

Waters Xevo TQ-S cronos

Overview and Maintenance Guide

General information

Audience and purpose

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

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Graphical parts locator: Identify and order parts using an interactive graphical navigator. Access maintenance procedures and reference documents.



Waters online toolbox: A collection of wizards that help you pick the correct chemistry consumables to meet your separation requirements, including vials, plates, filters, column selectivity charts, and more

Intended use of the Xevo TQ-S cronos

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

Calibrating

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

When calibrating mass spectrometers, consult the instrument's online Help system for calibration instructions.

Quality control

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

EMC considerations

FCC radiation emissions notice

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

Canada spectrum management emissions notice

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

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

ISM classification: ISM group 1 class A

This classification was assigned in accordance with CISPR 11 Industrial Scientific and Medical (ISM) instruments requirements.

Group 1 products apply to intentionally generated and/or used conductively coupled radio-frequency energy that is necessary for the internal functioning of the equipment.

Class A products are suitable for use in all establishments other than residential locations and those directly connected to a low-voltage power supply network supplying a building for domestic purposes.

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

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

EMC emissions

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

EMC grounding requirements

! **Notice:** To avoid difficulties in ensuring electromagnetic compatibility, if the instrument's pump control cable is attached to the vacuum hose, ensure that the cable is grounded to the mass spectrometer.

Legal manufacturer

Legal manufacturer:



	Waters Corporation 34 Maple Street Milford, MA 01757 USA
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Safety considerations





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

Applicable symbols


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

Symbol	Definition
	Manufacturer
	Date of manufacture

Symbol	Definition
	Confirms that a manufactured product complies with all applicable European Community directives
	UK Conformity Assessed marking confirms that a manufactured product is in conformity with the applicable requirements for products sold within Great Britain
	Australia EMC compliant
	Confirms that a manufactured product complies with all applicable United States and Canadian safety requirements
	Confirms that a manufactured product complies with all applicable United States and Canadian safety requirements
	Environmentally friendly use period (China RoHS): indicates the number of years from the date of manufacture until the product, or components within the product, are likely to be discarded or degrade into the environment
	Consult instructions for use
	Alternating current
	Electrical and electronic equipment with this symbol may contain hazardous substances and should not be disposed of as general waste For compliance with the Waste Electrical and Electronic Equipment Directive (WEEE) 2012/19/EU, contact Waters Corporation for the correct disposal and recycling instructions
	For indoor use only
	No pushing

Symbol	Definition
	Do not connect to an LC system
	Indicates the maximum load you can place on that item (for example, 10kg)
	Serial number
	Part number, catalog number

Safety hazard symbol notice

The  symbol indicates a potential hazard. Consult the documentation for important information about the hazard and the appropriate measures to prevent and control the hazard.

Electrical power safety notice

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

Equipment misuse notice

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

Considerations specific to the device

Power cord replacement hazard



Warning: To avoid electric shock, observe these precautions:

- The power cord functions as the safety disconnect device. Position the equipment so that you can reach the power cord easily.
- Use SVT-type power cords in the United States and HAR-type power cords, or better, in Europe. For requirements elsewhere, contact your local Waters distributor.
- Do not replace power cords with inadequately rated power cords.
- Inspect the power cords for damage and replace them if necessary.
- Power-off and unplug a system module or stand-alone device before performing any maintenance operation on it.

Solvent leakage hazard

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



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

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

Bottle placement prohibition



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

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

Spilled solvents hazard



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

Flammable solvents hazard



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

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

Glass breakage hazard



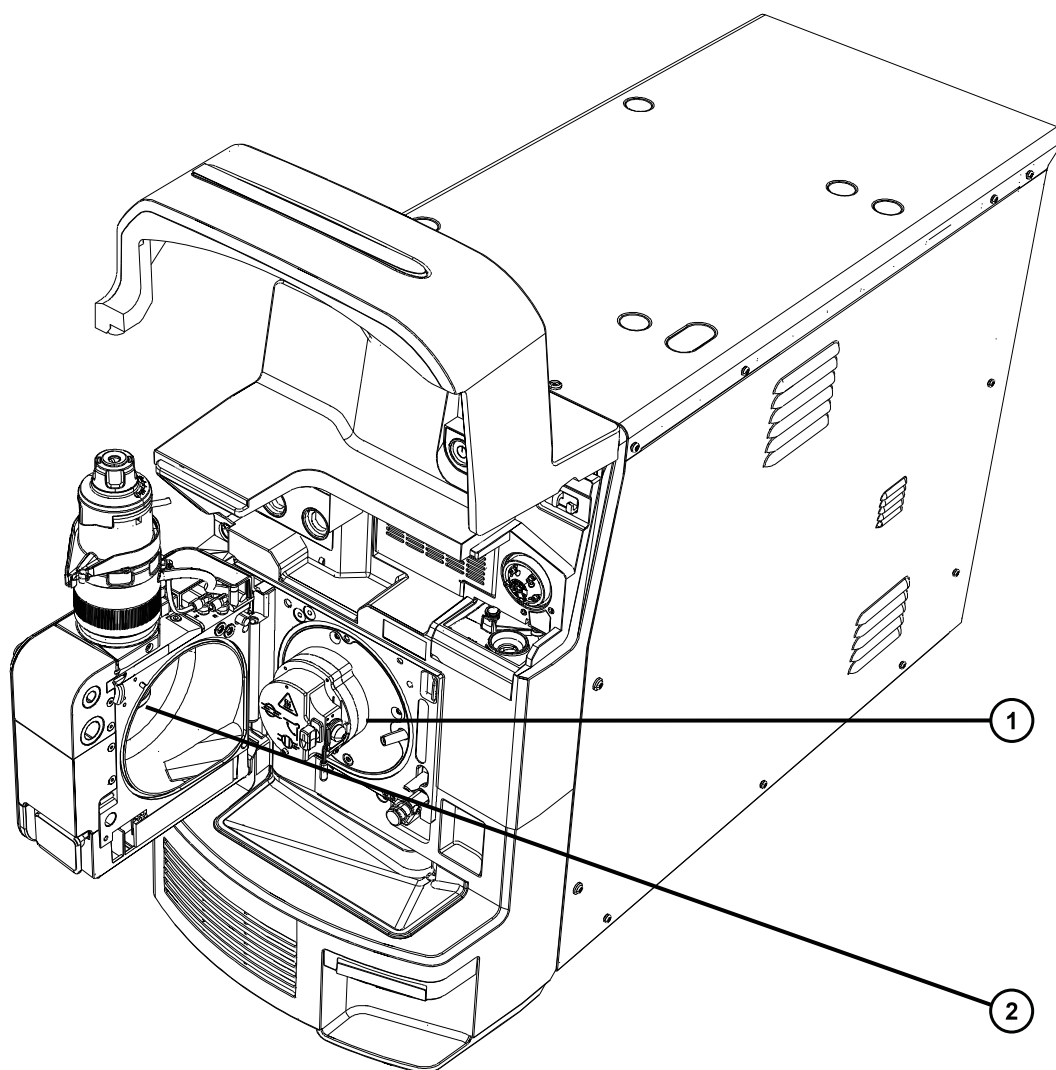
Warning: To avoid injuries from broken glass, falling objects, or exposure to biologically hazardous, toxic, or corrosive substances, never place containers on top of the instrument or on its front covers.

High-temperature hazard



Warning: To avoid burn injuries, avoid touching the listed components when operating or maintaining the instrument.

Mass spectrometer high-temperature hazard



- ① Source ion block assembly
- ② Desolvation heater

Hazards associated with removing an instrument from service



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



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



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

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

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

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

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

Safe disposal

Contact recycling@waters.com with any questions or concerns regarding the proper handling or disposal.

Dispose of Waters instrumentation products in accordance with applicable requirements and best practices as described below.

- Follow appropriate procedures for flushing the instrument's fluid paths of any hazardous samples or solvents.
- Waters instruments are subject to European Union's Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) Directives. According to these directives, do not dispose of instruments in the general waste stream. Similar "e-waste" laws also apply in other jurisdictions. In all cases, ensure that a certified electronics recycler processes end-of-life instruments.
- Some Waters instruments use batteries, mercury-containing lamps, or other replaceable components during the life span of the instrument. Handle such materials in accordance with local laws governing their processing and safe disposal.

Safety advisories

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

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1 Waters Xevo TQ-S cronos overview

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

You can use the Xevo TQ-S cronos with these high-performance Waters ZSpray sources:

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

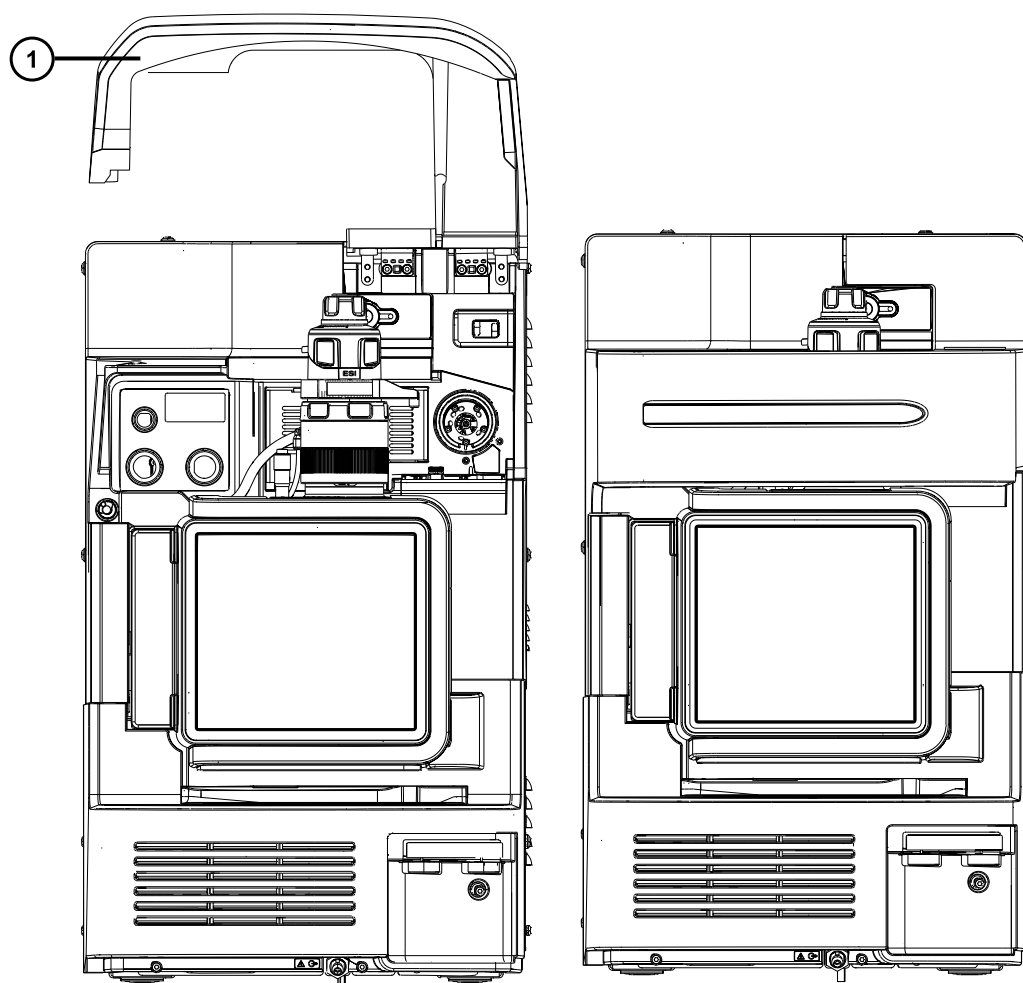
Note: ESI supports both the standard or the tool-free ESI probe.

- Optional UniSpray
- Optional atmospheric solids analysis probe (ASAP)

Refer to the appropriate manufacturer's documentation for additional details.

Refer to the instrument's online Help for more information about supported sources. See the *Waters Xevo TQ-S cronos Site Preparation Guide (715006216)* for mass spectrometer specifications.

Figure 1–1: Xevo TQ-S cronos shown with visor up and visor down



① Visor up

1.1 Automation and fluidics

The system software (IntelliStart for MassLynx, or waters_connect) monitors instrument performance and indicates when the instrument is ready for use.

The software automatically tunes and mass calibrates the instrument, displays performance readbacks, and enables simplified setup of the system for use in routine analytical applications. waters_connect software includes a dedicated health system that provides immediate feedback and suggestions for resolving common issues.

The fluidics system¹ is built into the mass spectrometer. It delivers sample directly to the MS probe from the LC column or from two integral reservoirs. The integral reservoirs can also deliver sample through direct or combined infusion, enabling you to optimize instrument performance at analytical flow rates.

See [Fluidics System \(Page 29\)](#) and the mass spectrometer's online Help for further details on the fluidics system.

1.2 ACQUITY UPLC-MS Xevo TQ-S cronos systems

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

1.2.1 Compatible systems - Xevo TQ-S cronos

The Waters Xevo TQ-S cronos is compatible with the following ACQUITY UPLC systems:

- ACQUITY UPLC
- ACQUITY UPLC H-Class, H-Class PLUS, H-Class PLUS Bio, and H-Class PLUS Binary
- ACQUITY UPLC I-Class and I-Class PLUS
- ACQUITY Premier
- ACQUITY Arc and ACQUITY Arc Bio
- Arc Premier

The ACQUITY Xevo TQ-S cronos UPLC-MS system includes an ACQUITY UPLC, ACQUITY UPLC H-Class, or ACQUITY UPLC I-Class, and the Waters Xevo TQ-S cronos fitted with the ESI/APCI/ESCI source.

Note: ACQUITY system options can vary depending on the software used to operate the instrument.

1.2.2 ACQUITY system core components

Core components for each ACQUITY system are listed below:

Table 1–1: ACQUITY system core components:

System	Core components
ACQUITY UPLC	<ul style="list-style-type: none">• Binary solvent manager• Sample manager• Column heater• UPLC detectors• Solvent tray

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

Table 1–1: ACQUITY system core components: (continued)

System	Core components
	<ul style="list-style-type: none"> • ACQUITY UPLC column • Software to control the system
ACQUITY UPLC H-Class	<ul style="list-style-type: none"> • Quaternary solvent manager • Sample manager with flow-through needle • Column heater–active • UPLC detectors • Solvent tray • ACQUITY UPLC column • Software to control the system
ACQUITY UPLC I-Class	<ul style="list-style-type: none"> • Binary solvent manager • Sample manager • Column heater–active • UPLC detectors • Solvent tray • ACQUITY UPLC column • Software to control the system
ACQUITY Premier	<ul style="list-style-type: none"> • Binary solvent manager or quaternary solvent manager • Sample manager • Column heater or column manager • ACQUITY Premier detectors • Solvent tray • ACQUITY Premier column • Software to control the system
ACQUITY Arc and ACQUITY Arc Bio	<ul style="list-style-type: none"> • Quaternary solvent manager • Sample manager • Column heater • ACQUITY Arc detectors • Solvent tray

Table 1–1: ACQUITY system core components: (continued)

System	Core components
	<ul style="list-style-type: none">• Analytical column• Software to control the system
Arc Premier	<ul style="list-style-type: none">• Binary solvent manager or quaternary solvent manager• Sample manager• Column heater or column manager• Arc Premier detectors• Solvent tray• Arc Premier column• Software to control the system

For additional information, see:

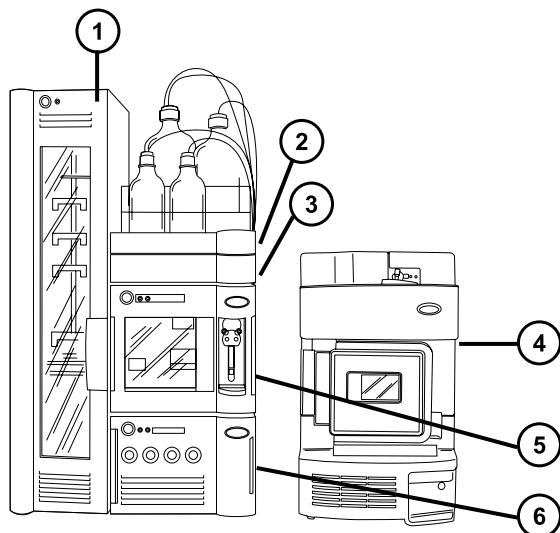
- *ACQUITY UPLC System Operator's Guide (71500082502)*
- *ACQUITY UPLC H-Class System Guide (715005049)*
- *ACQUITY UPLC I-Class System Guide (715003736)*
- *ACQUITY Premier System Guide (715006884)*
- *ACQUITY Arc System Guide (715004747)*
- *ACQUITY Arc Bio System Guide (715005476)*
- *Arc Premier System Guide (715007449)*

Also see *Controlling Contamination in LC/MS Systems (715001307)*.

You can find these documents on www.waters.com by clicking **Support > Support Documents and Downloads**.

1.2.3 Waters ACQUITY Xevo TQ-S cronos UPLC-MS system

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



- ① Sample organizer (optional)
- ② Solvent tray
- ③ Column heater
- ④ Xevo TQ-S cronos
- ⑤ Sample manager
- ⑥ Binary solvent manager

1.2.4 Software and data system

You can use either of the following software to control the mass spectrometer:

- MassLynx v4.2
- waters_connect

The software enables these major operations:

- Configuring the system
- Creating methods that define operating parameters for a run
- Automatically tuning and mass calibrating the mass spectrometer
- Running samples
- Acquiring data

- Monitoring the run
- Processing data
- Reviewing data
- Printing data

1.2.4.1 MassLynx software

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

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

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

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

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

1.2.4.2 waters_connect software

waters_connect software acquires, analyzes, and manages mass spectrometry data. waters_connect applications (including Acquisition Method Editor, Sample Submission, MS Quan, LC-MS Toolkit, UNIFI, System Console, and Administration) are included with the software.

See the waters_connect online Help for information about using waters_connect software.

You configure settings, monitor performance, run diagnostic tests, and maintain the system and its modules via the waters_connect System Console application and the UNIFI application.

See the instrument's online Help, available from the System Console application, for additional details.

1.3 Ionization techniques and source probes

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

1.3.1 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 source in ESI mode, you fit the source enclosure with an ESI probe adapter and ESI probe assembly.

The standard ESI probe assembly accommodates flow rates of up to 2 mL/min, making it suitable for LC applications in the range of 100 μ L/min to 2 mL/min. To reduce peak broadening for lower-flow-rate LC applications, such as 1-mm UPLC columns, use the optional, small-bore capillary, which can accommodate a maximum flow rate of 200 μ L/min.

See also: [ESI, ESCi, and APCI modes \(Page 47\)](#) for further details.

1.3.2 ESCi

ESCi mode is supplied as standard equipment on the mass spectrometer. In ESCi, the standard ESI probe adapter is used in conjunction with a corona pin, to allow alternating acquisition of ESI and APCI ionization data, which facilitates high throughput and wider compound coverage.

See [ESI, ESCi, and APCI modes \(Page 47\)](#) for further details.

1.3.3 APCI

An optional dedicated high-performance APCI interface is available. APCI produces singly charged protonated or deprotonated molecules for a broad range of nonvolatile analytes.

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

See [ESI, ESCi, and APCI modes \(Page 47\)](#) for further details.

1.3.4 UniSpray source

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

See [UniSpray standard source \(Page 67\)](#) for further details.

1.3.5 Atmospheric solids analysis probe (ASAP)

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

See the *Atmospheric Solids Analysis Probe for Universal Source Operator's Guide Supplement* (715007201) for further details.

1.4 Fluidics System

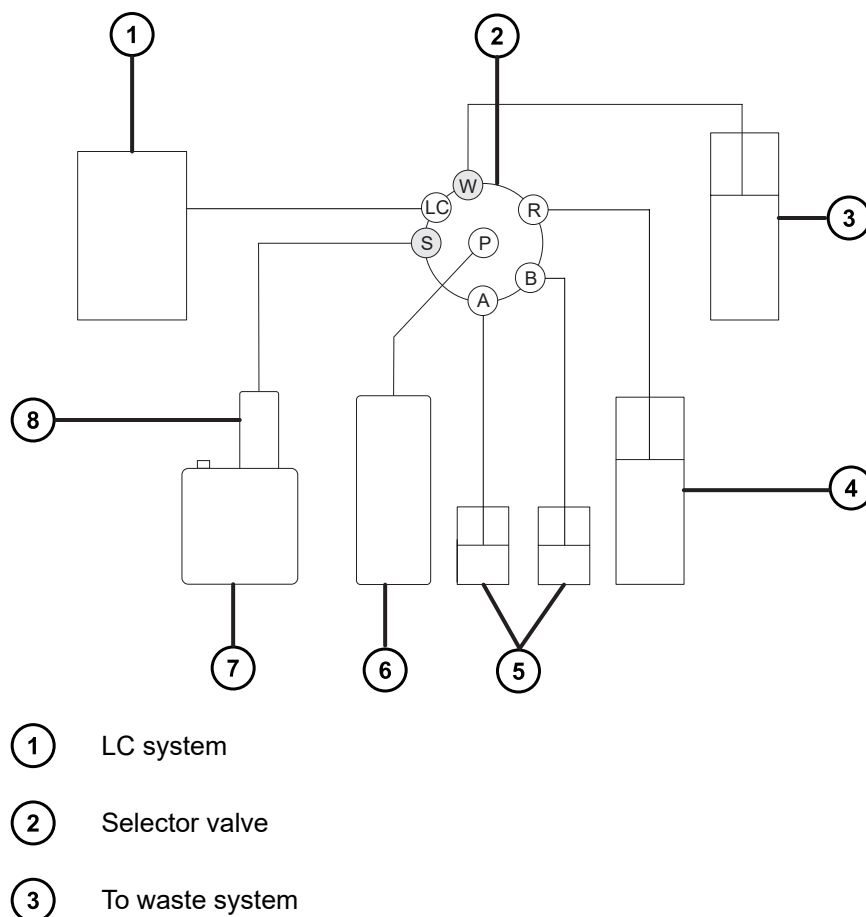
1.4.1 Overview

The fluidics system is built into the instrument and controls how sample is delivered to the source.

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

- From the LC system.
- From two integral reservoirs. Use standard reservoir bottles (15 mL) for instrument setup and calibration. Use 1.5-mL, low-volume vials (sold separately) to infuse smaller volumes. See [Preparing the fluidics system \(Page 43\)](#).
The reservoir bottles can also deliver sample through direct or combined infusion, permitting optimization at analytical flow rates.
- From a wash reservoir that contains solvent for automated flushing of the instrument's solvent delivery system.

Figure 1–3: Fluidics system



- ④ Wash bottle, located in solvent tray
- ⑤ Reservoirs A and B
- ⑥ Syringe pump
- ⑦ Source enclosure
- ⑧ Probe

1.4.2 System components

The onboard system incorporates a selector valve, an infusion pump, and two sample reservoirs mounted on the bottom, right-hand side of the instrument.

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

1.4.3 System operation

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

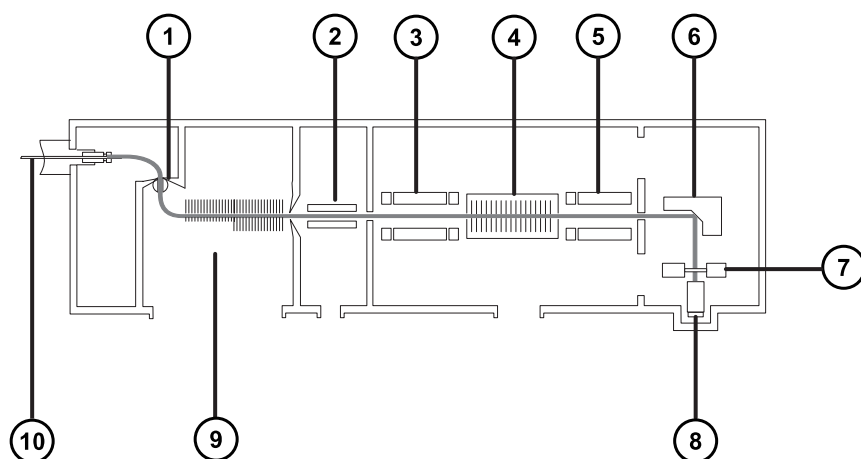
See the mass spectrometer's online Help for additional details about operation of the instrument's solvent delivery system.

1.5 Ion optics

The mass spectrometer's ion optics operate as follows:

1. Samples from the LC or instrument fluidics system are introduced at atmospheric pressure into the ionization source.
2. The ions pass through the sample cone into the vacuum system.
3. The ions pass through the transfer optics (the ion guide) to the quadrupole, where they are filtered according to their mass-to-charge ratios.
4. The mass-separated ions pass into the T-Wave collision cell where they either undergo collision-induced dissociation (CID) or pass to the second quadrupole.
5. The transmitted ions are detected by the photomultiplier detection system.
6. The signal is amplified, digitized, and sent to the mass spectrometry software.

Figure 1–4: Ion optics overview



- ① Sample cone
- ② Segmented quadrupole (ion guide 2)
- ③ MS1 quadrupole
- ④ T-Wave collision cell
- ⑤ MS2 quadrupole
- ⑥ Conversion dynode
- ⑦ Phosphor disk
- ⑧ Photomultiplier
- ⑨ Stepwave (ion guide 1)
- ⑩ Probe

1.6 MS operating modes

The following table shows the MS operating modes.

Table 1–2: MS operating modes:

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

Table 1–2: MS operating modes: (continued)

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

In MS mode, the instrument can acquire data at scan speeds as high as 20,000 Da/s. Use this mode for instrument tuning and calibration before MS/MS analysis. See the mass spectrometer’s online Help for further information.

Use the selected ion recording (SIR) mode for quantitation when you cannot find a suitable fragment ion to perform a more specific multiple reaction monitoring (MRM) analysis (see [MRM mode \(Page 34\)](#) for further details). In SIR and MRM modes, neither quadrupole is scanned, and no spectrum (intensity versus mass) is produced. The data obtained from SIR or MRM analyses derive from the chromatogram plot—specified mass intensity (SIR) or specified transition (MRM) versus time.

1.7 MS/MS operating modes

The following table shows the MS/MS operating modes.

Table 1–3: MS/MS operating modes:

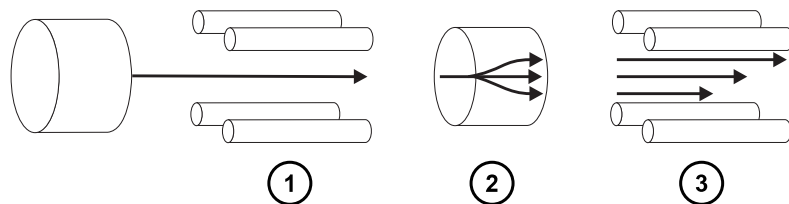
Operating mode	MS1	Collision cell	MS2
Product (daughter) ion spectrum	Static (at precursor mass)	Fragment precursor ions and pass all masses	Scanning
Precursor (parent) ion spectrum	Scanning		Static (at product mass)
MRM	Static (at precursor mass)		Static (at product mass)
PICS (Product Ion Confirmation Scan)	Static (at precursor mass)		Switching between static (at product mass) and scanning
Constant neutral loss spectrum	Scanning (synchronized with MS2)		Scanning (synchronized with MS1)

RADAR is an additional mode that allows you to create experiments containing both MS and MS/MS functions.

