

# **Agilent 6400 Series Triple Quad LC/MS**

## **Maintenance Guide**

**Research Use Only. Not for use in Diagnostic  
Procedures.**



**Agilent Technologies**

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## WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

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# 1

## Maintenance

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This chapter contains maintenance tasks for the Agilent 6400 Series Triple Quad LC/MS.



## Electrospray Ion Source

This section describes the removal, disassembly, cleaning, and reassembly of the API-interface and the assemblies that make up the source.

### To flush the nebulizer

<b>When required</b>	Daily or at the end of each shift (or more often) to flush traces of samples and buffers out of the tubing, valves and nebulizer.
<b>Tools required</b>	<ul style="list-style-type: none"><li>• Acetonitrile, HPLC-grade or better</li><li>• Water, HPLC-grade or better</li></ul>
<b>Parts required</b>	None

- 1 Make sure acetonitrile and water are two of the solvents installed in your liquid chromatograph.

#### NOTE

This procedure applies to both electrospray and APCI nebulizer.

- 2 Set the liquid chromatograph to pump a mixture of 90% acetonitrile and 10% water at 2 ml/minute.
- 3 Pump this mixture through the nebulizer for 3 minutes.

#### NOTE

This is a good general-purpose flushing mixture but you may need to adjust it based on the solvents, samples and buffers you are using. For example, a mixture of 50% acetonitrile and 50% water works well for removing salts.

## To clean the electrospray spray chamber daily

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

**Tools required**

- Cloths, clean, lint-free (p/n 05980-60051)
- Gloves, clean
- Isopropanol, reagent grade or better
- Mobile phase, current
- Wash bottle, clean
- Water, reagent-grade or better

**Parts required** None

### NOTE

Recent residue should be soluble in the mobile phase. If you are not sure what mobile phase was used recently, a mixture of 50% isopropanol and 50% water works well as a general cleaning solution.

- 1 Prepare the mobile phase you have been using.
- 2 Turn off the spray chamber.

### WARNING

**The electrospray spray chamber operates at high temperatures. Allow sufficient time to cool down before cleaning.**

- 3 Remove the electrospray nebulizer.
- 4 Open the spray chamber ([Figure 1](#)).

## 1 Maintenance

To clean the electrospray spray chamber daily



**Figure 1** Opened electrospray spray chamber

- 5 Rinse the interior of the spray chamber with the current mobile phase or with a mixture of isopropanol and water.

### **WARNING**

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

---

- 6 Wipe the interior of the spray chamber with a clean, lint-free cloth.

- 7 Rinse the area around the spray shield.

### **CAUTION**

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

---

- 8 Dampen a clean cloth with the mobile phase.

- 9 Wipe the spray shield and the area around the spray shield.

- 10 Close the spray chamber.

- 11 Reinstall the electrospray nebulizer.

### **WARNING**

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 electrospray spray chamber weekly

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

**Tools required**

- Abrasive paper, 4000 grit (p/n 8660-0827)
- Cloths, clean, lint-free (p/n 05980-60051)
- Cotton swabs (p/n 5080-5400)
- Gloves, clean
- Isopropanol, reagent grade or better
- Mobile phase, current
- Wash bottle, clean
- Water, reagent-grade or better

**Parts required** None

### NOTE

Recent residue should be soluble in the mobile phase. If you are not sure what mobile phase was used recently, a mixture of 50% isopropanol and 50% water works well as a general cleaning solution.

---

1 Turn off the spray chamber.

### WARNING

**The electrospray spray chamber operates at high temperatures. Allow sufficient time to cool down.**

2 Remove the electrospray nebulizer.

3 Open the spray chamber and remove it from the instrument.

4 Fill the spray chamber with clean mobile phase, or with a mixture of isopropanol and water.

## 1 Maintenance

To clean the electrospray spray chamber weekly



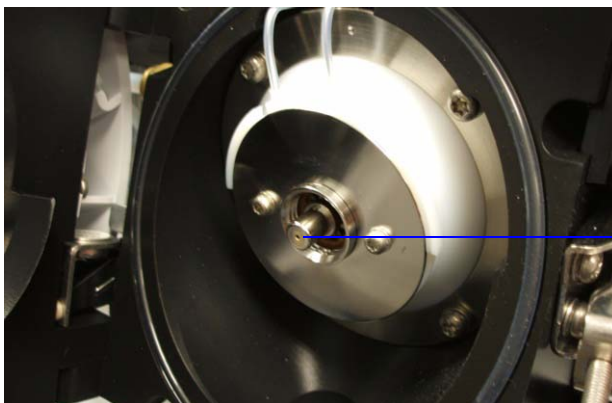
**Figure 2** Filling the spray chamber

### **WARNING**

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

---

- 5 Scrub the insulators and the interior of the spray chamber with a clean cotton swab.
- 6 Empty the spray chamber.
- 7 Reinstall the spray chamber on the instrument.
- 8 Remove the spray shield.
- 9 Use abrasive paper to gently clean the end of the capillary cap.

**Capillary cap****Figure 3** End of capillary cap

- 10** Dampen a clean cloth and wipe the end of the capillary cap.
- 11** Reinstall the spray shield.
- 12** Use abrasive paper to gently clean the spray shield.
- 13** Dampen a clean cloth and wipe the spray shield.
- 14** Rinse the area around the spray shield.

**Figure 4** Rinsing the area around the spray shield

## 1 Maintenance

To clean the electrospray spray chamber weekly

### CAUTION

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

---

**15** Wipe the area around the spray shield.

**16** Close the spray chamber.

**17** Reinstall the electrospray nebulizer.

## To remove the electrospray nebulizer

<b>When required</b>	When you need to access the nebulizer for maintenance.
<b>Tools required</b>	Gloves, clean
<b>Parts required</b>	None

### NOTE

Recent residue should be soluble in the mobile phase. If you are not sure what mobile phase was used recently, a mixture of 50% isopropanol and 50% water works well as a general cleaning solution.



**Figure 5** Electrospray nebulizer

- 1 Shut off the flow of LC solvent.
- 2 Shut off the flow of nebulizing gas.
- 3 Slide back the plastic cover from over the nebulizer.
- 4 Disconnect the LC tubing and nebulizing gas tubing from the nebulizer.
- 5 Turn the nebulizer counterclockwise until it disengages from the retaining screws.
- 6 Gently lift the nebulizer out of the spray chamber.

### WARNING

The tip of the nebulizer may be very hot. Allow it to cool before handling it.

## 1 Maintenance

### To replace the electrospray nebulizer needle

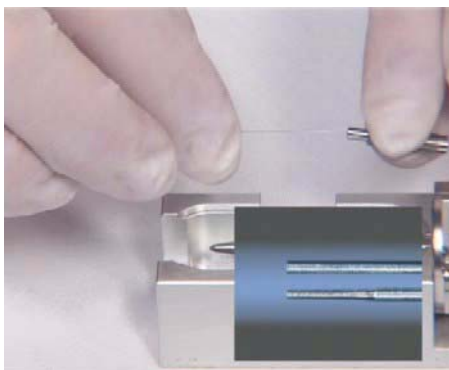
## To replace the electrospray nebulizer needle

- When required** When the needle is plugged. Common symptoms of a plugged needle are increased LC back pressure or off-axis spraying or dripping from the nebulizer
- Tools required**
- Adjustment fixture (p/n G1946-20215)
  - Gloves, clean
  - Pliers, long nose (p/n 7810-0004)
  - Wrench 3-mm, open-end (p/n 8710-2699)
  - Wrench ¼-inch x 5/16-inch, open-end (p/n 8710-0510)
- Parts required** Electrospray nebulizer needle kit (includes needle, ferrule, and needle holder, p/n G2427A)



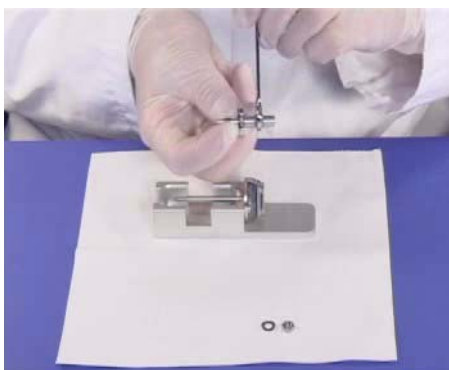
**Figure 6** Electrospray nebulizer needle in needle holder

- 1 Install the nebulizer in the adjustment fixture.
- 2 Loosen the locknut next to the zero-dead-volume (ZDV) union.
- 3 Remove the union from the nebulizer.
- 4 Loosen the locknut of the needle holder.
- 5 Unscrew the needle holder and pull it out of the nebulizer.
- 6 Slide the non-tapered end of the needle through the new needle holder from the narrower side.



**Figure 7** Sliding the non-tapered end of the needle through the new needle holder

- 7 Push a new ferrule, flat-side first, onto the needle.
- 8 Be sure the needle does not extend from the ferrule.
- 9 Reinstall the locknut and the union. Hand tighten the union.
- 10 Hold the needle holder steady with a 3-mm wrench. Tighten the union one-quarter to one-half turn to compress the ferrule.



**Figure 8** Tightening the union screw to compress the ferrule

- 11 Tighten the locknut against the union.
- 12 Pull carefully on the needle to ensure the needle is held firmly in place.
- 13 Replace locknut and washer.
- 14 Insert the needle into the nebulizer shaft.

## 1 Maintenance

To replace the electrospray nebulizer needle

### CAUTION

Take care when inserting the needle. The tapered end of the needle must pass through the restrictions in the nebulizer shaft. The tip of the needle can be damaged if excessive force is applied.

---

**15** Adjust the electrospray needle position before reinstalling the nebulizer in the spray chamber.

### NOTE

Record this procedure in the Maintenance Logbook.

---

## To adjust the electrospray nebulizer needle

**When required** After replacing the electrospray nebulizer needle or if symptoms indicate the needle is not correctly adjusted,

- Tools required**
- Adjustment fixture (p/n G1946-20215)
  - Gloves, clean
  - Magnifier (p/n G1946-80049)
  - Wrench 3-mm, open-end (p/n 8710-2699)
  - Wrench ¼-inch x 5/16-inch, open-end (p/n 8710-0510)

**Parts required** None

- 1 Install the nebulizer in the adjustment fixture.

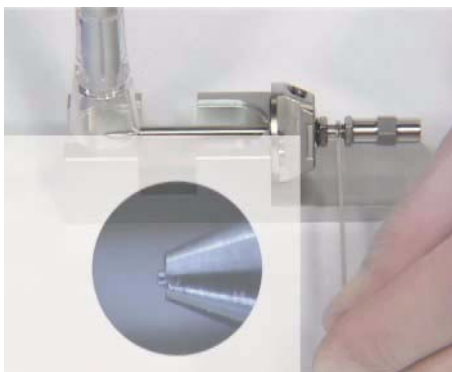


**Figure 9**

- 2 Loosen the needle holder locknut.
- 3 Position the magnifier so you can see the tip of the nebulizer.
- 4 Adjust the needle holder until the needle is even with the tip of the nebulizer.

## 1 Maintenance

### To adjust the electrospray nebulizer needle



**Figure 10** Adjusting the needle holder

- 5** Tighten the locknut. Make sure this does not change the position of the needle.
- 6** Remove the nebulizer from the adjustment fixture and reinstall it in the electrospray spray chamber.
- 7** Be very careful not to hit the tip of the nebulizer against anything. Any damage will have a large, negative effect on system performance.

#### NOTE

Record this procedure in the Maintenance Logbook.

## To reinstall the electrospray nebulizer

**When required** As necessary.

**Tools required** None

**Parts required** 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** Reconnect the nebulizing 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** Reconnect the LC tubing to the nebulizer.

### CAUTION

Do not overtighten the LC fitting. Overtightening the fitting can crush the tubing, creating a restriction.

---

**6** Close the nebulizer cover.

## ESI with Agilent Jet Stream Technology

This section describes the removal, disassembly, cleaning, and reassembly of the electrospray interface with Agilent Jet Stream Technology.

### To flush the nebulizer daily

<b>When required</b>	Daily or at the end of each shift (or more often) to flush traces of samples and buffers out of the tubing, valves and nebulizer
<b>Tools required</b>	<ul style="list-style-type: none"><li>• Acetonitrile, HPLC-grade or better</li><li>• Water, HPLC-grade or better</li></ul>
<b>Parts required</b>	None

- 1 Make sure acetonitrile and water are two of the solvents installed in your liquid chromatograph.
- 2 Set the liquid chromatograph to pump a mixture of 90% acetonitrile and 10% water at 2 ml/minute.
- 3 Pump this mixture through the nebulizer for 3 minutes.

