Agilent 6000 Series
LC/MS System

Maintenance Guide

Agilent Technologies
Notices

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Some Ion Mobility technology is covered by patents US6,818,890; US6,967,325; US7,888,635.

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In This Guide...

This book contains procedures to clean and maintain your Agilent 6000 Series LC/MS instrument. This book applies to all 6100 Series, 6200 Series, 6400 Series and 6500 Series LC/MS instruments.

1 Startup and Shutdown

This chapter describes how to start up and shut down your LC/MS System.

2 Calibrant Delivery System and Divert Valve

This chapter describes maintenance tasks for the calibrant delivery system (CDS) and divert valve.

3 Sources

This chapter describes maintenance procedures for the components that make up the source.

4 Ion Transfer Capillary

This chapter describes the procedures to remove, clean and reinstall the ion transfer capillary. These procedures apply to both single- and multi-bore capillaries.

5 High Pressure Ion Funnel

With time and with heavy usage, the high pressure ion funnel needs to be cleaned to maintain its performance on the LC/MS instrument.

6 Desolvation Assembly and Vacuum Manifold

This chapter describes the steps to maintain the assemblies that are inside of the vacuum manifold. For most procedures, the desolvation assembly needs to be removed to get to the vacuum manifold.
7 Vacuum System

This chapter includes procedures to maintain the vacuum system of the instrument. Do these steps according to the maintenance schedule or as indicated by instrument symptoms.

8 Reference

This chapter contains safety information, parts lists, and other reference information for your Agilent 6000 Series LC/MS.
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This chapter describes how to start up and shut down your LC/MS System.

For more details, see the site preparation guide that is sent to customers before installation. If you move the instrument, you must follow and repeat the steps detailed in the site preparation guide.

**WARNING** Always wear appropriate protection, including eye protection, lab coat, and gloves, when working with solvents and chemicals or when working with unassembled parts.
The LC/MS System instruments have three standard modes of operation that you can select from the software.

**On Mode**  
*On* is the fully operational status of the system. The instrument and the source are on. The LC/MS instrument icon indicates the state of the instrument:

Refer to the online Help to learn how to put the instrument in On mode.

**Standby Mode**  
In *Standby*, the source interface is on, the drying gas remains heated, and nebulizer flows are maintained. The source and ion optics voltages are turned off, and the mass spectrometer is not sending spectra to the computer. However, the LC/MS high voltage electronics are on.

For APCI and multimode sources: The vaporizer gas heaters are reduced.

For an instrument with Agilent Jet Stream source: The sheath gas temperature, drying gas flow, and drying gas temperatures are reduced.

This mode lets the instrument remain idle for periods lasting from minutes to days. You should place the instrument in Standby mode when it is not in use or when you want to change the ion source.

Refer to the online Help to learn how to put the instrument in Standby mode.

**Powered Off State**  
When the system is in the powered off state, the system is vented and the instrument is turned off to allow maintenance or to prepare for long periods when the instrument is not used.

### Table 1  
Instrument icon color indication

<table>
<thead>
<tr>
<th>Color</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>green</td>
<td>idle</td>
</tr>
<tr>
<td>blue</td>
<td>running, injecting</td>
</tr>
<tr>
<td>red</td>
<td>error</td>
</tr>
<tr>
<td>yellow</td>
<td>not ready</td>
</tr>
<tr>
<td>purple</td>
<td>pre-run, post-run</td>
</tr>
<tr>
<td>dark gray</td>
<td>offline</td>
</tr>
<tr>
<td>light gray</td>
<td>standby</td>
</tr>
</tbody>
</table>

Refer to the online Help to learn how to put the instrument in Standby mode.
Note that the only way to completely remove electrical power from the system is to unplug all power cords from the instrument.

**NOTE**

Before you move the instrument to another location, maintain it, or expect it to be idle for long periods of time, turn off both the front switch and the main power breaker switch behind the service panel.

**CAUTION**

If the LC/MS System is planned to be shut down for longer than one day, unplug the instrument from the wall outlet to prevent overheating of the turbo pump power supplies.
To start the system in Standby mode

This procedure brings the system from the powered off state to Standby mode.

1. Check that nitrogen gas for the drying gas is turned on. If equipped with a collision cell, check that nitrogen gas for the collision cell is turned on.

   When you use an Agilent Jet Stream source (single or dual nebulizer), the nitrogen gas requirements are greater than when operating with electrospray, APCI, APPI, or multimode sources. The supply line must have two gas filters (part number BHT-4 or RMSN-4) plumbed in parallel to achieve these flows without triggering errors at the instrument. Refer to the Installation Guide for more details.

2. Check that the rough pump is properly connected to the LC/MS instrument.
   a. Check that rough pump power cable is connected to the Foreline Pump power receptacle.
      
      For instruments without a pump expander box: The Foreline Pump power receptacle is behind the service panel.

      b. For instruments with an ion funnel: Check that the ion funnel pump is connected to the Auxiliary Pump power receptacle in the pump expander box.

   c. Check that the LC/MS mainframe pump has the correct voltage rating for your AC power (200 to 240 VAC).

   d. Check that the rough vacuum hose is connected to the inlet port of the rough pump.

   e. For instruments with an ion funnel: Check that the ion funnel rough vacuum hose is connected to the ion funnel rough pump inlet.

   f. Check that the switch on the rough pump (or pumps) is in the On position.

3. Check that all foreline and ion funnel pumps and the spray chamber exhaust are vented outside the laboratory.

   Vent all exhausts external to the building where they cannot be recirculated by environmental control systems. Do not vent exhaust into your laboratory. The exhaust fumes from the vacuum pumps and spray chamber contains trace amounts of the chemicals you analyze. Health hazards include chemical toxicity from solvents, buffers, samples and pump fluid vapor, as well as potentially biohazardous aerosols of biological samples.
4 Turn on the power for the computer and monitor.

5 Check that the instrument is plugged into a power outlet.

6 **For instruments with a pump expander box only:** Check that the power switch on the **pump expander box** is connected to the wall outlet and is turned on. The switch is illuminated green when the power is on.

7 Turn on the **front power switch** of the LC/MS System.
   This starts the pumping system and the electronics.

8 **For the 6200 Series and 6500 Series LC/MS instruments only:** In the TOF/Q-TOF Diagnostics program, connect to the system. Select the **Pump Down** and **HV Condition** options.
   The system monitors the vacuum pressure. Once the vacuum pressure reaches $3 \times 10^{-6}$ Torr, the system begins to condition the high voltage electronics.
   When high voltage conditioning is complete, close the Diagnostics program.

9 Start the data acquisition program.
   The system comes up in Standby mode.

For the 6200 Series and 6500 Series LC/MS instruments only: You will not be able to set the flows while the LC/MS system is in a “Not Ready” state. The system will remain in the Not Ready state while the high vacuum pressure is above $3.5 \times 10^{-6}$ Torr.

10 **For the 6200 Series and 6500 Series LC/MS instruments only:** Let the instrument continue to pump down.
    The Rough Vac (rough pump) pressure should be about 1.75 to 3.5 Torr, depending on the instrument type. The TOF Vac (flight assembly region) pressure reaches approximately $3 \times 10^{-6}$ Torr within two to three hours. The TOF Vac reading reaches the $10^{-7}$ Torr range after pumping overnight to several days.
    Leave the instrument in Standby.
To change between Standby and On

Use this procedure when:

- The LC/MS System is in Standby mode and you need to bring it into the On mode.
- Sample analysis is complete and you want to put the LC/MS instrument in Standby mode.

Before you change the state from On to Standby:

- Check that you have completed tuning and data acquisition and you have saved all data as needed (described in later chapters).

- In the data acquisition program, right-click the instrument icon, and then change the instrument state to Standby or On.

Refer to the online Help.

You can only activate the Standby mode or On mode if the ion source is mounted and closed. You can now select parameters for your measurement.

In Standby mode:

- The drying gas flow, drying gas temperature, nebulizer pressure, vaporizer temperature, and sheath gas temperature are reduced.
- The spray chamber high voltages are turned off. For 6200 Series and 6500 Series LC/MS instruments, voltages in the flight tube remain On to maintain stable operating voltages.
- The mass spectrometer stops generating spectra.
To shut down the instrument

You can turn off the LC/MS System when the instrument will be idle for an extended time or when you must do maintenance.

Before you begin, check that you have completed tuning and acquiring data, and that you have saved all data as needed.

**CAUTION**
When you vent the system from the data acquisition program, the LC/MS instrument does not turn off. You must follow the entire shutdown procedure.

**WARNING**
The spray shield and related spray chamber components are likely to be hot. Do not touch them!

1. Turn off the solvent flow.
   If you have analyte in any of the components in the sample delivery system, flush the delivery system with pure solvent before you continue.

2. If equipped with a ballast valve, check that the ballast valve on the rough pump is closed.

3. From the data acquisition program, vent the system.
   When you vent the system, these parts are turned off: spray chamber high voltages, the drying gas heater, the nebulization flow, the detector, and other lens voltages. The drying gas flow is set to 3.5 L/minute. If the APCI source is installed, the vaporizer heater is also turned off. If the installed source is an Agilent Jet Stream source, the sheath gas heater is also turned off. The Rough Pump turns off when the turbo speed is below 20 percent.

4. Wait until the instrument completely vents (reaching 760 Torr).
   **For 6200 Series and 6500 Series LC/MS instruments:** This step ensures that the flight tube is filled with nitrogen to protect the detector from moisture damage.

5. Turn off the front switch located in the lower left front corner of the instrument.

6. Unplug the main power cable behind the service panel. If the instrument is equipped with a pump expander box, also unplug the pump expander cable behind the service panel.
Do this to completely remove power from the instrument and to prevent the power supplies within the instrument from overheating.
You can also shut down the data acquisition program and computer.
The system is now shut down.

**Instrument Overview**

These figures show you where the various switches, covers, and external parts are located.

**6100 Series**

![Figure 1 Standard 6100 Series cover design.](image)
6200 Series

Figure 2  Standard 6200 Series LC/MS cover design. The main power switch is located on the front lower left.
6400 Series and 6500 Series

These figures show the 6400 Series and 6500 Series LC/MS instruments. 6400 Series share the same base unit design as the 6500 Series, except for the inclusion of a flight assembly.

Figure 3 6400 Series (inset) and 6500 Series LC/MS system. The main power switch is behind the service panel.
Figure 4  6400 Series (inset) and 6500 Series LC/MS system.
Figure 5  6400 Series (inset) and 6500 Series LC/MS with an iFunnel ion funnel
Figure 6  Ion Mobility Q-TOF LC/MS
Service Area

These pictures show you where various connectors are located.

Figure 7  Gas, LAN, and power connections behind service panel for the 6400 Series and 6500 Series instruments without a pump expander box,
Figure 8  Power connections and pump expander box behind service panel for 6400 Series and 6500 Series instruments with a pump expander box,
Figure 9  Connections behind service panel for 6200 Series LC/MS
This page intentionally left blank.
This chapter describes maintenance tasks for the calibrant delivery system (CDS) and divert valve.

When you do maintenance procedures on the divert valve:

- Do not bend any capillary line.
- The position of the divert valve can be set only in the On mode.
- Put the instrument in the Off mode.
- Remove the covers before you begin.
- Install the covers of the instrument after you finish.

**WARNING** Always wear appropriate protection, including eye protection, lab coat, and gloves, when working with solvents and chemicals or when working with unassembled parts.
## Table 2  Divert Valve Connection (see Figure 10 through Figure 12)

<table>
<thead>
<tr>
<th>No.</th>
<th>Port</th>
<th>Connection</th>
<th>User action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inlet</td>
<td>from the front inlet union behind the inlet cover</td>
<td>none</td>
</tr>
<tr>
<td>2</td>
<td>Inlet</td>
<td>from CDS</td>
<td>none (permanent connection from calibrant delivery system)</td>
</tr>
<tr>
<td>3</td>
<td>Outlet</td>
<td>to the ion source</td>
<td>connect the flexible capillary to the ion source</td>
</tr>
<tr>
<td>4</td>
<td>Loop</td>
<td>loop to port 6</td>
<td>none (permanent connection)</td>
</tr>
<tr>
<td>5</td>
<td>Waste</td>
<td>to the drain bottle</td>
<td>none</td>
</tr>
<tr>
<td>6</td>
<td>Loop</td>
<td>loop to port 4</td>
<td>none (permanent connected)</td>
</tr>
</tbody>
</table>
For 6100 Series, 6400 Series and 6500 Series LC/MS

Figure 10  Divert valve with port position indicators

For 6200 Series LC/MS
For 6100 Series, 6400 Series and 6500 Series LC/MS

For 6200 Series LC/MS

Figure 11  LC to LC/MS flow
For 6100 Series, 6400 Series and 6500 Series LC/MS

Solvent Selection Valve

Calibrant in

Waste

LC inlet

Nebulizer

For 6200 Series LC/MS

MS Selection Valve

Calibrant in

Waste

LC inlet

Nebulizer

Figure 12  Calibrant to LC/MS flow
To prepare tuning mix

This topic applies to only the 6200 Series and 6500 Series LC/MS with an Agilent Jet Stream source.

For many instruments, the standard tuning mix produces correct results. However, in some instances, a dilution is needed.

Dilute the tuning mix if:

- You get error messages that instruct you to dilute the calibrant.
- The tune report shows abundances greater than 750,000 counts. You need to dilute until the largest abundance is below 750,000 counts for a mass axis calibration. Typical tune mass abundances are in the range of 50,000 to 650,000 counts.

Do not dilute the tuning mix if:

- Your source is an APPI or APCI.

Tools needed

- LC/MS-grade acetonitrile
- deionized (18 MW-cm) water
- glass CDS bottle
- glass CDS bottle cap

Parts needed

- ESI-L Tuning Mix (for Dual ESI or Agilent Jet Stream)
- MMI-L Tuning Mix (for multimode source)
- Biopolymer Reference Mass Kit, which contains the HP-0321 solution (for Agilent Jet Stream)

The materials shipped with the instrument are of sufficient purity for this purpose.

These instructions make 100 mL of diluted tuning mix.

1 Add the components in the table below, in the order listed, to a clean glass CDS bottle. Refer to the table that is appropriate for your source.

Make sure you add the components in the order listed below to avoid precipitation of any components of the tuning mix.
To prepare tuning mix

### Table 3  AJS and Dual AJS except 6550/6560

<table>
<thead>
<tr>
<th>Source</th>
<th>Positive Mode</th>
<th>Negative Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undiluted Tuning Mix</td>
<td>10 ml ESI-L</td>
<td>2.5 ml ESI-L</td>
</tr>
<tr>
<td>Acetonitrile</td>
<td>85.5 mL</td>
<td>95.6 mL</td>
</tr>
<tr>
<td>Water</td>
<td>4.5 mL</td>
<td>1.9 mL</td>
</tr>
<tr>
<td>0.1 mM HP-0321 (included in the Biopolymer Reference Mass Kit)</td>
<td>3 µL</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Table 4  6550/6560 with Dual AJS ESI

<table>
<thead>
<tr>
<th>Source</th>
<th>Positive and Negative Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undiluted Tuning Mix</td>
<td>10 mL ESI-L</td>
</tr>
<tr>
<td>Acetonitrile</td>
<td>85.5 mL</td>
</tr>
<tr>
<td>Water</td>
<td>4.5 mL</td>
</tr>
<tr>
<td>0.1 mM HP-0321 (included in the Biopolymer Reference Mass Kit)</td>
<td>3 µL</td>
</tr>
</tbody>
</table>

### Table 5  Dual ESI

<table>
<thead>
<tr>
<th>Components</th>
<th>Positive Mode</th>
<th>Negative Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undiluted Tuning Mix</td>
<td>25 mL ESI-L</td>
<td>25 mL ESI-L</td>
</tr>
<tr>
<td>Acetonitrile</td>
<td>71.25 mL</td>
<td>71.25 mL</td>
</tr>
<tr>
<td>Water</td>
<td>3.75 mL</td>
<td>3.75 mL</td>
</tr>
</tbody>
</table>

### Table 6  Multimode

<table>
<thead>
<tr>
<th>Components</th>
<th>Positive Mode</th>
<th>Negative Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undiluted Tuning Mix</td>
<td>25 mL MMI-L</td>
<td>25 mL MMI-L</td>
</tr>
<tr>
<td>Acetonitrile</td>
<td>71.25 mL</td>
<td>71.25 mL</td>
</tr>
<tr>
<td>Water</td>
<td>3.75 mL</td>
<td>3.75 mL</td>
</tr>
</tbody>
</table>
2 Mix the contents thoroughly and install the calibrant bottle on the instrument.

3 Change to the Tune context, and then:
   a Open the reference B valve.
   b Allow at least one minute for the tuning mix to flush the previous solution from the calibrant system before you tune the instrument.

