

# **Waters SYNAPT G2 Mass Spectrometry System**

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

Revision A

**Waters**  
THE SCIENCE OF WHAT'S POSSIBLE.™

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



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

### Waters contact information

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

## Safety considerations

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

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.

## Considerations specific to the SYNAPT G2 MS system

### 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 C-3](#)), determine whether any solvents you use that are not listed are chemically compatible with the composition of the O-rings.

### Flammable solvents hazard



**Warning:** To prevent the ignition of accumulated solvent vapors inside the source, maintain a continuous flow of nitrogen through the source whenever significant amounts of flammable solvents are used during instrument operation.

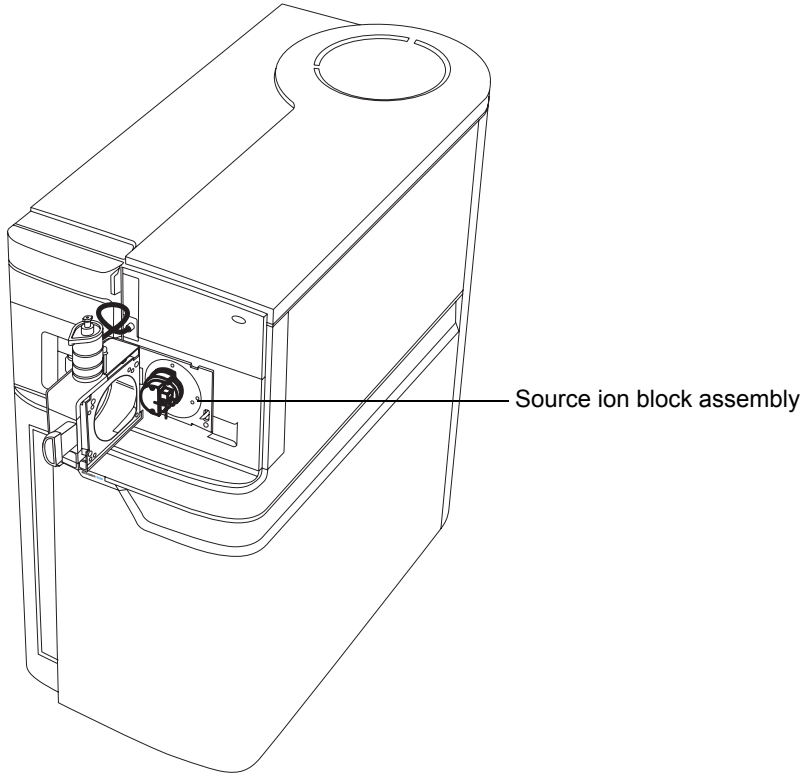
Never let the nitrogen supply pressure fall below 400 kPa (4 bar, 58 psi) during analyses that require flammable solvents. Connect to the LC output with a gas-fail connector to stop the LC solvent if the nitrogen supply fails.

## High temperature hazard



**Warning:** To avoid burn injuries, avoid touching the source enclosure with your hand when operating or servicing the instrument.

## Mass spectrometer high temperature hazard



## Hazards associated with removing an instrument from service



**Warning:** To avoid personal contamination with biohazardous or toxic 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 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. Management 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 carcinogenic, toxic, or biohazardous substances, you must wear chemical-resistant gloves when handling or disposing of used oil.

## Safety advisories





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

## Operating this instrument

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

### Applicable symbols

Symbol	Definition
	Confirms that a manufactured product complies with all applicable European Community directives
 <b>ABN 49 065 444 751</b>	Australia C-Tick EMC Compliant
	Confirms that a manufactured product complies with all applicable United States and Canadian safety requirements
	This product has been tested to the requirements of CAN/CSA-C22.2 No. 61010-1, second edition, including Amendment 1, or a later version of the same standard incorporating the same level of testing requirements

### 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

Waters designed this instrument to be used as a research tool to deliver authenticated, exact-mass measurement. It is not for use in diagnostic procedures.



## Calibrating

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

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

## Quality control

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

## ISM classification

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### ISM Classification: ISM Group 1 Class A

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

## EC Authorized Representative

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

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

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# 1 System Overview

This chapter describes the instrument, including its controls, sources, and IntelliStart™ Fluidics system.

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## Waters SYNAPT G2 MS

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The SYNAPT™ G2 Mass Spectrometry (MS) system is a hybrid, quadrupole/orthogonal acceleration, time-of-flight (oa-TOF) mass spectrometer controlled by MassLynx™ software.

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

- LockSpray™ ESI/APCI/ESCI® source (see [page 1-5](#)).
- NanoLockSpray™ ESI source (see [page 1-7](#)).

You can also use the following optional sources:

- Dual-mode APPI/APCI (see the *Waters Dual-Mode (APPI/APCI) Source for Xevo and SYNAPT G2 Instruments Operator's Guide*).
- MALDI (see the *Waters MALDI SYNAPT G2 Mass Spectrometry System Overview and Maintenance Guide*).

For the instrument's specifications, see the *Waters SYNAPT G2 MS Site Preparation Guide*.

## SYNAPT G2 MS UPLC/MS/MS systems

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The Waters SYNAPT G2 MS is compatible with the ACQUITY UPLC® and nanoACQUITY UPLC® systems. If you are not using either of those systems, refer to the documentation relevant to your LC system.

### ACQUITY UPLC SYNAPT G2 MS UPLC/MS/MS system

The ACQUITY UPLC SYNAPT G2 MS UPLC®/MS/MS system includes an ACQUITY UPLC system and the Waters SYNAPT G2 MS 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. MassLynx software controls the system.

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

## nanoACQUITY UPLC SYNAPT G2 MS nanoUPLC/MS/MS system

The nanoACQUITY UPLC SYNAPT G2 MS nanoUPLC/MS/MS system includes a nanoACQUITY UPLC system and the Waters SYNAPT G2 MS fitted with the NanoLockSpray source.

The nanoACQUITY UPLC system includes a binary solvent manager, auxiliary solvent manager, sample manager, column heater, sample organizer, detectors, and a specialized nanoACQUITY UPLC column. MassLynx software controls the system.

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

## Software

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### IntelliStart

IntelliStart software monitors the mass spectrometer's performance and reports when the instrument is ready for use. The software automatically mass calibrates the instrument and displays performance readbacks. 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 on IntelliStart technology.

The IntelliStart Fluidics system is built into the mass spectrometer. It delivers sample directly to the MS probe from the LC column or from three integral vials. The vials 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 1-9.

## MassLynx

MassLynx software, version 4.1, 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 installing and using MassLynx software.

## Instrument Console

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.

## Instrument sources

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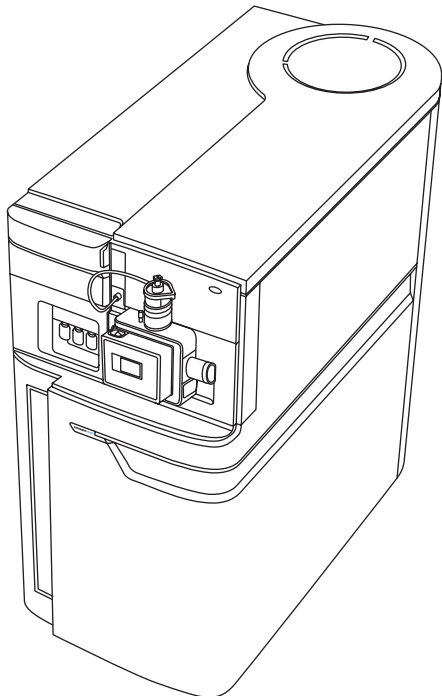
### LockSpray source and ionization modes

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
- nanoSpray

### SYNAPT G2 MS 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.

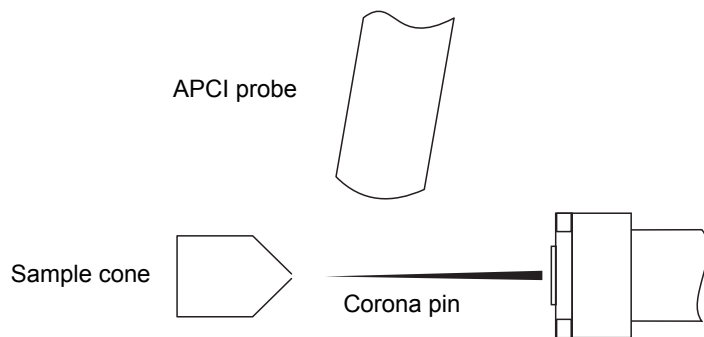
The standard ESI probe capillary accommodates flow rates of up to 2 mL/min making it suitable for LC applications in the range 100  $\mu$ L/min to 2 mL/min. To reduce peak broadening for lower-flow rate LC applications, such as 1-mm UPLC columns, use the optional small-bore capillary option, which can accommodate a maximum flow rate of up to 200  $\mu$ 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 allows electrospray ionization performed in the flow rate range of 5 to 1000 nL/min.

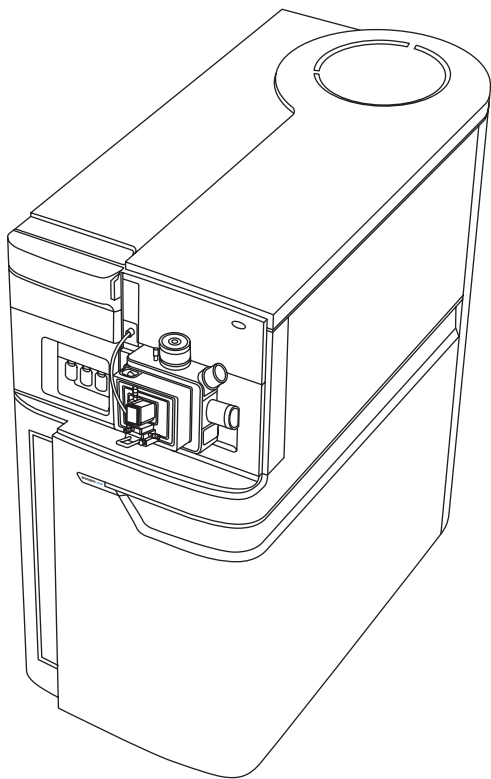
For a given sample concentration, the ion currents for similar experiments approximate to those in normal flow rate electrospray. However, because sample consumption is greatly reduced, the sensitivity gains are significant when you adopt similar scan parameters. Lock-mass correction with the NanoLockSpray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

The NanoLockSpray source enclosure consists of a sprayer—either universal, borosilicate glass capillary, or CE (see below)—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 MS 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 nanoACQUITY UPLC, uses a pump to regulate the flow rate as low as 100 nL/min.
- Borosilicate glass capillary NanoFlow (nanovials).  
This option uses metal-coated glass capillaries, which allow the lowest flow rates. Usable for one sample only, they must then be discarded.
- NanoFlow capillary electrophoresis (CE) sprayer.  
This option uses a make-up liquid at the CE capillary tip, which allows a stable electrospray to occur. The make-up flow rate is less than 1  $\mu$ L/min.

## 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 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 MS System Operator's Guide*.

## IntelliStart Fluidics system

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### Overview

The IntelliStart Fluidics system is built into the instrument; it controls how sample is delivered to the source.

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 vials.

**Tip:** The vials 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, 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 is plumbed directly to the NanoFlow sprayer using a suitably short piece of silica tubing.

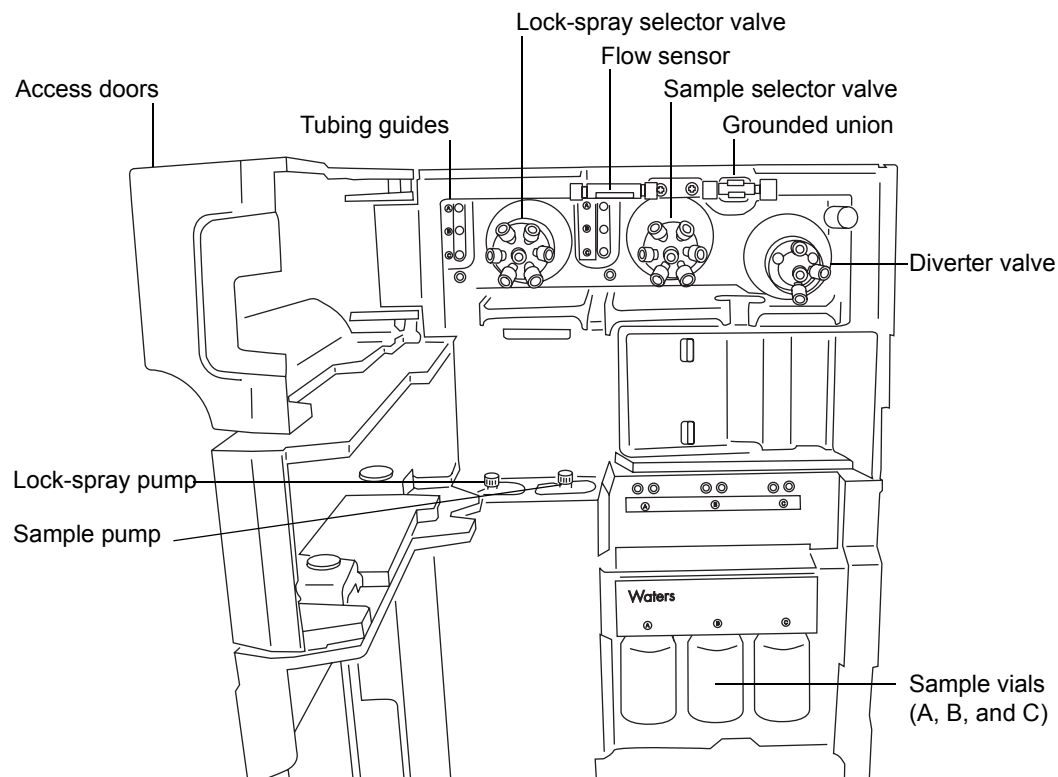
For reference flows for both the LockSpray and NanoLockSpray source, the IntelliStart Fluidics system delivers reference solution from vial B or, for extended operating hours, from a separate, external bottle of reference solution.

## IntelliStart Fluidics physical layout

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

### System components and configuration

(Tubing connections omitted for clarity)



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.
- Three, shared, 30-mL sample vials; A, B, and C.
- Plumbing for shared wash and waste bottles.

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

The wash reservoir and (optionally) the reservoir containing reference solution are external to the instrument; typically, they are bottles placed on top of the LC system. The waste reservoir is normally a bottle stored under the instrument bench.

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

## System operation

You use the console software to configure the IntelliStart Fluidics system. You can edit the parameters, frequency, and extent of the automation. See the mass spectrometer's online Help for further details on IntelliStart software and operating the IntelliStart Fluidics system.

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

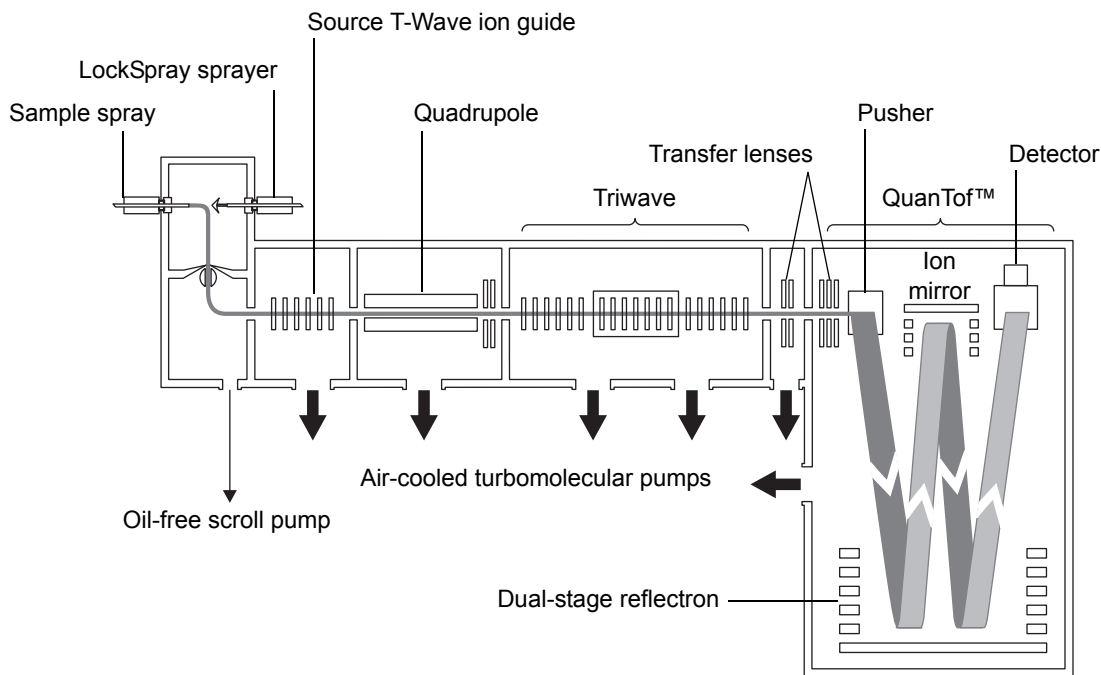
## Ion optics

---

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 ions pass through the sample cone, into the vacuum system.
3. The ions pass through the T-Wave™ ion guide to the quadrupole, where they are filtered according to their mass-to-charge ratio.
4. The mass-separated ions pass into the Triwave™ region, where they can undergo collision-induced dissociation (CID).
5. 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.
6. 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. You can use the TRAP T-Wave and TRANSFER T-Wave regions of the Triwave device for fragmentation analyses.

### Quadrupole

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

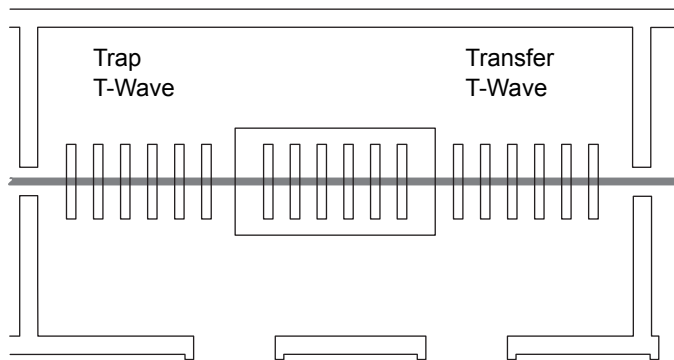
- Without applying the resolving dc voltage – A broad mass-to-charge range of ions passes through, and the TOF analyzer accurately measures their mass (MS acquisition).
- Applying the resolving dc voltage and selecting a specific mass.
- With the instrument automatically switching between MS and MS/MS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

## Triwave technology

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

- The first T-Wave ion guide (Trap) 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 to the oa-TOF for mass analysis.

## Triwave technology



See the mass spectrometer's online Help for details.



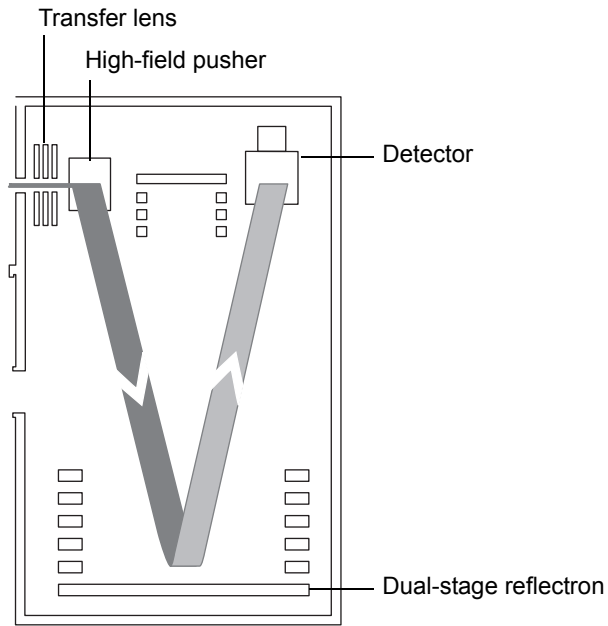
## TOF analyzer

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.

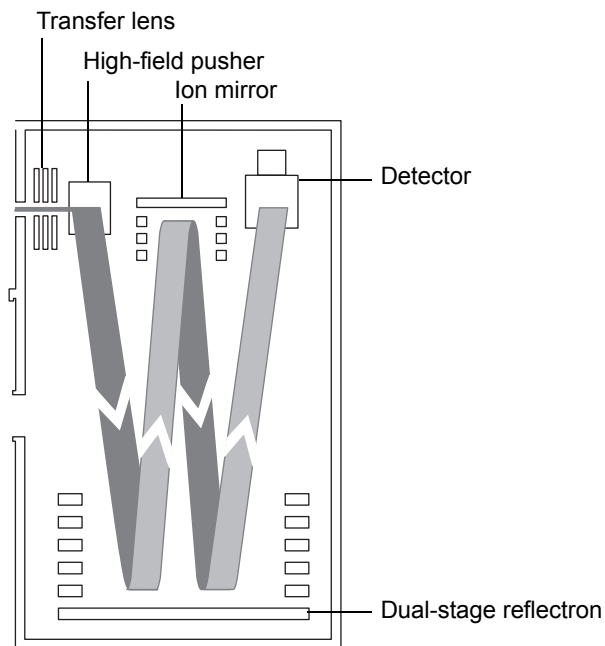
### TOF analyzer operating modes

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 <a href="#">page 1-16</a> ).
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"><li>• From the high-field pusher to the dual-stage reflectron.</li><li>• From the dual-stage reflectron to the ion mirror.</li><li>• From the ion mirror back to the dual-stage reflectron.</li><li>• From the dual-stage reflectron to the detector.</li></ul> See the figure on <a href="#">page 1-16</a> .

## Single-pass mode



## Double-pass mode



## Mass spectrometer configuration

---

The mass spectrometer consists of four principle components: the source, a quadrupole, a Triwave device, and a TOF mass analyzer. Ionized sample produced in the source travels through the quadrupole and Triwave. The TOF detector system records mass spectra as its output.

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

The following processes are performed using the MassLynx software:

- Configuring the SYNAPT G2 MS system
- Calibrating the SYNAPT G2 MS system
- Creating inlet and experiment methods that define operating parameters for an analysis run
- Running samples
- Monitoring acquisition status
- Acquiring data
- Processing data
- Viewing the data

**See also:** The *MassLynx User's Guide*. Also, the MassLynx online Help provides more information on installing and using the MassLynx software.

### Triwave device

The Triwave device consists of three T-Wave ion guides and is automatically configured. The device 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.

### TOF

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. So 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.

## Leak sensors

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Leak sensors in the drip trays of the SYNAPT G2 MS continuously monitor the instrument's IntelliStart Fluidics system for liquid leaks. A leak sensor stops system flow when it 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 a scroll pump and six turbomolecular pumps that pump down (evacuate) these regions of the system:

- Source T-Wave ion guide
- Quadrupole
- Triwave device
- Transfer lenses
- Time-of-flight (TOF) analyser

The oil-free scroll pump backs the turbo pumps and rough pumps the first vacuum stage.

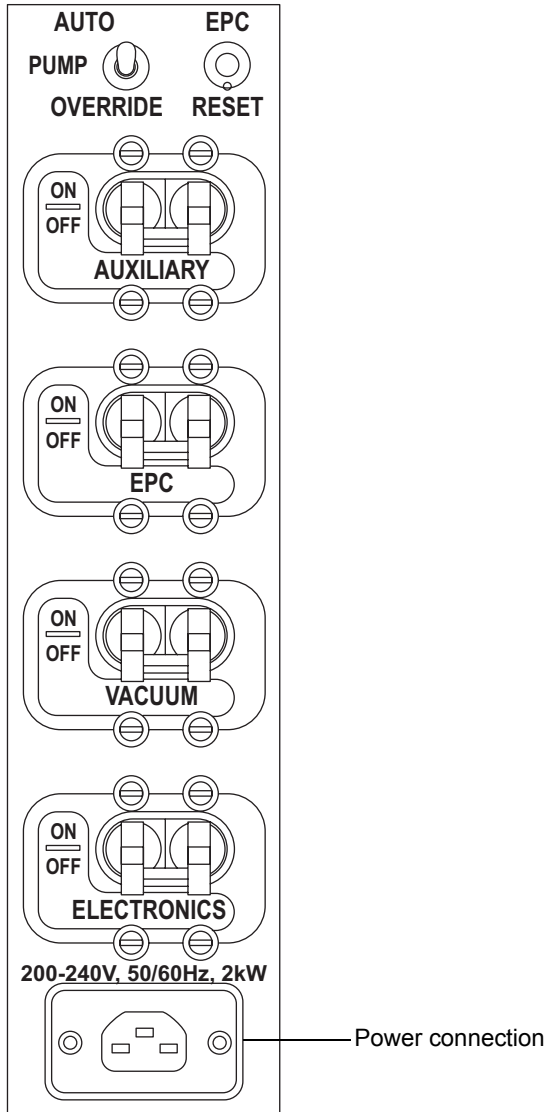
Protective interlocks guard against vacuum leaks and electrical or vacuum pump failure. The system monitors the turbomolecular pump speeds and continuously measures vacuum pressure with built-in gauges. The gauges also serve as switches, stopping operation when vacuum loss is sensed.

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, (see the figure on [page B-2](#)).

## 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). <b>Requirement:</b> The electronics and EPC switches must be switched on.
Auxiliary	This switch provides for future needs by operating a spare power source.
EPC	This switch controls the power supply to the embedded PC.
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, embedded PC, and auxiliary components.

# 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
<a href="#">Starting the mass spectrometer</a>	2-2
<a href="#">Preparing the IntelliStart Fluidics system</a>	2-4
<a href="#">Shutting down the mass spectrometer</a>	2-6
<a href="#">Rebooting the embedded PC</a>	2-7

## Starting the mass spectrometer

---

The Waters SYNAPT G2 MS is compatible with the ACQUITY UPLC and nanoACQUITY UPLC systems. If you are not using either of these systems, refer to the documentation relevant to your LC system.



**Caution:** Using incompatible solvents can severely damage the instrument. 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.

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

### To start the mass spectrometer




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

1. Ensure that all the mass spectrometer’s external connections are in place (see [Appendix B, “External Connections”](#)).
2. Power-on the MassLynx PC, and log in before powering-on the other instruments.
3. 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 1-19](#)).

**Result:** Each system component runs a series of startup tests.

4. Allow 4 minutes for the embedded PC to initialize.



5. Start the MassLynx software.  
**Tip:** You can monitor the Instrument Console for messages and LED indications.
6. 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.
7. Click Operate .  
**Result:** When the mass spectrometer is ready to operate, IntelliStart software displays "Ready" in the Instrument Console.

## Calibration information

You must calibrate the mass spectrometer prior to use. You can perform this task using IntelliStart software.

**See also:** The mass spectrometer's online Help.

## Flow rates for the ACQUITY UPLC SYNAPT G2 MS 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 MS 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
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 B-13.

### Installing the vials

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

#### Required materials

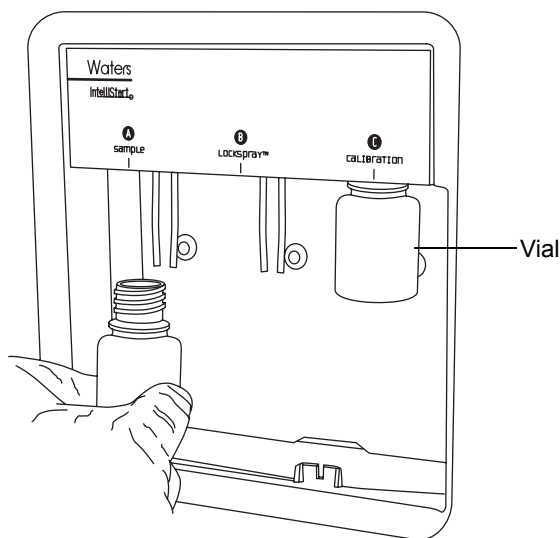
Chemical-resistant, powder-free gloves

#### To install the vials



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

1. Remove the vial caps.
2. Screw the vials onto the mass spectrometer, as shown below.

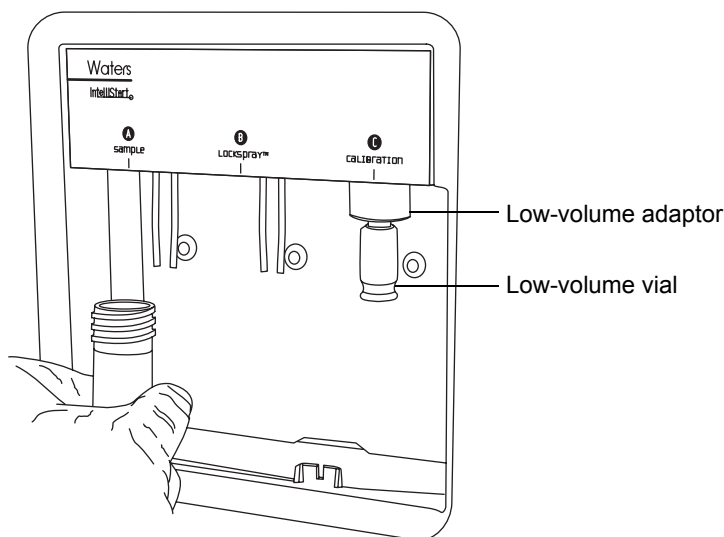


## To install the low-volume vials



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

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



**Warning:** Low-volume glass vials are fragile and can shatter, cutting fingers. Take care and never use force when screwing them into the adaptors.

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

## 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.

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

## Shutting down the mass spectrometer

---

You can shut down the system by putting it in Standby mode, by fully shutting it down, or by rebooting it.

### Putting the mass spectrometer in Standby mode

Leave the mass spectrometer in Operate mode except in the following cases, when you must put it in the Standby mode:

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


#### To put the system in Standby mode

In the Tune window, click  to put the mass spectrometer in Standby mode.

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

### 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:** When the turbomolecular pumps slow to half their normal operating speed, the vent valves open, and the instrument automatically vents.

5. Exit the MassLynx software.
6. Shut down the PC.

7. Switch off all the peripherals.
8. Switch off the vacuum, electronics, and the embedded PC and auxiliary breakers located on the rear panel.

## Rebooting the embedded PC

---

Reboot the embedded PC when either of these conditions applies:

- The MassLynx software fails to initialize.
- Immediately following a software upgrade.

### To reboot the embedded PC



**Caution:** When rebooting, do not switch off power to the instrument, as this will vent the instrument.

1. In the MassLynx software, close the Tune window.
2. On the instrument's rear panel, switch off the EPC power switch, wait 5 seconds, and switch it back on.
3. Wait 4 minutes to allow full rebooting to take place.
4. Open the MassLynx software.



# 3

## Configuring the LockSpray Source

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

- ESI
- APCI
- ESCi

### Contents

Topic	Page
<a href="#">Configuring the LockSpray source</a>	3-2
<a href="#">Configuring for ESI mode</a>	3-2
<a href="#">Installing the ESI small bore capillary option</a>	3-8
<a href="#">Configuring for APCI mode</a>	3-14
<a href="#">Configuring for ESCi mode</a>	3-19

## 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

## Configuring for ESI mode

---

To operate in ESI mode, you must fit the ESI probe to the LockSpray source enclosure. If you intend using the small-bore capillary option, fit the capillary to the probe first (see [page 3-8](#)).

For more information on using ESI mode, see the SYNAPT G2 MS system online Help.

## Installing the ESI probe

### Required materials

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

### To install the ESI probe



**Warning:** The LC system connections, ESI probe, and source can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



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

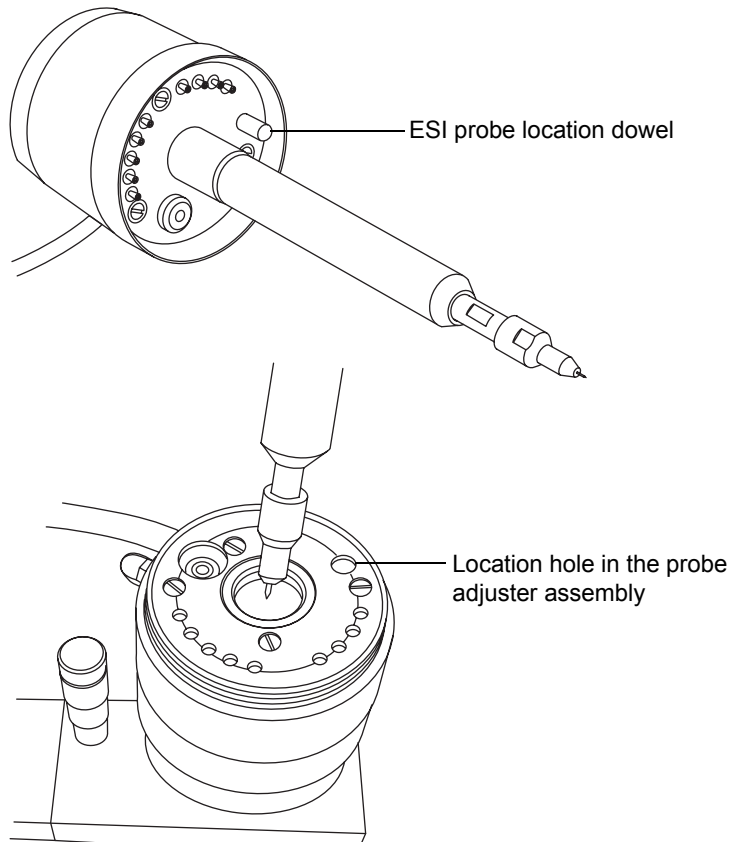


1. Prepare the instrument for working on the source (see [page 5-7](#)).

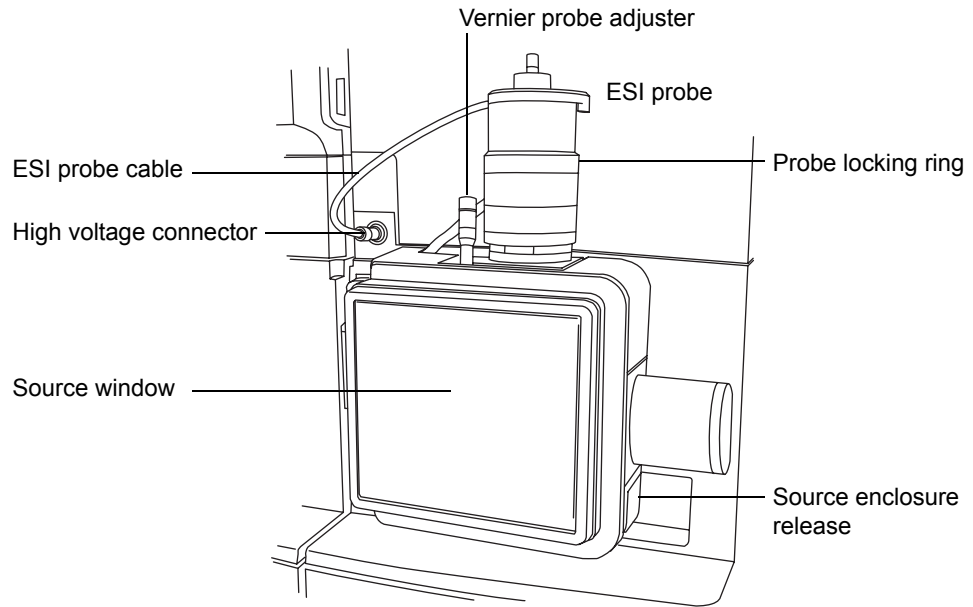



**Warning:** The ESI probe tip is sharp. To avoid puncture wounds, handle the ESI probe with care.

2. Remove the protective sleeve, if fitted, from the ESI probe tip.
3. 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.