#### NOTE

This is a good general-purpose flushing mixture but you may need to adjust it based on the solvents, samples and buffers you are using. For example, a mixture of 50% acetonitrile and 50% water works well for removing salts.

---

## To flush the nebulizer monthly

**When required** Monthly or as needed at the end of each shift (or more often) to flush traces of samples and buffers out of the tubing, valves and nebulizer

**Tools required**

- HPLC Flushing Solvent
- Cyclohexane, HPLC-grade or better
- Acetonitrile, HPLC grade or better
- Alternatively if available: isooctane, HPLC-grade or better

**Parts required** None

- 1 Make sure HPLC flushing, cyclohexane, and acetonitrile are three of the solvents installed in your liquid chromatograph.
- 2 Pump HPLC flushing solvent for 10 minutes at 5 mL/minute.
- 3 Switch to cyclohexane, and pump for 10 minutes at 5 mL/minute.
- 4 Pump this mixture through the nebulizer for 3 minutes.
- 5 Prepare enough acetonitrile and flush overnight.

### NOTE

This is a good general-purpose flushing mixture but you may need to adjust it based on the solvents, samples and buffers you are using. For example, substitute acetonitrile for isooctane for overnight flushing when heavy build-up is noticeable.

---

## 1 Maintenance

To clean the spray chamber daily for the ESI with Agilent Jet Stream

### To clean the spray chamber daily for the ESI with Agilent Jet Stream

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

**Tools required**

- Cloths, clean, lint-free (p/n 05980-60051)
- Gloves, clean
- Isopropanol, reagent grade or better
- Mobile phase, current
- Wash bottle, clean
- Water, reagent-grade or better

**Parts required** None

#### NOTE

Recent residue should be soluble in the mobile phase. If you are not sure what mobile phase was used recently, use a mixture of 50% isopropanol and 50% water as a general cleaning solution.

- 1 Prepare the mobile phase you have been using.
- 2 Turn off the spray chamber.

#### WARNING

**The electrospray with Agilent Jet Stream Technology spray chamber operates at high temperatures. Allow sufficient time to cool down before cleaning.**

- 3 Remove the nebulizer.
- 4 Open the spray chamber ([Figure 1](#)).

To clean the spray chamber daily for the ESI with Agilent Jet Stream



**Figure 11** Opened electrospray Agilent Jet Stream Technology spray chamber

- 5 Rinse the interior of the spray chamber with the current mobile phase or with a mixture of isopropanol and water.

**WARNING**

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

- 6 Wipe the interior of the spray chamber with a clean, lint-free cloth.
- 7 Rinse the area around the spray shield.

**CAUTION**

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

- 8 Dampen a clean cloth with the mobile phase.
- 9 Wipe the spray shield and the area around the spray shield.
- 10 Close the spray chamber.
- 11 Reinstall the electrospray nebulizer.

**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.

## 1 Maintenance

To clean the spray chamber weekly for the ESI with Agilent Jet Stream

### To clean the spray chamber weekly for the ESI with Agilent Jet Stream

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

**Tools required**

- Abrasive paper, 8000 grit (p/n 8660-0852)
- Cloths, clean, lint-free (p/n 05980-60051)
- Cotton swabs (p/n 5080-5400)
- Gloves, clean
- Isopropanol, reagent grade or better
- Mobile phase, current
- Wash bottle, clean
- Water, reagent-grade or better

**Parts required** None

#### NOTE

Recent residue should be soluble in the mobile phase. If you are not sure what mobile phase was used recently, a mixture of 50% isopropanol and 50% water works well as a general cleaning solution.

---

1 Turn off the spray chamber.

#### WARNING

The electrospray spray chamber operates at high temperatures. Allow sufficient time to cool down.

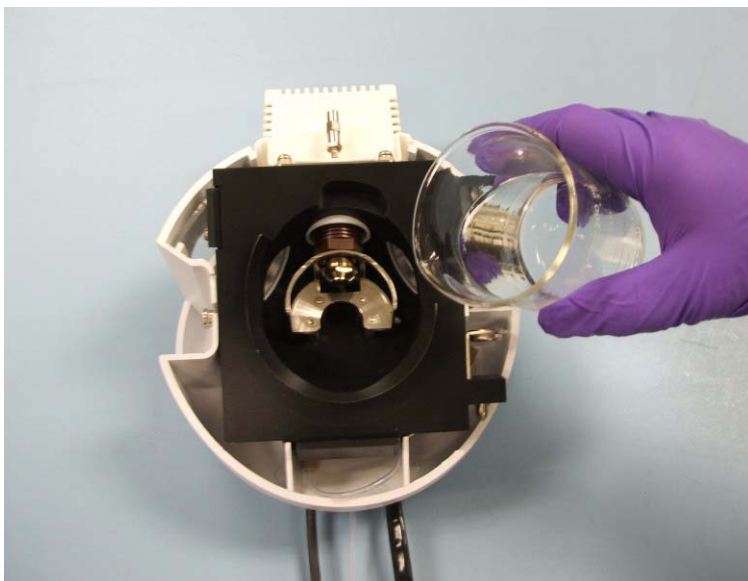
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2 Remove the electrospray nebulizer.

3 Open the spray chamber and remove it from the LC/MS.

4 Fill the spray chamber with clean mobile phase, or with a mixture of isopropanol and water.

To clean the spray chamber weekly for the ESI with Agilent Jet Stream



**Figure 12** Filling the spray chamber

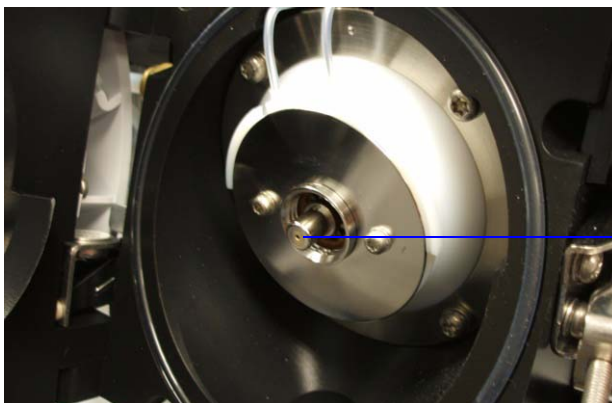
**WARNING**

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

- 5 Scrub the insulators and the interior of the spray chamber with a clean cotton swab.
- 6 Empty the spray chamber.
- 7 Reinstall the spray chamber on the instrument.
- 8 Remove the spray shield.
- 9 Use abrasive paper to gently clean the end of the capillary cap.

## 1 Maintenance

To clean the spray chamber weekly for the ESI with Agilent Jet Stream



Capillary cap

**Figure 13** End of capillary cap

**10** Dampen a clean cloth and wipe the end of the capillary cap.

**11** Reinstall the spray shield.

**12** Use abrasive paper to gently clean the spray shield.

**13** Dampen a clean cloth and wipe the spray shield.

**14** Rinse the area around the spray shield.



**Figure 14** Rinsing the area around the spray shield

To clean the spray chamber weekly for the ESI with Agilent Jet Stream

**CAUTION**

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

---

**15** Wipe the area around the spray shield.

**16** Close the spray chamber.

**17** Reinstall the electrospray nebulizer.

## 1 Maintenance

To remove the nebulizer for the ESI with Agilent Jet Stream

### To remove the nebulizer for the ESI with Agilent Jet Stream

**When required** When you need to access the nebulizer for maintenance

**Tools required** Gloves, clean

**Parts required** None

#### NOTE

Recent residue should be soluble in the mobile phase. If you are not sure what mobile phase was used recently, a mixture of 50% isopropanol and 50% water works well as a general cleaning solution.



**Figure 15** Electrospray nebulizer

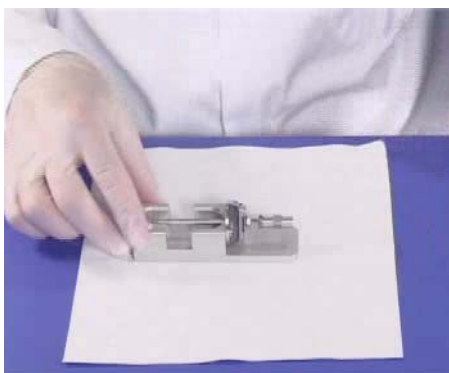
- 1 Shut off the flow of LC solvent.
- 2 Shut off the flow of nebulizing gas.
- 3 Slide back the plastic cover from over the nebulizer.
- 4 Disconnect the LC tubing and nebulizing gas tubing from the nebulizer.
- 5 Turn the nebulizer counterclockwise until it disengages from the retaining screws.
- 6 Gently lift the nebulizer out of the spray chamber.

#### WARNING

The tip of the nebulizer may be very hot. Allow it to cool before handling it.

## To replace the nebulizer needle for the ESI with Agilent Jet Stream

- When required** When the needle is plugged. Common symptoms of a plugged needle are increased LC back pressure or off-axis spraying or dripping from the nebulizer.
- Tools required**
- Adjustment fixture (p/n G1946-20215)
  - Gloves, clean
  - Pliers, long nose (p/n 7810-0004)
  - Wrench 3-mm, open-end (p/n 8710-2699)
  - Wrench ¼-inch x 5/16-inch, open-end (p/n 8710-0510)
- Parts required** Nebulizer accessory kit, ES with Agilent Jet Stream p/n G1958-60136

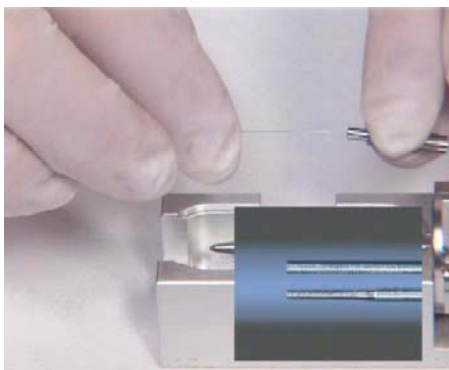


**Figure 16** Electrospray nebulizer needle in needle holder

- 1 Install the nebulizer in the adjustment fixture.
- 2 Loosen the locknut next to the zero-dead-volume (ZDV) union.
- 3 Remove the union from the nebulizer.
- 4 Loosen the locknut of the needle holder.
- 5 Unscrew the needle holder and pull it out of the nebulizer.
- 6 Slide the non-tapered end of the needle through the new needle holder from the narrower side.

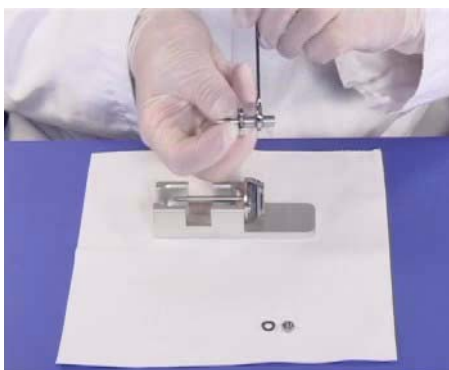
## 1 Maintenance

To replace the nebulizer needle for the ESI with Agilent Jet Stream



**Figure 17** Sliding the non-tapered end of the needle through the new needle holder

- 7 Push a new ferrule, flat-side first, onto the needle.
- 8 Be sure the needle does not extend from the ferrule.
- 9 Reinstall the locknut and the union. Hand tighten the union.
- 10 Hold the needle holder steady with a 3-mm wrench. Tighten the union one-quarter to one-half turn to compress the ferrule.



**Figure 18** Tightening the union screw to compress the ferrule

- 11 Tighten the locknut against the union.
- 12 Pull carefully on the needle to ensure the needle is held firmly in place.
- 13 Replace locknut and washer.
- 14 Insert the needle into the nebulizer shaft.

## To replace the nebulizer needle for the ESI with Agilent Jet Stream

**CAUTION**

Take care when inserting the needle. The tapered end of the needle must pass through the restrictions in the nebulizer shaft. The tip of the needle can be damaged if excessive force is applied.

---

**15** Adjust the electrospray needle position before reinstalling the nebulizer in the spray chamber.

**NOTE**

Record this procedure in the Maintenance Logbook.