Store the custom tuning mix in the refrigerator when it is not being used for extended periods of time.

Use these guidelines to adjust the custom tuning mix:

- In the final tune report, make sure all abundances listed in the report are between 50,000 and 700,000 counts for proper calibration of the mass axis. Dilution of the tuning mix up to 200-fold can be needed for instruments with exceptional sensitivity. Be careful in your laboratory work when you dilute greater than 50-fold because contamination and sodium trifluoroacetate adducts can become problematic at higher dilutions.

- The amount of water added affects the response of 118 m/z, with higher amounts yielding a greater response and vice versa. You can add water up to the amount of 5% (v/v). Do not add more water than that because some components of the tuning mix can precipitate under these conditions.

- If tune mass abundances are less than 10,000 counts, the tuning mix is over-diluted. Dilutions at this level can result in poor mass accuracies.

- Use the HP-321 solution in a 2000:1 (v/v) ratio to the ESI-L Tuning Mix. (If 10 mL ESI-L Low Concentration tuning mix is used, add 5 μL of the HP-321 solution.)

- Sodium TFA can cause problems during calibration, depending on how the calibrant is diluted and how much sodium is in the water. Table 7 lists the ions that can result from sodium TFA (both positive and negative mode).

---

Table 7  Elemental compositions and calculated masses of sodium trifluoroacetate ion clusters by electrospray ionization under positive-ion ([(CF3COONa)nNa]1) and negative-ion ([(CF3COONa)nCF3COO]2) modes

<table>
<thead>
<tr>
<th>n</th>
<th>Positive-ion calculated mass</th>
<th>Negative-ion calculated mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>158.96458*</td>
<td>248.96036*</td>
</tr>
<tr>
<td>2</td>
<td>294.93939*</td>
<td>384.93466*</td>
</tr>
<tr>
<td>3</td>
<td>430.91420*</td>
<td>520.90947*</td>
</tr>
<tr>
<td>4</td>
<td>566.88900*</td>
<td>656.88427*</td>
</tr>
<tr>
<td>5</td>
<td>702.86381*</td>
<td>792.85908*</td>
</tr>
<tr>
<td>6</td>
<td>838.83862*</td>
<td>928.83389*</td>
</tr>
<tr>
<td>7</td>
<td>974.81343*</td>
<td>1064.80870</td>
</tr>
<tr>
<td>8</td>
<td>1110.78824*</td>
<td>1200.78351</td>
</tr>
<tr>
<td>9</td>
<td>1246.76305*</td>
<td>1336.75832</td>
</tr>
<tr>
<td>10</td>
<td>1382.73786</td>
<td>1472.73313</td>
</tr>
<tr>
<td>11</td>
<td>1518.71267</td>
<td>1608.70794</td>
</tr>
<tr>
<td>12</td>
<td>1654.68747</td>
<td>1744.68274</td>
</tr>
<tr>
<td>13</td>
<td>1790.66228</td>
<td>1880.65755</td>
</tr>
<tr>
<td>14</td>
<td>1926.63709</td>
<td>2016.63236</td>
</tr>
<tr>
<td>15</td>
<td>2062.61190</td>
<td>2152.60717</td>
</tr>
<tr>
<td>16</td>
<td>2198.58671</td>
<td>2288.58198</td>
</tr>
<tr>
<td>17</td>
<td>2334.56152</td>
<td>2424.55679</td>
</tr>
<tr>
<td>18</td>
<td>2470.53633</td>
<td>2560.53160</td>
</tr>
<tr>
<td>19</td>
<td>2606.51114</td>
<td>2696.50640</td>
</tr>
<tr>
<td>20</td>
<td>2742.48594</td>
<td>2832.48121</td>
</tr>
<tr>
<td>21</td>
<td>2878.46075</td>
<td>2968.45602</td>
</tr>
<tr>
<td>22</td>
<td>3014.43556</td>
<td>3104.43083</td>
</tr>
<tr>
<td>23</td>
<td>3150.41037</td>
<td>3240.40564</td>
</tr>
<tr>
<td>24</td>
<td>3286.38518</td>
<td>3376.38045</td>
</tr>
</tbody>
</table>
2 Calibrant Delivery System and Divert Valve

To prepare tuning mix

Table 7 Elemental compositions and calculated masses of sodium trifluoroacetate ion clusters by electrospray ionization under positive-ion \( \left( [(\text{CF}_{3}\text{COONa})_n\text{Na}]^+ \right) \) and negative-ion \( \left( [(\text{CF}_{3}\text{COONa})_n\text{CF}_{3}\text{COO}]^- \right) \) modes (continued)

<table>
<thead>
<tr>
<th>n</th>
<th>Positive-ion calculated mass</th>
<th>Negative-ion calculated mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>3422.35999</td>
<td>3512.35526</td>
</tr>
<tr>
<td>26</td>
<td>3558.33480</td>
<td>3648.33007</td>
</tr>
<tr>
<td>27</td>
<td>3694.30961</td>
<td>3784.30487</td>
</tr>
<tr>
<td>28</td>
<td>3830.28441</td>
<td>3920.27968</td>
</tr>
<tr>
<td>29</td>
<td>3966.25922</td>
<td>4056.25449</td>
</tr>
</tbody>
</table>

*Peaks marked with asterisks were also observed under chemical ionization mode using a direct insertion probe.
To prepare the reference mass solution

This procedure applies to only the 6200 Series and 6500 Series LC/MS instrument.

The dilutions in this topic are used for installation and check-out. If needed, adjust the dilution for your own analysis.

**Tools needed**
- clean gloves
- 1000-mL narrow mouth bottle, included with the LC/MS instrument

**Parts needed**
- ES-TOF Reference Mass Kit, which contains two ampoules each (2.2 mL/ampoule) of the following reference ions:
  - 100 mM (millimolar) ammonium trifluoroacetate in 90:10 acetonitrile:water. This solution is abbreviated 100 mM TFANH4.
  - 5 mM (millimolar) purine in 90:10 acetonitrile:water
  - 2.5 mM (millimolar) hexakis(1H, 1H, 3H-tetrafluoropropoxy)phosphazine in 90:10 acetonitrile:water. This solution is abbreviated 2.5 mM HP-0921.
- Acetonitrile UV
- deionized (18 MW-cm) water

The reference solution provides internal reference masses for reference mass correction in positive and negative ion modes of operation. For the purposes of mass accuracy performance verification, make the following reference mass solution.

1. Put on protective clean gloves.
2. Using a graduated cylinder, pour 950 mL of Acetonitrile UV and 50 mL of deionized (18 MW-cm) water into the 1000-mL narrow mouth bottle.
3. Using a pipettor, add the following amounts of the individual calibrants to the 1000-mL narrow mouth bottle containing the Acetonitrile UV/deionized (18 MW-cm) water solution made in step 2.

<table>
<thead>
<tr>
<th>Calibrants</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFANH4</td>
<td>0.5 mL</td>
</tr>
<tr>
<td>Purine</td>
<td>1.0 mL</td>
</tr>
<tr>
<td>HP-0921</td>
<td>0.45 mL</td>
</tr>
</tbody>
</table>

6000 Series LC/MS Maintenance Guide
To prepare the reference mass solution

Before you break open each ampoule, invert the ampoule several times to mix. Inspect the ampoule's contents to ensure that all the solution is contained in the lower cylindrical base. Shake the ampoule, if needed, to dislodge any air pocket that can prevent solution from settling in the lower portion of the ampoule.

4 Cap and invert the bottle several times to thoroughly mix the reference mass solution.

5 Transfer 100 mL of this solution to CDS Reference Bottle “A”.

**Use of ES-TOF Reference Mass Solution**

Use these guidelines to adjust the amounts of IRM compounds to add to this preparation.

- IRM abundances less than 1000 counts generally do not yield acceptable ion statistics for good correction. Ideally, abundances will be at the level of 10,000 counts or greater at any point in the analysis where correction is desired.

- The abundances of the reference mass compounds change during an HPLC gradient, with lesser abundances occurring at higher organic compositions. This is especially true when using acetonitrile as the organic component. Make sure the abundances are high enough during the entire gradient.

<table>
<thead>
<tr>
<th></th>
<th>Dual ESI</th>
<th>Agilent Jet Stream ESI</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFANH4</td>
<td>0.5 mL</td>
<td></td>
</tr>
<tr>
<td>Purine</td>
<td>1.0 mL</td>
<td>0.4 mL</td>
</tr>
<tr>
<td>HP-0921</td>
<td>0.45 mL</td>
<td>1.0 mL</td>
</tr>
</tbody>
</table>
Interference at one of the reference masses can cause problem with mass accuracy, most likely the reference mass 121 m/z at the low end of the scan range, where the background response is the highest. This causes an error in determining that reference mass value, leading to an error in assignment of other mass peaks in that scan. Sometimes, the problem can be lessened by increasing the amount of that reference mass component. Sometimes a different compound can be chosen to serve as the reference mass compound (e.g., a phthalate response at 391.284286 m/z). More often, the problem is remedied by altering the sample cleanup procedures to remove the interfering component(s).

The values chosen for the reference mass correction depend on the adducts present during the analysis. Refer to the instruction sheet included with the internal reference mass kit for the accurate m/z values of the most common adducts.

For instruments with an Agilent Jet Stream source only: Higher sheath gas temperatures and sheath gas flows will increase the response of the 922 m/z reference mass compound.

The internal reference mass solution allows you to get accurate mass time-of-flight data. A minimum reference mass signal abundance of several thousand counts and maximum abundance of several hundred thousand counts will provide accurate reference mass corrections. If LC mobile phase modifiers are present (e.g. Na+, K+, acetate, formate), competition can cause multiple molecular species to attenuate the reference mass response. The actual concentrations of the mass reference compounds in the solution you prepare will depend upon several instrument operating parameters:

- LC gradient or isocratic operation
- LC flow rate, mobile phases and modifiers
- MS source settings including fragmentor and octopole RF voltages

The data acquisition mass range should be set wide enough to include all of the reference masses. For small molecule analysis, this range is typically m/z 50 to 1000 for positive mode and m/z 50 to 1100 for negative mode. Note that m/z 1034 is the TFA adduct of HP-0921.
### Table 10  ES-TOF Reference Masses (shaded cells indicate principal ions)

<table>
<thead>
<tr>
<th>Species</th>
<th>Positive Ion (m/z)</th>
<th>Negative Ion (m/z)</th>
<th>Formula Wt.</th>
<th>Molecular Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF3 (TFA fragment)</td>
<td>68.995758</td>
<td></td>
<td></td>
<td>C F3</td>
</tr>
<tr>
<td>TFA anion</td>
<td>112.985587</td>
<td>131.06</td>
<td></td>
<td>C2 O2 F3 (N H4)</td>
</tr>
<tr>
<td>Purine</td>
<td>121.050873</td>
<td>119.036320</td>
<td>120.11</td>
<td>C5 H4 N4</td>
</tr>
<tr>
<td>HP-0921</td>
<td>922.009798</td>
<td>1033.988109</td>
<td>921.24</td>
<td>C18 H18 O6 N3 P3 F24</td>
</tr>
<tr>
<td>HP-0921 (+ formate)</td>
<td></td>
<td>966.000725</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP-0921 (+ acetate)</td>
<td></td>
<td>980.016375</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## To check calibrant levels

<table>
<thead>
<tr>
<th>When needed</th>
<th>Monthly or weekly if you tune the instrument frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools needed</td>
<td>None</td>
</tr>
<tr>
<td>Parts needed</td>
<td>None</td>
</tr>
</tbody>
</table>

1. Examine each **calibrant bottle**. Enough tuning mix must be present to immerse the end of the intake tube.

![Calibrant bottle level](image.png)

**Figure 13** Calibrant bottle level

2. If the tuning mix level is within a few millimeters of the end of the intake tube, refill the **calibrant bottle**.

**NOTE**

Record this procedure in the Maintenance Logbook.

Make sure to use the correct calibrant for designated source.
To fill a calibrant bottle (6100 Series)

When needed As needed.

Tools needed None

Parts needed

<table>
<thead>
<tr>
<th>Source</th>
<th>Calibrant</th>
</tr>
</thead>
<tbody>
<tr>
<td>electrospray</td>
<td>ESI-L Tuning Mix</td>
</tr>
<tr>
<td>Agilent Jet Stream multimode</td>
<td></td>
</tr>
<tr>
<td>(6150 only)</td>
<td></td>
</tr>
<tr>
<td>ESI (6120, 6130)</td>
<td>ESI Tuning Mix</td>
</tr>
<tr>
<td>APPI</td>
<td></td>
</tr>
<tr>
<td>APCI (6120, 6130) multimode</td>
<td>APCI/APPI Calibrant</td>
</tr>
<tr>
<td>(6120, 6130)</td>
<td></td>
</tr>
<tr>
<td>APCI (6150 only)</td>
<td>APCI-TOF Tune Mix</td>
</tr>
</tbody>
</table>

1. Turn the calibrant bottle to be refilled clockwise until it can be removed from the fixed bottle cap.

2. Refill calibrant bottle with the appropriate tuning mix.

3. Put the intake tube into the refilled calibrant bottle as you lift the calibrant bottle into position.
CAUTION

Tighten the bottle by hand. The bottle only needs to be snug. Do not over-tighten the bottle, or you can cause the bottle cap to crack and leak. A leaky bottle cap can prevent the bottle from pressurizing and can lead to the evaporation of the contents.

4 Attach the **calibrant bottle** onto the fixed bottle cap. Turn the **calibrant bottle** counterclockwise to tighten.

5 Select **Flush Calibrant System** from the **Instrument** menu in the Tune view.

6 Wait until the flush is completed.

CAUTION

The tuning mixes are not interchangeable, even though they will give similar mass spectra. Failure to change the tuning mix when the source or inlet assembly is changed can result in miscalibration of the instrument and errors in mass assignments.

NOTE

Record this procedure in the Maintenance Logbook.
Calibrant Delivery System and Divert Valve

To fill a calibrant bottle (6200 Series, 6400 Series, and 6500 Series LC/MS)

When needed: As needed.

Tools needed: None

Parts needed:
- APCI/APPI Calibrant
- APCI-L Tuning Mix
- ESI-L Tuning Mix
- MMI-L Tuning Mix
- Reference Mix (created from ES-TOF Reference Mass Kit)

Instruments with an Agilent Jet Stream source use diluted ESI-L Tuning Mix. See “To prepare tuning mix” on page 30.

1. Turn the calibrant bottle to be refilled clockwise until it can be removed from the fixed bottle cap.
2. Refill the calibrant bottle with the appropriate tuning mix.
3. Put the intake tube into the refilled calibrant bottle as you lift the calibrant bottle into position.

**CAUTION**

Tighten the bottle by hand. The bottle only needs to be snug. Do not over-tighten the bottle, or you can cause the bottle cap to crack and leak. A leaky bottle cap can prevent the bottle from pressurizing and can lead to the evaporation of the contents.

4. Attach the calibrant bottle onto the fixed bottle cap. Turn the calibrant bottle counterclockwise to tighten.

**CAUTION**

The tuning mixes are not interchangeable, even though they will give similar mass spectra. Failure to change the tuning mix when the source or inlet assembly is changed can result in miscalibration of the instrument and errors in mass assignments.

**NOTE**

Record this procedure in the Maintenance Logbook.
To flush the calibrant delivery system

When needed
When symptoms indicate contamination in the calibrant delivery system (CDS). Especially when the contamination appears during tuning but not during data acquisition.

Tools needed
• LC/MS-grade acetonitrile
• LC/MS-grade water

Parts needed
None

1. Remove the calibrant bottle that is contaminated.
2. Install a calibrant bottle containing the 90%/10% solution of LC/MS-grade acetonitrile and LC/MS-grade water.
3. For the 6100 Series:
   a. In the ChemStation data acquisition program, select Flush calibrant system from the Instrument menu in the MSD tune view.
   b. Specify a flush time of 10 minutes and click OK.
   c. Wait while the calibrant delivery system pumps the mixture of acetonitrile and water through the system. After 10 minutes the calibrant delivery system stops pumping.
4. For the 6200 Series, 6400 Series and 6500 Series:
   a. In the MassHunter data acquisition program, in the Tune view, click the Manual Tune tab.
   b. Mark the Calibrant check box and click Apply.
   c. Wait while the calibrant delivery system pumps the mixture of acetonitrile and water through the system.
   d. After 10 minutes, clear the Calibrant check box and click Apply to stop the flow of calibrant.
5. Remove the calibrant bottle of acetonitrile and water.
6. Install a new calibrant bottle of calibrant depending on which source will be used.

CAUTION
Do not reinstall the old bottle of calibrant. The old calibrant can be the source of the contamination.
2 Calibrant Delivery System and Divert Valve
To flush the calibrant delivery system

7 Flush this channel of the **calibrant delivery system** for 5 minutes with the new calibrant.

**NOTE** Record this procedure in the Maintenance Logbook.
To check for leaks

When needed
When the sensor indicates a leak has occurred.