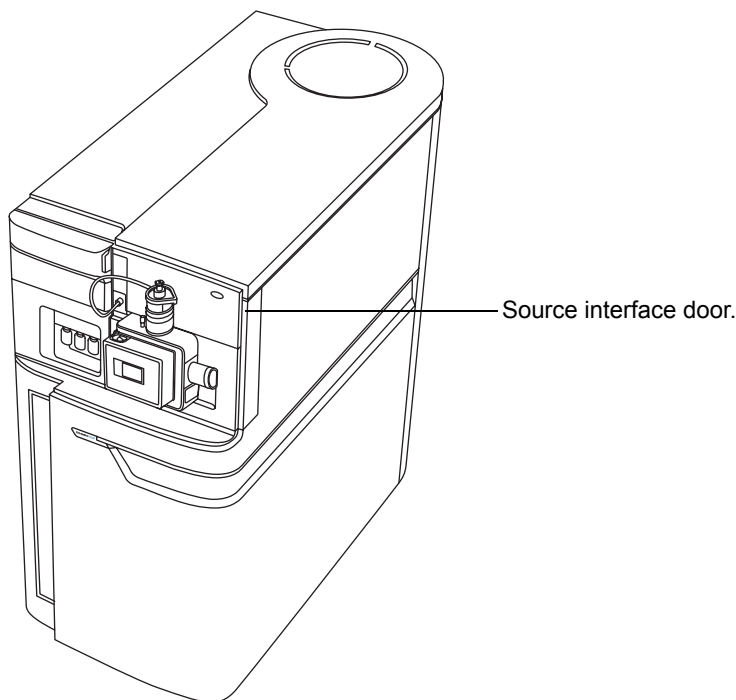
## ESI probe, mounted on the LockSpray source enclosure



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

4. Tighten the probe locking ring to secure the probe in place.
5. Connect the ESI probe's cable to the high voltage connector.
6. Slide open the instrument's source interface door.

## Source interface door



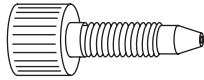
**Warning:** To avoid electric shock, do not use stainless steel tubing to connect the diverter valve to the ESI probe; use the PEEK tubing supplied with the instrument.

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

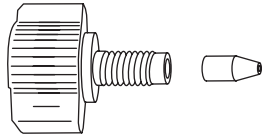
**Recommendation:** To reduce peak broadening, use 0.004-inch ID tubing for sample flow rates  $\leq 1.2$  mL/min; use 0.005-inch ID tubing for sample flow rates  $> 1.2$  mL/min.

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

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

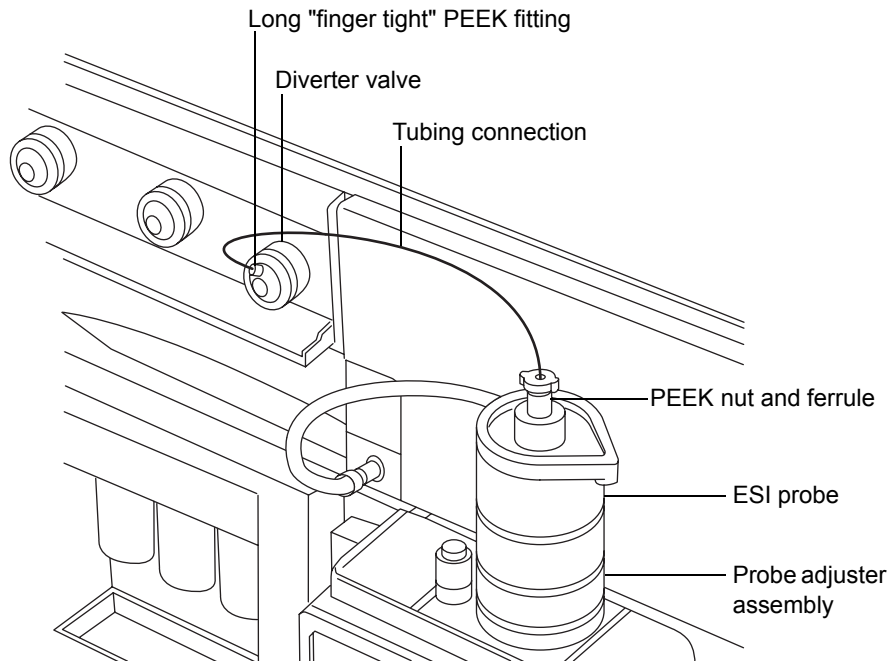


- At the probe, use a PEEK nut and ferrule, finger tightened, to connect to the PEEK union.



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

(The other connections are omitted for clarity.)



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

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

## Removing the ESI probe

### Required materials

Chemical-resistant, powder-free gloves

### To remove the ESI probe



**Warning:** The LC system connections, ESI probe, and source can be contaminated with biohazardous and/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.

1. Prepare the instrument for work performed on its source (see [page 5-7](#)).
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:** The ESI probe tip is sharp. To avoid puncture wounds, handle the probe with care.

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

## Installing the ESI small bore capillary option

---

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



**Caution:** 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
- 2  $\times$  7-mm wrenches
- 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
  - 2  $\times$  1/16-inch ferrules
- Metal gasket for the probe tip
- Safety goggles

## To install the capillary



**Warning:** The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



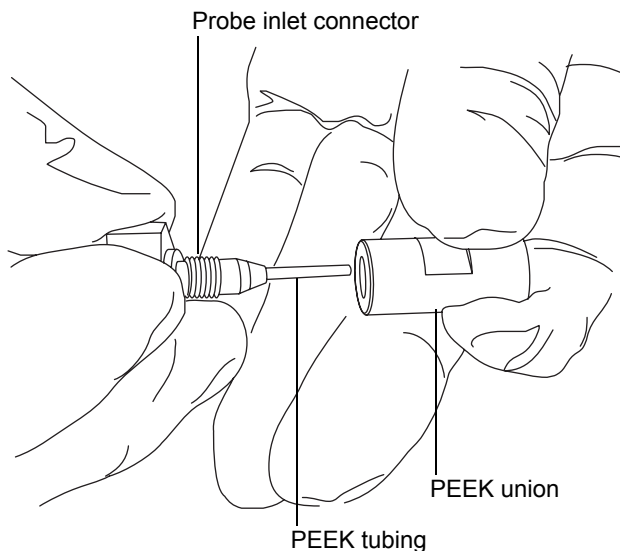
**Warning:** The ESI probe tip is sharp. To avoid puncture wounds, handle the probe with care.

1. Remove the existing capillary (see [page 5-59](#)).
2. Using the sharp knife or PEEK tubing cutter, cut an approximately 60-cm (24-inches) length of red PEEK tubing.

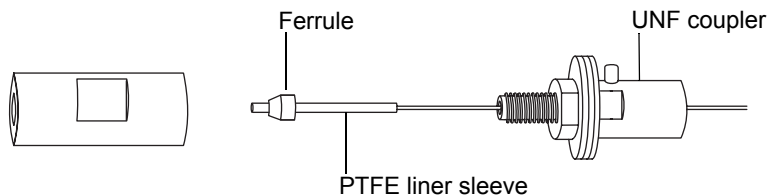
**Requirement:** To minimize dead volume, cut the ends of the tubing squarely (that is, perpendicular to the tube's horizontal axis).

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

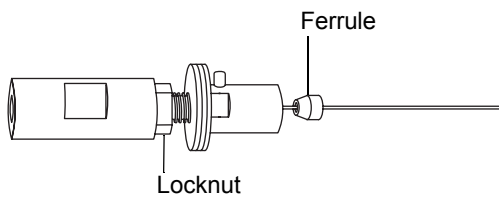
**Rationale:** Doing so ensures a minimum dead volume when fitting the capillary.



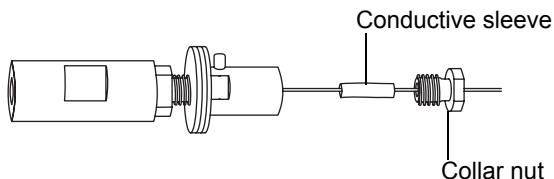
- Using the needle-nose pliers, slide the UNF coupler, PTFE liner sleeve, and a ferrule onto the capillary.



- 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.



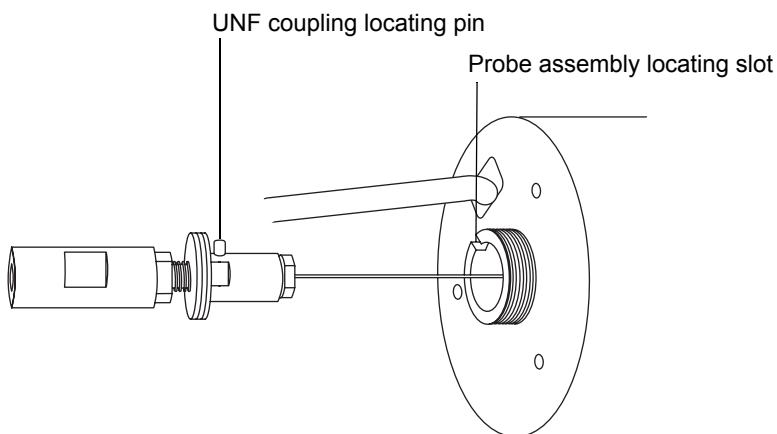
- Using two 7-mm wrenches, tighten the collar nut to the UNF coupling.





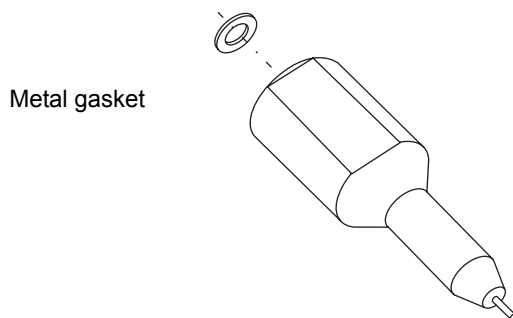
**Warning:** To avoid high-pressure jet spray, wear safety goggles when performing the leak test.

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.

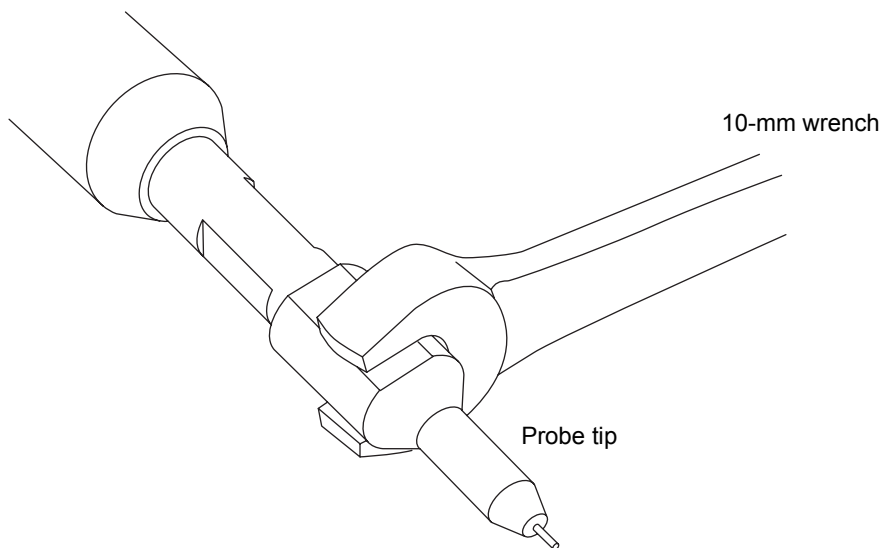
19. Fit the new metal gasket to the probe tip.



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

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

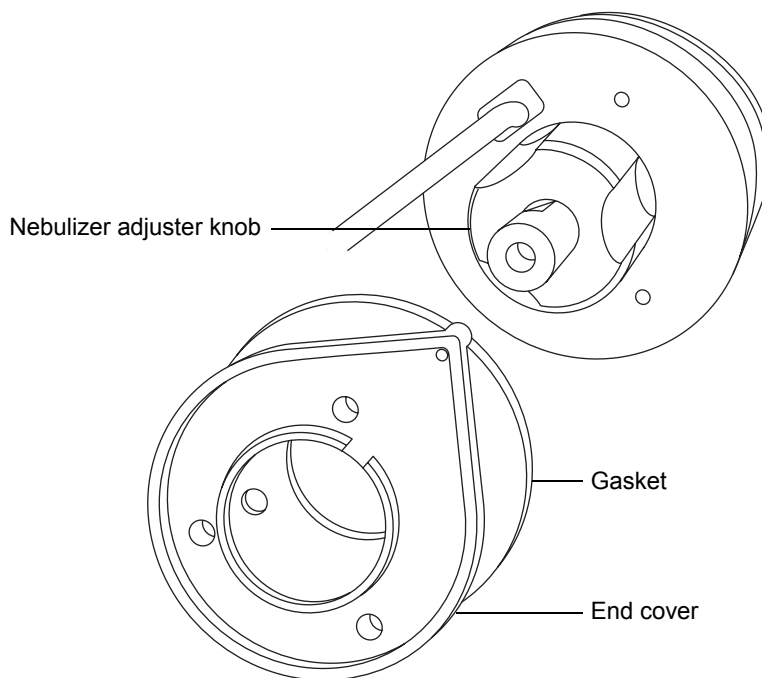
21. Using the 10-mm wrench, tighten the probe tip.



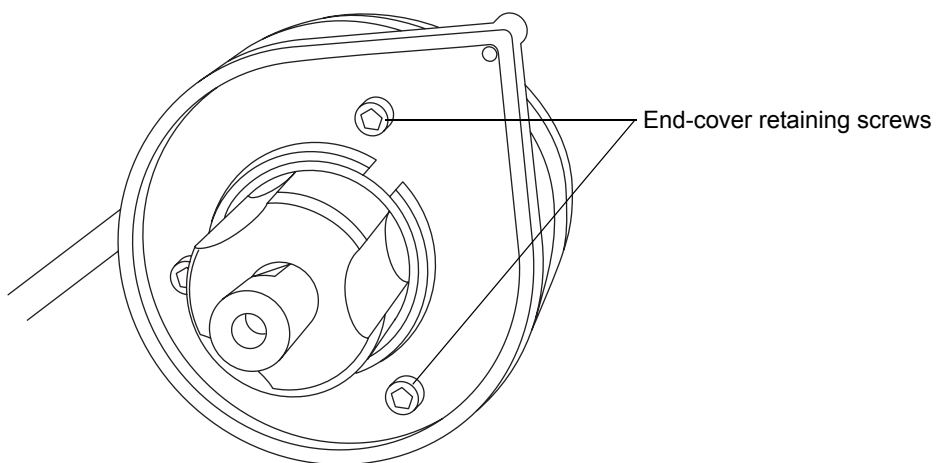
22. Using the nebulizer adjuster knob, adjust the capillary so that it protrudes by approximately 0.5 mm from the end of the probe tip.

**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 3 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 3-2](#)).

## Configuring for APCI mode

---

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

For more information on using APCI mode, see the SYNAPT G2 MS system online Help.

## Installing the APCI probe

### Required materials

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

### To install the APCI probe

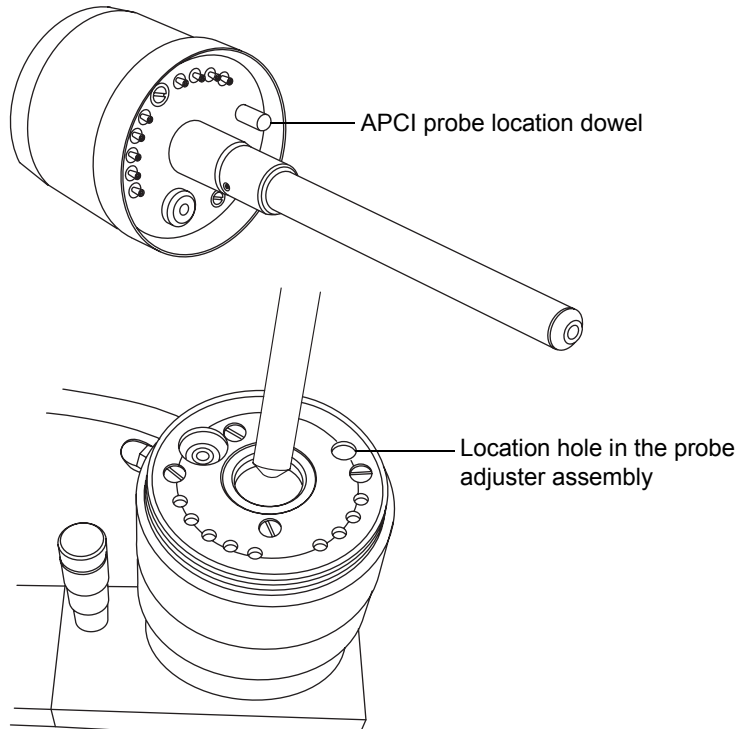


**Warning:** The LC system connections, APCI probe, and source can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



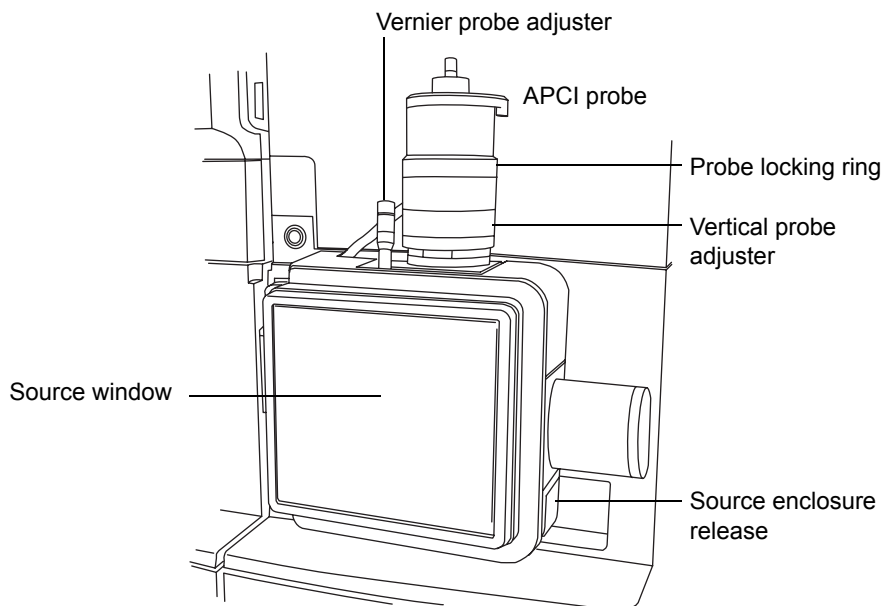
**Warning:** To avoid electric shock, prepare the instrument for work performed on its source before commencing this procedure.

1. Prepare the instrument for work performed on its source (see [page 5-7](#)).
2. Carefully slide the APCI 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.



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

### APCI probe mounted on the source enclosure



4. Slide open the instrument's source interface door (see the figure on [page 3-5](#)).



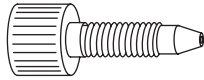
**Warning:** To avoid electric shock, do not use stainless steel tubing to connect the diverter valve to the APCI probe; use the PEEK™ tubing supplied with the instrument.

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

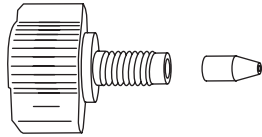
**Recommendation:** To reduce peak broadening, use 0.004-inch ID tubing for sample flow rates  $\leq 1.2$  mL/min; use 0.005-inch ID tubing for sample flow rates  $> 1.2$  mL/min.

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

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

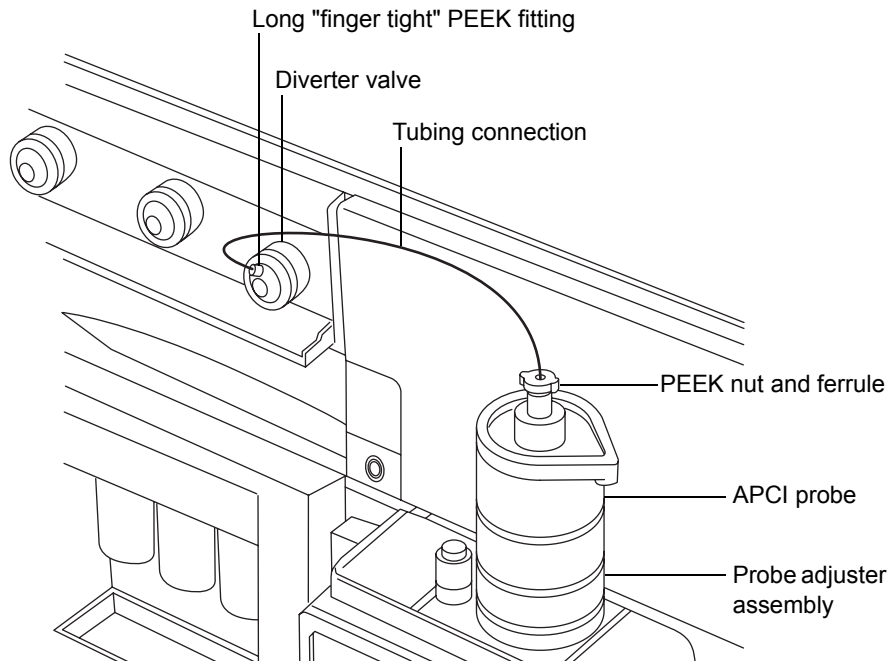


- At the probe, use a PEEK nut and ferrule, finger tightened, to connect to the PEEK union.



### Tubing connection between the diverter valve and the APCI probe

(The other tubing connections are omitted for clarity.)



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

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

## Installing the corona pin in the source

Install the corona pin according to the procedure on [page 5-12](#).

## Removing the corona pin from the source

Remove the corona pin according to the procedure on [page 5-14](#).

## Removing the APCI probe

### Required materials

Chemical-resistant, powder-free gloves

### To remove the APCI probe



**Warning:** The LC system connections, APCI probe, and source can be contaminated with biohazardous and/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.

1. Prepare the instrument for work performed on its source (see [page 5-7](#)).
2. Disconnect the diverter valve tubing from the APCI probe.
3. Unscrew the probe locking ring.
4. Carefully remove the probe from the probe adjuster assembly.



## 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 MS system online Help. When fitting the ESI probe to the LockSpray source enclosure, follow the procedure on [page 3-2](#).

### Optimizing the ESI probe for ESCi operation

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

### Installing the corona pin in the source

Install the corona pin according to the procedure on [page 5-12](#).

### Removing the corona pin from the source

Remove the corona pin according to the procedure on [page 5-14](#).



# 4 Configuring the NanoLockSpray source

The Waters NanoLockSpray™ dual, electrospray, 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.

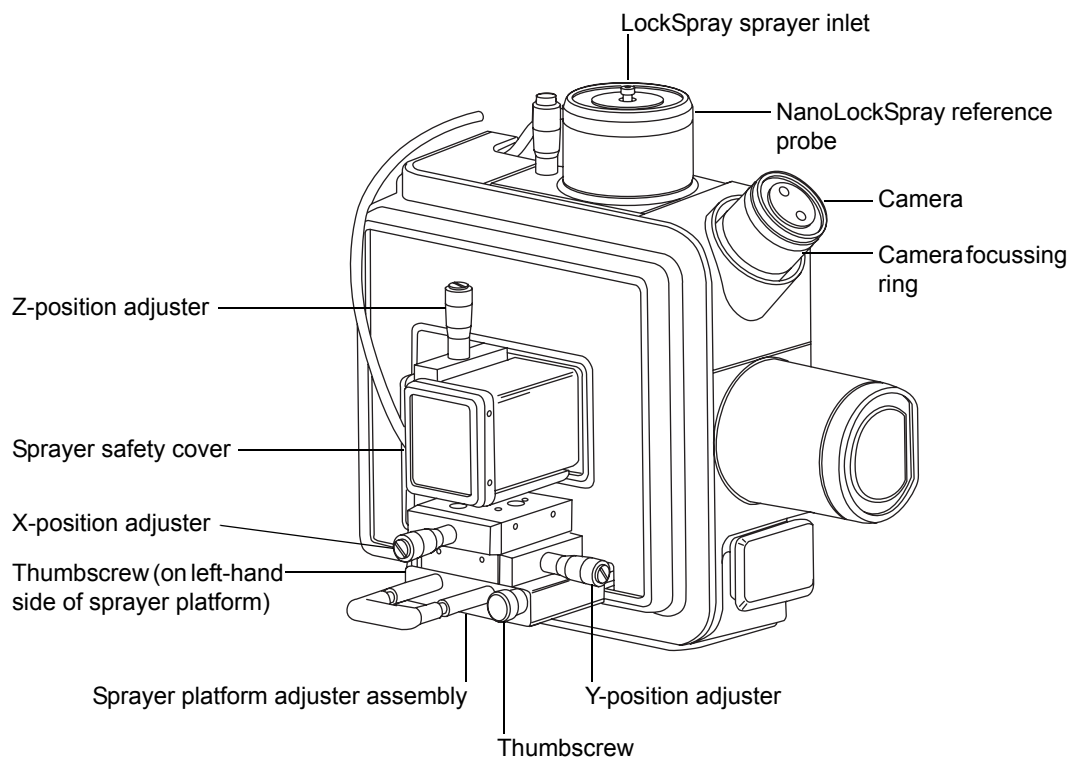
## Contents

Topic	Page
Overview of the NanoLockSpray source	4-2
Selecting and Configuring the NanoLockSpray source	4-4
Deploying the sprayer platform adjuster assembly	4-5
Adjusting the sprayer tip position	4-6
Setting up the camera	4-7
Optional glass capillary sprayer	4-8

# Overview of the NanoLockSpray source

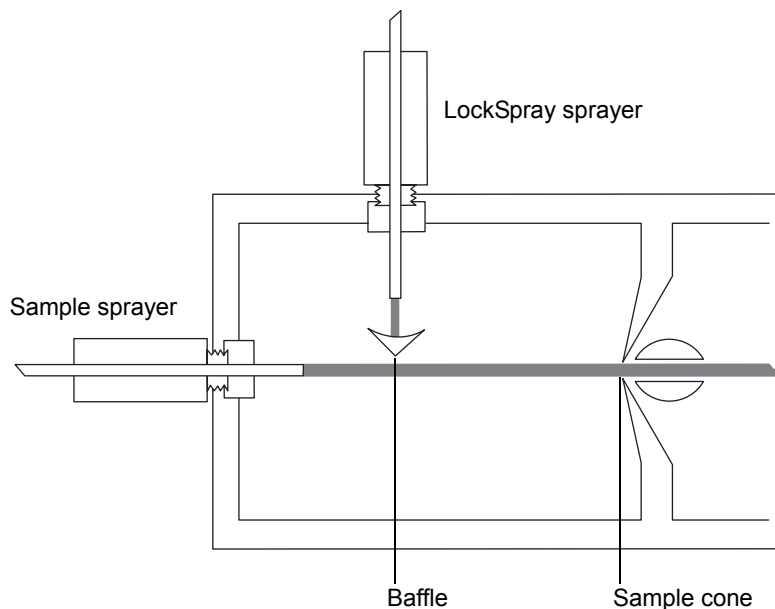
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## NanoLockSpray source



The NanoLockSpray source enclosure holds two nanospray sprayers positioned orthogonally with respect to one another. 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 acquiring 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 on how to set up these sprayers, see [page 4-4](#).

### LockSpray sprayer

The LockSpray sprayers for the LockSpray source and NanoLockSpray source operate as part of the instrument's IntelliStart Fluidics system. Fitted with a 500- $\mu$ L pump, the LockSpray sprayer operates at 0.5  $\mu$ L/min. You must choose the concentration of the lock-spray reference solution that gives a suitable ion intensity.

## NanoFlow gas supply

The sample sprayer nebulizer gas supply pressure is electronically controlled from 0 to 2 bar. The optimum pressure is sprayer-dependent, but usually lies between 0.3 and 1.0 bar.

## Purge gas

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 allow 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 4-5](#)).

## 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).

To select the NanoLockSpray source, from the Tune window, click Source > Nanoflow.

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 nebulizer sprayer	Flow injection or for coupling to nanoACQUITY UPLC with regulated flow rates down to 100 nL/min.
Borosilicate glass capillary NanoFlow (see <a href="#">page 4-8</a> ).	Extremely low flow rates (less than 100 nL/min).
NanoFlow capillary electrophoresis (CE) sprayer. For details, see the <i>Capillary Electrophoresis/Capillary Electrochromatography Sprayer User's Guide</i> (part number 6666522).	Stable electrospray by means of a make-up liquid at the CE capillary tip. The make-up flow rate is less than 1 $\mu$ L/min.

## 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 4-2](#)).
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 that the sprayer's safety cover is installed (see the figure on [page 4-2](#)).
2. Pull out the side thumbscrew, and push the sprayer platform into the source.
3. Release the side thumbscrew, locking the platform in position.
4. 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 baffle.
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.



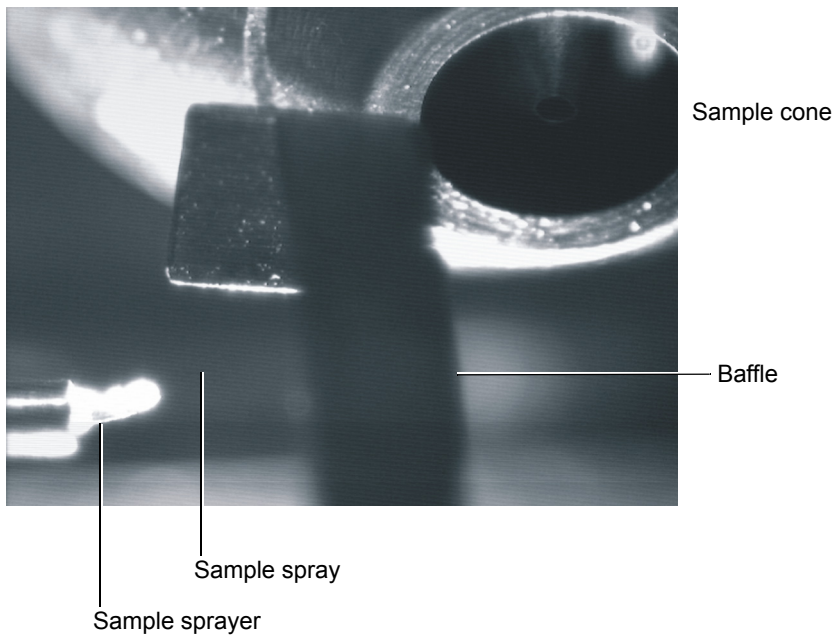
## Setting up the camera

---

### 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 4-2](#)).

## Optional glass capillary sprayer

---

The glass capillary sprayer is designed for use with metal-coated borosilicate glass capillaries, which allow extremely low flow rates (less than 100 nL/min). The capillaries are used for one sample only and must then be discarded.

To use the glass capillary sprayer, you must complete the following procedures:

- Install the glass capillary sprayer.
- Fit and load the glass capillary.
- Optimize the sprayer.

### Installing the glass capillary sprayer

#### Required materials

Chemical-resistant, powder-free gloves

#### To install the glass capillary sprayer



**Warning:** The source components can be contaminated with biohazardous and/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.

1. Prepare the instrument for work performed on its source (see [page 5-7](#)).



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

2. In the Tune window, click Source Standby , and confirm that the adjacent status display is yellow.
3. Retract the sprayer platform adjuster assembly from the source (see [page 4-5](#)).
4. Remove the sprayer's safety cover.

- Place the sprayer (with gas line fitted) on the platform, and secure it with the thumbscrew.
- Refit the safety cover.

## Fitting and loading the glass capillary

### Required materials

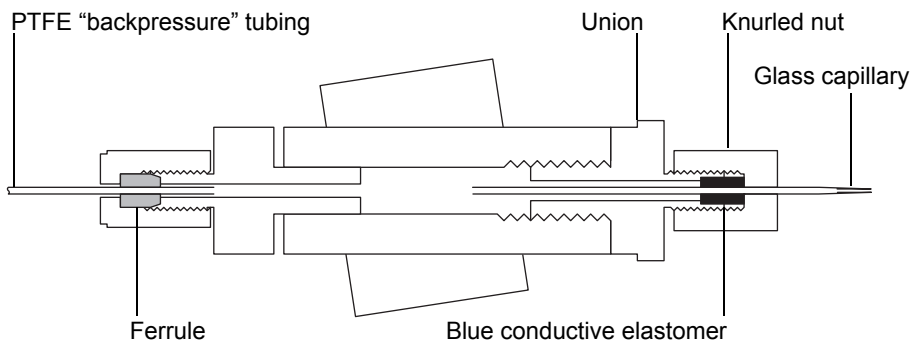
- Chemical-resistant, powder-free gloves
- Fused silica syringe needle or a GELoader<sup>®</sup> tip

### To fit and load the glass capillary



**Warning:** The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

- Unscrew the union at the front of the sprayer, and remove the sprayer's front section.

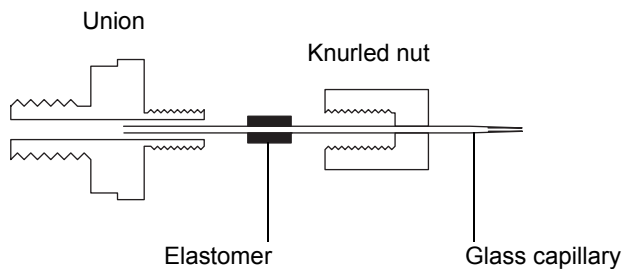


**Warning:** To avoid injury with a sliver of glass contaminated with toxic samples, do not touch the sharp end of the capillary.

