

Waters 2767 Sample Manager, Injector, and Collector

Installation and Maintenance Guide

General Information

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

Safety hazard symbol notice

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

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.

Electrical power safety notice

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

Equipment misuse notice

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









Safety advisories




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

Operating this device

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

Applicable symbols

Symbol	Definition
	Manufacturer
	Date of manufacture
	Authorized representative of the European Community
	Confirms that a manufactured product complies with all applicable European Community directives
	Australia EMC compliant
	Confirms that a manufactured product complies with all applicable United States and Canadian safety requirements
	Consult instructions for use
	Alternating current

Symbol	Definition
	<p>Electrical and electronic equipment with this symbol may contain hazardous substances and should not be disposed of as general waste.</p> <p>For compliance with the Waste Electrical and Electronic Equipment Directive (WEEE) 2012/19/EU, contact Waters Corporation for the correct disposal and recycling instructions.</p>
	<p>Serial number</p>
	<p>Part number catalog number</p>

Audience and purpose

This guide is intended for personnel who install, maintain, and troubleshoot the Waters 2767 Sample Manager, Injector, and Collector.

Intended use of the 2767 Sample Manager

Waters designed the Waters 2767 Sample Manager, Injector, and Collector to automate sample aspiration and injection from microplates (MTP), test tubes, scintillation vials, or conventional autosampler vials. The Waters 2767 Sample Manager, Injector, and Collector is for research use only.

Calibrating

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

Quality control

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

EMC considerations

Canada spectrum management emissions notice

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

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

ISM Classification: ISM Group 1 Class B

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

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

Class B products are suitable for use in both commercial and residential locations and can be directly connected to a low voltage, power-supply network.

EC authorized representative



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1

Introduction

This chapter describes the Waters® 2767 Sample Manager, which is a high-capacity sample processing system for the management of sample injections in:

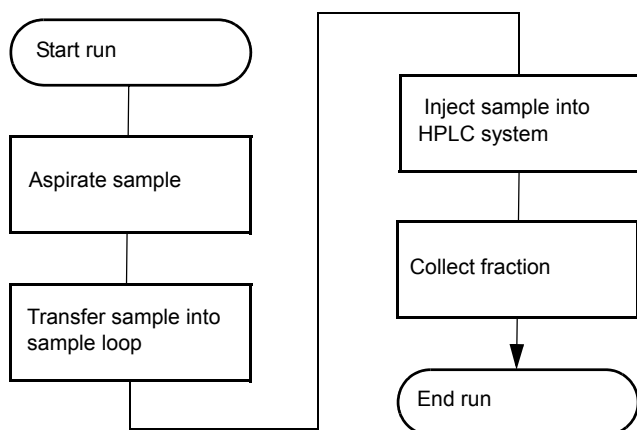
- High-performance liquid chromatography (HPLC) with fraction collection
- Liquid chromatography/mass spectrometry (LC/MS) with fraction collection

The 2767 Sample Manager automates sample aspiration and injection from microplates (MTP), test tubes, scintillation vials, or conventional autosampler vials. This instrument provides single-point management of injection and collection of separated peaks.

The 2767 Sample Manager connects to the computer, running MassLynx® software version 3.5x or higher, through an RS-232 port.

1.1 Sample flow

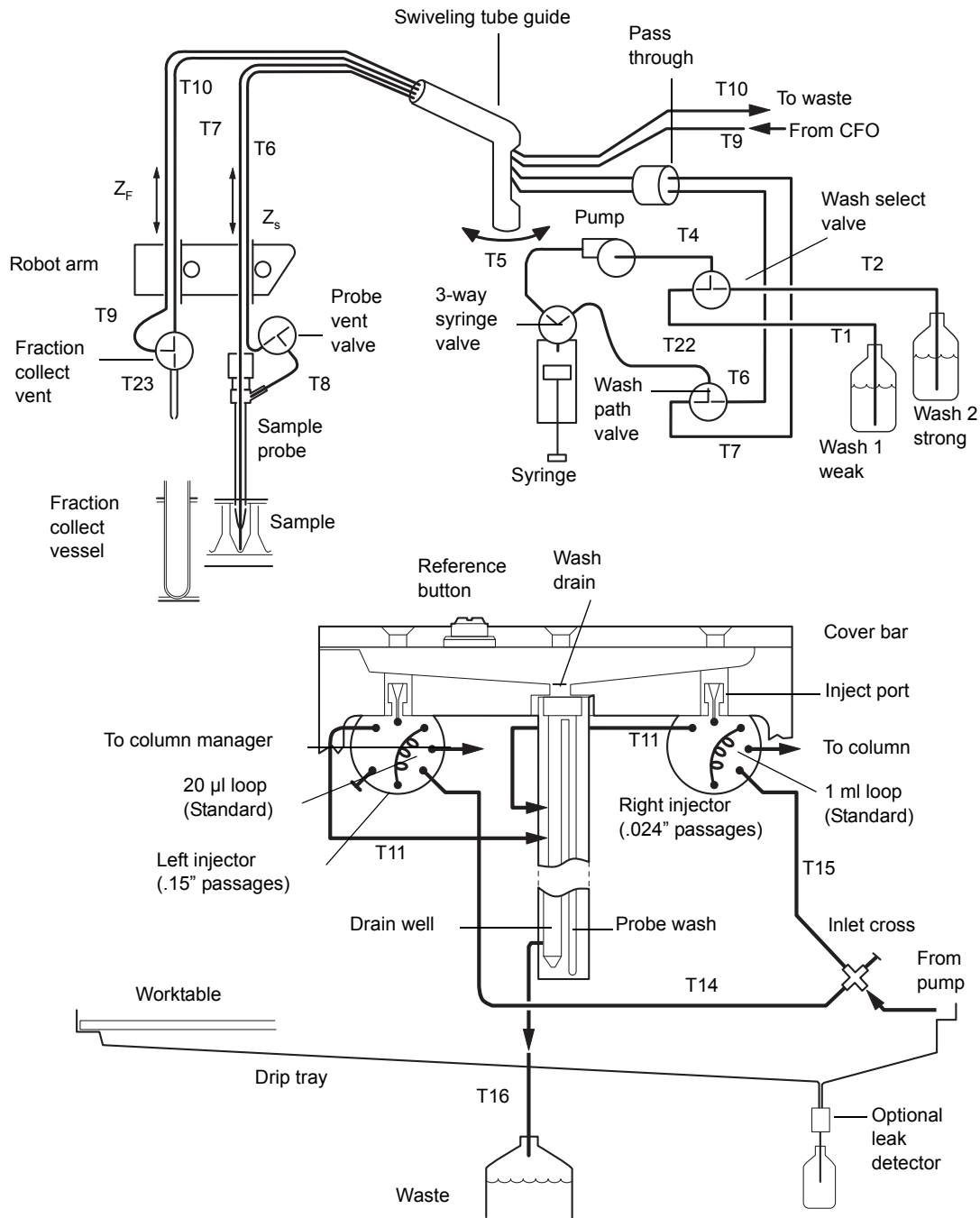
During operation, the sample flows through the 2767 Sample Manager, then into other instruments in the HPLC system and back to the 2767 for fraction collection. Following is the path of the sample as it flows through the 2767 Sample Manager.



The hardware components move the sample as follows:

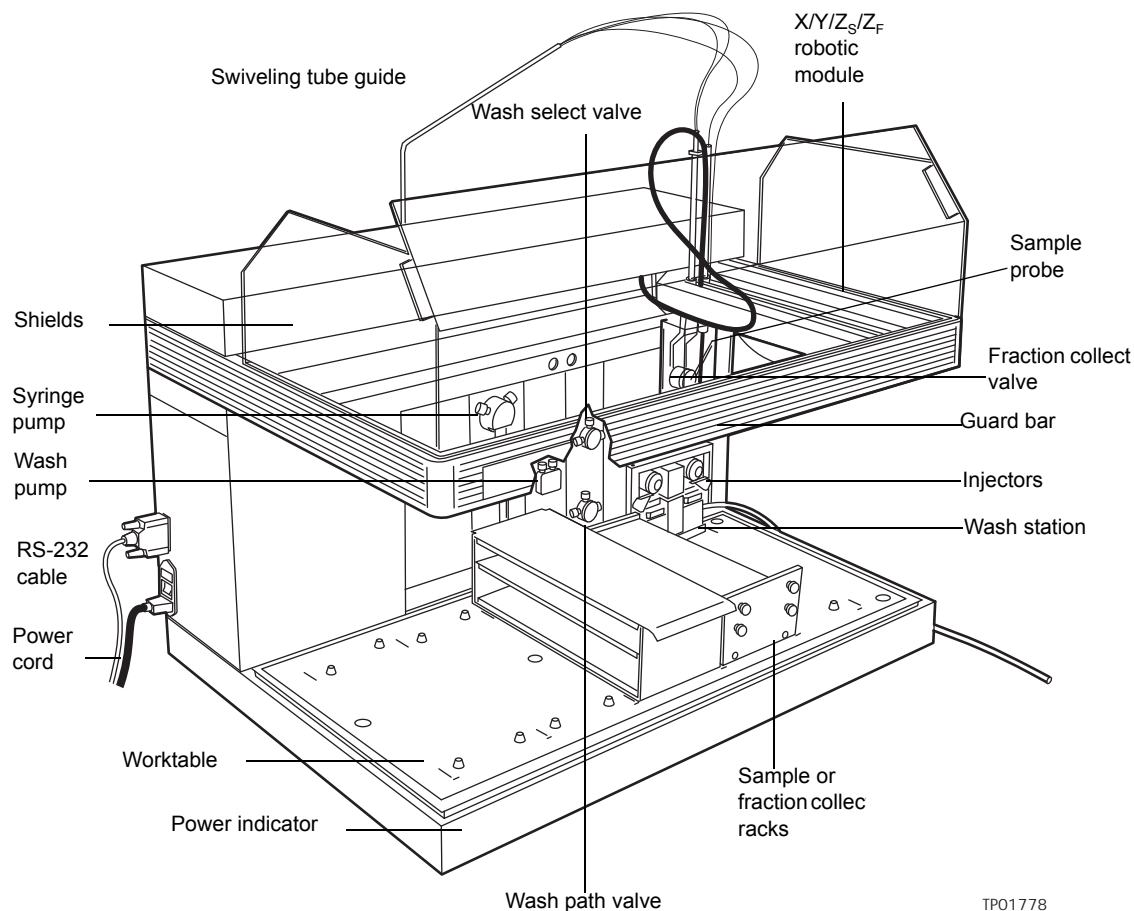
1. The probe aspirates sample from a sample container in a rack by moving the Z-arm to the sample container and lowering the probe into the sample. With the syringe valve open, the syringe plunger draws down to pull sample into the probe tip.
2. The probe moves to the injector, the injector valve moves to the load position, and then the probe transfers the sample through the injector port into the sample loop.
3. The injector moves the valve to the inject position, then the sample travels into the fluid stream, to the HPLC column, and to the detector. The wash pump then rinses the injector port and needle with solvent to minimize carryover.
4. If fraction collection is selected, the fraction dispense tube dispenses the fractions into wells, tubes, or vials in a rack.

Following is the solvent flow path through the 2767 Sample Manager.



1.2 Hardware

Following are the major components of the 2767 Sample Manager hardware.



1.2.1 Worktable

The worktable is the space under the probe and on top of the drip tray. It holds the sample and fraction collection racks that contain sample containers. To place the racks in the correct location, match the actual rack on the worktable to the type and location shown on the bed layout window in the MassLynx software. Align each rack with the marks on the worktable and slide the rack toward the back of the worktable to engage the locator pins. A drip tray underneath the worktable catches spills and drains into a dedicated waste container.

Tip: The far right rack position must be used for a rack containing samples for injection only. The remaining four rack positions can be designated as sample or fraction collection racks in the MassLynx software.

1.2.2 Sample injection and fraction collection racks

1.2.2.1 Sample injection

The following plates or racks have a stripper plate for sample injection and can be situated anywhere in the worktable area:

- Microplate (MTP) std, MTP deep, and MTP dense – Racks hold three microplates (MTP) in 96- and 384-well formats with standard or deep wells. An alignment kit is required for 384-well plates. Only the 96-well deep format plates should be used for fraction collection.
- Plates for 2-mL and 4-mL vials – Racks hold three vial plates. The 2-mL vial plate holds 48 vials per plate, and the 4-mL vial plate holds 24 vials per plate.
- 13-mm tubes – 96-test tube rack for 13 × 100 mm test tubes.

1.2.2.2 Fraction collection

The following racks can be used for fraction collection or sample reinjection. The test tubes or vials must not be covered, because these racks lack a stripper plate. These racks cannot be used in the far-right position in the worktable.

- 13-mm tubes – 112-test tube rack for 13 × 100 mm test tubes
- 16-mm tubes – 84-test tube rack for 16 × 100 to 150 mm test tubes
- 18-mm tubes – 78-test tube rack for 18 × 150 mm test tubes
- 25-mm tubes – 36-test tube rack for 25 × 150 mm test tubes
- 28-mm scintillation vials – 32-vial rack for 28-mm diameter scintillation vials
- MTP deep – Racks hold three 96-well deep format microtiter plates

Tips:

- The far right rack in the worktable must contain samples for injection. The remaining racks can be designated as sample injection or fraction collection racks in the MassLynx software.
- Test tubes less than 100 mm tall are not supported.
- If the height of test tubes in immediately adjacent racks differs by more than 25 mm, the rack containing the tallest test tubes must be to the right to maximize sample probe penetration depth. Test tubes taller than 100 mm can interfere with the probe vent channel.

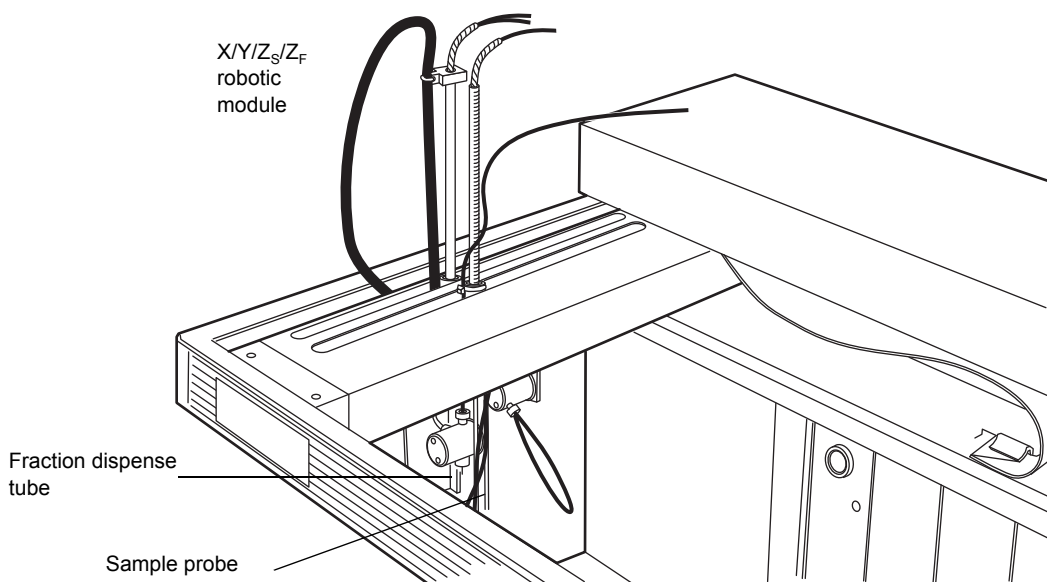
A fraction can be reinjected from any of the previous fraction collection racks provided the sample probe can access the solution in the fraction collection test tube. For more information about reinjecting a fraction, see [Chapter 3](#).

1.2.3 X/Y/Z_s/Z_f robotic module

The Waters 2767 Sample Manager has a robotic module that moves both the probe and the fraction dispense tube in three axes:

- The x-axis moves the vented probe and fraction dispense tube to the left and right.
- The y-axis moves the vented probe and fraction dispense tube forward and backward.
- The z-axis contains two parts:
 - The z_s-axis moves the vented sample probe up and down.
 - The z_f-axis moves the fraction dispense tube up and down.

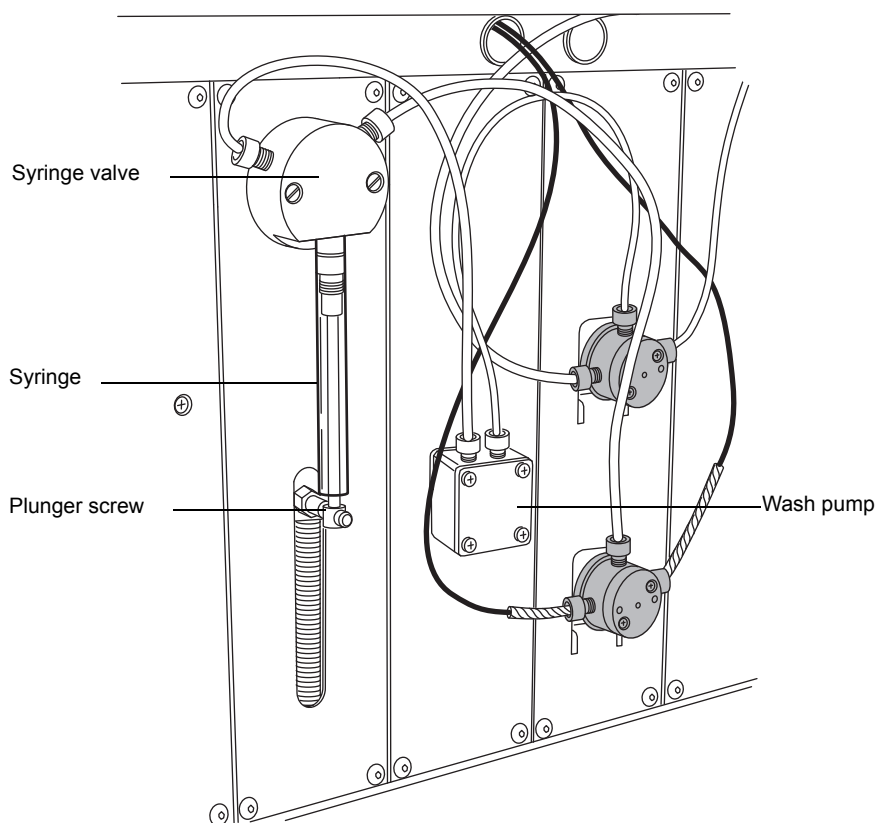
The major components of the robotic module appear in the following. The vented probe aspirates the sample from a MTP, test tube, or vial and dispenses the sample into the injector port. The probe is on the z_s-axis of the robotic arm. Sample coming from the detector(s) is routed back to the fraction collect valve and fraction dispense tube, which delivers it to the collection tubes, vials, or deep wells. The fraction dispense tube is on the z_f-axis of the robotic arm.



1.2.4 Syringe pump

The syringe pump aspirates and dispenses fluids from sample containers and dispenses fluids into the injector. See the following figure for a visual.

The syringe pump has a 3-port valve at the head of the syringe. The valve rotates position to aspirate wash solvent through the inlet port on the left and dispense it through the outlet port on the right. The plunger of the syringe is attached to the plunger shaft, which is connected to a lead screw that moves the plunger up and down.



1.2.5 Wash pump

The wash cycle can use one or two solvents:

- Wash solvent 1, typically a weak solvent
- Wash solvent 2, a strong solvent

The wash select valve opens to the selected wash solvent, and the wash pump draws solvent from a container, through the wash pump and syringe valve. Solvent then travels out the right port of the syringe valve, through the wash path valve, and through the sample probe in the wash station.

1.2.6 Injectors

The 2767 Sample Manager has two fixed-loop sample injectors with two separate injector ports to accommodate analytical- and preparatory-scale samples.

- The standard analytical sample loop is 20 μL .
- The standard prep loop is 1 mL.

You can install sample loops with capacities from 5 μL to 10 mL. For sample loops greater than 1 mL capacity, a larger holding loop must be added (see [page 24](#)). The probe delivers a sample through the injector port into the sample loop, where the injector delivers the sample onto the column. When selected on the Wash tab (see [page 65](#)), the injector port is washed after each injection to prevent sample carryover. The left injector has a 20- μL analytical sample loop with 0.015-inch internal passages. The right injector has a 1000- μL preparative sample loop with 0.024-inch internal passages.

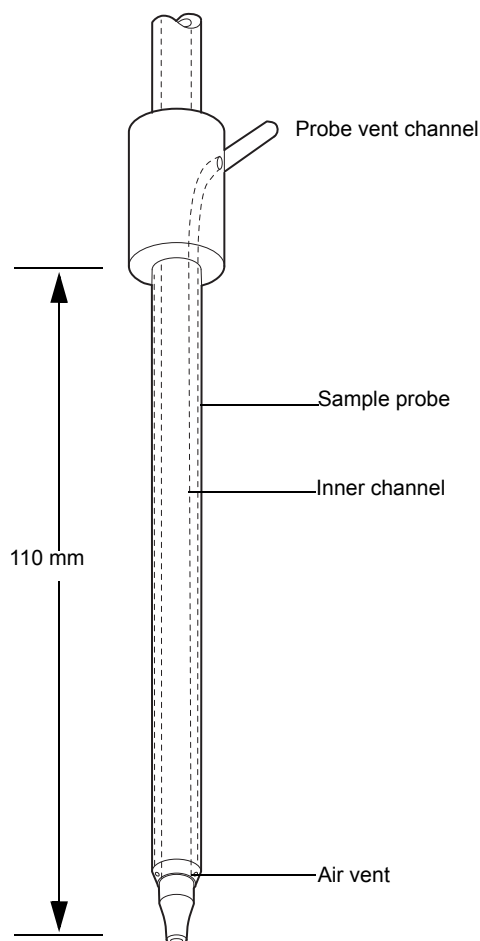
1.2.7 Wash station

During the wash cycle, the wash station is the default position for the sample probe. After the sample probe completes a liquid handling function, the excess solvent is discarded into the waste port. The sample probe then moves to the wash station and lowers into it. Washing is accomplished by pumping wash solvent through the sample probe. The wash solvent flows through the inner channel of the sample probe and overflows into the waste port. The waste wash solvent travels by gravity through the waste tube to a waste fluid container below the instrument. When selected on the Wash tab (see [page 65](#)), the wash solvent then flows through the probe vent channel.

When selected on the Wash tab (see [page 65](#)), you can also wash the inject port of the selected inject valve. The inject valve is in the inject position and wash solvent is sent to the waste container.

1.2.8 Sample probe

As the following figure shows, the sample probe consists of an inner channel and probe vent channel. The inner channel is used to aspirate sample, and the probe vent channel allows venting of the sample container. To wash the sample probe, the wash pump delivers wash solvent through the tube labeled T7 to wash the inner channel and the tube labeled T8 to wash the probe vent channel. Waste fluid drains from the wash station by gravity to the waste fluid container below the unit.



1.3 Spare parts and options

You can customize the 2767 Sample Manager with the following items to suit your application and site requirements. Recommended combinations appear in the table at the end of this section.

1.3.1 Sample loops

The unit has a 20- μ L sample loop installed on the left injector for analytical work and a 1 mL-sample loop installed on the right injector for preparative work. You can install sample loops in sizes that vary from 5 μ L to 10 mL. When using sample loops greater than 1 mL capacity you must

install a holding loop between the probe and syringe. Both sample and holding loops are supplied in the 2-, 5-, and 10-mL preparatory kits.

1.3.2 Holding loops

When using a syringe greater than 1-mL capacity, you must install a holding loop between the probe and syringe. The holding loop helps ensure that adequate volume can be safely drawn for injections equal to the full syringe volume without contaminating the syringe. The capacity of the holding loop should be at least 1.7 times the syringe size to allow for adequate overflow. Both sample and holding loops are supplied in the 2-, 5- and 10-mL preparatory kits.

1.3.3 Syringes

The unit has a 1-mL syringe. You can install syringes in sizes that vary from 250 μ L to 10 mL.

1.3.4 Racks

The unit uses racks to hold test tubes, scintillation vials, or microplates. The instrument lacks sample containers, solvent containers, or waste fluid containers.

Tip: At least one sample rack and one fraction collection rack are needed for system operation.

1.3.5 Fume hood

You can equip the 2767 Sample Manager with a fume hood to minimize solvent vapors that may escape into the laboratory air during fraction collection.

1.3.6 Leak detector

Waters strongly recommends that you install a leak detector to monitor the flow from the drip tray drain tube into the waste container. When flow is measured, the Waters leak detector shuts off the pump(s) via software control to prevent solvent overflow, and a warning message appears. The leak detector has an auxiliary signal that can be used to trigger a user-supplied shut-off valve for high-capacity solvent containers.

Tip: Do not route wash solvent lines into the leak detector. When the wash solvent lines are incorrectly routed to the leak detector, the normal flow of wash solvents shuts off the pump.

In the following table, standard 2767 Sample Manager components, appear in bold.