---

## 1 Maintenance

### To adjust the nebulizer needle for the ESI with Agilent Jet Stream

## To adjust the nebulizer needle for the ESI with Agilent Jet Stream

**When required** After replacing the electrospray nebulizer needle or if symptoms indicate the needle is not correctly adjusted

**Tools required**

- Adjustment fixture (p/n G1946-20215)
- Gloves, clean
- Magnifier (p/n G1946-80049)
- Wrench 3-mm, open-end (p/n 8710-2699)
- Wrench ¼-inch x 5/16-inch, open-end (p/n 8710-0510)

**Parts required** None

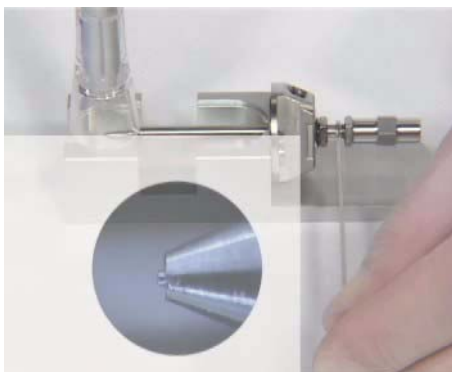
- 1 Install the nebulizer in the adjustment fixture.



**Figure 19**

- 2 Loosen the needle holder locknut.
- 3 Position the magnifier so you can see the tip of the nebulizer.
- 4 Adjust the needle holder until the needle is even with the tip of the nebulizer.

## To adjust the nebulizer needle for the ESI with Agilent Jet Stream



**Figure 20** Adjusting the needle holder

- 5** Tighten the locknut. Make sure this does not change the position of the needle.
- 6** Remove the nebulizer from the adjustment fixture and reinstall it in the electrospray spray chamber.
- 7** Be very careful not to hit the tip of the nebulizer against anything. Any damage will have a large, negative effect on system performance.

**NOTE**

Record this procedure in the Maintenance Logbook.

## 1 Maintenance

### To reinstall the nebulizer for the ESI with Agilent Jet Stream

## To reinstall the nebulizer for the ESI with Agilent Jet Stream

**When required** As necessary

**Tools required** None

**Parts required** 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 Reconnect the nebulizing 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 Reconnect the LC tubing the nebulizer.

### CAUTION

Do not overtighten the LC fitting. Overtightening the fitting can crush the tubing, which creates restriction.

---

6 Close the nebulizer cover.

## APCI Source

This section describes how to open and close the APCI source and maintain it.

### To clean the APCI spray chamber daily

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

**Tools required**

- Cloths, clean, lint-free (p/n 05980-60051)
- Gloves, clean
- Isopropanol, reagent grade or better
- Mobile phase, current
- Wash bottle, clean
- Water, reagent-grade or better

**Parts required** None

#### WARNING

**The APCI spray chamber operates at high temperatures. Allow sufficient time to cool down.**

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

#### CAUTION

Do not spray the mobile phase upward into the vaporizer.

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

## 1 Maintenance

To clean the APCI spray chamber daily

### NOTE

- Recent residue should be soluble in the mobile phase. If you are not sure what mobile phase was used recently, use a mixture of 50% isopropanol and 50% water as a general cleaning solution.
- Use the weekly cleaning procedure if symptoms of contamination persist, or if the spray shield or capillary cap shows significant discoloration that cannot be removed by the regular daily cleaning.

- 1 Turn off the spray chamber.
- 2 Remove the corona needle.
- 3 Make sure the needle has cooled and then carefully clean it with abrasive paper.
- 4 Open the spray chamber.



**Figure 21** Opened spray chamber

- 5 Rinse the interior of the spray chamber with the current mobile phase or with a mixture of isopropanol and water.
- 6 Wipe the interior of the spray chamber and the end of the vaporizer with a clean cloth.
- 7 Remove the spray shield.
- 8 Use abrasive paper to gently clean the end of the capillary cap.
- 9 Dampen a clean cloth and wipe the end of the capillary cap.
- 10 Reinstall the spray shield.
- 11 Use abrasive paper to gently clean the spray shield.

- 12** Dampen a clean cloth and wipe the spray shield.
- 13** Rinse the area around the spray shield.
- 14** Wipe the area around the spray shield with a clean cloth.
- 15** Close the spray chamber.
- 16** Reinstall the corona needle.

## 1 Maintenance

To clean the APCI spray chamber weekly

### To clean the APCI spray chamber weekly

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

**Tools required**

- Abrasive paper, 4000 grit (p/n 8660-0827)
- Cloth, clean, lint-free, 05980-60051
- Cotton swabs, 5080-5400
- Gloves, clean
- Isopropanol, reagent grade or better
- Mobile phase, current
- Wash bottle
- Water, reagent-grade or better

**Parts required** None

**1** Prepare the mobile phase you have been using.

Recent residue should be soluble in the mobile phase. If you are not sure what mobile phase was used recently, use a mixture of 50% isopropanol and 50% water as a general cleaning solution.

**2** Turn off the spray chamber.

**3** The APCI spray chamber operates at high temperatures. Allow sufficient time to cool down.

**4** Remove the corona needle.

**5** Make sure the needle has cooled and then carefully clean it with abrasive paper.

**6** Open the spray chamber.

**7** Rinse the interior of the spray chamber with the current mobile phase or with a mixture of isopropanol and water.

Some mobile phases are dangerous. Use caution that is appropriate for the current mobile phase.

#### CAUTION

Do not spray the mobile phase upward into the vaporizer.

- 8** Wipe the interior of the spray chamber and the end of the vaporizer with a clean cloth.
- 9** Remove the spray shield.
- 10** Use abrasive paper to gently clean the end of the capillary cap.
- 11** Dampen a clean cloth and wipe the end of the capillary cap.
- 12** Reinstall the spray shield.
- 13** Use abrasive paper to gently clean the spray shield.
- 14** Dampen a clean cloth and wipe the spray shield.
- 15** Rinse the area around the spray shield.

**CAUTION**

Do not spray directly at the end of the capillary. This can cause pressure surges in the vacuum system.

---

- 16** Wipe the area around the spray shield with a clean cloth.
- 17** Close the spray chamber.
- 18** Reinstall the corona needle.

## 1 Maintenance

### To remove the APCI nebulizer

## To remove the APCI nebulizer

**When required** When you need to access the nebulizer for maintenance.

**Tools required** • Gloves, clean

**Parts required** None



**Figure 22** APCI nebulizer

- 1 Shut off the flow of LC solvent.
- 2 Shut off the flow of nebulizing gas.
- 3 Disconnect the LC tubing and nebulizing gas tubing from the nebulizer.
- 4 Turn the nebulizer counterclockwise until it disengages from the retaining screws.
- 5 Gently lift the nebulizer out of the spray chamber.

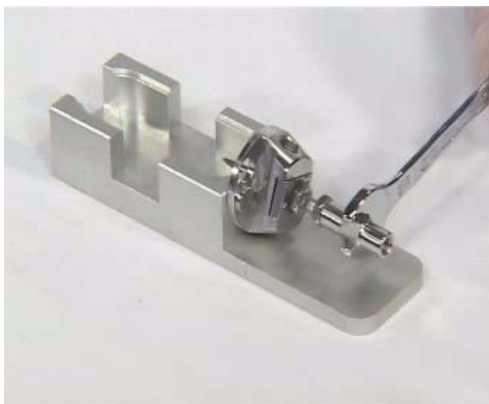
### **WARNING**

**The tip of the nebulizer may be very hot. Allow it to cool before handling it.**

## To replace the APCI nebulizer needle

- When required** When the needle is plugged. Common symptoms of a plugged needle are increased LC back pressure or off-axis spray from the nebulizer (difficult to see in an APCI system).
- Tools required**
- Adjustment fixture (p/n G1946-20215)
  - Gloves, clean, lint-free (large, p/n 8650-0030; small, p/n 8650-0029)
  - Pliers, long-nose (p/n 8710-0004)
  - Wrench 3-mm, open-end (p/n G1946-20203)
  - Wrench ¼-inch x 5/16-inch, 2 required (p/n 8710-0510)
- Parts required** Nebulizer needle kit, APCI (includes needle, ferrule, and needle holder, p/n G2428A).

- 1 Install the nebulizer in the adjustment fixture.

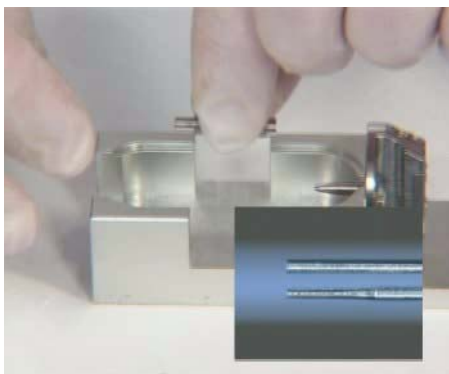


**Figure 23** Installing the nebulizer in the adjustment fixture

- 2 Loosen the locknut next to the zero-dead-volume (ZDV) union.
- 3 Remove the union from the nebulizer.
- 4 Loosen the locknut of the needle holder.
- 5 Unscrew the needle holder and pull it out of the nebulizer.
- 6 Slide the non-tapered end of the needle through the new needle holder from the narrower side.

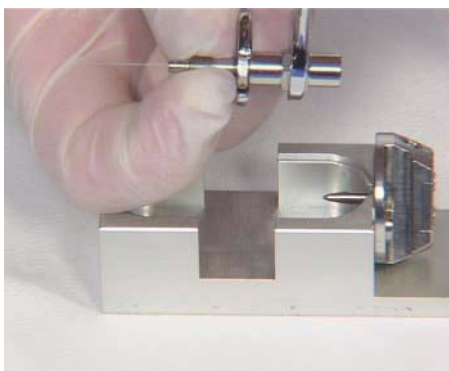
## 1 Maintenance

### To replace the APCI nebulizer needle



**Figure 24** Sliding the non-tapered end of the needle through the new needle holder

- 7 Push a new ferrule, flat-side first, onto the needle.
- 8 Be sure the needle does not extend from the ferrule.
- 9 Reinstall the locknut and the union. Hand tighten the union.
- 10 Hold the needle holder steady with a 3-mm wrench and tighten the union one-quarter to one-half turn to compress the ferrule.



**Figure 25** Tightening the union to compress the ferrule

- 11 Tighten the locknut against the union.
- 12 Pull carefully on the needle to ensure the needle is held firmly in place.
- 13 Replace locknut and washer.
- 14 Insert the needle into the nebulizer shaft.

**CAUTION**

Take care when inserting the needle. The tapered end of the needle must pass through restrictions in the nebulizer shaft. The tip of the needle can be damaged if excessive force is applied.

---

**15** Adjust the APCI needle position before reinstalling the nebulizer in the spray chamber.

**NOTE**

Record this procedure in the Maintenance Logbook.

---

## 1 Maintenance

### To adjust the APCI nebulizer needle

## To adjust the APCI nebulizer needle

**When required** After replacing the APCI nebulizer needle or if symptoms indicate the needle may not be correctly adjusted.

**Tools required**

- Adjustment fixture (p/n G1946-20215)
- Gloves, clean
- Magnifier (p/n G1946-80049)
- Wrench 3-mm, open-end (p/n 8710-2699)
- Wrench ¼-inch x 5/16-inch, 2 required (p/n 8710-0510)

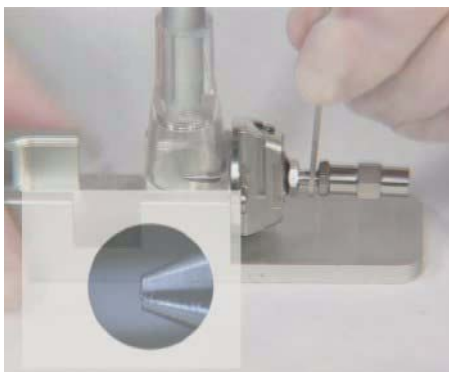
**Parts required** None

1 Install the nebulizer in the adjustment fixture.



**Figure 26** Installing the nebulizer in the adjustment fixture

- 2 Loosen the needle holder locknut.
- 3 Position the magnifier so you can view the tip of the nebulizer.
- 4 Adjust the needle holder until the needle is even with the tip of the nebulizer.



**Figure 27** Adjusting the needle holder

- 5** Tighten the locknut. Make sure this does not change the position of the needle.
- 6** Remove the nebulizer from the adjustment fixture and reinstall it in the APCI spray chamber.
- 7** Be very careful not to hit the tip of the nebulizer against anything. Any damage will have a large, negative effect on system performance.

**NOTE**

Record this procedure in the Maintenance Logbook.

