

Waters TQ Detector

Operator's Guide

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General Information

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Safety considerations

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

Safety hazard symbol notice

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

Considerations specific to the TQ Detector

Power cord replacement hazard



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

Solvent leakage hazard

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



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

- Renew 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 (see “[Items exposed to solvent](#)” on [page 171](#)), by determining whether any solvents you use are chemically compatible with the composition of the O-rings.

Flammable solvents hazard



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

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



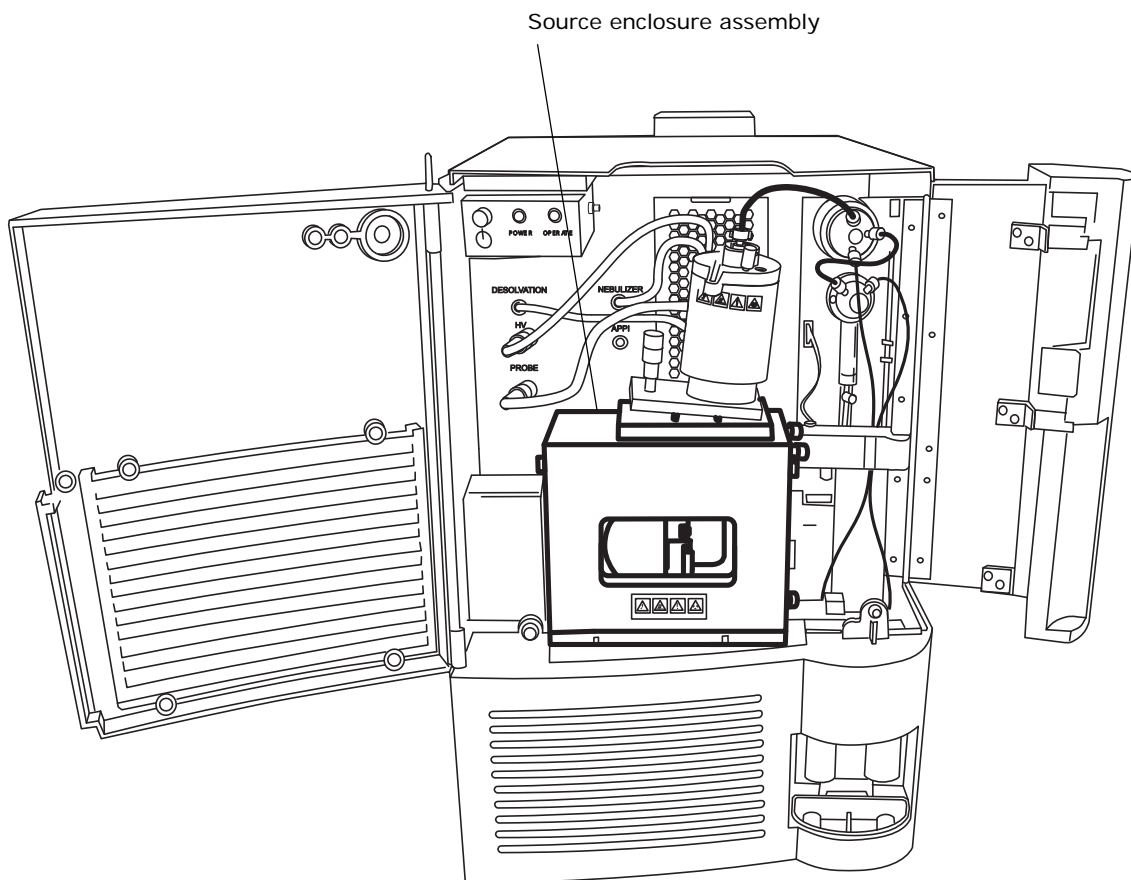
Warning: To avoid unmanaged solvent spillage, do not place tools or other objects in the drain channel on the probe top. Keep the channel free from blockages.

High temperature hazard



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

TQ Detector high temperature hazard



High voltage hazard



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.
- To avoid non-lethal electric shock, any equipment connected to the ESI and IonSABRE™ APCI probes must be grounded.
- To avoid harmless, static-like electric shock when the instrument is in Operate mode, avoid touching the areas marked with the high voltage warning symbol. To touch those areas, first put the instrument in Standby mode.

Hazards associated with removing an instrument from service



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



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

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

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

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

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

Bottle placement prohibition



Warning: To avoid injury from electrical shock or fire, and damage to the equipment, do not place vessels containing liquid atop the workstation or ancillary equipment or otherwise expose those units to dripping or splashing liquids.



Prohibited: Do not place vessels containing liquid—such as solvent bottles—atop the workstation or ancillary equipment or otherwise expose those units to dripping or splashing liquids.

FCC radiation emissions notice

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

Electrical power safety notice

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

Equipment misuse notice

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






Safety advisories







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

Operating this instrument

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

Applicable symbols

Symbol	Definition
	Manufacturer
	Date of manufacture
	Authorized representative of the European Community
	Confirms that a manufactured product complies with all applicable European Community directives
	Australia EMC compliant

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

Audience and purpose

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

Intended use of the TQ Detector

Waters designed the TQ (for tandem quadrupole) Detector for use as a research tool to deliver authenticated mass measurement in both MS and MS/MS modes. This Tandem Quad (TQ) Detector is for research use only and is not intended for use in diagnostic applications.

Calibrating

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

To calibrate the TQ Detector, consult the instrument's online Help system.

Quality control

Routinely run three QC samples that represent subnormal, normal, and above-normal levels of a compound. If sample trays are the same or very similar, vary the location

of the QC samples in the trays. Ensure that QC sample results fall within an acceptable range, and evaluate precision from day to day and run to run. Data collected when QC samples are out of range might not be valid. Do not report these data until you are certain that the instrument performs satisfactorily.

EMC considerations

Canada spectrum management emissions notice

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

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

ISM Classification: ISM Group 1 Class A

This classification has been assigned in accordance with IEC CISPR 11 Industrial Scientific and Medical (ISM) instrument requirements.

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

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

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

EC authorized representative



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1 Waters TQ Detector

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

1.1 Overview

1.1.1 Waters TQ Detector

The Waters[®] TQ Detector is a tandem quadrupole, atmospheric-pressure, ionization (API) mass spectrometer. Designed for routine UPLC[®]/MS/MS analyses in quantitative and qualitative applications, it can operate at fast acquisition speeds compatible with ultra-performance liquid-chromatography (UPLC).

Waters provides these ion sources with the instrument as standard equipment:

- ZSpray[™] (dual orthogonal sampling) interface.
- Multi-mode ESCi[®] ionization switching for atmospheric pressure chemical ionization (APCI) and electrospray ionization (ESI).

Optional ionization modes are IonSABRE[™] APCI and APPI (atmospheric pressure photoionization).

For instrument specifications, see the *Waters TQ Detector Site Preparation Guide*.

Figure 1–1: Waters TQ Detector

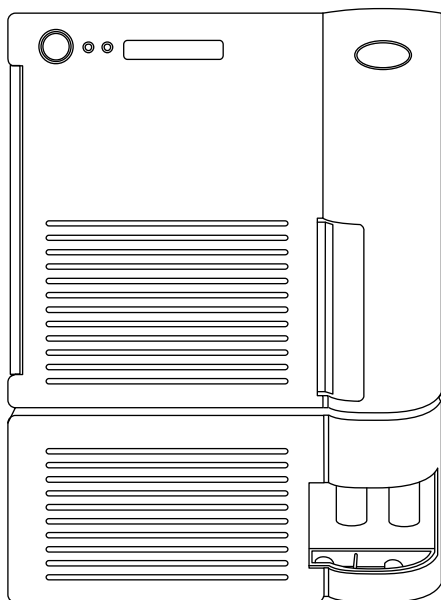
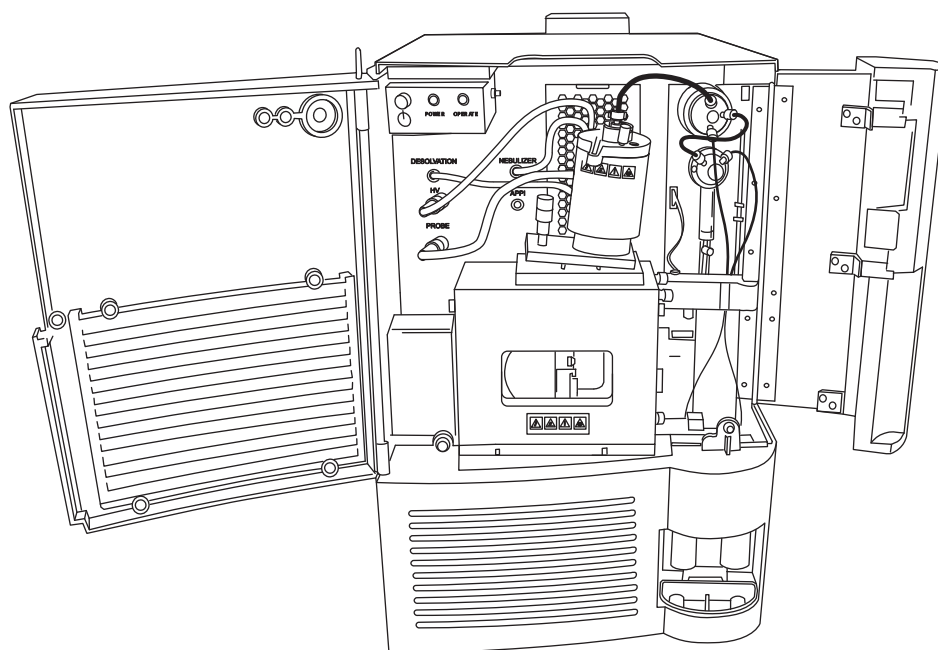


Figure 1–2: Waters TQ Detector, with doors open



1.1.1.1 IntelliStart technology

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

The software automatically tunes and mass calibrates the instrument and displays performance readbacks. Integrated with Empower™ chromatography software, MassLynx® mass spectrometry software, and ACQUITY UPLC® Console software, it

enables simplified setup of the system for use in routine analytical and open access applications. (See “[Software and data system](#)”).

The IntelliStart Fluidics system is built into the instrument. 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 so that you can optimize instrument performance at analytical flow rates. See the instrument’s online Help for further details of IntelliStart.

1.1.2 ACQUITY TQD UPLC/MS system

The ACQUITY® TQD UPLC/MS system includes an ACQUITY UPLC system and the Waters TQ Detector.

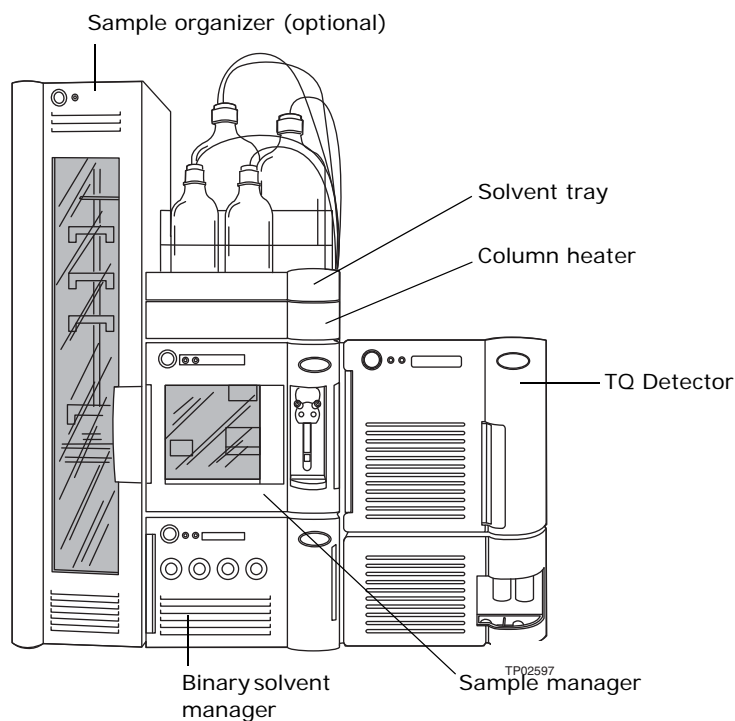
If you are not using your instrument as part of an ACQUITY UPLC system, refer to the documentation for your LC system.

1.1.2.1 ACQUITY UPLC system

The ACQUITY UPLC system includes a binary solvent manager, sample manager, column heater, optional sample organizer, optional detectors, and an ACQUITY UPLC column. Waters Empower™ chromatography software or MassLynx mass spectrometry software controls the system.

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

Figure 1–3: Waters ACQUITY TQD



1.1.3 Software and data system

The instrument is controlled by either Empower chromatography software or MassLynx mass spectrometry software. Each is a high-performance application that acquires, analyzes, manages, and distributes ultraviolet (UV), evaporative light scattering, analog, and mass spectrometry data.

Both Empower and MassLynx software enable these major operations:

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

See Empower and MassLynx 4.1 user documentation and online Help for more information on installing and using Empower or MassLynx software.

1.1.4 ACQUITY UPLC Console

The ACQUITY UPLC Console is a software application with which you configure settings, monitor performance, run diagnostic tests, and maintain the system and its modules. The ACQUITY UPLC Console functions independently of Empower and MassLynx software and does not recognize or control the data systems.

See the ACQUITY UPLC System console online Help for details.

1.2 Ionization techniques and source probes

1.2.1 Electrospray ionization (ESI)

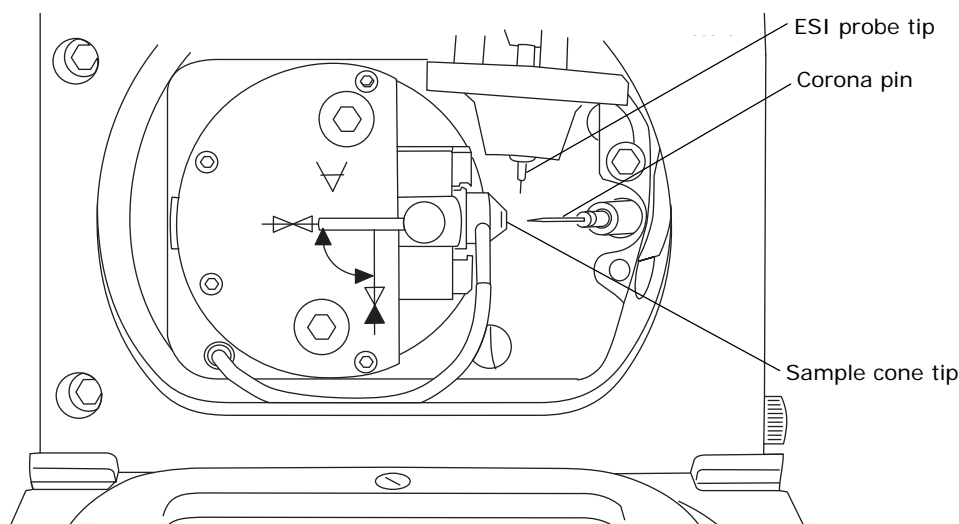
In electrospray ionization (ESI), a strong electrical charge is given the eluent as it emerges from a nebulizer. The droplets that compose the resultant aerosol undergo a reduction in size (solvent evaporation). As solvent continues to evaporate, the charge density increases until the droplet surfaces eject ions (ion evaporation). The ions can be singly or multiply charged. The multiply charged ions are of particular interest because the instrument separates them according to their mass-to-charge ratios (m/z), permitting the detection of high-molecular-weight compounds.

The instrument can accommodate eluent flow rates of up to 1 mL/min.

1.2.2 Combined ESI and APCI (ESCI)

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

Figure 1–4: ESCI mode



1.2.3 Atmospheric pressure chemical ionization

A dedicated, high-performance, atmospheric-pressure, chemical ionization (APCI) probe is offered as an option. See [Chapter 4, "Optional APCI Mode of Operation"](#), for full details.

1.2.4 Atmospheric pressure photoionization

Atmospheric pressure photoionization (APPI) is offered as an option. It uses photons generated by a krypton-discharge ultraviolet (UV) lamp (~10.2 eV) to produce sample ions from vaporized LC eluent.

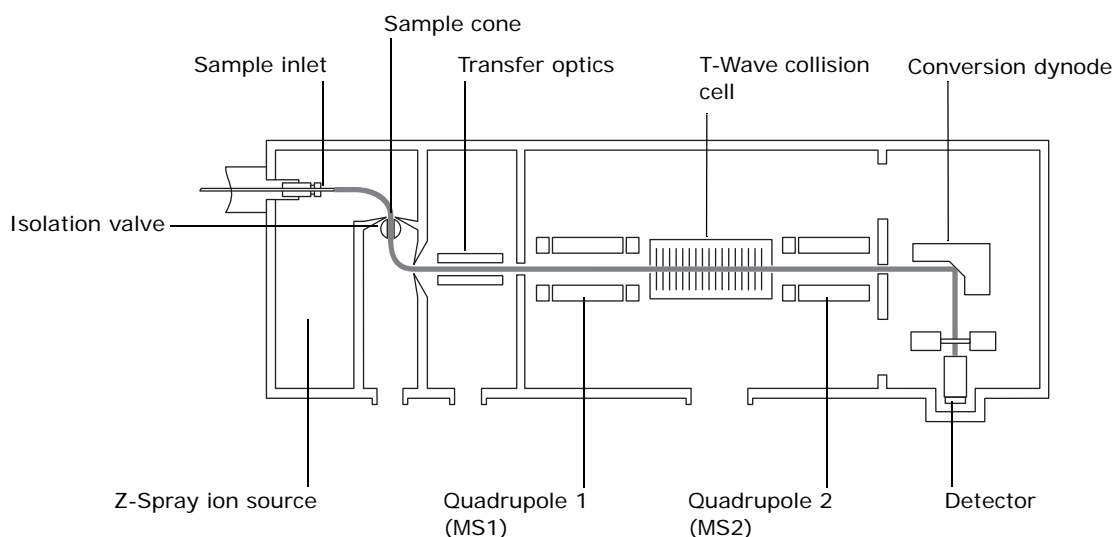
1.3 Ion optics

The instrument's ion optics operate as follows:

1. Samples from the LC or Intellistart 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, to the first 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. Any fragment ions are then mass-analyzed by the second quadrupole.
5. The transmitted ions are detected by the photomultiplier detection system.
6. The signal is amplified, digitized, and sent to the Empower chromatography or MassLynx mass spectrometry software.

Figure 1–5: Ion optics overview



1.4 MS operating modes

The following table shows the MS operating modes.

Table 1–1: MS operating modes

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

The MS1 mode, in which MS1 is used as the mass filter, is the most common and most sensitive method of performing MS analysis. It is directly analogous to using a single-quadrupole mass spectrometer.

The MS2 mode of operation is used to provide optimum performance when scan speeds exceed 2000 Da/s. It also provides a useful tool for instrument tuning and calibration before MS/MS analysis and for fault diagnosis. See the instrument online Help for further information on optimizing the TQ Detector for fast MS scanning.

The selected ion recording (SIR) mode of operation is used as a quantitation mode when no suitable fragment ion can be found to perform a more specific multiple reaction monitoring (MRM) analysis.

Rule: Only chromatograms—not spectra—are generated when acquiring in SIR mode.

1.5 MS/MS operating modes

The following table shows the MS/MS operating modes.

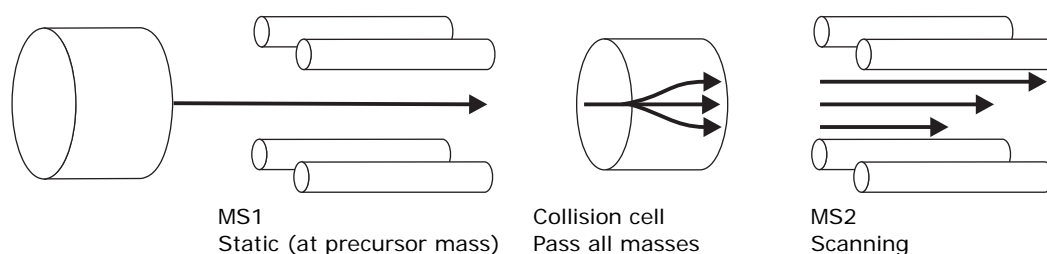
Table 1–2: MS/MS operating modes

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

1.5.1 Product (daughter) ion mode

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

Figure 1–6: Product ion mode



1.5.1.1 Typical applications

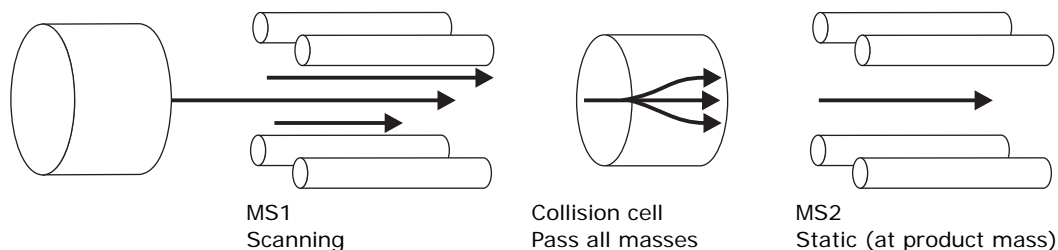
Product ion mode is typically used for the following applications:

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

- Structural elucidation (for example, peptide sequencing)

1.5.2 Precursor (parent) ion mode

Figure 1–7: Precursor ion mode



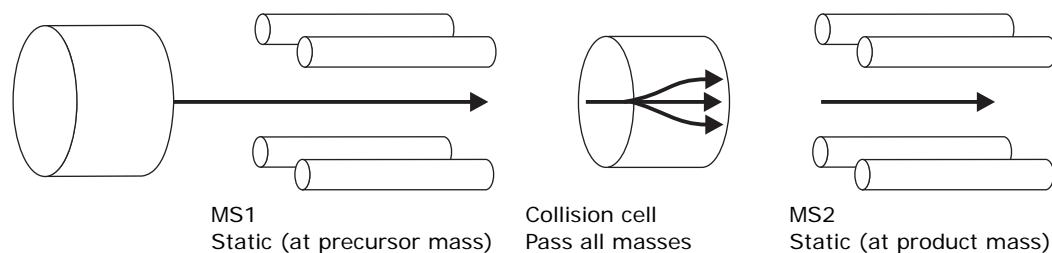
1.5.2.1 Typical application

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

1.5.3 Multiple reaction monitoring mode

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

Figure 1–8: Multiple reaction monitoring mode



1.5.3.1 Typical application

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

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

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

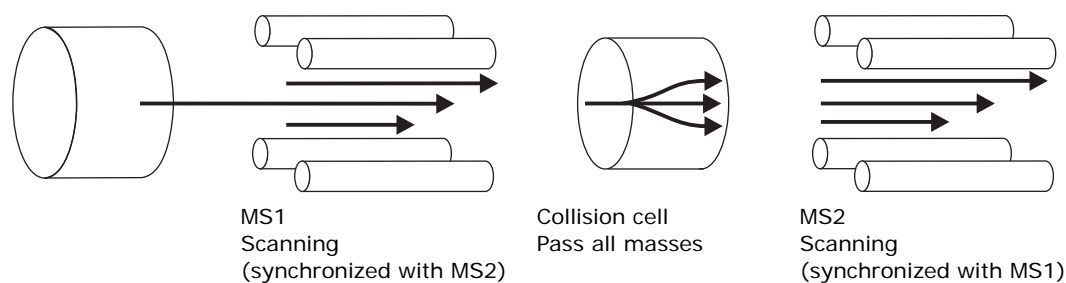
1.5.4 Constant neutral loss mode

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

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

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

Figure 1–9: Constant neutral loss mode



1.5.4.1 Typical application

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

1.6 Sample inlet

Either of two methods delivers solvent and sample to the installed probe:

- An LC system, which delivers the eluent from an LC analysis.
- IntelliStart Fluidics system, which uses onboard solutions to automate instrument optimization. You can deliver solutions by direct or combined infusion.

1.7 Leak sensors

Where fitted, leak sensors in the drip trays of the ACQUITY UPLC system and the TQ Detector continuously monitor system components for leaks. A leak sensor stops system flow when its optical sensor detects about 1.5 mL of accumulated, leaked

liquid in its surrounding reservoir. At the same time, the ACQUITY UPLC Console displays an error message alerting you that a leak has developed.

Tip: If you are using MassLynx software, refer to the software release notes provided at installation to confirm whether the leak sensors are enabled.

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

1.8 Vacuum system

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

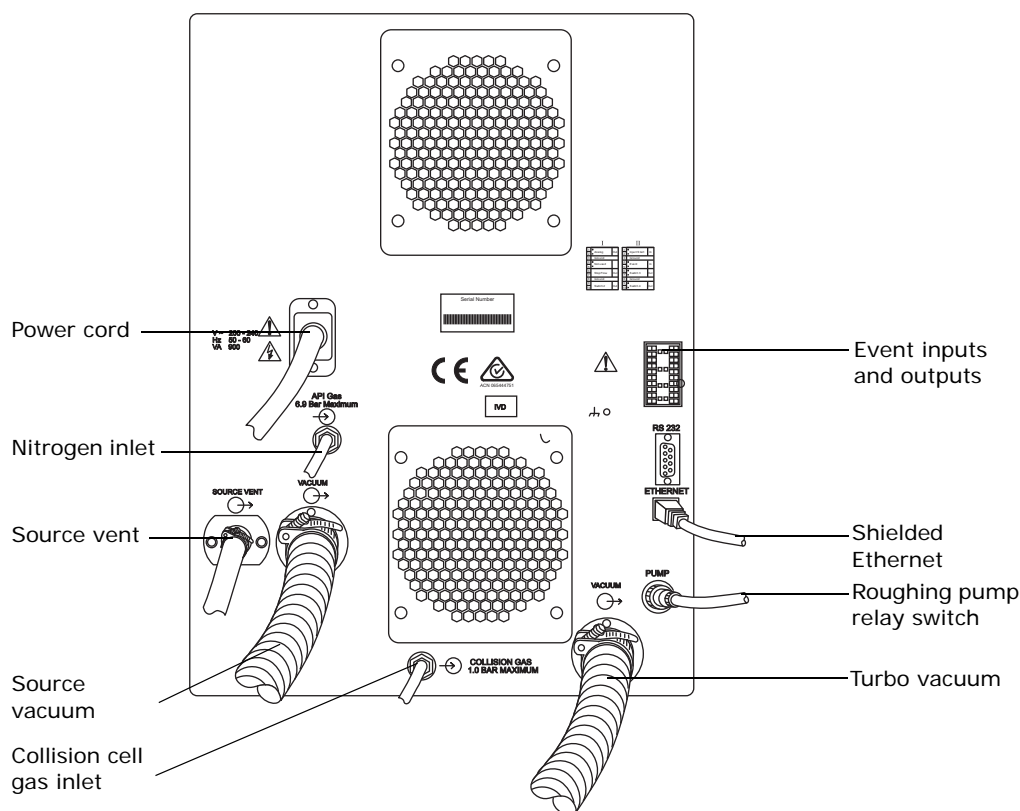
Vacuum leaks and electrical or vacuum pump failures cause vacuum loss, which protective interlocks guard against. The system monitors turbomolecular pump speed and continuously measures vacuum pressure with a built-in Pirani gauge. The gauge also serves as a switch, stopping operation when it senses vacuum loss.

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

1.9 Rear panel

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

Figure 1–10: Instrument rear panel



1.10 IntelliStart Fluidics system

1.10.1 Overview

The IntelliStart Fluidics system is built into the instrument. The system delivers sample directly to the MS probe in one of two ways:

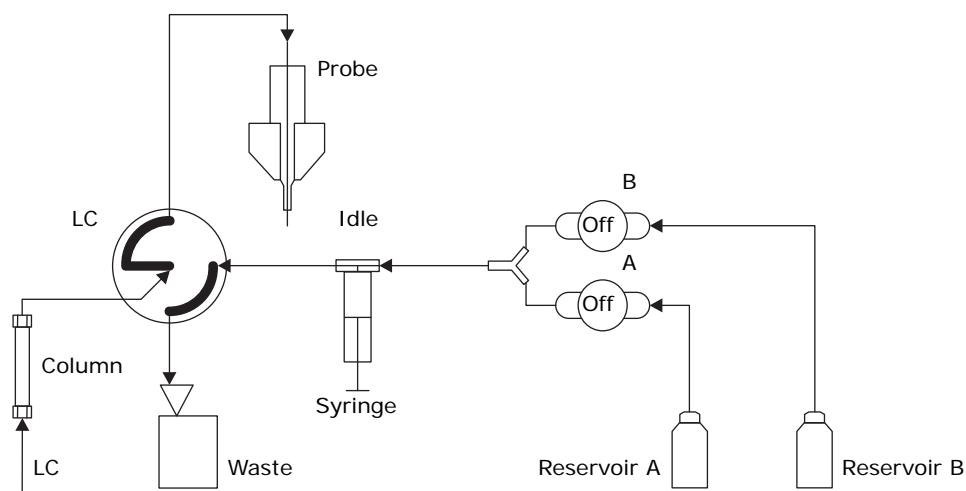
- From the LC column.
- From two integral reservoirs.

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

The system incorporates a multi-position valve with these attributes:

- An input connection from an external LC column.
- An input connection from the instrument's infusion syringe. (The infusion syringe is also connected to two reservoirs, A and B. In the software, you specify which reservoir to draw from.)
- An output connection to the probe.
- An output connection to a waste line.

Figure 1–11: IntelliStart Fluidics system



1.10.2 System operation

Control of solvent and sample delivery during auto-tuning, auto-calibration, and method development is automatically performed by the software.

IntelliStart Fluidics configuration requirements can be set in the system console. You can edit the parameters, frequency, and extent of the automation you want IntelliStart to perform. See the instrument's online Help for further details on IntelliStart software and operation of the instrument's solvent delivery system.

2 Preparing for Operation

This chapter describes how to start and shut-down the instrument.

2.1 Starting the instrument

The Waters TQ Detector is designed for compatibility with the ACQUITY UPLC system. If you are not using an ACQUITY UPLC system, refer to the documentation relevant to the system being used.

- ! **Notice:** To avoid causing severe damage to the instrument, use only compatible solvents. For more details, refer to the following sources:
- [Appendix C](#), for solvent information.
 - Appendix C of the *ACQUITY UPLC System Operator's Guide* for on solvent compatibility with ACQUITY.

Starting the instrument entails powering-on the ACQUITY workstation, logging into the workstation, powering-on the TQ Detector and all the other ACQUITY instruments and devices, and starting the Empower or MassLynx software.

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

To start the instrument:



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

1. Ensure the nitrogen supply is connected to the instrument's API gas connection.
Requirement: The nitrogen must be dry and oil-free, with a purity of at least 95%. Regulate the supply at 600 to 690 kPa (6.0 to 6.9 bar, 90 to 100 psi).
For more information on connections, see the figure on [page 27](#).
2. Ensure that the collision gas supply is connected to the instrument.
Requirement: The collision gas is argon; it must be dry and of high purity (99.9%). Regulate the supply at 50 kPa (0.5 bar, 7 psi).
3. Power-on the ACQUITY UPLC system workstation, and log in before powering-on the other instruments.
4. Press the power switch on the top, left-hand side of the instrument and ACQUITY instruments.
Result: Each system instrument "beeps" and runs a series of startup tests.
5. Allow 3 minutes for the embedded PC to initialize.

Tip: An audible alert sounds when the PC is ready.

The power and status LEDs change as follows:

- Each system instrument's power LED shows green.
- During initialization, the binary solvent manager's and sample manager's status LED flashes green.
- After the instruments are successfully powered-on, all power LEDs show steady green. The binary solvent manager's flow LED, the sample manager's run LED, and the TQ Detector's Operate LED remain off.

6. Start Empower or MassLynx software.



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


7. Launch IntelliStart using one of the following methods.

- MassLynx – In the MassLynx main window's lower left-hand corner, click IntelliStart.
- Empower – In the Run Samples window, right-click the TQ Detector's control panel, and then click Launch Intellistart.

Result: The TQ Detector's console appears. The instrument is in Standby mode.

8. Click Control > Pump to start the roughing pump. The Operate LED remains off.

9. Click Resolve  or Operate  to put the instrument into Operate mode. When the instrument is in good operating condition, IntelliStart displays "Ready".

Tip: Clicking Resolve  prepares the system for operation, putting the instrument into Operate mode. If clicking Resolve fails to put the instrument into Operate mode, IntelliStart displays corrective actions.

2.1.1 Configuring IntelliStart

To configure IntelliStart:

1. In the ACQUITY UPLC Console system tree, expand TQ Detector.
2. Click IntelliStart.
3. Click Configure > IntelliStart Configuration.
4. In the IntelliStart Configuration dialog box, in the Checks list, select the check boxes for the items you want checked during TQ Detector startup. Clear the check boxes of items you do not want checked.

Tip: To display detailed information for an item, highlight it and then click Properties.

5. Click OK.

2.1.2 Verifying the instrument's state of readiness

When the instrument is in good operating condition, the power and Operate LEDs show constant green. You can view any error messages in IntelliStart.

To access IntelliStart:

1. In the ACQUITY UPLC Console system tree, expand TQ Detector.
2. Click IntelliStart.

2.1.3 Tuning and calibration information

The instrument must be tuned and calibrated prior to use, tasks normally performed from IntelliStart.

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

2.1.4 Running the instrument at high flow rates

ACQUITY UPLC is run at high flow rates. To optimize desolvation, and thus sensitivity, you must run the ACQUITY TQD system at appropriate gas flows and desolvation temperatures. IntelliStart automatically sets these parameters when you enter a flow rate, according to the following table.

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

Flow rate (mL/min)	Source temp (°C)	Desolvation temp (°C)	Desolvation gas flow (L/h)
0.000 to 0.100	150	250	500
0.101 to 0.300	150	350	600
0.301 to 0.500	150	400	800
>0.500	150	450	900

Note: Under low ambient temperature, high moisture, and high flow rate conditions, condensation can occur in the instrument's source.

2.1.5 Monitoring the instrument LEDs

Light-emitting diodes on the instrument indicate its operational status.

2.1.5.1 Power LED

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

2.1.5.2 Operate LED

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

See the instrument's online Help topic "Monitoring the detector LEDs" for details of the Operate LED indications.

2.2 Preparing the IntelliStart Fluidics system

For additional information, see [page 164](#).