1.7.1 Product (daughter) ion spectrum

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

Figure 1–5: Product ion spectrum



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

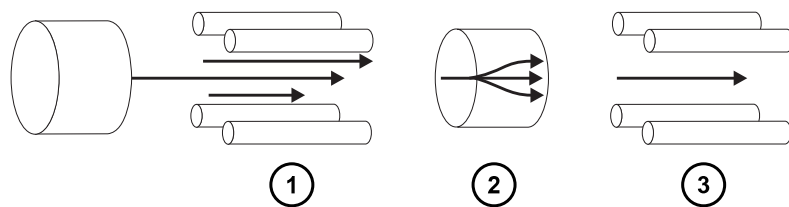
1.7.1.1 Typical applications

You typically use product ion spectrum for the following applications:

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

1.7.2 Precursor (parent) ion spectrum

Figure 1–6: Precursor ion spectrum



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

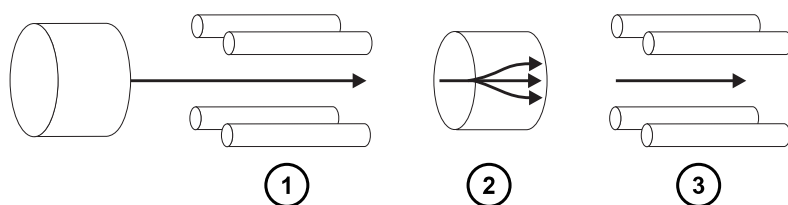
1.7.2.1 Typical application

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

1.7.3 MRM mode

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

Figure 1–7: MRM mode



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

1.7.3.1 Typical application

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

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

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

1.7.4 PICS mode

A variation on MRM that is activated by a single check box, PICS allows you to collect a product ion spectrum or MS Scan spectrum from the top of all detected peaks in MRM mode, for additional confidence in your peak assignment.

1.7.5 RADAR mode

In RADAR mode, the Xevo TQ-S cronos rapidly alternates between MRM and full-scan MS acquisition modes. The instrument tracks target analytes with precision in MRM mode, while at

the same time, scanning (in MS mode) the background for all other components. This enables fast characterization of potential matrix effects, providing a platform for more robust method development.

1.7.5.1 Typical application

You typically use RADAR mode during method development prior to performing MRM or PICS to quantify known analytes in complex samples. Typical applications include:

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

MRM analysis with no associated RADAR or PICS operation does not produce a spectrum, because only one transition is monitored at a time. As in SIR mode, a chromatogram is produced.

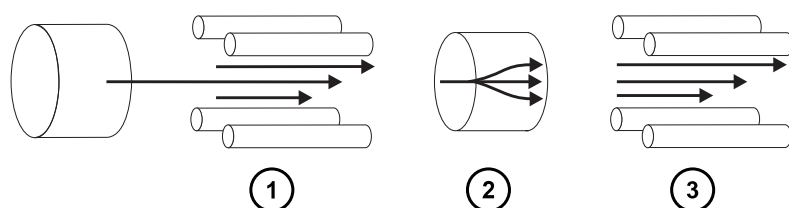
1.7.6 Constant neutral loss mode

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

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

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

Figure 1–8: Constant neutral loss mode



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

1.7.6.1 Typical application

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

1.8 Sample inlet

Any of three methods delivers solvent and sample to the installed probe:

- An LC system, which delivers the eluent from an LC analysis.
- The fluidics system, which uses onboard solutions to automate instrument optimization to deliver onboard solutions by direct or combined infusion.
- An FIA system, which delivers carrier solvent from flow injection analysis.

1.9 Leak sensors

Leak sensors in the instrument's drip trays continuously monitor for liquid leaks. A leak sensor stops system flow when its optical sensor detects about 1.5 mL of accumulated leaked liquid in its surrounding reservoir. At the same time, the software displays an error message alerting you that a leak has developed. Consult the *Waters ACQUITY UPLC Leak Sensor Maintenance Instructions* (71500082506) for complete details.

1.10 Vacuum system

An external roughing pump and an internal split-flow turbomolecular pump combine to create the source vacuum. The turbomolecular pump evacuates the analyzer and ion transfer region.

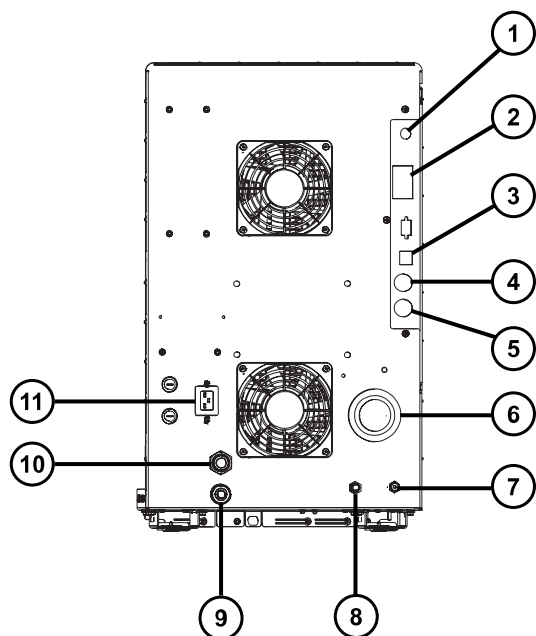
Vacuum leaks and electrical or vacuum pump failures cause vacuum loss, which triggers the protective interlocks to switch off the high voltage. The system monitors the turbomolecular pump speeds and continuously measures vacuum pressure with a built-in Pirani gauge. The gauge also serves as a switch, stopping operation when vacuum loss is sensed.

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

1.11 Rear panel

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

Figure 1–9: Mass spectrometer rear panel



- ① Video connection
- ② Event inputs and outputs
- ③ Shielded Ethernet
- ④ Waste bottle electrical connection
- ⑤ Roughing pump control
- ⑥ Source vacuum
- ⑦ Collision cell gas inlet
- ⑧ Nitrogen inlet
- ⑨ Turbo vacuum
- ⑩ Source vent
- ⑪ Power

2 Preparing the mass spectrometer for operation

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

2.1 Preparing to start the mass spectrometer

This instrument is compatible with the ACQUITY UPLC system. If you are not using an ACQUITY UPLC system, refer to the documentation relevant to the system you are using.

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

Strong solvents used to prepare mobile phases for normal-phase LC-MS, for example, hexane or tetrahydrofuran (THF), will adversely affect the performance of the materials shown in the table [Items exposed to solvents \(Page 171\)](#) and must not be used. You must evaluate the safety issues if these solvents are used as additives to the mobile phases at reduced concentration, or as sample diluents.

See also: Refer to the following sources for more details:

- Appendix [Materials of construction and compatible solvents \(Page 171\)](#) of this guide, for mass spectrometer solvent information
- Appendix C of the *ACQUITY UPLC System Operator's Guide (71500082502)*, for solvent compatibility with ACQUITY devices

To prepare the mass spectrometer for startup:



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

1. On the rear panel, ensure that the nitrogen supply is connected to the instrument's nitrogen inlet connection (see [Rear panel \(Page 36\)](#)).

Requirements:

- The nitrogen must be dry and oil-free, with a purity of at least 95% or, for APGC use, at least 99.999%. Regulate the supply at 600 to 690 kPa (6.0 to 6.9 bar, 90 to 100 psi).
 - A gas-fail device must be installed, to interrupt the flow of LC solvent should the nitrogen supply fail.
2. Ensure that the wash solvent bottle is placed in the solvent tray on top of the instrument, and that the end of the tubing from the fluidics valve is fully submerged in the solvent.

Note: For additional information on the fluidics connections, see the diagram on the inside of the fluidics valve access door, and [Plumbing schematic \(Page 174\)](#).

3. Ensure that the collision gas supply is connected to the instrument's collision cell gas inlet.

Requirement: The collision gas is argon; it must be dry and of high purity (99.997%). Regulate the supply at 50 kPa (0.5 bar, 7 psi).

2.2 Starting the mass spectrometer using MassLynx software

Starting the mass spectrometer comprises powering-on the workstation, logging in, powering-on the mass spectrometer and all other instruments, and then starting the software.

Requirements:

- Ensure that you have prepared the mass spectrometer. See [Preparing to start the mass spectrometer \(Page 38\)](#).
- Power-on and log in to the workstation, to ensure that it assigns the IP addresses of the system instruments.

See also: The mass spectrometer's online Help for details on the software.

To start the mass spectrometer using MassLynx software:

1. Power-on the workstation and log in.
2. Press the power switches on the top, left-hand side of the ACQUITY instruments, and then the power switch on the top, right-hand side of the mass spectrometer.

Result: Each system instrument runs a series of startup tests.

3. Wait 3 minutes for the embedded PC to initialize, as indicated by an audible alert.

Tip: The power and operate LEDs change as follows:

- During initialization, the solvent manager LED and sample manager LED flash green.
- After the instruments are successfully powered-on, all power LEDs show steady green. The solvent manager flow LED, the sample manager run LED, and the mass spectrometer Operate LED remain off.

4. Start the MassLynx software and monitor the Instrument Console software for messages and LED indications.
5. Pump down (evacuate) the mass spectrometer by following these steps:

- a. In the lower, left-hand corner of the MassLynx main window, click **IntelliStart**.

Result: The mass spectrometer console appears. The mass spectrometer is in Standby mode.

- b. To start the roughing pumps, click **Control > Pump**.

Tip: After a 20-second delay, during which the turbopump is starting, the roughing pump starts. IntelliStart displays “Instrument in standby”, and the Operate LED remains off.

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

Tip: In the Instrument Console, the System Ready indicator shows green when the instrument is fully pumped-down (evacuated).




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

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

6. Click **Resolve**  or **Operate** .

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

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

2.3 Starting the mass spectrometer using waters_connect software

Starting the mass spectrometer comprises powering-on the host PC, logging in, powering-on the mass spectrometer and all other instruments, and then starting the software.

Requirement: Prepare the mass spectrometer. See [Preparing to start the mass spectrometer \(Page 38\)](#).

See also: The mass spectrometer’s online Help for details on the software.

To start the mass spectrometer using waters_connect software:

1. Start the host PC and log on.
2. Press the power switch on the top, left-hand side of the ACQUITY instruments.

Requirement: Switch on the instrument that contains the network switch first. This is usually the Sample Manager.

Results:

- Each system instrument runs a series of startup tests.
 - The host PC assigns an IP address to each of the system instruments.
3. Set the on/off switch on the top right-hand side of the mass spectrometer's front panel to the On position.
 4. Allow three minutes for the embedded PC to initialize.
Tip: An audible alert sounds when the embedded PC is ready.
Tip: The power and operate LEDs change as follows:
 - During initialization, the binary solvent manager LED and sample manager LED flash green.
 - After the instruments are successfully powered-on, all power LEDs show steady green.
 5. Log on to the waters_connect Hub, and then click the **System Console**.
 6. Navigate to the system control panel within the software.
 7. From the Console Navigation pane on the left-hand side of the window, in the System pane, click the instrument (Xevo TQ-S cronos).
 8. To pump the instrument, click **Maintain > Maintenance > Vacuum > Pump Instrument**.
 9. Wait for the vacuum to reach the required level.

Note: You can monitor the vacuum status, internal pressures, and turbo pump speed on the Maintenance pane.

10. To put the instrument into Operate, click **Summary > Summary**, and then click  in the upper right-hand corner of the window.

The following message appears at the top of the Maintenance pane: `Instrument Health | Ready`.

Tip: You can also put the instrument into Operate from the Manual Optimization pane. To do this, from the Console Navigation pane, click **Tune Page > MS Tune Page**, and then click **Operate** in the upper right-hand corner of the pane.

Result: After you click Operate, these events take place:

- The Operate indicator flashes green.
- The API and collision gas flows start.
- The Operate indicator changes to constant green and the instrument is ready for use.

Requirement: Before acquiring data, ensure that the instrument is pumped down (evacuated) for at least three hours and in Operate for at least 30 minutes.

2.4 Verifying the instrument's state of readiness

When the instrument is in good operating condition, the power and Operate LEDs show steady green. You can view any error messages in IntelliStart software (MassLynx) or from the **Summary** page on the instrument **System Console** (waters_connect).

2.5 Monitoring the mass spectrometer LEDs

LEDs on the mass spectrometer indicate its operational status.

2.5.1 Power LED

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

2.5.2 Operate LED

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

See the mass spectrometer's online Help for details on the Operate LED indications.

2.6 Tuning and calibration information

You must tune and, if necessary, calibrate the instrument prior to use. You can perform these tasks using IntelliStart (MassLynx) or waters_connect software. For further instruction, see the mass spectrometer's online Help.

Note: For instruments controlled by waters_connect software, calibration must complete successfully prior to use. The calibration process ("Full instrument setup") runs automatically and configures the quadrupole resolution and calibration for routine use.

2.7 Running the mass spectrometer at higher flow rates

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

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

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

2.8 Preparing the fluidics system

This section contains information for preparing the fluidics system. For additional information, see [Connecting liquid waste lines \(Page 163\)](#) and [Plumbing the fluidics system \(Page 173\)](#).



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

2.8.1 Installing the reservoir bottles

Use standard reservoir bottles (15-mL) for instrument setup and calibration. Use the Low-volume Adapter Kit (sold separately) to infuse smaller volumes. The low-volume vials have a volume of 1.5 mL.

Required materials

Chemical-resistant, powder-free gloves

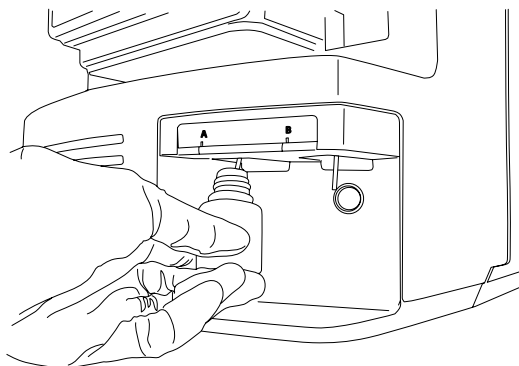
To install the reservoir bottles:



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

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

Figure 2–1: Installing the reservoir bottles



3. For each reservoir bottle, ensure that the ends of the solvent delivery tubes are positioned so they are close to, but not touching, the bottom of the bottle.

2.8.2 Installing the low-volume vials

To install the low-volume vials:



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

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



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

3. Screw each low-volume vial into the adapter.
4. For each low-volume vial, ensure that the ends of the solvent delivery tubes approach, but do not touch, the bottom of the vial.

2.8.3 Purging the fluidics

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

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

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

2.9 Rebooting the mass spectrometer

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

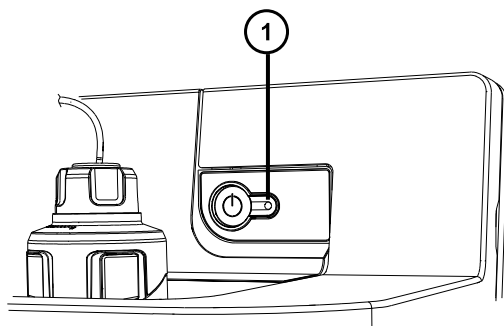
Reboot the mass spectrometer when either of these conditions applies:

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

To reboot the mass spectrometer:

1. Ensure that the mass spectrometer software is closed.
2. Insert a short length (7.5 cm) of PEEK tubing, or similar object, into the reset button aperture to operate the reset button.

Figure 2–2: Rebooting the mass spectrometer



① Reset button aperture

3. Remove the PEEK tubing from the reset button aperture.
4. Wait until the reboot sequence completes before starting the mass spectrometer software.

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

2.10 Leaving the mass spectrometer ready for operation

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

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

2.11 Emergency shutdown of the mass spectrometer



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



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

To shut down the mass spectrometer in an emergency:

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

3 Changing the mode of operation

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

- ESI (electrospray ionization)
- ESCi (combined electrospray and atmospheric pressure chemical ionization)
- APCI (atmospheric pressure chemical ionization)
- UniSpray

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

Note: Depending on the software used to control the instrument, some sources may not be available.

3.1 ESI, ESCi, and APCI modes

ESI, ESCi, and APCI modes are all configured using a standard source enclosure.

3.1.1 ESI mode

To operate in ESI mode, you must fit the ESI probe adapter to the source enclosure and install a probe assembly.

The ESI probe adapter fitted with a standard ESI probe assembly accommodates eluent flow rates as fast as 2 mL/min.

For further details, see [Electrospray ionization \(Page 27\)](#).

3.1.2 ESCi mode

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

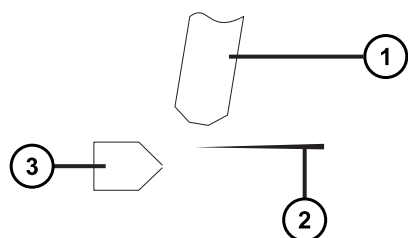
The system, with the ESI probe adapter installed and corona discharge pin fitted, can alternate between ESI and APCI ionization modes, facilitating data acquisition in ESI and APCI modes in parallel.

3.1.3 APCI mode

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

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

Figure 3–1: APCI mode



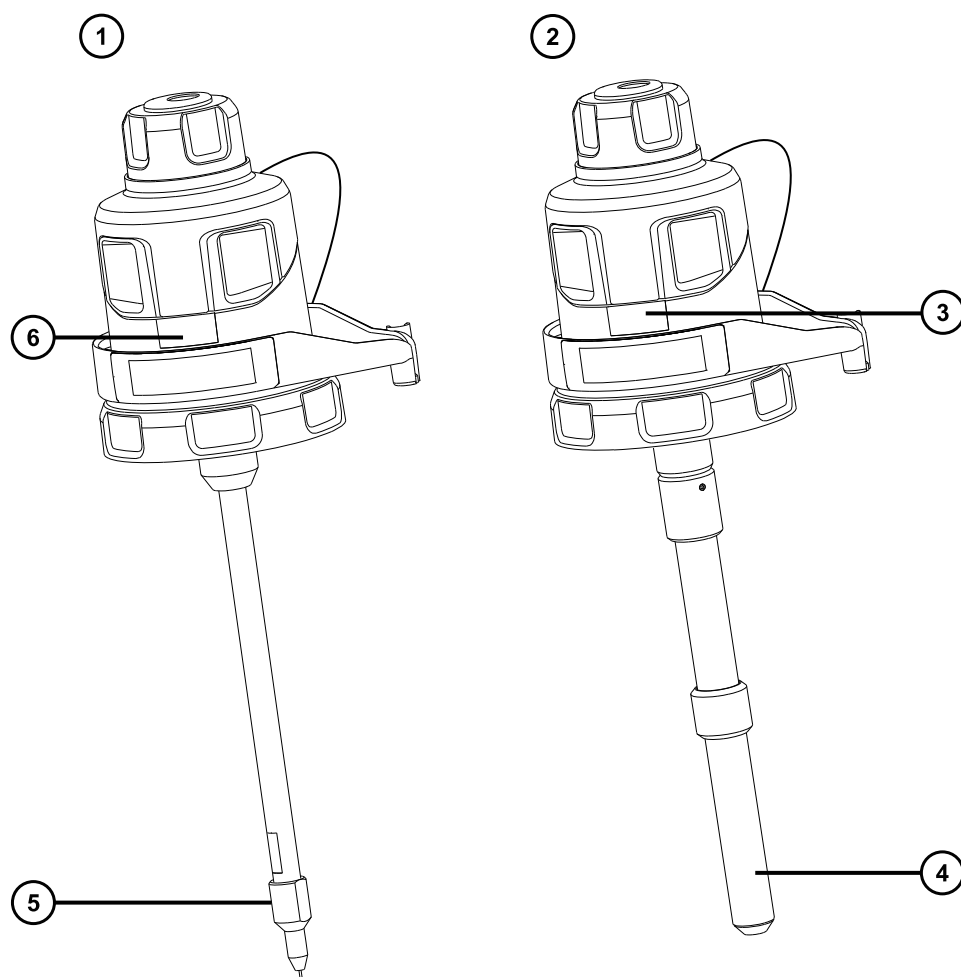
- ① APCI probe
- ② Corona pin
- ③ Sample cone

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

3.1.4 Configuring for ESI/ESCI/APCI modes

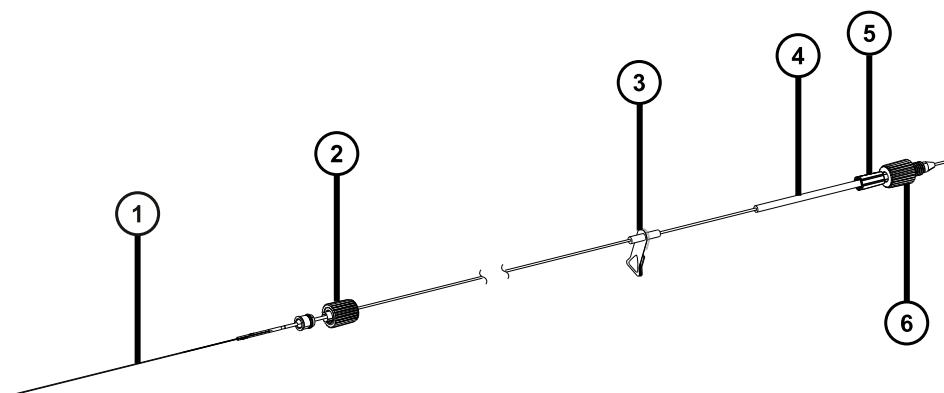
To operate in ESI, ESCI or APCI mode, you must fit the correct probe adapter and install a probe assembly.

Figure 3–2: Probe adapter types



- ① ESI probe adapter
- ② APCI probe adapter
- ③ ESI identification label
- ④ APCI probe heater
- ⑤ ESI probe tip
- ⑥ APCI identification label

Figure 3–3: Probe assembly



- ① Capillary
- ② Probe adapter PEEK fitting
- ③ Warning label
- ④ Identification label (includes part number and size information)
- ⑤ Fitting spring retainer
- ⑥ Probe inlet fitting

For ESCi and APCI modes, you must also install a corona pin.

Table 3–1: Configuration for ESI/ESCI/APCI modes

Mode	Probe adapter	Install corona pin
ESI	ESI	No
ESCI	ESI	Yes
APCI	APCI	Yes

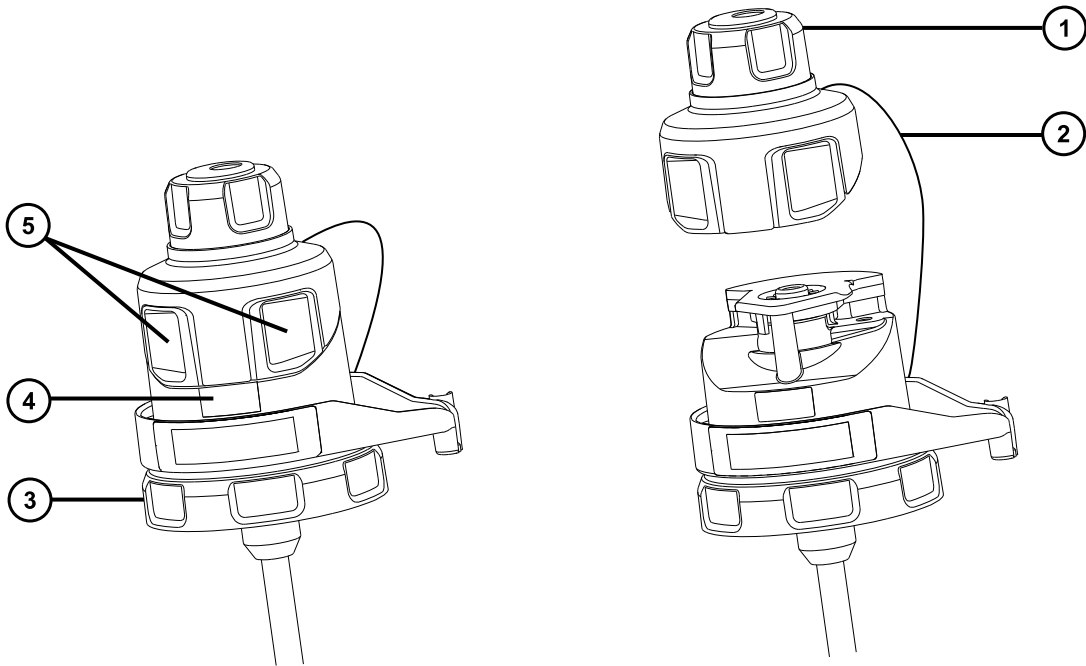
For more information on using each mode, see the Xevo TQ-S cronos system online Help.

The following sections explain how to complete the following tasks:

- [Installing the probe adapter \(Page 51\)](#)
- [Installing the probe assembly \(Page 54\)](#)
- [Removing the probe adapter \(Page 64\)](#)
- [Installing and removing the corona pin \(Page 65\)](#)

3.1.5 Installing the probe adapter

Figure 3–4: Probe adapter parts



- ① Probe adapter cap removed from probe adapter
- ② Probe adapter cap tether
- ③ Locking ring
- ④ Probe adapter identification label
- ⑤ Probe adapter cap release buttons

Required materials

- Chemical-resistant, powder-free gloves

To install the probe adapter:



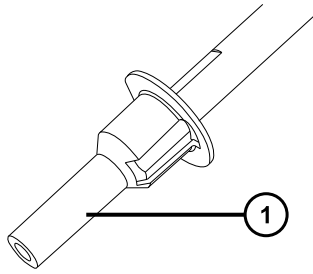
Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.



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

1. For ESI probe adapters, remove the protective cap, if fitted, from the probe tip.

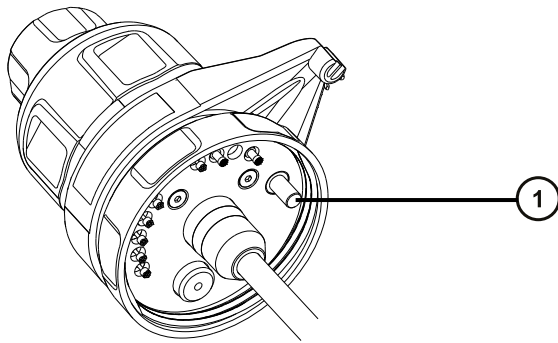
Figure 3–5: ESI probe protective cap



- ① Protective cap

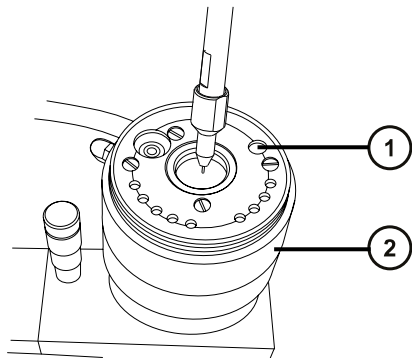
2. Carefully slide the probe adapter into the hole in the source enclosure's probe adjuster assembly, ensuring that the probe location dowel aligns with the location hole in the probe adjuster assembly.

Figure 3–6: Probe location dowel



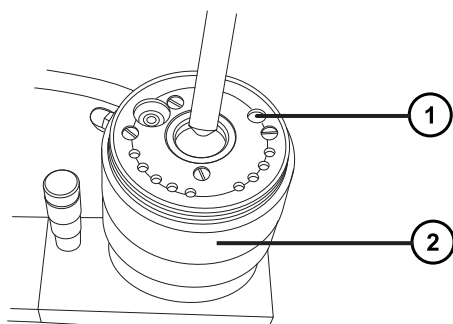
- ① Probe location dowel

Figure 3–7: Locating the ESI probe adapter



- ① Location hole for probe location dowel
- ② Probe adjuster assembly

Figure 3–8: Locating the APCI probe adapter

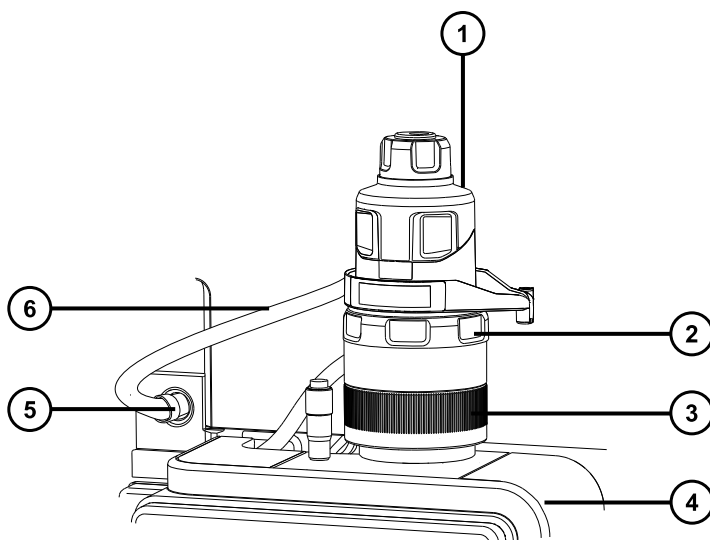


① Location hole for probe location dowel

② Probe adjuster assembly

3. Rotate the probe adapter locking ring clockwise to secure the probe adapter in place.

Figure 3–9: Probe adapter mounted on the source enclosure



① Probe adapter cap

② Probe adapter locking ring

③ Probe adjuster assembly

④ Source enclosure

⑤ High-voltage connector

⑥ ESI probe adapter cable (ESI probe adapter only)

4. For ESI probe adapters, connect the ESI probe adapter's cable to the high-voltage connector.
5. Install the probe assembly. See [Installing the probe assembly \(Page 54\)](#).