Tools needed
- T10 Torx screwdriver
- clean lint-free cloth

Parts needed
None

1. Remove the front cover and top cover from the instrument.
2. Remove the calibrant bottle or bottles.
3. Turn off the spray chamber nebulizer pressure, drying gas temp, and vaporizer temp (for APCI or multimode).
4. For 6200 Series and 6500 Series LC/MS instruments: Disconnect the nebulizer sample line and the sample nebulizer gas tubing from the nebulizer.

The spray chamber operates at very high temperatures. Do not continue until the spray chamber is cool.

5. Remove the spray chamber from the instrument.
6. Remove or loosen the two screws that attach the cover of the calibrant delivery system, and then remove the cover.
7. Check the catch tray. If you see liquid, the pump has a leak.
8. If a leak occurs during a long unattended run, the liquid from the leak can evaporate to give you the impression that no leak exists. Turn the system back on and make sure no leak exists.
9. If you find a leak, correct it and check the remaining locations.
10. Dry the catch tray and leak sensor with a clean lint-free cloth.
11. When the catch tray and leak sensor are thoroughly dry, reassemble the instrument.

NOTE
Record this procedure in the Maintenance Logbook.
To replace the inlet filter assembly

When needed  When back pressure is high on the LC pump or when the sensor indicates a leak has occurred.

Tools needed  • tweezers
  • 1/2-inch × 9/16-inch open-end wrench
  • 1/4-inch × 5/16-inch open-end wrench
  • T20 Torx screwdriver

Parts needed  • Universal Inlet Filter Replacement Kit, which includes:
  • inlet capillary adapter
  • inlet filter capillary

Use the capillary that is appropriate for your LC/MS model:
  • For 6100 Series: 01090-87611 (105 mm)
  • For LC/MS instruments with an ion funnel: G1316-87315 (130 mm)
  • For all other LC/MS instruments: G1315-87312 (150mm)

1  Stop the flow of LC solvent to the instrument.
2  For APCI or multimode: Turn off the spray chamber nebulizer pressure, drying gas temp, and vaporizer temp.
3  Remove the spray chamber.
4  Remove the front cover and top covers.
5  For 6200 Series, 6400 Series and 6500 Series: Remove the upper left front cover.

Figure 15  Inlet filter assembly for (from left) 6100 Series, 6200 Series, and 6400/6500 Series LC/MS.
6 Remove the **inlet filter assembly** (6100 Series):
   a  Loosen the front screw of the clamp and remove the clamp.
   b  Pull the **inlet filter assembly** backward out of the bracket.
   c  Disconnect the **nut** and **ferrule** end of the **inlet filter capillary** from the **SSV port**.

7 Remove the **inlet filter assembly** (6200 Series, 6400 Series, and 6500 Series):
   a  Remove the filter clip and the retaining screw at the top of the **inlet filter assembly**.
   b  Pull the **inlet filter assembly** out of the bracket.
   c  Disconnect the **nut** and **ferrule** end of the **inlet filter capillary** from the **SSV port**.

8 Install the new **inlet capillary adapter**:
   a  Insert the new **inlet capillary adapter** into the bracket. Attach the filter clip that holds the dummy inlet filter.
   b  Insert the union end of the new **inlet filter capillary** into the **inlet capillary adapter**. Make sure that the flat side faces towards the **M4 captive screw**.
   c  Use a **T20 Torx screwdriver** to tighten the **M4 captive screw**.
   d  Attach the ferruled end of the **inlet filter capillary** to the **SSV port**. Use a **1/4-inch × 5/16-inch open-end wrench** to tighten the fitting.

9 Reinstall all instrument covers, and the **spray chamber**.

**NOTE**

Record this procedure in the Maintenance Logbook.
To replace the MS selection valve rotor seal

When needed
Approximately annually or when no calibrant flow exists during tuning, or when the back pressure is high on the LC pump during acquisition.

Tools needed
• 9/64-inch hex key

Parts needed
• rotor seal

1. Stop the flow of LC solvent to the instrument.
2. Remove the front cover, top cover, and left side cover.
3. For the 6100 Series LC/MS: Remove the CDS cover.
4. Make a note of which port is plumbed to which tubing.
5. Remove the tubing connections from the six-port MS selection valve.
To replace the MS selection valve rotor seal

Use the 9/64-inch hex key to remove the three hex head screws from the stator face of the selection valve.

For 6100 Series, 6400 Series and 6500 Series LC/MS

For 6200 Series LC/MS

**Figure 16** Six-port MS selection valve.
To replace the MS selection valve rotor seal

7 Remove the rotor seal and replace it with a new one. Be sure to install it in the proper orientation.

Figure 17  CDS rotor seal in its proper orientation

8 Install the stator face assembly.
9 Reconnect the tubing to the selection valve.
10 Install the left side cover, top cover and front cover.

NOTE  Record this procedure in the Maintenance Logbook.
This chapter describes maintenance procedures for the components that make up the source.

**WARNING**
Always wear appropriate protection, including eye protection, lab coat, and gloves, when working with solvents and chemicals or when working with unassembled parts.
3 Sources

The sources covered in this chapter include:

- electrospray (ESI or Dual ESI)
- Agilent Jet Stream (AJS or Dual AJS)
- atmospheric pressure chemical ionization (APCI)
- multimode
- atmospheric pressure photoionization (APPI)
- HPLC-chip
Changing Ion Sources

This section describes the steps to change from one ion source to another. First follow the procedure to remove your current source. Then follow the procedure to install the new source.

To remove an electrospray or Agilent Jet Stream source

1  Put the instrument in standby mode.
   If the source is at operating temperature (for example 400°C), it can take 20 to 30 minutes to cool down to a safe temperature.
2  If needed, slide open the nebulizer cover.
3  Disconnect the nebulizer sample line and sample nebulizer gas tubing.
4  For the Dual ESI or the Dual AJS source: Disconnect the nebulizer reference mass line and reference nebulizer gas tubing.
5  For the Agilent Jet Stream source:
   • Disconnect the heater and high voltage cables.
   • Disconnect the sheath gas line at the connector and unplug it.
6  Open the spray chamber.

**WARNING** The spray chamber operates at very high temperatures. Do not continue until the spray chamber is cool.

7  For the Dual ESI or Dual AJS source: Plug the reference nebulizer gas outlet on the side of the instrument under the service panel.
8  Remove the spray chamber by lifting it along the axis of its hinges.
9  If you are changing to a different source type, replace the spray shield with one that is appropriate for the new source type.
3 Sources

To remove a multimode source

1. Put instrument in Standby mode.
2. Disconnect the electrical connectors to the multimode source.

**WARNING** The spray chamber operates at very high temperatures. Do not continue until the spray chamber is cool.

3. Disconnect the nebulizer sample line and sample nebulizer gas tubing from the nebulizer.
4. Open the spray chamber.
5. Remove the spray chamber by lifting it along the axis of its hinges.
6. If you are changing to a different source type, replace the spray shield with one that is appropriate for the new source type.

To remove an APCI or APPI source

1. Put instrument in Standby mode.
2. Disconnect the APCI or APPI heater cable.
3. For APCI source only, disconnect the APCI high voltage cable.

**WARNING** The spray chamber operates at very high temperatures. Do not continue until the spray chamber is cool.

4. Disconnect the nebulizer sample line and sample nebulizer gas tubing from the nebulizer.
5. Open the spray chamber.
6. Remove the spray chamber by lifting it along the axis of its hinges.
7. If you are changing to a different source type, replace the spray shield with one that is appropriate for the new source type.
To install an electrospray or Agilent Jet Stream source

1. Check that the standard capillary cap is installed.
2. Install the appropriate spray shield.
   - For ESI, install the ESI spray shield.
   - For Agilent Jet Stream, install the Agilent Jet Stream spray shield.
   Make sure the small hole is at the top (“12 o'clock position”). If needed, use a T10 Torx screwdriver to loosen the two screws in the end plate, and rotate the ESI spray shield clockwise until the hole is in the correct position. Gently tighten the Torx screws again.
3. Install the spray chamber.
4. Close the spray chamber.
5. For the Dual AJS source:
   - a. Remove the plug from the nebulizer reference mass line.
   - b. Connect the sheath gas tubing to the gas line.
   - c. Connect the electrical connections.
6. Connect the nebulizer sample line and sample nebulizer gas tubing to the analytical nebulizer.
7. For the Dual ESI and Dual AJS: Connect the nebulizer reference mass line and reference nebulizer gas tubing to the reference nebulizer.

**CAUTION**
Do not hit the tip of the nebulizer needle. The needle is not protected. If you damage the needle, system performance can be affected.

8. In the data acquisition program, update the method to specify the new source.
9. In the data acquisition program, turn on the LC/MS instrument.
10. While you wait for the source to reach its working temperature, continue to create the acquisition method, or load a previously stored method.
    If you load a method that was stored when using a different ion source, the instrument status turns red.
    When the source reaches its working temperature, you can use the instrument for analysis.
3 Sources
To install an electrospray or Agilent Jet Stream source

11 For the Agilent Jet Stream source: If needed, install the ESI-L Tuning Mix in the reference B port of the calibrant delivery system.

Figure 18 6230 with Agilent Jet Stream source (circled) attached. Note the open service panel on the left.
To install an APCI source

1. Install the ESI spray shield.
   Make sure the small hole is at the top (“12 o'clock position”). If needed, use a T10 Torx screwdriver to loosen the two screws in the end plate, and rotate the ESI spray shield clockwise until the hole is in the correct position. Gently tighten the Torx screws again.

2. Close the reference nebulizer gas tubing with a cap. A threaded plug is provided for this purpose.

3. Install the APCI spray chamber.

4. Close the spray chamber.

5. Connect the nebulizer sample line and sample nebulizer gas tubing to the nebulizer.

6. Connect the APCI heater cable and the APCI high voltage cable.

7. In the data acquisition program, update the method to specify the new source.

8. In the data acquisition program, turn on the LC/MS instrument.

9. While you wait for the source to reach its working temperature, continue to create the acquisition method, or load a previously stored method.
   If you load a method that was stored when using a different ion source, the instrument status turns red.
   When the source reaches its working temperature, you can use the instrument for analysis.

10. Let the source heat to its working temperature. Typically, about 15 minutes is needed.

11. Rinse a clean calibrant bottle with LC/MS-grade acetonitrile.
   The ship kit comes with a glass CDS bottle and glass CDS bottle cap.

12. Pour the APCI/APPI Calibrant into the calibrant bottle.

13. Attach the calibrant bottle back onto the calibrant delivery system.
To install an APPI source

1. Install the ESI spray shield.

2. Connect the SmartCard to the APPI external power supply assembly:
   - For 6100 Series: Connect the serial input end of the APPI serial cable (attached to the APPI power supply) to the RS-232 (D-SUB9) port on the SmartCard 3x (back side of the LC/MS instrument). Connect the serial output end of the APPI serial cable to the DSUB-9 extension cable.
   - For 6200 Series and 6500 Series: Connect the serial input end of the APPI serial cable (attached to the APPI power supply) to one end of the APPI USB to serial converter cable. Connect the other end of the APPI USB to serial converter cable to any USB port on the SmartCard 4 Plus (left side of the LC/MS instrument).
   - For 6400 Series: Connect the serial input end of the APPI serial cable to the RS-232 (D-SUB9) port on the SmartCard 4 (left side of the LC/MS instrument).

3. Rinse a clean calibrant bottle with LC/MS-grade acetonitrile.
   The ship kit comes with a glass CDS bottle and glass CDS bottle cap.

4. Pour the APCI/APPI Calibrant into the glass CDS bottle.

5. Attach the calibrant bottle back onto the calibrant delivery system.

6. Remove the currently installed source and install the APPI source onto the spray chamber mounts.

7. Connect the APPI vaporizer heater cable to its connector on the left side of the LC/MS instrument.

8. Connect the serial output end of the APPI serial cable (with DSUB-9 extension cable for 6100 Series) to the APPI source.

9. In the data acquisition program, update the method to specify the new source.

10. In the data acquisition program, turn on the LC/MS instrument.

11. While you wait for the source to reach its working temperature, continue to create the acquisition method, or load a previously stored method.
    If you load a method that was stored when using a different ion source, the instrument status turns red.
    When the source reaches its working temperature, you can use the instrument for analysis.
To install the HPLC-Chip/MS interface

- Refer to the *User Guide* for the interface.
Source Maintenance

To flush the nebulizer

**When needed**
Check the nebulizer weekly. If needed, flush traces of samples and buffers out of the tubing, valves and nebulizer.

**Parts needed**
- LC/MS-grade acetonitrile
- HPLC Flushing Solvent
- LC/MS-grade cyclohexane
- LC/MS-grade isoctane (optional)

1. On a weekly basis, inspect the nebulizer. See “To inspect, adjust, or replace the nebulizer needle (G1960-67470)” on page 70 or “To inspect the nebulizer” on page 70. If the nebulizer needs to be flushed, continue with this procedure.

2. Make sure HPLC Flushing Solvent, LC/MS-grade cyclohexane (or LC/MS-grade isoctane), and LC/MS-grade acetonitrile are three of the solvents installed in your liquid chromatograph.

3. Pump HPLC Flushing Solvent for 10 minutes at 5 mL/minute.

4. Change to LC/MS-grade cyclohexane, and pump for 10 minutes at 5 mL/minute.

5. Pump this mixture through the nebulizer for 3 minutes.

6. Prepare enough LC/MS-grade acetonitrile and flush overnight.

**NOTE**
This mixture is good for general-purpose flushing. If needed, adjust it based on the solvents, samples and buffers that you are using. A mixture of 50% LC/MS-grade acetonitrile and 50% LC/MS-grade water works well to remove salts.

**NOTE**
Record this procedure in the Maintenance Logbook.
To clean the spray chamber daily

**When needed**  
Daily or at the end of each shift or anytime you suspect carryover contamination from one sample or analysis to another.

**Tools needed**  
- clean gloves  
- clean lint-free cloth  
- LC/MS-grade isopropanol  
- clean wash bottle  
- LC/MS-grade water  
- 4000 grit abrasive paper  
- current mobile phase

**Parts needed**  
None

**NOTE**  
Recent residue is soluble in the mobile phase. If you are not sure what mobile phase was used recently, a mixture of 50% LC/MS-grade isopropanol and 50% LC/MS-grade water works well as a general cleaning solution.

1. Put on clean gloves.
2. In a clean wash bottle, prepare the current mobile phase that you last used with the instrument. You can also use a mixture of LC/MS-grade isopropanol and LC/MS-grade water.

**WARNING**  
Some mobile phases are dangerous. Use the degree of caution appropriate for the mobile phase being used.

3. Turn off the spray chamber.

**WARNING**  
The spray chamber operates at very high temperatures. Do not continue until the spray chamber is cool.
3 Sources
To clean the spray chamber daily

4 Remove nebulizers and other attachments:
   a Remove the electrospray, APCI, or APPI nebulizer. See “To remove the nebulizer” on page 69.
   b For Dual ESI or Dual AJS: Remove the reference nebulizer.
   c For multimode or APCI: Remove the APCI corona needle. When the APCI corona needle is cooled, carefully clean the needle with 4000 grit abrasive paper.
   d For the multimode: Remove the cosmetic cover. Remove the thermocouple probe if you need to wipe the spray chamber. Otherwise, leave the thermocouple probe intact.

5 Open the spray chamber (Figure 19 and Figure 20).

Figure 19  Opened ESI spray chamber for 6100 Series (left), 6200 Series (center) and 6400/6500 Series LC/MS.

Figure 20  Opened AJS spray chamber for 6100 Series (left), 6400 Series (center) and 6500 Series (right) LC/MS.
6 Clean the interior of the spray chamber:
   a  Rinse the interior of the spray chamber with the current mobile phase or with a mixture of LC/MS-grade isopropanol and LC/MS-grade water.
   b  Wipe the interior of the spray chamber with a clean lint-free cloth.
   c  For APCI, multimode, or APPI: Wipe the end of the vaporizer with a clean lint-free cloth.

7 Clean the spray shield and surrounding area:
   a  Rinse the area around the spray shield.
   b  Dampen a clean lint-free cloth with the current mobile phase.
   c  Wipe the spray shield and the area around the spray shield.

8 Reinstall nebulizers and all other attachments:
   a  Install all nebulizers that were removed. See “To install the nebulizer” on page 79.
   b  For the APCI and multimode source: Install the APCI corona needle.
   c  For the multimode source: Install the cosmetic cover. Install the thermocouple probe and adjust it so that it protrudes 15 mm from the inner spray chamber wall.