2.2.1 Installing the solvent manifold drip tray



Warning: To avoid personal contamination with biologically hazardous or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when working with the solvent manifold drip tray.

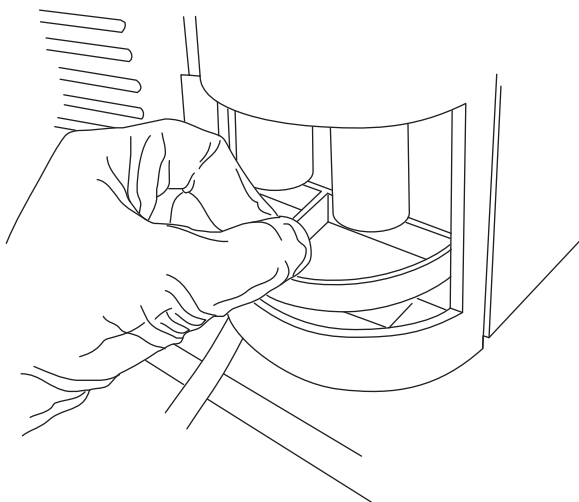


Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required material: Chemical-resistant, powder-free gloves

To install the solvent manifold drip tray:

Install the solvent manifold drip tray as shown below:



2.2.2 Installing the reservoir bottles

Use standard reservoir bottles (15-mL) for instrument setup and calibration. The Low-volume Adaptor Kit is included for infusing smaller volumes. The capacity of the low-volume vials is 1.5 mL.

Use standard reservoir bottles (15-mL) for instrument setup and calibration.



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

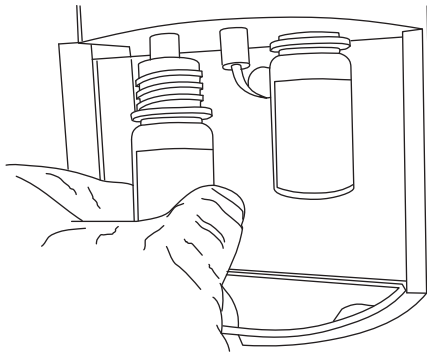


Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required material: Chemical-resistant, powder-free gloves

To install the reservoir bottles:

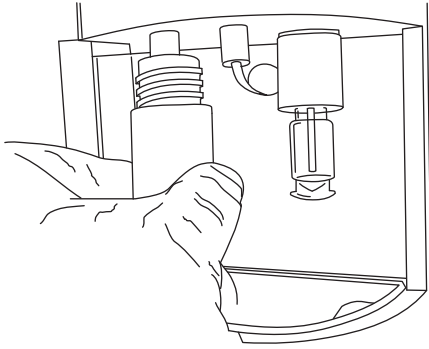
1. Remove the reservoir bottle caps.
2. Screw the reservoir bottles onto the instrument, as shown below.



To install low-volume vials:

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

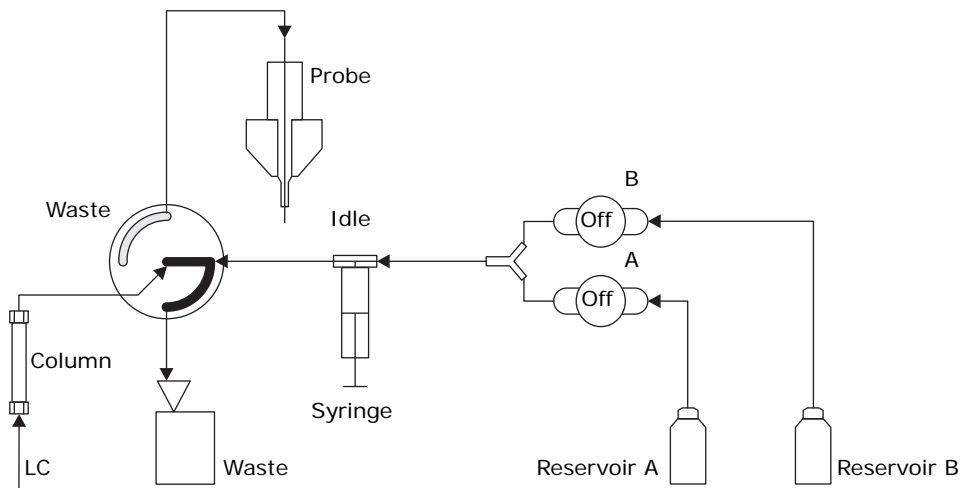
3. Screw the low-volume vial into the adaptor.



2.2.3 Diverter valve positions

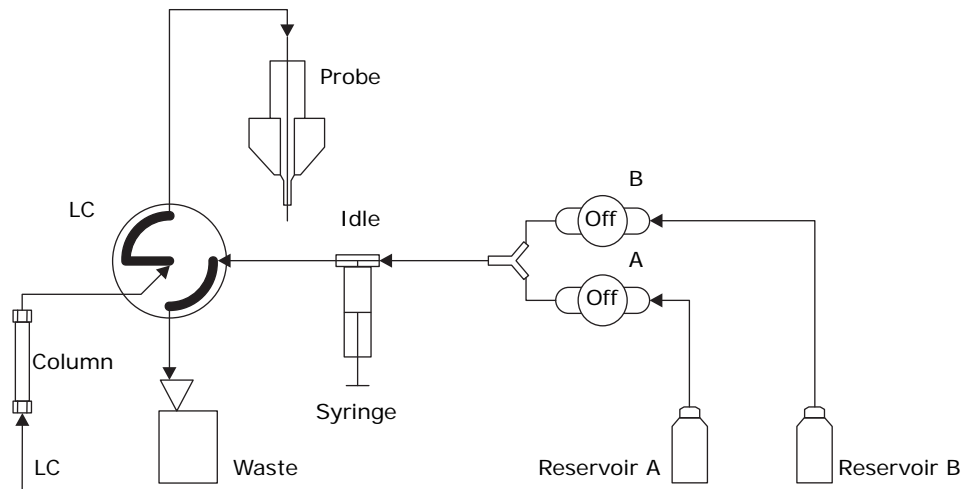
2.2.3.1 Column and syringe in home position after power-up

After power-up, the flow path between the column and waste is open. The syringe is empty, and the flow path between it and waste is open.

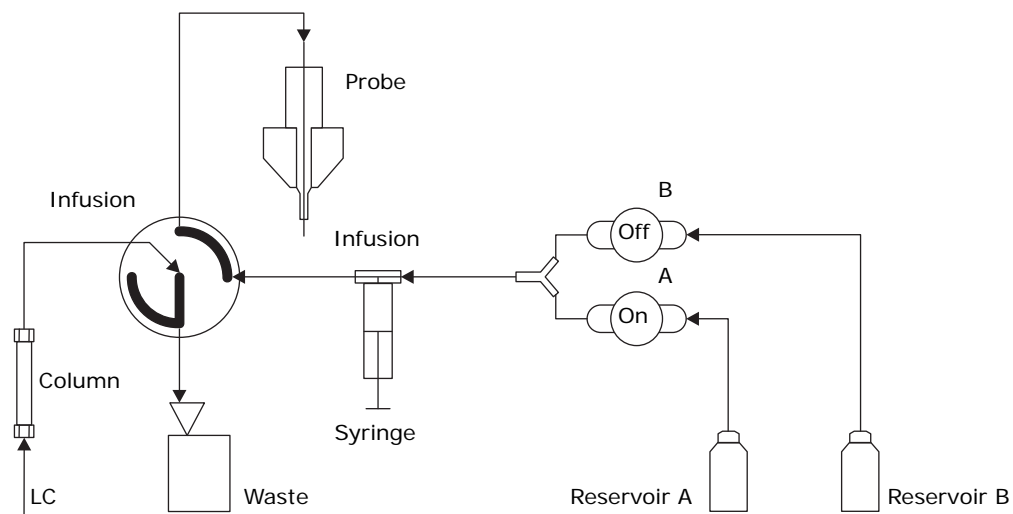


2.2.3.2 LC position

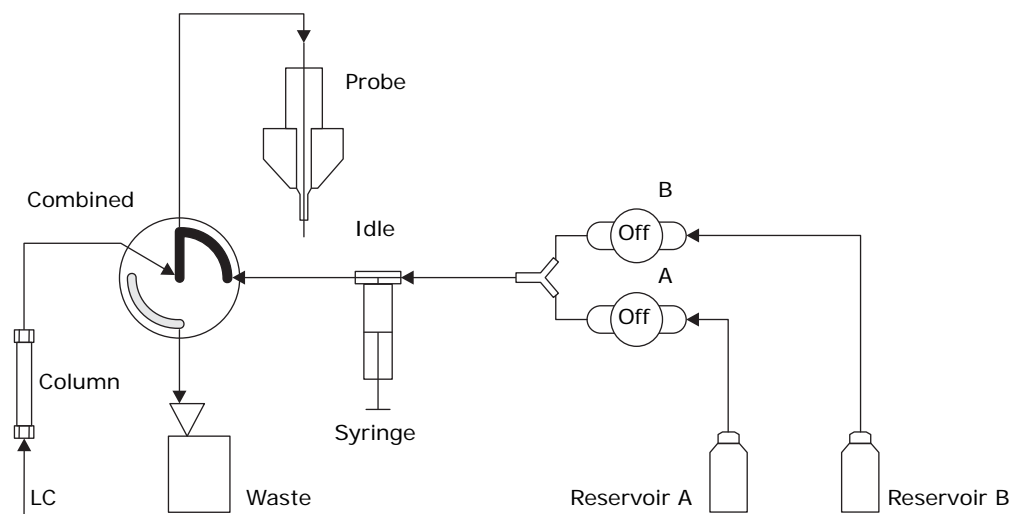
In the LC position, the flow path between the LC and probe is open, and the flow path between the syringe and waste is also open.



2.2.3.3 Infusion position

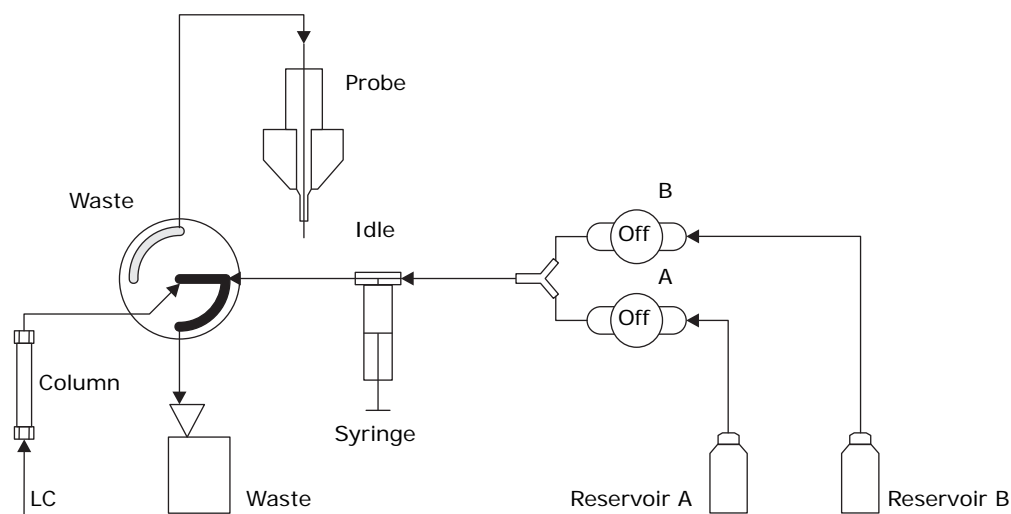


2.2.3.4 Combined position with LC flow and syringe in idle mode



2.2.3.5 Waste position

In the waste position, both the LC flow and the infusion syringe flow are directed to waste. The syringe mode can be only static or dispensing (that is, never drawing).



2.2.4 Purging the infusion syringe

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

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

2.3 Rebooting the instrument

Reboot the instrument when any of these conditions applies:

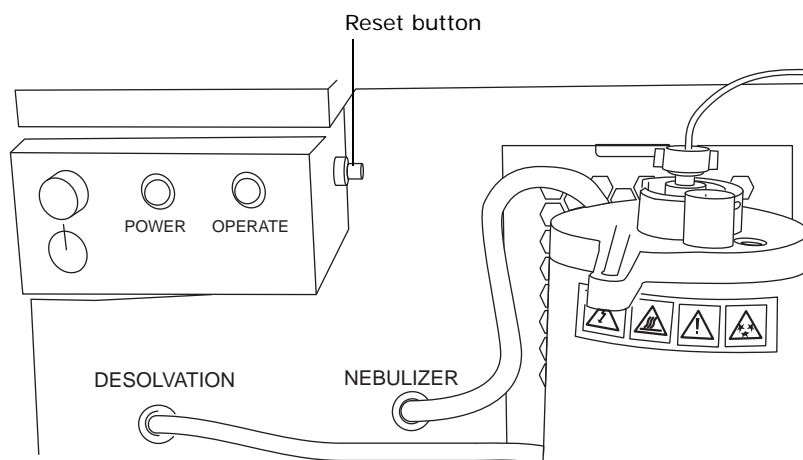
- The Tune window fails to respond.
- Empower or MassLynx software fails to initialize.
- Immediately following a software upgrade.

2.3.1 Rebooting the instrument by pressing the reset button

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

To reboot the instrument by pressing the reset button:

1. Open the instrument's front, left-hand door.
2. Press the red, reset button at the top, left-hand side of the instrument.



2.4 Leaving the mass spectrometer ready for operation

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

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

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

2.4.1 Emergency instrument shutdown

To shut down the instrument in an emergency:



Warning: To avoid electrical shock and to isolate the instrument from the main power supply, you must disconnect the power cable from the back of the instrument. The TQ Detector's power switch does not isolate the instrument.



Notice: Data can be lost during an emergency shutdown.

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

3 ESI and ESCi Modes of Operation

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

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

If your system uses APCI mode, see [Chapter 4, “Optional APCI Mode of Operation”](#).

3.1 Introduction

The ESI and ESCi ionization mode options use the standard ESI probe that is fitted to the instrument when it is shipped from the factory. For ESCi operation, the corona pin is used in conjunction with the ESI probe. The following sections explain how to install and remove the ESI probe and corona pin.

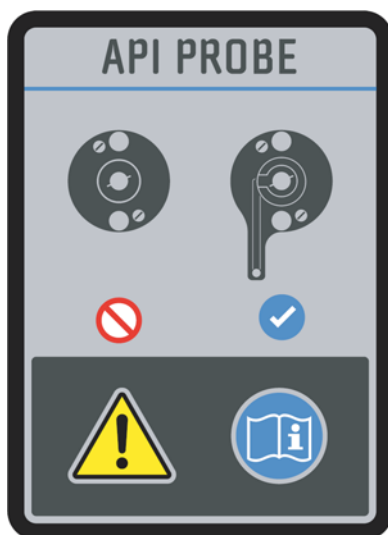
For further instructions, see [“Electrospray ionization \(ESI\)”](#) and [“Combined ESI and APCI \(ESCi\)”](#).

3.2 Installing the ESI probe



Warning: To avoid unmanaged solvent spillage and an associated risk of ignition, on instruments bearing the probe compatibility warning label (below), always use an ESI probe whose design incorporates a drain spout. In the event of a leak at the capillary union, using an older ESI probe model, whose design does not incorporate a drain spout, can lead to unmanaged solvent spillage and an associated risk of ignition.

Figure 3–1: Probe compatibility warning label



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing this procedure. The ACQUITY UPLC system connections, ESI probe, and source can be contaminated.



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required material: Chemical-resistant, powder-free gloves

To install the ESI probe:

1. Prepare the instrument for working on the source (see [page 58](#)).



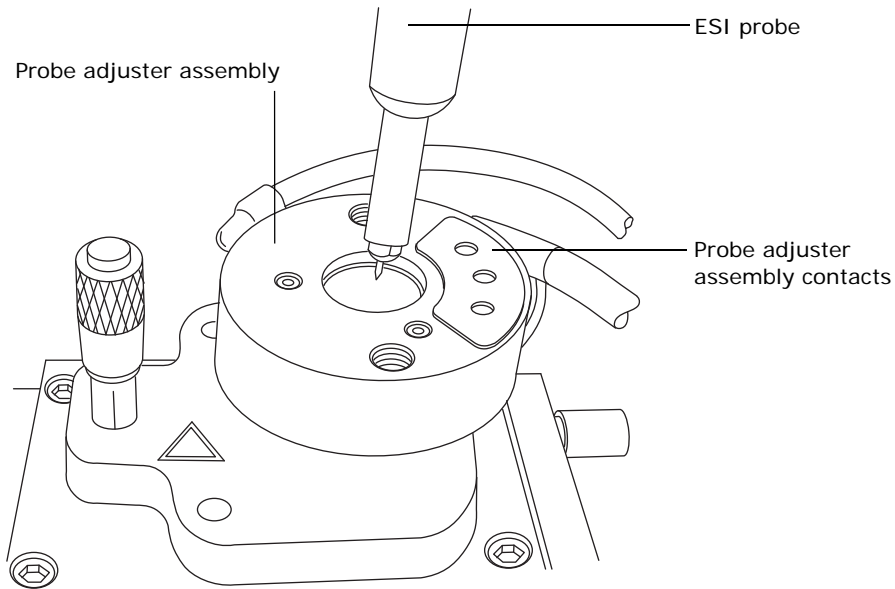
Warning: To avoid burn injuries, take great care while working with the instrument's access door open; the source can be hot.

2. Open the instrument's access door.



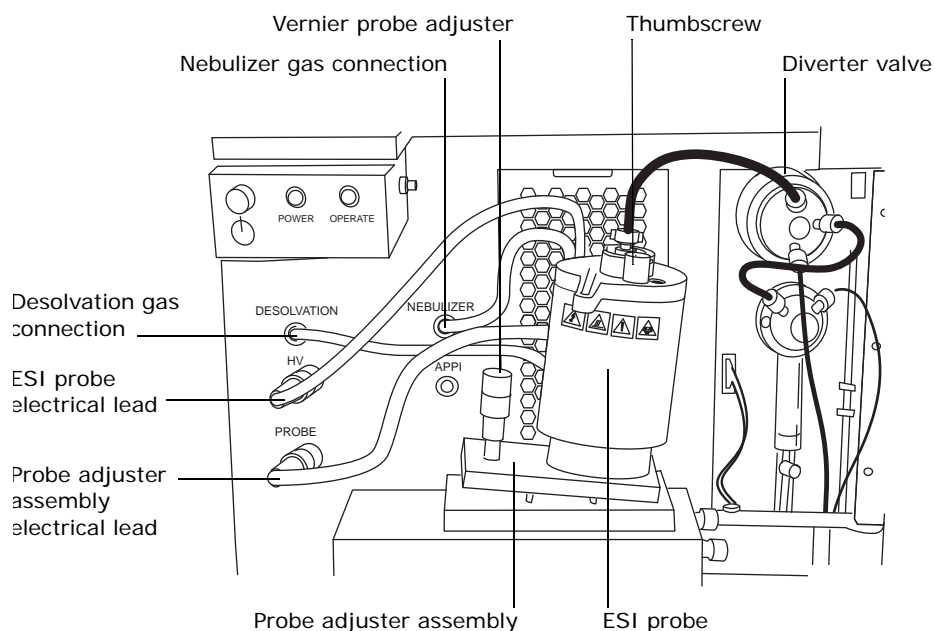
Warning: To avoid puncture wounds, handle the ESI probe with care; the ESI probe tip is sharp.

3. Remove the protective sleeve, if fitted, from the ESI probe tip.
4. Ensure that the contacts on the ESI probe align with the probe adjuster assembly contacts, and carefully slide the ESI probe into the hole in the probe adjuster assembly.



5. Secure the ESI probe by tightening the 2 thumbscrews.

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



6. Connect the ESI probe's PTFE tube to the nebulizer gas connection.
7. Ensure that the probe adjuster assembly's electrical lead is connected to the instrument's probe connection.
8. Connect the ESI probe's electrical lead to the instrument's HV connection.



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

9. Using tubing greater than or equal to 0.004-inch (ID), connect the diverter valve to the ESI probe.

Tip: Two tubes of different ID are supplied with the instrument.

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

10. Close the instrument's access door.

3.3 Installing the corona pin



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing this procedure. The ACQUITY UPLC system connections, ESI probe, and source can be contaminated.



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

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

To install the corona pin:

1. In the ACQUITY UPLC Console, click Standby , and confirm that the Operate indicator is not illuminated.



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

2. Open the instrument's access door.



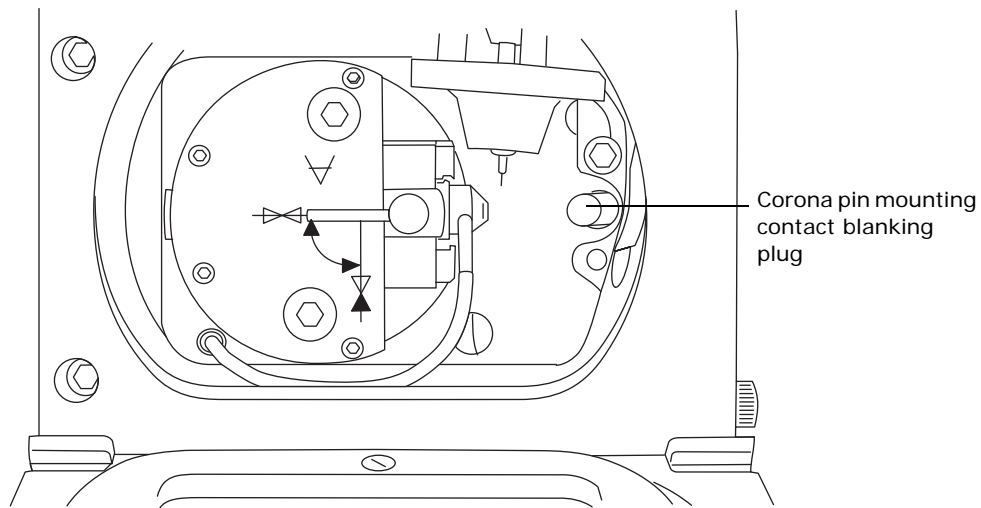
Warning: To avoid puncture wounds, take great care while working with the source enclosure door open if an ESI probe is fitted; the probe tip is sharp.



Notice: To avoid damage to the instrument, do not apply any downward force to the source enclosure door while the door is open.

3. Open the source enclosure door by releasing both spring-clips and lowering the door towards you.
4. Use the needle-nose pliers to remove the blanking plug from the corona pin mounting contact. Store the blanking plug in a safe location.

Figure 3–3: Corona pin mounting contact



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

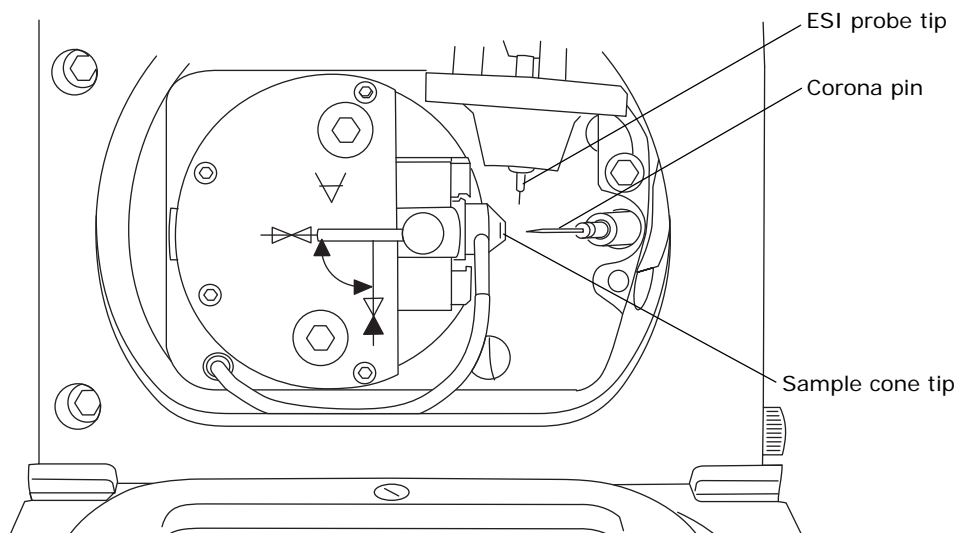


Notice: To avoid damage to the corona pin's tip and bending the pin, use the needle-nose pliers to grip the corona pin at the end that fits into the mounting contact.

5. Use the needle-nose pliers to fit the corona pin to the mounting contact.

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

Figure 3–4: Source, showing the corona pin, ESI probe tip, and sample cone



6. Use the vernier probe adjuster to position the ESI probe tip so that it is pointing approximately midway between the tips of the sample cone and corona pin. (See the figure [page 42.](#))
7. Close the source enclosure door, and secure it with both spring-clips.
8. Close the instrument's access door.

3.3.1 Optimizing the ESI probe for ESCi operation

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

3.4 Removing the corona pin



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing this procedure. The ACQUITY UPLC system connections, corona pin, ESI probe, and source can be contaminated.



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




Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

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

To remove the corona pin:

1. In the ACQUITY UPLC Console, click Standby , and confirm that the Operate indicator is not illuminated.



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

2. Open the instrument's access door.



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



Notice: To avoid damage to the instrument, do not apply any downward force to the source enclosure door while the door is open.

3. Open the source enclosure door by releasing both spring-clips and lowering the door towards you.



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



Notice: To avoid damage to the corona pin's tip and bending the pin, use the needle-nose pliers to grip the corona pin at the end that fits into the mounting contact.

4. Use the needle-nose pliers to remove the corona pin from its mounting contact. Store the corona pin in a safe location. (See the figure "[Source, showing the corona pin, ESI probe tip, and sample cone](#)".)
5. Use the needle-nose pliers to fit the blanking plug to the corona pin mounting contact. (See the figure "[Corona pin mounting contact](#)".)
6. Close the source enclosure door, and secure it with both spring-clips.
7. Close the instrument's access door.

3.5 Removing the ESI probe



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing this procedure. The ACQUITY UPLC system connections, ESI probe, and source can be contaminated.



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required material: Chemical-resistant, powder-free gloves

To remove the ESI probe:

1. Prepare the instrument for working on the source (see [page 58](#)).



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

2. Open the instrument's access door.
3. Disconnect the diverter valve tubing from the ESI probe.
4. Disconnect the ESI probe's electrical lead from the high voltage connection.
5. Ensure that the API gas is turned off.
6. Disconnect the ESI probe's PTFE tube from the nebulizer gas connection.

7. Undo the 2 thumbscrews securing the ESI probe to the probe adjuster assembly.



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

8. Carefully remove the ESI probe from the probe adjuster assembly.
9. If available, fit the protective sleeve to the ESI probe tip.
10. Close the instrument's access door.

4 Optional APCI Mode of Operation

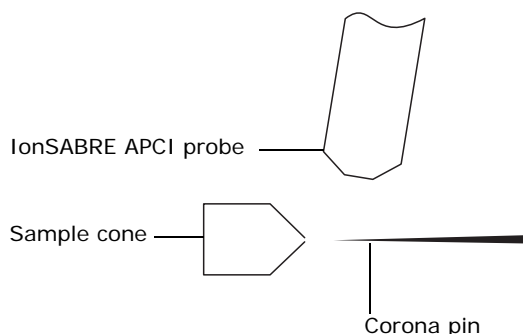
This chapter describes the optional atmospheric pressure chemical ionization (APCI) mode of operation, which uses the IonSABRE APCI source.

4.1 Atmospheric pressure chemical ionization

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

The APCI interface consists of the standard source fitted with a corona pin and a heated IonSABRE APCI probe. Mobile phase from the ACQUITY UPLC column enters the probe, where it is pneumatically converted to an aerosol, rapidly heated, and vaporized or gasified at the probe tip.

APCI mode





Hot gas from the IonSABRE 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.

4.2 IonSABRE APCI probe

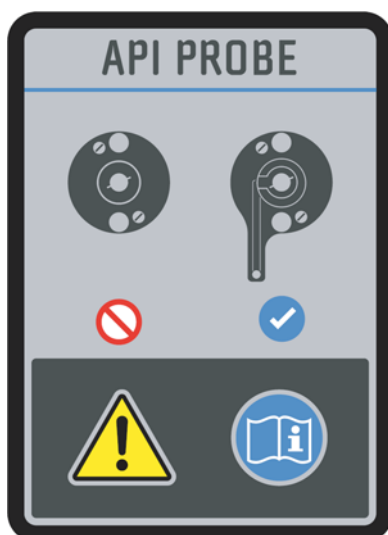
In the IonSABRE APCI probe, the nebulized gas plume expands in a directly heated region with a larger internal diameter. The increased aerosol expansion gives more



efficient droplet evaporation than the standard ESI probe. The nebulizer support gas controls the droplet residence times and positively sweeps the sample from the probe, giving optimized probe performance. The gas flow must be maintained at all times.


4.3 Installing the IonSABRE APCI probe


  **Warning:** To avoid unmanaged solvent spillage and an associated risk of ignition, on instruments bearing the probe compatibility warning label (below), always use an APCI probe whose design incorporates a drain spout. In the event of a leak at the capillary union, using an older APCI probe model, whose design does not incorporate a drain spout, can result in solvent spillage.

Probe compatibility warning label:



  **Warning:** To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing this procedure. The ACQUITY UPLC system connections, IonSABRE APCI probe, and source can be contaminated.

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

 **Requirement:** Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required material: Chemical-resistant, powder-free gloves

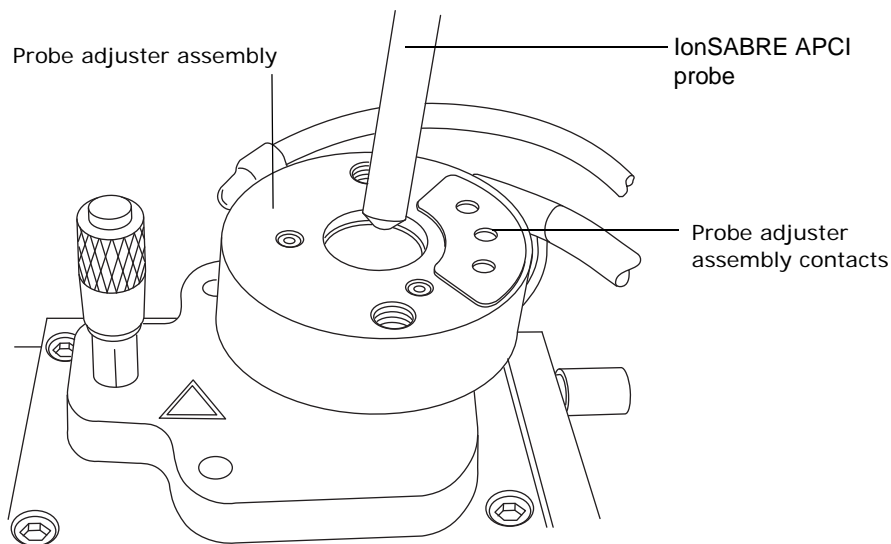
To install the IonSABRE APCI probe:

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



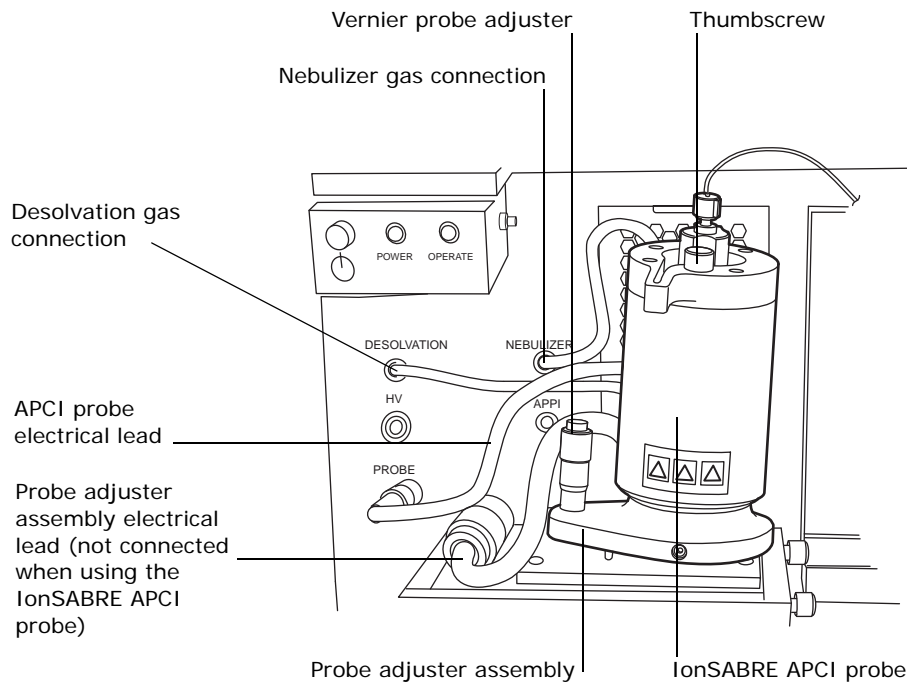
Warning: To avoid burn injuries, take great care while working with the instrument's access door open; the source can be hot.

2. Open the instrument's access door.
3. Ensure that the contacts on the IonSABRE APCI probe align with the probe adjuster assembly contacts, and carefully slide the IonSABRE APCI probe into the hole in the probe adjuster assembly.



4. Secure the IonSABRE APCI probe by tightening the 2 thumbscrews shown in the following figure.

IonSABRE APCI probe mounted on the source enclosure, showing the connections to the front panel



5. Connect the IonSABRE APCI probe's PTFE tube to the nebulizer gas connection.
6. At the instrument's front panel, disconnect the probe adjuster assembly's electrical lead from the probe connection.
7. Connect the IonSABRE APCI probe's electrical lead to the instrument's probe connection.



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

8. Using tubing of the appropriate internal diameter (ID), connect the fluidics system's diverter valve to the IonSABRE APCI probe.

Tip: Two tubes of differing ID are supplied with the instrument.

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

9. Close the instrument's access door.

4.4 Installing the corona pin

To install the corona pin:

Refer to "Installing the corona pin".

4.5 Removing the corona pin

To remove the corona pin:

Refer to [“Removing the corona pin”](#).

4.6 Removing the IonSABRE APCI probe

Required material: Chemical-resistant, powder-free gloves

To remove the IonSABRE APCI probe:



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing this procedure. The ACQUITY UPLC system connections, IonSABRE APCI probe, and source can be contaminated.



