Waters™

ACQUITY RDa Detector

Overview and Maintenance Guide

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Version 06

General information

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Local office contact information	For worldwide locations, telephone, fax, and conventional mail information is available at the Local Offices website.
Corporate contact information	Waters Corporation 34 Maple Street Milford, MA 01757 USA From the USA or Canada, phone 800-252-4752 or fax 508-872-1990.

Legal manufacturer

	Waters Corporation 34 Maple Street Milford, MA 01757 USA

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 practices and consult your organization's standard operating procedures as well as your local requirements for safety.

Safety hazard symbol notice

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

Considerations specific to the device

Power cord replacement hazard

Warning: To avoid electric shock, observe these precautions:

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

Flammable solvents hazard

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

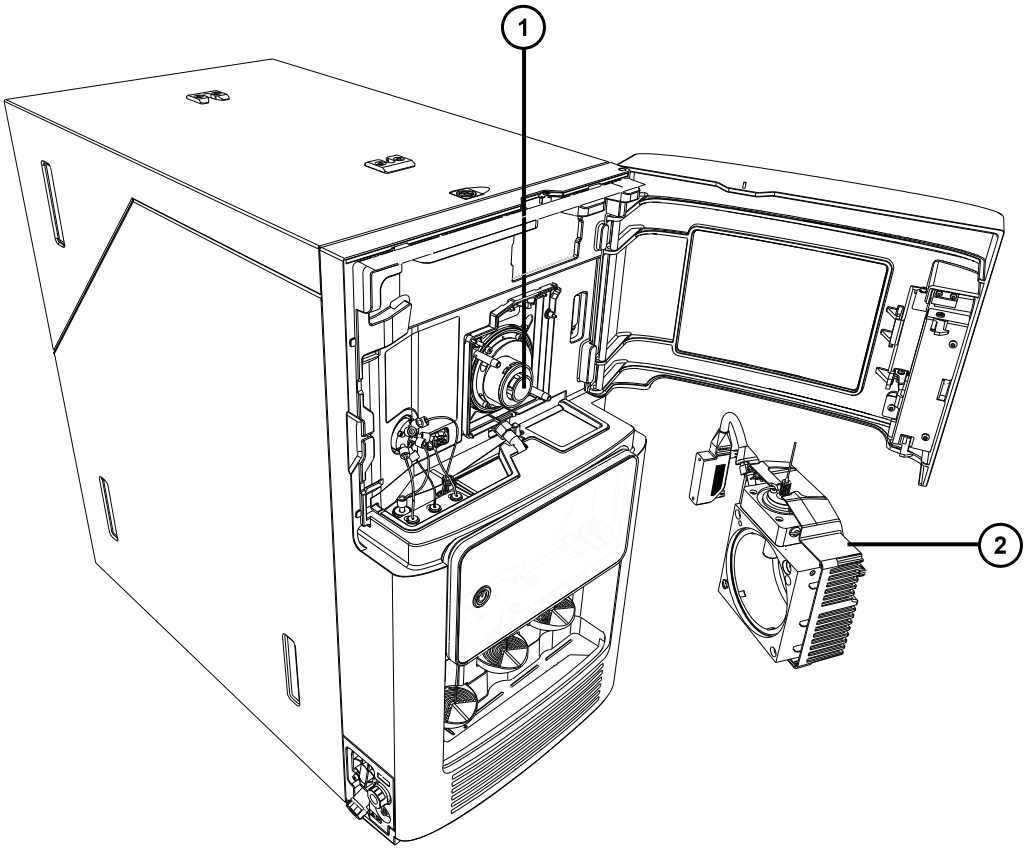
- Nitrogen flows continuously through the source.
- A gas-fail device is installed to interrupt the flow of LC solvent should the nitrogen supply fail.
- The nitrogen supply pressure does not fall below 400 kPa (4 bar, 58 psi) during an analysis requiring the use of flammable solvents.

The gas-fail device for the RDa Detector is the Stop Flow cable connected to the LC. If the nitrogen pressure falls below 400 kPa (4 bar, 58 psi), the instrument sends a stop-flow signal to the LC. You must connect the Stop Flow cable to the LC correctly so that if the gas supply fails, solvent does not flood the mass spectrometer's source and damage the device.

High temperature hazard

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

Mass detector high temperature hazard



1 Source components

2 Source enclosure

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.
- When the instrument is in Operate mode, avoid touching the areas marked with the high voltage warning symbol. To touch external areas marked with the symbol, first put the instrument in Power Save mode.

Hazards associated with removing an instrument from service

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

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

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

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

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, follow these guidelines:

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

Electrical power safety notice

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

Equipment misuse notice

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

Safety advisories

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

Operating the device

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

Applicable symbols

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

Symbol	Definition
	Manufacturer
	Date of manufacture
	Confirms that a manufactured product complies with all applicable European Community directives
	UK Conformity Assessed marking confirms that a manufactured product is in conformity with the applicable requirements for products sold within Great Britain
	Australia EMC compliant
	Confirms that a manufactured product complies with all applicable United States and Canadian safety requirements

Symbol	Definition
	Confirms that a manufactured product complies with all applicable United States and Canadian safety requirements
	Environmentally friendly use period (China RoHS): indicates the number of years from the date of manufacture until the product, or components within the product, are likely to be discarded or degrade into the environment
	ACT (Accountability, Consistency, and Transparency) is an environmental impact factor label that provides third-party verification of the sustainable impacts of a life science lab product, its operations, and its end of life.
	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 Waste Electrical and Electronic Equipment legislation, contact Waters Corporation for the correct disposal and recycling instructions
	For indoor use only
	No pushing
	Do not connect to an LC system
	Indicates the maximum load you can place on that item (for example, 10kg)
	Indicates that the part can be cleaned in an ultrasonic bath

Symbol	Definition
SN	Serial number
REF	Part number, catalog number

Audience and purpose

This guide is for novice users and assumes no knowledge of liquid chromatography or mass spectrometry principles. It provides an overview of the instrument and explains how to install it, prepare it for operation, and maintain it.

Intended use of the ACQUITY RDa Detector

The ACQUITY RDa Detector is a time-of-flight mass detector with an ESI source, and is intended for use as an analytical tool. It provides accurate mass data with minimal interaction from the user. The LC/MS ESI instrument is not intended for use in diagnostic applications.

Calibrating

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

Quality control

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

EMC considerations

FCC radiation emissions notice

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful

interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canada spectrum management emissions notice

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

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

ISM classification: ISM group 1 class A

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

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

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

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

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

EMC emissions

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

Safe disposal

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

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

- Follow appropriate procedures for flushing the instrument's fluid paths of any hazardous samples or solvents.
- Waters instruments are subject to European Union's Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) Directives. According

to these directives, do not dispose of instruments in the general waste stream. Similar “e-waste” laws also apply in other jurisdictions. In all cases, ensure that a certified electronics recycler processes end-of-life instruments. Under the WEEE Directive and implementing regulations, when customers buy new electrical and electronic equipment from Waters they are entitled to:

  - Return old equipment for recycling on a one-for-one, like-for-like basis (this varies depending on the country).
  - Return the new equipment for recycling when it ultimately becomes waste.

  For details on regional arrangements, see EU WEEE Compliance.

- Some Waters instruments use batteries, mercury-containing lamps, or other replaceable components during the life span of the instrument. Handle such materials in accordance with local laws governing their processing and safe disposal.

Table of contents

1 ACQUITY RDa Detector Overview

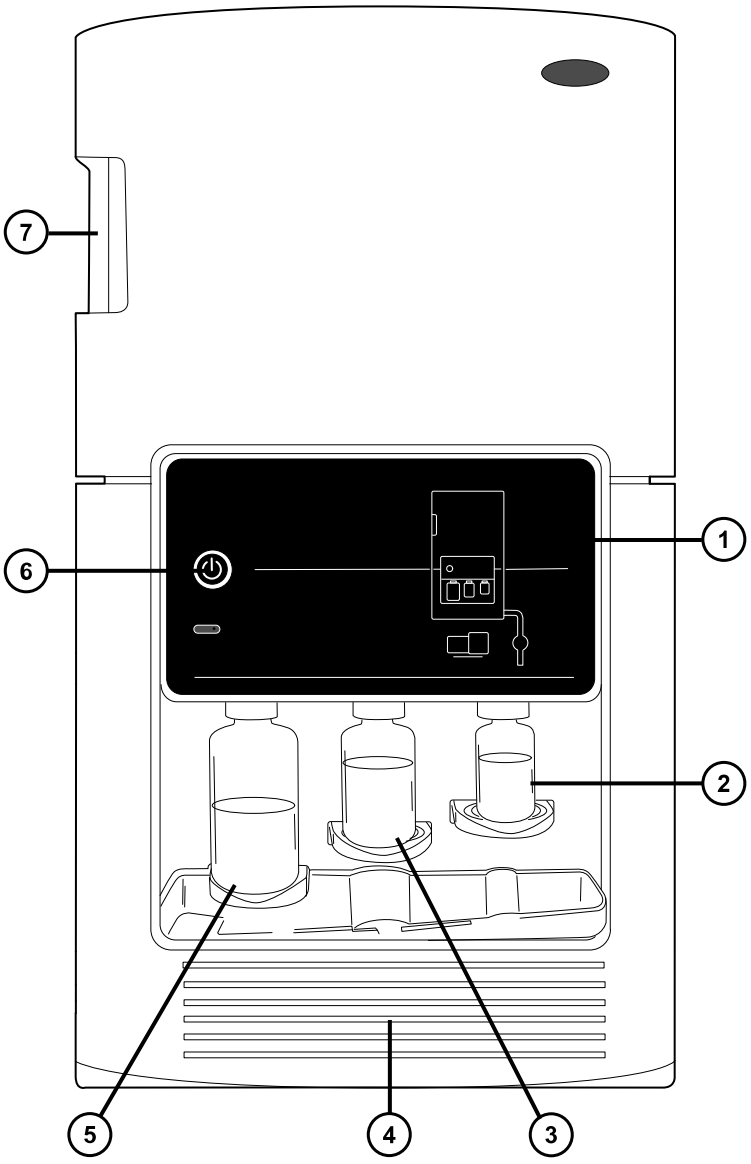
The ACQUITY RDa Detector is a time-of-flight mass detector with an ESI source, and is intended for use as an analytical tool. It provides accurate mass data with minimal user interaction.

The ACQUITY RDA Detector is a SmartMS-enabled mass detector with an automatic setup routine that ensures consistent results and continuously monitors and maintains performance, providing confidence in your data.

For optimum efficiency, the ACQUITY RDa Detector features self-diagnostic capabilities. If an error occurs, instructions appear from within the software to help you perform corrective action, or inform you that a Waters service engineer is required.

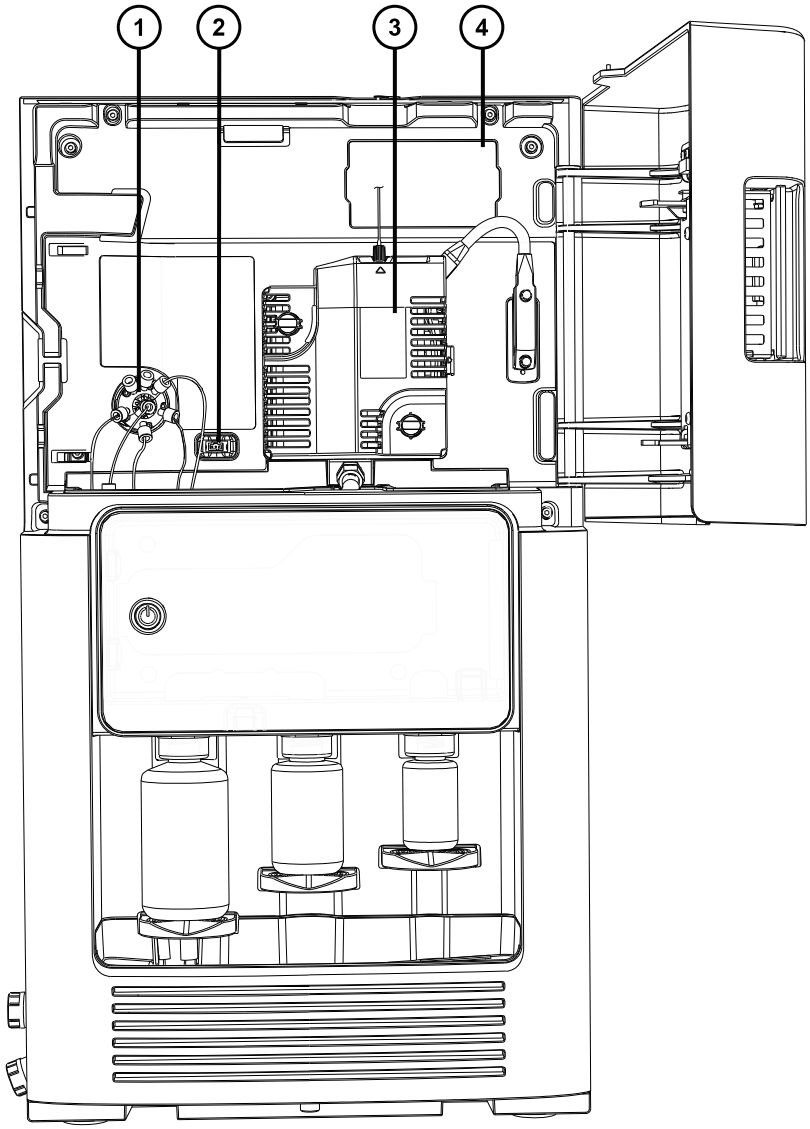
1.1 ACQUITY RDa Detector Front Panel Overview

Figure 1–1: ACQUITY RDa with the instrument door closed



1	Instrument display	2	Calibration reservoir bottle
3	Wash reservoir bottle	4	Air filter
5	Lock mass reservoir bottle	6	Power button
7	Instrument door handle		

Figure 1–2: ACQUITY RDa with the instrument door open



1	Divert valve	2	Leak sensor
3	Source	4	Air filter

1.2 Instrument display

The symbols on the ACQUITY RDa Detector's front panel display the current operating status of the system and its components:

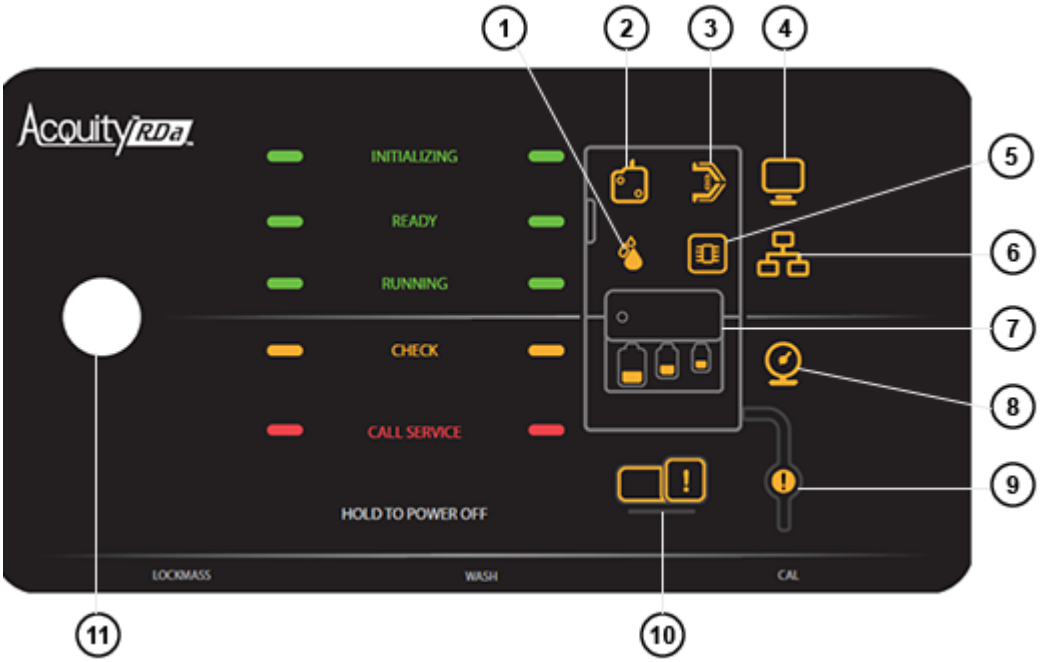
- Initializing
- Ready

- Running
- Check
- Call Service

The `Initializing` LED remains illuminated until instrument setup is complete. When the instrument setup is complete, the status LED changes to `Ready` and the instrument is ready for use.

If the instrument identifies a problem, the status changes to `Check` and an appropriate icon illuminates. Instructions will then appear from within the software to help you perform corrective action.

Figure 1–3: Instrument display



1	Fluidics	2	Source
3	Cone	4	Setup
5	Electronics	6	Communications
7	Refill fluidics	8	Gas
9	Exhaust	10	Vacuum
11	Power button		

1.3 Fluidics system

1.3.1 Fluidics system

Warning: To avoid injuries from broken glass, falling objects, or exposure to toxic substances, do not place containers directly on top of the instrument or on its front covers. Instead, use the bottle tray.

The divert valve automatically controls the flow of the fluidics in the system, delivering sample directly to the instrument's source in one of the following two ways:

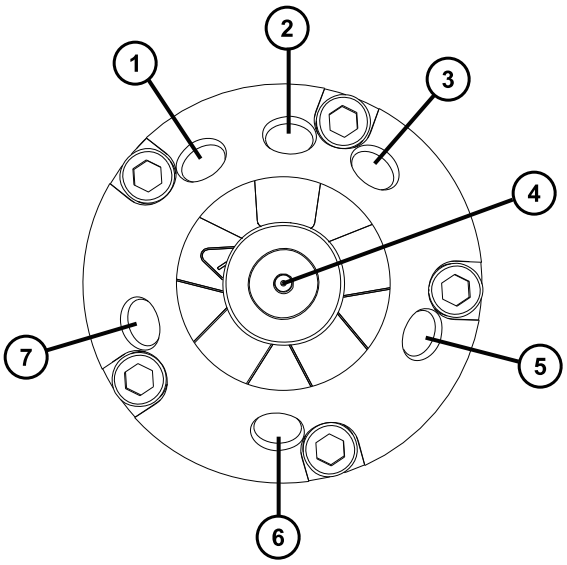
- From the LC column
- From one of the three integral reservoir bottles:
  - The lock mass reservoir, which has a capacity of 250 mL and is used for the lock mass solution and instrument setup.
  - The wash reservoir, which has a capacity of 125 mL and contains solvent for automated flushing of the instrument’s solvent delivery system.
  - The calibration reservoir, which has a capacity of 60 mL and is used during calibration.