9 Close the spray chamber.

**WARNING** Sharp edges can be found inside the spray chamber, such as the edge on the separator. Use caution when wiping the interior of the spray chamber.

**CAUTION** Do not spray the mobile phase directly toward the tip of the capillary. This can cause pressure surges in the vacuum system.

**CAUTION** Do not spray the mobile phase upward into the vaporizer. If the vaporizer is still hot, the mobile phase can cause the ceramic parts to shatter. Organic solvents can also catch fire.
3 Sources
To clean the spray chamber daily

NOTE Use the weekly cleaning procedure if symptoms of contamination persist or if the spray shield or capillary cap show significant discoloration that cannot be removed by the regular, daily cleaning.
To clean the spray chamber weekly

**When needed**  Weekly or whenever symptoms indicate that contamination exists in the spray chamber and normal daily cleaning does not correct the problem.

**Tools needed**

- clean gloves
- clean lint-free cloth
- LC/MS-grade isopropanol
- clean wash bottle
- LC/MS-grade water
- cotton swab
- 4000 grit abrasive paper
- current mobile phase

**Parts needed**  None

1. Prepare the **spray chamber** for cleaning.
   
   Do step 1 through step 4 in “To clean the spray chamber daily” on page 61.

2. For electrospRAY and Agilent JET STREAM sources: Clean the interior of the spray chamber:
   
   a. Open the **spray chamber** and remove it from the instrument.
   
   b. Fill the **spray chamber** with clean current mobile phase, or with a mixture of LC/MS-grade isopropanol and LC/MS-grade water.
To clean the spray chamber weekly

3 Sources

For APCI, multimode, and APCI: Clean the spray chamber as you do daily.
Do step 5 and step 6 in “To clean the spray chamber daily” on page 61.
4 Clean the **capillary cap**:
   a Remove the **spray shield**.
   b Use 4000 grit abrasive paper to gently clean the end of the **capillary cap**.
   c Dampen a **clean lint-free cloth** and wipe the end of the **capillary cap**.
   d Reinstall the **spray shield**.

![Figure 23](image)

*Figure 23* End of capillary cap (circled) for 6100 Series (left), 6200 Series (center) and 6400/6500 Series LC/MS.

5 Clean the **spray shield** and surrounding area:
   a Use abrasive paper to gently clean the **spray shield**.
   b Dampen a **clean lint-free cloth** and wipe the **spray shield**.
   c Rinse the area around the **spray shield**.
   d Wipe the area around the **spray shield**.
3 Sources
To clean the spray chamber weekly

Figure 24 Rinsing the area around the spray shield for 6100 Series (left), 6200 Series (center) and 6400/6500 Series LC/MS

CAUTION Do not spray the mobile phase directly toward the tip of the capillary. This can cause pressure surges in the vacuum system.

6 Reinstall nebulizers and all other attachments:
   a Install all nebulizers that were removed. See “To install the nebulizer” on page 79.
   b For the APCI and multimode source: Install the APCI corona needle.
   c For the multimode source: Install the cosmetic cover. Install the thermocouple probe and adjust it so that it protrudes 15 mm from the inner spray chamber wall.

7 Close the spray chamber.

Refer to the Multimode Source Maintenance Guide to clean the multimode charging electrode assembly.

NOTE Record this procedure in the Maintenance Logbook.
To remove the nebulizer

When needed  When you need to access the nebulizer for maintenance.
Tools needed  clean gloves
Parts needed  None

NOTE  Recent residue is soluble in the mobile phase. If you are not sure what mobile phase was used recently, a mixture of 50% LC/MS-grade isopropanol and 50% LC/MS-grade water works well as a general cleaning solution.

Figure 25  ESI nebulizer (left) and APCI nebulizer

1  Put on clean gloves.
2  Shut off the flow of LC solvent.
3  Shut off the flow of nebulizing gas.
4  Slide back the plastic cover from over the nebulizer.
5  Disconnect the nebulizer sample line and sample nebulizer gas tubing from the nebulizer.
6  Turn the nebulizer counterclockwise until it disengages from the retaining screws.

WARNING  The tip of the nebulizer can be very hot. Do not touch the nebulizer until it is cool.

7  Gently lift the nebulizer out of the spray chamber.
To inspect the nebulizer

Do this procedure if you have the G1960-67470 Nebulizer Adjustment Kit.

**WARNING** Wear safety glasses when you focus the magnifier. The magnifier can cause injury to your eye if the magnifier slips while you pull it out of the holder.

1. Insert the nebulizer into the Nebulizer Adjustment Fixture:
   a. Carefully insert the tip of the nebulizer into the end of the Nebulizer Adjustment Fixture.
   b. Slide the heads of the two spring loaded socket head cap screws through the mounting holes on the body of the nebulizer.
   c. Turn the nebulizer body 1/8 turn counter-clockwise.

   If the nebulizer is too tight or too loose, loosen or tighten the nut on the captured screws to adjust the tension on the spring.

2. To inspect the end of the nebulizer for poor needle centering, plugged needles, or nozzle damage (Figure 26):
   a. Gently push the 40× Magnifier into the end horizontal position of the Nebulizer Adjustment Fixture. The focal length approximately corresponds to the end of the magnifier.
   b. Push the LED Flashlight into the Nebulizer Adjustment Fixture. No tool is needed.

   For ES or ESI nebulizers, use Vertical #2 Position.
   For APCI nebulizers, use Vertical #1 Position.
To inspect the side of the nebulizer for the correct needle adjustment length, damaged needle, or corroded nozzle (Figure 27):

a Gently push the LED Flashlight into the end horizontal position of the Nebulizer Adjustment Fixture.

b Push the 40× Magnifier into the Nebulizer Adjustment Fixture. No tool is needed. The focal length approximately corresponds to the end of the magnifier.

For ES or ESI nebulizers, use Vertical #2 Position.
For APCI nebulizers, use Vertical #1 Position.
3 Sources
To inspect the nebulizer

4 Turn on the LED Flashlight. The on/off switch is at the end of the flashlight.

CAUTION Do not hit or touch the end of the nebulizer or you can damage the needle.

5 Gently slide and rotate the 40× Magnifier into or out of the Nebulizer Adjustment Fixture to focus the magnifier on the end of the nebulizer nozzle and needle. For the APCI nebulizer, if needed, remove the pocket clip to focus properly. See Table 12 for correct needle position.

If the needle is not in the correct position or shows signs of wear or damage, continue to “To adjust or replace the nebulizer needle” on page 73.
To adjust or replace the nebulizer needle

**WARNING** Wear safety glasses when you focus the magnifier. The magnifier can cause injury to your eye if the magnifier slips while you pull it out of the holder.

**When needed**
- When the needle is plugged. Common symptoms of a plugged needle are:
  - increased LC back pressure
  - off-axis spraying
  - dripping from the nebulizer
  - reference nebulizer needle is not spraying.
- When the needle appears to be corroded or damaged. See Figure 28.

**Figure 28** Corroded needle in nebulizer

**Tools needed**
- Nebulizer Adjustment Fixture
- clean gloves
- pliers or wrench, depending on nebulizer holder
  - long-nose pliers (p/n 7810-0004)
  - 3-mm open-end wrench (p/n 8710-2699)
3 **Sources**

To adjust or replace the nebulizer needle

- wrench or driver, depending on nebulizer style:
  - ¼-inch x 5/16-inch open-end wrench (p/n 8710-0510)
  - T6 Torx driver (p/n 8710-2548)
  - 1.5-mm ball driver (p/n 8710-1570)

**Parts needed** nebulizer needle kit. See Table 11. Each kit contains:

- needle
- ferrule
- needle holder

**Table 11** Needle replacement kits

<table>
<thead>
<tr>
<th>Nebulizer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESI Nebulizer Replacement Kit used with ES Nebulizer</td>
<td>G1958-60137</td>
</tr>
<tr>
<td>ESI Nebulizer Accessory Ship Kit used with ESI Nebulizer</td>
<td>G1946-68703</td>
</tr>
<tr>
<td>APCI Nebulizer Accessory Ship Kit used with Tested APCI Nebulizer Assembly</td>
<td>G1946-68704</td>
</tr>
</tbody>
</table>

1 Put on **clean gloves**.

2 Determine the nebulizer holder type from **Figure 29**.
To adjust or replace the nebulizer needle

3 Install the nebulizer in the Nebulizer Adjustment Fixture.
4 Loosen the locknut next to the zero-dead-volume (ZDV) union.
5 Remove the union from the nebulizer needle holder.
6 Loosen the fastener (locknut, 1.5-mm hex screw, or T6 Torx screw) that secures the needle holder in place.
7 If you need to replace the needle:
   a Loosen the **needle holder** and pull it out of the nebulizer body. Dispose of the used needle properly.
   b Rinse the inside of the nebulizer body with water and an organic solvent (methanol is preferred) to remove any contamination inside the nebulizer body.
   c Thread the new **needle holder** into the nebulizer body.
   d While holding the adjustment fixture in a vertical position, install the new **ferrule** in the needle holder. The wider end goes into the **needle holder**.
   e Carefully remove the new **needle** from the shipping tube and adhesive strip. Identify the sharp end of the needle.

![Figure 30](image) Blunt end of nebulizer needle

![Figure 31](image) Sharp end of nebulizer needle (zoomed)

**CAUTION**

Do not bend the needle as you slide it into the ferrule. The needle is fragile. A bent needle results in poor alignment with the nebulizer body.

   f Carefully slide the sharp end of the **needle** through the **ferrule** until 1 cm of the **needle** remains at the ferrule.
   g Push the **needle** into the **ferrule** until the needle is slightly visible flush with the ferrule.
If the needle is pushed in too far, when the union is installed and the ferrule is compressed, the HPLC flow is restricted or blocked, which results in poor or no spray from the nebulizer.

Reinstall the locknut and the union. Hand-tighten the union.

Hold the needle holder steady with a 3-mm open-end wrench or ¼-inch x 5/16-inch open-end wrench, depending on your nebulizer holder style.

Tighten the union one-half to three quarters of a turn, or until an audible squeak is heard.

The ferrule is now compressed.

Use a ¼-inch x 5/16-inch open-end wrench to adjust the top of the needle to the proper distance from the end of the nozzle. See Table 12.

Tighten the lock nut and verify adjustment while you view the nebulizer tip through the magnifier.

See Figure 32 and Figure 33 for images of correctly adjusted nebulizer needles.

Table 12  Recommended Needle adjustment Distance

<table>
<thead>
<tr>
<th>Nebulizer</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microflow Nebulizer Assembly</td>
<td>0.003 inch</td>
</tr>
<tr>
<td>ES Tested Nebulizer</td>
<td>0.000 (flush)</td>
</tr>
<tr>
<td>Tested ESI Nebulizer Assembly</td>
<td>0.003 inch</td>
</tr>
<tr>
<td>Tested APCI Nebulizer Assembly</td>
<td>0.000 (flush)</td>
</tr>
</tbody>
</table>
3 Sources
To adjust or replace the nebulizer needle

**Figure 32** Side view of a correctly adjusted Tested ESI Nebulizer, with 0.003-inch distance marked.

**Figure 33** Example of a centered needle.

**NOTE** Record this procedure in the Maintenance Logbook.
To install the nebulizer

When needed: As needed.
Tools needed: None
Parts needed: None

1. Insert the nebulizer part way into the spray chamber.

**CAUTION**
Do not hit the tip of the needle as you insert the nebulizer. The tip of the needle is easily damaged.

2. Connect the sample nebulizer gas tubing to the nebulizer.
3. Finish inserting the nebulizer into the spray chamber.
4. Turn the nebulizer clockwise and lock it in place.
5. Connect the sample nebulizer gas tubing to the nebulizer.

**CAUTION**
Do not over-tighten the LC fitting. An over-tightened fitting can crush the tubing, which creates a restriction.

**NOTE**
Record this procedure in the Maintenance Logbook.
To clean the corona needle

Do these steps for the APCI or multimode source. If system performance is not restored, replace the corona needle.

**When needed**
When you observe decrease sensitivity, decreased signal stability, and increase corona voltage during APCI operation.

**Tools needed**
- 4000 grit abrasive paper
- clean lint-free cloth
- clean gloves
- LC/MS-grade isopropanol

**Parts needed**
None

1. Put on clean gloves.

**WARNING**
The needle and related parts can be very hot. Do not touch the needle or related parts until they are cool.

2. Pull the **corona needle** assembly out of the **spray chamber**.

3. Fold a piece of **4000 grit abrasive paper** over the base of the needle.

4. Pull and twist the **4000 grit abrasive paper** along the needle and off the tip of the needle.
To clean the corona needle

5 Repeat step 3 and step 4 several times, or until the needle looks clean and shiny.

6 Starting at the base of the needle, wipe the needle with a clean lint-free cloth. The cloth can be dry or dampened with LC/MS-grade isopropanol.

7 Reinstall the corona needle assembly in the spray chamber.

CAUTION

Do not bend or blunt the tip of the needle, or it will decrease system performance. Sharpening the needle is not needed.

CAUTION

Do not hit tip of the corona needle. The tip can bend, which can decrease system performance.

NOTE

Record this procedure in the Maintenance Logbook.
3 Sources
To replace the corona needle

To replace the corona needle

If this procedure fails to restore system performance, replace the corona needle.

CAUTION

Do not hit tip of the corona needle. The tip can bend, which can decrease system performance.

When needed

When symptoms indicate poor corona needle performance and cleaning the needle does not restore performance.

Tools needed

• clean gloves

Parts needed

• corona needle

1 Put on clean gloves.

WARNING

The needle and related parts can be very hot. Do not touch the needle or related parts until they are cool.

2 Pull the corona needle assembly out of the spray chamber.
3 Remove the needle collar from the corona needle shaft.

Figure 37 Twist the corona needle to remove it from the shaft.

4 Remove the old corona needle from the collar.
5  Install a new corona needle, with its integral ferrule, in the collar.

Figure 38  Installing a new needle into the collar

6  Turn the collar onto the needle holder and tighten by hand.
7  Reinstall the corona needle assembly in the spray chamber.

CAUTION  Do not hit tip of the corona needle. The tip can bend, which can decrease system performance.

NOTE  Record this procedure in the Maintenance Logbook.
To change HPLC-Chip capillaries

**When needed**
When broken, blocked or kinked

**Tools needed**
- cube wrench
- 3-mm hex key

**Parts needed**
- Fused silica/PEEK capillary

1. Unload the HPLC-Chip.

**WARNING**
Do this procedure only if the HPLC-Chip/MS Interface is mounted to the LC/MS or sits flat on a table. The center of gravity shifts during the procedure, and the instrument will tip over without adequate support.

2. Press the cover release button once. When the lock opens, pull the front panel down.

3. Unlock the stages assembly and flip it out.

4. Remove the capillary cover (A) and open the thumb screw of the strain relief (B). See Figure 40.

---

**Figure 40**
Stages assembly
5  Loosen the slotted PEEK fitting using the cube wrench and pull the capillary out. See Figure 41.

![Figure 41  Slotted PEEK fitting](image)

6  Push the new Fused silica/PEEK capillary through the capillary guide until the stopper is flush with the end of the guide tube. Tighten the thumb screw firmly.

The strain relief will only function properly if all 4 capillaries are in place.

![Figure 42  New capillary in the capillary guide](image)
3 Sources
To change HPLC-Chip capillaries

7 Connect the capillaries as follows to the HPLC-Chip valve stator:
   For forward-flush mode (default)
   - port 1 - not used
   - port 2 - 15 μm (orange) to nanopump
   - port 3 - 75 μm (blue) to infusion pump
   - port 4 - not used
   - port 5 - 100 μm (black) to waste
   - port 6 - 25 μm (yellow) to port 6 of the μ-WPS

   For backflush mode
   - port 1 - not used
   - port 2 - 15 μm (orange) to nanopump
   - port 3 - 75 μm (blue) to infusion pump
   - port 4 - not used
   - port 5 - 25 μm (yellow) to port 6 of the μ-WPS
   - port 6 - 100 μm (black) to waste

8 Route the capillaries exactly as shown in Figure 43.

Figure 43  Routing capillaries
Do not over-tighten the cover screws when you reinstall the capillary cover. You can strip the threads in the screw holes.

9  Reinstall the capillary cover.

Figure 44

10 Flip the stages assembly up and close the front panel.

NOTE

Record this procedure in the Maintenance Logbook.
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4
Ion Transfer Capillary

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To clean the capillary  92
To install the capillary  94

This chapter describes the procedures to remove, clean and reinstall the ion transfer capillary. These procedures apply to both single- and multi-bore capillaries.

WARNING Always wear appropriate protection, including eye protection, lab coat, and gloves, when working with solvents and chemicals or when working with unassembled parts.
To remove the capillary

When needed
When you need to clean or replace the capillary.

Tools needed
clean gloves

Parts needed
None

1 Vent the system.
2 Put on clean gloves.
3 Unplug the instrument power cord from the power outlet after venting is complete.