## 1 Maintenance

### To reinstall the APCI nebulizer

## To reinstall the APCI nebulizer

**When required** As necessary.

**Tools required** None

**Parts required** None

- 1 Insert the nebulizer into the spray chamber.
- 2 Turn it clockwise to lock it into place.
- 3 Reconnect the nebulizing gas tubing to the nebulizer.
- 4 Reconnect the LC tubing to the zero-dead-volume union.
- 5 Do not overtighten the LC fitting. Overtightening the fitting can crush the tubing, creating a restriction.

## To clean the corona needle

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

**Tools required**

- Abrasive paper, 4000 grit (p/n 8660-0827)
- Cloths, clean, lint-free (p/n 05980-60051)
- Gloves, clean
- Isopropanol, reagent grade or better

**Parts required** None

1 Pull the corona needle assembly out of the spray chamber.

### WARNING

**The needle and related parts get very hot during operation. Make sure they have cooled before proceeding.**

---

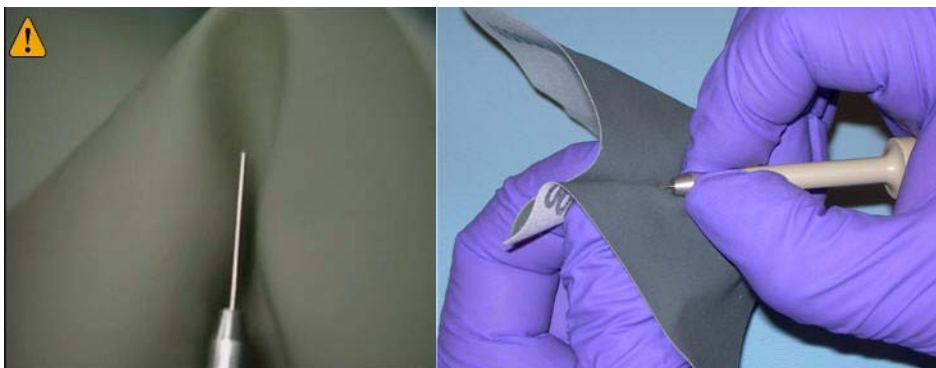


**Figure 28** Dirty APCI corona needle.

- 2 Fold a piece of abrasive paper over the base of the needle.
- 3 Pull and twist the abrasive paper along the needle and off the tip of the needle.

## 1 Maintenance

### To clean the corona needle



**Figure 29** Pulling and twisting abrasive paper along the tip of the needle.

#### CAUTION

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

- 4 Repeat [step 2](#) and [step 3](#) several times.
- 5 Starting at the base of the needle, wipe the needle with a clean cloth. The cloth can be dry or dampened with isopropanol.



**Figure 30** APCI corona needle after cleaning.

- 6 Reinstall the corona needle assembly in the spray chamber.

## To replace the corona needle

### CAUTION

Do not hit the tip of the needle against anything. It will bend the tip which will decrease system performance.

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

---

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

**Tools required**

- Cloths, clean, lint-free (p/n 05980-60051)
- Gloves, clean
- Isopropanol, reagent grade or better

**Parts required** Corona needle (p/n G2429A)

1 Pull the corona needle assembly out of the spray chamber.

### WARNING

**The needle and related parts get very hot during operation. Make sure they have cooled before proceeding.**

---

2 Remove the needle collar.

3 Remove the old corona needle from the collar.

4 Install a new needle, with its integral ferrule, in the collar.

## 1 Maintenance

To replace the corona needle



**Figure 31** Installing a new needle into the collar

**5** Turn the collar onto the needle holder and tighten by hand.

**6** Reinstall the corona needle assembly in the spray chamber.

### CAUTION

Do not hit the tip of the needle against anything. It will bend the tip which will decrease system performance.

### NOTE

Record this procedure in the Maintenance Logbook.

## Multimode Source, APPI Source and HPLC-Chip/MS Interface

This section describes how to maintain the multimode source, APPI source and HPLC-Chip/MS interface.

### To clean the multimode source daily

**When required** Daily or anytime you suspect carryover contamination from one sample or analysis to another, or when you must access the end cap and capillary cap for cleaning and inspection.

**Tools required**

- Gloves
- Wash bottle, clean

**Parts required**

- Abrasive paper, 4000 grit (p/n 8660-0827)
- Cloths, clean, lint-free (p/n 05980-60051)
- Cotton swabs (p/n 5080-5400)
- Mobile phase from the current method *or* clean isopropanol, reagent grade or better
- Water, reagent-grade or better

1 Turn off the spray chamber, nebulizer pressure, drying gas flow, drying gas temp, and vaporizer temp.

#### **WARNING**

**Do not touch the multimode source or the capillary cap. They may be very hot. Allow the multimode source to cool down before you handle them.**

- 
- 2 Remove the nebulizer and the APCI corona needle.
  - 3 Remove the cosmetic cover. You will have to remove the thermocouple probe before you can wipe the spray chamber. Otherwise, leave the thermocouple intact.
  - 4 Open the spray chamber.

## 1 Maintenance

### To clean the multimode source daily

- 5 Rinse the interior of the spray chamber using the wash bottle filled with the current mobile phase or with a mixture of isopropanol and water.

#### NOTE

Recent residue should be soluble in the mobile phase. If you are not sure what mobile phase was used recently, a solution of 50% isopropanol and 50% water works well as a general cleaning solution.

---

#### WARNING

**Some mobile phase are hazardous chemicals. Use the degree of caution appropriate for the mobile phase being used.**

---

- 6 Wipe the interior of the spray chamber with a clean, lint-free cloth.

#### WARNING

**Sharp edges can be found inside the spray chamber, such as the separator. Pay close attention when wiping the interior of the spray chamber.**

---

- 7 Rinse the area around the spray shield. Do not spray directly toward the tip of the capillary. This can cause pressure surges in the vacuum system.
- 8 Dampen a clean cloth with the mobile phase. Wipe the spray shield, field shaping electrodes and the area around the spray shield.
- 9 Replace the nebulizer and the APCI corona needle.
- 10 Install the thermocouple probe and adjust it so that it protrudes 15 mm from the inner spray chamber wall.
- 11 Replace the cosmetic cover.
- 12 Close the spray chamber.

#### NOTE

Use the weekly cleaning process if symptoms of contamination persist, or if the spray shield or capillary cap show significant discoloration that can not be removed by the normal daily cleaning procedure.

---

## To clean the multimode source weekly

The cleaning procedure for cleaning the multimode source weekly is similar to the daily procedure. The main difference is that the multimode source is removed from the instrument in the weekly procedure.

**When required** Weekly if the normal daily cleaning procedure is not sufficient

**Tools required**

- Gloves
- Wash bottle, clean

**Parts required**

- Abrasive paper, 4000 grit (p/n 8660-0827)
- Cloths, clean, lint-free (p/n 05980-60051)
- Cotton swabs (p/n 5080-5400)
- Mobile phase from the current method *or* clean isopropanol, reagent grade or better
- Water, reagent-grade or better

- 1 Remove the multimode source.
- 2 Fill the spray chamber with clean mobile phase, or with a mixture of isopropanol and water.

### NOTE

Recent residue should be soluble in the mobile phase. If you are not sure what mobile phase was used recently, a solution of 50% isopropanol and 50% water works well as a general cleaning solution.

### WARNING

**Some mobile phase are hazardous chemicals. Use the degree of caution appropriate for the mobile phase being used.**

- 3 Scrub the corona insulator and the interior of the spray chamber with a clean cotton swab.
- 4 Empty the spray chamber
- 5 Wipe the interior of the spray chamber with a clean, lint-free cloth

## 1 Maintenance

To clean the multimode source weekly

### **WARNING**

**Sharp edges can be found inside the spray chamber, such as the separator. Be careful when wiping the interior of the spray chamber.**

---

- 6** Remove the spray shield. Use abrasive paper to gently clean the end of the capillary cap.
- 7** Dampen a clean cloth and wipe the end of the capillary cap.
- 8** Reinstall the spray chamber.
- 9** Use abrasive paper to gently clean the spray shield. Dampen a clean cloth and wipe the spray shield.
- 10** Rinse the area around the spray shield then wipe the area around the spray shield.
- 11** Reinstall the spray chamber on the instrument.
- 12** Replace the nebulizer and APCI corona needle.
- 13** Install the thermocouple probe and adjust it so that it protrudes 15mm from the inner spray chamber wall.
- 14** Replace the cosmetic cover.
- 15** Close the spray chamber.

## To replace the APPI UV Lamp

**When** Replace the lamp if it becomes cracked or damaged, or if the lamp intensity has dropped considerably. The UV lamp has a useful lifetime of 6000 to 8000 hours if the  $\text{MgF}_2$  window is not damaged.

**Tools Required**

- T15 Torx driver (p/n 8710-1622)
- T20 Torx driver (p/n 8710-1615)
- Hex Key Set (2 mm Hex Key) (p/n 9810-0641)

**Parts List**

- UV Lamp, APPI (p/n G1971-60025)
- Clean Cloth (p/n 05980-60051)
- Vinyl/Rubber Gloves
- Cotton Swab (p/n 5080-5400)
- Isopropanol

### NOTE

Handle the quartz lamp body with gloves and keep it free of oils or grease. If the lamp body is touched or comes in contact with these materials, clean it with isopropyl alcohol.

### 1 Remove the Cosmetic Covers

- a Place the APPI source on a clean flat surface. Use a lint-free clean cloth to protect the Teflon coating on the spray chamber.
- b Remove the Nebulizer Cover. The cover should pop off easily, but you may need to pull the cover apart slightly. See [Figure 32](#).
- c Use a Torx T-20 screwdriver to remove the Cosmetic Cover Screws. See [Figure 32](#). You might need a Torx T-15 screwdriver for the latch pot screw (not shown).
- d With the spray chamber face down, carefully remove the Cosmetic Cover while holding onto the Spray Chamber Cover Windows (left and right). These can easily fall out and break. See [Figure 33](#).

## 1 Maintenance

To replace the APPI UV Lamp



**Figure 32** Removing the Nebulizer Cover (left) and Removing the Cosmetic Cover screws



**Figure 33** Removing the Cosmetic Cover

**2** Remove the APPI lamp drive module:

- a** Use a 2 mm Hex Key to remove the four screws securing the APPI Lamp Drive Module. Store the screws in a safe location. See [Figure 34](#), left.
- b** Gently lift the Lamp Drive Module off of the APPI lamp assembly. The lamp has no wires because it is excited by an RF waveform.

Keep track of the nylon insulators underneath the Lamp Drive Module. They will fall off of the source and tend to roll. See [Figure 34](#), right.



**Figure 34** Use a 2 mm Hex Key (left) and Nylon Insulators

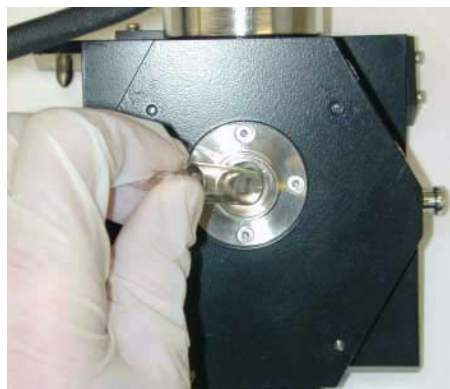
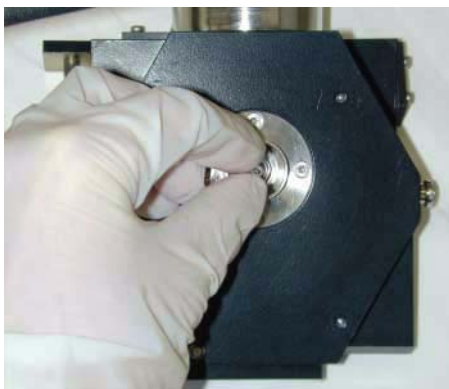
The UV lamp and lamp holder are now exposed. The lamp is held in place with an O-ring seal.

**3** Remove and install the APPI UV lamp:

- a** Grasp the exposed end of the lamp with gloved fingers and gently rock the lamp back and forth while pulling the lamp out of the lamp holder. See [Figure 35](#).

## 1 Maintenance

To replace the APPI UV Lamp



**Figure 35** Grasp end of UV lamp (left) and pull lamp out of lamp holder (right)

- b** Install the new UV lamp into the lamp holder. Use a slight rocking motion to push the lamp through the O-ring seal. Push the lamp into the lamp holder until it extends approximately 6 mm into the spray chamber. See [Figure 36](#).



**Figure 36** UV lamp should extend 6 mm (left). Lamp drive module should lie flat (right). Make sure switch is located on contact pin (circled above).