The waste reservoir is normally a bottle stored under the instrument bench.

During normal operation, you must keep the instrument door closed.

The following figure shows the only configuration allowed for the divert valve.

Figure 1–4: Divert valve



1	Connection to the probe capillary assembly	2	Connection from the LC outlet

3	Connection to the waste line	4	Connection to the piston pump
5	Connection to the calibration reservoir bottle	6	Connection to the wash reservoir bottle
7	Connection to the lock mass reservoir bottle		

Note: The divert valve has a total of seven ports, one of which connects to the RDa source via the probe capillary assembly. The divert valve is fully automated to send the LC flow to either the source or waste. The flow state function selects the position of the LC flow. When the fluidics are operating, the flow state is set to waste as the LC flow is diverted to waste.

1.4 ACQUITY RDa Detector leak sensors

A leak sensor in the instrument's drip tray continuously monitors for liquid leaks. If a leak occurs, the instrument detects it and the software stops the LC flow to prevent the loss of sample and any damage to the system. At the same time, the software displays an error message alerting you that a leak has developed. Check that the divert valve connections from the sample bottles at the front of the machine are not leaking. If they are, tighten the nuts to stop the leak, or replace the leaking fitting.

To replace the leak sensor, see Replacing the leak sensor (Page 58).

2 Preparing for operation

To confirm that the instrument is ready for operation, verify the following conditions:

- The power supply, the vacuum pump, and the nitrogen gas are connected to the instrument. See Appendix D (Page 89) for details on all the instrument's external connections.
- The following fluidics connections are made:
  - The LC outlet flow (from the column or optical detector) is connected to the divert valve.
  - The ESI capillary is connected between the divert valve and ESI source inlet.
  - The wash, lock mass, and calibration bottles all contain a sufficient volume of solution and are mounted to the instrument in the correct reservoir slots. See Fluidics System (Page 20).
- The instrument door is closed.

If you moved the instrument and you need to reconnect it, see Preparing the System for Operation. (Page 79)

2.1 Software and data system

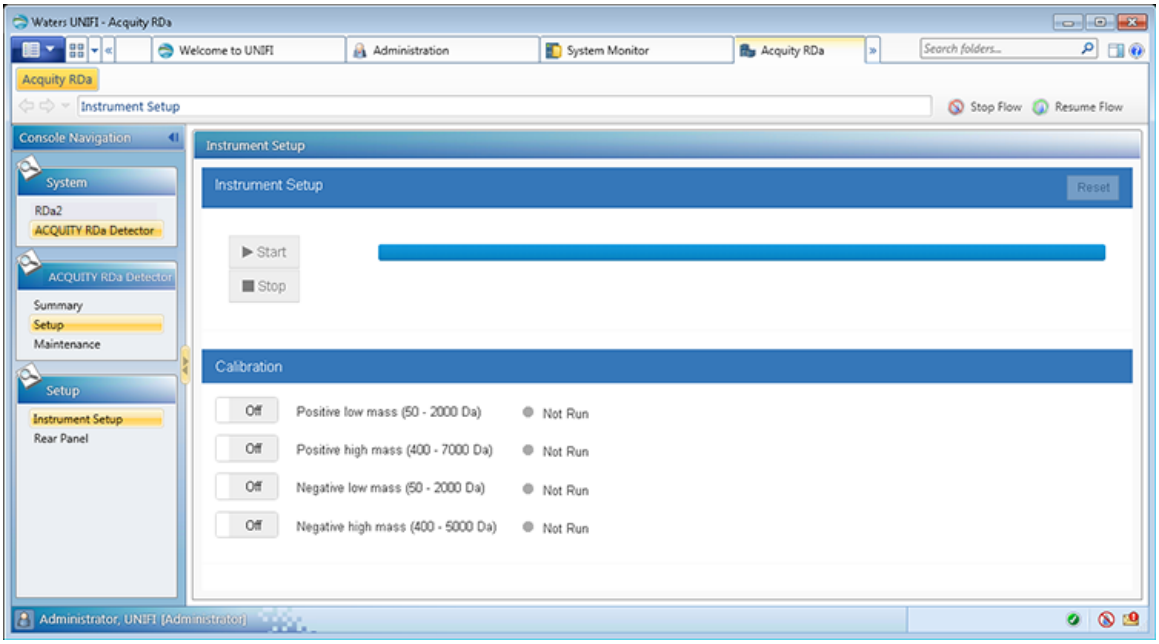
waters_connect software, which controls the ACQUITY RDa Detector and LC system, enables the following major operations:

- Configuring the system
- Using the setup feature to automatically tune and mass calibrate the detector
- Monitoring the analysis
- Acquiring data:
  - Full Scan
  - Full Scan with Fragmentation
- Processing data
- Reviewing data
- Printing reports

2.1.1 Calibrating and tuning the instrument

To calibrate and tune the instrument, use the Instrument Setup function on the **Acquity RDa** tab to define the mass range and polarity settings, and then click **Start**.

Figure 2–1: RDa setup and calibration



Tips:

- If the required calibration is not available when setting up an analysis, the samples will not run. If this happens, the software will guide you on how to complete the calibration.
- When transitioning from **Power Save** mode to **Operate** mode, Waters recommend that you allow the instrument to stabilize for one hour prior to use.
- If the **Start** button on the instrument setup control panel is not available, the instrument is currently not ready to run the setup.

To setup and create a calibration:

1. Click **Setup**.
2. Select at least one of the following calibration slots:
   - Positive low mass (50 - 2000 Da)
   - Positive high mass (400 - 7000 Da)
   - Negative low mass (50 - 2000 Da)
   - Negative high mass (400 - 5000 Da)
3. Click **Start**.

Notes:

- A progress bar displays as the instrument is calibrated, to show how the calibration is progressing.
- The date and time of the successful calibration appears against the slot.

- You can, in the future, create a calibration for any slot that was not initially calibrated when Instrument Setup was first enabled.
- To delete the current calibration from a slot, set the appropriate slot to **Off**. To recalibrate the slot, reselect it and then click **Start**.
- To clear the instrument of its current setup, click **Reset**.

2.1.2 Acquisition Modes

The ACQUITY RDa Detector supports two acquisition modes:

- Full Scan
- Full Scan with Fragmentation

Full Scan

This mode collects Full Scan data at a single fixed cone voltage. This is typically the lowest cone voltage that produces the optimum precursor ion signal.

Full Scan with Fragmentation

This mode collects mass spectral data for the parent ion and its fragments. Use the fragment ions to add confidence when identifying an analyte.

Note: Do not open the instrument door during data acquisition. Doing so places the instrument into Power Save mode.

Tip: Consult the instrument online Help for further details about using the Acquisition modes.

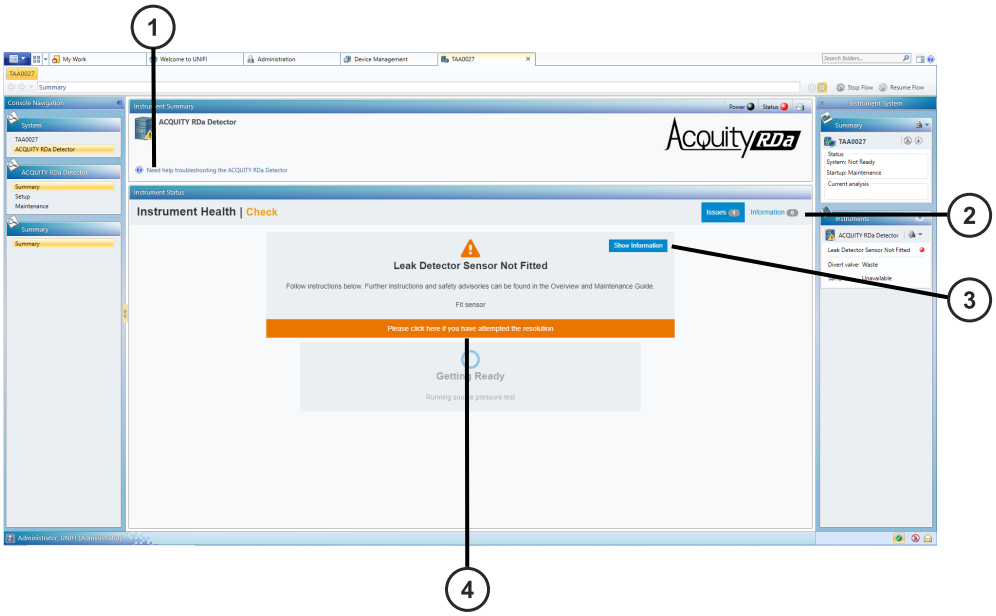
2.1.3 ACQUITY RDa Detector health system

The ACQUITY RDa Detector's health system constantly inspects and monitors performance. If an issue is detected, the instrument immediately notifies you via the software and front display. The instrument self-diagnoses problems. Depending on the severity of the issue, the instrument either requests that you carry out some intervention to correct the issue, or informs you that you must contact Waters service.

Depending on the type and cause of the failed health check, the instrument moves to either `Check` state or `Error` state. In the `Check` state, the software displays a health card that explains how you can rectify the problem. When you complete the instructions outlined, the instrument runs the test again to confirm that the issue is corrected. If the issue remains, another solution may be displayed as detailed below.

If multiple health checks are flagged as problems, they are displayed in a prioritized order. Errors are always presented ahead of Warnings, as Errors require you to contact your Waters service engineer. When a health check is rectified, the next in priority is displayed until all are resolved.

Figure 2–2: RDa health system



1. Link to online Help
2. Issues and Information tabs
3. Show Information button
4. Health card

Issues tab

The following are displayed under the **Issues** tab:

- Activities - The instrument is in a `Getting Ready` state. Activities are actions the instrument is performing to get to a `Ready` state.
- Warnings - The instrument is in a `Check` state. Warnings are issues observed by the health system that you can rectify through user maintenance activities.
- Errors - The instrument is in an `Error` state and requires the help of a Waters service engineer. The panel on the instrument displays the words `Call Service`.

Information tab

Additional information is displayed on the Summary page under the **Information** tab. These alerts do not affect the instrument health or the operation of the instrument; instead, they can help when multiple scientists are using the system. For example, you can see if the Source Pressure Test was overridden or if calibrations were not run for specific slots.

2.2 Leaving the instrument in Power Save mode

When you are not using the instrument, stop the LC flow, and put the instrument in Power Save mode, to conserve energy and reduce nitrogen consumption (see the online Help for details).

Tip: If the instrument has been in Power Save mode for more than 60 minutes and you transition to Operate mode, Waters recommend that you allow the instrument to stabilize for at least one hour before you calibrate the instrument or run any samples.

2.3 Power-cycling the ACQUITY RDa Detector

To power-cycle the ACQUITY RDa Detector when it is powered-on:

1. Power-down the instrument by pressing and holding the power button for approximately five seconds until the instrument powers-down.
2. To power-up the instrument, wait approximately 15 seconds, and then press the power button.
3. Wait approximately five minutes.
4. When the instrument is ready, the Operate button on the Console page becomes available. When this happens, click the **Operate** button.
5. Wait for the instrument to reach the correct vacuum pressure. When this occurs, the Instrument Setup function becomes available on the Console page.

3 Maintenance

Review maintenance guidelines and procedures, which are necessary to ensure optimal instrument performance.

Keep to recommended maintenance schedules, and perform maintenance as required and described in relevant topics.

3.1 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 3–1: Maintenance schedule

Procedure	Frequency	Additional information
Replace the probe capillary assembly	When sensitivity decreases to unacceptable levels	See Replacing the probe capillary assembly (Page 53).
Replace or refit the source enclosure o-ring	As required	See Replacing or refitting the source enclosure o-ring (Page 32).
Clean the sample cone assembly	As required	See Removing the sample cone assembly (Page 34) and Cleaning the source components (Page 39).
Clean the source components	When sensitivity decreases to unacceptable levels	See Cleaning the source components (Page 33).
Replace the air filters	Annually	See Replacing the air filters (Page 56).
Clean the instrument case	As required	See Cleaning the exterior of the equipment (Page 56).
Inspect and adjust the rotary backing pump's oil level	Weekly	See Maintaining the rotary backing pump’s oil (Page 62).
Empty the exhaust trap bottle in the instrument exhaust line	Check daily, empty as required	See Emptying the source exhaust trap bottle (Page 61).
Change the rotary backing pump oil	Annually	See Maintaining the rotary backing pump’s oil (Page 62).

Table 3–1: Maintenance schedule (continued)

Procedure	Frequency	Additional information
Change the rotary backing pump's filter elements	Annually	See Replacing the rotary backing pump's filter elements (Page 64).

3.2 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.

3.3 Replacing fuses

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

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

If either of the instrument's fuses, located on the rear panel, ruptures or becomes otherwise faulty, replace it with a fuse of the following type and rating.

Table 3–2: Fuse information

Location	Size	Type	Current rating	Rupture capacity	Voltage rating
Rear panel	5 × 20 mm	T	6.3 A	H	250 V

3.4 Safety and handling

Be aware of the following safety considerations when performing maintenance procedures:

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

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

Warning: To avoid electric shock, observe these precautions:

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

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

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

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

See Appendix A (Page 67) for safety advisory information.

3.5 Preparing the instrument for working on the source

For safety reasons, you must, depending on the maintenance task, either put the instrument into Power Save mode or turn the instrument off before you perform any maintenance on the source. The following procedures instruct you on what you need to do and when.

3.6 Removing and refitting the source enclosure

Remove the source enclosure to gain access to the source components that need routine cleaning and replacement.

3.6.1 Removing the source enclosure from the instrument

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

Notice: To avoid damaging the fragile probe, use care when removing it from the source enclosure.

Warning: To avoid puncture injuries from the sharp ESI capillary, use care when inserting and removing the probe from the source enclosure.

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

Required tools and materials

- Chemical-resistant, powder-free gloves

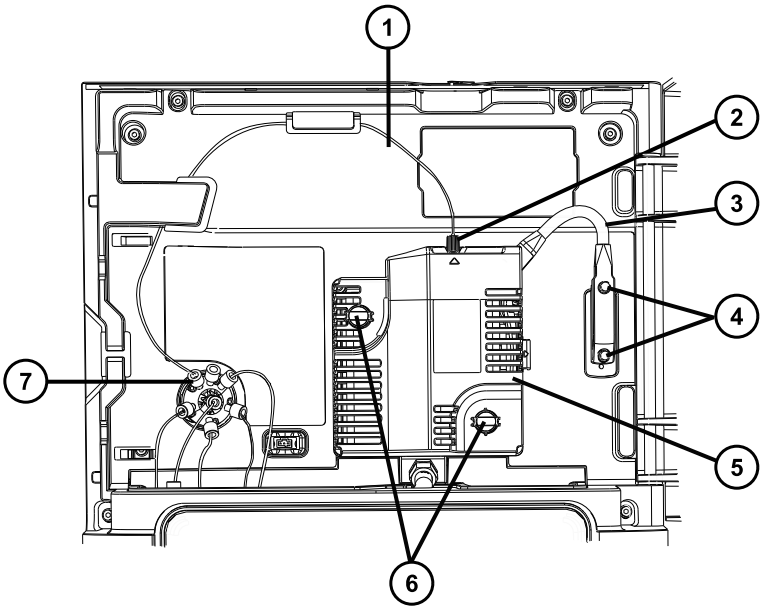
To remove the source enclosure:

1. In the system console software, click **Power Save** to put the instrument into Power Save mode.

   Important: To avoid injury, do not remove the ion block, restrictor, or source ion guide when the instrument is in Power Save mode. To remove these components you must turn off the instrument and wait five minutes for it to vent. Power-off the instrument by pressing and holding the power button for approximately five seconds until the instrument powers-off.

2. Open the instrument door.

Figure 3–1: Removing the source enclosure



1	Probe capillary assembly	2	Probe capillary connection at source

3	Electrical cable	4	Electrical cable screws
5	Source enclosure	6	Source enclosure thumbscrews
7	Probe capillary connection at divert valve		

3. Disconnect the source enclosure's electrical cable from the front of the instrument by loosening the screws, and pull the cable from the socket.
4. Loosen the two thumbscrews on the front of the source enclosure.
5. Remove the source enclosure by pulling it away from the instrument using both hands, and place it on a flat surface.

3.6.2 Fitting the source enclosure to the instrument

Required tools and materials

- Chemical-resistant, powder-free gloves

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

To fit the source enclosure to the instrument:

1. Use both hands to slide the source enclosure onto the instrument's supporting rods.
2. To secure the enclosure against the instrument, tighten the two thumbscrews on the front of the source enclosure.

   Notice: To avoid damage to the electrical connector's screws, do not overtighten them.

3. Connect the electrical cable to the socket on the right-hand side of the instrument's front panel and tighten the screws.
4. To avoid trapping and damaging the capillary in the instrument door, slide the capillary beneath the retaining clips.
5. Close the instrument door.
6. In the system console, click **Operate** to put the instrument into Operate mode.

   Notes:

- When transitioning from Power Save to Operate, Waters recommend that you allow the instrument to stabilize for one hour before you perform a calibration.
- If the instrument is off, power it up (see Starting the instrument (Page 82)).

3.7 Replacing or refitting the source enclosure O-ring

If the instrument indicates that it has failed a source pressure test, you need to inspect the source enclosure O-ring to ensure that it is fitted correctly and not damaged.