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

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



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

2. Open the instrument's access door.
3. Disconnect the diverter valve tubing from the IonSABRE APCI probe.
4. Disconnect the IonSABRE APCI probe's electrical lead from the instrument's probe connection.
5. Disconnect the IonSABRE APCI probe's PTFE tube from the nebulizer gas connection.
6. Undo the 2 thumbscrews securing the probe to the probe adjuster assembly.
7. Carefully remove the probe from the probe adjuster assembly.
8. Close the instrument's access door.

5 Maintenance Procedures

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

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

5.1 Maintenance schedule

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

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

Table 5–1: Maintenance schedule

Procedure	Frequency	For information...
Clean the instrument case.	As required.	See page 61 .
Empty the exhaust trap bottle in the instrument exhaust line.	Check daily, empty as required.	See page 62 .
Empty the liquid trap bottle in the roughing pump exhaust line.	Check daily, empty as required.	See page 64 .
Gas ballast the roughing pump.	ESI – weekly; APCI – daily.	See page 66 .
Inspect and adjust the roughing pump oil level.	Weekly.	See page 68 .
Clean the source components.	When sensitivity decreases to unacceptable levels.	See page 70 .
Clean or replace the ESI probe tip.	When sensitivity decreases to unacceptable levels.	See page 95 .
Replace the ESI probe capillary.	When sensitivity decreases to unacceptable levels or sample flow is inconsistent.	See page 96 .
Clean the APCI probe tip. (Options using the APCI IonSABRE probe only.)	When sensitivity decreases to unacceptable levels.	See page 101 .

Table 5–1: Maintenance schedule

Procedure	Frequency	For information...
Replace the APCI probe capillary.	When sensitivity decreases to unacceptable levels or sample flow is inconsistent.	See page 102 .
Clean or replace the corona pin (APCI and ESCi modes).	When the corona pin is corroded or black, or the sensitivity decreases to unacceptable levels.	See page 109 .
Replace the APCI probe heater.	If the heater fails when the instrument is pumped down (evacuated).	See page 110 .
Replace the ion block heater cartridge.	If the heater fails to heat when the instrument is pumped down (evacuated).	See page 111 .
Replace the source assembly seals.	Annually.	See page 115 .
Clean or replace the instrument's air filters.	Annually.	See page 123 .
Change the roughing pump oil.	Annually.	See page 127 .
Replace the roughing pump's demister element.	Annually. Tip: Applications that contaminate the roughing pump oil reduce this period, which must be determined from experience.	See page 130 .

5.2 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.

5.3 Troubleshooting with Connections INSIGHT

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

automatically and securely captures and sends information about the support needs of your system directly to Waters.

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

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

- <http://www.waters.com>
- Connections INSIGHT Quick Start Guide
- Connections INSIGHT User's Guide
- *Connections INSIGHT Troubleshooting Notes*
- Your sales representative
- Your local Waters subsidiary
- Waters Customer Support

To submit a Connections Insight request:

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

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

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

5.4 Safety and handling

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



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



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



Warning: To avoid electric shock,

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



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



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





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

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

5.5 Preparing the instrument for work performed on the source

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

To prepare the instrument:

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

5.6 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.



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



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required material: Chemical-resistant, powder-free gloves

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

1. Prepare the instrument for working on the source (see [page 58](#)).



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

2. Open the instrument's access door.



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

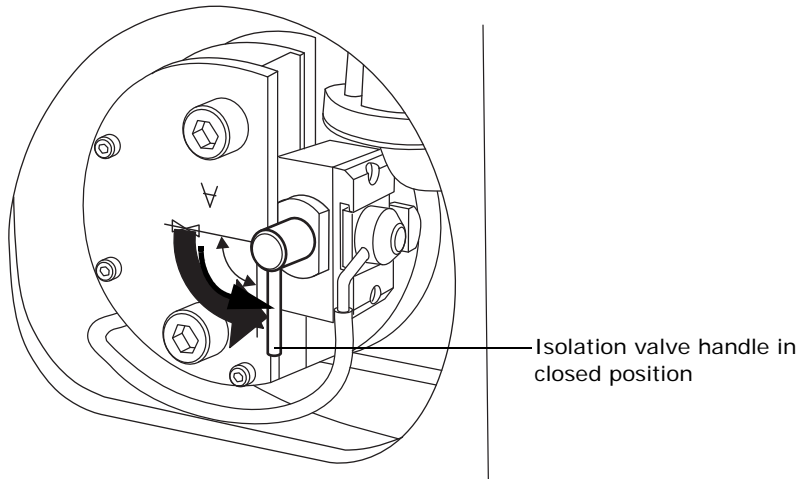
- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).



Notice: To avoid damage to the instrument, do not apply any downward force to the source enclosure door while the door is open.

3. Open the source enclosure door by releasing both spring-clips and lowering the door towards you.

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



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



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

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



Notice: To avoid damage to the instrument, do not apply any downward force to the source enclosure door while the door is open.



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

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

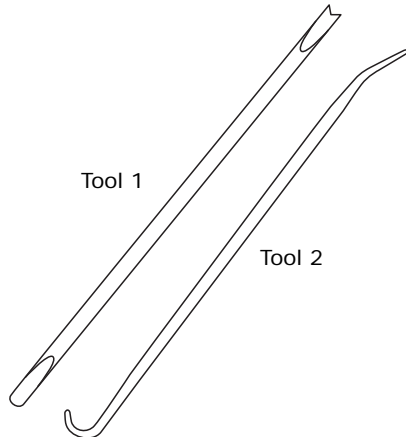
1. Open the source isolation valve by moving its handle clockwise to the horizontal position.
2. Close the source enclosure door, and secure it with both spring-clips.
3. Close the instrument's access door.

5.7 Removing O-rings and seals

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

You must dispose of all used O-rings and seals; do not re-use old O-rings or seals on the instrument.

Figure 5–1: O-ring removal kit



To remove an O-ring:

! **Notice:** To avoid scratching components with the removal tool, remove O-rings and seals carefully.

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



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, dispose of the O-ring or seal in accordance with local environmental regulations.

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

5.8 Cleaning the instrument's exterior

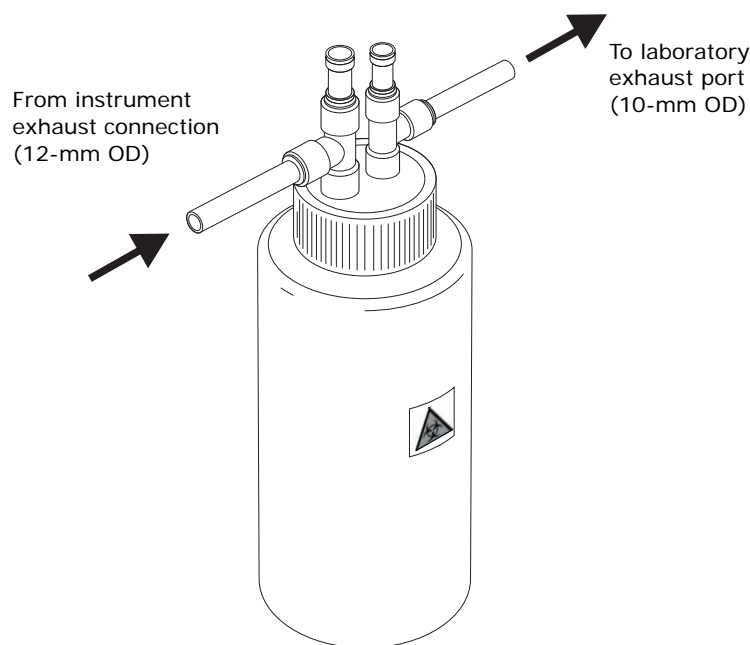
! **Notice:** To avoid scratching, abrading or otherwise damaging the instrument's case, do not use abrasives or solvents to clean it.

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

5.9 Emptying the exhaust trap bottle

Check the exhaust trap bottle in the instrument exhaust line daily and empty it before it is completely full.

Figure 5–2: Instrument exhaust trap bottle





Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- snoop[®] (or equivalent) leak detector liquid

To empty the exhaust trap bottle:

1. In the ACQUITY UPLC Console, click Stop Flow  to stop the LC flow.
2. In the ACQUITY UPLC Console, click API  to stop the desolvation gas flow.





Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while handling the exhaust trap bottle. The waste liquid in the exhaust trap bottle comprises ACQUITY UPLC solvents and analytes.

3. Unscrew and remove the exhaust trap bottle cap.



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

4. Dispose of the waste liquid in accordance with local environmental regulations.
5. Fit and tighten the exhaust trap bottle cap.
6. Ensure that the exhaust trap bottle is secured in the upright position.
7. In the ACQUITY UPLC Console, click API  to start the desolvation gas flow.
8. In the ACQUITY UPLC Console, click Start Flow  to start the LC flow.



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 biohazardous or toxic materials.

! **Notice:** To avoid damage to the instrument, snoop (or equivalent) leak detector liquid must be used only for the purpose described in the following step; it must not be used on any other part of the instrument.

9. Use snoop (or equivalent) leak detector liquid to ensure that there are no leaks at the exhaust trap bottle cap.

5.10 Emptying the roughing pump exhaust liquid trap bottle

Check the liquid trap bottle in the roughing pump exhaust line daily and empty it before it is completely full.

Figure 5–3: Roughing pump exhaust liquid trap bottle for an oil-filled roughing pump

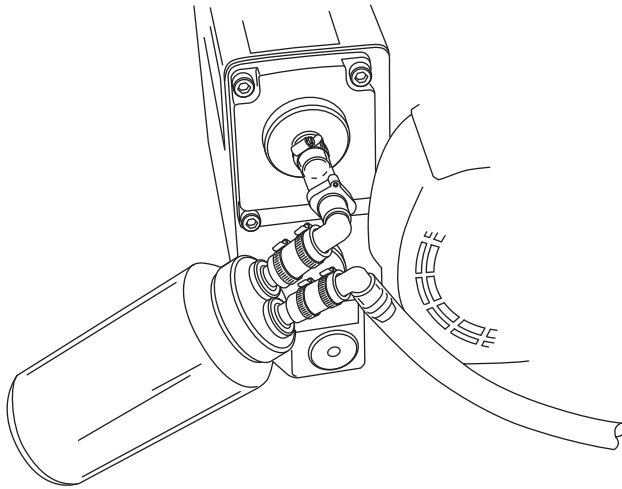
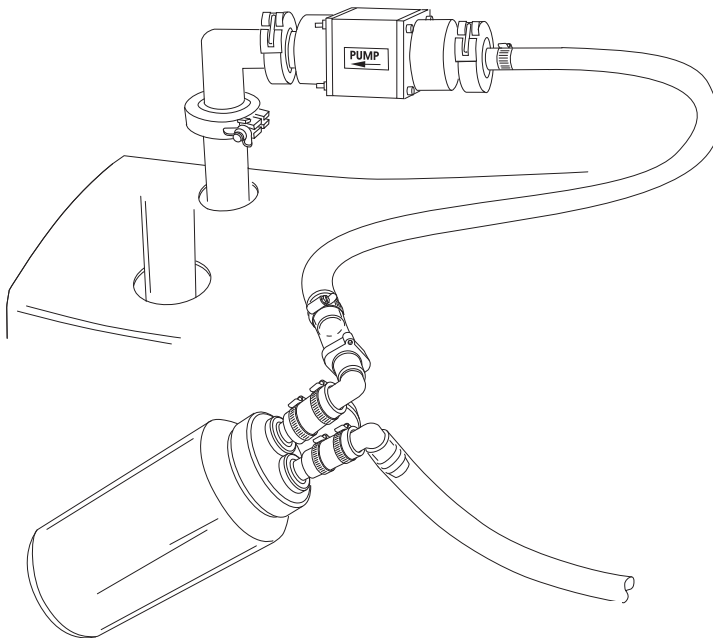


Figure 5–4: Roughing pump exhaust liquid trap bottle for an oil-free roughing pump





Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- snoop (or equivalent) leak detector liquid

To empty the exhaust liquid trap bottle:

1. Close the source isolation valve (see [page 59](#)).



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while handling the roughing pump liquid trap bottle. The liquid in the bottle can be contaminated with biohazardous or toxic analyte accumulated during normal operation.



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

2. Unscrew and remove the roughing pump liquid trap bottle cap.



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

3. Dispose of the waste liquid in accordance with local environmental regulations.
4. Fit and tighten the roughing pump liquid trap bottle cap.
5. Ensure that the roughing pump liquid trap bottle is secured in the upright position.
6. Open the source isolation valve (see [page 59](#)).



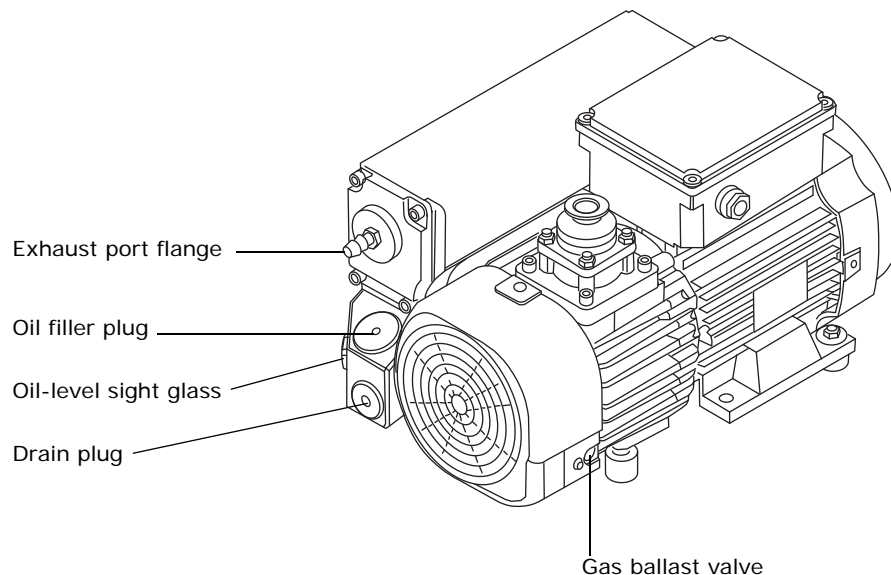
Notice: To avoid damage to the instrument, snoop (or equivalent) leak detector liquid must be used only for the purpose described in the following step; it must not be used on any other part of the instrument.

7. Use snoop (or equivalent) leak detector liquid to ensure that there are no leaks at the liquid trap bottle cap.

5.11 Gas ballasting the roughing pump

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

Figure 5–5: Roughing pump



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

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

Gas ballast the roughing pump when these conditions apply:

- With ESI operation, once a week.
- With frequent APCI operation, once a day.
- When the roughing pump oil appears cloudy.
- When the vacuum pressure is higher than normal.
- When condensate forms in the roughing pump exhaust line.
- When you change the roughing pump oil.

Your roughing pump can be fitted with either of the following:

- A screwdriver-operated gas ballast valve. See [page 67](#).
- A handle-operated gas ballast valve. See [page 68](#).

5.11.1 Gas ballasting a pump fitted with a screwdriver-operated gas ballast valve

Required material: Flat-blade screwdriver

To gas ballast the roughing pump:




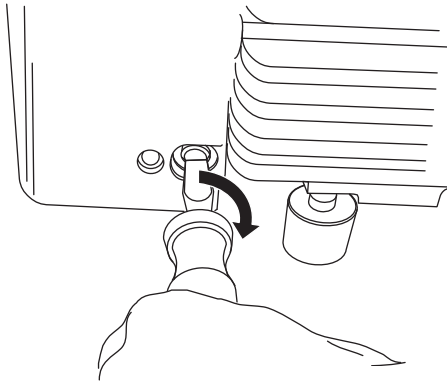
Warning: To avoid burn injuries, take great care while working with the roughing pump: it can be hot.



Notice: To avoid damage,


- do not vent the instrument when the roughing pump is gas ballasting.
- do not gas ballast the roughing pump while the instrument is in Operate mode.
- avoid gas ballasting the roughing pump for more than 2 hours.

1. Use the flat-blade screwdriver to turn the gas ballast valve on the pump a quarter-turn to the open, , position.



2. Run the pump for 30 to 60 minutes.

Tip: It is normal for the roughing pump temperature to increase during ballasting. To maintain an ambient temperature of <math><40\text{ }^{\circ}\text{C}</math> (104 °F) where the pump is located, ensure there is adequate ventilation.

3. Use the flat-blade screwdriver to turn the gas ballast valve to the closed, , position.

5.11.2 Gas ballasting a pump fitted with a handle-operated gas ballast valve

To gas ballast the roughing pump:



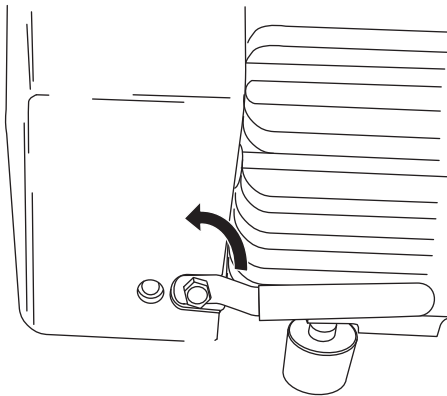
Warning: To avoid burn injuries, take great care while working with the roughing pump: it can be hot.



Notice: To avoid damage,

- do not vent the instrument when the roughing pump is gas ballasting.
- do not gas ballast the roughing pump while the instrument is in Operate mode.
- avoid gas ballasting the roughing pump for more than 2 hours.

1. Move the gas ballast valve handle on the pump a counterclockwise from the horizontal position to the vertical position.



2. Run the pump for 30 to 60 minutes.

Tip: It is normal for the roughing pump temperature to increase during ballasting. To maintain an ambient temperature of <math><40\text{ }^\circ\text{C}</math> (104 °F) where the pump is located, ensure there is adequate ventilation.

3. Move the gas ballast valve handle on the pump clockwise from the vertical position to the horizontal position.

5.12 Checking the roughing pump oil level



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

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

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

The roughing pump oil level appears in the roughing pump's oil level sight glass. Check the oil level at weekly intervals; you must maintain the oil level so that it is at or near the MAX level when the pump is not operating.

Tip: The oil level in the sight glass is lower when the roughing pump is running than when it is stopped. When the pump is running, the oil level is typically at 30% to 60% of the MAX level. For further information, see the figure on [page 66](#) and [page 69](#).

5.13 Adding oil to the roughing pump

If you check the roughing pump oil level and it is found to be low, you must add oil to the roughing pump. See [page 68](#).



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- 8-mm Allen wrench
- Container to catch used oil
- Funnel
- Anderol vacuum oil, type GS 495

To add oil to the roughing pump:

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



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



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

2. Use the 8-mm Allen wrench to unscrew and remove the roughing pump's oil filler plug (see the figure on [page 66](#)).



Notice: To maintain pump performance, use only Anderol vacuum oil, type GS 495.

3. Using the funnel, add Anderol vacuum oil, type GS 495, into the oil filler aperture until the oil reaches the oil level sight glass MAX level.

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

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

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

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

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

6. Start the instrument (see [page 29](#)).

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

- The oil level drops slightly during the first month of operation.
- The oil changes color (darkens) over time.
- After running the pump for 12 to 48 hours, it is common to see a few drops of oil near the filler plug. Excess oil around the lip of the filler plug will run down and drip off the pump once the pump reaches operating temperature.
- When the pump begins to run at normal operating temperature, spilled oil smells slightly.

5.14 Cleaning the source components

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

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

See [page 70](#).

If cleaning the sample cone and gas cones fails to increase signal sensitivity, also clean the ion block, isolation valve, and extraction cone (see [page 78](#)).

If cleaning the ion block, isolation valve, and extraction cone fails to increase signal sensitivity, also clean the source hexapole assembly (see [page 91](#)).

5.15 Cleaning the sample cone and gas cone

The cone gas assembly (comprising the sample cone, O-ring, and gas cone) can be removed for cleaning without venting the instrument.

5.15.1 Removing the cone gas assembly from the source



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



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



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

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



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



Notice: To avoid damage to the instrument, do not apply any downward force to the source enclosure door while the door is open.

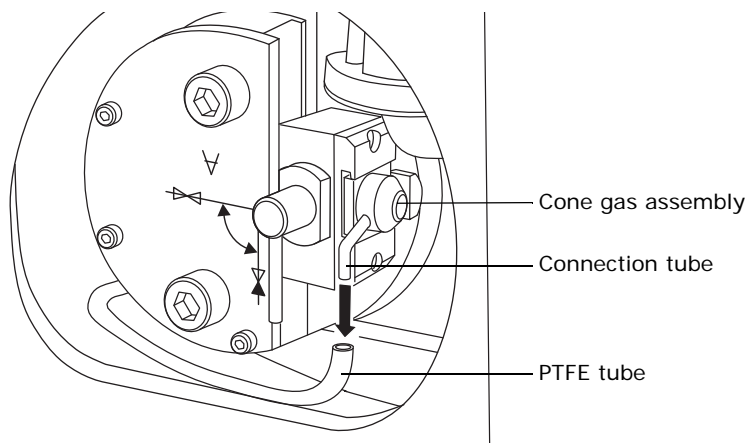


Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

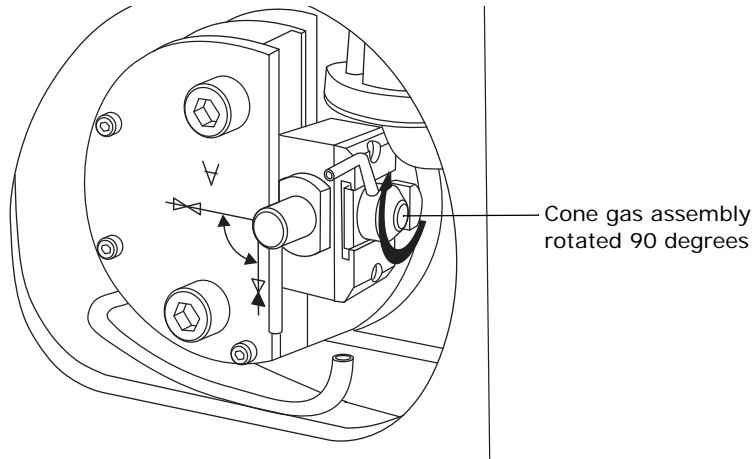
Required material: Chemical-resistant, powder-free gloves

To remove the cone gas assembly from the source:

1. Close the source isolation valve (see [page 59](#)).
2. Disconnect the PTFE tube from the cone gas assembly connection tube.

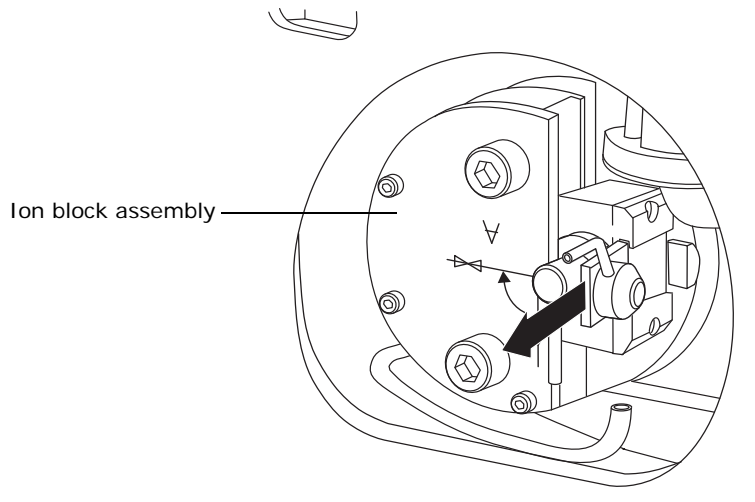


3. Grasp the cone gas assembly connection tube, and use it as a lever to rotate the cone gas assembly 90 degrees, moving the connection tube from the vertical to the horizontal position.



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

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



5.15.2 Disassembling the cone gas assembly



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

! **Notice:** To avoid damage to the instrument, do not apply excessive force to the source enclosure door when using the extraction tool on the source door.



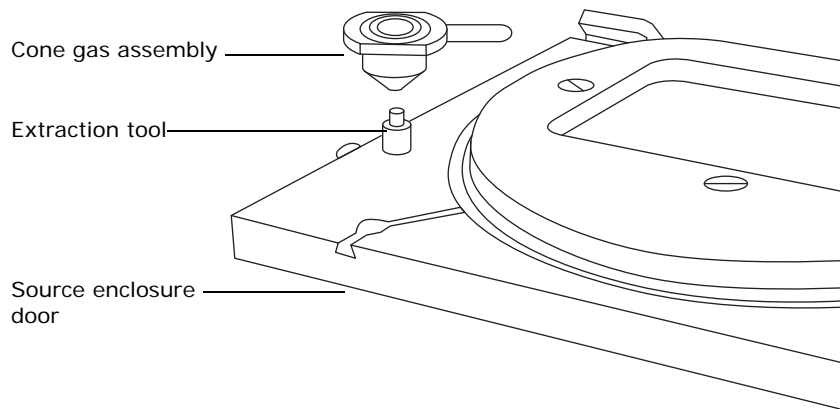
Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required material: Chemical-resistant, powder-free gloves

To disassemble the cone gas assembly:

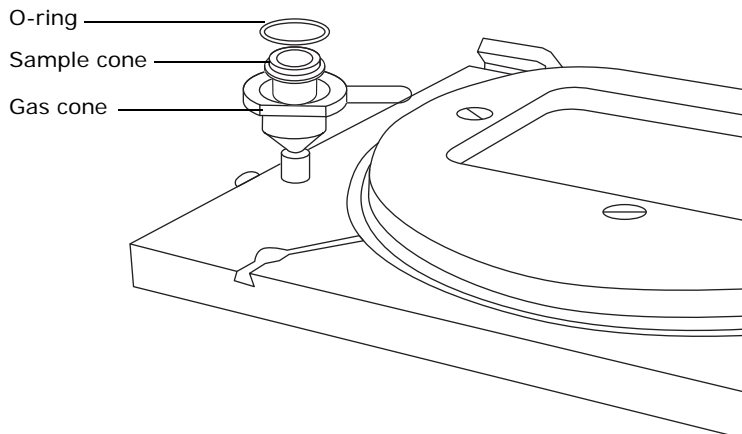
1. Position the cone gas assembly inlet over the extraction tool on the source enclosure door.

Alternative: Use the hand-held extraction tool supplied with the instrument. This tool is used in a similar manner to that fitted to the source enclosure door.



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

- Carefully push down on the gas cone to separate the gas cone, sample cone, and O-ring.



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

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

5.15.3 Cleaning the sample cone and gas cone



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



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



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

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

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

To clean the sample cone and gas cone:

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

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

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

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

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

5.15.4 Assembling the cone gas assembly

! **Notice:**

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

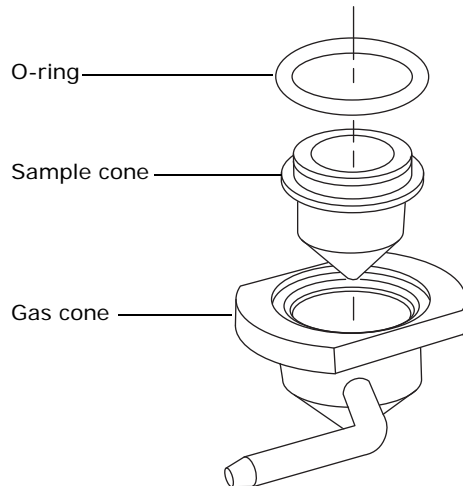


Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required material: Chemical-resistant, powder-free gloves

To assemble the cone gas assembly:

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



2. Fit a new O-ring into the groove created between the sample cone and gas cone.

5.15.5 Fitting the cone gas assembly to the source



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



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

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



Notice: To avoid damage,

- do not apply any downward force to the source enclosure door while the door is open.
- do not open the source isolation valve before fitting the cone gas assembly to the ion block assembly.

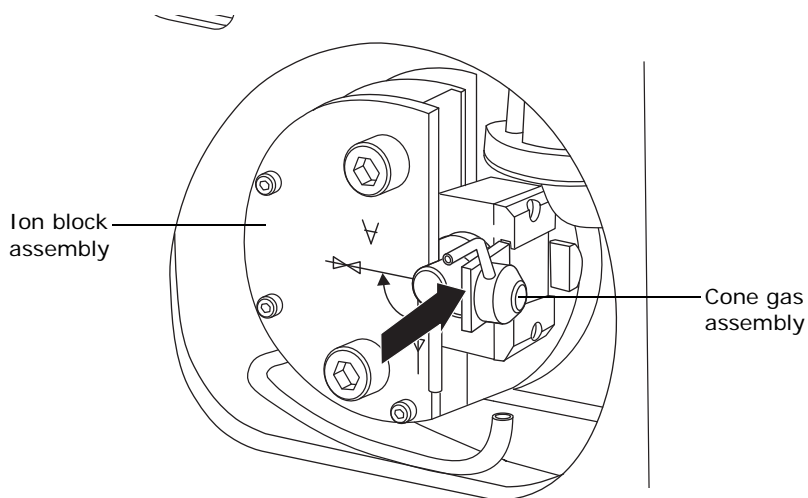


Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required material: Chemical-resistant, powder-free gloves

To fit the cone gas assembly to the source:

1. Ensure that the source isolation valve is in the closed position (see [page 59](#)).
2. Hold the cone gas assembly so that the connection tube is horizontal and at the top, then slide the cone gas assembly into the ion block assembly.



3. Grasp the cone gas assembly connection tube and use it as a handle to rotate the cone gas assembly 90 degrees, moving the connection tube from the horizontal to the vertical position.
4. Connect the PTFE tube to the cone gas assembly connection tube.
5. Open the source isolation valve.

6. Close the source enclosure door, and secure it with both spring-clips.
7. Close the instrument's access door.

5.16 Cleaning the ion block, isolation valve, and extraction cone

The ion block and extraction cone must be cleaned if cleaning the sample cone and gas cone fails to increase signal sensitivity.

5.16.1 Removing the ion block assembly from the source assembly



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- 6-mm Allen wrench

To remove the ion block assembly:

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



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

2. Open the instrument's access door.



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

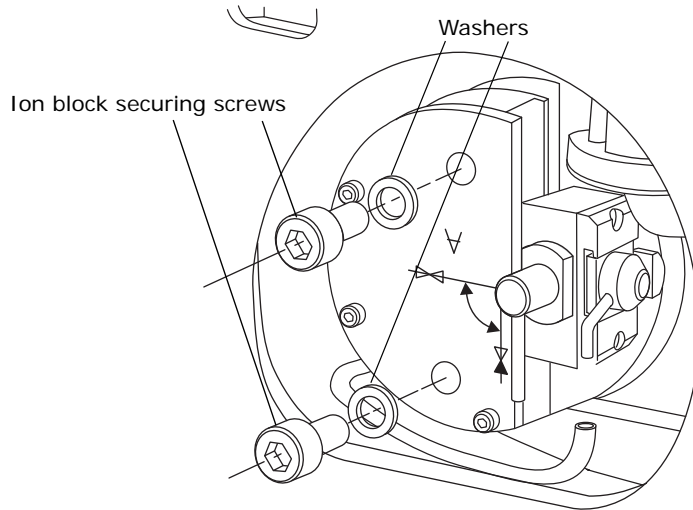
- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).



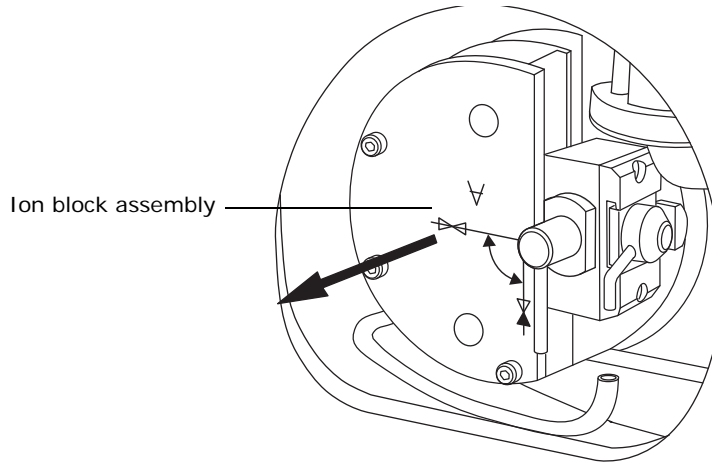
Notice: To avoid damage to the instrument, do not apply any downward force to the source enclosure door while the door is open.

3. Open the source enclosure door by releasing both spring-clips and lowering the door towards you.
4. Close the source isolation valve (see [page 59](#)).
5. Disconnect the PTFE tube from the cone gas assembly connection tube.