Sample Manager sampling combinations

Sample Loop (μ L)	Injector Valve	Syringe (μ L)	Holding Loop (μ L)
5 (0.007-inch ID)	Analytical	250	
		500	
		1000	
		2500	2300
		5000	7200
		10,000	18,000
20 (0.020-inch ID)	Analytical	250	

Sample Manager sampling combinations (continued)

Sample Loop (µL)	Injector Valve	Syringe (µL)	Holding Loop (µL)
		500	
		1000	
		2500	2300
		5000	7200
		10,000	18,000
50 (0.020-inch ID)	Analytical	250	
		500	
		1000	
		2500	2300
		5000	7200
		10,000	18,000
100 (0.020-inch ID)	Analytical	250	
		500	
		1000	
		2500	2300
		5000	7200
		10,000	18,000
	Preparative	250	
		500	
		1000	
		2500	2300
		5000	7200
		10,000	18,000
200 (0.030-inch ID)	Analytical	250	
		500	
		1000	
		2500	2300
		5000	7200
		10,000	18,000
	Preparative	250	
		500	
		1000	
		2500	2300
		5000	7200
		10,000	18,000
500 (0.030-inch ID)	Analytical	500	
		1000	
		2500	2300

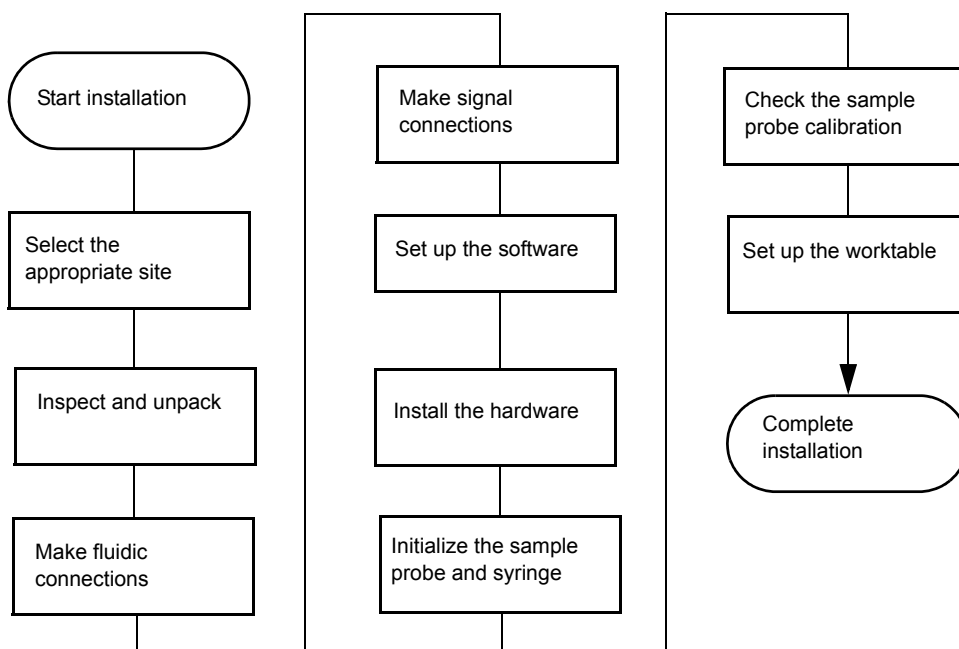
Sample Manager sampling combinations (continued)

Sample Loop (μL)	Injector Valve	Syringe (μL)	Holding Loop (μL)
		5000	7200
		10,000	18,000
	Preparative	500	
		1000	
		2500	2300
		5000	7200
		10,000	18,000
1000 (0.030-inch ID)	Preparative	1000	
		2500	2300
		5000	7200
		10,000	18,000
2000 (0.040-inch ID)	Preparative	2500	2300
		5000	7200
		10,000	18,000
5000 (0.080-inch ID)	Preparative	5000	7200
		10,000	18,000
10,000 (0.080-inch ID)	Preparative	10,000	18,000
Standard Components			
20 μL Analytical Sample Loop standard	Analytical Injector 0.015-in. Passages	1000 μL Syringe	T7 line 1700 μL
1000 μL Preparative Sample Loop	Preparative Injector 0.024-in. Passages		
	Injector Waste Lines 0.040-in. ID × 6.5-in. long		

2 Unpacking and Installing the 2767 Sample Manager

This chapter describes how to install the Waters 2767 Sample Manager. The following figure outlines the primary installation steps.

Tip: To install the 2767 Sample Manager, you should know how to set up and operate general laboratory instruments and computer-controlled devices and how to handle solvents.



2.1 Site selection and power requirements

Required materials

To install the instrument, you need the Startup Kit, which includes such tools as a flat-blade screwdriver and a metric Allen wrench set. You also need:

- Racks for sample injection and fraction collection (not included)
- Waste fluid container large enough for system use
- Wash solvent reservoirs
- Sample containers (e.g., 2-mL vials, 13 × 100 mm test tubes)

2.1.1 Site selection

Select a site for the 2767 Sample Manager that meets the requirements in the following table.

Site selection requirements:

Factor	Requirement
Temperature	15 to 40 °C (59 to 104 °F).
Relative humidity	Maximum relative humidity 85% for temperatures up to 31 °C, decreasing linearly to 50% relative humidity at 40 °C.
Bench space	Width: 34 in. (86.4 cm). Depth: 24.5 in. (62.2 cm). Height: 30 in. (76.2 cm). Height: 33 in. (83.8 cm) with optional fume hood. Level to within $\pm 2^\circ$.
Weight	120 lbs. (59.4 kg).
Vibration	Negligible.
Clearance	At least 1 in. (2.5 cm) at the back for ventilation. Space for fluid waste container below the instrument and solvent containers next to the instrument.
Static electricity	Negligible.
Power	Auto-selecting, 110/230 Vac $\pm 10\%$, 47 to 63 Hz, maximum 250 watts.
Electromagnetic fields	Negligible. No nearby source of electromagnetic noise, such as arcing relays or electric motors.
Fume hood (optional)	4-in. duct with greater than 80 CFM flow.

2.1.2 Power requirements

The 2767 Sample Manager requires the following:

- Grounded alternating current (AC) power source
- Minimal power transients and fluctuations



Warning: To avoid possible electric shock, always turn off the instrument and unplug the power cord before performing maintenance procedures.



Warning: For continued protection against fire hazard, replace fuses with those of the same type and rating.

2.2 Inspecting and unpacking

The components of the 2767 are packed and ship in one or more cartons that contain the following items:

- Waters 2767 Sample Manager
- Power cord, signal cables, and shields
- Release notes
- Startup Kit
- Optional fume hood (separate carton)
- Optional racks (separate carton)

2.2.1 Inspecting the shipping container

Inspect the exterior of the container for such possible shipping damage as:

- Water damage or discoloration
- Cuts or gashes
- Collapsed corners
- Crushed top, sides, or bottom

2.2.2 Unpacking the instrument

Ensure there is enough space to unpack the instrument and its accessories.

To unpack the instrument:

1. Remove the plastic wrap, if any, and the bands securing the carton to the pallet. Remove the top and the sides of the shipping carton and the packing material.
2. Check the contents of each carton against the packing slip to confirm all items are present.
3. Leave the 2767 Sample Manager in the box, and remove the front and side shields from the worktable.
4. Remove the Startup Kit box from the worktable.
5. Check that the contents of the Startup Kit match the Startup Kit list.
Tip: To prevent damage, lift the instrument by the bottom. Do not lift the instrument by the robotic arm.
6. Remove the instrument from the bottom styrofoam cushion and the box bottom, and place the instrument on the work surface.
Tip: To avoid overheating the 2767 Sample Manager, ensure that there is at least 1 inch (2.5 cm) of clearance at the back of the instrument.
7. Locate the signal cables.
8. If you detect any damage to the contents of any of the cartons, see the *Waters Licenses, Warranties, and Support* document.
9. Save the shipping cartons for future transport or shipment.

10. If you detect any discrepancy in the contents of the order and are in the United States or Canada, contact Waters Technical Service at 800-252-4752. In other locations, call your local Waters subsidiary, your local Waters Technical Service Representative, or Waters corporate headquarters in Milford, Massachusetts (U.S.A.).

2.2.3 Releasing the X/Y/Z_S/Z_F robotic arm

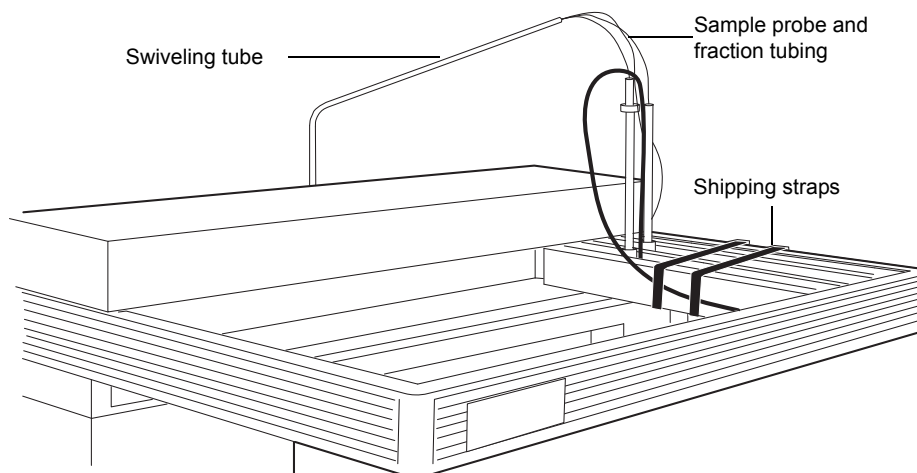
The X/Y/Z_S/Z_F robotic arm is secured to the guard bar for shipping.

Required material

- Scissors

To release the X/Y robotic arm:

1. Open the Velcro closure that secures the shipping straps around the X/Y/Z_S/Z_F robotic arm.



2. Remove the packing material from the top of the frame. Remove the tie wrap and tubing from the top of the probe guide, and remove the tie wrap from the probe below the frame.

Tip: To prevent damage to the X/Y/Z_S/Z_F robotic arm when moving, relocating, or shipping the 2767 Sample Manager, before moving the instrument reinstall the packing material and secure the robotic arm to the guard bar with the shipping straps.

3. To release the Z_S/Z_F arm, cut the tie wrap and remove the split clear tubing on the top and bottom of each Z rack.

2.2.4 Installing the shields

The 2767 Sample Manager is equipped with shields to protect you from injury during operation.



Warning: Shields must be installed for safe operation of the 2767 Sample Manager.

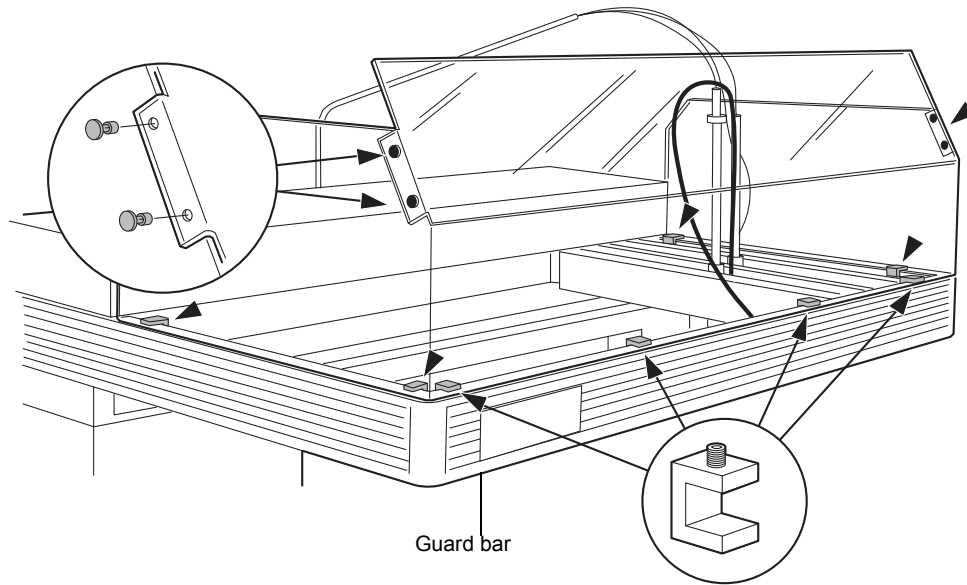
Tip: If you are installing the fume hood, see [page 44](#). The fume hood includes specialized protective shields.

Required materials

- Side shields
- Front shield
- Screw kit includes clips, screws and black pop-in fasteners
- Allen wrench
- Isopropyl alcohol

To install the shields:

1. Remove the paper from the front and side shields.
2. Center the front shield on top of the front guard bar above the worktable. Make sure the flange faces the back of the unit.



3. Place the four shield clips with the set screws facing upward onto the flange in the notches. Use an Allen wrench to tighten the set screw in the clamp.
Tip: Position the set screws facing upward so they do not interfere with X/Y/Z_S/Z_F arm.
4. Repeat steps 2 and 3 for both side shields using two shield clips per side shield. The side shields are interchangeable.
5. Press the black pop-in fasteners into the holes at the corners of the front shield to secure it to the side shields. Use two fasteners to secure each side shield to the front shield.
6. Slide the X/Y/Z_S/Z_F arm to the far left to ensure that the shields and connectors do not interfere with the movement of the robotic arm.
7. Clean all three shields with isopropyl alcohol and lint-free cloths.

2.3 Making fluidic connections

Solvents that are compatible with the 2767 Sample Manager can range from water and aqueous solutions to organic solvents. Ensure that the sample and sample matrix are soluble in the solvents you use for elution and washing.

Tip: Mixing aqueous buffers and miscible organic solvents with each other can cause precipitation due to salt formation or solubility limitations. Precipitates can block the sample probe or injector and interfere with sample aspiration.

Following are the fluidic connections for the 2767 Sample Manager:

- Installing wash solvent reservoirs and wash inlet tubes
- Setting up the swiveling tube guide
- Installing fraction collection and HPLC waste tubes
- Installing the wash station drain tube
- Installing the drip tray drain tube
- Installing the injector tube

Tip: Check all plastic fittings and tighten, if needed. The fittings can loosen during shipment, particularly if the unit has undergone temperature extremes.



Warning: Observe safe laboratory practices when handling solvents. See the Material Safety Data Sheets for the solvents you use.

Tip: For proper drip protection, ensure that the tube fittings are tightened before operating the system.

2.3.1 Installing wash solvent reservoirs and wash inlet tubes

The wash solvent reservoirs contain the solvents used to wash the sample probe and injectors. The wash inlet tubes deliver the wash solvents from the wash solvent reservoirs to the wash select valve. Wash solvent 2 is typically the strong wash solvent, if selected in the software. Wash solvent 1 is the weak wash solution that is used for the final wash. Wash solvent 2 should be similar to or identical with the initial chromatographic mobile phase. The wash solvents and reservoirs are not provided with the 2767 Sample Manager.

Tip: If you are not using wash solvent 2, do not connect the tubing (T2).

Required materials

- Wash 1 tube marked T1, Wash 2 tube marked T2
- Wash solvent 1 and wash solvent 2 reservoirs labeled (compatible with your solvents) (not provided)

Tip: Buffered solutions should not be used for washing.

To install the wash inlet tubes:

1. Locate the tubes labeled T1 (Wash 1) and T2 (Wash 2) that are connected to the solvent select valve.

2. Drop the unconnected end of the Wash 1 tube marked T1 into the wash solvent reservoir containing the weak wash solution (not provided).
3. Drop the unconnected end of the Wash 2 tube marked T2 into the wash solvent reservoir containing the strong wash solution (not provided).
4. Secure the wash solvent tubes to the wash solvent reservoirs.

Tips:

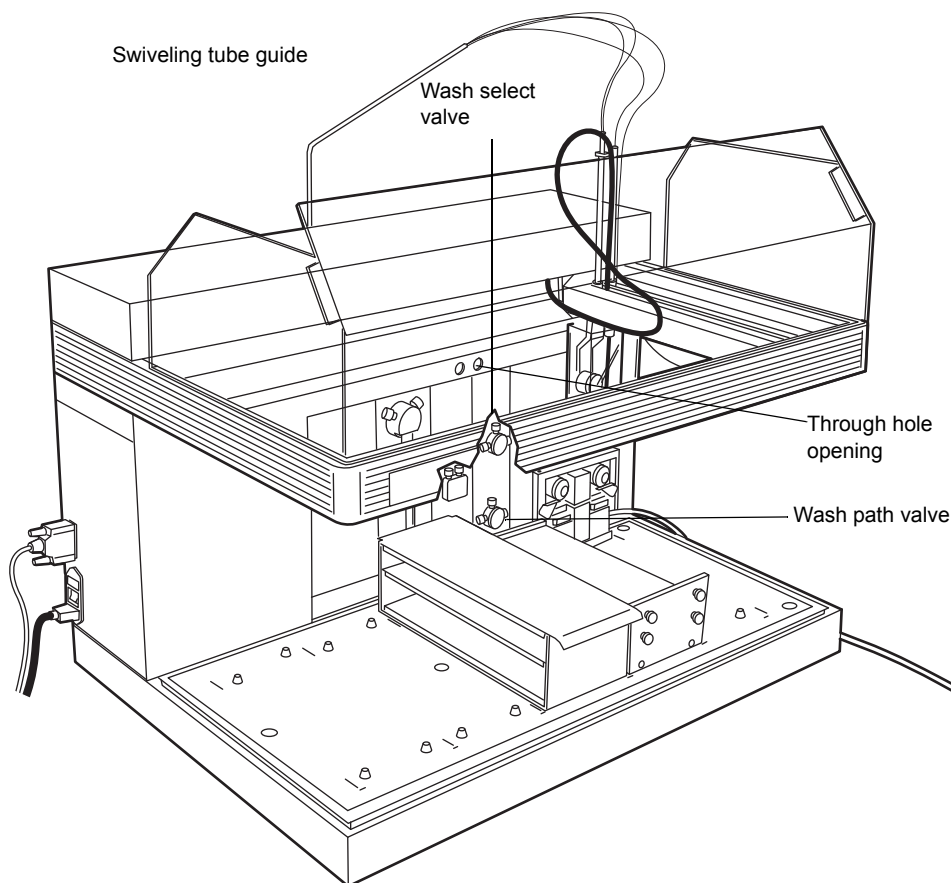
- Do not insert a filter in the wash solvent tubes.
- To prevent spill damage to the 2767 Sample Manager, do not place solvent containers on top of the instrument.

2.3.2 Setting up the swiveling tube guide

The swiveling tube guide gathers the tubes to the sample probe and the fraction dispense tube, allowing the X/Y/Z_S/Z_F robotic arm to move freely around the worktable.

To set up the swiveling tube guide:

1. Insert the tube guide in the black holder on the upper portion of the back panel.
2. Push the tubes labeled T6 and T7 through one of the round through-hole openings on the back panel so the ends of the tubes lie near the wash path valve.



3. Screw the tube marked T7 into the left side of the wash path valve.

4. Screw the tube marked T6 into the right side of the wash path valve.
5. Make sure that both tubes are against the back panel so that the tubes do not get snagged by the robotic arm mechanism.

2.3.3 Installing fraction collection and HPLC waste tubes

2.3.3.1 Fraction collection tube

Depending on system configuration, the fraction collection tube connects the fraction dispense tube with the System Fluidics Organizer or UV detector outlet. The tube marked T9 (or T27 or T28 from the Startup Kit depending on the desired flow rate range) is prerouted through the swiveling tube guide. Connect the free end of the tube to the System Fluidics Organizer splitter or detector. The 2767 Sample Manager is equipped with a 0.020-inch ID fraction collection tube (T9). A 0.010-inch ID fraction collection tube (T27) and a 0.040-inch ID fraction collection tube (T28) are also provided for lower and higher flow rates. See the following table for the maximum flow rate for each fraction collection tube. Minimizing tubing will minimize band spreading.

Caution: To prevent tubing or fitting failure, adhere to the guidelines in the following table.

Maximum flow rates for fraction collection tubes

T Number	Tube ID (inches)	Maximum Flow Rate (mL/min)
T9 (standard)	0.020	30
T27	0.010	5
T28	0.040	150

2.3.3.2 HPLC waste tube

The HPLC waste tube runs from the fraction collect valve to the waste container (not provided or such secondary fraction collector(s) as the Waters Fraction Collector II).

Required materials

- Teflon[®] tubing marked T10
- Waste solvent container (compatible with your solvents) (not provided)

To install the HPLC waste tube:

1. Find the tube marked T10 (prerouted through the swiveling tube guide).
2. Place the free end of the tube in the waste container or secondary fraction collector. Ensure that the HPLC waste tube does not get crimped or bent. A crimp or bend in the line may prevent adequate flow.

Tip: To properly drain the HPLC waste fluid, ensure that the end of the HPLC waste tube in the waste container always remains above the waste fluid.

2.3.4 Installing the wash station drain tube

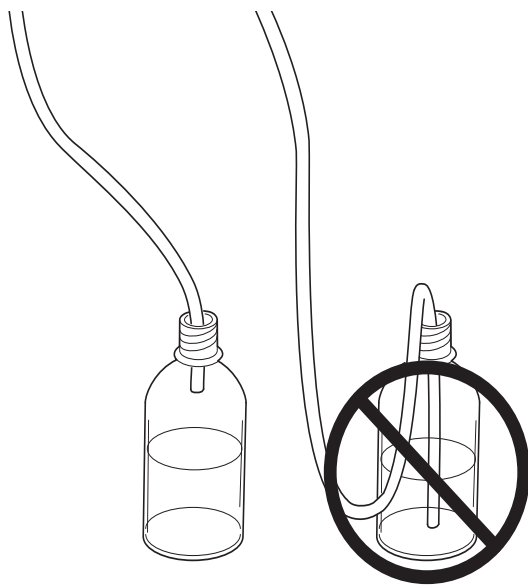
The 2767 Sample Manager Startup Kit includes one 10-foot Tygon® 2075 1/4-inch internal diameter waste tube. You must cut this tube into two pieces: one piece functions as the wash station drain tube, and the other serves as the drip tray drain tube (see [page 36](#)).

Required materials

- Tygon 2075 waste tube 1/4-inch internal diameter, cut 10 feet long
- Waste solvent container (compatible with your solvents) (not provided)

To install the wash station drain tube:

1. Cut the waste tube to the length needed to route wash solvent from the wash station to the normal waste bottle (not provided) stored under the 2767 Sample Manager.
2. Connect one end of the tube to the stainless steel fitting on the back of the wash station, and secure with the hose clamp provided.
3. Place the end of the waste tube in a solvent waste container below the instrument. The wash station drain tube must slope downward to allow the waste fluid to flow into the waste container.



4. Secure the tube to the container. Loosely cover the waste container opening with laboratory film to prevent fumes and splashes without sealing it tightly.

Tip: To properly drain the waste fluid, ensure that the:

- End of the waste station drain tube in the waste container always remains above the waste fluid.
- Waste station drain tube does not get crimped or bent. A crimp or bend in the line may prevent adequate flow to the waste container.
- Waste station drain tube has a downward slope of 1/2 inch per foot to provide adequate drainage.

2.3.5 Installing the drip tray drain tube

The 2767 Sample Manager has a drip tray to collect any liquid spill in the worktable area. The drip tray has a separate drain tube to an auxiliary waste container (not provided) or an optional leak detector. This drain tube isolates any liquid that may overflow into the drip tray from the normal waste. In normal operation, solvent should not flow into the drip tray.

The 2767 Sample Manager Startup Kit includes one 10-foot Tygon 1/4-inch ID waste tube. You need to cut this tube into two pieces: one piece functions as the wash station drain tube (see [page 35](#)), and the other serves as the drip tray drain tube.

Required materials

- Tygon 2075 waste tube 1/4-inch internal diameter, cut 10 feet long
- Waste solvent container (compatible with your solvents) (not provided or optional leak detector)

To install the drip tray drain tube:

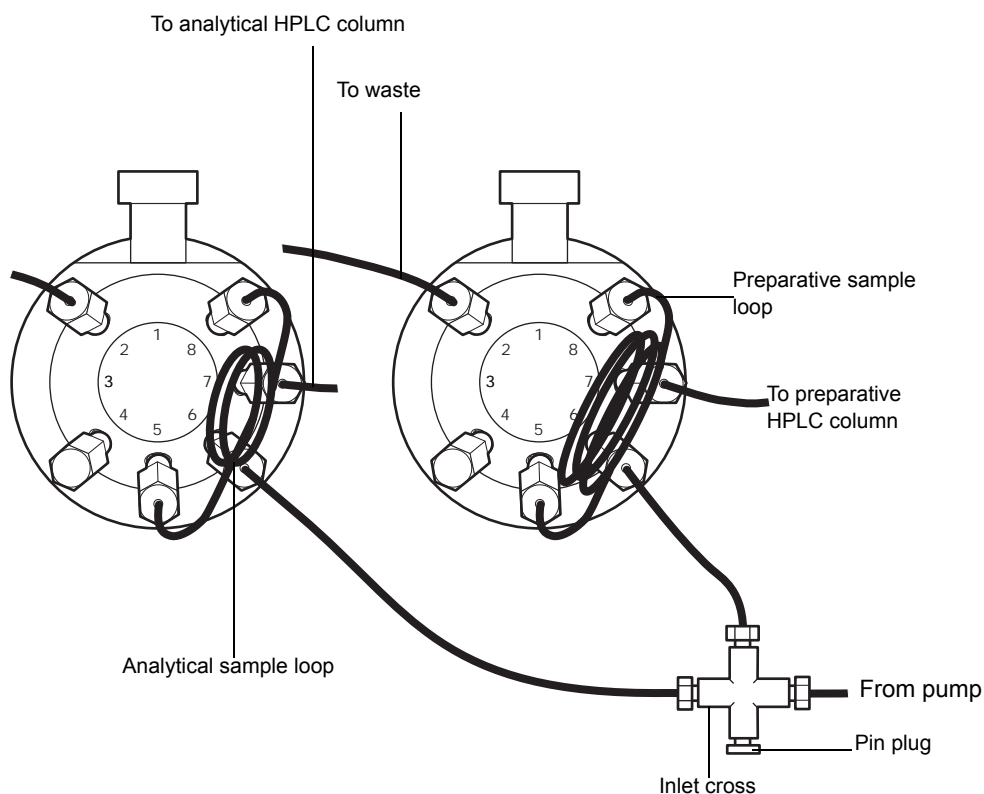
1. Affix the Tygon (1/4-inch ID) drain tube to the drain port on the bottom-right side of the drip tray.
2. Place the end of the drip tray drain tube in the fluid waste container or optional leak detector that is below the instrument. The drip tray drain tube must slope downward to allow the waste fluid to flow into the waste container.
3. Label the waste container as drip tray waste.
4. Secure the tube to the waste container. Cover the waste container opening with laboratory film to prevent fumes and splashes without sealing it tightly.