Required tools and materials

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

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

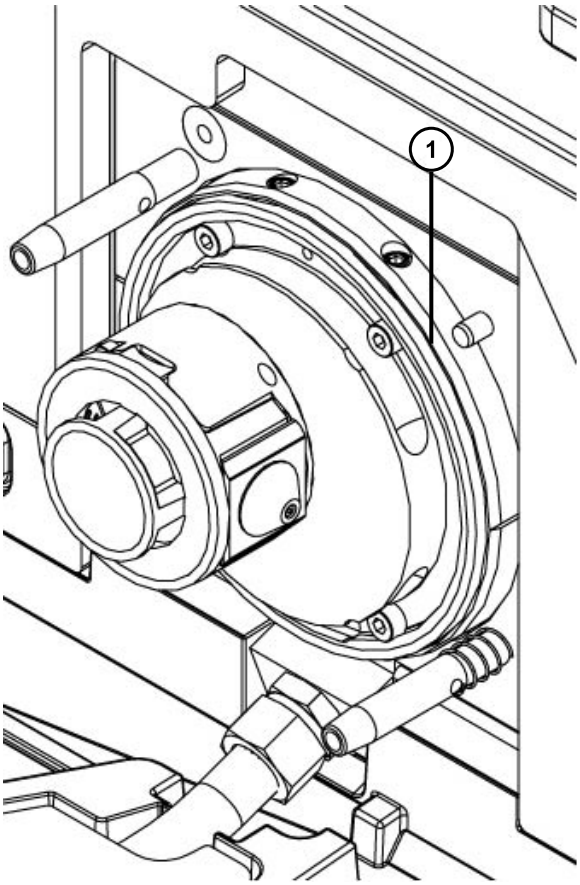
Warning: To avoid burn injuries, allow the ion block assembly to cool before performing this procedure.

Important: Ensure that the instrument is in Power Save mode before performing this procedure.

To replace or refit the source enclosure O-ring:

1. Remove the source enclosure from the instrument (see Removing the source enclosure from the instrument (Page 29)).
2. Inspect the source enclosure O-ring and ensure that it is fitted correctly and undamaged.

Figure 3–2: Source enclosure O-ring



1 Source enclosure O-ring

3. If the O-ring is fitted incorrectly, remove and refit it.
4. If the O-ring is damaged, remove it, and then fit a replacement O-ring.
5. Fit the source enclosure to the instrument (see Fitting the source enclosure to the instrument (Page 31)).

3.8 Cleaning the source components

Clean the source components when these conditions apply:

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

3.8.1 Removing the sample cone assembly

Required tools and materials

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

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

Warning: To avoid burn injuries, allow the ion block assembly to cool before performing this procedure.

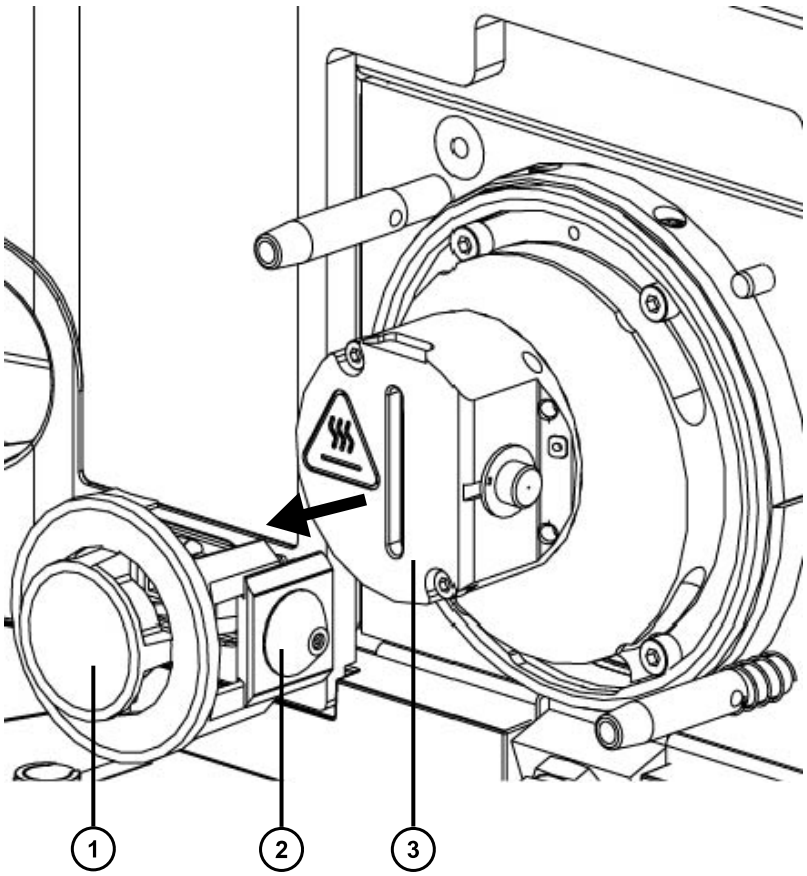
Attention: To avoid possible issues with the instrument, ensure that this procedure is completed within two hours.

Important: Ensure that the instrument is in Power Save mode before performing this procedure.

To remove the sample cone assembly:

1. Remove the source enclosure (see Removing the source enclosure from the instrument (Page 29)).
2. Remove the PEEK cone clamp and the gas cone by pulling the cone clamp away from the instrument.

Figure 3–3: Removing the gas cone and the PEEK cone clamp

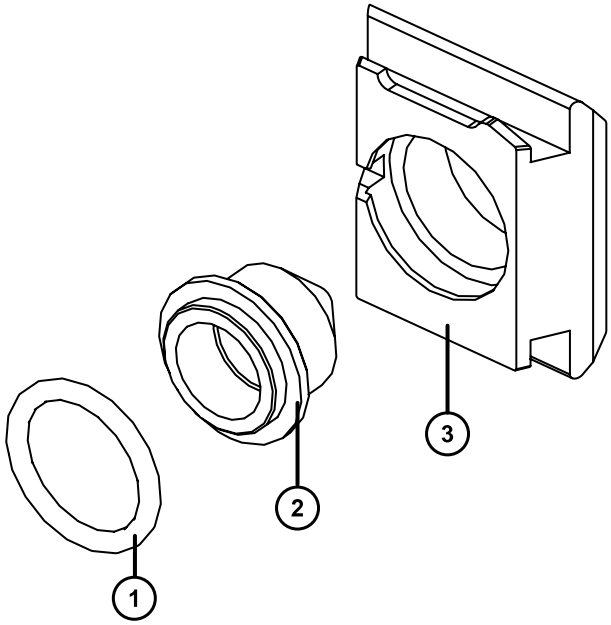


1. PEEK cone clamp
2. Gas cone (with cone on the reverse side)
3. Ion block

Note: The gas cone conceals the sample cone assembly.

3. Remove the sample cone assembly from the gas cone.

Figure 3–4: Sample cone assembly components



1. Sample cone O-ring
2. Sample cone
3. Gas cone

4. Inspect the gas cone and sample cone for contamination. If these components are visibly fouled, to clean them, see Cleaning the source components (Page 39).
5. To refit the sample cone assembly, see Refitting the source components (Page 40).

3.8.2 Removing the ion block and restrictor

Clean the ion block when cleaning the sample cone assembly fails to increase signal sensitivity.

Required tools and materials

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

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

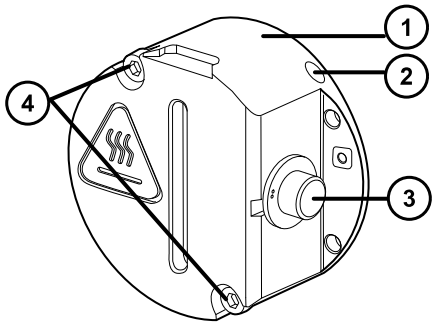
Warning: To avoid burn injuries, allow the ion block assembly to cool before performing this procedure.

Important: Ensure that the instrument is powered-off before performing this procedure.

To remove the ion block:

1. Remove the source enclosure (see Removing the source enclosure from the instrument (Page 29)).
2. Remove the PEEK cone clamp and the gas cone by pulling the cone clamp away from the instrument.
3. Loosen and remove the two screws securing the ion block to the instrument using the 2.5-mm hex wrench.

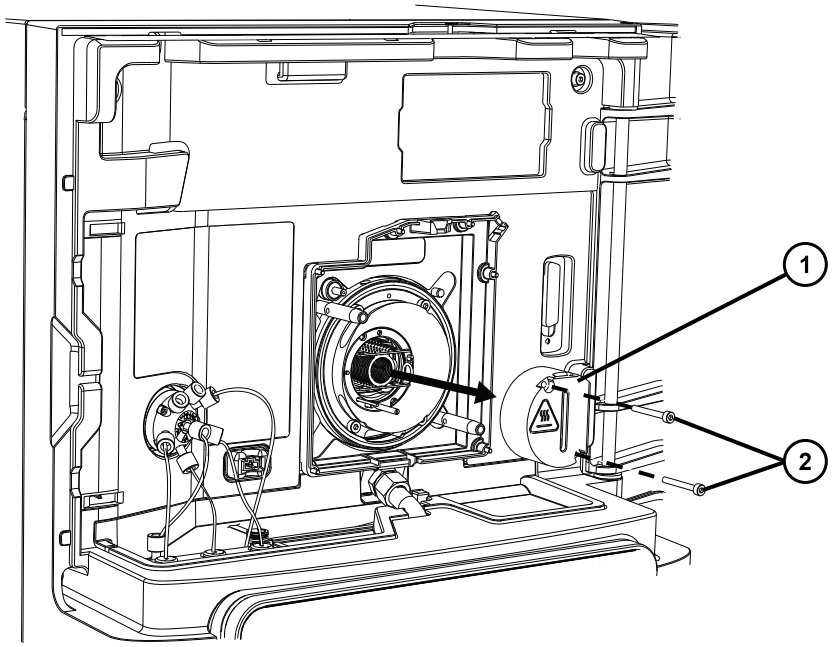
   Figure 3–5: Ion block



1	Ion block	2	Slot
3	Restrictor	4	Screws

4. Remove the ion block from the source housing.

Figure 3–6: Removing the ion block



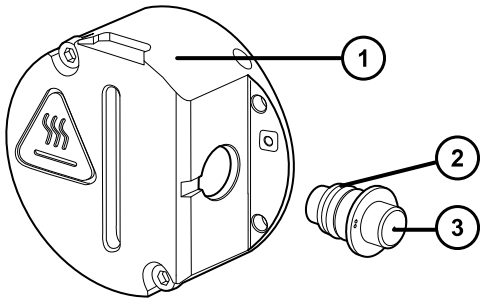
1 Ion block

2 Securing screws

Note: If the ion block does not release, insert the short end of the hex wrench into the slot on the ion block and, using the long end, lever the wrench from side to side to break the seal between the ion block and the source housing. Do not insert any other implement to break the seal between the ion block and the source housing.

5. Remove the restrictor from the ion block.

Figure 3–7: Restrictor removed from ion block



1 Ion block

2 Restrictor O-ring

③ Restrictor

6. Remove the O-ring from the restrictor.
7. Clean the components (see Cleaning the source components (Page 39)).

   Note: In addition to the ion block and restrictor, you can use the same procedure to clean the sample cone.

3.8.3 Cleaning the source components

Depending on the component type, the frequency with which you clean the source components may vary. For details, see Maintenance schedule (Page 27).

Required tools and materials

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

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

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

To clean the source components:

1. Remove any O-rings from the source components.

   Important: If an O-ring is visibly damaged, replace it.
2. Immerse the ion block, restrictor, and sample cone in separate glass vessels containing 1:1 methanol/water.

Note: Do not clean the consumable components such as the O-rings. Instead, replace these consumables when performing general maintenance, when the components are visibly damaged, or when the performance or cleanliness of the machine is compromised.

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

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

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

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

3.8.4 Refitting the source components

Required tools and materials

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

To refit the source components:

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

Note: This procedure presumes that the ion block, restrictor, and sample cone were cleaned.

1. Refit the O-rings onto the restrictor and the gas cone assembly.
2. Insert the restrictor into the ion block.

3. Inspect the source enclosure O-ring and ensure that it is fitted correctly and undamaged. Refit or replace the O-ring as required.
4. Place the ion block assembly against the ion block support on the front of the instrument, aligning the screw positions.
5. Secure the ion block to the instrument using the two screws and tighten them using the 2.5-mm hex wrench.
6. Reassemble the gas cone assembly, and then refit this to the PEEK cone clamp.
7. Refit the PEEK cone clamp and the gas cone assembly to the ion block.
8. Refit the source enclosure (see Fitting the source enclosure to the instrument (Page 31)).

3.9 Cleaning the ion guide assembly

Clean the ion guide assembly when these conditions apply:

- Cleaning the source components fails to increase signal stability.
- Replacing the entrance aperture seal and disc fails to increase signal stability.

3.9.1 Removing the ion guide assembly from the source assembly

Required tools and materials

- Chemical-resistant, powder-free gloves
- 2-mm hex wrench
- 3-mm hex wrench
- Flat-blade screwdriver

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

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

Notice: To avoid damaging the ion guide assembly, handle it and its components carefully throughout the cleaning procedure. In particular, do not touch the wiring.

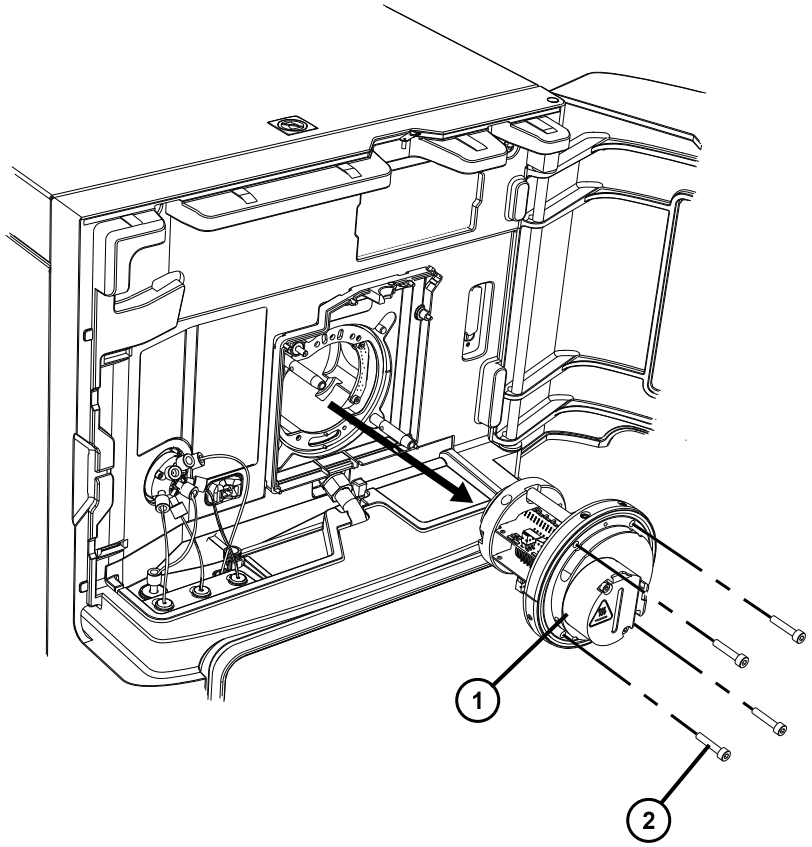
Important: Ensure that the instrument is powered-off before performing this procedure.

To remove the ion guide assembly from the source assembly:

1. Remove the source enclosure from the instrument (see Removing the source enclosure from the instrument (Page 29)).
2. Remove the PEEK cone clamp and the gas cone by pulling the cone clamp away from the instrument.
3. Use the 3-mm hex wrench to remove the four screws that secure the pumping block to the instrument.
4. Carefully pull the pumping block away from the instrument and place it on a flat surface.

   Note: The ion guide assembly is attached to the rear side of the pumping block.

   Figure 3–8: Removing the pumping block and ion guide

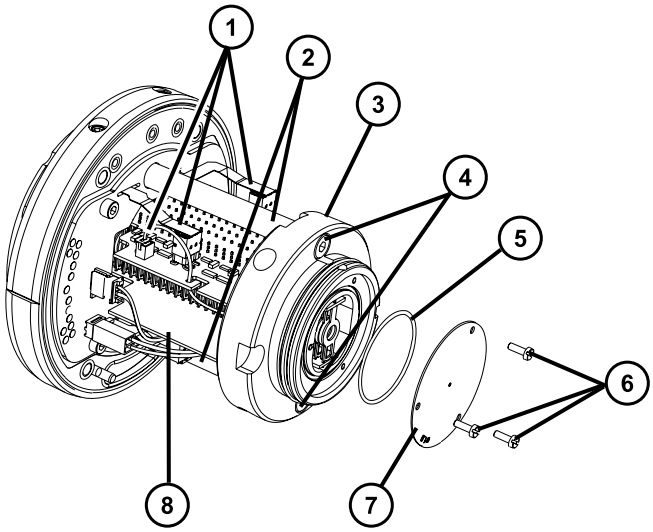


   1 Pumping block

   2 Securing screws (4)

5. Remove the three slotted screws that secure the differential aperture to the ion guide housing using the flat-blade screwdriver, and then remove the differential aperture.

Figure 3–9: Removing the differential aperture

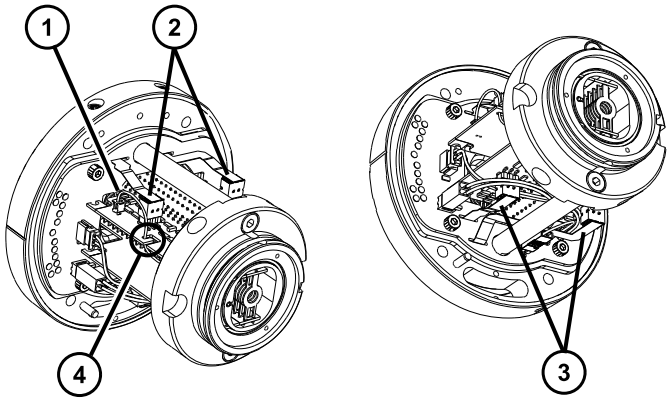


1	Electrical connectors	2	Ion guide support rods
3	Differential aperture support	4	Differential aperture support screws
5	Differential aperture O-ring	6	Differential aperture securing screws
7	Differential aperture	8	Ion guide

Recommendation: Clean the differential aperture (see Cleaning the differential aperture (Page 45)) before disassembling the ion guide housing. If cleaning the differential aperture fails to increase signal sensitivity, continue with this procedure, and then clean the ion guide (see Cleaning the ion guide assembly (Page 46)).