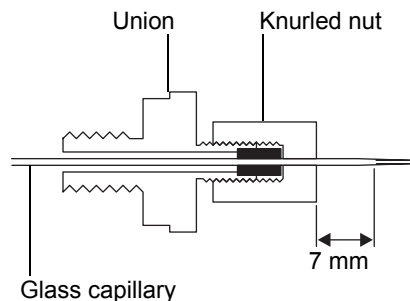


**Caution:** The capillaries are extremely fragile. Handle them with great care from their square-cut ends. Touching their sharp end can render the needle inoperable.

- Carefully remove the capillary from its case by lifting it vertically while pressing down on the foam with two fingers.
- Over the square-cut end of the capillary, pass first the knurled nut, then approximately 5 mm of conductive elastomer, and finally the union.



- Finger tighten the nut onto the union.
- Ensure that the tip of the glass capillary protrudes about 7 mm from the front of the knurled nut, as measured from the end of the nut to the shoulder of the glass capillary, and then full tighten the nut onto the union.



- Load sample into the capillary using either a fused silica syringe needle or a GELoader tip.

**Tip:** Shake the loaded capillary to move the liquid to the tip of the sprayer.

- With the sprayer mounted on the adjuster platform, screw the union back into the assembly; finger-tight is sufficient.
- In the MassLynx Tune window ensure the Capillary parameter is set to 0 V.
- Push the sprayer platform into the source (see [page 4-5](#)).

## To optimize the glass capillary sprayer

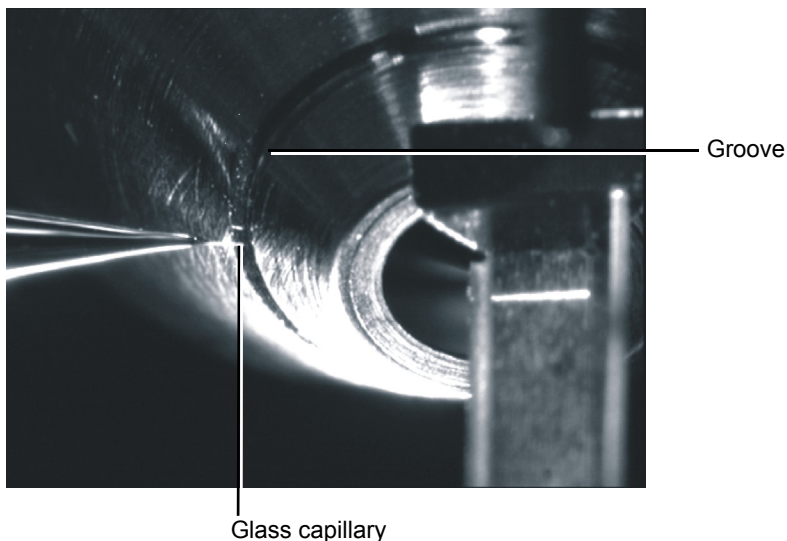


**Warning:** To avoid eye injuries, always wear eye protection when cutting fused silica.



**Warning:** To avoid injury from trace chemicals on the probe, always wear chemical-resistant, powder-free gloves.

1. Set the NanoFlow gas pressure to 0.3 bar and the cone gas to 40 L/h.
2. Ascertain that sample is flowing by observing a droplet on the tip.  
**Tip:** If you cannot observe a droplet, increase the pressure briefly, up to a maximum of 1.5 bar, and then return the pressure to 0.3 bar.
3. If you observe a droplet, continue the procedure at [step 9](#).  
**Requirement:** If you do not observe a droplet, in the MassLynx Tune window, ensure the Capillary parameter is set to 0 V, and follow [step 4](#) through [step 8](#).
4. Move the sprayer back and to the left-hand side until the tip aligns with the groove on the cone.  
**Tip:** Aligning is best done while viewing from the front of the source.
5. While watching the camera image, carefully move the tip forward toward the groove, until it touches, and a small piece of the glass capillary shears off.



6. Return the sprayer to its previous position.
7. Ascertain that sample is flowing by observing a droplet on the tip.  
**Tip:** If you cannot observe a droplet, increase the pressure briefly, up to a maximum of 1.5 bar, and then return the pressure to 0.3 bar.
8. If you observe a droplet, continue the procedure at [step 9](#).  
**Requirement:** If you do not observe a droplet, repeat [step 4](#) through [step 8](#).  
If, after you repeat [step 4](#) through [step 8](#), you still cannot observe a droplet, discard the glass capillary and fit a new one (see [page 4-9](#)).
9. Set the capillary voltage slider to between 1.0 and 3.0 kV.
10. With an ion beam now visible on the peak display, optimize the sprayer position and capillary voltage for maximum signal intensity.  
**Tip:** The spray optimizes between 1.0 and 3.0 kV. To stop the sprayer, set the capillary voltage to 0.

# 5

## 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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Replacing the IntelliStart Fluidics tubing	5-98



## Maintenance schedule

---

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

### Maintenance schedule

Procedure	Frequency	For information...
Clean the instrument case.	As required.	See <a href="#">page 5-18</a> .
Empty the nitrogen exhaust trap bottle.	Check daily, empty as required.	See <a href="#">page 5-19</a> .
Replace the oil-free (scroll) pump's seals.	Annually.	See Edwards document <i>XDS35i Instruction Manual A730-01-880</i> .
Clean the source components.	When sensitivity decreases to unacceptable levels.	See <a href="#">page 5-21</a> .
Replace the ESI probe tip.	When sensitivity decreases to unacceptable levels.	See <a href="#">page 5-55</a> .
Replace the ESI probe capillary.	When sensitivity decreases to unacceptable levels or sample flow is inconsistent.	See <a href="#">page 5-59</a> .
Clean the APCI probe tip. (Options using the APCI probe only.)	When sensitivity decreases to unacceptable levels.	See <a href="#">page 5-67</a> .
Replace the APCI probe capillary.	When sensitivity decreases to unacceptable levels or sample flow is inconsistent.	See <a href="#">page 5-68</a> .
Replace the LockSpray probe capillary.	Annually.	See <a href="#">page 5-74</a> .

## Maintenance schedule (continued)

Procedure	Frequency	For information...
Clean or replace the corona pin (APCI and ESCi modes).	When the corona pin is corroded or black, or the sensitivity decreases to unacceptable levels.	See <a href="#">page 5-83</a> .
Replace the APCI probe heater.	If the heater fails to heat the probe.	See <a href="#">page 5-84</a> .
Replace the ion block heater cartridge.	If the heater fails to heat the ion block.	See <a href="#">page 5-87</a> .
Replace the source assembly seals.	Annually.	See <a href="#">page 5-91</a> .
Replace the mass spectrometer air filters.	Annually.	See <a href="#">page 5-95</a> .
Replace the IntelliStart Fluidics tubing.	In the event of blockage in the tubing connections between the IntelliStart Fluidics system components.	See <a href="#">page 5-98</a> .

## Spare parts

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

## Troubleshooting using Connections Insight

---

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

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

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

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

- <http://www.waters.com>
- Your sales representative
- Your local Waters subsidiary
- Waters Customer Support

### 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. Note that saving a service profile or plot file using the Instrument Console software 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:** The instrument components can be contaminated with biologically hazardous materials. Always wear chemical-resistant, powder-free gloves while handling the components.



**Warning:** To prevent injury, always observe Good Laboratory Practices 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:** The probe and source can be hot. To avoid burn injuries, take great care while working with these components.



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

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

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




## Preparing the instrument for work performed on its source

---



**Warning:** Follow the procedure described below 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  to stop the LC flow or, if column flow is required, divert the LC flow to waste as follows:
  - a. In the Instrument Console system tree, expand SYNAPT G2 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 source.

### Removing the source enclosure from the instrument

#### Required materials

Chemical-resistant, powder-free gloves

#### To remove the source enclosure



**Warning:** The source components can be contaminated with biohazardous and/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.

1. Prepare the instrument for work performed on its source (see [page 5-7](#)).



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

2. Remove the probe from the source.
  - If you are removing an ESI probe, see [page 3-7](#).
  - If you are removing an APCI probe, see [page 3-18](#).
3. Slide open the instrument's source interface door (see the figure on [page 3-5](#)).

4. Disconnect the source enclosure cables from the instrument's connectors.

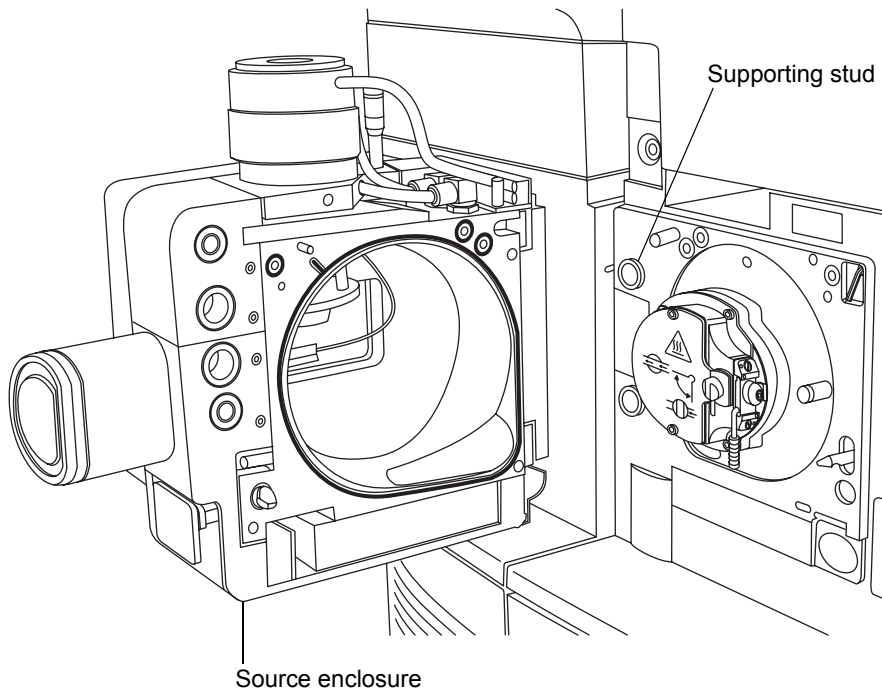


**Warning:** The corona pin tip is sharp. To avoid puncture wounds, take great care while working with the source enclosure open if a corona pin is fitted.

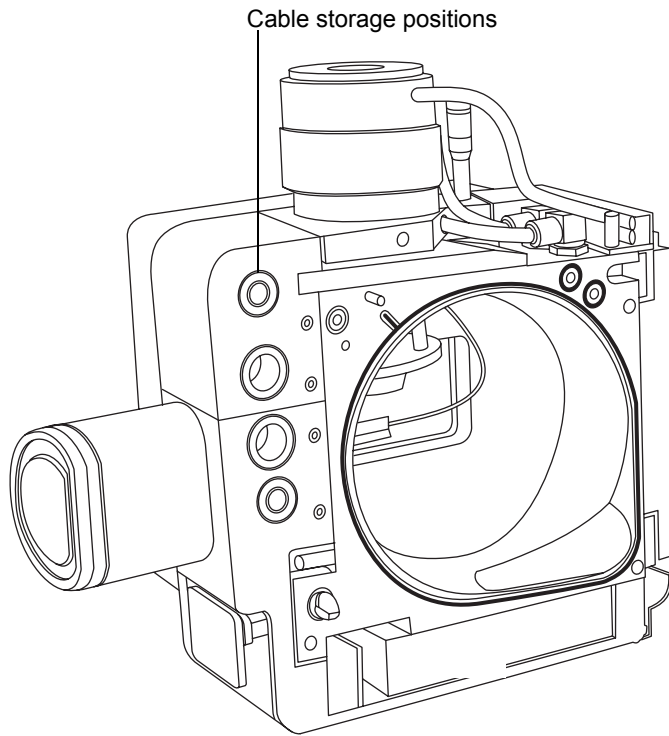


**Caution:** To avoid damaging the sample inlet when removing a NanoLockSpray source enclosure, move the sprayer platform out of the source enclosure before opening it (see [page 4-5](#)).

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

### To fit the source enclosure to the instrument



**Warning:** The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



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

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



**Caution:** 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 4-5](#)).

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

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



**Warning:** The LC system connections, ESI probe, and source can be contaminated with biohazardous and/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.

1. Prepare the instrument for work performed on its source (see [page 5-7](#)).



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

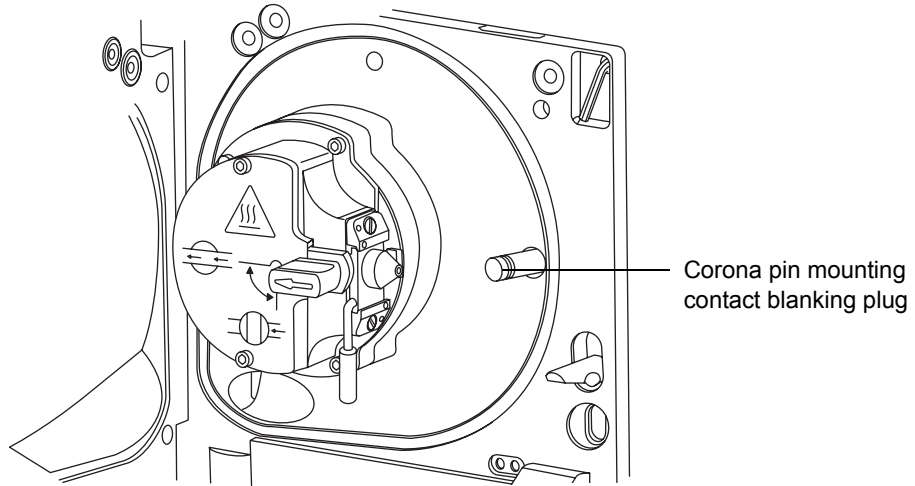


**Warning:** The ESI probe tip is sharp. To avoid puncture wounds, take great care while working with the source enclosure open if an ESI probe is fitted.

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.

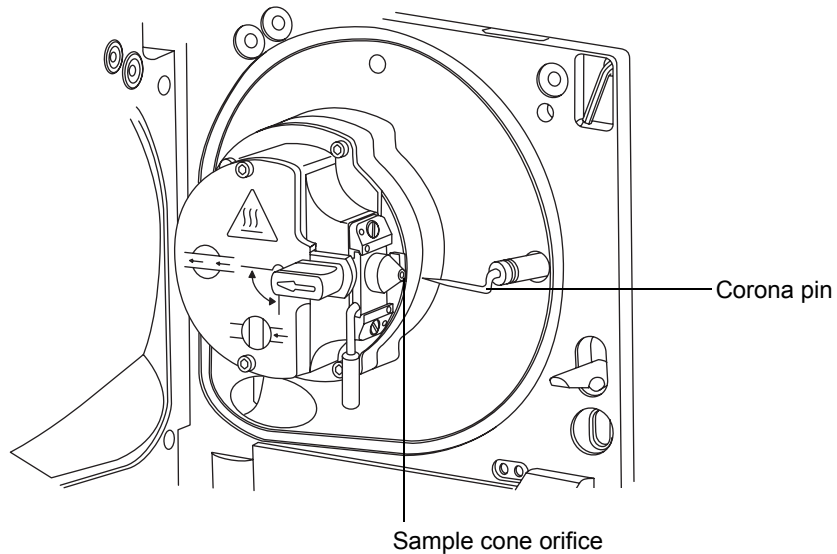
## Corona pin mounting contact



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 3-4](#)), 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

### To remove the corona pin from the source



**Warning:** The LC system connections, ESI probe, and source can be contaminated with biohazardous and/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.

1. Prepare the instrument for work performed on its source (see [page 5-7](#)).



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



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

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 5-13](#)).  
**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

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



**Warning:** The source components can be contaminated with biohazardous and/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.

1. Prepare the instrument for work performed on its source (see [page 5-7](#)).



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

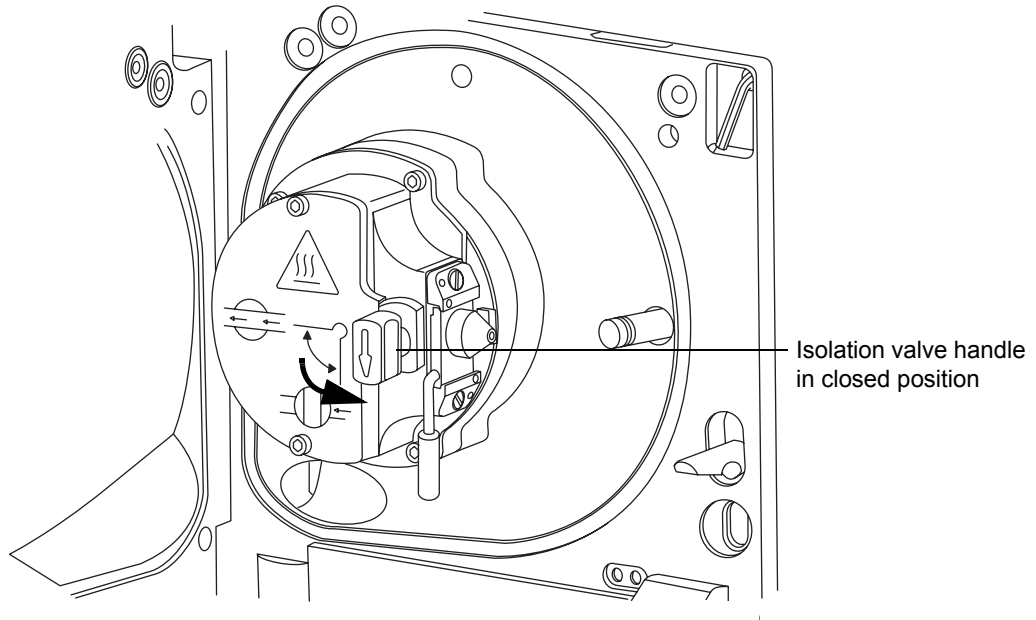


**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

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

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

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



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



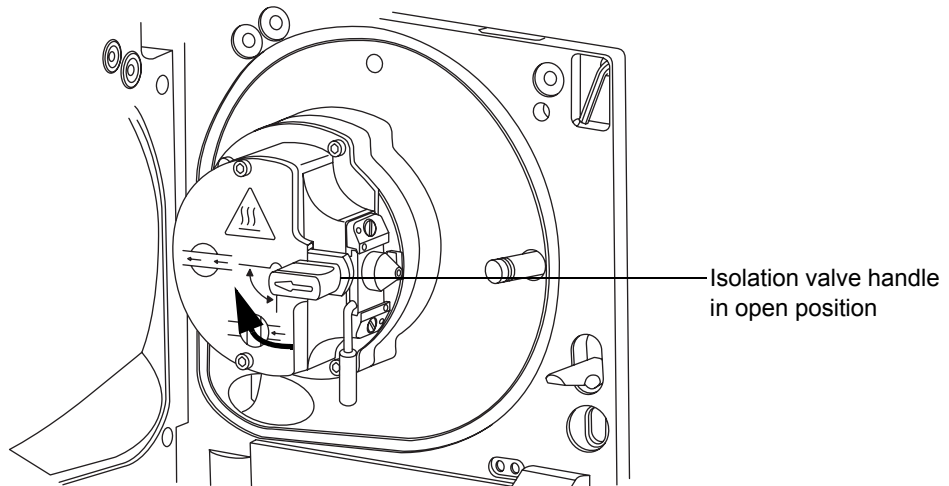
**Warning:** The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



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

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

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



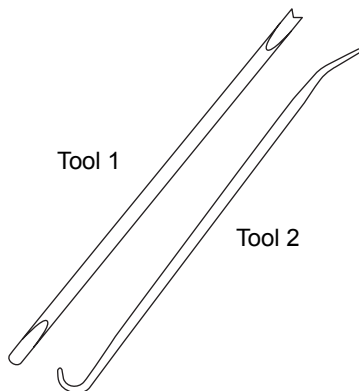
2. Close the source enclosure.

## 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 accompanies the instrument.

### O-ring removal kit



## To remove an O-ring



**Caution:** When removing an O-ring or seal from a component, be careful not to scratch the component with the removal tool.

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 mass spectrometer case

---



**Caution:** Do not use abrasives or solvents to clean the instrument's case.

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

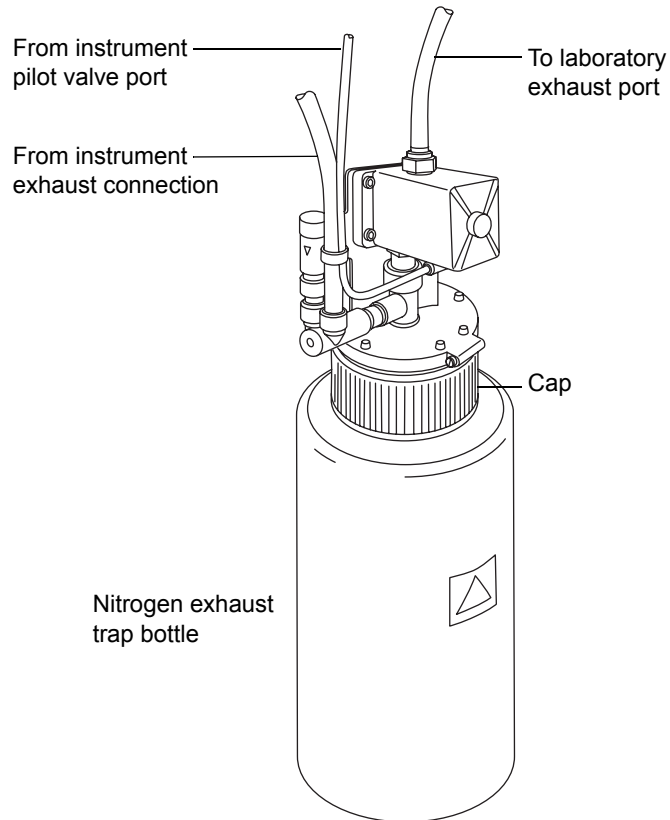


# Emptying the nitrogen exhaust trap bottle

---

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

## 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.



**Warning:** The waste liquid in the nitrogen exhaust trap bottle comprises ACQUITY UPLC solvents and samples. Always wear chemical-resistant, powder-free gloves while handling it.

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



**Warning:** The waste liquid can be contaminated with biohazardous and/or toxic materials. Dispose of it according to local environmental regulations.

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

**Tip:** An automatic pressure test is performed.

8. In the Instrument Console, click Start Flow .

## Cleaning the source components

---

Clean the sample cone and cone gas nozzle (see [page 5-21](#)) 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, also clean the extraction cone (see [page 5-31](#)).

If cleaning the extraction cone fails to increase signal sensitivity, clean the ion block and isolation valve (see [page 5-38](#)).

If cleaning the ion block and isolation valve fails to increase signal sensitivity, also clean the source T-Wave ion guide assembly (see [page 5-49](#)).

## 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

## To remove the sampling cone assembly from the source



**Warning:** The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



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



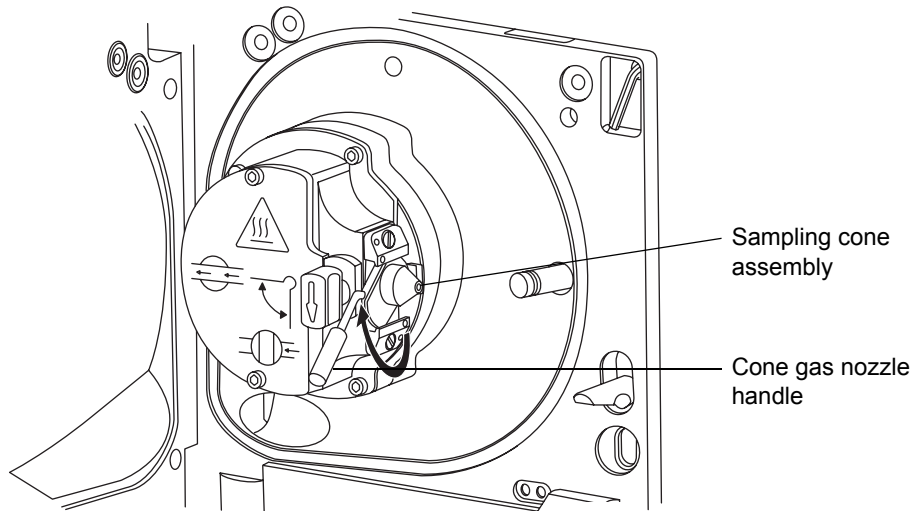
**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:


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



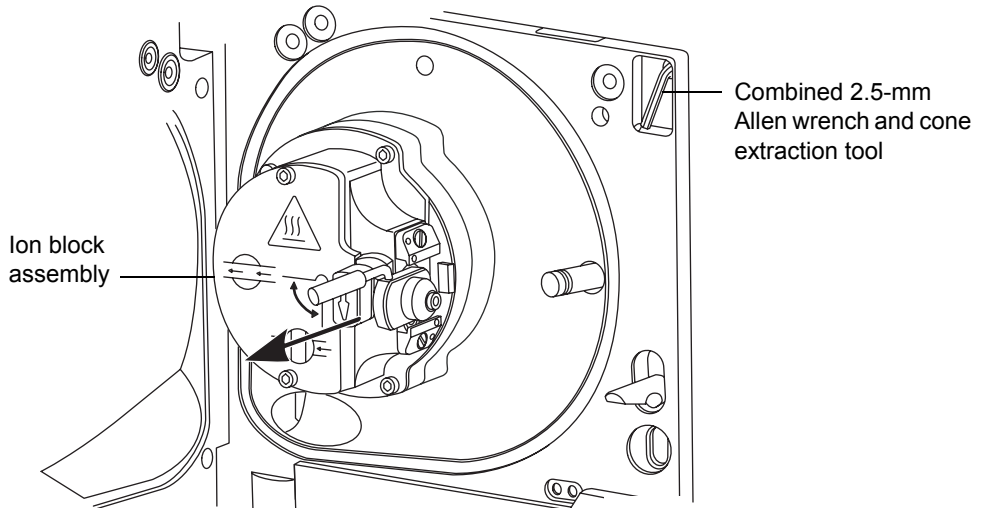
**Warning:** The source can be hot. To avoid burn injuries, take great care while working with the source enclosure open.

1. Close the source isolation valve (see [page 5-15](#)).
2. Grasp the cone gas nozzle handle, and use it to rotate the sampling cone assembly 90 degrees, moving the handle from the vertical to the horizontal position.



 **Caution:** 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

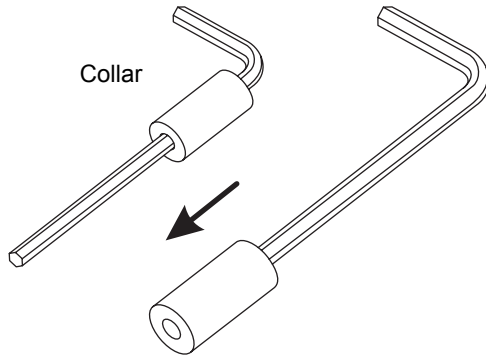
- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool

### To disassemble the sampling cone assembly

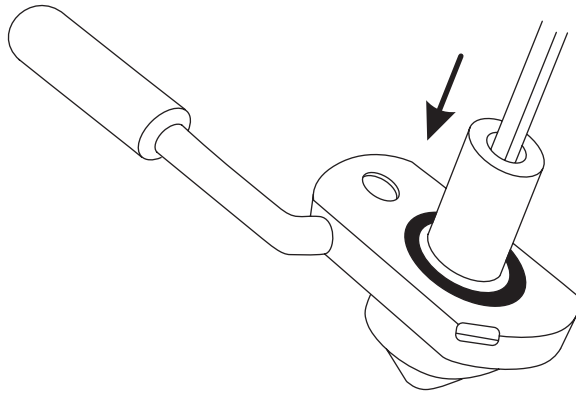


**Warning:** The sampling cone assembly can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

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.



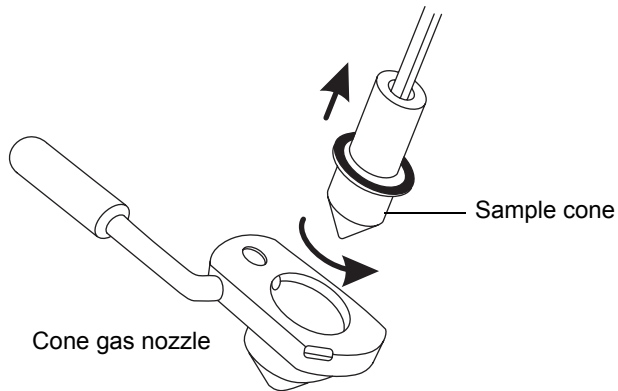
3. Insert the collar in the sample cone.



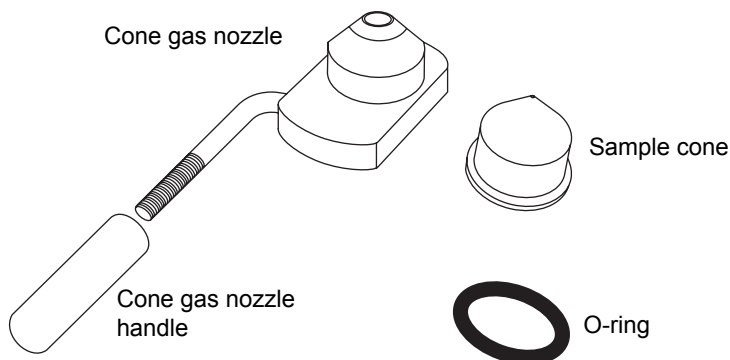


**Caution:** The sample cone is fragile. Never place it on its tip; always place it on its flanged base.

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



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:** The O-ring can be contaminated with biohazardous and/or toxic materials. Dispose of it 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.



## To clean the sample cone and cone gas nozzle



**Warning:** The sample cone and cone gas nozzle can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



**Warning:** Formic acid is extremely corrosive and toxic. Work with extreme care. Use a fume hood and suitable protective equipment.



**Caution:** The sample cone is fragile. Never place it on its tip; always place it on its flanged base.

1. If the sample cone contains debris, place a drop of formic acid on its orifice.
2. Immerse the sample cone, 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.



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

4. Carefully remove the components from the vessels, and blow-dry them with inert, oil-free gas.

5. Inspect each component for persisting contamination. If contamination is present, do as follows:
  - a. Using the wash bottle containing 1:1 methanol/water, rinse the component over the large beaker.
  - b. Blow-dry the component with inert, oil-free gas.
6. Inspect each component for persisting contamination.

**Requirement:** If contamination is present, repeat the cleaning procedure. If contamination is still present, dispose of the component, and obtain a new one before reassembling the sampling cone assembly.

## Assembling the sampling cone assembly

### Required materials

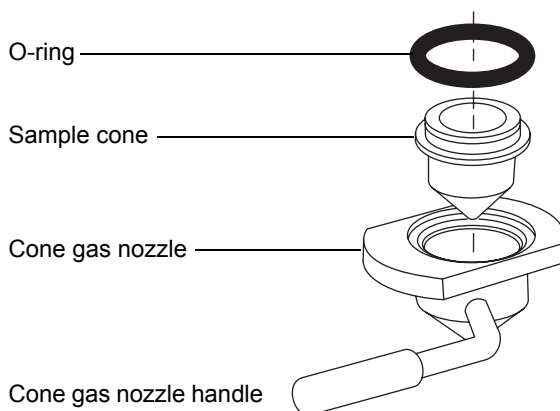
Chemical-resistant, powder-free gloves

### To assemble the sampling cone assembly



#### Caution:

- To avoid recontaminating the sampling cone assembly, wear clean chemical-resistant, powder-free gloves during this procedure.
  - The sample cone is fragile. Never place it on its tip; always place it on its flanged base.
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

### To fit the sampling cone assembly to the source



**Warning:** The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



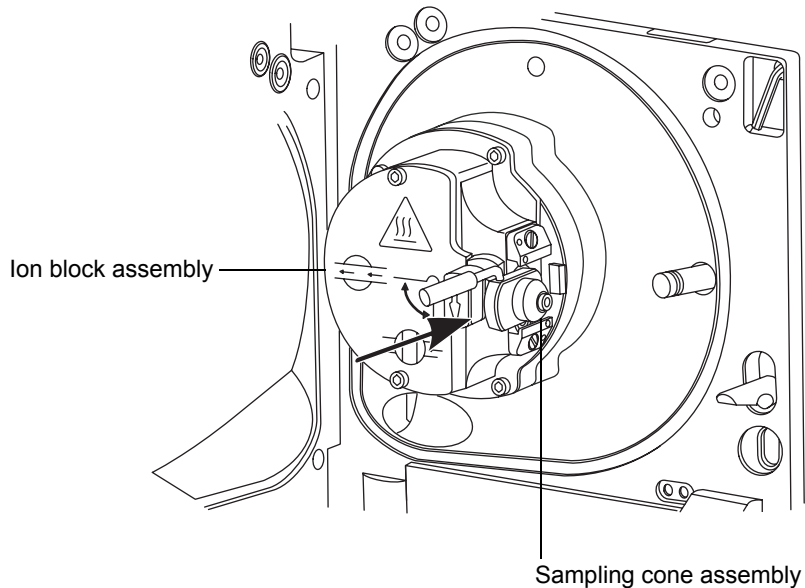
**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

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



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

1. Ensure that the source isolation valve is in the closed position (see [page 5-15](#)).
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 5-16](#)).
5. Close the source enclosure.

## Cleaning the extraction cone

---

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

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

#### Required materials

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

#### To remove the ion block assembly



**Warning:** The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Vent and shut down the mass spectrometer. See the mass spectrometer's online Help for details.