- c** Replace the nylon insulation and reinstall the lamp drive module. Make sure the lamp drive module lies flat against the nylon insulator. See [Figure 37](#). If the lamp drive module does not lie flat, the UV lamp may not be inserted far enough.

- This prevents damage to the spray chamber cover windows.

See **Figure 37**.



**Figure 37** Reinstall cosmetic covers.

## To change HPLC-Chip capillaries

**When** When broken, blocked or kinked

**Tools Required**

- Cube wrench (p/n G4240-83800)
- Hex key 3 mm, 12-cm long (p/n 8710-2411)

**Parts List**

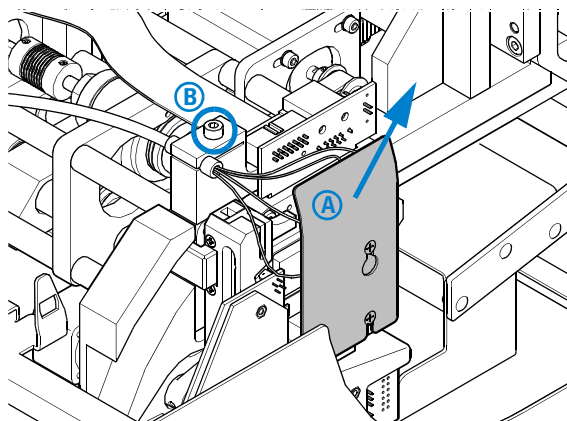
- Fused silica/PEEK capillary (see Parts)

### 1 Unload the HPLC-Chip

#### CAUTION

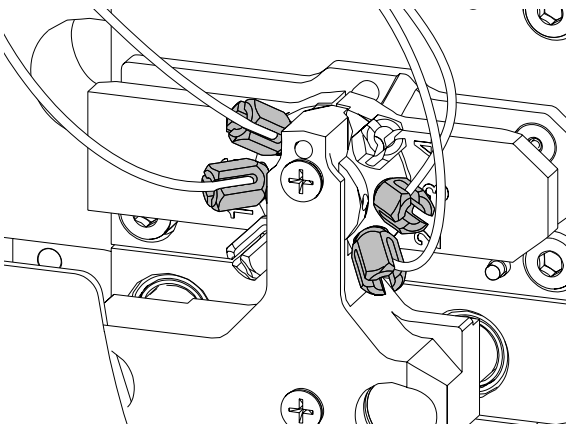
Do this procedure only if the Triple Quad LC/MS System is mounted on the MS or is sitting flat on a table because the center of gravity shifts and the instrument will tip over without adequate support.

- 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 38](#).



**Figure 38**

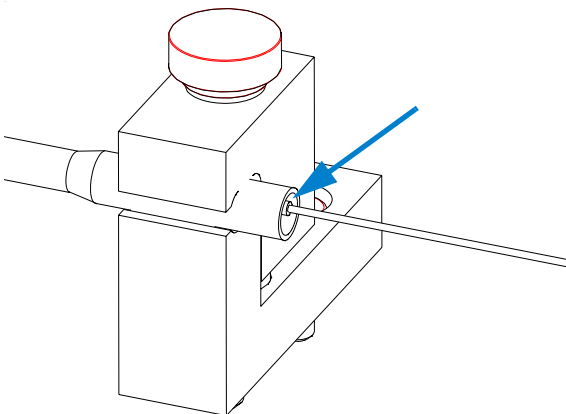
- 5 Loosen the slotted PEEK fitting using the Cube wrench and pull the capillary out. See [Figure 39](#).



**Figure 39**

- 6 Push the new 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 40**

## 1 Maintenance

### To change HPLC-Chip capillaries

#### 7 Connect the capillaries as follows to the HPLC-Chip valve stator:

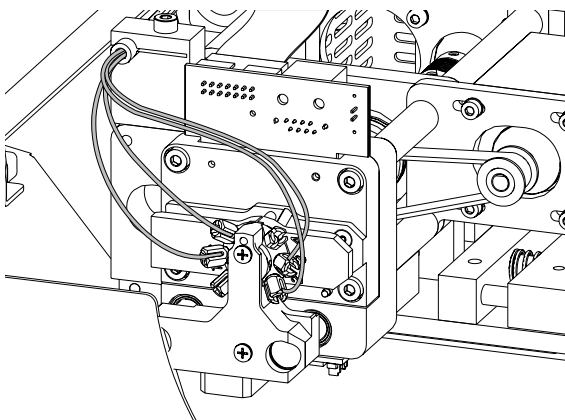
For forward-flush mode (default)

- port 1 - not used
- port 2 - 15  $\mu\text{m}$  (orange) to nanopump
- port 3 - 75  $\mu\text{m}$  (blue) to infusion pump
- port 4 - not used
- port 5 - 100  $\mu\text{m}$  (black) to waste
- port 6 - 25  $\mu\text{m}$  (yellow) to port 6 of the  $\mu$ -WPS

For backflush mode

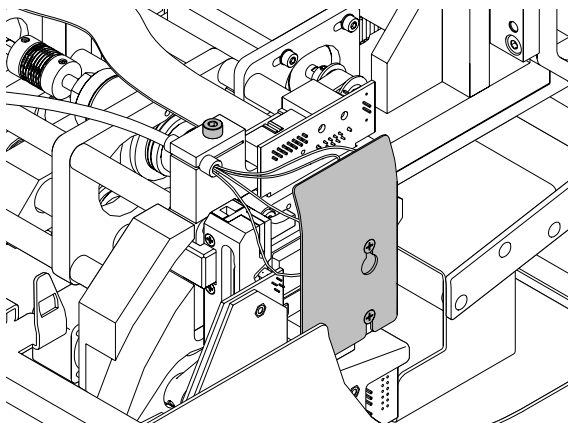
- port 1 - not used
- port 2 - 15  $\mu\text{m}$  (orange) to nanopump
- port 3 - 75  $\mu\text{m}$  (blue) to infusion pump
- port 4 - not used
- port 5 - 25  $\mu\text{m}$  (yellow) to port 6 of the  $\mu$ -WPS
- port 6 - 100  $\mu\text{m}$  (black) to waste

#### 8 Route the capillaries exactly as shown in [Figure 41](#).



**Figure 41**

#### 9 Reinstall the capillary cover. Do not overtighten the cover screws!



**Figure 42**

**10** Flip the stages assembly up and close the front pane.

## Ion Transfer Capillary

This section describes the steps to remove, clean and reinstall the ion transfer capillary.

### To remove the capillary

**When required** When you need to clean or replace the capillary.

**Tools required** Gloves, clean

**Parts required** None

- 1 Vent the system.
- 2 Unplug the instrument power cord from the power outlet after venting is complete.
- 3 Open the spray chamber.

#### **WARNING**

**The spray chamber operates at very high temperatures. Give the spray chamber time to cool before proceeding.**

---

- 4 Remove the spray shield.
- 5 Remove the capillary cap from the end of the capillary.
- 6 Carefully with a rotational motion, pull the capillary out of the desolvation assembly.



**Figure 43** Pulling the capillary out of the desolvation assembly

**CAUTION**

Carefully with a rotational motion, 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.

---

## 1 Maintenance

To clean the capillary

### To clean the capillary

- When required** When you observe decreased sensitivity and decreased signal stability
- Tools required**
- 5190-1401 Cleaning Powder, Dielectric Capillary
  - 100mL polypropylene graduated cylinder, or glass-graduated cylinder with two 1 mL pipette tip
- Parts required** Powdered Precision Cleaner (Alconox catalog number 1104)

- 1 Dissolve 1 g Alconox Powdered Precision Cleaner in 100 mL deionized water.

This concentration is the recommended concentration for “manual or ultrasonic cleaning”.

- 2 Place the ion transport capillary upright in a 100 mL polypropylene graduated cylinder and fill with Alconox solution.
- 3 Sonicate the graduated cylinder with the ion transport capillary in an ultrasonic cleaner for 10 to 15 minutes.



You may use a 1 mL pipette over the end of the ion transport capillary to protect the metallized 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 protective gloves.

- 4 Rinse the ion transport capillary and graduated cylinder several times with deionized water.
- 5 Fill the graduated cylinder with deionized water and sonicate the graduated cylinder with the ion transport capillary for 10 to 15 minutes.
- 6 Remove the ion transport capillary from the graduated cylinder and remove the pipette tip (if one was used).
- 7 Blow out excess water from the ion transport capillary bore using AeroDuster or oil-free pressurized gas.
- 8 Install the ion transport capillary in LC/MS Desolvation Assembly:
  - a Lubricate the ion transport capillary surface with isopropanol and insert carefully into Desolvation Assembly. Support the front and rear of the capillary and keep it level during installation.

When 2 to 3 cm of the capillary remains extended from the Desolvation Assembly, the capillary will “hold up” on the rear contact spring. Continue to apply pressure until approximately 1 cm remains extended from the Desolvation Assembly.

- b Lubricate the ion transport capillary tip with isopropanol and install the Capillary Cap.
  - c Install the threaded Spray Shield by turning clockwise.

## 1 Maintenance

To clean the capillary

9 Close the spray chamber and begin an instrument pump down.

### NOTE

If a new capillary was installed, record this procedure in the Maintenance Logbook.

---

## To reinstall the capillary

**When required** After cleaning the capillary or when installing a new capillary.

**Tools required** Gloves, clean

**Parts required** Isopropanol, HPLC grade or better

- 1 Lubricate the capillary entrance end with isopropanol.
- 2 Slide the capillary out with rotational motion into the desolvation assembly. The capillary must be aligned correctly so that its end will fit into a fixed capillary cap inside the desolvation assembly.



**Figure 44** Reinstalling the capillary

### CAUTION

Putting vertical or horizontal pressure on the capillary can break it.

- 3 Reinstall the capillary cap over the outer end of the capillary.
- 4 Reinstall the spray shield.
- 5 Close the spray chamber.

### NOTE

If a new capillary was installed, record this procedure in the Maintenance Logbook.

## Desolvation Assembly

This section describes how to maintain the desolvation assembly.

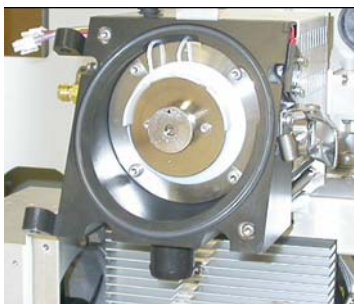
### To remove the desolvation assembly

<b>When required</b>	When you need to access the optics assembly
<b>Tools required</b>	<ul style="list-style-type: none"><li>• Wrench, ½-inch x 9/16-inch, open-end (p/n 8710-0877)</li><li>• Screwdriver, TORX, T-20 (p/n 8710-1615)</li></ul>
<b>Parts required</b>	None

#### NOTE

**The spray chamber and desolvation assembly operate at very high temperatures. Give them time to cool before proceeding.**

- 1 Vent the system.
- 2 Unplug the instrument power cord from the power outlet after venting is complete.
- 3 Remove the front, top and left side covers.
- 4 Disconnect the connections to the Aux module on top of the vacuum manifold, and lift off and remove the Aux module. Disconnect the drying gas tubing from the desolvation assembly.
- 5 Disconnect the drying gas heater cable from the desolvation assembly.
- 6 Disconnect the drain hose from the desolvation assembly.
- 7 Remove the two retaining screws that keep the desolvation assembly attached to the support rods.



**Figure 45** Desolvation assembly with retaining screws removed

**8** Slide the desolvation assembly off of the support rods.

**NOTE**

The capillary column is contained in the desolvation assembly. It does not need to be removed in order to remove the desolvation assembly.

---

## 1 Maintenance

### To clean skimmer 1

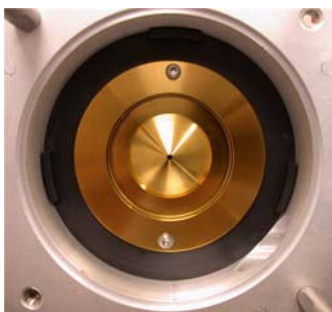
#### To clean skimmer 1

**When required** When symptoms indicate it is necessary.

**Tools required** Cloth, clean, lint-free (p/n 05980-60051)  
Gloves, clean  
Isopropanol, reagent grade or better  
Water, reagent-grade or better

**Parts required** None

- 1 Remove the desolvation assembly.
- 2 Dampen a clean cloth with a mixture of Isopropanol and water.
- 3 Wipe the skimmer.