WARNING
Some instruments use two external power cords to provide input power. Make sure you unplug the input power cord for the main power supply and the input power cord for the pump expander box (into which the two rough pumps are plugged) before you continue.

4 Open the spray chamber.

WARNING
The spray chamber operates at very high temperatures. Do not continue until the spray chamber is cool.

5 Remove the spray shield.
6 Remove the capillary cap from the end of the capillary.
7 Carefully pull the capillary out of the desolvation assembly.

CAUTION
Carefully pull the capillary out along its long axis. The capillary is glass or of similar material, and you can break it by putting vertical or horizontal pressure on it.
To remove the capillary

![Image: Pulling the capillary out of the desolvation assembly]

**Figure 45** Pulling the capillary out of the desolvation assembly
To clean the capillary

When needed
When you observe decreased sensitivity and decreased signal stability

Tools needed
- clean gloves
- Alconox Powdered Precision Cleaner
- deionized (18 MW-cm) water
- LC/MS-grade isopropanol
- graduated cylinder
  - 100-mL polypropylene graduated cylinder for single-bore capillaries
  - 10-mL polypropylene graduated cylinder for multi-bore capillaries, or
  - glass graduated cylinder and two 1 mL pipette tip

Parts needed
Alconox Powdered Precision Cleaner

1. Put on clean gloves.
2. Dissolve 1 gram of Alconox Powdered Precision Cleaner in 100 mL of deionized (18 MW-cm) water.
   This concentration is the recommended concentration for “manual or ultrasonic cleaning”.
3. Place the ion transport capillary upright in a the graduated cylinder and fill with Alconox Powdered Precision Cleaner solution.
4. Sonicate the graduated cylinder that contains the ion transport capillary in an ultrasonic cleaner for 10 to 15 minutes.
If you use a glass graduated cylinder, cover the end of the ion transport capillary with a 1-mL pipette tip to protect the metalized plating. Trim the pipette tip to approximately 4 cm so that the capillary can be immersed in the cleaning solution.

To maintain proper cleanliness, handle the ion transport capillaries with clean gloves.

5 Rinse the ion transport capillary and graduated cylinder several times with deionized (18 MW-cm) water.

6 Fill the graduated cylinder with deionized (18 MW-cm) water and sonicate the graduated cylinder that contains the ion transport capillary for 10 to 15 minutes.

7 Remove the ion transport capillary from the graduated cylinder and remove the pipette tip (if one was used).

8 Blow out excess water from the ion transport capillary bore using an air sprayer or oil-free pressurized gas.

Note

Record this procedure in the Maintenance Logbook.
To install the capillary

When needed  After cleaning the capillary or when installing a new capillary.

Tools needed  clean gloves

Parts needed  LC/MS-grade isopropanol

1  Lubricate the capillary entrance end with LC/MS-grade isopropanol.

2  Carefully insert the capillary straight into the desolvation assembly. Support the front and rear of the capillary and keep it level during installation.

Unlike the single bore capillary, the hexabore capillary has an orientation and can be inserted in one way only.

The capillary must be aligned correctly so that its end fits into a fixed capillary cap inside the desolvation assembly.

When 2 to 3 cm of the capillary remains extended from the desolvation assembly, the capillary “holds up” on the rear contact spring.

3  Continue to apply pressure until approximately 1 cm remains extended from the desolvation assembly.

\[
\text{Figure 46  Reinstalling the capillary}
\]

\text{CAUTION}

Do not put vertical or horizontal pressure on the capillary, or the capillary can break.
4 Lubricate the capillary tip with LC/MS-grade isopropanol.

**CAUTION**
Do not twist or turn the capillary cap when you install it or you can damage the metal plating.

5 Install the **capillary cap** over the outer end of the capillary.

6 Install the **spray shield**. Turn the **spray shield** clockwise to install.
   If you are installing the standard **spray shield**, make sure that the small hole is at the 12 o’clock (vertical) position.

7 Close the **spray chamber**.

8 Pump down the instrument.

**NOTE**
If a new capillary was installed, record this procedure in the Maintenance Logbook.
This page intentionally left blank.
With time and with heavy usage, the high pressure ion funnel needs to be cleaned to maintain its performance on the LC/MS instrument.

Do the procedures in this chapter if your LC/MS instrument includes a high pressure ion funnel.

**WARNING**

Always wear appropriate protection, including eye protection, lab coat, and gloves, when working with solvents and chemicals or when working with unassembled parts.
5 High Pressure Ion Funnel
To remove the high pressure ion funnel

To remove the high pressure ion funnel

Do these steps for instruments that include a high pressure ion funnel.

Tools Needed
- long-nose pliers
- T20 Torx screwdriver

1 Vent the LC/MS and unplug the system.
2 Let the source cool down, and then remove it.
3 Use a T20 Torx screwdriver to remove the two M4 screws that hold down the desolvation assembly, and then remove the assembly.
4 Disconnect the five internal wires from the feed-throughs. Use a long-nose pliers. See Figure 47.
   Connectors are fragile. Please be gentle when you remove these wires.

   Figure 47 Five internal wires from the feed-through.

5 Loosen the two captive screws that secure the ion funnel to the housing.
   See Figure 48.
   The screws are captive, so they will not come all the way out.
6 Remove the high pressure ion funnel from the housing. (You can grab onto the heat sinks and pull the funnel out of the housing.)

![Image of high pressure ion funnel]

**Figure 48** Loosening captive screw on the high pressure ion funnel.
To clean the high pressure ion funnel

**Tools Needed**
- 2000-mL clean beaker
- LC/MS-grade isopropanol
- clean gloves

**WARNING**
This cleaning procedure requires the use of a sonicator and isopropanol. You must clean the high pressure ion funnel in an approved fume hood with proper airflow (lift), or you can experience a flash fire or explosion. The front window sash must be in the closed position (down). All other electrical heating appliances such as hot plates must be turned off.

**WARNING**
Wear chemical-resistant gloves and safety glasses (goggles) for your safety.

1. Put on clean gloves.
2. Put the ion funnel on the table and on top of a clean lint-free cloth. See Figure 49.

**Figure 49**
High pressure ion funnel on top of a clean cloth.
To clean the high pressure ion funnel

3 Slowly put the ion funnel in a glass beaker. See Figure 50.

![Image of ion funnel in a glass beaker]

**Figure 50** High pressure ion funnel in a glass beaker.

4 Slowly pour water into the beaker until the solvent covers the ion funnel completely. Sonicate the ion funnel for 5 minutes to remove any built up salts or water soluble residue.

5 Pour the water out of the beaker and into an appropriate waste container.
5 High Pressure Ion Funnel
To clean the high pressure ion funnel

6 Slowly pour LC/MS-grade isopropanol into the beaker until the solvent covers the ion funnel completely.

Figure 51 Pouring isopropanol into the glass beaker.

7 Sonicate the assembly in a beaker of LC/MS-grade isopropanol for 15 minutes.
8 Pour the LC/MS-grade isopropanol out of the beaker and into an appropriate waste container.
9 Remove the high pressure ion funnel from beaker and allow the LC/MS-grade isopropanol to drain off the entire assembly.
10 Put the ion funnel into the beaker. Slowly pour LC/MS-grade methanol into the beaker until the solvent covers the ion funnel completely. Sonicate the ion funnel for 5 minutes.
11 Use clean compressed nitrogen to blow out the remaining LC/MS-grade methanol from between the funnel plates.

NOTE Record this procedure in the Maintenance Logbook.
To install the high pressure ion funnel

**Parts Needed**
- long-nose pliers
- T20 Torx screwdriver

1. Install the **ion funnel** into the housing and secure with the two captive screws.

2. Connect the five internal wires to the feed throughs:
   - Connect the two orange wires to the top connectors.
   - Connect the black wire to the bottom-rear connector.
   - Connect the red wire to the front-rear connector.
   - Connect the white wire to the bottom-most connector.
   - See Figure 52.

3. Install the **desolvation assembly** with two M4 captive screws.

4. Install the **AJS source**.

5. Pump down the instrument.
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6 Desolvation Assembly and Vacuum Manifold

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This chapter describes the steps to maintain the assemblies that are inside of the vacuum manifold. For most procedures, the desolvation assembly needs to be removed to get to the vacuum manifold.

WARNING Always wear appropriate protection, including eye protection, lab coat, and gloves, when working with solvents and chemicals or when working with unassembled parts.
Desolvation Assembly

To remove the desolvation assembly

**CAUTION** Use care when you do this procedure. Damages that you cause during maintenance are not covered under warranty. If you need assistance, contact Agilent.

<table>
<thead>
<tr>
<th>When needed</th>
<th>When you need to access the ion optics assembly.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools needed</td>
<td>1/2-inch × 9/16-inch open-end wrench</td>
</tr>
<tr>
<td></td>
<td>T20 Torx screwdriver</td>
</tr>
<tr>
<td>Parts needed</td>
<td>None</td>
</tr>
</tbody>
</table>

1 Vent the system.
2 Turn off the power.
3 Unplug the instrument **power cord** from the power outlet after venting is complete.
4 Remove the **front cover** and **top cover**.
5 For the **6200 Series, 6400 Series and 6500 Series**: Also remove the **left side cover**.

**WARNING**

The spray chamber operates at very high temperatures. Do not continue until the spray chamber is cool.

The desolvation assembly operates at very high temperatures. Do not continue until the desolvation assembly is cool.

6 Remove the source. Put the storage cover on the source and set it aside.
7 Disconnect all cables and tubings:
   a Disconnect the connections to the auxiliary module on top of the vacuum manifold.
   b Disconnect the drying gas tubing from the desolvation assembly.
   c Disconnect the drying gas heater cable from the desolvation assembly.
   d Disconnect the drain hose from the desolvation assembly.
   e For the 6500 Series LC/MS instrument: Disconnect the PEEK nut on the tubing from the calibrant delivery system to the desolvation assembly.
   f Disconnect the spray chamber high voltage cable from the desolvation assembly.
   g Remove thumb screw from the front of the auxiliary module.
   h For the 6200 Series: Loosen the two T10 Torx screw at the bottom of the APCI power supply bracket. Do not remove the screws. Lift the auxiliary module up and off the manifold cover.

8 Fully loosen the captured retaining screw at the top of the desolvation assembly.

9 Remove the two T20 Torx screw that keep the desolvation assembly attached to the support rods.

Figure 53 Removing the desolvation assembly. Remove the screws that are circled in the figure.
To remove the desolvation assembly

Slide the desolvation assembly off of the support rods. Be careful not to drop the O-ring on the desolvation assembly.

Figure 54  Remove retaining screws from desolvation assembly.

Figure 55  Remove retaining screws from desolvation assembly (with IRM)

NOTE  Slide the desolvation assembly off of the support rods. Be careful not to drop the O-ring on the desolvation assembly.

The capillary is contained in the desolvation assembly. It does not need to be removed when you remove the desolvation assembly.
To install the desolvation assembly

**CAUTION** Use care when you do this procedure. Damages that you cause during maintenance are not covered under warranty. If you need assistance, contact Agilent.

When needed As needed.
Tools needed • 1/2-inch × 9/16-inch open-end wrench
Parts needed None

1. Put the desolvation assembly on the support rods and slide it back until it seals against the vacuum manifold.
2. Install the two retaining screws.
3. Reconnect the drain hose to the desolvation assembly.
4. Reconnect the drying gas heater cable to the desolvation assembly.
5. Reconnect the sample nebulizer gas tubing to the desolvation assembly.
6. Reinstall the auxiliary module on top of the vacuum manifold.
7. Fully tighten the captured retaining screw at the top of the desolvation assembly.
8. Reconnect the connections to the auxiliary module.
Vacuum Manifold Cover

Before you can maintain the components in the vacuum manifold, you will need to remove the manifold cover.

To open the vacuum manifold

When needed       As needed for maintenance.
Tools needed      • anti-static wrist strap
Parts needed      None

1 Vent the system.
2 Unplug the instrument power cord from the power outlet after venting is complete.

WARNING Some instruments use two external power cords to provide input power. Make sure you unplug the input power cord for the main power supply and the input power cord for the pump expander box (into which the two rough pumps are plugged) before you continue.

3 Remove the front cover from the instrument.
4 Remove the top cover from the instrument.
5 Put on an anti-static wrist strap. Attach the anti-static wrist strap to a grounded surface such as the back panel of the instrument.
6 For the 6200 Series and 6500 Series: Remove the left side cover.

CAUTION When you disconnect cables from the auxiliary module, firmly hold the connectors while you gently unclip and pull the connectors apart. The cables from the auxiliary module can be easily damaged. You can also bend connector pins, which can cause incorrect error messages or communication with the main board to fail.
7 Disconnect all the connections to the auxiliary module, and lift off and remove the auxiliary module.

8 For the 6200 Series, 6400 Series and 6500 Series: Remove the thumb screws and two T20 Torx screws.

9 Lift off the vacuum manifold cover.

To close the vacuum manifold

When needed As needed.
Tools needed None
Parts needed None

NOTE If you worked on any components in the vacuum manifold, check to be sure the electrical connections are correct before closing the vacuum manifold.

1 Position the manifold cover on the vacuum manifold.

2 Install any screws that were removed when the manifold cover was removed.

3 Install the auxiliary module on to the top of the vacuum manifold.

4 Connect all the cables to the auxiliary module that were previously disconnected.

5 For 6200 Series, 6400 Series, and 6500 Series LC/MS, install the left side cover.

6 Install the front cover.

7 Install the top cover of the LC/MS instrument.

8 Plug the power cord back to the system.

9 Pump down the instrument.
**Ion Optics Assembly**

**To clean skimmer 1**

**CAUTION** Use care when you do this procedure. Damages that you cause during maintenance are not covered under warranty. If you need assistance, contact Agilent.

<table>
<thead>
<tr>
<th>When needed</th>
<th>When symptoms indicate that cleaning is needed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools needed</td>
<td>• clean lint-free cloth</td>
</tr>
<tr>
<td></td>
<td>• clean gloves</td>
</tr>
<tr>
<td></td>
<td>• LC/MS-grade isopropanol</td>
</tr>
<tr>
<td></td>
<td>• LC/MS-grade water</td>
</tr>
<tr>
<td>Parts needed</td>
<td>None</td>
</tr>
</tbody>
</table>

1. Put on clean gloves.
2. Examine the **skimmer** for any visual contamination. See Figure 56.

![Sample residue on skimmer](image)
3 Remove the **desolvation assembly**.

4 Dampen a clean lint-free cloth with a mixture of LC/MS-grade isopropanol and LC/MS-grade water.

5 Wipe the **skimmer**.

   The **skimmer** must be shiny after it is wiped. If the contamination or sample residue on the **skimmer** cannot be removed, and then the **ion optics** must be removed and cleaned more thoroughly. Please contact Agilent Customer Service for more information.

![Image of skimmer being wiped](image1.png)

**Figure 57**  Wiping the skimmer (left) and an example of a clean **skimmer**.

---

**CAUTION**

The tip of the skimmer is delicate. Do not damage it.

---

6 Install the **desolvation assembly**. See “To install the desolvation assembly” on page 109.

---

**NOTE**

Record this procedure in the Maintenance Logbook.
To remove the ion optics assembly (6200 Series)

This procedure is for 6200 Series LC/MS only. For all other instruments, see “To remove the ion optics assembly (6100 Series, 6400 Series, and 6500 Series)” on page 125.

Use care when you do this procedure. Damages that you cause during maintenance are not covered under warranty. If you need assistance, contact Agilent.

When needed
- When determined by an Agilent-trained Service Engineer to be absolutely necessary.
- When the ion optics assembly needs to be cleaned.

Tools needed
- clean gloves
- clean lint-free cloth
- 500-mL clean beaker, 2×
- tweezers
- T10 Torx screwdriver
- T15 Torx screwdriver
- 1.5-mm ball driver

Parts needed
- LC/MS-grade methanol
- LC/MS-grade isopropanol
- LC/MS-grade acetone

None

1 Vent the instrument.
2 Turn the front power switch off.
3 Remove covers:
   a Remove the front cover and disconnect the status panel ribbon cable.
   b Remove the top cover. Remove the screws that secure the top cover from the back or front of the instrument, depending on the instrument model.
   c Remove the cosmetic cover behind the spray chamber cover. Use the T10 Torx screwdriver to remove the four Torx screws.
4 Remove gas and sample line connections from the nebulizer and gas supplies.

5 Remove all high voltage cables from their connectors.

6 Unlatch the ion source and swing open the door.

7 Remove the desolvation assembly. See “To remove the desolvation assembly” on page 106.

8 Remove the ion optics assembly:
   a Remove the four T20 Torx screw that attach the vacuum manifold cover and remove the manifold cover.
   b Wear clean gloves. Remove the green top wire and the vacuum manifold bottom black wires of ion optics 1 from the vacuum manifold.
   c Disconnect the yellow skimmer voltage wire in the rear manifold connected to the ion optics 1 partition.
   d Remove the T20 Torx screw that holds the blue wire to the ion optics 1 octopole housing in the rear chamber.

