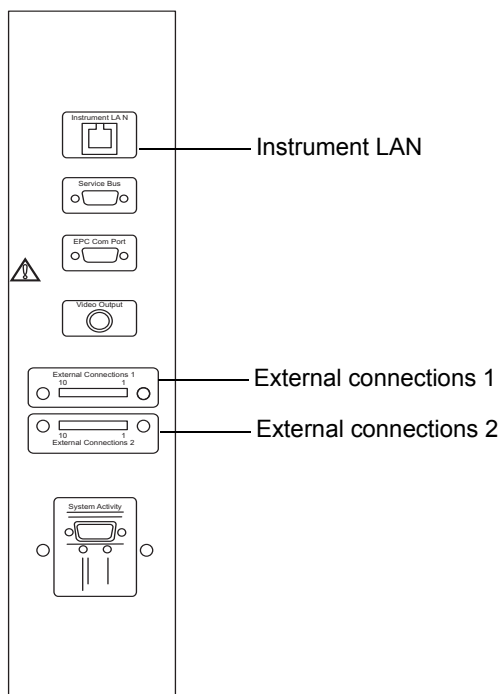
Notice: To avoid damaging the instrument,

- never apply a voltage to the Analog (out) connectors; these are active connections driven by the instrument.
- do not apply voltages higher than those shown in the tables on [page 343](#).

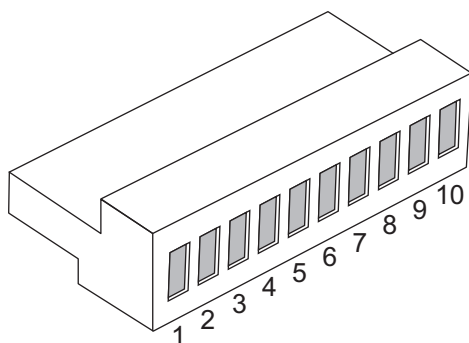
Two removable connectors (designated External Connections 1 and External Connections 2) are on the mass spectrometer's rear panel; these connectors hold the screw terminals for input/output signals. The connectors are keyed so that they can receive a signal cable inserted only one way.

B External Connections

Mass spectrometer electrical connections:



Input/output signal connector configuration:



External connections 1:

Pin	Function	Rating
1	Event In 1+, digital signal, optimum +3.3V max +5V	+5 V
2	Event In 1-, digital ground, 0V	0 V
3	Not used	
4	Event In 2+, digital signal, optimum +3.3V max +5V	+5 V
5	Event In 2-, digital ground, 0V	0 V
6	Not used	
7	Not used	
8	Not used	
9	Not used	
10	Not used	

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

Signal connections

Mass spectrometer signal connections:

Signal connections	Description
Analog Out	Used for analog chart output functionality. The output voltage range is 0 to 2 V. The resolution of the voltage output is 12 bits.
Gas Fail Interlock Out	Used to stop the solvent flow if the nitrogen gas supply fails.
Event Out 1, Event Out 2	Allows the mass spectrometer to trigger an external event.
Event In 1, Event In 2	Allows an external device to start data acquisition.

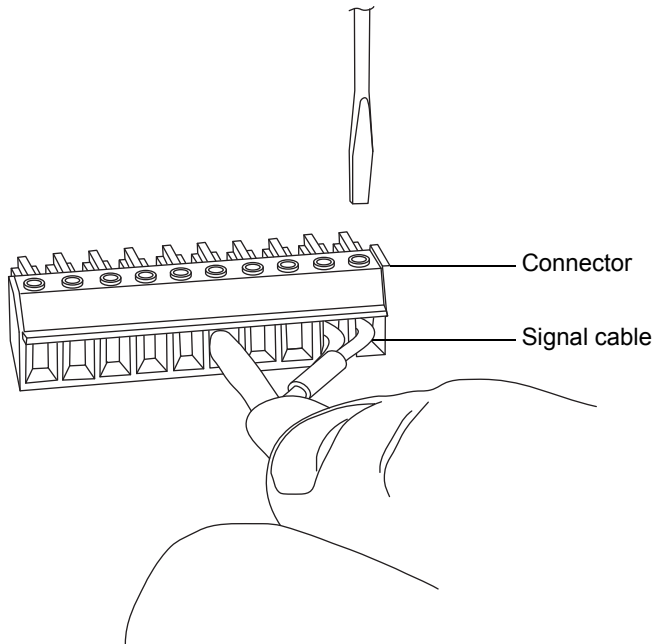
Requirement: To meet the regulatory requirements of immunity from external electrical disturbances, install connector covers over the signal connectors.