**Figure 46** Wipe the skimmer.

#### CAUTION

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

- 4 Reinstall the desolvation assembly.

## To reinstall the desolvation assembly

**When required** As necessary

**Tools required** Wrench, 1/2-inch x 9/16-inch, open-end (p/n 8710-0877)

**Parts required** 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 nebulizing gas tubing to the desolvation assembly.
- 6 Reinstall the Aux module on top of the vacuum manifold.
- 7 Reconnect the connections to the Aux module.

## Calibrant Delivery System and Divert Valve

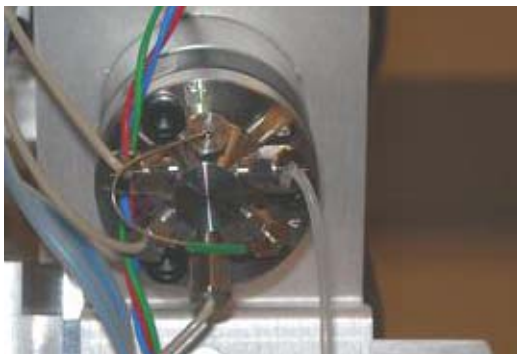
This section describes maintenance tasks that are related to the calibrant delivery system and divert valve.

When you do maintenance procedures on the divert valve:

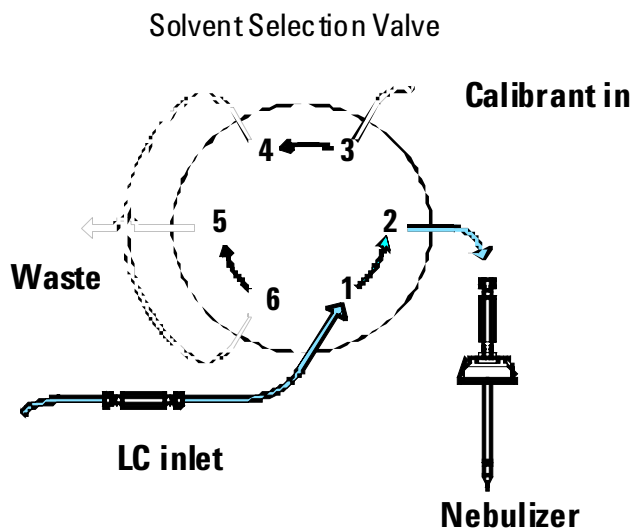
- Check drain bottle in shorter intervals as usual!
- Do not bend any capillary line.
- The position of the divert valve can be set only in the On mode.
- Put the instrument in the Off mode.
- Remove the covers before you begin.
- Install the covers of the instrument after you finish.

**Table 1** Divert Valve Connection (see [Figure 47](#))

No.	Port	Connection	User action
1	Inlet	from the front inlet union behind the inlet cover	none
2	Inlet	from CDS	none (permanent connection from calibrant delivery system)
3	Outlet	to the ion source	connect the flexible capillary to the ion source
4	Loop	loop to port 6	none (permanent connection)
5	Waste	to the drain bottle	none
6	Loop	loop to port 4	none (permanent connected)

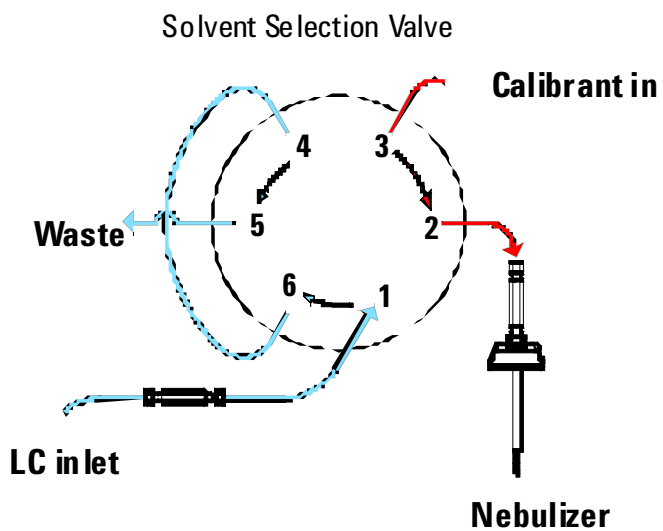


**Figure 47** Divert valve with port position indicators



**Figure 48** LC to LC/MS flow

**1 Maintenance**  
**Calibrant Delivery System and Divert Valve**



**Figure 49** Calibrant to LC/MS flow

## To check calibrant levels

**When required** Monthly or weekly if you tune the instrument frequently

**Tools required** None

**Parts required** None

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

---

## To fill a calibrant bottle

**When required** As necessary.

**Tools required** None

**Parts required**

- APCI/APPI Calibrant (p/n G2432A)
- APCI-L Tuning Mix (p/n G1969-85010)
- ESI-L Tuning Mix (p/n G1969-85000)
- MMI-L Tuning Mix (p/n G1969-85020)

The 6460 with Agilent Jet Stream Technology uses the ESI-L Tuning Mix.

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

### CAUTION

Tighten the bottle by hand. Do not overtighten it. The bottle only needs to be snug.

---

### NOTE

Record this procedure in the Maintenance Logbook.

---

## To check for leaks

**When required** When the sensor indicates a leak has occurred.

**Tools required**

- Cloths, clean, lint-free (p/n 05980-60051)
- Cotton swabs (p/n 5080-5400)
- Screwdriver, TORX, T-10 (p/n 8710-1623)

**Parts required** None

- 1 Remove the front cover and top cover from the instrument.
- 2 Remove the calibrant bottles.
- 3 Turn off the Spray Chamber nebulizer pressure, drying gas temp, and vaporizer temp (for APCI or multimode).
- 4 Disconnect the nebulizing gas tubing and the LC tubing from the nebulizer.
- 5 Remove the spray chamber from the instrument.

### WARNING

**The spray chamber operates at very high temperatures. Do not touch any parts inside the chamber until they have had time to cool.**

- 6 Remove the two screws and remove the cover of the calibrant delivery system.
- 7 Check the catch tray. If you see liquid, the pump has a leak. If no liquid is present, the leak sensor may be out of calibration. See the online Help for instructions to calibrate the leak sensor.
- 8 If a leak occurs during a long unattended run, the liquid from the leak may evaporate to give you the impression that no leak exists and the leak sensor is out of calibration. Turn the system back on and make sure no leak exists before you recalibrate the leak sensor.
- 9 Check the selection valve, the waste fitting, the inlet fitting, and the calibrant delivery system valves. If you find a leak, correct it and check the remaining locations.
- 10 Dry the catch tray and leak sensor.
- 11 When the catch tray and leak sensor are thoroughly dry, reassemble the instrument.

## 1 Maintenance

### To replace the LC filter elements

## To replace the LC filter elements

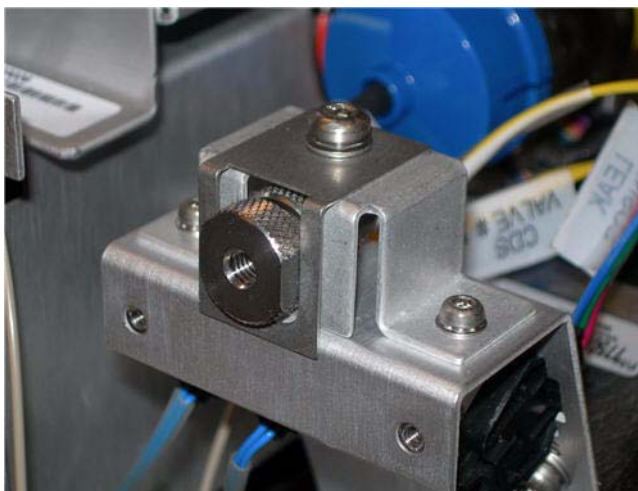
**When required** When back pressure is high on the LC pump or when the sensor indicates a leak has occurred.

**Tools required**

- Tweezers
- Wrench, ½-inch

**Parts required** Filter Element, 5 µm (p/n 0100-2051)

- 1 Stop the flow of LC solvent to the instrument.
- 2 Remove the front and top covers.
- 3 Turn off the spray chamber nebulizer pressure, drying gas temp, and vaporizer temp (if APCI or multimode).
- 4 Remove the spray chamber.
- 5 Remove the upper left front cover to access the inlet filter assembly.



**Figure 50** Inlet filter assembly

- 6 Remove the retaining screw at the top of the inlet filter assembly and pull the filter assembly forward out of the bracket.
- 7 While holding the knurled lower part of the assembly, twist the upper part counterclockwise until the two parts are separated.

## To replace the MS selection valve rotor seal

- 8 Use tweezers to remove the filter element from the upper part of the assembly. The filter element is a stainless steel frit surrounded by a Teflon ring.
- 9 Insert the new filter element.
- 10 Reassemble the filter assembly.
- 11 Reinsert the assembly into the bracket and reinstall the top retaining screw.
- 12 Reinstall the covers and spray chamber.

## To replace the MS selection valve rotor seal

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

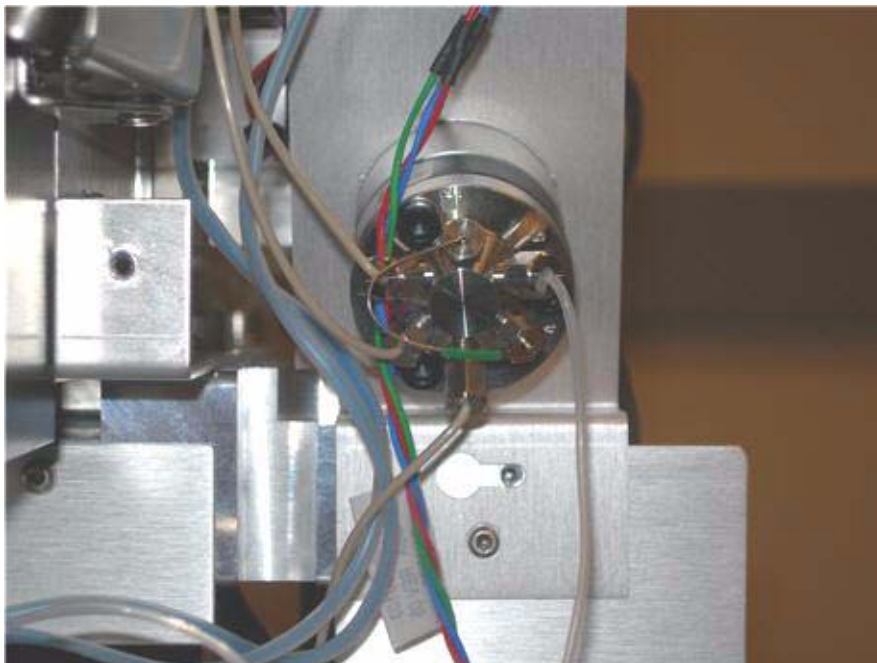
**Tools required** Hex key wrench

**Parts required** Rotor seal (p/n 0100-1855)

- 1 Stop the flow of LC solvent to the instrument.
- 2 Remove the front cover.
- 3 Remove the top cover.
- 4 Remove the left side cover.
- 5 Remove the tubing connections from the six-port MS selection valve.

## 1 Maintenance

To replace the MS selection valve rotor seal



**Figure 51** Six-port MS selection valve

- 6** Use the hex key wrench to remove the three hex head screws from the stator face of the selection valve.
- 7** Remove the rotor seal and replace it with a new one. Be sure to install it in the proper orientation.
- 8** Reinstall the stator face assembly.
- 9** Reconnect the tubing to the selection valve.
- 10** Reinstall the left, top and front covers.

## Analyzer and Ion Optics Assembly

This section describes the maintenance steps for the analyzer and ion optics assembly.

### To open the analyzer

**When required** As necessary for maintenance.

**Tools required** None

**Parts required** None

- 1 Vent the system.
- 2 Unplug the instrument power cord from the power outlet after venting is complete.
- 3 Remove the front cover from the instrument.
- 4 Remove the top cover from the instrument.
- 5 Remove the left side covers.
- 6 Disconnect the connections to the Aux module, and lift off and remove the Aux module. Put on an antistatic wrist strap. Attach the wrist strap to a grounded surface such as the back panel of the instrument.
- 7 Lift off the vacuum manifold cover.

## 1 Maintenance

### To replace the electron multiplier horn

## To replace the electron multiplier horn

- When required** When sensitivity is poor and autotune consistently sets the detector gain to its maximum value
- Tools required**
- Gloves, clean
  - Pliers, long-nose (p/n 8710-0004)
- Parts required** High gain electron multiplier horn (p/n G2571-80103)

- 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.