6. Remove the differential aperture O-ring.
7. Disconnect the five electrical connectors from the ion guide, leaving them attached to the pumping block.

Figure 3–10: Ion guide – electrical connectors



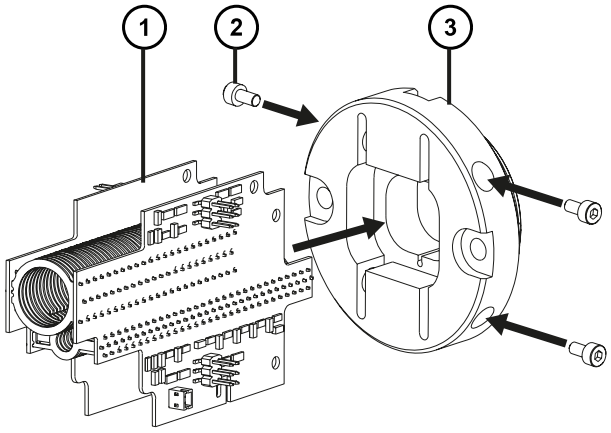
1	2-way connector – top view	2	6-way connectors – top view
3	6-way connectors – underside view	4	Wire routing notch

8. Remove the two screws that secure the differential aperture support to the ion guide support rods using the 2.5-mm hex wrench, and then remove the differential aperture support and ion guide from the pumping block.

   Note: The ion guide is attached to the differential aperture support.

9. To detach the ion guide from the differential aperture support, remove the four ion guide securing screws using the 2.5-mm hex wrench.

Figure 3–11: Removing the ion guide



1 Ion guide

2 Ion guide securing screws (fourth screw is obscured)

3 Differential aperture support

10. To clean the components, see Cleaning the differential aperture (Page 45) and Cleaning the ion guide assembly (Page 46).

3.9.2 Cleaning the differential aperture

Required tools and materials

- Chemical-resistant, powder-free gloves
- Suitable glass vessel in which to completely immerse the differential aperture when cleaning
- HPLC-grade deionized water
- Waters MS Cleaning Solution (186006846) or HPLC-grade (or better) 1:1 methanol/water
- Holding container for used cleaning solution
- Ultrasonic bath
- Source of oil-free, inert gas (for example, nitrogen) for drying

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

To clean the differential aperture:

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

   Tip: You can reuse Waters MS Cleaning Solution for one subsequent cleaning.
5. Flush with deionized water until all the MS cleaning solution is removed.

   Important: Ensure that no MS Cleaning Solution remains on the component before continuing this procedure.
6. Fill the vessel with isopropyl alcohol, ensuring that the differential aperture is immersed completely.
7. Place the vessel containing the differential aperture in the ultrasonic bath for 20 minutes.
8. Carefully remove the differential aperture from its vessel and blow-dry the component using inert, oil-free gas.
9. Discard the used isopropyl alcohol, using an appropriate waste container.

3.9.3 Cleaning the ion guide assembly

Required tools and materials

- Chemical-resistant, powder-free gloves
- Suitable vessel in which to completely immerse the ion guide assembly when cleaning
- Two lengths of PEEK, PTFE, or stainless steel tubing, appropriately sized for suspending the ion guide assembly in the glass vessels when cleaning
- HPLC-grade deionized water
- Waters MS Cleaning Solution (186006846) or HPLC-grade (or better) 1:1 methanol/water
- Holding container for used Waters MS Cleaning Solution
- HPLC-grade isopropyl alcohol
- Ultrasonic bath
- Source of oil-free, inert gas (for example, nitrogen) for drying

Warning: To avoid injury when working with MS cleaning solution, take care when handling it and use a fume hood and suitable protective equipment.

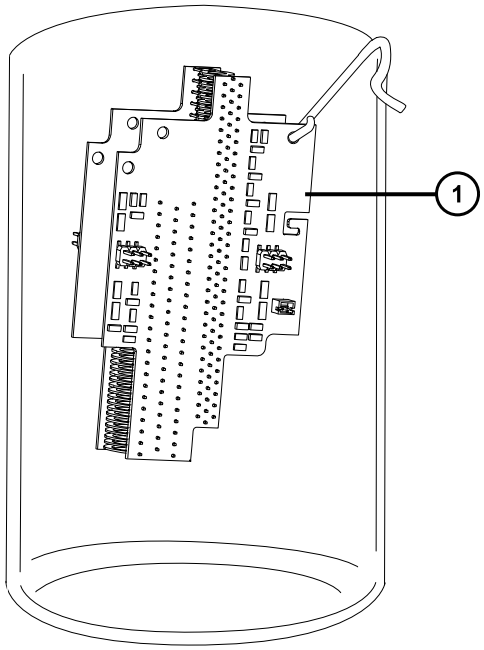
Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.

To clean the ion guide assembly:

1. Bend a PEEK, PTFE, or stainless steel tube into a hook shape and use it to carefully suspend the first ion guide PCB assembly in the glass vessel so that the bottom of the assembly does not touch the bottom of the vessel.

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

Figure 3–12: Cleaning the ion guide



1 Ion guide

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

   Tip: You can reuse Waters MS Cleaning Solution for one subsequent cleaning.
5. Flush with deionized water until all the MS cleaning solution is removed.

   Important: Ensure that no MS Cleaning Solution remains on the component before continuing this procedure.
6. Fill the vessel with isopropyl alcohol, ensuring that the ion guide is immersed completely.
7. Place the vessel containing the ion guide in the ultrasonic bath for 20 minutes.
8. Carefully remove the ion guide from its vessel and blow-dry the component using inert, oil-free gas.
9. Discard the used isopropyl alcohol using an appropriate waste container.

3.9.4 Fitting the ion guide assembly to the instrument

Required tools and materials

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

- 3-mm hex wrench
- Flat-blade screwdriver

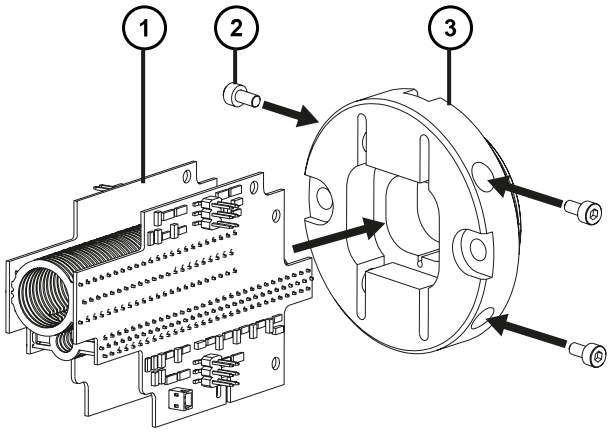
Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.

Important: Ensure that the instrument is powered-off before performing this procedure.

To fit the ion guide assembly to the instrument:

1. Carefully slide the ion guide's PCBs into the differential aperture support.

   Figure 3–13: Assembling the ion guide housing

   1 Ion guide

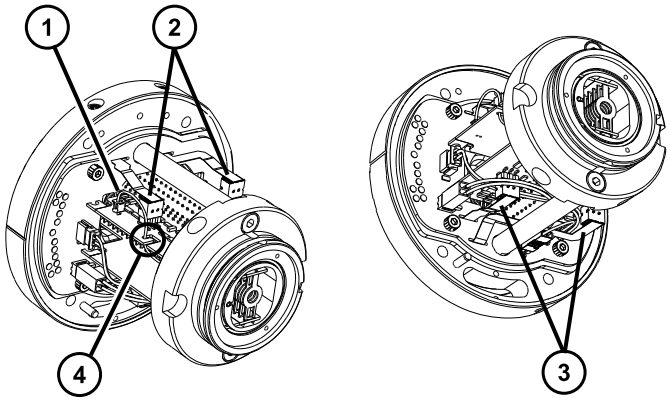
   2 Ion guide securing screws (fourth screw is obscured)

   3 Differential aperture support

2. Secure the ion guide to the differential aperture support using the four ion guide securing screws and tighten them using the 2.5-mm hex wrench.
3. Secure the ion guide and differential aperture support assembly to the pumping block's ion guide support rods using the two differential aperture support screws and tighten them using the 2.5-mm hex wrench.

   Tip: It is normal for the ion guide assembly to have some freedom to move when assembled correctly.
4. Reconnect the five electrical connectors to the ion guide.

Figure 3–14: Ion guide – electrical connectors



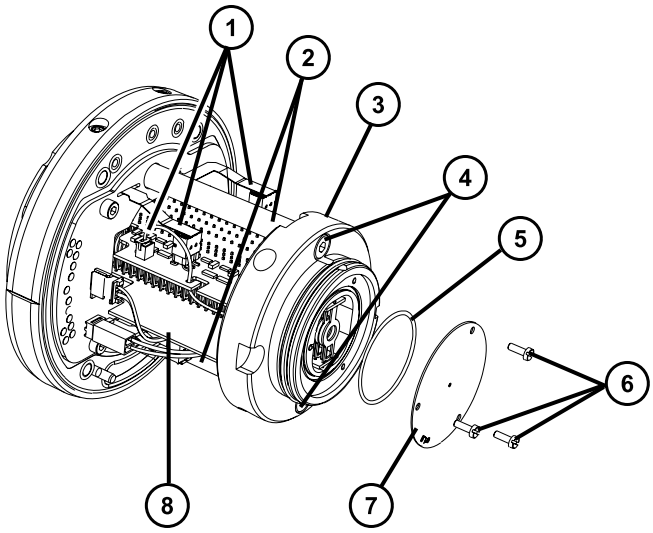
1	2-way connector – top view	2	6-way connectors – top view
3	6-way connectors – underside view	4	Wire routing notch

Note: Ensure that you route the wire for the 2-way connector through the wire routing notch.

5. Fit the differential aperture O-ring to the differential aperture support.

Note: If the O-ring is visibly damaged, replace it.

Figure 3–15: Fitting the O-ring and differential aperture



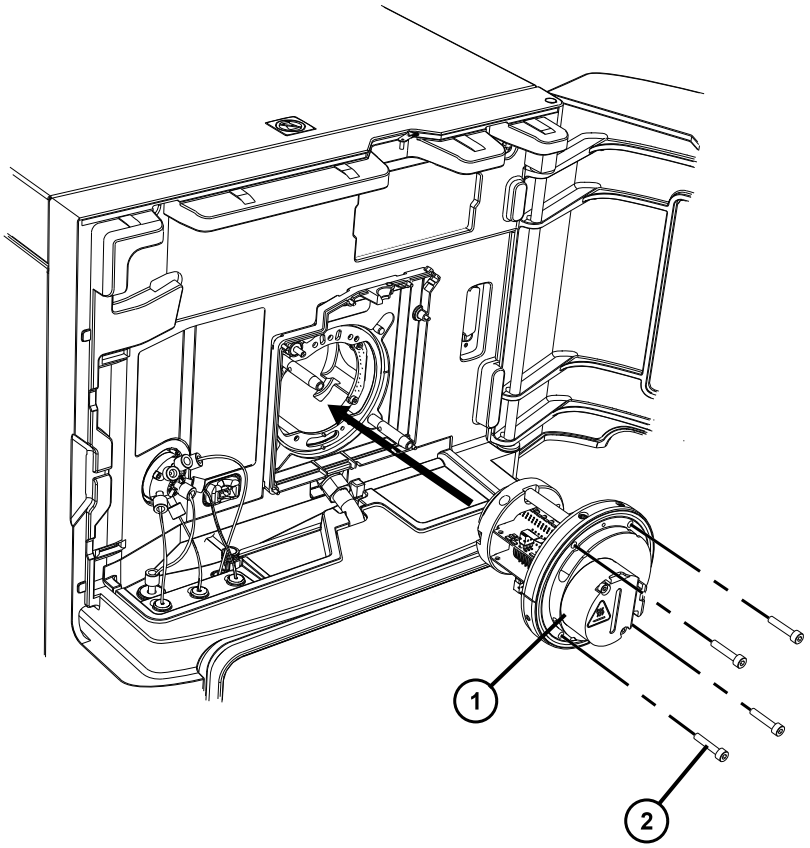
1	Electrical connectors	2	Ion guide support rods

3	Differential aperture support	4	Differential aperture support screws
5	Differential aperture O-ring	6	Differential aperture securing screws
7	Differential aperture	8	Ion guide

6. Fit the differential aperture to the differential aperture support using the three slotted screws, and then secure the screws using a flat-blade screwdriver.
7. Carefully slide the pumping block and ion guide assembly into the instrument's source housing.

   Tip: To correctly orient the pumping block, ensure that the ion guide remains visible at the left-hand edge of the pumping block's front face.

Figure 3–16: Fitting the pumping block



1 Pumping block

2 Securing screws (4)

8. Secure the pumping block to the instrument using the four pumping block securing screws, and then tighten them using the 3-mm hex wrench.

9. Refit the PEEK cone clamp and the gas cone assembly to the ion block.
10. Fit the source enclosure to the instrument (see Fitting the source enclosure to the instrument (Page 31)).

3.10 Replacing the source enclosure

Required tools and materials

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

Notice: To avoid damaging the fragile probe, use care when removing it from the source enclosure.

Warning: To avoid puncture injuries from the sharp ESI capillary, use care when inserting and removing the probe from the source enclosure.

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

Important: To avoid injury, do not remove the ion block, restrictor, or source ion guide when the instrument is in Power Save mode. To remove these components you must turn off the instrument and wait five minutes for it to vent. Power-down the instrument by pressing and holding the power button for approximately five seconds until the instrument powers-down.

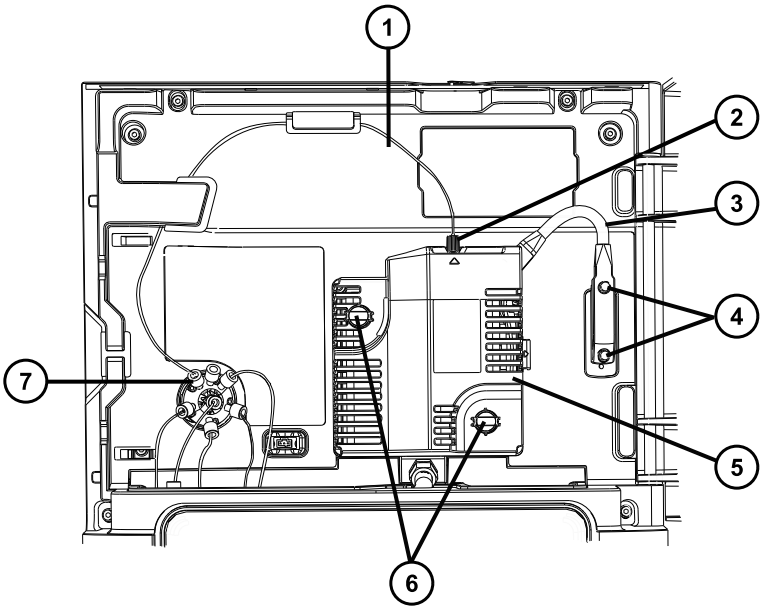
Required materials

- Chemical-resistant, powder-free gloves
- Replacement source enclosure

To replace the source enclosure:

1. In the software, click **Power Save** to put the instrument into Power Save mode.
2. Open the instrument door.

Figure 3–17: The main components



1	Probe capillary assembly	2	Probe capillary connection at source
3	Electrical cable	4	Electrical cable screws
5	Source enclosure	6	Source enclosure thumbscrews
7	Probe capillary connection at divert valve		

3. Disconnect the source enclosure's electrical cable from the front of the instrument by loosening the screws and pull the cable from the socket.
4. Loosen the two thumbscrews on the front of the source enclosure.
5. Remove the source enclosure by pulling it away from the instrument using both hands and place it on a flat surface.
6. Loosen the probe fitting, and then remove the probe capillary from the top of the source enclosure before you carefully insert it into the inlet on the new source enclosure.
7. Tighten the probe fitting until it clicks.
8. Discard the old source enclosure.
9. Use both hands to slide the replacement source enclosure onto the instrument's supporting rods.
10. To secure the enclosure against the instrument, tighten the two thumbscrews on the front of the source enclosure.

Notice: To avoid damage to the electrical connector's screws, do not overtighten them.

11. Connect the electrical cable to the socket on the right-hand side of the instrument's front panel and tighten the screws.
12. To avoid trapping and damaging the capillary in the instrument door, slide the capillary beneath the retaining clips.
13. Close the instrument door.
14. In the software, click **Operate** to put the instrument into Operate mode.

    Note: When transitioning from Power Save mode to Operate mode, Waters recommends that you allow the instrument to stabilize for one hour before you perform a calibration.

3.11 Replacing the probe capillary assembly

Warning: To avoid puncture injuries from the sharp probe capillary, use care when inserting it into the source enclosure.

Important: To avoid damaging the fragile probe capillary, if the instrument is situated above eye level, disconnect the source enclosure and place it on a bench top or other surface so that you can exercise caution when inserting the probe (see Removing the source enclosure from the instrument (Page 29)).