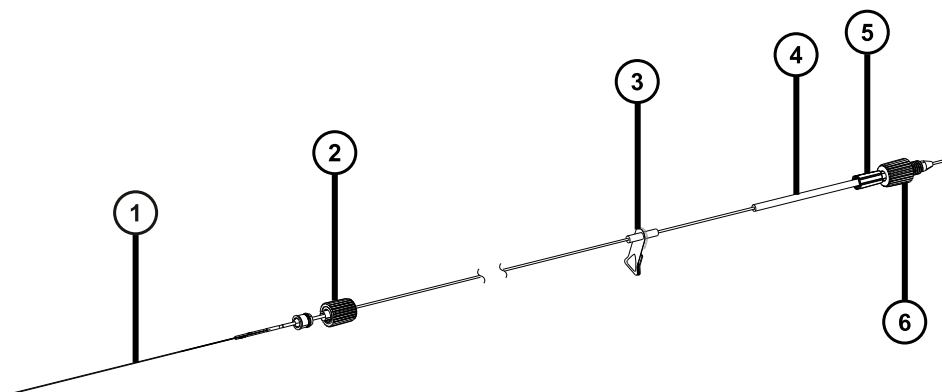
3.1.6 Installing the probe assembly

Requirements:

- Ensure that you use a probe assembly appropriate for your application. For example, using an ESI probe assembly with an APCI probe adapter compromises instrument performance. Use the part number on the identification label to verify the probe assembly type.
- Ensure that the probe adapter is installed on the source, with the probe adapter cap removed. See [Installing the probe adapter \(Page 51\)](#).
- To minimize delays and dispersion, select the shortest probe assembly to connect the diverter valve to the probe.

! **Notice:** Do not adjust the length of the probe assembly. Cutting the PEEKsil tubing renders the probe assembly unusable.

Figure 3–10: Probe assembly



- ① Capillary
- ② Probe adapter PEEK fitting
- ③ Warning label
- ④ Identification label showing part number
- ⑤ Fitting spring retainer
- ⑥ Probe inlet fitting

Notes:

- The high-voltage warning label **3** does not appear on all probe assemblies.
- The fitting used for ACQUITY UPC² systems differs from the probe inlet fitting **6** shown here. See [Connecting the probe assembly to a UPC² system \(Page 62\)](#).

Required materials

- Chemical-resistant, powder-free gloves

To install the probe assembly:



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



Warning: To avoid electric shock, do not insert any item into the probe cap aperture when the probe cap is fitted to the instrument.



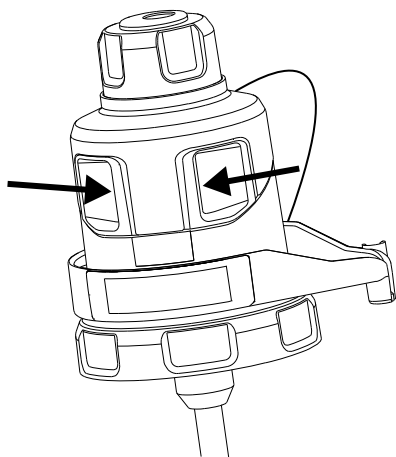
Notice: To avoid damaging the probe assembly, take care when inserting the capillary into the probe adapter. Do not use force.



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

1. To prepare for installing a probe assembly, press together the probe-adapter-cap release buttons, in the direction shown by the arrows in the following figure, and lift the probe adapter cap off the probe adapter.

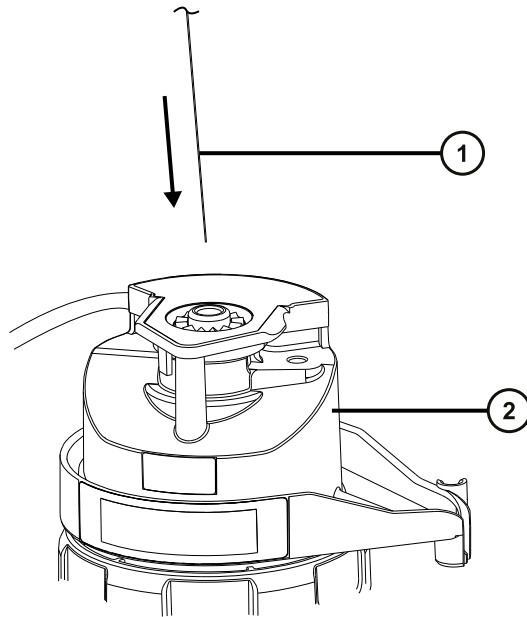
Figure 3–11: Probe adapter cap release



2. Carefully insert the probe assembly capillary into the probe adapter.

Tip: To aid insertion, turn the capillary gently as you insert it, feeding the entire capillary into the probe adapter.

Figure 3–12: Inserting the probe assembly

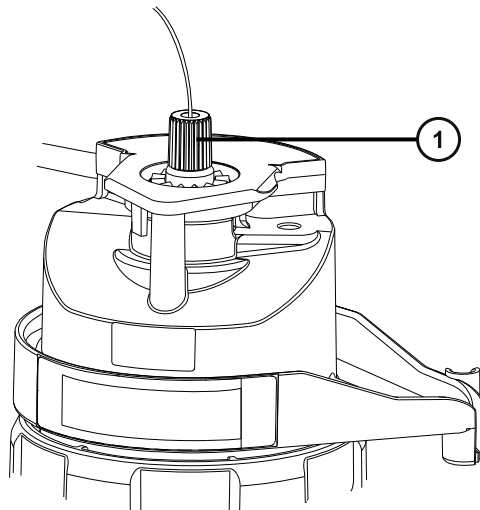


① Probe assembly capillary

② Probe adapter

3. Screw the probe adapter fitting into the probe adapter, finger-tight only, until you hear a click.

Figure 3–13: Probe assembly fitted to the probe adapter



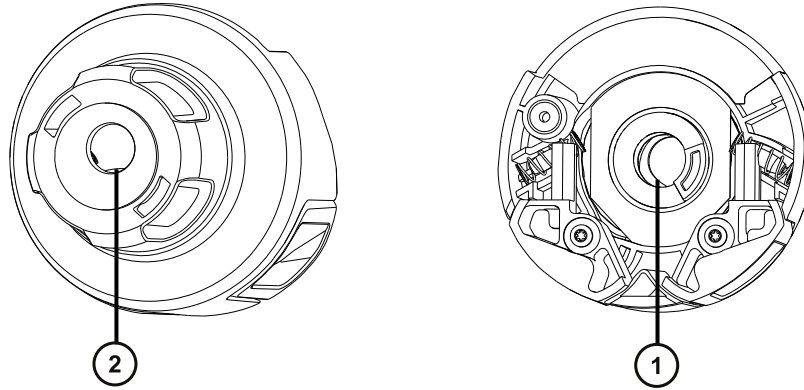
① Probe adapter fitting

Tip: The probe adapter fitting varies in size depending on the probe assembly type. If you cannot fit the probe adapter cap fully, as described in step 6, ensure that you are installing

the correct probe assembly. For example, the UniSpray probe assembly will not fit the tool-free probe adapter.

4. Tilt the probe adapter cap so that the ball bearing is located in the recess at the bottom of the aperture, and then insert the probe assembly tubing through the aperture.

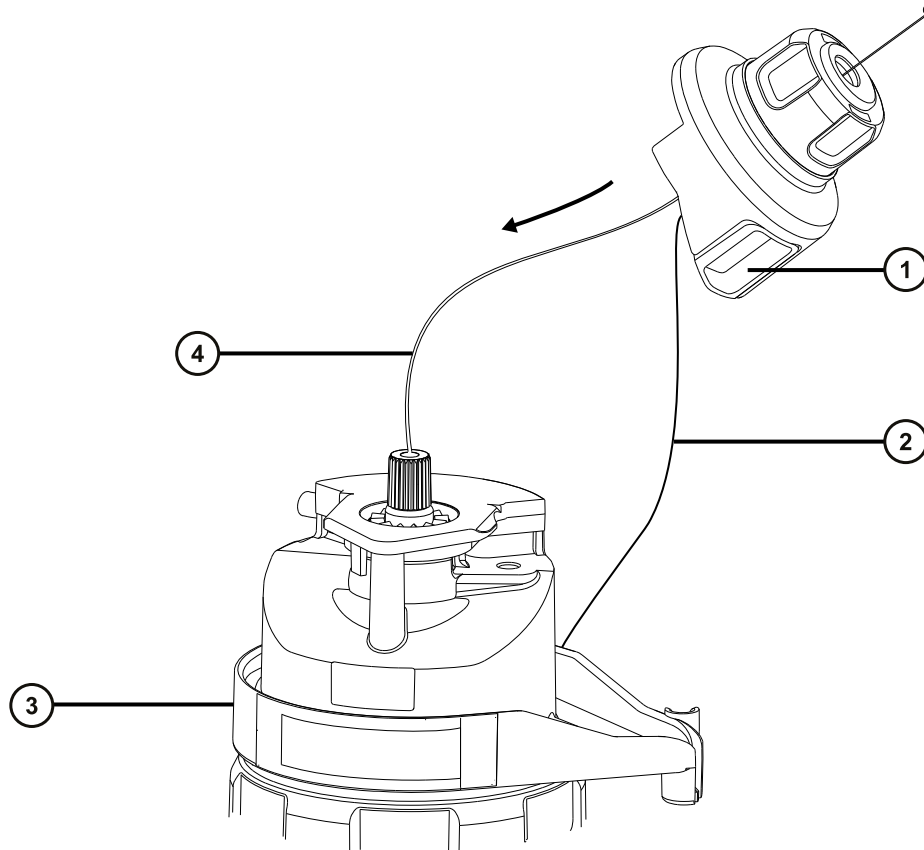
Figure 3–14: Probe adapter cap



- ① Probe cap aperture from the underside
- ② Probe cap aperture from the top

Tip: The probe assembly tubing can pass through the aperture only when the ball bearing is located in the recess at the bottom and does not block the aperture. To ensure that the probe assembly does not contact the high voltage inside the probe adapter, the ball bearing prevents you from installing the probe assembly when the probe adapter is fitted to the source enclosure.

Figure 3–15: Fitting the probe adapter cap



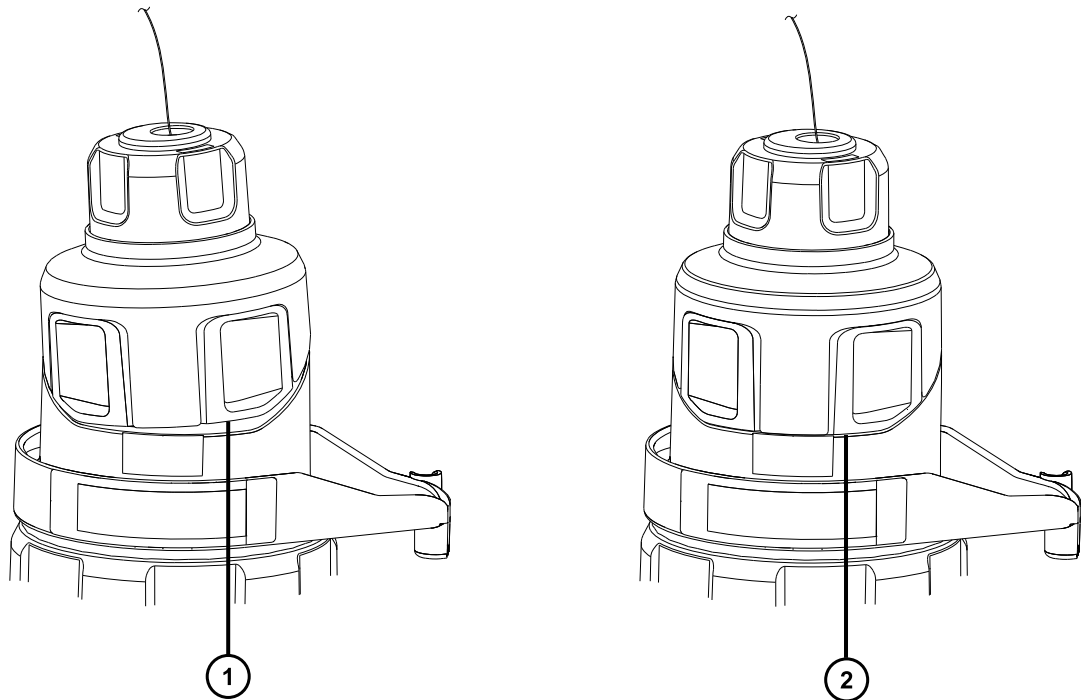
- ① Probe adapter cap
- ② Probe adapter cap tether
- ③ Probe adapter
- ④ Probe assembly tubing

5. Slide the probe adapter cap along the probe assembly, over the probe adapter inlet fitting.
6. Push the probe adapter cap onto the probe adapter until it clicks.

Tips:

- Do not squeeze the probe adapter cap release buttons when fitting the probe adapter cap.
- Ensure that the probe adapter cap is correctly seated and that both release buttons engage with the probe adapter, producing a click.
- If you cannot fit the probe adapter cap fully, ensure that you are installing the correct probe assembly type.

Figure 3–16: Seating the probe adapter cap

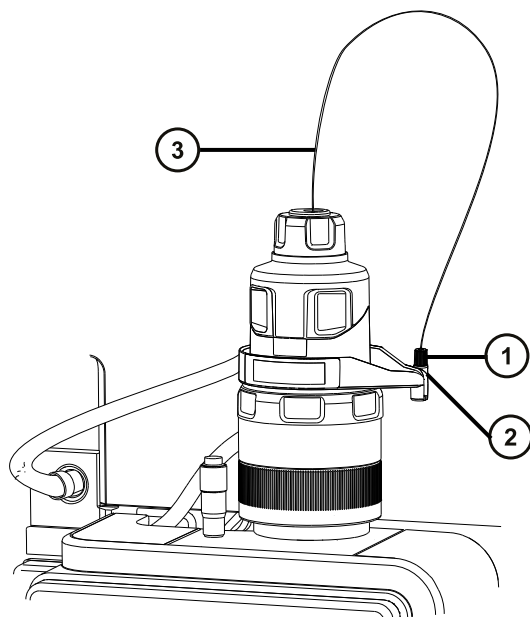


- ① Probe adapter cap seated incorrectly: edge does not align with the edge of the probe adapter
- ② Probe adapter cap seated correctly: edge aligns with the edge of the probe adapter

Note: If you fit the probe adapter cap when the source enclosure is closed and the mass spectrometer is in Operate, the high-voltage supply to the probe turns on and the instrument performs a pressure test. To prevent gas escaping audibly through the probe adapter, ensure that the instrument is not in Operate mode until a probe assembly is installed. You must remove the probe adapter cap before installing the probe assembly.

Tip: If you are not immediately connecting the probe assembly to the inlet system, insert the probe inlet fitting into the inlet fitting holder.

Figure 3–17: Inlet fitting holder



- ① Probe inlet fitting
- ② Inlet fitting holder
- ③ Probe assembly tubing



Warning: To avoid electric shock or solvent ignition, when connecting ESI or UPC² source probes directly to non-Waters equipment, ensure that the liquid outlet connection is grounded.

7. Connect the probe inlet fitting to the inlet system.

Note: If you are connecting to a UPC² system, see [Connecting the probe assembly to a UPC² system \(Page 62\)](#).

3.1.7 Removing and refitting the probe inlet fitting

To feed the probe assembly through narrow channels, you might need to remove the probe inlet fitting, and then refit it on the other side of the channel. The inlet end of the probe assembly features a spring-loaded design to minimize dead-volume at the connection to the inlet.

Requirement: When connecting the probe assembly to an ACQUITY UPC² system, you must use the supplied gold-plated UPC² fitting. See [Connecting the probe assembly to a UPC² system \(Page 62\)](#).

Required materials

- Chemical-resistant, powder-free gloves

To remove the probe inlet fitting:

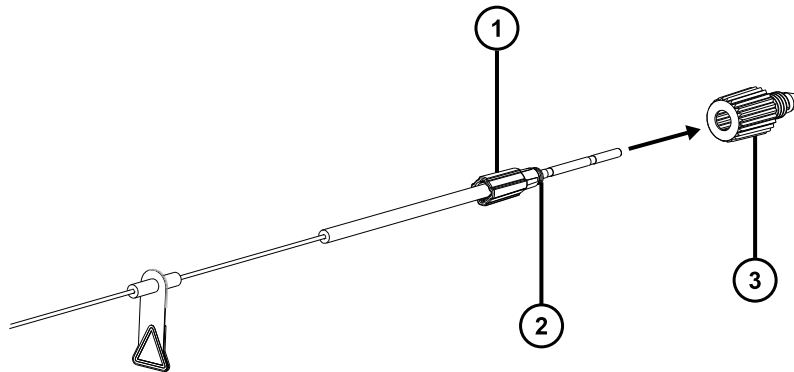


Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.

1. Pull the inlet fitting from the end of the probe assembly.

Tip: Hold the fitting spring retainer in place while the probe inlet fitting is removed to prevent it from sliding along the probe assembly.

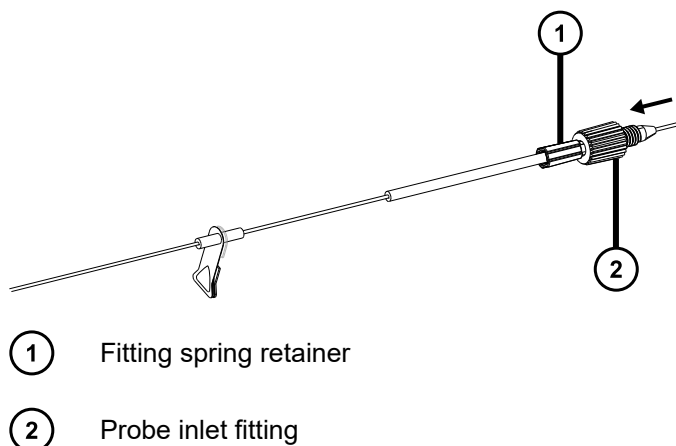
Figure 3–18: Removing the probe inlet fitting



- ① Fitting spring retainer
- ② Fitting spring
- ③ Probe inlet fitting

2. Feed the probe assembly through the narrow channel.
3. Slide the probe inlet fitting onto the probe assembly.
4. Push the probe inlet fitting onto the fitting spring retainer, ensuring that the retainer remains fully attached to the spring.

Figure 3–19: Fitting the probe inlet fitting



3.1.8 Connecting the probe assembly to a UPC² system

To connect the probe assembly to a UPC² system, first fit the supplied UPC² inlet fitting to the end of the probe assembly. The probe assembly connects to the UPC² system's Isocratic Solvent Manager (ISM).

Requirement: You must use the supplied UPC² fitting to connect the probe assembly to a UPC² system. Do not use the PEEK inlet fitting.

Required materials

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

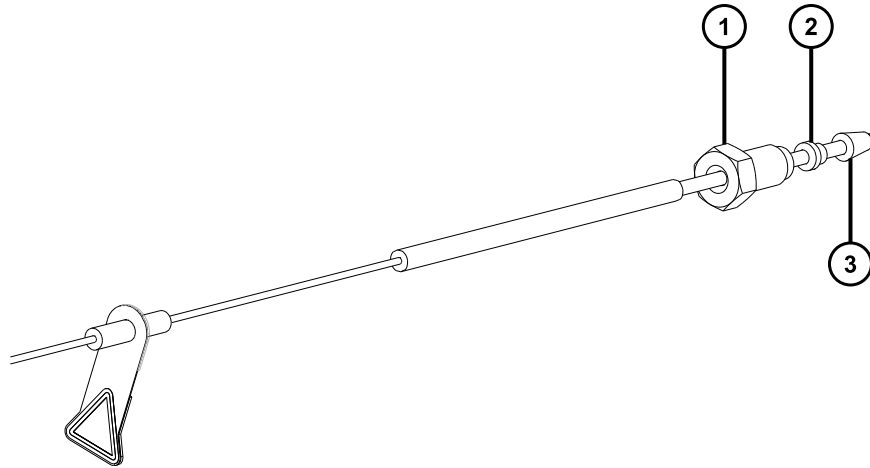
To connect the probe to a UPC² system:



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

1. Slide the compression nut, backing ring, and ferrule onto the inlet end of the probe assembly.

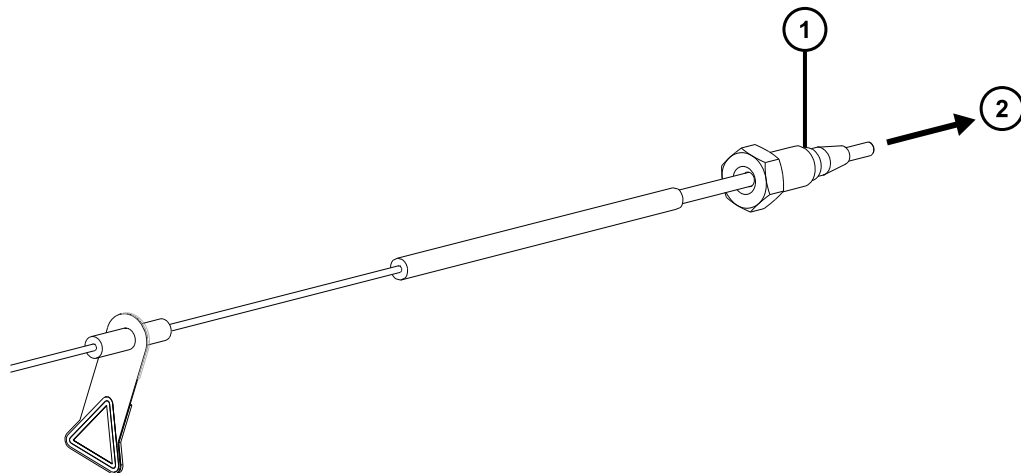
Figure 3–20: Fitting the compression nut, backing ring, and ferrule to the probe assembly



- ① Compression nut
- ② Backing ring
- ③ Ferrule

2. Insert the probe assembly into the ISM's restrictor port until you encounter resistance.

Figure 3–21: Connecting the probe assembly to the ISM

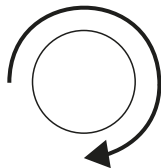


- ① Compression nut, backing ring, and ferrule
- ② To ISM restrictor port

3. Slide the compression nut, backing ring, and ferrule into the restrictor port.
4. Using your fingers, screw the compression nut into the splitter port until you feel resistance.

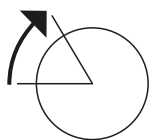
5. If you are connecting the probe assembly for the first time, using a 1/4-inch open-end wrench, tighten the compression nut until you feel an increase in resistance, and then tighten by another 3/4-turn.

Figure 3–22: 3/4-turn



If you are refitting a previously installed probe assembly, using a 1/4-inch open-end wrench, tighten the compression nut up to a 1/6-turn.

Figure 3–23: 1/6-turn



3.1.9 Removing the probe adapter

Remove the probe adapter before performing any of the following actions:

- Switching between ESI and APCI modes (see [Installing the probe adapter \(Page 51\)](#)).
- Installing the Low-flow ESI probe (see the *Low-flow ESI Probe Operator's Guide* (715004382)).
- Replacing the ESI probe tip or gasket (see [Replacing the ESI probe tip and gasket \(Page 122\)](#)).

Tip: You can replace the probe assembly without removing the ESI probe tip.

You can remove the probe adapter with or without the probe assembly installed. To remove the probe assembly, see [Removing the probe assembly \(Page 120\)](#).

Required materials

Chemical-resistant, powder-free gloves

To remove the probe adapter:



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



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



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

1. For ESI probes, disconnect the probe adapter cable from the high voltage connector.
2. Unscrew the probe adapter locking ring.



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

3. Carefully remove the probe adapter from the probe adjustor assembly.
4. For ESI probe adapters, if available, fit the protective cap to the probe tip.

3.1.10 Installing and removing the corona pin

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

3.1.10.1 Installing the corona pin in the source

Required materials

Chemical-resistant, powder-free gloves

To install the corona pin in the source:



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



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

1. Prepare the instrument for working on the source (see [Preparing the instrument for working on the source \(Page 76\)](#)).



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

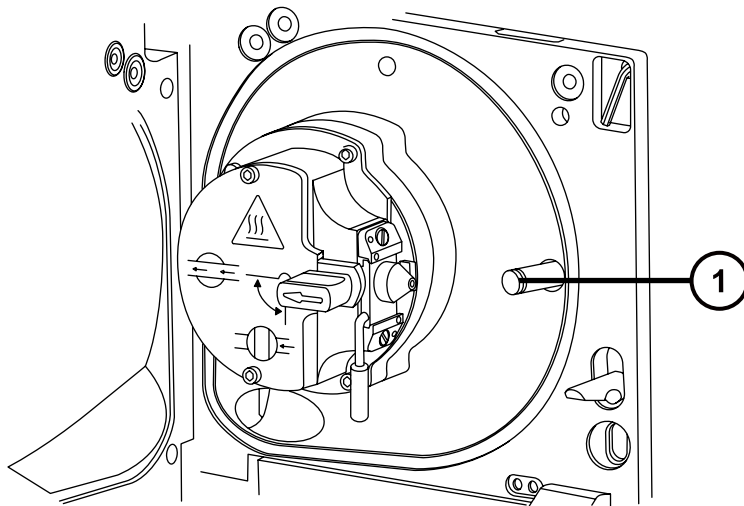


Warning: To avoid puncture wounds, handle sharp parts and materials with care.

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

Tip: Store the blanking plug in a safe location.

Figure 3–24: Corona pin mounting contact



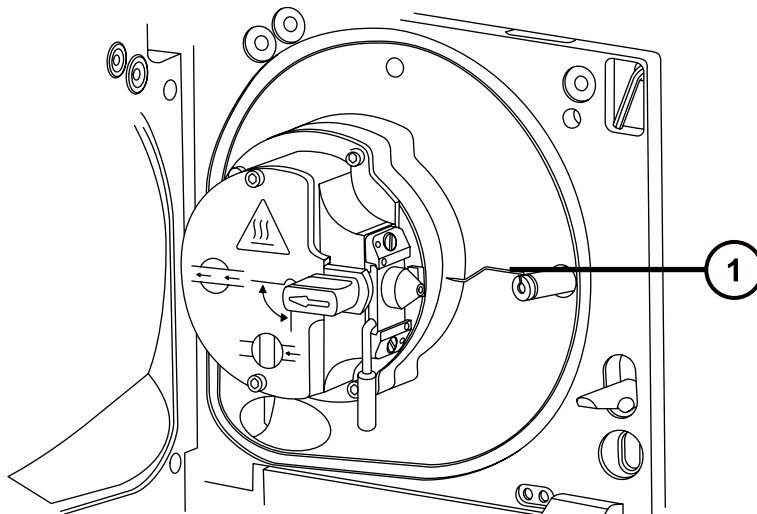
- ① Corona pin mounting contact blanking plug



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

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

Figure 3–25: Corona pin



- ① Corona pin

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

3.1.10.2 Removing the corona pin from the source

Required materials

Chemical-resistant, powder-free gloves

To remove the corona pin from the source:



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



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

1. Prepare the instrument for working on the source (see [Prepare the instrument for working on the source \(Page 76\)](#)).



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



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

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



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

3. Remove the corona pin from its mounting contact (see the figure in [Installing the corona pin in the source \(Page 65\)](#)).