To properly drain the waste fluid, ensure that the:

- End of the drip tray drain tube in the waste container always remains above the waste fluid.
- Drip tray drain tube does not get crimped or bent. A crimp or bend in the line may prevent adequate flow to the waste container.
- Drip tray drain tube has a downward slope of 1/2 inch per foot to provide adequate drainage. Do not insert a trap on the drip tray drain tube.

2.3.6 Installing the injector tubes

You must install tubing from the solvent delivery module to the inlet cross and from the injector(s) to your HPLC column(s). The tube from each injector to the wash station is already installed.



To install the injector tube:

1. Install the tube for an HPLC column inlet to port 7 of the inject valve.
2. Install the tube from the 2545 Binary Gradient Module outlet or other the solvent delivery module to the inlet cross port.

Tip: Only the injector in use is flushed with mobile phase solvents. No mobile phase passes through the inactive injector.

For more information on HPLC solvent requirements and pump configuration, refer to the *Waters 2545 Binary Gradient Module Operator's Guide*.

2.4 Making electrical connections

Use this section to:

- Install the communications cable
- Make signal connections
- Make power connection

When the 2767 Sample Manager makes an injection, it generates several TTL (open collector) signals that can be used to start the operation of peripheral devices. These signals are provided through event cables connected to a 10-pin terminal strip on the lower-left corner of the 2767 Sample Manager back panel.

2.4.1 Installing the communications cable

Required material

- DB9 RS-232 cable kit (includes DB25Male/DB9Female adapter)

To install the RS-232 communications cable from the 2767 Sample Manager to the computer:

1. Connect the 25-pin male side of the DB25Male/DB9Female adapter to the 25-pin D-sub receptacle on the left side of the 2767 Sample Manager, and then tighten into position.
2. Connect the male side of the standard 9-pin RS-232 cable to the 9-pin female side of the adapter.
3. Connect the other side of the RS-232 cable (female side) to the 9-pin male connector, serial port COM1, on the back of your computer, and then tighten into position.

2.4.2 Making signal connections

The 2767 rear panel includes a removable connector that holds the clip terminals for analog signals. This connector is keyed so it can be inserted only one way. The signals function as I/O, or event, signals.

Following are 2767 Sample Manager terminal functions.

I/O signals for the 2767 sample manager

Connector number	Signal	Description
1	– (Negative)	Connects signal cable to appropriate HPLC module in order to provide inject start signal. The 2767 Sample Manager sends outgoing signal automatically upon injections.
2	+ (Positive)	Connects signal cable to appropriate HPLC module in order to provide inject start signal. The 2767 Sample Manager sends outgoing signal automatically upon injections.
3	S1	Sends outgoing signal to HPLC column selection valve (see page 67).
4	S2	Sends outgoing signal to HPLC column selection valve (see page 67).
5	S3	Sends outgoing signal to HPLC column selection valve (see page 67).
6	S4	Sends outgoing signal to HPLC column selection valve (see page 67).
7	Gnd	Connects instrument to ground.

I/O signals for the 2767 sample manager (continued)

Connector number	Signal	Description
8, 9, 10		These three connectors are not used.
I/O Output Signal Specifications		
Output Low		0 Vdc
Sink Current		-20 mA each, total -70 mA maximum
Output High		5 Vdc
Source Current		+20 mA each, total +70 mA maximum

2.4.3 Making power connections

The 2767 Sample Manager uses two 5-A main fuses (see [Appendix B](#)). The power supply automatically switches configuration for your power source (110/220 Vac).



Warning: To avoid possible electrical shock, always power off the instrument before connecting or disconnecting the power cord.


To install the power cord from the 2767 Sample Manager to the power source:

1. Attach the female connector into the power receptacle on the left side of the instrument.
2. Connect the male connector into an earth-grounded power source (see [Appendix B](#)).

2.5 Setting up the MassLynx software

The 2767 Sample Manager is controlled by MassLynx software. See the *MassLynx User's Guide* for information on selecting and displaying data files. The 2767 Sample Manager does not support the MassLynx Open Access environment. This ensures the fraction collection cycle is uninterrupted.

2.5.1 Configuring the software


From the MassLynx Main window, click  to access the Inlet Editor.

Inlet editor

File Name	File Text	Inlet File	Bottle	Inject Volume
1 Test		default	3.1:1.A	3.000

Index	ID	Description	Status	Status Advice

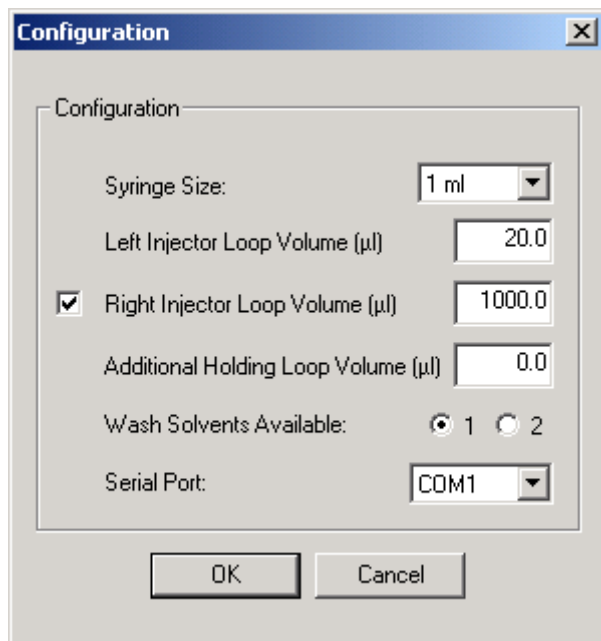
Ready Idle 0:0 Sample Recording Disabled

The Inlet Editor controls the each component of the AutoPurification System. To access the 2767 Sample Manager method parameters, click  from the Inlet Editor.



2.5.2 Configuring the 2767 Sample Manager

To configure your 2767 Sample Manager, select **Waters2767 > Configuration** from the Inlet Editor.



2.5.2.1 Syringe Size field

The Syringe Size field specifies the volume of the currently installed syringe. The default syringe size is 1 mL. Ensure the syringe size shown matches the syringe installed on your 2767 Sample Manager. Use the drop-down menu to select a different syringe size. If you are installing a syringe other than the default 1-mL syringe, see the [table titled “Sample Manager sampling combinations” on page 1-24](#) to ensure the syringe is compatible with the sample loop and holding loop.

Tip: The syringe must be equal to or larger than the largest sample loop in use.

2.5.2.2 Left Injector Loop Volume (µL) and Right Injector Loop Volume (µL) fields

The Right and Left Injector Loop Volume fields specify the volume of the sample loop currently installed on the each injector. The 2767 Sample Manager is equipped with a 20-µL analytical sample loop with 0.015-inch internal valve passages on the left injector. The right injector has a 1000-µL preparative sample loop with 0.024-inch internal valve passages. The check box to the left of the Right Injector Loop Volume field is used to support other sample managers where the right injector is not present and is selected by default on the 2767 Sample Manager. See the [table titled “Sample Manager sampling combinations” on page 1-24](#) for recommended combinations of sample loops, syringes, and holding loops.

2.5.2.3 Additional holding Loop Volume (µL) field

A holding loop must be added when a syringe of greater than 1-mL capacity is installed. The holding loop is used to ensure that adequate volume can be safely drawn for injections equal to the full syringe volume without contaminating the syringe. The Additional Holding Loop field

specifies the volume of the holding loop. The 2767 Sample Manager has an intrinsic holding loop of 1.7 mL. See the [table titled “Sample Manager sampling combinations” on page 1-24](#) for recommended combinations of sample loops, syringes, and holding loops.

2.5.2.4 Wash Solvents Available field

The Wash Solvents Available field specifies the number of wash solvents connected to your 2767 Sample Manager. One wash solvent, wash solvent 1 (weak wash solution), is the default. This field determines the number of wash solvents shown on the Wash tab (see [page 65](#)).

Tip: If you are not using wash solvent 2, do not connect the tubing (T2).

2.5.2.5 Serial Port field

The Serial Port field specifies the communications port used for the RS-232 communications cable. The 2767 Sample Manager can be configured to operate using any RS-232 communications port. The default setting is COM1.

2.6 Installing the hardware

You must install the syringe before operating the 2767 Sample Manager.

2.6.1 Installing the syringe

The pipetting and dispensing system is powered by an integral high-precision, single-piston syringe pump. The syringe pump moves 3000 steps for a full syringe, so volume resolution depends on syringe size. The Startup Kit contains a 1-mL syringe. You can install a syringe with a capacity of 250 or 500 μL or 1.0, 2.5, 5.0, or 10 mL on the syringe pump. See the [table titled “Sample Manager sampling combinations” on page 1-24](#) for recommended combinations of sample loops, syringes, and holding loops.

Tip: The syringe must be equal to or larger than the largest sample loop in use.

To wet the syringe, manually pull the solvent into the syringe and dispense it. Wet the syringe with reagent-grade solvent you plan to use for HPLC runs. Allow no syringe to run dry more than a few cycles without solvent.



Warning: To avoid possible injury, power off the unit when putting your hands in the worktable space.

If you are installing a syringe other than the 1-mL syringe in the Startup Kit or if you are replacing the syringe with a syringe with a different maximum volume than the installed syringe, change the hardware configuration before installing or replacing the syringe.

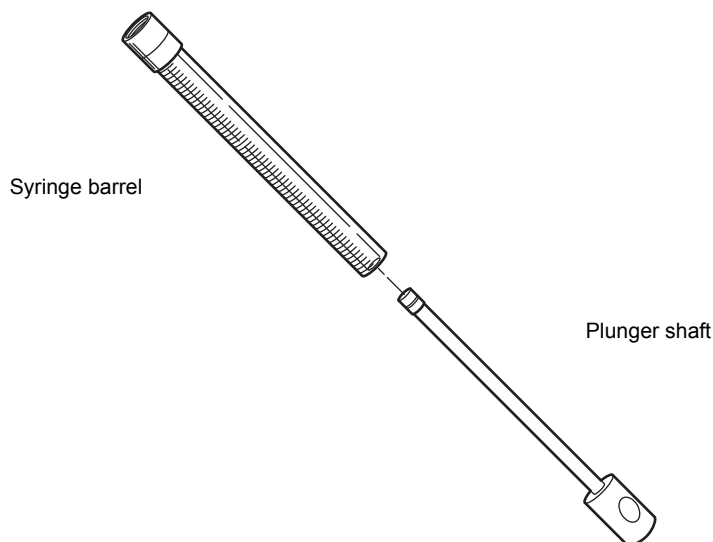
To install the syringe:

1. From the Inlet Editor, select **Waters2767 > Configuration**.
2. Select the appropriate syringe size from the Syringe Size μL list.
3. Accept the default values in the other fields.

4. Click **OK**.
5. Select **LC > Reset Injector** from the Inlet Editor to activate the new syringe size.

To install a syringe on the syringe pump:

1. From the Inlet Editor, select **Waters2767 > Change Syringe**. The plunger shaft moves to the installation position.
2. Insert the plunger into the barrel of the syringe.



3. When the plunger shaft stops moving, remove the plunger shaft screw from the plunger shaft.
4. Mount the bottom of the syringe plunger on the plunger shaft.
5. Replace the plunger shaft screw on the base of the plunger shaft.
Tip: To avoid stripping the bayonet threads when mounting the syringe barrel on the bottom of the 3-port syringe valve, gently push the syringe barrel upward. Do not overtighten.
6. Align the top of the syringe barrel with the bayonet fitting of the valve, then screw the barrel onto the fitting while pushing upward slightly.
7. Prime the pump as described in Chapter 3, until all tubes are free of air bubbles. Prewetting and prefilling the new syringe with wash solvent may facilitate system priming.

2.6.2 Installing the fume hood (optional)

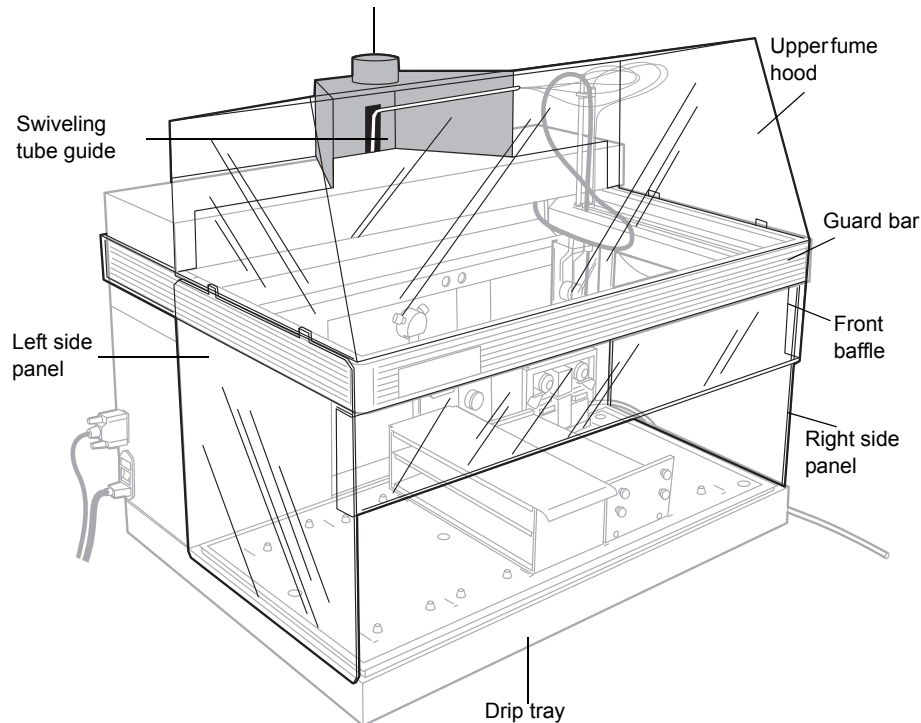
The 2767 Sample Manager can be equipped with an optional fume hood to allow for self-contained ventilation.

Required materials

- Fume hood
- Screw kit includes clips, screws, and black pop-in fasteners
- Allen wrench
- Duct (4-inch) (not provided)

To install the fume hood:

1. Remove the paper from the top shield of the fume hood.
 2. Mount the top shield of the fume hood on the guard bar above the worktable.
 3. Lift the metal rear portion of the fume hood to align the side channels with the side flanges of the front cover.
 4. Lower the metal rear portion of the fume hood until it rests on the 2767 Sample Manager.
 5. Slide the fume hood forward so its front edge aligns with the guard bar.
 6. Install eight shield clips with set screws facing upward along the guard bar to secure the fume hood. There are four notches in the front of the guard bar and two notches on each side of the guard bar for the shield clips. Use an Allen wrench to tighten the set screw in the clamp.
 7. Ensure that the swiveling tube guide pivots freely inside the fume hood. If the swiveling tube guide rubs the inside of the fume hood, bend the swiveling tube guide at the elbow slightly. The movement of the swiveling tube guide must not be restricted.
 8. Hold the right side panel with the flange toward the worktable of the 2767 Sample Manager, and align the top with the slots in the upper fume hood. Carefully bend the side panel slightly to lift the side panel over the drip tray so the flange rests inside the drip tray.
 9. Repeat step 8 for the left side panel.
 10. Place the front baffle under the front guard bar, and secure it to the side panels with the black pop-in fasteners.
- Tip:** Ensure the shield clips restrict no motion of the robotic arm. Clean all shields with isopropyl alcohol and lint-free cloths.
11. Connect the duct work (not provided) to the opening on the metal rear portion of the fume hood. The 4-inch duct work must provide greater than 80 CFM flow with a minimum face velocity of 10 ft/min.



2.7 Initializing the sample probe and syringe pump

The sample probe and syringe pump automatically run through an initialization routine each time you:

- Start MassLynx software
- Change the Bed Layout dialog box

The initialization routine sends the sample probe to the home position, then to the wash station and back to the home position. The routine checks the home position of the syringe pump and finally sets the left and right injectors.

To initialize the sample probe and syringe pump at any other time, select **LC > Reset Injector** from the Inlet Editor.

Tip: If an error occurs or the power fails when the sample probe is down, power off the device, then manually move the sample probe up before resetting the injector.

2.8 Checking the sample probe calibration

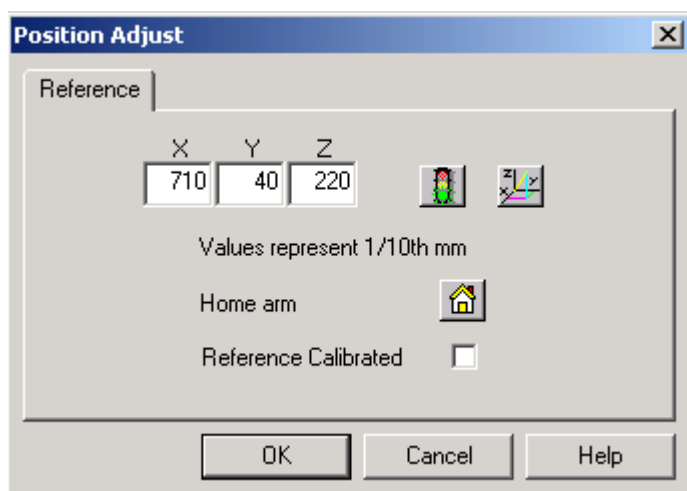
The sample probe requires checking to ensure it is calibrated:


- Before first use
- When the probe is replaced
- When sample probe movement has been impeded

Caution: To avoid injury, always keep your hands outside the worktable, and avoid leaning over the instrument during this procedure.

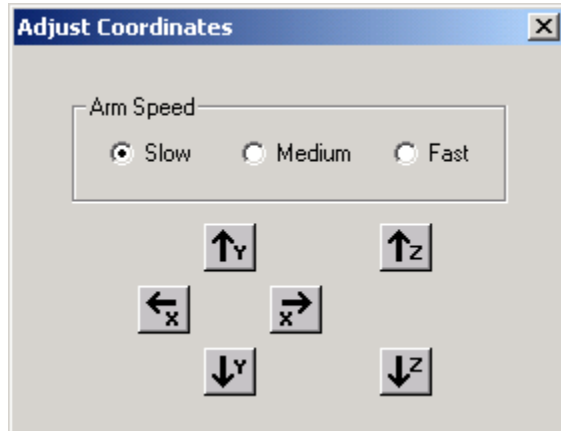
To check the sample probe calibration:

1. From the Inlet Editor, select **Waters2767 > Reference Position**.

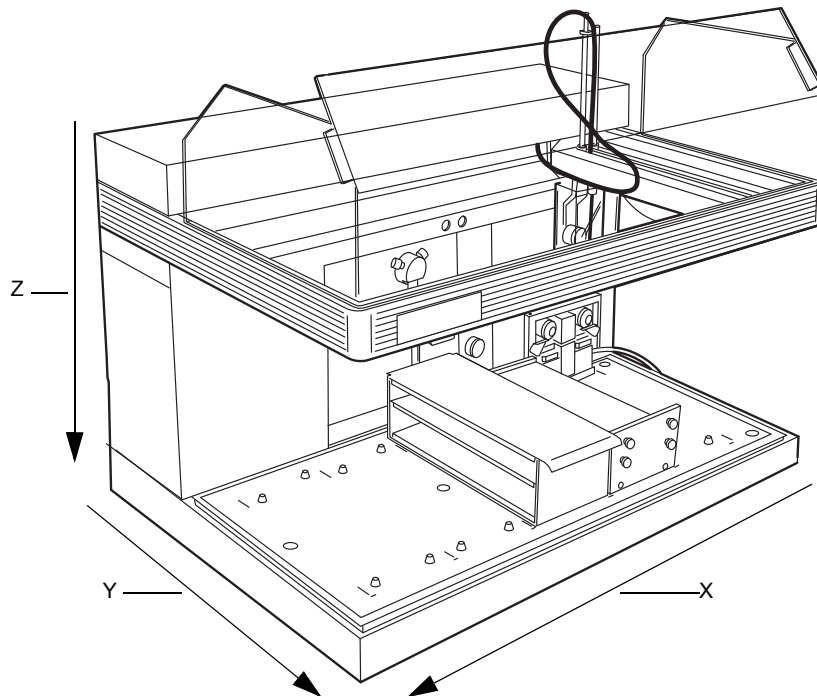


2. Click  to access the Adjust Coordinates screen.

Tip: When you know the X, Y, Z coordinates, you can enter them in the Position Adjust screen. You cannot enter numbers in the Adjust Coordinates screen.




The X, Y, Z coordinates are measured in 1/10th millimeters, so 1 mm equals 10 units. The following figure shows the X, Y, and Z directions, with the arrowheads pointing in the direction of increasing numbers. Slow arm speed equals 1 step per move, medium arm speed equals about 5 steps per move, and fast arm speed equals about 10 steps per move.

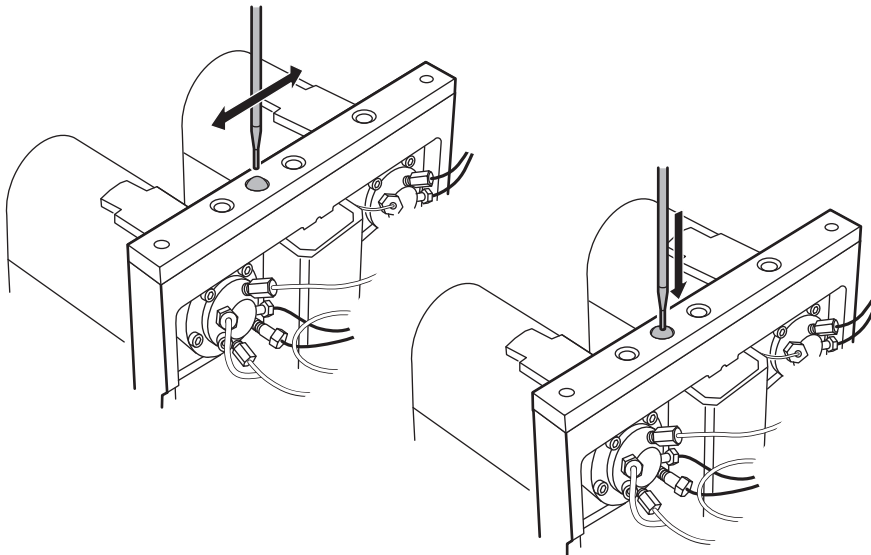


3. Click the **Adjust Coordinates** screen or use the arrow keys (right and left for X-direction, up and down for Y direction, or Page Up and Page Down for Z direction) to move the sample probe to the top of the reference button. Select an arm speed appropriate for the amount of movement required.

Tip: The Z value shown on the Adjust Coordinates screen is 90% of the value shown on the Position Adjust screen so that the sample probe will move close to but not press the


reference button. This allows x- and y- movement before the sample probe presses the reference button.

Click  on the Position Adjust dialog box to verify a calibrated reference position.



4. Select **Slow** arm speed, and then click **Page Up** and **Page Down** to slowly lower the sample probe so it presses the reference button. Press the beige reference button until the collar of the button is flush with the metal base.
5. Click **OK** to return to the Position Adjust screen.
6. Select **Reference Calibrated** to indicate the reference was calibrated. If you do not select Reference Calibrated, the sample probe will not move in the Z-direction during normal operation. This field is not selected initially to protect the sample probe before it is calibrated. You must clear the field before installing a new sample probe.

Tip: After the sample probe is calibrated to the reference button, you must calibrate the first position of each rack.

7. If the sample probe is not in the home position, click  (**Home**) to home the sample probe.
8. Click **OK** to save the reference calibration and return to the Inlet Editor.

2.9 Setting up the worktable

Setting up worktables involves customizing the worktables for your sample and fraction collection racks. The 2767 Sample Manager uses rectangular racks that hold test tubes, vials, or microplates. You position the racks horizontally in the worktable. The bed layout in the Main MassLynx window designates the arrangement and the types of racks that hold test tubes, vials, or microplates. The 2767 Sample Manager worktable holds up to five racks, with the rightmost rack reserved for sample injection. Setting up a worktable can include any of the following procedures:

- Selecting a rack
- Loading samples into racks
- Loading racks in the worktable
- Configuring bed layout
- Teaching the racks and containers
- Changing a rack in a worktable
- Customizing a rack

After customizing the bed layout, you must calibrate the first position of each rack (see [page 57](#)).

2.9.1 Selecting a rack

2.9.1.1 Sample injection

Each sample injection rack is equipped with a stripper plate to allow the probe to penetrate the sample container, withdraw the sample, and retract while leaving the sample container in place in the rack.

Use the following racks for sample injection:

- Microplate (MTP) std, MTP deep, and MTP dense – Racks hold three microplates (MTP) in 96- and 384-well formats with standard or deep wells. A holder kit is required for 384-well plates to provide additional accuracy. Only the 96-well deep format plates should be used for fraction collection.
Tip: If you are using a stripper plate, all microplates in a rack must be the same height and type.
- Plates for 2-mL and 4-mL vials – Racks hold three vial plates. The 2-mL vial plate holds 48 vials per plate, and the 4-mL vial plate holds 24 vials per plate.
- 13-mm tubes – 96-test tube rack for 13 × 100 mm test tubes.