6. Use the 6-mm Allen wrench to unscrew and remove the 2 ion block assembly securing screws and associated washers.



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



5.16.2 Disassembling the source ion block assembly



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



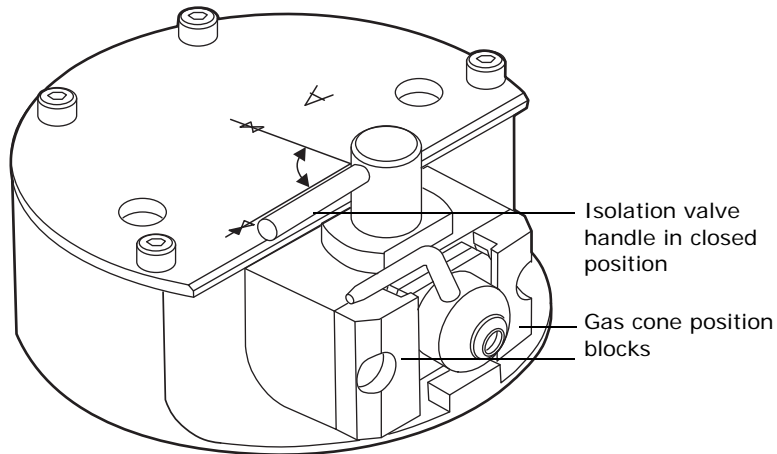
Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- 1.5-mm, 2.5-mm, and 6-mm Allen wrenches
- O-ring removal kit
- Needle-nose pliers

To disassemble the ion block assembly:

1. Ensure that the isolation valve is closed.

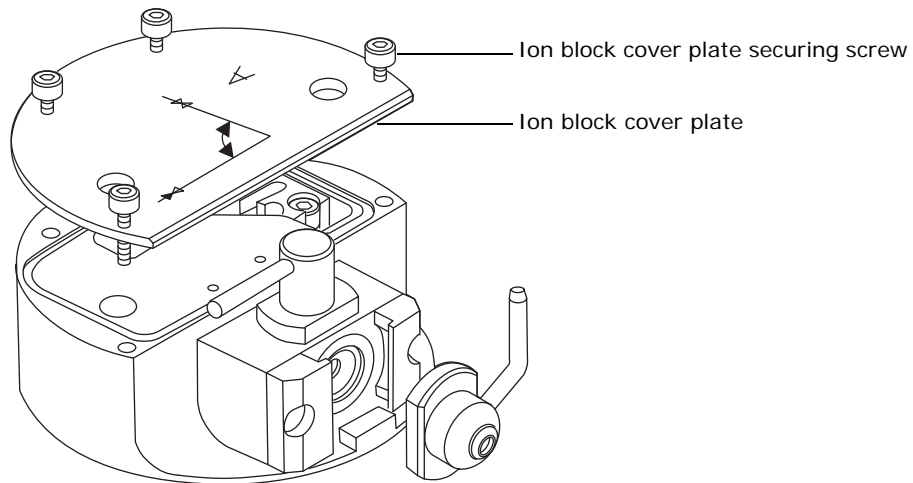


2. Grasp the cone gas assembly connection tube and use it as a lever to rotate the cone gas assembly 90 degrees.

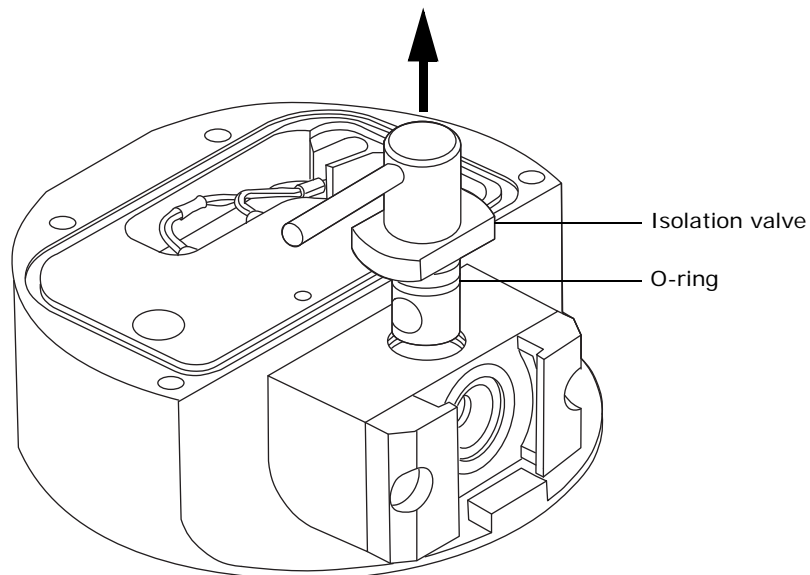
- !** **Notice:** To ensure correct operation of the ion block assembly after reassembly,
- the gas cone position block must not be removed
 - the screws holding the gas cone position blocks in place must not be adjusted.

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

4. Use the 2.5-mm Allen wrench to loosen the 4 ion block cover plate captive securing screws.



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



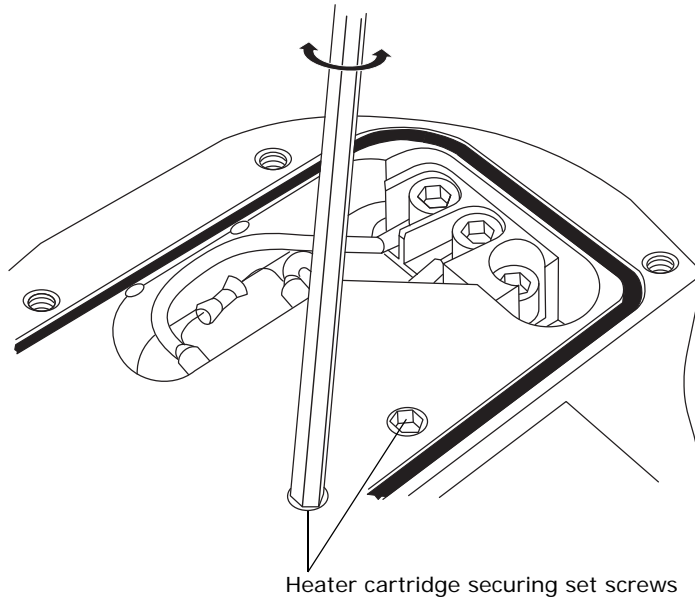
7. Use the O-ring removal kit to carefully remove the isolation valve O-ring (see [page 61](#)).



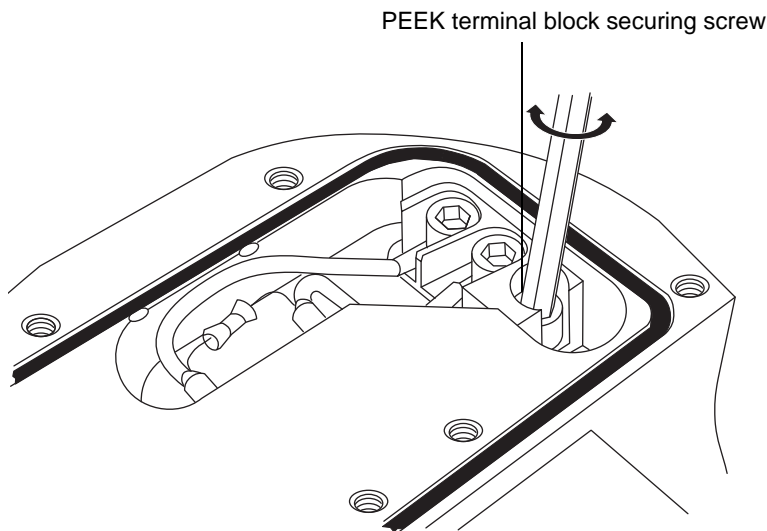
Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, which can be present on the isolation valve O-ring, dispose of the isolation valve O-ring in accordance with local environmental regulations.

8. Dispose of the isolation valve O-ring in accordance with local environmental regulations.

9. If the 2 set screws securing the heater cartridge to the PEEK terminal block are fitted, use the 1.5-mm Allen wrench to loosen them.



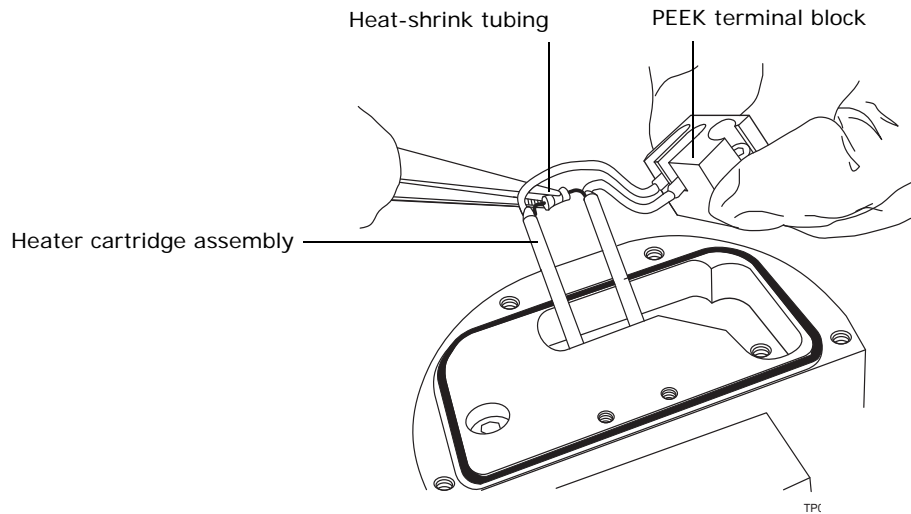
10. Use the 2.5-mm Allen wrench to loosen the captive PEEK terminal block securing screw.



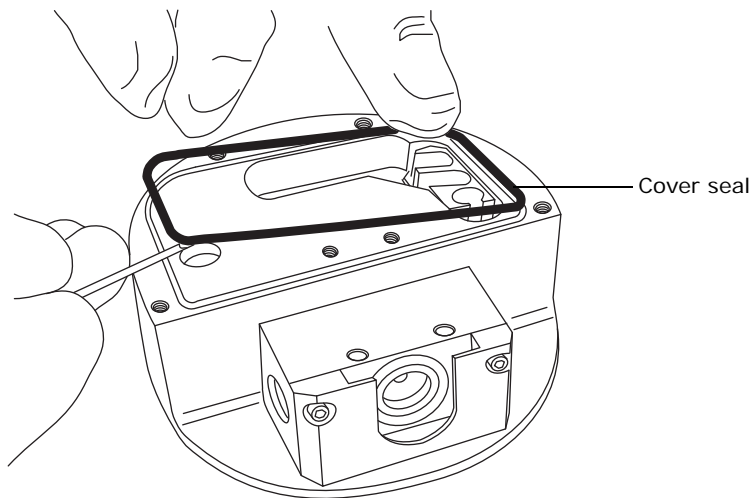
! **Notice:** To avoid damaging the heater cartridge assembly wires, do not bend or twist them either side of the heater cartridge assembly heat-shrink tubing when removing the assembly from the ion block.

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

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



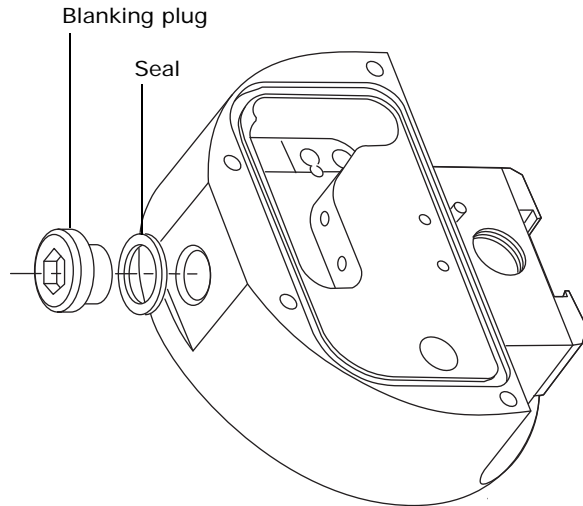
13. Use the O-ring removal kit to carefully remove the cover seal from the ion block (see also [page 61](#)).



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, dispose of the cover seal in accordance with local environmental regulations.

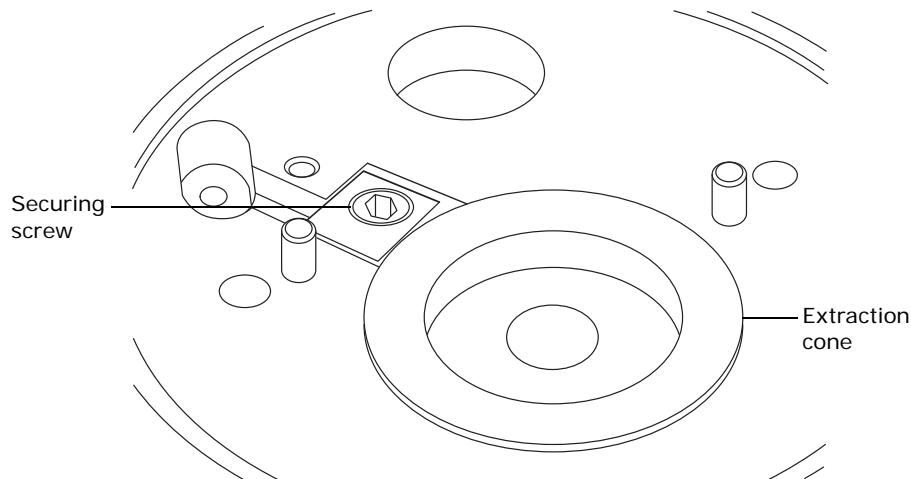
14. Dispose of the cover seal in accordance with local environmental regulations.

15. Use the 6-mm Allen wrench to remove the ion block blanking plug and associated seal.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, dispose of the blanking plug seal in accordance with local environmental regulations.

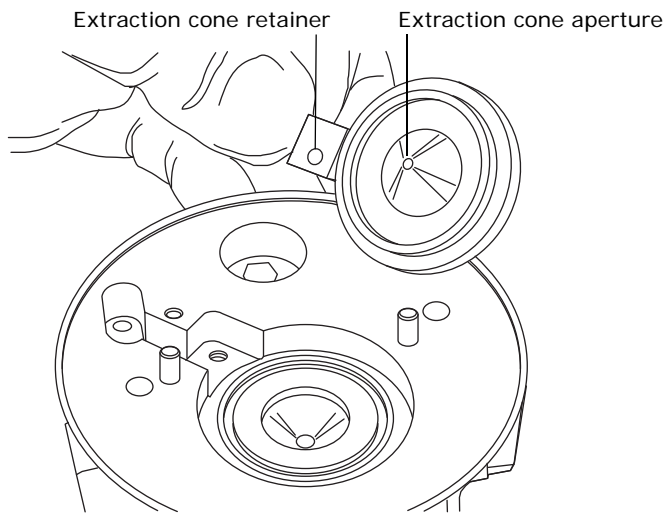
16. Dispose of the blanking plug seal in accordance with local environmental regulations.
17. Use the 2.5-mm Allen wrench to loosen the captive extraction cone retainer securing screw.



Notice:

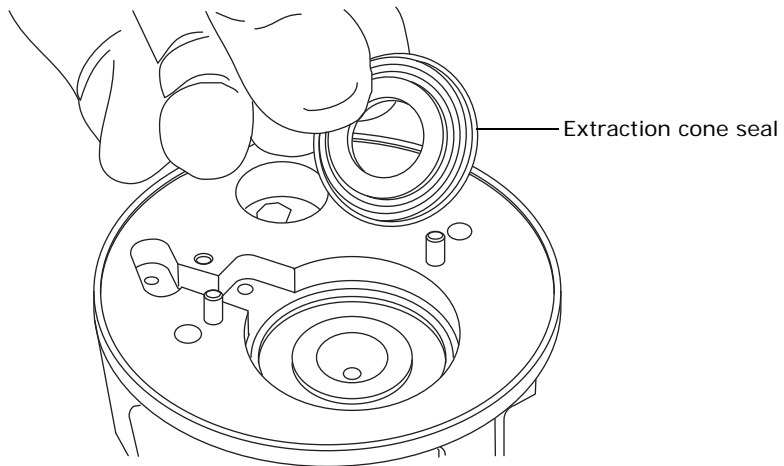
- To avoid damaging the extraction cone aperture, take great care when removing the it from the ion block.
- To avoid damaging the fragile extraction cone, do not place it on its tip; instead, place it on its flanged base.

18. Remove the extraction cone retainer and extraction cone from the ion block.



19. Remove the extraction cone retainer from the extraction cone.

20. Remove the extraction cone seal from the ion block.



5.16.3 Cleaning the ion block, isolation valve, and extraction cone



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



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



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

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

To clean the ion block components:

1. Immerse the ion block, isolation valve, and extraction cone separately in glass vessels containing 1:1 methanol/water.



Notice: To avoid damage, do not clean non-metal parts (for example, the heater cartridge assembly) in this way.

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

2. Place the vessels in the ultrasonic bath for 30 minutes.
3. If you used formic acid in the cleaning solution, do as follows:
 - a. Rinse the components by immersing them separately in glass vessels containing water and then placing the vessels in the ultrasonic bath for 20 minutes.
 - b. Displace the water by immersing the components separately in glass vessels containing methanol and then placing the vessels in the ultrasonic

bath for 10 minutes.



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing the rest of this procedure. This will prevent recontamination of the cleaned components.

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

5.16.4 Assembling the source ion block assembly



Notice:

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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- 1.5-mm, 2.5-mm, and 6-mm Allen wrenches
- Needle-nose pliers
- Isopropyl alcohol in small container

To assemble the ion block assembly:

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



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

3. Fit the extraction cone retainer and extraction cone to the ion block.
4. Use the 2.5-mm Allen wrench to tighten the captive screw securing the extraction cone retainer.
5. Fit a new blanking plug seal to the ion block blanking plug.

6. Use the 6-mm Allen wrench to fit and tighten the blanking plug to the ion block.

! **Notice:** To avoid damaging the heater cartridge assembly wires, do not bend or twist them either side of the heater cartridge assembly heat-shrink tubing when fitting the assembly to the ion block.

7. Using the needle-nose pliers to gently grasp the heat-shrink tubing on the heater cartridge assembly, slide the assembly and the PEEK terminal block into the ion block.
8. Use the 2.5-mm Allen wrench to tighten the captive PEEK terminal block securing screw.

! **Notice:** To avoid damage to the heater cartridge, do not overtighten the set screws.

9. If the 2 set screws securing the heater cartridge to the PEEK terminal block are fitted, use the 1.5-mm Allen wrench to fit and tighten them.
10. Ensure that the grooves for the cover seal and extraction cone seal are free from dirt and debris.

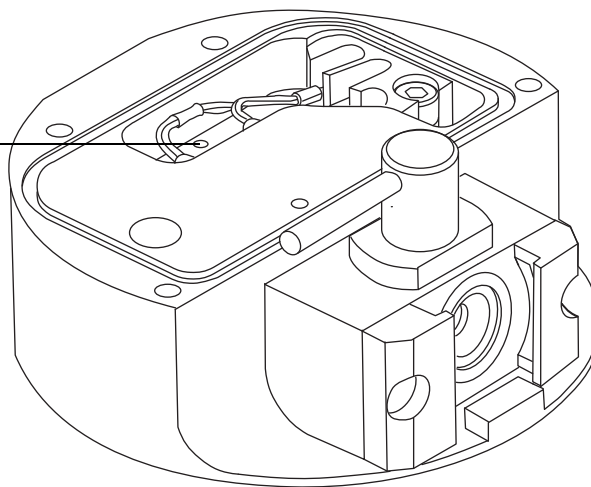
Tip: If contamination is present, use 1:1 methanol/water, applied to a lint-free cloth, to carefully clean the grooves.

11. Fit a new cover seal to the ion block, ensuring that it is correctly seated.
12. Soak a new isolation valve O-ring in isopropyl alcohol for a few minutes.


Rationale: Doing so lubricates the O-ring and aids your fitting the O-ring to the isolation valve.

13. Fit the new O-ring to the isolation valve.
14. Fit the isolation valve to the ion block assembly.
15. If an ion block assembly set screw is fitted, use the 1.5 mm Allen wrench to loosen the set screw. If an ion block assembly set screw is not fitted go to [step 19](#).

Ion block assembly set
screw



16. To tighten the ion block assembly set screw, hold the ion block in position against the PEEK ion block support on the instrument.

 **Notice:** To avoid damage to the thermocouple, do not overtighten the set screw.

17. Carefully tighten the set screw until it makes contact with the thermocouple.
18. Remove the ion block from the PEEK ion block support on the instrument.
19. Fit the ion block cover plate to the ion block assembly, and then use the 2.5-mm Allen wrench to tighten the 4 ion block cover plate captive securing screws.
20. Holding the cone gas assembly so that the connection tube is horizontal and at the top, slide the cone gas assembly into the ion block assembly.
21. Grasp the cone gas assembly connection tube, and use it as a handle to rotate the cone gas assembly 90 degrees, moving the connection tube from the horizontal to the vertical position.

5.16.5 Fitting the ion block assembly to the source assembly



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

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



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



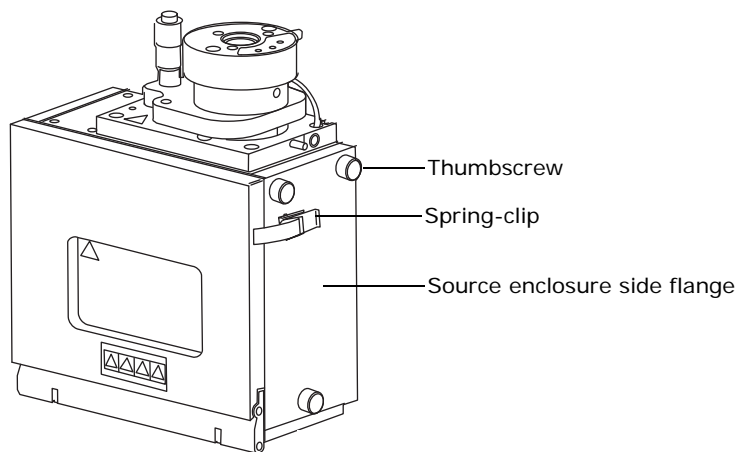
Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- 6-mm Allen wrench

To fit the ion block assembly:

1. Unscrew and remove the 3 thumbscrews that secure the right-hand side flange to the source enclosure.



2. Open the source enclosure door by releasing both spring-clips and lowering the door towards you.
3. Remove the side flange from the source enclosure.

Rationale: This step allows you to see the ion block assembly as you fit it to the PEEK ion block support.

! **Notice:** To avoid damage to the instrument, do not apply any downward force to the source enclosure door while the door is open.

4. Fit the ion block assembly to the PEEK ion block support.
5. Use the 6-mm Allen wrench to fit and then slowly and evenly tighten the 2 ion block assembly securing screws and their associated washers.
6. Look through the hole in the side of the source enclosure and view the area where the ion block assembly meets the PEEK ion block support. If you see a gap, the extraction cone has slipped out of position during installation. If this is the case, remove the ion block assembly, refit the extraction cone, and reinstall the ion block assembly on the PEEK ion block support.
7. When you are satisfied with the installation of the ion block assembly, fit the side flange to the source enclosure.
8. Fit and tighten the 3 thumbscrews that secure the right-hand side flange to the source enclosure.
9. Connect the PTFE tube to the cone gas assembly connection tube.
10. Open the source isolation valve (see [page 59](#)).
11. Close the source enclosure door, and secure it with both spring-clips.

5.17 Cleaning the source hexapole assembly

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

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



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



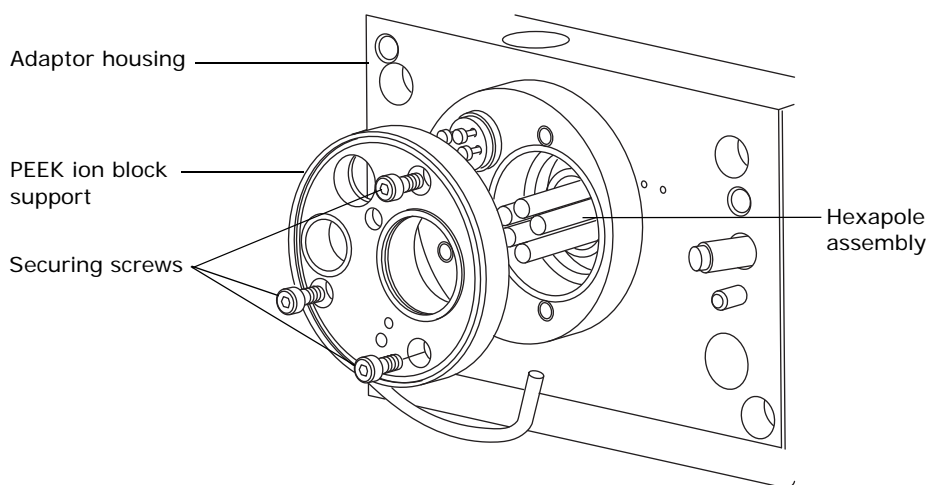
Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

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

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

1. Remove the ion block assembly from the PEEK ion block support (see [page 78](#)).
2. Use the 3-mm Allen wrench to unscrew and remove the 3 screws securing the PEEK ion block support to the adaptor housing.



3. Remove the PEEK ion block support from the adaptor housing.
4. Use the O-ring removal kit to carefully remove all the O-rings from the PEEK ion block support (see [page 61](#)).



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

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

! **Notice:** To avoid damage, when removing the hexapole assembly from the adaptor housing, observe these precautions:

- Avoid scratching the internal surfaces of the adaptor block.
- Do not compress the hexapole rods.

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

5.17.2 Cleaning the hexapole assembly



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

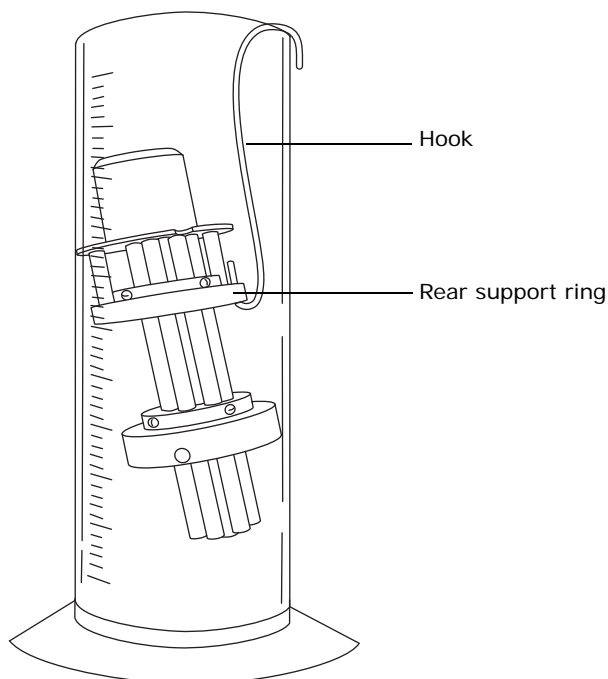
- Chemical-resistant, powder-free gloves.
- 500-mL measuring cylinder or appropriately sized glass vessel in which to completely immerse the hexapole when cleaning. Use only glassware not previously cleaned with surfactants.
- Length of small diameter stainless steel tube.
- HPLC-grade, or better, methanol.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

To clean the source hexapole assembly:

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

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

3. Use the hook to carefully suspend the hexapole assembly into the glass vessel with the bottom of the assembly clear of the bottom of the vessel.



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing the rest of this procedure. This will prevent recontamination of the hexapole assembly.

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

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

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

! **Notice:** To avoid damage, when fitting the hexapole assembly into the adaptor housing, observe these precautions:

- Avoid scratching the internal surfaces of the adaptor block.
- Do not compress the hexapole rods.



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- 3-mm Allen wrench
- Lint-free cloth
- HPLC-grade, or better, 1:1 methanol/water

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

1. Carefully fit the source hexapole assembly into the adaptor housing, aligning the notches in the differential aperture at its rear with the two bottom support rails on the analyzer assembly. Then carefully slide the assembly fully into place.
2. Ensure that the grooves for the PEEK ion block support O-rings are free from dirt and debris.

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

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

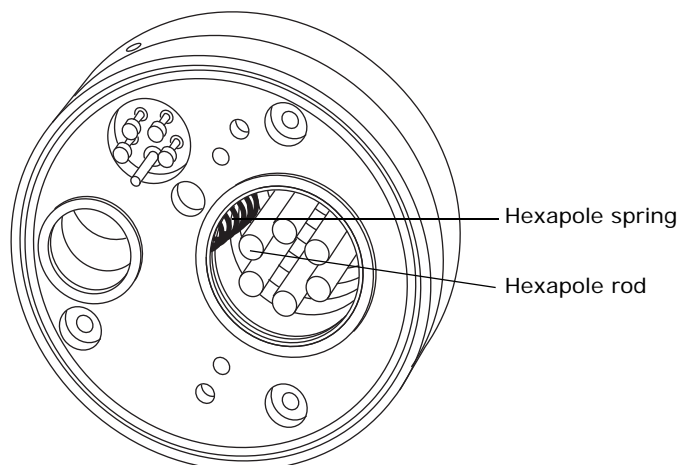
Tip: To fit an O-ring in its groove, start fitting the O-ring at the notch in the groove and then progressively work the ring into the groove in either direction from the notch.

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

! **Notice:** To ensure correct operation of the instrument, neither hexapole spring must touch a hexapole rod.

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

Tip: Look through the PEEK ion block support as you tighten the securing screws. Ensure that neither hexapole spring buckles and touches a hexapole rod.



6. Fit the ion block assembly to the PEEK ion block support (see [page 89](#)).

5.18 Replacing the ESI probe tip

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 threads are damaged.



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



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



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- 6-mm (¼-inch) wrench

To replace the ESI probe tip:

1. Remove the probe from the source (see also [page 46](#)).
2. Use the 6-mm (¼-inch) wrench to unscrew and remove the probe tip.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, dispose of the probe tip in accordance with local environmental regulations.

3. Dispose of the probe tip in accordance with local environmental regulations.
4. Use the 6-mm (¼-inch) wrench to fit and tighten the new probe tip to the probe.
5. Adjust the probe tip so that the fully extended capillary (when the probe nebulizer adjuster knob is fully screwed down) protrudes by approximately 1 to 1.5 mm.
6. Fit the probe to the source (see also [page 40](#)).

5.19 Replacing the ESI probe sample capillary

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



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



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



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

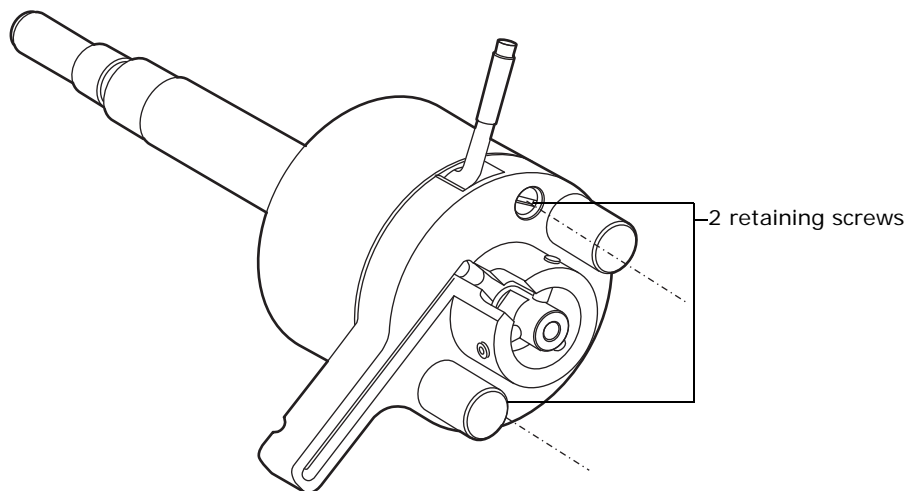
Required materials:

- Chemical-resistant, powder-free gloves
- 1.5-mm Allen wrench
- 6-mm (¼-inch) wrench
- 5/16-inch wrench
- 7/16-inch wrench
- Flat-blade screwdriver

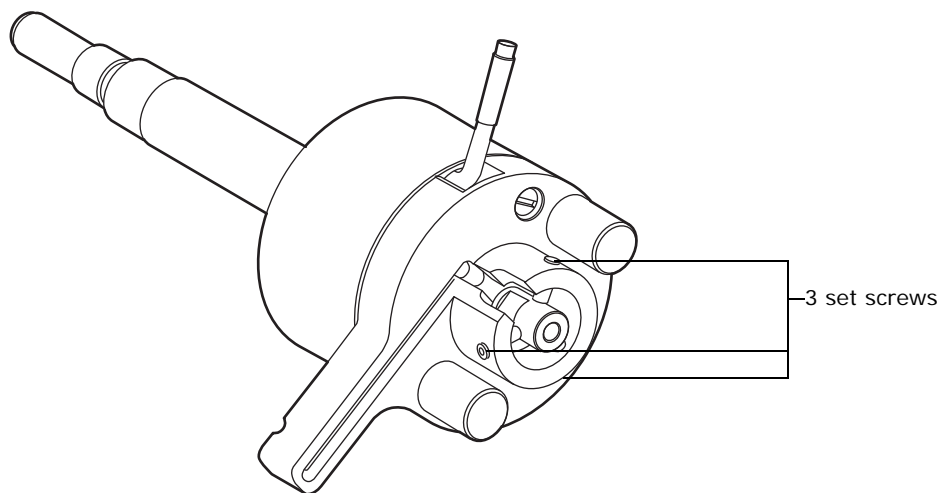
- Needle-nose pliers
- LC pump
- HPLC-grade, or better, 1:1 acetonitrile/water

To replace the capillary:

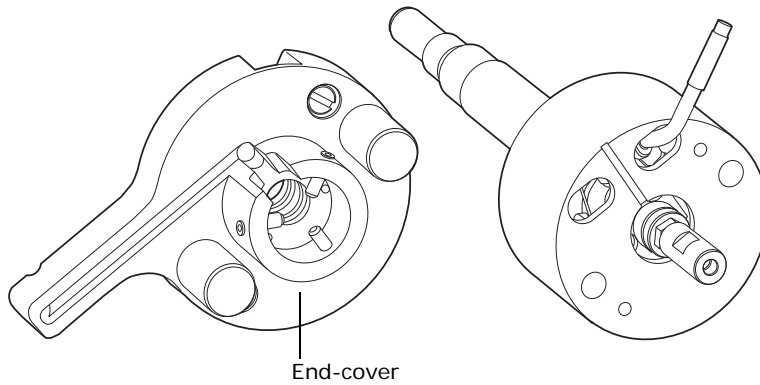
1. Remove the probe from the source (see [page 46](#)).
2. Use the screwdriver to remove the 2 probe end-cover retaining screws.



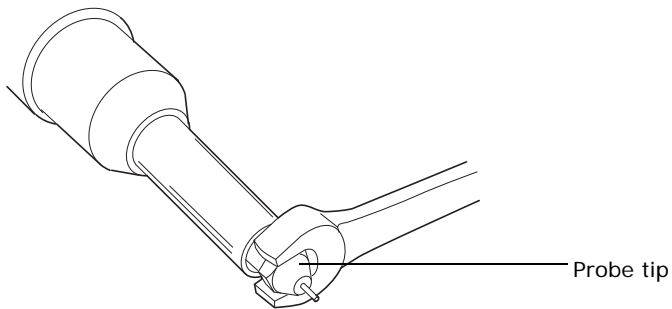
3. Use the 1.5-mm Allen wrench to loosen the 3 set screws on the LC PEEK union.