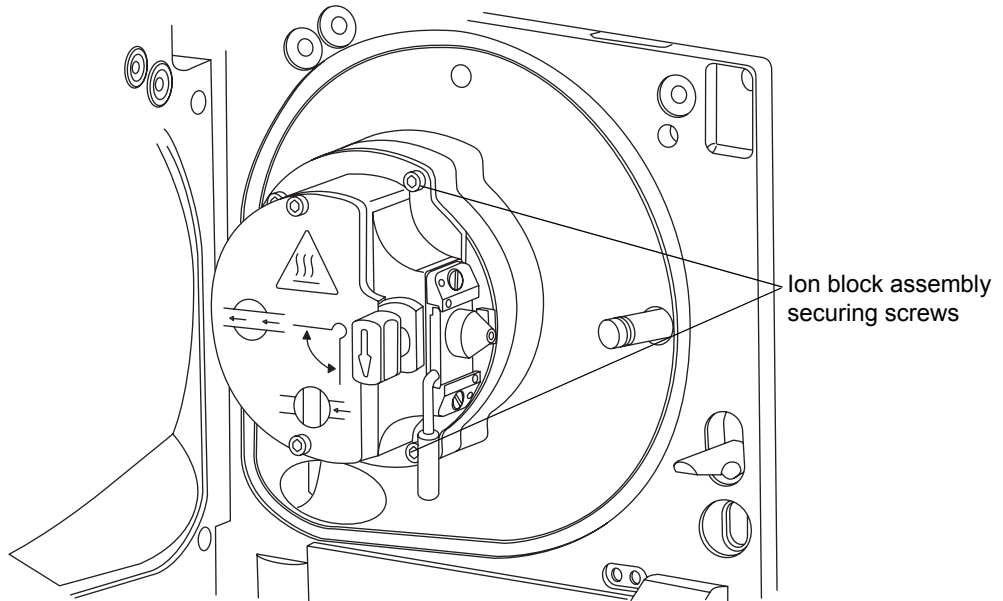
**Warning:** The source can be hot. To avoid burn injuries, allow it to cool for at least 30 minutes before proceeding.



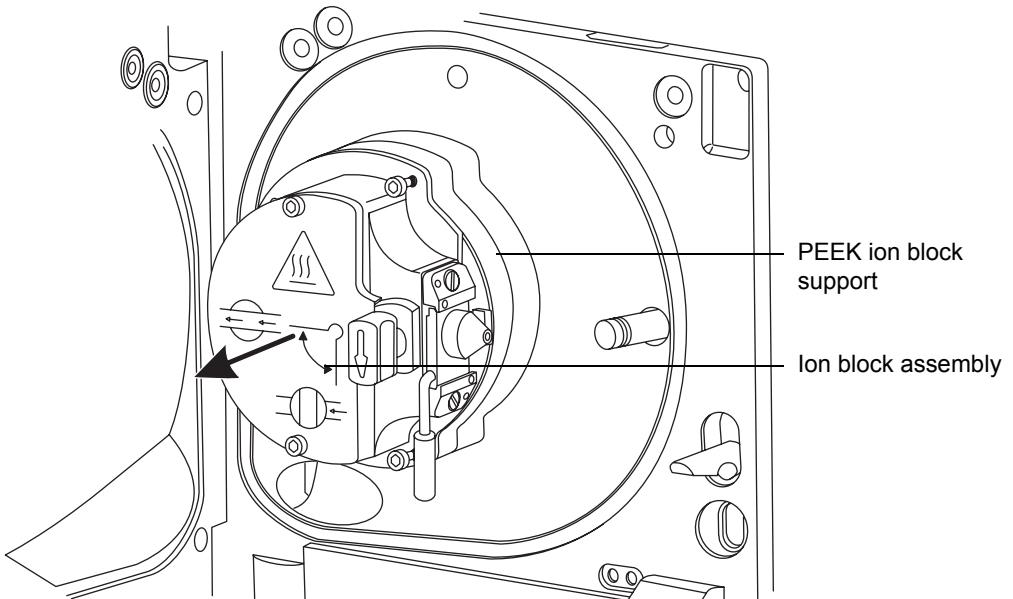
**Warning:** To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

- An ESI probe is fitted (the probe tip is sharp).
  - A corona pin is fitted (the pin tip is sharp).
2. Open the source enclosure.
  3. 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 4 captive screws that secure the ion block assembly.



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



## Removing the extraction cone from the ion block

### Required materials

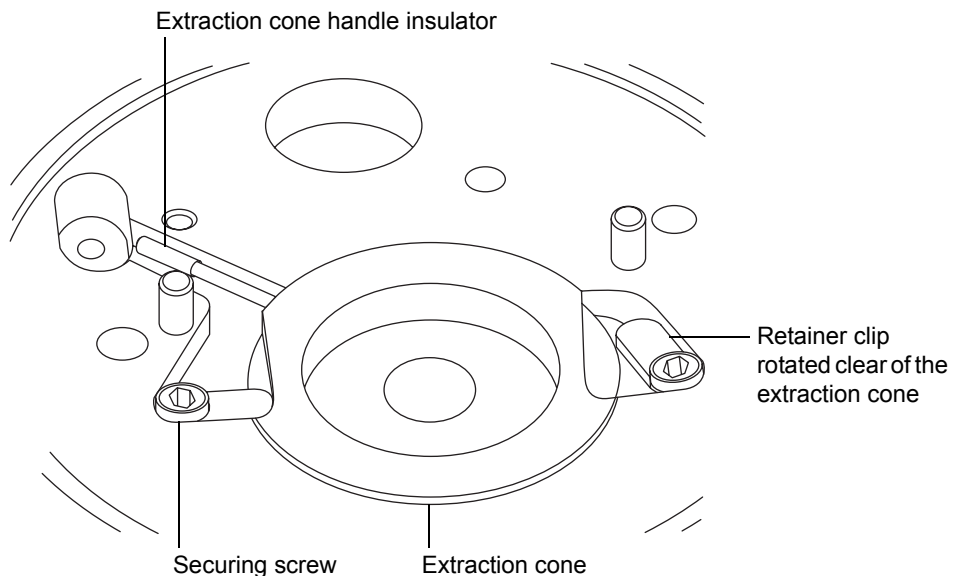
- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool

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



**Warning:** The ion block components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

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

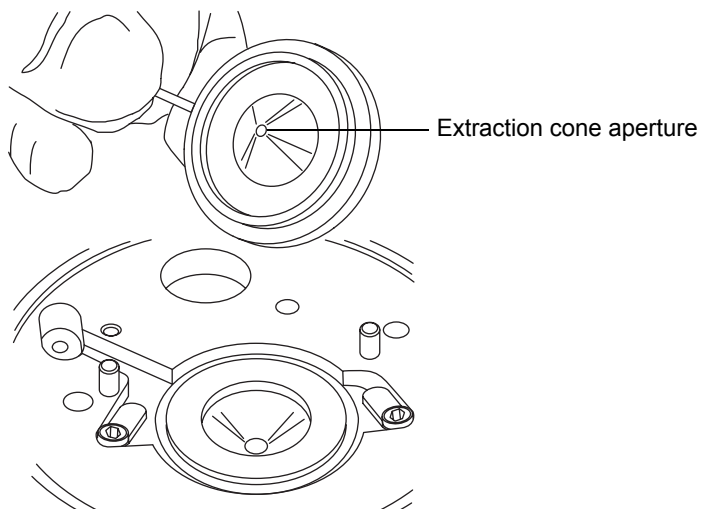




**Caution:**

- Take great care not to damage the extraction cone aperture when removing the extraction cone from the ion block.
- The extraction cone is fragile. Never place it on its tip; always place it on its flanged base.

2. Remove the extraction cone from the ion block.



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

## Cleaning the extraction cone

### Required materials

- Chemical-resistant, powder-free gloves.
- Appropriately sized glass vessel in which to completely immerse the extraction cone when cleaning. Use only glassware not previously cleaned with surfactants.
- HPLC-grade (or better) methanol.
- HPLC-grade (or better) water.
- Formic acid.



- Ultrasonic bath.
- Source of oil-free, inert gas (for example, nitrogen) for drying (air-drying optional).
- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water.
- Large beaker.

### To clean the extraction cone



**Warning:** The extraction cone can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



**Warning:** Formic acid is extremely corrosive and toxic. Work with extreme care, use a fume hood and suitable protective equipment.



**Caution:** The extraction cone is fragile. Never place it on its tip; always place it on its flanged base.

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

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

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

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

- Rinse the extraction cone by immersing it in a glass vessel containing water and then placing the vessel in the ultrasonic bath for 20 minutes.
- Remove any residual water from the extraction cone by immersing it in a glass vessel containing methanol and then placing the vessel in the ultrasonic bath for 10 minutes.



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

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



**Warning:** The extraction cone can be contaminated with biohazardous and/or toxic materials. Dispose of it according to local environmental regulations.

5. Inspect the extraction cone for persisting contamination.

**Requirement:** If contamination is present, repeat the cleaning procedure. If contamination is still present, dispose of the extraction cone, and obtain a new one.

## Fitting the extraction cone to the ion block

### Required materials

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

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



**Warning:** The ion block can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

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

## 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

### To fit the ion block assembly to the source assembly



**Warning:** The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



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

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



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

1. Fit the ion block assembly to the PEEK ion block support.
2. Using the combined 2.5-mm Allen wrench and cone extraction tool, fit and then slowly tighten the 4 screws that secure the ion block assembly sequentially and in small increments.
3. Replace the combined 2.5-mm Allen wrench and cone extraction tool in its storage location on the source adaptor housing.
4. Ensure that the source isolation valve is closed (see [page 5-15](#)).
5. Close the source enclosure.

## Cleaning the ion block assembly

---

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

### Disassembling the source ion block assembly

#### Required materials

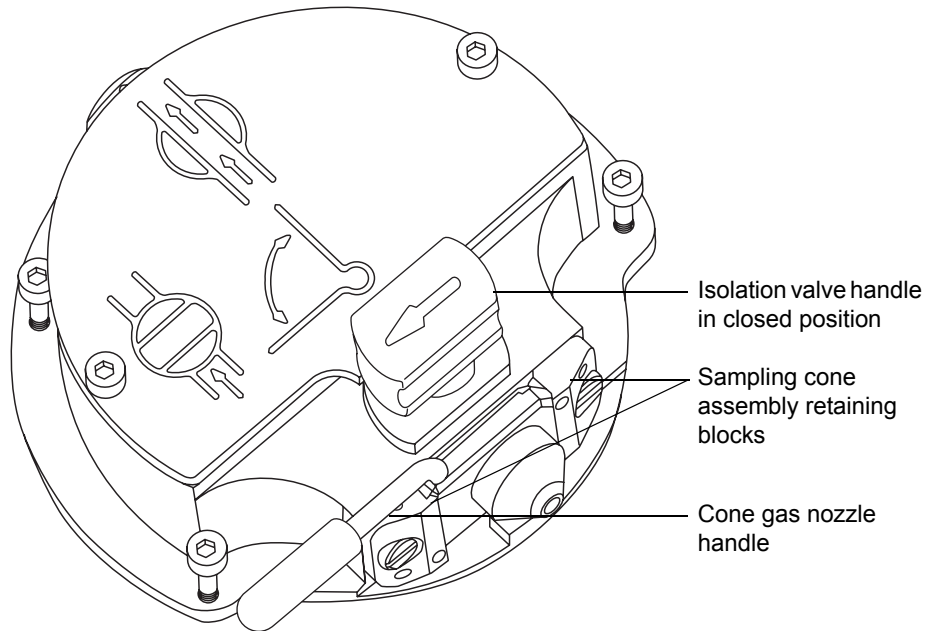
- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool
- O-ring removal kit
- Needle-nose pliers

#### To disassemble the ion block assembly



**Warning:** The ion block assembly can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Remove the ion block assembly from the source assembly (see [page 5-31](#)).
2. Ensure that the isolation valve is closed.



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

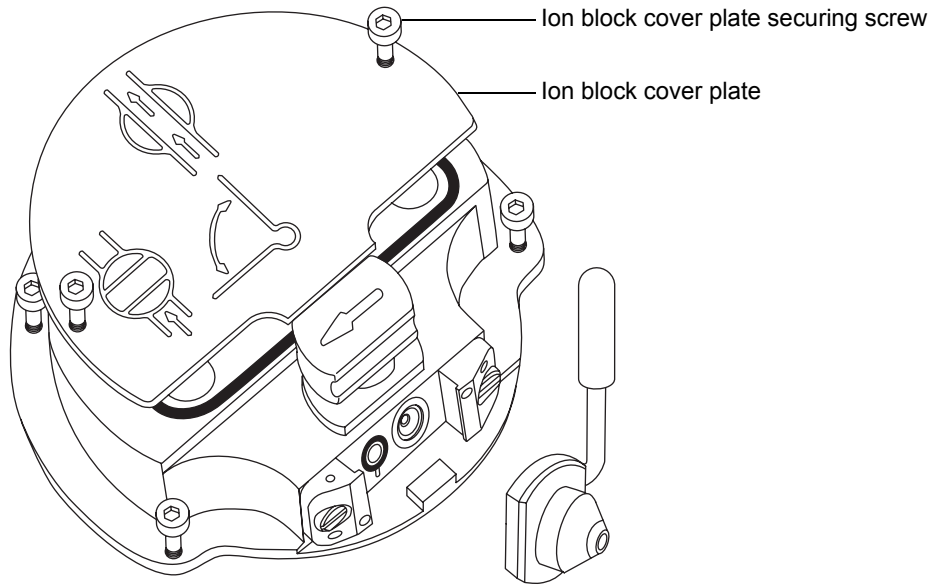


**Caution:** To ensure correct operation of the ion block assembly after reassembly,

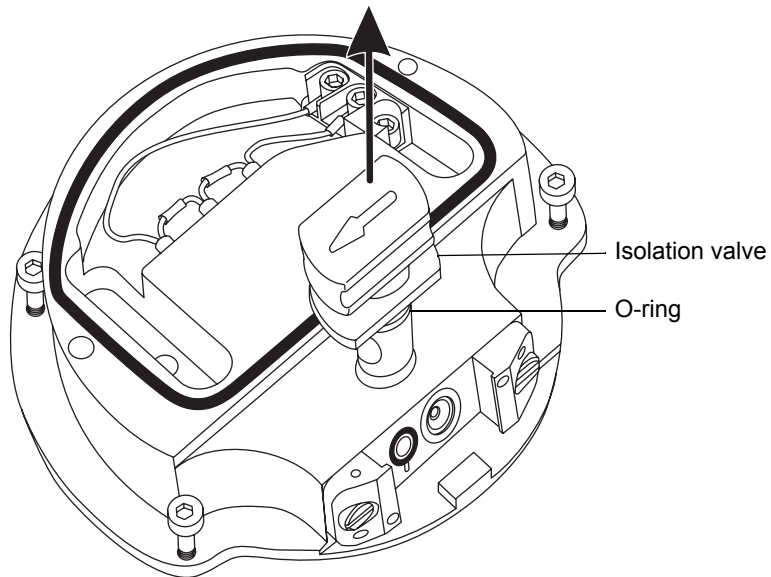
- do not remove the sampling cone assembly retaining blocks.
- do not adjust the screws securing the sampling cone assembly retaining blocks.

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

- Using the combined 2.5-mm Allen wrench and cone extraction tool, loosen the 2 captive screws that secure the ion block cover plate.



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

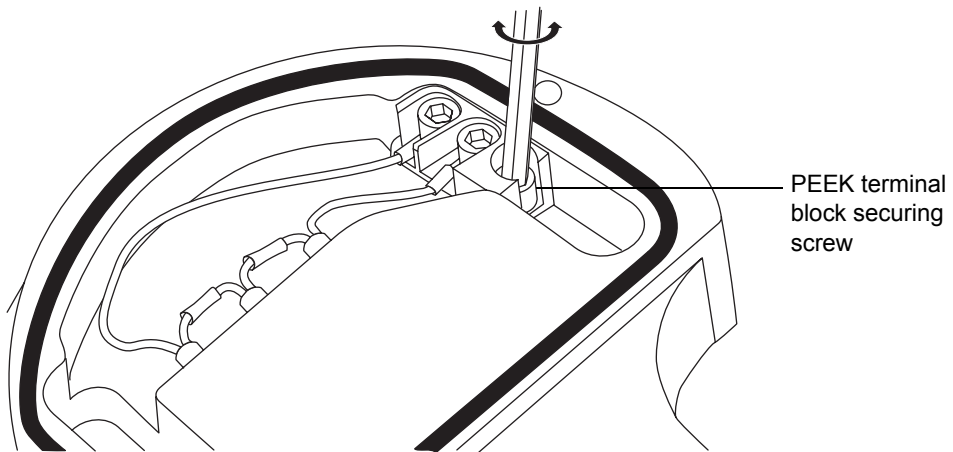


- Using the O-ring removal kit, carefully remove the isolation valve O-ring (see [page 5-17](#)).



**Warning:** The isolation valve O-ring can be contaminated with biohazardous and/or toxic materials. Dispose of it according to local environmental regulations.

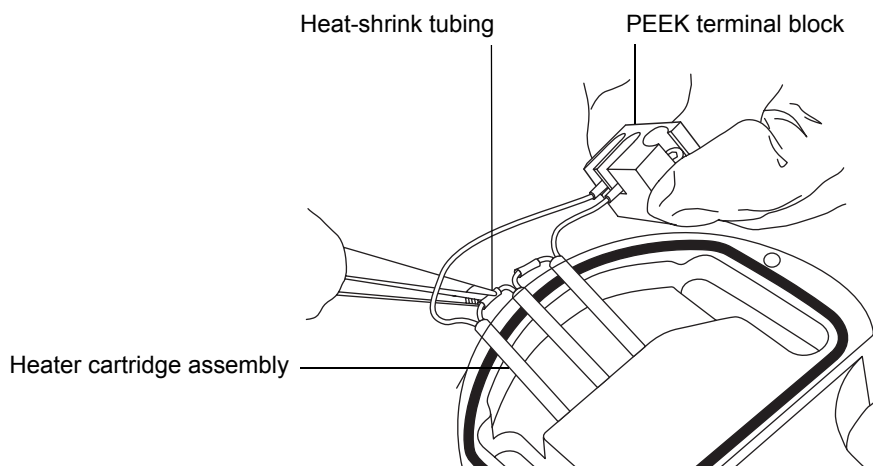
- If the isolation valve O-ring shows signs of deterioration or damage, dispose of it in accordance with local environmental regulations.
- Using the combined 2.5-mm Allen wrench and cone extraction tool, loosen the captive screw that secures the PEEK terminal block.



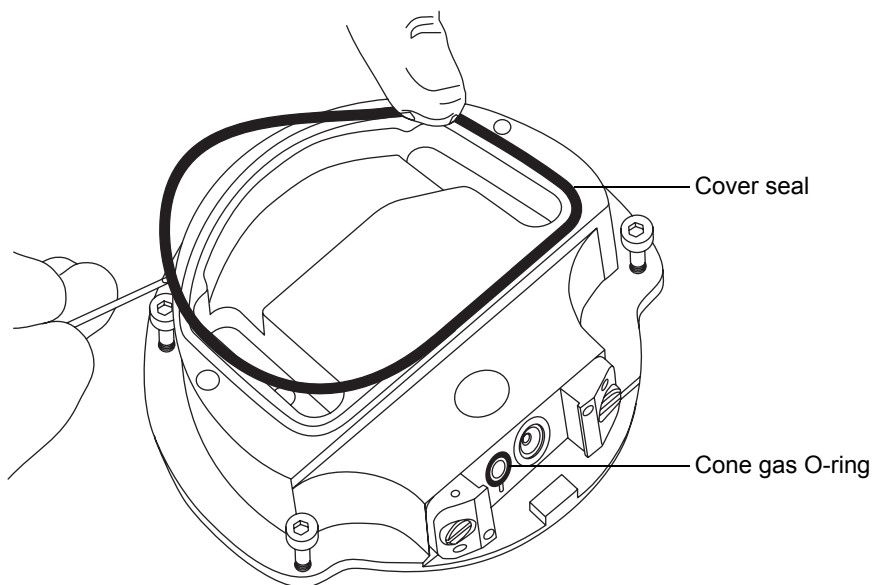
**Caution:** To avoid damaging the heater cartridge assembly wires, do not bend or twist them when removing the assembly from the ion block.

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

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



13. Using the O-ring removal kit, carefully remove the cover seal from the ion block (see [page 5-17](#)).



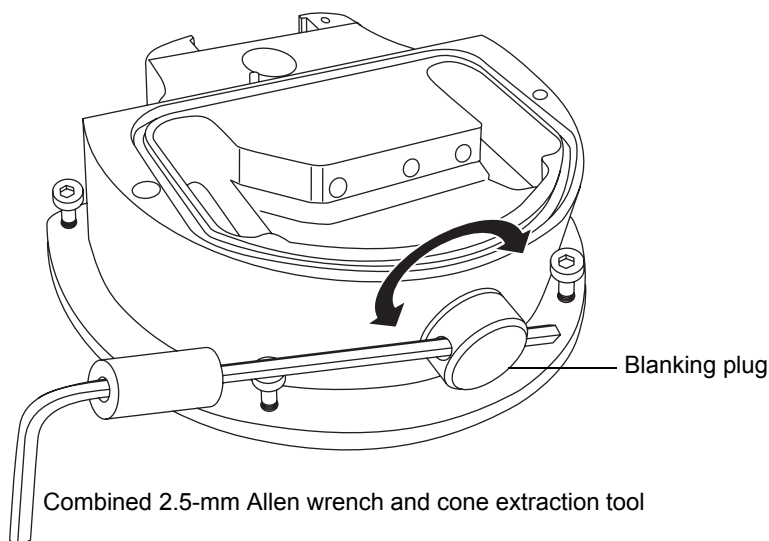


- Using the O-ring removal kit, carefully remove the cone gas O-ring from the ion block.



**Warning:** The cover seal and cone gas O-ring can be contaminated with biohazardous and/or toxic materials. Dispose of them according to local environmental regulations.

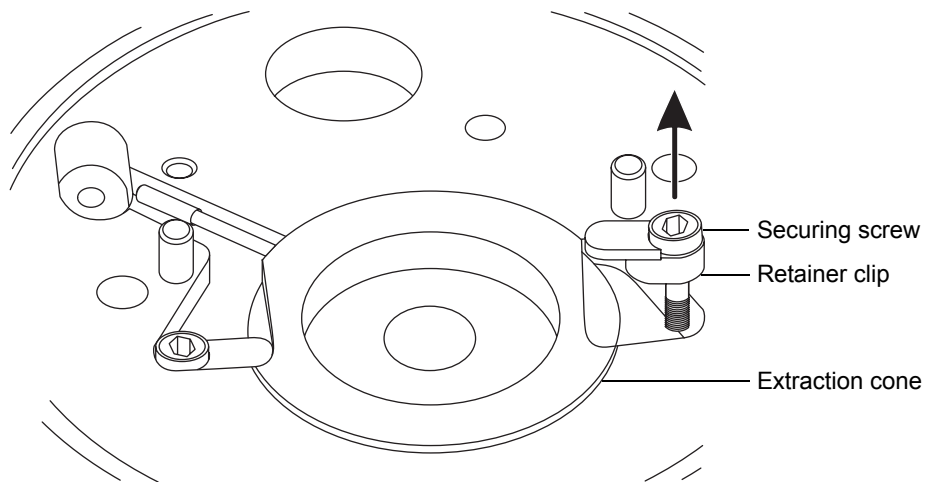
- If the cover seal or cone gas O-ring shows signs of deterioration or damage, dispose of it in accordance with local environmental regulations.
- Insert the combined 2.5-mm Allen wrench and cone extraction tool through the hole in the ion block blanking plug, and then unscrew and remove the ion block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



**Warning:** The blanking plug seal can be contaminated with biohazardous and/or toxic materials. Dispose of it according to local environmental regulations.

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

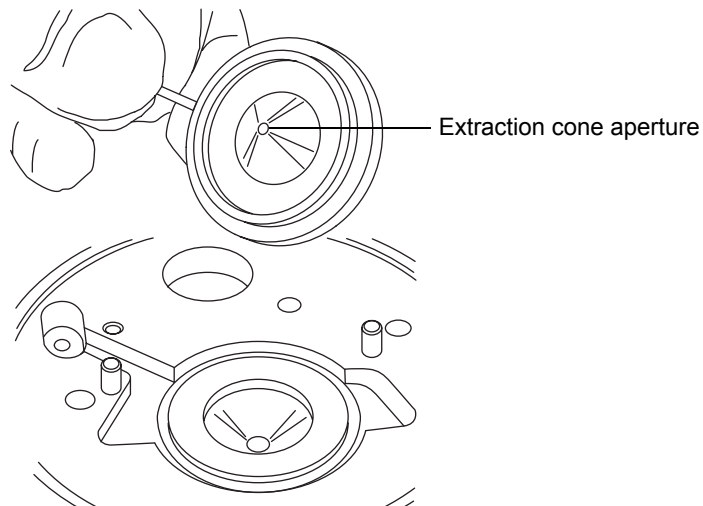
18. Using the combined 2.5-mm Allen wrench and cone extraction tool, remove the captive screws securing the 2 PEEK extraction cone retainer clips.



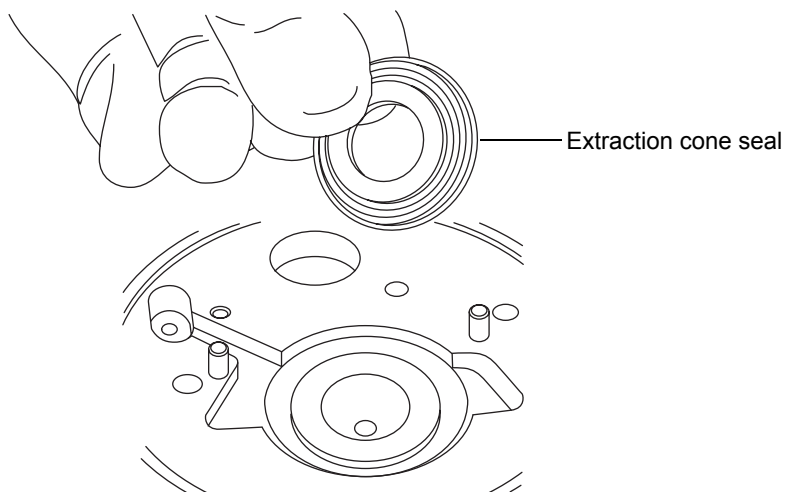
**Caution:**

- Take great care not to damage the extraction cone aperture when removing the extraction cone from the ion block.
- The extraction cone is fragile. Never place it on its tip; always place it on its flanged base.

19. Remove the extraction cone from the ion block.



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



## Cleaning the ion block components

### Required materials

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

## To clean the ion block components



**Warning:** The ion block components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



**Warning:** Formic acid is extremely corrosive and toxic. Work with extreme care, use a fume hood and suitable protective equipment.

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

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

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

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

- Rinse the components by immersing them separately in 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.



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

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

**Requirement:** If contamination is present, do as follows:

- a. Using the wash bottle containing 1:1 methanol/water, rinse the component over the large beaker.
- b. Blow-dry the component with inert, oil-free gas.



**Warning:** The components can be contaminated with biohazardous and/or toxic materials. Dispose of them according to local environmental regulations.

5. Inspect each component for persisting contamination.

**Requirement:** If contamination is present, repeat the cleaning procedure.

If contamination is still present, dispose of the component, and obtain a new one before reassembling the sampling cone assembly.

## Assembling the source ion block assembly

### Required materials

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

### To assemble the ion block assembly



**Caution:**

- To avoid recontaminating the ion block assembly, wear clean chemical-resistant, powder-free gloves during this procedure.
  - The extraction cone is fragile. Never place it on its tip; always place it on its flanged base.
1. Fit the extraction cone seal to the ion block.



**Caution:** Take great care not to damage the extraction cone aperture when fitting the extraction cone to the ion block.

2. Fit the extraction cone handle insulator to the extraction cone handle.
3. Fit the extraction cone to the ion block.
4. Fit the 2 PEEK extraction cone retainer clips to the ion block.

5. Using the combined 2.5-mm Allen wrench and cone extraction tool, tighten the captive screw securing each extraction cone retainer clip to the ion block.
6. Fit the blanking plug O-ring to the ion block blanking plug.  
**Requirement:** Fit a new O-ring, if necessary.
7. Fit the blanking plug to the ion block, and finger-tighten it.
8. Insert the combined 2.5-mm Allen wrench and cone extraction tool through the hole in the blanking plug, and use it to fully tighten the plug.



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

9. Using the needle-nose pliers to gently grasp the heat-shrink tubing on the heater cartridge assembly, slide the assembly and the PEEK terminal block into the ion block.
10. Using the combined 2.5-mm Allen wrench and cone extraction tool, tighten the captive screws that secure the PEEK terminal block.
11. Ensure that the grooves for the cover seal, cone gas O-ring, and isolation valve O-ring are free from dirt and debris.  
**Tip:** If contamination is present, use 1:1 methanol/water, applied to a lint-free cloth, to carefully clean the grooves.
12. Fit the cover seal to the ion block, ensuring that it is correctly seated.  
**Requirement:** Fit a new O-ring, if necessary.
13. Fit the cone gas O-ring to the ion block, ensuring that it is correctly seated.  
**Requirement:** Fit a new O-ring, if necessary.
14. If the old isolation valve O-ring has been disposed of, soak a new O-ring in isopropyl alcohol for a few minutes.  
**Rationale:** Doing so lubricates the O-ring and aids fitting the O-ring.
15. Fit the O-ring to the isolation valve.
16. Fit the isolation valve to the ion block assembly so that it is in the closed position.

17. Fit the ion block cover plate to the ion block assembly, and then, using the combined 2.5-mm Allen wrench and cone extraction tool, tighten the 2 captive screws that secure the ion block cover plate.
18. Hold the sampling cone assembly so that the cone gas nozzle handle is oriented horizontally and at the top, and then slide the sampling cone assembly into the ion block assembly.
19. Grasp the sampling cone assembly handle, and use it to rotate the sampling cone assembly through 90 degrees.
20. Fit the ion block assembly to the source assembly (see [page 5-37](#)).

## **Cleaning the source T-Wave ion guide assembly**

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

### **Removing the T-Wave ion guide assembly from the source assembly**

#### **Required materials**

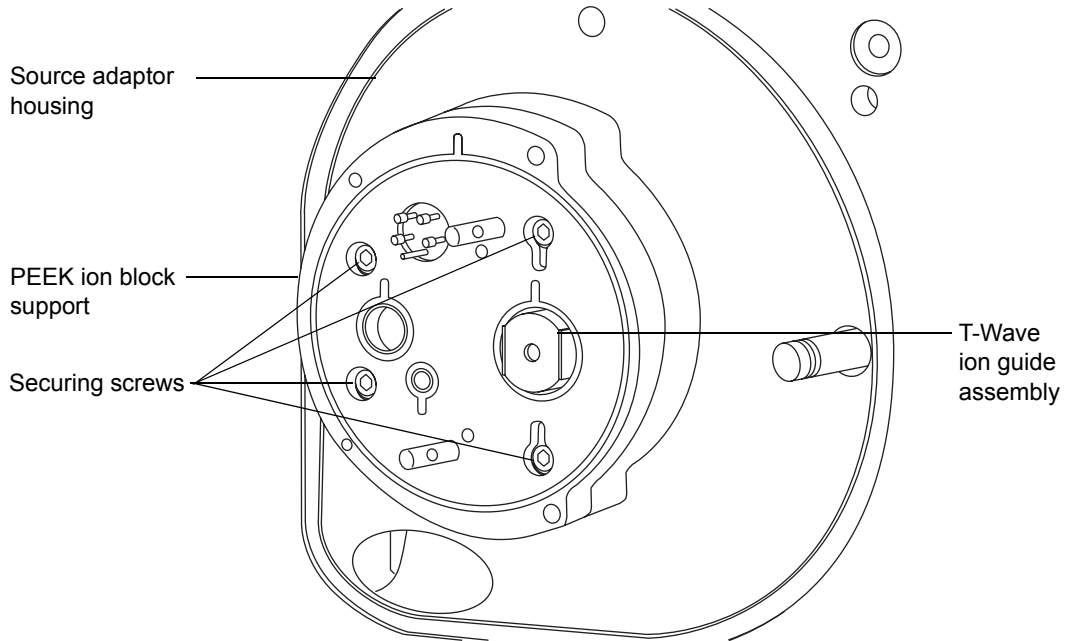
- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool
- 3-mm Allen wrench
- O-ring removal kit

#### **To remove the T-Wave ion guide assembly**



**Warning:** The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Remove the ion block assembly from the PEEK ion block support (see [page 5-31](#)).
2. Using the 3-mm Allen wrench, unscrew and remove the 4 screws securing the PEEK ion block support to the source adaptor housing.



3. Remove the PEEK ion block support from the source adaptor housing.
4. Using the O-ring removal kit, carefully remove all the O-rings from the PEEK ion block support (see [page 5-17](#)).



**Warning:** The O-rings can be contaminated with biohazardous and/or toxic materials. Dispose of them according to local environmental regulations.

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



**Caution:** To avoid damage when removing the T-Wave ion guide assembly from the source adaptor housing, avoid scratching the internal surfaces of the adaptor block.

6. Carefully grasp the T-Wave ion guide assembly and remove it from the source adaptor housing.



# Disassembling the T-Wave ion guide assembly

## Required materials

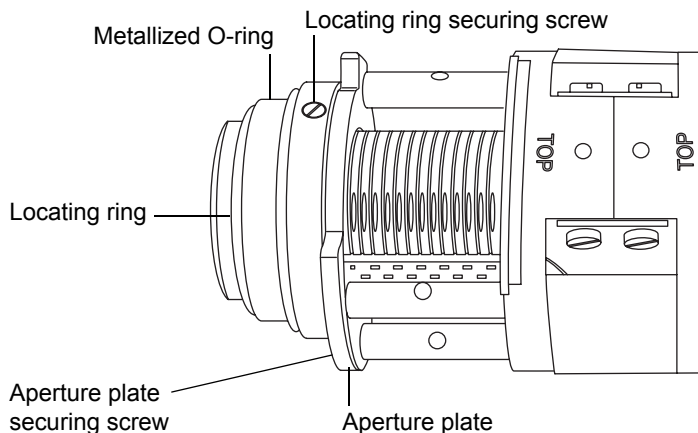
- Chemical-resistant, powder-free gloves
- Jeweler's screwdriver

## To disassemble the T-Wave ion guide assembly



**Warning:** The T-Wave ion guide components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Using the jeweler's screwdriver, remove the 3 screws securing the locating ring to the T-Wave ion guide assembly.



2. Remove the metallized O-ring from the assembly.



**Warning:** The metallized O-ring can be contaminated with biohazardous and/or toxic materials. Dispose of it according to local environmental regulations.

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

3. Remove the locating ring from the assembly.

4. Using the jeweler's screwdriver, remove the 3 screws securing the aperture plate to the assembly.
5. Remove the aperture plate from the assembly.

**Requirement:** Do not further disassemble the T-Wave ion guide.

## Cleaning the T-Wave ion guide assembly aperture plate

### Required materials

- Chemical-resistant, powder-free gloves
- Glass-fiber pen
- Source of oil-free, inert gas (for example, nitrogen).