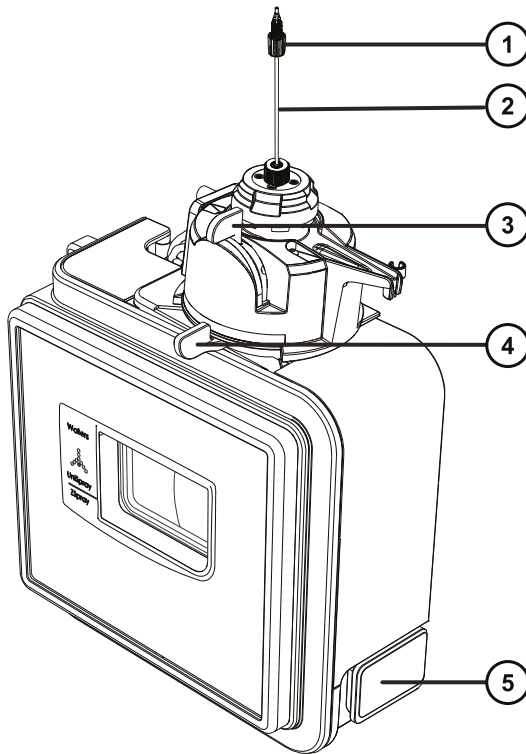
Tip: Store the corona pin in a safe location.

4. Fit the blanking plug to the corona pin mounting contact (see the figure in [Installing the corona pin in the source \(Page 65\)](#)).
5. Close the source enclosure.

3.2 UniSpray standard source

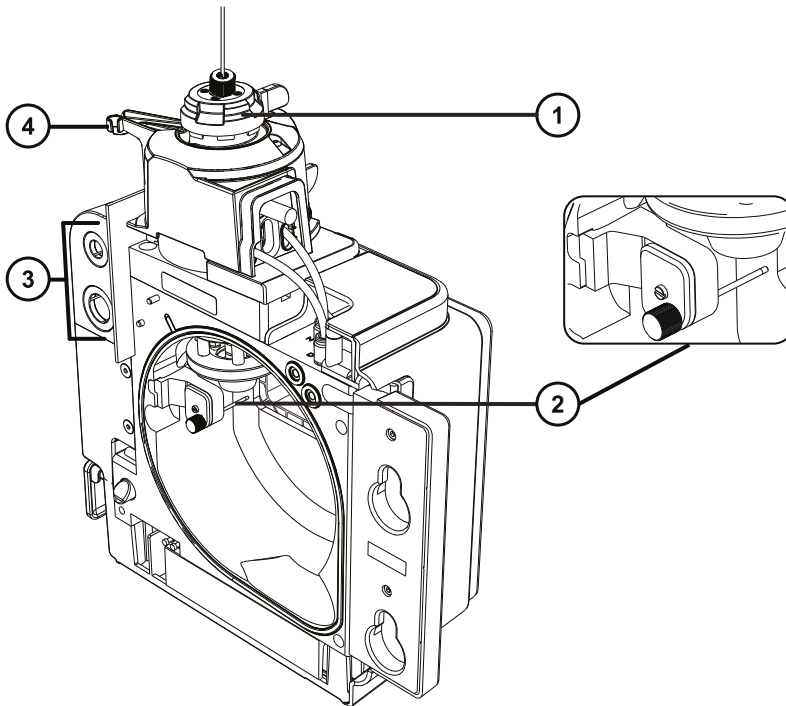
The UniSpray source standard version is available for use on quadrupole-based mass spectrometers.

Figure 3–26: UniSpray standard source – front



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

Figure 3–27: UniSpray standard source – rear



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

See also: Topics about maintaining the source components:

- [Replacing the UniSpray probe assembly \(Page 135\)](#)
- [Maintaining the impactor pin \(Page 138\)](#)

3.2.1 Installing the UniSpray source

3.2.1.1 Installing the UniSpray standard source

Required materials

- Chemical-resistant, powder-free gloves



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

Important: Before installing the UniSpray standard source, inspect the UniSpray source's impactor pin to determine whether it requires cleaning or replacement according to the maintenance schedule. For instructions about cleaning or replacing the impactor pin, see [Cleaning or replacing the UniSpray impactor pin \(Page 139\)](#).

To install the UniSpray source:

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



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



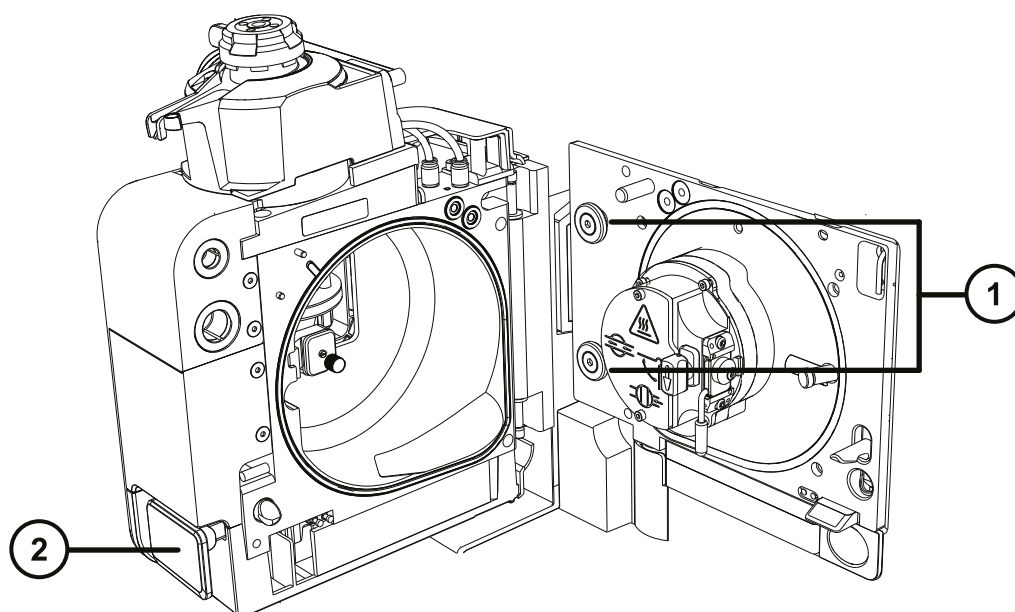
Warning: To avoid burn injuries, exercise care when handling the components of the source enclosure heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.

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

See also: [Installing the UniSpray probe assembly \(Page 136\)](#).

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

Figure 3–28: Fitting the source

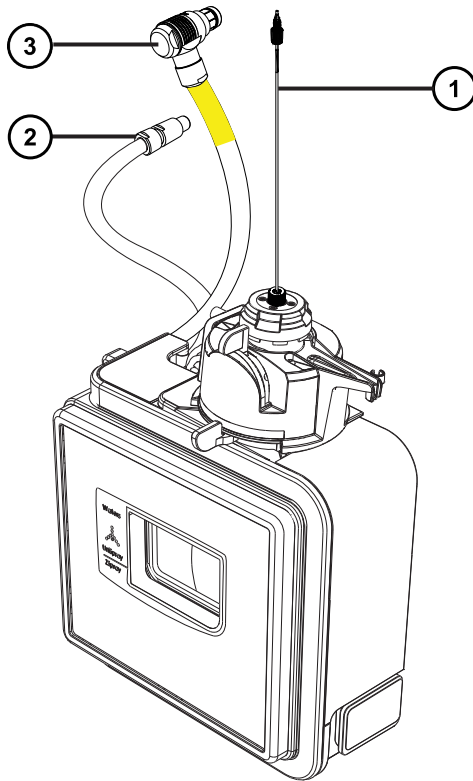


- 1 Supporting studs

② Source enclosure door release handle

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

Figure 3–29: UniSpray standard source connections



① Probe assembly

② Impactor pin high-voltage cable

③ Probe adjuster cable (yellow)

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

Result: The source pressure test initiates.



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

3.2.2 Removing the UniSpray source

3.2.2.1 Removing the UniSpray standard source

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

Required materials

- Chemical-resistant, powder-free gloves



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



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

To remove the UniSpray source:

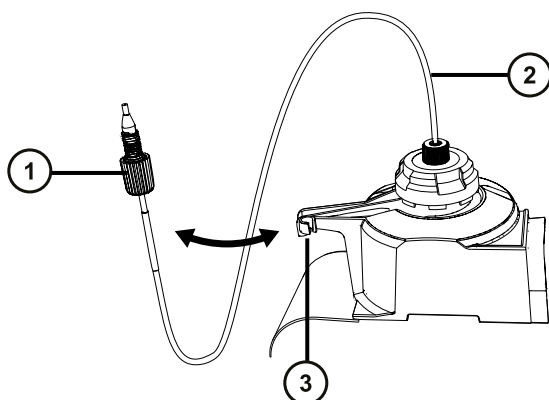
1. To prepare the instrument for working on the source, stop solvent flow, ensure that the instrument is in Standby mode, and stop desolvation gas flow.



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

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

Figure 3–30: Fitting the UniSpray probe to the storage clip on the source probe adjuster



- ① Probe assembly PEEK fitting
- ② Probe assembly

③ Storage clip on the overflow spur

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

4 Maintenance procedures

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

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

4.1 Maintenance schedule for Xevo TQ-S cronos

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

Table 4–1: Maintenance schedule

Procedure	Frequency	For information...
Clean the instrument case.	As required.	See Cleaning the instrument case (Page 83) .
Empty the nitrogen exhaust trap bottle.	Check daily, empty as required.	See Emptying the nitrogen exhaust trap bottle (Page 83) .
Inspect and adjust the roughing pump oil level.	Weekly.	See Maintaining the rotary backing pump's oil (Page 85) .
Clean the source components.	When source components are visibly fouled, the background or high-peak contaminants are unacceptably high, or sensitivity decreases to unacceptable levels.	See Cleaning the source components (Page 88) .
Replace the ESI probe tip.	When sensitivity decreases to unacceptable levels, or if blocked or damaged.	See Replacing the ESI probe tip and gasket (Page 122) .
Replace the probe assembly.	When sensitivity decreases to unacceptable levels or signal is unstable due to inconsistent sample flow.	See: Replacing the probe assembly (Page 120) .
Clean the APCI probe tip. (Options using the APCI probe adapter only.)	When sensitivity decreases to unacceptable levels or when significant chemical interference is present.	See Cleaning the APCI probe tip (Page 125) .

Table 4–1: 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 Cleaning or replacing the corona pin (Page 129) .
Replace the APCI probe heater. (Options using the APCI probe adapter only.)	If the heater fails to heat when the instrument is switched to Operate.	See Replacing the APCI probe heater (Page 126) .
Replace the ion block heater cartridge.	If the heater fails to heat when the instrument is pumped down (evacuated).	See Replacing the ion block source heater (Page 116) .
Replace the probe assembly (UniSpray mode).	When sensitivity decreases to unacceptable levels or signal is unstable due to inconsistent sample flow.	See Replacing the UniSpray probe assembly (Page 135) .
Clean or replace the impactor pin (UniSpray mode).	When the impactor pin is corroded or black, or the sensitivity decreases to unacceptable levels.	See Maintaining the UniSpray impactor pin (Page 138) .
Replace the source assembly seals.	Annually.	See Replacing the source assembly seals (Page 130) .
Inspect and adjust the rotary backing pump's oil level.	Weekly.	See Maintaining the rotary backing pump's oil (Page 85) .
Change the rotary backing pump oil.	Annually.	See Maintaining the rotary backing pump's oil (Page 85) .
Replace the roughing pump's demister element.	Annually. Note: Applications that contaminate the roughing pump oil reduce this period, which must be determined from experience.	See Edwards document <i>EMF3, EMF10 and EMF20 Oil Mist Filters Instruction Manual</i> (A462-26-880).
Replace the air filters.	Annually.	See Replacing the air filter (Page 133) .

4.2 Spare parts

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

4.3 Safety and handling

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



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



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



Warning: To avoid electric shock, observe these precautions:

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



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



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

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



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

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

See [Safety advisories \(Page 141\)](#) for safety advisory information.





4.4 Preparing the instrument for working on the source

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

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


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

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

1. In the Instrument Console, click **Stop Flow**  to stop the LC flow.
Note: If column flow is required, divert the LC flow to waste:
 - a. In the Instrument Console system tree, expand Xevo TQ-S cronos Detector, Interactive Fluidics.
 - b. Click **Control** .
 - c. Select **Waste** as the flow state.
2. In the Instrument Console, click **Standby**  and confirm that the Operate indicator is not illuminated.
3. Wait three minutes to allow the desolvation gas flow to cool the probe and source.
4. In the Instrument Console, click **API**  to stop the desolvation gas flow.
5. Lift the visor on the front of the instrument so that it is clear of all the source components and probe.

4.4.2 Using waters_connect software to prepare the instrument for operations on or inside its source

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

1. Navigate to the system control panel within the software (**waters_connect Hub > System Console**).
2. From the Console Navigation pane on the left-hand side of the window, in the System pane, click the instrument (Xevo TQ-S cronos).
3. To put the instrument into Standby, click **Summary > Summary**, and then click  in the upper right-hand corner of the window.

Tip: You can also put the instrument into Standby from the Manual Optimization pane. To do this, from the Console Navigation pane, click **Tune Page > MS Tune Page**, and then click **Standby** in the upper right-hand corner of the pane.

4. Wait three minutes to allow the desolvation gas flow to cool the probe and source.
5. Lift the visor on the front of the instrument so that it is clear of all the source components and probe.

4.5 Removing and refitting the source enclosure

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

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

4.5.1 Removing the source enclosure from the instrument

Required materials

Chemical-resistant, powder-free gloves

To remove the source enclosure:



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

1. Prepare the instrument for working on the source (see [Preparing the instrument for working on the source \(Page 76\)](#)).



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

2. Remove the probe adapter from the source ([Removing the probe adapter \(Page 64\)](#)).
3. Disconnect the probe adjuster and options cables from the instrument's connectors.



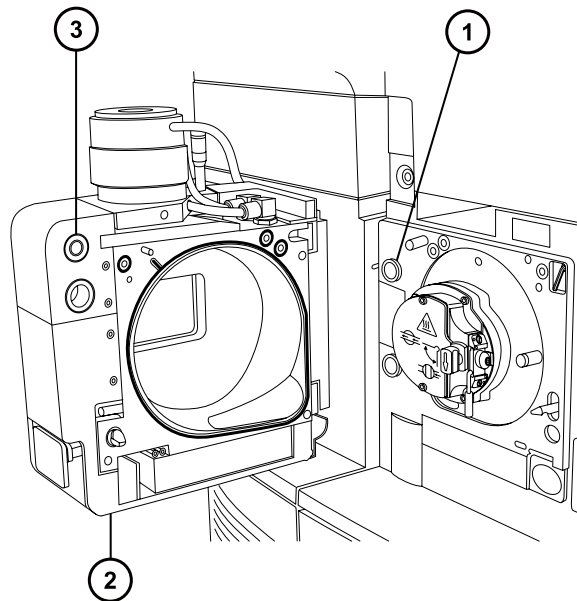
Warning: To avoid puncture wounds, handle sharp parts and materials with care.



Notice: To avoid damaging the sample inlet, when removing a NanoLockSpray source enclosure, you must slide the sprayer platform out of the source enclosure before you open the enclosure.

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

Figure 4–1: Removing the source enclosure



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

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

4.5.2 Fitting the source enclosure to the instrument

Required materials

Chemical-resistant, powder-free gloves

To fit the source enclosure to the instrument:



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



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

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

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



Notice: To avoid damaging the sample inlet, when removing a NanoLockSpray source enclosure, you must slide the sprayer platform out of the source enclosure before you open the enclosure.

2. Close the source enclosure.
3. Connect the probe adjuster and options 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.

4.6 Operating the source isolation valve

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

Required materials

Chemical-resistant, powder-free gloves

4.6.1 Closing the source isolation valve

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



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

1. Prepare the instrument for working on the source (see [Preparing the instrument for working on the source \(Page 76\)](#)).



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



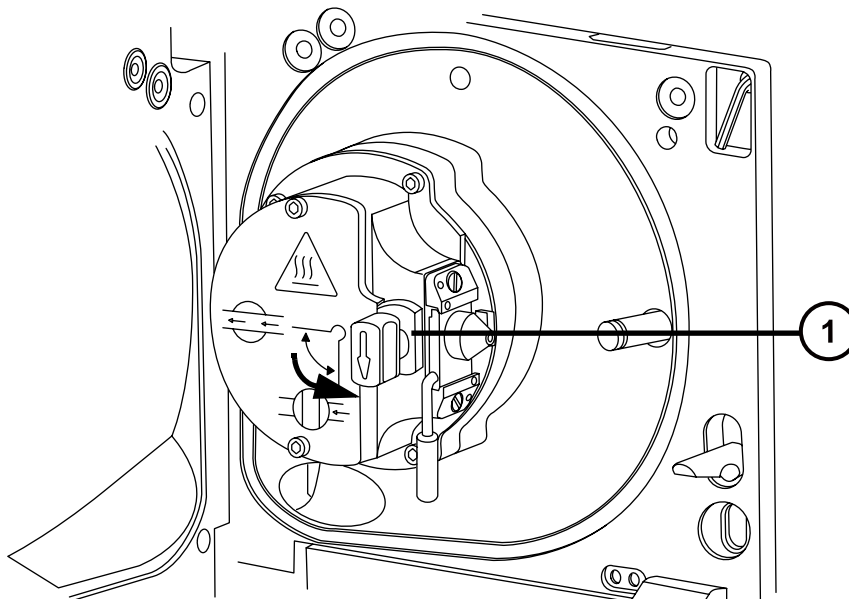
Warning: To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

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

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

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

Figure 4–2: Closing the source isolation valve



- 1 Isolation valve handle in closed position

4.6.2 Opening the source isolation valve

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



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

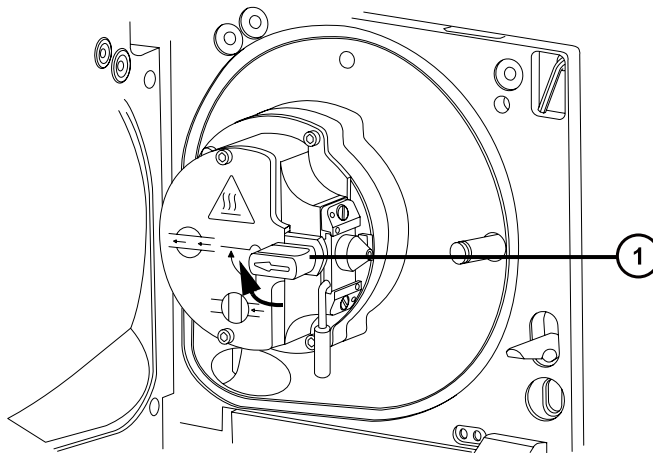


Warning: To avoid puncture wounds, take great care while working with the source enclosure open if one or both of these conditions apply:

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

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

Figure 4–3: Source isolation valve opened



① Isolation valve handle in open position

2. Close the source enclosure.

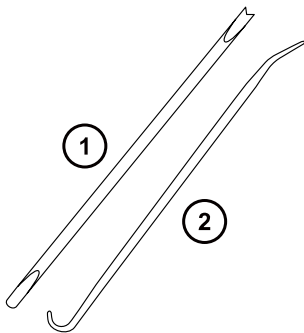
4.7 Removing O-rings and seals

You must remove O-rings or seals from instrument components when performing certain maintenance procedures.

4.7.1 O-ring removal kit

Note: The O-ring removal kit (700005054) is available to order separately.

Figure 4–4: O-ring removal kit



① Tool 1

② Tool 2

To remove an O-ring:

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

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

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



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

4.8 Cleaning the instrument case

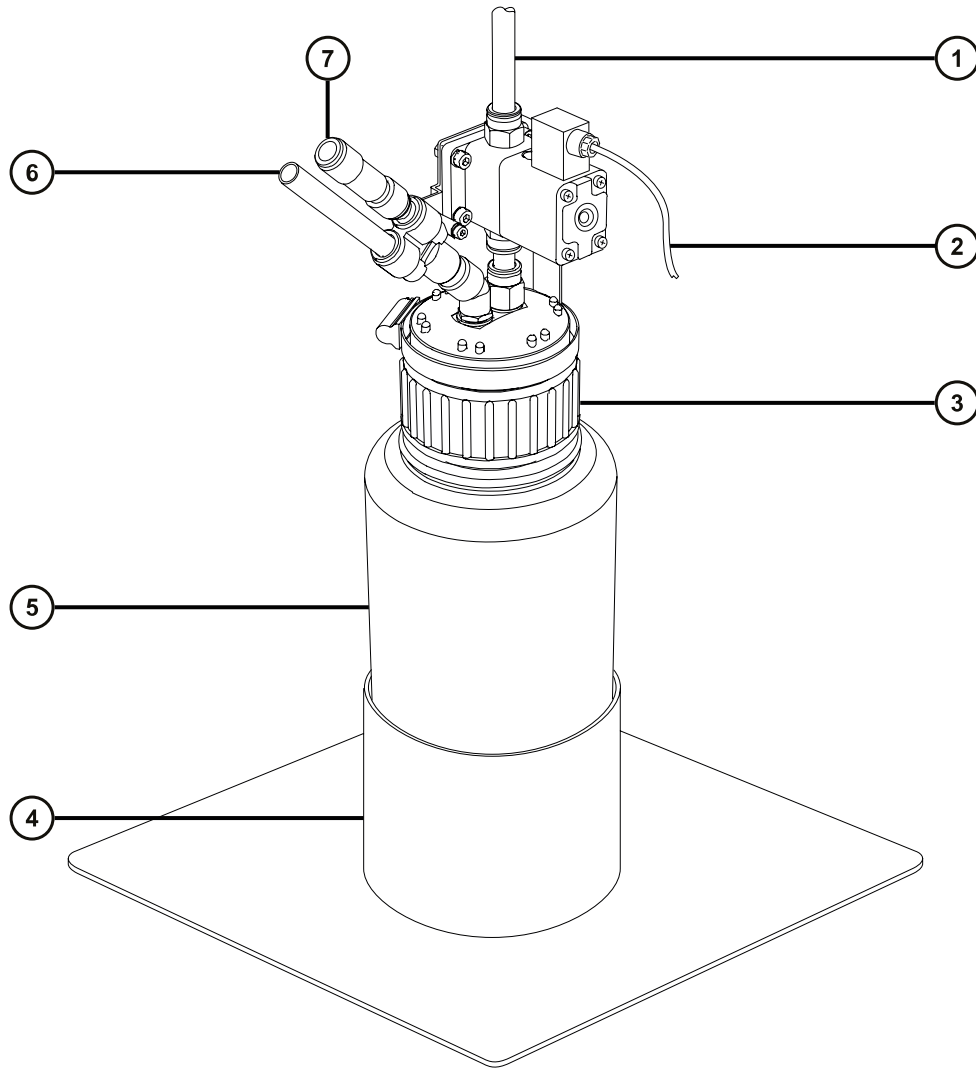
! **Notice:** To avoid abrading the surfaces of the instrument, do not use abrasives or solvents when cleaning them.

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

4.9 Emptying the nitrogen exhaust trap bottle

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

Figure 4–5: Nitrogen exhaust trap bottle




- ① To laboratory exhaust port
- ② Valve control cable (from instrument)
- ③ Cap
- ④ Bottle support
- ⑤ Nitrogen exhaust trap bottle
- ⑥ From instrument exhaust connection
- ⑦ One-way valve

Required materials

Chemical-resistant, powder-free gloves

To empty the nitrogen exhaust trap bottle:

1. In the instrument console, click **Stop Flow** .
2. Pull the source enclosure release (located at the bottom, right-hand side) outward and swing open the enclosure.



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

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



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

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

Tip: An automatic pressure test is performed.

8. In the instrument console, click **Start Flow** .

4.10 Maintaining the rotary backing pump's oil



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

Refill the backing pump's oil when the oil level is low.

Tip: To inspect the oil level, view it through the sight glass on the pump's rear panel.

Replace the backing pump's oil when either of these conditions apply:

- The oil in the pump appears darker than new oil, is odorous, or is visibly contaminated.
- The oil has been in use for more than one year.

Required tools and materials

- Chemical-resistant, powder-free gloves
- Tray on which to place the pump
- Container to catch used oil
- Suitable pump oil



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



Warning: To avoid burn injuries, allow the pump to cool before touching surfaces displaying the burn warning symbol.



Warning: To avoid slip injuries, inspect the pump for oil leaks.

To add oil to the backing pump:

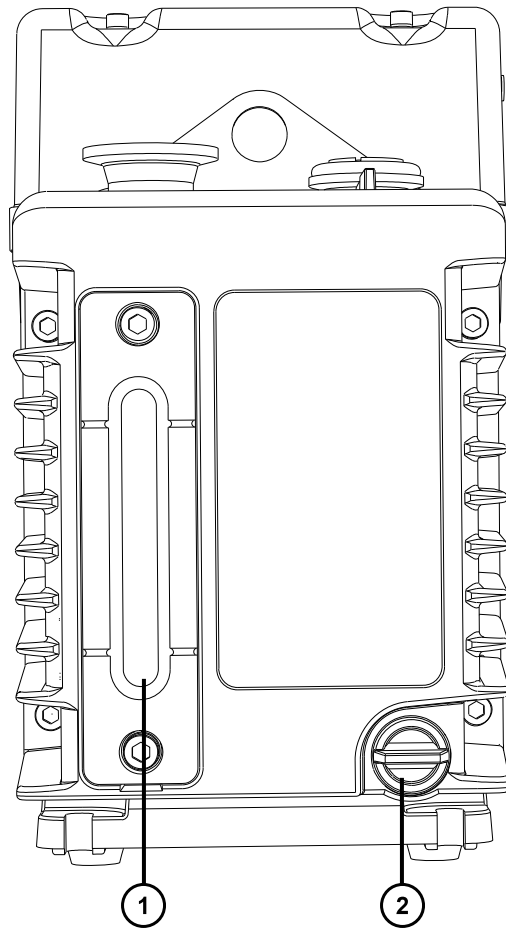
1. Power-off the instrument using the power button in the top, left-hand corner of the front panel.
2. Wait approximately five minutes to allow the instrument to vent.
3. Switch off the pump and disconnect the power cable.



Warning: To avoid skeletal or muscle injury associated with lifting heavy objects, at least two persons must lift the pump.

4. Place the pump on a tray suitable for catching dripping oil.
5. Remove the oil drain plug from the pump's rear panel.

Figure 4–6: Backing pump rear panel



- ① Oil level sight glass
- ② Oil drain plug

6. Tilt the pump slightly and catch the oil in a suitable container.
7. Dispose of the oil according to local environmental regulations.
8. Insert the oil drain plug into the pump's rear panel.
9. To flush the pump, pour 50 mL of fresh oil into the pump inlet on the pump's top side.

Tip: If you encounter difficulty, remove the separator.

10. Operate the pump briefly.
11. Remove the oil drain plug and drain the flushing oil into a suitable container.
12. If necessary, repeat steps 9 through 11 until all contaminants are removed.
13. Insert the oil drain plug into the pump's rear panel.
14. Remove the oil inlet plug and pour fresh oil into the oil inlet port until the level reaches the sight glass's "max" mark.



Notice: Do not fill the pump beyond the “max” mark.

15. Refit the oil inlet plug.

4.11 Cleaning the source components

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

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

If cleaning the sample cone and cone gas nozzles fails to increase signal sensitivity, also clean the ion block and isolation valve (see [Cleaning the ion block components \(Page 103\)](#)).

If cleaning the ion block and isolation valve fails to increase signal sensitivity, also clean the ion guide assembly (see [Cleaning the ion guide assembly \(Page 111\)](#)).

4.12 Cleaning the sampling cone assembly

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

4.12.1 Removing the sampling cone assembly from the source

Required materials

Chemical-resistant, powder-free gloves

To remove the sampling cone assembly from the source:



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



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



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

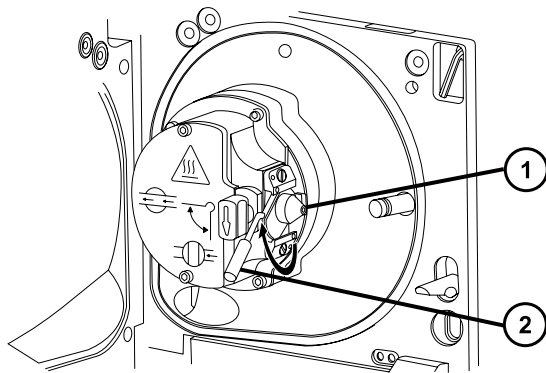
- An ESI probe is fitted (the probe's tip is sharp).
- A corona pin is fitted (the pin's tip is sharp).