9 Disconnect the white ion focus wire in the rear manifold that is connected to the ion optics ion focus lens.

**Figure 58**  Optics assembly, all cables connected
6 Desolvation Assembly and Vacuum Manifold
To remove the ion optics assembly (6200 Series)

Figure 59  Optics assembly, all cables disconnected.

10 Press on the skimmer spacer with your right hand fingers while you hold the skimmer side with your left hand. This prevents the ion optics assembly from falling on the floor when it pops loose.

11 Put the manifold cover back on to keep dust out while you clean the ion optics.

Figure 60  Removing the ion optics assembly
To clean the ion optics assembly (6200 Series)

Use care when you do this procedure. Damages that you cause during maintenance are not covered under warranty. If you need assistance, contact Agilent.

**Tools needed**
- clean gloves
- clean lint-free cloth
- 500-mL clean beaker, 2×
- tweezers
- T10 Torx screwdriver
- T15 Torx screwdriver
- 1.5-mm ball driver

**Parts needed**
- LC/MS-grade methanol
- LC/MS-grade isopropanol
- LC/MS-grade acetone
- reagent-grade formic acid
- deionized (18 MW-cm) water
- Alconox Powdered Precision Cleaner
To clean the ion optics assembly (6200 Series)

1. Place the complete **ion optics assembly** under a fume hood on clean lint-free cloth.

![Figure 61  Ion focus lens removal](image)

8-mm M2×0.4 screw
screw pin
2. Remove the two T6 Torx screw on the ion focus lens.

3. Remove the skimmer O-ring and partition O-ring, and then turn the ion optics on its side and remove the two skimmer T10 Torx screw.
To clean the ion optics assembly (6200 Series)

Figure 63  Reference on alignment of the ion optics assembly partition and skimmer spacer if skimmer spacer is removed. Note the skimmer spacer can be removed to better clean octopole rods but is not recommended. The skimmer spacer can damage the octopole rods when you try to put it back on.

Figure 64  Skimmer O-ring and partition O-ring removed
To clean the ion optics assembly (6200 Series)

Remove these two 8-mm T10 Torx screws to remove the skimmer for better access to the rods for cleaning.

4. Remove the **skimmer** and **skimmer O-ring**.

   The **skimmer** can be hard to separate from the **skimmer spacer**. You can use one finger inserted into the **skimmer** space cutout to push on the opposite side of the **skimmer** to help pop it loose.

**CAUTION**

Do not let your finger come in contact with the octopole rods, or you can damage the octopole rods.

**CAUTION**

Never disassemble ion optics 1 further than instructed here. You can damage the ion optics assembly if you do.
Clean the octopole:

a  Pull the octopole out of the skimmer spacer. The octopole is now ready to be sonicated. Do not disassemble the octopole any further.

b  Put entire octopole assembly into a beaker.

c  Sonicate the octopole assembly in each of these solvents, in the order listed. For each solvent, add the solvent to the beaker, sonicate for 5 minutes, and then pour out the solvent. Do this one solvent at a time.

   - LC/MS-grade isopropanol
   - 0.1% reagent-grade formic acid in water
   - LC/MS-grade water
   - LC/MS-grade methanol

CAUTION

- Do not abrasively clean the skimmer because it is plated, and abrasive cleaning will damage the plating.
- Do not expose the skimmer to these solvents.
- Do not reuse the solvents between sets of components.
- Do not oversonicate the assembly or you will damage the octopole or octopole wires.
6 Sonicate the **skimmer** and **ion focus lens**:  
   a. Put both the **skimmer** and **ion focus lens** into a clean beaker.  
   b. Sonicate the parts in each of these solvents, *in the order listed*. For each solvent, add the solvent to the beaker, sonicate for 5 minutes, and then pour out the solvent. Do this one solvent at a time.  
   - LC/MS-grade isopropanol  
   - LC/MS-grade acetone  
   - LC/MS-grade methanol  
   - 1% solution of Alconox Powdered Precision Cleaner  
   c. Rinse the beaker with at least 10 volume washes using clean LC/MS-grade water. Do not leave any detergent residue on the lens elements.  
   d. Rinse the lens elements with LC/MS-grade methanol to remove any remaining water.  
   e. Wipe the **skimmers** and lenses a with a clean lint-free cloth dampened with solvent (LC/MS-grade methanol).

7 Reassemble the **ion optics assembly**:  
   a. Replace the **ion focus lens** on the **octopole assembly** with two T6 Torx screws.  
   b. Place the **O-ring** back on the **skimmer**.  
   c. Place the **skimmer** back on the **skimmer spacer** with two T10 Torx **screw** screws.  
   d. Place the partition **O-ring** back on the partition.  
   e. Place the **skimmer spacer O-ring** back on the **skimmer spacer**.  
   f. Reinstall the **ion optics** into the **vacuum manifold** and reverse all disassembly procedures.  
   g. Test for continuity before installing. Check that Negative on **green top wire** and Positive on Black Wire Readings are OL (over limit).

**NOTE**  
Record this procedure in the Maintenance Logbook.
To clean the ion optics assembly (6200 Series)

Figure 67  Testing for continuity.

Figure 68 shows the exploded view of the ion optics assembly.

Figure 68  An exploded view of the ion optics assembly. Note that this picture is provided for reference only. The ion optics assembly is never to be disassembled to this level.
To remove the ion optics assembly (6100 Series, 6400 Series, and 6500 Series)

**CAUTION** Use care when you do this procedure. Damages that you cause during maintenance are not covered under warranty. If you need assistance, contact Agilent.

1. Vent the system.
2. Remove the ion source.
3. Remove the desolvation assembly.
4. Remove the vacuum manifold cover.
5. Unplug all of the ion optics cables so that the ion optics assembly can be removed. Pay close attention to the orientation of the cables and their respective locations.

**WARNING** Some instruments use two external power cords to provide input power. Make sure you unplug the input power cord for the main power supply and the input power cord for the pump expander box (into which the two rough pumps are plugged) before you continue.

6. Use your finger to push on the skimmer spacer to get the ion optics to pop out of the instrument. Be careful to catch it so it doesn't fall on the floor. See Figure 69.
To remove the ion optics assembly (6100 Series, 6400 Series, and 6500 Series)

Figure 69  Optics assembly
To clean the ion optics assembly (6100 Series, 6400 Series and 6500 Series)

**CAUTION** Use care when you do this procedure. Damages that you cause during maintenance are not covered under warranty. If you need assistance, contact Agilent.

**Parts needed**
- clean gloves
- clean lint-free cloth
- 500-mL clean beaker, 2×
- tweezers
- T10 Torx screwdriver
- T15 Torx screwdriver
- 1.5-mm ball driver
- LC/MS-grade methanol
- LC/MS-grade acetone
- LC/MS-grade isopropanol
- LC/MS-grade acetone
- reagent-grade formic acid
- deionized (18 MW-cm) water
- Alconox Powdered Precision Cleaner

1. Place the **ion optics assembly** under a fume hood on a **clean lint-free cloth** (Figure 70).
2. Remove the **skimmers**:
   - Reposition the assembly that holds the **skimmer spacer**, and remove the two screws that hold **skimmer 1**.
   - For 6120, after you remove **skimmer 1**, remove the two screws that hold **skimmer 2** to the black **skimmer spacer**. Then remove **skimmer 2**.
   - Carefully remove **skimmer 1** (Figure 71). If needed, use a flat blade screwdriver to gently pry **skimmer 1** from its seat.
To clean the ion optics assembly (6100 Series, 6400 Series and 6500 Series)

**CAUTION**
The screwdriver blade can damage the octopole rods. The octopole rods are damaged, you must replace the entire assembly.

**Figure 70** Ion optics assembly

**Figure 71** Skimmer 1. The hole in the skimmer varies by instrument type.
3 Remove the lenses:
   a Remove the two screws that hold the octopole to the skimmer spacer (Figure 72). Be careful not to let the ion optics fall on the table. Support the octopole by holding it up by the octopole tube.

   b Disconnect wiring harness and connections (Figure 73). The red wire is for lens 2 and the white ion focus wire is for lens 1.
To clean the ion optics assembly (6100 Series, 6400 Series and 6500 Series)

- Leave the yellow wires attached to skimmer spacer (Figure 74). Leave the ion optics in the skimmer spacer and use it as a stand to remove lens 2, spacer insulator, and lens 1. Be careful not to damage the octopole rods.
To clean the ion optics assembly (6100 Series, 6400 Series and 6500 Series)

- Use the 1.5-mm ball driver to remove the two screws that hold lens 2 (Figure 75).

- Remove the spacer insulator (Figure 76).
To clean the ion optics assembly (6100 Series, 6400 Series and 6500 Series)

- Remove lens 1.

**CAUTION**
- Do not abrasively clean the skimmer because it is plated, and abrasive cleaning will damage the plating.
- Do not expose the skimmer to these solvents.
- Do not reuse the solvents between sets of components.
- Do not oversonicate the assembly or you will damage the octopole or octopole wires.
4 Clean the **octopole**:
   a Pull the **octopole** out of the **skimmer spacer**. The **octopole** is now ready to be sonicated. Do not disassemble the **octopole** any further.

   ![Octopole assembly](image)

   **Figure 77** Octopole assembly

   b Put entire **octopole assembly** into a beaker.
   c Sonicate the octopole assembly in each of these solvents, *in the order listed*. For each solvent, add the solvent to the beaker, sonicate for 5 minutes, and then pour out the solvent. Do this one solvent at a time.
   
   - LC/MS-grade isopropanol
   - 0.1% reagent-grade formic acid in water
   - LC/MS-grade water
   - LC/MS-grade methanol

5 Clean the **skimmer** and lenses:
   a Put **skimmer**, **lens 1** and **lens 2** into a beaker.
   b Sonicate the parts in each of these solvents, *in the order listed*. For each solvent, add the solvent to the beaker, sonicate for 5 minutes, and then pour out the solvent. Do this one solvent at a time.

   - LC/MS-grade isopropanol
   - LC/MS-grade acetone
   - LC/MS-grade methanol
6 Desolvation Assembly and Vacuum Manifold
To clean the ion optics assembly (6100 Series, 6400 Series and 6500 Series)

1% solution of Alconox Powdered Precision Cleaner

**c** Rinse the beaker with at least 10 volume washes using clean LC/MS-grade water. Do not leave any detergent residue on the lens elements.

**d** Rinse the lens elements with LC/MS-grade methanol to remove any remaining water.

**e** Wipe the skimmers and lenses a with a clean lint-free cloth dampened with solvent (LC/MS-grade methanol).

**6** Remove the parts from the beaker, place them on a clean lint-free cloth and allow them to air dry.

**7** Wipe the skimmer spacer completely with a clean lint-free cloth dampened with LC/MS-grade methanol. Make sure to wipe off any oil droplets.

**8** Inspect the octopole rods:

**a** Check that the octopole rods are not broken.

**b** Using a small ball driver or pair of tweezers, gently touch each octopole rod on its end to make sure that it has not come detached from the connection on the end support. Do this on both ends of the octopole rods.

**NOTE**
If any of the octopole rods are found to be damaged or detached, replace the ion optics assembly. Octopole rods cannot be reattached.

**9** Assemble the ion optics assembly:

**a** Install the octopole assembly into the skimmer spacer. Position the octopole assembly so that the screws on skimmer side of skimmer spacer can be installed.

**b** For 6120, reinstall skimmer 2.

**c** Install skimmer 1. Remember to install the black O-ring that goes behind skimmer 1.

**d** Install lens 1, space insulator and lens 2.

**e** Attach the wiring harness.

**f** Connect all previously disconnected wires (see Figure 70).

**Figure 78 and Figure 79 show shows the exploded view of the ion optics assembly.**
To clean the ion optics assembly (6100 Series, 6400 Series and 6500 Series)

**Figure 78** An exploded view of the ion optics assembly for instruments with skimmer 2 (6120).

**Figure 79** An exploded view of the ion optics assembly (one skimmer only)
6 Desolvation Assembly and Vacuum Manifold
To clean the ion optics assembly (6100 Series, 6400 Series and 6500 Series)

10 Install the ion optics assembly:
  a Install the reassembled ion optics assembly (see Figure 80) into the vacuum manifold.
  b Connect the green top wire and black octopole leads.
  c Connect the lens cable connector.

![The re-assembled ion optics assembly](image)

**Figure 80** The re-assembled ion optics assembly

11 Reinstall the desolvation assembly.
   See “To install the desolvation assembly” on page 109.

**NOTE** Record this procedure in the Maintenance Logbook.
Beam-shaping assembly

These procedures are for the 6200 Series LC/MS instruments only.

To remove and clean the complete beam shaping assembly

CAUTION
Use care when you do this procedure. Damages that you cause during maintenance are not covered under warranty. If you need assistance, contact Agilent.

1. Remove the ion optics assembly. See “To remove the ion optics assembly (6200 Series)” on page 114 or “To remove the ion optics assembly (6100 Series, 6400 Series, and 6500 Series)” on page 125.

2. If both the ion optics assembly and beam-shaper slicer assembly are going to be cleaned, do the steps in “To clean the ion optics assembly (6200 Series)” on page 117 through step 7 or “To clean the ion optics assembly (6100 Series, 6400 Series and 6500 Series)” on page 127 through step 9.

3. Disconnect the green horizontal Q wire and brown vertical Q wire from the rear vacuum manifold cable harness feed-through.
4 Disconnect the bottom left purple top slit wire and bottom black bottom slit wire from the rear vacuum manifold cable harness feed-through.

5 Disconnect the black snap connector with the red slicer voltage wire, yellow skimmer voltage wire, blue octopole housing wire, and white ion focus wire.

6 Use a pair of tweezers to remove the black bottom slit wire and purple top slit wire from the connections on the beam-shaper slicer assembly.

7 Remove the purple top slit wire and black bottom slit wire from the rear vacuum manifold and set it aside.

If these wires are not removed, the beam-shaper slicer assembly cannot be pulled through the vacuum manifold into the ion optics region and out the desolvation chamber attachment of the front manifold.
8 Loosen the four **T20 Torx screw** (circled in the figure to the left) that hold the **beam-shaper slicer assembly** in place. Insert the **T20 Torx screwdriver** from the front of the manifold.

The screws are capture type and will not fall after they are loosened.
9 Remove the beam-shaper slicer assembly from the source side of the manifold.

10 Place the complete beam-shaper slicer assembly under a fume hood on clean lint-free cloth for disassembly and cleaning.

11 Inspect the correct wiring as shown in this picture. Remember that you removed the purple top slit wire black bottom slit wire harness before you removed it from manifold.

12 Remove the red slicer voltage wire with black snap connector from the slicer housing.
The figure to the left shows all wiring connections with the **purple top slit wire** and **black bottom slit wire** connected. Use this picture for reference when you reassemble the unit. You will reinstall the **purple top slit wire** and **black bottom slit wire** after the **purple top slit wire** and **beam-shaper slicer assembly** is placed back into the **vacuum manifold**.

The figure to the left shows the **red slicer voltage wire** removed. Note that the **red slicer voltage wire** is removed from the circled screw.
6 Desolvation Assembly and Vacuum Manifold

To remove and clean the complete beam shaping assembly:

13 Loosen the two 8-mm T10 Torx screw that are attached to each of the two brown wire, and then remove the brown wire that connect the slit cable assembly to the “horizontal” P-filter rods. These wires are slotted so the P-filter rods can be left in place.

You can remove the P-filter rods, or leave them in the housing and just rinse them off with LC/MS-grade methanol.

14 Gently push each P-filter rod against its reference “stop” when any P-filter rod screw has been loosened for any reason.

15 Loosen the two 8-mm T10 Torx screw that attach each of the two green horizontal Q wire to the Quad holder and the “vertical” P-filter rod. These wires are slotted so the P-filter rods can be left in place.

16 Remove the green horizontal Q wire.

17 Remove the complete beam-shaper cable with green horizontal Q wire and brown vertical Q wire. Tighten the screws if the P-filter rods will not be removed.

18 Gently push each P-filter rod against its reference “stop” when the screw is tightened.
To remove and clean the complete beam shaping assembly

19 Remove the slicer exit on the exit end of the slicer body assembly.

20 Locate the two pins (circled in the figure to the left) in the slicer body assembly that align with the two small pin holes in the slicer exit. Remove the two 8-mm T10 Torx screw to remove the slicer exit.
21 Remove the Quad holder from the slicer body assembly. Remove the four M3 screws that fasten the two assemblies together.