Required materials

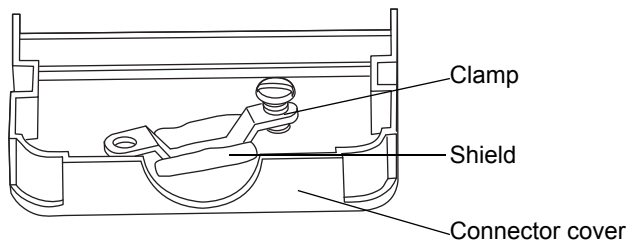
- Small flat-bladed screwdriver
- Connector covers

To make the signal connections:

1. Determine the signal connection location from the silk-screened label on the rear panel of each instrument.
2. Use the small flat-bladed screwdriver to attach the positive and negative leads of the signal cable to the connector.

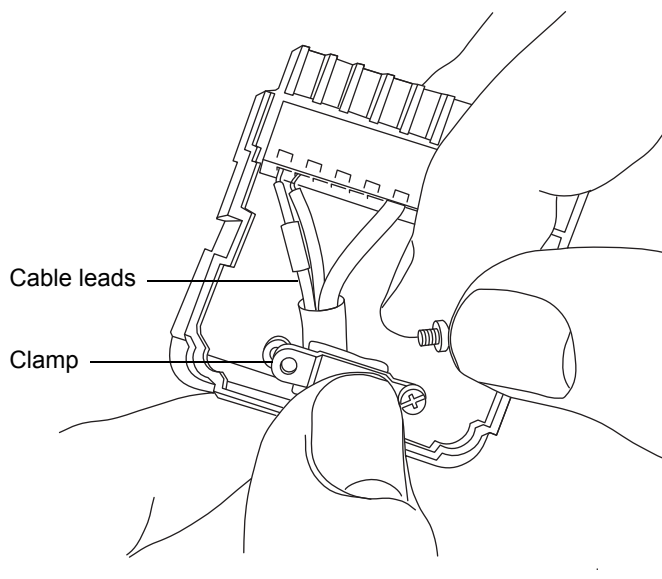


3. Slide the clamp (with the bend facing down) into the protective shield.
4. Insert the clamp and shield (with the bend facing down) into the connection cover, and insert and finger tighten one self-tapping screw.

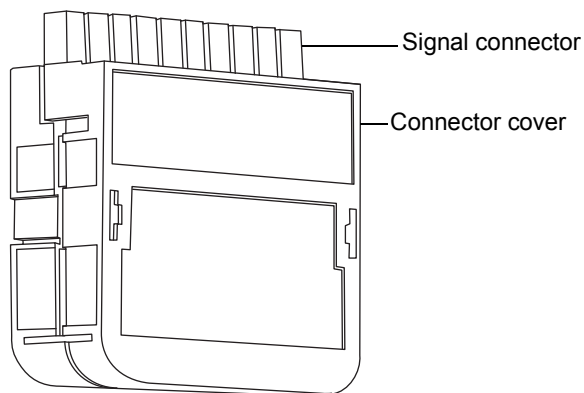


B External Connections

5. Insert the connector with the signal cable into the connection cover, position the clamp over the cable leads, and insert and finger tighten the clamp into place with the second self-tapping screw.



6. Use the screwdriver to fully tighten the self-tapping screws.
7. Place the second connector cover over the first cover, and snap it into place.



Connecting the workstation (system without ACQUITY UPLC)



Warning: To avoid injury from electric shock or fire, and to avoid damage to the workstation and ancillary equipment, do not place objects filled with liquid—such as solvent bottles—on these items, or expose them to dripping or splashing liquids.

Requirement: Use a shielded network cable with the mass spectrometer to ensure compliance with FCC limits.

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.

Required materials

Shielded network cable

To connect the workstation:

Requirement: Use a shielded network cable with the mass spectrometer to ensure compliance with FCC limits.

1. Connect the monitor to the PC.
2. Connect one end of the shielded network cable to the port labeled instrument LAN on the rear panel of the mass spectrometer (see [page 342](#)).
3. Connect the free end of the shielded network cable to the port labeled instrument LAN on the workstation rear panel.

Connecting Ethernet cables (system with ACQUITY UPLC)

Requirement: Use shielded network cables with the mass spectrometer to ensure compliance with FCC limits.

Required materials

Two shielded network cables

To make Ethernet connections:

1. Connect one end of one shielded Ethernet cable to the network switch.
2. Connect the free end of the shielded Ethernet cable to the Ethernet card on the preconfigured ACQUITY UPLC[®] workstation.

Tip: On preconfigured systems, the Ethernet card is identified as the Instrument LAN card.

3. Connect one end of the second shielded network cable to the port labeled instrument LAN on the rear panel of the mass spectrometer (see [page 342](#)).
4. Connect the free end of the shielded Ethernet cable to the network switch.