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

1. Close the source isolation valve (see [Closing the source isolation valve \(Page 80\)](#)).
2. Grasp the cone gas nozzle handle, and use it to rotate the sampling cone assembly 90 degrees, moving the handle from the vertical position to the horizontal position.

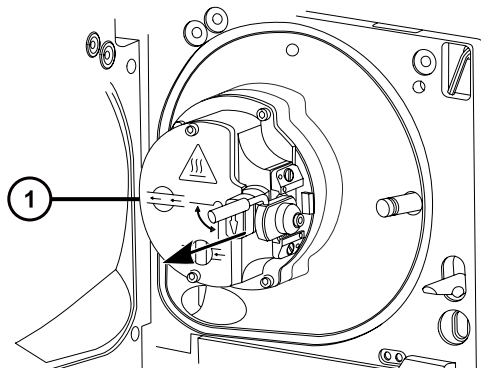
Figure 4–7: Removing the sampling cone assembly



- ① Sampling cone assembly, comprising the cone gas nozzle, sampling cone, and O-ring
- ② Cone gas nozzle handle

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

Figure 4–8: Removing the sampling cone assembly



- ① Ion block assembly



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

4.12.2 Disassembling the sampling cone assembly

Required materials

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

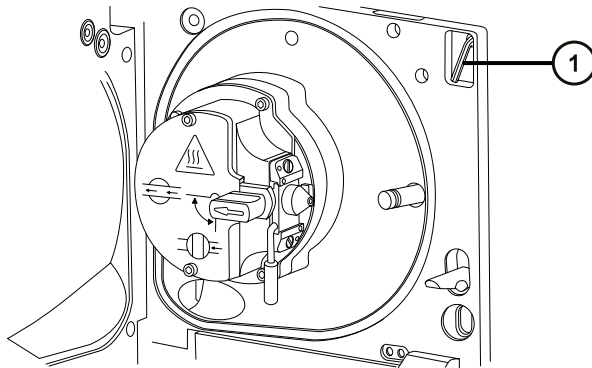
To disassemble the sampling cone assembly:



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

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

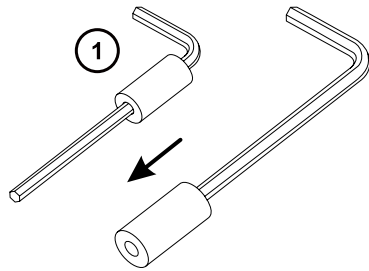
Figure 4–9: Cone extraction tool location



- ① Combined 2.5-mm hex wrench and cone extraction tool

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

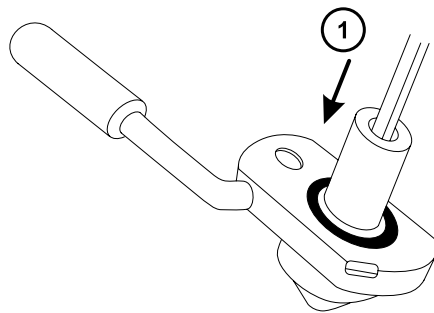
Figure 4–10: Cone extraction tool



① Collar

3. Insert the collar in the sample cone.

Figure 4–11: Inserting the cone extraction tool

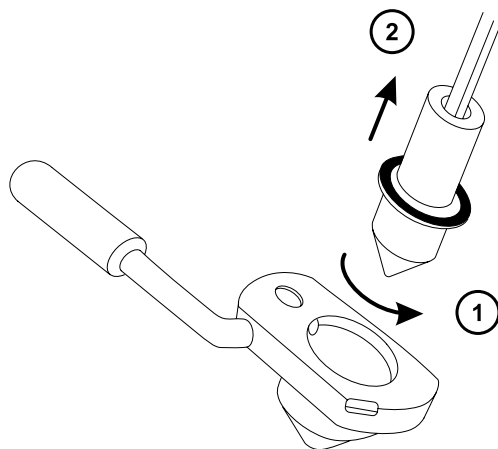


① Insert the collar

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

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

Figure 4–12: Removing the sample cone

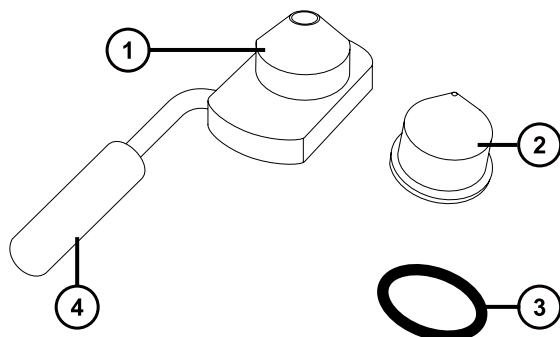


① Rotate the tool

② Remove the sample cone

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

Figure 4–13: O-ring removed from the sample cone



① Cone gas nozzle

② Sample cone

③ O-ring

④ Cone gas nozzle handle



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

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

4.12.3 Cleaning the sample cone and cone gas nozzle

Required materials

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

- Oil-free argon gas or Oil-free nitrogen gas
- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water
- Large beaker

To clean the sample cone and cone gas nozzle:



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



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

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

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

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

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

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

Note: If you used formic acid in the cleaning solution, proceed to step 4. If not, go to step 5.

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

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

5. Carefully remove the components from the vessels and blow dry them with inert, oil-free gas.
6. Inspect each component for persisting contamination. If contamination is present, do as follows:

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



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

7. Inspect each component for persisting contamination.

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

4.12.4 Assembling the sampling cone assembly

Required materials

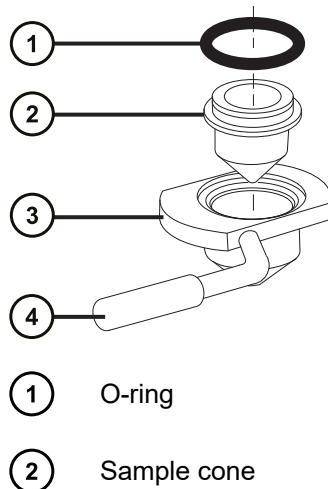
Chemical-resistant, powder-free gloves

To assemble the sampling cone assembly:

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

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

Figure 4–14: Sampling cone assembly



- ③ Cone gas nozzle
- ④ Cone gas nozzle handle

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

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

4.12.5 Fitting the sampling cone assembly to the source

Required materials

Chemical-resistant, powder-free gloves

To fit the sampling cone assembly to the source:



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



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

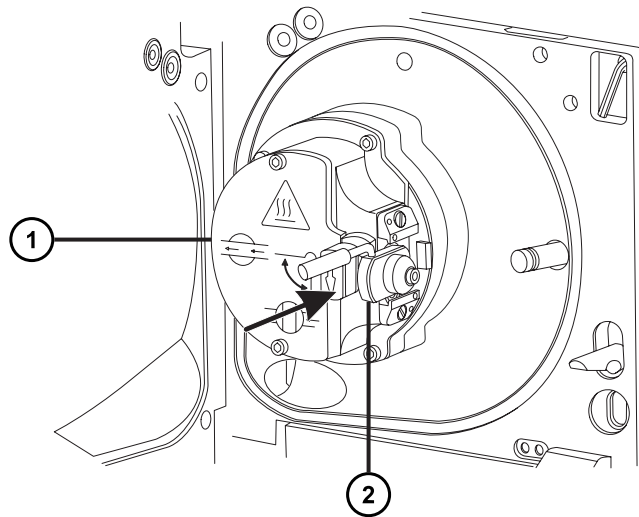
- An ESI probe is fitted (the probe's tip is sharp).
- A corona pin is fitted (the pin's tip is sharp).



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

1. Ensure that the source isolation valve is in the closed position (see [Closing the source isolation valve \(Page 80\)](#)).
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.

Figure 4–15: Fitting the sampling cone assembly



- ① Ion block assembly
- ② Sampling cone assembly

3. Grasp the cone gas nozzle handle, and use it to rotate the sampling cone assembly 90 degrees, moving the handle downward from the horizontal to the vertical position.
4. Open the source isolation valve (see [Opening the source isolation valve \(Page 81\)](#)).
5. Close the source enclosure.

4.13 Cleaning the ion block assembly

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

4.13.1 Removing the ion block assembly from the source assembly

Required materials

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

To remove the ion block assembly:



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

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



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

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



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



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

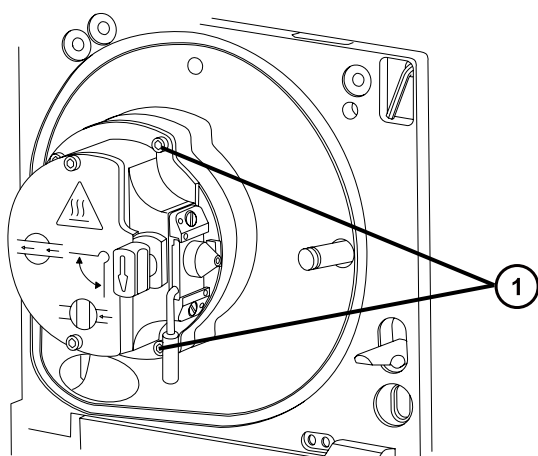
- An ESI probe is fitted (the probe's tip is sharp).
- A corona pin is fitted (the pin's tip is sharp).

3. Remove the source enclosure (see [Removing and refitting the source enclosure \(Page 78\)](#)).

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

4. Close the source isolation valve (see [Closing the source isolation valve \(Page 80\)](#)).
5. Use the combined 2.5-mm hex wrench and cone extraction tool to unscrew the four captive ion block assembly securing screws.

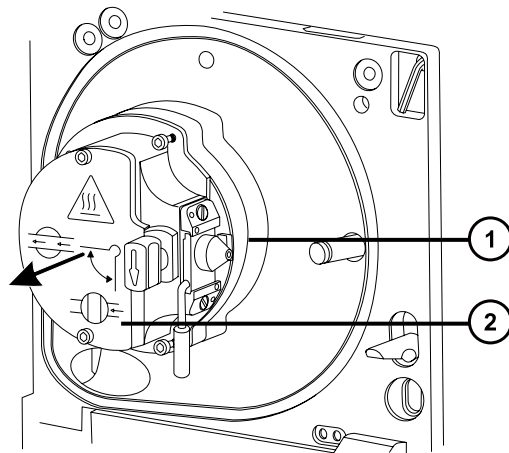
Figure 4–16: The ion block assembly securing screws



① Ion block assembly securing screws

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

Figure 4–17: Removing the ion block assembly



① PEEK ion block support

② Ion block assembly

4.13.2 Disassembling the source ion block assembly

Required materials

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

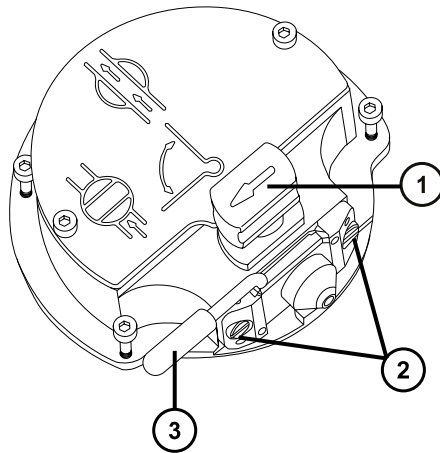
To disassemble the ion block assembly:



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

1. Ensure that the source isolation valve is closed.

Figure 4–18: Source ion block assembly



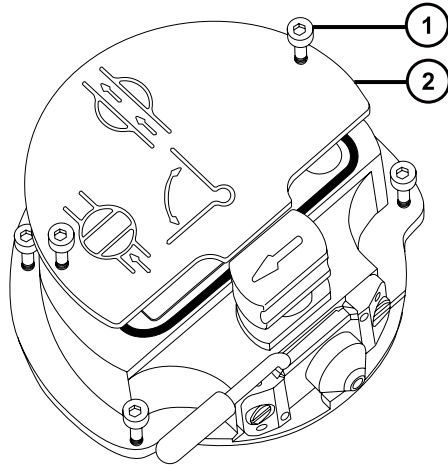
- ① Source isolation valve handle in closed position
- ② Sampling cone assembly retaining blocks
- ③ Cone gas nozzle handle

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

Important: To ensure correct operation of the ion block assembly after reassembly:

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

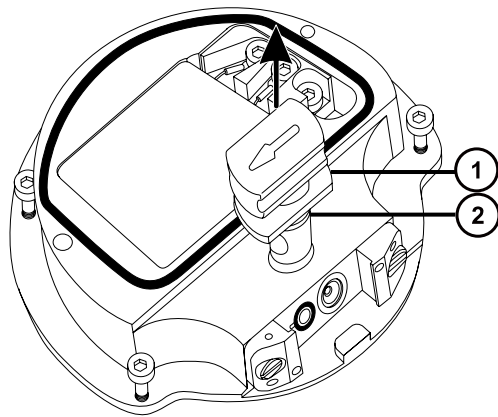
Figure 4–19: Source ion block cover plate



- ① Ion block cover plate securing screw
- ② Ion block cover plate

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

Figure 4–20: Removing the isolation valve from the ion block



- ① Isolation valve
- ② O-ring

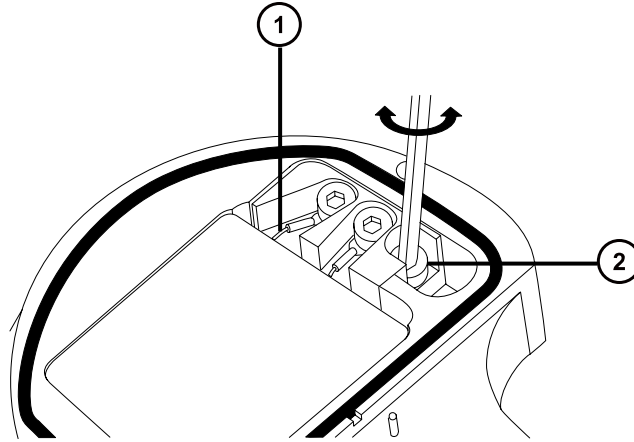
7. Use the O-ring removal kit to carefully remove the isolation valve O-ring (see [Removing O-rings and seals \(Page 82\)](#)).



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

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

Figure 4–21: Loosening the PEEK terminal block securing screw



- ① Heater cartridge assembly wires
- ② PEEK terminal block securing screw

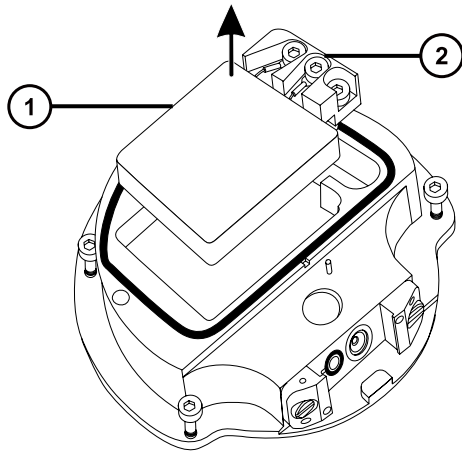


Notice: To avoid damaging the heater cartridge assembly wires, do not bend or twist them when removing the assembly and ceramic heater mounting block from the ion block.

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

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

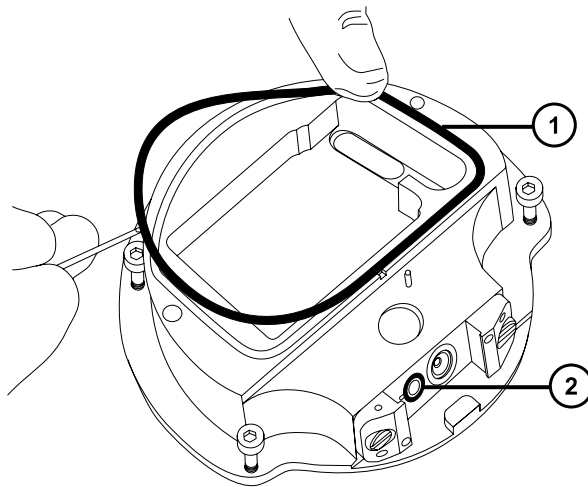
Figure 4–22: Removing the PEEK terminal block and ceramic heater mounting block



- ① Ceramic heater mounting block
- ② PEEK terminal block

11. Use the O-ring removal kit to carefully remove the cover seal from the ion block (see also [Removing O-rings and seals \(Page 82\)](#)).

Figure 4–23: Removing the cover seal from the ion block



- ① Cover seal
- ② Cone gas O-ring

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



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

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

4.13.3 Cleaning the ion block components

Required materials

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

To clean the ion block components:



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



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

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

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

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

Note: If you used formic acid in the cleaning solution, proceed to step 3. If not, go to step 4.

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

- a. Rinse the components by immersing them separately in glass vessels containing water, and then placing the vessels in the ultrasonic bath for 20 minutes.
- b. Remove residual water from the components by immersing them in separate glass vessels containing methanol, and then placing the vessels in the ultrasonic bath for 10 minutes.



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

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

Requirement: If contamination is present, do as follows:

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



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

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

4.13.4 Assembling the source ion block assembly

Required materials

- Chemical-resistant, powder-free gloves
- Combined 2.5-mm hex wrench and cone extraction tool
- Isopropyl alcohol in small container
- HPLC-grade (or better) 1:1 methanol/water
- Lint-free cloth

To assemble the ion block assembly:



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



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

1. Carefully fit the PEEK terminal block and ceramic heater mounting block, complete with heater cartridge assembly, to the ion block.
2. Use the combined 2.5-mm hex wrench and cone extraction tool to tighten the captive PEEK terminal block securing screw.
3. Ensure that the grooves for the cover seal, cone gas O-ring, and isolation valve O-ring are free from dirt and debris.

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

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

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

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

4.13.5 Fitting the ion block assembly to the source assembly

Required materials

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

To fit the ion block assembly to the source assembly:



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



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

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



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

1. Fit the ion block assembly to the PEEK ion block support.
2. Use the combined 2.5-mm hex wrench and cone extraction tool to fit, and then slowly tighten, the four ion block assembly securing screws sequentially and in small increments.
3. Open the source isolation valve (see [Opening the source isolation valve \(Page 81\)](#)).
4. Fit the source enclosure (see [Fitting the source enclosure to the instrument \(Page 79\)](#)).
5. Close the source enclosure.
6. Connect the power cords for the mass spectrometer and the roughing pump to the main power source.

4.14 Cleaning the ion guide assembly

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

4.14.1 Removing the pumping block assembly and ion guide assembly from the instrument

Required materials

- Chemical-resistant, powder-free gloves
- 3-mm hex wrench



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

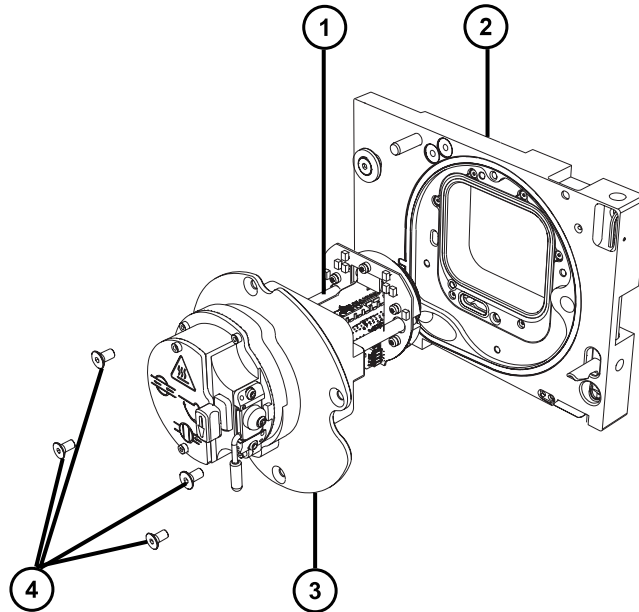


Warning: To avoid burn injuries, exercise care when handling the components of the source enclosure heated to high temperatures. Wait until the hot components have sufficiently cooled before you handle them.

To remove the pumping block assembly and ion guide assembly from the instrument:

1. Remove the source enclosure from the instrument (see [Removing and refitting the source enclosure \(Page 78\)](#)).
2. Use the 3-mm hex wrench to unscrew and remove the 4 screws securing the pump block assembly to the instrument.

Figure 4–24: Removing the pumping block assembly and ion guide assembly



- ① Ion guide assembly
- ② Housing
- ③ Pumping block assembly
- ④ Securing screws (4)

! **Notice:** To avoid damaging the ion guide assembly when removing it from, or fitting it to, the source assembly, do not grasp the ion guide by its metal lens plates. Instead, grasp the circuit boards on the top and bottom of the device.

3. Carefully remove the pumping block assembly and ion guide assembly from the instrument.

4.14.2 Removing the ion guide assembly and differential aperture from the pumping block assembly

Required materials

- Chemical-resistant, powder-free gloves
- 3-mm hex wrench

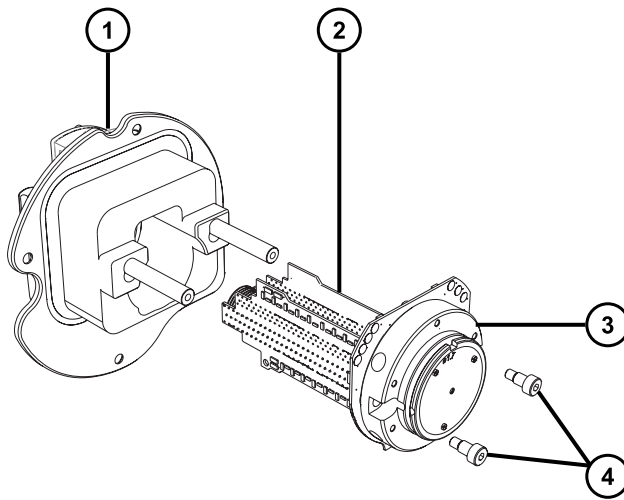


Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

To remove the ion guide assembly and differential aperture from the pumping block assembly:

1. Use the 3-mm hex wrench to unscrew and remove the 2 screws securing the differential aperture and ion guide assembly boards to the pumping block assembly.

Figure 4–25: Removing the ion guide assembly and differential aperture



- ① Pumping block assembly
- ② Ion guide assembly
- ③ Differential aperture support and circuit board
- ④ Securing screws (2)



Notice: To avoid damaging the ion guide assembly when removing it from, or fitting it to, the source assembly, do not grasp the ion guide by its metal lens plates. Instead, grasp the circuit boards on the top and bottom of the device.

2. Grasping the ion guide assembly by its top and bottom circuit boards, carefully remove the differential aperture and ion guide assembly from the pumping block assembly.

4.14.3 Removing the differential aperture support and the differential aperture from the ion guide assembly

Required materials

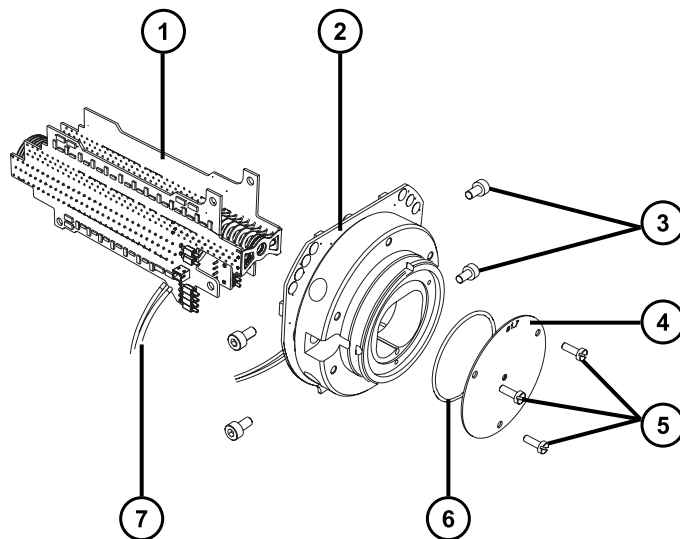
- Chemical-resistant, powder-free gloves
- 2.5-mm hex wrench
- Flat-blade screwdriver
- O-ring removal kit



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

1. Place the ion guide assembly with differential aperture onto a clean, flat surface.

Figure 4–26: Removing the differential aperture support and differential aperture



- ① Ion guide assembly
- ② Differential aperture support and circuit board
- ③ Securing screws (2 per side)
- ④ Differential aperture

- ⑤ Securing screws (3)
- ⑥ O-ring
- ⑦ Connecting cables for differential aperture support

2. Disconnect the cable from the ion guide assembly that connects the ion guide assembly to the differential aperture support.
3. Use the 2.5-mm hex wrench to unscrew and remove the 4 screws securing the differential aperture support to the ion guide assembly.
4. Remove the differential aperture support with its circuit board.

Note: Do not remove the circuit board from the rear of the differential aperture.

5. Use the flat-blade screwdriver to unscrew and remove the 3 screws securing the differential aperture from its support.
6. Inspect the O-ring for signs of deterioration or damage, and remove and replace the O-ring, if necessary.



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

4.14.4 Cleaning the differential aperture

! **Notice:** To prevent damage to the differential aperture support and the inductors on its circuit board, do not attempt to clean the differential aperture support or its circuit board.

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.
- Ultrasonic bath
- HPLC-grade deionized water
- Waters MS Cleaning Solution (186006846) or HPLC-grade (or better) 1:1 methanol/water
- HPLC-grade isopropyl alcohol
- Suitable holding container for storing the used cleaning solution
- Oil-free nitrogen gas or other oil-free, inert gas, suitable for drying



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

To clean the differential aperture:

1. Place the differential aperture in the glass vessel for cleaning.
2. Add Waters MS Cleaning Solution or 1:1 methanol/water to the vessel until the differential aperture is immersed completely.
3. Place the cleaning vessel with the differential aperture in an ultrasonic bath for 20 minutes.
4. Carefully pour the used cleaning solution from the cleaning vessel into the holding container, retaining the differential aperture in the cleaning vessel.

Tip: You can reuse Waters MS Cleaning Solution for one subsequent cleaning.

5. Fill the cleaning vessel with deionized water to rinse the differential aperture, and then discard the water.
6. Repeat step 5 to rinse the differential aperture a second time.
7. Fill the cleaning vessel with isopropyl alcohol until the differential aperture is immersed completely.
8. Carefully remove the differential aperture from its cleaning vessel and blow-dry the component using inert, oil-free gas.
9. Discard the used isopropyl alcohol using an appropriate waste container.

4.14.5 Cleaning the ion guide assembly

! **Notice:** To avoid damaging the ion guide assembly, use only methanol and water as solvents. Do not use acetone, chlorinated solvents, or acid.

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.
- Suitable length of PEEK or PTFE tubing used for suspending the ion guide assembly in the glass cleaning vessel
- Large beaker and Wash bottle for rinsing the ion guide assembly
- Ultrasonic bath
- Waters MS Cleaning Solution (186006846) or HPLC-grade (or better) 1:1 methanol/water
- HPLC-grade (or better) methanol

- Suitable holding container for storing the used cleaning solution
- Oil-free nitrogen gas or other oil-free, inert gas suitable for drying



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

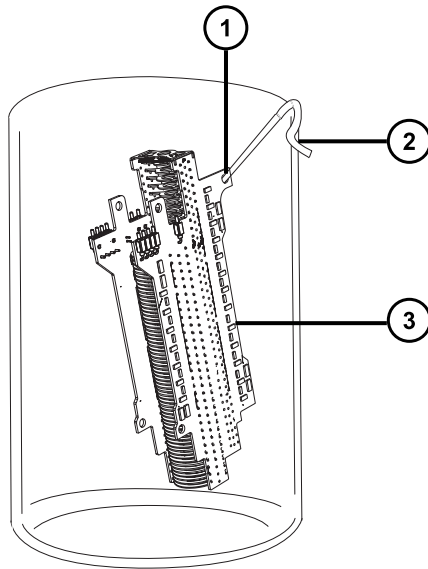
To clean the ion guide assembly:

1. Bend the PEEK or PTFE tube end into a hook shape.
2. Insert the hook into one of the holes in the ion guide's rear circuit board carrier.

Important: To avoid vibration-caused damage to the ion guide assembly, ensure that the bottom of the assembly is not in contact with the bottom of the glass vessel.