Tip: The far-right rack can only be used for injection. The remaining racks can be designated as sample injection or fraction collection racks.

2.9.1.2 Fraction collection

Fraction collection racks do not use a stripper plate so the test tubes, vials, or plates must not be covered. These racks can only be used for fraction collection or sample reinjection. If you are using microplates, use only 96-deep well microplates for fraction collection.

Tip: The fraction collection racks cannot be used in the far-right position in the worktable.

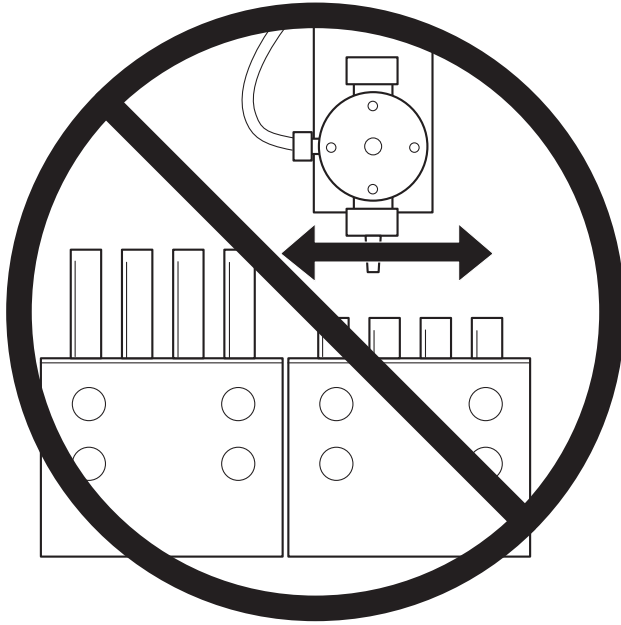
Use the following racks for fraction collection:

- 13-mm tubes – 112-test tube rack for 13 × 100 mm test tubes
- 16-mm tubes – 84-test tube rack for 16 × 100 to 150 mm test tubes
- 18-mm tubes – 78-test tube rack for 18 × 150 mm test tubes
- 25-mm tubes – 36-test tube rack for 25 × 150 mm test tubes
- 28-mm scintillation vials – 32-vial rack for 28-mm diameter scintillation vials
- MTP deep – Racks hold three 96-well deep format microtiter plates


Tip: If the height of test tubes in immediately adjacent racks differs by more than 25 mm, the rack with the tallest test tubes must be to the right to maximize sample probe penetration depth. Test tubes taller than 100 mm can interfere with the probe vent channel.

When the 2767 Sample Manager collects fractions, the Z_F-arm lowers the fraction dispense tube into the collecting vessel to eliminate any sample loss. When placing fraction collection racks in

the worktable, put the fraction collection rack with the taller test tubes to the right of any fraction collection rack with shorter test tubes.

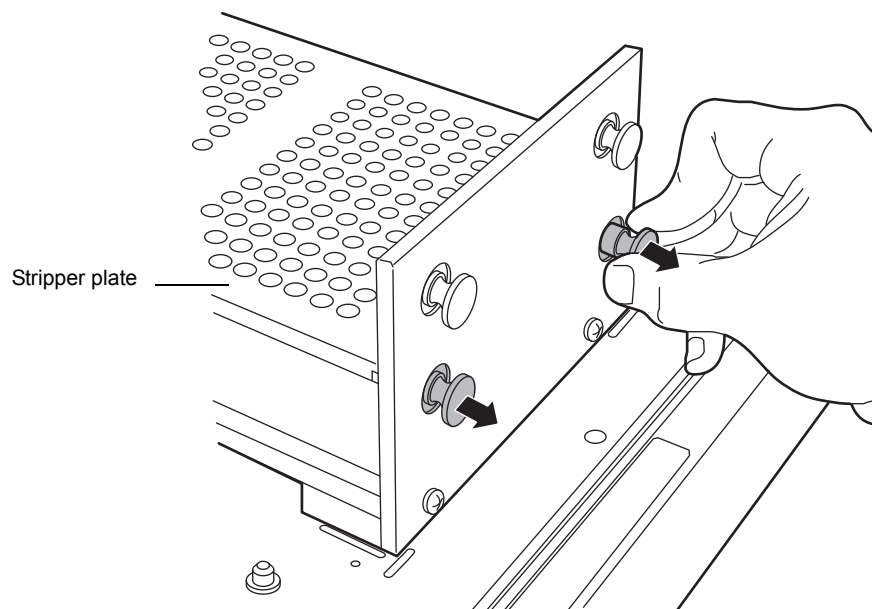


2.9.2 Loading samples into racks

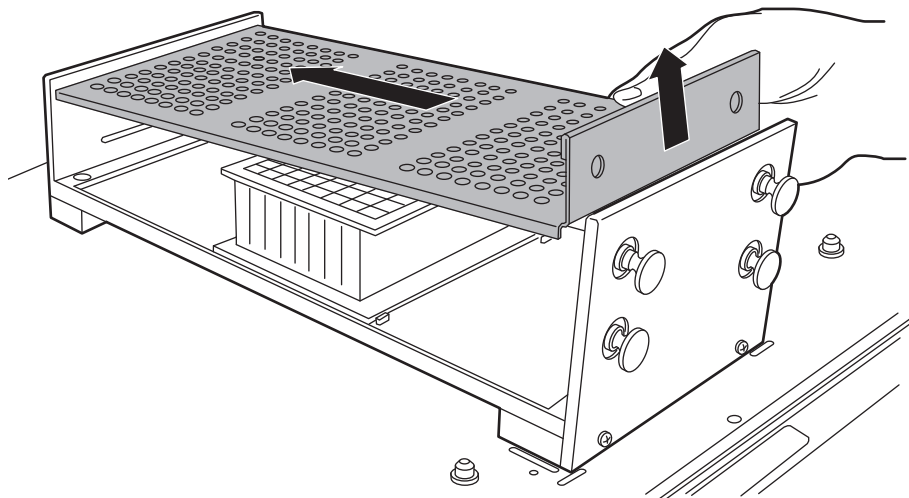
 **Warning:** To avoid possible injury, always keep your hands clear of the 2767 Sample Manager sample probe during operation.

To load samples for injection into a sample rack with a stripper plate:

1. Release the stripper plate by snapping the knobs on the front side of the rack away from the stripper plate.



2. Lift the front of the stripper plate up over the front of the rack, and then slide the stripper plate toward the front to dislodge the back of the stripper plate from the rack.

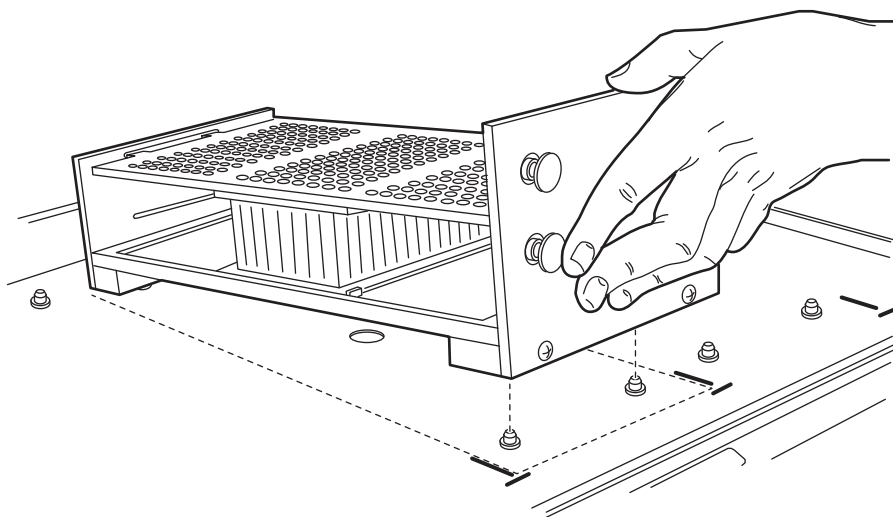


3. Load your sample plates, vials, or test tubes.
4. Insert the stripper plate in the opening on the back side of the rack, and lower the stripper plate so it rests just above your samples.
5. Snap the two knobs on the front side of the rack to secure the stripper plate.

2.9.3 Loading racks into the worktable

Tip: The far-right rack in the worktable must contain samples for injection. The remaining racks can be designated as sample injection or fraction collection racks in the MassLynx software.

Align the racks using the marks on the worktable, then lower the back end of the rack and slide it toward the back of the worktable. The pins on the worktable fit into the bottom of the rack to locate it. The long marks on the worktable outline the rectangular area of the Waters racks.

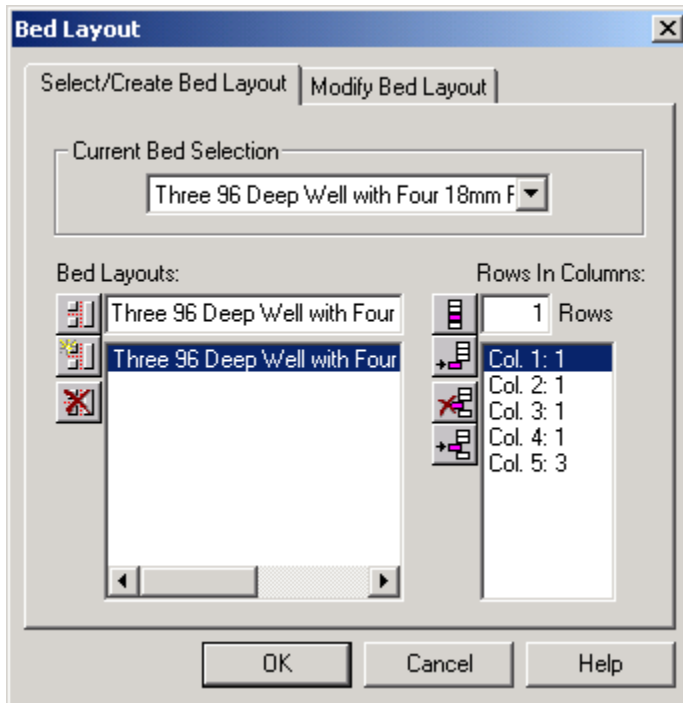


Gilson® racks can be used for fraction collection. When placing such racks on the worktable, use the small, circular marks to position the curved front of the rack.

2.9.4 Configuring the bed layout

The bed layout shows the types and relative locations of rack in the 2767 Sample Manager worktable. You configure the bed layout using the Bed Layout dialog box. You can also use this dialog box to change existing bed layouts or customize new ones.








To configure your bed layout, select **Waters2767 > Bed Layout** from the Inlet Editor.



2.9.4.1 Select/Create Bed Layout page

The Select/Create Bed Layout page displays the current bed layout, the bed layout you are editing, and a list of other defined bed layouts. The Current Bed Selection field shows the active bed layout. Use the drop-down list to select the current bed layout. The Bed Layouts field displays the bed selected for editing. To select another bed layout, use the mouse to highlight the bed layout from the drop-down list. In this example, the current bed selection is being edited, so the same bed layout appears in both fields. The bed layout is arranged in columns and rows and describes the racks or plates on the worktable. Racks in the bed layout are numbered from left to right. The Rows in Columns section of the screen displays the number of columns and rows in the bed being edited. In this example, the Three 96 Well with Four 18mm Racks bed shows the fraction collection racks with 18 mm tubes in columns 1 through four (Col. 1:1, Col. 2:1, Col. 3:1, and Col. 4:1) and the sample injection rack with three microplates as column 5 (Col. 5:3) in front of the injector. The following table describes the function of each icon on the Select/Create Bed Layout dialog box.


Select/create bed layout icons

Icon	Description
Bed layouts	
	Changes the name of the selected bed layout when you enter new name.
	Creates a new bed layout.
	Deletes the selected bed layout.
Rows in columns	
	Causes the number of rows in the selected column to be the same as the number in the Rows field.
	Adds a new column to the end of the bed layout. This column will contain the same number of rows as in the Row edit box.
	Deletes the selected column.
	Inserts a column above the selected column. This column will contain the same number of rows as in the Row edit box. On the worktable, the inserted column appears to the left of the initially selected column.

To activate an existing bed layout:

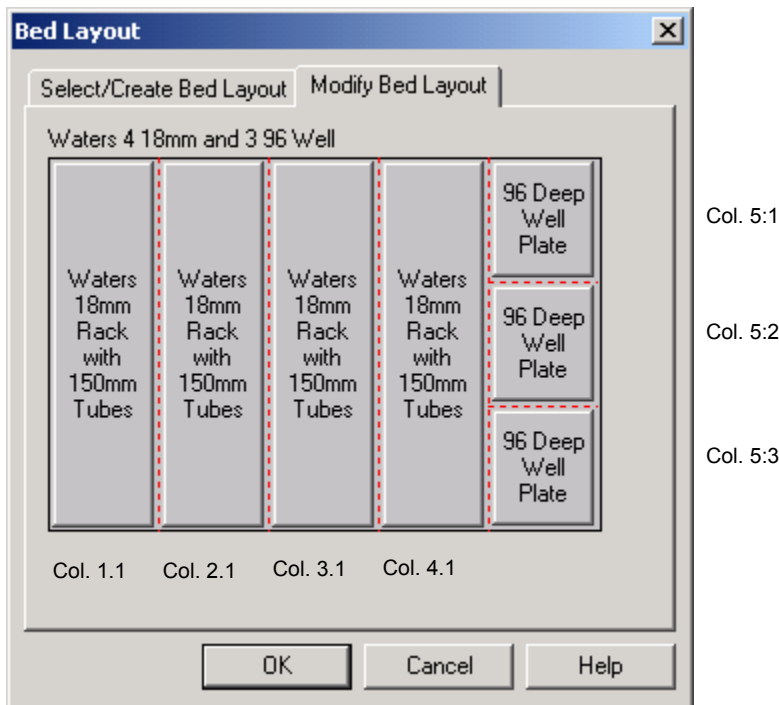
1. From the Bed Layouts list, select the bed layout you wish to edit.
2. From the drop-down box, select the same bed layout from the Current Bed Selection.
3. Click **OK**.

To create a new bed layout:

1. Type a descriptive name in the Bed Layouts field.
2. Click  (**Create New**) to create a new bed layout.
3. In the Rows in Columns field, enter the number of rows in the rack. For bed layout purposes, columns refer to the number of racks in the worktable and rows refer to microplates in a rack. A rack with three microtiter plates contains three rows, while a rack with test tubes contains one row. The number of test tubes in a rack or wells in a plate is defined in the Plate Generator dialog box.

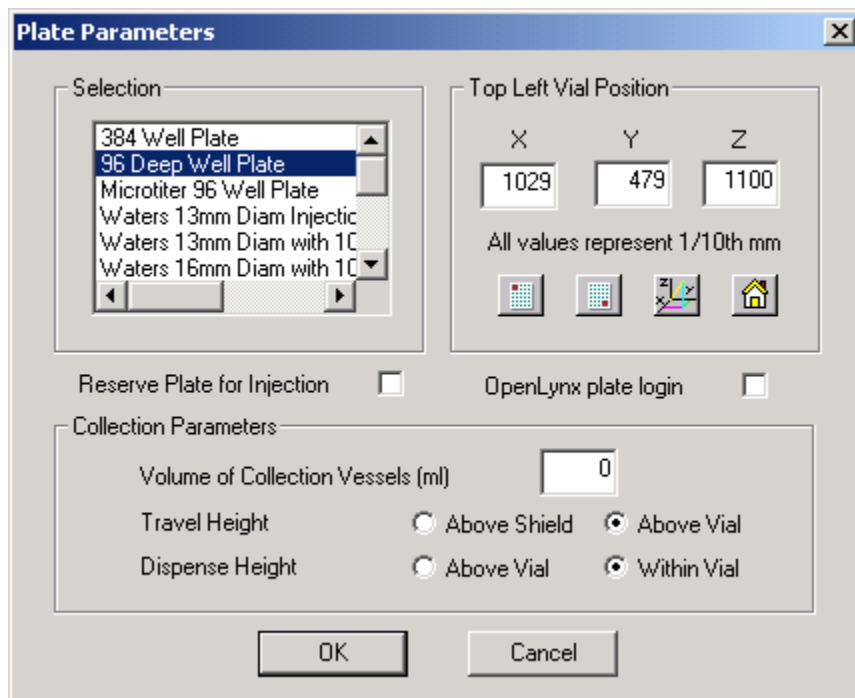
2.9.4.2 Modify Bed Layout page

The Modify Bed Layout page displays the bed layout selected for editing. This example has a rack with three 96-well deep format microplates for injection in the rightmost position in the worktable, then four racks with 18 × 150 mm tubes for collection in the remaining positions in the worktable.



2.9.4.3 Plate parameters



In the Modify Bed Layout tab, click a rack (**Waters 18mm Rack with 150mm Tubes**) or a plate (**96 Deep Well Plate**) to access the Plate Parameters dialog box. These racks are created and defined using the Plate Generator dialog box.



2.9.4.4 Selection

The plate or rack highlighted is the plate or rack you selected on the Modify Bed Layout tab. All information on the Plate Parameters dialog box refers to the selected plate or rack. To select another rack or plate, scroll through the list, and highlight the desired plate or rack type.

2.9.4.5 Top Left Vial Position

The Top Left Vial Position section of the dialog box displays the X, Y, Z coordinates of the position in the leftmost column and the row that is closest to the back of the 2767 Sample Manager of the rack selected. The coordinates are shown in 1/10th mm. This section of the dialog box is used to check and modify the position of the selected rack. Click  (**Top Left**) to move the sample probe to the top-left vial position of the currently selected rack or plate in the rack. The sample probe drops to the bottom of the tube or well as specified by the z-coordinate. Click  (**Bottom Right**) to move the probe to the bottom-right position of the currently selected rack or plate in the rack. The sample probe drops to the bottom of the tube or well as specified by the z-coordinate.

Tip: You must check the calibration of both the top-left and bottom-right positions of each rack.

! **Notice:** Set the z- coordinate to 0 until the x- and y- coordinates are set to avoid stalling or damaging the sample probe.

If the calibration needs to be refined for either position, access the Adjust Coordinates dialog box. Use the keyboard arrows or the click the icons to move the sample probe.

2.9.4.6 Reserve Plate for Injection

Some plates, such as standard well microplates, can only be used for sample injection. Select **Reserve Plate for Injection** to designate the plate for sample injections only so no fractions will be collected. For racks on the extreme right position (Col5), it is impossible to access all positions with the fraction dispense tube for fraction collection. This field must be selected.

2.9.4.7 OpenLynx Plate Login

This plate position is defined for use by OpenLynx login. See the *OpenLynx User's Guide* for more information.

2.9.4.8 Collection Parameters

The Volume of Collection Vessels (mL) field defines the volume of the collection vessels that will be used for the selected rack or plate. The default is 10 mL.

The Travel Height option button selected defines the height to which the sample probe moves up during travel steps:

- Above Shield – Sample probe moves up to the shield so the sample probe is protected by the shield during movement. This option prevents inadvertent damage to the fraction dispense tube.
- Above Vial – Sample probe moves just above the plane of the vial or test tube. This option minimizes sample loss for multiple tube fractions.

The Dispense Height option button selected defines the height to which the fraction dispense tube moves up during dispense steps:

- Above Vial – Fraction dispense tube remains slightly above the plane of the vessel when the fraction is dispensed into the collection vessel. Select this option in combination with a travel height set at Above Vial to provide the most rapid movement from vessel to vessel.
- Within Vial – Fraction dispense tube descends into the collection vessel when the fraction is dispensed into the collection vessel. Select this option to prevent possible cross contamination.

2.9.5 Teaching sample racks and containers

After placing your sample racks in the worktable and setting up the worktable in MassLynx, you must calibrate the sample probe to the first position in each rack and teach the sample probe the bottom of your sample container. The 2767 Sample Manager uses vial depth to calculate travel height for injecting sample and dispensing fractions. The sample probe reaches into a sample container a maximum of 110 mm. For samples in test tubes more than 100 mm deep, you must




lower the sample probe into the container so that the bottom of the cylindrical portion of the probe is 0.5 to 1 mm from the top of the test tube.

! **Notice:** When teaching the sample probe the bottom of a tube more than 110 mm deep, never let the cylindrical portion of the probe go lower than the top of the vessel.



Tip: Use the sample probe to teach all racks and plates, even those that will be used exclusively for fraction collection. Do not use the fraction dispense tube in the teaching routine.

You can teach racks or plates by using icons or entering coordinate values.

To teach the racks or plates using icons:

1. Click  to access the Adjust Coordinates dialog box, in which you adjust the X, Y, and Z axes using the directional icons.
2. Click **OK** when you are satisfied with the position of the sample probe at the bottom of the upper-left vial of the rack or plate.
3. Verify the sample probe position in the top-left () position.
4. Verify the sample probe position in the bottom-right position ().
5. Click **OK**.

To teach the racks or plates by entering coordinates:

1. On the Plate Parameters dialog box, enter coordinates in the X, Y, and Z edit boxes.
2. Click  to move the sample probe to the top-left position of the rack or plate.
3. Repeat steps 1 and 2 until you are satisfied with the top-left position.
4. Verify the sample probe position in the bottom-right position  .
5. Click **OK**.

Tip: You must teach coordinates for a new rack type in a new position on the worktable (see [page 57](#)).

2.9.6 Changing a rack in a worktable

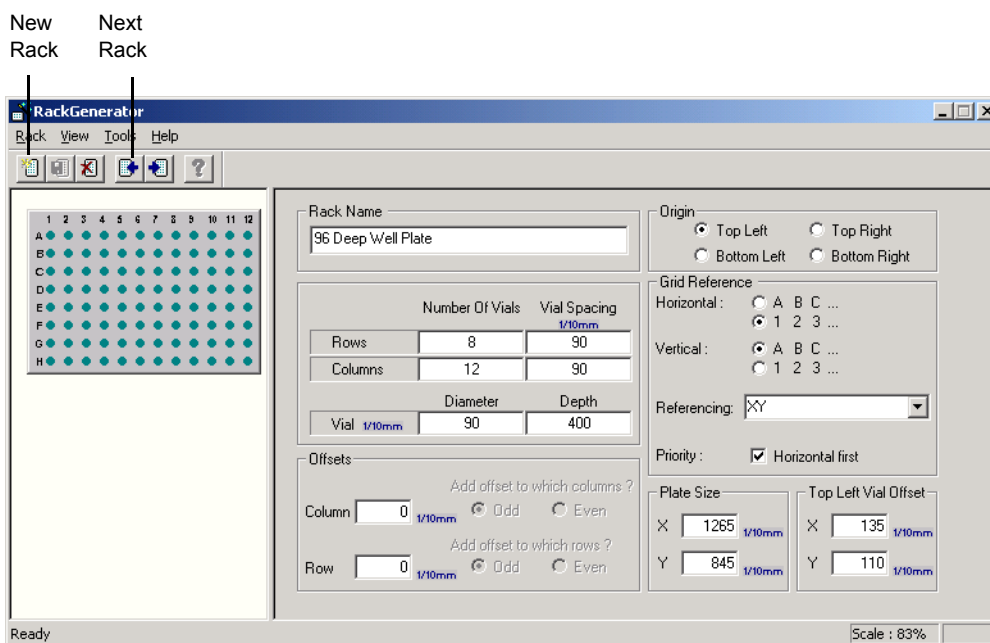
To change the plate type in a previously defined bed layout, you must modify that layout.



To modify an existing bed layout:

1. From the Inlet Editor, select **Waters2767 > Bed Layout**. The Bed Layout dialog box displays the current layout and a list of other, defined bed layouts.
2. Select the layout you want to modify in the Bed Layouts list box, and then click **Modify Bed Layout**. The Modify Bed Layout dialog box appears.
3. In the Plate Position and Type dialog box, click the plate you wish to change.
4. Select the plate you want to use to replace the selected plate in the bed layout.
5. Click **OK**.

2.9.7 Customizing a rack

The Rack Generator dialog box allows you to define each rack or plate. To customize a plate or rack type, select **Waters2767 > Plate Generator** from the Inlet Editor.



To create a new rack, select **Rack > New Rack** or click  (**New Rack**). To modify an existing rack, click  (**Next Rack**) to scroll through the list of defined racks until the rack appears in the Rack Name text box.

The graphic on the left portion of the dialog box shows the current plate or rack.

Tip: Save your plate or rack by selecting **Rack > Save Current Rack**.

2.9.7.1 Rack name

Displays the rack or plate being edited, which in this example is 96 Deep Well Plate.

2.9.7.2 Number of vials

Enter the vials in rows (horizontal) and columns (vertical) that make up the plate or rack. In this example, the 96-deep well plate has 8 rows and 12 columns.

2.9.7.3 Vial spacing

Enter the distance from the center of one vial to the center of the next vial, in 1/10 mm.

2.9.7.4 Diameter

Enter the vial diameter, in 1/10 mm.

2.9.7.5 Depth

Enter the vial depth, in 1/10 mm. Vial depth determines the Travel Height and Dispense Height of the sample probe when Above Vial Height is selected.

2.9.7.6 Offsets

Use the offset parameters if the rows and columns in your rack are not aligned in straight lines. The offset measurements are in 1/10 mm. Waters racks do not use offsets, and the default values are 0.

2.9.7.7 Origin

Click the option button that represents the location of the first vial in your rack or plate. In this example, the first vial, 1A, is at the top left of the plate.