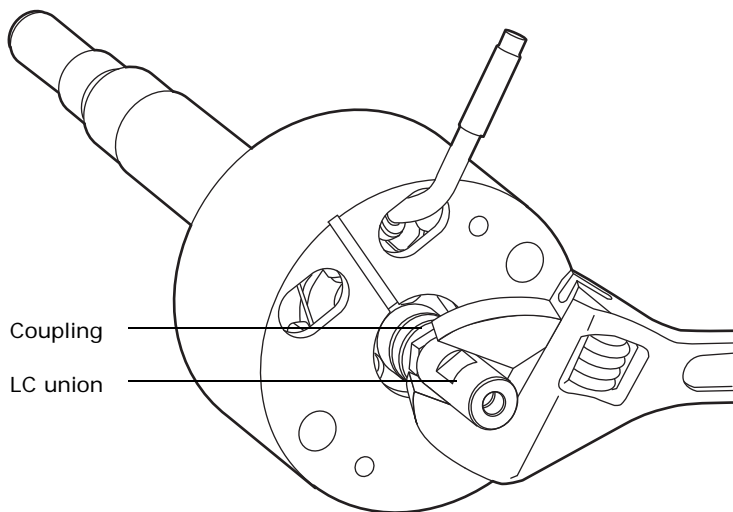
4. Remove the end-cover.



5. Use the 6-mm wrench to remove the probe tip.

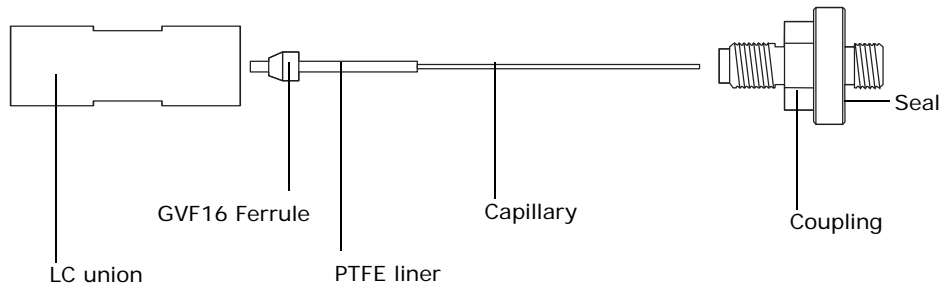


6. Use the 7/16-inch wrench to unscrew the coupling and union from the probe.



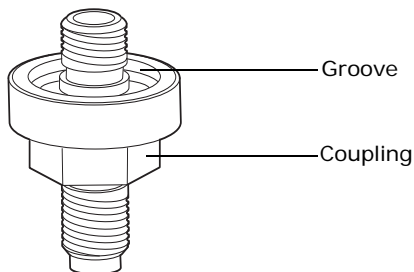
7. Withdraw the LC union, coupling and capillary from the probe.

- Remove the LC union, capillary and seal from the coupling.



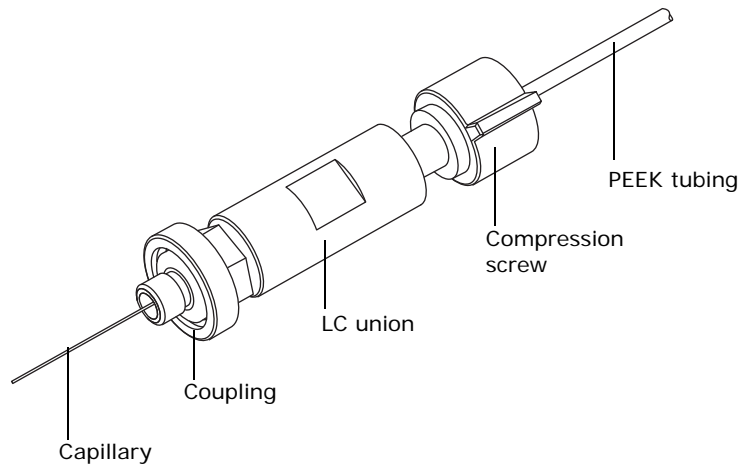
Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, dispose of the capillary, PTFE liner, ferrule assembly, and seal in accordance with local environmental regulations.

- Dispose of the capillary, PTFE liner, ferrule assembly, and seal in accordance with local environmental regulations.
- Use the needle-nose pliers to remove the conductive sleeve from the inner bore of the probe assembly fitting.
- Slide a new GVF16 ferrule onto the PTFE liner tube.
- Fit a new seal into the groove facing the short end of the coupling.

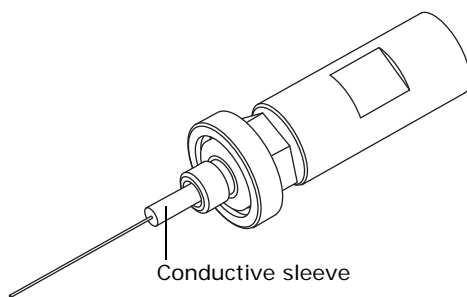


- Slide the coupling—short end first—onto the capillary, followed by the new PTFE liner tube and ferrule.
- Push the capillary through the LC union until it can be seen in the other end of the LC union.
- Lightly screw the coupling into the LC union so that it does not restrict movement of the capillary.
- Slide a compression screw and ferrule onto a piece of 1/16 × 0.0025 bore (5M) PEEK tubing and push the probe capillary back through the LC union until the PEEK tubing butts against the stop.

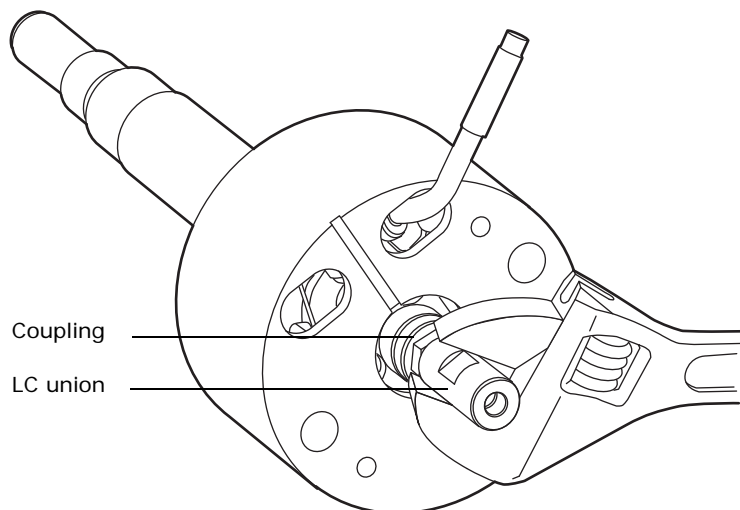
Rationale: This ensures that the probe capillary is set to correct depth.



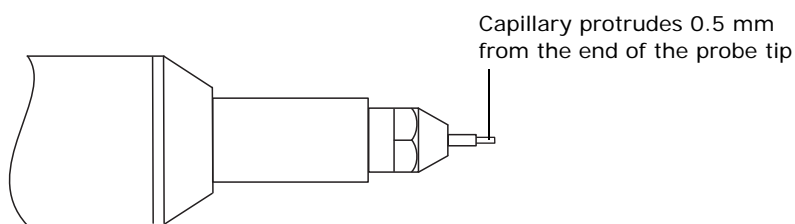
17. Tighten the coupling on the LC union so that it is snug but not tight.
18. Gently tug the capillary to make sure it remains secure.
19. Check for leaks in the assembly by attaching the free end of the PEEK tubing to an LC pump and pumping 1:1 acetonitrile/water through it at 1 mL/min.
20. If leakage occurs, disassemble and remake the connection, and then repeat the leak test.
21. When performing the leak test, check the backpressure on the LC pump, which will be relatively high if the capillary is blocked. If this is the case, replace the capillary.
22. When the leak test is performed successfully, disconnect the PEEK tubing from the LC pump.
23. Remove the PEEK tubing and compression screw from the LC union.
24. Slide the conductive sleeve onto the capillary, and then feed the capillary through the probe.



25. Attach the coupling nut to the probe, and gently tighten it with the 7/16-inch wrench.



26. Replace the probe tip, and then screw down until the capillary protrudes approximately 0.5 mm from the end of the tip.




27. Fit the probe end-cover.
28. Fit and tighten the two probe end-cover retaining screws.
29. Tighten the 3 set screws to clamp the LC union in place.
30. Fit the probe to the instrument (see [page 40](#)).

5.20 Cleaning the IonSABRE APCI probe tip

Clean the APCI probe tip when a buffer buildup is detected on the probe tip or when the signal intensity weakens.

To clean the APCI probe tip:

1. Stop the liquid flow.
2. In the Tune window, click Gas  to start the desolvation gas flow.
3. In the Source tab, set Desolvation to 650 L/hr.
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.

5.21 Replacing the IonSABRE APCI probe sample capillary

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

5.21.1 Removing the existing capillary



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



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

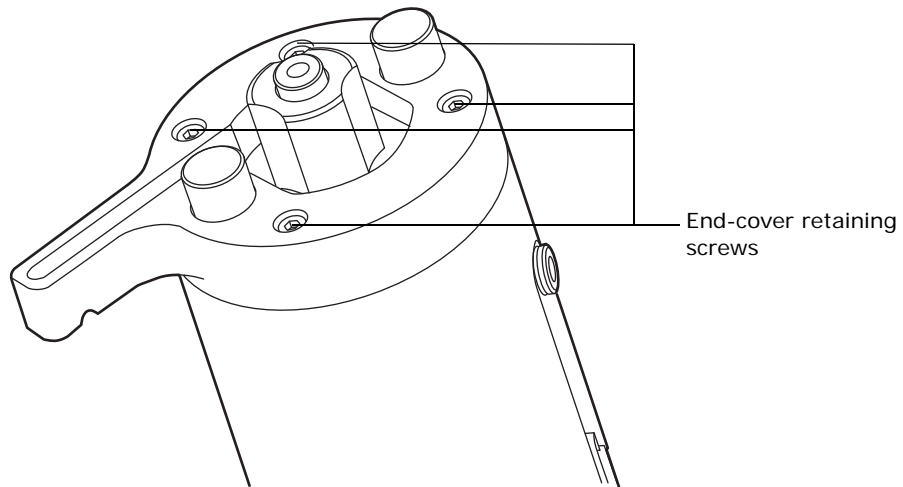
Required materials:

- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- 7-mm wrench
- 8-mm wrench
- 2.5-mm Allen wrench

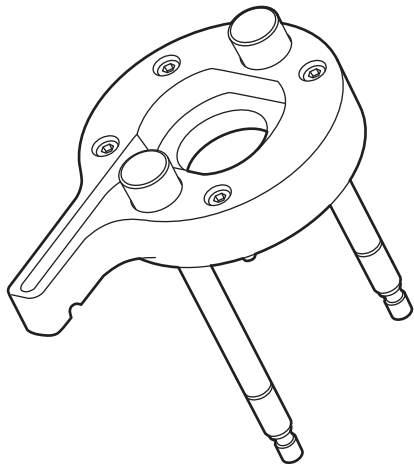
To remove the existing capillary:

1. Remove the probe from the source (see [page 53](#)).

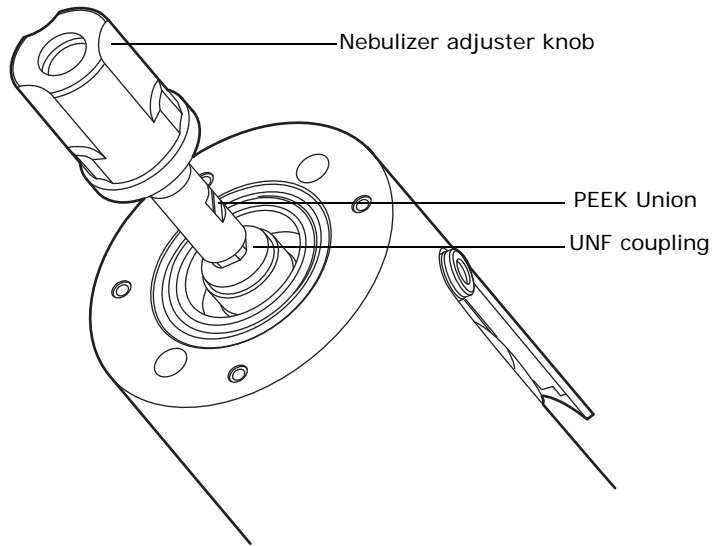
2. Use the 2.5-mm Allen wrench to remove the 4 probe end-cover retaining screws.



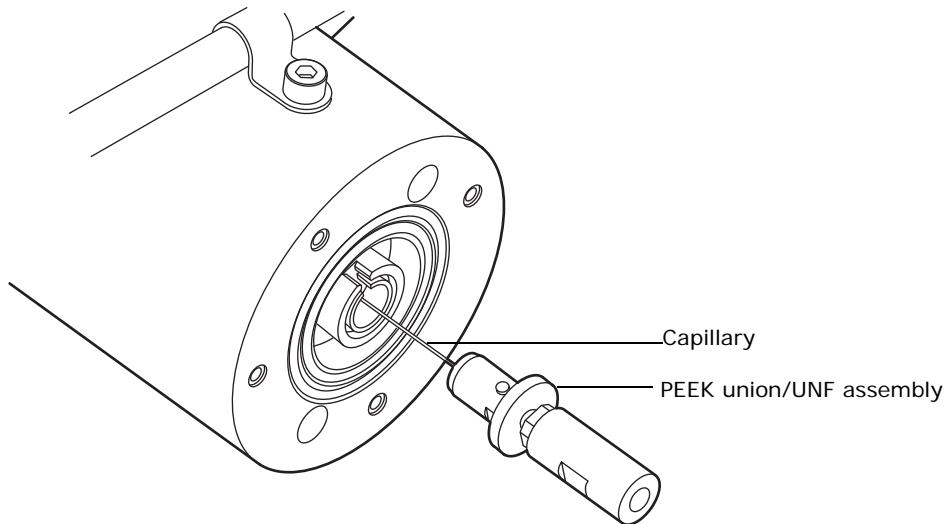
3. Remove the probe end cover assembly.



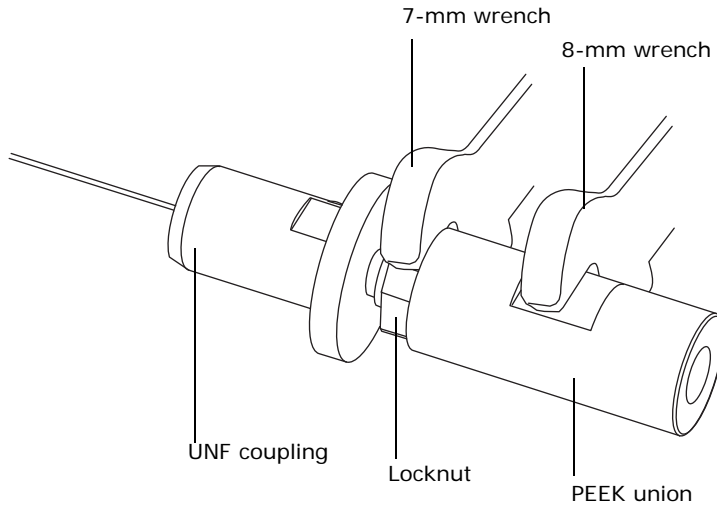
4. Unscrew and remove the nebulizer adjuster knob to reveal the PEEK union and UNF coupling.



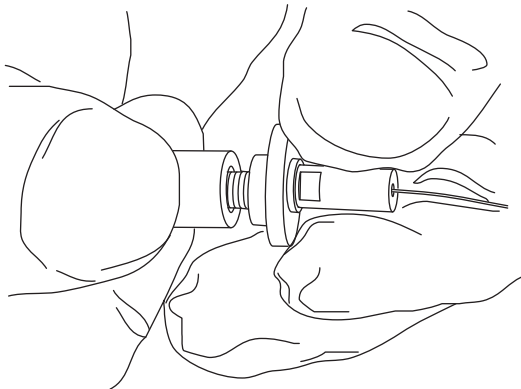
5. Remove the PEEK union/UNF coupling assembly, and capillary from the probe.



6. Grip the PEEK union with the 8-mm wrench and use the 7-mm wrench to loosen the locknut.

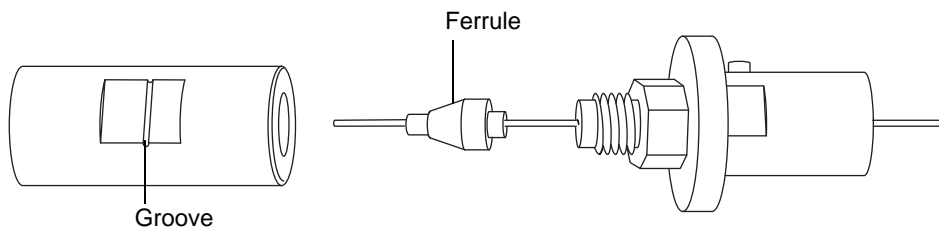


7. Unscrew the PEEK union from the UNF coupling.
Tip: This connection is finger-tight only.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, dispose of the capillary and ferrule in accordance with local environmental regulations.

8. Remove the capillary and ferrule from the UNF coupling and dispose of them safely.



Tip: The groove on the PEEK union indicates that it is a wide-bore PEEK union, as required by APCI capillaries. Retain it for reassembly.

5.21.2 Installing the new capillary



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- 7-mm wrench
- 8-mm wrench
- 2.5-mm Allen wrench
- Length of red PEEK tubing
- LC pump
- HPLC-grade, or better, 1:1 acetonitrile/water
- Replacement capillary
- Replacement ferrule

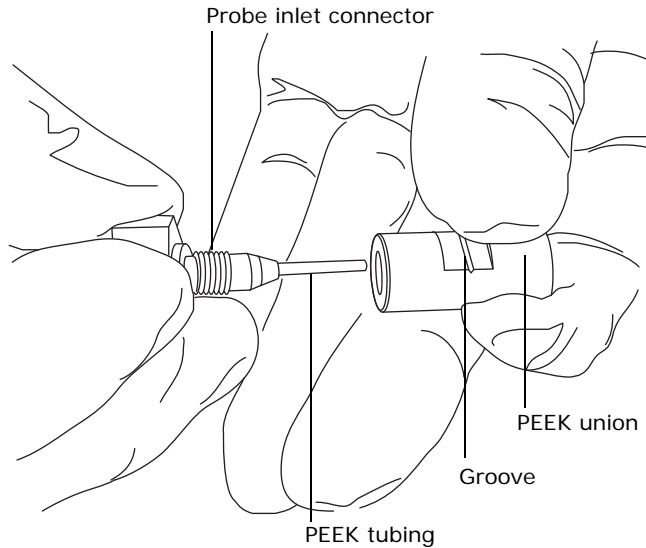
To install the new capillary:

1. Insert a square-cut length of red PEEK tubing in the probe inlet connector, and screw the connector, finger-tight, into the PEEK union.

Tips:

- This step ensures a minimum dead volume when fitting the capillary.

- The groove on the PEEK union indicates that it is a wide-bore PEEK union as required by APCI capillaries.

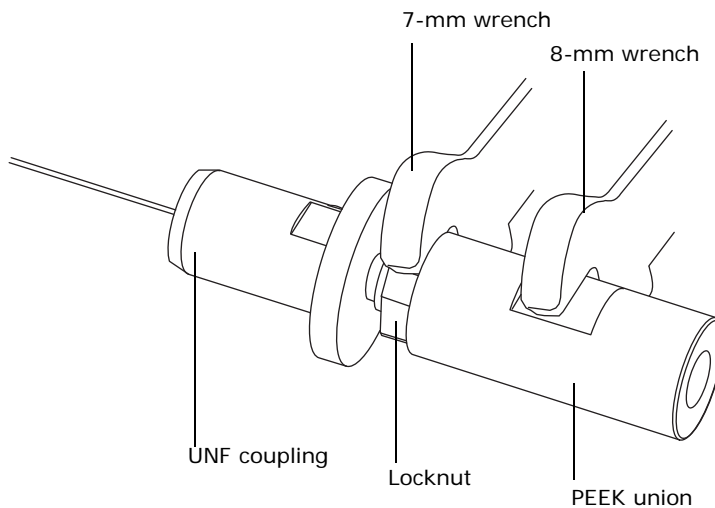


2. Fit the UNF coupling to the new capillary.
3. Use the needle-nose pliers to slide a new ferrule onto the capillary.
4. To avoid interference with the capillary fit, screw the locknut towards the body of the UNF coupling.
5. Insert the capillary in the PEEK union, and ensure that it is fully seated.
6. Screw the UNF coupling into the PEEK union, finger-tight only.
7. Pull on the capillary gently, testing to ensure that it stays in place.

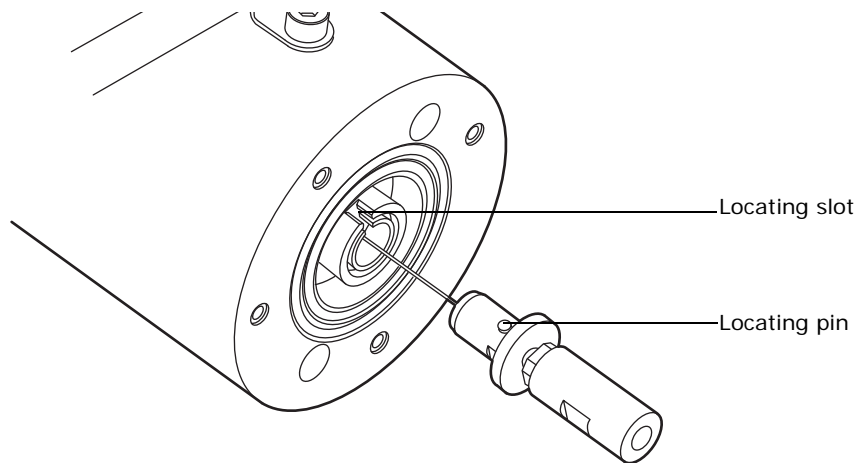


Warning: To prevent the PEEK union from loosening when the LC line is fitted, ensure that the locknut is appropriately tightened.

8. Grip the PEEK union with the 8-mm wrench, and use the 7-mm wrench to tighten the locknut against the PEEK union.

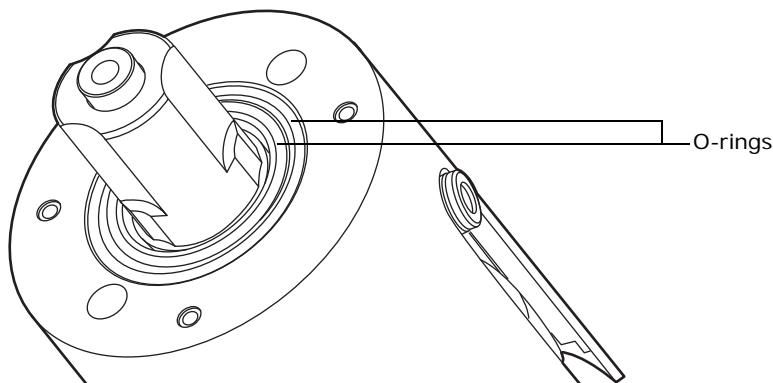


9. Check for leaks in the assembly by attaching the free end of the PEEK tubing to an LC pump and pumping 1:1 acetonitrile/water at 1 mL/min.
 10. If leakage occurs, disassemble and remake the connection, and repeat the leak test.
 11. When performing the leak test, check the backpressure on the LC pump, which will be high if the capillary is blocked.
- Requirement:** If you determine the capillary is blocked, replace it.
12. When the leak test has been performed successfully, disconnect the PEEK tubing from the LC pump.
 13. Remove the probe inlet connector and PEEK tubing from the PEEK union.
 14. Carefully thread the capillary through the probe assembly.
 15. Depress the PEEK union so that the locating pin on the UNF coupling is fully engaged in the locating slot at the head of the probe assembly.



16. When the union is fully depressed, fit and tighten the nebulizer adjuster knob. Do not tighten the knob fully.

! **Notice:** To ensure any potential leaks are managed and drain through the spout, ensure the 2 O-ring seals are present before fitting the probe end-cover.



17. Fit the probe end-cover to the probe assembly.

18. Use the 2.5-mm Allen wrench to fit, and tighten the 4 end-cover securing screws.
19. Fit the probe to the instrument (see [page 50](#)).

5.22 Cleaning or replacing the corona pin



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



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



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



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



Notice: To avoid damage to the instrument, do not apply any downward force to the source enclosure door while the door is open.



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- HPLC-grade, or better, methanol
- Lint-free tissue

To clean or replace the corona pin:

1. Remove the corona pin from the source (see [page 45](#)).
2. Replace the pin if it is deformed or otherwise damaged.

Requirement: Otherwise clean the tip of the pin with the lapping film, and then wipe it clean with a methanol-saturated tissue.

3. Install the corona pin in the source (see [page 43](#)).

5.23 Replacing the APCI probe heater

Replace the APCI probe heater if it fails to heat.



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

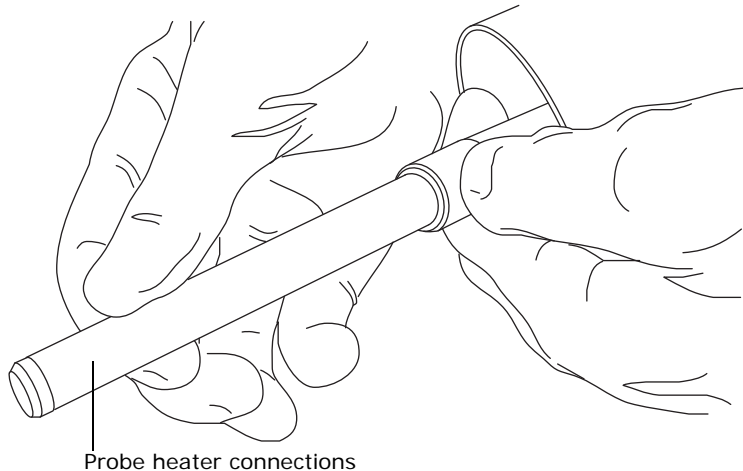
- Chemical-resistant, powder-free gloves
- Replacement probe heater

To replace the APCI probe heater:

1. Remove the probe from the source (see [page 53](#)).

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

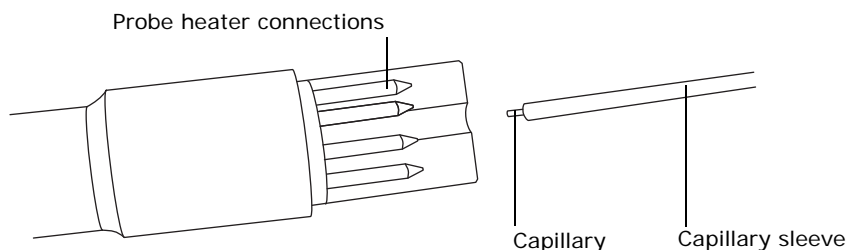
2. Gripping the probe heater as shown, carefully pull it off the probe assembly.



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

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

- Carefully slide the replacement probe heater over the capillary sleeve on the probe assembly



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

- Fit the probe heater to the probe assembly, ensuring that the heater is fully seated on the probe assembly.
- Fit the probe to the instrument (see [page 50](#)).

5.24 Replacing the ion block source heater

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



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

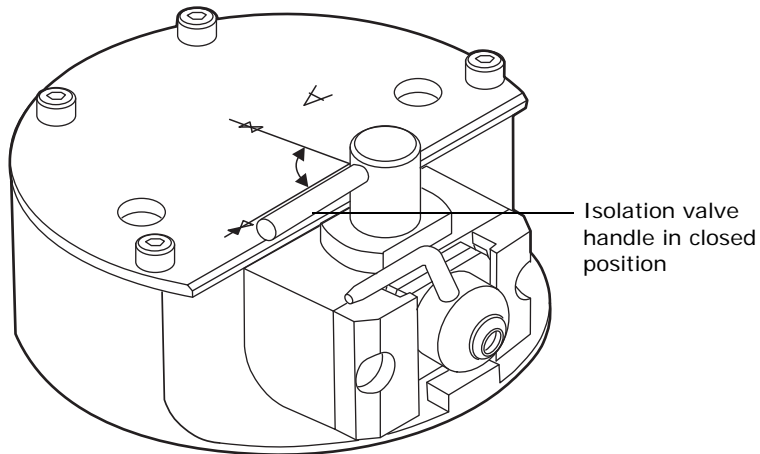
Required materials:

- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- 1.5-mm and 2.5-mm Allen wrenches

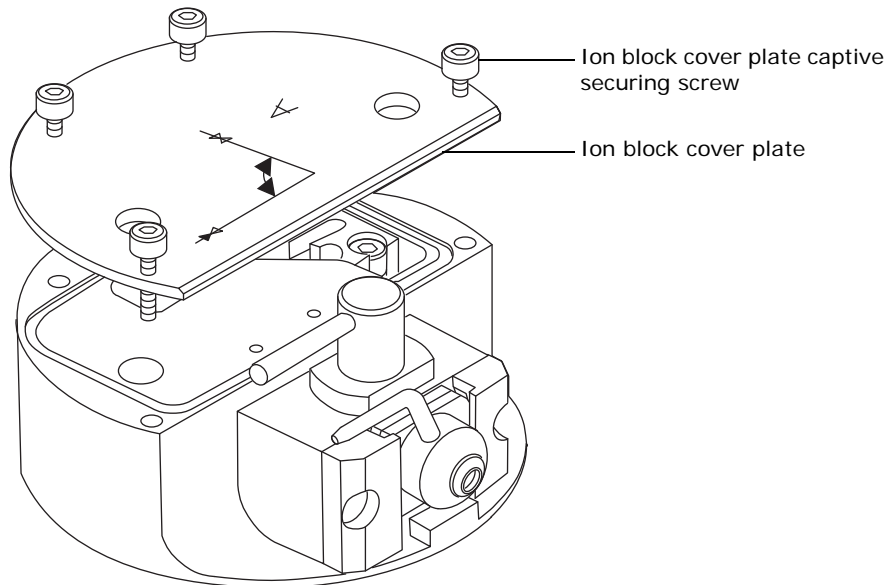
To replace the ion block source heater:

- Remove the ion block assembly from the instrument (see [page 78](#)).

2. Ensure that the isolation valve is closed.

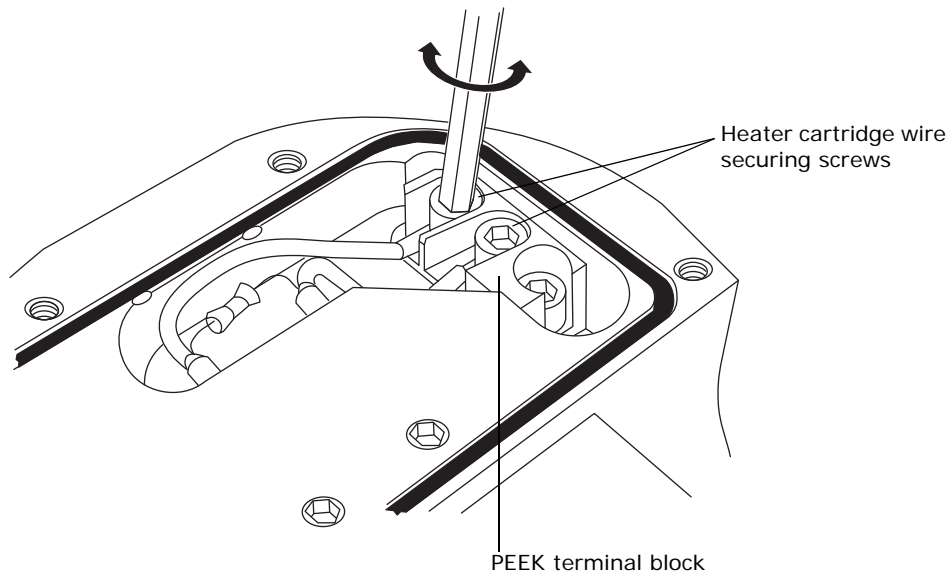


3. Use the 2.5-mm Allen wrench to loosen the 4 captive screws securing the ion block cover plate.

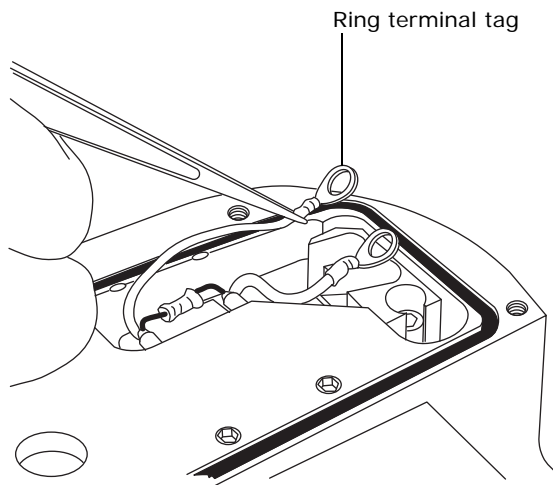


4. Remove the ion block cover plate.

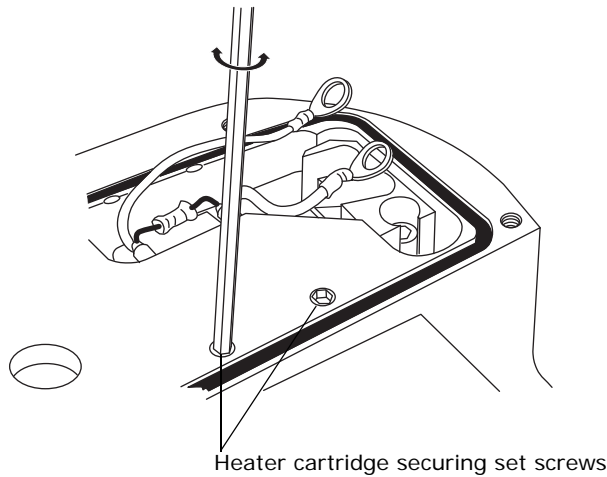
5. Use the 1.5-mm Allen wrench to remove the 2 screws securing the heater wires to the PEEK terminal block.