3. Bend the opposite end of the tube into a hook shape that allows you to suspend the ion guide assembly in the glass vessel so the bottom of the assembly does not touch the bottom of the vessel.

Figure 4–27: Cleaning the ion guide assembly



- ① Hole in the ion guide's rear circuit board carrier through which the tubing hook is inserted
- ② Opposite end hook used to suspend the ion guide assembly
- ③ Rear circuit board carrier on the ion guide assembly

4. Add Waters MS Cleaning Solution or 1:1 methanol/water to the cleaning glass vessel until the ion guide assembly is immersed completely.

5. Place the cleaning vessel with the ion guide assembly in the ultrasonic bath for 30 minutes.

! **Notice:** To avoid contaminating system components, wear clean, chemical-resistant, powder-free gloves when performing this procedure.

6. Wearing clean, chemical-resistant, powder-free gloves, carefully remove the ion guide assembly from its vessel and blow-dry it using inert, oil-free gas.

7. Inspect the ion guide assembly for persisting contamination. If contamination is present, do as follows:

a. Use the wash bottle containing methanol to rinse the ion guide assembly over the large beaker.

b. Blow-dry the ion guide assembly with inert, oil-free gas.

8. Use an appropriate waste container to discard the used methanol.

9. Pour the used cleaning solution from the cleaning vessel into the holding container.

Tip: You can reuse Waters MS Cleaning Solution for one subsequent cleaning.

4.14.6 Fitting the differential aperture and the differential aperture support onto the ion guide assembly

Required materials

- Chemical-resistant, powder-free gloves
- 2.5-mm hex wrench
- Flat-blade screwdriver
- O-ring removal kit



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

! **Notice:** To avoid damaging the ion guide assembly when removing it from, or fitting it to, the source assembly, do not grasp the ion guide by its metal lens plates. Instead, grasp the circuit boards on the top and bottom of the device.

To fit the differential aperture and the differential aperture support onto the ion guide assembly:

1. Inspect the O-ring between the differential aperture and the differential aperture support for signs of deterioration or damage. If necessary, use the O-ring removal kit to remove and replace the O-ring.



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

2. Use the flat-blade screwdriver to fit and tighten the 3 screws that secure the differential aperture to the differential aperture support.
3. Position the differential aperture support against the ion guide assembly, and then use the 2.5-mm hex wrench to fit and tighten the 4 screws that secure the differential aperture support to the ion guide assembly.
4. Reconnect the electrical cable from the ion guide assembly to the differential aperture support.

4.14.7 Fitting the ion guide assembly and differential aperture onto the pumping block assembly

Required materials

- Chemical-resistant, powder-free gloves
- 3-mm hex wrench



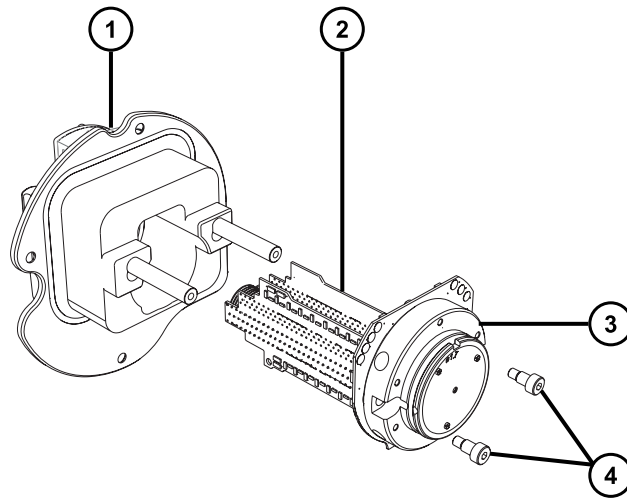
Warning: To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when performing this procedure.

! **Notice:** To avoid damaging the ion guide assembly when removing it from, or fitting it to, the source assembly, do not grasp the ion guide by its metal lens plates. Instead, grasp the circuit boards on the top and bottom of the device.

To fit the ion guide assembly and differential aperture onto the pumping block assembly:

1. Using care not to damage the seals on the pumping block assembly, position the ion guide assembly and differential aperture onto the two studs of the pumping block assembly.

Figure 4–28: Fitting the ion guide assembly and differential aperture



- ① Pumping block assembly
- ② Ion guide assembly
- ③ Differential aperture support and circuit board
- ④ Securing screws (2)

2. Use the 3-mm hex wrench to thread and tighten the 2 screws used to fit the differential aperture and ion guide assembly boards to the pumping block assembly.

4.14.8 Fitting the pumping block assembly and ion guide assembly onto the instrument

Required materials

- Chemical-resistant, powder-free gloves
- 3-mm hex wrench



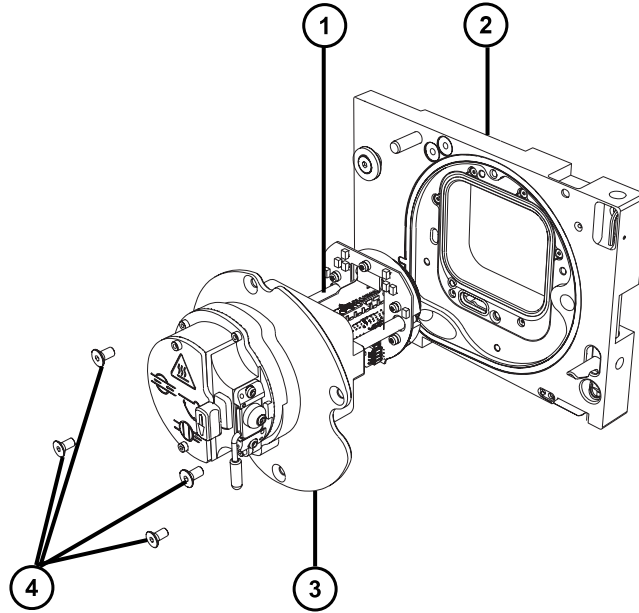
Warning: To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when performing this procedure.

! **Notice:** To avoid damaging the ion guide assembly when removing it from, or fitting it to, the source assembly, do not grasp the ion guide by its metal lens plates. Instead, grasp the circuit boards on the top and bottom of the device.

To fit the pumping block assembly and ion guide assembly onto the instrument:

1. Using care not to damage the seals between the pumping block assembly and instrument, position the pumping block assembly and ion guide assembly onto the instrument.

Figure 4–29: Fitting the pumping block and ion guide assemblies



- ① Ion guide assembly
- ② Housing
- ③ Pumping block assembly
- ④ Securing screws (4)

2. Use the 3-mm hex wrench to thread and tighten the 4 screws into the pumping block assembly and housing to secure the pump block assembly to the instrument.
3. Fit the source enclosure to the instrument as described in [Fitting the source enclosure to the instrument \(Page 79\)](#).

4.15 Replacing the ion block source heater

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

Required materials

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

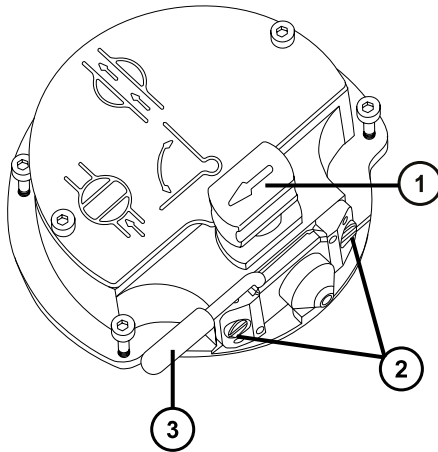
To replace the ion block source heater:



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

1. Remove the ion block assembly from the instrument (see [Removing the ion block assembly from the source assembly \(Page 96\)](#)).
2. Ensure that the isolation valve is closed.

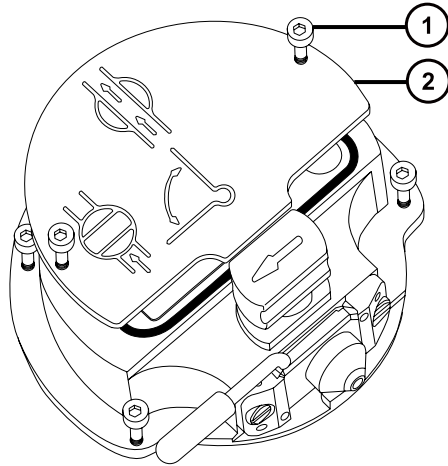
Figure 4–30: Ion block isolation valve closed



- ① Source isolation valve handle in closed position
- ② Sampling cone assembly retaining blocks
- ③ Cone gas nozzle handle

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

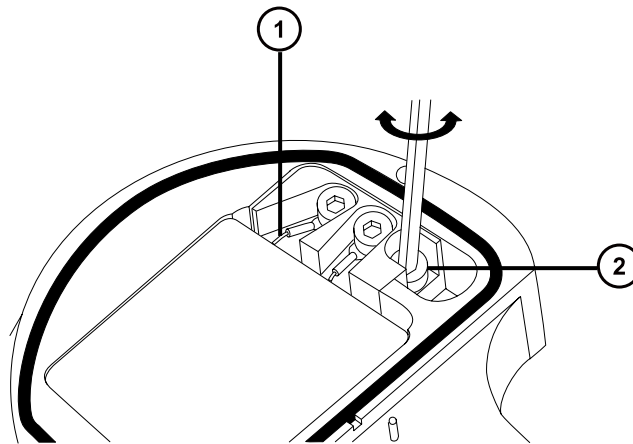
Figure 4–31: Loosening the captive screws



- ① Ion block cover plate securing screw
- ② Ion block cover plate

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

Figure 4–32: Loosening the captive PEEK terminal block securing screw



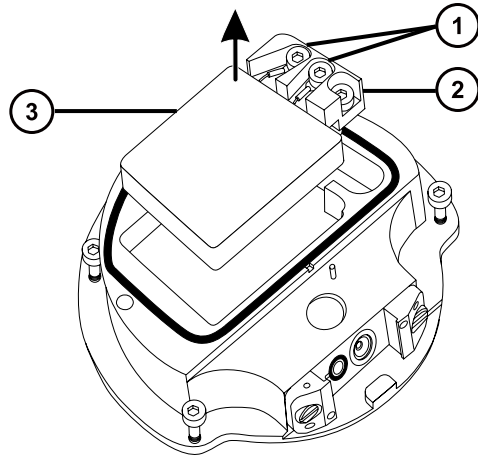
- ① Heater cartridge assembly wires
- ② PEEK terminal block securing screw

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

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

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

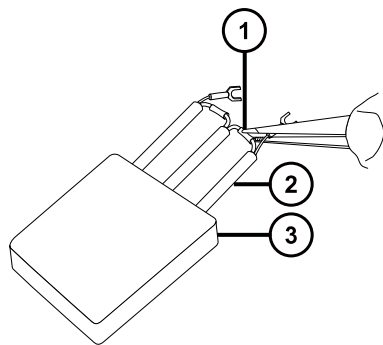
Figure 4–33: Removing the PEEK terminal block



- ① Heater wire securing screws
- ② PEEK terminal block
- ③ Ceramic heater mounting block

7. Use the combined 2.5-mm hex wrench and cone extraction tool to loosen the two screws securing the heater wires to the PEEK terminal block.
8. Disconnect the heater cartridge wires from the PEEK terminal block.
9. Use the needle-nose pliers to gently grasp the heat-shrink tubing on the heater cartridge assembly and slide the assembly out of the ceramic heater mounting block.

Figure 4–34: Removing the assembly from the ceramic heater mounting block



- ① Ceramic heater mounting block
- ② Heat-shrink tubing
- ③ Heater cartridge assembly

10. Dispose of the heater cartridge assembly.



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

11. Use the needle-nose pliers to gently grasp the heat-shrink tubing on the new heater cartridge assembly and slide the assembly into the ceramic heater mounting block.
12. Use the needle-nose pliers to position the heater cartridge's wiring ring tags fully under their securing screws.
13. Use the combined 2.5-mm hex wrench and cone extraction tool to tighten the two wire-securing screws.
14. Fit the PEEK terminal block and ceramic heater mounting block, complete with heater cartridge assembly, to the ion block.
15. Use the combined 2.5-mm hex wrench and cone extraction tool to tighten the captive PEEK terminal block securing screw.
16. Fit the ion block cover plate to the ion block assembly, and then use the combined 2.5-mm hex wrench and cone extraction tool to tighten the two captive screws securing the ion block cover plate.
17. Fit the ion block assembly to the instrument (see [Fitting the ion block assembly to the source assembly \(Page 105\)](#)).

4.16 Replacing the probe assembly

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

4.16.1 Removing the probe assembly

Required materials

- Chemical-resistant, powder-free gloves

To remove the probe assembly:



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



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

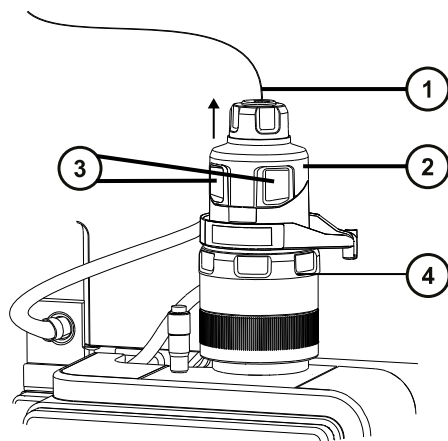


Warning: To avoid electric shock or solvent ignition, when connecting ESI or UPC² source probes directly to non-Waters equipment, ensure that the liquid outlet connection is grounded.

1. Squeeze the probe adapter cap release buttons together and lift the probe cap off the probe adapter, sliding it over the probe assembly.

Tip: Removing the probe adapter cap disconnects the high-voltage supply and the gas flow to the probe, and stops the source nebulizer and desolvation gas flows.

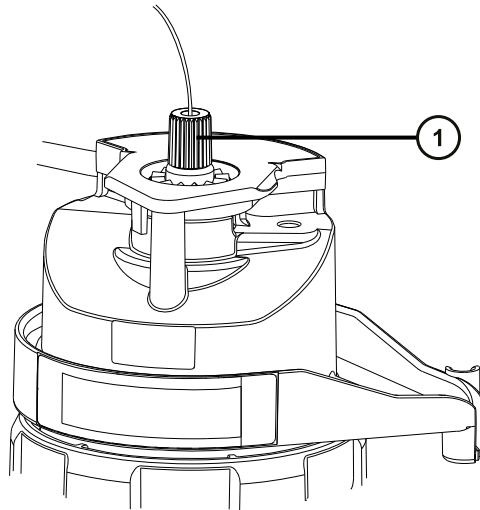
Figure 4–35: Removing the probe adapter cap



- ① Probe assembly
- ② Probe adapter cap
- ③ Probe adapter cap release buttons
- ④ Probe adapter

2. Unscrew the finger-tight PEEK fitting.

Figure 4–36: PEEK fitting



① PEEK fitting

3. Remove the probe assembly.



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

4. Dispose of the probe assembly in accordance with local environmental regulations.

5. To install a new probe assembly, see [Installing the probe assembly \(Page 54\)](#).

4.17 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.

4.17.1 Removing the ESI probe tip and gasket

Required materials

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

To remove the ESI probe tip and gasket:



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



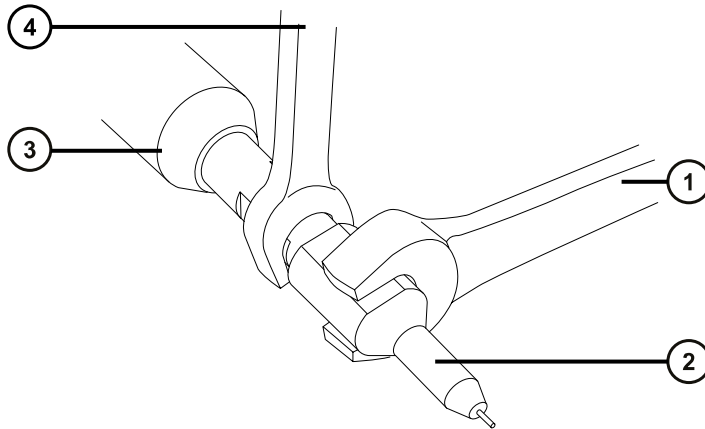
Warning: To avoid burn injuries, take great care while performing this procedure.



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

1. Remove the ESI probe adapter from the source (see [Removing the probe adapter \(Page 64\)](#)).
2. Use the 7-mm wrench in conjunction with the 10-mm wrench to remove the probe tip.

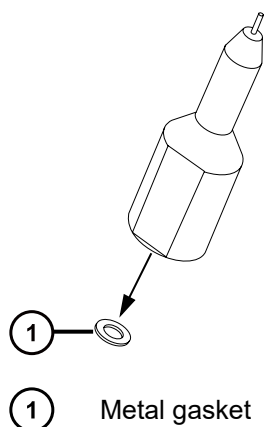
Figure 4–37: Removing the probe tip



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

3. Remove the metal gasket from the probe tip.

Figure 4–38: Removing the metal gasket



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

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

4.17.2 Fitting the ESI probe tip and gasket

Required materials

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

To fit the ESI probe tip and gasket:



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



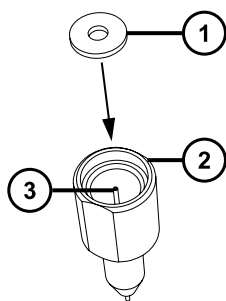
Warning: To avoid puncture injuries, handle sample needles, syringes, fused silica lines, and borosilicate tips with extreme care.



Notice: To avoid damage, do not reuse metal gaskets. Always fit a new gasket.

1. Fit the new metal gasket into the probe tip.

Figure 4–39: Inserting the gasket



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

2. Fit the probe tip, and screw the tip onto the probe assembly.
3. Use the 7-mm wrench in conjunction with the 10-mm wrench to tighten the probe tip.




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

4. Fit the ESI probe adapter to the source (see [Installing the probe adapter \(Page 51\)](#)).
5. If required, re-optimize the probe position (see the mass spectrometer's online Help).

4.18 Cleaning the APCI probe tip

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

To clean the APCI probe tip:

1. On the Manual Optimization page, click **Stop fluidics** .
2. To start the API gas flow, click **Gas** .
3. Set Desolvation Gas to 650 L/h.
4. Set APCI probe Temp to 650 °C.
5. Click **Operate** .
6. Wait 10 minutes.

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

7. Click **Standby** .

4.19 Replacing the APCI probe heater

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

4.19.1 Removing the APCI probe heater

Required materials

Chemical-resistant, powder-free gloves

To remove the APCI probe heater:



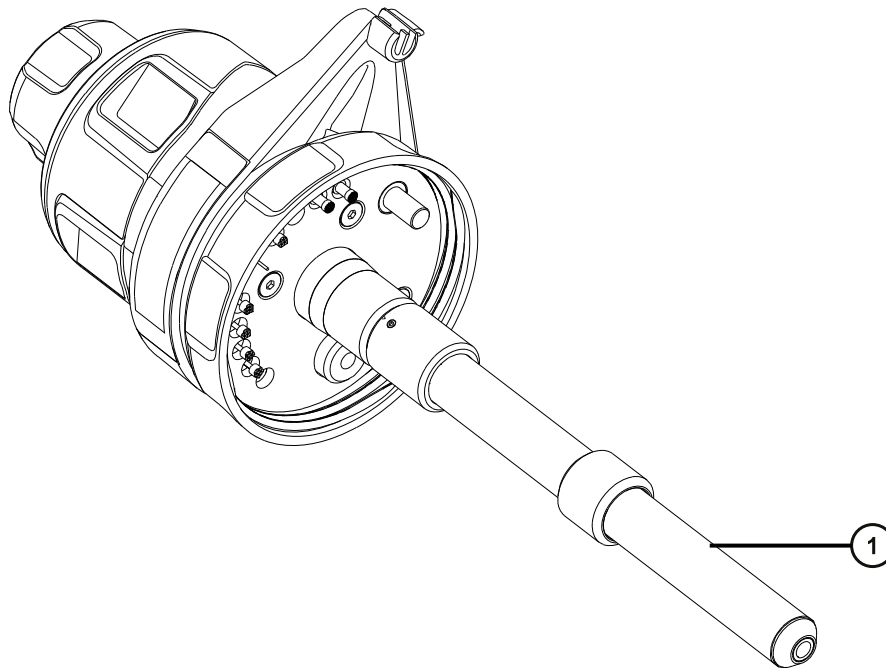
Warning: To avoid burn injuries, take great care while working with the probe and source; these components can be hot.



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

1. Remove the probe adapter from the source (see [Removing the probe adapter \(Page 64\)](#)).

Figure 4–40: Probe heater



- ① Probe heater



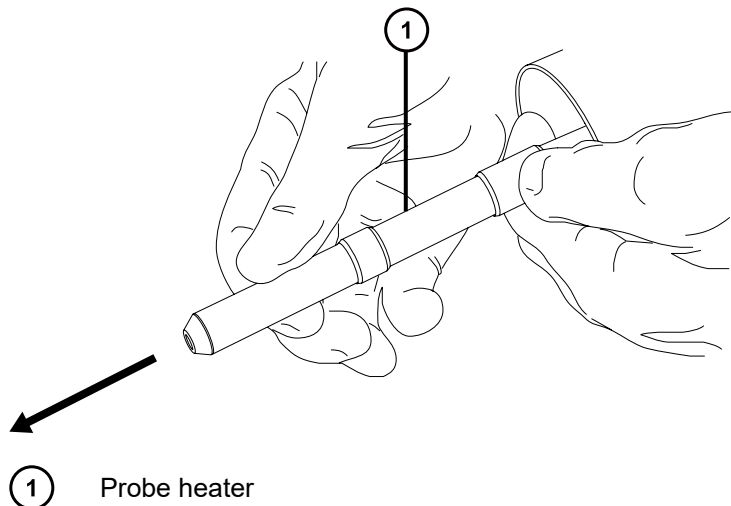
Notice: To avoid damaging the probe heater's electrical connections, do not twist the heater when removing it from or refitting it to the probe adapter.



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

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

Figure 4–41: Removing the probe heater



① Probe heater



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

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

4.19.2 Fitting the new APCI probe heater

Required materials

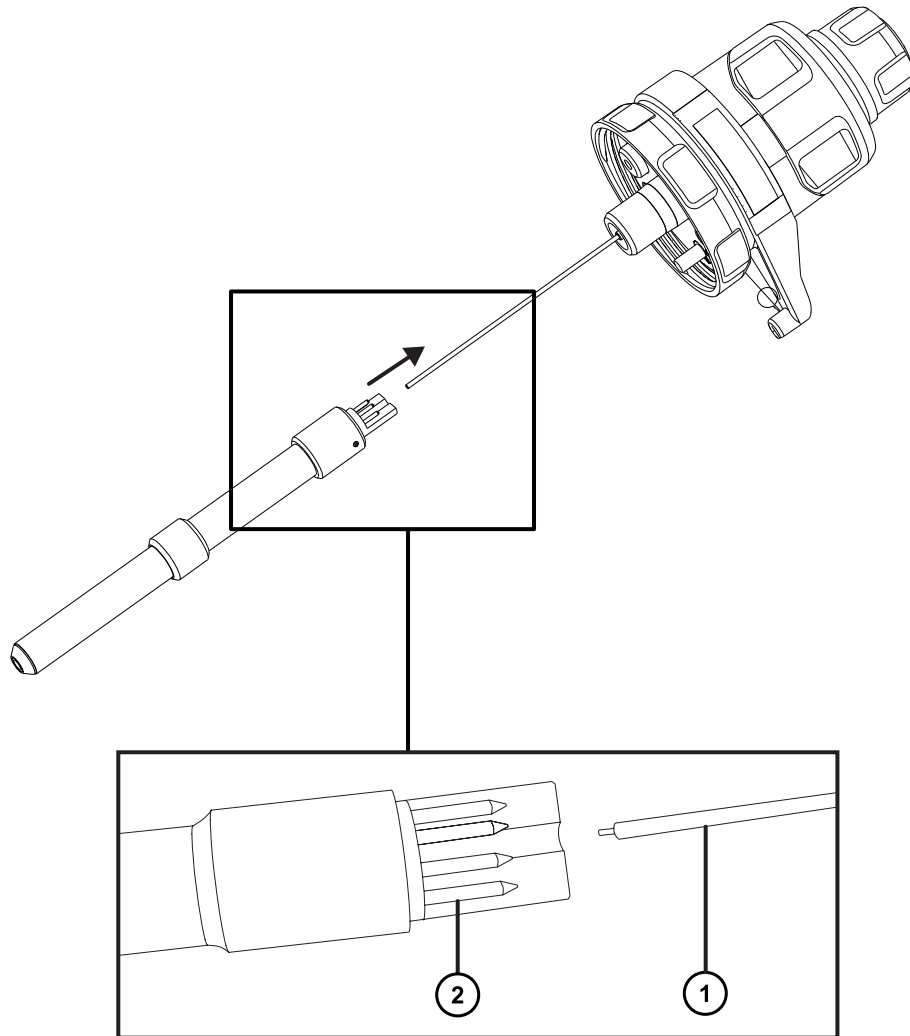
- Chemical-resistant, powder-free gloves
- APCI probe heater

To fit the new APCI probe heater:

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

1. Carefully slide the probe heater over the capillary sleeve on the probe adapter, ensuring that the heater is fully seated on the probe adapter.

Figure 4–42: Fitting the probe heater



- ① Capillary sleeve
- ② Probe heater connections

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

2. Fit the probe adapter to the instrument (see [Installing the probe adapter \(Page 51\)](#)).

4.20 Cleaning or replacing the corona pin

Required materials

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

To clean or replace the corona pin:



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



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



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

1. Remove the corona pin from the source (see [Removing the corona pin from the source \(Page 67\)](#)).
2. Replace the corona pin if it is deformed or damaged. Otherwise clean its tip with the lapping film, and then wipe it clean with a methanol-saturated tissue.



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

3. If you are replacing the corona pin, dispose of the old pin in accordance with local environmental regulations.
4. Install the corona pin in the source (see [Installing the corona pin in the source \(Page 65\)](#)).

4.21 Replacing the source assembly seals



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



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

Renew the following seals:

- Probe adjuster assembly probe seal
- Probe adjuster assembly nebulization gas seal
- Source enclosure seal
- Nebulizer gas seal
- Desolvation gas seal

4.21.1 Removing the probe adjuster assembly probe and source enclosure seals

Required materials

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

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



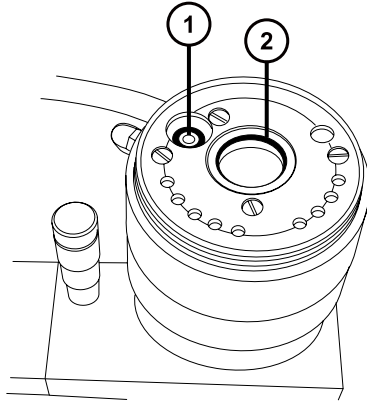
Warning: To avoid personal contamination with biologically hazardous, toxic, and corrosive materials, wear chemical-resistant, powder-free gloves when performing this procedure.

1. Remove the source enclosure from the instrument (see [Removing the Source Enclosure from the Instrument \(Page 78\)](#)).
2. Use the O-ring removal kit to carefully remove the following seals from the probe adjuster assembly:

- Probe seal
- Nebulizer gas seal

See also: See [Removing O-rings and seals](#). (Page 82)

Figure 4–43: Probe adjuster assembly seals

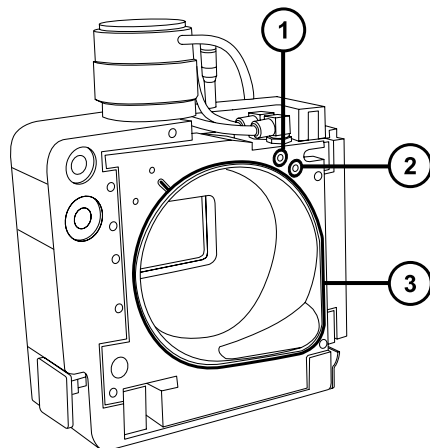


- ① Probe adjuster nebulizer gas seal
- ② Probe adjuster assembly probe seal

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

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

Figure 4–44: Source enclosure seals



- ① Nebulizer gas seal
- ② Desolvation gas seal

③ Source enclosure seal



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

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

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

Required materials

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

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



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

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

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

2. Fit the new source enclosure seal to the source enclosure.

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

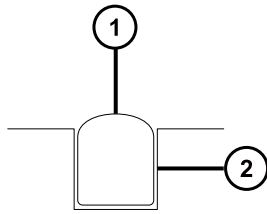
Tip: Start by feeding the seal into the groove at the bottom right-hand corner, then work around the seal in the counterclockwise direction.