### To clean the aperture plate



**Warning:** The aperture plate can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Using the glass-fiber pen, gently remove ion burn marks from the aperture plate

**Requirement:** Pay particular attention to the inner surfaces of the aperture plate.

2. Visually inspect the aperture plate to ensure that no fibers from the glass-fiber pen remain on the plate.

**Tip:** If fibers are present, blow them off the aperture plate with inert, oil-free gas.

## Cleaning the T-Wave ion guide

### Required materials

- Chemical-resistant, powder-free gloves
- Wash bottle containing HPLC-grade (or better) methanol
- Large beaker

- Appropriately-sized glass vessel in which to completely immerse the T-Wave ion guide when cleaning
- Requirement:** Use only glassware not previously cleaned with surfactants.
- HPLC-grade (or better) 1:1 methanol/water
  - Ultrasonic bath
  - Source of oil-free, inert gas (for example, nitrogen) for drying (air-drying optional)

### To clean the T-Wave ion guide



**Warning:** The T-Wave ion guide can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



**Caution:** Use only methanol when cleaning the T-Wave ion guide. Use of acetone, chlorinated solvents, or acid will damage the assembly.

1. Using the wash bottle containing methanol, rinse the T-Wave ion guide over the large beaker.
2. Place the T-Wave ion guide in the glass vessel.
3. Add 1:1 methanol/water to the glass vessel until the T-Wave ion guide is immersed completely.
4. Place the glass vessel in the ultrasonic bath for 30 minutes.



**Caution:**

- To avoid recontaminating the T-Wave ion guide, wear clean, chemical-resistant, powder-free gloves for the rest of this procedure.
  - Do not dry the T-Wave ion guide by any method other than blow drying. Otherwise, reintroduced contamination can create difficulty pumping down (evacuating) the instrument.
5. Carefully remove the T-Wave ion guide from the glass vessel.
  6. Blow-dry the T-Wave ion guide with inert, oil-free gas.

## Assembling the T-Wave ion guide assembly

### Required materials

- Chemical-resistant, powder-free gloves
- Jeweler's screwdriver

### To assemble the T-Wave ion guide assembly



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

1. Fit the aperture plate to the T-Wave ion guide assembly.
2. Using the jeweler's screwdriver, fit and tighten the 3 screws securing the aperture plate to the T-Wave ion guide assembly.
3. Fit the locating ring to the T-Wave ion guide assembly.
4. Fit the metallized O-ring to the T-Wave ion guide assembly.

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

5. Using the jeweler's screwdriver, fit and tighten the 3 screws securing the locating ring to the T-Wave ion guide assembly.

## Fitting the T-Wave ion guide assembly, PEEK ion block support, and ion block assembly to the source assembly

### Required materials

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

## To fit the T-Wave ion guide assembly and PEEK ion block support to the source



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



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

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

1. Ensuring that the “Top” labels (stamped on the assembly’s PEEK supports) are uppermost, carefully slide the T-Wave ion guide assembly into the pumping block.
2. Ensure that the grooves for the PEEK ion block support O-rings are free from dirt and debris.

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

3. Fit the O-rings to the PEEK ion block support.

**Requirement:** Fit new O-rings, if necessary.

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

4. Fit the PEEK ion block support to the instrument’s housing.
5. Using the 3-mm Allen wrench, fit and tighten the 4 PEEK screws that secure the ion block support.
6. Fit the ion block assembly to the PEEK ion block support (see [page 5-37](#)).

## Replacing the ESI probe tip and gasket

---

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

## Removing the ESI probe tip and gasket

### Required materials

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

### To remove the ESI probe tip and gasket



**Warning:** The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

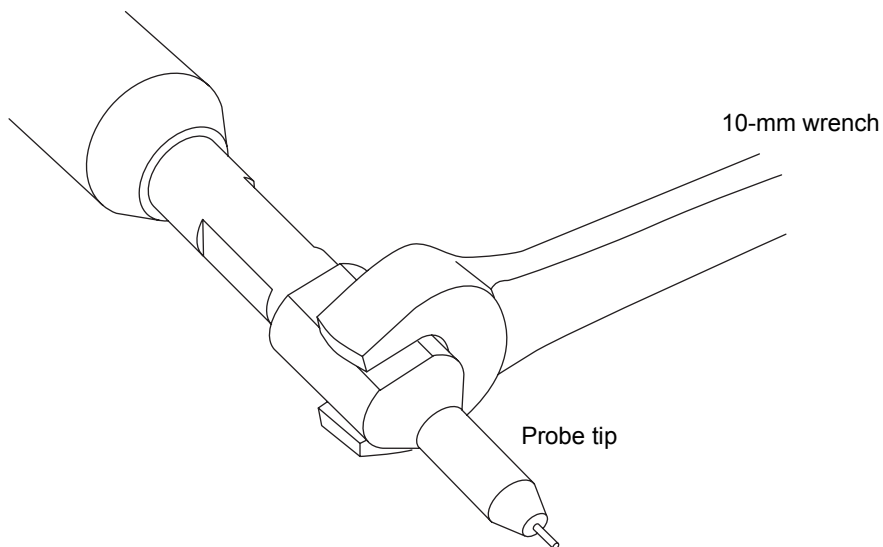


**Warning:** The probe and source can be hot. To avoid burn injuries, take great care while performing this procedure.

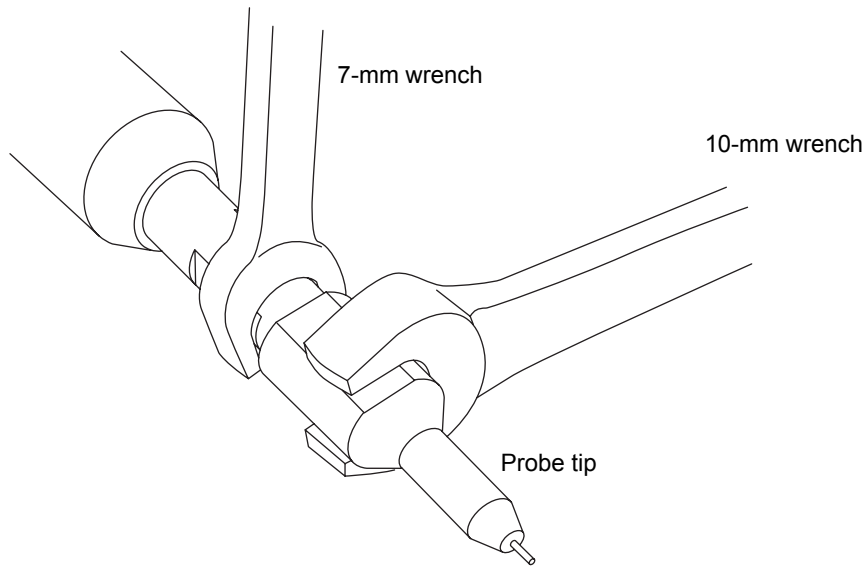


**Warning:** The ESI probe tip is sharp. To avoid puncture wounds, handle the probe with care.

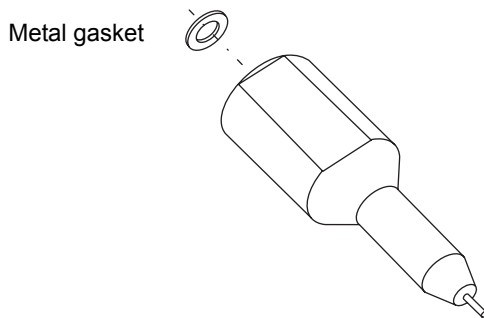
1. Remove the ESI probe from the source (see [page 3-7](#)).
2. Using the 10-mm wrench, remove the probe tip.



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



3. Remove the metal gasket from the probe tip.



**Warning:** The probe tip and metal gasket can be contaminated with biohazardous and/or toxic materials. Dispose of them according to local environmental regulations.

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

## Fitting the ESI probe tip and gasket

### Required materials

- Chemical-resistant, powder-free gloves
- 10-mm wrench
- New metal gasket

### To fit the ESI probe tip and gasket



**Warning:** The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



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

1. Fit the new metal gasket into the probe tip.  
**Requirement:** Use a new probe tip, if necessary.
2. Fit the probe tip over the capillary, and screw the tip onto the probe assembly.



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

3. Using the 10-mm wrench, tighten the probe tip.
4. Using the nebulizer adjuster knob, adjust the capillary so that it protrudes by approximately 0.5 mm from the end of the probe.
5. Fit the ESI probe to the source (see [page 3-2](#)).



## Replacing the ESI probe sample capillary

---

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

### Removing the existing capillary

#### Required materials

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

#### To remove the existing capillary



**Warning:** The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



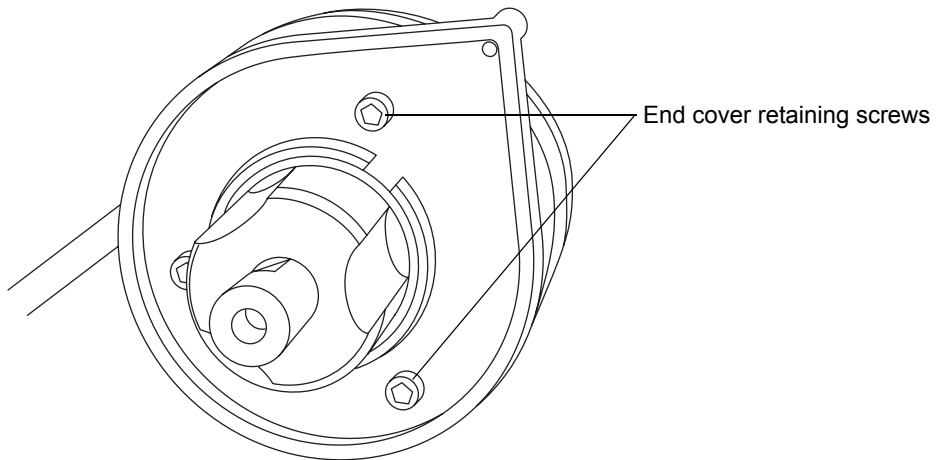
**Warning:** The probe and source can be hot. To avoid burn injuries, take great care while performing this procedure.



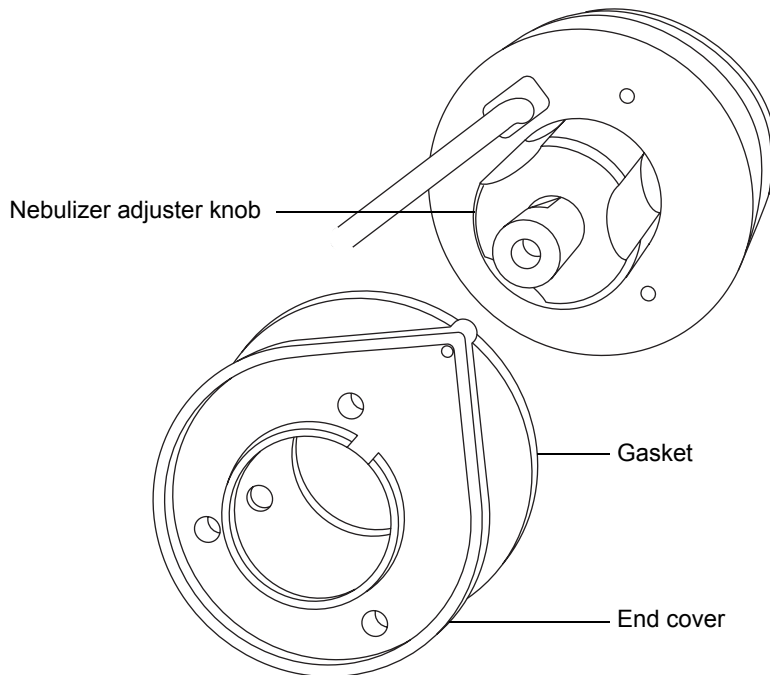
**Warning:** The ESI probe tip is sharp. To avoid puncture wounds, handle the probe with care.

1. Remove the probe from the source (see [page 3-7](#)).
2. 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, remove the 3 probe end cover retaining screws.

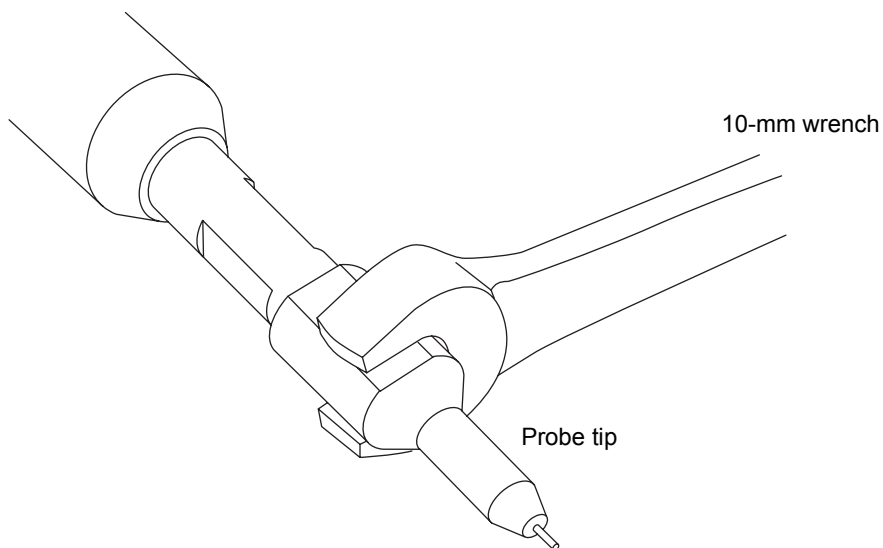


- Remove the end cover and gasket from the probe assembly.

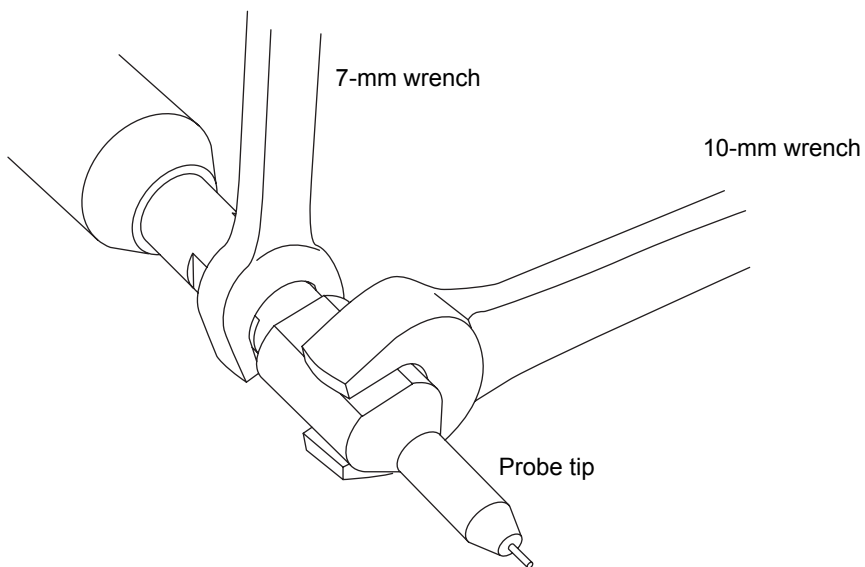


- Unscrew and remove the nebulizer adjuster knob.

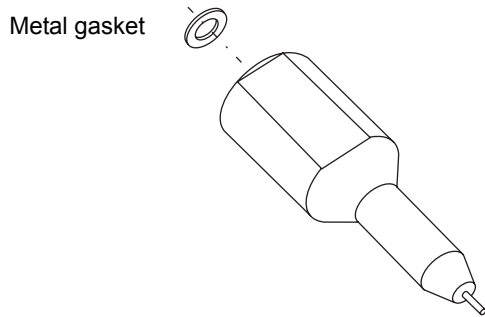
6. Using the 10-mm wrench, remove the probe tip.



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

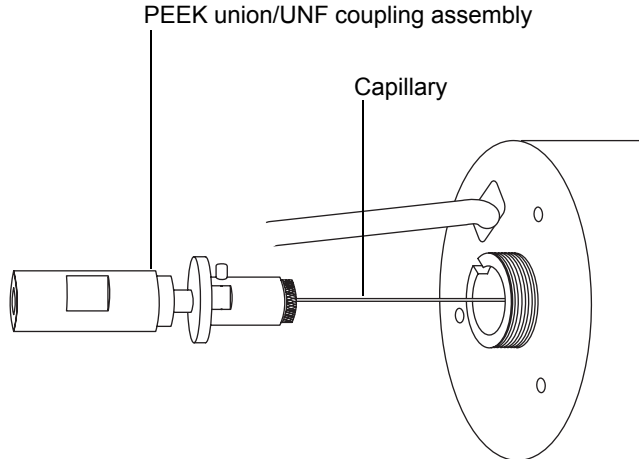


7. Remove the metal gasket from the probe tip.

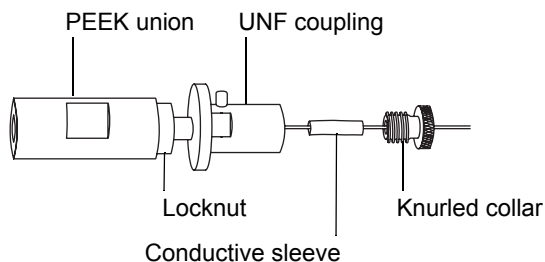


**Warning:** The metal gasket can be contaminated with biohazardous and/or toxic materials. Dispose of it according to local environmental regulations.

8. Dispose of the metal gasket in accordance with local environmental regulations.
9. Remove the PEEK union/UNF coupling assembly and capillary from the probe.



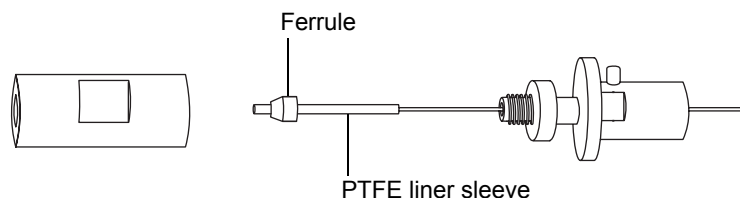
10. Unscrew and remove the knurled collar from the UNF coupling.



11. Remove the knurled collar and conductive sleeve from the capillary.
12. Using the 7-mm wrench, loosen the locknut.

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

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



14. Remove the ferrule and PTFE liner sleeve from the capillary.
15. Remove the capillary from the UNF coupling.



**Warning:** The capillary, PTFE liner sleeve, and ferrule can be contaminated with biohazardous and/or toxic materials. Dispose of them according to local environmental regulations.

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

## Installing the new capillary

### Required materials

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

### To install the new capillary



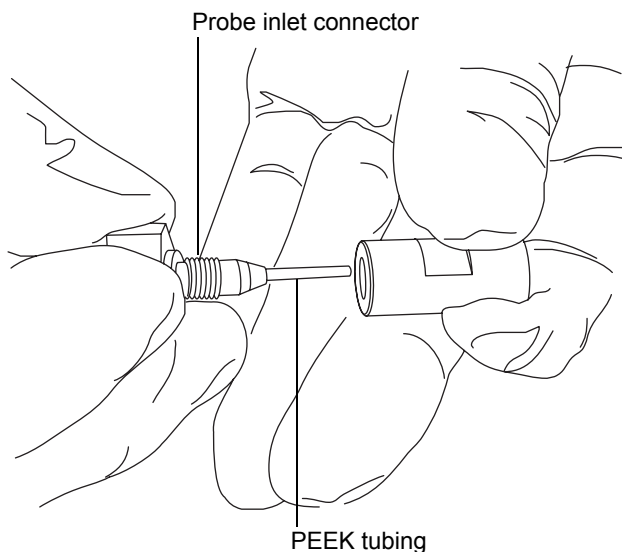
**Warning:** The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



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

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

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

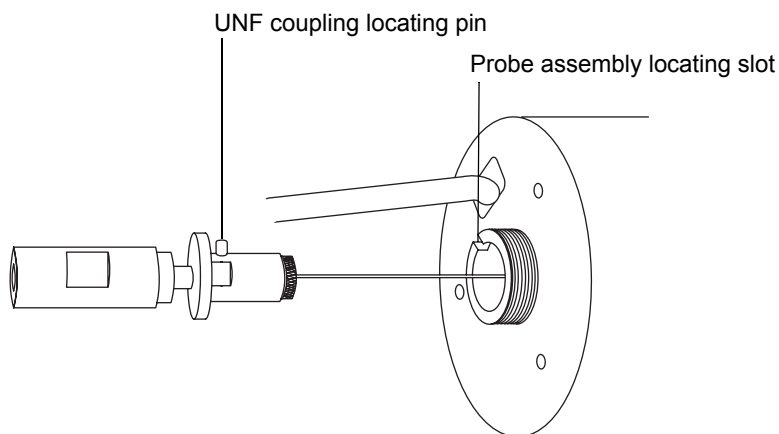


3. Fit the UNF coupling to the new capillary.
4. Using the needle-nose pliers, slide a new liner sleeve and ferrule onto the capillary.
5. Insert the capillary in the PEEK union, and ensure that it is fully seated.
6. Screw the UNF coupling into the PEEK union, finger-tight only.
7. Gently tug on the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



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

11. Perform a leak test by attaching the free end of the PEEK tubing to an LC pump and pumping 50:50 acetonitrile/water through it, at 1 mL/min.
  - If leakage occurs, disassemble and remake the connection, and repeat the leak test.
  - If the backpressure on the LC pump is high, replace the capillary, and repeat the leak test.
12. When no leakage occurs and the backpressure on the LC pump is normal, disconnect the PEEK tubing from the LC pump.
13. Remove the probe inlet connector and PEEK tubing from the PEEK union.
14. Carefully thread the capillary through the probe assembly.
15. Carefully push the PEEK union/UNF coupling assembly and capillary into the probe assembly so that the locating pin on the UNF coupling is fully engaged in the locating slot at the head of the probe assembly.



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



19. Using the combined 2.5-mm Allen wrench and cone extraction tool, fit and tighten the 3 probe end cover retaining screws.
20. Fit the metal gasket to the probe tip.
21. Fit the probe tip over the capillary, and screw the tip onto the probe assembly.



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




22. Using the 10-mm wrench, tighten the probe tip.
23. Using the nebulizer adjuster knob, adjust the capillary so that it protrudes by approximately 0.5 mm from the end of the probe tip.
24. Replace the combined 2.5-mm Allen wrench and cone extraction tool in its storage location on the source adaptor housing.
25. Fit the ESI probe to the source (see [page 3-2](#)).

## Cleaning the APCI probe tip

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

### To clean the APCI probe tip

1. On the Instrument Console system tree, click SYNAPT G2 > Manual optimization.
2. On the manual optimization page, click  to stop the liquid flow.
3. Click Gas  to start the desolvation gas flow.
4. Set Desolvation Gas to 650 L/hr.
5. Set APCI Probe Temp to 650 °C.
6. Click Operate .

7. Wait 10 minutes.

**Rationale:** The high APCI probe heater temperature removes any chemical contamination from the probe tip.

8. Click Standby .

## Replacing the APCI probe sample capillary

---

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

### Removing the existing capillary

#### Required materials

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

#### To remove the existing capillary



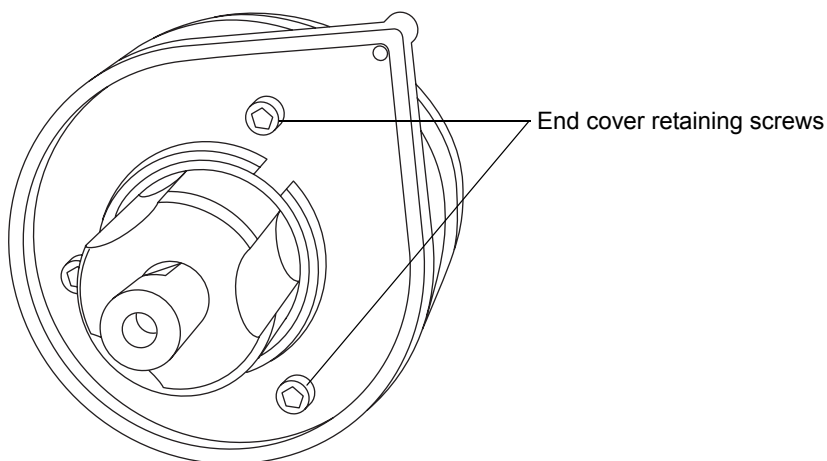
**Warning:** The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



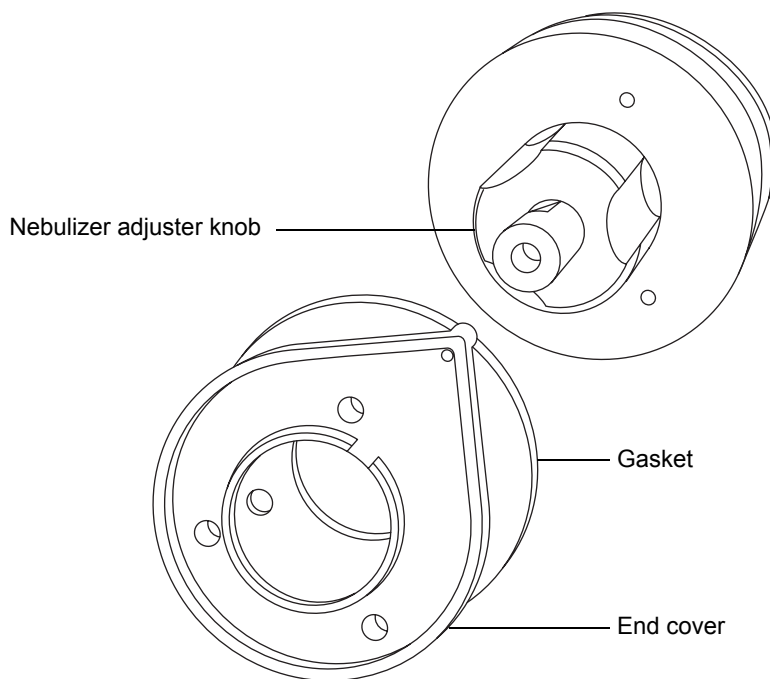
**Warning:** The probe and source can be hot. To avoid burn injuries, take great care while performing this procedure.

1. Remove the probe from the source (see [page 3-18](#)).
2. 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, remove the 3 probe end cover retaining screws.

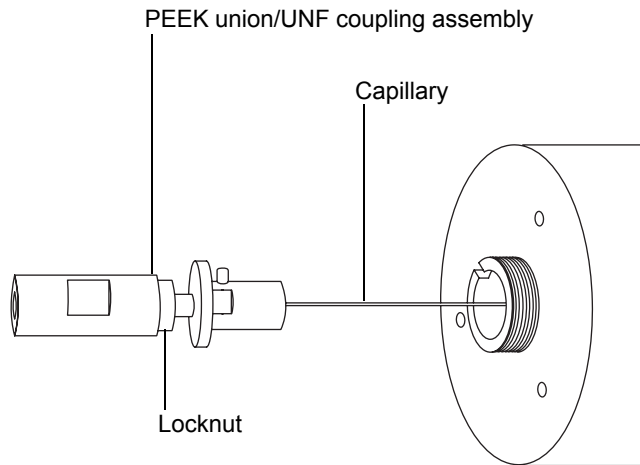


- Remove the end cover and gasket.

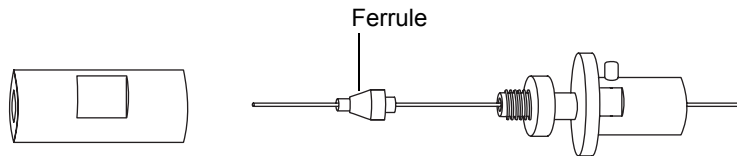


- Unscrew and remove the nebulizer adjuster knob.

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



- Using the 7-mm wrench, loosen the locknut.
- Unscrew the PEEK union from the UNF coupling (this connection is finger-tight only).



- Remove the ferrule from the capillary.
- Remove the capillary from the UNF coupling.



**Warning:** The capillary and ferrule can be contaminated with biohazardous and/or toxic materials. Dispose of them according to local environmental regulations.

- 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

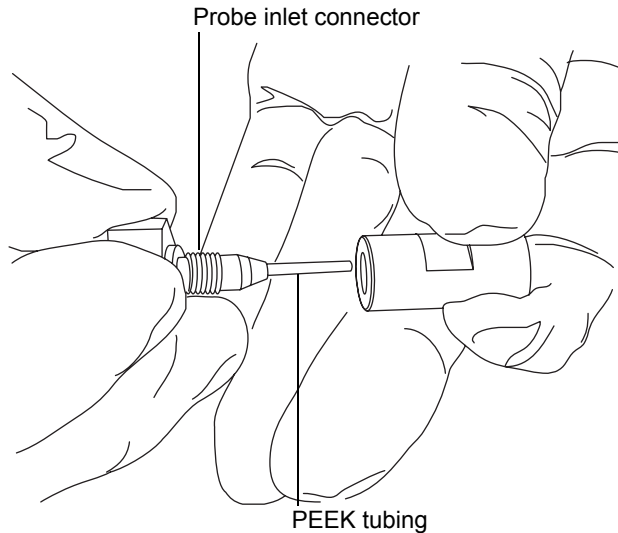
### To install the new capillary



**Warning:** The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

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

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

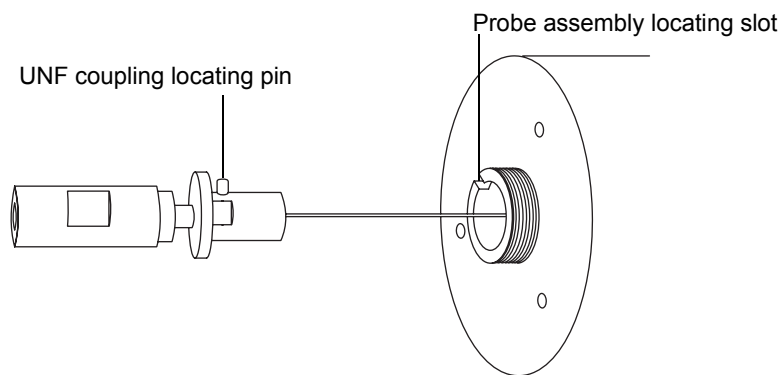


3. Fit the UNF coupling to the new capillary.
4. Using the needle-nose pliers, slide a new ferrule onto the capillary.
5. Insert the capillary in the PEEK union, and ensure that it is fully seated.
6. Screw the UNF coupling into the PEEK union, finger-tight only.
7. Gently tug on the capillary, testing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



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

9. Perform a leak test by attaching the free end of the PEEK tubing to an LC pump and pumping 50:50 acetonitrile/water through it, at 1 mL/min.
  - If leakage occurs, disassemble and remake the connection, and repeat the leak test.
  - If the backpressure on the LC pump is high, replace the capillary, and repeat the leak test.
10. When no leakage occurs and the backpressure on the LC pump is normal, disconnect the PEEK tubing from the LC pump.
11. Remove the probe inlet connector and PEEK tubing from the PEEK union.
12. Remove the probe heater (see [page 5-84](#)).
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. Using the combined 2.5-mm Allen wrench and cone extraction tool, fit and tighten the 3 screws that secure the end cover.

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



**Caution:**

- When handling the probe heater, take great care to grip the heater so as not to damage its electrical wiring.
  - Take great care not to damage the probe heater's electrical connections, capillary sleeve, or capillary when fitting the heater over the capillary sleeve.
21. Fit the probe heater (see [page 5-86](#)).
  22. Fit the probe to the instrument (see [page 3-14](#)).
  23. In the Instrument Console, click API  to start the probe and desolvation gas flows.

## 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



## To remove the existing capillary

1. Prepare the instrument for working on the source (see [page 5-7](#)).

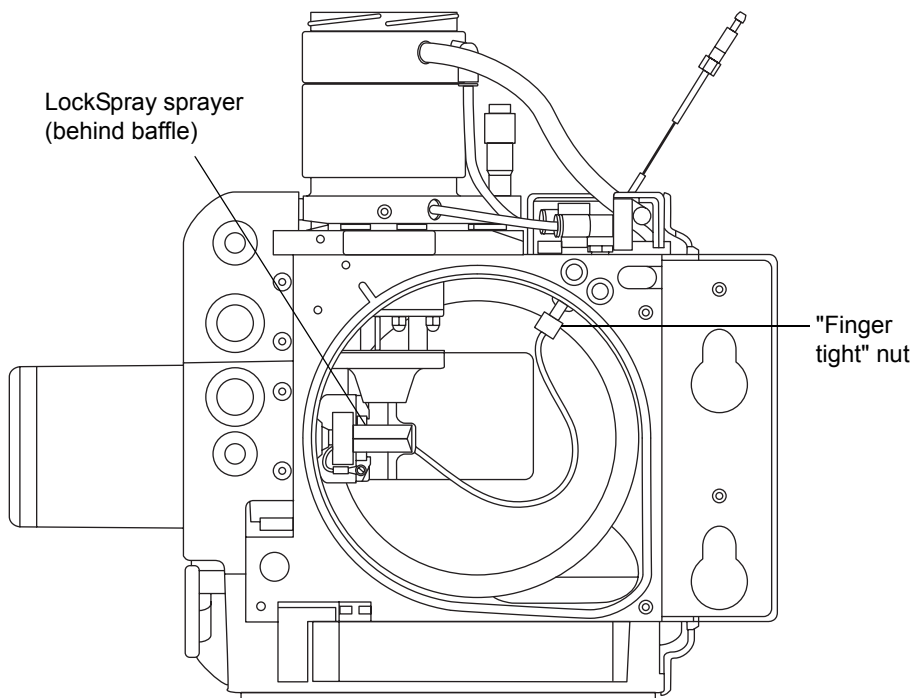


**Warning:** The probe and source can be hot. To avoid burn injuries, take great care while working with these components.