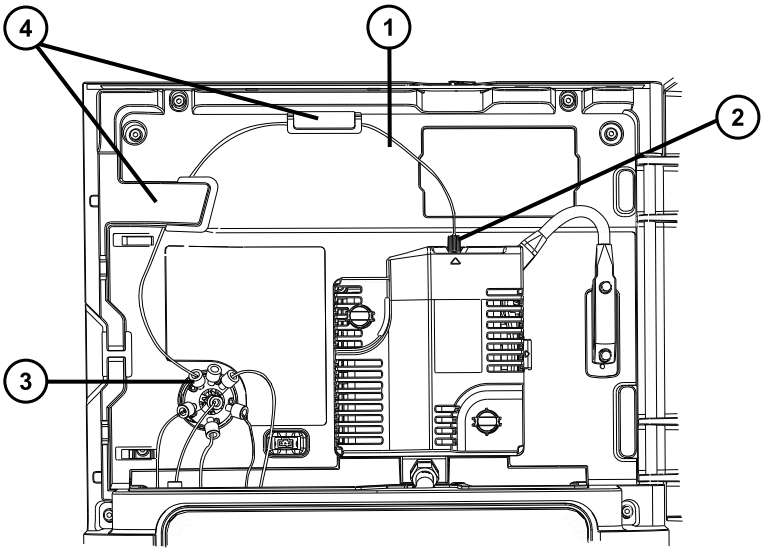
Required tools and materials

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

To replace the probe capillary assembly:

1. In the system console, click **Power Save** to put the instrument in Power Save mode.
2. Open the instrument door.

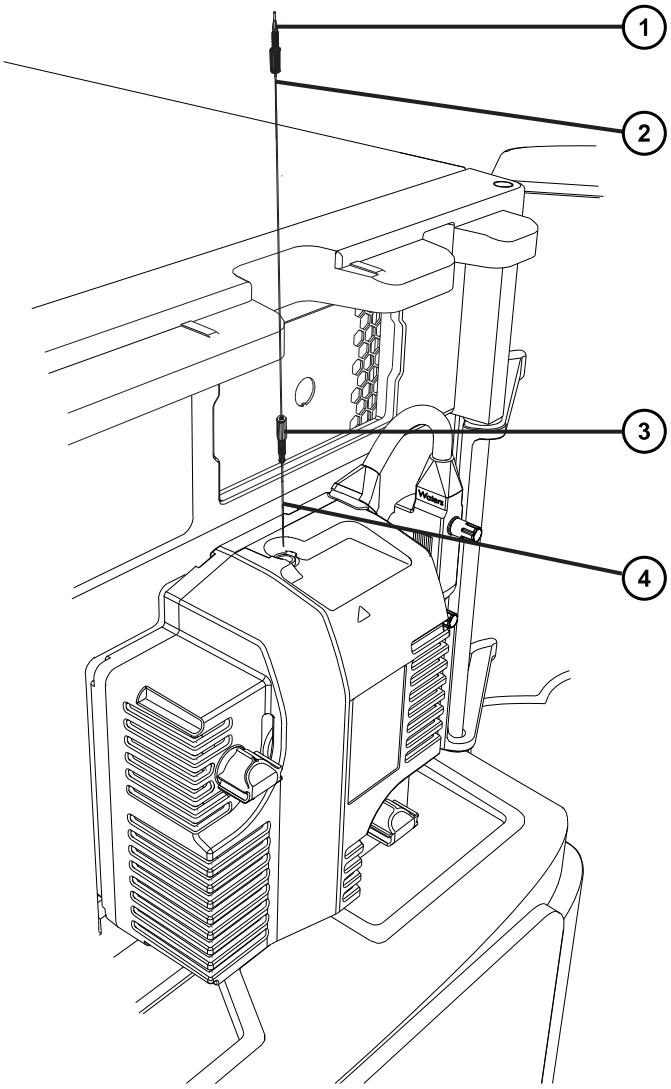
Figure 3–18: Replacing the probe capillary assembly



1	Probe capillary assembly	2	Probe capillary connection at source
3	Probe capillary connection at diverter valve	4	Capillary retaining clips

3. Loosen and remove the end of the probe capillary assembly connected to the diverter valve.
4. Remove the capillary tubing from the retaining clips.
5. Loosen and remove the end of the probe capillary connected to the top of the source enclosure.
6. Remove and dispose of the probe capillary assembly.
7. Using the replacement probe capillary assembly, carefully insert the capillary end into the inlet on top of the source enclosure and tighten the fitting until it clicks.

Figure 3–19: Fitting the probe capillary assembly



1	PEEK fitting	2	Probe capillary assembly
3	Probe fitting	4	Capillary

8. Fit the PEEK fitting end of the probe capillary assembly to the port S on the diverter valve and secure until finger-tight.

   Important: To avoid dead volumes, ensure that the capillary bottoms out in the valve.

9. To avoid trapping and damaging the capillary in the instrument door, slide the capillary beneath the retaining clips.
10. Close the instrument door.
11. In the system console, click **Operate** to put the instrument into Operate mode.

Note: When transitioning from **Power Save** to **Operate**, Waters recommends that you allow the instrument to stabilize for one hour before you perform a calibration.

3.12 Cleaning the exterior of the equipment

Warning: To avoid electric shock:

- Ensure that the electrical power to the equipment is interrupted.
- When cleaning the surface of the equipment, apply water to a cloth, and then wipe the instrument or device. Do not spray or otherwise apply water directly onto any equipment surface.

Warning: To avoid personal injury, use eye and hand protection during the cleaning process.

Required tools and materials

- Chemical-resistant, powder-free gloves
- Protective eyewear

To clean the exterior of the equipment:

- Clean surfaces of the equipment using only a clean, soft, lint-free paper towel or clean cloth dampened with water.

3.13 Replacing the air filters

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

Air filters are located in two places on the instrument. One air filter is situated in a recess above the source and the other is located underneath the front of the instrument and is held in place by a thumbscrew.

Required tools and materials

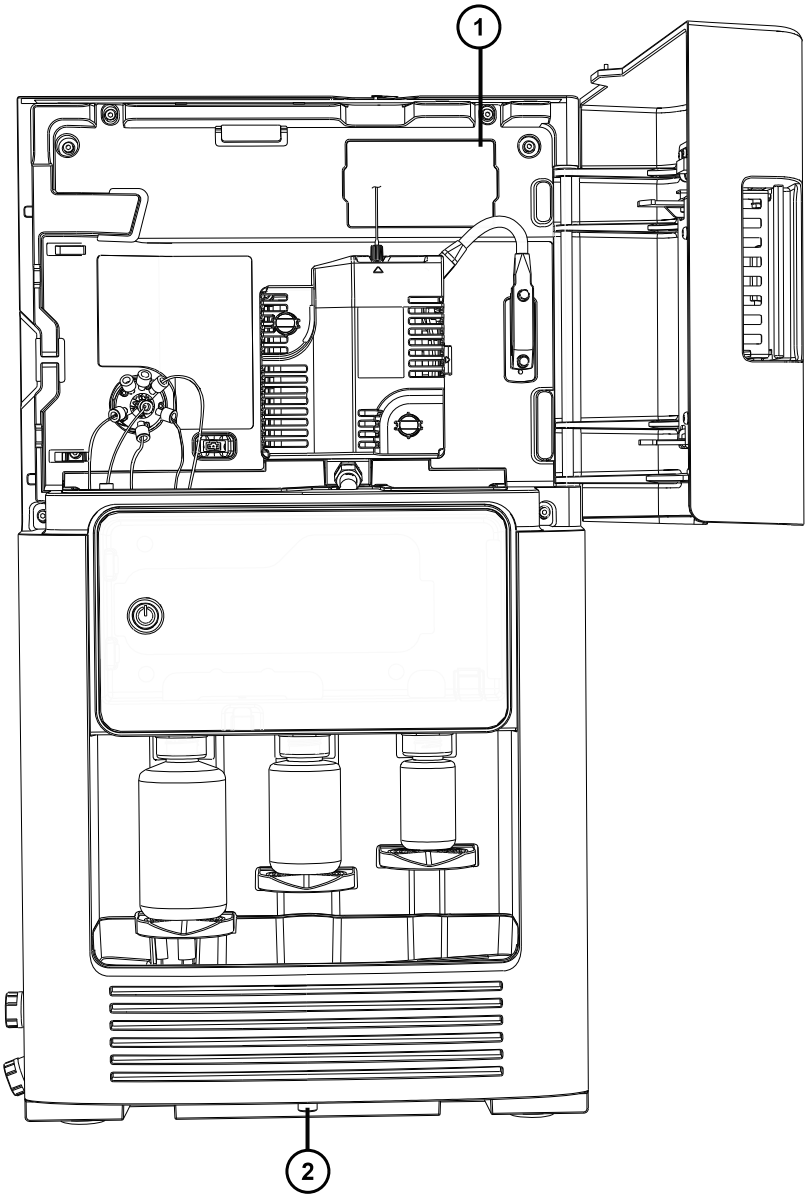
- Air filters

To replace the air filters:

1. Open the instrument door.

2. Remove the air filter above the source enclosure by grasping the filter between your fingers and pulling it out of the grill enclosure.

Figure 3–20: Air filter locations



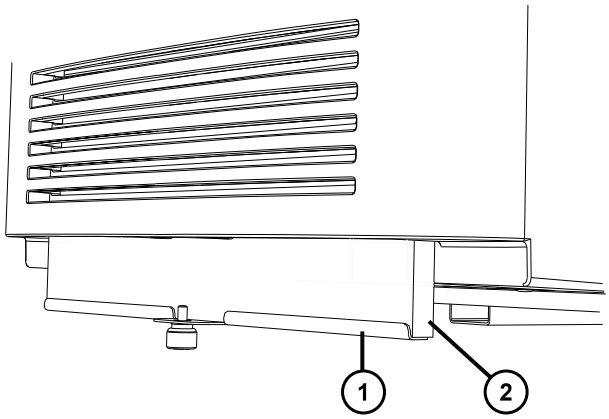
1 Air filter

2 Air filter frame thumbscrew

3. Dispose of the filter.
4. Place the new filter on the inside part of the grill with its edges secured by the metal lip.
5. Close the instrument door.
6. Unscrew the thumbscrew at the bottom of the instrument that secures the air filter frame to the instrument.

7. Remove the air filter frame.

Figure 3–21: Removing the air filter frame



1 Air filter frame

2 Air filter

8. Dispose of the filter.
9. Fit the new filter into the air filter frame.
10. Place the air filter frame into the instrument.
11. Tighten the thumbscrew.

3.14 Replacing the leak sensor

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

Warning: To avoid eye injury, use eye protection when performing this procedure.

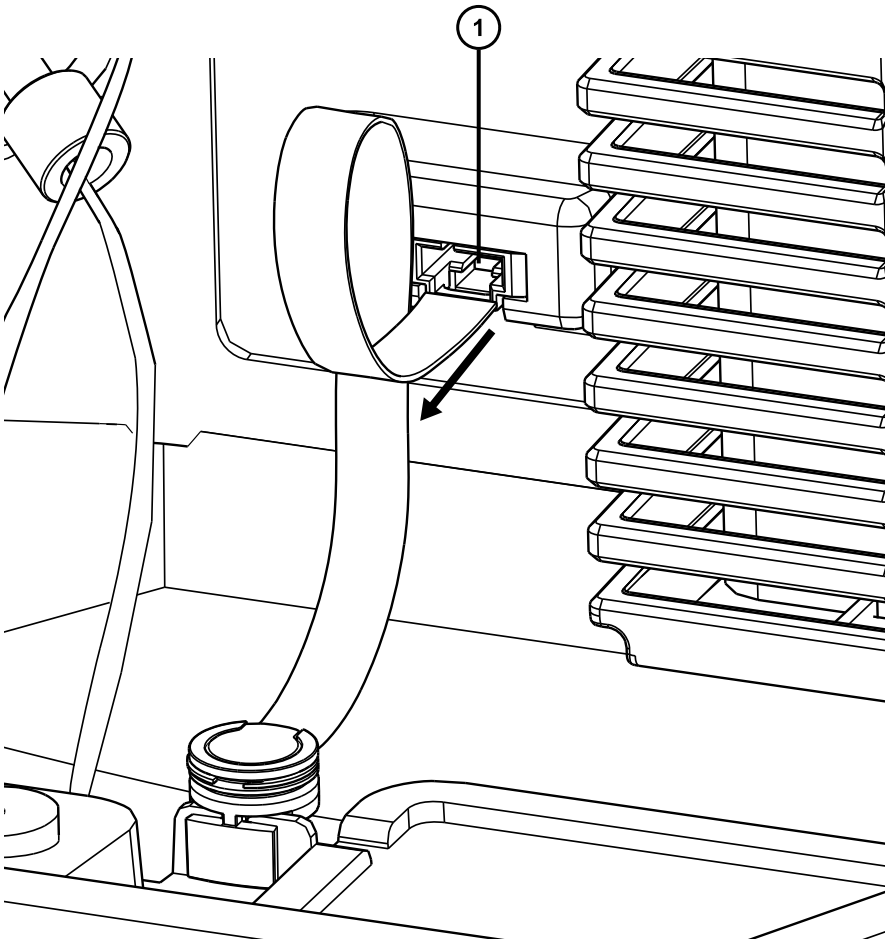
Required tools and materials

- Chemical-resistant, powder-free gloves
- Protective eyewear
- Replacement leak sensor

To replace the leak sensor:

1. Open the instrument door.

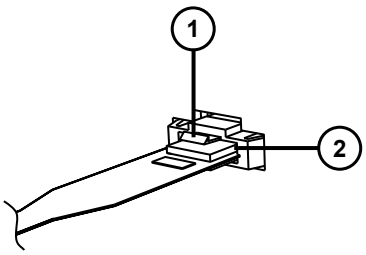
Figure 3–22: Removing leak sensor tab



1 Tab

2. Press down on the tab to detach the leak sensor connector from the front of the device.

Figure 3–23: Leak sensor connector

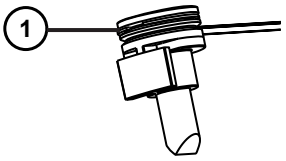


1 Tab

2 Leak sensor connector

3. Grasp the leak sensor by its serrations and pull it upward to remove it from its reservoir.

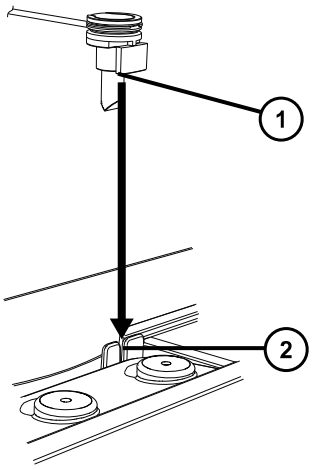
Figure 3–24: Leak sensor serrations



1 Serrations

4. Unpack the new leak sensor.
5. Align the leak sensor's T-bar with the slot in the side of the leak sensor reservoir and slide the leak sensor into place.

Figure 3–25: Aligning T-bar with slot

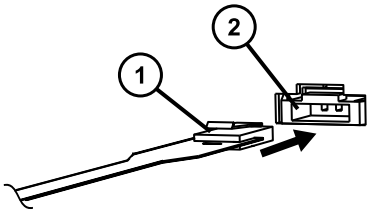


1 T-bar

2 Slot in leak sensor reservoir

6. Connect the leak sensor connector to the front of the device.

Figure 3–26: Attaching leak sensor connector



1 Leak sensor connector

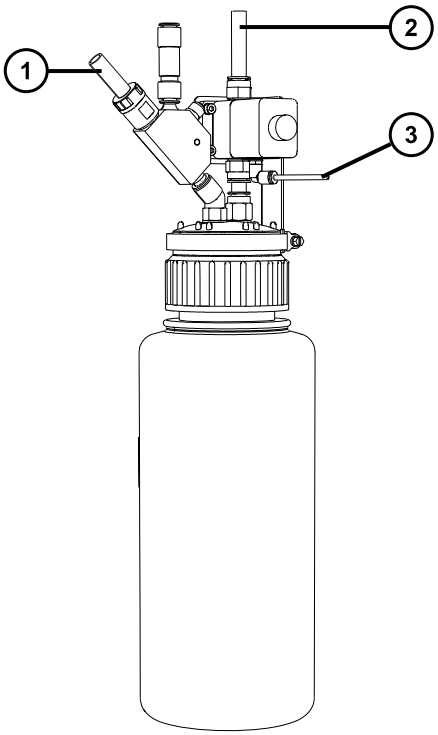
2 Leak sensor port on front of device

7. Close the instrument door.

3.15 Emptying the source exhaust trap bottle

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

Figure 3–27: Source exhaust trap bottle



1. From pinch valve assembly (3/8-inch I.D. convoluted tubing)
2. To laboratory exhaust port (12-mm O.D.)
3. 4-mm nitrogen line from the pinch valve assembly to the pilot valve.

Required tools and materials

- Chemical-resistant, powder-free gloves

To empty the source exhaust trap bottle:

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

1. In the software, stop the LC flow.

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

2. Unscrew and remove the nitrogen exhaust trap from its cap and associated fittings.

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

3. Dispose of the waste liquid in accordance with local environmental regulations.
4. Fit and fully tighten the trap onto its cap.
5. Secure the trap in the upright position.
6. In the software, start the LC flow.

3.16 Maintaining the rotary backing pump's oil

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

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

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

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

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

Required tools and materials

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

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

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

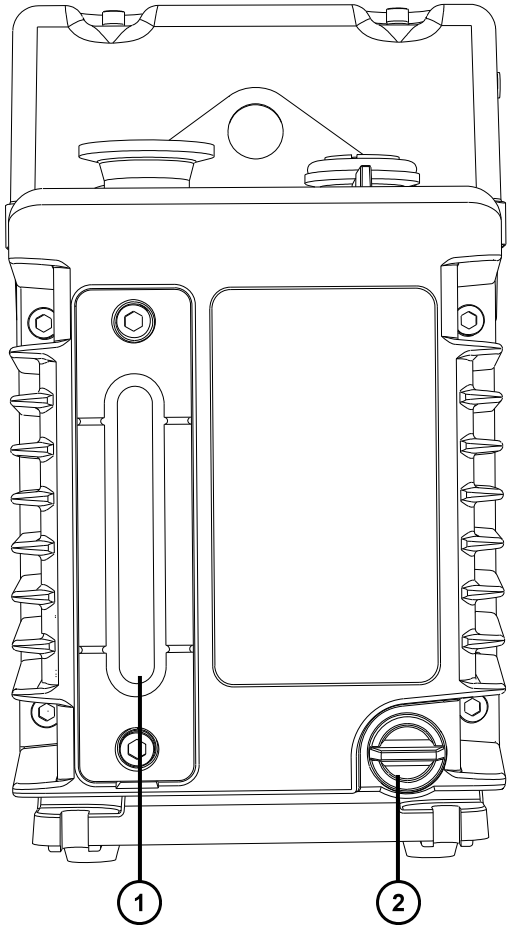
Warning: To avoid slip injuries, inspect the pump for oil leaks.

To add oil to the backing pump:

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

   Warning: To avoid skeletal or muscle injury associated with lifting heavy objects, at least two persons must lift the pump.
4. Place the pump on a tray suitable for catching dripping oil.
5. Remove the oil drain plug from the pump's rear panel.