2.9.7.8 Grid referencing

The Grid Reference feature of the Rack Generator dialog box allows you to define up to 12 vial referencing schemes for your racks. Each referencing scheme defines the labeling and sequencing of the vials or wells in the rack. You can use XY, sequential continuous, or sequential discontinuous referencing, assign horizontal or vertical priority, and (for XY sequencing) define the horizontal and vertical axes as either numerical or alphabetic. The following table describes the Grid Reference parameters in the Plate Generator dialog box. For more information, see [page 61](#).

Grid reference parameters

Parameter	Description
Horizontal	Specifies the horizontal axis positions as alphabetic (ABC) or numeric (123), when using XY referencing. Default: numeric.
Vertical	Specifies the vertical axis positions as alphabetic (ABC) or numeric (123), when using XY referencing. Default: alphabetic.

Grid reference parameters (continued)

Parameter	Description
Referencing	Specifies the vial referencing scheme for the current rack. Possible values are XY, Sequential Discontinuous, and Sequential Continuous. Default: XY.
Priority	
XY Referencing	With Horizontal First selected, specifies that the horizontal axis position appears first when referencing a vial (1,A). When Horizontal First is deselected, specifies that the vertical axis position appears first when referencing a vial (A,1). Default: Horizontal First selected.
Sequential Referencing	With Horizontal First selected, specifies that vials be numbered horizontally (left to right). When Horizontal First is deselected, specifies that vials be numbered vertically (top to bottom). Default: Horizontal First selected.

Vial referencing examples

Following are four examples of vial referencing for a simplified 4 × 3 vial rack.

Vial referencing examples

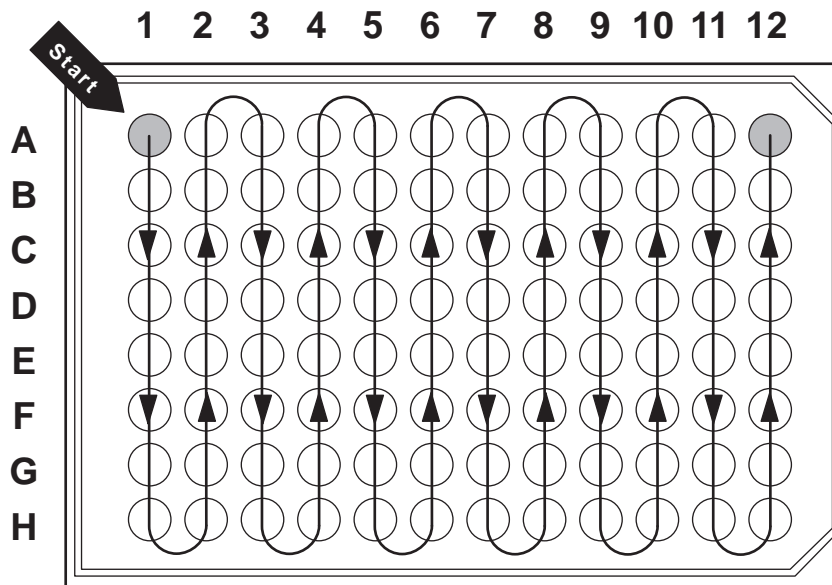
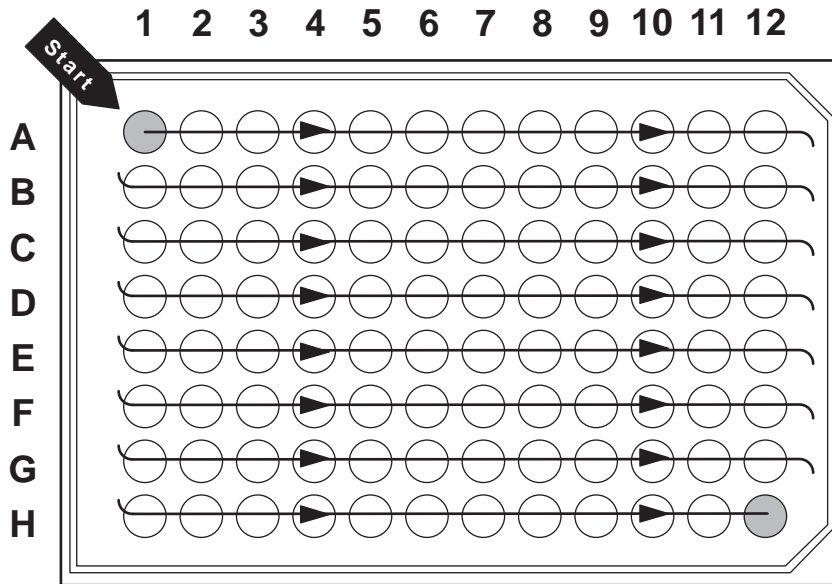
	1	2	3	4	Horizontal: 1 2 3... Vertical: A B C... Referencing: XY Priority: Horizontal first selected
A	1,A	2,A	3,A	4,A	
B	1,B	2,B	3,B	4,B	
C	1,C	2,C	3,C	4,C	

	1	2	3	4	Horizontal: 1 2 3... Vertical: A B C... Referencing: XY Priority: Horizontal first not selected
A	A,1	A,2	A,3	A,4	
B	B,1	B,2	B,3	B,4	
C	C,1	C,2	C,3	C,4	

					Horizontal: N/A Vertical: N/A Referencing: Sequential Discontinuous Priority: Horizontal first selected
	1	2	3	4	
	5	6	7	8	
	9	10	11	12	

					Horizontal: N/A Vertical: N/A Referencing: Sequential Continuous Priority: Horizontal first not selected
	1	6	7	12	
	2	5	8	11	
	3	4	9	10	

The following figures show a sequential processing order for the last two examples on a 96-well microplate.



2.9.7.9 Plate size

The 2767 Sample Manager does not use the Plate Size fields. Default values may appear in these fields to support other instruments.

2.9.7.10 Top left vial offset

The 2767 Sample Manager does not use the Top Left Vial Offset fields. Default values may appear in these fields to support other instruments.

3 Preparing for Operation


3.1 Checking wash solvents

To check the solvents before starting a run:

- Ensure that all solvent containers have the correct solvent for your applications.
- Ensure that wash solvent 1 (weak solvent) feeds the tube labeled T1 and wash solvent 2 (strong solvent) feeds the tube labeled T2.
- Follow standard laboratory practice to filter the solvents before use.
- Refill solvent containers and filter solvent, if needed.
- Check and empty the fluid waste container, if needed.
- Allow no syringe to run for more than a few cycles without solvent.
- If you change containers or types of solvent, prime the wash pump and syringe pump by thoroughly flushing with solvent (see [page 68](#)), and ensure that all tubes are free of air bubbles.

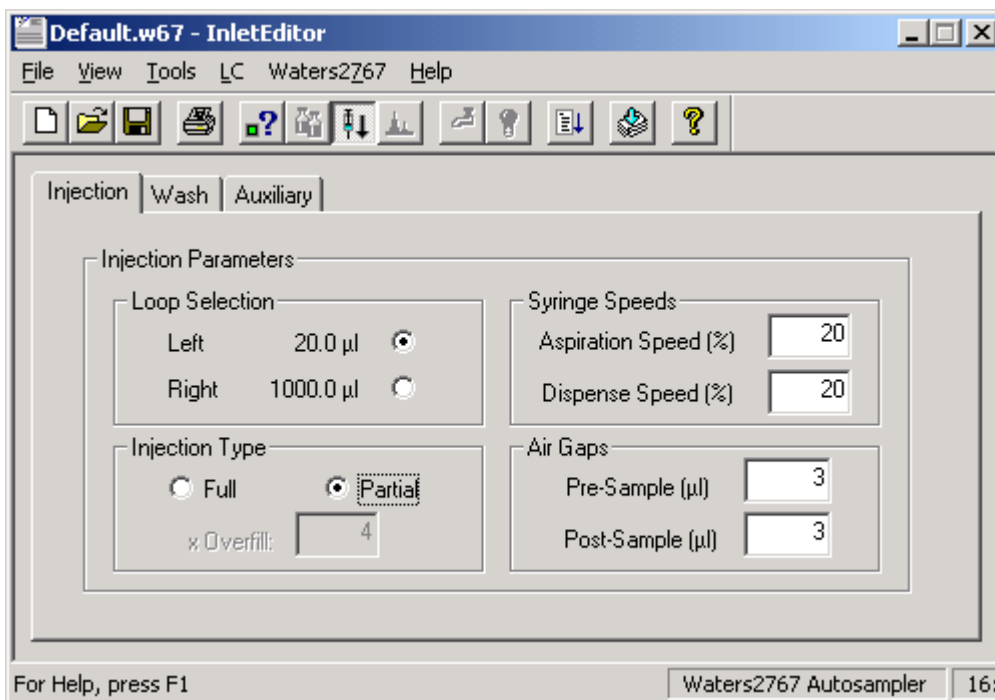
Tip: To avoid precipitating salts when changing from buffers to high-organic-content solvents, use an intermediate solvent (e.g., distilled or deionized water).

3.2 Setting MassLynx method parameters

Setting up a MassLynx method involves establishing run-specific conditions for injecting the sample, washing the sample probe and injectors, and diluting the sample before injection, if needed. To set these parameters from the Inlet Editor, click  to access the 2767 control menus, and then click the **Injection, Wash, or Auxiliary** tab.

3.2.1 Setting injection parameters

The Injection tab on the Inlet Editor window allows you to specify the sample loop, injection mode, syringe speed, and air gaps for the sample injection.



3.2.1.1 Loop selection

Select the appropriate sample loop for the injection by clicking the option button. The 2767 Sample Manager ships with a left injector, which has a 20- μ L sample loop for analytical work, and a right injector, which has a 1000- μ L sample loop for preparative work. The left and right loop size is set on the Configuration dialog box. See [page 42](#) for information on selecting different sample loops. Solvent flow does not travel in either direction through the unused injector. Ensure that the sample loop size is appropriate for the installed syringe and flow rate of your chromatography system. See the [table titled "Sample Manager sampling combinations" on page 1-24](#) for recommended combinations of sample loops, syringes, and holding loops. The left loop is the default selection.

3.2.1.2 Injection type

Click the option button to determine the injection mode. The Partial loop injection option uses the volume specified in the sample queue to perform the injection, and draws only the specified sample volume. The Full loop injection option determines the sample volume to draw by multiplying the selected sample loop volume by the x Overfill factor. The x Overfill factor field, available when the full loop injection option is selected, specifies the number of sample loop volumes drawn and centered in the sample loop. For example, a full loop injection with a 100- μ L sample loop and a 3 x Overfill factor draws 300 μ L of sample per injection.

Tip: The capacity of the holding loop should be roughly twice the syringe size to allow for adequate overfill. For more information on holding loop, sample loop, and syringe sizes, see the [table titled "Sample Manager sampling combinations" on page 1-24](#).

For analytical work, a full loop injection with a 4x overfill is recommended. Ensure that the holding loop is adequately sized. For preparative work, a partial loop injection is recommended.

3.2.1.3 Syringe speeds

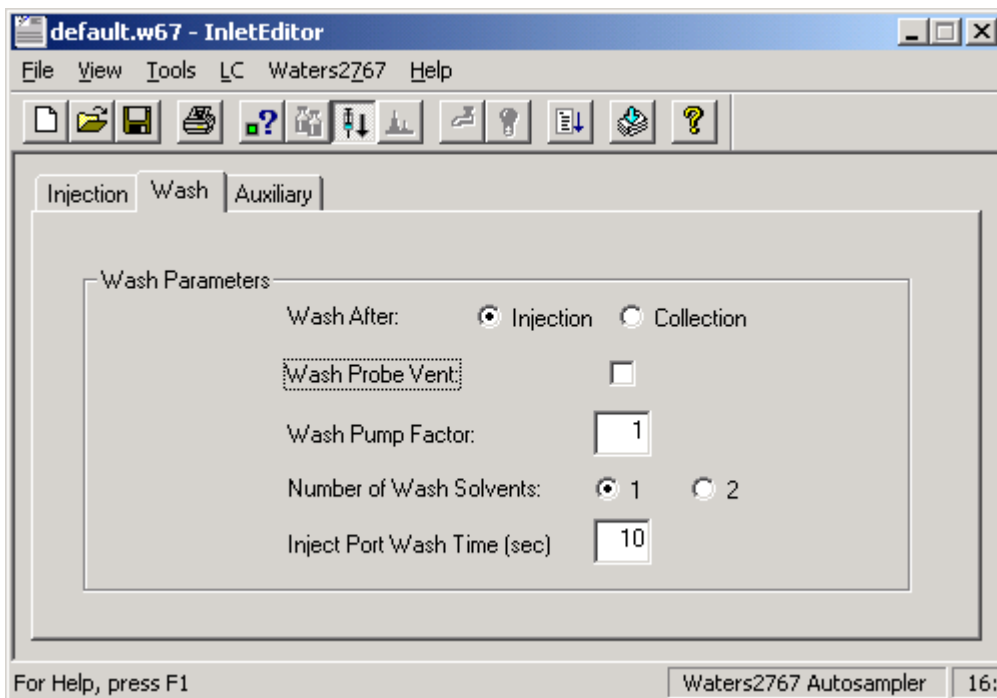
The syringe speed is set as a percentage of the maximum travel speed. Valid syringe speeds range from 5 to 100% for that syringe size. The speed range is optimized for the syringe size, so the 100% maximum speed is not the same for all syringes. A value of 100% operates the syringe at full speed, while 50% slows the syringe to approximately half speed. The default value for the aspiration speed and dispense speed is 20%. The aspiration speed sets the syringe speed when drawing sample into the sample probe; a slow aspiration speed minimizes sample foaming. The dispense speed sets the syringe speed when loading the sample in the sample loop and dispensing wash solvent 1 (weak solvent) for sample dilution.

3.2.1.4 Air gaps

You can set pre- and postsample air gaps to minimize sample dispersion. The default air gap value is 3 μL pre- and postsample. Using the default air gap value of 3 μL pre- and postsample, the sample probe draws air for the time required to draw 3 μL , then draws the sample into the sample probe and finally draws another 3 μL of air. Set the pre- and postsample air gap fields to 0 if you require no air gap.

3.2.2 Setting wash parameters

The Wash tab on the Inlet Editor window allows you to specify when, how much, and which solvents wash the sample probe and whether the wash step includes the injection port and probe vent channel. Solvent consumption depends on the size of the sample, the sample loop, the holding loop, and whether you are using one or two wash solvents. It is best to determine solvent consumption experimentally.



3.2.2.1 Wash after

Use the Wash After option button to control whether the sample probe wash step occurs immediately after injection or waits until the end of the fraction collection run. The Wash After Injection option saves time by performing the wash step before fraction collection, but use this option only when certain there is enough time to complete the wash step before collecting the fraction. By default, the Wash After option button is set to Injection.

Tip: If you are not collecting fractions, set the Wash After option button to **Injection**.

Tip: If you select **Wash After Injection**, ensure the probe has enough time after the injection to complete the wash cycle before collecting your peak of interest. If the desired peak elutes before the wash cycle is complete, the peak will not be collected.

3.2.2.2 Wash probe vent

The sample probe has an outer vent channel (see [page 23](#)) that allows air to enter a sealed sample container so the specified sample volume required for injection can be withdrawn from the container. When you select the Wash Probe Vent check box, wash solvent 1 (weak) flushes the outer vent channel while the sample probe is in the wash station. Washing the sample probe outer vent channel after each injection increases the time and wash solvent required for each injection. In certain applications, some sample may remain in the probe vent, so it is best to select Wash Probe Vent. This checkbox is cleared by default.

3.2.2.3 Wash pump factor

The wash pump factor allows you to control the wash sequence to minimize carryover and optimize cycle time. The wash pump factor is a multiplication factor of the wash pump time. The wash pump time, defined as the total time the wash pump remains on, depends on the holding loop size and whether you are using one or two wash solvents. The default setting is 1. The following table shows the relative amount of time required for the wash steps that compose the wash factor.

Wash pump factor steps

Sample Probe			
	Inner		Outer
Wash Solvent	2 (strong)	1 (weak)	1 (weak)
% of Wash Pump Factor	20	60	20

3.2.2.4 Number of wash solvents

You can configure the 2767 Sample Manager with either one or two wash solvents (see [page 42](#)). Select the option button that corresponds to the number of wash solvents connected to your 2767 Sample Manager. Using both a weak wash (wash solvent 1) and a strong wash (wash solvent 2) increases the wash time and solvent consumption, because the system must be fully cleansed of the strong solvent before starting the next injection. If you select two solvents, the final step uses wash solvent 1 (weak) to flush the entire holding loop, sample probe, and injector port. This may significantly increase wash solvent 1 (weak) usage. The default is one wash solvent (the weak wash solvent).

Tip: If you select one wash solvent from the Configuration dialog box and run a method using 2 wash solvents, an error will occur at run time.

3.2.2.5 Port wash time (sec)

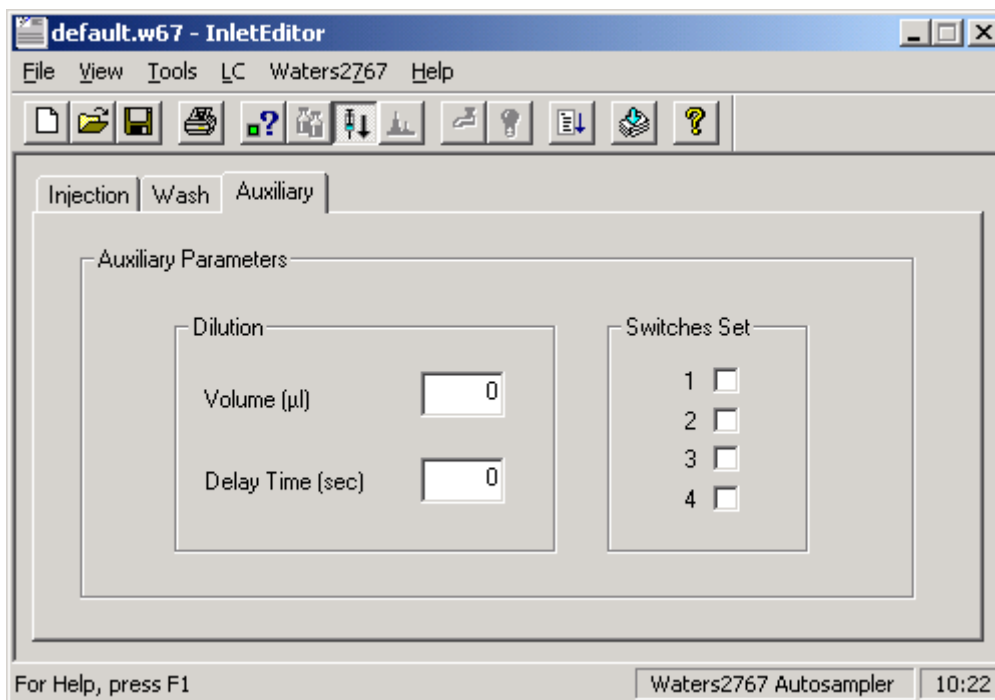
The Port Wash Time check box allows you to enter the number of seconds for which to wash the injector port. The sample probe travels to the injector, and the wash pump delivers wash solvent 1 to wash the injector port. The default is 10 seconds. The following table shows the relative amount of time needed for the inject port wash steps.

Injector port wash steps

	Inject Port		
Step	Clear Probe Vent (750 µL)	Above Port Wash	In Port Wash
% of Port Wash Time		50	50

3.2.3 Setting auxiliary parameters

The Auxiliary tab on the Inlet Editor window allows you to establish the parameters for sample dilution before injection and to connect your 2767 Sample Manager to a column selector.



3.2.3.1 Dilution

The dilution options allow you to specify the amount of wash solvent 1 (weak solvent) to add to your sample container and the delay time for diffusion before withdrawing the injection volume. Diluting into capped vessels is not recommended.

3.2.3.2 Volume (µL)

Enter the volume of wash solvent 1 (weak solvent) to dispense into your selected sample before injection. The syringe will deliver the volume of wash solvent using the defined syringe dispense speed. The default setting for Volume is 0 so no sample dilution occurs.

3.2.3.3 Delay time (sec)

Enter the time, in seconds, that the 2767 Sample Manager will delay after dispensing the dilution volume to allow for diffusion. The sample aspiration will begin only after this period has expired. The default setting for Delay Time is 0.

3.2.3.4 Switches set

The Switches Set checkboxes let you configure the 2767 Sample Manager to control external devices (e.g., a column selector). These switches are set to the selected configuration whenever the Inlet Method is downloaded and set up.

3.3 Priming the 2767 sample manager

To ensure correct operation of the 2767 sample manager, prime both the syringe and wash pump before operating the instrument. Prime the wash pump and the syringe pump to:

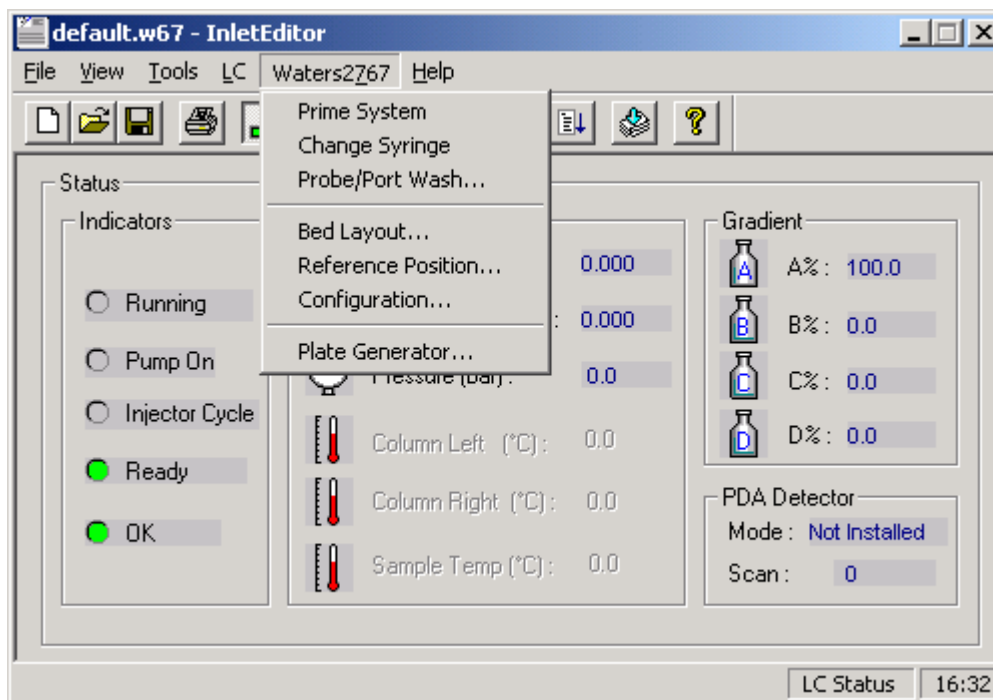
- Remove all bubbles from the tubing
- Flush the tubing and syringe with solvent
- Exchange solvent types

Principles of pump operation include the following guidelines:

- For prolonged storage, prime the pumps with 10% methanol or isopropyl alcohol.
- Allow the wash pump or syringe to run dry for no more than a few cycles.
- Wipe up all spills on and around the pumps immediately.
- Prime the pump with well-degassed solvent.
- Prime the wash pump before priming the syringe pump.

3.3.1 Priming the system

To prime the pumps, select **Waters 2767 > Prime System** from the Inlet Editor.



If you selected two wash solvents from the Configuration dialog box, the wash pump is primed sequentially with wash solvent 2, then wash solvent 1. The prime system cycle moves the sample probe to the wash station and primes the wash pump, then draws the wash solvent into the syringe. The wash solvent rinses the inner and outer surfaces of the sample probe. The priming sequence stops automatically and the sample probe returns to the home position.

3.3.2 Priming the injectors



To prime the 2767 Sample Manager injectors, you must turn on the high pressure pump that supplies mobile phase to your chromatography system, and the chromatography columns must be filled with solvent. Both the analytical and preparative chromatographic systems must be full of fluid. Before you make your first injection, operate an Inlet Method in both analytical (<5 mL) and preparative (>5 mL) flow rate ranges.

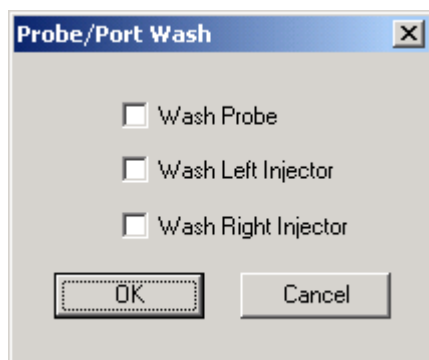
3.3.3 Washing the sample probe and injector ports

You can wash the sample probe, left injector, and right injector without running a method or if you aborted a method to prevent cross contamination.

To start a wash:

1. Select **File > Open** from the Inlet Editor.
2. Select the method.

3. Check the wash settings on the Wash tab. If you changed the wash settings, click  (**Save**).
4. Click  to download the method.
5. Select **Waters2767 > Probe/Port Wash**.



6. Select the items to wash.
7. Click **OK**.

If you aborted a method, the probe/port wash cycle uses the parameters set of the aborted method.