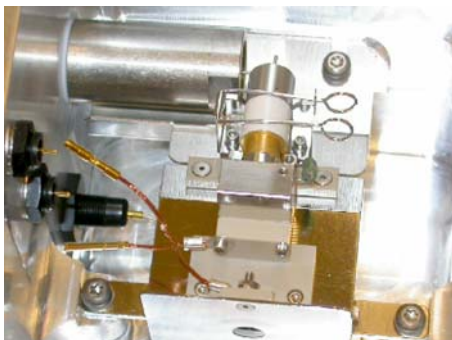
#### NOTE

Record this procedure in the Maintenance Logbook.

## To clean the high energy dynode

<b>When required</b>	When sensitivity is poor and autotune consistently sets the detector gain to its maximum value
<b>Tools required</b>	<ul style="list-style-type: none"><li>• Beakers, large (2 required, at least 500 ml each)</li><li>• Gloves, clean</li><li>• Hex wrench, 0.8mm (p/n 8710-1225)</li><li>• Isopropanol, reagent grade or better</li><li>• Pliers, long-nose (p/n 8710-0004)</li><li>• Screwdriver, TORX, T-20 (p/n 8710-1615)</li></ul>
<b>Parts required</b>	None

- 1 Disconnect the two braided wires from the electron multiplier.
- 2 Remove the two screws that hold the electron multiplier to the vacuum manifold.



**Figure 52** Electron multiplier exposed

- 3 Remove the electron multiplier and, at the same time, carefully disconnect the two remaining rigid wires.
- 4 Remove the electron multiplier horn from the electron multiplier.

### CAUTION

The solvents used in the cleaning process will damage the electron multiplier horn.

## 1 Maintenance

### To clean the high energy dynode

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

#### CAUTION

The solvents used in the cleaning process will damage the resistor.

---

- 6 Place the electron multiplier (without the horn or resistor) into a beaker containing 200 ml of isopropanol. Make sure the high energy dynode is immersed.
- 7 Gently agitate the beaker by hand for 1 minute.

#### CAUTION

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

---

- 8 Transfer the electron multiplier to another beaker containing about 200 ml of methanol. Make sure the high energy dynode is immersed.
- 9 Gently agitate the beaker by hand for 1 minute. This helps to rinse off the isopropanol.

#### CAUTION

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

---

- 10 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.
- 11 Reinstall the resistor and electron multiplier horn.
- 12 Reinstall the electron multiplier in the vacuum manifold and, at the same time, connect the two rigid wires to the electron multiplier.
- 13 Install and tighten the two screws that hold the electron multiplier in place. Reconnect the two braided wires to the electron multiplier.

## To close the analyzer

**When required** As necessary after analyzer maintenance.

**Tools required** None

**Parts required** None

### NOTE

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

- 1 Position the manifold cover on the vacuum manifold.
- 2 Reinstall the top cover of the instrument.
- 3 Reinstall the Aux module on to the top of the vacuum manifold.
- 4 Reconnect the connections to the Aux module.
- 5 Reinstall the left side covers. Reinstall the front cover of the instrument.
- 6 Pump down the instrument.

## 1 Maintenance

### To clean the ion optics assembly

## To clean the ion optics assembly

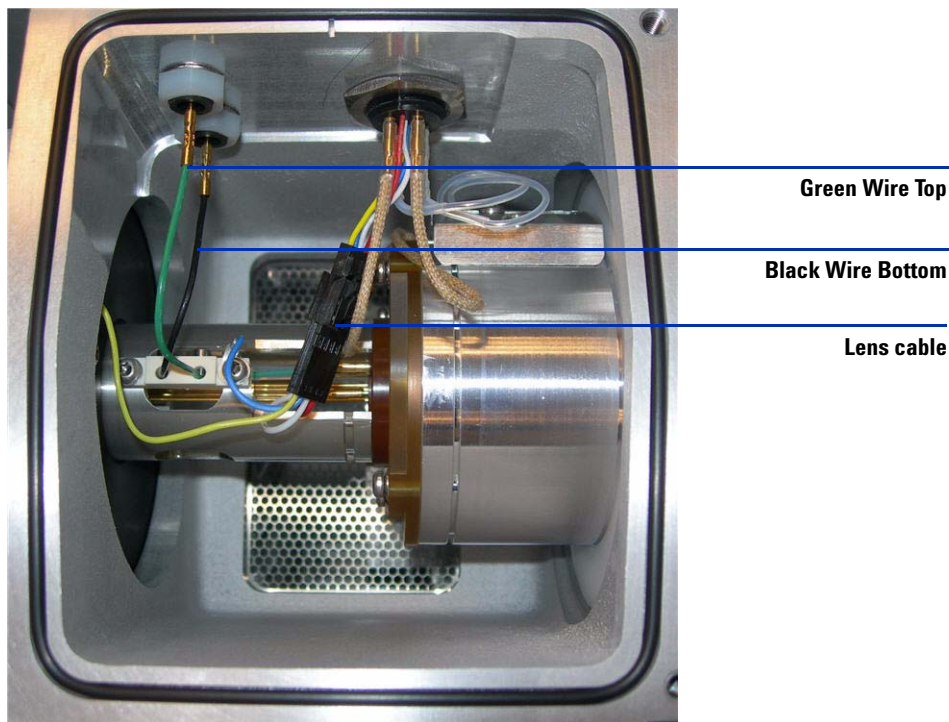
**When required** When the system has difficulty tuning, or when the system has poor sensitivity.

**Tools required**

- Gloves, clean
- Cloths, clean, lint-free (p/n 05980-60051)
- Beakers, 500 ml, 2 ea
- Tweezers
- Screwdriver, TORX, T-10 (p/n 8710-1623)
- Ball driver, 1.5 mm (p/n 8710-1570)
- Methanol, reagent grade or better
- Isopropanol, reagent grade or better
- Acetone, reagent grade or better

**Parts required** None

- 1 Vent the system.
- 2 Remove the 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.
- 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 53](#).



**Figure 53** Optics assembly

- 7 Place the ion optics assembly on a clean cloth (Figure 54). Reposition assembly holding the skimmer spacer and remove the two screws that hold skimmer 1 and carefully be removed skimmer 1 (Figure 55). You may need to use a flat blade screwdriver to gently pry skimmer 1 from its seat.

**CAUTION**

Be careful! The screwdriver blade can damage the octopole rods. If you damage the octopole rods, you must replace the entire assembly.

## 1 Maintenance

To clean the ion optics assembly



**Figure 54** Ion optics assembly



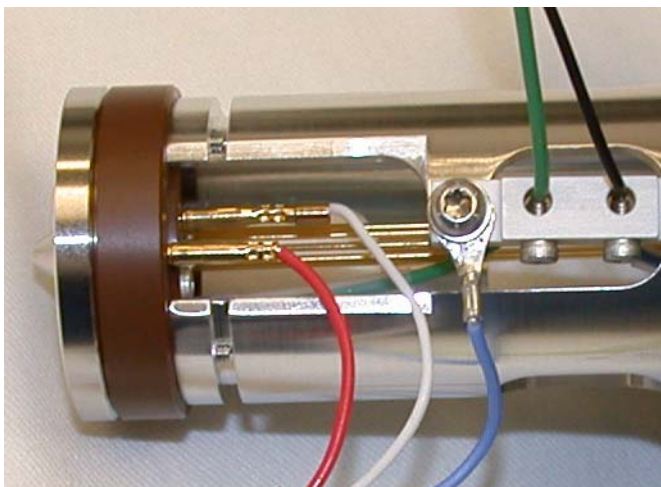
**Figure 55** Skimmer 1 (detail)

- 8 Remove the two screws holding the octopole to the skimmer space (Figure 56). Be careful not to let the ion optics fall on the table. Support the octopole by holding it up by the octopole tube.



**Figure 56** Octopole rods extending through Skimmer Spacer.

- 9 Disconnect wiring harness and connections ([Figure 57](#)). The lens 2 red wire and lens 1 white wire. The yellow wire can remain attached to skimmer spacer ([Figure 58](#)). 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.



**Figure 57** Lens 1 and Lens 2 wires

## 1 Maintenance

To clean the ion optics assembly

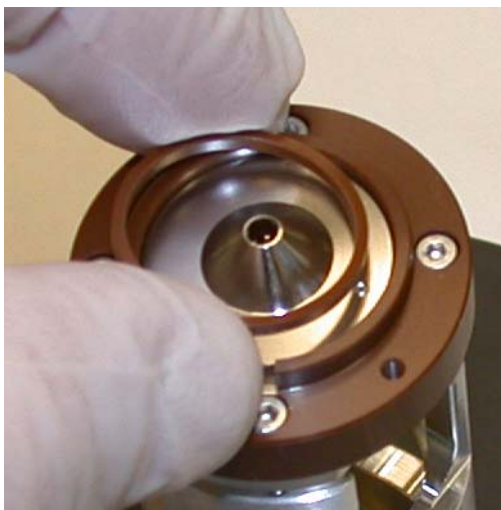


**Figure 58** Skimmer spacer

**10** Use the 1.5 mm ball driver to remove the two screws that hold Lens 2 ([Figure 59](#)). Then remove the spacer insulator ([Figure 60](#)).



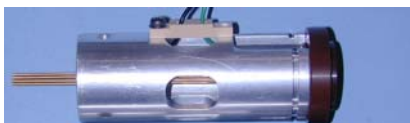
**Figure 59** Lens 2



**Figure 60** Spacer insulator

**11** Remove Lens 1.

**12** Pull the octopole out of the skimmer spacer. The octopole is now ready to be sonicated. There should be no further disassembly of the octopole.



**Figure 61** Octopole assembly

**13** Take the entire octopole assembly and place it in a beaker of high purity isopropanol. Sonicate for 5 minutes. Pour out the isopropanol and refill the beaker with 100% acetone. Sonicate for another 5 minutes. Pour out the acetone and refill with 100% methanol. Sonicate for another 5 minutes.

**14** Place Skimmer, Lens 1 and Lens 2 in a beaker of high purity isopropanol. Sonicate for 5 minutes. Pour out the isopropanol and refill the beaker with 100% acetone. Sonicate for another 5 minutes. Pour out the acetone and

## 1 Maintenance

### To clean the ion optics assembly

refill with 100% methanol. Sonicate for another 5 minutes. The skimmers and lenses can be wiped with lint-free cloth with solvent (methanol).

#### NOTE

- Do not abrasively clean the skimmer because it is plated, and abrasive cleaning will damage the plating.
  - Do not expose the skimmer O-ring to these solvents.
  - Do not reuse the solvents between sets of components.
  - Sonicating the assembly will *not* damage the octopole or octopole wires unless you sonicate it for a long period.
- 

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

**16** Wipe the skimmer spacer completely with a lint-free cloth dampened with methanol. Make sure to wipe off any oil droplets.

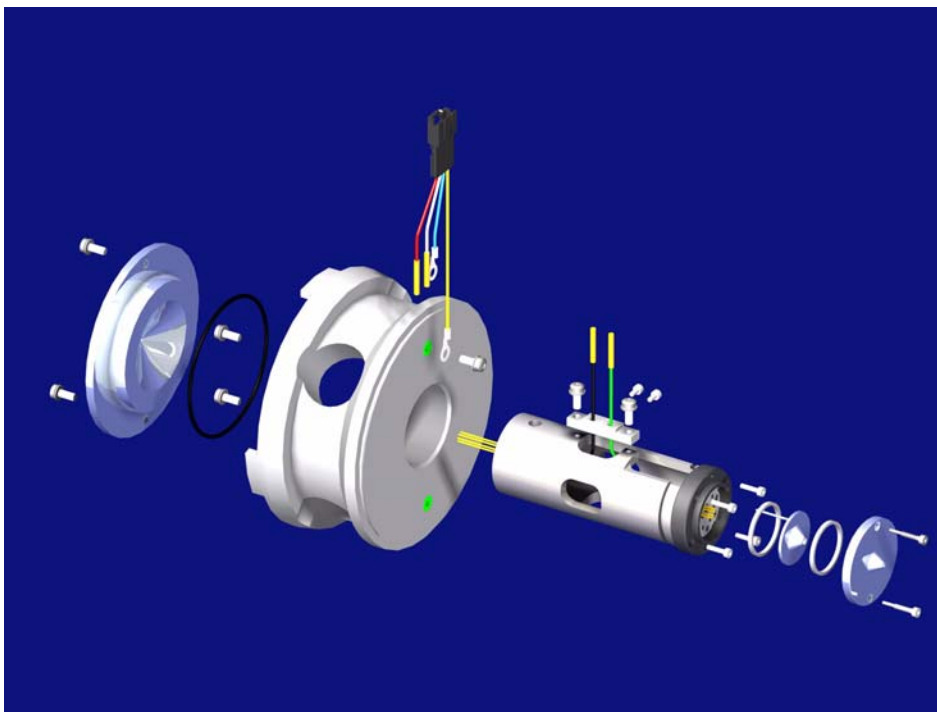
**17** Inspect the octopole rods to make sure they are not broken. Using a small ball driver or pair of tweezers, gently touch each octopole rod on its end to make sure that it has not come detached from the connection on the end support. Do this on both ends of the octopole rods.