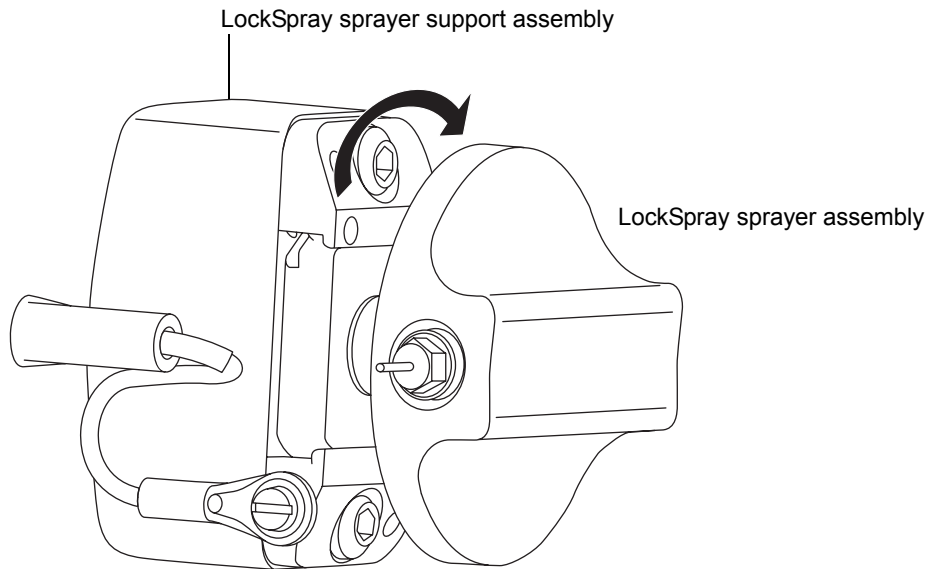


**Warning:** The ESI probe tip is sharp. To avoid puncture wounds, if an ESI probe is fitted to the source, remove the probe before continuing with this procedure.

2. If an ESI probe is fitted to the source, remove it from the source (see [page 3-7](#)).
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 "finger tight" 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:** The capillary can be contaminated with biohazardous and/or toxic materials. Dispose of it 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° counterclockwise to lock it in place.
7. Finger-tighten the nut on the inside of the source enclosure.
8. Close the source enclosure.

## Replacing the NanoLockSpray reference probe capillary

---

Replace the NanoLockSpray reference probe TaperTip™ or capillary if it is irreversibly blocked, or if it is 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

#### To remove the NanoLockSpray reference probe



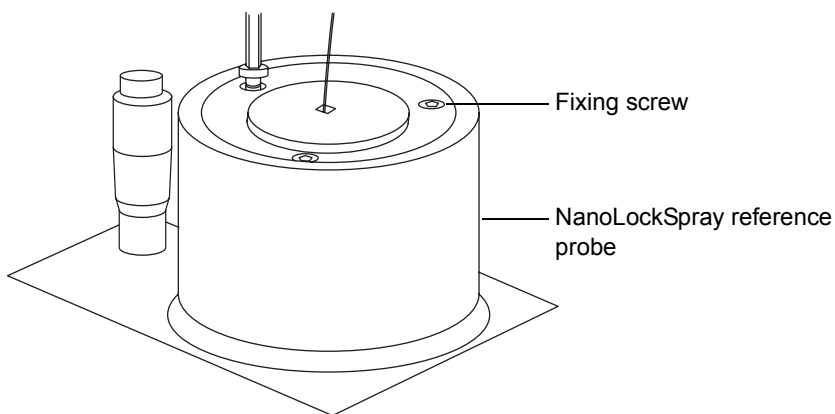
**Warning:** All plumbing connections, the probe, and the source can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



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

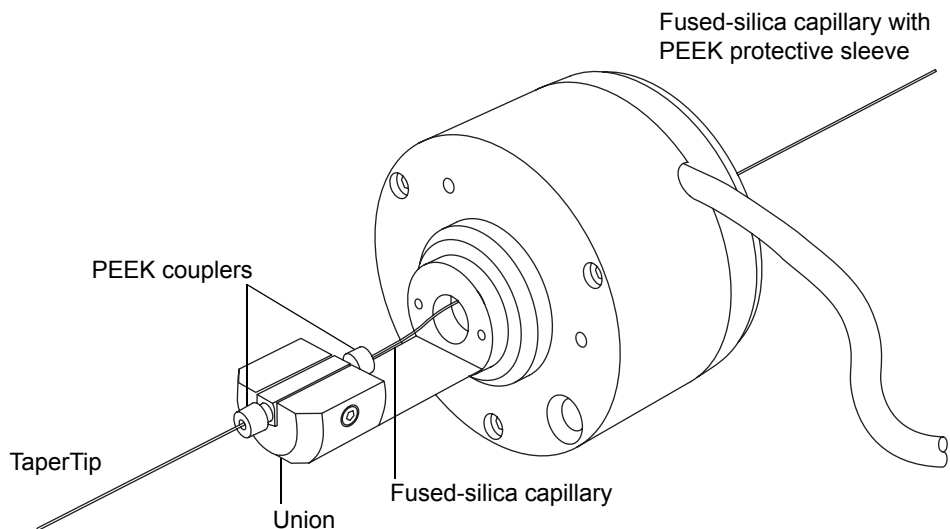
1. Prepare the instrument for work performed on its source (see [page 5-7](#)).
2. Disconnect the reference probe's cable from the instrument's high voltage connector.
3. Disconnect the fused silica capillary from the instrument's IntelliStart Fluidics system.
4. Remove the NanoLockSpray source enclosure from the instrument (see [page 5-8](#)).
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 3 fixing screws from the top of the NanoLockSpray reference probe.



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

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



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



**Warning:** The fused silica capillary can be contaminated with biohazardous and/or toxic materials. Dispose of it according to local environmental regulations.

11. Dispose of the fused silica capillary and TaperTip, 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.

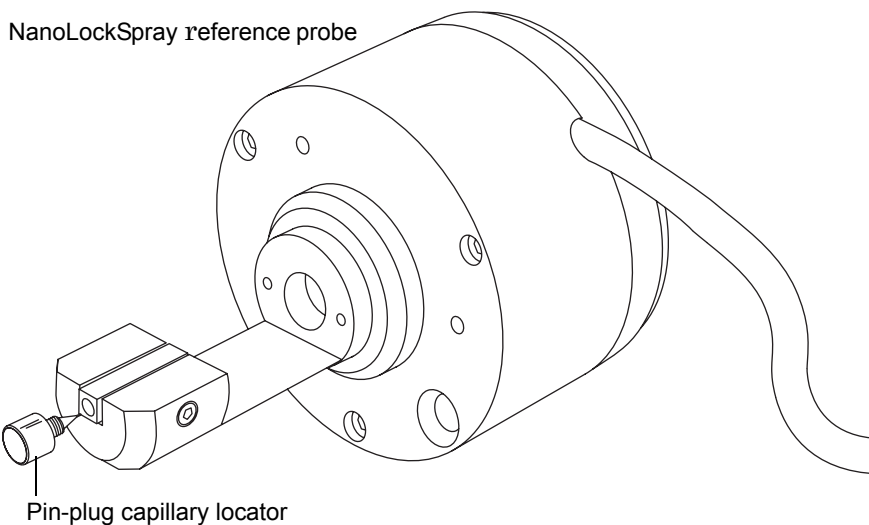
## Installing the new TaperTip and capillary

### Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm Allen wrench and cone extraction tool
- Fused silica cutting tool
- Pin-plug capillary locator
- TaperTip
- 375-mm length of 25- $\mu$ L, fused-silica capillary, sleeved for protection by 0.015-inch ID PEEK tubing
- F-130 "finger tight" nut

## To install the new TaperTip and capillary

1. On the NanoLockSpray reference probe assembly, screw the pin-plug capillary locator into the end of the union block.



2. Thread the capillary through the body of the NanoLockSpray reference probe.
3. Slide a PEEK coupler over the end of the fused-silica capillary.
4. Locate the PEEK coupler in the union, and carefully slide the fused-silica capillary into the union until it butts against the pin-plug capillary locator.

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

5. Tighten the PEEK coupler to hold the capillary in place.
6. Unscrew and remove the pin-plug capillary locator.



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



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

7. Align the PEEK coupler in the end of the union and slide the TaperTip into the union until it butts against the fused-silica capillary.



**Caution:** Overtightening the coupler on the TaperTip crushes it, causing blockages.

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



**Caution:** The fragile TaperTip at the end of the NanoLockSpray reference probe is easily broken during insertion into the source.

9. Mount the NanoLockSpray reference probe on the NanoLockSpray source enclosure.
10. Using the combined 2.5-mm Allen wrench and cone extraction tool, tighten the 3 screws that secure the NanoLockSpray reference probe.
11. Replace the combined 2.5-mm Allen wrench and cone extraction tool in its storage location on the source adaptor housing.
12. Fit the NanoLockSpray source enclosure to the instrument (see [page 5-11](#)).
13. Using an F-130 "finger tight" nut, connect the fused-silica capillary to the grounded union in the instrument's IntelliStart Fluidics system.
14. Connect the NanoLockSpray reference probe's cable to the instrument's high voltage connector.



# 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
- New corona pin

## To clean or replace the corona pin



**Warning:** The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



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



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



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

1. Remove the corona pin from the source (see [page 5-14](#)).
2. Replace the corona pin if it is deformed or otherwise damaged. Otherwise, clean the tip of the pin with the lapping film, and then wipe it clean with a methanol-saturated tissue.



**Warning:** The corona pin can be contaminated with biohazardous and/or toxic materials. Dispose of it according to local environmental regulations.

3. If you are replacing the corona pin, dispose of the old pin in accordance with local environmental regulations.
4. Install the corona pin in the source (see [page 5-12](#)).

# Replacing the APCI probe heater

---

Replace the APCI probe heater if it fails to heat the probe.

## Removing the APCI probe heater

### Required materials

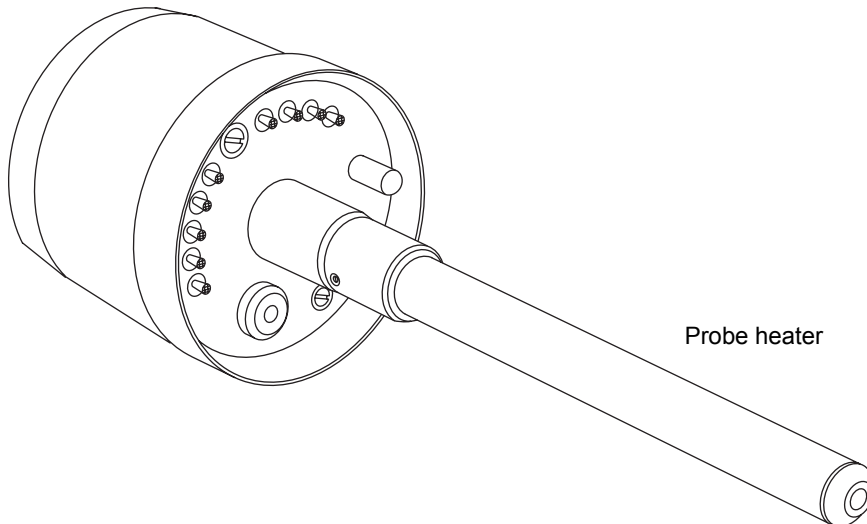
Chemical-resistant, powder-free gloves


### To remove the APCI probe heater



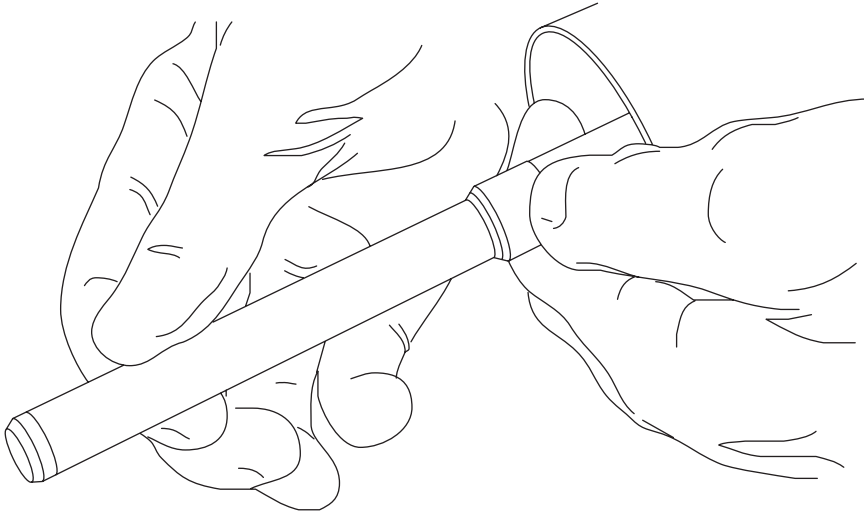
**Warning:** The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.



1. Remove the probe from the source (see [page 3-18](#)).



 **Caution:** 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:** The probe heater can be contaminated with biohazardous and/or toxic materials. Dispose of it according to local environmental regulations.


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

## Fitting the new APCI probe heater

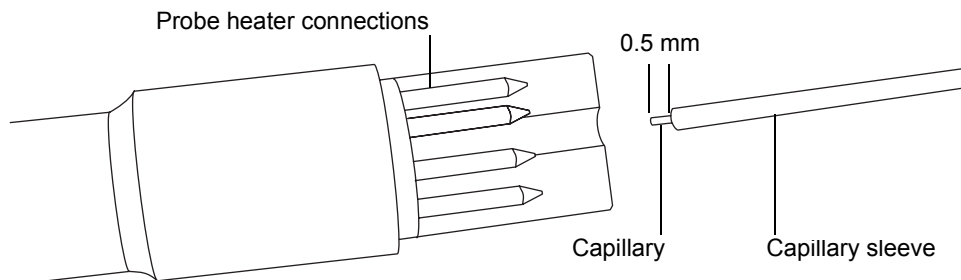
### Required materials

- Chemical-resistant, powder-free gloves
- APCI probe heater


### To fit the new APCI probe heater


 **Caution:** Take great care not to damage the probe heater's electrical connections, the capillary sleeve, or capillary when fitting the heater over the capillary sleeve.

1. Using the probe adjuster knob, adjust the capillary so that it protrudes approximately 0.5 mm from the end of the capillary sleeve.



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

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

3. Fit the probe heater to the probe assembly, ensuring that the heater is fully seated on the probe assembly.
4. Fit the probe heater cover to the probe assembly.
5. Fit the probe to the instrument (see [page 3-14](#)).
6. In the Instrument Console, click API  to start the desolvation gas flow.

# Replacing the ion block source heater

---

Replace the ion block source heater if it fails to heat the ion block.

## Required materials

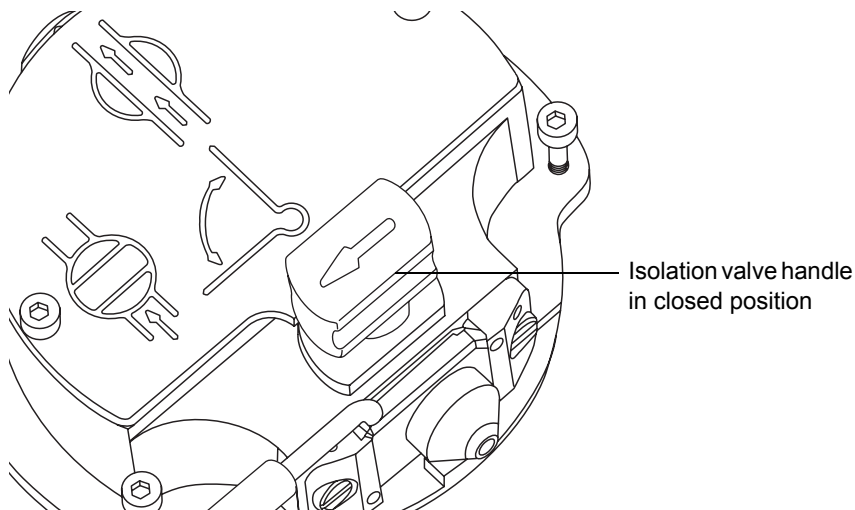
- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- Combined 2.5-mm Allen wrench and cone extraction tool
- Ion block source heater

## To replace the ion block source heater

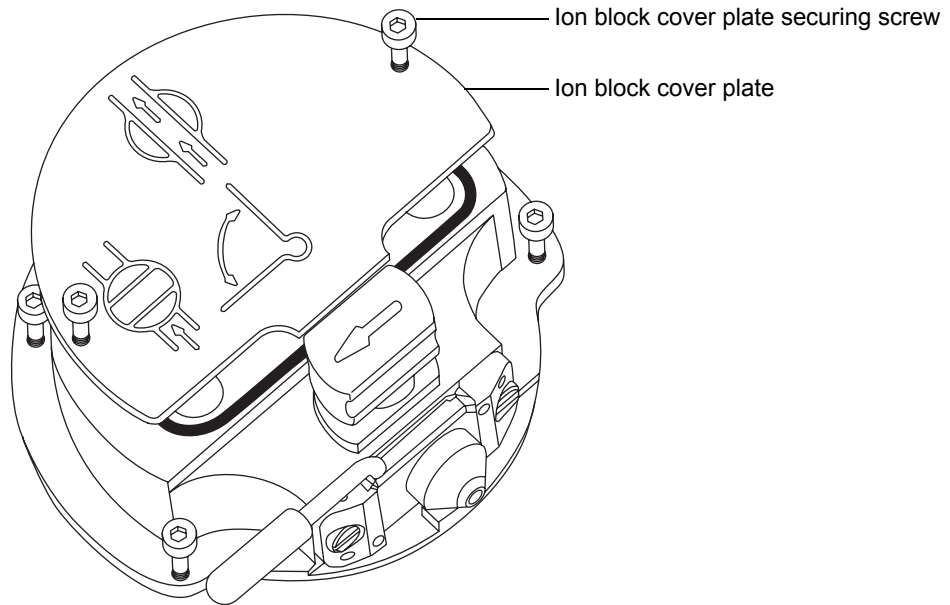


**Warning:** The ion block assembly can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

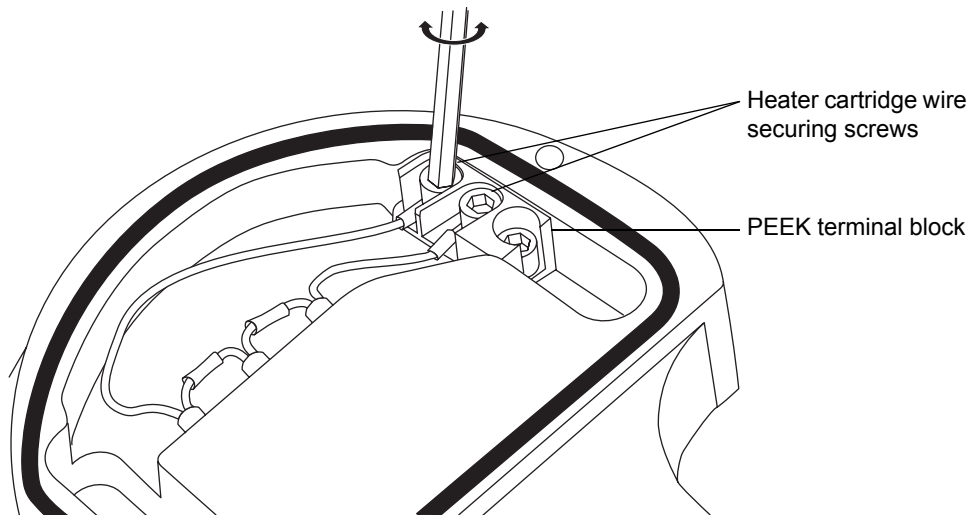
1. Remove the ion block assembly from the instrument (see [page 5-31](#)).
2. Ensure that the isolation valve is closed.



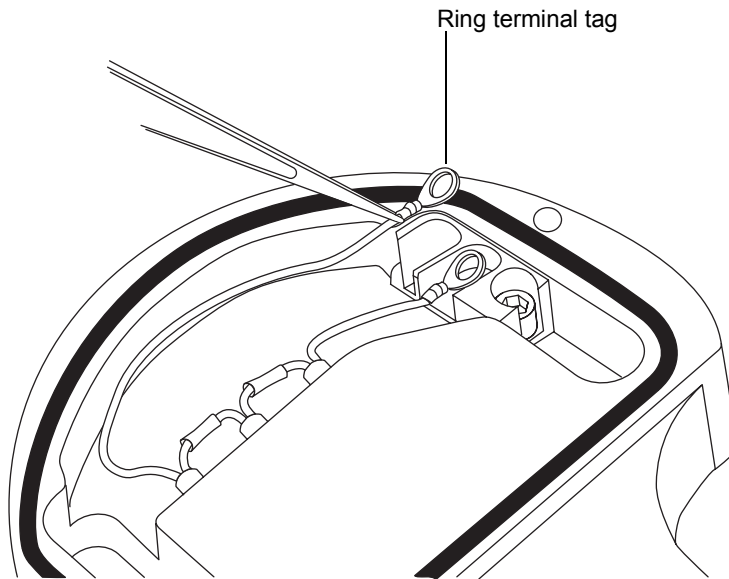
- Using the combined 2.5-mm Allen wrench and cone extraction tool, loosen the 2 captive screws securing the ion block cover plate.



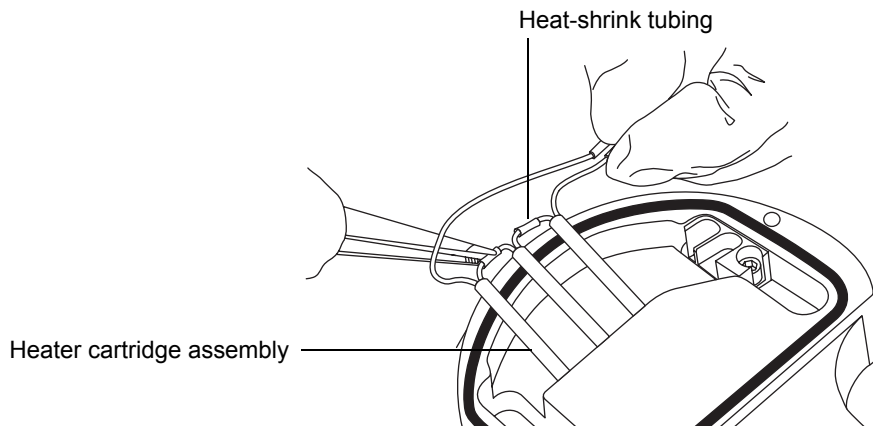
- Remove the ion block cover plate.
- Using the combined 2.5-mm Allen wrench and cone extraction tool, remove the 2 screws securing the heater wires to the PEEK terminal block.



- Using the needle-nose pliers, carefully swing the ring terminal tags out of the terminal block.



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





**Warning:** The heater cartridge assembly can be contaminated with biohazardous and/or toxic materials. Dispose of it according to local environmental regulations.

8. Dispose of the heater cartridge assembly in accordance with local environmental regulations.



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

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



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

10. Using the needle-nose pliers, position the 2, heater-cartridge ring tags fully down on the PEEK block terminals.
11. Using the combined 2.5-mm Allen wrench and cone extraction tool, fit and tighten the 2 screws securing the heater wires to the PEEK terminal block.
12. Fit the ion block cover plate to the ion block assembly, and then using the combined 2.5-mm Allen wrench and cone extraction tool, tighten the 2 captive screws securing ion block cover plate.
13. Fit the ion block assembly to the instrument (see [page 5-37](#)).



## Replacing the LockSpray source assembly seals

---

**Note:** You do not need to 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

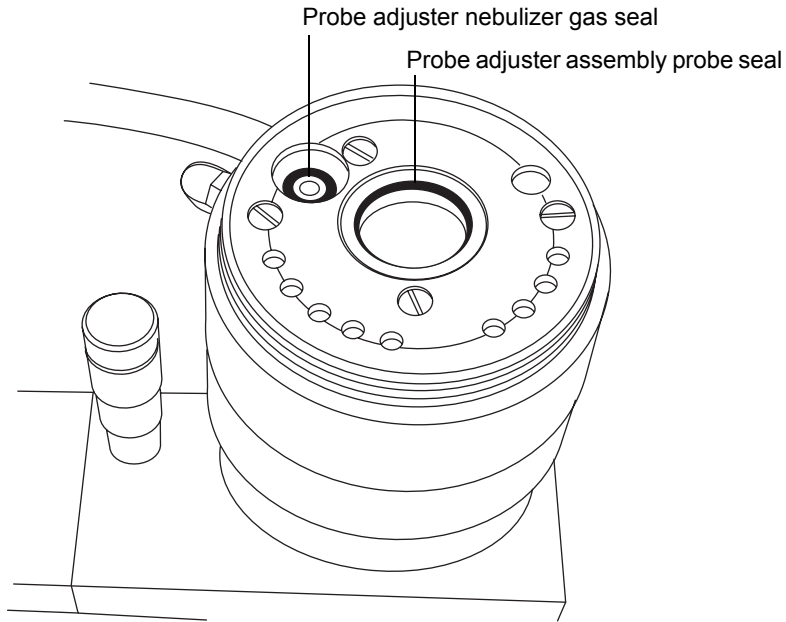
- Chemical-resistant, powder-free gloves
- O-ring removal kit

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

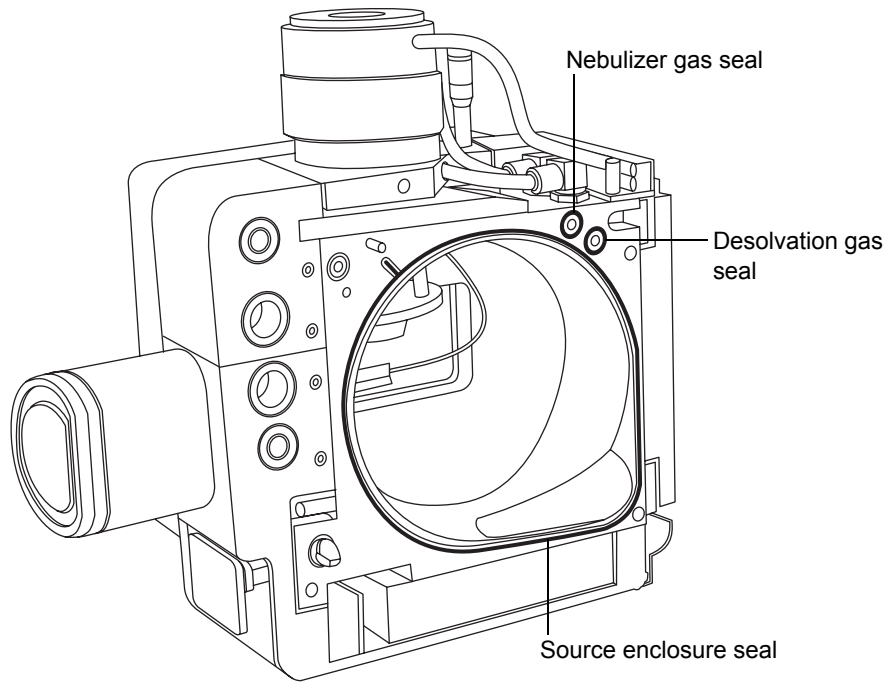


**Warning:** The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Remove the source enclosure from the instrument (see [page 5-8](#)).
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:** The seals can be contaminated with biohazardous and/or toxic materials. Dispose of them 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

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



**Warning:** The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Ensure that all the grooves for seals are free from dirt and debris.

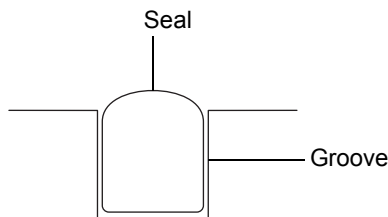
**Tip:** If contamination is present, use 1:1 methanol/water, applied to a lint-free cloth, to carefully clean the grooves.



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

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 counterclockwise direction, pressing it into the groove.
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.

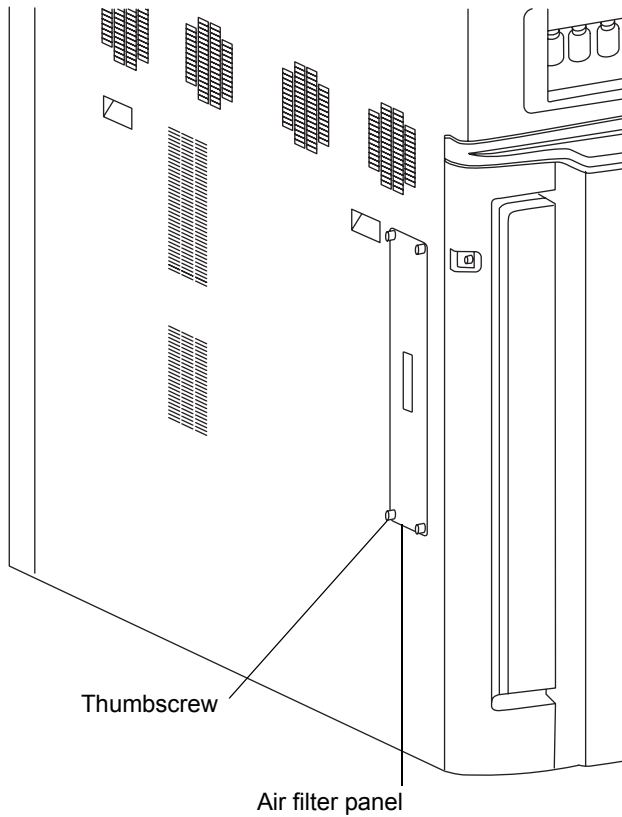


4. Fit the following new seals to the probe adjuster assembly:
  - Probe seal
  - Nebulizer gas seal
5. Fit the source enclosure to the instrument (see [page 5-11](#)).

## 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

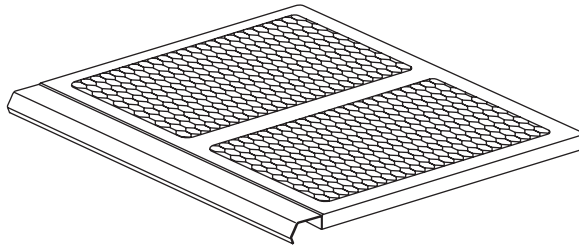
### Required materials

- 2.5-mm Allen wrench
- New air filter

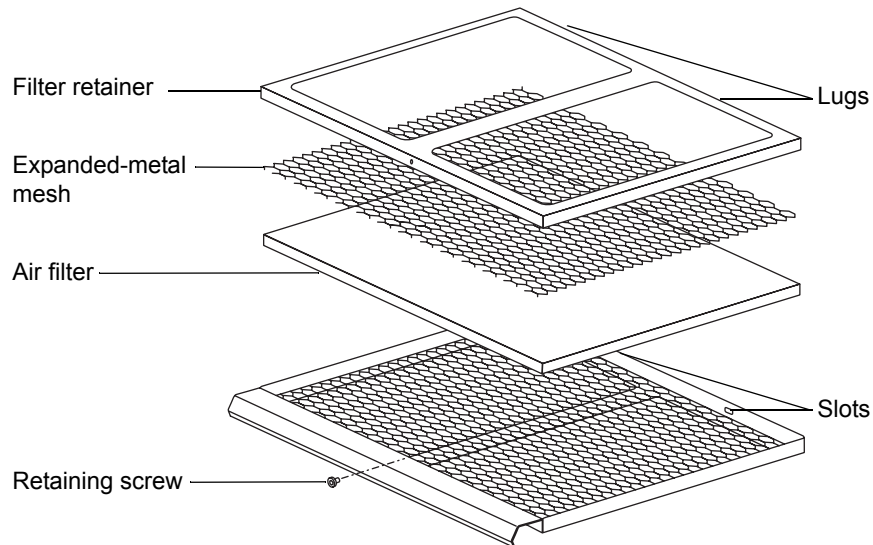
## To replace the air filter

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 has two lugs that 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.

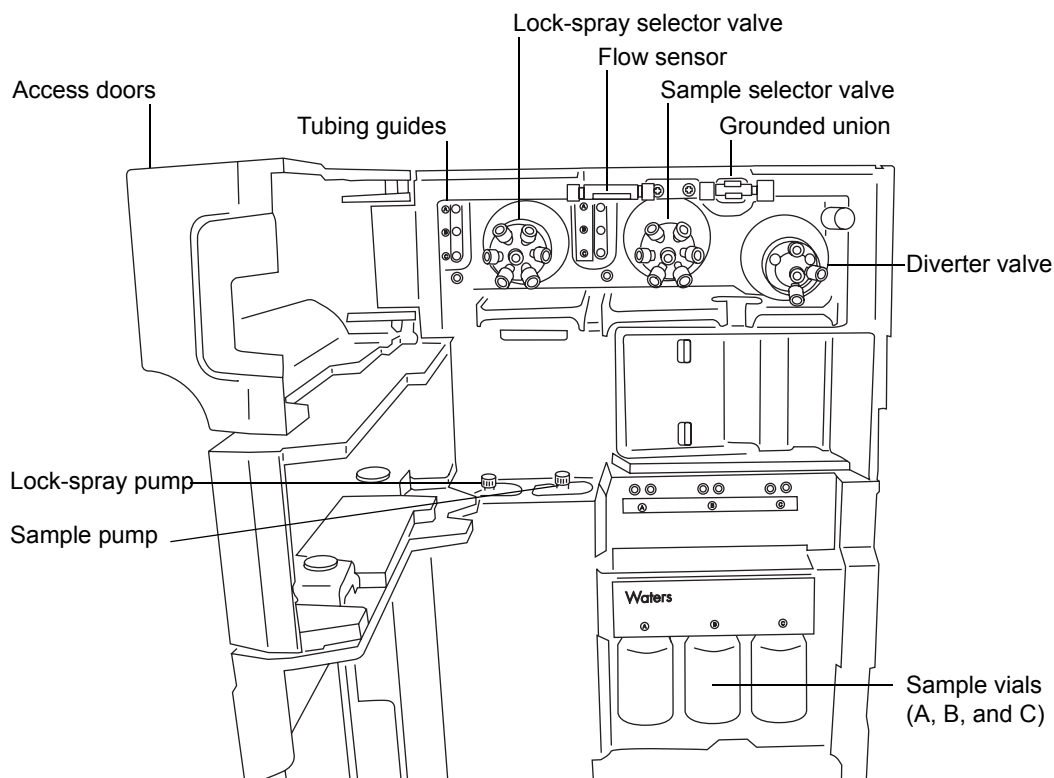
## Replacing the IntelliStart Fluidics tubing

In the event of a blockage in the tubing connections between the IntelliStart Fluidics system components, you must replace the tubing. These procedures explain how to replace the tubing for the LockSpray and sample delivery systems. However, they exclude probe connections, which vary according to your application. For probe connection instructions, see [page 3-2](#) or [page 3-14](#) for the relevant procedure:

- For the ESI probe, see “[Installing the ESI probe](#)” on [page 3-2](#).
- For the APCI probe, see “[Installing the APCI probe](#)” on [page 3-14](#).

### The IntelliStart Fluidics system layout

(Tubing connections omitted for clarity.)





## Removing the IntelliStart Fluidics tubing

This procedure 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

### To remove the tubing



**Warning:** All tubing and fittings can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while working on the system.

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:** The IntelliStart Fluidics tubing and fittings can be contaminated with biohazardous and/or toxic materials. Dispose of them according to local environmental regulations.