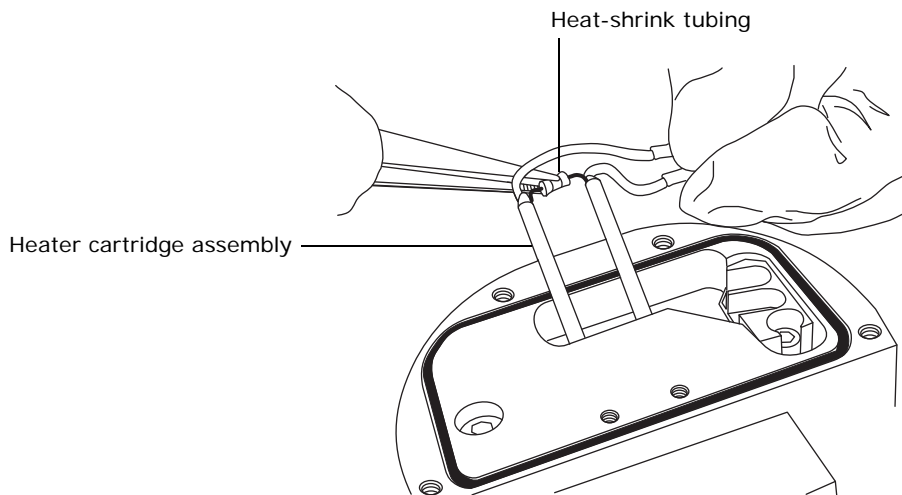
6. Use the needle-nose pliers to carefully swing the ring terminal tags out of the terminal block.



7. If the 2 set screws securing the heater cartridge to the PEEK terminal block are fitted, use the 1.5-mm Allen wrench to loosen them.



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



9. Dispose of the heater cartridge assembly.

! **Notice:** To avoid damaging the heater cartridge assembly wires, do not bend or twist them either side of the heater cartridge assembly heat-shrink tubing when fitting the assembly to the ion block.

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

! **Notice:** To avoid damage to the heater cartridge, do not overtighten the set screws.

11. If the 2 set screws securing the heater cartridge to the PEEK terminal block are fitted, use the 1.5-mm Allen wrench to fit and tighten them.

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

12. Use the needle-nose pliers to position the 2 heater wire ring tags fully down on the PEEK block terminals.

13. Use the 1.5-mm Allen wrench to fit and tighten the 2 screws securing the heater wires to the PEEK terminal block.

14. Fit the ion block cover plate to the ion block assembly, and then use the 2.5-mm Allen wrench to tighten the 4 captive screws securing ion block cover plate.

15. Fit the ion block assembly to the instrument (see [page 89](#)).

5.25 Replacing the source assembly seals



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

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

- Source enclosure door seal
- Source enclosure door glass seal
- Source enclosure housing seal
- Source enclosure side flange seal
- Probe adjuster assembly probe seal
- Probe adjuster assembly flange seal

To complete this procedure, you must pressure test the source, as described in the *Waters Source Pressure Test Unit Operator's Guide*.

5.25.1 Removing the source enclosure from the instrument



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- 5-mm Allen wrench

To remove the source enclosure:

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



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

2. Remove the probe from the source.
 - If you are removing an ESI probe, see [page 46](#).
 - If you are removing an IonSABRE APCI probe, see [page 53](#).



Notice: To avoid damage to the instrument, do not apply any downward force to the source enclosure door while the door is open.

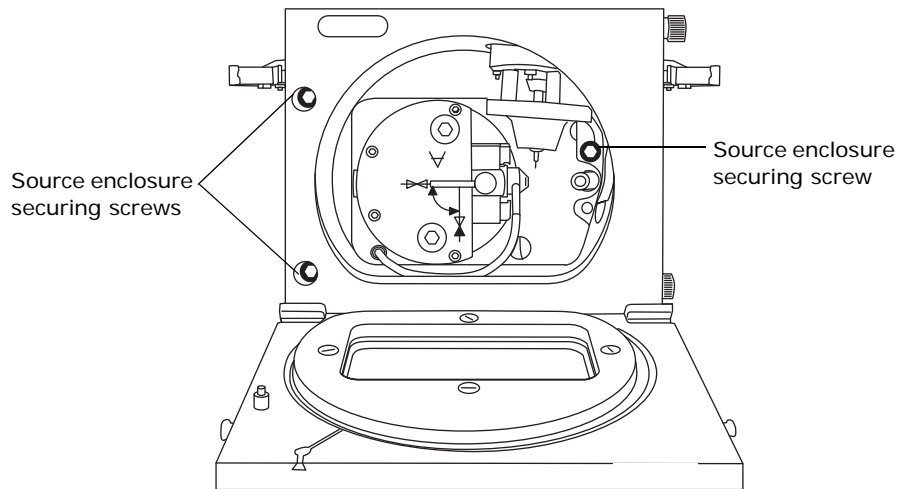
3. Open the source enclosure door by releasing both spring-clips and lowering the door towards you.



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

4. If using ESCi mode or an IonSABRE APCI probe, carefully remove the corona pin (see [page 45](#)).
5. Disconnect the probe's electrical connection at the instrument's front panel.
6. Disconnect the PTFE tubing at the desolvation gas connection on the front panel.
7. Disconnect the 2-pin connector at the rear of the source enclosure.

- Use the 5-mm Allen wrench to loosen the 3 captive source enclosure securing screws.



! **Notice:** To avoid damage to the instrument, do not apply any downward force to the source enclosure door when removing the source enclosure from the instrument's housing.

- Remove the source enclosure from the instrument.

5.25.2 Disassembling the source enclosure and probe adjuster assembly



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



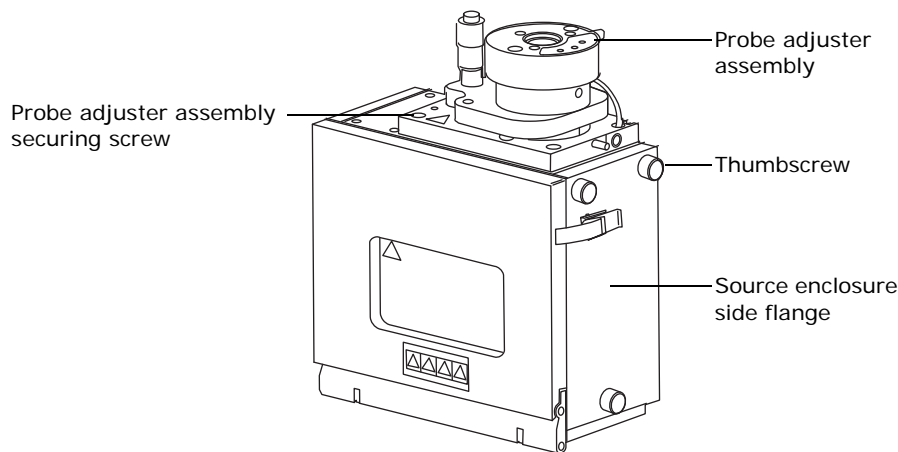
Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- 4-mm Allen wrench

To dismantle the source enclosure and probe adjuster assembly:

1. Use the 4-mm Allen wrench to remove the 4 screws securing the probe adjuster assembly to the source enclosure.



2. Remove the probe adjuster assembly from the source enclosure.
3. Unscrew and remove the 3 thumbscrews and door spring-clip that secure the source enclosure side flange to the source enclosure.
4. Remove the source enclosure side flange from the source enclosure.

5.25.3 Removing the seals from the source enclosure and probe adjuster assembly



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



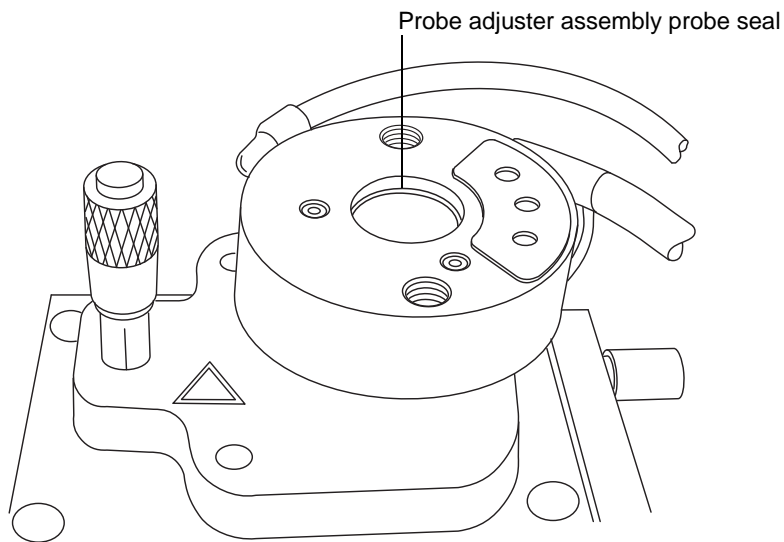
Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

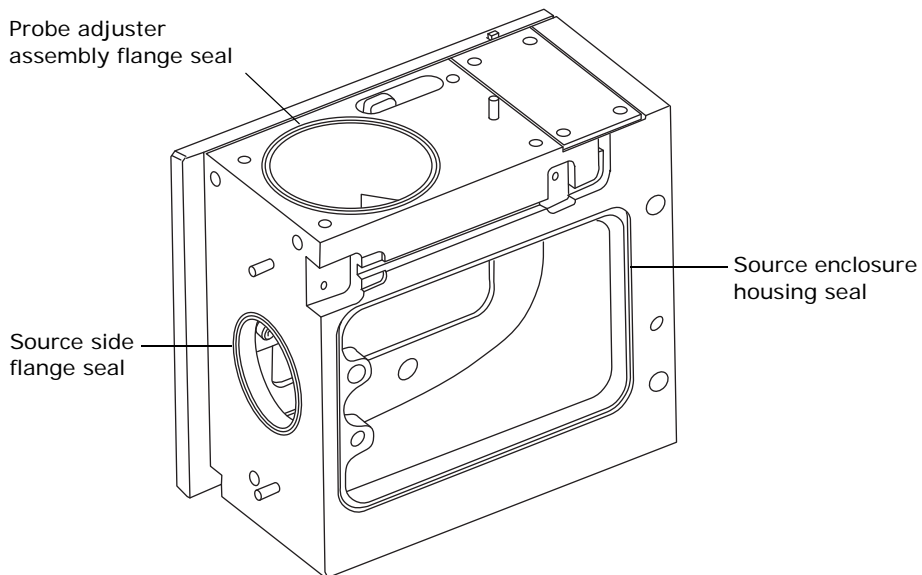
- Chemical-resistant, powder-free gloves
- Flat-blade screwdriver
- O-ring removal kit

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

1. Use the O-ring removal kit to carefully remove the probe adjuster assembly probe seal from the probe adjuster assembly (see [page 61](#)).



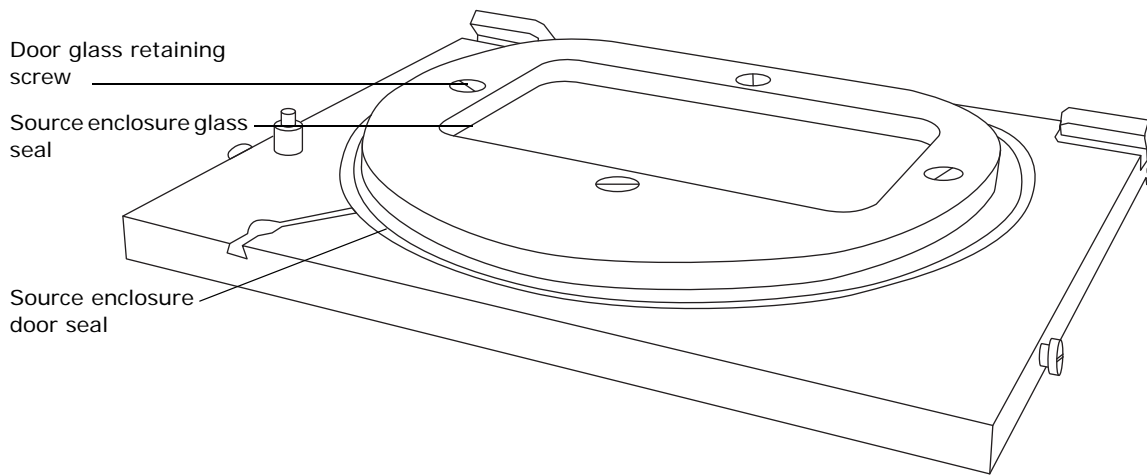
2. Use the O-ring removal kit to carefully remove the following seals from the source enclosure:
 - Source enclosure housing seal
 - Source enclosure side flange seal
 - Probe adjuster assembly flange seal



! **Notice:** To avoid damage to the instrument, do not apply any downward force to the source enclosure door while the door is open.

3. Open the source enclosure door by releasing both spring-clips and lowering the door towards you.

4. Use the O-ring removal kit to carefully remove the seal from the source enclosure door.



5. Use the screwdriver to remove the 4 screws securing the glass-retaining plate to the source enclosure door.
6. Remove the plate from the source enclosure door.
7. Remove the glass from the source enclosure door.
8. Use the O-ring removal kit to carefully remove the door glass seal from the source enclosure door.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, dispose of all the seals in accordance with local environmental regulations.

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

5.25.4 Fitting the new source enclosure and probe adjuster assembly seals



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

! **Notice:** To avoid damage to the instrument, do not apply any downward force to the source enclosure door while the door is open.



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

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

To fit the new source enclosure and probe seals:

1. Ensure that all the grooves for seals are free from dirt and debris.
Tip: If contamination is present, use 1:1 methanol/water, applied to a lint-free cloth, to carefully clean the grooves.
2. Fit the new door glass seal to the source enclosure door.
3. Fit the glass to the source enclosure door.
4. Fit the glass retaining plate to the source enclosure door.
! **Notice:** The 4 screws securing the glass retaining plate must be sequentially and incrementally tightened until they are all fully tight.
5. Fit and tighten the 4 screws securing the glass retaining clips to the source enclosure door.
! **Notice:** Ensure that the tails of the source enclosure door seals are correctly located in the groove when fitting them to the source enclosure door.
6. Fit the new source enclosure door seal to the source enclosure door.
7. Close the source enclosure door, and secure it with both spring-clips.
8. Fit the following new seals to the source enclosure:
 - Source enclosure housing seal
 - Source enclosure side flange seal
 - Probe adjuster assembly flange seal
9. Fit the new probe adjuster assembly probe seal to the probe adjuster assembly.

5.25.5 Assembling the probe adjuster assembly and source enclosure



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- 4-mm Allen wrench

To assemble the probe adjuster assembly and source enclosure:

1. Fit the source enclosure side flange to the source enclosure.
! **Notice:** The source enclosure side flange securing thumbscrews must each be sequentially and incrementally tightened until they are all fully tight.

2. Fit and tighten the 3 thumbscrews that secure the source enclosure side flange to the source enclosure.
3. Fit the probe adjuster assembly to the source enclosure.
 - ! **Notice:** The probe adjuster assembly securing screws must each be sequentially and incrementally tightened until they are all fully tight.
4. Use the 4-mm Allen wrench to fit and tighten the 4 screws securing the probe adjuster assembly to the source enclosure.

5.25.6 Fitting the source enclosure to the instrument

Required materials:



Warning: To avoid possible excessive leakage of biohazardous or toxic solvent vapor into the laboratory atmosphere, perform the procedure exactly as described in this section.

- ! **Notice:**
 - To avoid recontaminating the source, wear clean, chemical-resistant, powder-free gloves during this procedure.
 - To avoid damage to the instrument, do not apply any downward force to the source enclosure door when fitting the source enclosure to the instrument's housing.



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

- Chemical-resistant, powder-free gloves
- 5-mm Allen wrench

To fit the source enclosure to the instrument:

1. Ensuring that the wires to the microswitch do not become trapped between the source enclosure and the instrument's housing, fit the source enclosure to the housing.
 - ! **Notice:** The source enclosure securing screws must each be sequentially and incrementally tightened until they are all fully tight.
2. Use the 5-mm Allen wrench to tighten the 3 captive screws securing the source enclosure.
3. Connect the 2-pin connector at the rear of the source enclosure.
4. Connect the PTFE tubing to the desolvation gas connection at the instrument's front panel
5. Connect the probe's electrical connection at the instrument's front panel.



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

6. If using ESCi mode or an IonSABRE APCI probe, carefully fit the corona pin (see [page 43](#)).
7. Close the source enclosure door, and secure it with both spring-clips.
8. Fit the probe to the source.
 - If you are fitting an ESI probe, see [page 40](#).
 - If you are fitting an IonSABRE APCI probe, see [page 50](#).
9. Start the instrument (see [page 29](#)).



Warning: To confirm the integrity of the source exhaust system, a source pressure test must be performed, as described in the *Waters Source Pressure Test Unit Operator's Guide*.

10. Perform a source pressure test, as described in the *Waters Source Pressure Test Unit Operator's Guide*.

5.26 Maintaining the instrument air filters

5.26.1 Cleaning the air filter inside the instrument's lower bezel

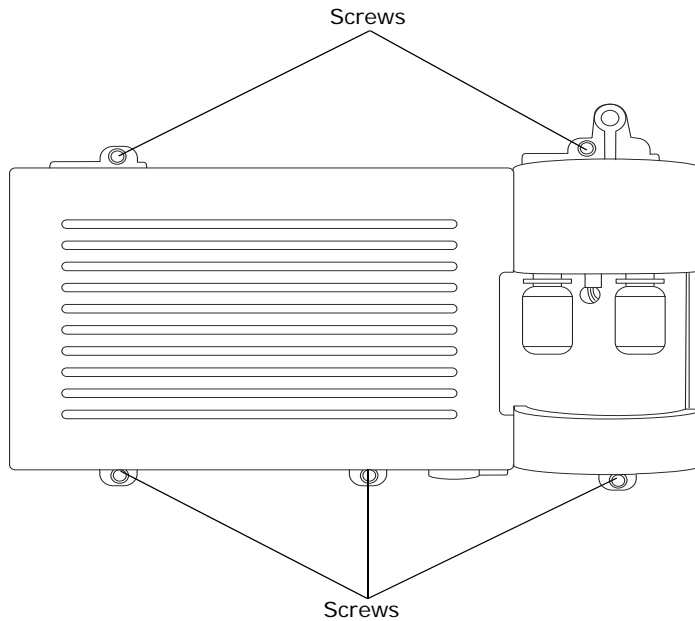
Required materials:

- T10 TORX[®] driver
- Vacuum cleaner

To clean the air filter inside the instrument's lower bezel:

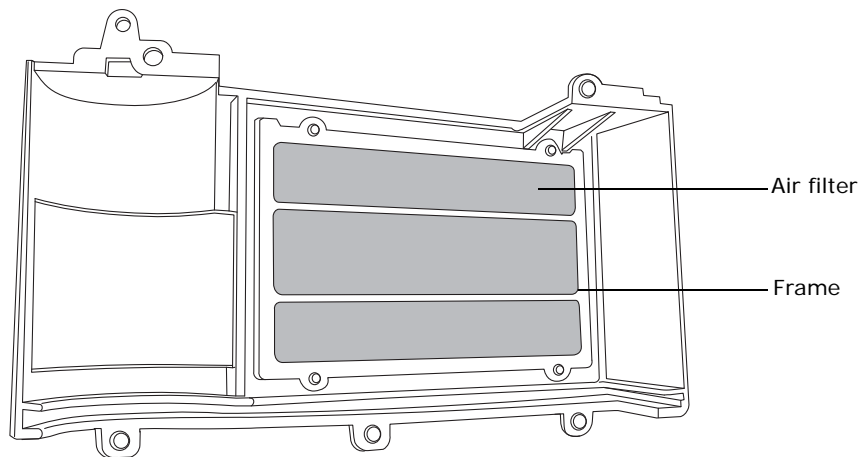
1. Use the T10 TORX driver to remove the 5 screws that secure the lower bezel in place.

Figure 5–6: Instrument's lower bezel



2. Use a vacuum cleaner to clean the air filter located inside the instrument's lower bezel.

Figure 5–7: Air filter inside the instrument's lower bezel



3. Reinstall the lower bezel.

5.26.2 Replacing the air filter inside the lower bezel

If you cannot clean the air filter by vacuuming, replace it with a new filter.

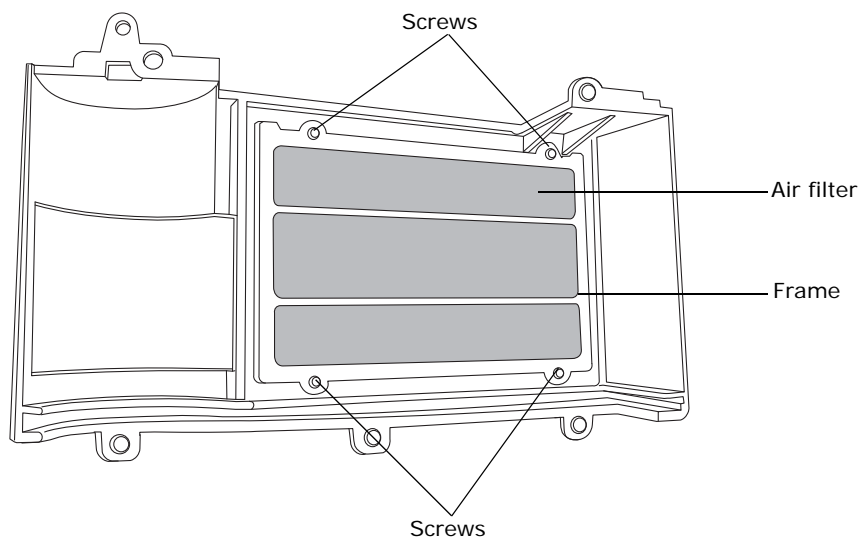
Required materials:

- T10 TORX driver
- TQ Detector lower bezel air filter

To replace the air filter inside the lower bezel:

1. Remove the 5 screws that secure the lower bezel in place (see the figure on [page 124](#)).
2. Use the T10 TORX driver to remove the 4 screws that secure the air filter frame and air filter to the inside of the lower bezel.

Figure 5–8: Air filter inside the lower bezel



3. Remove the air filter from the air filter frame and dispose of it.
4. Align the new air filter within the air filter frame.
5. Use the T10 TORX driver to fit and tighten the 4 screws securing the air filter and frame to the inside of the lower bezel.
6. Reinstall the lower bezel.

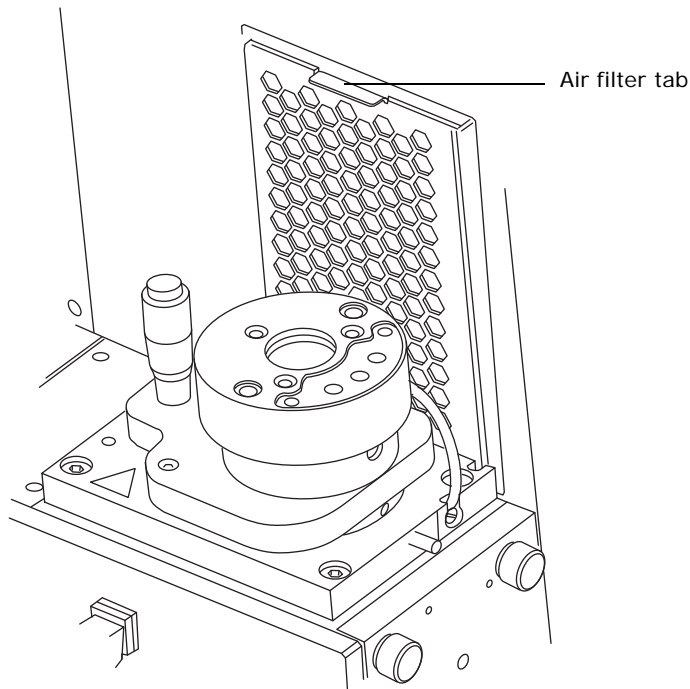
5.26.3 Cleaning the air filter behind the source probe

Required material: Vacuum cleaner

To clean the air filter behind the source probe:

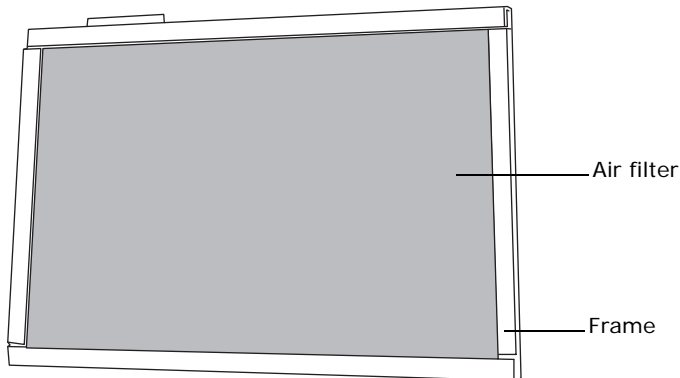
1. Remove the probe from the source.
 - If you are removing an ESI probe, see [page 46](#).
 - If you are removing an IonSABRE APCI probe, see [page 53](#).
2. Grasp the air filter tab, and remove the air filter frame by lifting it toward you.

Figure 5–9: Air filter tab



3. Use a vacuum cleaner to clean the air filter.

Figure 5–10: Air filter removed from behind the source probe



4. Reinstall the air filter.
5. Fit the probe to the source.
 - If you are fitting an ESI probe, see [page 40](#).
 - If you are fitting an IonSABRE APCI probe, see [page 50](#).

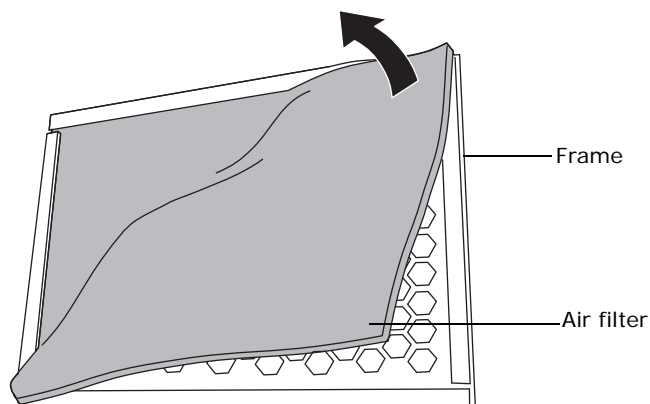
5.26.4 Replacing the air filter behind the source probe

To replace the air filter behind the source probe:

1. Remove the probe from the source.
 - If you are removing an ESI probe, see [page 46](#).

- If you are removing an IonSABRE APCI probe, see [page 53](#).
2. Grasp the air filter tab and remove the air filter frame by lifting it toward you (see the figure on [page 126](#)).
 3. Remove the air filter from the air filter frame and dispose of it.

Figure 5–11: Removing air filter from frame



4. Insert the new air filter in the air filter frame.
5. Reinstall the air filter.
6. Fit the probe to the source.
 - If you are fitting an ESI probe, see [page 40](#).
 - If you are fitting an IonSABRE APCI probe, see [page 50](#).

5.27 Replacing the roughing pump oil

Change the roughing pump oil annually.

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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- 8-mm Allen wrench
- Flat-blade screwdriver
- Container to catch used oil
- Funnel
- 1-L container of Anderol vacuum oil, type GS 495

To replace the roughing pump oil:

1. Gas ballast the roughing pump for 1 hour to reduce the oil viscosity (see [page 66](#)).

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

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

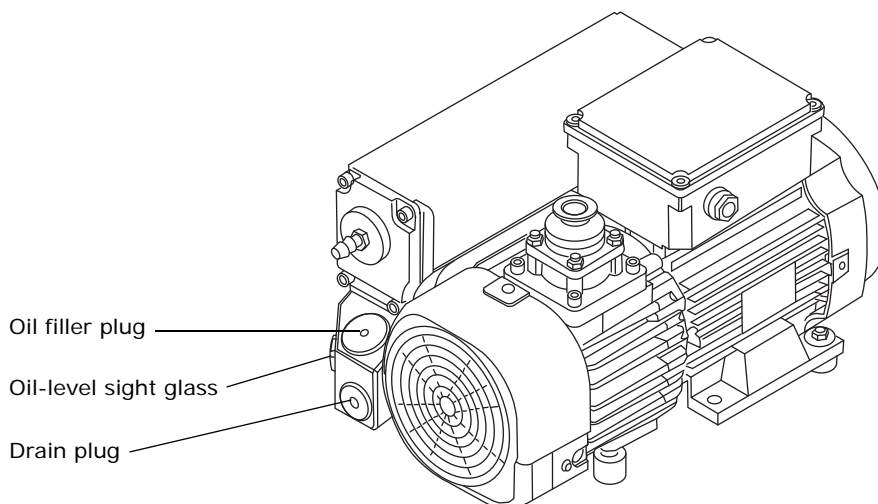


Warning: To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when adding or replacing oil. The roughing pump oil can be irritant, or contaminated with biohazardous or toxic analyte accumulated during normal operation.



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

4. Place the container for used oil under the pump's drain plug.
5. Use the 8-mm Allen wrench to remove the oil filler plug.



6. Use the 8-mm Allen wrench to remove the oil drain plug.
7. Tip the pump toward the drain plug aperture and allow the oil to drain completely into the container.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, dispose of the roughing pump oil in accordance with local environmental regulations.

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

- ! **Notice:** To avoid oil leakage when fitting the oil drain plug to the roughing pump, observe these precautions:
- Ensure that the plug is not cross-threaded.
 - Ensure that the O-ring is not pinched.
 - Do not overtighten the plug.

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

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

- ! **Notice:** To maintain pump performance, use Anderol vacuum oil, type GS 495.

11. Using the funnel, pour all the oil from the 1-L container into the oil filler aperture.
12. Wait a few minutes, and then recheck the oil level.
13. Ensure that the O-ring on the oil filler plug is clean and properly seated.

- ! **Notice:** To avoid oil leakage when fitting the oil filler plug to the roughing pump, observe these precautions:
- Ensure that the plug is not cross-threaded.
 - Ensure that the O-ring is not pinched.
 - Do not over tighten the plug.

14. Use the 8-mm Allen wrench to refit the oil filler plug.
15. Start the instrument (see [page 29](#)).
16. Gas-ballast the roughing pump (see [page 66](#)).

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

- The oil level drops slightly during the first month of operation.
- The oil changes color (darkens) over time.
- After running the pump for 12 to 48 hours, it is common to see a few drops of oil near the filler plug. Excess oil around the lip of the filler plug will run down and drip off the pump once the pump reaches operating temperature.
- When the pump begins to run at normal operating temperature, spilled oil smells slightly.

5.28 Replacing the roughing pump's oil demister element

Replace the roughing pump's oil demister element annually.

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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

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

To remove the roughing pump oil demister element:

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

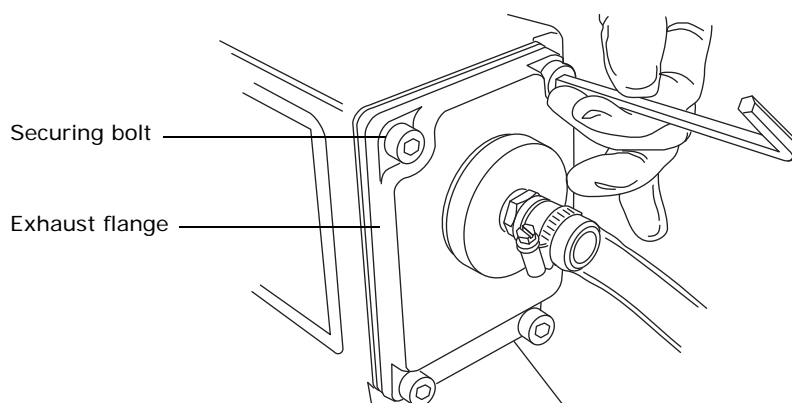


Warning: To avoid personal contamination with biohazards or toxic materials, and to avoid spreading contamination to uncontaminated surfaces, wear clean, chemical-resistant, powder-free gloves when replacing the oil demister element. The roughing pump oil can be irritant, or contaminated with biohazardous or toxic analyte accumulated during normal operation.

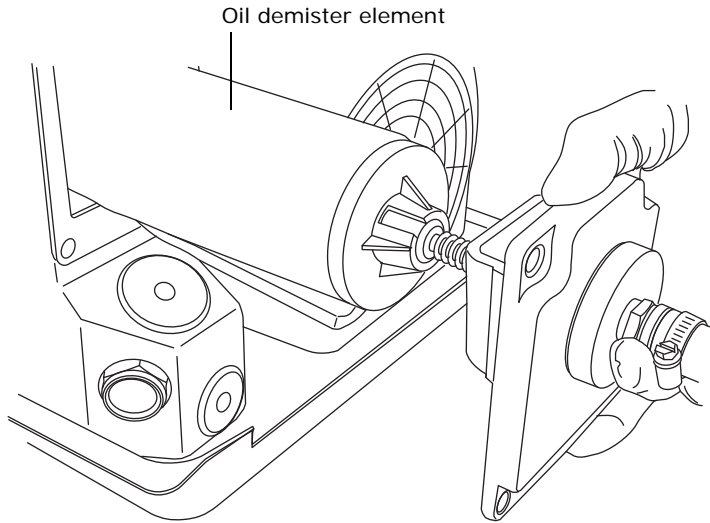


Warning: To avoid burn injuries, take great care while working with the roughing pump: it can be hot.

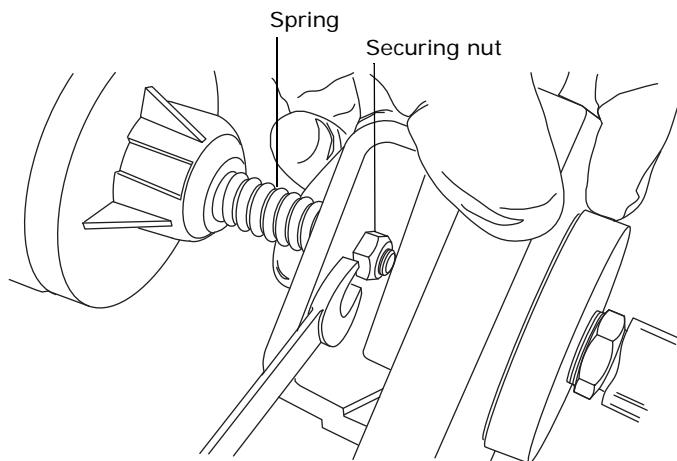
3. Use the 6-mm Allen wrench to remove the 4 bolts securing the exhaust flange to the roughing pump.