When re-assembling, make sure to tighten the screws completely. Make sure that each slit plate is pushed towards the center to assure that it is properly seated against the reference stops/features found on the slit spacer. The figure to the left shows the two slit plate being pressed to the center during reassembly.

The figure to the left shows 4 P-filter rod in the Quad holder separated from the slicer body assembly.
Desolvation Assembly and Vacuum Manifold

To remove and clean the complete beam shaping assembly

22 Gently push each P-filter rod against its reference “stop” (circled in the figure to the left) when the screw is tightened.

23 Lift and remove the 2 slit plate from the slit spacer.
6 Desolvation Assembly and Vacuum Manifold
To remove and clean the complete beam shaping assembly

24 Remove the plastic slit spacer from the slicer body assembly.
When you reassemble the unit, note the small pin on the slicer body assembly (circle in the figure to the left) engaged in the hole of the slit spacer.
Desolvation Assembly and Vacuum Manifold

To remove and clean the complete beam shaping assembly

Figure 81   Slicer assembly part number identification.

Record this procedure in the Maintenance Logbook.
To clean the beam-shaping slicer parts

Use care when you do this procedure. Damages that you cause during maintenance are not covered under warranty. If you need assistance, contact Agilent.

Parts needed
- deionized (18 MW-cm) water
- Alconox Powdered Precision Cleaner
- LC/MS-grade isopropanol
- LC/MS-grade acetone
- LC/MS-grade methanol

1. Clean the two slit plate, slicer exit, slicer body assembly, and the four P-filter rod with deionized (18 MW-cm) water and a small amount of Alconox Powdered Precision Cleaner in a clean beaker.
   Use a clean tech wipes to clean all metal surfaces.

2. Use deionized (18 MW-cm) water to rinse all of the Alconox Powdered Precision Cleaner off of the two slit plate, slicer exit, slicer body assembly, and the four P-filter rod.
   Be sure to rinse all Alconox Powdered Precision Cleaner off the parts.

3. Sonicate the beam-shaping slicer parts:
   a. Place the two slit plate, slicer exit, slicer body assembly, and the four P-filter rod in a clean beaker.
   b. Sonicate for 5 minutes.
   c. Pour out the LC/MS-grade isopropanol.
   d. Refill the beaker with 100% LC/MS-grade acetone.
   e. Sonicate for another 5 minutes.
   f. Pour out the LC/MS-grade acetone.
   g. Refill with 100% LC/MS-grade methanol.
   h. Sonicate for another 5 minutes.

4. Rinse the quad holder slit spacer and screws with LC/MS-grade methanol and wipe clean.
To clean the beam-shaping slicer parts

5 Reassemble the beam-shaper slicer assembly. Do in reverse order the steps used to disassemble the part.

6 Check the beam-shaper slicer assembly for electric shorts:
   a Use a multimeter to simultaneously touch the left pin coming off the slit plate and the body of the slicer body assembly.
   b Check that the multimeter displays “OL”.
   c Repeat this measurement on the right pin coming off the second slit plate.

The beam-shaper slicer assembly is now clean and ready to install into the manifold.

Figure 82 Testing the beam-shaping assembly with a multimeter.
To clean the beam-shaping slicer parts

7 Reinstall the beam-shaper slicer assembly into the vacuum manifold.
   Do in reverse order the steps used to remove the beam-shaper slicer assembly from the vacuum manifold.

8 Reinstall the ion optics assembly into the vacuum manifold.
   Make sure to keep the ion optics assembly and beam-shaper slicer assembly in the same physical orientation in the vacuum manifold as they were when they were removed.

9 Make sure all wiring connections are correct.

10 Do in reverse order the steps used to vent and remove the ion optics assembly and beam-shaper slicer assembly to prepare the instrument to pump down.

11 Turn on the instrument at the front power switch.
   The instrument automatically starts the pump down process.

12 After the instrument starts up, start the Diagnostics program in the data acquisition program.
   Connect the instrument from the menu in the Diagnostics program.
13 In the **Parameters** tab, check the rough pump vacuum and turbo speed to see the progress of the pump down.

14 Do a high voltage conditioning for a 2-Hour cycle (optics service). The high vacuum condition starts after the high vacuum has reached $2.0 \times 10^{-6}$ Torr.

15 When the high voltage conditioning is done and the vacuum is acceptable ($5.0 \times 10^{-7}$ Torr), tune the instrument:
   - Do initial positive and negative tune in 2 GHz Extended Dynamic range.
   - Do standard positive and negative polarity switching tunes.

**NOTE**

Record this procedure in the Maintenance Logbook.
6 Desolvation Assembly and Vacuum Manifold
Electron Multiplier

Electron Multiplier

These procedures are for the 6100 Series and the 6400 Series LC/MS instruments only.

To replace the electron multiplier horn

**CAUTION** Use care when you do this procedure. Damages that you cause during maintenance are not covered under warranty. If you need assistance, contact Agilent.

**When needed** When sensitivity or poor and autotune consistently sets the detector gain to its maximum value

**Tools needed**
- clean gloves
- long-nose pliers

**Parts needed**
- electron multiplier replacement horn (6100 Series)
- high gain electron multiplier (6400 Series)
1. Disconnect the signal wire from the electron multiplier horn.
2. Open the retaining clip.
3. Remove the electron multiplier horn.
4. Install a new electron multiplier horn.
5. Close the retaining clip.
6. Connect the signal wire to the pin on the electron multiplier horn.
7. Close the analyzer.

**NOTE**

Record this procedure in the Maintenance Logbook.
To clean the high energy dynode

Use care when you do this procedure. Damages that you cause during maintenance are not covered under warranty. If you need assistance, contact Agilent.

<table>
<thead>
<tr>
<th>When needed</th>
<th>When sensitivity is poor and autotune consistently sets the detector gain to its maximum value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools needed</td>
<td>• 500-mL clean beaker or larger, 2 required</td>
</tr>
<tr>
<td></td>
<td>• clean gloves</td>
</tr>
<tr>
<td></td>
<td>• 0.8 mm hex key</td>
</tr>
<tr>
<td></td>
<td>• LC/MS-grade isopropanol</td>
</tr>
<tr>
<td></td>
<td>• LC/MS-grade methanol</td>
</tr>
<tr>
<td></td>
<td>• long-nose pliers</td>
</tr>
<tr>
<td></td>
<td>• T20 Torx screwdriver</td>
</tr>
<tr>
<td>Parts needed</td>
<td>None</td>
</tr>
</tbody>
</table>

1. Put on clean gloves.
2. Disconnect the two braided wires from the electron multiplier.
3. Remove the two screws that hold the electron multiplier to the vacuum manifold.

**Figure 84** Electron multiplier exposed
4 Remove the electron multiplier and, at the same time, carefully disconnect the two remaining rigid wires.

5 Remove the electron multiplier horn from the electron multiplier.

6 Loosen the two small set screws that hold the resistor in place. Remove the resistor.

CAUTION

The electron multiplier horn and resistor must be removed before you put the electron multiplier in isopropanol. The isopropanol can damage the electron multiplier horn and resistor.

7 Place the electron multiplier (without the horn or resistor) into a beaker containing 200 mL of LC/MS-grade isopropanol. Make sure the high energy dynode is immersed.

8 Gently agitate the beaker by hand for 1 minute.

CAUTION

Do not use an ultrasonic bath. An ultrasonic bath can loosen screws or disrupt the precise alignment of electron multiplier components.

9 Transfer the electron multiplier to another beaker containing about 200 mL of LC/MS-grade methanol. Make sure the high energy dynode is immersed.

10 Gently agitate the beaker by hand for 1 minute. This helps to rinse off the LC/MS-grade isopropanol.

11 Remove the electron multiplier and allow it to dry. The methanol will dry quickly. Do not bake the electron multiplier or otherwise try to speed the drying process.

12 Reinstall the resistor and electron multiplier horn.

13 Reinstall the electron multiplier in the vacuum manifold and, at the same time, connect the two rigid wires to the electron multiplier.

14 Install and tighten the two screws that hold the electron multiplier in place. Reconnect the two braided wires to the electron multiplier.

NOTE

Record this procedure in the Maintenance Logbook.
This page intentionally left blank.
This chapter includes procedures to maintain the vacuum system of the instrument. Do these steps according to the maintenance schedule or as indicated by instrument symptoms.

**WARNING**

Always wear appropriate protection, including eye protection, lab coat, and gloves, when working with solvents and chemicals or when working with unassembled parts.
To check the rough pump fluid level (Agilent MS40+)

Check the level and color of the pump fluid weekly.

- Check the fluid level in the window of the rough pump. The fluid level should be between the marks for Max and Min (see Figure 85).
- Check that the color of the pump fluid is clear or almost clear with few suspended particles.
- If the pump fluid is dark or full of suspended particles, replace it.

![Fluid level window on the rough pump](image)

**Figure 85** Fluid level window on the rough pump
## To add rough pump fluid (Agilent MS40+)

<table>
<thead>
<tr>
<th>When needed</th>
<th>Add pump fluid when the pump fluid level is low.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools needed</td>
<td>• funnel</td>
</tr>
<tr>
<td></td>
<td>• clean chemical resistant gloves</td>
</tr>
<tr>
<td></td>
<td>• 10 mm hex key</td>
</tr>
<tr>
<td>Parts needed</td>
<td>• SW60 oil</td>
</tr>
</tbody>
</table>

### WARNING

Wear chemical-resistant gloves and safety glasses (goggles) for your safety.

### WARNING

Never add or replace the rough pump fluid while the pump is on. Hot oil can splash out and cause harm.

### WARNING

The fill cap and pump can be dangerously hot. Do not touch the fill cup or pump until they are cool.

### CAUTION

Use only the rough pump fluid appropriate for your pump (SW60 oil for Agilent MS40+). Any other fluids can substantially reduce pump life and invalidates the pump warranty.

1. Put on clean chemical resistant gloves.
2. Vent and turn off the instrument.
   - See "To shut down the instrument" on page 15.
3. Unplug the instrument **power cord** or cords from the electrical outlet.
   - Leave the **power cord** or cords unplugged while you do this procedure.
To add rough pump fluid (Agilent MS40+)

4 Remove the fill cap on the rough pump.
5 Add new SW60 oil until the fluid level is near, but not over the maximum mark beside the fluid level window (see Figure 85). Use a funnel.
6 Reinstall the fill cap.
7 Wipe off all excess oil around and underneath the pump.
8 Reconnect the power cord or cords.
9 Start up the instrument.

See “To start the system in Standby mode” on page 12.

NOTE
Record this procedure in the Maintenance Logbook.

WARNING
Some instruments use two external power cords to provide input power. Make sure you unplug the input power cord for the main power supply and the input power cord for the pump expander box (into which the two rough pumps are plugged) before you continue.
To add rough pump fluid (Agilent MS40+)

Figure 86  Rough pump (Agilent MS40+).
To replace the rough pump fluid (Agilent MS40+)

Replace the pump fluid every six months. Replace it sooner if the fluid appears dark or cloudy.

Tools needed
- funnel
- clean chemical resistant gloves
- 10 mm hex key
- container for catching old pump fluid

Parts needed
- SW60 oil

**WARNING**
Wear chemical-resistant gloves and safety glasses (goggles) for your safety.

**WARNING**
Never add or replace the rough pump fluid while the pump is on. Hot oil can splash out and cause harm.

**WARNING**
The fill cap and pump can be dangerously hot. Do not touch the fill cup or pump until they are cool.

**WARNING**
Do not touch the fluid. The residue from some samples are toxic. Properly dispose of the fluid.

**CAUTION**
Use only the rough pump fluid appropriate for your pump (SW60 oil for Agilent MS40+). Any other fluids can substantially reduce pump life and invalidates the pump warranty.

1. Turn off the instrument.
   See “To shut down the instrument” on page 15.
2. Unplug the **power cord** or cords from the instrument
   Leave the **power cord** or cords unplugged while performing this procedure.
Some instruments use two external power cords to provide input power. Make sure you unplug the input power cord for the main power supply and the input power cord for the pump expander box (into which the two rough pumps are plugged) before you continue.

3 Place a container under the drain plug of the rough pump.
4 Remove first the fill cap (see Figure 85 on page 158), and then open the drain plug.
   Allow the fluid to drain completely.
5 Reinstall the drain plug.
6 Pour in new pump fluid until the fluid level is near, but not above the maximum mark beside the fluid level window (see Figure 85 on page 158).
7 Reinstall the fill cap.
8 Reconnect the power cord or cords.
9 Start up the instrument.
   See “To start the system in Standby mode” on page 12.
10 After 30 minutes pump down, inspect the pump for leak.
   Inspect for leak after overnight pump down.

NOTE
Record this procedure in the Maintenance Logbook.
7 Vacuum System
To replace the fuses

To replace the fuses

When needed  As needed.

Tools needed  • long flat-blade screwdriver

Parts needed  • 8 Amp Fuse (2110-0969)
• 12.5 Amp Fuse (2110-1398)

WARNING Never replace a fuse while the instrument is plugged into the power outlet. You run the risk of an electric shock and you will damage the instrument.

CAUTION If the instrument is plugged in and turned on when you change a fuse, the instrument begins to pump down immediately. If the system is not completely assembled when pump down begins, the vacuum system can be damaged.

1 Unplug the instrument power cord or cords from the power outlet.

Figure 87 Disconnect the instrument power cable.
Some instruments use two external power cords to provide input power. Make sure you unplug the input power cord for the main power supply and the input power cord for the pump expander box (into which the two rough pumps are plugged) before you continue.

2 Using a flat blade screw driver, remove the fuse holder of the blown fuse.

3 Replace with the appropriate fuse. See “Replaceable Fuses” on page 181.

4 Reinstall the fuse holder.

5 Plug in the instrument.

   For instruments with two external power cords, plug in both the cord for the main power supply cord and the cord for the pump expander box (to which the two rough pumps are connected).

6 Push the front power switch to start an automatic pump down sequence.

   Record this procedure in the Maintenance Logbook.
To bake out the LC/MS

When needed The system needs to bake out when the system is turned on for the first time or anytime system has been vented. Clean the source weekly if the daily cleaning procedure does not work.

Tools needed None.

Parts needed None

1 In the data acquisition program, set these Manual Tune values:
   - drying gas flow (without ion funnel) = 7 L/min
   - drying gas flow (with ion funnel) = 11 L/min.
   - nebulizer pressure = 40 psi.
   - drying gas temperature = 300°C.
   - vaporizer temperature = 250°C (when applicable).
   - LC flow = 0.5 mL/minute. Use the solvent mixture appropriate for your instrument models.

2 Make sure the position of the MS selection valve is set so that the LC flow is diverted to the spray chamber.

3 Bake out the system for at least 2 hours.

CAUTION If the system has been exposed to humid conditions during shipping or storage, a minimum of 4 hours bake out is needed to prevent arcing of the quadrupole.

NOTE Record this procedure in the Maintenance Logbook.
This chapter contains safety information, parts lists, and other reference information for your Agilent 6000 Series LC/MS.

**WARNING** Always wear appropriate protection, including eye protection, lab coat, and gloves, when working with solvents and chemicals or when working with unassembled parts.
Safety

Symbols on instruments

Electrical symbols

The following table describes the electrical symbols that can be displayed on the LC/MS instrument.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Symbol] | Indicates a protected ground terminal.  
*Indique une borne de mise à la terre.* |

Safety symbols

The following table describes the safety symbols that can be displayed on the LC/MS instrument. Each symbol appears by itself or with text that explains the relevant hazard. These safety symbols can also appear next to DANGER, WARNING, or CAUTION.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Symbol] | The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect risk of harm to the operator and to protect the apparatus against damage.  
*Cet appareil porte ce symbole pour indiquer à l'utilisateur de consulter le manuel d'utilisation afin de se protéger contre tout danger et d'éviter d'endommager l'instrument.* |

Table 14  Safety symbols (continued)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Symbol](image1) | Indicates dangerous voltages.  
*Indique des tensions dangereuses.* |
| ![Symbol](image2) | The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up.  
*L’appareil comporte ce symbole pour indiquer qu’il présente des surfaces chaudes et que l’utilisateur ne doit pas les toucher lorsqu’elles sont chaudes.* |
| ![Symbol](image3) | Electric discharge hazard.  
*Risque de décharge électrique* |
| ![Symbol](image4) | Do not discard this electrical/electronic product in domestic household waste.  
*Ne jetez pas ce produit électrique / électronique avec les ordures ménagères.* |
| ![Symbol](image5) | Two live circuits. Disconnect both power cords before maintenance.  
*Deux circuits sous tension. Débranchez les deux cordons d’alimentation avant l’entretien.* |
General instrument safety

**WARNING** PHYSICAL INJURY HAZARD: Use the LC/MS instrument only as specified in the user instructions. Using the system in a manner not specified by Agilent Technologies can result in personal injury or damage to the instrument.