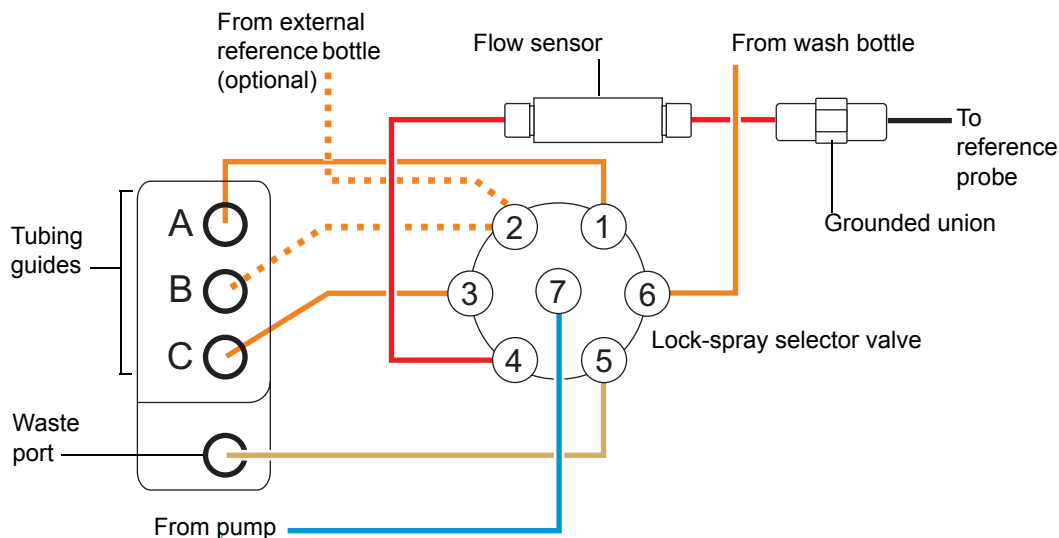
5. Dispose of the tubes and fittings in accordance with local environmental regulations.

## Plumbing the IntelliStart Fluidics LockSpray system

This section describes how to plumb the LockSpray 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	Vial A	0.020	1/16	Orange	680
2	Vial B	0.020	1/16	Orange	680
3	Vial 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	LockSpray selector pump	0.010	1/16	Blue	300
-	Flow sensor to grounded union	0.005	1/32	Red	60
-	Grounded union to reference probe	Probe and flow-rate dependent.			

## Required materials

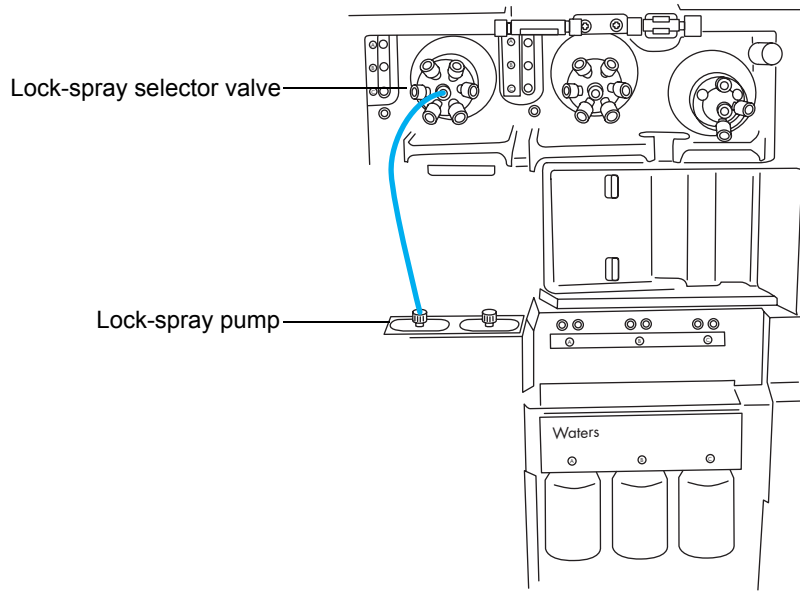
- Chemical-resistant, powder-free gloves
  - SYNAPT G2 fluidics tubing and fitting kit
- Tip:** This kit contains components for both the sample and LockSpray system plumbing.
- For the LockSpray reference probe connection
    - 375 mm of 0.005-inch ID red PEEK
    - Long "finger tight" fitting
  - For the NanoLockSpray source reference probe connection
    - 375 mm of 25- $\mu$ L, fused-silica capillary (supplied in 1-m lengths)
    - Protective sleeve consisting of 0.015-inch ID PEEK tubing
    - F-130 "finger tight" nut

## To plumb the LockSpray system

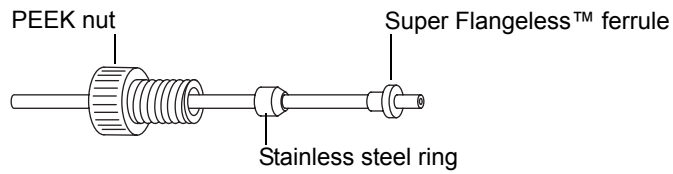


**Warning:** All tubing and fittings can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while working on the system.

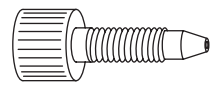
1. Open the access doors to the IntelliStart Fluidics system.
2. Using a PEEK nut, Super Flangeless™ ferrule, and stainless steel (SS) ring, connect the blue, 1/16-inch, 300-mm, PEEK tubing from the LockSpray pump to port 7 on the LockSpray selector valve, where you use the long "finger tight" fitting.



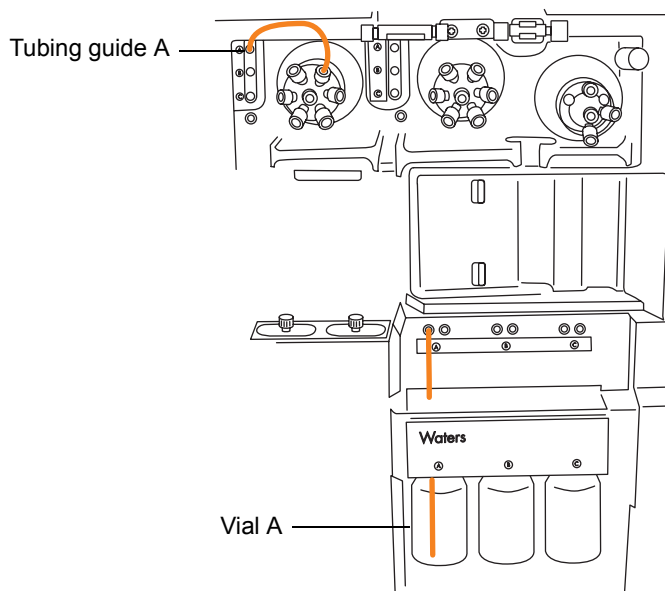
**PEEK nut, Super Flangeless ferrule, and stainless steel (SS) ring**



**Long "finger tight" fitting**



- 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 vial A.

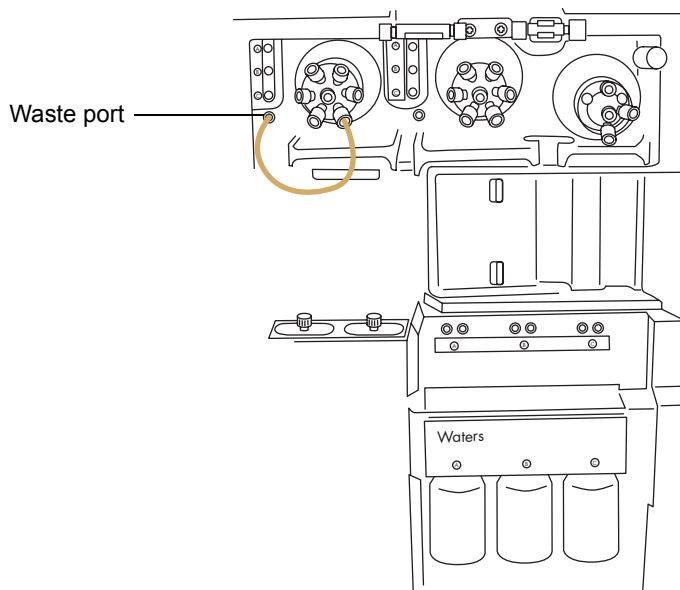


**Requirement:** As the tubing emerges from the tubing guide, thread a long "finger tight" fitting over it. Push the tubing through the left-hand hole, to the bottom of the vial, and tighten the fitting.


**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.
- Using a long "finger tight" fitting, connect orange, 1/16-inch, 680-mm, PEEK tubing from port 2 of the LockSpray selector valve to the reference vial, or orange, 1/16-inch, 1000-mm, PEEK tubing to the external reference bottle.
    - To use vial B as the reference solution, thread the tubing through tubing guide B, and use a long "finger tight" fitting.

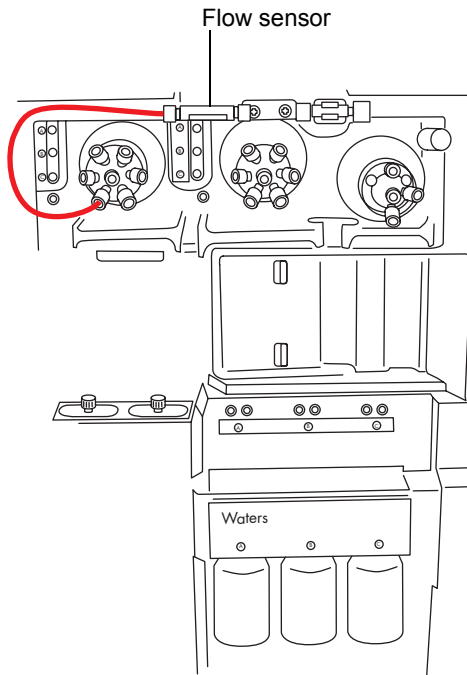
- To use an external reference bottle, push the tubing to the bottom of the reference solution, and secure the tubing at the bottle neck to prevent it floating to the surface during use.
5. Using a long "finger tight" fitting, connect orange, 1/16-inch, 680-mm, PEEK tubing from port 3 of the LockSpray selector valve, through tubing guide C and into vial 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 vial, 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.



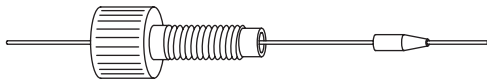
**Tip:** The liquid waste system collects waste without requiring a fitted connection. Waste drains through the connector at the base of the instrument and into a waste bottle (see [page B-13](#)).

 **Caution:** The narrower, 1/32-inch tubing can slip out of the port. Once the fitting is tightened, give the tubing a gentle tug to ensure it is gripped correctly.

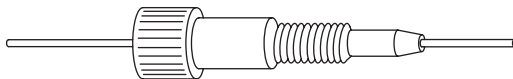
- Using a long "finger tight" PEEK nut and 1/32-inch, PEEK ferrule, connect the red, 1/32-inch, 200-mm, PEEK tubing from port 4 of the LockSpray selector valve to the left-hand side of the flow sensor, where you use the 1/32-inch, 6-40 Valco compression fitting assembly.



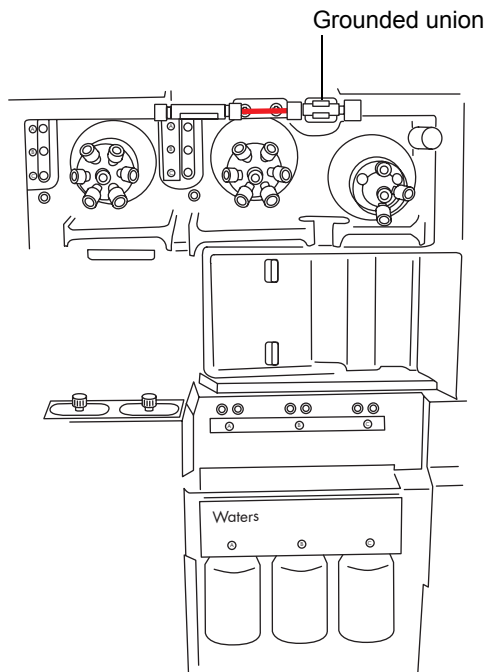
**Long "finger tight" PEEK nut and 1/32-inch, PEEK ferrule**



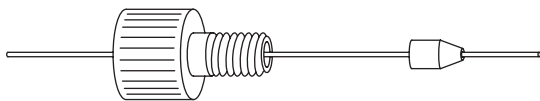
**1/32-inch, 6-40 Valco compression fitting assembly**



- 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**



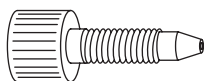




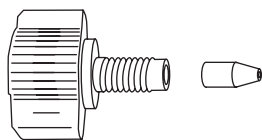
**Warning:** To avoid electric shock, do not use stainless steel tubing to connect the grounded union to the reference probe.

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.



- For the NanoLockSpray source, see [“Installing the new TaperTip and capillary” on page 5-89](#).



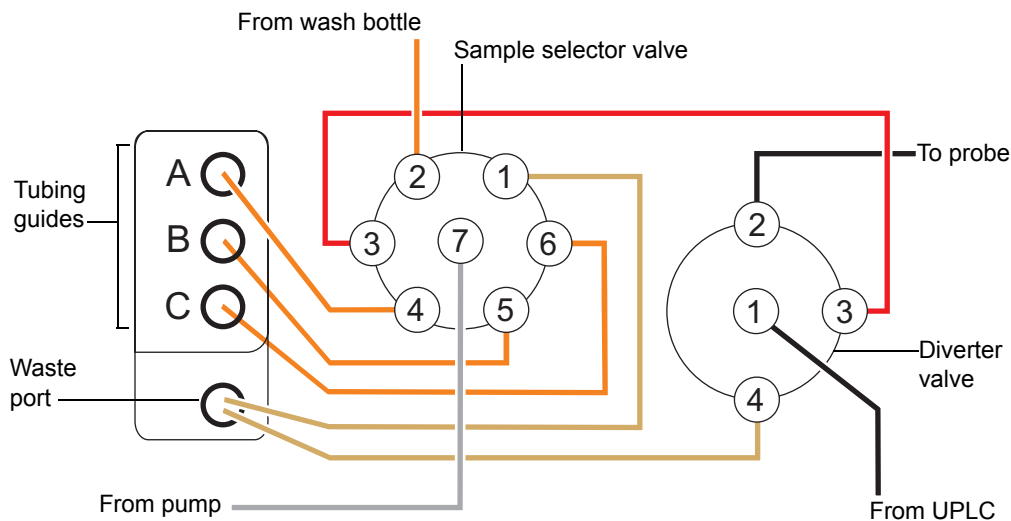
**Caution:** Ensure that the tubing does not become trapped when you close the access door to the IntelliStart Fluidics system.

11. Close the access doors to the IntelliStart Fluidics system.

## Plumbing the IntelliStart Fluidics sample delivery system

This section explains how to plum the sample delivery system for standard flow applications. For low flow, nanoACQUITY UPLC applications, the column outlet passes directly to the nanoflow sprayer, bypassing the IntelliStart Fluidics system.

### IntelliStart Fluidics sample delivery tubing schematic



All tubing is PEEK, with the exception of the connection between 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	Divert valve	0.005	1/16	Red	200
Sample / 4	Vial A	0.020	1/16	Orange	680
Sample / 5	Vial B	0.020	1/16	Orange	680
Sample / 6	Vial C	0.020	1/16	Orange	680
Sample / 7	Analyte pump	0.040	1/16	n/a	500
Divert / 4	Waste	0.040	1/16	Natural	1000

## Required materials

- Chemical-resistant, powder-free gloves
- SYNAPT G2 fluidics tubing and fitting kit

**Tip:** This kit contains components for both the sample and LockSpray system plumbing.

## To plumb the analyte system



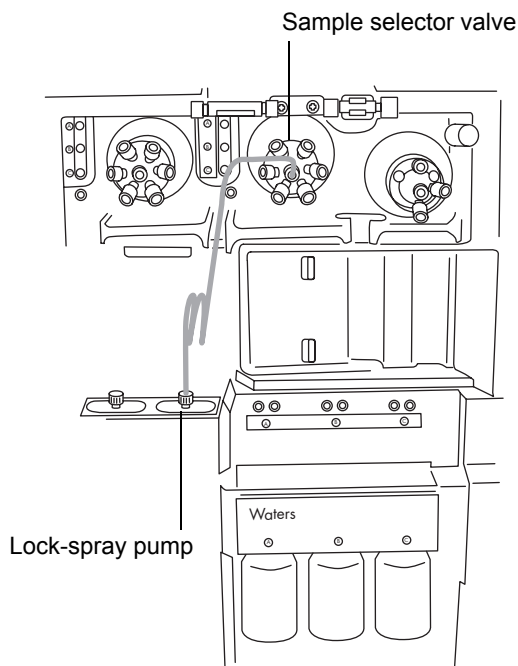
**Warning:** The IntelliStart Fluidics tubing and fittings can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while working on the system.

1. Open the access doors to the IntelliStart Fluidics system.

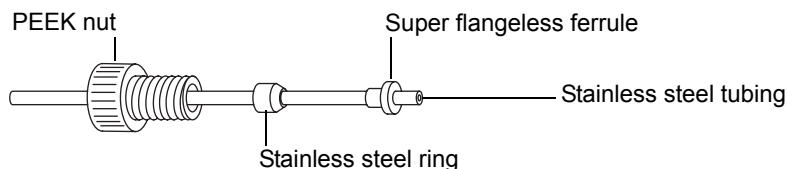


**Caution:** The steel tubing requires high-pressure seals at each end. Ensure that you tighten the fittings appropriately.

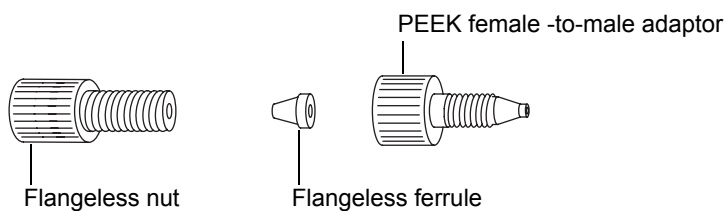
2. Using the stainless steel tubing, connect the sample pump to port 7 of the sample selector valve.



- 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.

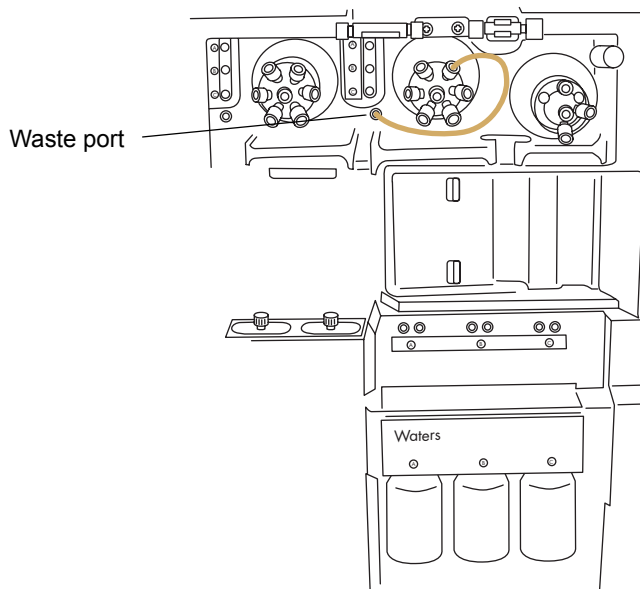


- d. Slide the transparent, 1/16-inch flangeless nut and blue, 1/16-inch flangeless ferrule over the tubing.

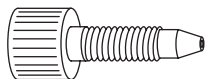
**Rationale:** These components provide fail-safe pressure relief in case of a blockage.

- e. Insert the tubing in the female-to-male adaptor in port 7, and tighten the fittings.

- 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.



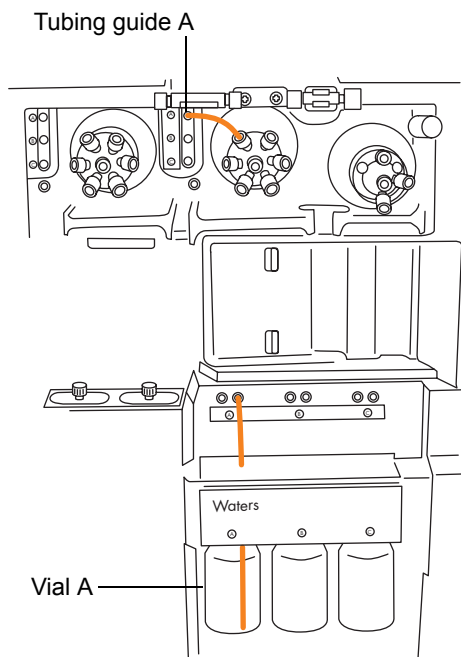
### Long "finger tight" fitting



**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 B-13](#)).

- 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 vial A.

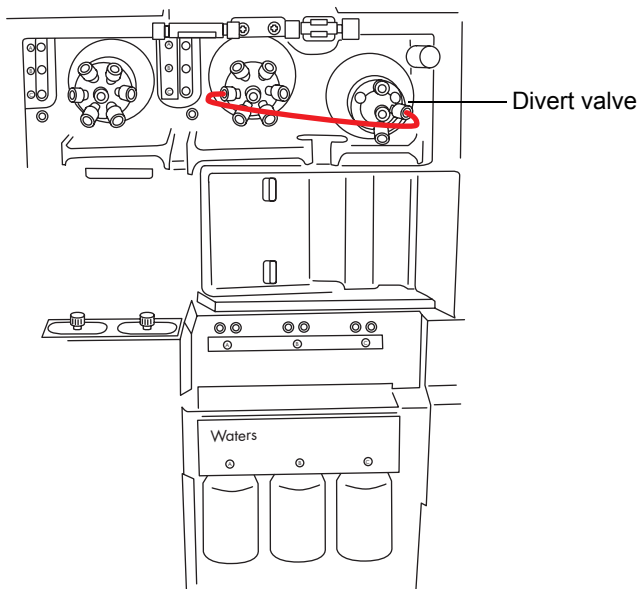


**Requirement:** As the tubing emerges from the tubing guide, thread the long "finger tight" fitting over it, push the tubing through the right-hand hole, to the bottom of the vial and tighten the fitting.

**Tips:** Follow these suggestions if you find threading the tubes through the guides difficult:

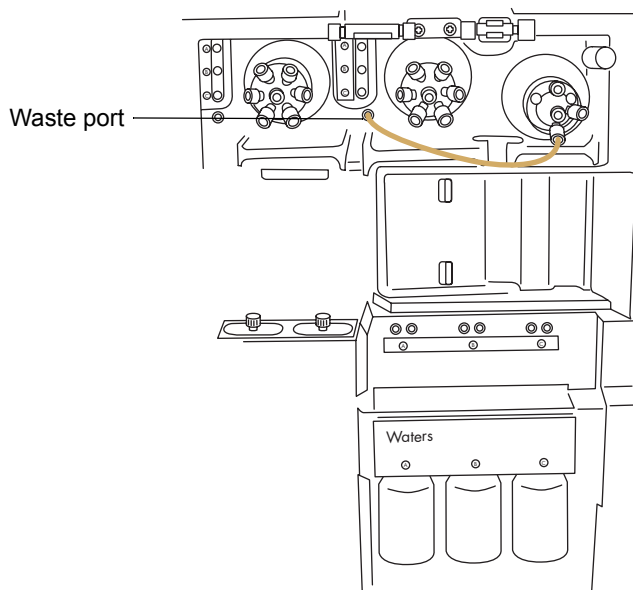
- Thread the tubes upward from the bottom hole.
  - Using needle-nose pliers, make a 20° bend, 10 mm from the end of the tubing. Then rotate the tubing, as necessary, as you thread it through the guide.
- Repeat this procedure for port 5 to vial B and port 6 to vial C.

- 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 divert valve.




- Using a long "finger tight" fitting, connect 1/16-inch, 1000-mm, natural-colored PEEK tubing to port 4 of the divert 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 sample selector valve to the source probe, observing the relevant procedure:
  - For the ESI probe, see [page 3-2](#).
  - For the APCI probe, see [page 3-14](#).

 **Caution:** Ensure that the tubing does not become trapped when you close the access doors to the IntelliStart Fluidics system.

10. Close the access doors to the IntelliStart Fluidics system.



# A Safety Advisories

Waters instruments display hazard symbols designed to alert you to the hidden dangers of operating and maintaining the instruments. Their corresponding user guides also include the hazard symbols, with accompanying text statements describing the hazards and telling you how to avoid them. This appendix presents all the safety symbols and statements that apply to the entire line of Waters products.

## Contents

Topic	Page
<a href="#">Warning symbols</a>	<a href="#">A-2</a>
<a href="#">Caution symbol</a>	<a href="#">A-5</a>
<a href="#">Warnings that apply to all Waters instruments</a>	<a href="#">A-6</a>
<a href="#">Electrical and handling symbols</a>	<a href="#">A-11</a>

## Warning symbols

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Warning symbols alert you to the risk of death, injury, or seriously adverse physiological reactions associated with an instrument's use or misuse. Heed all warnings when you install, repair, and operate Waters instruments. Waters assumes no liability for the failure of those who install, repair, or operate its instruments to comply with any safety precaution.

### Task-specific hazard warnings

The following warning symbols alert you to risks that can arise when you operate or maintain an instrument or instrument component. Such risks include burn injuries, electric shocks, ultraviolet radiation exposures, and others.

When the following symbols appear in a manual's narratives or procedures, their accompanying text identifies the specific 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 needle puncture.)



**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 eye injury.)

## Specific warnings

The following warnings can appear in the user manuals of particular instruments and on labels affixed to them or their component parts.

### Burst warning

This warning applies to Waters instruments fitted with nonmetallic tubing.



**Warning:** Pressurized nonmetallic, or polymer, tubing can burst. Observe these precautions when working around such tubing:

- 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, which significantly reduces the pressure at which the tubing can rupture.

### Mass spectrometer flammable solvents warning

This warning applies to instruments operated with flammable solvents.



**Warning:** Where significant quantities of flammable solvents are involved, a continuous flow of nitrogen into the ion source is required to prevent possible ignition in that enclosed space.

Ensure that the nitrogen supply pressure never falls below 400 kPa (4 bar, 58 psi) during an analysis in which flammable solvents are used. Also ensure a gas-fail connection is connected to the LC system so that the LC solvent flow stops if the nitrogen supply fails.

## Mass spectrometer shock hazard

This 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.

This warning applies to certain instruments when they are in Operate mode.



**Warning:** High voltages can be present at certain external surfaces of the mass spectrometer when the instrument is in Operate mode. To avoid non-lethal electric shock, make sure the instrument is in Standby mode before touching areas marked with this high voltage warning symbol.

## Biohazard warning

This warning applies to Waters instruments that can be used to process material that might contain biohazards: substances that contain biological agents capable of producing harmful effects in humans.



**Warning:** Waters instruments and software can be used to analyze or process potentially infectious human-sourced products, inactivated microorganisms, and other biological materials. To avoid infection with these agents, assume that all biological fluids are infectious, observe Good Laboratory Practices, and consult your organization's biohazard safety representative regarding their proper use and handling. Specific precautions appear in the latest edition of the US National Institutes of Health (NIH) publication, *Biosafety in Microbiological and Biomedical Laboratories* (BMBL).

## Chemical hazard warning

This warning applies to Waters instruments that can process corrosive, toxic, flammable, or other types of hazardous material.



**Warning:** Waters instruments can be used to analyze or process potentially hazardous substances. To avoid injury with any of these materials, familiarize yourself with the materials and their hazards, observe Good Laboratory Practices (GLP), and consult your organization's safety representative regarding proper use and handling. Guidelines are provided in the latest edition of the National Research Council's publication, *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*.

## Caution symbol

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The caution symbol signifies that an instrument's use or misuse can damage the instrument or compromise a sample's integrity. The following symbol and its associated statement are typical of the kind that alert you to the risk of damaging the instrument or sample.



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

## Warnings that apply to all Waters instruments

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When operating this device, follow standard quality control procedures and the equipment guidelines in this section.



**Attention:** Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**Important:** Toute modification sur cette unité n'ayant pas été expressément approuvée par l'autorité responsable de la conformité à la réglementation peut annuler le droit de l'utilisateur à exploiter l'équipement.

**Achtung:** Jedwede Änderungen oder Modifikationen an dem Gerät ohne die ausdrückliche Genehmigung der für die ordnungsgemäße Funktionstüchtigkeit verantwortlichen Personen kann zum Entzug der Bedienungsbefugnis des Systems führen.

**Avvertenza:** qualsiasi modifica o alterazione apportata a questa unità e non espressamente autorizzata dai responsabili per la conformità fa decadere il diritto all'utilizzo dell'apparecchiatura da parte dell'utente.

**Atencion:** cualquier cambio o modificación efectuado en esta unidad que no haya sido expresamente aprobado por la parte responsable del cumplimiento puede anular la autorización del usuario para utilizar el equipo.

**注意:** 未經有關法規認證部門允許對本設備進行的改變或修改,可能會使使用者喪失操作該設備的權利。

**注意:** 未经有关法规认证部门明确允许对本设备进行的改变或改装,可能会使使用者丧失操作该设备的合法性。

**주의:** 규정 준수를 책임지는 당사자의 명백한 승인 없이 이 장치를 개조 또는 변경할 경우, 이 장치를 운용할 수 있는 사용자 권한의 효력을 상실할 수 있습니다.

**注意:** 規制機関から明確な承認を受けずに本装置の変更や改造を行うと、本装置のユーザーとしての承認が無効になる可能性があります。



**Warning:** Use caution when working with any polymer tubing under pressure:

- Always wear eye protection when near pressurized polymer tubing.
- Extinguish all nearby flames.
- Do not use tubing that has been severely stressed or kinked.
- Do not use nonmetallic tubing with tetrahydrofuran (THF) or concentrated nitric or sulfuric acids.
- Be aware that methylene chloride and dimethyl sulfoxide cause nonmetallic tubing to swell, which greatly reduces the rupture pressure of the tubing.

**Attention:** Manipulez les tubes en polymère sous pression avec précaution:

- Portez systématiquement des lunettes de protection lorsque vous vous trouvez à proximité de tubes en polymère pressurisés.
- Eteignez toute flamme se trouvant à proximité de l'instrument.
- Evitez d'utiliser des tubes sévèrement déformés ou endommagés.
- Evitez d'utiliser des tubes non métalliques avec du tétrahydrofurane (THF) ou de l'acide sulfurique ou nitrique concentré.
- Sachez que le chlorure de méthylène et le diméthylesulfoxyde entraînent le gonflement des tuyaux non métalliques, ce qui réduit considérablement leur pression de rupture.

**Vorsicht:** Bei der Arbeit mit Polymerschläuchen unter Druck ist besondere Vorsicht angebracht:

- In der Nähe von unter Druck stehenden Polymerschläuchen stets Schutzbrille tragen.
- Alle offenen Flammen in der Nähe löschen.
- Keine Schläuche verwenden, die stark geknickt oder überbeansprucht sind.
- Nichtmetallische Schläuche nicht für Tetrahydrofuran (THF) oder konzentrierte Salpeter- oder Schwefelsäure verwenden.
- Durch Methylenchlorid und Dimethylsulfoxid können nichtmetallische Schläuche quellen; dadurch wird der Berstdruck des Schlauches erheblich reduziert.



**Attenzione:** fare attenzione quando si utilizzano tubi in materiale polimerico sotto pressione:

- Indossare sempre occhiali da lavoro protettivi nei pressi di tubi di polimero pressurizzati.
- Spegnere tutte le fiamme vive nell'ambiente circostante.
- Non utilizzare tubi eccessivamente logorati o piegati.
- Non utilizzare tubi non metallici con tetraidrofurano (THF) o acido solforico o nitrico concentrati.
- Tenere presente che il cloruro di metilene e il dimetilsolfossido provocano rigonfiamenti nei tubi non metallici, riducendo notevolmente la pressione di rottura dei tubi stessi.

**Advertencia:** se recomienda precaución cuando se trabaje con tubos de polímero sometidos a presión:

- El usuario deberá protegerse siempre los ojos cuando trabaje cerca de tubos de polímero sometidos a presión.
- Si hubiera alguna llama las proximidades.
- No se debe trabajar con tubos que se hayan doblado o sometido a altas presiones.
- Es necesario utilizar tubos de metal cuando se trabaje con tetrahidrofurano (THF) o ácidos nítrico o sulfúrico concentrados.
- Hay que tener en cuenta que el cloruro de metileno y el sulfóxido de dimetilo dilatan los tubos no metálicos, lo que reduce la presión de ruptura de los tubos.

**警告:** 當在有壓力的情況下使用聚合物管線時，小心注意以下幾點。

- 當接近有壓力的聚合物管線時一定要戴防護眼鏡。
- 熄滅附近所有的火焰。
- 不要使用已經被壓癟或嚴重彎曲管線。
- 不要在非金屬管線中使用四氫呋喃或濃硝酸或濃硫酸。
- 要了解使用二氯甲烷及二甲基亞楓會導致非金屬管線膨脹，大大降低管線的耐壓能力。





**警告:** 当有压力的情况下使用管线时, 小心注意以下几点:

- 当接近有压力的聚合物管线时一定要戴防护眼镜。
- 熄灭附近所有的火焰。
- 不要使用已经被压瘪或严重弯曲的管线。
- 不要在非金属管线中使用四氢呋喃或浓硝酸或浓硫酸。
- 要了解使用二氯甲烷及二甲基亚砜会导致非金属管线膨胀, 大大降低管线的耐压能力。

**경고:** 가압 폴리머 튜브로 작업할 경우에는 주의하십시오.

- 가압 폴리머 튜브 근처에서는 항상 보호 안경을 착용하십시오.
- 근처의 화기를 모두 끄십시오.
- 심하게 변형되거나 꼬인 튜브는 사용하지 마십시오.
- 비금속(Nonmetallic) 튜브를 테트라히드로푸란(Tetrahydrofuran: THF) 또는 농축 질산 또는 황산과 함께 사용하지 마십시오.
- 염화 메틸렌(Methylene chloride) 및 디메틸설폭시드(Dimethyl sulfoxide)는 비금속 튜브를 부풀려 튜브의 파열 압력을 크게 감소시킬 수 있으므로 유의하십시오.