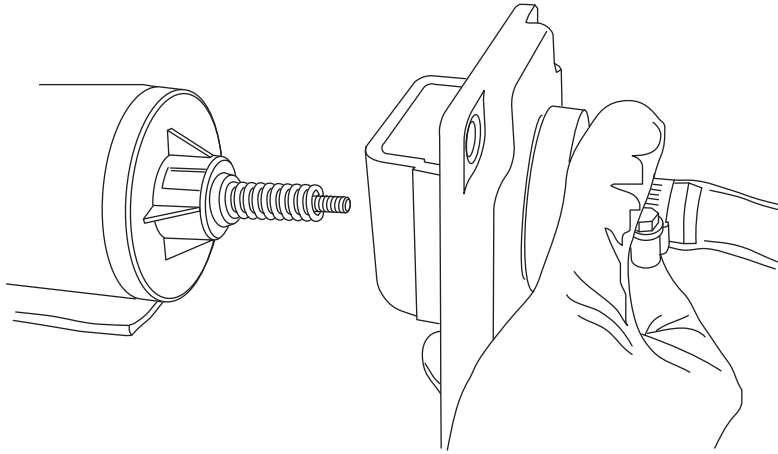
- Using both hands, carefully remove the exhaust flange and oil demister element from the roughing pump.



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



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



7. Remove the spring from the oil demister element.



Warning: To prevent contaminating the environment with biologically hazardous or toxic materials, dispose of the oil demister element in accordance with local environmental regulations.

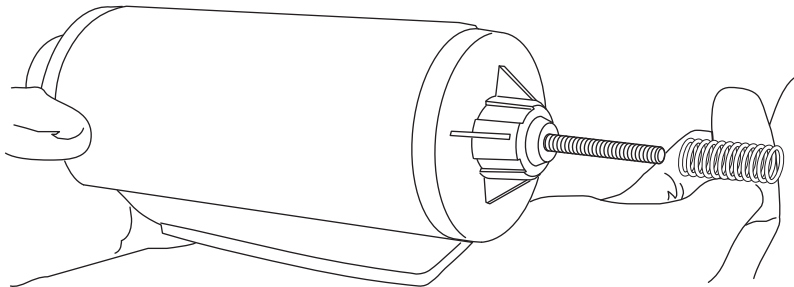
8. Dispose of the oil demister element in accordance with local environmental regulations.

To fit the new oil demister element:



Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing this procedure. The pump oil can be contaminated with analyte accumulated during normal operation.

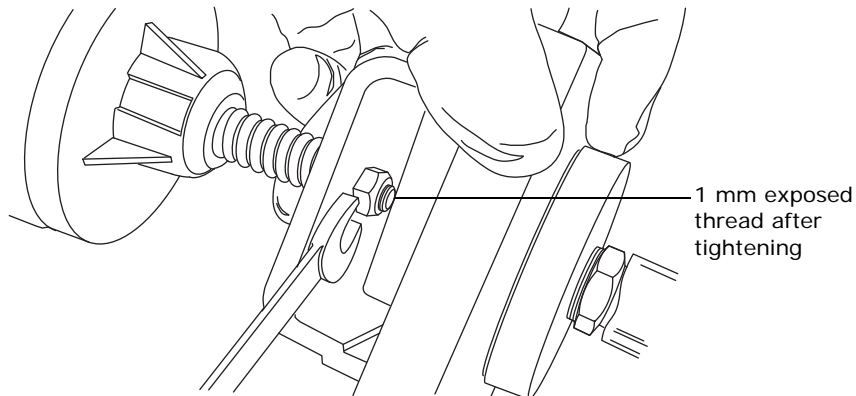
1. Fit the spring to the new oil demister element.



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

! **Notice:** To avoid overtightening the nut that secures the oil demister element to the exhaust flange, ensure that only approximately 1 mm of thread is exposed beyond the nut when it is tightened.

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



4. Ensure that the inscription "TOP" is at the top of the oil demister element, and, using both hands, carefully fit the oil demister element and exhaust flange to the roughing pump.

! **Notice:** The bolts securing the source exhaust flange to the roughing pump must each be sequentially and incrementally tightened until they are all fully tight.

5. Use the 6-mm Allen wrench to fit the 4 bolts securing the exhaust flange to the roughing pump.
6. Start the instrument (see [page 29](#)).


A Safety Advisories

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

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 appear in a manual's narrative sections or procedures, an accompanying statement identifies the applicable risk and explains how to avoid it.


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


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

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

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

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

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

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

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

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



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



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



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



Warning: (Risk of tipping.)



Warning: (Risk of explosion.)



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

A.1.1 Specific warnings

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

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

A.1.1.4 Biohazard warning

The following warning applies to Waters instruments and devices that can process material containing biohazards, which are substances that contain biological agents capable of producing harmful effects in humans.



Warning: To avoid infection with potentially infectious, human-sourced products, inactivated microorganisms, and other biological materials, assume that all biological fluids that you handle are infectious.

Specific precautions appear in the latest edition of the US National Institutes of Health (NIH) publication, *Biosafety in Microbiological and Biomedical Laboratories* (BMBL).

Observe Good Laboratory Practice (GLP) at all times, particularly when working with hazardous materials, and consult the biohazard safety representative for your organization regarding the proper use and handling of infectious substances.

A.1.1.5 Biohazard and chemical hazard warning

These warnings apply to Waters instruments and devices that can process biohazards, corrosive materials, or toxic materials.




Warning: To avoid personal contamination with biohazards, toxic materials, or corrosive materials, you must understand the hazards associated with their handling. Guidelines prescribing the proper use and handling of such materials appear in the latest edition of the National Research Council's publication, *Prudent Practices in the Laboratory: Handling and 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 or device can be subject to use or misuse that can damage it or compromise a non-clinical sample's integrity. The exclamation point symbol and its associated statement alert you to such risk.

 **Notice:** To avoid damaging the instrument's case, do not clean it with abrasives or solvents.

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 refilling or replacing solvent bottles.



Requirement: Wear clean, chemical-resistant, powder-free gloves when handling samples.

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.



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



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



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



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



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



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



注意: 未經有關法規認證部門明確允許對本設備進行的改變或改裝,可能會使使用者喪失操作該設備的合法性。



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



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



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

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



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

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



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

- In der Nähe von unter Druck stehenden Polymerschläuchen stets Schutzbrille tragen.
- Alle offenen Flammen in der Nähe löschen.
- Keine Schläuche verwenden, die stark geknickt oder überbeansprucht sind.
- Nichtmetallische Schläuche nicht für Tetrahydrofuran (THF) oder konzentrierte Salpeter- oder Schwefelsäure verwenden.

Durch Methylenchlorid und Dimethylsulfoxid können nichtmetallische Schläuche quellen; dadurch wird der Berstdruck des Schlauches erheblich reduziert.



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

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



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

- El usuario deberá protegerse siempre los ojos cuando trabaje cerca de tubos de polímero sometidos a presión.
- Si hubiera alguna llama las proximidades.
- No se debe trabajar con tubos que se hayan doblado o sometido a altas presiones.
- Es necesario utilizar tubos de metal cuando se trabaje con tetrahidrofurano (THF) o ácidos nítrico o sulfúrico concentrados.

Hay que tener en cuenta que el cloruro de metileno y el sulfóxido de dimetilo dilatan los tubos no metálicos, lo que reduce la presión de ruptura de los tubos.



警告：當在有壓力的情況下使用聚合物管線時，小心注意以下幾點。

- 當接近有壓力的聚合物管線時一定要戴防護眼鏡。
- 熄滅附近所有的火焰。
- 不要使用已經被壓癟或嚴重彎曲管線。
- 不要在非金屬管線中使用四氫呋喃或濃硝酸或濃硫酸。

要了解使用二氯甲烷及二甲基亞楓會導致非金屬管線膨脹，大大降低管線的耐壓能力。



警告：当有压力的情况下使用管线时，小心注意以下几点：

- 当接近有压力的聚合物管线时一定要戴防护眼镜。
- 熄灭附近所有的火焰。
- 不要使用已经被压瘪或严重弯曲的管线。
- 不要在非金属管线中使用四氢呋喃或浓硝酸或浓硫酸。

要了解使用二氯甲烷及二甲基亚枫会导致非金属管线膨胀，大大降低管线的耐压能力。



경고: 가압 폴리머 튜브로 작업할 경우에는 주의하십시오.

- 가압 폴리머 튜브 근처에서는 항상 보호 안경을 착용하십시오.
- 근처의 화기를 모두 끄십시오.
- 심하게 변형되거나 꼬인 튜브는 사용하지 마십시오.
- 비금속(Nonmetallic) 튜브를 테트라히드로푸란(Tetrahydrofuran: THF) 또는 농축 질산 또는 황산과 함께 사용하지 마십시오.

염화 메틸렌 (Methylene chloride) 및 디메틸술폭시드 (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、その場合、チューブは極めて低い圧力で破裂します。



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



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



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



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



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



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



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



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



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

A.6 Warnings that address the replacing of fuses

The following warnings pertain to instruments and devices equipped with user-replaceable fuses. Information describing fuse types and ratings sometimes, but not always, appears on the instrument or device.

Finding fuse types and ratings when that information appears on the instrument or device



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



Attention: pour éviter tout risque d'incendie, remplacez toujours les fusibles par d'autres du type et de la puissance indiqués sur le panneau à proximité du couvercle de la boîte à fusible de l'instrument.



Vorsicht: Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert auf den Tafeln neben den Sicherungsabdeckungen des Geräts gedruckt sind.



Attenzione: per garantire protezione contro gli incendi, sostituire i fusibili con altri dello stesso tipo aventi le caratteristiche indicate sui pannelli adiacenti alla copertura fusibili dello strumento.



Advertencia: Para evitar incendios, sustituir los fusibles por aquellos del tipo y características impresos en los paneles adyacentes a las cubiertas de los fusibles del instrumento.



警告：為了避免火災，更換保險絲時，請使用與儀器保險絲蓋旁面板上所印刷之相同類型與規格的保險絲。



警告：为了避免火灾，应更换与仪器保险丝盖旁边面板上印刷的类型和规格相同的保险丝。



경고：화재의 위험을 막으려면 기기 퓨즈 커버에 가까운 패널에 인쇄된 것과 동일한 타입 및 정격의 제품으로 퓨즈를 교체하십시오.





警告：火災予防のために、ヒューズ交換では機器ヒューズカバー脇のパネルに記載されているタイプおよび定格のヒューズをご使用ください。


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.


 **Attention:** pour éviter tout risque d'incendie, remplacez toujours les fusibles par d'autres du type et de la puissance indiqués dans la rubrique "Remplacement des fusibles" du chapitre traitant des procédures de maintenance.


 **Vorsicht:** Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert im Abschnitt "Sicherungen ersetzen" des Kapitels "Wartungsverfahren" angegeben sind.


 **Attenzione:** per garantire protezione contro gli incendi, sostituire i fusibili con altri dello stesso tipo aventi le caratteristiche indicate nel paragrafo "Sostituzione dei fusibili" del capitolo "Procedure di manutenzione".

 **Advertencia:** Para evitar incendios, sustituir los fusibles por aquellos del tipo y características indicados en la sección "Sustituir fusibles".

 **警告：**為了避免火災，更換保險絲時，應使用「維護步驟」章節中「更換保險絲」所指定之相同類型與規格的保險絲。

 **警告：**为了避免火灾，应更换“维护步骤”一章的“更换保险丝”一节中介绍的相同类型和规格的保险丝。

 **경고：**화재의 위험을 막으려면 유지관리 절차 단원의 "퓨즈 교체" 절에 설명된 것과 동일한 타입 및 정격의 제품으로 퓨즈를 교체하십시오.

 **警告：**火災予防のために、ヒューズ交換ではメンテナンス項目の「ヒューズの交換」に記載されているタイプおよび定格のヒューズをご使用ください。

A.7 Electrical and handling symbols

A.7.1 Electrical symbols

The following electrical symbols and their associated statements can appear in instrument manuals and on an instrument's front or rear panels.

Table A-1:













Symbol	Description
	Electrical power on
	Electrical power off
	Standby
	Direct current

Table A-1:

Symbol	Description
	Alternating current
	Alternating current (3 phase)
	Safety ground
	Frame, or chassis, terminal
	Fuse
	Functional ground
	Input
	Output

A.7.2 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.

Table A-2:

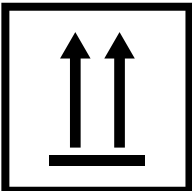


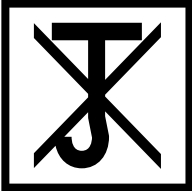
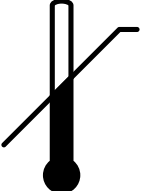
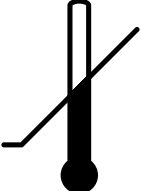
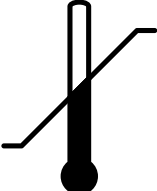
Symbol	Description
	Keep upright!
	Keep dry!
	Fragile!

Table A-2:

Symbol	Description
	Use no hooks!
	Upper limit of temperature
	Lower limit of temperature
	Temperature limitation

B External Connections

This appendix describes the instrument's external connections.



Warning: To avoid injury, Waters recommends that the instrument be lifted using suitable machinery and the supplied harness; the instrument is heavy.



Notice: To avoid damage,

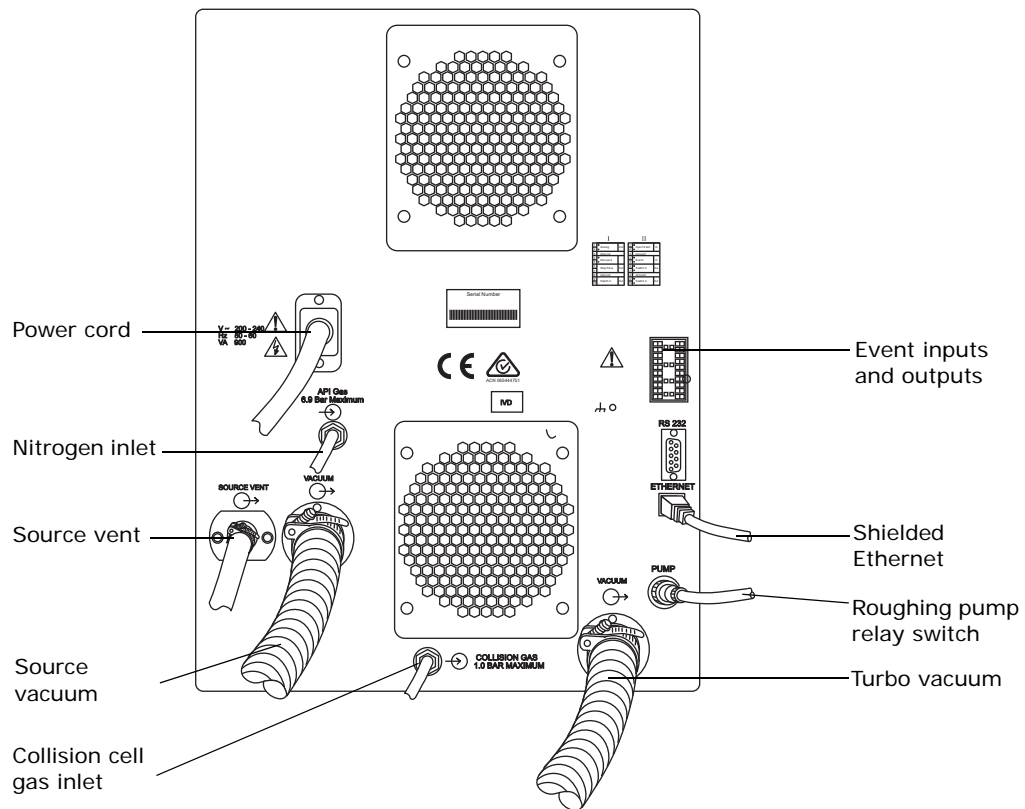
- contact Waters Technical Service before moving the instrument.
- if you must transport the instrument, or remove it from service, contact Waters Technical Service for recommended cleaning, flushing, and packaging procedures.

See [page 56](#).

B.1 External wiring and vacuum connections

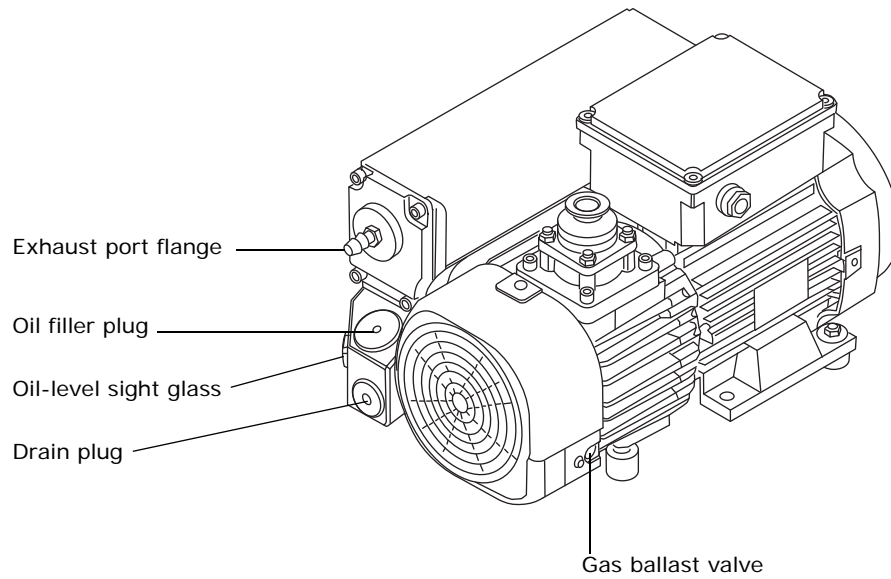
Rear panel connections appear in the figure below.

Figure B-1: Rear panel



B.2 Connecting the oil-filled roughing pump

Note: To connect the alternative dry roughing pump, see [page 154](#).

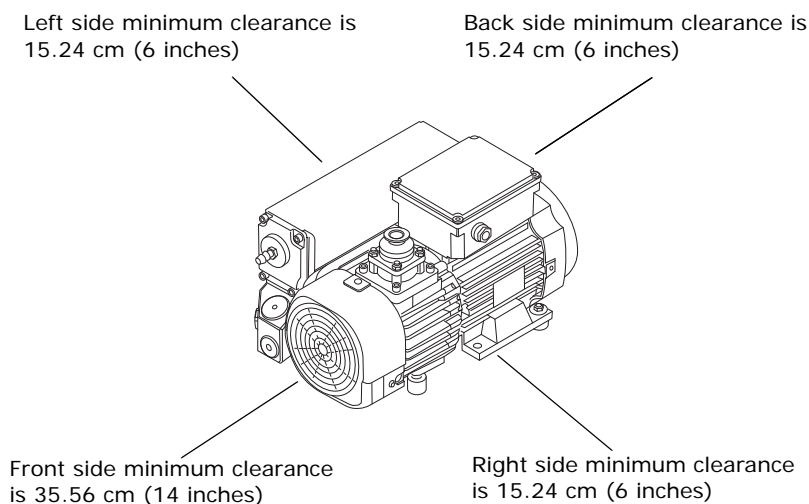


Warning: To avoid personal contamination with biologically hazardous or toxic materials, wear chemical-resistant, powder-free gloves while performing this procedure.



Notice:

- To ensure correct operation of the roughing pump, the pump must be installed within 1 degree of horizontal.
- The area where the roughing pump is located must have an ambient temperature of 15 to 40 °C (59 to 104 °F).
- To ensure proper ventilation, the pump must be installed with the following minimum clearances:




Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

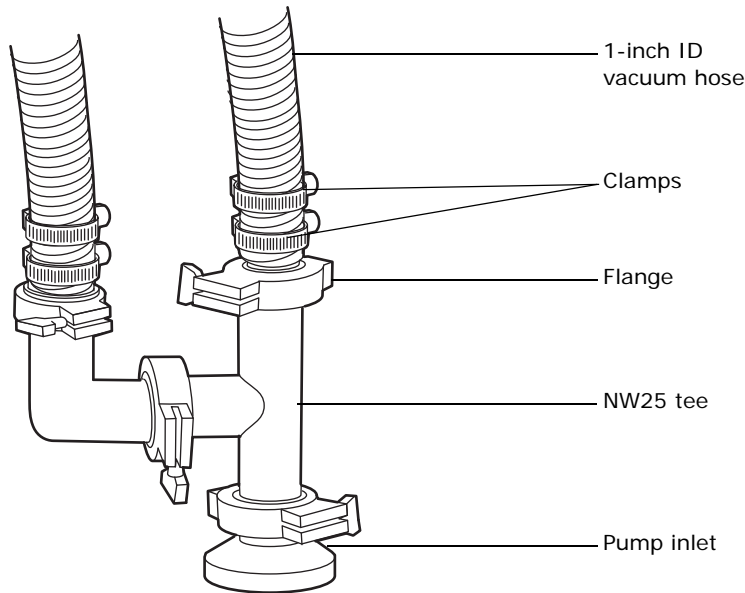
- Chemical-resistant, powder-free gloves
- 7-mm nut driver
- 8-mm Allen wrench
- Sharp knife
- 1-L exhaust trap bottle (included in the startup kit)
- Elbows (included in the Waters Rough Pump Connect Kit)
- NW25 tee (included in the startup kit)
- NW25 center rings (included in the startup kit)
- NW25 clamps (included in the startup kit)
- PVC exhaust tubing (included in the Waters Rough Pump Connect Kit)
- PVC hose clamps (included in the Waters Rough Pump Connect Kit)
- 1-inch ID vacuum hose (included in the Waters Rough Pump Connect Kit)

To connect the roughing pump:

Requirement: The pump must be oriented in a way that allows easy daily access to the gas ballast valve and oil-level sight glass.

1. Place the PTFE drip tray on the floor, within 5 feet of the instrument.
 **Warning:** To avoid injury, at least two people must lift the roughing pump; the pump is heavy.

2. Place the pump on the PTFE drip tray.
3. Attach the NW25 tee, included in the startup kit, to the inlet of the pump using the NW25 center ring, and then secure the connection with a clamp.



4. Attach the flanged end of a length of 1-inch ID vacuum hose to each open port on the NW25 tee. Use the NW25 center rings and clamps provided in the startup kit. Use the 7-mm nut driver to install the clamps.
5. Connect the opposite ends of the two lengths of vacuum hose in [step 4](#) to the two, 1-inch OD, straight, vacuum ports on the instrument's rear panel. Secure the hose ends with clamps supplied in the startup kit; install 2 clamps on each hose end.



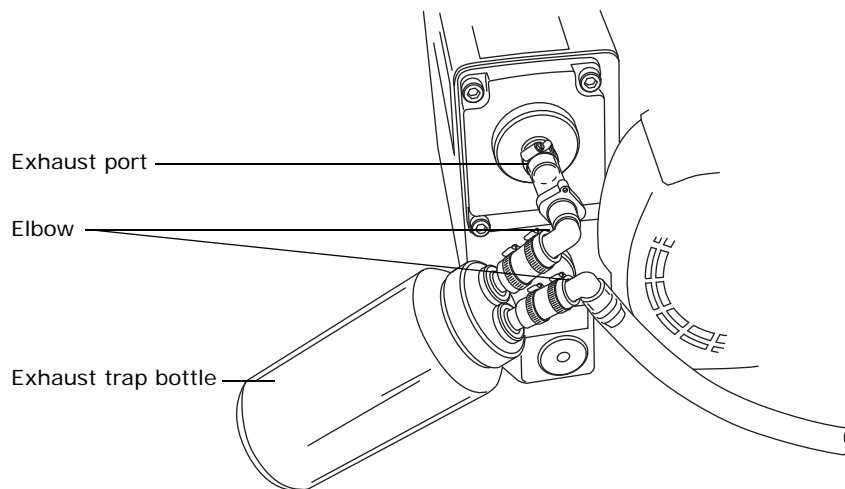
Notice:

- To prevent condensation from forming in the exhaust tubing between the roughing pump and the exhaust trap bottle, you must minimize the length of the tube.
- To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

6. Connect an approximately 36.4-cm (2.5-inch) length of 12.7-mm clear PVC exhaust tubing to the roughing pump exhaust port NW25 nozzle fitting. Secure the tubing with a hose clamp.

! **Notice:** To prevent condensation from draining backward and damaging the pump, the exhaust tubing must be installed with an exhaust trap bottle; the bottle must be positioned at or below the roughing pump exhaust port.

7. Connect an elbow to the other end of the PVC exhaust tubing, and connect the elbow to one of the fittings on the exhaust trap bottle (included in the startup kit).



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

8. Connect a length of 12.7-mm clear PVC exhaust tubing to an elbow and connect the elbow to the other fitting on the exhaust trap bottle. The exit line of the exhaust trap bottle can be at any elevation.
9. Secure the exhaust trap bottle in a conspicuous location.

! **Notice:** To avoid damaging the instrument, ensure that two separate exhaust systems are used: one for nitrogen, the other for the roughing pump. Vent them to atmosphere through separate exhaust lines. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the roughing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

10. Route the open end of the exhaust tubing to a suitable exhaust vent.
11. Check the oil level in the pump.

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

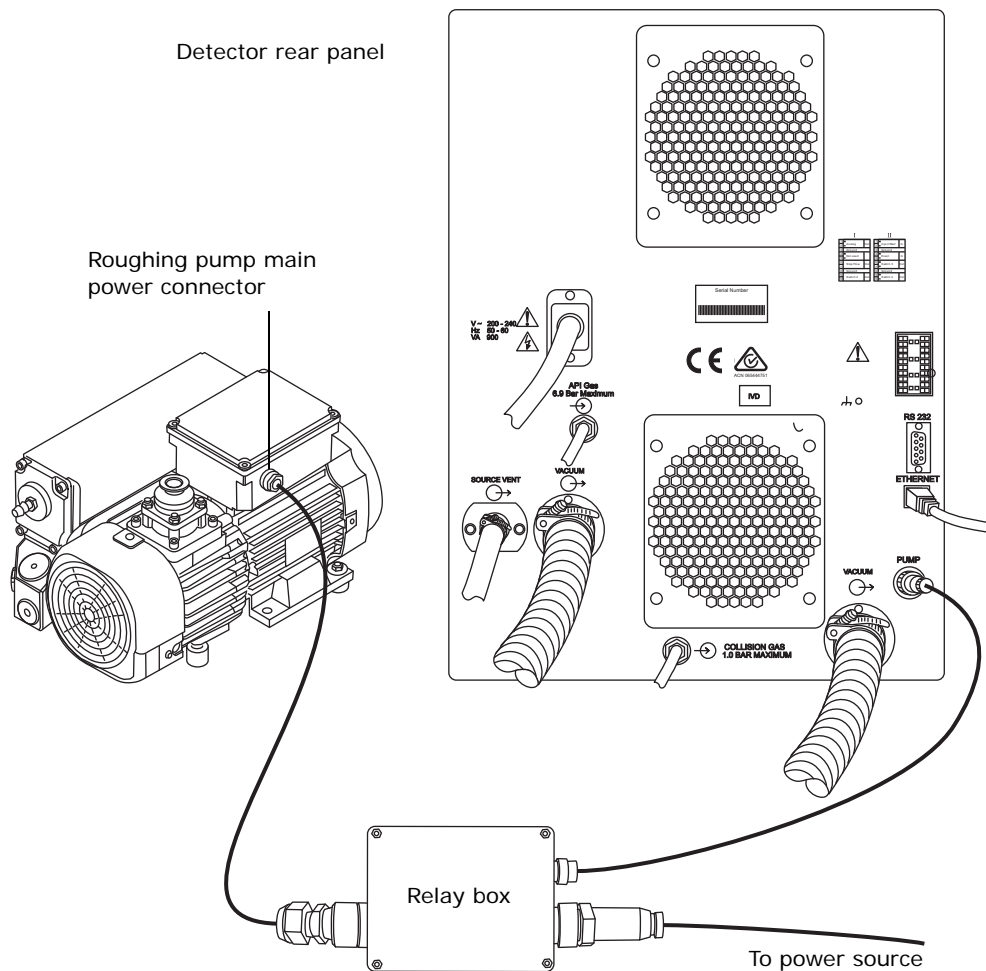
See [page 68](#), and, if needed, [page 69](#).

12. Make the electrical connections to the roughing pump.

- If your roughing pump has an external relay box, see [page 153](#).
- If your roughing pump does not have an external relay box, see [page 154](#).

B.2.1 Making the electrical connections for a roughing pump with an external relay box

Figure B–2: Roughing pump connections with an external relay box

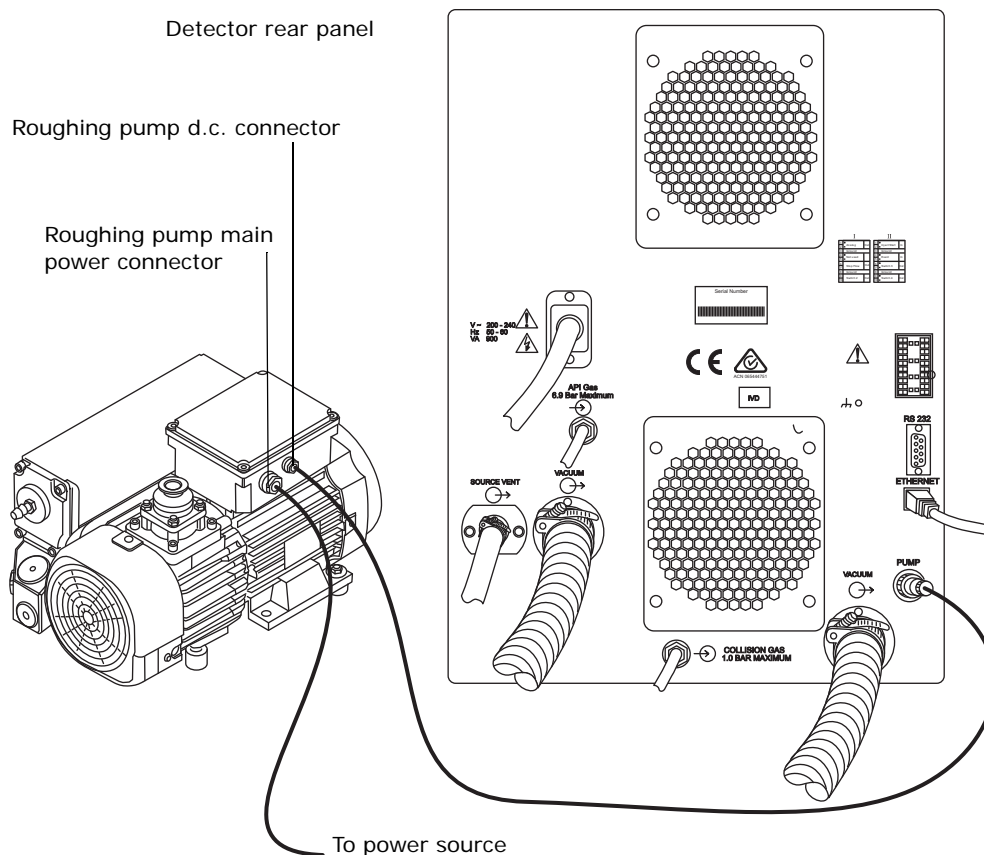


To make the electrical connections for a roughing pump with an external relay box:

1. Connect the power cable from the roughing pump relay box connector to the relay box.
2. Connect the relay cable from the relay box to the pump connector on the instrument's rear panel.
3. Connect the relay box power connector to the main power source.

B.2.2 Making the electrical connections for a roughing pump without an external relay box

Figure B–3: Roughing pump connections without an external relay box



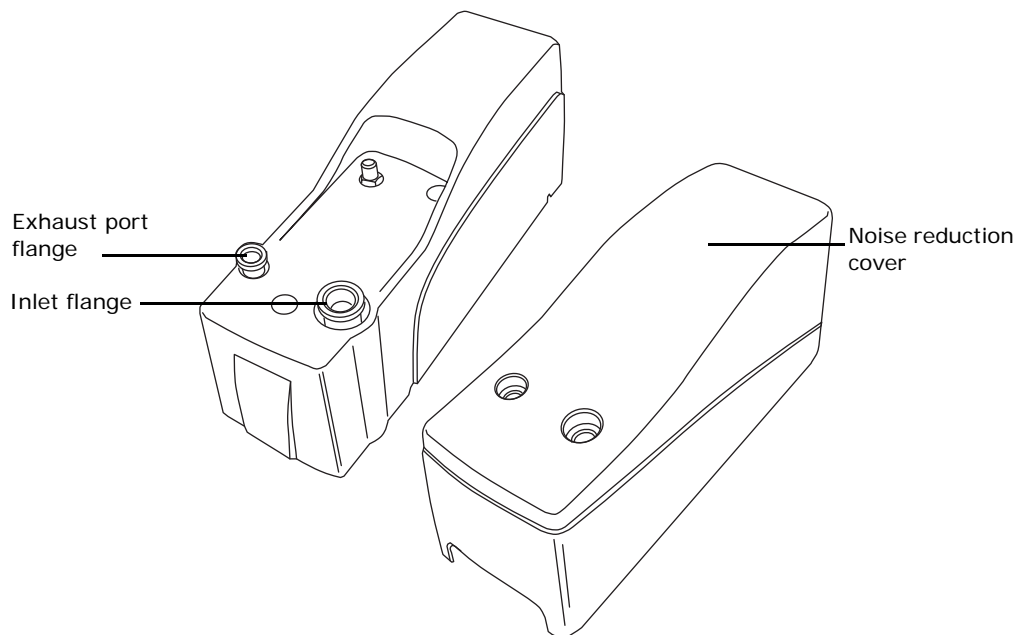
To make the electrical connections for a roughing pump without an external relay box:

1. Connect the roughing pump power cord to the main power source.
2. Connect the relay cable from the roughing pump d.c. connector to the pump connector on the instrument's rear panel.

B.3 Connecting the oil-free roughing pump

The oil-free roughing pump is an optional alternative to the standard oil-filled roughing pump. To connect the oil-filled roughing pump, see [page 149](#).

The noise reduction cover must be installed over the pump to minimize operating noise, unless the pump is installed in a cabinet that includes sound dampening and ventilation.