3. Fit the following new seals to the source enclosure:

- Nebulizer gas seal
- Desolvation gas seal

Requirement: Fit the seals, which incorporate a special cross-section, into grooves, as shown.

Figure 4–45: Fitting the seal into the groove



- ① Seal
- ② Groove

4. Fit the following new seals to the probe adjuster assembly:
 - Probe seal
 - Nebulizer gas seal
5. Fit the source enclosure to the instrument (see [Fitting the source enclosure to the instrument \(Page 79\)](#)).

4.22 Replacing the air filter

You must replace the air filter annually.

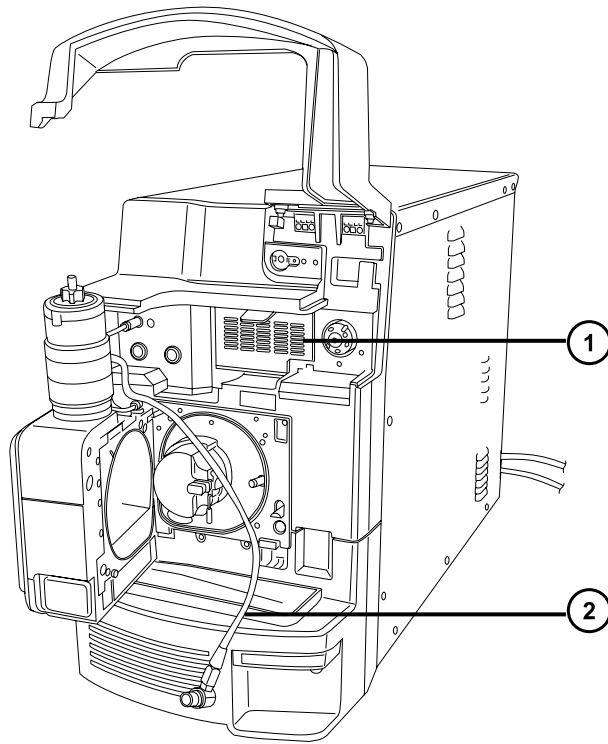
Required materials

- New air filter

To replace the air filter:

1. Lift the instrument's visor so the source probe is fully exposed.
2. Fully open the source enclosure.
3. Disconnect the probe cable from the high-voltage connector, and leave the cable in a position that does not obstruct the air filter grill.

Figure 4–46: Source enclosure open

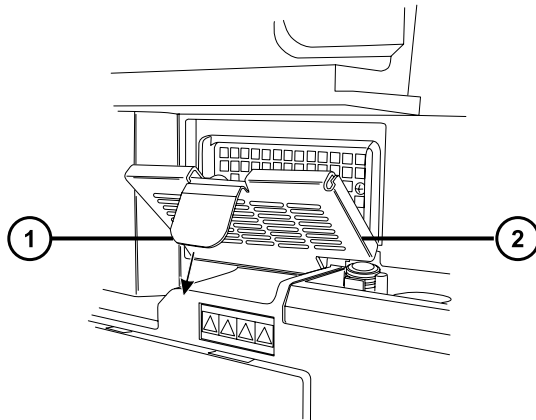


① Air filter grill

② Probe cable

4. Open the air filter grill by pulling the tab at the top of the grill toward you.

Figure 4–47: Replacing the air filter



① Air filter tab

② Air filter grill



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

5. Remove and dispose of the old filter.
6. Place the new filter flat on the inside part of the grill, with its edges beneath the metal lip.
7. Close the air filter grill.
8. Connect the probe cable to the high-voltage connector.
9. Close the source enclosure.
10. Lower the instrument's visor.

4.23 Replacing the UniSpray probe assembly

Replace the probe assembly on the UniSpray source if it becomes irreversibly blocked, or if it becomes contaminated or damaged.

4.23.1 Removing the UniSpray probe assembly

Required materials

- Chemical-resistant, powder-free gloves



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

To remove the UniSpray probe assembly:

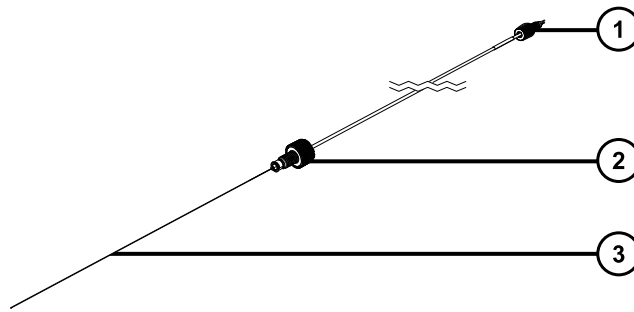
1. To prepare the instrument for working on the source, stop solvent flow, ensure that the instrument is in Standby mode, and stop desolvation gas flow.



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

2. Unscrew the probe's PEEK fitting to disconnect the probe assembly's input from the fluidics.

Figure 4–48: UniSpray probe assembly



- ① PEEK fitting
- ② Probe fitting
- ③ Probe capillary

3. Unscrew the probe fitting and pull the probe assembly out of the shaft inlet on top of the source enclosure.



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

4. Dispose of the probe and fittings in accordance with local environmental regulations.
5. Install a replacement UniSpray probe assembly (see [Installing the UniSpray probe assembly \(Page 136\)](#)).

4.23.2 Installing the UniSpray probe assembly

4.23.2.1 Installing the UniSpray probe assembly

Required materials

- Chemical-resistant, powder-free gloves
- UniSpray probe assembly



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

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

! **Notice:** Ensure that you install the correct probe capillary assembly for your probe type. Using the incorrect probe capillary assembly for the probe type can compromise instrument performance.

To install the UniSpray probe assembly:

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



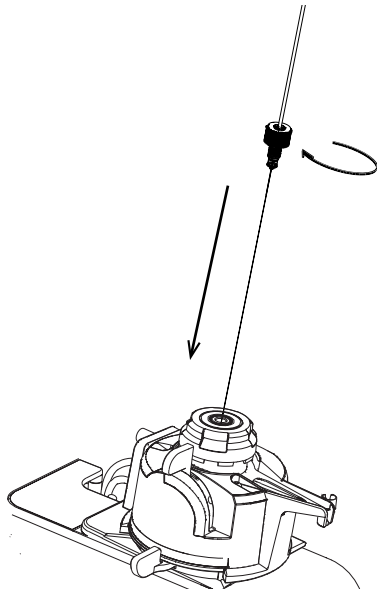
Warning: To avoid harmless, static-like electric shock, ensure that the instrument is in Standby mode before beginning this procedure.



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

2. Remove the existing probe assembly from the source (see [Removing the UniSpray probe assembly \(Page 135\)](#)).
3. Carefully insert the probe assembly into the probe inlet shaft on top of the source enclosure and tighten the probe fitting.

Figure 4–49: Inserting the UniSpray probe assembly into the source



Notice: To avoid damaging the capillary on instruments where the source is situated above eye level, remove the source from the device and move it to a lower position before inserting the probe assembly into the probe.

See also: [Removing the UniSpray source \(Page 72\)](#).

4. If you removed the source enclosure from the device to fit the probe assembly, reinstall the source enclosure.

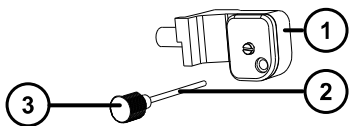
See also: [Installing the UniSpray source \(Page 69\)](#).

5. Screw the probe assembly's PEEK fitting into the appropriate fluidics port for your instrument until it is finger tight.

4.24 Maintaining the UniSpray impactor pin

UniSpray directs the spray at an impactor pin held at a voltage, creating smaller charged droplets, amenable to easy desolvation. This section provides details about removing, cleaning, and installing the UniSpray impactor pin.

Figure 4–50: UniSpray Impactor pin



- ① Impactor pin mounting block
- ② Impactor pin
- ③ Pin handle

4.24.1 Removing and installing the UniSpray impactor pin

Required materials

- Chemical-resistant, powder-free gloves
- UniSpray impactor pin



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

To install the UniSpray impactor pin in the source:

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



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



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

2. Pull open the source enclosure release handle and swing open the enclosure.
3. Unscrew the pin handle and withdraw the pin from the mounting block.
4. Dispose of the used pin in accordance with local environmental regulations.

Important: When you install a new impactor pin, or you clean the existing pin based on the maintenance schedule, clean the pin before you insert it into the source, as specified in [Cleaning or replacing the UniSpray impactor pin \(Page 139\)](#).

5. While holding the pin handle, insert the pin through the inlet on the mounting block and screw the pin handle into the mounting block until it is finger tight.
6. Close the source enclosure.
7. For details about aligning and optimizing the source, refer to the quick reference card supplied with the source, or refer to the online Help if it is available with your instrument's software.

4.24.2 Cleaning or replacing the UniSpray impactor pin

Required materials

- Chemical-resistant, powder-free gloves
- Lapping film
- HPLC-grade (or better) methanol
- Lint-free tissue
- Impactor pin



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



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



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

To clean the impactor pin:

1. Remove the impactor pin from the UniSpray source (see [Removing and installing the UniSpray impactor pin \(Page 138\)](#)).
2. Inspect the impactor pin and replace it if it is deformed or damaged.
3. Clean the pin by polishing it along its length using 1- μ m lapping film, and then wiping it clean with a methanol-saturated, lint-free tissue.



Notice: To avoid damaging the impactor pin, do not rotate the pin when polishing it with the lapping film or when wiping it clean.

4. Install the impactor pin in the UniSpray source (see [Removing and installing the UniSpray impactor pin \(Page 138\)](#)).

4.25 Replacing the instrument's fuses



Warning: To avoid electric shock, disconnect the mass spectrometer from the power supply before replacing fuses. The mass spectrometer has two fuses and uses double pole/neutral fusing circuitry. Circuits can remain live even when one fuse has blown.



Warning: To avoid electrical fire, ensure that replacement fuses comply with the ratings affixed to the rear panel of the module.

If one or both of the mass spectrometer's fuses blow, the instrument will shut down immediately. If this occurs, disconnect the power cord from the rear panel, and replace the fuses, located at the bottom left-hand-side of the instrument's rear panel, with T10AH250V, 6x32mm fuses.

A Safety advisories

Waters products display safety symbols that identify hazards associated with the product's operation and maintenance. The symbols also appear in product manuals with statements that describe the hazards and advise how to avoid them. This appendix presents all safety symbols and statements that apply to Waters' product offerings. The symbols and statements can apply to a specific product, or apply to other products within the same system.

A.1 Warning symbols

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

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



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



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



Warning: (Risk of electric shock.)



Warning: (Risk of fire.)



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



Warning: (Risk of hand crush injury.)



Warning: (Risk of injury caused by moving machinery.)



Warning: (Risk of exposure to ultraviolet radiation.)



Warning: (Risk of contacting corrosive substances.)



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



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



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



Warning: (Risk of tipping.)



Warning: (Risk of explosion.)



Warning: (Risk of high-pressure gas release.)

A.1.1 Specific warnings

A.1.1.1 Burst warning

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



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

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

A.1.1.2 Mass spectrometer shock hazard

The following warning applies to all Waters mass spectrometers.



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

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



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

A.1.1.3 Mass spectrometer flammable solvents warning

This warning applies to mass spectrometers performing an analysis that requires the use of flammable solvents.



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

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

A.1.1.4 Biohazard warning

The following warning applies to Waters instruments and devices that can process biologically hazardous materials. Biologically hazardous materials are substances that contain biological agents capable of producing harmful effects in humans.



Warning: To avoid infection from blood-borne pathogens, inactivated microorganisms, and other biological materials, assume that all biological fluids that you handle are infectious.

Specific precautions appear in the latest edition of the US National Institutes of Health (NIH) publication *Biosafety in Microbiological and Biomedical Laboratories* (BMBL).



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

A.1.1.5 Biohazard and chemical hazard warning

This warning applies to Waters instruments and devices that can process biohazards, corrosive materials, or toxic materials.



Warning: To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, you must understand the hazards associated with their handling. Guidelines prescribing the proper use and handling of such materials appear in the latest edition of the National Research Council's publication, *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Observe Good Laboratory Practice (GLP) at all times, particularly when working with hazardous materials, and consult the safety representative for your organization regarding its protocols for handling such materials.

A.2 Notices

Notice advisories appear where an instrument, device, or component can be subject to use or misuse that can damage it or compromise a sample's integrity. The exclamation point symbol and its associated statement alert you to such risk.



Notice: To avoid damaging the case of the instrument or device, do not clean it with abrasives or solvents.

A.3 Bottles Prohibited symbol

The Bottles Prohibited symbol alerts you to the risk of equipment damage caused by solvent spills.



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

A.4 Required protection

The Use Eye Protection and Wear Protective Gloves symbols alert you to the requirement for personal protective equipment. Select appropriate protective equipment according to your organization's standard operating procedures.



Requirement: Use eye protection when performing this procedure.



Requirement: Wear clean, chemical-resistant, powder-free gloves when performing this procedure.

A.5 Warnings that apply to all Waters instruments and devices

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



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



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



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



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



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



警告： 未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。



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



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



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



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

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



Avertissement : Manipulez les tubes en polymère sous pression avec précaution:

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



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

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



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

- Indossare sempre occhiali da lavoro protettivi nei pressi di tubi di polimero pressurizzati.
- Spegnerne 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.
- Apagar cualquier llama que pudiera haber encendida en 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： 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砷会导致非金属管线膨胀，大大降低管线的耐压能力。



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。
- 不要使用已經被壓扁或嚴重彎曲管線。
- 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砷會導致非金屬管線膨脹，大大降低管線的耐壓能力。



경고: 가압 폴리머 튜브로 작업할 경우에는 주의하십시오.

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



警告: 圧力のかかったポリマーチューブを扱うときは、注意してください。

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

This warning applies to Waters instruments fitted with nonmetallic tubing or operated with flammable solvents.



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



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



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



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



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



警告 : 使用者必须非常清楚如果设备不是按照制造厂商指定的方式使用, 那么该设备所提供的保护将被削弱。



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消弱。



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。

A.6 Warnings that address the replacement of fuses

The following warnings pertain to instruments and devices equipped with user-replaceable fuses. Information describing fuse types and ratings sometimes, but not always, appears on the instrument or device.

Finding fuse types and ratings when that information appears on the instrument or device:



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



Avertissement : pour éviter tout risque d'incendie, remplacez toujours les fusibles par d'autres du type et de la puissance indiqués sur le panneau à proximité du couvercle de la boîte à fusible de l'instrument.



Warnung: Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert auf den Tafeln neben den Sicherungsabdeckungen des Geräts gedruckt sind.



Avvertenza: per garantire protezione contro gli incendi, sostituire i fusibili con altri dello stesso tipo aventi le caratteristiche indicate sui pannelli adiacenti alla copertura fusibili dello strumento.



Advertencia: Para evitar incendios, sustituir los fusibles por aquellos del tipo y características impresos en los paneles adyacentes a las cubiertas de los fusibles del instrumento.



警告： 为了避免火灾，应更换与仪器保险丝盖旁边面板上印刷的类型和规格相同的保险丝。



警告： 为了避免火灾，更換保險絲時，請使用與儀器保險絲蓋旁面板上所印刷之相同類型與規格的保險絲。



경고: 화재의 위험을 막으려면 기기 퓨즈 커버에 가까운 패널에 인쇄된 것과 동일한 타입 및 정격의 제품으로 퓨즈를 교체하십시오.



警告: 火災予防のために、ヒューズ交換では機器ヒューズカバー脇のパネルに記載されているタイプおよび定格のヒューズをご使用ください。

Finding fuse types and ratings when that information does not appear on the instrument or device:



Warning: To protect against fire, replace fuses with those of the type and rating indicated in the “Replacing fuses” section of the Maintenance Procedures chapter.



Avertissement : pour éviter tout risque d'incendie, remplacez toujours les fusibles par d'autres du type et de la puissance indiqués dans la rubrique "Remplacement des fusibles" du chapitre traitant des procédures de maintenance.



Warnung: Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert im Abschnitt "Sicherungen ersetzen" des Kapitels "Wartungsverfahren" angegeben sind.



Avvertenza: per garantire protezione contro gli incendi, sostituire i fusibili con altri dello stesso tipo aventi le caratteristiche indicate nel paragrafo "Sostituzione dei fusibili" del capitolo "Procedure di manutenzione".



Advertencia: Para evitar incendios, sustituir los fusibles por aquellos del tipo y características indicados en la sección "Sustituir fusibles".



警告 : 为了避免火灾，应更换“维护步骤”一章的“更换保险丝”一节中介绍的相同类型和规格的保险丝。



警告 : 为了避免火灾，更換保險絲時，應使用「維護步驟」章節中「更換保險絲」所指定之相同類型與規格的保險絲。



경고: 화재의 위험을 막으려면 유지관리 절차 단원의 “퓨즈 교체” 절에 설명된 것과 동일한 타입 및 정격의 제품으로 퓨즈를 교체하십시오.















警告: 火災予防のために、ヒューズ交換ではメンテナンス項目の「ヒューズの交換」に記載されているタイプおよび定格のヒューズをご使用ください。

A.7 Electrical symbols

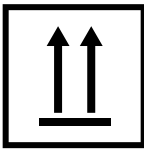

The following electrical symbols and their associated statements can appear in instrument manuals and on an instrument's front or rear panels.



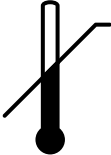
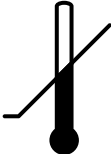
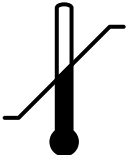
Symbol	Description
	Electrical power on

Symbol	Description
	Electrical power off
	Standby
	Direct current
	Alternating current
	Alternating current (three phase)
	Safety ground
	Frame or chassis terminal connection
	Fuse
	Functional ground
	Input
	Output
	Indicates that the device or assembly is susceptible to damage from electrostatic discharge (ESD)

A.8 Handling symbols

The following handling symbols and their associated statements can appear on labels affixed to the packaging in which instruments, devices, and component parts are shipped.

Symbol	Description
	Keep upright!
	Keep dry!

Symbol	Description
	Fragile!
	Use no hooks!
	Upper limit of temperature
	Lower limit of temperature
	Temperature limitation

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.



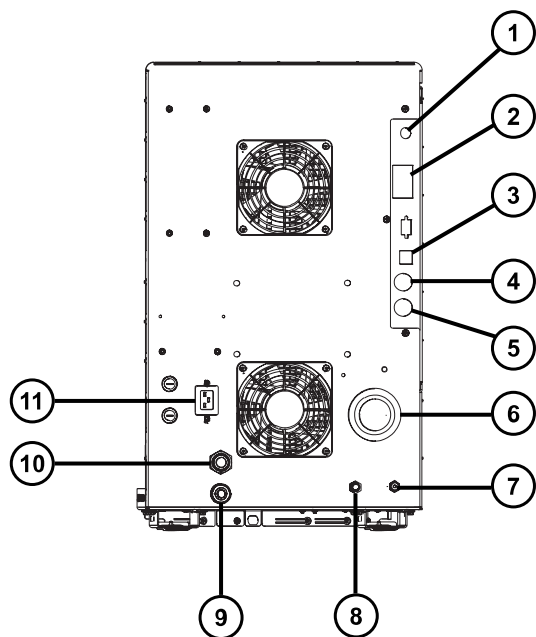
Notice: To avoid damaging the mass spectrometer, observe the following precautions:

- Contact Waters Technical Service before moving the instrument.
- If you must transport the instrument, or remove it from service, contact Waters Technical Service for recommended cleaning, flushing, and packaging procedures.

B.1 External wiring, vacuum, and gas connections

Rear panel connections appear in the figure below. The connectors and controls not identified are for use by Waters engineers only.

Figure B-1: Rear panel connections

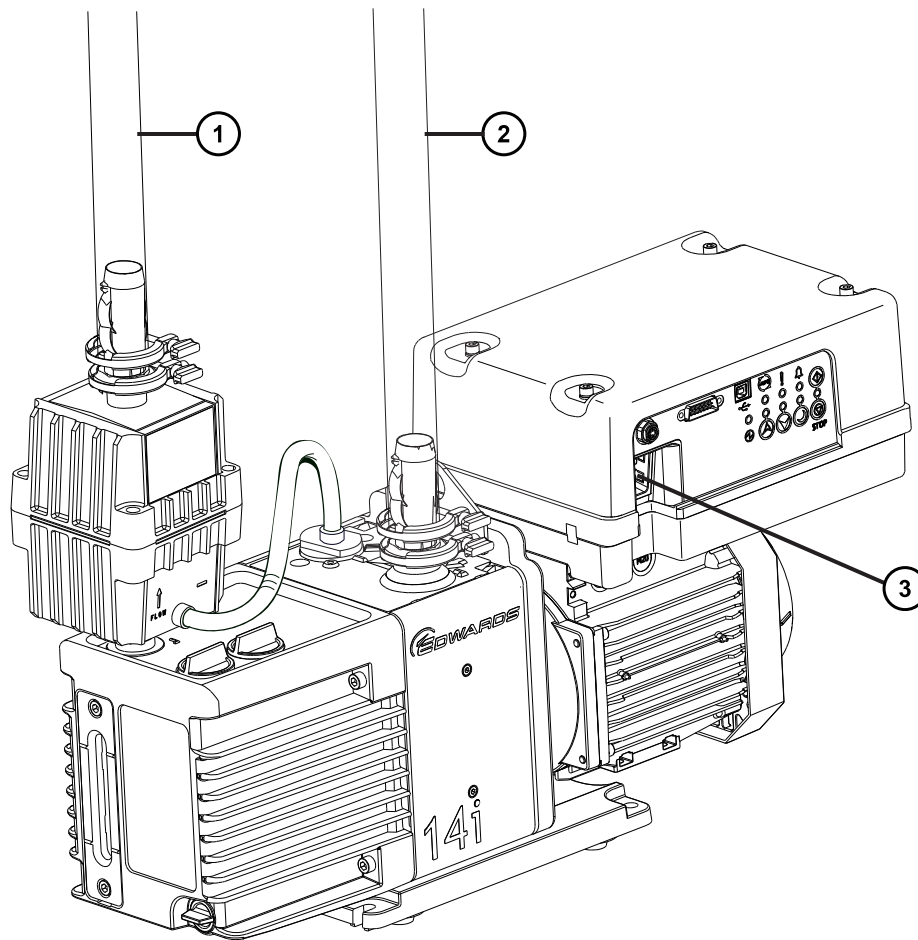


- ① Nano camera connection
- ② Event input and outputs

- ③ Shielded Ethernet
- ④ Waste bottle electrical connection
- ⑤ Roughing pump control
- ⑥ Source vacuum
- ⑦ Collision cell gas inlet (argon)
- ⑧ Nitrogen inlet
- ⑨ Turbo vacuum
- ⑩ Source vent
- ⑪ Power

B.2 Connecting the Edwards oil-filled backing pump

Figure B-2: Connecting the backing pump



- ① Exhaust port
- ② Vacuum hose assembly
- ③ Power cable connector

Required tools and materials

- Chemical-resistant, powder-free gloves
- 7-mm nut driver
- 8-mm hex wrench
- Utility knife
- NW25 clamp (included in the installation kit)

- NW25 O-ring (included in the installation kit)
- PVC exhaust tubing (included in the installation kit)
- PVC hose clamps (included in the installation kit)
- 25-mm ID vacuum hose (included in the installation kit)



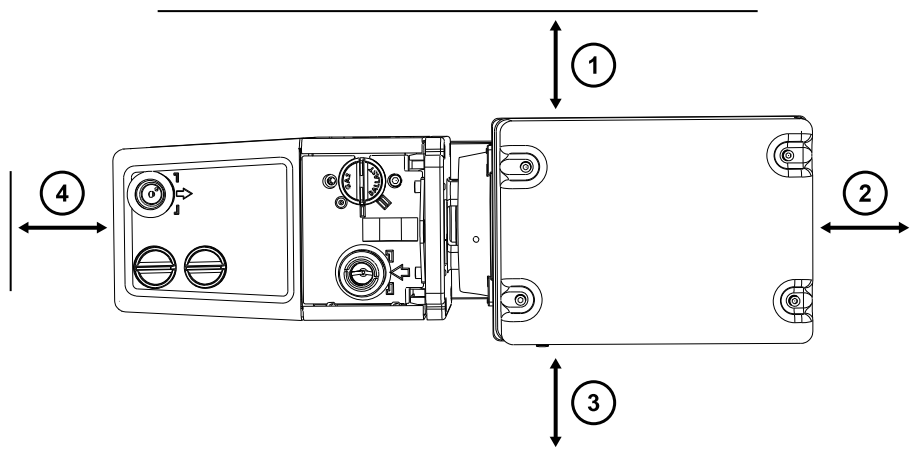
Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.

! **Notice:** To ensure the correct operation of the backing pump, it must be installed within one degree of horizontal.

! **Notice:** The area where the backing pump is located must have an ambient temperature of 15 to 40 °C (59 to 104 °F).

Note: To ensure proper ventilation, the pump must be installed with the following minimum clearances:

Figure B-3: Backing pump clearance



- ① Left-side minimum clearance is 15.0 cm (5.9 inches)
- ② Back-side minimum clearance is 15.0 cm (5.9 inches)
- ③ Right-side minimum clearance is 15.0 cm (5.9 inches)
- ④ Front-side minimum clearance is 35.0 cm (13.8 inches)

To connect the backing pump:



Warning: To avoid skeletal or muscle injury associated with lifting heavy objects, enlist the appropriate number of people to lift an instrument or device. If necessary, use lifting equipment that can raise it to the height of the laboratory bench.

1. Place a suitable PTFE drip tray on the floor within 1.52 m (5 feet) of the instrument.

Requirement: The pump must be oriented in a way that allows easy daily access to the gas ballast valve and the oil-level sight glass.

2. Place the pump on the PTFE drip tray.
3. Use the NW25 center ring and clamp and the 7-mm nut driver to attach the flanged end of a length of 1-inch ID vacuum hose to the vacuum port on the pump.
4. Use a hose clamp to connect the opposite end of the length of 1-inch vacuum hose in step 3 to the 1-inch OD straight vacuum port on the instrument's rear panel.

Note: To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely.

5. Use a hose clamp to connect a length of 19-mm clear PVC exhaust tubing to the pump exhaust port.



Notice: The instrument requires two separate exhaust systems: one for nitrogen, the other for the backing pump. Vent them to atmosphere through separate exhaust lines. Oil mist can severely damage the instrument if the nitrogen exhaust line connects with the backing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

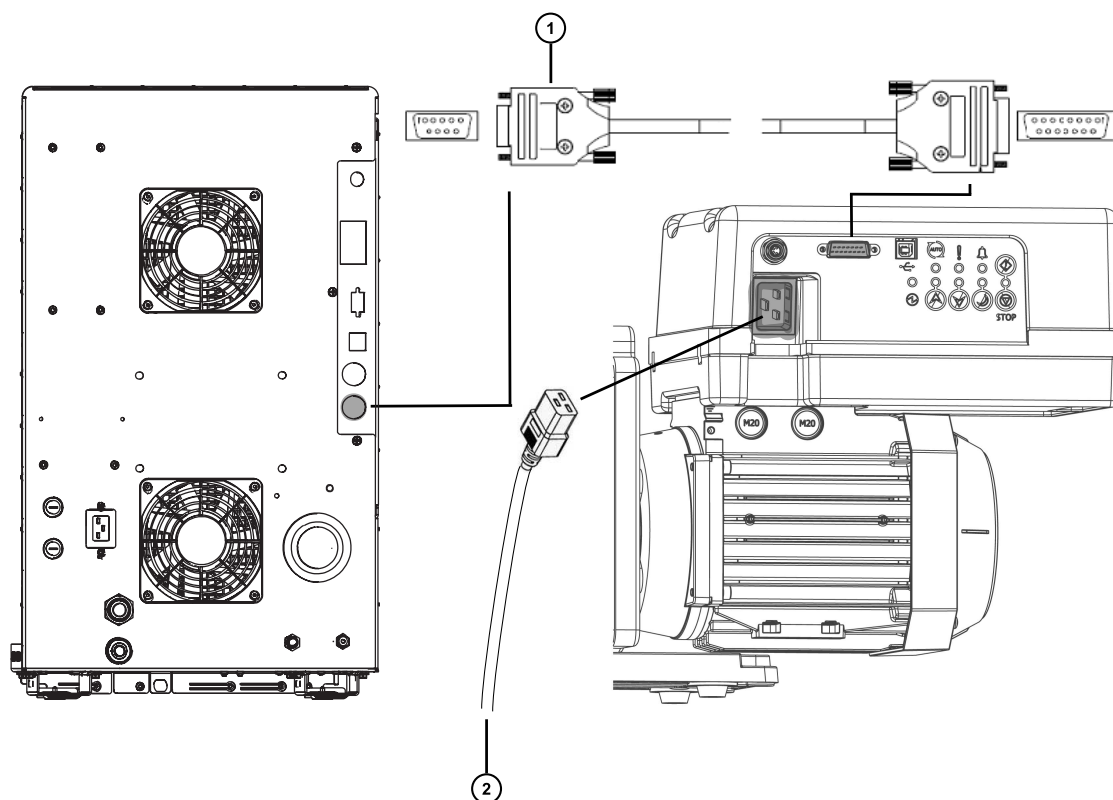
6. Route the open end of the exhaust tubing to a suitable exhaust vent.