3.4 Collecting fractions

Setting up fraction collection using the 2767 Sample Manager involves:

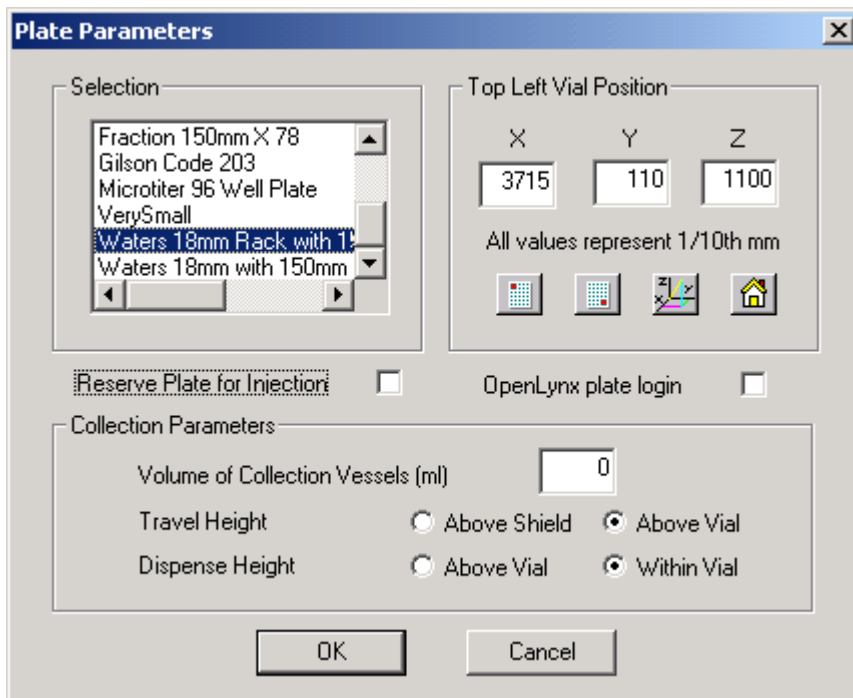
- Setting plate parameters
- Setting racks in the worktable
- Setting up sample reinjection
- Checking the fraction input tubes

3.4.1 Setting plate parameters

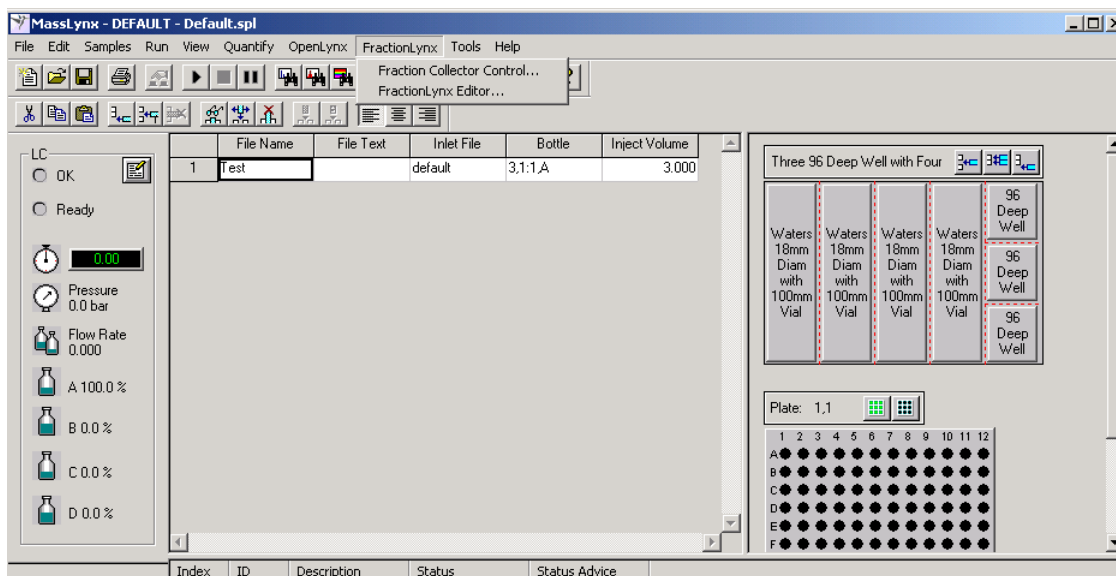
When the 2767 Sample Manager collects fractions, the fraction dispense tube lowers to a selected height relative to the collection vessel before collecting the fraction. You can set the travel height of the fraction dispense tube on the Plate Parameters dialog box so that the fraction dispense tube retracts to a height either above the collection vessel or above the safety shield. For optimum speed, click the **Above Vial** option button. The default setting is Above Vial. The Dispense Height sets the height of the fraction dispense tube when the fraction is dispensed into the collection vessel. The Above Vial option button provides the most rapid movement from vial to vial, but click the **Within Vial** button to reduce fraction loss due to static spray and prevent possible cross-contamination. The default setting is Within Vial.

Tip: Do not cover the vessels in the fraction collection racks. The vessels must be open so the fraction dispense tube can deliver the fraction.

The Volume of Collection Vessels allows you to set the maximum volume, in milliliters, that the 2767 Sample Manager can dispense into a collection vessel.



To set other fraction collection parameters, select **FractionLynx > FractionLynx Editor** from the Main MassLynx window. See the *FractionLynx User's Guide* for additional information.



3.4.2 Setting racks in the worktable

When you place fraction collection racks in the worktable, put the fraction collection rack containing the taller test tubes to the right of any fraction collection rack with shorter test tubes. For suitable fraction collection racks, see [page 50](#).

Tip: If the height of test tubes in immediately adjacent racks differs by more than 25 mm, the rack with the tallest test tubes must be placed to the right to maximize sample probe penetration depth.

3.4.3 Setting up sample reinjection

The 2767 Sample Manager can collect a fraction, then reinject an aliquot of that fraction. The sample probe, however, can only go 110 mm deep into a tube. To ensure there is enough volume in the collection vessel for the sample probe to reinject a fraction, at minimum the sample volume must fill the bottom:

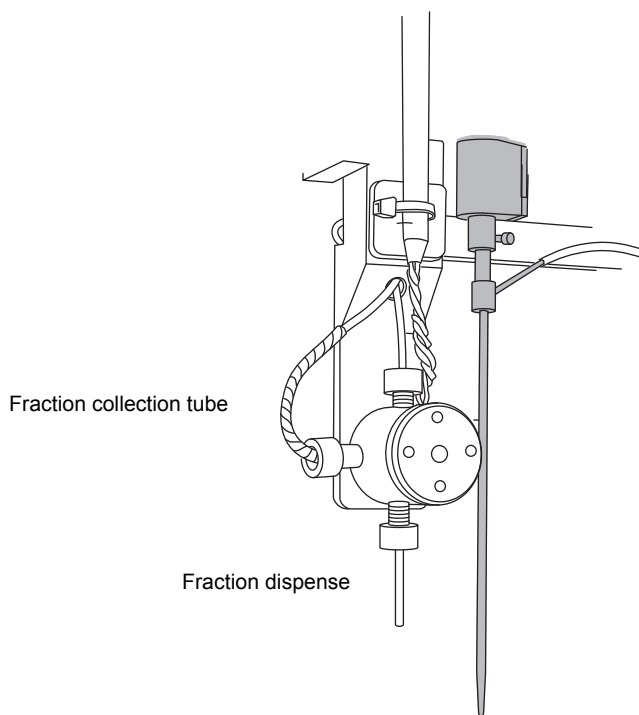
- 15 mm of a 125-mm tube
- 40 mm of a 150-mm tube

If you plan to reinject multiple samples from a fraction, there must be enough volume in the fraction collection vessel for the sample probe to withdraw each sample.

Tip: If the height of test tubes in immediately adjacent racks differs by more than 25 mm, the rack with the tallest test tubes must be placed to the right to maximize sample probe penetration depth.

3.4.3.1 Checking the fraction collection tube

The 2767 Sample Manager has a 0.020-inch ID fraction collection tube, marked T9, for typical system operation. You can install a 0.010-inch ID fraction collection tube, marked T27, to optimize fraction collection for a low flow rate chromatography system. If you operate your chromatography system at a high flow rate, you can install a 0.040-inch ID fraction collection tube, marked T28. The Startup Kit has both optional fraction collection tubes. See the [table titled "Maximum flow rates for fraction collection tubes" on page 2-34](#).



4 Maintaining the 2767 Sample Manager

This chapter describes routine maintenance procedures you can perform to ensure the Waters 2767 Sample Manager consistently provides accurate and precise results. You also perform these procedures when you determine that a specific component in the 2767 Sample Manager has a problem. For information about isolating instrument problems, see [Chapter 5](#).

Regularly performing maintenance helps ensure the accuracy and precision of the 2767 Sample Manager. The following table suggests intervals for the maintenance procedures to ensure uninterrupted operation. If you use the system heavily or with aggressive solvents, you may need to perform the maintenance procedures more often.

Suggested maintenance intervals

Procedure	Interval
Preventative maintenance	Every 6 months
Replace the probe	Every 3 to 6 months, as needed
Rebuild the injector	Every 6 months
Rebuild injector port	Every 3 months, and when a new probe is installed
Replace the syringe seal	Every 3 to 6 months
Replace the 3-port syringe valve	As needed
Clean and lubricate lead screw	As needed
Replace or change the sample loop	As needed
Maintain the X/Y/Z _S /Z _F Mechanism	Every 3 to 6 months, as needed
Replace valves	As needed
Replace the tubing	As needed
Replace fuses	As needed

4.0.1 Spare parts

Waters recommends that you replace only parts mentioned in this document. For spare parts details, see the Waters Quality Parts Locator on the Waters web site's Services/Support page.

4.1 Maintenance considerations

When performing maintenance procedures on your 2767 Sample Manager, consider the following safety considerations.



Warning: To avoid possible electric shock, always turn off the instrument and unplug the power cord before performing the maintenance procedures in this chapter. Do not remove the back cover, because it lends no access to any customer-serviceable parts.



Warning:

- To prevent possible injury, always observe safe laboratory practices when handling solvents, changing tubing, or operating the 2767 Sample Manager. Know the physical and chemical properties of the solvents you use. Refer to the Safety Material Data Sheets for the solvents in use.
- To avoid possible injury, always keep your hands outside the worktable, and do not lean over the instrument during operation.
- Do not operate without proper safety shields. Safety shields must be installed for safe operation.



Warning: To avoid possible injury during 2767 Sample Manager operation, always keep your hands clear of the sample probe and fraction dispense tube.

Tips:

- To avoid damaging electrical parts, never disconnect an electrical assembly while power is applied to the 2767 Sample Manager. Once power is turned off, wait about 10 seconds before disconnecting an assembly.
- To avoid damage due to electrostatic discharge, do not touch integrated circuit chips or other components.

4.1.0.1 General operating procedures

To keep your 2767 Sample Manager running smoothly, follow the operating procedures and guidelines in [Chapter 3](#). Keep the probe and the worktable clean for best results.

4.1.0.2 Contacting Waters technical service

If you encounter any problems replacing parts in the 2767 Sample Manager and you are in the United States or Canada, contact Waters technical service at 800 252-4752. From other locations, call your Waters subsidiary or Technical Service Representative or Waters corporate headquarters in Milford, Massachusetts (U.S.A.).

4.2 Cleaning the instrument

For best results, clean the probe daily and the worktable components weekly.



Warning: To avoid possible injury, ensure that the 2767 Sample Manager is powered off during cleaning.

To clean the worktable:

1. Examine the PTFE coating on the probe to ensure it is not cracked or chipped. If the PTFE coating is damaged, replace the probe (see [page 75](#)).
2. Clean the probe by wiping it gently with a lint-free cloth dampened with isopropyl alcohol.
3. Clean the shields and surfaces of the worktable with a lint-free cloth dampened with isopropyl alcohol.
4. If the sample or fraction racks are dirty, clean them with a lint-free cloth dampened with isopropyl alcohol.

4.3 Replacing the sample probe

Use this procedure to replace the sample probe every 6 months. Additionally, replace the sample probe any time it shows signs of damage (e.g., bends, scratches, cracks, plugs) or if the injector port seal leaks.

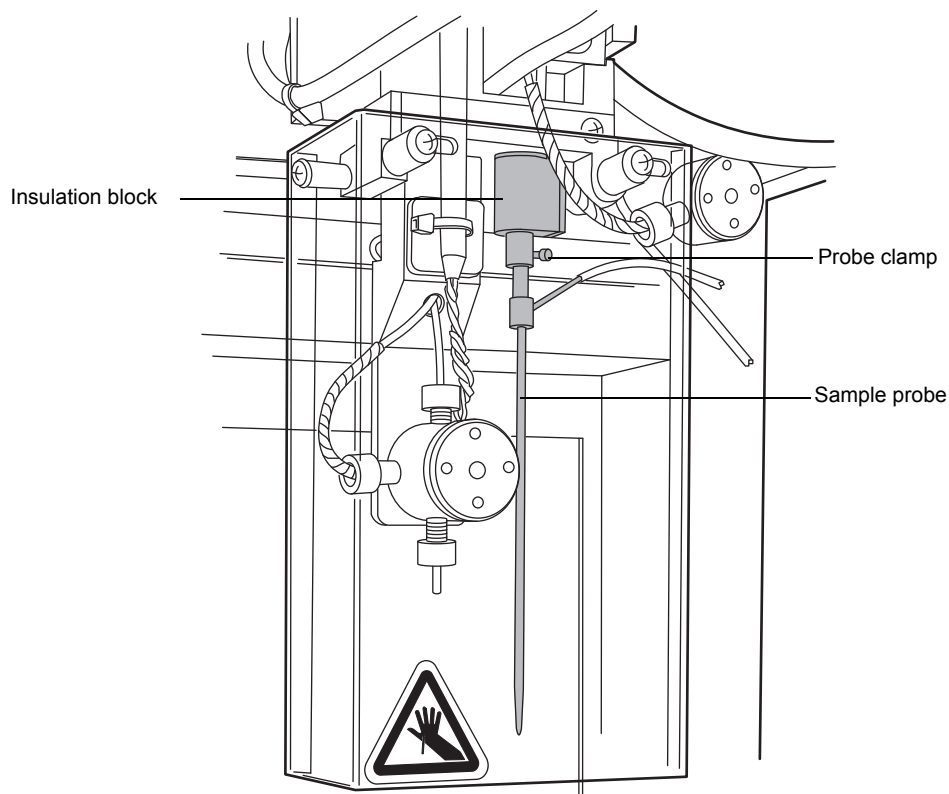
Required materials

- Allen wrench, 1.5-mm
- Allen wrench, 2.0-mm
- Emery paper
- Replacement vented sample probe

To replace the probe:

1. From the Inlet Editor, select **Waters 2767 > Reference Position**. The Position Adjust dialog box appears.
2. Clear the Reference Calibrated checkbox. When this checkbox is deselected, the sample probe will not move in the Z-direction. This prevents accidentally damaging the probe before it is calibrated.
3. Power off the 2767 Sample Manager.
4. Manually lower the Z-drive shaft to access the sample probe.
5. Remove the insulation block and sample probe assembly using a 2.0-mm Allen wrench.
6. Slide the tube sleeve up over the tube, using Emery paper if needed.
7. Remove the probe clamp in the insulation block using a 1.5-mm Allen wrench.
8. Remove the heavy tubing.

9. Pull the sample probe down to release it from the clamp.



10. While holding the sample probe, remove the tubing from the top and side of the probe.
11. Reinstall tubing on the new sample probe.
12. Reposition the sample probe in the probe clamp.
13. Push upward until the sample probe seats into position.
14. Align the probe clamp and tighten using the Allen wrench (1.5 mm).
15. Slide tube sleeve down to secure the joint at the top of the sample probe.
16. Secure the insulation block and sample probe assembly.
17. Power on the 2767 Sample Manager.
18. From the Inlet Editor, select **Waters 2767 > Reference Position** to calibrate the sample probe (see [page 46](#)).
Tip: After calibrating the sample probe, select **Reference Calibrated** to allow the sample probe to move in the Z direction.
19. Replace the inject port seal.

4.4 Rebuilding injectors

Use this procedure to rebuild your injector if you see:

- Leaking solvent
- Poor reproducibility
- High back pressure

To rebuild a Rheodyne injector, replace the rotor seal and injector port fitting.

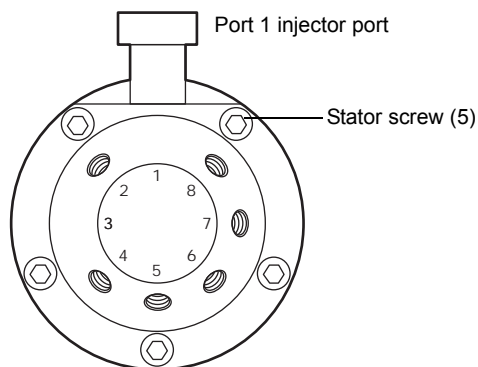
Tip: The right inject valve labeled (port 4 not machined) has a 0.024-inch internal diameter passage for preparative samples. The left inject valve has a 0.015-inch internal diameter passage for analytical samples.

Required materials

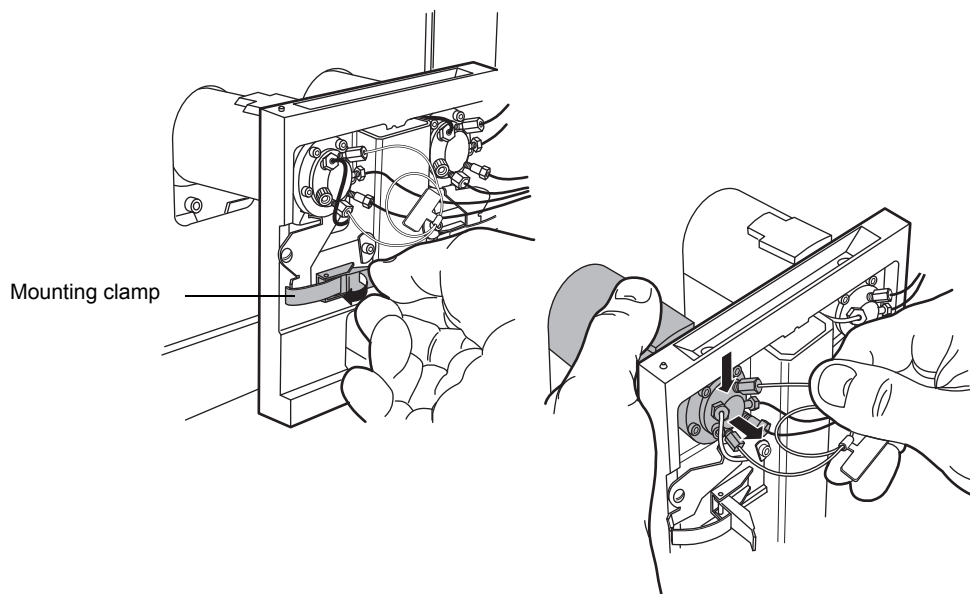
- Allen wrench, 9/64-inch
- Replacement rebuild kit
- Replacement injector port

To rebuild the injector:

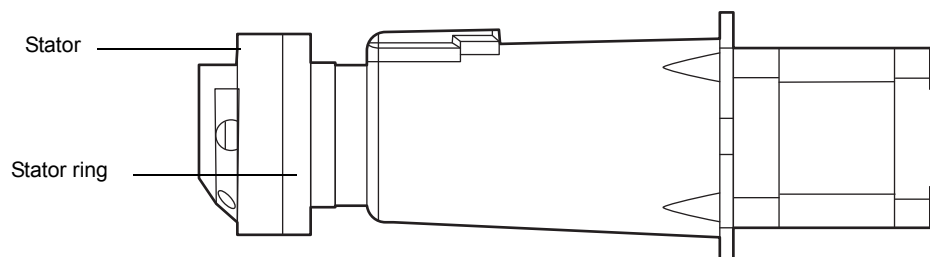
1. Remove all the tubing from the front of the injector, the sample loop, and the injector port.
2. Loosen the screws, and remove the four stator screws with a 9/64-inch Allen wrench.



3. Release injection mounting clip, and slide the inject valve down and toward you.

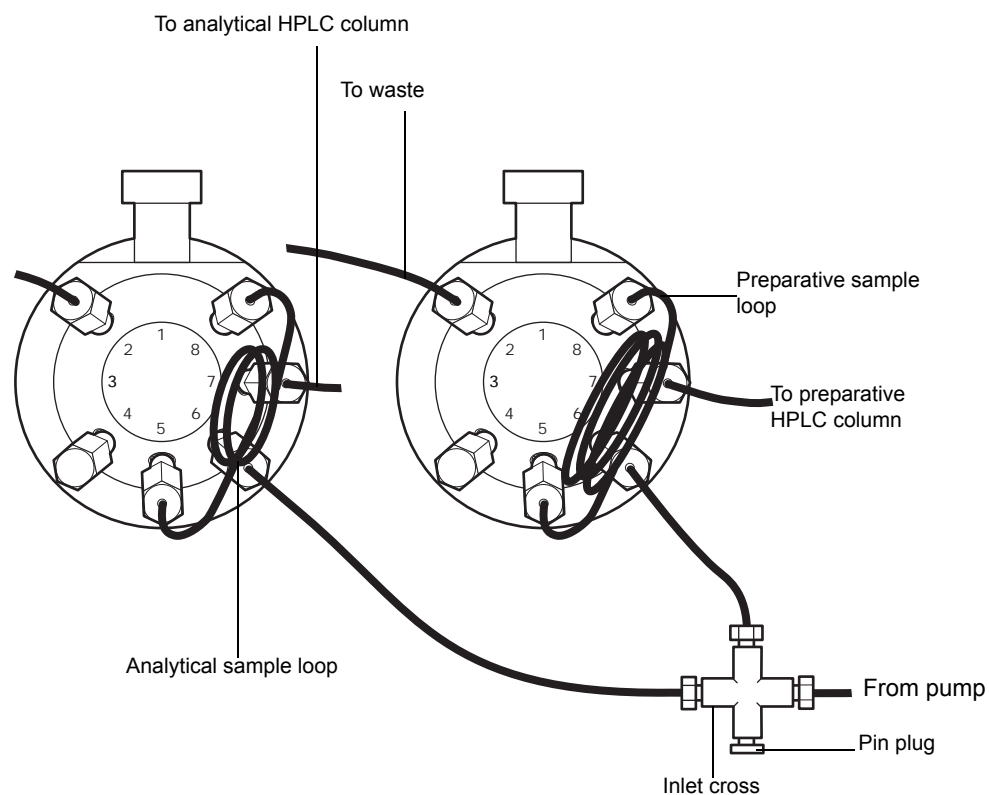


4. Remove the injector port fittings.
Tip: Port 4 is pin-plugged for the analytical (left) injector, and it is not machined for the preparative (right) injector.
5. Remove the stator, stator face assembly, and stator ring.



6. Pull the rotor seal off the pins.
7. Install the new rotor seal with the grooves facing the stator.
Tip: For preparative injectors, the new rotor seal and stator are marked with "P" for identification.
8. Install the stator ring, stator face assembly, and stator, ensuring that each locating pin matches the appropriate hole.
9. Replace the five stator screws, and tighten them uniformly and in parallel.
10. Install a new injector port.

11. Install the sample loop and the tubing.



12. Reposition the inject valve and tighten the mounting clips.

Tip: To avoid interference with the sample rack, bend the body of the loop toward the side of the valve.

4.5 Replacing injector port

Use this procedure to replace the injector port if you see solvent leaking from the injector or if you have poor reproducibility.

Required materials

- 1/4-inch wrench
- Injector port kit

To replace the injector port:

1. Release the injection mounting clip (see the preceding figure), and slide the inject valve down and toward you.
2. Remove the probe guide and O-ring using a 1/4-inch wrench (see the preceding figure).
3. Remove the inject port containing the seal by inserting the 0.0030-inch steel drill bit into the port and spinning it clockwise.
4. Lift the port out of the body of the valve.

5. Place the new inject port into the cavity in the inject valve.
6. Tighten the probe guide with the 1/4-inch wrench.
7. Lift the inject valve body back into position and replace the mounting clip.
8. Snap the mounting clip to secure the inject valve in position.

4.6 Maintaining the syringe

Replace the syringe if you:

- See solvent leaking from the bottom of the syringe barrel
- See air bubbles in the syringe
- Encounter reproducibility problems

To maintain the syringe you can:

- Replace a syringe
- Inspect a syringe seal
- Replace a syringe seal

4.6.1 Replacing a syringe

Use this procedure to replace the syringe every 6 months or if the syringe is leaking, worn, and/or damaged.

Tip: To install a different size syringe, see [Chapter 2](#).

Required materials

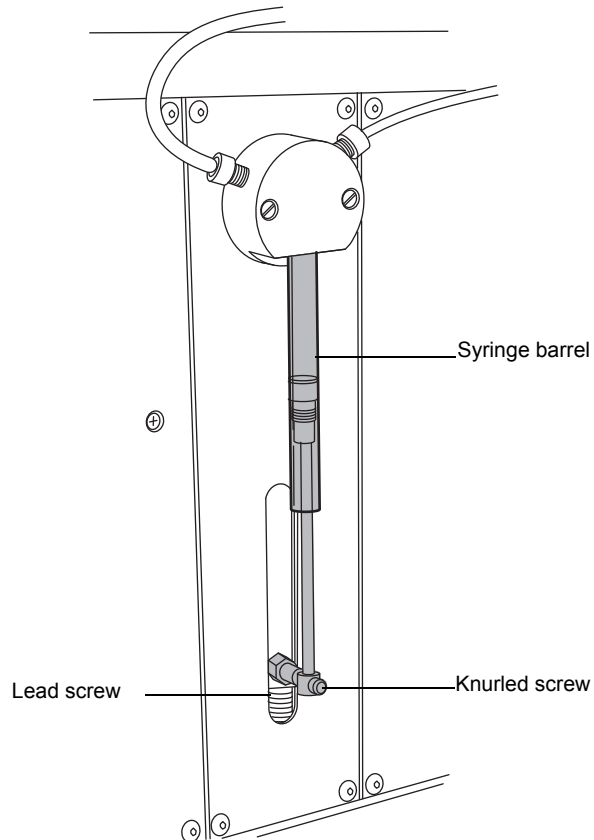
Use an appropriately sized syringe:

- 1-mL syringe, standard size
- 2.5-mL syringe
- 5-mL syringe
- 10-mL syringe
- 250- μ L syringe
- 500- μ L syringe

Tip: If you are installing a syringe other than the default 1-mL syringe, see [Chapter 1](#) to ensure the syringe is compatible with the sample and holding loops.