Figure 3–28: Backing pump rear panel



1 Oil level sight glass

(2) Oil drain plug

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

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

    Notice: Do not fill the pump beyond the "max" mark.
15. Refit the oil inlet plug.

3.17 Replacing the rotary backing pump's filter elements

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

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

Required tools and materials

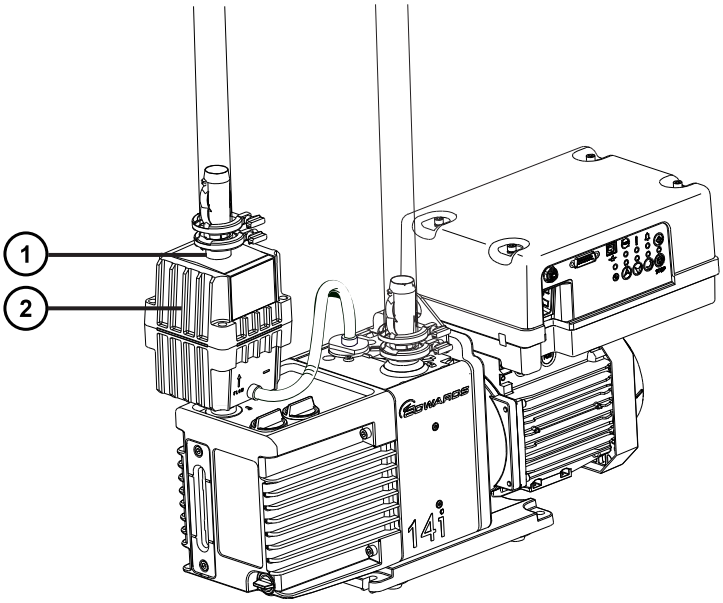
- Chemical-resistant, powder-free gloves
- 4-mm hex wrench
- Replacement filter elements
- Cloth/Paper towel

To replace the rotary backing pump's filter elements:

1. Disconnect the pump from the electrical supply.

2. Clean the filter case by wiping it with a paper towel or cloth.
3. Disconnect the vacuum hose from the filter outlet.

Figure 3–29: Rotary backing pump and filter

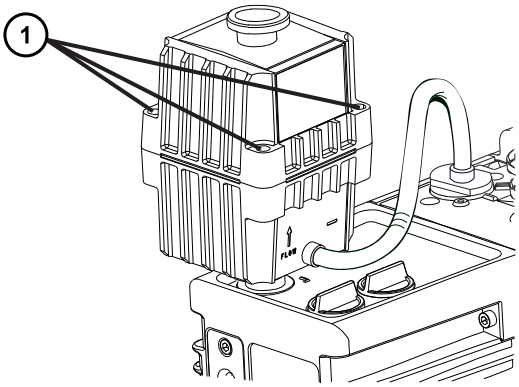


1 Filter outlet

2 Filter case

4. Use the 4-mm hex wrench to remove the four screws that secure the upper filter case to the lower filter case, and then remove the upper case.

Figure 3–30: Filter case screws

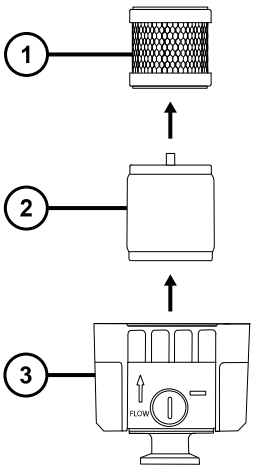


1 Filter screws

Note: In the figure, the filter obscures the fourth screw.

5. Lift the odor element and mist filter element out of the lower filter case and dispose of them in accordance with local environmental regulations.

Figure 3–31: Filter elements



1 Odor element

2 Mist filter element

3 Lower filter case

6. Wipe the inside of the upper and lower filter cases with a paper towel or cloth.

   Note: Do not remove O-rings from the filter case.

7. Fit the new filter elements.

   Note: Ensure that the foam sealing rings on the top and bottom of the elements are properly seated.

8. Fit the upper filter case to the lower filter case using the four filter case screws.
9. Secure the screws using the 4-mm hex wrench.
10. Connect the vacuum hose to the filter outlet.

3.18 Replacing the fluidics tubing

In the event of a blockage in the tubing connections between the fluidics system components, the software prompts you to replace the tubing.

- For the probe, see Connecting the probe (Page 79).

A Safety advisories

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

A.1 Warning symbols

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

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

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

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

Warning: (Risk of electric shock.)

Warning: (Risk of fire.)

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

Warning: (Risk of hand crush injury.)

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

Warning: (Risk of exposure to ultraviolet radiation.)

Warning: (Risk of contacting corrosive substances.)

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

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

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

Warning: (Risk of tipping.)

Warning: (Risk of explosion.)

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

A.1.1 Specific warnings

A.1.1.1 Burst warning

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

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

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

A.1.1.2 Mass spectrometer shock hazard

The following warning applies to all Waters mass spectrometers.

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

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

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

A.1.1.3 Mass spectrometer flammable solvents warning

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

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

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

A.1.1.4 Biohazard warning

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

Warning: To avoid infection from blood-borne pathogens, inactivated microorganisms, and other biological materials, assume that all biological fluids that you handle are infectious.

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

Warning: To avoid injury when working with hazardous materials, consult the Safety Data Sheets regarding the solvents you use and follow good laboratory practices. Additionally, consult the safety representative for your organization regarding its protocols for handling such materials.

A.1.1.5 Biohazard and chemical hazard warning

This warning applies to Waters instruments and devices that can process biohazards, corrosive materials, or toxic materials.

Warning: To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, you must understand the hazards associated with their handling.
Guidelines prescribing the proper use and handling of such materials appear in the latest edition of the National Research Council's publication, *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*.
To avoid injury when working with hazardous materials, consult the Safety Data Sheets regarding the solvents you use. Additionally, consult the safety representative for your organization regarding its protocols for handling such materials and follow good laboratory practices.

A.2 Notices

Notice advisories appear where an instrument, device, or component can be subject to use or misuse that can damage it or compromise a sample's integrity. The exclamation point symbol and its associated statement alert you to such risk.

Notice: To avoid damaging the case of the instrument or device, do not clean it with abrasives or solvents.

A.3 Bottles Prohibited symbol

The Bottles Prohibited symbol alerts you to the risk of equipment damage caused by solvent spills.

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

A.4 Required protection

The Use Eye Protection and Wear Protective Gloves symbols alert you to the requirement for personal protective equipment. Select appropriate protective equipment according to your organization's standard operating procedures.

Requirement: Use eye protection when performing this procedure.

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

A.5 Warnings that apply to all Waters instruments and devices

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

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

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

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

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

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

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

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

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

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

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

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

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

- Portez systématiquement des lunettes de protection à proximité de tubes en polymère sous pression.
- Éteignez toute flamme se trouvant à proximité de l’instrument.
- Évitez d'utiliser des tubes sévèrement déformés ou endommagés.
- N’exposez pas les tuyaux non métalliques au tétrahydrofurane, ou THF, ou à de l’acide nitrique ou sulfurique concentré.
- Sachez que le chlorure de méthylène et le diméthylesulfoxyde entraînent le gonflement des tuyaux non métalliques, ce qui réduit considérablement leur pression de rupture.

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

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

Avvertenza: Fare attenzione quando si utilizzano tubi in materiale polimerico sotto pressione:

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

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

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

警告： 当有**压**力的情况下使用聚合物管**线时**，小心注意以下几点：

- 当接近有**压**力的聚合物管**线时**一定要戴防**护**眼**镜**。
- 熄**灭**附近所有的火焰。
- 不要使用已**经**被**压瘪**或**严**重弯曲的管**线**。
- 不要在非金属管**线**中使用四**氢呋**喃或**浓**硝酸或**浓**硫酸。
- 要了解使用二**氯**甲**烷**及二甲基**亚砜**会**导**致非金属管**线**膨**胀**，大大降低管**线**的耐**压**能力。

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**碸**會導致非金屬管線膨脹，大大降低管線的耐壓能力。

경고: 가압 폴리머 튜브로 작업할 경우에는 주의하십시오.

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

This warning applies to Waters instruments fitted with nonmetallic tubing or operated with flammable solvents.

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

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

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

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

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

警告： 使用者必须非常清楚如果设备不是按照制造厂商指定的方式使用，那么该设备所提供的保护将被削弱。

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

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

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

A.6 Warnings that address the replacement of fuses

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

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

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

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

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

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

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

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

警告： 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。

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、ヒューズを交換する場合は、装置ヒューズカバーの隣のパネルに記載されている種類および定格のヒューズをご使用ください。

Finding fuse types and ratings when that information does not appear on the instrument or device:

Warning: To protect against fire, replace fuses with those of the type and rating indicated in the “Replacing fuses” section of the Maintenance Procedures chapter.

Avertissement : Pour éviter tout risque d’incendie, remplacez toujours les fusibles par d’autres du type et de la puissance indiqués dans la rubrique « Remplacement des fusibles » du chapitre traitant des procédures de maintenance.

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

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

Advertencia: Para evitar incendios, sustituir los fusibles por otros del tipo y características indicados en la sección "Sustituir fusibles" del capítulo Procedimientos de mantenimiento.

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

警告： 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。

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

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

A.7 Electrical symbols

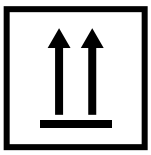
The following electrical symbols and their associated statements can appear in instrument manuals and on an instrument’s front or rear panels.

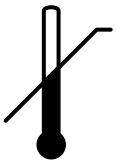
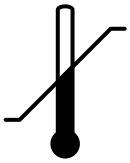
Symbol	Description
	Electrical power on

Symbol	Description
	Electrical power off
	Power Save
	Direct current
	Alternating current
	Alternating current (three phase)
	Safety ground
	Frame or chassis terminal connection
	Fuse
	Functional ground
	Input
	Output
	Indicates that the device or assembly is susceptible to damage from electrostatic discharge (ESD)

A.8 Handling symbols

The following handling symbols and their associated statements can appear on labels affixed to the packaging in which instruments, devices, and component parts are shipped.

Symbol	Description
	Keep upright!
	Keep dry!

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

B Preparing the system for operation

Your instrument is ready to run following installation by a Waters service engineer. If you move the instrument and need to reconnect it, carry out the following procedures.

B.1 Rear panel connections

Verify that all the instruments external connections are connected: see External Connections (Page 89).

For details of supported inlet system configurations, contact Waters Technical Service.

B.2 Sample Inlet

Connect the ACQUITY RDa detector to the LC instrument via the divert valve using the supplied 500-mm probe assembly.

Notice: To avoid the pressure exceeding the limits of the preceding instrument, ensure that you use the recommended tubing size and lengths for your instrument.

B.3 Connecting the probe

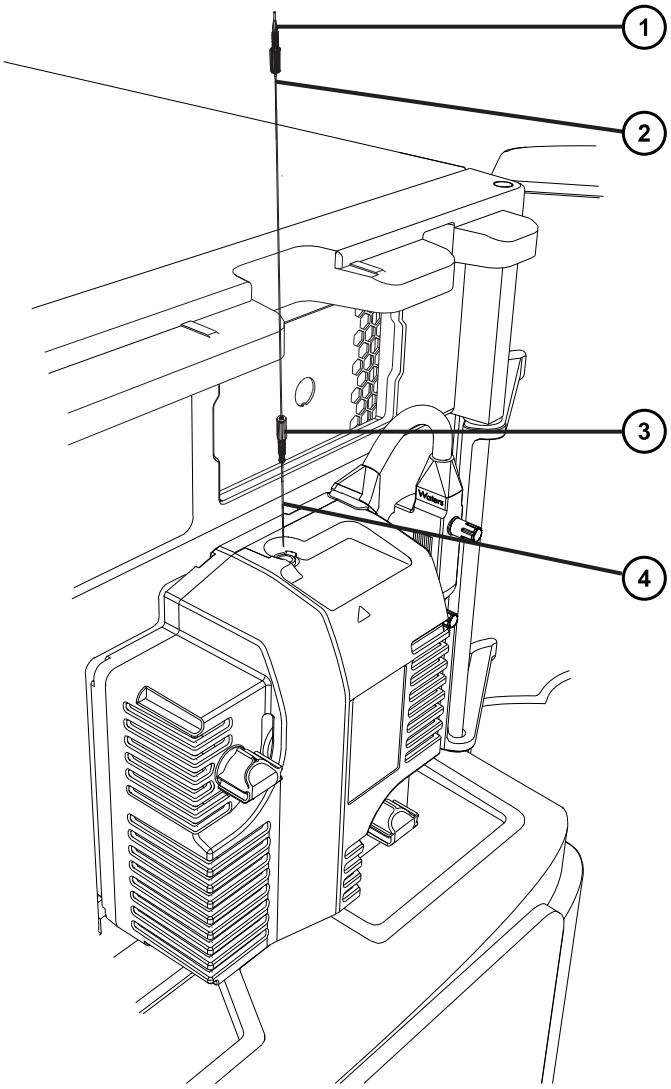
Warning: To avoid puncture injuries from the sharp probe capillary, use care when inserting it into the source enclosure.

Notice: To avoid damaging the fragile probe capillary, if the instrument is situated above eye level, disconnect the source enclosure and place it on a bench top or other surface so that you can exercise caution when inserting the probe (see Removing the source enclosure from the instrument (Page 29)).

To connect the probe:

1. Carefully insert the probe capillary into the inlet atop the source enclosure and tighten the probe fitting until it clicks.

Figure B–1: Inserting the probe



1. PEEK fitting
2. Probe capillary assembly
3. Probe fitting
4. Capillary

2. Fit the PEEK fitting end of the probe capillary assembly to the port S on the divert valve and secure until finger-tight.

   Important: To avoid dead volumes, ensure that the capillary bottoms out in the valve.

3. To avoid trapping and damaging the capillary in the instrument door, slide the capillary beneath the retaining clips.

B.4 Preparing the fluidics system

For additional information, see Fluidics system (Page 20).

Warning: To avoid injuries from broken glass, falling objects, or exposure to toxic substances, do not place containers directly on top of the instrument or on its front covers. Instead, use the bottle tray.

B.4.1 Installing the reservoir bottles

Use the following size reservoir bottles:

- Lock mass (250-mL)
- Wash (125-mL)
- Calibrant (60-mL)

Note: For correct operation of the fluidics system, solvent delivery tubing must approach, but not touch, the bottom of each reservoir bottle. To ensure that an appropriate length of solvent delivery tubing protrudes from the fluidics panel, adjust the tubing from the valves of the fluidics system.

Required tools and materials

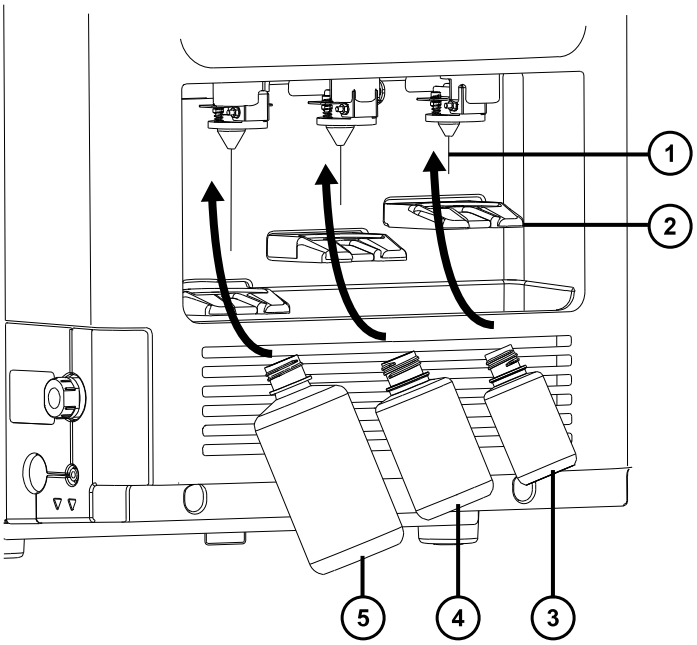
- Chemical-resistant, powder-free gloves

To install the reservoir bottles:

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

1. Remove the reservoir bottle caps.
2. Place each bottle onto the ACQUITY RDa detector, as shown below.

Figure B–2: Installing reservoir bottles



1	Solvent delivery tube	2	Reservoir bottle stand
3	Calibrant reservoir	4	Wash reservoir
5	Lock mass reservoir		

3. For each reservoir bottle, ensure that the ends of the solvent delivery tubes approach, but do not touch, the bottom of the bottle, and rest the reservoir bottle on the stand below the solvent delivery tube.

B.4.2 Purging the fluidics

If the solution bottle runs dry, air will enter the tubing and affect the performance of the instrument. If this happens, you must purge the fluidics. Simply replacing a bottle does not require you to purge the fluidics. See the ACQUITY RDa Detector online Help for details.

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

B.5 Starting the instrument

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

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

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

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

To start the instrument:

1. Power-on the workstation or the network client PC and log in.
2. Press the power button on the top-left hand side of the sample manager FTN. Allow time for the module to initialize.
3. Power on the RDa detector by pressing the power button on the left-hand side of the display panel.

   Note: The ACQUITY RDa pumps down and performs instrument checks.
4. Allow approximately five minutes for the instruments to establish communications.

   Tip: The power and status LEDs show steady green when the instruments have established communications.
5. Power-on the remaining ACQUITY modules using the power button on the top left-hand side of the modules.
6. To access the LC-MS modules, from the workstation PC desktop, double-click the **waters_connect HUB** icon, and then click **System Console**.
7. In the software, monitor the system console for messages and LED indications.
8. Wait for the instrument to reach the correct vacuum pressure. When it reaches the correct pressure, the Instrument Setup function becomes available on the Setup panel of the Console page.

   Note: If the instrument has been vented for longer than one hour, it can take several hours to reach the correct pressure.
9. When the instrument is ready, the **Operate** button on the Console page becomes available.
10. To prepare the instrument for use, run Instrument Setup from the Setup panel of the Console page. This calibrates and tunes the instrument.

    Notes:

- When you first put the ACQUITY RDa into Operate mode, for optimum performance, Waters recommends that you allow the instrument to stabilize for one hour before you perform a calibration.
- When you are not using the instrument, to conserve energy and reduce nitrogen consumption, stop the LC flow and put the instrument in Power Save mode.