Moving or lifting the system

**WARNING** PHYSICAL INJURY HAZARD: The LC/MS instrument is heavy. The 6100 series LC/MS instruments require at least two people to lift the instrument. The 6200, 6400, and 6500 series LC/MS instruments require at least four people.

Operating the instrument

Before you operate the instrument, make sure that you have:

- Been given instructions on general safety practices for laboratory and specific safety practices for the instrument.
- Read and understood all material safety data sheets (MSDS) for chemicals handled.
Physical hazard safety

Solvents

**WARNING** PHYSICAL INJURY HAZARD: Always wear appropriate protection, including eye protection and gloves, when working with solvents and chemicals. Refer to the applicable MSDS for more information about the materials you are working with.

Electrical safety

**WARNING** When the LC/MS instrument is plugged into a power source, even if the power switch is off, dangerous voltages can exist:

- In the wiring between the LC/MS instrument power cord and the AC power supply.
- The AC power supply
- In the wiring from the AC power supply to the power switch.

**WARNING** Never remove a cover unless specifically instructed to do so. With the power switch on, potentially dangerous voltages can exist:

- On all electronics boards in the instrument.
- In the internal wires and cables connected to these boards.
- In the wires for any heater.

**WARNING** The printed circuit (PC) boards in the LC/MS instrument can be damaged by electrostatic discharge. Do not touch any of the boards unless absolutely necessary. If you must handle the PC boards, wear a grounded wrist strap and take other anti-static precautions. Wear a grounded wrist strap any time you must remove the LC/MS instrument covers.
Severe electrical shock can result from operating the LC/MS instrument without its power cords in place.

Grounding circuit continuity is required for the safe operation of equipment.

Use properly configured and approved line cords for the voltage supply in your facility. Refer to the *Site Prep Guide* for details.

If the power cord insulation is damaged, frayed, or worn, replace the cord. Contact your Agilent representative.

Plug the LC/MS instrument AC input power cords into properly grounded receptacles with adequate current capacity. The branch circuit over-current protection Circuit Breakers protecting the building receptacles must be rated no more than 20A.

Be sure that the LC/MS main supply cable is routed in such a way as to minimize the risk of a tripping hazard. Agilent Technologies recommends the use of mechanical protection, such as a rubberized cable guard on the floor to cover and protect the main supply cable.

Make sure that the point at which the detachable power cords are connected to the LC/MS instrument is clear from clutter and that it is accessible at all times.

Do not interrupt the protective conductor inside or outside the LC/MS system or disconnect the protective earth terminal. Such actions create a shock hazard for the operator and can damage the instrument.
The use of incorrect or makeshift fuses or the short-circuiting of fuse holders creates a shock hazard for the operator and can damage the instrument. Replace fuses only with fuses of identical current rating and type. See “Replaceable Fuses” on page 181.

Excessive fluctuations in the line voltage can create a shock hazard and can damage the instrument. This equipment must be installed in a Category II environment as defined in IEC 664.

For all instruments, the supply voltage must not fluctuate more that ±10%.

For any instrument with an Agilent Jet Stream source, the line voltage must not fluctuate more that +10/-5% from the rated voltage.

Temperature safety

Some parts of the LC/MS instrument operate at temperatures high enough to cause serious burns. Always cool heated parts of the LC/MS down to room temperature before you work on them.

To cool the instrument faster, set the heated zone to room temperature. Turn the zone off after it has reached the set point.

If you must do maintenance work on a hot part, use a wrench and wear gloves.
General chemical safety

**WARNING** CHEMICAL HAZARD: Before handling any chemicals, refer to the Material Safety Data Sheet (MSDS) provided by the manufacturer, and observe all relevant precautions.

To minimize the hazards of chemicals:

- Read and understand the MSDS provided by the manufacturer before you store, handle, or work with any chemicals or hazardous materials.
- Minimize contact with chemicals. Wear appropriate personal protective equipment when handling chemicals (for example, safety glasses, gloves, or protective clothing).
- Minimize the inhalation of chemicals. Do not leave chemical containers open. Use only with adequate ventilation (for example, fume hood).
- Check regularly for chemical leaks or spills. If either of those occur, follow the cleanup procedures from the manufacturer, as recommended in the MSDS.
- Comply with all local, state/provincial, or national laws and regulations related to chemical storage, handling, and disposal.
Chemical waste safety

HAZARDOUS WASTE: Refer to Material Safety Data Sheets and local regulations for handling and disposal.

CAUTION

WARNING CHEMICAL WASTE HAZARD: Wastes produced by the LC/MS System are potentially hazardous and can cause injury, illness, or death.

WARNING CHEMICAL WASTE HAZARD: The iFunnel pump, foreline pump, and source exhaust contain traces of the chemicals that you are analyzing. The exhaust products can be toxic. Vent the pump and source exhaust outside your laboratory or into a fume hood. Make sure to comply with all local environmental regulations.

To minimize the hazards of chemical waste:

- Read and understand the MSDS provided by the manufacturers of the chemicals in the waste container before you store, handle, or dispose of chemical waste.

- Provide primary and secondary waste containers. Both containers must be compatible with the waste material and meet federal, state/provincial, and local requirements for container storage.

- Minimize contact with chemicals. Wear appropriate personal protective equipment when handling chemicals (for example, safety glasses, gloves, or protective clothing).

- Minimize the inhalation of chemicals. Do not leave chemical containers open.

- Handle chemical wastes in a fume hood.

- After emptying a waste container, seal it with the cap provided.

- Dispose of the contents of the waste tray and waste bottle in accordance with good laboratory practices and local, state/provincial, or national environmental and health regulations.

- Ensure that the LC/MS instrument waste is stored, transferred, transported, and disposed of according to all local, state/provincial, and/or national regulations.
Conformity and Standards

The Agilent 6000 Series LC/MS meets the following IEC (International Electro-technical Commission) classifications:

- Equipment Class: I (Laboratory Equipment)
- Installation Category: II
- Pollution Degree: 2

This unit has been designed and tested in accordance with recognized safety standards and is designed for use indoors. *If the instrument is used in a manner not specified by Agilent Technologies, the protections provided by the instrument may be impaired.*

Safety and Regulatory Certifications

The Agilent 6000 Series LC/MS conforms to the following safety standards:

- Canadian Standards Association (CSA): CAN/CSA–C22.2 No. 61010–1–04
- CSA/Nationally Recognized Test Laboratory (NRTL): UL 61010–1:2005
- International Electrotechnical Commission (IEC): 61010–1
- EuroNorm (EN): 61010–1

The Agilent 6000 Series LC/MS conforms to the following regulations on Electromagnetic Compatibility (EMC) and Radio Frequency Interference (RFI):

- CISPR 11/EN 55011: Group 1, Class A
- IEC/EN 61326
- AUS/NZ
- Canada ICES-001 (Cet appareil ISM est conforme a la norme NMB–001 du Canada.)

The Agilent 6000 Series LC/MS is designed and manufactured under a quality system registered to ISO 9001.
Electromagnetic Compatibility

Under CISPR11, operation of the LC/MS instrument is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try one or more of the following measures:

1. Relocate the radio or antenna.
2. Move the device away from the radio or television.
3. Plug the device into a different electrical outlet, so that the device and the radio or television are on separate electrical circuits.
4. Make sure that all peripheral devices are also certified.
5. Make sure that appropriate cables are used to connect the device to peripheral equipment.
6. Consult your equipment dealer, Agilent Technologies, or an experienced technician for assistance.

Changes or modifications not expressly approved by Agilent Technologies could void the user's authority to operate the equipment.
Sound Emission Declaration

Sound pressure

Sound pressure $L_p < 70$ dB according to EN 27779:1991.

Schalldruckpegel


Environmental Conditions

<table>
<thead>
<tr>
<th>Equipment Class</th>
<th>Class 1 Laboratory Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution Degree</td>
<td>2</td>
</tr>
<tr>
<td>Installation Category</td>
<td>II</td>
</tr>
<tr>
<td>Environment</td>
<td>Indoor Use</td>
</tr>
<tr>
<td>Altitude</td>
<td>Not to exceed 3000 m</td>
</tr>
<tr>
<td>Electrical supply</td>
<td>200 - 240 V AC, 50/60 Hz, maximum 2850 VA</td>
</tr>
<tr>
<td>Mains supply voltage</td>
<td>Fluctuations not to exceed 10% of nominal supply voltage</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>15 to 35°C (59 to 95°F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>&lt; 85% RH at 35°C</td>
</tr>
</tbody>
</table>
Tools and Parts

The tools and parts used to maintain your LC/MS instrument are listed here. Except where noted, all part numbers are Agilent part numbers.

Tools

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000-mL narrow mouth bottle</td>
<td>9301-6460</td>
</tr>
<tr>
<td>1.5-mm ball driver</td>
<td>8710-1570</td>
</tr>
<tr>
<td>1/4-inch × 5/16-inch open-end wrench</td>
<td>8710-0510</td>
</tr>
<tr>
<td>1/2-inch × 9/16-inch open-end wrench</td>
<td>8710-0877</td>
</tr>
<tr>
<td>1/2-inch wrench</td>
<td></td>
</tr>
<tr>
<td>9/64-inch hex key</td>
<td>8710-2394</td>
</tr>
<tr>
<td>0.8 mm hex key</td>
<td>8710-1225</td>
</tr>
<tr>
<td>2 mm hex key</td>
<td>9810-0641</td>
</tr>
<tr>
<td>3-mm hex key, 12-cm long</td>
<td>8710-2411</td>
</tr>
<tr>
<td>3-mm open-end wrench</td>
<td>8710-2699</td>
</tr>
<tr>
<td>10 mm hex key</td>
<td>8710-2612</td>
</tr>
<tr>
<td>100-mL polypropylene graduated cylinder</td>
<td></td>
</tr>
<tr>
<td>10-mL polypropylene graduated cylinder</td>
<td></td>
</tr>
<tr>
<td>500-mL clean beaker</td>
<td></td>
</tr>
<tr>
<td>2000-mL clean beaker</td>
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<tr>
<td>4000 grit abrasive paper</td>
<td>8660-0827</td>
</tr>
<tr>
<td>clean gloves</td>
<td>8650-0030 (small)</td>
</tr>
<tr>
<td>clean chemical resistant gloves</td>
<td>9300-1751</td>
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<td></td>
<td>8650-0029 (large)</td>
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## Reference

### Tools

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>clean lint-free cloth</td>
<td>05980-60051</td>
</tr>
<tr>
<td>clean wash bottle</td>
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</tr>
<tr>
<td>cotton swab</td>
<td>5080-5400</td>
</tr>
<tr>
<td>cube wrench</td>
<td>G4240-83800</td>
</tr>
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<td>funnel</td>
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<tr>
<td>glass CDS bottle</td>
<td>9300-2576</td>
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<tr>
<td>glass CDS bottle cap</td>
<td>9300-2575</td>
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<tr>
<td>long flat-blade screwdriver</td>
<td>8710-1029</td>
</tr>
<tr>
<td>long-nose pliers</td>
<td>7810-0004</td>
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<tr>
<td>Nebulizer Adjustment Kit</td>
<td>G1960-67470</td>
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<tr>
<td>T10 Torx screwdriver</td>
<td>8710-1623</td>
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<tr>
<td>T15 Torx screwdriver</td>
<td>8710-1622</td>
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<td>T20 Torx screwdriver</td>
<td>8710-1615</td>
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<td>tweezers</td>
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## Parts and Supplies

### Replaceable Fuses

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<thead>
<tr>
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<tbody>
<tr>
<td>T8A 250V</td>
<td>2110-0969</td>
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<tr>
<td>T12.5A 250V</td>
<td>2110-1398</td>
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### Reagents

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>deionized (18 MΩ·cm) water</td>
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<tr>
<td>HPLC Flushing Solvent</td>
<td>G1969-85026</td>
</tr>
<tr>
<td>LC/MS-grade acetonitrile</td>
<td>G2453-85060</td>
</tr>
<tr>
<td>LC/MS-grade acetone</td>
<td></td>
</tr>
<tr>
<td>LC/MS-grade cyclohexane</td>
<td></td>
</tr>
<tr>
<td>LC/MS-grade isoctane</td>
<td></td>
</tr>
<tr>
<td>LC/MS-grade isooctane</td>
<td></td>
</tr>
<tr>
<td>LC/MS-grade isopropanol</td>
<td></td>
</tr>
<tr>
<td>LC/MS-grade methanol</td>
<td>8500-1867</td>
</tr>
<tr>
<td>LC/MS-grade water</td>
<td>8500-2236</td>
</tr>
<tr>
<td>reagent-grade formic acid</td>
<td>G2453-85060</td>
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### Common Parts

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>M3 screw</td>
<td>0515-0375</td>
</tr>
<tr>
<td>M4 captive screw</td>
<td>G2597-20007</td>
</tr>
<tr>
<td>T6 Torx screw</td>
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Calibrant Delivery System

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
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<tbody>
<tr>
<td>Acetonitrile UV</td>
<td>Burdick &amp; Jackson catalog #015-4</td>
</tr>
<tr>
<td>APCI/APPI Calibrant</td>
<td>G2432A</td>
</tr>
<tr>
<td>APCI-L Tuning Mix</td>
<td>G1969-85010</td>
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<tr>
<td>APCI-TOF Tune Mix</td>
<td>G1969-85010</td>
</tr>
<tr>
<td>Biopolymer Reference Mass Kit</td>
<td>G1969-85003</td>
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<tr>
<td>ESI Tuning Mix</td>
<td>G2431A</td>
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<tr>
<td>ESI-L Tuning Mix</td>
<td>G1969-85000</td>
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<tr>
<td>ES-TOF Reference Mass Kit</td>
<td>G1969-85001</td>
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<tr>
<td>MMI-L Tuning Mix</td>
<td>G1969-85020</td>
</tr>
<tr>
<td>rotor seal</td>
<td>0100-1855</td>
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<tr>
<td>Universal Inlet Filter Replacement Kit</td>
<td>G1960-67100</td>
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Source

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>APCI Nebulizer Needle Kit</td>
<td>G2428A</td>
</tr>
<tr>
<td>APPI external power supply assembly</td>
<td>G1971-60024</td>
</tr>
<tr>
<td>APPI USB to serial converter cable</td>
<td>8121-1013</td>
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<tr>
<td>DSUB-9 extension cable</td>
<td>G1971-60500</td>
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<tr>
<td>corona needle</td>
<td>G1947-20029</td>
</tr>
<tr>
<td>Fused silica/PEEK capillary</td>
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## Ion Transfer Capillary

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
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<tbody>
<tr>
<td>Alconox Powdered Precision Cleaner</td>
<td>5190-1401</td>
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## Vacuum Manifold

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
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<tbody>
<tr>
<td>8-mm M2×0.4 screw</td>
<td>0515-1046</td>
</tr>
<tr>
<td>electron multiplier replacement horn (for 6100 series)</td>
<td>05971-80103</td>
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<tr>
<td>high gain electron multiplier (for 6400 series)</td>
<td>G2571-80103</td>
</tr>
<tr>
<td>T10 Torx screw</td>
<td></td>
</tr>
<tr>
<td>T20 Torx screw</td>
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</tr>
<tr>
<td>screw pin</td>
<td>G1946-20211</td>
</tr>
<tr>
<td>washer split lock</td>
<td>2190-0017</td>
</tr>
<tr>
<td>yellow wire</td>
<td>G1969-60804</td>
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## Vacuum System

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>8 Amp Fuse</td>
<td>2110-0969</td>
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<tr>
<td>12.5 Amp Fuse</td>
<td>2110-1398</td>
</tr>
<tr>
<td>8-mm T10 Torx screw</td>
<td>0515-0372</td>
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<tr>
<td>beam-shaper cable</td>
<td>G2597-60802</td>
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<tr>
<td>beam-shaper slicer assembly</td>
<td>G2597-60200</td>
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<tr>
<td>cable optics assembly</td>
<td>G2597-60800</td>
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<tr>
<td>P-filter rod</td>
<td>G1969-20065</td>
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<tr>
<td>Quad holder</td>
<td>G2597-20006</td>
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<tr>
<td>slit cable assembly</td>
<td>G2597-60801</td>
</tr>
<tr>
<td>slicer body assembly</td>
<td>G2597-60139</td>
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<tr>
<td>slicer exit</td>
<td>G2597-20001</td>
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<tr>
<td>slit plate</td>
<td>G2597-20080</td>
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<tr>
<td>slit spacer</td>
<td>G2597-20005</td>
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<tr>
<td>SW60 oil</td>
<td>6040-1361</td>
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In This Book

This book contains procedures to clean and maintain your Agilent 6000 Series LC/MS instrument. This book applies to all 6100 Series, 6200 Series, 6400 Series and 6500 Series LC/MS instruments.