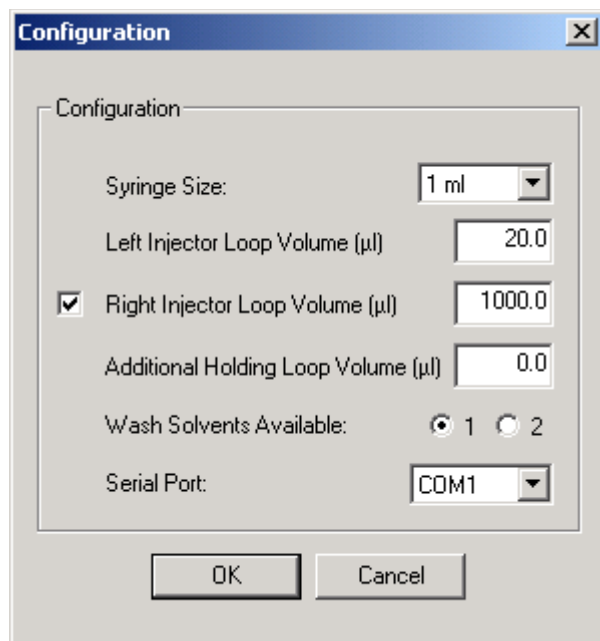
To replace a syringe:

1. From the Inlet Editor, select **Waters2767 > Change Syringe**. The plunger shaft of the syringe lowers to allow room to remove the syringe.
2. Remove the knurled plunger screw at the base of the syringe plunger.



3. Carefully unscrew the syringe barrel from the bayonet fitting (about 1 1/2 turns) while pulling downward slightly.
4. Slide the syringe plunger from the lead screw.

5. If you are installing a syringe of a different size, select **Waters2767 > Configuration** from the Inlet Editor.



6. From the Syringe Size μL list, select the new syringe size.
7. Install the plunger in the syringe barrel.
8. Install the syringe on the syringe pump (see [Chapter 2](#)). Prewetting and prefilling the new syringe with wash solvent may facilitate system priming.
9. Prime the syringe pump as described in [Chapter 3](#), until the syringe and all tubing are free of air bubbles.
10. Prime the pump as described in [Chapter 3](#), until all tubing is free of air bubbles.

4.6.2 Inspecting a syringe seal

The syringe seal requires periodic replacement. The frequency depends on the duty cycle of the pump, the type of fluids being run through the system, the size of the syringe, and how well the instrument is maintained. Replace the seal if it is leaking or damaged.

To inspect the syringe seal:

1. Remove the syringe (see the next section).
2. Remove the plunger from the syringe barrel.
3. Inspect the syringe seal at the tip of the plunger for wear and tear.
4. Replace the seal if it is damaged (see the next section).
5. Install the plunger in the syringe barrel.
6. Install the syringe on the syringe pump (see [Chapter 2](#)).
7. Prime the pump (see [Chapter 3](#)) until all tubing is free of bubbles.

4.6.3 Replacing a syringe seal

Use this procedure to replace the seal for 0.25-, 0.5-, 1.0-, 2.5-, 5.0, or 10-mL syringes. The frequency of replacement depends on the duty cycle of the pump, the type of fluids being run through the system, the size of the syringe, and how well the instrument is maintained.

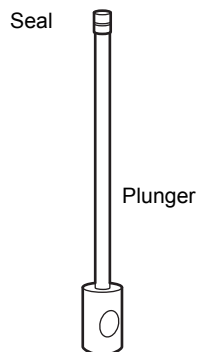
Tip: To prevent damage to the O-rings beneath the seal on the 5-mL and 10-mL syringes, use care when you remove the seal. Replace the O-ring if it is damaged.

Required materials

- Single-edged razor or precision knife (2.5-mL syringe or smaller)
- Pliers (5- and 10-mL syringes)
- Flat table top (5- and 10-mL syringes)
- Distilled and deionized water
- Replacement syringe seal

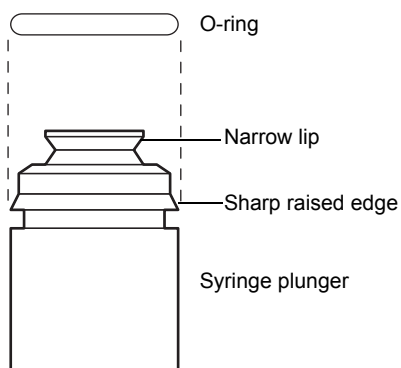
To replace the syringe seal on the plunger:

1. Remove the plunger from the syringe barrel.
2. Remove the syringe seal:
 - For a small syringe (2.5-mL or smaller), use a single-edged razor or precision knife to carefully cut the seal lengthwise, and then remove the seal from the plunger. Take care to avoid damaging the plunger.

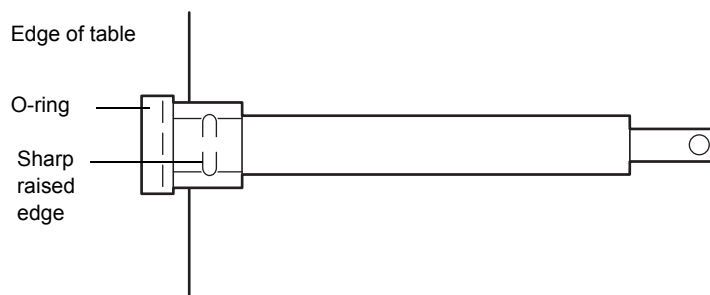


- For 5.0- and 10-mL syringes, remove the seal from the plunger tip using a pair of pliers and gripping the seal approximately one-third of the way down.

Tip: 5.0- and 10-mL syringes have an O-ring beneath the seal. Be careful not to damage the O-ring. If you must replace the O-ring, slip the new O-ring over the narrow lip on the plunger.



3. Wet the O-ring (if present) and plunger tip with distilled and deionized water.
4. Place the seal on a flat surface with the open end facing up. Press the plunger tip firmly into the hole until it snaps into position.
5. For 5.0- and 10-mL syringes, lay the plunger on a flat table top, and position the plunger so the seal (from the O-ring up) hangs over the edge (see the following figure). Slowly roll the plunger to align with the table edge, pressing firmly on the portion of the seal below the O-ring. Rotate the plunger three complete turns to ensure that the sharp, raised edge of the plunger bites into the seal for a secure fit.



6. Wet the seal with distilled and deionized water, and install the plunger in the syringe barrel.
7. Install the syringe on the syringe pump (see [Chapter 2](#)).

4.7 Replacing the 3-port syringe valve

Replace the 3-port syringe valve if you:

- See solvent leaking from the sample probe
- Have a damaged or blocked 3-port syringe valve
- Encounter reproducibility problems

Required materials

- Flat-blade screwdriver

- Replacement 3-port syringe valve

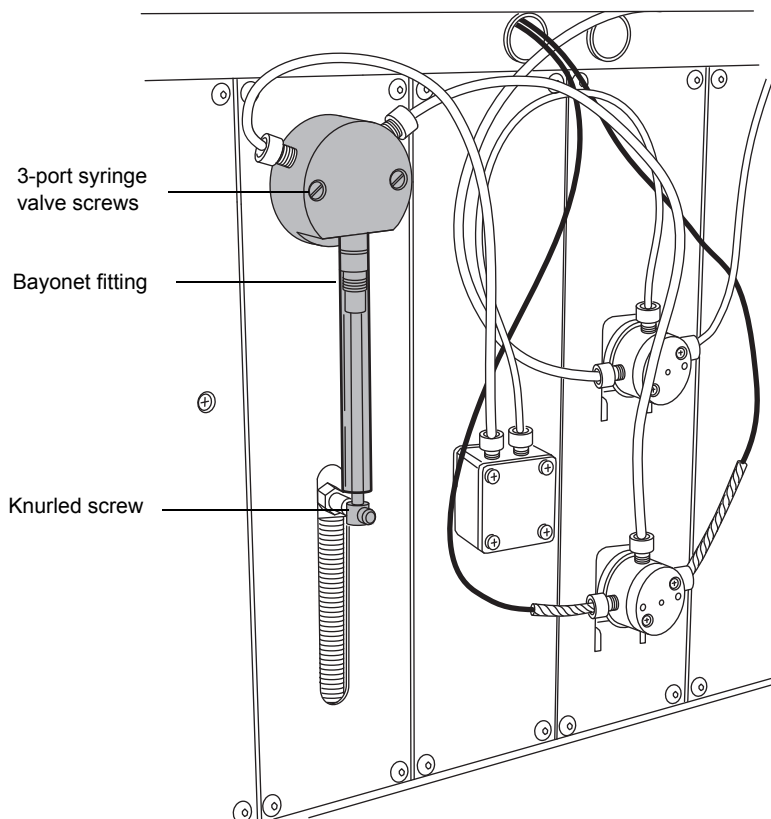
You must remove the syringe barrel before replacing the 3-port syringe valve.

To remove the syringe barrel:

1. From the Inlet Editor, select **Waters2767 > Change Syringe**. The plunger shaft of the syringe lowers to allow room to remove the syringe.
2. Remove the knurled plunger screw at the base of the syringe plunger.
3. Carefully unscrew the syringe barrel from the bayonet fitting (about 1-1/2 turns) while pulling downward slightly.

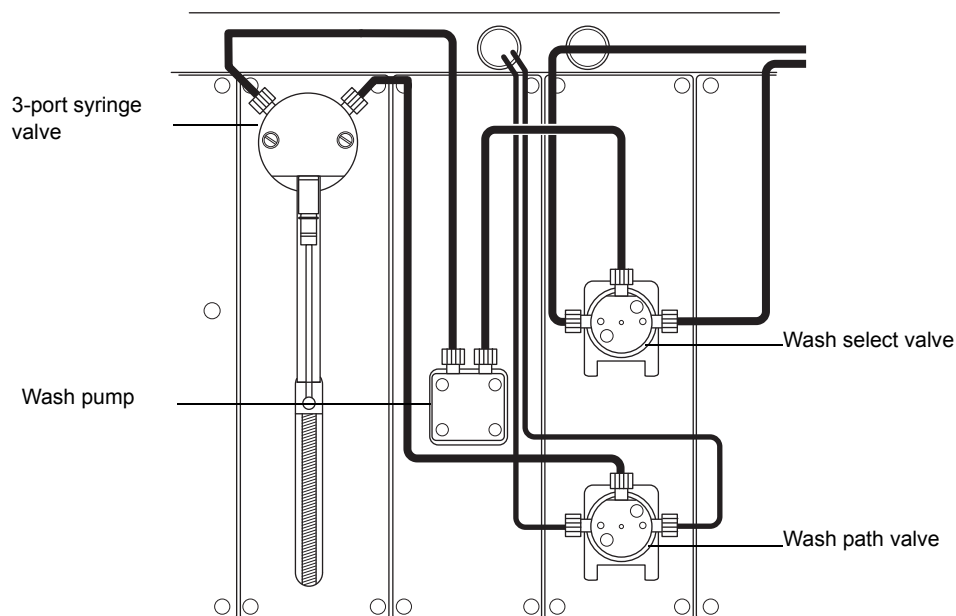
To replace the 3-port syringe valve:

1. Remove all tubing and the syringe from the 3-port syringe valve.
2. Use the flat-blade screwdriver to loosen the two screws on the valve.



3. Remove the valve.
4. To install the valve:
 - a. Rotate the valve body so that the bayonet fitting is toward the bottom of the pump.
 - b. Install the new valve by aligning the D coupler on the valve stem with the D hole in the encoder.
 - c. Gently push the valve in place, ensuring that the locating pins in the frame side of the valve body fit in the holes on the pump frame.

- d. Replace the two screws.
5. Connect the tubing to the 3-port syringe valve.



6. Install the syringe on the 3-port valve by screwing the syringe barrel into the bayonet fitting (about 1-1/2 turns) while pushing upward slightly.
7. Select **Waters2767 > Prime System** to reinitialize the syringe pump.
8. Prime the pump as described in Chapter 3, until all tubing is free of air bubbles.

4.8 Cleaning and lubricating the lead screw

Clean the lead screw periodically with air if the syringe pump is used in a dusty environment. Lubricate the screw if the pump makes an unusual noise or if the syringe stalls frequently. Lubrication is usually only needed every 1 million syringe strokes. If the pump appears to need lubrication more frequently, suspect another problem.

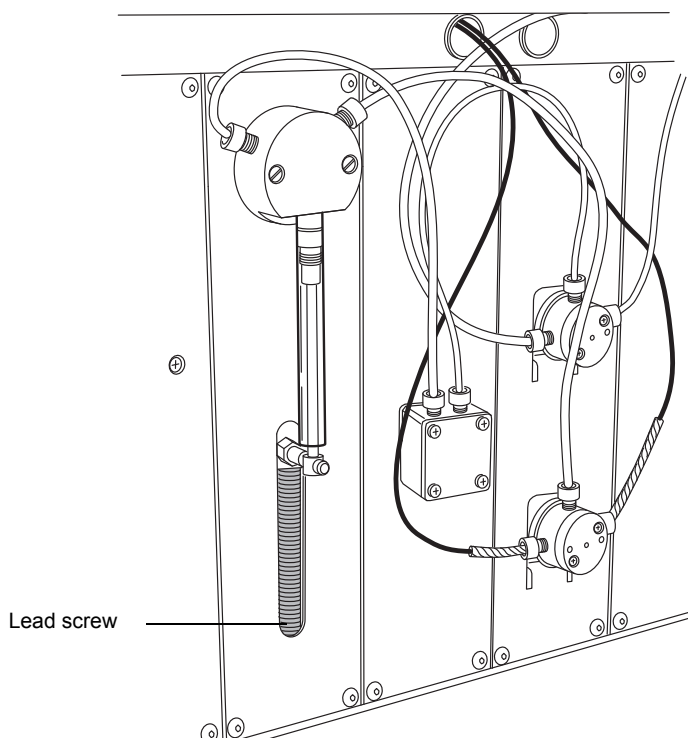
Tip: Use the lubrication kit to lubricate the lead screw.

Required material

- Lubrication kit

To lubricate the lead screw:

1. From the Inlet Editor, select **Waters2767 > Prime System** to ensure that the syringe plunger is in the home position.



2. Insert the lubrication needle through the opening in the front panel, then apply a thin vertical line of lubricant to the entire lead screw.
3. From the Inlet Editor, select **Waters 2767 > Prime System** to ensure that the lubricant is spread evenly across the lead screw.

Tip: Do not let the syringe pump run without solvent for more than a few cycles.

4.9 Replacing the sample loop

Replace the sample loop when any of the following conditions occurs:

- Your application requires a sample loop with a different volume.
- Your chromatographic peaks are distorted or show tailing.
- The ends of the sample loop are damaged.

Required materials

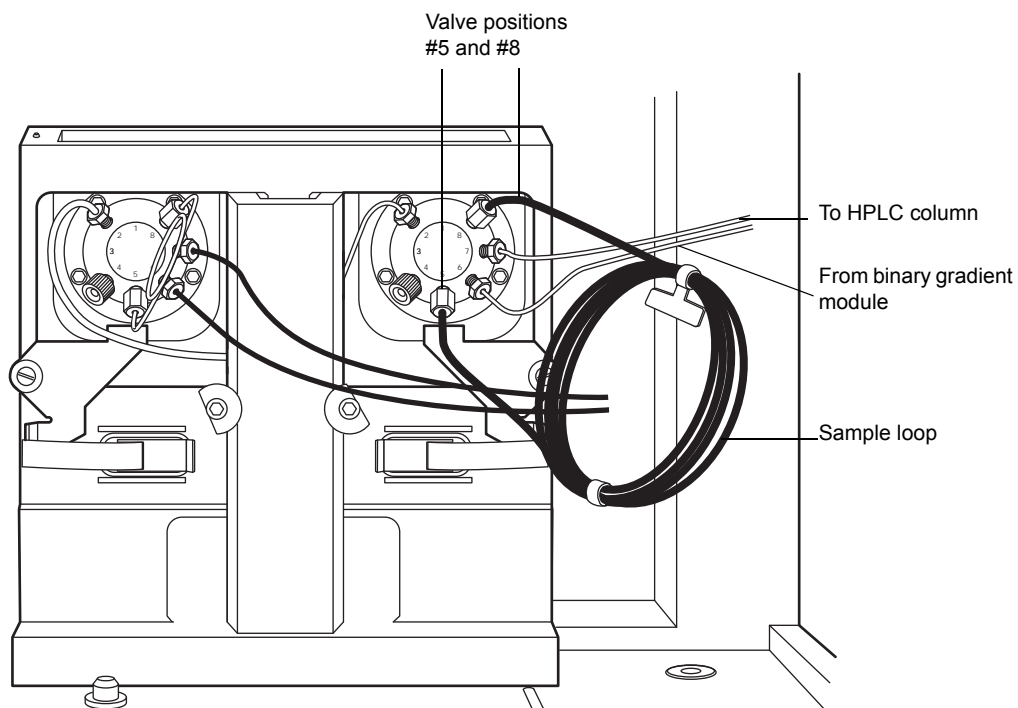
- Wrench, 1/4-inch, open-ended
- Replacement loop

Tip: The 2767 Sample Manager includes a 20- μ L sample loop on the left inject valve and a 1-mL sample loop on the right inject valve. You can install sample loops from 5 μ L to 10 mL.

Tip: Sample loops greater than 1-mL capacity require a holding loop between the probe and syringe. The capacity of the holding loop should be at least twice the sample loop size to allow for adequate overfill.

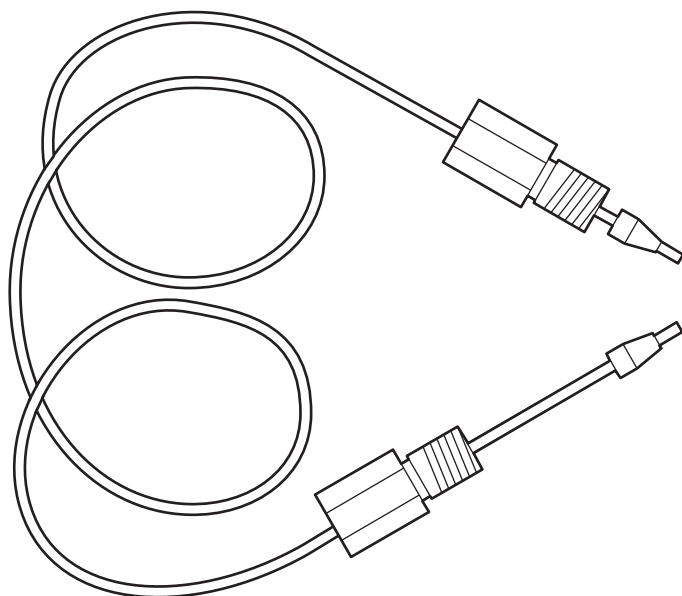
To remove and replace the sample loop:

1. Use the 1/4-inch wrench to remove the fittings on the #5 and #8 ports of the inject valve.



2. Remove the sample loop and its fittings.
3. Carefully remove the replacement sample loop and fittings from the packaging.
4. Slide a ferrule and compression screw onto one end of the sample loop as shown in the following figure, then seat the end into the #5 inject valve port.

Tip: Ensure that the ends of the sample loop are fully inserted into the ports in the inject valve.



5. Tighten the fitting with the wrench until snug.
6. Repeat [step 4](#) and [step 5](#) for the other end of the sample loop and for the #8 inject valve port (see the preceding figure).
7. Slide the inject valve back toward the rear panel.
8. Position the sample loops to the side so they do not interfere with sample rack placement or sample probe movement.
9. If you are installing a sample loop of a different size, select **Waters2767 > Configuration from the Inlet Editor**. The Configuration dialog box appears (see [Chapter 2](#)). Enter the new sample loop volume in either the Right Injector Loop Volume (μL) or Left Injector Loop Volume (μL) field.

Tip: The sample loops, holding loops, and syringe size must be properly sized. For recommended combinations, see [Chapter 1](#).

4.10 Cleaning and lubricating the X/Y/Z_S/Z_F mechanism

Clean the X/Y/Z_S/Z_F mechanism every 3 to 6 months. If the instrument is operated in a dusty or humid environment, clean the X/Y/Z_S/Z_F mechanism every 3 months.

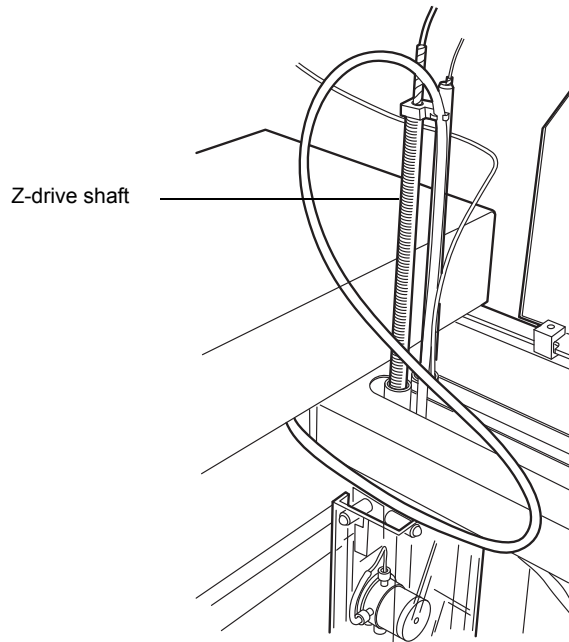
Tip: To avoid seriously damaging the instrument, do not clean the X/Y/Z_S/Z_F axis guide rails or Z-drive shaft with alcohol or any solvent. Use only isopropyl alcohol and a lint-free cloth to clean other parts of the 2767 Sample Manager. Other cleaning agents may affect the performance of the instrument.

Required materials

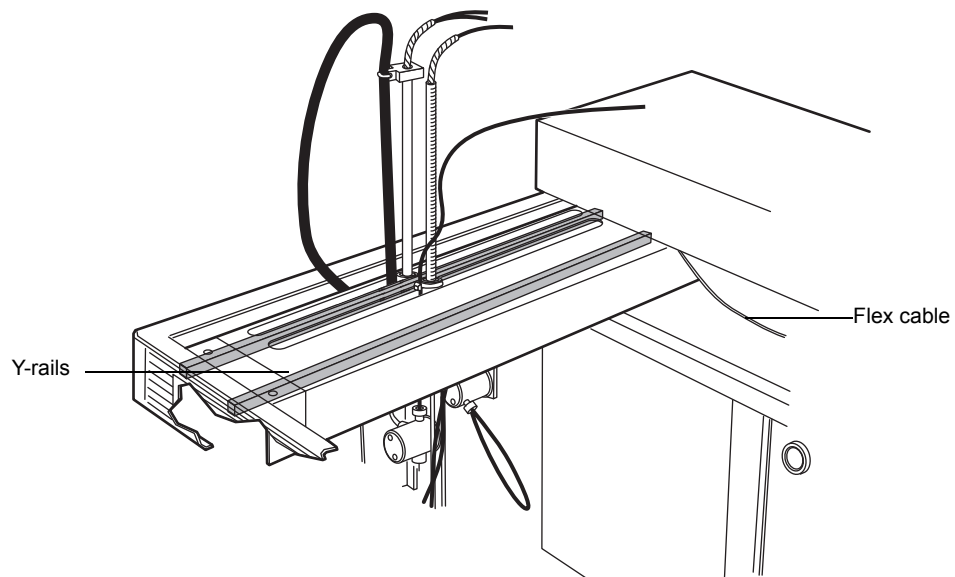
- Dry, lint-free cloth
- Lubricant

To clean the X/Y/Z_s/Z_F mechanism:

1. Power off the 2767 Sample Manager.
2. Clean the Z-drive shaft with a dry, lint-free cloth.



3. Clean the probe.
4. Put lubricant on a clean cloth and wipe the X- and Y-rails.



5. Wipe the inside of the flex cable channel using a lint-free cloth dampened with isopropyl alcohol.
Tip: When cleaning the square shaft pinion, ensure that no alcohol enters the Z-bearing or is wiped on the y-axis guide rails.
6. Wipe the square shaft pinion located underneath the arm using a lint-free cloth dampened with isopropyl alcohol.

4.11 Replacing the wash path and wash select valves

Required material

- Replacement solenoid valve

To replace the wash path or wash select valve:

1. Gently remove the valve by pulling it toward you.
2. Remove fluidic lines from the valve.
3. Remove the valve from the connector.
4. Install the new valve to the connector.
5. Install the tubing on the valve (see the following table).
6. Reposition valve.

Wash path valve and wash select valve selections

Position	Tube	Description
Wash path valve		
Right	T6	Wash path valve to sample probe vent valve
Top	T22	Wash path valve to syringe valve
Left	T7	Wash path valve to probe inner lumen
Wash select valve		
Right	T2	Wash select valve to wash 2 bottle containing strong solvent
Top	T4	Wash select valve to wash pump inlet
Left	T1	Wash select valve to wash 1 bottle containing weak solvent

4.12 Replacing tubing

All tubing must be kept clean and free of crimps. Dirty, blocked, or crimped tubing can cause poor accuracy and precision, loss of air gap, or syringe stalls. Replace the tubing, if needed. Frequency of replacement depends on duty cycle, reagents, and maintenance.