Note: To ensure correct operation of the pump, do not let the oil drop below the minimum level.

7. Check the oil level in the pump (see [Maintaining the rotary backing pump's oil \(Page 85\)](#)).
8. Make the electrical connections to the rotary backing pump (see [Making the electrical connections to the rotary backing pump \(Page 158\)](#)).

B.2.1 Making the electrical connections to the rotary backing pump

Figure B-4: Backing pump electrical connections



① Backing pump control cable

② To power source

To make the electrical connections to the rotary backing pump:

1. Connect the pump control cable from the pump to the backing pump connector on the instrument's rear panel.
2. Connect the rotary backing pump power cord to the mains power source.

B.3 Connecting to the nitrogen gas supply

Required materials

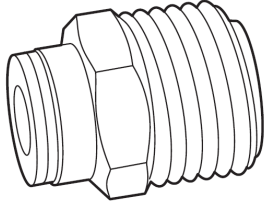
- Chemical-resistant, powder-free gloves
- Utility knife
- Large, adjustable wrench

- 6-mm PTFE tubing (included in the Waters Xevo TQ-S cronos Installation Kit)
- Nitrogen regulator

To connect the nitrogen gas supply:

1. Attach the nitrogen regulator to the nitrogen supply.
2. Install the 6-mm stud into the regulator outlet.

Figure B-5: 6-mm stud

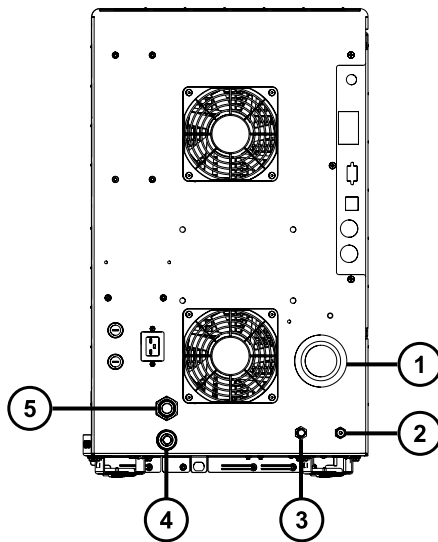


3. Connect the 6-mm PTFE tubing to the 6-mm stud.
4. Use the utility knife to cut a 3.8-cm to 5.0-cm (1.5-inch to 2-inch) length of 6-mm PTFE tubing from the other end of the tubing.

Requirement: Cut the tubing squarely.

5. Connect one end of the 3.8-cm to 5.0-cm PTFE tubing to the nitrogen supply in-line filter exit.
6. Connect the other end of 3.8-cm to 5.0-cm PTFE tubing to the nitrogen inlet port on the rear of the instrument.
7. Connect the remaining length of the 6-mm PTFE tubing to the other end of the in-line filter.

Figure B-6: Gas and exhaust connections



① Source vacuum

- ② Collision cell gas inlet (Argon)
- ③ Nitrogen inlet
- ④ Turbo vacuum
- ⑤ Source vent

B.4 Connecting to the collision cell gas supply

Required materials

- Chemical-resistant, powder-free gloves
- Large, adjustable wrench
- 1/8-inch Swagelok nut and ferrule
- 1/8-inch stainless steel tube (supplied with the instrument)

To connect the collision cell gas supply:

1. Use the 1/8-inch Swagelok nut and ferrule to connect the 1/8-inch stainless steel tube to the collision cell gas inlet on the rear of the instrument (see the figure in [Connecting to the nitrogen gas supply \(Page 158\)](#)).
2. Use the wrench to tighten the 1/8-inch Swagelok nut.
3. Connect the free end of the tube to the collision gas supply.

B.5 Connecting the nitrogen exhaust line

Required materials

- Chemical-resistant, powder-free gloves
- Utility knife
- 12-mm PTFE tubing (included in the Waters Rough Pump Connect Kit)
- Snoop (or equivalent) leak detector liquid

To connect the nitrogen exhaust line:



Warning: To prevent the nitrogen exhaust from carrying biologically hazardous, toxic, or corrosive LC solvents, you must use a nitrogen exhaust trap bottle and a laboratory exhaust system. The laboratory exhaust system must provide a minimum vacuum of 0.20 kPa (2 mbar, 0.03 psi) below atmospheric pressure (negative pressure).



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



Warning: To avoid the buildup of hazardous gases, do not place the nitrogen exhaust trap bottle in an enclosed cabinet.



Notice: To prevent serious damage to the instrument, two separate exhaust systems are required: one for nitrogen, the other for the roughing pumps. Vent the exhausts to atmosphere through separate lines. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the roughing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

1. Locate the exhaust trap bottle in an accessible area below the instrument.
2. Cut a length of 12-mm tubing long enough to connect the instrument to the exhaust trap bottle.

Requirement: Cut the tubing squarely.

3. Connect one end of the tubing to the exhaust port on the rear panel and the other end to one of two ports on the exhaust trap bottle.
4. Cut a length of 12-mm tubing long enough to connect the exhaust trap bottle to the exhaust vent.
5. Insert one end of the tubing into the remaining port on the exhaust trap bottle and route the other end to the exhaust vent.



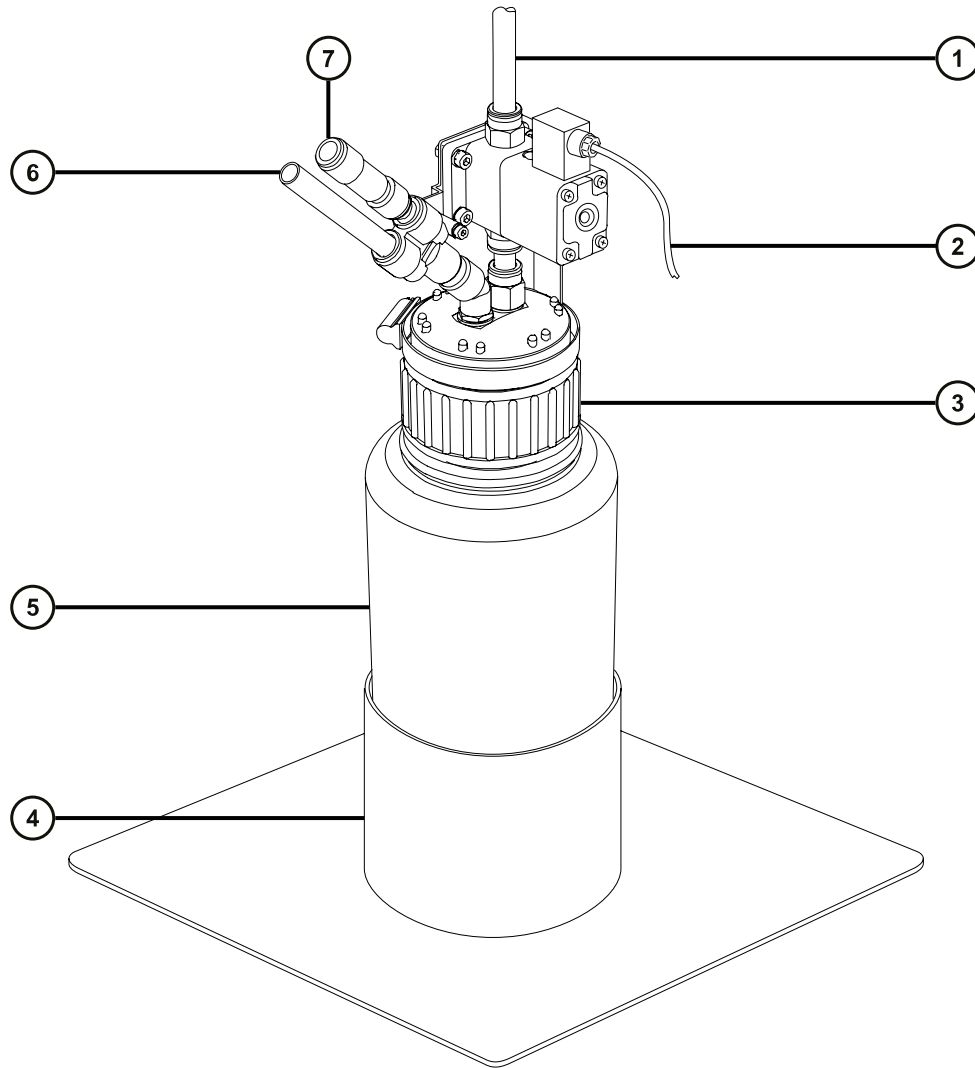
Warning: To prevent leaks in the source exhaust system, confirm the integrity of the system by performing the following leak test. Leaks can result in the release of biologically hazardous or toxic materials.



Notice: To avoid damage to the instrument, use Snoop (or its equivalent) leak detector liquid only for the purpose described in the following step. Do not use it on any other part of the instrument.

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

Figure B-7: Connecting the nitrogen exhaust line



- ① To laboratory exhaust port (12 mm)
- ② Valve control cable (from instrument)
- ③ Cap
- ④ Bottle support
- ⑤ Nitrogen exhaust trap bottle
- ⑥ From instrument waste (12 mm)
- ⑦ One-way valve

B.6 Connecting liquid waste lines

To ensure that waste materials are safely drained to the waste container, connect both the bottle tray and the mass spectrometer's drain cup to the waste container.

Required materials

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

To connect the liquid waste line:



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

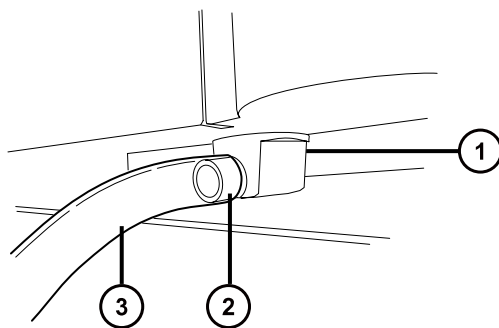
1. Place a suitable waste container below the mass spectrometer.



Notice: To avoid distorting the drip tray or causing the drain cup to leak, restrain the drain cup when attaching or removing the waste line.

2. Slide a drain line over the barbed fitting of the drain (located on the bottom, left-hand side of the mass spectrometer, and on the base of the bottle tray).

Figure B-8: Connecting liquid waste lines



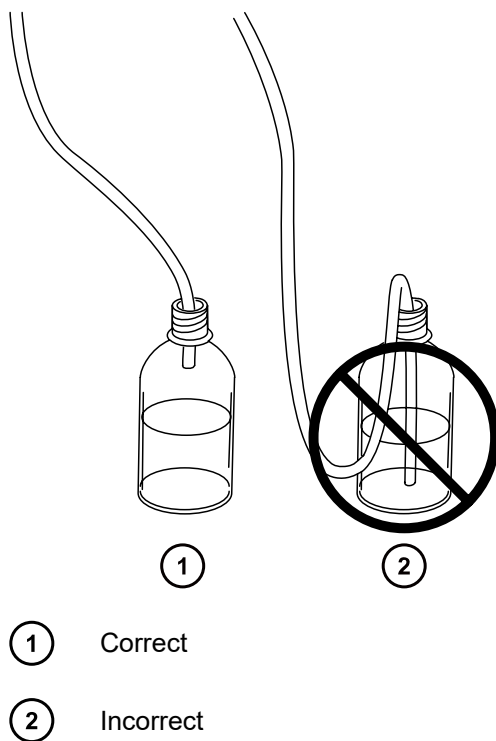
- ① Drain cup
- ② Barbed fitting
- ③ Drain line



Warning: To prevent leakage of biologically hazardous, toxic, or corrosive materials:

- Do not crimp or bend drain lines. A crimp or bend can impede flow to the waste container.
 - Empty the waste container before the lower ends of the drain tubes are covered by waste solvent.
3. Route the waste lines to the waste container. If necessary, shorten the waste tubes so their ends are above the surface of the waste solvent.

Figure B-9: Positioning of drain tube



B.7 Connecting to the workstation



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

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

Before connecting the workstation to the instrument, set up the workstation according to its accompanying instructions. Locate the workstation within 5 meters (16 feet) of the instrument.

Requirement: Use shielded network cables with the instrument to reduce susceptibility to radio and electrical frequency interference.

To connect the workstation:

1. Connect the monitor to the workstation PC.
2. Connect one end of the shielded, crossover, network cable to the port labeled instrument LAN on the workstation rear panel.
3. Connect the free end of the shielded, crossover, network cable to the Ethernet port in the top, right-hand corner of the mass spectrometer's rear panel.

B.7.1 Connecting the workstation to the power source

To connect the workstation to the power source:

! **Notice:** Do not connect the workstation's power supply cord until you complete the installation procedures in the previous sections.

1. Select the appropriate power cord for your location.
2. Connect the female end of the power cord to the power port on the rear panel of the workstation.

B.8 Connecting Ethernet cables (systems with ACQUITY LC)

Requirement: Use shielded network cables with the mass spectrometer to ensure compliance with FCC limits.

To make Ethernet connections:

1. Connect one end of one shielded Ethernet cable to the ACQUITY instrument's network switch, and then connect the free end to the Ethernet card on the preconfigured ACQUITY workstation.

Tip: On preconfigured systems, the Ethernet card is identified as the Instrument LAN card.

2. Connect one end of the other shielded Ethernet cable to the Ethernet port in the top, right-hand corner of the mass spectrometer's rear panel, and then connect the free end to the ACQUITY instrument's network switch.

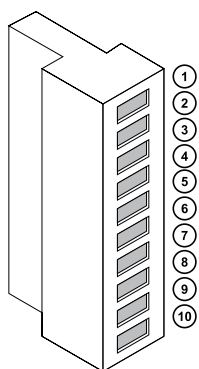
B.9 I/O signal connectors



Warning: To avoid electric shock, all electrical connections to the rear panel must be separated from hazardous voltages by double or reinforced insulation. Circuits of this type are classified as safety extra low voltage (SELV). Examples of circuits that are typically SELV include contact closure inputs and outputs for auto-samplers, and UV, RI, and fluorescence detector signal outputs for LC-MS systems. The electrical connections on the rear panel of this mass spectrometer are all SELV.

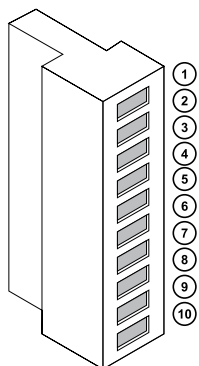
The instrument's rear panel includes two removable connectors that hold the screw terminals for I/O signals. These connectors are keyed so they can receive a signal cable inserted only one way.

Figure B–10: I/O signal connector I



- ① Analog (Out)
- ② Analog (Out)
- ③ Ground
- ④ Not used
- ⑤ Not used
- ⑥ Stop flow (Out)
- ⑦ Stop flow (Out)
- ⑧ Ground
- ⑨ Switch 2 (Out)
- ⑩ Switch 2 (Out)

Figure B–11: I/O signal connector II



- ① Inject start (In)
- ② Inject start (In)
- ③ Ground
- ④ Event (In)
- ⑤ Event (In)
- ⑥ Switch 3 (Out)
- ⑦ Switch 3 (Out)
- ⑧ Ground
- ⑨ Switch 4 (Out)
- ⑩ Switch 4 (Out)

B.9.1 Making I/O signal connections

Table B–1: Instrument analog-out/event-in connections

Signal connections	Description
Analog (Out)	Used for analog chart output functionality. The output voltage range is 0 to 1 V. The resolution of the voltage output is 12 bits.
Stop Flow (Out)	Used to stop the solvent flow if the nitrogen gas supply fails. Maximum 30 V, 0.5 A, 10 W.
Inject Start (In)	Signals the start of an injection. Maximum 30 V.

Table B–1: Instrument analog-out/event-in connections (continued)

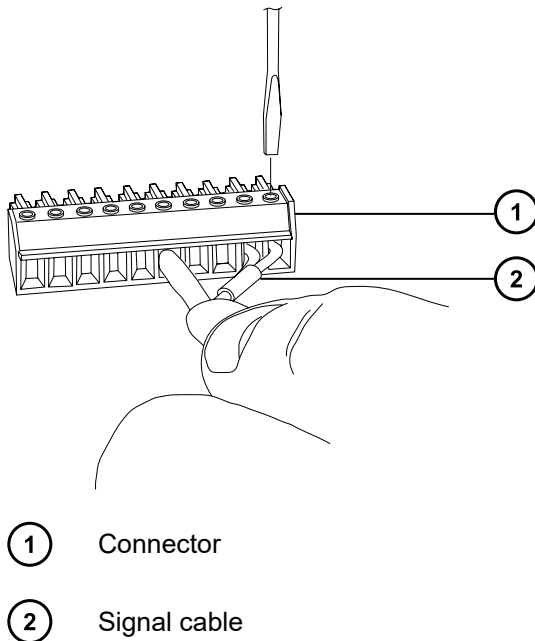
Signal connections	Description
Event (In)	Allows an external device to start data acquisition. Maximum 30 V.
Switch 2 (Out)	Used to send time-based contact closure signals to external devices. Maximum 30 V, 0.5 A, 10 W.
Switch 3 (Out)	Used to send time-based contact closure signals to external devices. Maximum 30 V, 0.5 A, 10 W.
Switch 4 (Out)	Used to send time-based contact closure signals to external devices. Maximum 30 V, 0.5 A, 10 W.

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

To make signal connections:

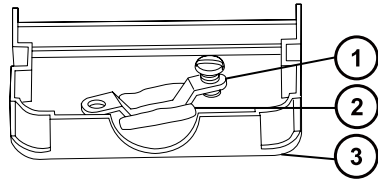
1. Reference the signal connection location from the silk-screened label for inject start or any other input/output connection you plan to use from Connector I or II on the rear panel of each instrument.
2. To make the signal connections, attach the positive and negative leads of the signal cable to the connector.

Figure B–12: Attaching the signal cable leads to the connector



- Slide the clamp (with the bend facing down) into the protective shield.
- Insert the clamp and shield (with the bend facing down) into the connection cover, and loosely tighten with 1 self-tapping screw.

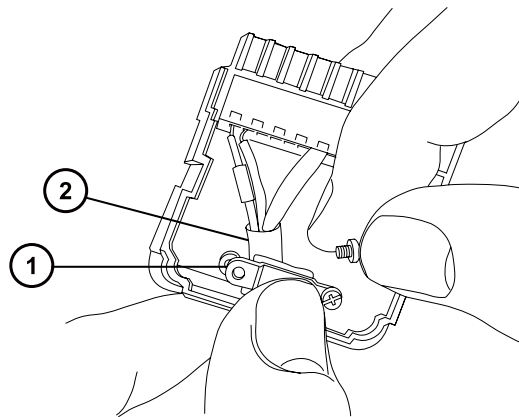
Figure B-13: Inserting the clamp and shield



- ① Clamp
- ② Shield
- ③ Connection cover

- Insert the connector with the signal cable into the connection cover, and position the clamp over the cable leads. Tighten the clamp into place with the second self-tapping screw.

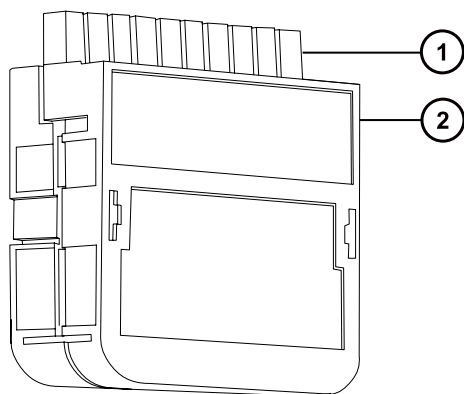
Figure B-14: Inserting the connector



- ① Clamp
- ② Cable leads

- Place the second connection cover over the first cover, and snap it into place.

Figure B–15: Joining the covers



① Signal connector

② Connector cover

B.10 Connecting to the power supply

The instrument requires a separate, grounded power source. The ground connection in the electrical outlet must be common and connected near the system.

To connect to the power source:

Recommendation: Use a line conditioner or an uninterruptible power supply (UPS) for optimum long-term input voltage stability.



Warning: To avoid electric shock, use the SVT-type power cord in the United States and HAR-type (or better) in Europe. The main power cord must be replaced with one of adequate rating. 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 instrument.
2. Connect the male end of the instrument power cord to the 200 to 240 V AC wall outlet.
3. Connect the power cord from the roughing pump relay box to the 200 to 240 V AC wall outlet.

Tip: The system software controls electrical power to the pump.

C Materials of construction and compatible solvents



Warning: To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, you must address any safety issues raised by the contents of this Appendix. Doing so confirms the integrity of the source exhaust system.

C.1 Preventing contamination

For information on preventing contamination, refer to *Controlling Contamination in LC/MS Systems* (715001307). You can find this document on www.waters.com by clicking **Support > Support Documents and Downloads**.

C.2 Items exposed to solvents

The items that appear in the following table can be exposed to solvent. You must evaluate the safety issues if the solvents used in your application differ from the solvents typically used with these items. See [Solvents used to prepare mobile phases \(Page 172\)](#) for details about the most common ingredients used to prepare mobile phases.

Table C–1: Items exposed to solvent:

Item	Material
Autotune reservoirs	High-density polyethylene
Corona discharge pin mounting contact	PEEK
Gas exhaust port	Aluminum
Gas tubes	Fluorinated ethylene propylene
Ion block	Stainless steel
Ion block support	PEEK
Isolation valve	Gold-plated aluminum/bronze
O-rings	Viton or PTFE-encapsulated Viton
Probe adjuster bellows	PTFE/Viton

Table C–1: Items exposed to solvent: (continued)

Item	Material
Probe adjuster assembly	Anodized aluminum, glass-filled acetal, and stainless steel
Push-in gas fittings	Nickel/brass
Solvent waste/leak management	Tygon tubing
Source enclosure	Aluminum alloy
Source enclosure view port	Toughened plate glass
Drip trays	Aluminum
Trap bottle	Polypropylene
Trap bottle push-in fittings	Nitrile butadiene rubber, stainless steel, polybutylene terephthalate, and polyoxymethylene

C.3 Solvents used to prepare mobile phases

These solvents are the most common ingredients used to prepare mobile phases for reverse-phase LC-MS (API):

- Water
- Methanol
- Acetonitrile
- Formic acid ($\leq 0.1\%$)
- Acetic acid ($\leq 0.1\%$)
- Ammonium acetate (< 50 mM)
- Ammonium formate (< 50 mM)
- Trifluoroacetic acid (TFA) ($< 0.2\%$)

These solvents are not expected to cause any problems with the materials identified in [Items exposed to solvents \(Page 171\)](#).

Strong solvents used to prepare mobile phases for normal-phase LC-MS, for example, hexane or tetrahydrofuran (THF), will adversely affect the performance of the materials shown in the table [Items exposed to solvents \(Page 171\)](#) and must not be used. You must evaluate the safety issues if these solvents are used as additives to the mobile phases at reduced concentration or as sample diluents.

D Plumbing the fluidics system

This section provides reference information for replacing the tubing in the fluidics system.



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



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

D.1 Preventing contamination

For information on preventing contamination, refer to *Controlling Contamination in LC/MS Systems* (715001307). You can find this document on www.waters.com by clicking **Support > Support Documents and Downloads**.

D.2 The selector valve

The selector valve is located behind the visor on the right-hand side of the instrument. The letters etched on the front of the valve represent the components to which the associated port is connected. Etched letters with a light background indicate inputs, while letters with a dark, etched background indicate outputs. The following table outlines the component to which each port connects, and whether the port is a fluid input or output.

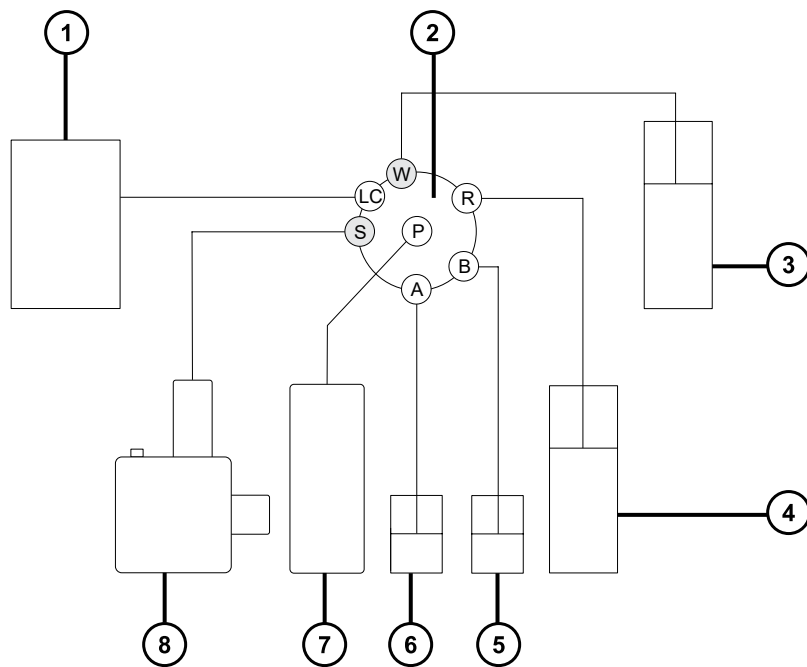
Table D-1: Selector valve connections

Port	Component	Input/Output
P	Infusion pump	Both
A	Sample reservoir A	Input
B	Sample reservoir B	Input
R	Rinse/wash bottle	Input
W	Waste bottle	Output
LC	LC column	Input
S	Xevo TQ-S cronos ion source	Output

D.3 Plumbing schematic

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

Figure D-1: Plumbing schematic



- ① LC column
- ② Selector valve
- ③ Waste
- ④ Wash
- ⑤ Reservoir B
- ⑥ Reservoir A
- ⑦ Pump
- ⑧ Xevo TQ-S cronos probe

D.4 Tubing and connection specifications

! **Notice:** To avoid leaks when plumbing the instrument fluidics system, use only the tubes, nuts, and ferrules shown in the following tables, to ensure over-pressure protection. The use of parts other than those recommended here can result in leaks, which the built-in leak sensor does not always detect.

When replacing tubing and connectors, refer to the tables below for the correct specifications.

Table D–2: Replacement tubing specifications

Port	ID (in)	Color (PEEK tubing)	Length (m)
R, A, and B	0.020	Orange	0.65
W	0.005	Red	0.2
S	0.004	Black	0.4
LC	0.004	Black	As required

Table D–3: Replacement nut and ferrule specifications

Port	Nut code	Ferrule code
P	P245	P200
LC	F196	F192
S, W, R, A, and B	F130	–

Important: The tubing for the sample reservoirs (ports A and B) is not user-serviceable. To replace the tubing, contact Waters to arrange an engineer visit.