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

**19** Reinstall skimmer 1. Don't forget the black O-ring that goes behind skimmer 1.

**20** Install lens 1, space insulator and lens 2. Re-attach the wiring harness. Connect all previously disconnected wires (see [Figure 54](#)).

[Figure 62](#) shows the exploded view of the ion optics assembly.



**Figure 62** An exploded view of the ion optics assembly

- 21 After reassembly of the ion optics assembly (see [Figure 63](#)), reinstall the ion optics assembly into the vacuum manifold. Connect the green and black octopole leads, and reconnect the lens cable connector.

## Maintenance

## To clean the ion optics assembly



**Figure 63** The re-assembled ion optics assembly

- 22** Reinstall the desolvation assembly onto the front of the vacuum manifold. Reinstall the Aux module onto the top of the vacuum manifold, and reconnect the connections to the Aux module. Reconnect the drying gas heater cable, and the drying gas line to the side of the desolvation assembly.

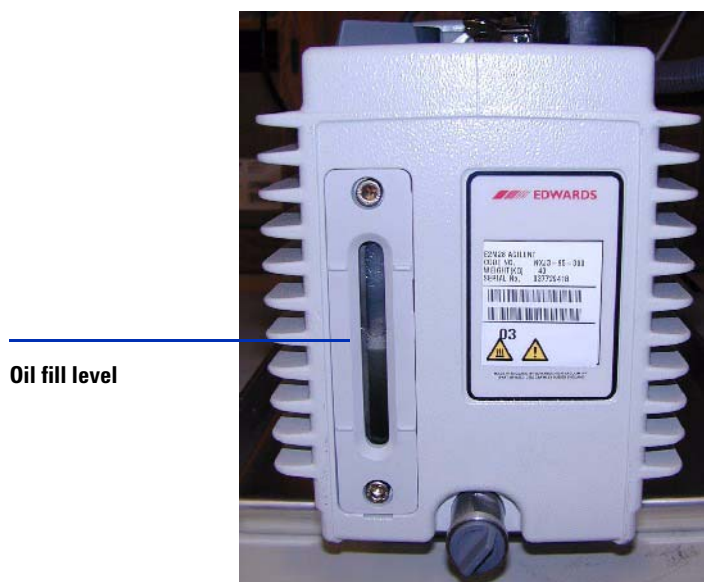
## Vacuum System

This section lists procedures to maintain the vacuum system of the instrument. They should be performed according to the maintenance schedule or as indicated by instrument symptoms.

### To check the rough pump fluid level

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 64](#)).
- 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.



**Figure 64** Fluid level window on the rough pump

## 1 Maintenance

To check the rough pump fluid level

### CAUTION

Never add or replace the rough pump fluid while the pump is on.

---

### NOTE

Record this procedure in the Maintenance Logbook.

---

## To check the oil mist filter

Check the oil mist filter **weekly**.

- Check the oil mist filter.

Check for any damage and if pump fluid has been collected in it.

- Check the oil mist filter for damage.

If the oil mist filter is damaged, replace it.

- Check whether oil has collected in the bottom of the oil mist filter.

If oil is found in the oil mist filter, open the gas ballast valve counterclockwise just enough to return the condensed oil back to the pump. Close the gas ballast valve clockwise.

### NOTE

When you close the ballast valve, you increase the efficiency of the pump. However, you lose oil to the mist filter if you don't recycle. Check the status of your oil mist filter at least once per week to ensure that it does not fill with oil. If you lose too much oil in the rough pump, the vacuum will not be maintained, and the Q-TOF will vent.

---

## To add rough pump fluid

Add pump fluid when the pump fluid level is low. Before you begin, make sure you have:

- Funnel
- Gloves, chemical resistant, clean, lint free (p/n 9300-1751)
- Rough pump fluid (Inland 45 oil, p/n 6040-0834)

### CAUTION

Wear chemical-resistant gloves and safety glasses (goggles)

### WARNING

Never add pump fluid while the pump is on.

### WARNING

The fill cap and pump may be dangerously hot. Check that the fill cup and pump are cool before you touch them.

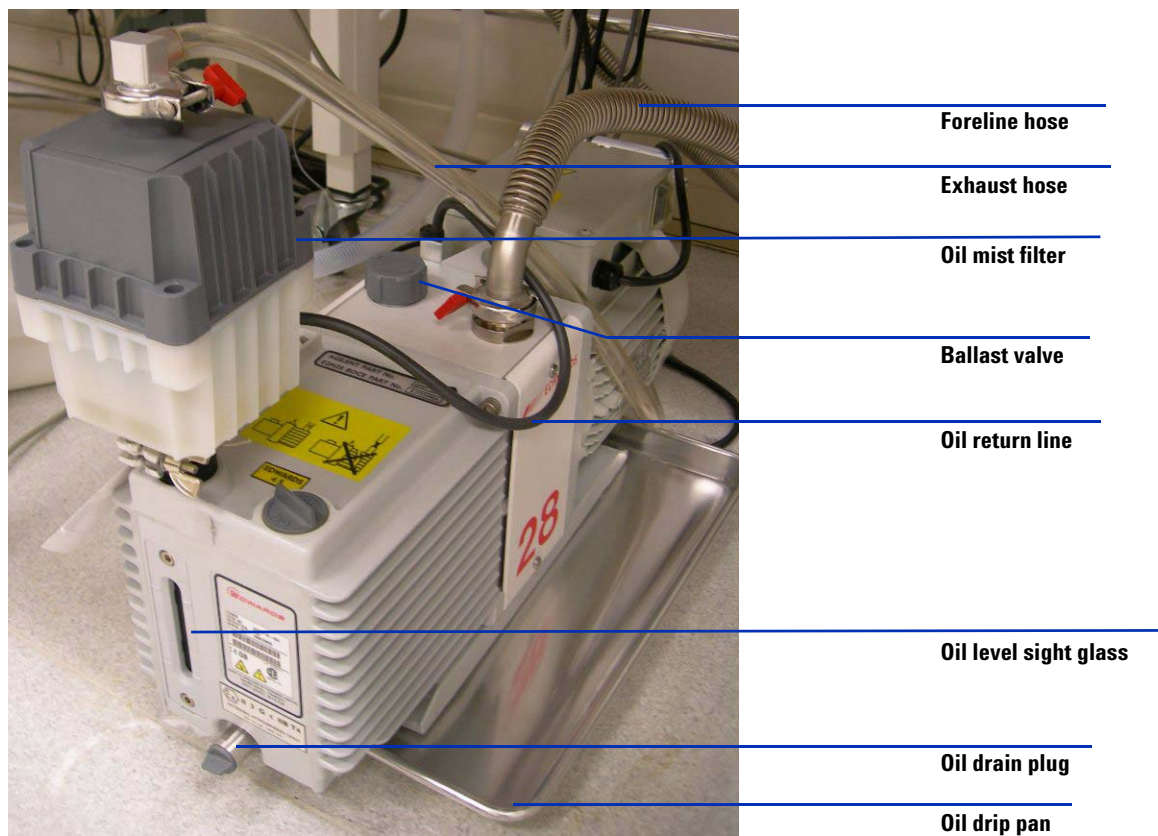
### CAUTION

Use only Edwards rough pump fluid (Inland 45 oil, p/n 6040-0834). Any other fluids can substantially reduce pump life and invalidates the pump warranty.

- 1 Vent and turn off the instrument.  
See [“To shut down the instrument”](#) on page 17.
- 2 Unplug the instrument power cord from the electrical outlet.  
Leave the power cord unplugged while you do this procedure.
- 3 Remove the fill cap on the rough pump (see [Figure 65](#)).
- 4 Add new pump fluid until the fluid level is near, but not over the maximum mark beside the fluid level window (see [Figure 65](#)).
- 5 Reinstall the fill cap.
- 6 Wipe off all excess oil around and underneath of the pump.
- 7 Reconnect the power cord.

**8** Start up the instrument.

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



**Figure 65** Rough pump.

## 1 Maintenance

### To replace the rough pump fluid

## To replace the rough pump fluid

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

Before you begin, make sure you have:

- Container for catching old pump fluid
- Funnel
- Gloves, chemical resistant, clean, lint free (p/n 9300-1751)
- Rough pump fluid (Inland 45 oil, p/n 6040-0834)
- Screwdriver, flat-bladed, large (p/n 8710-1029)

### CAUTION

Wear chemical-resistant gloves and safety glasses (goggles)

### WARNING

Never add pump fluid while the pump is on.

### WARNING

The fill cap and pump may be dangerously hot. Check that the fill cap and pump are cool before you touch them.

### WARNING

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

### CAUTION

Use only Edwards rough pump fluid (Inland 45 oil, p/n 6040-0834). 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 17.

- 2** Unplug the power cord from the instrument

Leave the power cord unplugged while performing this procedure.

- 3** Place a container under the drain plug of the rough pump (see [Figure 65](#) on page 103).
- 4** Remove first the fill cap (see [Figure 65](#) on page 103), 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 65](#) on page 103).
- 7** Reinstall the fill cap.
- 8** Reconnect the power cord.
- 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.

## 1 Maintenance

To replace the fuses

### To replace the fuses

<b>When required</b>	As necessary.
<b>Tools required</b>	Flat Blade Screw Driver
<b>Parts required</b>	<ul style="list-style-type: none"><li>• 8 Amp Fuse 2110-0969</li><li>• 12 Amp Fuse 2110-1398</li></ul>

#### WARNING

**Never replace the fuses with the instrument plugged into the power outlet. The instrument will immediately begin to pump down.**

- 1 Unplug the instrument power cord from the power outlet.



**Figure 66** Disconnect the instrument power cable.

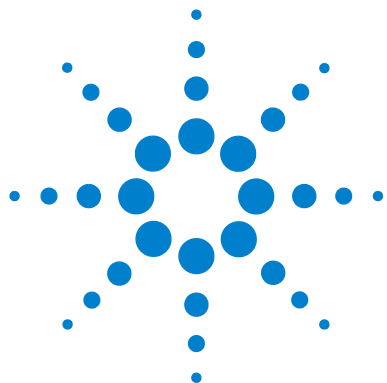
- 2 Using a flat blade screw driver, remove the fuse holder of the blown fuse



**Figure 67** AC Board fuses

- 3 Replace with the appropriate fuse. See [“Replaceable Fuses”](#) on page 111.
- 4 Reinstall the fuse holder.
- 5 Plug in the instrument.
- 6 Push the front power switch to start an automatic pump down sequence.

**1 Maintenance**  
To replace the fuses



## 2 Reference

Safety [110](#)

Environmental Conditions [111](#)

Replaceable Fuses [111](#)

This chapter contains safety and other reference information for your Agilent 6400 Series Triple Quad LC/MS.



## Safety

If the Agilent 6400 Series Triple Quad LC/MS is used in a manner not specified by Agilent Technologies, the protections provided by the instrument may be impaired.



Caution,  
Risk of danger,  
Consult documentation



Caution,  
Risk of Electric Shock



Caution,  
Hot Surfaces,  
Risk of Burns

## Environmental Conditions

Equipment Class	Class 1 Laboratory Equipment
Pollution Degree	2
Installation Category	II
Environment	Indoor Use
Altitude	Not to exceed 3000 m
Electrical supply	200 - 240 V AC, 50/60 Hz, 2500 VA
Mains supply voltage	Fluctuations not to exceed 10% of nominal supply voltage
Operating Temperature	15 to 35°C (59 to 95°F)
Humidity	< 85% RH at 35°C

## Replaceable Fuses

8A	2110-0969
12A	2110-1398

**2    Reference**  
**Replaceable Fuses**



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## **In This Book**

This book contains tasks to help you maintain your Agilent 6400 Series Triple Quad LC/MS.

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