B.6 Divert valve flow rate considerations

It is important that you use the supplied PEEK tubing to connect your TUV/FLR optical detector to the divert valve, to prevent damage to the flow cell caused by exceeding its maximum recommended pressure limit.

The following table lists the maximum recommended cell back pressure levels for system configurations that include an in-line optical detector.

Table B–1: Divert valve recommended pressures/tubing

In-line optical detector	Maximum flow cell back pressure	Tubing
ACQUITY Premier TUV Detector	1000 psi	Red PEEK tubing, up to 500 mm, 0.005-inch ID
ACQUITY Premier eLambda PDA Detector	1000 psi	Red PEEK tubing, up to 500 mm, 0.005-inch ID
ACQUITY Premier FLR Detector	500 psi	Red PEEK tubing, up to 500 mm, 0.005-inch ID

Notice: To avoid the pressure exceeding the limits of the preceding instrument, ensure that you use the recommended tubing size and lengths for your instrument.

Note: You must position the LC to the left of the ACQUITY RDa, with a distance of 50-100 mm between the instruments, to allow the red PEEK tubing to reach from the LC to the divert valve.

B.7 Stop flow

When the ACQUITY RDa Detector is switched into Power Save mode, or when a nitrogen gas failure is detected, the instrument sends a stop-flow signal to the LC. The stop-flow signal switches off all solvent flow from the LC in order to prevent damage to the ACQUITY RDa Detector. The message `Stop-flow active` appears in the ACQUITY Console when the stop-flow function is active.

If the LC flow needs to be reestablished while the ACQUITY RDa Detector is in Power Save mode, or when it is switched off, you must ensure that the instrument is removed from the solvent flow path.

Note: To avoid irreparable damage to the instrument when it is in Power Save mode or switched off, disconnect the instrument from the solvent flow path. If the instrument is connected to the LC, ensure that the divert valve is set to flow to waste.

C Specifications

The applicability of the following specifications depends on the conditions in individual laboratories. Refer to the *ACQUITY RDa Detector System Site Preparation Guide*, or contact the Waters Technical Service organization for additional information about the specifications.

C.1 Physical specifications

The following table lists the physical specifications for the ACQUITY RDa detector.

Table C–1: Physical specifications

Attribute	Standard RDa
Height	75.0 cm
Width	40.0 cm
Depth	75.0 cm
Weight	80 kg

C.2 Environmental specifications

The following table lists the environmental specifications for the ACQUITY RDa detector.

Table C–2: Environmental specifications

Attribute	Specification
Operating temperature (performance is specified)	15 °C to 28 °C
Operating humidity	20% to 80%, non-condensing
Temperature stability	This must be better than 2 °C or 3.5 °F peak-to-peak in 1.5 hours

Note: Fluctuations in temperature can affect the performance of the instrument. To avoid this, ensure that the instrument operates within the specified ranges.

C.3 Electrical specifications

The following table lists the electrical specifications for the ACQUITY RDa detector.

Table C–3: Electrical specifications

Attribute	Specification
Protection class[a]	Class I
Overvoltage category[b]	II
Pollution degree[c]	2
Moisture protection[d]	IPX0
Line voltages, nominal	100 V to 240 V
Frequency	50/60 Hz
Maximum power draw	400 W

a. Protection Class I – The insulating scheme used in the instrument to protect from electrical shock. Class I identifies a single level of insulation between live parts (wires) and exposed conductive parts (metal panels), in which the exposed conductive parts are connected to a grounding system. In turn, this grounding system is connected to the third pin (ground pin) on the electrical power cord plug.

b. Overvoltage Category II – Pertains to instruments that receive their electrical power from a local level such as an electrical wall outlet.

c. Pollution Degree 2 – A measure of pollution on electrical circuits that can produce a reduction of dielectric strength or surface resistivity. Degree 2 refers only to normally nonconductive pollution. Occasionally, however, expect a temporary conductivity caused by condensation.

d. Moisture Protection – Normal (IPX0) – IPX0 means that no Ingress Protection against any type of dripping or sprayed water exists. The “X” is a placeholder that identifies protection against dust, if applicable.

C.4 Input Output specifications

The following table lists the input and output specifications for the ACQUITY RDa detector.

Table C–4: Input and output specifications

Attribute	Specification
USB Ports	Maximum voltage: 5 V Maximum current: 1 A Transmission rate: 480 Mbits/s
Com Port (RS232)	Baud rate: 9600 8 bits, no parity, 1 stop bit (8-N-1)
Contact Closure Outputs (Stop Flow/Switch)	Maximum voltage: 30 V Maximum current: 0.5 A Maximum VA rating: 3 W
Event Inputs (Inject Start/Event In)	Voltage threshold: 2.5 V

Table C–4: Input and output specifications (continued)

Attribute	Specification
	Maximum input voltage: 100 V Minimum input voltage: -100 V Maximum current: 1.12 mA

D External connections

This appendix describes the mass spectrometer's external connections.

Warning: To avoid skeletal or muscle injury associated with lifting heavy objects, do not attempt to lift the mass spectrometer. To move the instrument, contact Waters Technical Service.

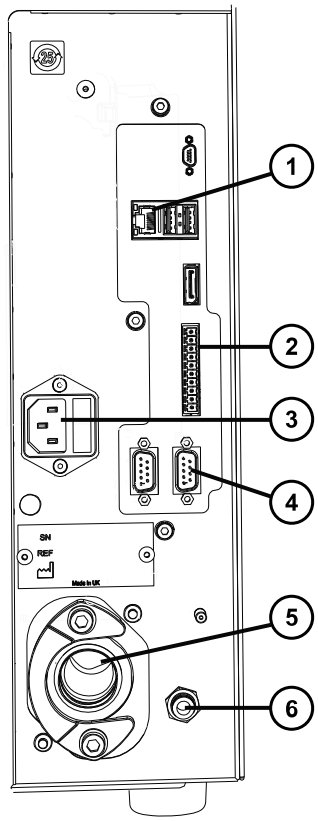
Notice: To avoid damaging the mass spectrometer, observe the following precautions:

- Contact Waters Technical Service before moving the instrument.
- If you must transport the instrument, or remove it from service, contact Waters Technical Service for recommended cleaning, flushing, and packaging procedures.

D.1 Mass detector: external wiring and vacuum connections

The instrument's external connectors are shown below.

Figure D–1: Mass detector external connectors



1 Shielded Ethernet

2 Event inputs and outputs

3 Power connector

4 Roughing pump connector

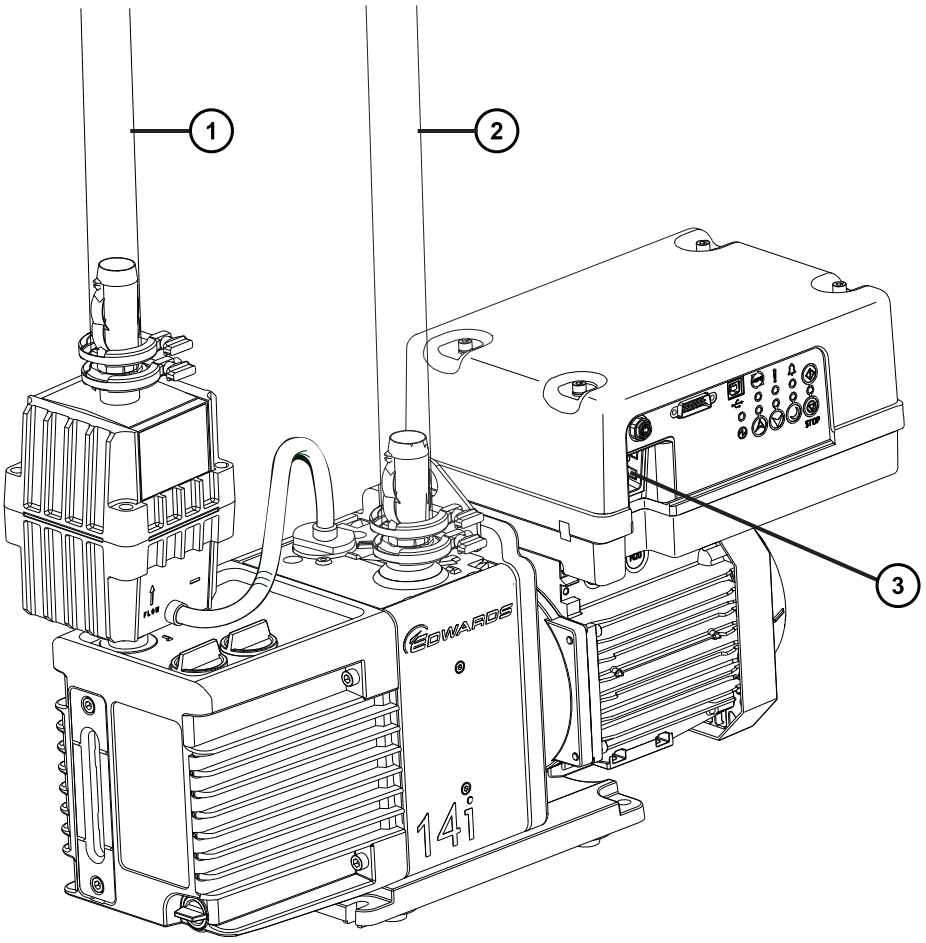
5 Vacuum port

6 Nitrogen inlet

Note: Connectors not labeled in the figure are for Waters service use only.

D.2 Connecting the Edwards oil-filled backing pump

Figure D–2: Connecting the backing pump



1. Exhaust port
2. Vacuum hose assembly
3. Power cable connector

Required tools and materials

- Chemical-resistant, powder-free gloves
- 7-mm nut driver
- 8-mm hex wrench
- Utility knife
- NW25 clamp (included in the installation kit)

- NW25 O-ring (included in the installation kit)
- PVC exhaust tubing (included in the installation kit)
- PVC hose clamps (included in the installation kit)
- 25-mm ID vacuum hose (included in the installation kit)

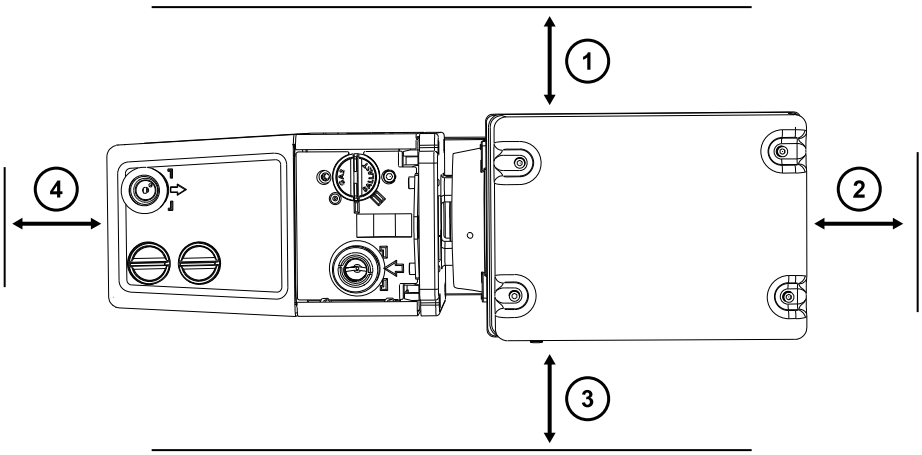
Warning: To avoid personal contamination with biologically hazardous or toxic compounds, wear clean, chemical-resistant, powder-free gloves when performing this procedure.

Notice: To ensure the correct operation of the backing pump, it must be installed within one degree of horizontal.

Notice: The area where the backing pump is located must have an ambient temperature of 15 to 40 ºC (59 to 104 ºF).

Note: To ensure proper ventilation, the pump must be installed with the following minimum clearances:

Figure D–3: Backing pump clearance



1. Left-side minimum clearance is 15.0 cm (5.9 inches)
2. Back-side minimum clearance is 15.0 cm (5.9 inches)
3. Right-side minimum clearance is 15.0 cm (5.9 inches)
4. Front-side minimum clearance is 35.0 cm (13.8 inches)

To connect the backing pump:

Warning: To avoid skeletal or muscle injury associated with lifting heavy objects, enlist the appropriate number of people to lift an instrument or device. If necessary, use lifting equipment that can raise it to the height of the laboratory bench.

1. Place a suitable PTFE drip tray on the floor within 1.52 m (5 feet) of the instrument.

   Requirement: The pump must be oriented in a way that allows easy daily access to the gas ballast valve and the oil-level sight glass.
2. Place the pump on the PTFE drip tray.
3. Use the NW25 center ring and clamp and the 7-mm nut driver to attach the flanged end of a length of 1-inch ID vacuum hose to the vacuum port on the pump.
4. Use a hose clamp to connect the opposite end of the length of 1-inch vacuum hose in step 3 to the 1-inch OD straight vacuum port on the instrument's rear panel.

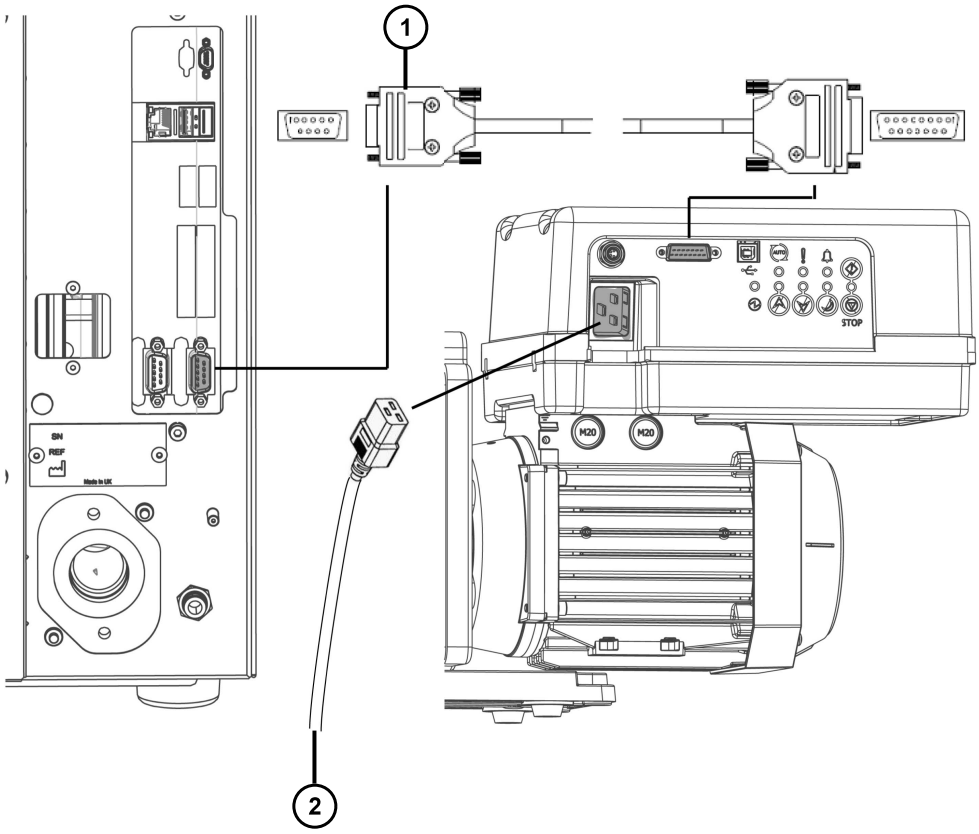
   Note: To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely.
5. Use a hose clamp to connect a length of 19-mm clear PVC exhaust tubing to the pump exhaust port.

   Notice: The instrument requires two separate exhaust systems: one for nitrogen, the other for the backing pump. Vent them to atmosphere through separate exhaust lines. Oil mist can severely damage the instrument if the nitrogen exhaust line connects with the backing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.
6. Route the open end of the exhaust tubing to a suitable exhaust vent.

   Note: To ensure correct operation of the pump, do not let the oil drop below the minimum level.
7. Check the oil level in the pump (see Maintaining the rotary backing pump's oil (Page 62)).
8. Make the electrical connections to the rotary backing pump (see Making the electrical connections to the rotary backing pump (Page 94)).

D.2.1 Making the electrical connections to the rotary backing pump

Figure D–4: Backing pump electrical connections



1 Backing pump control cable

2 To power source

To make the electrical connections to the rotary backing pump:

1. Connect the pump control cable from the pump to the backing pump connector on the instrument's rear panel.
2. Connect the rotary backing pump power cord to the mains power source.

D.3 Connecting to the nitrogen gas supply

Required tools and materials

- Chemical-resistant, powder-free gloves
- 6-mm PTFE tubing (included in the installation kit)

- 6-mm stud
- Nitrogen regulator
- PTFE tube cutter
- Wrench

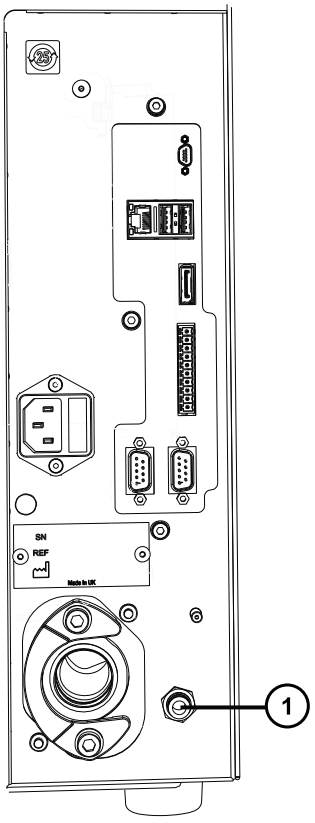
To connect the nitrogen gas supply:

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

Notice: To avoid gas leaks, use the tube cutter to cut the PTFE tubing squarely.

1. Use the tube cutter to cut a length of 6-mm PTFE tubing long enough to connect the rear of the instrument to the nitrogen regulator.
2. Connect one end of the 6-mm PTFE tubing to the nitrogen inlet port on the rear of the instrument.