**警告:** 圧力のかかったポリマーチューブを扱うときは、注意してください。

- 加圧されたポリマーチューブの付近では、必ず保護メガネを着用してください。
- 近くにある火を消してください。
- 著しく変形した、または折れ曲がったチューブは使用しないでください。
- 非金属チューブには、テトラヒドロフラン(THF)や高濃度の硝酸または硫酸などを流さないでください。
- 塩化メチレンやジメチルスルホキシドは、非金属チューブの膨張を引き起こす場合があります、その場合、チューブは極めて低い圧力で破裂します。



**Warning:** The user shall be made aware that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

**Attention:** L'utilisateur doit être informé que si le matériel est utilisé d'une façon non spécifiée par le fabricant, la protection assurée par le matériel risque d'être défectueuses.

**Vorsicht:** Der Benutzer wird darauf aufmerksam gemacht, dass bei unsachgemäßer Verwendung des Gerätes die eingebauten Sicherheitseinrichtungen unter Umständen nicht ordnungsgemäß funktionieren.

**Attenzione:** si rende noto all'utente che l'eventuale utilizzo dell'apparecchiatura secondo modalità non previste dal produttore può compromettere la protezione offerta dall'apparecchiatura.

**Advertencia:** el usuario deberá saber que si el equipo se utiliza de forma distinta a la especificada por el fabricante, las medidas de protección del equipo podrían ser insuficientes.

**警告:** 使用者必須非常清楚如果設備不是按照製造廠商指定的方式使用，那麼該設備所提供的保護將被削弱。

**警告:** 使用者必須非常清楚如果設備不是按照製造廠商指定的方式使用，那麼該設備所提供的保護將被削弱。

**경고:** 제조업체가 명시하지 않은 방식으로 장비를 사용할 경우 장비가 제공하는 보호 수단이 제대로 작동하지 않을 수 있다는 점을 사용자에게 반드시 인식시켜야 합니다.







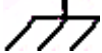
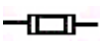

**警告:** ユーザーは、製造元により指定されていない方法で機器を使用すると、機器が提供している保証が無効になる可能性があることに注意して下さい。

# Electrical and handling symbols

---





## Electrical symbols

These can appear in instrument user manuals and on the 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
	Recycle symbol: Do not dispose in municipal waste.

## Handling symbols

These handling symbols and their associated text can appear on labels affixed to the outer packaging of Waters instrument and component shipments.

	Keep upright!
	Keep dry!
	Fragile!
	Use no hooks!

# B External Connections

This appendix describes the mass spectrometer's external connections.



**Warning:** The mass spectrometer is heavy. To avoid injury, use suitable machinery and the supplied harness to lift it.



**Caution:**

- 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 using Connections Insight”](#) on page 5-5.

## Contents

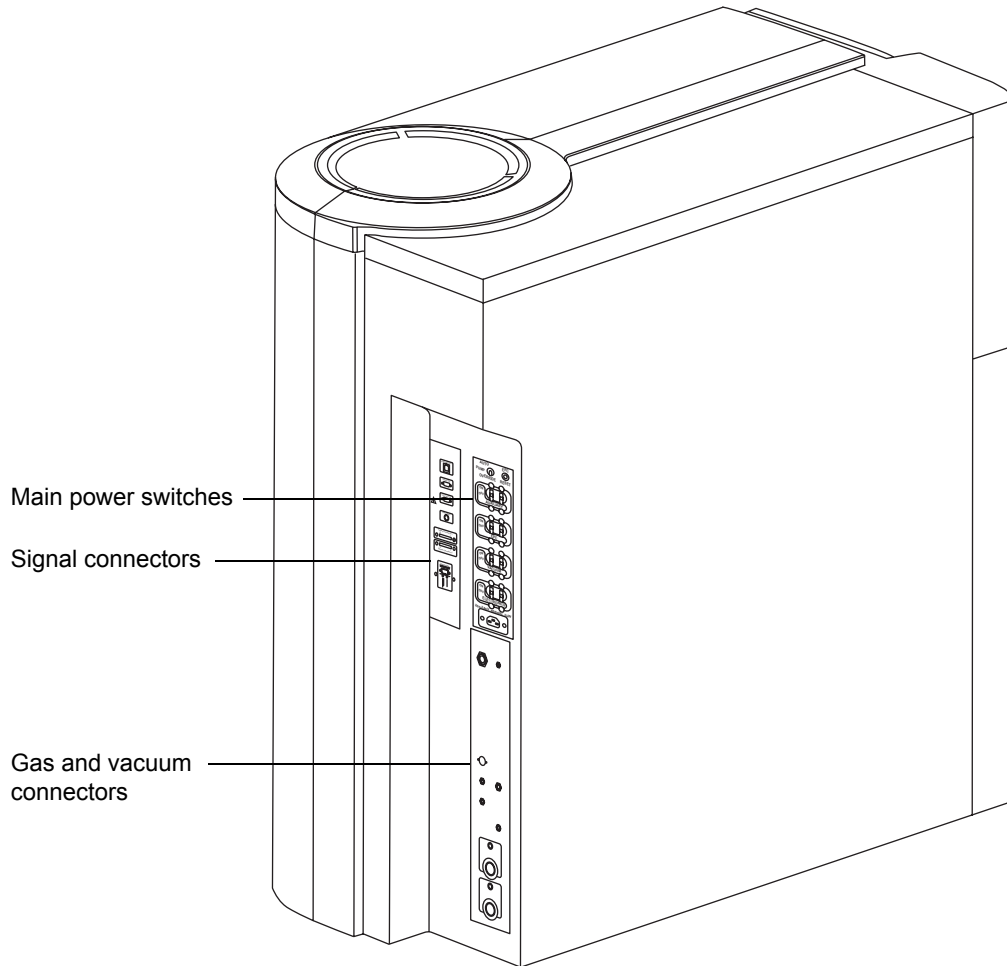
Topic	Page
<a href="#">Mass spectrometer external wiring and vacuum connections</a>	B-2
<a href="#">Connecting the Edwards oil-free roughing pump</a>	B-3
<a href="#">Connecting to the nitrogen gas supply</a>	B-7
<a href="#">Connecting to the collision cell gas supply</a>	B-9
<a href="#">Connecting the nitrogen exhaust line</a>	B-10
<a href="#">Connecting the liquid waste line</a>	B-13
<a href="#">Input/output signal connectors</a>	B-15
<a href="#">Connecting the workstation (system without ACQUITY UPLC)</a>	B-21
<a href="#">Connecting Ethernet cables (system with ACQUITY UPLC)</a>	B-21
<a href="#">Connecting to the electricity source</a>	B-22
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# Mass spectrometer external wiring and vacuum connections

---

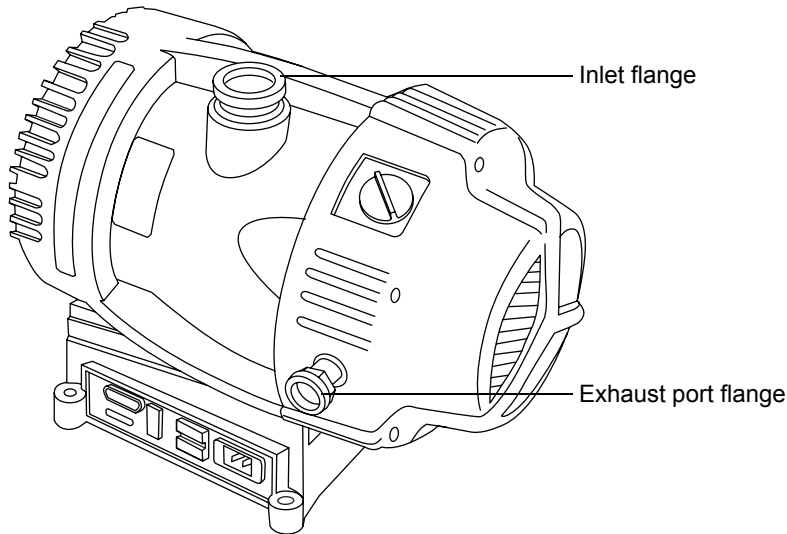
The locations of the instrument's rear panel connectors are shown below.

## Mass spectrometer rear panel connectors and switches



# Connecting the Edwards oil-free roughing pump

---



## Required materials

- Chemical-resistant, powder-free gloves
- Sharp knife
- Speedivalves
- NW25 tees (included in the SYNAPT™ G2 installation kit)
- NW25 elbows (included in the SYNAPT G2 installation kit)
- NW25 center rings (included in the SYNAPT G2 installation kit)
- NW25 clamps (included in the SYNAPT G2 installation kit)
- NW40 center rings (included in the SYNAPT G2 installation kit)
- NW40 clamps (included in the SYNAPT G2 installation kit)
- NW25/NW40 adaptor (included in the SYNAPT G2 installation kit)
- 12.7-mm clear PVC exhaust tubing (included in the SYNAPT G2 installation kit)
- PVC hose clamps (included in the SYNAPT G2 installation kit)
- Vacuum hoses (included in the SYNAPT G2 installation kit)

## To connect the oil-free roughing pump

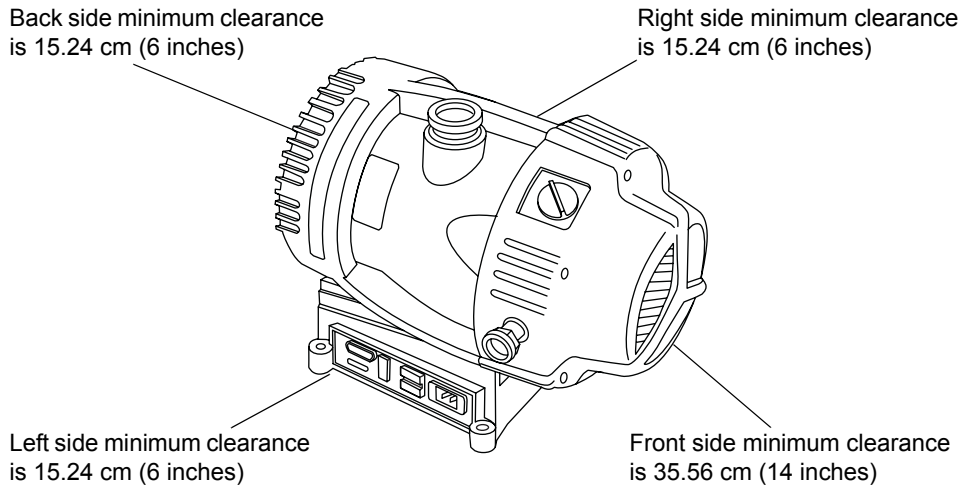


**Warning:** The pump and its connections can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves when performing this procedure.



### Caution:

- To ensure correct operation of the roughing pump, install it within 1 degree of horizontal.
- Locate the roughing pump in an area where the ambient temperature is 12 to 40 °C (54 to 104 °F).
- To ensure proper ventilation, install the pump with the following minimum clearances:

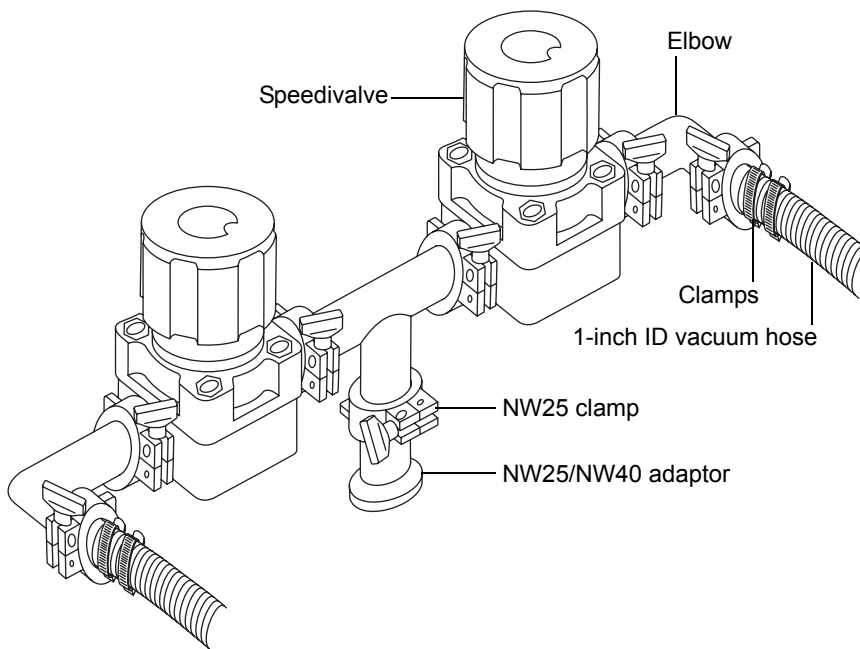


**Warning:** The roughing pump is heavy. To avoid injury, at least two people must lift the pump.

1. Place the pump on the floor, within 1 m of the instrument.
2. Attach the NW25/NW40 adaptor to the roughing pump inlet flange using an NW40 center ring, and then secure the connection with an NW40 clamp.



3. Attach the NW25 tee to the NW25/NW40 adaptor using an NW25 center ring, and then secure the connection with an NW25 clamp.



4. Attach a Speedivalve to one of the open ports on the NW25 tee using an NW25 center ring, and then secure the connection with an NW25 clamp.
5. Attach an NW25 elbow to the open port on the Speedivalve using an NW25 center ring, and then secure the connection with an NW25 clamp.
6. Attach the flanged end of a vacuum hose to the open port on the NW25 elbow, using an NW25 center ring, and then secure the connection with an NW25 clamp.
7. Repeat [step 4](#) through [step 6](#) for the remaining open port on the NW25 tee.
8. Connect the free ends of the vacuum hoses to the roughing pump vacuum connections on the mass spectrometer's rear panel (see [page B-8](#)).

9. Install 2 clamps on each hose end.



**Caution:** To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

10. Connect the 12.7-mm clear PVC exhaust tubing to the roughing pump exhaust port NW25 nozzle fitting using an NW25 center ring, and then secure the connection with an NW25 clamp, using the 7-mm nut driver to install the clamp.
11. Secure the exhaust tubing with a hose clamp.

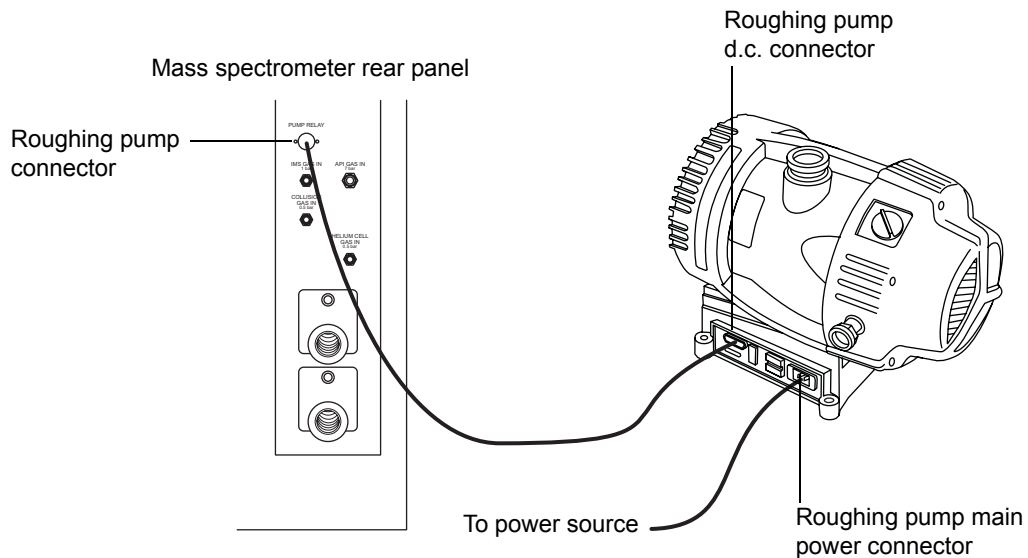


**Caution:** The instrument requires two separate exhaust systems: one for nitrogen, the other for the roughing pump. Your warranty does not cover damage caused by routing exhaust lines incorrectly. See also [“Connecting the nitrogen exhaust line” on page B-10](#).

12. Route the open end of the exhaust tubing to a suitable exhaust vent.  
**See also:** The *Waters SYNAPT G2 MS/HDMS Site Preparation Guide* (part number 715002097).
13. Make the electrical connections to the roughing pump (see [page B-7](#)).

# Making the electrical connections to the Edwards oil-free roughing pump

## Roughing pump electrical connections



## To make the electrical connections for the oil-free roughing pump

1. Connect the roughing pump power cord to the main power source.
2. Connect the relay cable from the roughing pump's dc connector to the pump connector on the mass spectrometer's rear panel.

# Connecting to the nitrogen gas supply

---

## Required materials

- Chemical-resistant, powder-free gloves
- 6-mm (¼-in) PTFE tubing (included in the SYNAPT G2 Installation Kit)
- Nitrogen regulator (not supplied)

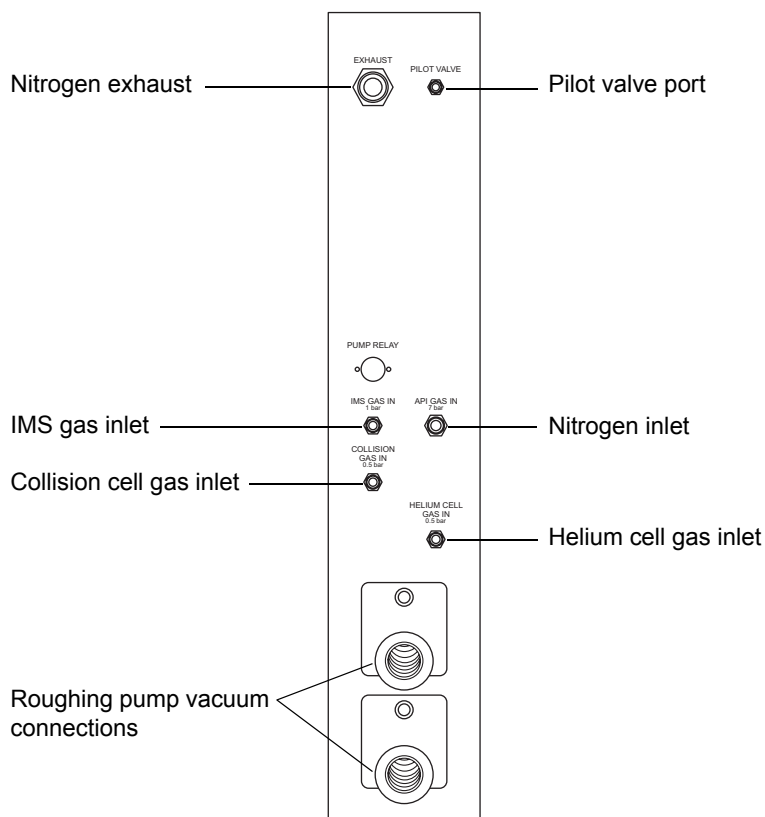
## To connect the nitrogen gas supply



**Warning:** The 6-mm (¼-in) PTFE tubing must not be cut to size; use the complete 5-m (16-ft) length as supplied.

1. Connect one free end of the 6-mm PTFE tubing to the API gas in port on the rear of the instrument.

### 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<sup>®</sup> 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 B-8](#)).
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 50 kPa (0.5 bar, 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 MS installation kit)

## To connect the nitrogen exhaust line



### Warning:

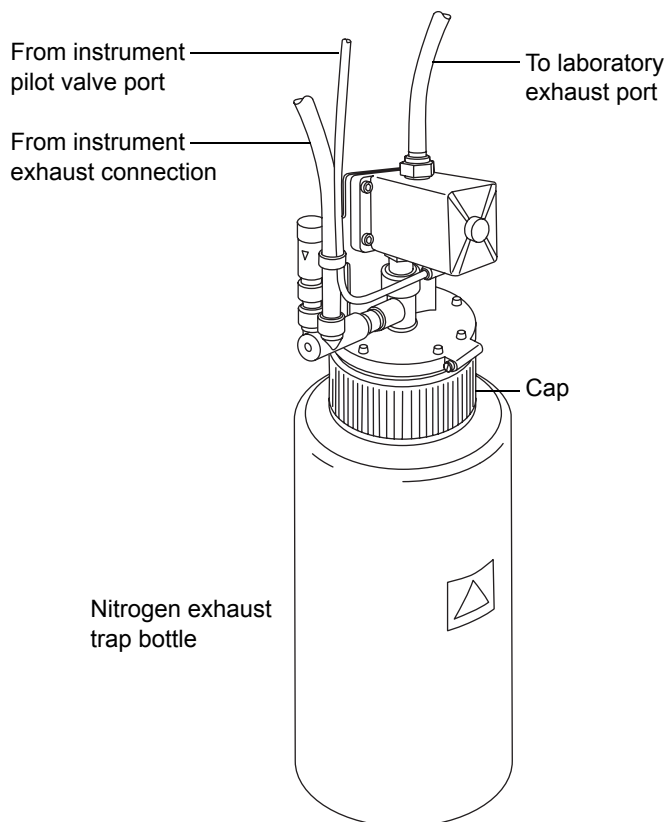
- Biohazardous and/or toxic LC solvents and samples can be carried in the nitrogen exhaust, which must be vented via the nitrogen exhaust trap bottle and laboratory exhaust system. The laboratory exhaust system must provide a minimum vacuum of 0.20 kPa (2 mbar, 0.03 psi) below atmospheric pressure (negative pressure).
- The exhaust connections can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves when performing this procedure.
- To avoid the buildup of hazardous gases, do not place the nitrogen exhaust trap bottle in an enclosed cabinet.




**Caution:** The instrument requires two separate exhaust systems: 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.

1. Locate the nitrogen exhaust trap bottle in an accessible area below the instrument.

### Nitrogen exhaust trap bottle



 **Caution:** To avoid gas leaks, use the sharp knife to cut the PTFE tubing squarely (that is, perpendicular to its horizontal axis).

2. Cut a length of 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 B-8](#)).

5. Cut a length of 12-mm tubing long enough to connect the instrument to the nitrogen exhaust trap bottle.
6. Connect one end of the tubing to the exhaust port on the instrument's rear panel.
7. Connect the free end of the tubing to the inlet port on the nitrogen exhaust trap bottle.



**Caution:** To avoid gas leaks, use the sharp knife to cut the PTFE tubing squarely (that is, perpendicular to its horizontal axis).

8. Cut a second length of 12-mm tubing long enough to connect the nitrogen exhaust trap bottle to the exhaust vent.
9. Insert one end of the tubing into the outlet port on the nitrogen exhaust trap bottle.
10. Route the free end of the tubing to the exhaust vent.



**Warning:** To confirm the integrity of the source exhaust system, perform the following test.



**Caution:** To avoid damage to the instrument, use snoop<sup>®</sup> (or its equivalent) leak detector liquid only for the purpose described in the following step. Do not use it on any other part of the instrument.

11. Use snoop (or equivalent) leak detector liquid to ensure that there are no leaks at the instrument exhaust and laboratory exhaust system line connections.



## Connecting the liquid waste line

---

### Required materials

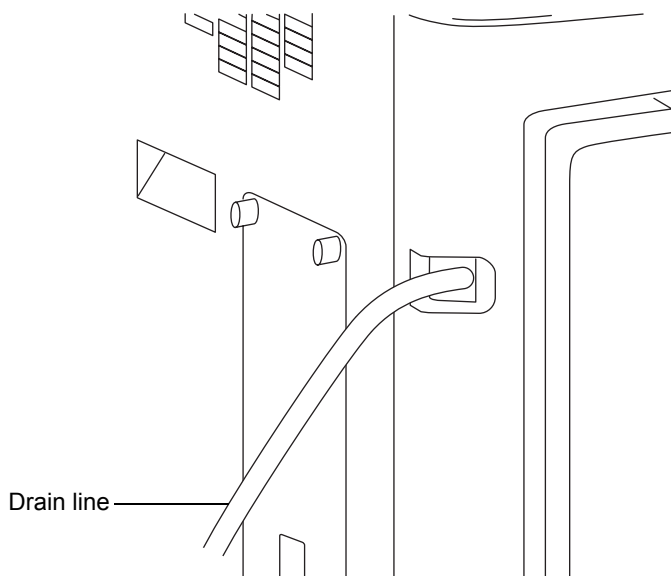
- Chemical-resistant, powder-free gloves
- Waste container

### To connect the liquid waste line



**Warning:** The waste line and connection can be contaminated with biologically hazardous materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

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 materials,

- do not crimp or bend 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 to the rear panel must be separated from hazardous voltages by double or reinforced insulation. Circuits of this type are classified as safety extra low voltage (SELV). Examples of circuits that are typically SELV include contact closure inputs and outputs for auto-samplers, and UV, RI, and fluorescence mass spectrometer signal outputs for LC/MS systems. The electrical connections on the rear panel of this mass spectrometer are all SELV.

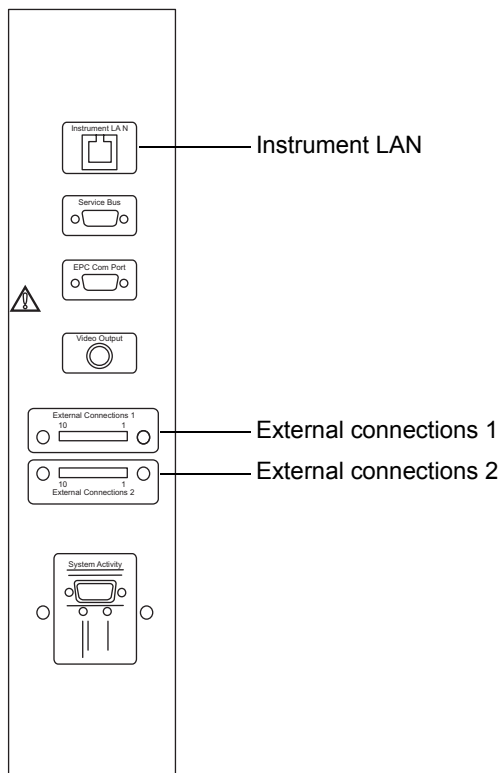


**Caution:** To avoid damaging the instrument,

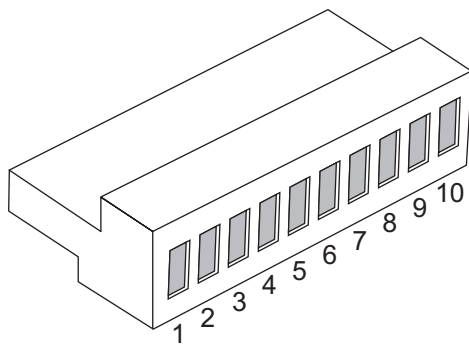
- never apply a voltage to the Analog (out) connectors; these are active connections driven by the instrument.
- do not apply voltages higher than those shown in the tables on [page B-17](#).

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.

## 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	CE Interlock Out, common	+30 V dc, 100 mA
9	CE Interlock Out, normally closed (N/C)	+30 V dc, 100 mA
10	CE Interlock Out, normally open (N/O)	+30 V dc, 100 mA

## 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

## External connections 2 (continued)

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.
CE interlock Out	Interfaces with a capillary electrophoresis power supply so that the instrument is safely interlocked against high voltages.

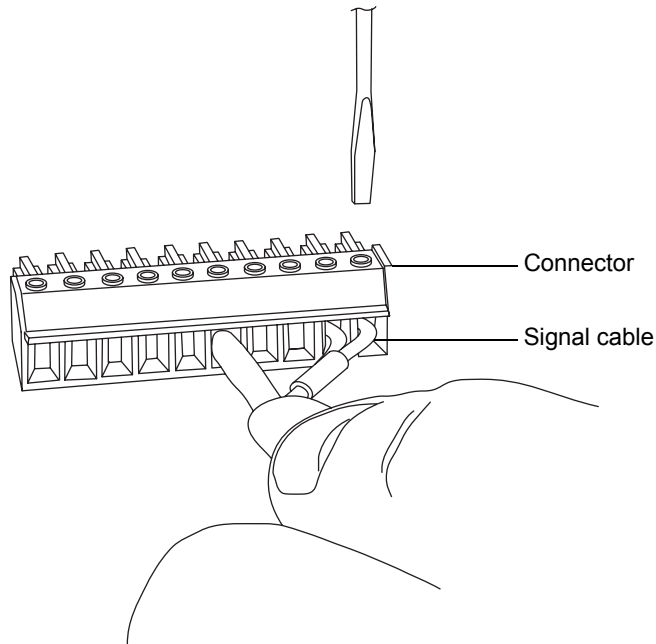
**Requirement:** To meet the regulatory requirements of immunity from external electrical disturbances, install connector covers over the signal connectors.

### Required materials

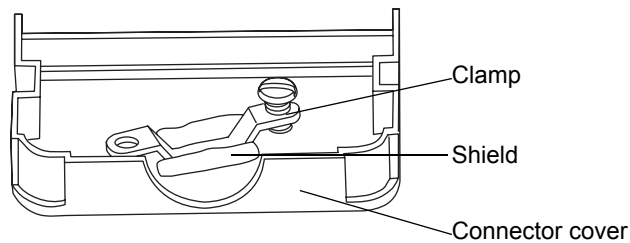
- Small flat-bladed screwdriver
- Connector covers

## To make the signal connections

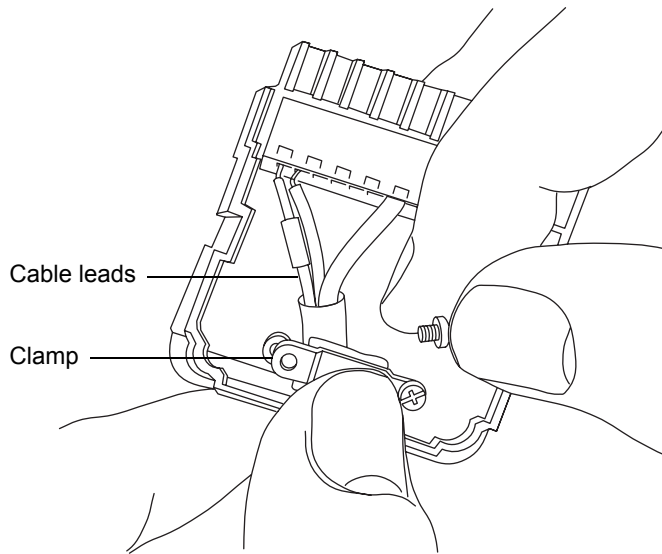
1. Determine the signal connection location from the silk-screened label on the rear panel of each instrument.
2. Use the small flat-bladed screwdriver to attach the positive and negative leads of the signal cable to the connector.



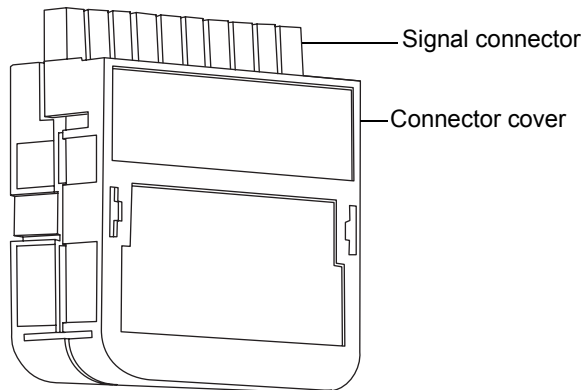
3. Slide the clamp (with the bend facing down) into the protective shield.
4. Insert the clamp and shield (with the bend facing down) into the connection cover, and insert and finger tighten one self-tapping screw.



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)

---

**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 B-16](#)).
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<sup>®</sup> 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 B-16](#)).
4. Connect the free end of the shielded Ethernet cable to the network switch.

## Connecting to the electricity source

---



**Caution:** 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.



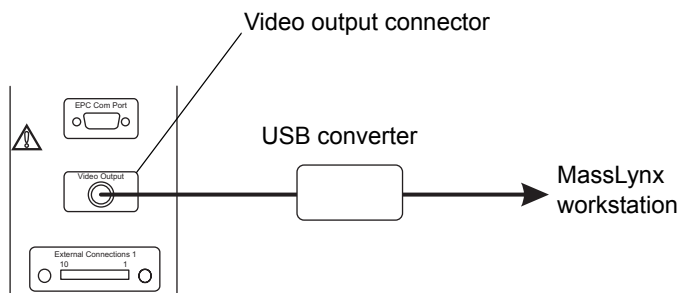
**Warning:** To avoid electrical shock, use the SVT-type power cord in the United States and HAR-type (or better) in Europe. For information regarding what cord to use in other countries, contact your local Waters distributor.

1. Connect the female end of the power cord to the receptacle on the rear panel of the mass spectrometer (see [page B-2](#)).
2. Connect the male end of the mass spectrometer power cord to a suitable 200 to 240 V a.c. wall outlet.

## Connecting the NanoLockSpray source camera

---

The NanoLockSpray™ source camera 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.
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 ready 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 installs.

8. Click Finish.

# C Materials of construction and compliant solvents



**Warning:** To confirm the integrity of the source exhaust system, you must address any safety issues raised by the contents of this Appendix.

## Contents

Topic	Page
Preventing contamination	C-2
Items exposed to solvent	C-2
Solvents used to prepare mobile phases	C-3

## Preventing contamination

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For information on preventing contamination, see *Controlling Contamination in LC/MS Systems* (part number 715001307). You can find this document on <http://www.waters.com>; click Services and Support and then Support Center.

## 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 C-3](#) for details about the most common ingredients used to prepare mobile phases.]

### Items exposed to solvent

Item	Material
Corona discharge pin mounting contact	PEEK <sup>TMa</sup>
Gas exhaust port	Aluminium
Gas tubes	FEP <sup>b</sup>
Ion block	Stainless steel
Ion block support	PEEK <sup>a</sup>
Isolation valve	Gold-plated aluminium/bronze
O-rings	Viton <sup>®</sup> or PTFE <sup>c</sup> -encapsulated Viton
Probe adjuster bellows	PTFE <sup>c</sup> /Viton
Probe adjuster assembly	Anodized aluminium, glass filled acetal, and stainless steel
Probe shaft	PEEK <sup>a</sup>
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 <sup>d</sup> , SST <sup>e</sup> , PBT <sup>f</sup> , and POM <sup>g</sup>

- a. Polyetheretherketone
- b. Fluorinated ethylene propylene
- c. Polytetrafluoroethylene
- d. Nitrile butadiene rubber
- e. Stainless steel
- f. Polybutylene Terephthalate
- g. Polyoxymethylene

## Solvents used to prepare mobile phases

---

The following lists the most common ingredients used to prepare mobile phases for reverse-phase LC/MS (API):

- Water
- Methanol
- Acetonitrile
- Formic acid (<0.1%)
- Acetic acid (<0.1%)
- Trifluoroacetic acid (<0.1%)
- Ammonium acetate (<10 mM)
- Ammonium formate (<10 mM)

These solvents are not expected to cause any problems with the materials appearing in the table on [page C-2](#).





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