Connecting to the electricity source

! **Notice:** To avoid electrical damage to the instrument, do not connect the instrument's power supply cord until you complete the installation procedures in the previous sections.

The mass spectrometer requires a separate, grounded electricity source. The ground connection in the electrical outlet must be common and connected near the system.

Required materials

Power cord appropriate to your country

To connect to the electricity source:

Recommendation: Use a line conditioner or an uninterruptible power supply (UPS) for optimum long-term input voltage stability.

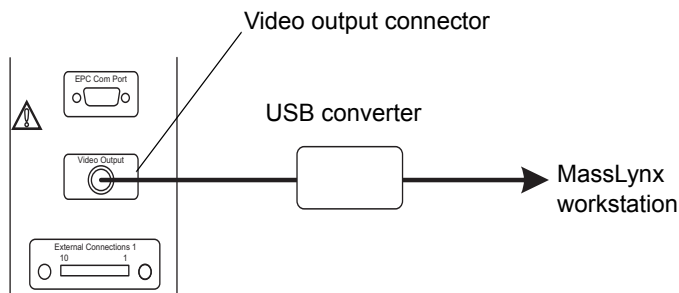


Warning: To avoid electrical shock, use the SVT-type power cord in the United States and HAR-type (or better) in Europe. The main power cord must be replaced with one of adequate rating. To learn which cord to use in other countries, contact your local Waters distributor.

1. Connect the female end of the power cord to the receptacle on the rear panel of the mass spectrometer (see [page 318](#)).
2. Connect the male end of the mass spectrometer power cord to a suitable 200 to 240 Va.c. wall outlet.

Connecting the camera for a NanoLockSpray or ionKey source

The camera for both the NanoLockSpray™ and ionKey™ sources is connected to the MassLynx® workstation by means of a USB converter.



To connect the camera to the MassLynx workstation:

1. Connect the coaxial cable between the video output connector on the instrument's rear panel and the interface 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 USB cable between the interface box and any free USB socket on the MassLynx workstation.

Installing the camera driver software

The MassLynx workstation will be supplied with the camera driver software already installed. However, if you reinstall MassLynx, you will need to reinstall the camera driver software using the Found New Hardware Wizard for the USB Converter.

Installing the camera driver software:

1. In the Found New Hardware Wizard dialog, click No, not at this time.
2. Click Next.
3. Click Install from a list or specific location (Advanced).
4. Click Next.
5. Select Search for the best driver in these locations.
6. Select Include this location in the search, and browse to C:\MassLynx\USBCameraDriver.
7. Click Next.

Result: The software and drivers install.

8. Click Finish.

C Materials of construction and compliant solvents



Warning: To avoid harmful effects of source solvents escaping, and to confirm the integrity of the source exhaust system, you must address any safety, toxic or biologically hazardous issues raised by the contents of this Appendix.

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Preventing contamination

For information about preventing contamination, refer to *Controlling Contamination in UltraPerformance LC/MS and HPLC/MS Systems* (part number 715001307), which you can download from the Waters Web site (www.waters.com).

Items exposed to solvent

The items that appear in the following table can be exposed to solvent. You must evaluate the safety issues if the solvents used in your application differ from the solvents normally used with these items. See [page 355](#) for details about the most common ingredients used to prepare mobile phases.

Items exposed to solvent:

Item	Material
Gas exhaust port	Aluminium
Gas tubes	FEP ^a
Ion block	Stainless steel
Ion-block support	PEEK ^{TM g}
Isolation valve	Gold-plated aluminium/bronze
O-rings	Viton [®] or PTFE ^b -encapsulated Viton
Probe adjuster bellows	PTFE ^b /Viton
Probe adjuster assembly	Anodized aluminium, glass filled acetal, and stainless steel
Probe shaft	PEEK ^g
Push-in gas fittings	Nickel/brass
Solvent waste/leak management	Tygon tubing
Source enclosure	Alochromed aluminium
Source enclosure view port	Toughened plate glass
Waste bottle	Polypropylene
Waste bottle push-in fittings	NBR ^c , SST ^d , PBT ^e , and POM ^f

a. Fluorinated ethylene propylene

b. Polytetrafluoroethylene

- c. Nitrile butadiene rubber
- d. Stainless steel
- e. Polybutylene Terephthalate
- f. Polyoxymethylene
- g. Polyether ether ketone

Solvents used to prepare mobile phases

The following list of the most common ingredients used to prepare mobile phases for reverse-phase LC/MS (API):

- Water
- Methanol
- Acetonitrile
- Formic acid (<0.1%)
- Acetic acid (<0.1%)
- Trifluoroacetic acid (<0.1%)
- Ammonium acetate (<10 mM)
- Ammonium formate (<10 mM)

These solvents are not expected to adversely affect performance of the materials appearing in the table on [page 354](#).