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

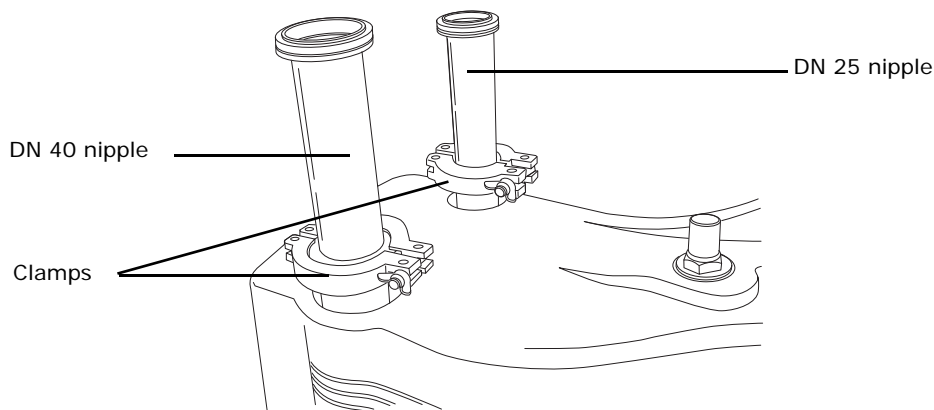
Required materials:

- Chemical-resistant, powder-free gloves
- 7-mm nut driver
- 8-mm Allen wrench
- Sharp knife
- 1-L exhaust trap bottle (included in the startup kit)
- Elbows (included in the Waters Rough Pump Connect Kit)
- NW25 tee (included in the startup kit)
- NW25 center rings (included in the startup kit)
- NW25 clamps (included in the startup kit)
- NW25 full nipple (included in the Alcatel pump kit)
- DN25 reducing nipple (included in the Alcatel pump kit)
- NW40 center rings (included in the Alcatel pump kit)
- NW40 clamps (included in the Alcatel pump kit)
- DN40 full nipple flange (included in the Alcatel pump kit)
- PVC exhaust tubing (included in the Waters Rough Pump Connect Kit)
- PVC hose clamps (included in the Waters Rough Pump Connect Kit)
- 1-inch ID vacuum hose (included in the Waters Rough Pump Connect Kit)
- Isolation valve (included in the Alcatel pump kit)

- External silencer (included in the Alcatel pump kit)
- Noise reduction cover (included in the Alcatel pump kit)

To install the noise reduction cover:

1. Remove the clamp and blank flange from the pump inlet.
2. Attach the DN40 nipple to the top of the inlet filter and o-ring assembly and then secure the connection with a clamp.
3. Attach the DN25 nipple to the outlet fitting and secure the connection with a clamp.
4. Connect the gray pump control cable to the rear of the pump.
5. Connect the power cord to the rear of the pump.
6. Install the noise reduction cover.



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



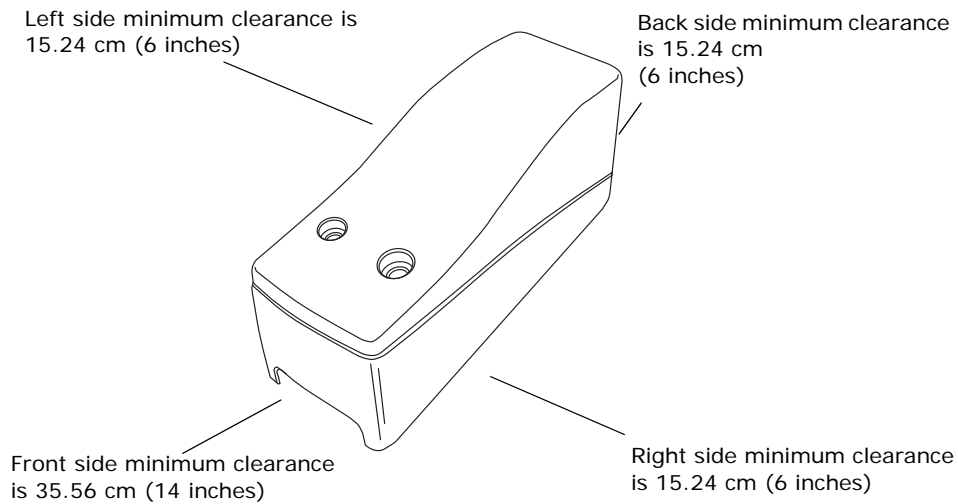
Notice:

- To ensure correct operation of the roughing pump, the pump must be installed within 1 degree of horizontal.
- The area where the roughing pump is located must have an ambient temperature of 15 to 40 °C (59 to 104 °F).
- To ensure proper ventilation, the pump must be installed with the following minimum clearances:



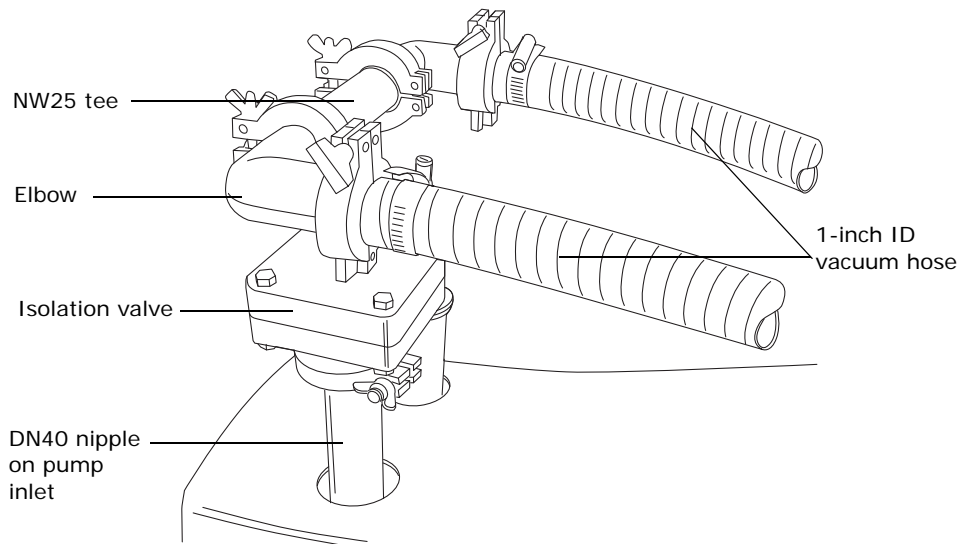
Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

To connect the oil-free roughing pump:



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

1. Place the pump on the floor, within 1.5 m (5 feet) of the instrument.
2. Attach the isolation valve, NW25 tee, and elbows to the DN40 nipple on the pump inlet, and then secure these connections with clamps, as shown in the figure below.



3. Attach the flanged end of a length of 1-inch ID vacuum hose to each open port on the NW25 tee.

Tip: Use the NW25 center rings and clamps provided in the startup kit. Use the 7-mm nut driver to install the clamps.

4. Connect the opposite ends of the two lengths of vacuum hose in [step 3](#) to the two, 1-inch OD, straight, vacuum ports on the instrument's rear panel. Secure the hose ends by installing 2 clamps supplied in the startup kit on each hose end.



Notice:

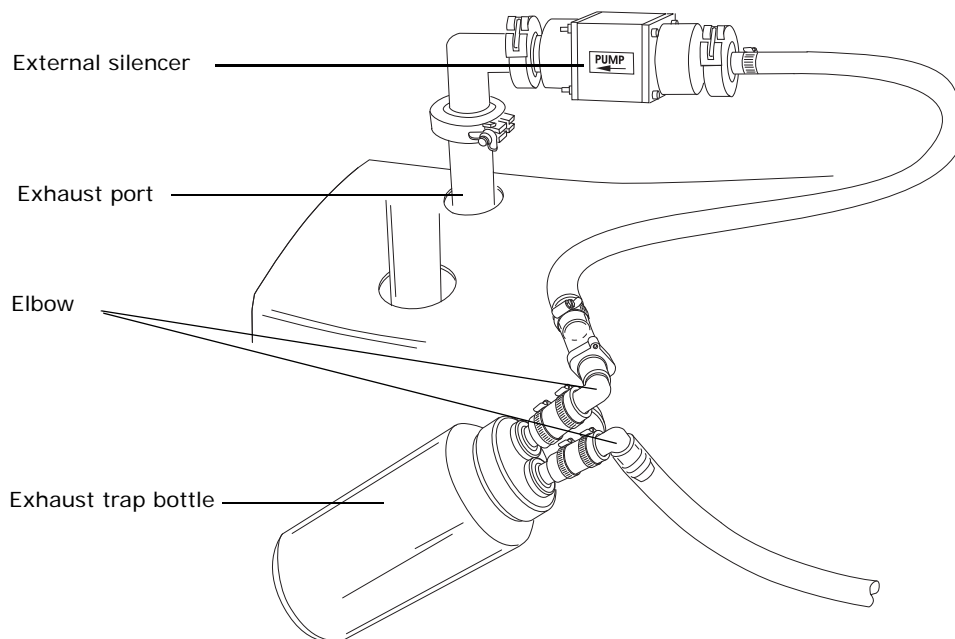
- To prevent condensation from forming in the exhaust tubing between the roughing pump and the exhaust trap bottle, you must minimize the length of the tube.
- To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

5. Attach the DN25 elbow to the DN25 nipple on the pump exhaust outlet and secure the connection with a clamp.
6. Install the external silencer, with the arrow pointing toward the pump, to the open port of the DN25 elbow, and then secure the connection with a clamp.
7. Attach the DN25 reducing nipple to the outlet of the external silencer and secure the connection with a clamp.
8. Connect an approximately 300 mm (12 inch) length of 12.7-mm clear PVC exhaust tubing to the DN25 reducing nipple, securing the tubing with a hose clamp.



Notice: To prevent condensation from draining backward and damaging the pump, the exhaust tubing must be installed with an exhaust trap bottle; the bottle must be positioned at or below the roughing pump exhaust port.

9. Connect an elbow to the other end of the PVC exhaust tubing, and connect the elbow to one of the fittings on the exhaust trap bottle (included in the startup kit).

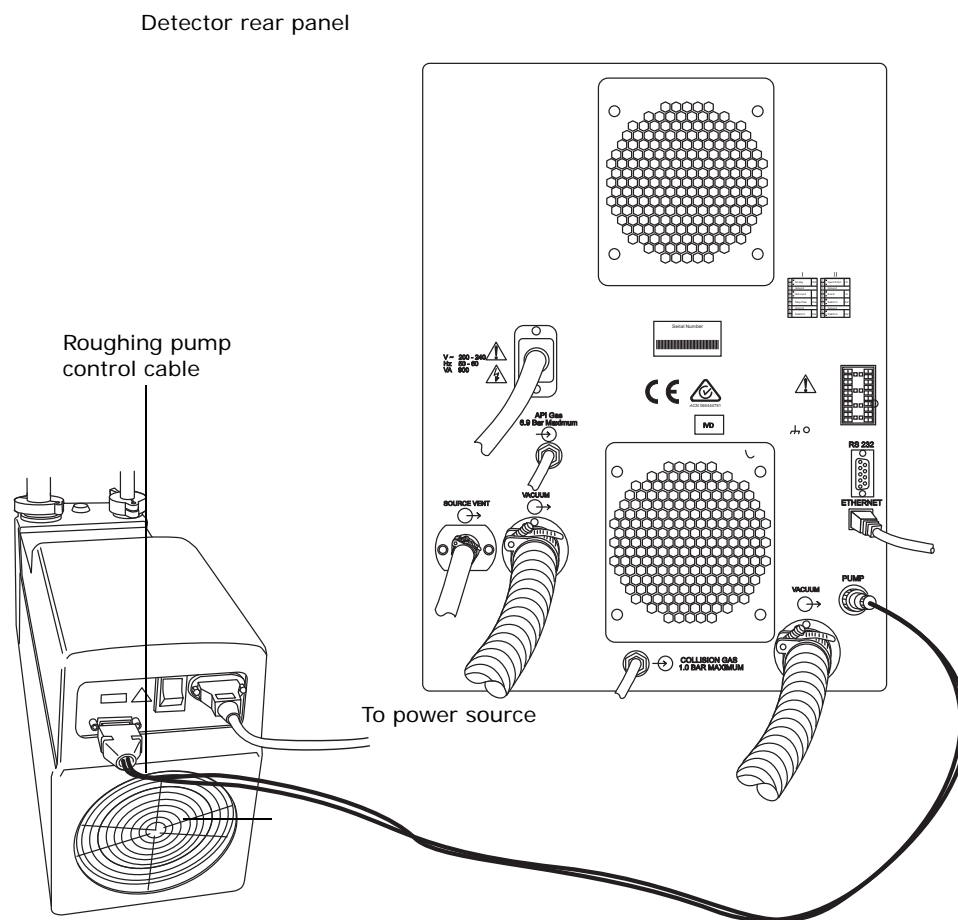


! **Notice:** To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

10. Connect a length of 12.7-mm clear PVC exhaust tubing to an elbow and connect the elbow to the other fitting on the exhaust trap bottle. The exit line of the exhaust trap bottle can be at any elevation.
11. Secure the exhaust trap bottle in a conspicuous location.
12. Route the open end of the exhaust tubing to a suitable exhaust vent.
13. Make the electrical connections to the roughing pump.

B.3.1 Making the electrical connections for an oil-free roughing pump

Figure B-4: Roughing pump connections



To make the electrical connections for a oil-free roughing pump:

1. Route the cables through the opening in the rear of the noise reduction cover.

2. Connect the gray pump control cable to the pump connector on the instrument's rear panel.
3. Connect the power cable and power-on the instrument.

B.4 Connecting to the nitrogen gas supply

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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

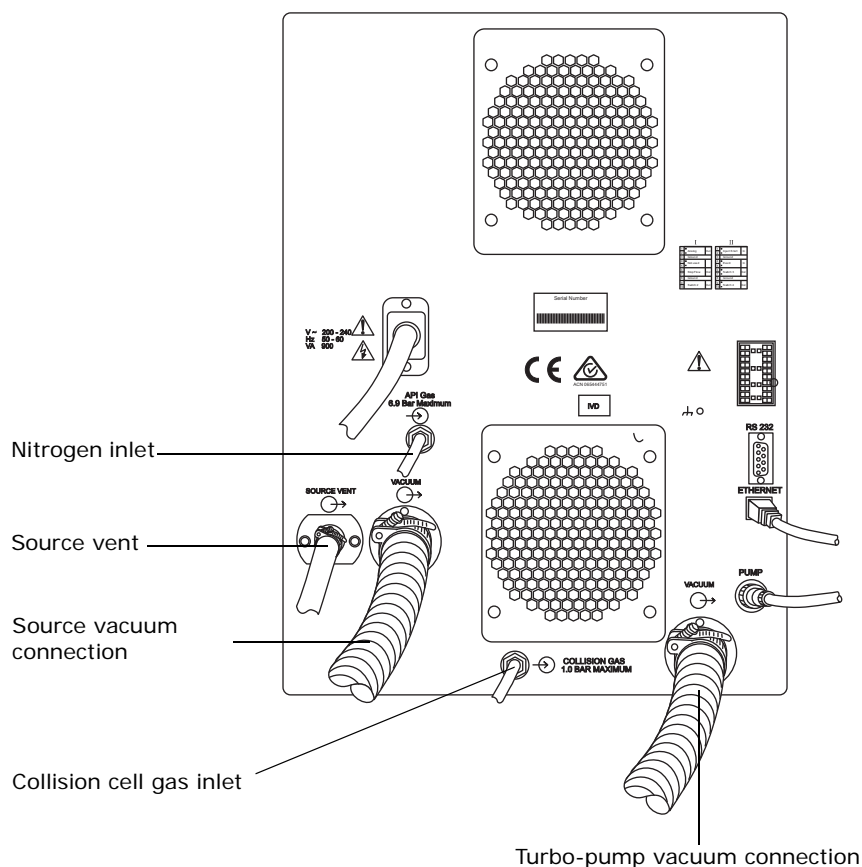
Required materials:

- Chemical-resistant, powder-free gloves
- Sharp knife
- Wrench
- 6-mm PTFE tubing (included in the Waters Rough Pump Connect Kit)

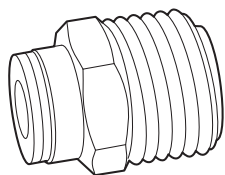
To connect the nitrogen gas supply:

1. Use the sharp knife to cut a 3.8 to 5.0-cm (1.5 to 2-inch) length of 6-mm PTFE tubing.
2. Connect this piece of tubing to one end of the nitrogen supply in-line filter.
3. Connect the remaining length of the 6-mm PTFE tubing to the other end of the filter.
4. Connect the free end of the short piece of 6-mm PTFE tubing to the nitrogen inlet port on the rear of the instrument.

Figure B–5: Gas and exhaust connections



5. Attach a nitrogen regulator (not provided) to the nitrogen supply.
6. Install the 6-mm stud into the regulator outlet.



7. Connect the free end of the long piece of 6-mm PTFE tubing to the 6-mm stud.

B.5 Connecting to the collision cell gas supply



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves

- 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 on [page 161](#)).
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.6 Connecting the nitrogen exhaust line



Warning: To avoid hazards associated with improperly exhausted solvents, observe these requirements:

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

! **Notice:** To avoid damaging the instrument, ensure that two separate exhaust systems are used: one for nitrogen, the other for the roughing pump. Vent them to atmosphere through separate exhaust lines. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the roughing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required materials:

- Chemical-resistant, powder-free gloves
- Sharp knife
- 10-mm and 12-mm PTFE tubing (included in the Waters Rough Pump Connect Kit)
- snoop[®] (or equivalent) leak detector liquid

To connect the nitrogen exhaust line:

1. Locate the exhaust trap bottle in an accessible area below the instrument. see the figure on [page 164](#).

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

2. Cut a length of 12-mm tubing long enough to connect the instrument to the exhaust trap bottle.
3. Connect one end of the tubing to the exhaust port on the rear panel. Connect the other end to one of two ports on the exhaust trap bottle.

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

4. Cut a second length of 10-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. Route the other end to the exhaust vent.

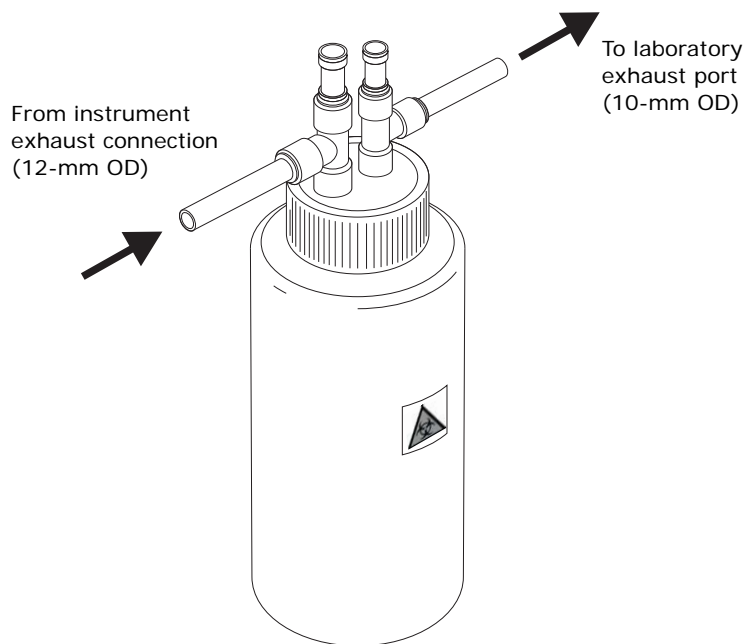


Warning: To confirm the integrity of the source exhaust system, the following leak test must be performed.

! **Notice:** To avoid damage to the instrument, snoop (or its equivalent) leak detector liquid must be used only for the purpose described in the following step. It must not be used 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–6: Exhaust trap bottle



B.7 Connecting the liquid waste line



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



Requirement: Wear clean, chemical-resistant, powder-free gloves while performing this procedure.

Required material: Chemical-resistant, powder-free gloves

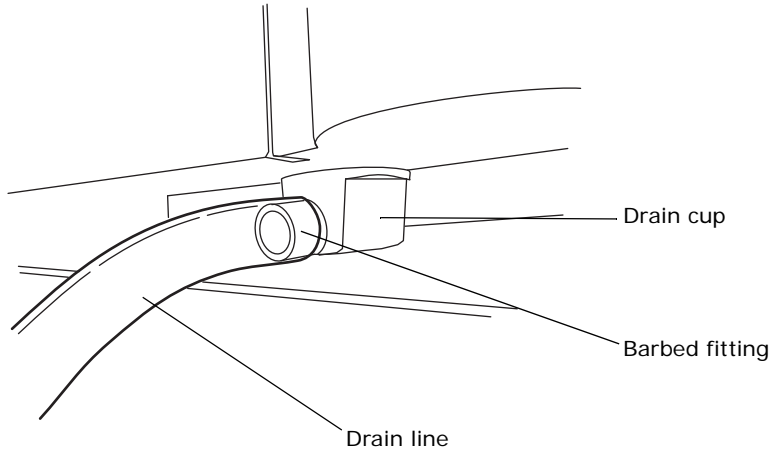
To connect the liquid waste line:

1. Place a suitable waste container below the instrument.



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.

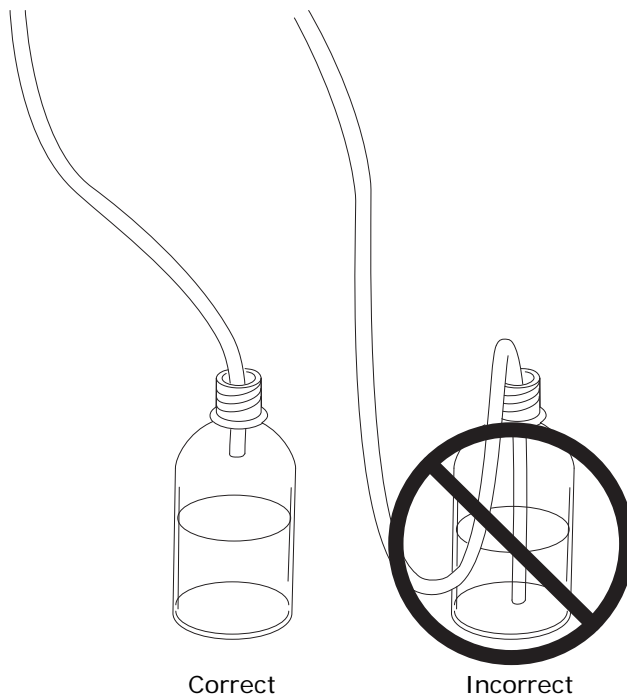
2. Slide a drain line over the barbed fitting of the drain (located at the bottom of the instrument).



Warning: To prevent leakage of biohazardous or toxic materials, ensure that the

- drain line does not crimp or bend. A crimp or bend can impede flow to the waste container.
 - waste container is emptied before the lower end of the drain tube is covered by waste solvent.
3. Route the waste line to the waste container. If necessary, shorten the waste tube so that its end is above the surface of the waste solvent.

Figure B-7: Positioning of drain tube



B.8 Connecting the workstation

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: Shielded network cables must be used with the instrument to ensure compliance with FCC, and other, limits.

To connect the workstation:

1. Connect the monitor to the PC.
2. Connect one end of the shielded network cable to the appropriate port on the rear panel of the instrument.
3. Connect the other end of the shielded network cable to the port labeled instrument LAN on the workstation rear panel.

To connect the instrument to the power source:

! **Notice:** Do not connect the instrument's power supply cord until you complete the installation procedures in the previous sections.

1. Select the correct power cord for your location.
2. Connect the female end of the power cord to the power port on the rear panel of the instrument.

B.9 Connecting Ethernet cables

Requirement: Shielded Ethernet cables must be used with the instrument to ensure compliance with FCC, and other, limits.

To make Ethernet connections:

1. Connect one end of one shielded Ethernet cable to the network switch, and then connect the other end to the Ethernet card on the preconfigured ACQUITY[®] workstation.

Tip: On preconfigured systems, the Ethernet card is identified as the Instrument LAN card.

2. Connect one end of the other shielded Ethernet cable to the back of the instrument, and then connect the other end to the network switch.

B.10 I/O signal connectors



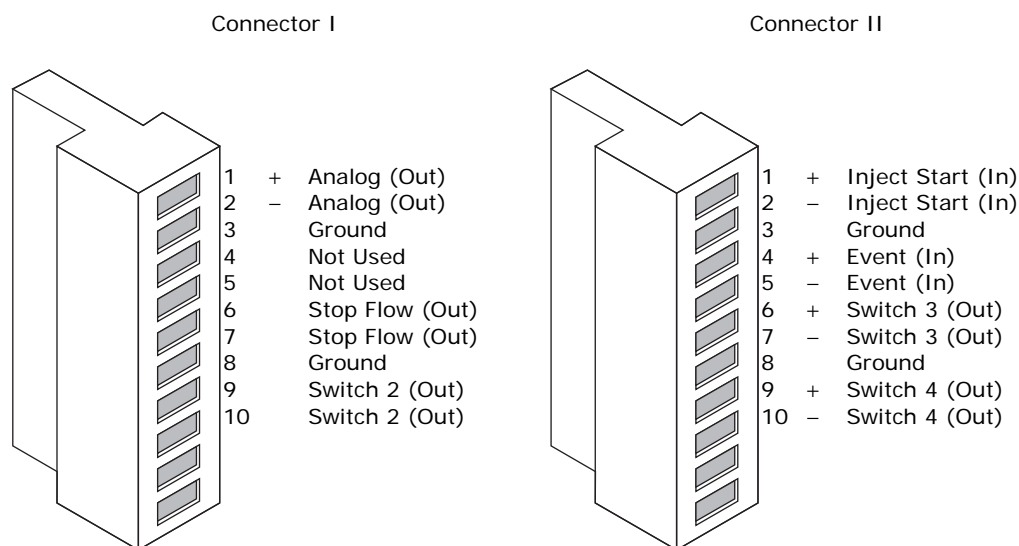
Warning: To avoid electric shock, all electrical connections to the rear panel must be separated from hazardous voltages by double or reinforced insulation. Circuits of this type are classified as safety extra low voltage (SELV). Examples of circuits that are typically SELV include contact closure inputs 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.

To avoid electric shock and damage to the instrument, do not apply more than

- ± 30 V d.c. to the Analog (Out) connection.
- 30 V d.c. to the Stop Flow (Out), Inject Start (In), Switch 2 (Out), Switch 3 (Out), and Switch 4 (Out) connections.

The instrument's rear panel includes two removable connectors that hold the screw terminals for I/O signals. These connectors are keyed so that they can receive a signal cable inserted only one way.

Figure B-8: I/O signal connectors



B.10.1 Signal connections

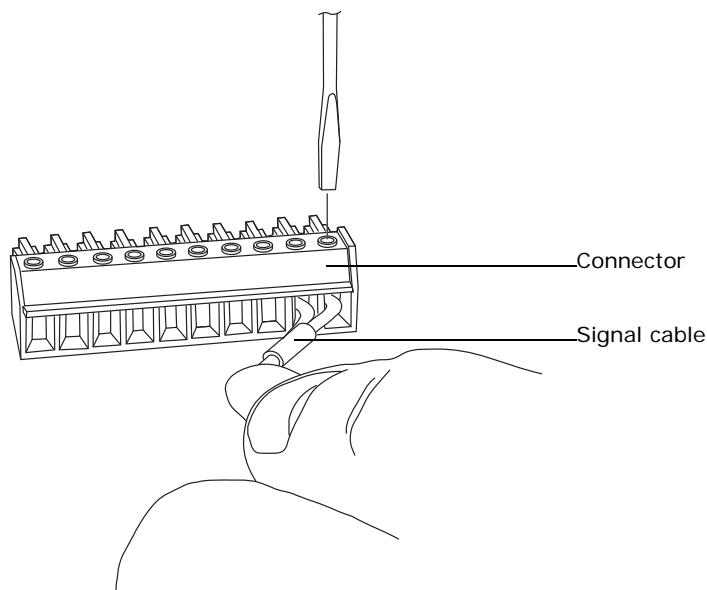
Table B–1: Instrument analog-out/event-in connections

Signal connections	Description
Analog (Out)	Used for analog chart output functionality. The output voltage range is 0 to 2 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.
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, you must install connection covers over the signal connectors.

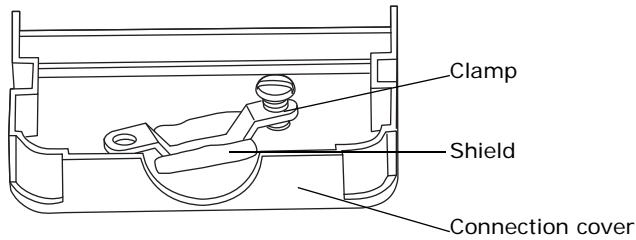
To make signal connections:

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.

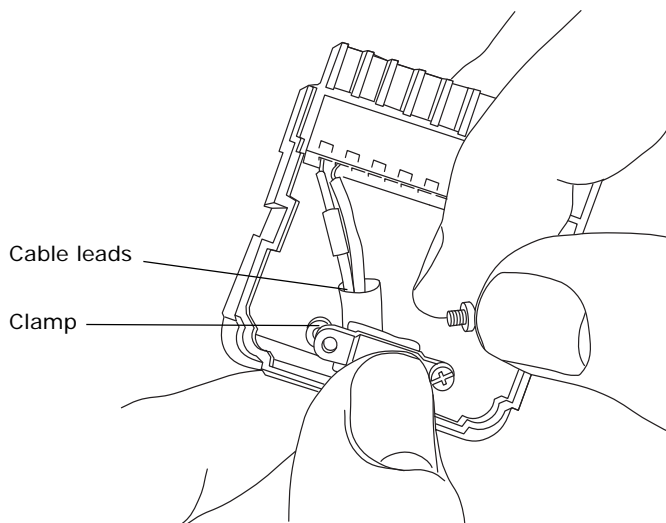


3. Slide the clamp (with the bend facing down) into the protective shield.

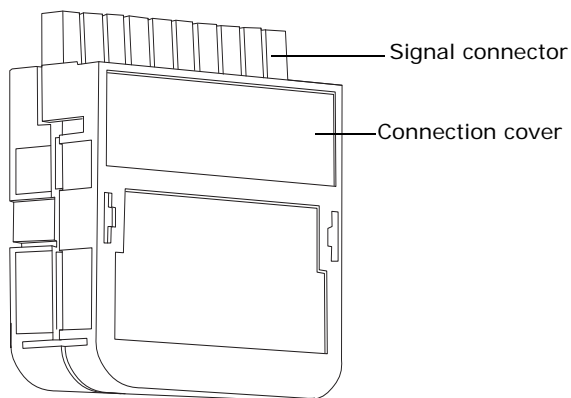
4. Insert the clamp and shield (with the bend facing down) into the connection cover, and loosely tighten with one self-tapping screw.



5. 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.



6. Place the second connection cover over the first cover, and snap it into place.



B.11 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. To learn which cord to use in other countries, contact your local Waters distributor.

1. Connect the female end of the power cord to the receptacle on the rear panel of the instrument.
2. Connect the male end of the instrument power cord to the 200 to 240 V AC wall outlet prepared as described in the instrument *Site Preparation Guide*.
3. Connect the power cord from the roughing pump relay box to the 200 to 240 V AC wall outlet prepared as described in the instrument *Site Preparation Guide*.

Tip: The system software controls electrical power to the pump.

C Materials of Construction and Compliant Solvents



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

C.1 Preventing contamination

For information about preventing contamination, refer to *Controlling Contamination in UltraPerformance LC/MS and HPLC/MS Systems* (part number 715001307), which you can download from the Waters Web site (www.waters.com).

C.2 Items exposed to solvent

The items that appear in the following table can be exposed to solvent. You must evaluate the safety issues if the solvents used in your application differ from the solvents normally used with these items. See [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	Aluminium
Gas tubes	Fluorinated ethylene propylene
Ion block	Stainless steel
Ion block support	PEEK
Isolation valve	Gold-plated aluminium/bronze
O-rings	Viton® or PTFE-encapsulated Viton
Probe adjuster bellows	PTFE/Viton
Probe adjuster assembly	Anodized aluminium, glass filled acetal, and stainless steel

Table C–1: Items exposed to solvent(Continued)

Item	Material
Probe shaft	PEEK
Push-in gas fittings	Nickel/brass
Solvent waste/leak management	Tygon tubing
Source enclosure	Alochromed aluminium
Source enclosure view port	Toughened plate glass
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

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

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

These solvents are not expected to adversely affect performance of the materials shown in the preceding table.

D Preparing samples for LC/MS system check with Empower software

This appendix describes the procedure for preparing a sulfadimethoxine standard for use with the LC/MS System Check projects supplied for Empower software.

D.1 Assembling required materials

You must assemble the following materials before starting to prepare your sample:

- Solution kit containing 1 mg/mL sulfadimethoxine stock in methanol. This solution kit is provided with your instrument.
- 1 L of solvent made up of 90:10 water/acetonitrile plus 0.1% formic acid (v/v).
- Clean class A volumetric flasks, 100-mL (3).
- Clean class A pipettes (TD), 1-mL (3).
- PTFE-sealed screw-top amber sample bottles (glass or Nalgene[®]): 125-mL (3), 15-mL.
- Sample vial, 2-mL.

D.2 Preparing the sulfadimethoxine standard

The target mass of sulfadimethoxine on the ACQUITY UPLC column is 5 pg. Because the supplied LC/MS System Check methods specify an injection volume of 5 μ L, you must prepare a 1 pg/ μ L sulfadimethoxine solution.

To dilute the stock solutions to the final standard concentration:

1. Pour 1 mL of the stock solution into one of the 100-mL volumetric flasks.
2. Dilute to the 100 mL mark with solvent.
Result: The flask contains a 10 ng/ μ L sulfadimethoxine solution.
3. Into a second 100-mL volumetric flask, pour 1 mL of the solution created in [step 2](#).
4. Dilute to the 100 mL mark with solvent.
Result: The flask contains a 100 pg/ μ L sulfadimethoxine solution.

5. Into the final 100-mL volumetric flask, pour 1 mL of the solution created in [step 4](#).
6. Dilute to the 100 mL mark with solvent.
Result: The flask contains the 1 pg/μL sulfadimethoxine standard solution.

D.3 Storing the solutions

Store each of the solutions in an appropriate container. Waters recommends using the following sample bottles:

- For the stock solution, a 15-mL sample bottle.
- For the 10 ng/μL solution, a 125-mL sample bottle.
- For the 100 pg/μL solution, a 125-mL sample bottle.
- For the final sulfadimethoxine standard solution, a 125-mL sample bottle.

D.4 Using the solution in an LC/MS System Check run

The final sulfadimethoxine standard solution is ready for use in an LC/MS System Check run with the Empower software.

To use the solution in an LC/MS System Check run:

1. Pour 1 mL of the sulfadimethoxine standard solution into the 2-mL sample vial.
2. Place the vial in position 2:A,7 in the ACQUITY Sample Manager.
3. Run LC/MS System Check, as described in the instrument's online Help.