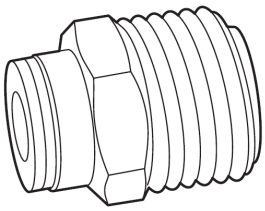
Figure D–5: Location of nitrogen inlet port



1 Nitrogen Inlet port

3. Attach the nitrogen regulator to the nitrogen supply.
4. Install the 6-mm stud into the regulator outlet.

Figure D–6: 6-mm stud



5. Connect the free end of the long piece of 6-mm PTFE tubing to the 6-mm stud.

   Requirement: The nitrogen must be dry and oil-free, with a purity of at least 95%. Regulate the supply at 650 to 750 kPa (6.5 to 7.5 bar, 94 to 109 psi).

D.4 Connecting the source exhaust line

Required tools and materials

- Chemical-resistant, powder-free gloves
- PTFE tube cutter
- 12-mm PTFE tubing (included in the installation kit)

Warning: To prevent exposure to biologically hazardous, toxic, or corrosive LC solvents, the source exhaust line supplied with the system must be either fed into a ducted laboratory fume hood or connected to a laboratory exhaust system. The source exhaust line must be vented in such a way that the pressure at the outlet never exceeds atmospheric pressure to ensure the correct functioning of the API source pressure monitoring system.

Warning: To avoid the buildup of hazardous gases, do not place the nitrogen exhaust trap bottle in an enclosed cabinet.

Notice: The instrument requires two separate exhaust systems: one for nitrogen, the other for the backing pump. Vent them to atmosphere through separate exhaust lines. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the backing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

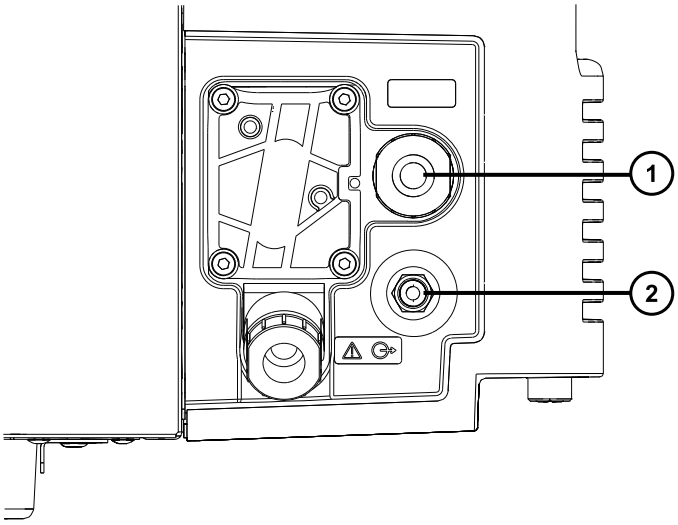
Notice: To avoid gas leaks, use the tube cutter to cut the PTFE tubing squarely.

To connect the source exhaust line:

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

Note: Ensure that there is a negative gradient between the exhaust port and the trap bottle inlet.

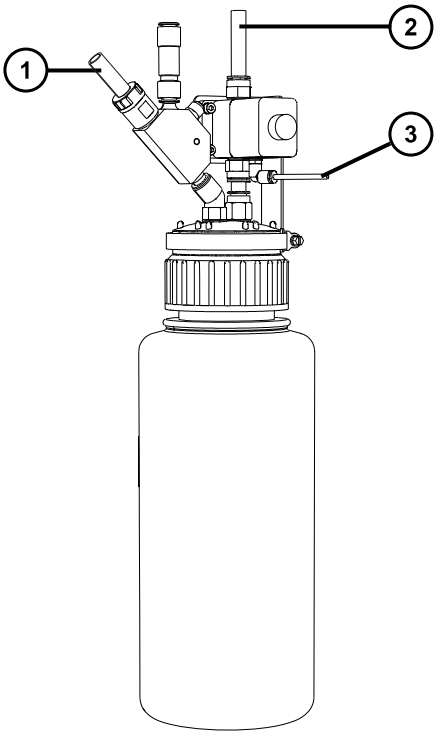
Figure D–7: Location of source exhaust port



1 Source exhaust port

2 Nitrogen outlet

Figure D–8: Exhaust trap bottle



1 From instrument exhaust port (3/8-inch convoluted tubing)

(2) To laboratory exhaust port (12-mm OD)

(3) From instrument nitrogen outlet (4-mm nitrogen line)

2. Cut a length of 3/8-inch convoluted tubing long enough to connect the instrument to the exhaust trap bottle.
3. Connect one end of the tubing to the source exhaust port on the side of the instrument, and the other end to the correct port on the exhaust trap bottle.
4. Cut a length of 4mm tubing long enough to connect the instrument to the exhaust trap bottle.
5. Connect one end of the tubing to the nitrogen outlet port on the side of the instrument and the other end to the correct port on the exhaust trap bottle.
6. Cut a length of 12-mm tubing long enough to connect the exhaust trap bottle to the laboratory exhaust system.
7. Insert one end of the tubing into the remaining port on the exhaust trap bottle, and route the other end to the laboratory exhaust system.

D.5 Connecting liquid waste lines

To ensure that waste materials are safely drained to the waste container, connect the mass detector's drain to the waste container.

Required tools and materials

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

To connect the liquid waste lines:

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

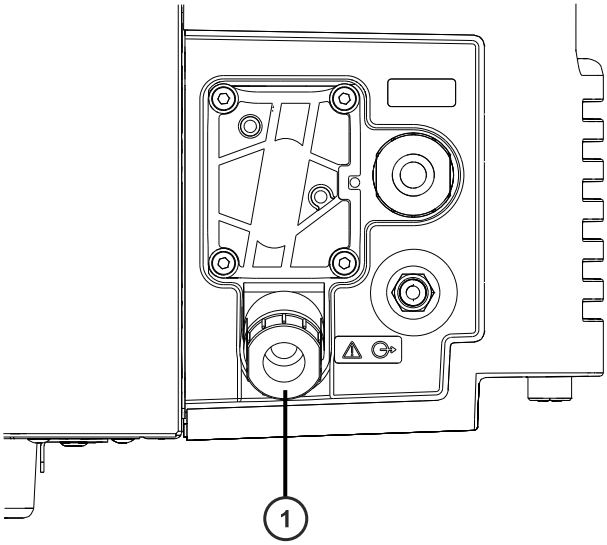
Warning: To avoid spreading contamination with biologically hazardous, toxic, and corrosive materials, dispose of all waste materials according to local environmental regulations.

Warning: To prevent leakage of biologically hazardous, toxic, or corrosive materials:

- Do not crimp or bend drain lines. A crimp or bend can impede flow to the waste container.
- Empty the waste container before the lower ends of the drain tubes are covered by waste solvent.

1. Place a suitable waste container below the mass detector.
2. Remove the compression nut from the compression fitting, and then slide the nut over the waste line.

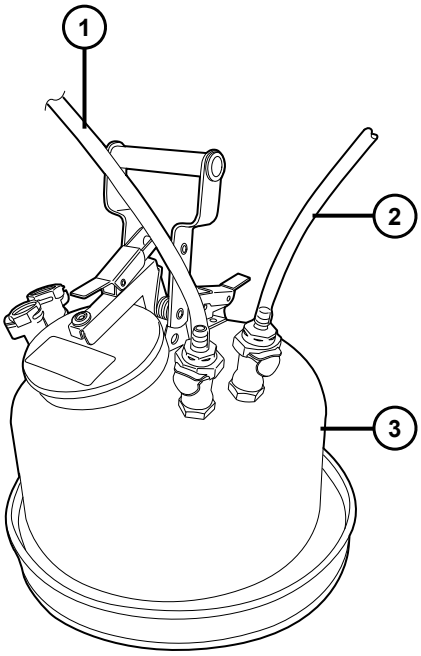
Figure D–9: Location of waste line compression fitting



1 Compression fitting

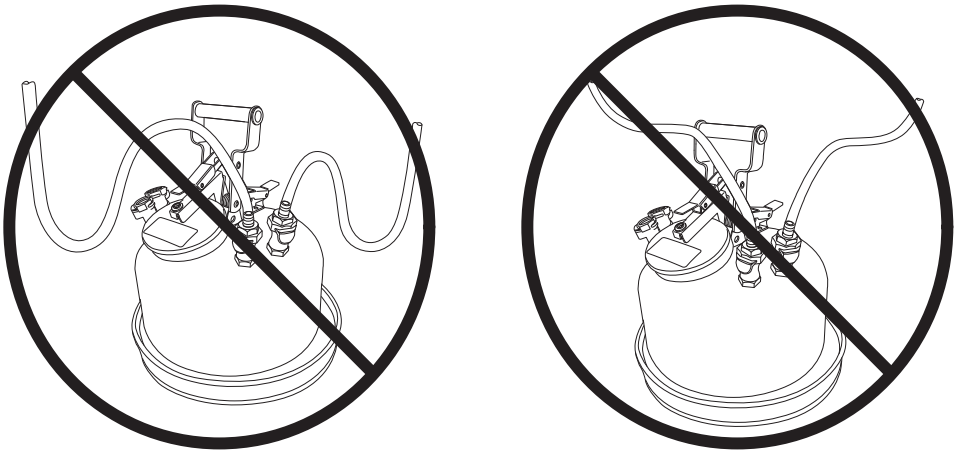
3. Push the waste line and the nut onto the compression fitting, and then finger-tighten.
4. Route the tubing to a suitable waste container. If necessary, shorten the waste tubes so that their ends are above the surface of the waste solvent.

Figure D–10: Example of a suitable waste container



1. Waste tubing (from stack of system modules)
2. Waste-container vent tubing (to fume hood)
3. Waste container

Figure D–11: Examples of incorrectly routed tubing



D.6 Electricity source

Most modules require a separate, grounded power source. Ensure that the ground connection in the power outlet is common and physically close to the module.

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

Notice: To avoid damaging the electronic components of the sample manager and the column-heater or column-heater/cooler, always power-off the sample manager and column heater/cooler before connecting or disconnecting the interconnect cable.

D.6.1 Connecting to a wall electricity source

Warning: To avoid electric shock, observe these precautions:

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

Note: Some column modules, such as the MaxPeak Premier Column Heater – Active (CH-A) and the column-heater 30-cm (CH-30A), receive their power from the sample manager via the interconnect cable.

Recommendation: Use a line conditioner and uninterruptible power supply (UPS) for optimum, long-term, input-voltage stability. Contact Waters to ensure the correct selection and size.

To connect to a wall electricity source:

1. Connect the female end of the power cord to the receptacle on the rear panel of the module.
2. Connect the male end of the power cord to a suitable grounded wall outlet.

D.6.2 Connecting to a cart's electricity source

If your system includes an optional cart, follow this procedure to connect each module to a power source.

Warning: To avoid electric shock, observe these precautions:

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

Recommendation: Use a line conditioner and uninterruptible power supply (UPS) for optimum long-term input-voltage stability.

To connect to a cart's electricity source:

1. Connect the female end of the cart's electrical cables (included in the startup kit) to the receptacle on the rear panel of each system module.
2. Connect the hooded, male end of the cart's electrical cables to the power strips on its back.
3. Connect each power strip's cable to a wall outlet operating on its own circuit.

D.7 Connecting Ethernet cables (systems with ACQUITY LC)

Requirement: Use shielded Ethernet cables with the mass spectrometer to ensure compliance with FCC limits.

To make Ethernet connections:

1. Connect one end of one shielded Ethernet cable to the ACQUITY instrument’s network switch, and then connect the free end to the Ethernet card on the pre-configured ACQUITY workstation.

   Tip: On pre-configured systems, the Ethernet card is identified as the Instrument LAN card.
2. Connect one end of the other shielded Ethernet cable to the Ethernet port in the top, right-hand corner of the mass spectrometer’s rear panel, and then connect the free end to the ACQUITY instrument’s network switch.

D.8 Input/output signal connectors

Warning: To avoid electric shock, separate all electrical connections to the rear panel 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 autosamplers, and UV, RI, and fluorescence detector signal outputs for LC/MS systems. The electrical connections on the rear panel of this mass spectrometer are all SELV.

The instrument's rear panel includes a removable connector that holds the screw terminals for I/O signals. These connectors are keyed so that they can receive a signal cable inserted only one way.

Notice: To avoid damage to the instrument, do not exceed these voltages:

- ±30 Vdc to the Analog connection.
- 30 Vdc to the Stop Flow, Inj Start, and Switch connections.

Figure D–12: I/O signal connector

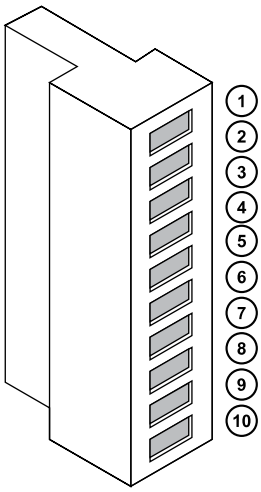


Table D–1: I/O signal connections

Callout	Screenprint	Software function	Description
1	Stop Flow +	Gas fail / Event Out 1	Used to stop the solvent flow if the nitrogen gas supply fails. To install the stop flow cable, connect the cable between the Stop Flow +/- connections on the ACQUITY RDa Detector and
2	Stop Flow -		

Table D–1: I/O signal connections (continued)

Callout	Screenprint	Software function	Description
			the ACQUITY UPLC I-Class/Premier BSM. For the ACQUITY RDa Detector, use Pins 1 and 2; for the ACQUITY UPLC I-Class/Premier BSM, use Pins 3 and 4. Maximum 30 V, 0.5 A
3	Switch +	Event Out 2	Used to send time-based contact closure signals to external devices. Maximum 30 V, 0.5 A
4	Switch -		
5	Injection Start +	Event In 1	Signals the start of an injection. >5 V or <1.5 V
6	Injection Start -	Event In Ground	
7	Event In +	Event In 2	Allows an external device to start data acquisition. >5 V or <1.5 V
8	Event In -	Event In Ground	
9	Analog -	Analog Ground	0 to 10 V, not used
10	Analog +	Analog Output	

Note: Event Out 1, Event Out 2, Event In 1, and Event In 2 are configurable in the software.

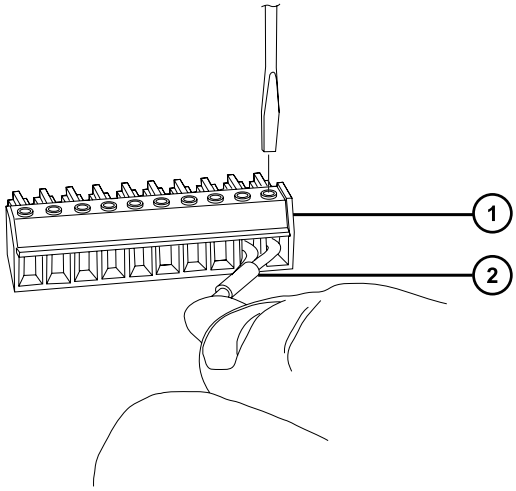
D.8.1 Signal connections

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

To make signal connections:

1. For input and output signal connection details, see Input/output signal connectors (Page 103).
2. To make the signal connections, attach the positive and negative leads of the signal cable to the connector.

Figure D–13: Signal connections

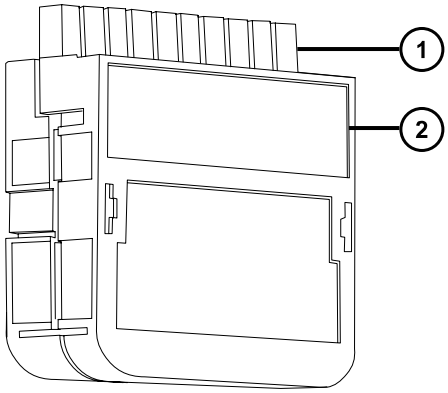


1 Connector

2 Signal cable

3. Place the second connection cover over the first cover and snap it into place.

Figure D–14: Connection cover



1 Signal connector

2 Connection cover

E Materials of construction and compatible solvents

Warning: To avoid personal contamination with biologically hazardous, toxic, or corrosive materials, you must address any safety issues raised by the contents of this Appendix. Doing so confirms the integrity of the source exhaust system.

E.1 Preventing contamination

For information on preventing contamination, refer to *Controlling Contamination in LC/MS Systems* (715001307), which is available at www.waters.com.

E.2 Items exposed to solvents

The items that appear in the following tables can be exposed to solvent. You must evaluate the safety issues if the solvents used in your application differ from the solvents typically used with these items. See Solvents used to prepare mobile phases (Page 107) for details about the most common ingredients used to prepare mobile phases.

Table E–1: Fluidics items:

Item	Material
Leak sensor	Various
Syringe pump	HTZP (ceramic), Viton, UHMWPE, and PEEK
Select valve	RPC-10 (a type of PEEK) and 316 stainless steel

Table E–2: Pumping block and analyzer items:

Item	Material
Pumping block rear gasket	FEPM
Pumping block front gasket	FEPM
Ion block gasket	FKM

Table E–2: Pumping block and analyzer items: (continued)

Item	Material
O-ring	FKM

Table E–3: Pinch valve items:

Item	Material
Waters 1/4-inch pinch valve	EPDM
Custom seal	EPDM

Table E–4: Exhaust bottle items:

Item	Material
Push-in union Y, 12-mm dia	Various
Nipple, 12-mm, SMC	PBT
45 deg male elbow, 12-mm dia	Various
Washer rubber	NR
1/4-inch BSP Dowty washer	NBR
1/4-inch x 12-mm dia male connector	Various
12-mm dia male connector, 3/8-inch universal thread	Various
Single check valve	Various
Reducer nipple	PBT

Table E–5: Source items:

Item	Material
ESI probe/gas inlet gasket	FKM

E.3 Solvents used to prepare mobile phases

These solvents are the most common ingredients used to prepare mobile phases for reverse-phase LC/MS (API):

- Water
- Methanol
- Acetonitrile

- Formic acid (≤0.1%)
- Acetic acid (≤0.1%)
- Ammonium acetate (≤10 mM)
- Ammonium formate (≤10 mM)
- Isopropanol
- Propanol
- Trifluoroacetic acid (≤0.1%)
- Hexafluoroisopropanol (≤5%)
- Triethylamine (≤0.1%)

These solvents are not expected to adversely affect performance of the materials shown in the preceding table.