4.12.0.1 Fraction collection tube

The fraction collection tube connects the detector or System Fluidics Organizer to the fraction dispense valve. The standard 2767 Sample Manager has a 10-foot long fraction collection tube (T9) with a 0.020-inch ID. For optimum performance at low and high flow rates, optional fraction collection tubes are available:

- T27 for low flow rates, 0.010-in ID
- T28 for high flow rates, 0.040-in ID

See Chapter 2 for the maximum flow rate for each fraction collection tube.

Required material

- Replacement fraction collection tube

To replace the fraction collection tube:

1. Disconnect the fraction collection tube from the left side of the fraction dispense valve.
2. Disconnect the other end of the fraction collection tube from the detector or System Fluidics Organizer.
3. Slide the tube out of the swiveling tube guide and fraction dispense apparatus.
4. Feed the new fraction collection tube through the swiveling tube guide and fraction dispense apparatus.
5. Connect the new fraction collection tube to the left side of the fraction dispense valve.
6. Connect the other end of the new fraction collection tube to the detector or System Fluidics Organizer.

4.13 Replacing fuses

The 2767 Sample Manager uses two 5.0-A main fuses (see [Appendix B](#)). The power supply automatically switches configuration for your power source (110/220 Vac operation). To prevent additional instrument downtime, replace both main fuses whenever one fuse fails.



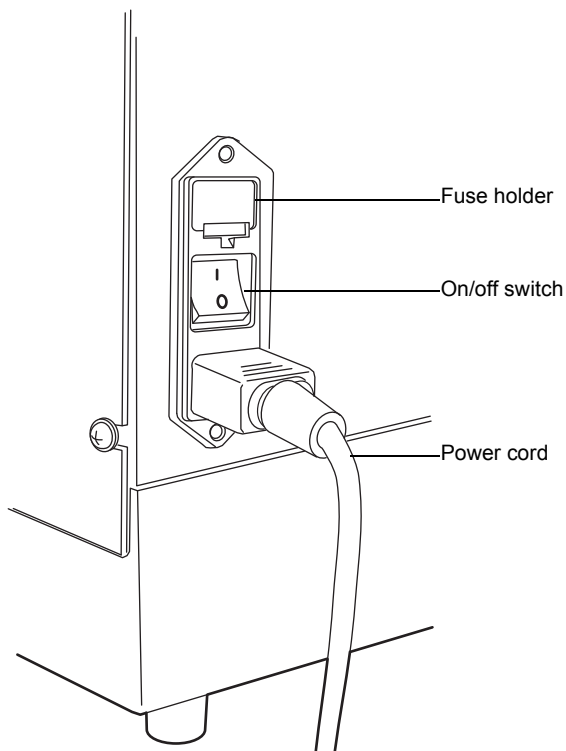
Warning: To protect against fire hazard, replace fuses with the appropriate type and rating.

Required material

- Replacement ac fuse, 5.0 A

To replace a fuse:

1. Power off the 2767 Sample Manager.
2. Remove the fuse holder from the left side panel.



3. Remove the fuses from the fuse holder.
4. Install two new fuses with the appropriate type and rating.
5. Install the fuse holder.
6. Power on the instrument.
7. If the fuse fails again in a short period of time, suspect another problem. See [Chapter 5](#).

5 Troubleshooting

This chapter describes how to find the source of and fix problems you may encounter with the 2767 Sample Manager. Information on troubleshooting software problems is in the following documents:

- *MassLynx Software Release Notes*
- *MassLynx User's Guide*
- *MassLynx Guide to Data Acquisition*
- *MassLynx Interfacing Guide*
- *MassLynx Guide to Inlet Control*
- *FractionLynx User's Guide*

5.0.0.1 Proper operating procedures

To keep your 2767 Sample Manager running optimally, follow the operating procedures and guidelines in Chapter 3. Also, perform the maintenance procedures in Chapter 4.

Check the 2767 Sample Manager periodically to ensure it is operating within acceptable parameters. Run control samples daily when running assays.

To troubleshoot problems with the instrument, see the tables later in this chapter.

5.1 Contacting Waters technical service

If you encounter any problems replacing parts in the 2767 Sample Manager and you are in the United States or Canada, contact Waters Technical Service at 800 252-4752. From other locations, call your local Waters subsidiary or Technical Service Representative or call Waters corporate headquarters in Milford, Massachusetts (U.S.A.).

5.2 Safety and handling

When troubleshooting the 2767 Sample Manager, remember the following safety considerations.



Warning: To avoid possible electrical shock, do not remove the back cover, because it lends no access to any customer-serviceable parts.



Warning: To prevent injury, always observe good laboratory practices when you handle solvents, change tubing, or operate the 2767 Sample Manager. Know the physical and chemical properties of the solvents you use. See the Material Safety Data Sheets for the solvents in use.



Warning: To avoid possible injury, always keep your hands outside the worktable and do not lean over the instrument during operation.

Tips:

- To avoid damaging electrical parts, never disconnect an electrical assembly while power is applied to the 2767 Sample Manager. Once power is turned off, wait about 10 seconds before you disconnect an assembly.
- To avoid damage due to electrostatic discharge, do not touch integrated circuit chips or other components.

5.3 Error messages

Use the following table to find an error message with the possible cause and suggested corrective action. Some error messages indicate which device (e.g., arm, wash pump, valve, syringe) to is the error source.

Error messages

Error Message	Cause	Corrective Action
Plunger Overload	Syringe speed set too high for solvent viscosity.	Confirm that the syringe size entered in the Configuration dialog box matches the syringe on the instrument. Lower syringe speed.
	Plugged injector port.	Replace injector port (see page 79).
Valve Overload	Syringe jammed or bound by dry buffer.	Replace syringe valve (see page 84).

Error messages (continued)

Error Message	Cause	Corrective Action
Initialization Error	Cannot initialize because robotic arm movement is obstructed.	Check the robotic arm movement mechanism for obstructions. Ensure that the shipping straps (see page 30) were removed from the robotic arm at installation.
	Dirt on X- and Y-rails.	Clean rails (see page 89).
	Fuse blown.	Replace fuse (see page 93).
	RS-232 cable loose or disconnected	Firmly connect cable.
	No power to the 2767 Sample Manager	Power on the device.
	Wrong communication port	Set the correct COM port (see page 42).
Invalid Operand	Values out of range.	Check the coordinate values for the Run method. x-, y-, z-coordinate values must not contain more than four digits.
		Run another method.
		Restart the software.
Device Not Implemented	Loose or damaged cables.	Check the power and power cord.
		Check communications.
		Check cables and connections.
Time-out Error	Loose or damaged communications cable.	Check communications.
	Device powered off.	Check the instrument. Power on and reinitialize, by selecting Waters2767 > Reset Communications .
Communications Timeout	Communication cable damaged or loose.	Check cables and connections.
	Device powered off.	Check the instrument. Power on, if necessary, and re initialize, by selecting Waters2767 > Reset Communications .

Error messages (continued)

Error Message	Cause	Corrective Action
Not Initialized	Lost communication or device powered off.	Power on and re initialize the device by selecting Waters2767 > Reset Communications.
		Check RS-232 cable.
No Acknowledgment Received from Device	Communication error with the device.	Reinitialize the device by selecting Waters2767 > Reset Communications.
	Device powered off.	Check the instrument. Power on, if necessary, and re initialize, by selecting Waters2767 > Reset Communications.
Z-axis Value Out of Range	Entered invalid z-coordinate on the Position Adjust screen.	Enter a z-coordinate value less than the current value.
	Selected wrong rack.	Confirm that the rack selected on the Bed Layout dial box matches the rack on the worktable.
Step Loss Detected on X-axis or Step Loss Detected on Y-axis	Movement of the arm obstructed.	Reposition the tubes and cables to allow arm to move freely. Clear any obstructions.
		Initialize the device by selecting Waters2767 > Reset Communications.
	Dirt accumulated on rails.	Clean rails (see page 89).
Step Loss Detected on Z-axis	Movement of the sample probe or fraction dispense tube obstructed.	Check the movement mechanism for obstructions.
		Reteach sample probe (see page 46).
Invalid Plate Position	X-, y-, z-coordinate-coordinate values are outside of worktable	Edit Bed Layout.
Unable to Open Bed Information	File containing bed definitions deleted.	Recreate bed definitions.
Unable to Open Plate Information	File containing plate definitions deleted.	Recreate plate definitions.
Syringe Volume too Small for Total Draw	Syringe size is not appropriate for method parameters.	Either change syringe or adjust method parameters.

Error messages (continued)

Error Message	Cause	Corrective Action
Configuration Does Not Support Two Wash Solvents	Current method uses two wash solvents, but system is configured for one wash solvent.	Edit the method to use one wash solvent or select two wash solvents on the Configuration dialog box (see page 42), then fill wash solvent 2 reservoir and add wash 2 tube (T2).
Left Injection Valve: Position Error and Right Injection Valve: Position Error	Defective sticking injection valve.	Rebuild injection valve (see page 77).

5.4 Fluidics

5.4.0.1 Liquid handling rules

When implementing programs or methods, operators should be familiar with general rules of liquid handling. Treat all samples, standards, and reference controls alike.

5.4.0.2 Method parameters

Some method parameters in the 2767 Sample Manager software can affect performance. These parameters include aspiration volume, dispense volume, aspiration speed, dispense speed, air gaps, wash volume, and probe depth. Optimization of these parameters is determined empirically.

5.4.0.3 Quality control

Routinely run three quality-control samples. Quality-control samples should represent subnormal, normal, and above-normal levels of a compound. Ensure that quality-control sample results are within acceptable range, and evaluate precision from day to day and run to run. Data collected when quality-control samples are out of range may be invalid. Do not report this data until you ensure that chromatographic system performance is acceptable.

5.5 Troubleshooting hardware problems

This section provides information for troubleshooting the 2767 Sample Manager. If the suggested solutions do not solve the problem, contact Waters Technical Service.

Troubleshooting hardware problems

Symptom	Possible Cause	Corrective Action	
Poor injection precision	The tubing or the syringe has bubbles.	Use well-degassed wash fluid.	
		Prime and purge with degassed wash fluid (see page 68).	
		Prime the wash pump before priming the syringe pump.	
		To remove persistent bubbles in the syringe, remove the syringe, flush the syringe manually with well-degassed methanol until the bubbles are removed, then reinstall the syringe.	
		The tubing is dirty, damaged, blocked, leaking, or crimped.	Replace the tubing (see page 91).
		The plunger tip scratched the inside of the syringe barrel.	Replace the entire syringe, (see page 80).
		The syringe seal is worn or damaged.	Replace the syringe seal (see page 83).
		Syringe speed set too high.	Reduce syringe speed on the Injection tab of the Inlet Editor (see page 64).
		The injector port is leaking.	Recalibrate reference button (see page 46) or replace the injector port (see page 79).
		The fittings on the 3-port syringe valve are loose.	Tighten the fittings on the 3-port syringe.
		The 3-port syringe valve is worn or leaking.	Replace the 3-port syringe valve (see page 84).
		The probe is scratched, worn, damaged, dirty, bent, blocked, or the tip is bent.	Replace the probe (see page 75).
		The syringe is too large for the requested volume.	Install a smaller syringe (see page 80).
	There are carryover effects due to inadequate rinse volume between samples.	Increase the rinse volume. Click the Wash tab on the Inlet Editor and increase the probe wash duration.	
	Maintenance procedures have not been performed.	Perform maintenance procedures (see the table titled "Suggested maintenance intervals" on page 4-73).	

Troubleshooting hardware problems

Symptom	Possible Cause	Corrective Action
Variable sample aspiration volume	The syringe barrel is loose or misaligned.	Check the alignment and tighten the syringe on the 3-port syringe valve.
	The syringe seal is worn.	Replace the syringe seal (see page 83).
	The fittings on the 3-port syringe valve are loose.	Tighten the fittings on the 3-port syringe valve.
	The 3-port syringe valve is worn.	Replace the 3-port syringe valve (see page 84).
	The plunger tip scratched the inside of the syringe barrel.	Replace the entire syringe (see page 80).
	The capped vials have a partial vacuum or pressure buildup.	Loosen the caps.
Fluid leaks from the bottom of the syringe	The fittings on the 3-port syringe valve are loose.	Tighten the fittings on the 3-port syringe valve.
	The syringe barrel is loose or misaligned.	Check the alignment and tighten the syringe on the 3-port syringe valve.
	The syringe seal is worn.	Replace the syringe seal (see page 83).
	The plunger tip scratched the inside of the syringe barrel.	Replace the entire syringe (see page 80).
Fluid found on vial caps or racks	The tubing is loose.	Tighten the tubing fittings.
	The 3-port syringe valve is worn.	Replace the 3-port syringe valve (see page 84).
Fluid in the drip tray	The tubing has leaks, blockages, crimps, or air bubbles.	Tighten or straighten the fittings, then prime the pumps (see page 68) to flush the air bubbles. If the tubing still has leaks, blockages, crimps, or air bubbles, replace the tubing (see page 91).
	The syringe barrel is loose or misaligned.	Check the alignment and tighten the syringe on the 3-port syringe valve.
	The wash station is blocked.	Clean the wash station and check the fittings.
	The wash station tubing is damaged, blocked, loose, or leaking.	Tighten or replace the tubing.

Troubleshooting hardware problems

Symptom	Possible Cause	Corrective Action
Fluid in the drip tray, cont.	The tubing to the waste container has a trap in the tubing.	Ensure that fluid flows freely into the waste container by vertically straightening out the tubing.
	The end of the waste fluid tubing is submerged in fluid or foam in the waste container.	Ensure that the end of the tubing is not submerged in fluid or foam.
	The dispense fluid from the sample probe overflowed the sample container.	Decrease the dilution volume of sample in the sample container (see page 67).
	The probe missed the position and dispensed into a rack or the drip tray.	Ensure that the correct racks are installed for the worktable, then calibrate the probe to all reference positions on the worktable.
	Racks are wet from earlier cleaning or spills.	Clean and dry the racks thoroughly.
	Loose injector fittings	Tighten fittings.
Noisy syringe pump	The lead screw is sticking.	Clean and lubricate the lead screw (see page 86).
Syringe stalls	The 3-port syringe valve is defective or worn.	Replace the 3-port syringe valve (see page 84).
	The tubing is dirty, blocked, or crimped.	Replace the tubing (see page 91).
	The syringe barrel is loose or misaligned.	Check the alignment and tighten the syringe on the 3-port syringe valve.
	The tubing connectors are blocked.	Clean the tubing connectors, or replace the tubing (see page 91).
	Syringe speed set too high	Reduce syringe speed (see page 46)
	The lead screw is sticking.	Clean and lubricate the lead screw (see page 86).

Troubleshooting hardware problems

Symptom	Possible Cause	Corrective Action
Probe crash	The injector port is blocked or damaged.	Replace the injector port (see page 79).
	Physical racks do not agree with the bed layout.	Exchange racks or modify bed layout (see page 53)
	Sample containers or racks are not installed correctly.	Ensure that sample containers and racks are installed correctly (see page 51).
	Bad plate definition	Re-generate plate (see page 59).
	The probe is not calibrated to the worktable.	Calibrate the probe to the reference button on the worktable (see page 46).
	The probe is bent.	Replace the probe (see page 75).
Broken vials	Sample containers or racks are not installed correctly.	Ensure that sample containers and racks are installed correctly.
	The probe is not calibrated to the worktable.	Calibrate the probe to all reference positions on the worktable (see page 46).
	The probe is bent.	Replace the probe (see page 75).
Damaged injector port	The probe is damaged or bent or the tip is bent.	Replace the probe (see page 75) and the injector port (see page 79).
	The injector port is damaged or absent.	Inspect the probe for damage and replace the injector port (see page 79).
No injection signal	MassLynx trigger option set incorrectly	From the Inlet Editor, select Tools > Instrument Configuration > Triggers to set the trigger options.
No injection	The injector port is blocked or damaged.	Replace the injector port (see page 79).
Damaged injector port	The injector valve is blocked, damaged, or not operating.	Repair or replace the injector valve as directed in the manufacturer's instructions (see page 77).
	The syringe pump is damaged or worn.	Replace the syringe pump.
	The inject valve is not switching to the inject position.	Replace the injector.

Troubleshooting hardware problems

Symptom	Possible Cause	Corrective Action
Damaged injector port, cont.	No sample in vial or sample probe not reaching the fluid level.	Ensure that the vial has sufficient volume. in it.
		Check the sample probe z-coordinate to make sure that it reaches the bottom of the vial. If Reference Calibrated check box is clear on the Position Adjust dialog box (see page 46) the sample probe will not lower into the vial.
Leaking injector	A fitting on the injector is loose.	Tighten the fitting.
	The rotor seal is damaged.	Replace the rotor seal as directed in the manufacturer's instructions.
Cannot initialize	RS-232 connector to MassLynx workstation is loose.	Tighten connection (see page 38).
	Communication port setting is incorrect.	Select proper communications port (see page 42).
	The fuse is blown.	Replace the main fuse (see page 93).
	Device is not turned on.	Power on the 2767 Sample Manager.
	The power supply has a problem.	Contact Waters Technical Service.
	The cables are not securely plugged in.	Securely fasten all cables and the power cord.
Intermittent run failures	The cables are not securely plugged in.	Securely fasten all cables and the power cord.
	A cable is damaged.	Replace cables one at a time until the problem is solved.
	RS-232 connector to MassLynx workstation is loose.	Tighten connection (see page 38).
Inoperative instrument	The instrument power is off.	Power on the 2767 Sample Manager.
	The power cord is unplugged at either end.	Check the power cord at the instrument and at the outlet.
	A main fuse is blown.	Replace the main fuses (see page 93).
	Power to the outlet is off.	Ensure that the power to the outlet is on.


A Safety Advisories

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

A.1 Warning symbols


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


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


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


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

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

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

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

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

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

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

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



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



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



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



Warning: (Risk of tipping.)



Warning: (Risk of explosion.)



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

A.1.1 Specific warnings

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

A.1.1.1 Burst warning

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



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

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

A.1.1.2 Biohazard warning

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



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

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

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

A.1.1.3 Biohazard and chemical hazard warning

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



Warning: To avoid personal contamination with biohazards, toxic materials, or corrosive materials, you must understand the hazards associated with their handling.

Guidelines prescribing the proper use and handling of such materials appear in the latest edition of the National Research Council's publication, *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*.

Observe Good Laboratory Practice (GLP) at all times, particularly when working with hazardous materials, and consult the safety representative for your organization regarding its protocols for handling such materials.

A.2 Notices

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

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

A.3 Bottles Prohibited symbol

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



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

A.4 Required protection

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



Requirement: Use eye protection when refilling or replacing solvent bottles.



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

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

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



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



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



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



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



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



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



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



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



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



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

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



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

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



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

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

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



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

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



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

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

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



警告：當在有壓力的情況下使用聚合物管線時，小心注意以下幾點。

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

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



警告: 当有压力的情况下使用管线时, 小心注意以下几点:

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

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



경고: 가압 폴리머 튜브로 작업할 경우에는 주의하십시오.

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

염화 메틸렌 (Methylene chloride) 및 디메틸설폭사이드 (Dimethyl sulfoxide) 는 비금속 튜브를 부풀려 튜브의 파열 압력을 크게 감소시킬 수 있으므로 유의하십시오.



警告: 圧力のかかったポリマーチューブを扱うときは、注意してください。

- 加圧されたポリマーチューブの付近では、必ず保護メガネを着用してください。
- 近くにある火を消してください。
- 著しく変形した、または折れ曲がったチューブは使用しないでください。
- 非金属チューブには、テトラヒドロフラン(THF)や高濃度の硝酸または硫酸などを流さないでください。

塩化メチレンやジメチルスルホキシドは、非金属チューブの膨張を引き起こす場合があり、その場合、チューブは極めて低い圧力で破裂します。



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



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



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



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



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



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



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



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



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

A.6 Warnings that address the replacing of fuses

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

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



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



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



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



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



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



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



警告：為了避免火災，應更換與儀器保險絲蓋旁邊面板上印刷的類型和規格相同的保險絲。



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



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

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



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



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



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



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



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



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



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



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





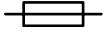



警告：火災予防のために、ヒューズ交換ではメンテナンス項目の「ヒューズの交換」に記載されているタイプおよび定格のヒューズをご使用ください。

A.7 Electrical and handling symbols

A.7.1 Electrical symbols

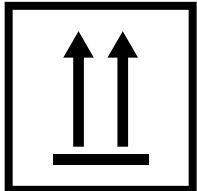


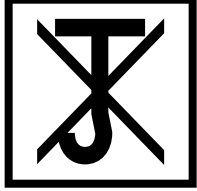
The following electrical symbols and their associated statements can appear in instrument manuals and on an instrument's front or rear panels.

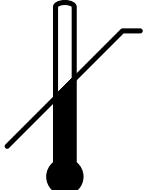
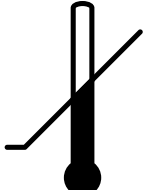
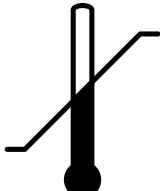
Symbol	Description
	Electrical power on
	Electrical power off
	Standby
	Direct current
	Alternating current
	Alternating current (3 phase)

Symbol	Description
	Safety ground
	Frame, or chassis, terminal
	Fuse
	Functional ground
	Input
	Output

A.7.2 Handling symbols

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

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

Symbol	Description
	Upper limit of temperature
	Lower limit of temperature
	Temperature limitation

B Specifications

This appendix supplies instrument specifications.

Tip: It is the sole responsibility of each laboratory to verify that the system works for its applications.

B.1 Physical specifications

Physical specifications

Item	Specification
Footprint with required clearance: Height Depth Width	30 in. (76.2 cm); 33 in. (83.8 cm) with optional fume hood 24.5 in. (62.2 cm) 34 in. (86.4 cm)
Weight	120 pounds (59.4 kg)
Worktable (width × depth × height)	15.1 in. × 5.9 in. × 6.9 in. (38.4 cm × 15.0 cm × 17.5 cm)
Wetted surface materials	316L stainless steel, Tefzel® (ETFE), Teflon® (FEP and PTFE), polyetheretherketone (PEEK)
Ventilation	At least 1 in. (2.5 cm) from a wall or obstructing surface
Safety	UL, C-UL, CE, IEC 1010-1

B.2 Environmental specifications

Environmental specifications

Item	Specification
Operating temperature	15 to 40 °C (59 to 104 °F)
Operating environment	Indoor use
Relative humidity	Maximum relative humidity 85% for temperatures up to 31 °C, decreasing linearly to 50% relative humidity at 40 °C
Storage temperature	0 to 50 °C (32 to 122 °F)
Altitude	Up to 2,000 meters (6562 feet)

B.3 Electrical specifications

Electrical specifications

Item	Specification
Power supply input	Auto-selecting 110/230 Vac $\pm 10\%$, 47 to 63 Hz, maximum 250 watts. Requires earth-grounded power source.
Fuses	Two 5-A fuses
Power supply output	Generates 24 V. All services internal to the instrument operate on 24 V.
Installation category	Overvoltage Category II
Input voltages	Autoselecting 110/230 Vac $\pm 10\%$
Frequency	47 to 63 Hz
Maximum power output	250 watts
Pollution degree*	2

*A measure of pollution on electrical circuits, the pollution degree can reduce dielectric strength or surface resistivity. Degree 2 refers only to normally nonconductive pollution. Occasionally, however, expect a temporary conductivity caused by condensation.

B.4 Operational specifications

Operational specifications

Item	Specification			
	X-Axis	Y-Axis	Z _S -Axis	Z _F -Axis
Travel range				
mm	645	300	170	170
in.	25.40	11.81	6.69	6.69
Resolution				
mm	0.2234	0.0142	0.0982	0.0982
in.	0.009	0.006	0.004	0.004
Accuracy over travel ^a				
mm	± 0.20	± 0.14	± 0.14	± 0.14
in.	± 0.008	± 0.006	± 0.006	± 0.006
Max Acceleration (steps/sec ²)	5000	10,000	10,000	30,000
Max Velocity (steps/sec ²)	3300	3300	2200	4400

a. Accuracy and precision were determined within run, and coordinates were measured independently.

B.5 Liquid handling specifications

Liquid handling specifications

Item	Description
Injector volume (fixed sample loop)	20 μ L standard; 5 μ L, 50 μ L, 100 μ L, 200 μ L, 500 μ L, 1.0 mL, 2.0 mL ^a , 5.0 mL ^a , and 10 mL ^a
Syringe sizes	1.0 mL standard; 250 μ L, 500 μ L, 2.5 mL, 5.0 mL, and 10 mL
Resolution	Mechanical resolution is 1/3000 of syringe volume. Smallest recommended volume is 24 steps or 2 μ L, whichever is larger.
Syringe delivery accuracy	>99% at full stroke with a 1.0-mL syringe
Analytical Precision	<0.75% RSD; 1 mL syringe, 20- μ L fixed loop on left (analytical) inject valve, 4x overflow mode, six replicates; using either: <ul style="list-style-type: none"> phenone mix, 254 nm; eluent and sample diluent: degassed methanol:water, 60:40, premixed; Symmetry[®]C₁₈ column, 3.9 \times 50 mm; 1 mL/min uracil and caffeine both at 0.03 mg/L in water:methanol, 80:20, 272 nm; eluent and wash solvent: degassed water:methanol, 80:20, premixed; XTerra[®]MS C₁₈ column 5 μm, 4.6 \times 50 mm; 1 mL/min
Carryover	<0.05% using Waters standard test protocol and dual wash solvents

a. Prep Kit includes holding loop.

